RESTRICTED

TM 9-819A

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

2 1/2-TON 6 x 6 TRUCK M135

DEPARTMENT OF THE ARMY • JULY 1951

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TM 9-819A is published for the information and guidance of all concerned.

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BY ORDER OF THE SECRETARY OF THE ARMY:

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United States Army

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For explanation of distribution formula, see SR 310-90-1.

CONTENTS

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for information and guidance of the personnel to whom this matériel is issued. They contain information on the operation and organizational maintenance of the matériel as well as descriptions of major units and their functions in relation to other components of the matériel.

b. The appendix contains a list of current references, including supply catalogs, forms, technical manuals, and other available publications applicable to the matériel.

c. This first edition manual is published in advance of complete technical review. Any errors or omissions will be brought to the attention of the Chief of Ordnance, Washington 25, D. C., Attention: ORDFM-Pub.

2. Forms, Records, and Reports

a. GENERAL. Forms, records, and reports are designed to serve necessary and useful purposes. Responsibility for the proper execution of these forms rests upon commanding officers of all units operating and maintaining vehicles. It is emphasized, however, that forms, records, and reports are merely aids. They are not a substitute for thorough practical work, physical inspection, and active supervision.

b. AUTHORIZED FORMS. The forms generally applicable to units operating and maintaining these vehicles are listed in the appendix. No forms other than those approved for the Department of the Army will be used. For a current and complete listing of all forms, see current SR 310-20-6.

c. FIELD REPORTS OF ACCIDENTS. The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in the SR 385-10-40 series of special regulations. These reports are required whenever accidents involving injury to personnel or damage to matériel occur.

d. REPORT OF UNSATISFACTORY EQUIPMENT OR MATERIALS. Any suggestions for improvement in design and maintenance of equipment, safety and efficiency of operation or pertaining to the application of prescribed petroleum fuels, lubricants, and/or preserving materials, will be reported through technical channels, as prescribed in SR 700-45-5, using DA AGO Form 468—Unsatisfactory Equipment Report, to the Chief of Ordnance, Washington 25, DC, ATTN: ORDFM. Any suggestions are encouraged in order that other organizations may benefit.

Section II. DESCRIPTION AND DATA

3. Description

a. GENERAL. The truck described in this manual is designated as 2½-Ton 6 x 6 Cargo Truck, M135. The vehicle is equipped with one driving front axle and two driving rear axles, with six driving wheels. A conventionally mounted soft-top cab is used on all vehicles, with a metal cargo type body mounted on frame independent of cab (figs. 1, 2, 3, and 4). Truck may be used to transport cargo or personnel, and is equipped with towing shackles and pintle at rear, to tow other vehicles.

b. POWER PLANT. Power is supplied by a GMC type 302, gasoline, six-cylinder in-line, valve-in-head engine, conventionally four-point mounted. Engine assembly and mounted accessories are accessible after alligator type hood is raised (fig. 11).

c. TRANSMISSION. A special GM Hydra-Matic transmission, mounted directly to engine, has four automatic forward speeds and one reverse in each of two ranges, high and low. Speed changes are automatic in both ranges after driver manually places control lever in selected range positions.

d. TRANSFER. A single speed transfer, mounted to rear of transmission, transmits power through conventional propeller shafts to front and rear driving axles. Transfer mechanism provides automatic engagement and disengagement of front driving axle, permitting front axle to run free except when required for tractive effort. A manually operated lever permits transfer to be placed in neutral or driving position. A power-take-off opening is provided on left side of transfer for mounting a power-take-off.

e. FRONT AXLE AND SUSPENSION.

(1) The front driving axle is full-floating, hypoid, single reduction type, having a banjo type housing. The differential carrier assembly is interchangeable with rear

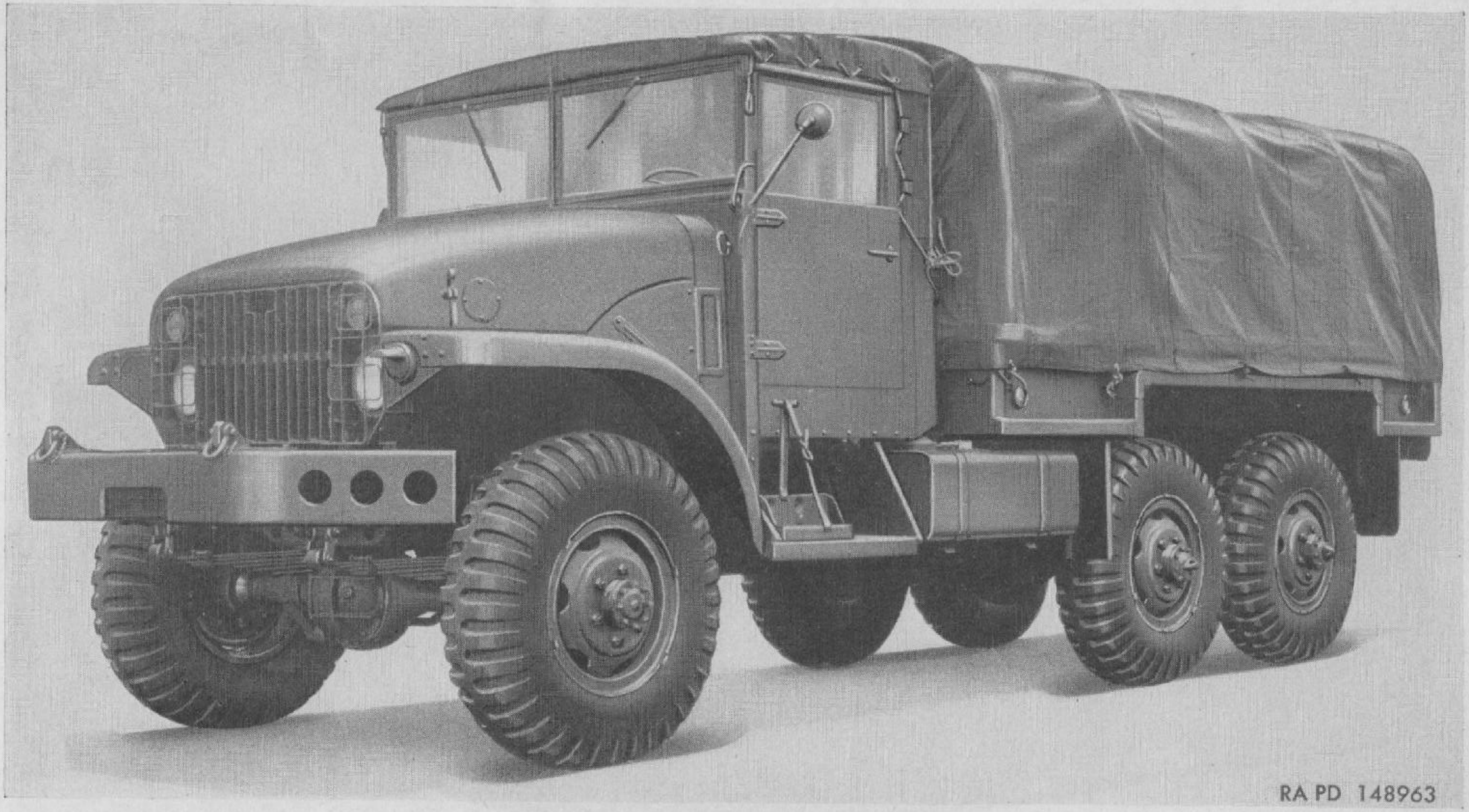


Figure 1. Left front view of vehicle w/o winch.

Figure 2. Left front view of vehicle w/winch.

Figure 3. Right rear view of vehicle w/o winch.

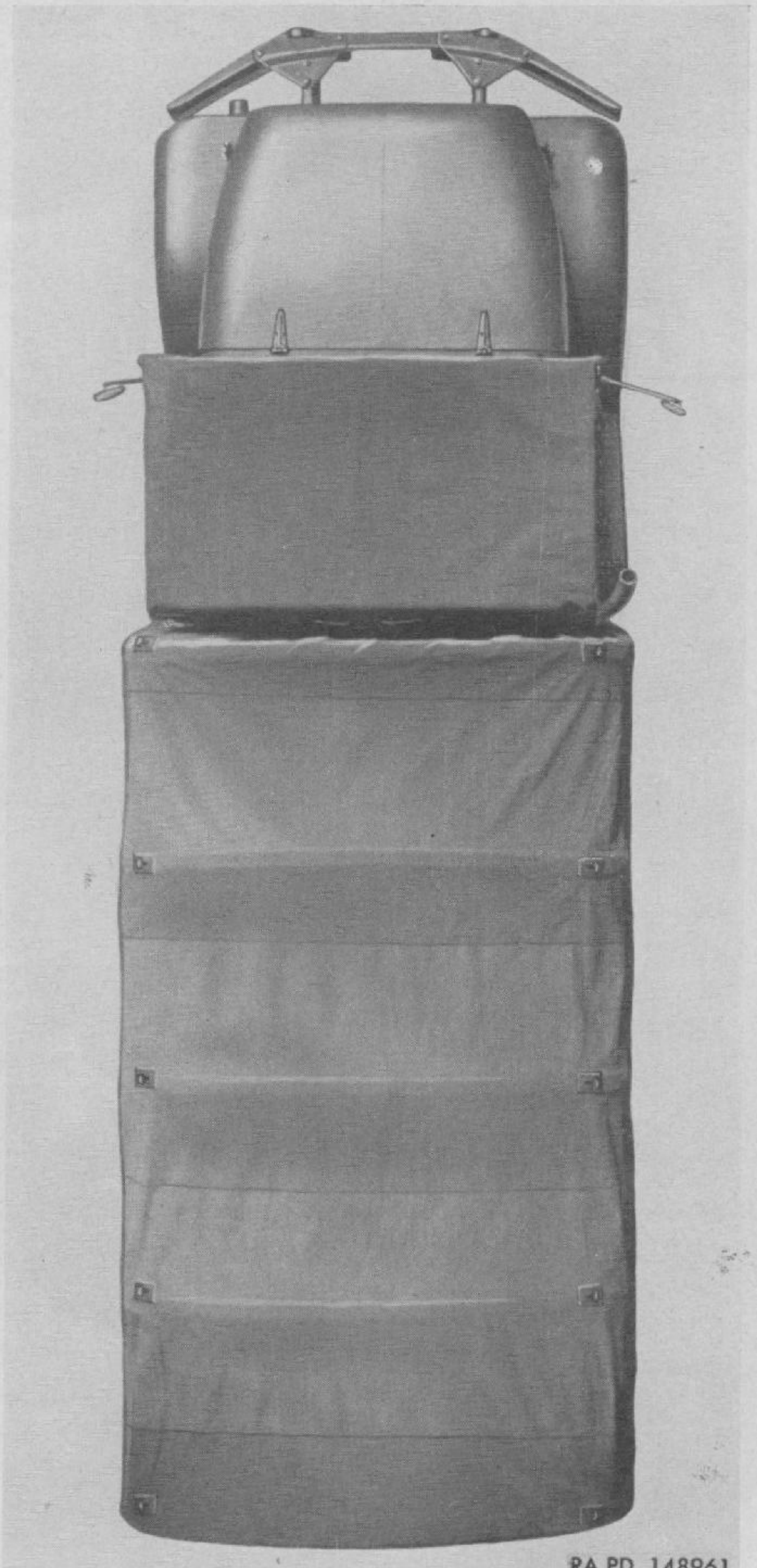


Figure 4. Top view of vehicle w/o winch.

axle differential carrier assemblies. The axle assembly incorporates constant velocity universal joints at steering knuckles which permit steering of the vehicle in conventional manner.

(2) Front axle suspension consists of semi-elliptic type springs, shackled at both ends, and mounted to axle housing with U bolts. Front springs carry only lateral and vertical loads. Three torque rods, two lower and one upper, transmit driving and braking forces to frame and hold axle in position under vehicle.

f. Rear Axles and Suspension.

(1) Both driving rear axles are full-floating, hypoid, single reduction type with banjo type housings and are driven from transfer by conventional propeller shafts. Differential carrier assemblies are interchangeable between the two rear axles and with the front axle differential carrier assembly.

(2) Rear spring suspension consists of an articulated main spring assembly and a fixed secondary spring on each side. Both springs are inverted semi-elliptic type with slipper type ends. The main articulated springs are mounted with U bolts on trunnion housings which in turn are mounted on opposed tapered roller bearings. The secondary springs are mounted rigidly with U bolts on frame directly above main springs. Ends of both springs contact brackets on each axle housing. Torque rods, three to each axle, transmit driving and braking forces to frame the hold axles in position under vehicle.

g. Brake System.

(1) Service brakes are air-actuated hydraulic type, operating brake shoes at all wheels. Air-actuated power cylinder transmits hydraulic pressure to dual wheel cylinders at each wheel. Air compressor, mounted to engine and driven by a belt from chankshaft pulley, supplies compressed air for the system as well as to trailer service connections. Two air storage tanks are provided. Service brakes are actuated with a brake pedal.

(2) A contracting band type parking brake assembly is mounted on output shaft at rear of transfer. A latch type parking brake lever, to right of driver, operates brake through rods and linkage for emergency stops or to hold vehicle while parking.

h. CAB AND BODY.

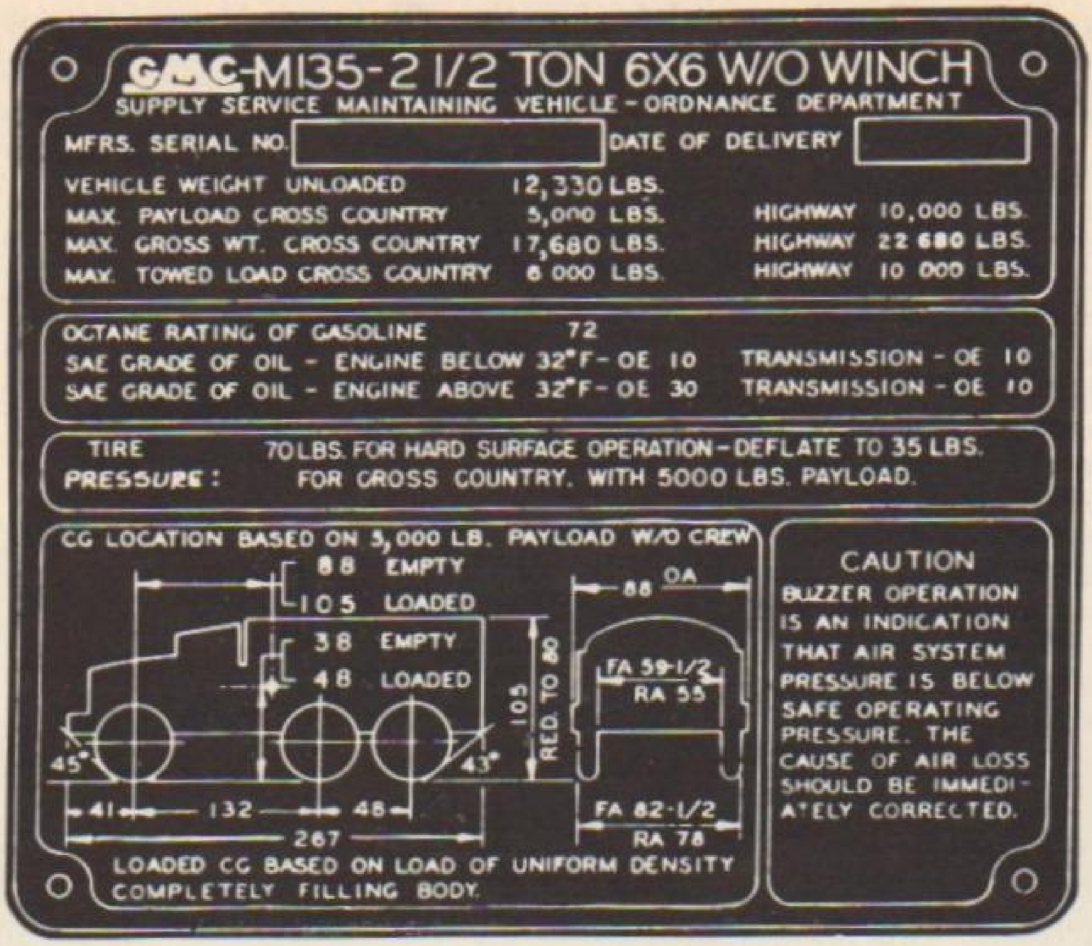
(1) The three-man cab consists of a metal open top enclosure around driver's compartment. Metal cab doors, equipped with glass windows, are hinged to cab structure on each side. Windows can be raised and lowered with conventional regulator mechanism. The two windshield sections can be positioned for ventilation, or the entire window frame can be lowered to a horizontal position over hood. Canvas top and back curtain, lashed in position to cab structure, can be positioned or removed to provide ventilation or accessibility.

(2) The steel cargo body, mounted to frame in back of cab, is equipped with front and side cargo racks which include bow sockets. Top paulin and end curtain can be installed over removable bows and lashed to body structure. Hinged troop seats, incorporated in side cargo racks, are provided. Hinged tail gate incorporates a hinged step for use when entering or leaving body when tail gate is lowered.

i. PROVISIONS FOR SPECIAL EQUIPMENT. Some provisions have been made in the standard vehicle design to permit ready installation of such winterization and fording equipment that may be furnished. Installation and use of such equipment are described in other directives.

4. Differences Between Models.

Some of the 2½-Ton, 6 x 6 Cargo Trucks, M135 are equipped with a front-mounted, worm-geared, jaw-clutch, drum winch, mounted on support brackets attached to frame side rails (fig. 2). This equipment and necessary changes of weights and dimensions are designated on vehicle identification plate (fig. 5). A power-take-off for winch operation, mounted on left side of transfer, drives winch through propeller shafts and universal joints. When winch is not included, power-take-off, drive lines, and power-take-off control linkage are omitted. Without winch, the front bumper is mounted with cable guide slot down.



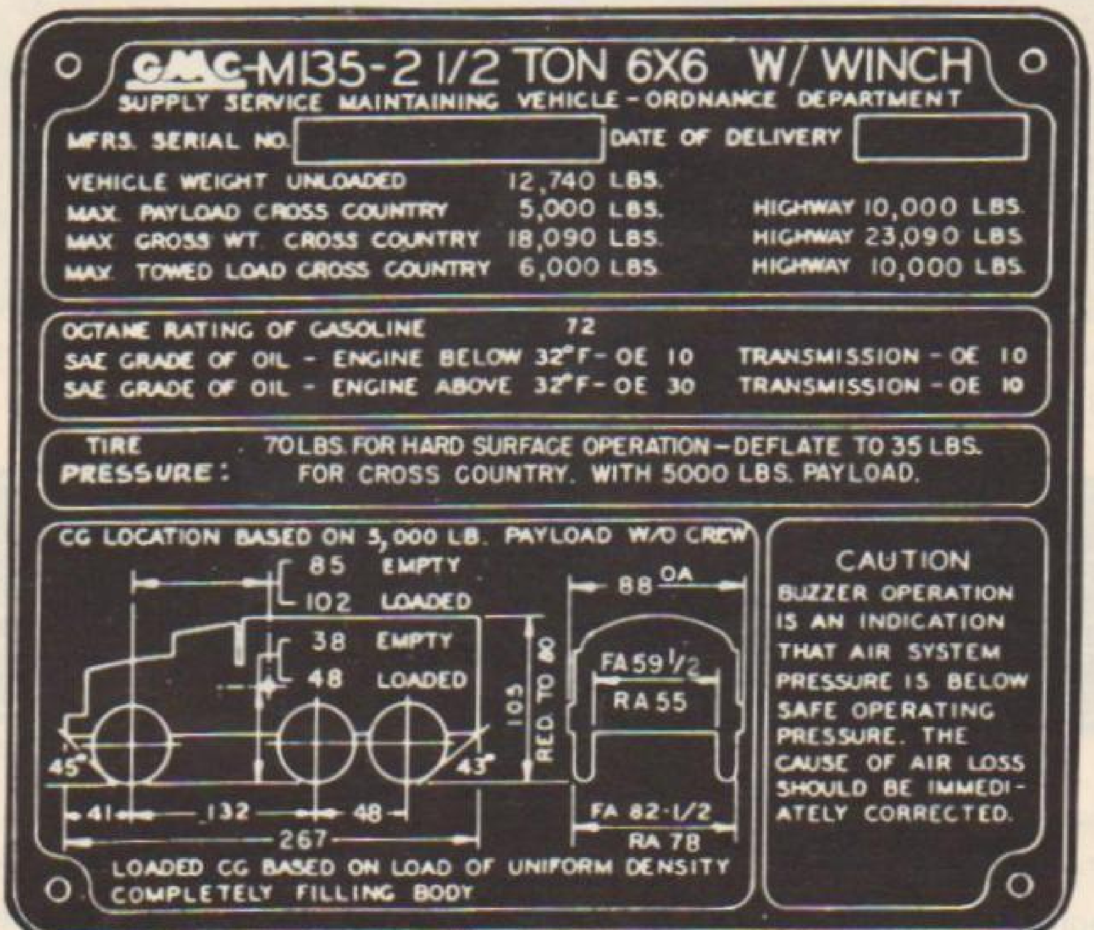


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Figure 5. Vehicle identification plates (w/ and w/o winch).

5. Name, Caution, and Instruction Plates

Table I. Name, Caution, and Instruction Plates

Plate	Location	Figure
Vehicle identification	On instrument panel	8
Publication	On instrument panel	8
Transmission instruction	On instruction plate panel	8
Winch instruction	On instruction plate panel	8
Draining instruction	On instrument panel	8
Engine serial number	Right-hand side of engine crankcase	7
Transmission name	Right-hand side of transmission case.	
Distributor name	On distributor body.	
Generator name	On generator field frame.	
Starter name	In starter field frame.	
Generator-regulator name	On regulator base.	
Winch name	On top of winch assembly.	
Carburetor name	On carburetor body.	
Air compressor name	On air compressor crankcase.	

a. VEHICLE IDENTIFICATION PLATE. Identification or trunk name plate is mounted on instrument panel to right of map compartment (fig. 8). Plate includes vehicle serial number, shipment date, load capacities, dimensional data, and other pertinent vehicular information.

b. PUBLICATION PLATE (fig. 6). This plate is mounted directly under the vehicle identification and draining instruction plates to the right of the map compartment (fig. 8). The plate includes references to ORD 9 SNL G–749, TM 9–1819AA, TM 9–1819AB, and TM 9–1819AC. *Do not requisition these four publications since they are not yet available; when published, they will be distributed automatically to personnel concerned and listed in the appropriate indexes.*

Figure 6. Publication plate.

c. TRANSMISSION INSTRUCTION PLATE (fig. 12). Plate is mounted on instruction plate panel in front of steering wheel (fig. 8). This plate includes brief instructions on the operation of transmission and transfer.

d. WINCH INSTRUCTION PLATE (fig. 17). Plate is mounted on instruction plate panel in front of steering wheel (fig. 8). This plate includes brief instructions on the use of the winch.

e. DRAINING INSTRUCTION PLATE (fig. 68). Plate is mounted to the right of map compartment directly under the vehicle identification plate (fig. 8). This plate contains brief instructions on draining the engine cooling system.

f. ENGINE SERIAL NUMBER (fig. 7). Manufacturer's engine serial number is stamped on plate mounted on boss on crankcase at right front of engine, directly behind generator.

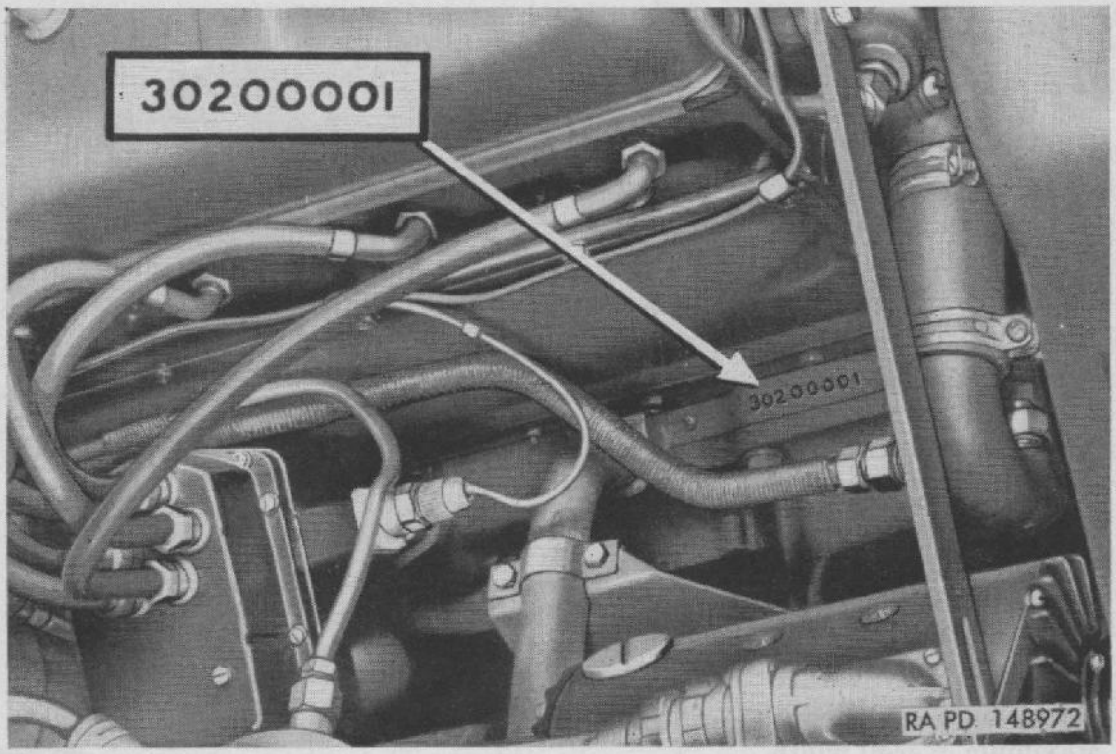


Figure 7. Location of engine serial number.

g. TRANSMISSION NAME PLATE. Transmission name plate is located on right-hand side of transmission case.

h. DISTRIBUTOR NAME PLATE. Plate, located on end of distributor body, includes manufacturer's model number and voltage data.

i. GENERATOR NAME PLATE. Plate, located on side of generator, includes ordnance number, manufacturer's model number, voltage, amperage, and serial number.

j. STARTER NAME PLATE. Plate, located on left side of starter, includes voltage, direction of rotation, ordnance part number, manufacturer's model number, and serial number.

k. GENERATOR-REGULATOR NAME PLATE. Plate, located on right-hand side of regulator, includes model number, ordnance number, voltage, and amperage.

l. WINCH NAME PLATE. Plate, located on top of winch assembly (fig. 186), identifies winch assembly by manufacturer's model and serial numbers.

m. CARBURETOR NAME PLATE. Small plate on engine side of carburetor body, includes manufacturer's model and part numbers.

n. AIR COMPRESSOR NAME PLATE. Plate on left side of air compressor crankcase includes manufacturer's model and serial numbers.

6. Tabulated Data

a. VEHICLE WEIGHT DATA.

Vehicle weight (unloaded):	
W/winch	12,740 lb.
W/o winch	12,330 lb.
Maximum payload (w/ or w/o winch):	
Highway operation	10,000 lb.
Cross-country operation	5,000 lb.
Maximum gross weight (including personnel):	
Highway operation:	
W/winch	23,090 lb.
W/o winch	22,680 lb.
Cross-country operation:	
W/winch	18,090 lb.
W/o winch	17,680 lb.
Maximum towed load (w/ or w/o winch):	
Highway operation	10,000 lb.
Cross-country operation	6,000 lb.

b. DIMENSIONAL DATA.

Maximum overall length	267 in.
Maximum overall width	88 in.
Maximum height:	
Overall	105 in.
Lowest reducible	80 in.
Tire tread (track):	
Front	71 in.
Rear	66½ in.
Width at outside of tires:	
Front	82½ in.
Rear	78 in.
Width at inside of tires:	
Front	59½ in.
Rear	55 in.
Wheelbase (front axle to rear spring seat centerline)	156 in.
Front of vehicle to front axle centerline	41 in.
Front axle to forward rear axle centerline	132 in.
Forward rear axle to rear rear axle centerline	48 in.
Rear rear axle centerline to rear of vehicle	46 in.
Shipping cubic (at lowest reducible height)	1,140 cu. ft.

Body dimensions:	
Length (inside)	147 in.
Width (inside):	
Between sides	80 in.
Between wheelhouses	48½ in.
Height (inside):	
Floor to paulin bows	60 in.
Floor to top of seats	16¾ in.
Floor to top of side racks	36½ in.

c. OPERATIONAL DATA.

Angle of approach	45°
Angle of departure	43°
Ground clearance at axles	12½ in.
Minimum turning radius (right or left turn)	35 ft.
Maximum fording depth (without fording equipment)	60 in.
Tire size	11.00/20
Tire pressure:	
Hard surface operation	70 lb.
Cross-country operation (with 5,000 lb. payload)	35 lb.

d. PERFORMANCE DATA.

Maximum permissible speed:	
HIGH RANGE	
F-1	58 mph.
F-2	58 mph.
LOW RANGE	
F-1	15 mph.
F-2	15 mph.
R (reverse)	
HIGH RANGE	12 mph.
LOW RANGE	3 mph.
Maximum grade	60 percent
Engine horsepower (SAE)	38.4
Winch capacity	10,000 lbs.

e. CAPACITIES.

Fuel tank	56 gal.
Cooling system	22 qt.
Crankcase (refill)	11 qt.
Air cleaner	2 qt.
Transmission	15 qt. (aprx)
Transfer:	
W/ power-take-off	7½ pt.
W/o power-take-off	6½ pt.
Differentials:	
Front	15½ pt.
Forward rear	13½ pt.
Rear rear	11½ pt.
Steering gear housing	1½ pt.
Winch:	
Worm housing	1¼ pt.
End bearing frame housing	1 pt.

f. DETAILED DATA REFERENCES. For additional detailed tabulated data pertaining to individual components and systems, refer to the index.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATÉRIEL

7. Purpose

a. When a new or reconditioned vehicle is first received by the using organization, it is necessary for the organizational mechanics to determine whether the vehicle has been properly prepared for service by the supplying organization and to be sure it is in condition to perform any mission to which it may be assigned when placed in service. For this purpose, inspect all assemblies, subassemblies, and accessories to be sure they are properly assembled, secure, clean, and correctly adjusted and/or lubricated. Check all tools and equipment (ch 3, sec I) to be sure every item is present, in good condition, clean, and properly mounted or stowed.

b. In addition, perform a "run-in" of at least 50 miles on all new or reconditioned vehicles and a sufficient number of miles on used vehicles to completely check their operation, according to procedures in paragraph 10 herein.

c. Whenever practicable, the vehicle driver will assist in the performance of these services.

8. Correction of Deficiencies

Deficiencies disclosed during the course of the "run-in" will be treated as follows:

a. Any deficiencies within the scope of the maintenance echelon of the using organization will be corrected before the vehicle is placed in service.

b. Deficiencies beyond the scope of the maintenance echelon of the using organization will be referred to a higher echelon for correction.

c. Deficiencies of serious nature should be brought to the attention of the supplying organization.

9. Preliminary Service

a. FIRE EXTINGUISHER. See that extinguisher is present (fig. 8) and fully charged.

b. FUEL, OIL, AND WATER. Check coolant level (par. 126*a*), and value of antifreeze (par. 292). Open coolant level cock (fig. 67) and fill only to this level. Fill fuel tank to correct level (par. 116*b*). Check engine oil level (par. 59*b*).

Caution: If there is a tag attached to the oil filler cap concerning the contents of crankcase, follow instructions on the tag before starting engine, when item *s* below, is reached.

Note. Do not check transmission oil level until after engine is started as instructed in item *s* below.

c. BATTERIES. Make hydrometer test and add water if necessary (par. 141 *b* and *c*). Check terminal connections. Replace waterproofing on battery terminals if necessary (par. 141*a*.)

d. COMPRESSED AIR TANKS. Drain air tanks (fig. 136). Close drain cock.

e. AIR CLEANER AND CRANKCASE BREATHER. Inspect Carburetor air cleaner for proper oil level (par. 59*e*). Inspect crankcase breather for oil level (par. 59*d*). Service as necessary.

f. ACCESSORIES AND BELTS. Examine all accessories for security of mounting. Check adjustment of drive belts (pars. 129 and 229).

g. ELECTRICAL WIRING. Examine all accessible wiring for chafing, cracking, and looseness of connections.

h. TIRES. Gage all tires, including spare (par. 240*a*). Remove all objects lodged in treads. Examine all tires for damage. See that all valve caps are present and finger tight.

i. WHEEL AND FLANGE NUTS. Check all wheel nuts for tightness (par. 239*b*). Check axle shaft flange nuts for tightness (pars. 198 and 205).

j. FENDERS AND BUMPERS. Examine fenders and bumpers for condition and security.

k. TOWING CONNECTIONS. Inspect towing shackles and pintle for looseness and damage. Inspect trailer service and emergency air connections.

l. BODY AND CAB. Inspect cab top and curtains, and body paulin for damage and presence of lashing ropes.

m. GLASS AND REAR-VIEW MIRROR. Clean windshield and other glass. Clean and focus rear-view mirrors.

n. LUBRICATE. Lubricate according to lubrication order (par. 57). Perform services *o* through *r* during lubrication.

o. Springs and Suspension. Inspect front and rear springs for sag, broken or shifted leaves, loose rebound clips, U bolts, and shackles. Check shock absorbers and links, torque rods, and rear spring seats for looseness or damage. Check shock absorbers and rear spring seats for leakage.

p. Steering Linkage. Inspect steering linkage for loose or damaged parts.

q. Propeller Shafts and Pillow Block. Check propeller shafts for loose mounting and connections (par. 213). Check pillow block mounting stud nuts for looseness (par. 215).

r. Unit Vents. Axle housings, brake power cylinder, master cylinder, fuel tank, transfer, and transmission are vented through lines connected to vent gallery on right side of frame. Check vent connections at units and at vent gallery.

s. Engine Warm-Up. Start engine (par. 37*a*). Run at idle for 3 to 5 minutes, then check transmission oil (par. 59*f*). Warm up engine (par. 38).

t. Choke. Observe operation of choke and adjust linkage if necessary (par. 113*b*).

u. Instruments. Observe action of battery charge indicator (par. 38*d*), oil pressure gage (par. 38*c*), temperature gage (par. 38*b*), and air pressure gage (par. 38*e*) during warm-up. Fuel gage should register level of fuel in tank (par. 32).

v. Engine Controls. Note whether engine responds to accelerator pedal and hand throttle.

w. Horn and Windshield Wipers. Test horn (par. 26), and operation of windshield wiper blades (par. 272).

x. Lamps, Lights, and Reflectors. Observe if all lights operate correctly with main light switch in proper positions (par. 42).

y. Leaks. Inspect under hood and beneath truck for indications of fuel, oil, and coolant leaks.

z. Tools and Equipment. See that all tools and equipment are present, in good condition, and properly stowed or mounted.

10. Run-In Test

a. General. Refer to section III of this chapter for operating instructions. During the road test of the vehicle, the following procedures will be consulted and performed. Services *j* to *m* below will be performed at 10-mile intervals with the vehicle halted.

b. AIR PRESSURE. Observe whether the brake air pressure builds up at a normal rate to the specified maximum limits and then cuts off (par. 31).

c. DASH INSTRUMENTS AND GAGES. Observe all instruments frequently, noting whether they operate within the prescribed limits, temperatures, and pressures. Refer to section II of this chapter.

d. HORN AND WINDSHIELD WIPERS. See that they operate properly.

e. BRAKES, FOOT AND PARKING. Foot brakes should stop vehicle smoothly without side pull within reasonable distance with approximately one-third reserve pedal travel. Parking brake should hold vehicle on reasonable incline, with over one-third reserve ratchet travel.

f. TRANSMISSION AND TRANSFER. Shift mechanism must operate smoothly.

g. STEERING. Note any excessive pulling to either side, wandering, or shimmy.

h. ENGINE. Engine must respond to controls and have maximum pulling power without unusual noises, stalling, misfiring, overheating, or unusual exhaust smoke.

i. UNUSUAL NOISES. Be on the alert continually for unusual noises that would indicate looseness of parts, damaged or malfunctioning units in the power train, cab, body, or wheels.

Note. Halt vehicle at 10-mile intervals for services *j* to *m* below.

j. BRAKE POWER CYLINDER OPERATION. Check operation of brake power cylinder by making a brake application, observing the amount of physical pressure required to depress pedal. If pedal pushes down hard, power cylinder is not functioning properly or air pressure is low.

k. AIR PRESSURE SYSTEM LEAKS. With the air pressure at a maximum (100 psi) and the brakes applied, stop the engine. There should not be a noticeable drop in pressure within one minute.

l. TEMPERATURES. Cautiously hand-feel each brake drum and wheel hub for abnormal temperatures. Examine transfer, transmission, and differential housings for overheating and oil leaks.

m. LEAKS. With engine running, and fuel, engine oil, and cooling systems under operating pressures, look within engine compartment and under vehicle for leaks.

n. PUBLICATIONS AND REPORTS.

(1) *Publications.* See that vehicle technical manual (TM 9-819A), lubrication order, Standard Form No. 91

(Operator's Report of Motor Vehicle Accident) and DA AGO Form 478 (MWO and Major Unit Assembly Replacement Record and Organization Equipment File) are in the truck, legible, and properly stowed.

Note. For new trucks, Department of the Army registration number and truck nomenclature must be filled in on DA AGO Form 478.

(2) *Reports.* Upon completion of the run-in test, correct or report any deficiencies noted. Report condition of vehicle to designated individual in authority.

Section II. CONTROLS AND INSTRUMENTS

11. General

a. This section describes, locates, illustrates, and furnishes the driver with sufficient information pertaining to the various controls and instruments provided for the proper operation of the vehicle.

b. All pedal and hand lever controls, instruments, gages, and switches are grouped in the driver's compartment (figs. 8 and 9) and are readily accessible to the driver for the operation of the vehicle. The major graduations, letters, figures, and pointer tips on instruments and gages grouped in instrument cluster (fig. 10) are coated with luminous paint.

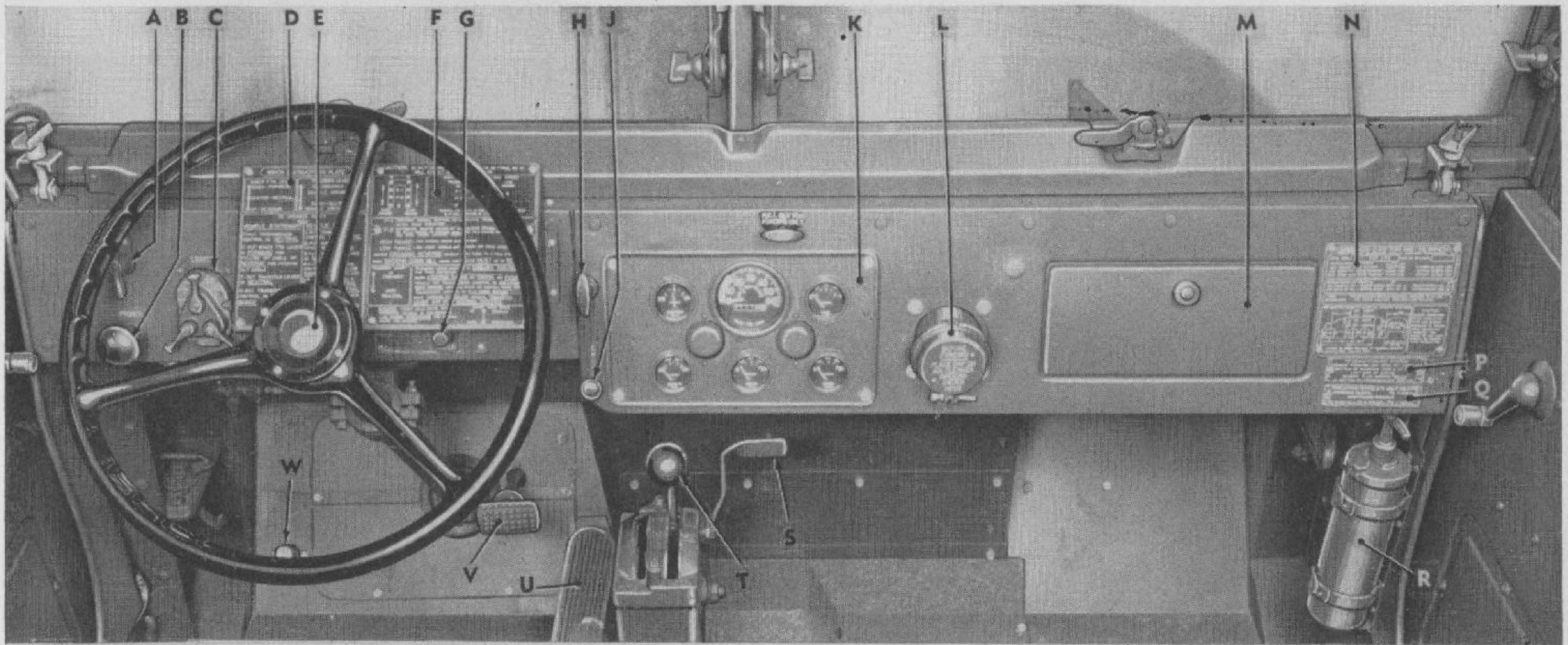
Note. There is no clutch pedal.

12. Service Brake Pedal

The brake pedal is located on floor, accessible to driver's right foot (fig. 8), and is used to control service brakes at all wheels. Brakes are applied by depressing pedal. Degree of brake application is in direct proportion to the amount of physical effort applied to the pedal (par. 41).

13. Accelerator Pedal

Treadle type accelerator pedal is located on cab floor just to right of brake pedal (figs. 8 and 9). Engine is accelerated from idling speed to governed speed in varying degrees, depending upon pressure applied to pedal. When foot pressure is released, pedal will return to engine idling position.



A—IGNITION SWITCH
B—PRIMER PUMP KNOB
C—MAIN LIGHT SWITCH
D—WINCH INSTRUCTION PLATE
E—HORN BUTTON
F—TRANSMISSION INSTRUCTION PLATE
G—WINDSHIELD WIPER CONTROL KNOB
H—THROTTLE CONTROL HANDLE
J—CHOKE CONTROL KNOB
K—INSTRUMENT CLUSTER
L—AIR INTAKE (WITH FORDING)
M—MAP COMPARTMENT
N—VEHICLE IDENTIFICATION PLATE
P—DRAINING INSTRUCTION PLATE
Q—PUBLICATION PLATE
R—FIRE EXTINGUISHER
S—STARTER SWITCH LEVER
T—TRANSMISSION CONTROL LEVER
U—ACCELERATOR PEDAL
V—BRAKE PEDAL
W—HEAD LIGHT DIMMER SWITCH

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Figure 8. Instrument panel in driver's compartment.

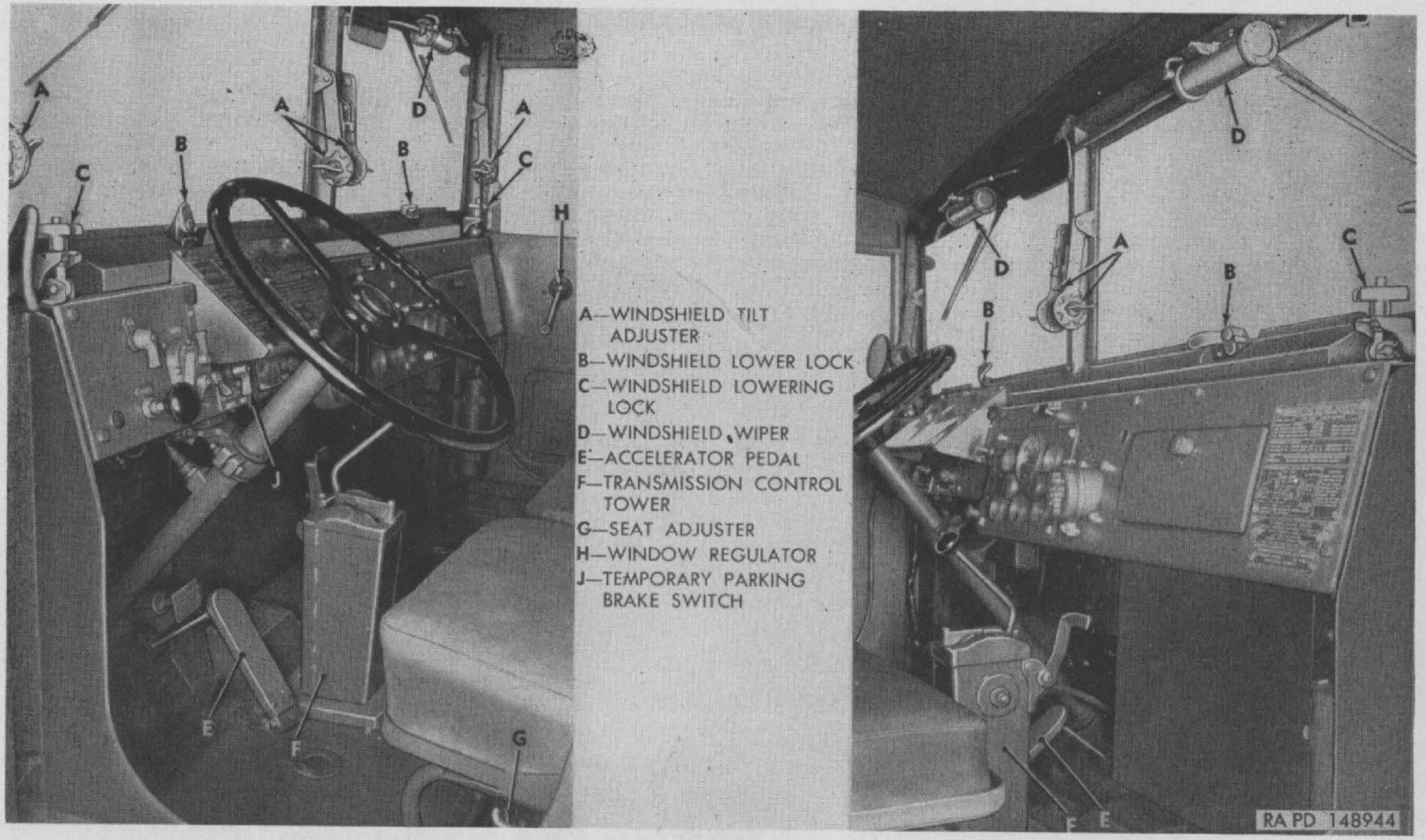


Figure 9. Left and right views into driver's compartment.

14. Parking Brake

a. PARKING BRAKE LEVER. Hand-operated lever is located to the right of driver between driver's and codriver's seat, near floor. A band type brake, mounted at rear of transfer, is applied by pulling up on lever which is held in any desired position by a pawl and sector device. Brake is released by squeezing release handle against lever, and lowering lever to floor. Brake is normally used to hold vehicle when parked.

b. TEMPORARY PARKING BRAKE SWITCH. Temporary parking brake switch, located on instrument panel under instruction plate panel at left of steering column (fig. 9), controls circuit to solenoid valve connected into master cylinder outlet hydraulic line. Plate under switch lever is marked ON, OFF, and TEMPORARY PARKING BRAKE ONLY. Operation of switch is described in paragraph 41*b* (2).

Caution: This parking brake is for emergency use only in the event of failure of the hand-operated parking brake, and should not be depended upon to hold the vehicle for extended periods. Hand-operated parking brake must be adjusted or repaired at the earliest possible opportunity, or the condition must be reported to ordnance maintenance personnel. Switch should remain in OFF position except when temporary parking brake is being used.

15. Transmission Control Lever

Control lever is located on control tower, to the right and slightly ahead of driver (fig. 8). The control lever operates in adequately marked shift pattern slots (fig. 13). Lever must be manually positioned in accordance with desired range and conditions as explained in paragraph 40.

16. Transfer Lever

Hand operated lever is under and slightly to the right of driver's seat near floor. Lever is operated up and down in a slot and is used to position transfer into neutral and driving positions. Plate on lever indicates positioning of lever in accordance to transmission instruction plate (fig. 12). Proper use of lever is explained in paragraph 39.

17. Power-Take-Off Lever

When winch is used, power-take-off control lever is located adjacent to the transfer lever. This lever is manually positioned to operate winch and is placed in various positions according to marked plate on handle and winch instruction plate (fig. 17). Operation of lever in conjunction with winch operation is explained in paragraph 45.

18. Ignition Switch

Lever-type ignition switch is located on instrument panel to driver's left (fig. 8). Lever must be turned to left to complete ignition circuit before engine can be started. When ignition circuit is completed, temperature gage, oil pressure gage, air pressure gage, and fuel level gage circuits are energized, permitting reading of the values on those gages.

19. Throttle Control Handle

The throttle control handle is located on instrument panel at the left of the instrument cluster (fig. 8). Throttle handle can be pulled out in varying degrees to accelerate engine from idle to governed speed. Handle is automatically locked in accelerating positions, and can be unlocked and pushed back after handle is turned one-quarter turn to right or left. This control is generally used to set throttle to desired starting and warming-up speed, and to obtain sustained speeds when operating auxiliary units.

20. Choke Control

Choke control knob is located on instrument panel just to left of instrument panel cluster (fig. 8). Choke control button is connected with carburetor choke valve which is closed proportionally to degree button is pulled out. Control is used when starting and operating a cold engine. Control button must be pushed in after engine is started and operating correctly.

21. Primer Pump

Primer pump knob is located on instrument panel at left-hand end (fig. 8). Pulling the knob out and pushing it in again, in a pumping action, pumps a stream of fuel directly into the intake manifold. The primer is used to facilitate engine starting during cold weather (par. 37).

22. Windshield Wiper Control

Wiper control knob is located on instrument panel at right of steering column, below the instruction plate panel (fig. 8). Turning the knob in varying degrees controls the action of the two air-operated windshield wipers. Each wiper is also equipped with a manually operated lever.

23. Main Light Switch

The main light switch is located on instrument panel to the driver's left (fig. 8). This switch is a three-lever type with main, auxiliary, and mechanical switch levers. The levers are positioned to control all lights on the vehicle (par. 42).

24. Dimmer Switch

Foot-operated dimmer switch is located on floor board, accessible to driver's left foot (fig. 8). The switch is used to control the upper and lower beams of the service driving head lights. Use of this switch permits driver to dim lights when passing other vehicles or to turn on bright lights when needed. Dimmer switch is only operative when main light switch is positioned on SER DRIVE (par. 42).

25. High Beam Light

Light is located in instrument panel cluster and is marked HIGH BEAM directly under light (fig. 10). This light illuminates whenever upper beam of service driving light is used.

26. Horn Button

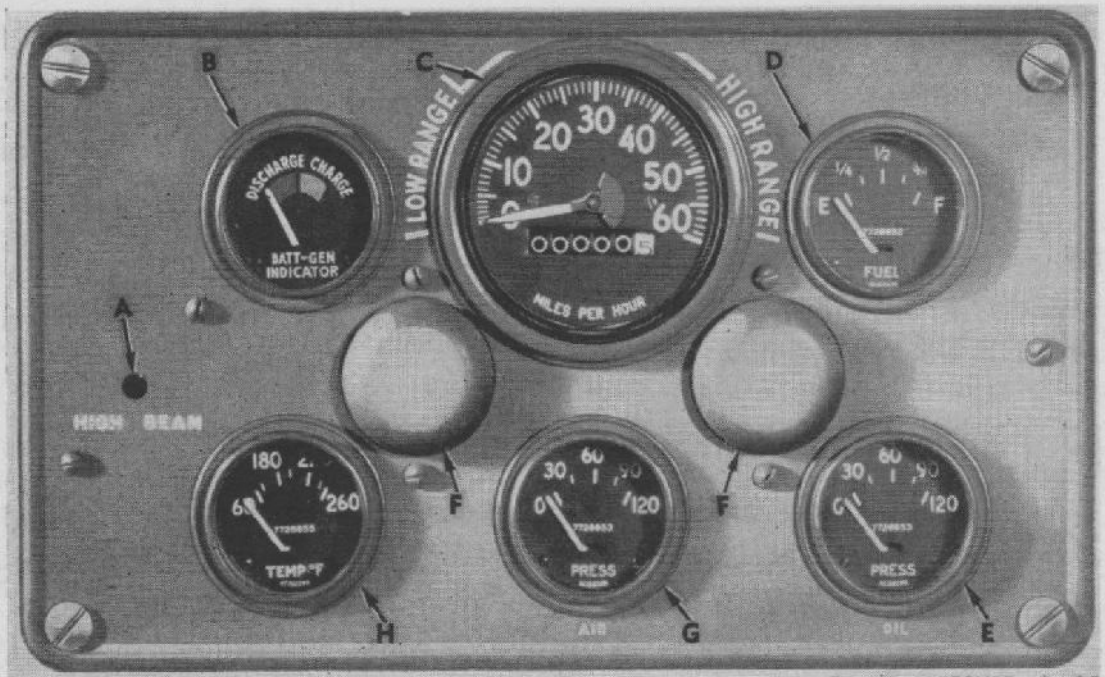
Horn button is located in center of steering wheel (fig. 8) and is depressed to sound air-horn.

27. Starter Switch Lever

Starter switch lever is mounted on transmission control tower (fig. 8). When hand lever is pulled toward driver, lever linkage engages starter switch mounted on starter field frame. The starter lever cannot be engaged until transmission control lever is shifted into neutral position.

28. Battery Charge Indicator

The indicator, marked BATT-GEN INDICATOR, is located in instrument cluster (fig. 10). Face of gage is divided into two arcs marked DISCHARGE and CHARGE. The DISCHARGE arc is colored red and the CHARGE arc is colored green. The purpose of the indicator is to indicate charging activity of the generating circuit. The indicator will generally show a charge reading (pointer in green arc) when engine is first started, and continue to show charging activity as engine speed is increased, depending upon electrical power being used. Abnormal discharge reading (pointer in red arc) with engine running at normal speed indicates deficiency in generating system. Failure to show charge reading while using all lights may also indicate deficiency in generating system.



A—HIGH BEAM LIGHT
B—BATTERY CHARGE INDICATOR
C—SPEEDOMETER
D—FUEL GAGE
E—OIL PRESSURE GAGE
F—PANEL LIGHTS
G—AIR PRESSURE GAGE
H—TEMPERATURE GAGE

RA PD 148995

Figure 10. Instrument panel cluster.

29. Temperature Gage

Temperature gage, marked TEMP ° F, is located in instrument panel cluster, directly under battery charge indicator (fig. 10). Face of gage is marked in graduations of 40° F from 60° to 260° F. After ignition switch is turned on, gage is activated by a sending unit mounted in engine thermostat housing. Purpose of the gage is to indicate temperature of engine cooling system in degrees Fahrenheit. Operating temperatures between 160° F. and 220° F. are satisfactory for engine operation under normal operating conditions. If temperature rises sharply during warm-up or normal operation, stop engine and determine cause. Excessive low operating temperatures during normal operation also indicates faulty cooling system.

30. Oil Pressure Gage

Oil pressure gage (marked OIL on panel under gage, and marked PRESS on gage face) is located in lower right portion of instrument panel cluster (fig. 10). Gage hand is marked in graduations of 30 psi from 0 to 120 psi. After ignition switch is turned on, gage is activated during engine operation by a sending unit connected to engine oil system gallery. Purpose of gage is to indicate engine oil pressure when engine is running. When engine is started cold, oil pressure may rise sharply, then recede to normal after engine is warmed up. With engine at slow idling, pressure should be approximately five psi. Absence of oil pressure during engine operation indicates faulty oiling system or inoperative gage circuit, and engine should be immediately stopped.

31. Air Pressure Gage

Air pressure gage (marked AIR on panel under gage, and marked PRESS on gage face) is located on instrument panel cluster to the left of oil pressure gage (fig. 10). Gage face is marked in graduations of 30 psi from 0 to 120 psi. After ignition switch is turned on, gage is activated by a sending unit connected to air pressure line. Purpose of the gage is to indicate air pressure in air storage tanks. Full pressure in system is 100 psi. With engine running, air compressor governor cuts in at approximately 75 psi and compressor builds pressure up to full pressure (100 psi). Do not drive vehicle until pressure is up to 60 psi. If, during operation, air pressure buzzer sounds (when below 60 psi) vehicle should be stopped and cause of air leakage corrected.

32. Fuel Gage

Fuel gage is located in upper right portion of instrument panel cluster (fig. 10). Face of gage is marked FUEL and is graduated; E (empty); ¼; ½; ¾; F (full). Purpose of gage is to indicate level of fuel in fuel tank. Ignition switch must be turned on to show reading on gage.

Caution: Do not permit ignition switch to remain on for any length of time if fuel gage shows E (empty). Submerged type fuel pump in tank is actuated when ignition switch is on and is lubricated by fuel; therefore pump may be damaged unless tank contains some fuel.

33. Speedometer

Speedometer is located in center of instrument panel cluster (fig. 10). Speedometer indicates truck road speed in miles-per-hour, and also records total mileage. Face of speedometer is marked in graduations of 1 mph from 0 to 60 mph. Maximum permissible road speeds in high and low transmission ranges are indicated on transmission control plate (fig. 12); these speeds are also marked on instrument cluster around circumference of speedometer (fig. 10).

34. Miscellaneous Controls

Other controls shown on figure 9, which may be used by driver during operation of truck, are explained in other paragraphs of this manual as follows:

a. DRIVER'S SEAT ADJUSTER. Refer to paragraph 273*b*.

b. WINDSHIELD ADJUSTMENTS. Refer to paragraph 271*b*.

Section III. OPERATION UNDER USUAL CONDITIONS

35. General

a. This section contains instructions for the mechanical steps necessary to operate the 2½ Ton 6 x 6 Cargo Truck M135 under conditions of moderate temperatures and humidity. For operation under unusual conditions, refer to section V of this chapter.

b. Before attempting to operate this vehicle, the driver should become familiar with important items and procedures pertaining to operation and driving of this truck which are described in other sections of this manual. These are—

(1) *Controls and instruments.* The driver must become familiar with the location and purpose of the controls and instruments as described in section II of this chapter.

(2) *Preventive maintenance by driver or operator.* The before-operation, during-operation, at-the-halt, and after-operation procedures outlined in paragraph 67 must be accomplished to obtain efficient operation.

(3) *Cab top and curtain positioning.* Procedures covering the positioning of cab top and curtains for driver protection, ventilation, or visibility are explained in paragraph 270.

(4) *Windshield positioning.* Procedures covering the positioning of windshield are explained in paragraph 271.

(5) *Seat adjustment and positioning.* Procedures covering the adjustment of driver's seat and the positioning of codriver's seat are explained in paragraph 273.

36. Positioning Hood

a. HOOD POSITIONS. The alligator type hood is retained in closed position with a conventional hood clasp on each side near front of hood. Hood can be raised to two positions.

b. FIRST RAISED POSITION. Release the hood clasp on each side of hood. Grasp nose of hood and raise to first position (fig. 11). Telescoping side supports will automatically lock and hold hood in this position. Inspection and light maintenance of engine accessories can be accomplished with hood in first raised position.

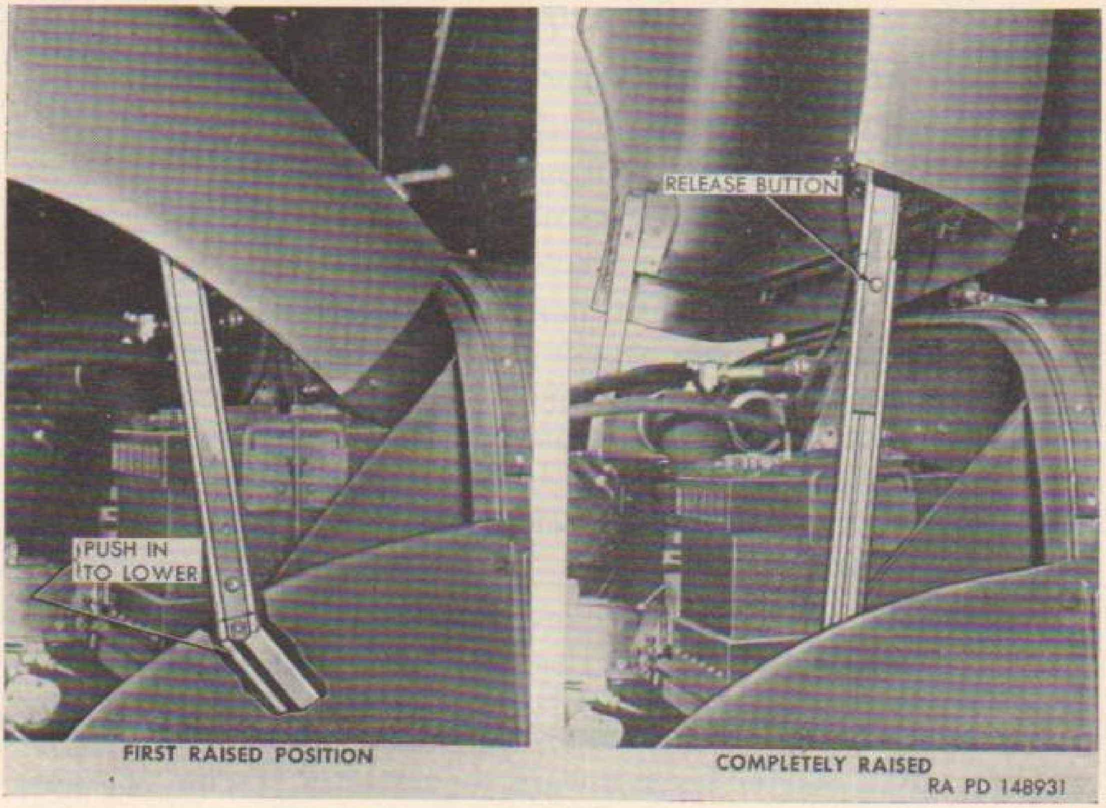


Figure 11. Positioning hood.

c. SECOND RAISED POSITION. Press release button (fig. 11) on each side support; then raise hood to a vertical position. More extensive maintenance and inspection operations can be accomplished with hood in completely raised position.

d. LOWERING HOOD. To lower hood from completely raised position, press release button on each side support; then lower hood to first raised position. To lower hood from first raised position, raise hood slightly, then slightly push lower support (fig. 11) on each side, toward cab. Hood can then be lowered to closed position.

37. Starting and Stopping Engine

a. STARTING THE ENGINE. Before starting the engine, the driver should accomplish the before-operation procedures outlined in paragraph 67.

(1) Before engine is started, position control levers as follows:

(*a*) *Transfer lever.* Place in UP-ENGAGED position (par. 39*b*).

(*b*) *Transmission control lever.* Place in N position (par. 40*c*).

(*c*) *Power-take-off lever (if used.)* Place in CENTER-NEUTRAL position (par. 45*a*).

(*d*) *Parking brake lever.* Pull up lever to fully apply brake.

(2) If engine is cold, pull out choke control knob (CHOKE). Pull out throttle-control handle (THROTTLE) about one-half inch.

(3) If vehicle has been parked in severe cold atmospheric temperature, use primer pump if necessary. Pull primer pump knob out and push in again with a pumping action. Two or three pumping operations should suffice. Do not use primer unnecessarily. During normal weather temperature conditions primer is not required to start engine.

(4) Turn ignition switch lever to on position.

Note. Low air preessure buzzer will sound after ignition switch is turned on if air pressure is below 60 psi. Buzzer will continue to sound after engine starts until pressure is built up to over 60 psi.

(5) Pull starter lever toward driver until starter operates. Transmission control lever must be in N position before starter lever can be operated. Release lever the instant engine starts.

Note. Starter should not be engaged for periods of more than 30 seconds.

After starter has been engaged without results, wait 10 to 15 seconds before using starter again. If after several attempts, engine will not start, determine the cause (par. 70*b*) and correct.

(6) After engine starts, adjust choke and hand throttle to even idling speed.

(7) Truck may be pushed or towed to start engine, if necessary (par. 43*a*).

b. STOPPING ENGINE. Engine should be permitted to idle for a few minutes before turning off ignition switch to stop engine.

38. Engine Warm-up

a. WARM-UP PERIOD. Engine should be permitted to operate through a short warm-up period whenever conditions permit. This warm-up period permits the driver to observe the gages for proper readings, and to check performance of the engine before the truck is placed under way. During warm-up period, engine should be run at normal idling speed.

Note. Engine should be run 3 to 5 minutes at idling speed before checking transmission oil level (par. 59*f*).

b. OPERATING TEMPERATURE. Operating temperatures between 160° and 220° F. are satisfactory for engine operation under normal operating conditions. Whenever conditions permit, engine temperature should attain 160° F. before vehicle is moved. If temperature rises sharply above 220° F. during warm-up or normal operation, stop engine and determine cause.

c. OIL PRESSURE. When engine is first started, oil consistency may cause a sharp rise in pressure reading. As engine warms up, pressure should recede slowly to normal (approximately 5 psi with engine idling). Pressure reading may fluctuate as engine speed decreases or increases. A sudden drop or an erratic fluctuation of pressure indicates faulty engine oiling system, and engine should be stopped and cause corrected.

d. BATTERY CHARGE INDICATOR. The indicator will generally show a charge reading when engine is started, and continue to show charging activity as engine speed is increased depending upon the electrical power being used.

e. AIR PRESSURE. When engine is started, low air pressure buzzer will sound if pressure is below 60 psi. Vehicle should not be moved until pressure is over 60 psi. Do not run engine over one-third throttle to build up air pressure during warm-up.

39. Use of Transfer

a. TRANSFER CONTROLS. Transfer is placed into neutral or driving position with a manually operated lever located slightly to right of and under driver's seat. Plate on the lever handle is marked UP-ENGAGED (transfer in driving position) and DOWN-NEUTRAL (transfer in neutral). Positions of lever are also indicated on transmission instruction plate (fig. 12). Lever operates in a slot and will lock in either up or down position.

b. USE OF LEVER. Normally, transfer lever should be placed in and remain in UP-ENGAGED (driving) position at all times including parking. However, for certain towing operations (par. 43) and winching operations (section IV of this chapter), transfer lever should be positioned as explained for such conditions.

c. FRONT AXLE ENGAGEMENT. Transfer mechanism provides automatic engagement and disengagement of front driving axle in accordance with road and load conditions. Transfer front axle engagement mechanism is manually shifted for operation in forword or reverse driving through interconnection with transmission manual shift linkage.

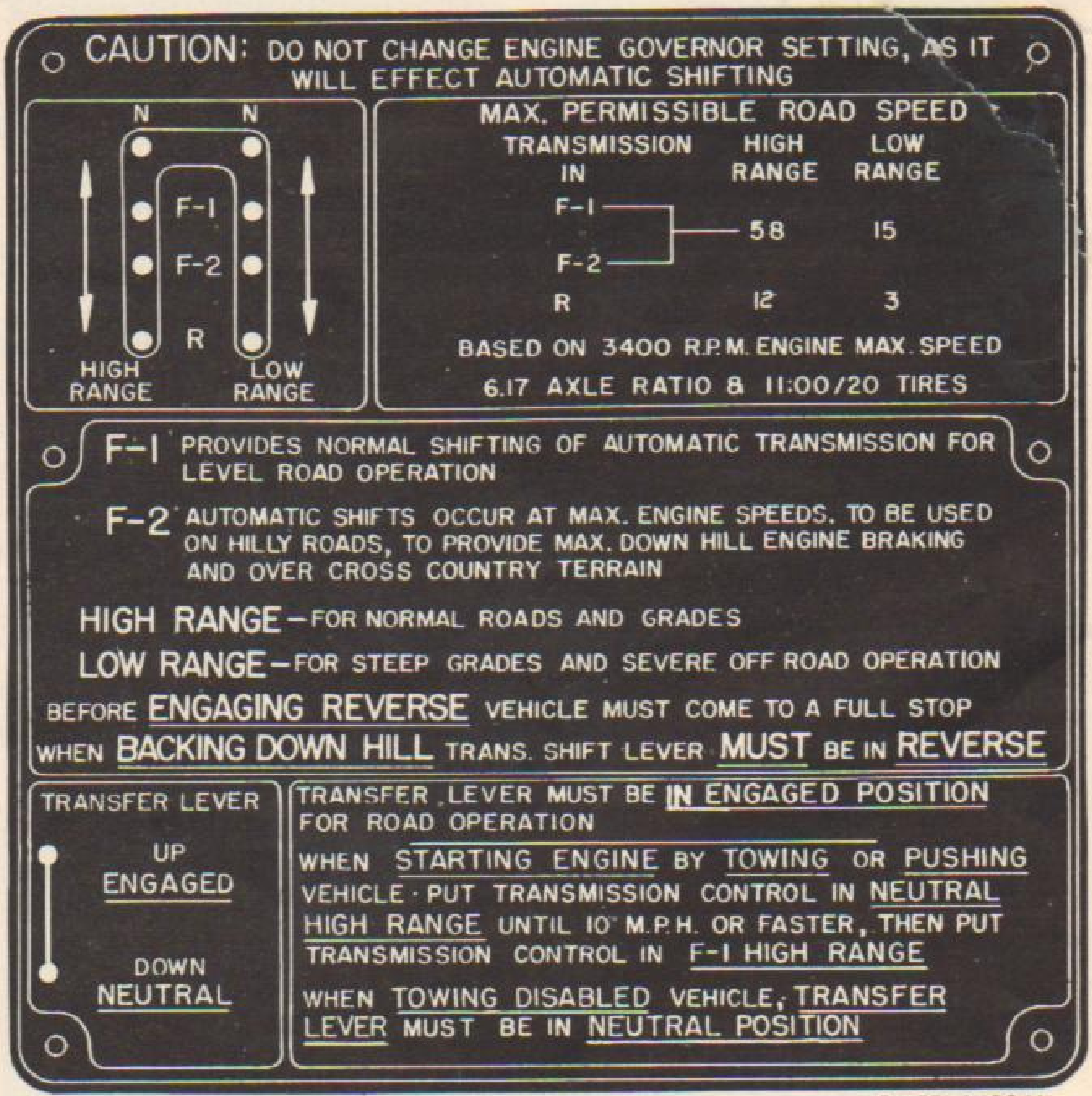


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Figure 12. Transmission instruction plate.

40. Use of Transmission

a. GENERAL. Transmission is automatic and does not require a clutch pedal for operation. Transmission has four automatic forward speeds and one reverse in each of two ranges, HIGH and LOW. The forward speeds in each range are selected automatically in accordance with performance demands required by load and road conditions. The driver manually selects control lever positions depending upon terrain conditions. When lever position is properly selected, maximum efficiency for any combination of conditions is provided.

b. SHIFT LOCK. Transmission cannot be moved out of neutral position unless throttle linkage is in idling position. If control cannot easily be moved out of neutral, do not use force. Make sure throttle and accelerator pedal are in idling position.

c. TRANSMISSION CONTROL LEVER POSITIONS. Transmission control lever, mounted on tower to right of driver, operates in a marked shift pattern slot (fig. 13). Shift positions are also indicated on transmission instruction plate (fig. 12).

(1) *Neutral.* Neutral position is marked N over LOW RANGE and HIGH RANGE slots. With lever in either neutral position, transmission is inoperative.

(2) *F-1 position.* Lever can be positioned in F-1 LEVEL (forward speed) position in either HIGH RANGE or LOW RANGE slot.

(3) *F-2 position.* Lever can be positioned in F-2 HILLY (forward speed) position in either HIGH RANGE or LOW RANGE slot.

(4) *Reverse.* Lever can be positioned in R reverse position in either HIGH RANGE or LOW RANGE slot.

(5) *Positioning lever.* Transmission control lever knob must be pressed downward when moving lever out of any position except N (neutral).

d. ACTION IN F-1 LEVEL POSITION. With transmission in F-1 position (in either HIGH RANGE or LOW RANGE), automatic shift patterns of the four automatic speeds vary according to throttle opening and vehicle speed. With light throttle, shifts occur at low speeds, and as throttle is opened, shifts occur at relatively higher speeds until full throttle is reached. When operating in 4th speed, a "forced downshift" to 3d speed can be obtained for maximum acceleration and power. This is accomplished by depressing accelerator to stop. Note that a slight resistance must be overcome to completely open the throttle. Transmission will automatically downshift from 4th to 3d ratio, providing vehicle speed (in HIGH RANGE) is less than 35 mph. Upshift from 3d to 4th ratio will occur whenever accelerator is released, or automatically when speed of approximately 38 mph is attained.

e. Action in F–2 Hilly Position. With transmission in F–2 position (in either HIGH RANGE or LOW RANGE), transmission will upshift from 1st to 2d ratios when speed of engine approaches maximum governed speed. Further upshifts will not occur within normal governed speed of engine. However, transmission can be held in 3d speed by first attaining that speed in F–1 position; then shifting into F–2 position. Downshift to lower ratios will not take place until engine speed is reduced to

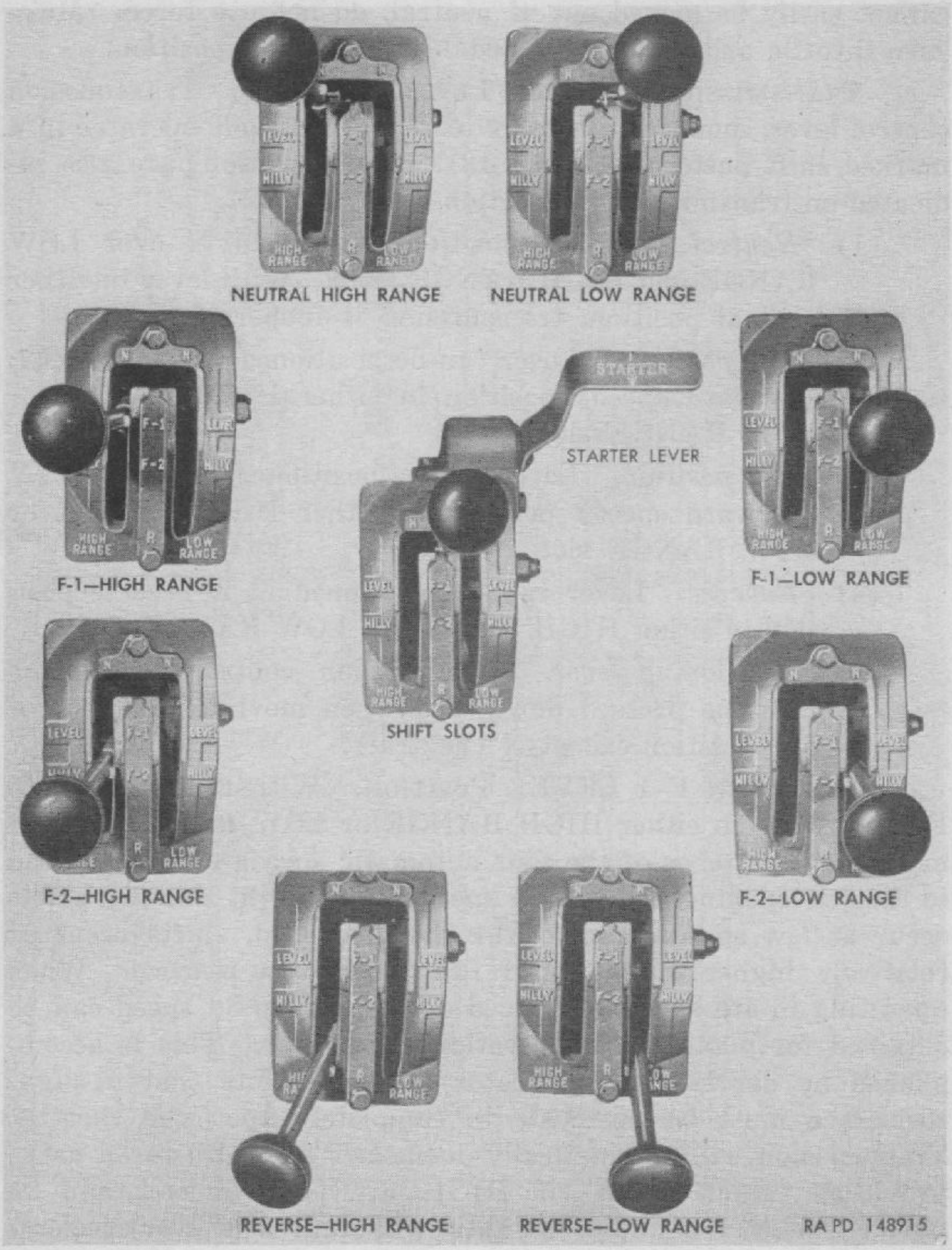


Figure 13. Transmission control lever positions.

approximately one-half governed speed. Consequently, transmission can be kept in a desired ratio over a wide range of engine speeds by proper use of accelerator. This permits proper ratios for climbing long hills and for traversing undulating terrain, and also provides maximum engine braking power when descending long or steep hills.

f. ACTION IN LOW RANGE. With transmission in LOW RANGE positions, road speed is reduced to approximately one-quarter of that obtained in equivalent HIGH RANGE positions, and pulling ability is increased accordingly. LOW RANGE positions should be used for off-the-road operation, and when load and road conditions cause vehicle speed to be reduced to 10–15 mph. Under such conditions, shift should not be made until vehicle speed is reduced accordingly.

Caution: Do not remain in LOW RANGE above 15 mph as this represents maximum speed in LOW RANGE as shown on instrument cluster (fig. 10) and transmission instruction plate (fig. 12). Faster speeds should be obtained only in HIGH RANGE.

g. NORMAL DRIVING.

(1) The driver should keep in mind that the *greater part of normal forward driving is accomplished with transmission in F–1 LEVEL, HIGH RANGE position.* Control lever should remain in this position except when parking, reversing, or when conditions necessitate driving in F–2 HILLY position, or in LOW RANGE (either in F–1 LEVEL or F–2 HILLY).

(2) With transmission in forward driving position, the truck will move forward as accelerator pedal is pressed down. Transmission is automatically shifted through range of ratios as vehicle speed increases, and will progressively downshift as road speed decreases.

(3) To stop truck for normal traffic stop, release accelerator and apply brakes as necessary. It is not necessary to move transmission lever out of driving position unless vehicle is to remain stopped for some time. To again move truck, release brakes and depress accelerator pedal.

Note. Whenever driver leaves his seat, parking brake must be applied and transmission control lever moved to N (neutral) position; otherwise just an accidental touching of accelerator pedal will move truck.

h. REVERSING.

(1) To engage reverse (R) in either HIGH RANGE or LOW RANGE, vehicle must be brought to a complete stop.

(2) While pressing down on lever knob, move lever to R in HIGH RANGE or LOW RANGE, as desired. Press down on accelerator to move truck. Release accelerator and apply brake to stop truck.

(3) To move lever from R to any other position, truck must be at a complete stop.

i. PARKING. When parking or when working on vehicle with engine running, always place transmission control lever in neutral (N) position and apply parking brake. *Transmission cannot be locked in gear to park on a steep incline.* Parking brake must be used to hold truck under such conditions.

j. COASTING. Do not coast in N (neutral) and with engine not running. If attempting to start engine by coasting, follow instructions in paragraph 43*a*. If backing down hill, always place lever in R position.

41. Use of Brakes.

a. SERVICE BRAKES.

(1) *Air pressure.* Service brake system in an air-actuated hydraulic system. Vehicle should not be moved until air pressure is at least 60 psi. Vehicle should be stopped if pressure falls below 60 psi (when buzzer sounds). Some degree of braking can be obtained without air pressure assistance; however, considerable physical effort must be applied to brake pedal. Vehicle should not be moved under these circumstances except in case of emergency.

(2) *Application.* Degree of brake application is in direct proportion to the amount of physical pressure applied to brake pedal. Gradually apply brakes as hard as speed and road conditions permit; then reduce pedal pressure gradually as speed is reduced, so that a very slight pressure is used at completion of stop. If brakes are applied lightly at beginning, and pressure increased as speed decreases, the final high pressure will produce a severe stop.

b. PARKING BRAKE.

(1) *Hand-operated parking brake.* Brake is applied by pulling up on hand lever located at right of driver. To release brake, pull up on lever, and at the same time squeeze release handle against lever. While holding release handle against lever, lower lever to floor, engaging lever in clip on floor. Brake should be used only for holding the vehicle when parked, and should not be used to stop vehicle except in case of emergency.

(2) *Temporary parking brake.* Temporary parking brake is controlled by switch on instrument panel (par, 14*b*), which controls circuit to solenoid valve connected into master cylinder outlet hydraulic line.

Caution: This parking brake is for emergency use only in the event of failure of the hand-operated parking brake, and should not be depended upon to hold the vehicle for extended periods. Hand-operated parking brake must be adjusted or repaired at the earliest possible opportunity, or the condition must be reported to ordnance maintenance personnel.

When switch is turned to ON position and service brakes applied, solenoid acts to prevent hydraulic brake fluid returning to the master cylinder, thus holding the hydraulic brakes applied. To release brakes, turn switch to OFF position. Switch may be turned ON either before or after applying the service brakes, but it must be turned ON before releasing brake pedal to hold brakes applied.

42. Use of Lights

a. MAIN LIGHT SWITCH. All lights are controlled by the three-lever main light switch (fig. 14) located on instrument panel (fig. 8).

(1) *Main switch lever.* The five-position main switch lever is located at upper part of switch with lever pointing up (fig. 14). This lever can be positioned to control all lights except instrument panel lights and parking lights. The mechanical (or locking) switch lever must be used when positioning main switch lever to BO DRIVE, or STOP LIGHT or SER DRIVE positions.

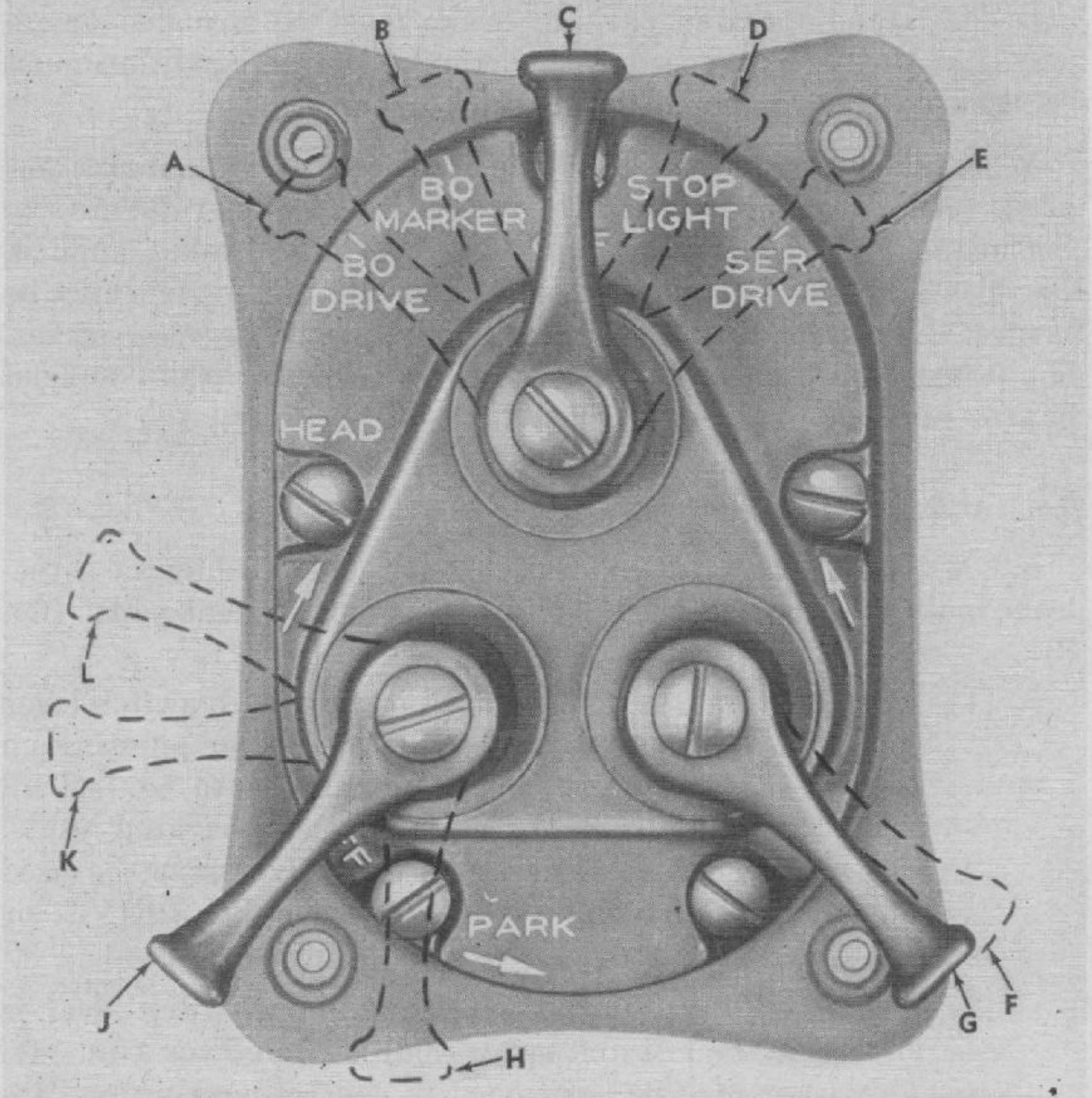
(2) *Auxiliary switch lever.* The auxiliary switch lever is located to the left and below main switch lever (fig. 14). This lever may be positioned to control parking and instrument panel lights when main switch lever is in positions as explained in *b* below.

(3) *Mechanical switch lever.* The mechanical (or locking) switch lever is located to the right and below the main switch lever (fig. 14). This lever must be held in raised position before main switch lever can be positioned to BO DRIVE, STOP LIGHT, or SER DRIVE positions.

b. OPERATION OF MAIN LIGHT SWITCH.

(1) *OFF position.* With main switch lever in OFF position, all lights are off.

(2) *Blackout marker position.* When main-switch lever is turned to the left to BO MARKER position, circuits for blackout marker lights, blackout stop light and blackout tail lights are energized. The auxiliary-switch lever can be turned up for dim or bright instrument panel lights.



A—MAIN SWITCH—"BO DRIVE" POSITION
B—MAIN SWITCH—"BO MARKER" POSITION
C—MAIN SWITCH—"OFF" POSITION
D—MAIN SWITCH—"STOPLIGHT" POSITION
E—MAIN SWITCH—"SER DRIVE" POSITION
F—MECHANICAL SWITCH—UNLOCKED
G—MECHANICAL SWITCH—LOCKED
H—AUXILIARY SWITCH—"PARK" POSITION
J—AUXILIARY SWITCH—"OFF" POSITION
K—AUXILIARY SWITCH—DIM PANEL LIGHTS
L—AUXILIARY SWITCH—BRIGHT PANEL LIGHTS

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Figure 14. Main light switch positions.

(3) *Blackout drive position.* When main-switch lever is turned to the left to BO DRIVE position, the circuits for blackout head light is energized, as well as circuits for blackout marker, blackout stop, and blackout tail lights. The mechanical switch must be held in unlocked position to turn main switch lever from BO MARKER to BO DRIVE. The auxiliary-switch lever can be turned up for dim or bright instrument panel lights.

(4) *Stop light position.* The mechanical switch lever must be held in a raised position while main switch lever is being placed into STOP LIGHT position. This position is used for daylight driving. Left service stop light will illuminate when brakes are applied.

(5) *Service drive position.* The mechanical switch lever must be held in raised position while main switch lever is being placed into SER DRIVE position from OFF. Main switch lever can be placed into SER DRIVE from STOP LIGHT without raising mechanical switch lever. When main switch lever is in SER DRIVE, right and left service head lights, and left service tail light are illuminated. Left service stop light will illuminate when brake is applied.

(6) *Parking position.* After main switch lever is placed into SER DRIVE, auxiliary switch lever can be positioned into PARK to illuminate right and left front parking lights and left service tail light. Instrument panel lights are dim with auxiliary lever in PARK position. With main switch lever remaining in SER DRIVE, auxiliary switch lever can be placed in OFF, or instrument panel light positions, to again illuminate service lights.

(7) *Instrument panel lighting.* With main switch lever in any position except OFF, auxiliary switch lever can be turned to left from OFF to first position for dim panel lights or to second position for bright panel lights.

c. DIMMER SWITCH. Foot-operated dimmer switch, located on floor to driver's left (fig. 8), is used to control high and low service head light beams. When the high beam is used, light on instrument panel cluster (HIGH BEAM, fig. 10) will illuminate.

d. TRAILER RECEPTACLE (fig. 15). The trailer light receptacle at left rear of frame is interconnected with mainlight switch. The main light switch positions control blackout and service lights on trailer in same manner as controlled on truck. Clip on receptacle cover holds trailer harness plug in place.

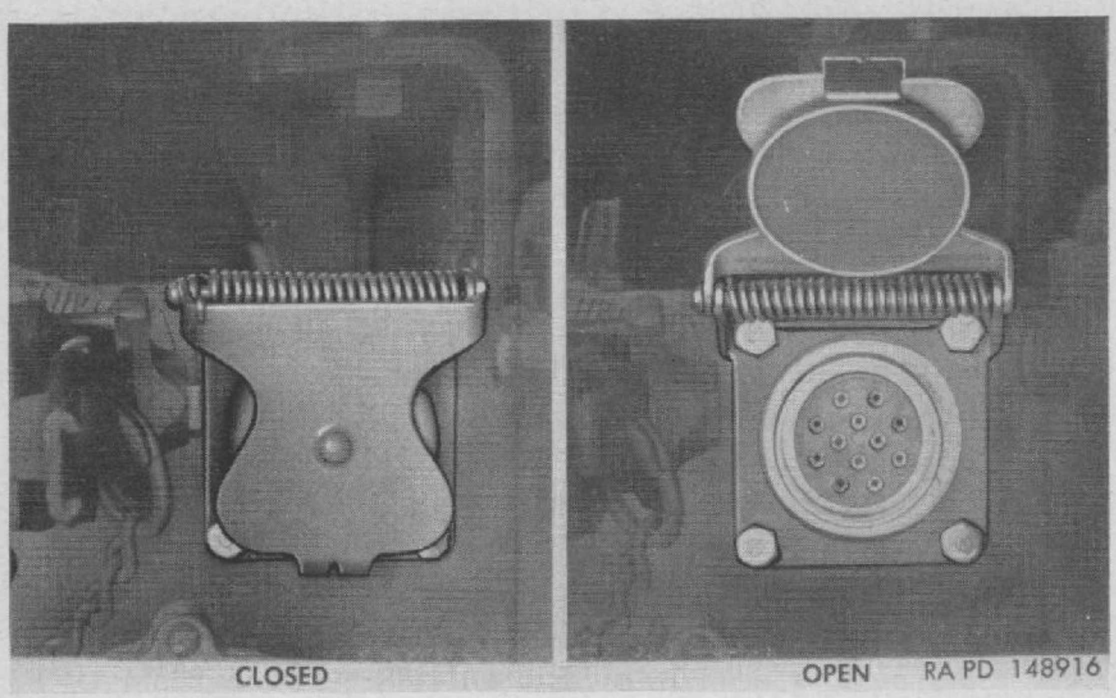

Figure 15. Trailer light receptacle.

43. Towing the Vehicle

a. TOWING TO START ENGINE. Engine can be started by pushing or towing vehicle; however, succeeding instructions must be carefully followed to avoid damage to transmission.

(1) Raise transfer lever to UP-ENGAGED position.

(2) Place transmission control lever into N HIGH RANGE (fig. 13).

(3) Use choke, throttle, and primer pump as described for normal starting of engine (par. 37*a*).

(4) Turn ignition switch to ON position. When a vehicle speed of 10-12 mph is reached, move transmission control lever into F-1 HIGH RANGE position (fig. 13).

Caution: Do not place transmission control lever into F-2 or into any LOW RANGE position.

(5) If engine fails to start within a reasonably short distance, determine cause and correct.

b. TOWING DISABLED VEHICLE. Before towing a disabled vehicle, place transmission lever into N position, and transfer lever into DOWN-NEUTRAL position in the disabled vehicle. Driver of the towing vehicle must keep in mind that brakes on the disabled vehicle may be less effective than normal, since air pressure may be reduced or depleted.

c. USE OF PINTLE (fig. 16). To open pintle, pull lock pin from upper half of pintle. Pull trigger handle rearward and at same time, pull up on upper half of pintle. To close, push upper half down against pintle hook. Latch will automatically engage. Insert chained cotter pin in hole in latch.

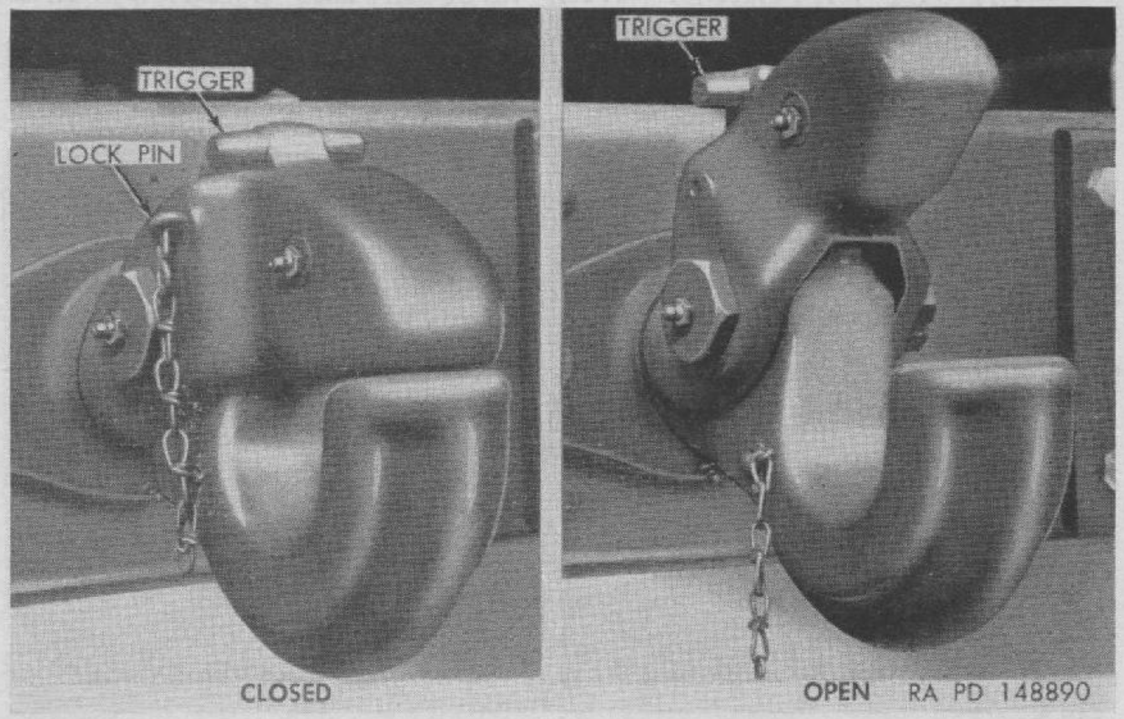

Figure 16. Pintle operating positions.

Section IV. OPERATION OF MATÉRIEL USED IN CONJUNCTION WITH MAJOR ITEM

44. Winch Description

The winch assembly, mounted at front of some trucks, is operated by a power-take-off on tranfer through drive shafts. Winch can be used as explained in paragraph 45 below. For complete description of winch, refer to paragraph 284.

45. Winch Controls

a. POWER-TAKE-OFF LEVER. The engagement of the power-take-off which drives winch is obtained by means of a lever, located under right side of driver's seat. Lever operates up and down in a three position slot. Positions of the lever are marked on lever handle plate and are also indicated on winch instruction plate (fig. 17). These positions are—

(1) *DOWN-FORWARD.* With lever in this position, cable can be wound in on drum as when pulling load (par. 46*b*).

(2) *CENTER-NEUTRAL.* With lever in center position or NEUTRAL, winch is inoperative (except for unwinding cable at winch) (par. 46*d*).

(3) *UP-REVERSE.* With lever in this position, winch cable can be unwound under load (par. 46*c*).

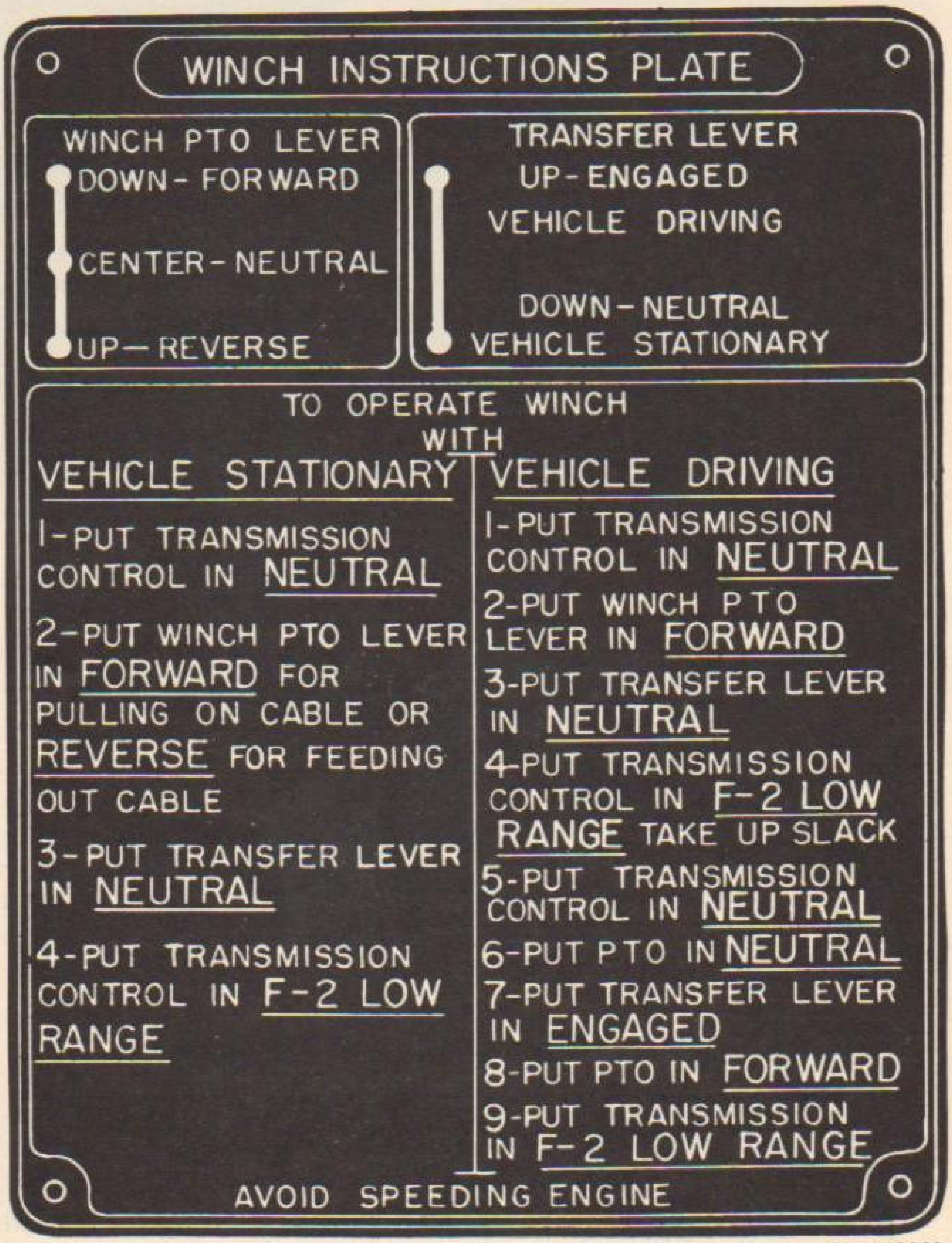

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Figure 17. Winch instruction plate.

b. CONTROLS AT WINCH.

(1) *Drum clutch lever.* Hand operated lever, located at right side of winch (fig. 18), is used to engage or disengage winch drum from power-take-off drive shaft. Pulling the lever away from winch engages drum. Pushing lever in toward winch disengages drum.

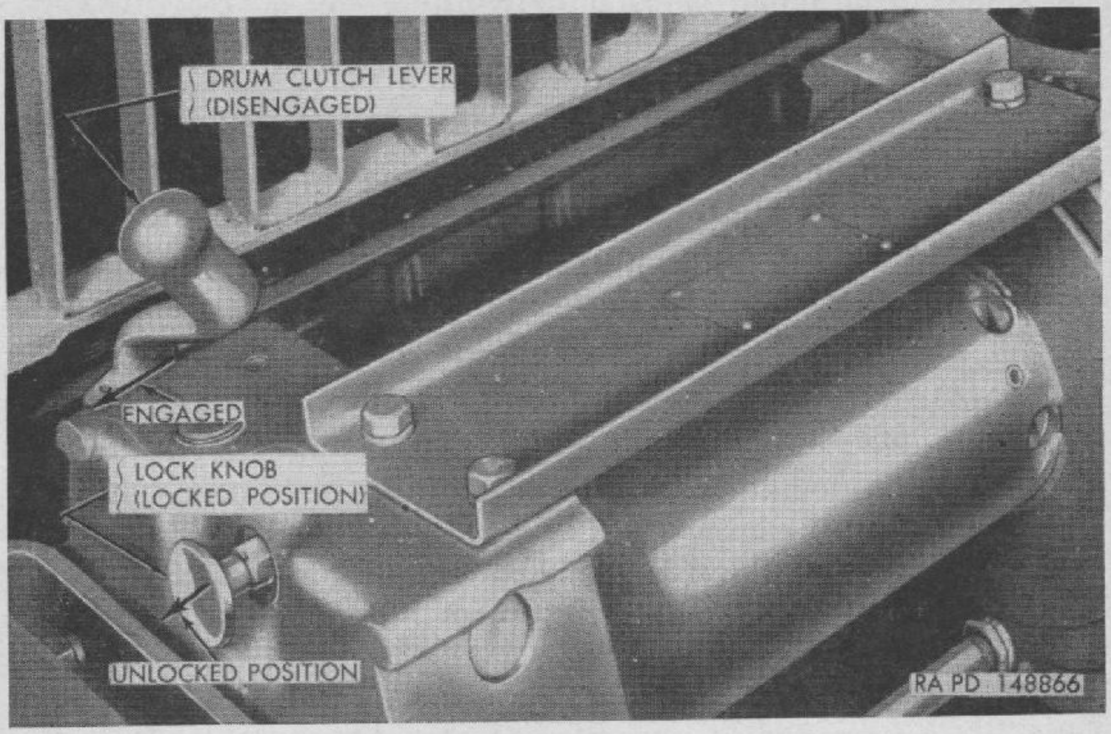


Figure 18. Controls at winch.

(2) *Lock knob.* Lock knob, on right side of winch frame (fig. 18), locks drum to prevent cable unwinding, as when under way. Knob is pulled out and turned one-quarter turn to disengage drum. To again engage drum, turn knob one-quarter turn and release. Inner end of lock engages one of several holes in drum.

(3) *Automatic controls.* An automatic safety brake in winch mechanism will sustain a load while power-take-off lever is being positioned. A drag brake will prevent drum from over-running cable when cable is being pulled from drum.

46. Winch Operation

a. VEHICLE IN MOTION (WINCH NOT IN USE).

(1) Place power-take-off lever into NEUTRAL.

(2) Push drum clutch lever at winch (fig. 18) in toward winch drum (disengaged postion). Winch will not operate with lever in this position.

(3) Make sure that lock knob (fig. 18) is in, engaging drum (locked position). Cable will not unwind with lock knob in this position.

b. PULLING LOAD (WINDING IN CABLE).

(1) *With vehicle stationary.*

(*a*) Pull out lock knob at winch (fig. 18) and rotate one-quarter turn to disengaged position (knob out).

(*b*) Pull drum clutch lever (fig. 18) outward as far as possible (away from winch drum).

(*c*) Lower transfer lever to DOWN-NEUTRAL position. Apply parking brake firmly. Move transmission control lever to N (neutral) position. Start engine.

(*d*) Lower power-take-off lever to DOWN-FORWARD position. With engine idling, move transmission control lever to F–2 LOW RANGE position.

(*e*) Use hand throttle to accelerate engine to not over one-third throttle (aprx 1,200 rpm), to pull in cable.

(*f*) Automatic brake, incorporated in winch, will hold load if engine speed is reduced to slow idle or if power-take-off lever is shifted into CENTER-NEUTRAL position.

Note. Winch delivers maximum power with first layer wound on drum. Under many conditions, this is not possible; however, pay out as much cable from drum as possible before starting to pull.

(2) *Winching out vehicle (with driving wheels assistance).*

(*a*) At winch, pull out lock knob and rotate one-quarter turn to unlocked position (fig. 18). Pull drum clutch lever outward as far as possible (away from winch drum).

(*b*) Place transmission control lever in N (neutral). Start engine.

(*c*) Place power-take-off lever in DOWN-FORWARD position.

(*d*) Place transfer lever in DOWN-NEUTRAL position.

(*e*) With engine idling, move transmission control lever to F–2 LOW RANGE position. Accelerate engine enough to take up slack in cable. Reduce engine speed to idle, move transmission control lever to N (neutral), and raise power-take-off lever to CENTER-NEUTRAL position.

(*f*) Raise transfer lever to UP-ENGAGED position, place power-take-off lever in DOWN-FORWARD position, then move transmission control lever to F-2 LOW RANGE. With hand throttle, accelerate engine (not over one-third throttle) to pull in cable, at the same time providing driving wheels assistance. Avoid speeding the engine.

c. PAYING OUT LOAD (UNWINDING CABLE UNDER LOAD).

(1) Paying out or unwinding cable under load should be accomplished in the cab.

(2) At winch (fig. 18), pull out lock knob and rotate one-quarter turn to hold in unlocked position. Pull drum clutch lever as far as possible away from winch drum (engaged position).

(3) Place transmission control lever in N (neutral). Start engine.

(4) Place transfer lever in DOWN-NEUTRAL position. Place power-take-off lever in UP-REVERSE position.

(5) With engine idling, place transmission control lever into F-2 LOW RANGE.

(6) Accelerate engine (not over one-third throttle) to pay out cable.

Note. Cable can also be payed out with power-take-off lever in DOWN-FORWARD position by placing transmission control lever in R (reverse), either in HIGH RANGE or LOW RANGE.

d. UNWINDING CABLE AT WINCH. Push drum clutch lever in toward winch drum (disengaged position). Pull out lock knob and rotate one-quarter turn to unlocked position. Place power-take-off lever in CENTER-NEUTRAL position. Pull out necessary cable from drum. Drag brake will keep drum from spinning.

e. WINDING CABLE AFTER USE.

(1) *From cab.*

(*a*) At winch (fig. 18), pull out lock knob and rotate to unlocked position (knob out). Pull drum clutch lever outward as far as possible away from winch drum (engaged position).

(*b*) Attach end of cable to suitable anchor to provide tension on entire cable while winding in.

(*c*) Place transmission control lever in N (neutral), then start engine.

(*d*) Lower transfer lever to DOWN-NEUTRAL. Lower power-take-off lever to DOWN-FORWARD.

(*e*) With engine idling, move transmission control lever to F-2 LOW RANGE.

(f) Apply light pressure to brake pedal, and accelerate engine (not over one-third throttle) to wind in cable to insure a tight, neat wind.

(2) *At winch.*

(a) Apply tension to cable by attaching end to a moveable object heavy enough to maintain a tension. If too much tension is applied, drum clutch lever cannot be disengaged while winch drum is turning.

(b) At winch, push drum clutch lever as far as possible toward winch drum (disengaged position). Pull out lock knob and rotate to disengaged position (knob out).

(c) With transmission control lever in N (neutral), start engine.

(d) Lower transfer lever to DOWN-NEUTRAL. Apply parking brake firmly. Lower power-take-off lever to DOWN-FORWARD position.

(e) Lock hand throttle to desired speed (not over one-third throttle.

(f) At winch, wind in cable by means of drum clutch lever. Pull lever outward to engage winch drum. Push lever toward winch to disengage winch drum.

Note. Cable should not be rewound on drum after use without some tension on cable. Winding on first layer of cable is particularly important. Coils of cable must be tight against each other to prevent coils on next layer pressing down between preceding coils. Wind cable evenly and slowly on drum. Do not handle cable with bare hands. Use gloves or a bar to guide cable evenly on drum.

47. Fire Extinguisher

a. GENERAL. Fire extinguisher is mounted inside cab at right-hand side below instrument panel (fig. 8). Fire extinguisher is liquid type, charged with carbon tetrachloride.

b. OPERATION. Remove fire extinguisher from bracket. Turn to left to unlock, then pump handle in and out. Direct spray at source of flame. Put out one section of fire completely before attempting to extinguish another.

Caution: Action of carbon tetrachloride on flame produces a toxic gas; avoid exposure to fumes.
Refill extinguisher immediately after use.

c. REFILLING. Check quantity of liquid in fire extinguisher by locking handle, then shaking. Extinguisher must be completely full at all times. Remove plug and gasket from top of extinguisher. Using funnel, fill extinguisher completely with carbon tetrachloride; then install gasket and plug. Do not use water or liquids other than fire extinguisher liquid. Container and funnel must be clean and free from moisture, since extinguisher liquid and water combine into a liquid highly corrosive to interior mechanism of extinguisher.

Section V. OPERATION UNDER UNUSUAL CONDITIONS

48. General Conditions

a. In addition to the operating procedures described for usual conditions, special instructions of a technical nature for operating and servicing this vehicle under unusual conditions are contained or referred to herein. In addition to the normal preventive maintenance service, special care in cleaning and lubrication must be observed where extremes of temperature, humidity, and terrain conditions are present or anticipated. Proper cleaning, lubrication, and storage and handling of fuels and lubricants not only insure proper operation and functioning, but also guard against excessive wear of the working parts and deterioration of the matériel.

b. TM 21-300 contains very important instructions on drivers selection, training, and supervision and TM 21-305 prescribes special driving instructions for operating wheeled vehicles under unusual conditions.

Caution: It is imperative that the approved practices and precautions be followed. A detailed study of these TM's is essential for use of this matériel under unusual conditions.

c. Refer to paragraphs 60 to 63 inclusive for lubrication under unusual conditions, to table III paragraph 67 for preventive maintenance checks, and to chapter 3, section XXXV, for maintenance procedures.

d. When chronic failure of matériel results from subjection to extreme conditions, report of the condition should be made on DA AGO Form 468 (par. 2*d*).

49. Extreme-Cold Weather Conditions

a. General Problems.

(1) Extensive preparation is necessary of matériel scheduled for operation in extreme cold weather. Generally, extreme cold will cause lubricants to thicken or congeal, freeze batteries, or prevent them from furnishing sufficient current for cold weather starting, crack insulation,

and cause electrical short circuits, prevent fuels from vaporizing and properly combining with air to form a combustible mixture for starting, and will cause the various construction materials to become hard, brittle, and easily damaged or broken.

(2) For description of operations in extreme cold, refer to FM 70-15 as well as to TM 9-2855.

Caution: It is imperative that the approved practices and precautions be followed. TM 9-2855 contains information which is applicable to this vehicle as well as to all other vehicles. It must be considered an essential part of this manual, not merely an explanatory supplement to it.

b. WINTERIZATION EQUIPMENT. Information on winterization equipment used for operation in extreme cold weather 0° to −65° F. is contained in SB 9-16.

c. FUELS, LUBRICANTS, AND ANTIFREEZE COMPOUNDS (STORAGE, HANDLING, AND USE). The operation of equipment at arctic temperatures will depend to a great extent upon the condition of the fuels, lubricants, and antifreeze compounds used in the equipment. Immediate effects of careless storage and handling or improper use of these materials are not always apparent, but any deviation from proper procedures may cause trouble at the least expected time. Refer to SB 9-16 for detailed instructions.

50. Extreme Cold Weather Operation

a. GENERAL.

(1) The driver or operator must always be on the alert for indications of the effect of cold weather on the vehicle.

(2) The driver or operator must be very cautious when placing the vehicle in motion after a shutdown. Congealed lubricants may cause failure of parts. Tires frozen to the ground or frozen to the shape of the flat spot while underinflated must be considered. One or more brake shoes may be frozen fast and require preheating to avoid damage to the mating surfaces. After warming up the engine thoroughly, place transmission in F-2 LOW RANGE and drive vehicle slowly about 100 yards to permit lubricant in all gear cases to be evenly distributed, being careful not to stall the engine. This should heat transmission and tires to a point where normal operation can be expected.

(3) Constantly note instrument readings. If temperature gage reading quickly exceeds 220° F, stop the vehicle and investigate the cause.

b. AT HALT OR PARKING.

(1) When halted for short shutdown periods, the vehicle should be parked in a sheltered spot out of the wind. If no shelter is available, it will be helpful to park so that the vehicle engine does face into the wind. For long shutdown periods, park on high ground or in most desirable position available; if high dry ground is not available, effort should be made to prepare a footing of planks or brush. Chock in place if necessary.

(2) When preparing a vehicle for shutdown period, place control levers in the neutral position to prevent them from possible freezing in an engaged position. Freezing may occur when water is present due to condensation.

(3) Clean all parts of the vehicle of snow, ice, and mud as soon as possible after operation. Refer to table III paragraph 67 for detailed after-operation procedures. If the winter front and side covers are installed, be sure to protect all parts of the engine and engine accessories against entrance of loose, drifting snow during the halt. Cover and shield the vehicle but keep the ends of the canvas paulins off the ground to prevent them from freezing to the ground.

(4) If no power plant heating device is present, the battery should be removed and stored in a warm place.

(5) Refuel immediately in order to reduce condensation in the fuel tanks.

51. Extreme Hot Weather Operation

a. GENERAL. Operate vehicle at maximum engine speed to maintain maximum air, oil, and water circulation. Continuously watch the temperature gage and halt the vehicle for a cooling-off period whenever necessary and the tactical situation permits. Do not stop engine to cool it off; run at fast idle to maintain good air, oil, and water circulation. Make frequent inspections and servicing of cooling unit, oil filter, and air cleaner. If the engine temperature consistently rises above 220° F, look for dust, sand, or insects in radiator fins and blow out any accumulation with compressed air or water under pressure. Flush cooling system if necessary.

b. AT HALT OR PARKING.

(1) Do not park the vehicles in the sun for long periods, as the heat and sunlight will shorten the life of the tires. When practicable, park vehicle under cover to protect it from sun, sand, and dust.

(2) Cover inactive vehicles with paulins if no other suitable shelter is available. Where entire vehicle cannot be covered, protect windshields, windows, and radiator against etching by sand, and protect engine compartment against entry of sand. Head vehicle into wind.

(3) Vehicles inactive for long periods in hot humid weather are subjected to rapid rusting and accumulation of fungi growth. Make frequent inspections and clean and lubricate to prevent excessive deterioration.

52. Operation on Unusual Terrain

a. GENERAL.

(1) Vehicle operation on snow or ice and in deep mud requires the use of tire chains. Chains must be installed in pairs (front and rear) to prevent power-train damage and wear. Select a transmission range, depending on terrain and grade, to permit getting vehicle in motion with minimum throttle. Avoid use of maximum throttle, as this may cause vehicle to spin and "dig-in."

(2) Operators at all times must know the position in which the front wheels are steered, as the vehicle may travel straight ahead even though the wheels are cramped right or left. A piece of string tied to the front portion of the steering wheel rim in "straight-ahead" position will indicate to the driver whether the front wheels are "ploughing." This ploughing action may cause the vehicle to stall, or suddenly veer to right or left.

(3) If one or more wheels become mired and the others spin, it may be necessary to be winched or towed by companion vehicle, or to jack up the wheel which is spinning and insert planking or matting beneath it. Do not jam sticks and stones under a spinning wheel, as this only forms an effective block and will wear the tire tread unnecessarily.

(4) Operation in sand requires daily cleaning of air cleaners and fuel and oil filters.

(5) At high altitudes, coolant in vehicles boils at proportionately lower points than 212° F, thus it will be

necessary to keep a close watch on the engine temperature during the summer months.

b. AFTER-OPERATION PROCEDURES. Clean all parts of the vehicle of snow, ice, mud, dust, and sand as soon as possible after operation. Particular care should be taken to remove collections of ice, snow, and mud from the wheels, radiator core, engine components, steering knuckles and arms, brake cylinder boots and hoses, crankcase breather oil filters, air cleaners, and electrical connections.

Caution: Remove large collections of ice, caked mud, etc, from under fenders where accumulated.

53. Fording Operation

a. GENERAL. In fording, vehicles may be subjected to water varying in depth from only a few inches to depths sufficient to completely submerge the vehicle. Factors to be considered are spray-splashing precautions, normal fording capabilities, deep water fording using fording kits, and accidental complete submersion.

b. NORMAL FORDING. Fording of bodies of water up to maximum vehicle fording depth of 60 inches is based on the standard vehicle with water-proofing protection privided for critical units when manufactured but without deep water fording kit.

Caution: Fording to maximum depth (60 in) should be undertaken only for brief periods or short distances. If water over 30-inches deep is to be forded repeatedly or for extended periods, fording kit should be used.
Observe the following precautions:

(1) Do not exceed the known fording limits of the vehicles.

(2) The engine must be operating satisfactorily before attempting to ford.

(3) Shift transmission control lever into F-2 LOW RANGE. Enter the water at low engine speed. After submersion, increase engine speed. Should the engine stall while submerged, it may be started in the usual manner.

(4) All normal fording should be at speeds of from 3 to 4 mph to avoid forming a "bow wave." Brake efficiency will be decreased after emergence. Applying the brakes a few times will help dry out the brake linings after dry land has been reached.

(5) If accidental complete submersion occurs, the vehicle will be salvaged, temporary preservation applied as out-

lined in paragraph 62 and then sent to the ordnance maintenance unit as soon as possible for necessary permanent maintenance.

c. DEEP WATER FORDING. Refer to TM 9-2853 for general information, description, and methods of use of deep water fording kits.

d. AFTER-FORDING OPERATION. Immediately after a vehicle emerges from the water, if the tactical situation permits, accomplish maintenance operations listed in paragraph 294.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PARTS, SPECIAL TOOLS, AND EQUIPMENT FOR ORGANIZATIONAL MAINTENANCE

54. General

Tools, equipment, and spare parts are issued to the using organization for maintaining the matériel. Tools and equipment should not be used for purposes other than prescribed and, when not in use, should be properly stored in the chest and/or roll provided for them. Spare parts are supplied to the using organization for replacement of those parts likely to become worn, broken, or otherwise unserviceable providing such operations are within the scope of organizational maintenance functions. Spare parts, tools, and equipment supplied for the 2½-Ton 6 x 6 Cargo Truck M135 will be listed in Department of Army Supply Catalog ORD 7 SNL G-749, which is the authority for requisitioning replacements (this catalog is not yet available; see par. 5*b*).

55. Common Tools and Equipment

Standard and commonly used tools and equipment having general application to this matériel will be listed for issue by the ORD 7 catalog and by TIA and T 10 & E.

56. Special Tools and Equipment

Certain tools and equipment (fig. 19) specially designed for organizational maintenance, repair, and general use with the matériel are listed in table II for information only. This list is not to be used for requisitioning replacements.

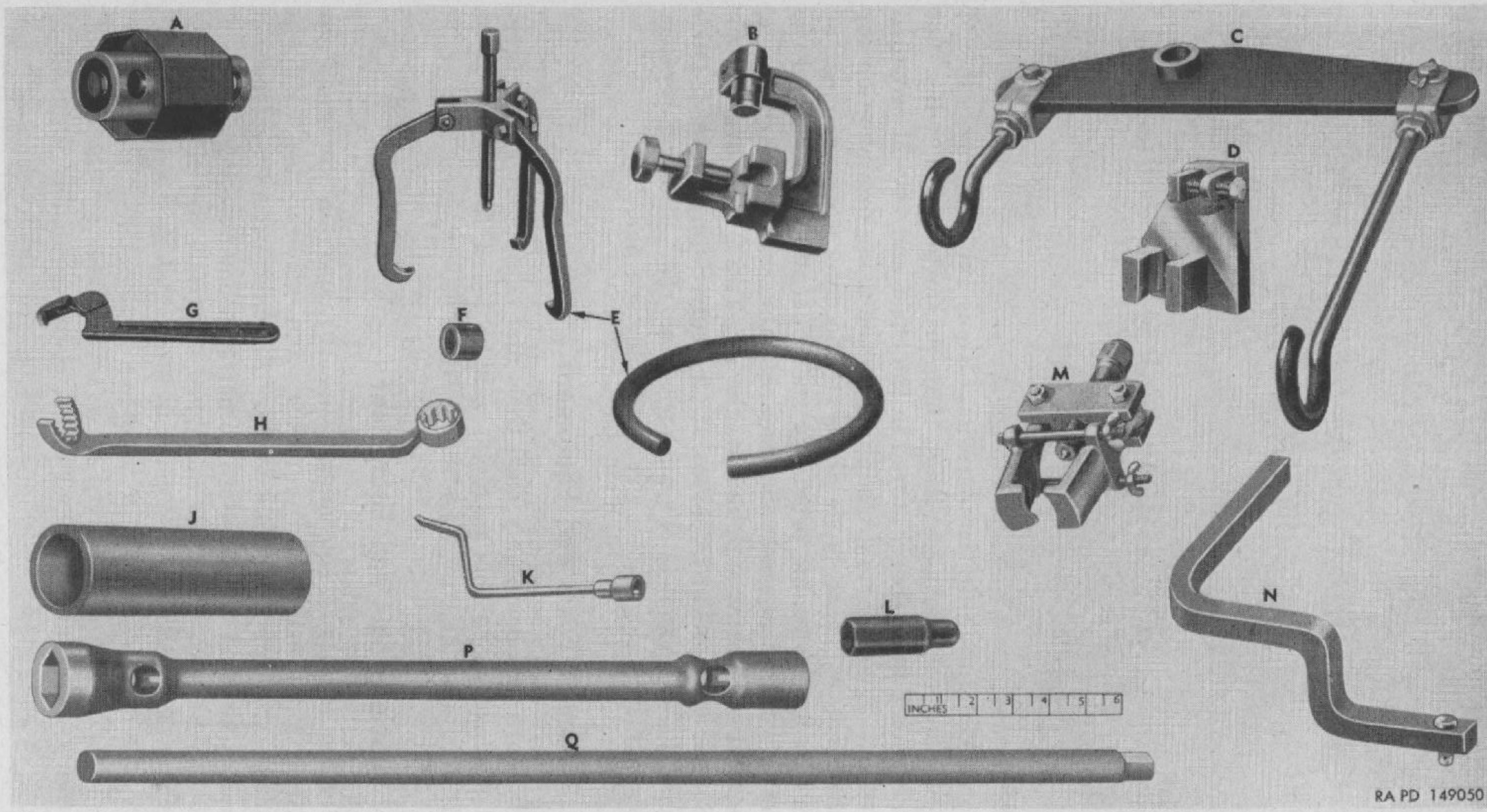


Figure 19. Special tools and equipment for organizational maintenance.

A—WRENCH—7950169
B—GAGE—7950058
C—SLING—7950170
D—TOOL—7950171
E—PULLER—41-P-2954
F—ADAPTER—7950054
G—WRENCH—41-W-3249-900
H—WRENCH—41-W-3297-760

J—REPLACER—7950063
K—TOOL—7950060
L—WRENCH—41-W-3335-30
M—PULLER—41-P-2952
N—FIXTURE—7950168
P—WRENCH—41-W-3838-40
Q—HANDLE—41-H-1541-10

Figure 19—Continued.

Table II. Special Tools and Equipment for Organizational Maintenance

Item	Identifying number	References		Use
		Fig	Par	
ADAPTER, steering wheel puller.	7950054	19, 152	251	Use with PULLER 41-P-2954.
FIXTURE, gaging, transmission throttle valve.	7950168	19, 103	178	For setting transmission throttle valve lever.
GAGE, exhaust-valve-cap clearance.	7950058	19, 32	96 *d*	For checking exhaust-valve-stem-to-rotation-cap clearance.
HANDLE, wheel brg adj and wheel stud nut wrench, diam ¾ in, lgh 30 in.	41-H-1541-10	19	239, 245	Handle used with wheel nut WRENCH 41-W-3838-40 and wheel bearing nut WRENCH.
PULLER, steering gear arm, univ type.	41-P-2952	19, 151	250	For removing pitman arm.
PULLER, steering wheel, univ type.	41-P-2954	19, 152	251	For removing steering wheel.
REPLACER, oil seal sleeve (axle).	7950063	19, 146	245	For installing oil seal sleeve on front and rear axles.
SLING, engine lifting	7950170	19, 40	100, 102, 105	For replacing power plant.
TOOL, bending	7950171	19	178	For bending transmission throttle valve lever.
TOOL, brake spring	7950060	19, 131, 132	221	For replacing brake shoe return springs.
WRENCH, spanner, hook, adj, diam of circle range ¾ to 2 in.	41-W-3249-900	19, 78	100, 102, 105, 135, 137	For disconnecting and connecting wiring harness connectors.
WRENCH, spark plug, conduit nut (hi-tension) dble end.	41-W-3297-760	19, 53, 54	109	For disconnecting and connecting spark plug cables.
WRENCH, spark plug, sgle-hd socket, hex, size of opng 27/32 in.	41-W-3335-30	19, 54	109	Use with WRENCH—7083301 for replacing spark plugs.
WRENCH, wheel stud nut, dble-hd socket, hex, and sq, size of opngs hex 1½ in, sq 13/16 in, lgh 18⅜ in.	41-W-3838-40	19	239	Use with HANDLE 41-H-1541-10 for removing wheel nuts.
WRENCH, wheel bearing nut	7950169	19	244, 245, 246	For replacing wheel bearing nuts.

Section II. LUBRICATION AND PAINTING

57. Lubrication Chart

The lubrication instructions in the chart illustrated in figures 20A and 20B prescribe cleaning and lubricating procedures as to locations, intervals, and proper materials for this vehicle. That lubrication which is to be performed by ordnance maintenance personnel is listed on the chart in the notes. The chart in figures 20A and 20B will be used until such time as an official lubrication order is prepared and printed; when available, the official lubrication order will be distributed automatically to personnel concerned.

58. General Lubrication Instructions

a. USUAL CONDITIONS. Service intervals specified on the lubrication chart are for normal operation and where moderate temperature and atmospheric conditions prevail.

b. LUBRICATION EQUIPMENT. Each vehicle is supplied with lubrication equipment adequate for its maintenance. Clean this equipment both before and after use. Operate the lubricating guns carefully and in such a manner as to insure a proper distribution of the lubricant.

c. POINTS OF APPLICATION.

(1) Lubricating fittings, lever, filler, and drain plugs, and other points of application are shown in figures 21 through 27 and are referenced to the lubrication order. Wipe these devices and the surrounding surfaces clean before and after lubricant is applied.

(2) A ¾-inch red circle should be painted around all lubricating fittings.

d. REPORTS AND RECORDS.

(1) Report unsatisfactory performance of prescribed petroleum fuels, lubricants, or preserving materials, using DA AGO Form 468, Unsatisfactory Equipment Report.

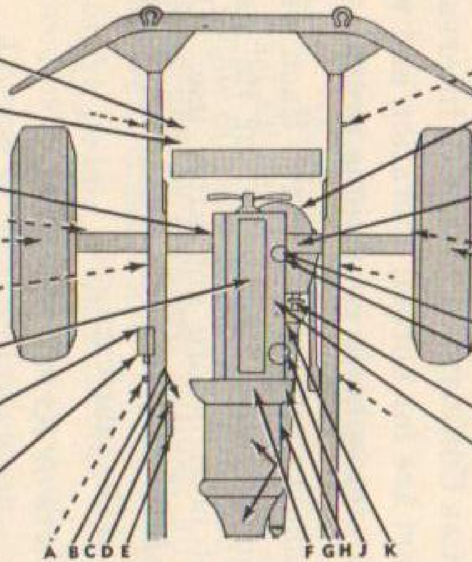
(2) Maintain a record of lubrication of the vehicle on DA AGO Form 461, Work Sheet for Wheeled and Half-Track Vehicles—Preventive Maintenance Service and Technical Inspection.

TRUCK, CARGO, 2½-TON, 6x6, M135

Intervals are based on normal operation. Reduce to compensate for abnormal operation and severe conditions or contaminated lubricants. During inactive periods, intervals may be extended commensurate with adequate preservation. Relubricate after washing or fording.

Clean fittings before lubricating. Clean parts with thinner, paint, volatile mineral spirits (TPM) or SOLVENT, dry cleaning (SD). Dry before lubricating. Lubricate dotted arrow points on both sides of the equipment.

		Lubricant	Interval
F, Fig 21	**Winch Shaft Shear Pin** (See Note 11) (Some Models)	PL	1
G, Fig 21	**Winch Shaft Universal Joint and Slip Joint** (Some Models)	CG	1
AE, Fig 27	**Air Compressor Governor** (See Note 13)	PL	1
WW, XX, Fig 26	**Front Wheel Bearings** (See Note 8)	WB	A
X, Fig 23	**Shock Absorbers** (Check Level)	LO	A
N, Fig 22	**Crankcase Drain** (Drain and Refill—Cap. 11 qts.) (See Note 2)	S	
PP, Fig 25	**Steering Gear Drain** (Drain and Refill—Cap. 1½ pts.) (See Note 5)		A
NN, Fig 25	**Steering Gear Fill and Level** (Check Level)	GO	W



Interval	Lubricant		
1	CG	**Spring Shackle**	W, Fig 23
W	GO	**Front Axle Differential Fill and Level** (Check Level)	AA, Fig 23
A		**Front Axle Differential Drain** (Drain and Refill—Cap. 15½ pts.) (See Note 5)	BB, Fig 23
1	CG	**Universal Joint and Steering Knuckle** (Check Level) (See Note 7)	Y, Z, Fig 23
—	OE	**Crankcase Fill**	L, Fig 22
D	OE	**Crankcase Breather** (See Note 1)	M, Fig 22
1	CG	**Universal Joint**	TT, Fig 25
6		**Distributor** (See Note 4)	S, T, U, Fig 22

FOLD FOLD

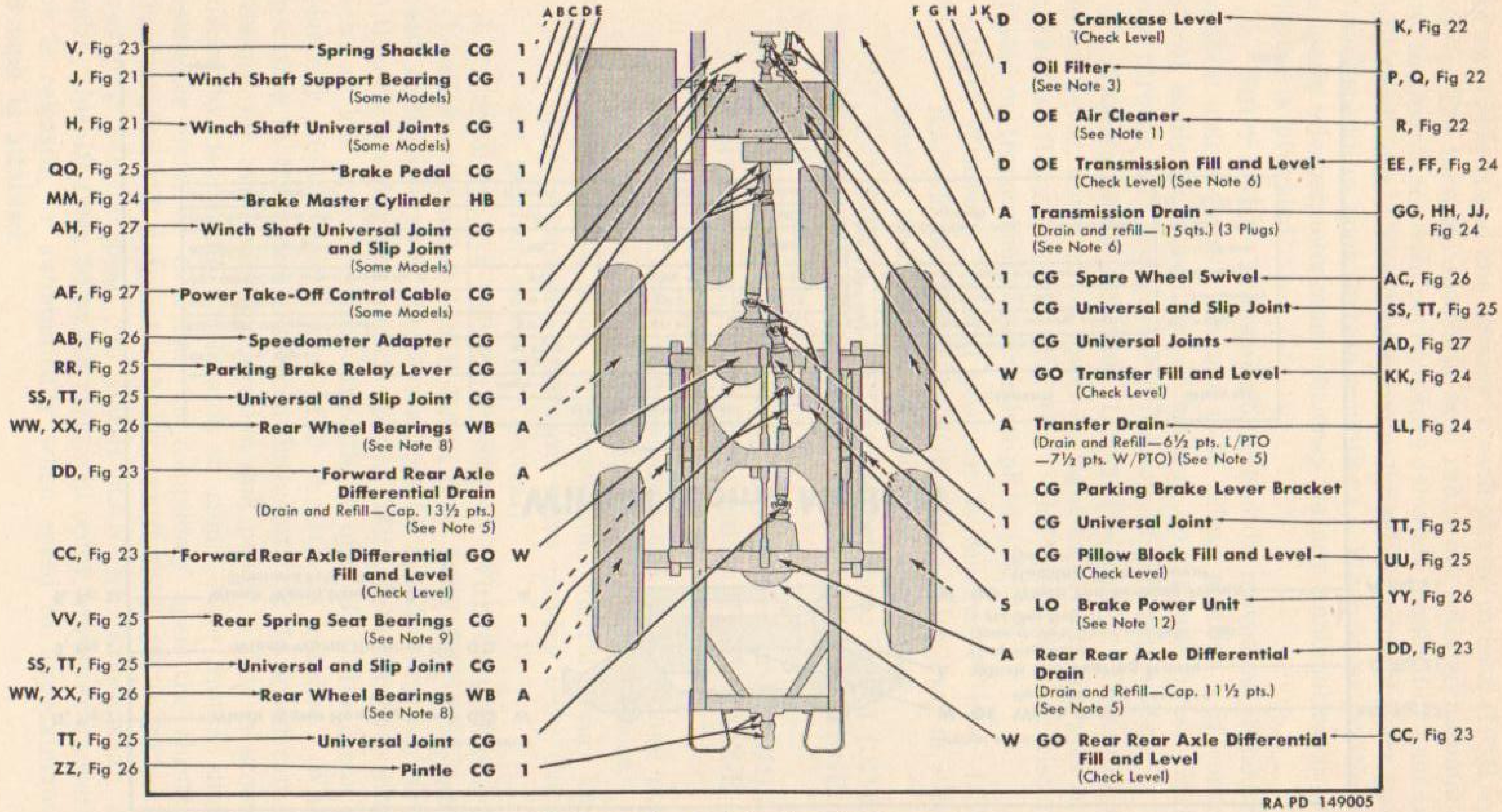


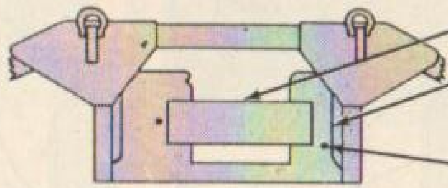
Figure 20A. Lubrication chart—front.

Lubricant • Interval

D, Fig 21 → **Winch Worm Housing Level** GO W
(Check Level)

B, Fig 21 → **Winch Worm Housing Fill** GO —

E, Fig 21 → **Winch Worm Housing Drain** A
(Drain and Refill—Cap. 1¼ pts.)
(See Note 5)



Interval • Lubricant

W OE **Winch Cable** ← AG, Fig 27
(Some Models) (See Note 10)

A **Winch End Bearing Frame Housing Drain** ← C, Fig 21
(Some Models) (Drain and Refill—Cap. 1 pt.) (See Note 5)

W GO **Winch End Bearing Frame Housing Fill and Level** ← A, Fig 21
(Some Models) (Check Level)

WINCH (Some Models)

KEY

LUBRICANTS	EXPECTED TEMPERATURES Above +32° F	+40° F to −10° F	0° F to −65° F
OE—OIL, lubr, engine	OE 30 or NS 9250	OE 10 or NS 9110	OES
GO—LUBRICANT, gear, universal	GO 90	GO 90	GOS
CG—GREASE, lubr, general purpose	CG 1	CG 0	OG 00
WB—GREASE, lubr, general purpose No. 2	WB	WB	OG 00
HB—FLUID, hydraulic brake	HB	HB	HBA
LO—OIL, lubricating, light	LO	LO	LO
PL—OIL, lubr, preservative	PL (Med)	PL (Special)	PL (Special)

For Artic Operation Refer to TM-9-2855

LUBRICANTS	INTERVALS
OES—OIL, lubr, engine, sub-zero	D—Daily
GOS—LUBRICANT, gear, universal, sub-zero	W—Weekly
OG—GREASE, lubr, Ord. Dept.	S—Semi-annually
HBA—FLUID, hydraulic brake, arctic	A—Annually
CW—LUBRICANT, chain, exposed gear and wire rope	1—1,000 Miles
	6—6,000 Miles
	12—12,000 Miles

NOTES

FOLD FOLD

1. AIR CLEANERS AND BREATHERS—(Oil Bath Type) Daily, replenish to bead level with OE, crankcase grade. Every 1,000 miles, clean oil reservoir and refill with OE as above. Disassemble, clean all parts, refill with OE as above whenever crankcase oil is changed. For desert or extremely dusty operation, disassemble, clean all parts and refill once every operating day or more frequently if required.

2. CRANKCASE—Drain every 6,000 miles or semiannually. Drain only after operation. Refill to FULL mark on gage. For proper operation on heavy duty oils, engine thermostat must be functioning properly to maintain engine coolant temperature at +140°F minimum. Run engine a few minutes and recheck oil level. CAUTION: Be sure pressure gage indicates oil is circulating.

3. OIL FILTER—Every 1,000 miles, remove plug in bottom of shell and drain sediment. Install plug. Run engine a few minutes and check oil level. Every 6,000 miles, or semiannually while crankcase is being drained, remove element, drain and clean inside of shell and install new element.

4. DISTRIBUTOR—Semiannually, wipe breaker cam lightly with CG and lubricate breaker arm pivot and wick under rotor with 1 to 2 drops of PL;

5. GEAR CASES (EXCEPT TRANSMISSION)—Drain every 12,000 miles or annually. Drain only after operation. Fill to plug level before operation.

6. TRANSMISSION—Start engine and run for 3 to 5 minutes at idling speed with transmission lever in "N" (neutral) position before checking fluid level. If engine has been run previously, and is at operating temperature, level should be at "HOT FULL" mark on gage (dipstick). If engine is not at operating temperature level should be at "COLD." Replenish fluid while engine is running at idle speed and transmission lever is in "N" (neutral) position. Bring fluid level up to gage marking as above. CAUTION: DO NOT OVERFILL. Every 12,000 miles, or annually, remove flywheel housing underpan, then remove pipe plug from torus cover, also remove plug at bottom of case marked "OIL" and plug at rear of case. Reinstall plugs and flywheel housing underpan. Pour 10 quarts of oil (OE-10) into case, or when temperature of +10°F or below is expected use (OES). Start engine and operate at idle speed for 3 to 5 minutes with transmission lever in "N" neutral, then add sufficient fluid (approximately 5 quarts) to bring level up to "COLD" mark on gage.

7. FRONT AXLE UNIVERSAL JOINTS AND STEERING KNUCKLES—Remove plug on front side of steering knuckle support, apply lubricant to grease fitting in bottom of spherical surface at outer end of axle housing until lubricant reaches level of the plug opening. Replace plug. Every 12,000 miles or annually, remove, clean, dry, inspect and relubricate.

8. WHEEL BEARINGS—Every 12,000 miles or annually, remove, clean, dry and repack.

9. REAR SPRING SEAT BEARINGS—Apply lubricant through fitting until new lubricant is forced past seal at inner side of seat.

10. WINCH CABLE—After each operation clean and oil with used crankcase oil or OE. Weekly, if cable has not been used, coat outer coils. Monthly unwind entire cable, clean and oil. Semiannually if cable is not generally used, unwind entire cable and soak, by means of a brush, with PL (Special). Wipe off excess and coat cable with CW. Coat winch drum also with CW before rewinding cable on drum.

11. WINCH DRIVE SHAFT SHEAR PIN—Every 6,000 miles, or semiannually, remove shear pin, remove universal joint from shaft, clean, dry, and coat shaft and inside of universal joint with PL (Special) to prevent rusting.

12. BRAKE POWER UNIT—Remove pipe plug at rear of cylinder shell and fill (approximately 3 oz) to plug level with LO.

13. AIR COMPRESSOR GOVERNOR—Remove two slotted plugs at top of air compressor governor and apply 3 or 4 drops of PL. Install plugs.

14. OIL CAN POINTS—Monthly or every 1,000 miles lubricate carburetor linkage, transmission control linkage, transfer control linkage, starter control linkage, brake pedal linkage, parking brake linkage and pivot points with PL.

15. DO NOT LUBRICATE—Springs, Shock Absorber Links, and Torque Rods.

16. LUBRICATED AT TIME OF DISASSEMBLY BY ORDNANCE PERSONNEL—Starter, generator, and speedometer flexible shaft.

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Figure 20B. Lubrication chart—rear.

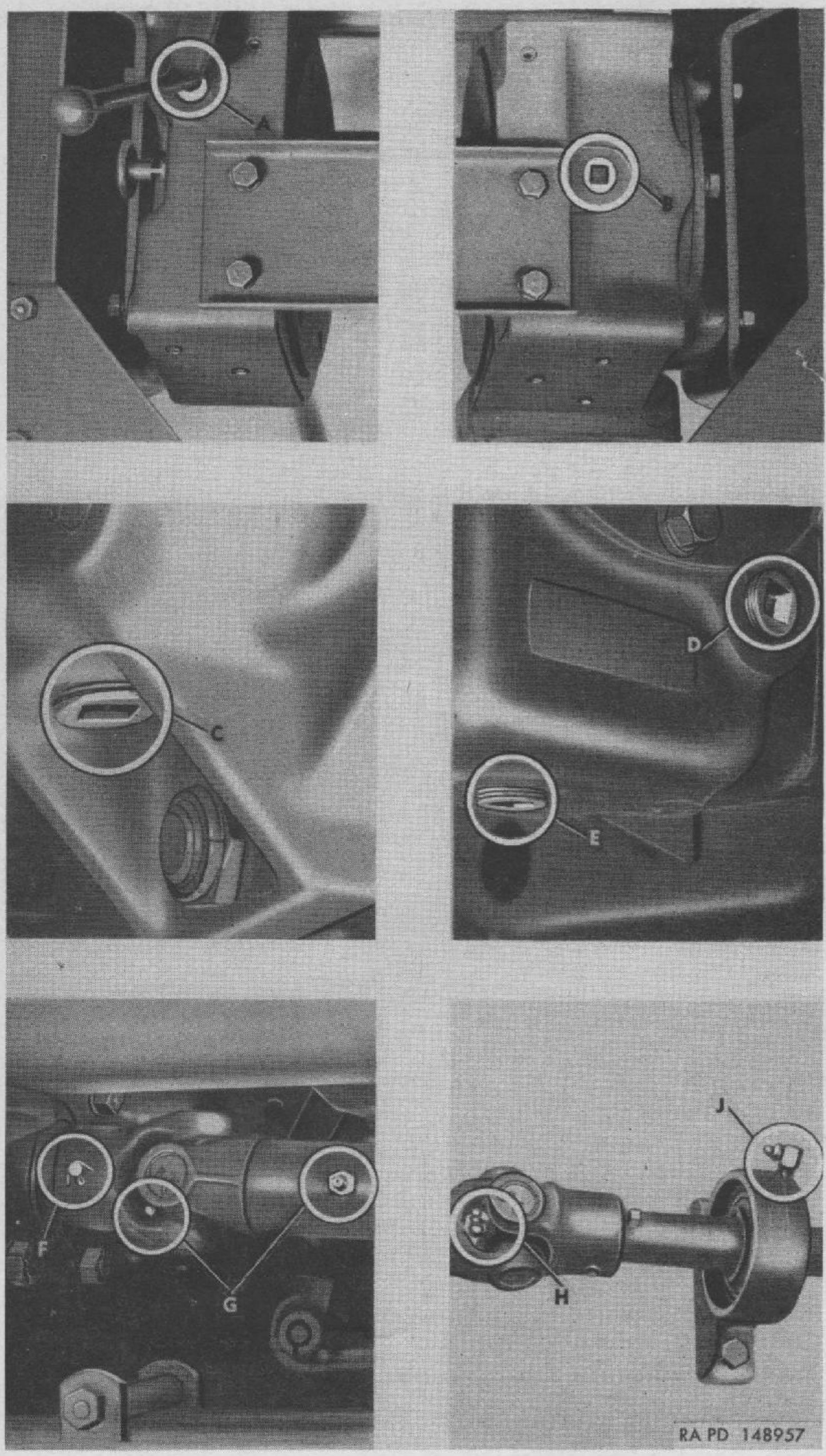


Figure 21. Localized lubrication views (points A through J).

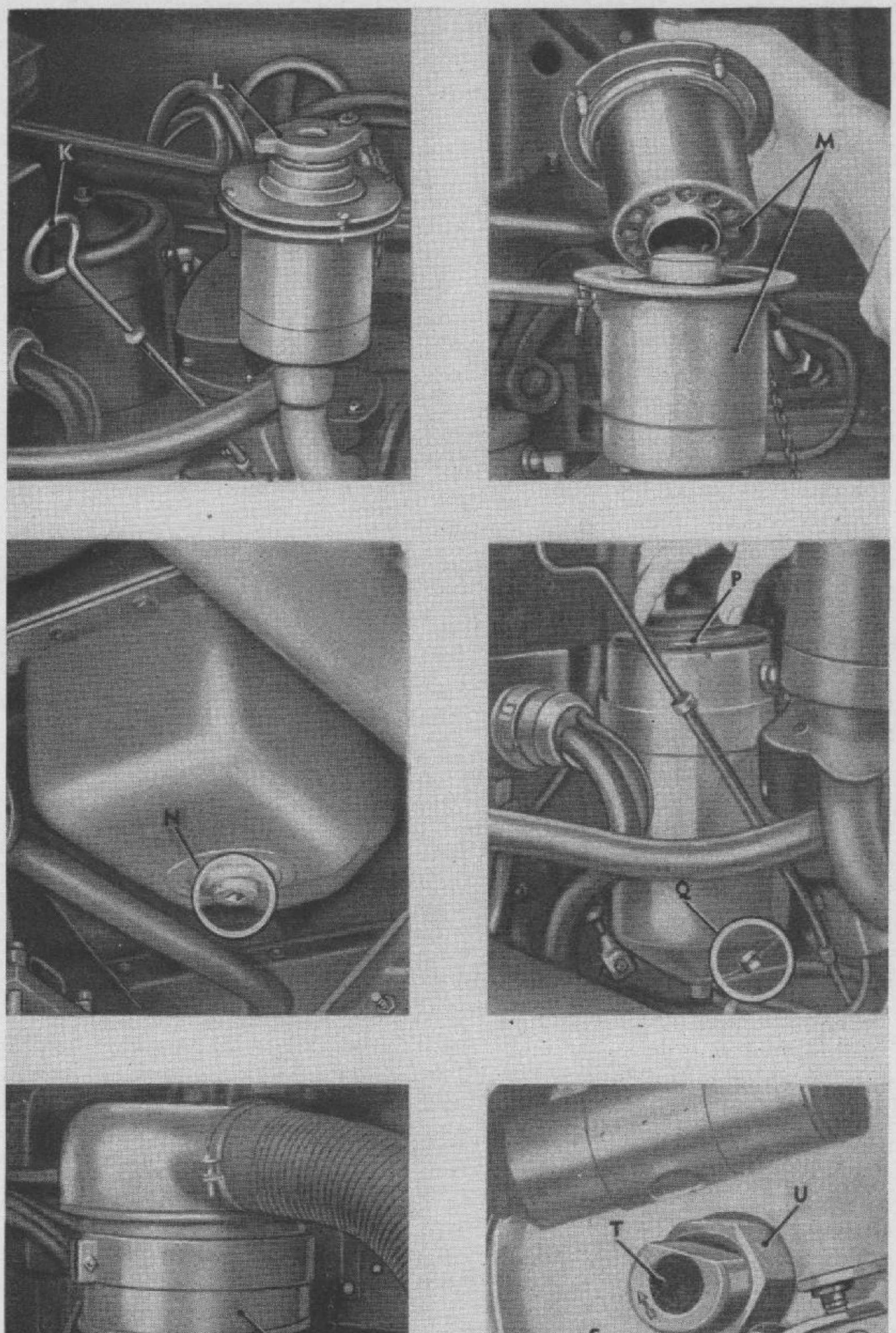


Figure 22. Localized lubrication views (points K through U).

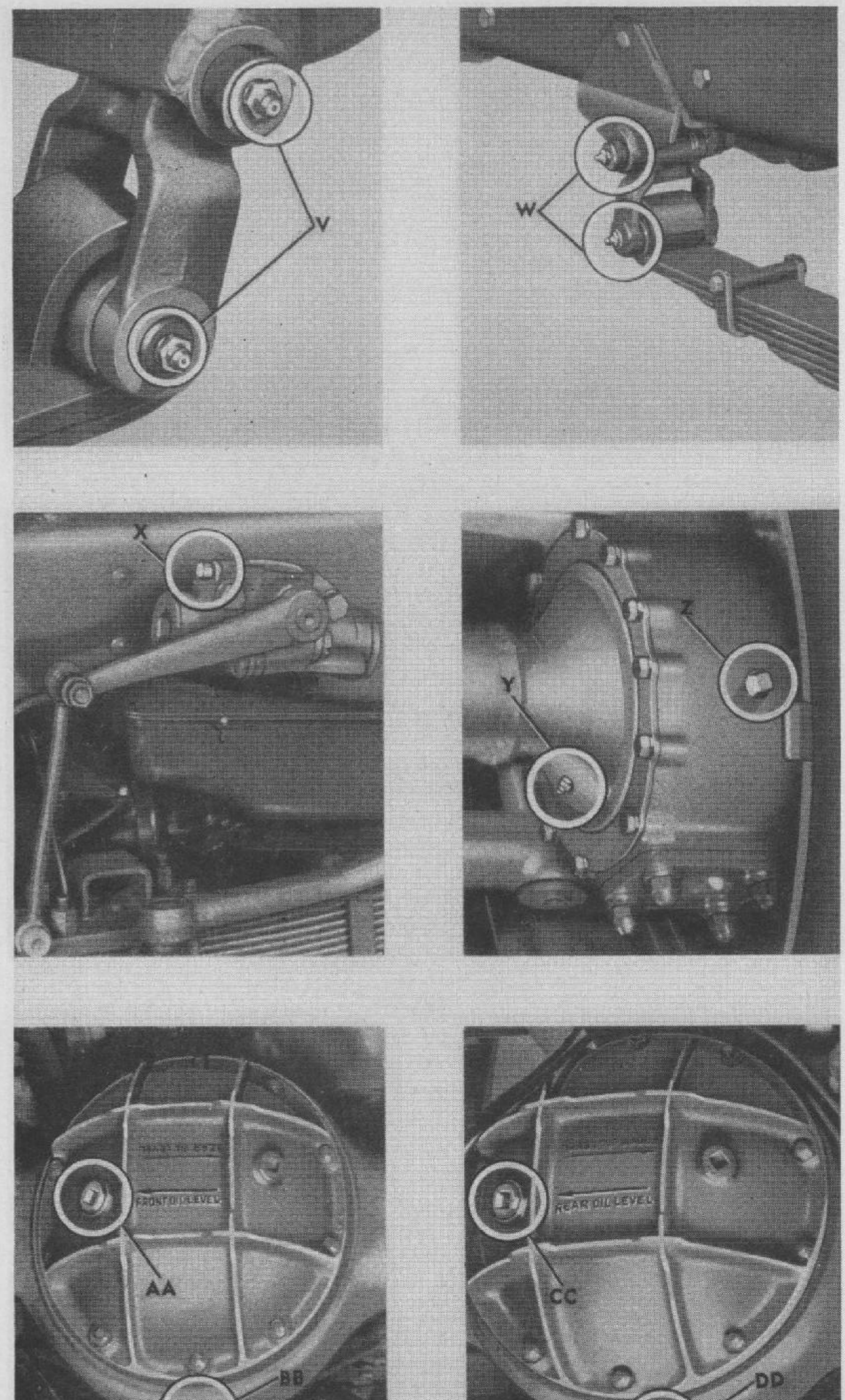


Figure 23. Localized lubrication views (points V through DD).

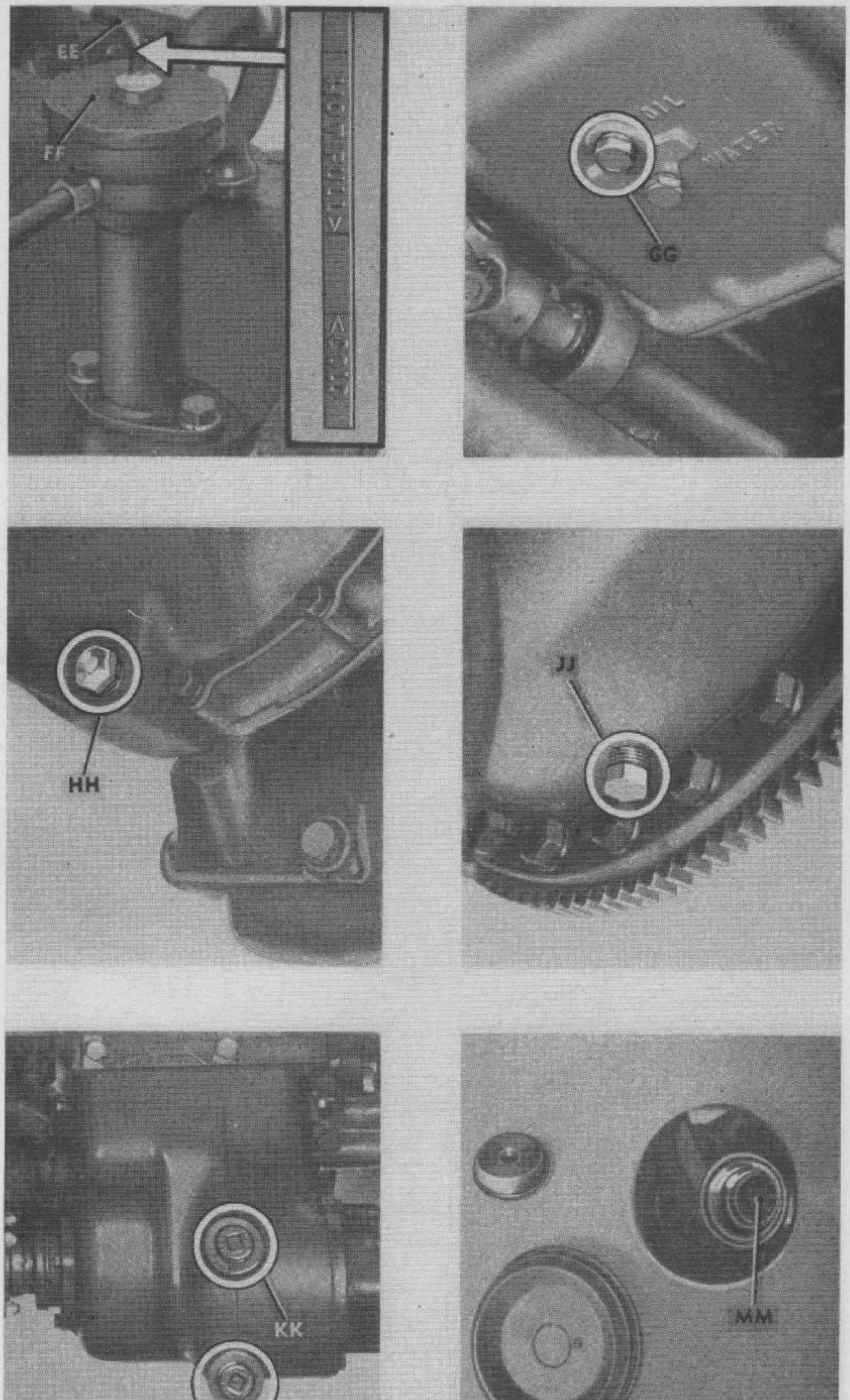


Figure 24. Localized lubrication views (points EE through MM).

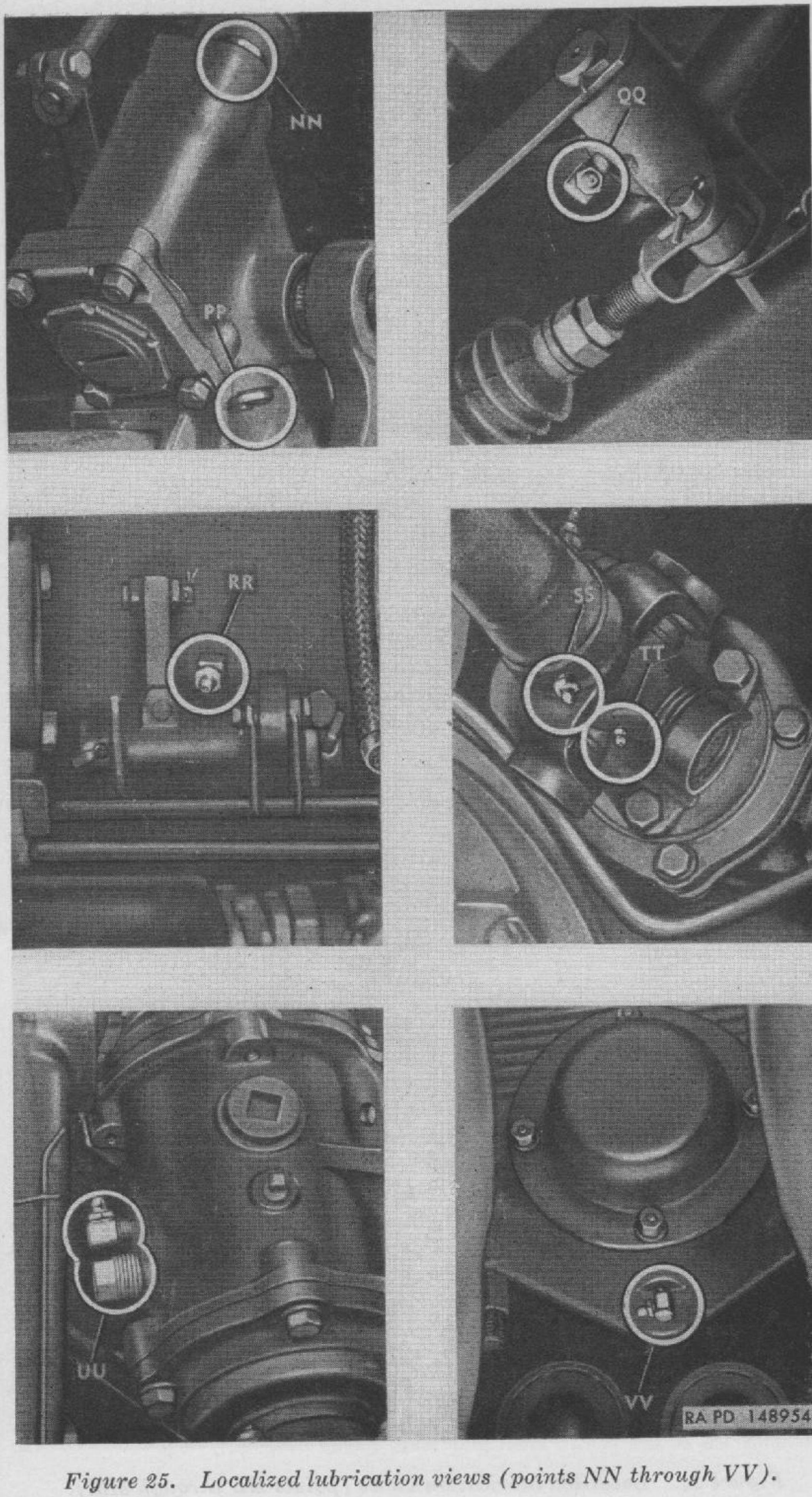


Figure 25. Localized lubrication views (points NN through VV).

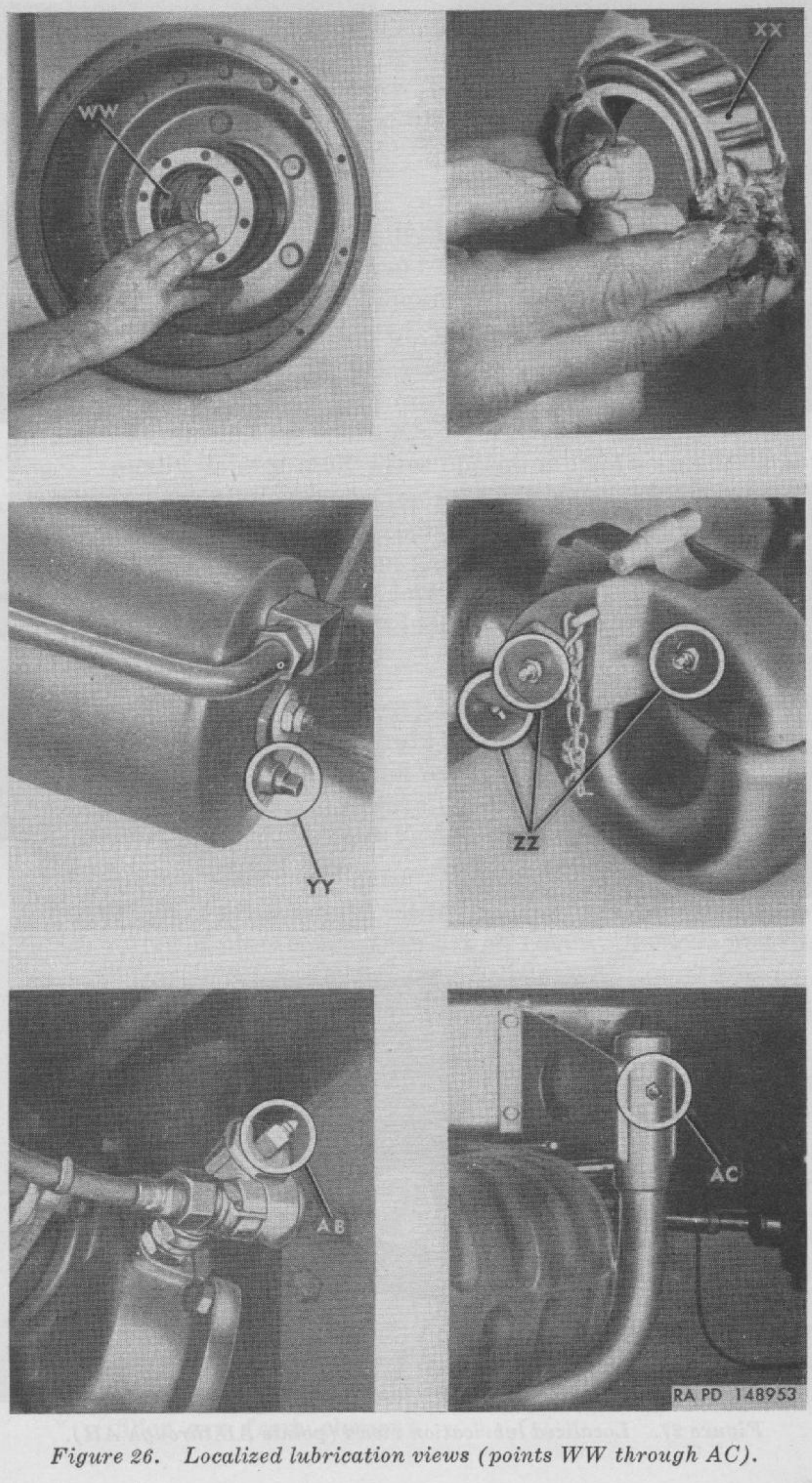


Figure 26. Localized lubrication views (points WW through AC).

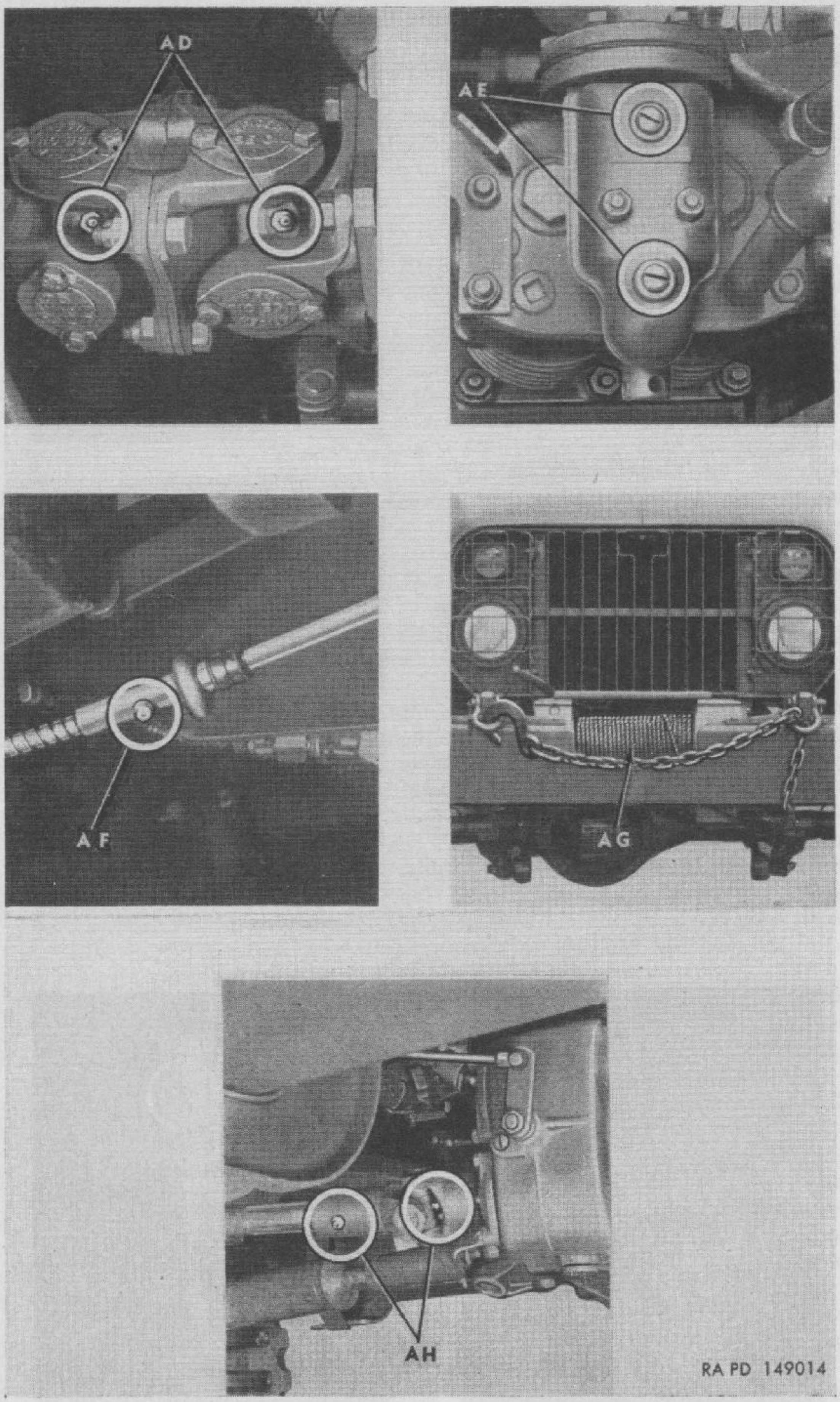


Figure 27. Localized lubrication views (points AD through AH).

59. Specific Lubrication Information

a. GENERAL. The following instruction notes are supplemental to and repeat for clarity those notes on lubrication chart (fig. 20A and 20B) which pertain to lubrication and service of individual units and parts.

b. ENGINE CRANKCASE.

(1) *Checking level.* Daily, check level in oil pan at gage (dipstick) on right-hand side of crankcase (K, fig. 22), immediately after stopping engine. Replenish to keep lubricant level to FULL mark on gage (dipstick). Oil filler cap is at top of crankcase breather assembly (L. fig. 22).

(2) *Draining and refilling.* Every 6,000 miles or semi-annually, immediately after operation, while engine is hot, remove plug from bottom of oil pan (N, fig. 22). After thoroughly draining, replace drain plug and refill crankcase to FULL mark on gage (K, fig. 22). Run engine a few minutes, recheck level, and add oil if required. Be sure oil pressure gage indicates oil is circulating.

c. OIL FILTER.

(1) *Draining filter.* Every 1,000 miles remove plug near bottom of shell and drain sediment (Q, fig. 22). Install plug. Start engine and operate for a few minutes, then stop engine and check oil level on gage. Replenish to FULL mark on gage (K, fig. 22).

(2) *Element replacement.*

(*a*) Whenever engine oil is changed, remove bolt at center of filter cover, then lift off cover. Remove and discard element (P, fig. 22).

(*b*) Remove plug at bottom of filter shell to completely drain lubricant.

(*c*) Clean inside of shell with clean rag immersed in dry-cleaning solvent or volatile-mineral-spirits paint thinner to remove all old lubricant.

(*d*) Reinstall plug tightly at bottom of filter shell. Install new element in shell; then install cover, using new cover gasket. Tighten cover bolt.

d. CRANKCASE BREATHER VENTILATOR.

(1) *Disassembly.* Every 1,000 miles, remove element from housing by loosening four screws alternately until element can be lifted from housing (M, fig. 22). Remove filler cap from element.

(2) *Cleaning.* Clean element and inside of housing, using dry-cleaning solvent or volatile-mineral-spirits paint thinner. Clean cloth, dampened in cleaner, can be used to clean housing.

(3) *Assembly.* Refill housing to OIL LEVEL mark with same grade engine oil as being used in crankcase. Install element in housing and tighten four retaining screws alternately and evenly.

e. CARBURETOR AIR CLEANER (R, fig. 22).

(1) *Disassembly.* Every 1,000 miles, remove reservoir by releasing four latches. Pull element downward to remove from body of cleaner.

(2) *Cleaning.* Pour oil from reservoir. Clean reservoir and element, using dry-cleaning solvent or volatile-mineral-spirits paint thinner, to remove all old lubricant and dirt. Permit element to dry thoroughly. Do not use compressed air on element.

(3) *Assembly.* Install element in cleaner body. Fill reservoir to OIL LEVEL mark with same grade engine oil as being used in crankcase. Install reservoir and fasten four latches.

f. TRANSMISSION.

(1) *Checking fluid level.* Dipstick gage, located in filler cap, is marked with two level marks: COLD—lower mark and HOT FULL—upper mark (EE, fig. 24). These two marks are used when checking transmission fluid level.

Note. Under normal conditions, fluid level should not lower unless leak exists; also, a level greater than HOT FULL sometimes indicates failure of internal parts.

(*a*) *Transmission cold.* When engine has not been run for an extended period, start engine and run for 3 to 5 minutes at idling speed with transmission lever N (neutral) position. With engine still idling, withdraw gage; wipe off and reinsert; then, again withdraw gage. Level reading should be at COLD mark (EE, fig. 24).

(*b*) *Transmission hot.* When engine has been run and is at operating temperature, start engine and run 3 to 5 minutes at idling speed with transmission lever in N (neutral) position. With engine still idling, withdraw gage; wipe off and reinsert; then, again withdraw gage. Level reading should be at HOT FULL mark (EE, fig. 24).

(2) *Replenishing fluid.* With engine running at idle speed and transmission lever in N (neutral) position, remove filler cap and gage (EE, and FF, fig. 24). Add sufficient oil to bring level up to gage marking (EE, fig. 24), depending upon whether unit is cold or hot ((1) above). Install cap and gage; then recheck level.

Caution: Do not overfill.

(3) *Draining.*

(*a*) *Drain torus cover.* Remove 8 cap screws and lock washers attaching underpan to flywheel housing. Turn engine by flywheel until torus cover plug is at lowest point, then remove plug (JJ, fig. 24).

(*b*) *Drain bottom pan.* Remove plug at bottom of transmission pan.

Note. This plug is indicated by mark OIL on pan adjacent to plug (GG fig. 24).

(*c*) *Drain rear case.* Remove plug at rear of case (HH, fig. 24).

(*d*) *Install plugs.* Apply thin coating of sealing compound to torus cover plug threads; then install and tighten plug. Install underpan to flywheel housing using 8 cap screws and lock washers. Tighten cap screws. Install bottom pan plug, also rear case plug, using new gaskets under each plug.

(4) *Filling.* Remove filler cap and gage; then pour 10 quarts of oil into case. Reinstall filler cap and gage. Start engine, and run at idle speed for 3 to 5 minutes, with transmission lever in N (neutral) position. Remove filler cap and add sufficient additional oil (aprx 5 quarts) to bring level up to COLD mark on gage (EE, fig. 24).

Note. The refill capacity is approximately 15 quarts, but correct level is determined by gage reading rather than quantity added.

Caution: Do not overfill.

g. WINCH DRIVE SHAFT SHEAR PIN. Apply preservative lubricating oil to winch shear pin (F, fig. 21) to prevent pin sticking. Every 6,000 miles, or semi-annually, remove shear pin (par. 285*b*), clean, and apply preservative lubricating oil to prevent rusting. Install shear pin (par. 285*c*).

h. DISTRIBUTOR. Remove distributor cover and lift rotor from shaft.

(1) *Breaker arm pivot.* Apply two or three drops of preservative lubricating oil to pivot pin (S, fig. 22).

(2) *Breaker cam.* Wipe a small quantity of general purpose grease to lobes of breaker cam (U, fig. 22).

(3) *Rotor wick.* Apply two or three drops of preservative lubricating oil to wick in end of distributor drive shaft (T, fig. 22).

(4) *Install rotor and cover.* Install distributor rotor and distributor cover.

i. AXLE DIFFERENTIALS.

(1) *Checking level.* Remove lower plug in axle housing cover. Correct plug is indicated by lettering cast in cover; front axle is marked FRONT OIL LEVEL (AA, fig. 23), while rear axle covers are marked REAR OIL LEVEL (CC, fig. 23). Add lubricant to bring level up to within ½ inch of plug opening when cold or to plug level when hot. Install and tighten level plug.

(2) *Draining and refilling.* Every 12,000 miles or annually, while unit is hot, preferably immediately after operation, remove plug at bottom of axle housing bowl (BB and DD, fig. 23) to drain lubricant. Install and tighten drain plug. Fill axle to within one-half inch of plug opening. Install and tighten filler plug. Note that lubricant capacity shown on lubrication order (par. 57) is different in each axle; this is due to mounting angles and inverted position of differential at front.

j. TRANSFER.

(1) *Checking level.* Remove filler plug (KK, fig. 24) and if necessary, add sufficient lubricant to bring level to within one-half inch of plug opening when cold or to plug level when hot. Install and tighten level plug.

(2) *Draining and refilling.* Every 12,000 miles or annually, while unit is hot, preferably immediately after operation, remove bottom plug (LL, fig. 24) in case to drain lubricant. If vehicle is equipped with power-take-off, also remove plug at bottom of power-take-off, mounted on transfer. Install and tighten drain plugs. Fill transfer to within one-half inch of plug opening (KK, fig. 24). Install and tighten filler plug.

k. STEERING GEAR.

(1) *Checking level.* Remove filler plug (NN, fig. 25) and add sufficient lubricant to bring level up to filler plug opening. Install and tighten filler plug.

(2) *Draining and refilling.* Every 12,000 miles or annually, while unit is hot, preferably immediately after

operation, remove drain plug at bottom of housing (PP, fig. 25) to drain lubricant. Install and tighten drain plug. Fill housing to level of filler plug opening. Install and tighten filler plug.

l. WHEEL BEARINGS.

(1) *Remove hubs and bearings.* Every 12,000 miles or annually, remove hubs and bearings (pars. 245 and 246).

(2) *Cleaning and inspection.* Wash bearings, cones and cups, steering knuckle or axle housing, and inside of hubs with dry-cleaning solvent or volatile-mineral-spirits paint thinner, using stiff brush to remove old lubricant. Dry parts thoroughly, but do not spin bearings when compressed air is used for drying. Inspect bearing cones and cups and replace if worn or damaged.

(3) *Lubricate and install.* Apply thin coat (approximately 1/16 inch thick) of lubricant to inside of hub (WW, fig. 26) and to front axle steering knuckle and rear axle housing, to retard rust. Lubricate bearings with a packer or by hand method (XX, fig. 26), kneading lubricant into all spaces of the bearing. The lubricant in the bearing is sufficient until the next service period. Do not fill hub, since any excess may leak onto brakes.

Caution: Cleanliness when handling bearings after they have been lubricated is extremely important; also, proper bearing adjustment is equally important to bearing life.

Install hubs and bearings and adjust (pars. 245 and 246).

m. WINCH WORM HOUSING.

(1) *Checking level.* Remove level plug at end of housing (D, fig. 21) and add sufficient lubricant through filler plug (B, fig. 21) opening at top of housing to bring lubricant level up to level plug opening. Install and tighten filler and level plugs.

(2) *Draining and refilling.* Every 12,000 miles or annually, while unit is hot, preferably immediately after operation, remove plug (E, fig. 21) at bottom of housing to drain lubricant. Reinstall and tighten drain plug. Remove level and filler plugs. Fill through filler plug opening until lubricant is up to level plug opening. Install and tighten level (D, fig. 21) and filler (B, fig. 21) plugs.

n. WINCH END-FRAME HOUSING.

(1) *Checking level.* Remove filler plug at top of housing (A, fig. 21) and check level of lubricant with rule. Proper lubricant level is 7⅝ inches below top of housing. Add lubricant to bring level up to this dimension.

(2) *Draining and refilling.* Every 12,000 miles or annually, while unit it hot, preferably immediately after operation, remove plug at bottom of housing (C, fig. 21) to drain lubricant. Install and tighten drain plug. Fill through filler plug opening (A, fig. 21) using 1 pint of lubricant. Install and tighten filler plug.

o. WINCH CABLE. After each operation, clean and oil cable (AG, fig. 27) with used crankcase oil or engine oil. Weekly, if cable has not been used, coat outer coils. Monthly, unwind entire cable, clean, and oil. Semiannually, if cable is not generally used, unwind entire cable and soak by means of a brush, using preservative lubricating oil. Wipe off excess and coat cable with wire rope lubricant. Coat winch drum also before rewinding cable on drum.

p. SHOCK ABSORBERS. Remove plug at front of housing (X, fig. 23) and check fluid level. If fluid is not up to plug level, disconnect link from arm by removing link stud nut, then remove link from arm. Fill to plug level with light lubricating oil. Pump arm up and down slowly to expel air from shock absorber. Repeat filling and pumping operations until all air is removed and fluid is at filler plug opening. Install and tighten filler plug. Connect link to arm and tighten link stud nut.

q. BRAKE POWER UNIT. Remove pipe plug at rear of unit (YY, fig. 26) and apply approximately 3 ounces of light lubricating oil, or until fluid is level with plug opening. Install and tighten pipe plug.

r. BRAKE MASTER CYLINDER. Remove floor board cover and master cylinder extension tube cap. Add hydraulic brake fluid until level of fluid is within approximately one-half inch of bottom of extension tube (MM, fig. 24). Reinstall tube cap and floor board cover.

s. FRONT AXLE UNIVERSAL JOINT AND STEERING KNUCKLE. Remove pipe plug at front of steering knuckle support (Z, fig. 23) and apply lubricant through fitting in spherical surface at outer end of axle housing (Y, fig. 23), until lubricant level is up to pipe plug opening (Z, fig. 23). Install and tighten pipe plug. Remove axle shaft and universal joint assemblies, clean, dry, and repack (par. 199) every 12,000 miles or annually.

t. PROPELLER SHAFT UNIVERSAL JOINTS AND SLIP JOINTS. Apply lubricant through fitting in each universal joint trunnion (TT, fig. 25) until lubricant appears around trunnion seals. Universal joint trunnions (AD, fig. 27) used in joints between transmission and transfer are fitted with pressure relief valves. Apply lubricant through fitting in each slip joint (SS, fig. 25) until lubricant appears at vent hole at end of shaft.

u. WINCH SHAFT UNIVERSAL JOINTS AND SLIP JOINTS. Apply lubricant through fitting in each universal joint and each slip joint (G, and H, fig. 21 and AH, fig. 27) until lubricant appears at journals and splines.

v. REAR SPRING SEAT BEARINGS. Apply lubricant through fitting at bottom of each spring seat (VV, fig. 25) until lubricant is forced past seal at inside of spring seat.

w. PILLOW BLOCK. Remove plug at side of housing near lubrication fitting (UU, fig. 25); then apply lubricant through fitting (UU, fig. 25) until level with plug opening.

60. Lubrication Under Unusual Conditions

a. UNUSUAL CONDITIONS. Reduce service intervals specified on the lubrication order, i. e., lubricate more frequently, to compensate for abnormal or extreme conditions, such as high or low temperatures, prolonged periods of high speed operation, continued operation in sand, mud, or dust, immersion in water, or exposure to moisture. Any of these operations or conditions may cause contamination and quickly destroy the protective qualities of the lubricants. Intervals may be extended during inactive periods commensurate with adequate preservation.

Note. Operation in mud requires that spring shackle pins, propeller shaft universal joints, and slip joints be lubricated immediately before and after such operation, and every 4 hours during sustained operation under these conditions.

b. CHANGING GRADE OF LUBRICANTS. Lubricants are prescribed in the "KEY" of the lubrication order (par. 57) in accordance with three temperature ranges; above +32° F., +40° to —10° F., and from 0° to —65° F. Change the grade of lubricants whenever weather forecast data indicate that air temperatures will be consistently in the next higher or lower temperature range or when sluggish starting caused by lubricant thickening occurs. No change in grade will be made when a temporary rise in temperature is encountered.

c. MAINTAINING PROPER LUBRICANT LEVELS. Lubricant levels must be observed closely and necessary steps taken to replenish in order to maintain proper levels at all times.

61. Lubrication For Continued Operation Below 0° F.

Refer to TM 9-2855 for instructions on necessary special preliminary lubrication of the vehicle.

62. Lubrication After Fording Operations

a. After any fording operation, in water 12 inches or over, lubricate all chassis points as well as any other points required, in accordance with paragraph 294, for maintenance operations after fording.

b. If the vehicle has been in deep water for a considerable length of time or was submerged beyond its fording capabilities precautions must be taken as soon as practicable, to avoid damage to the engine and other vehicle components, as follows:

1. Perform a complete lubrication service (par. 57).

(2) Inspect engine crankcase oil. If water or sludge is found, drain the oil and flush the engine with preservative engine oil. Before putting in new oil, drain the oil filter and install a new filter element (par. 59*c*).

Note. If preservative engine oil is not available, engine lubricating oil may be used.

(3) Operation in bodies of salt water enhances the rapid growth of rust and corrosion, especially on unpainted sufaces. It is most important to remove all traces of salt water and salt deposits from every part of the vehicle. For assemblies which have to be disassembled, dried, and relubricated, perform these operations as soon as the situation permits. Wheel bearings must be disassembled and repacked after each submersion. Regardless of the temporary measures taken, the vehicle must be delivered as soon as practicable to the ordnance maintenance unit.

63. Lubrication After Operation Under Dusty and Sandy Conditions

After operation under dusty or sandy conditions, clean and inspect all points of lubrication for fouled lubricants and relubricate as necessary.

Note. A lubricant which is fouled by dust and sand makes an abrasive mixture that causes rapid wear of parts.

64. Painting

Instructions for the preparation of the matériel for painting, methods of painting, and materials to be used are contained in TM 9-2851. Instructions for camouflage painting are contained in FM 5-20B.

Section III. PREVENTIVE MAINTENANCE SERVICES

65. General

a. RESPONSIBILITY AND INTERVALS. Preventive maintenance services are the responsibility of the using organization. These services consist generally of before-operation, during-operation, at-the-halt, after-operation, and weekly services performed by the driver or operator and the scheduled services to be performed at designated intervals by organization mechanic or maintenance crews. Intervals are based on normal operations. Reduce intervals for abnormal operations or severe conditions. Intervals during inactive periods may be extended accordingly.

b. DEFINITION OF TERMS. The general inspection of each item applies also to any supporting member or connection and is generally a check to see whether the item is in good condition, correctly assembled, secure, and not excessively worn.

(1) 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: not bent or twisted, not chafed or burred, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, and not deteriorated.

(2) The inspection of a unit to see that it is "correctly assembled" is usually an external visual inspection to see whether or not it is in its normal assembled position in the vehicle.

(3) Inspection of a unit to determine if it is "secure" is usually an external visual examination or a check by hand, wrench, or pry-bar for looseness. Such an inspection must include any brackets, lock washers, lock nuts, locking wires, or cotter pins used.

(4) By "excessively worn" is meant worn beyond serviceable limits or to a point likely to result in failure if the unit is not replaced before the next scheduled inspection.

66. Cleaning

a. GENERAL. Any special cleaning instructions required for specific mechanisms or parts are contained in the pertinent section. General cleaning instructions are as follows:

(1) Use dry-cleaning solvent or volatile-mineral-spirits paint thinner to clean or wash grease or oil from all parts of the vehicle.

(2) A solution of one part grease-cleaning compound to four parts of dry-cleaning solvent or volatile-mineral-spirits paint thinner may be used for dissolving grease and oil from engine block, chassis, and other parts. Use cold water to rinse off any solution which remains after cleaning.

(3) After the parts are cleaned, rinse and dry them thoroughly. Apply a light grade of oil to all polished metal surfaces to prevent rusting.

(4) Before installing new parts, remove any preservative materials, such as rust-preventive compound, protective grease, etc.; prepare parts as required (oil seals, etc.); and for those parts requiring lubrication, apply the lubricant prescribed in the lubrication order (par. 57).

b. GENERAL PRECAUTIONS IN CLEANING.

(1) Dry-cleaning solvent and volatile-mineral-spirits paint thinner are inflammable and should not be used near an open flame. Fire extinguishers should be provided when these materials are used. Use only in well ventilated places.

(2) These cleaners evaporate quickly and have a drying effect on the skin. If used without gloves, they may cause cracks in the skin and, in the case of some individuals, a mild irritation or inflammation.

(3) Avoid getting petroleum products such as dry-cleaning solvent, volatile-mineral-spirits paint thinner, engine fuels, or lubricants on rubber parts as they will deteriorate the rubber.

(4) The use of Diesel fuel oil, gasoline, or benzine (benzol) for cleaning is prohibited.

67. Preventive Maintenance by Driver or Operator

a. PURPOSE. To insure efficient operation, it is necessary that the vehicle be systematically inspected at intervals each day it is operated and weekly, so defects may be discovered and corrected before they result in serious damage or failure. Certain scheduled maintenance services will be performed at these designated intervals. Any defects or unsatisfactory operating characteristics beyond the scope of the driver or operator to correct must be reported at the earliest opportunity to the designated individual in authority.

b. SERVICES. Drivers or operators preventive maintenance services are listed in table III. Every organization must thoroughly school its personnel in performing the maintenance procedures for this vehicle as set forth in this manual.

Intervals					Procedure
Before-operation	During-operation	At-the-halt	After-operation	Weekly	
					USUAL CONDITIONS
					Caution: Place all tags describing condition of vehicle in the driver's compartment in a conspicuous location so that they will not be overlooked.
					(1) *Fuel, oil, and water.*
x		x	x	x	(*a*) *Fuel.* Check the amount of fuel in tank (par. 32) and note any indication of leaks. Add fuel if necessary (par. 116), and check the spare fuel containers.
x		x	x	x	(*b*) *Engine oil.* Check oil level and add oil if necessary (par. 59*b*).
x			x	x	(*c*) *Transmission oil.* Check transmission oil level (par. 59*f*) after engine has been started ((4) below).
x		x	x	x	(*d*) *Water.* Check coolant level in the cooling system and note any leaks. When water is added (par. 126) during period that antifreeze is in use, a hydrometer test must be made an antifreeze added, if necessary, to provide safe operation to meet lowest anticipated temperature.
					(2) *Tires.*
x		x	x	x	(*a*) All tires should be properly inflated (par. 240*a*) and spare properly secured in carrier (par. 242).
			x	x	(*b*) Remove all foreign matter such as nails, glass, or stones from tires and from between duals (if used). Examine tires for signs of low pressure, abnormal tread wear, cuts, and presence of valve caps. All tires with cuts extending to or into the cord body or worn smooth in center of tread or which show abnormal tread wear must be reported to proper authority for corrective action.
				x	(*c*) Check tires for proper matching (par. 240*c*) and irregular wear and change position as required.
x		x	x	x	(3) *Visual inspection of equipment.* Determine if lamps, reflectors, horn, fire extinguisher, mirrors, paulins, tools, etc., are in the proper place and in good operating condition.
x		x		x	(4) *Leaks, general.* With engine running, and fuel, engine oil, transmission oil, and coolant under operating pressures, check

Table III—Continued

Drivers or Operators Preventive Maintenance Services

Intervals					Procedure
Before-operation	During-operation	At-the-halt	After-operation	Weekly	
					USUAL CONDITIONS—Continued under the truck and in the engine compartment for any indication of leaks.
					Note. Transmission oil level can only be checked after engine has run 3 to 5 minutes (par. 59*f*).
x	x				(5) *Instruments.* With engine running, check all instruments for normal readings (ch. 2, sec. II).
	x				(6) *Operating observations.* While the vehicle is in operation, the driver or operator should be alert for any sounds that may be a sign of trouble, such as knocks, squeaks, rattles, or hums. The instruments should be checked and any unusual reading noted which would indicate any part of the vehicle functioning improperly. Every time the brakes are used, gears shifted, or the vehicle turned, the driver or operator should instinctively consider it a test and note any unusual or unsatisfactory performance.
					(7) *Clean equipment.*
			x		(*a*) Clean dirt and trash from inside of body and cab. Clean glass and, when practical, wipe off exterior of equipment.
				x	(*b*) Wash the vehicle when possible. If not possible, wipe off thoroughly. Thoroughly clean engine and engine compartment of all excess dirt, trash, fuel, and oil drippings.
				x	(8) *Battery.* Clean and add necessary water (par. 141). Check terminal connections to see that they are securely fastened and properly coated with water-proofing material.
				x	(9) *Assemblies and belts.* Check all assemblies such as carburetor, generator, regulator, starter, and water pump for loose connections or mountings. Check adjustment for fan belt (par. 129*b*) and air compressor drive belt (par. 229*a*). If found to be improperly adjusted, report to the proper authority.

Table III—Continued

Drivers or Operators Preventive Maintenance Services

Intervals					Procedure
Before-operation	During-operation	At-the-halt	After-operation	Weekly	
					USUAL CONDITIONS—Continued
				x	(10) *Electrical wiring.* Check all accessible wiring and ascertain that it is securely connected and supported, that insulation is not cracked or chafed, and that conduits and shielding are in good condition and secure. Report any unserviceable wiring.
			x	x	(11) *Tools and equipment.* Check to see that all tools and equipment are serviceable and in their proper place. Clean tools and equipment.
				x	(12) *Fuel strainer* (fig. 60). Clean fuel tank filler neck strainer.
			x	x	(13) *Compressed air tanks.* Open drain cock (fig. 136) and drain off condensation. Check to see that tank and air line connections are secure.
			x	x	(14) *Lights.* Observe if the lights operate properly (par. 42). Inspect all lenses and warning reflectors for dirt and damage; clean if necessary.
			x	x	(15) *Horn and windshield wipers.* Test horn for proper operation. Test windshield wipers to insure proper functioning and cleaning action.
				x	(16) *Towing connections.* Inspect towing shackles, pintle, and safety chains for looseness and damage. Test pintle to be sure that latching mechanism closes completely and latches securely (par. 43*c*).
				x	(17) *Springs and suspensions.* Check springs for abnormal sag, broken or shifted leaves, loose or missing rebound clips, "U" bolts, or shackles. Check shock absorbers for loose mounting, damage, or leaks. Check torque rods for distortion or looseness. Check rear spring seats for leaks.
				x	(18) *Unit vents.* Axle housings, brake power cylinder, master cylinder, fuel tank, transfer, and transmission are vented through lines connected to vent gallary on right side of frame. Check vent connections for looseness at units and at vent gallery.

Drivers or Operators Preventive Maintenance Services

Intervals					Procedure
Before-operation	During-operation	At-the-halt	After-operation	Weekly	
					USUAL CONDITIONS—Continued
				x	(19) *Publications.* Check to see that all appropriate publications concerning the operation and maintenance of the equipment are on hand and in good order.
			x	x	(20) *Lubrication as needed.* Lubricate in accordance with instructions contained in lubrication order (par. 57).
					UNUSUAL CONDITIONS
					Preventive maintenance services for usual conditions will apply, with emphasis on servicing by the operator to combat the effect of unusual conditions of extreme cold, extreme heat, unusual terrain, and fording. The special services described below are required to assure best results under unusual conditions.
					EXTREME COLD (pars. 291 and 292) and (TM 9-2855)
		x	x		(21) *Cooling and fuel systems.* Refuel and add denatured alcohol as required.
			x	x	(*a*) Drain fuel tank and clean sump to remove condensation and sludge; refuel tank.
			x	x	(*b*) Check level and specific gravity of radiator coolant. Add ethylene glycol and/or water if needed.
					Note. If system carries arctic antifreeze compound, make a warning tag and place it on or near the radiator filler neck. The tag should read: THIS SYSTEM IS FILLED WITH ARCTIC ANTIFREEZE COMPOUND.
					Caution: Do not add water or any other type of antifreeze.
				x	(22) *Lubricants.* Check and, if necessary, change lubricants and special oils to conform with the lubrication chart (par. 57).
				x	Check gear cases for collections of sludge and water and clean out if necessary and refill.
					Note. It is necessary to have lubricant warm and fluid for draining and refilling.

Drivers or Operators Preventive Maintenance Services

Intervals: Before-operation	During-operation	At-the-halt	After-operation	Weekly	Procedure
					UNUSUAL CONDITIONS—Continued
					EXTREME COLD—Continued
		x	x		(23) *Control levers.* Position levers in neutral position.
x		x		x	(24) *Tires.* Check for tires frozen to ground or for frozen flat spots.
x				x	(*a*) Check for availability and serviceability of tire chains.
x				x	(*b*) Check for proper pressure (par. 240*a*).
x				x	(25) *Battery.* Check for proper charge and electrolyte level.
			x		Remove battery and store in warm place if vehicle is not equipped with power plant heater.
x			x	x	(26) *Clean.* Clean snow, ice, and mud from all parts of vehicle.
x					(27) *Brakes.* Check for frozen brake shoes.
x				x	(28) *Winterization equipment.* Check personnel heater and windshield defrosters (if available) for proper operation.
			x	x	(*a*) Check power plant heater unit for proper functioning.
			x	x	(*b*) Check all winterization equipment for secure installation and proper functioning.
			x		(*c*) Check radiator cover, broad blankets, under chassis blanket, hardtop closure, etc., for security and proper adjustment.
					EXTREME HEAT (par. 293)
x		x		x	(29) *Cooling and fuel system.* Check air cleaner, fuel and oil filters, and radiator fins and clean as often as necessary to keep them in good condition.
x				x	(30) *Battery.* Check electrolyte level.
				x	(*a*) Check for proper charge.
			x		(*b*) Remove battery and store in cool place if necessary to park for extended period.
x		x	x		(31) *Tires.* Shield tires, if possible, from direct rays of the sun.
x			x	x	Check for proper pressure (par. 240*a*).
					UNUSUAL TERRAIN (par. 295)
			x		(32) *Lubrication.* Check for fouled lubricants and lubricate as necessary (par. 60).

Table III—Continued

Drivers or Operators Preventive Maintenance Services

Intervals					Procedure
Before-operation	During-operation	At-the-halt	After-operation	Weekly	
					UNUSUAL CONDITIONS—Continued UNUSUAL TERRAIN—Continued
x				x	(33) *Tires.* Check for proper pressure (par. 240*a*). Check for availability and serviceability of tire chains.
x				x	(34) *Cooling and fuel systems.* Check air cleaner, fuel and oil filters, and radiator fins and clean as often as necessary to keep them in good condition.
					Caution: Under extremely dusty conditions or blowing sand, it will be necessary to service the air cleaner several times daily during operation to prevent entry of dust or sand into the engine. Failure to do this may wear out engine parts in a short time.
x			x	x	(35) *Clean.* Clean all parts of vehicle of snow, ice, mud, dust, and sand.
				x	Check for any sand-blasted surfaces and paint as required.
x			x		(36) *Vents.* Check engine vents and other exposed vents and keep them covered with cloth to prevent entry of dust, sand, or drifting snow.
					FORDING OPERATIONS (par. 53)
x					(37) *Fording limits.* Check vehicle fording limits. See paragraph 53 for operation precautions.
x			x		(38) *Tires.* Check for proper pressure (par. 240*a*).
x				x	Check for availability and serviceability of tire chains. Install if necessary.
x					(39) *Battery.* Check vent caps for tightness to prevent entrance of water.
			x		Check electrolyte for contamination and check for seepage of water into battery. Check charge as soon as practicable and add electrolyte and change if necessary.
			x		(40) *Clean.* Remove water and sludge from all parts of the vehicle. If fording through salt water, wash with fresh water.
			x		(41) *Cooling and fuel systems.* Check air cleaner, oil and fuel filters, and clean or replace if necessary.

Table III—Continued

Drivers or Operators Preventive Maintenance Services

Intervals					Procedure
Before-operation	During-operation	At-the-halt	After-operation	Weekly	
					UNUSUAL CONDITIONS—Continued FORDING OPERATIONS—Continued
					(42) *Lubrication.* Lubricate as specified in paragraph 62.
			x		(43) *Engine and trannsmission.* Check for evidence of water or grit and replace oil if necessary. If engine oil must be replaced, flush before adding new oil.
			x		(44) *Brake system.* Check for proper operation.

68. Preventive Maintenance by Organizational Maintenance Mechanics

a. INTERVALS. The indicated frequency of the preventive maintenance services is considered a minimum requirement for normal operation of the vehicle. Under unusual operating conditions, such as extreme temperatures, dust or sand, or extremely wet terrain, it may be necessary to perform certain maintenance services more frequently.

b. DRIVER OR OPERATOR PARTICIPATION. The drivers or opertors should accompany vehicle and assist the mechanics while periodic organizational preventive maintenance services are performed. Ordinarily, the driver should present the vehicle for a scheduled preventive maintenance service in a reasonably clean condition.

c. SPECIAL SERVICES. These are indicated by the item numbers in the columns which show the interval at which the services are to be performed and show that the parts or assemblies are 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 are as follows:

(1) *Adjust.* Make all necessary adjustments in accordance with the instructions contained in pertinent section of this manual, information contained in changes to the subject publication or technical bulletins.

(2) *Clean.* Clean the unit as outlined in paragraph 66 to remove old lubricant, dirt, and other foreign material.

(3) *Special lubrication.* This applies either to lubrication operations that do not appear on the vehicle lubrication order or to items that do appear on such orders but which should be performed in connection with the maintenance operations if parts have to be disassembled for inspection or service.

(4) *Serve.* This usually consists of performing special operations, such as replenishing battery water, draining and refilling units with oil, and changing or cleaning the oil filter, air cleaner, or elements.

(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 a 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 washer, lock nuts, lock wire, or cotter pins to secure the tightening.

d. SPECIAL CONDITIONS. When conditions make it difficult to perform the complete preventive maintenance procedures at one time, they can sometimes be handled in sections. Plan to complete all operations within the week if possible. All available time at halts 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.

e. WORK SHEET. The numbers of the preventive maintenance procedures that follow are identical with those outlined on DA AGO Form 461, Work Sheet for Wheeled and Half-Track Vehicles—Preventive Maintenance Service and Technical Inspection. Certain items on the work sheet that do not apply to this vehicle are not included in the procedures in this manual. In general, the sequence of items on the work sheet is followed, but in some instances there is deviation for conservation of the mechanic's time and effort.

f. PROCEDURES. Table IV lists the services to be performed by the organizational mechanic or maintenance crew at the designated intervals. Each page of the table has two columns at its left edge for designated intervals of 6,000 miles or 6 months and 1,000 miles or 60 days, respectively. Very often it will be found that a particular procedure does not apply to both scheduled maintenances. In order to determine which procedure to follow, look down the column corresponding to the maintenance procedure and wherever an item number appears perform the operations indicated opposite the number.

Table IV

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals: 6,000 Miles or 6 Months	Intervals: 1,000 Miles or 60 Days	Procedure
		ROAD TEST
		The driver of a vehicle is often unaware of defects in his vehicle which have developed gradually and to which he has become accustomed. The fact that many drivers lack the ability to detect the developing causes of vehicle failures makes it desirable for the mechanic to road-test the vehicle as part of the periodic preventive maintenance services. During and before this road test, any repairs or adjustments necessary to insure safe operation should be made. The appropriate paragraph in the following service procedures should be consulted. If a defect is found on the road test which does not require immediate correction, note it on the check sheet and make provisions for securing necessary replacement parts or units. The defect can be corrected later during the service.
		Note. If the tactical situation does not permit a full road test, perform items 2, 3, 4, 5, 6, 9, 10, 11, 12, and 14 which require slight or no movement of the vehicle. When a road test is possible, it should be for a distance and under conditions suitable to determine condition of vehicle.
1	1	*Before-operation service.* Perform the before-operation service as outlined in table III (par. 67) as a check to determine whether the vehicle is in a satisfactory condition to make the road test safely and that it is adequately supplied with fuel, engine oil, and coolant.
2	2	*Air pressure build-up (governor cut-off and low-pressure buzzer).* During the warm-up period (par. 38), operate the engine at fast idle (not over one-third throttle) and observe if the air pressure builds up at a normal rate to 100 psi and whether the governor then cuts off to stop compressing action. Observe if the low-pressure buzzer operates until air pressure reaches 60–65 psi and then stops as pressure is built up above the danger point.
3	3	*Instruments and gages.* Observe as follows:
		Oil pressure gage. Observe oil pressure at frequent intervals and under all conditions of engine speed to see that oil pressure is indicated. Oil pressure should be approximately 5 psi at slow idling speed.
		Caution: If gage indicates zero or excessively low oil pressure, stop the engine immediately and investigate the cause.
		Battery charge indicator. Observe the indicator to see that it is indicating normally. With the batteries fully charged, the reading should show charge for a short

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		ROAD TEST—Continued time after starting engine and then return to slightly above zero charge with all lights and electrical accessories switched off. If battery is low, charge will be indicated for a longer period of time. Abnormal discharge reading with engine at normal operating speed indicates deficiency in the generating circuit. Failure to show a charge reading with all electrical accessories in operation may also indicate deficiency in generating circuit. Report condition.
		Speedometer. Watch the speedometer for proper operation, excessive fluctuation, and unusual noises that might indicate worn or damaged gears or cables. Note if accumulating mileage is recording satisfactorily.
		Temperature gage. Note the temperature gage and see that it indicates in the normal range. The temperature should increase gradually during warm-up period. Temperatures between 160° and 220° F. are satisfactory for normal operating conditions. Below-normal temperature after a reasonable warm-up period may indicate that thermostat is stuck open (par. 131). Temperatures above normal may indicate that the thermostat is stuck closed (par. 131), or the cooling system is clogged.
		Fuel gage. Observe whether the fuel gage indicates the approximate level of fuel in the tank.
4	4	*Horns, mirrors, and windshield wipers.* If tactical situation permits, test the horn for proper operation and tone. Examine the rear view mirror and the windshield wiper blades and arms to see that they are in good condition and secure. Observe whether the blades make good contact with the glass, and that they operate properly through their complete stroke without indication of loose motor mountings.
5	5	*Brakes, service.* Operate service brakes at varying vehicle speeds. Apply brakes sufficiently to stop vehicle in minimum distance, observing their effectiveness. Note whether the vehicle pulls to one side, observe any unusual noises, pedal travel and feel, and pull-back spring action.
5	5	*Parking brake.* Stop the vehicle on an incline; then apply the parking brake and observe, if it holds the vehicle effectively, that the application lever has over one-third of its travel in reserve, and that the ratchet and pawl latch the applied brake securely. *Note.* Parking brake should be adjusted if there is less than one-half ratchet travel reserve (par. 234).

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		ROAD TEST—Continued
7	7	*Transmission.* With transmission at normal operating temperature and with engine idling, move transmission control lever through all positions in both ranges (par. 40*b*). Make sure lever snaps firmly into each position. Note if vehicle has tendency to "creep" or if engine slows down when lever is moved out of "N" (neutral) position. Cause may be due to engine idling too fast or to faulty transmission. Drive vehicle in all forward and reverse positions; make sure all proper shifts occur smoothly and that none are missed. Be on the alert for unusual noises which might indicate improper operation of transmission.
7		Road test vehicle in all driving positions. Make sure all proper shifts occur within speed ranges specified in paragraph 40. Adjust linkage, if required for correction of improper automatic shifting. When transmission shifts properly, make stall speed test described in paragraph 176, as an over-all check of power plant performance.
7	7	*Transfer.* With transmission in "N" (neutral) position, move transfer lever into "UP-ENGAGED" and "DOWN-NEUTRAL" positions. Drive vehicle with transfer lever in "UP-ENGAGED" position; then attempt to drive with lever in "DOWN-NEUTRAL" position to make sure transfer is in neutral.
7		Jack up one wheel on each axle. Run engine with transmission in both forward and reverse positions. Front wheel should revolve and in same direction as rear wheels. Failure of front wheel to turn would indicate deficiency in front axle drive clutch or in shifting linkage to drive clutch.
8	8	*Steering.* With vehicle in motion, observe for excessive wheel free play. Rotate the steering wheel fully in both directions and note any indication of binding or bumpy feel. Vehicle should show a tendency to straighten out of the turn. As the vehicle is operated at normal speeds, observe any tendency to wander, shimmy, or pull to one side. Examine the steering column and steering wheel to see that they are in good condition and secure.
9	9	*Engine.* Observe engine operating characteristics as follows:
		Unusual noises. Listen for knocks and rattles as the engine is accelerated, decelerated, and while it is under both light and heavy loads.

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		ROAD TEST—Continued
		Acceleration and power. Operate the engine at various speeds noting whether the vehicle has normal pulling power and acceleration. A slight ping during fast acceleration is normal. Continuing or heavy ping may indicate early timing, heavy accumulation of carbon, or low octane number fuel.
		Governed speed. With vehicle in gear, slowly depress the acclerator to the toe board, and by observing the speedometer reading, see if the vehicle reaches, but does not exceed, the governed speed specified on caution plate (fig. 12).
10	10	*Unusual noises.* Be on the alert continually for unusual noises that would indicate looseness of parts, damaged, or malfunctioning units in the power train, cab, body, or wheels.
11	11	*Air-hydraulic brake cylinder operation.* Depress brake pedal slowly and note if the cylinder can be felt assisting the movement of the pedal. Little or no assist action indicates power cylinder is not functioning correctly.
12	12	*Compressed air system leak.* With air pressure at governed maximum (100 psi) and the brakes applied, stop the engine. There should not be a noticeable drop in pressure within one minute. If any pressure drop occurs during this check, test the compressed air system for leaks by the soap suds method (par. 227*b*).
13	13	*Temperatures.* After completing the run, note as follows:
		Brakes, drums, and hubs. Hand feel all the brake drums and hubs cautiously for abnormal temperature. An overheated brake drum or hub may be an indication of a dragging brake or defective, dry, or improperly adjusted wheel bearing; and an abnormally cool brake drum is an indication of an inoperative brake.
		Axles, transmission, and transfer. Cautiously feel the axle differential and carrier, 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. This should be corrected or reported to proper authority.
14	14	*Leaks.* Look within the engine compartment and underneath the vehicle for engine oil, water, and fuel leaks, and determine their source.
16	16	*Gear oil leaks.* Observe axle housing, transmission, and transfer to see that they are not leaking.

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		MAINTENANCE OPERATIONS
		Caution: Use necessary precaution to block the vehicle so that it may be operated safely in gear at reasonable speeds. If the facilities are not available for adequately and safely jacking up and blocking vehicle, omit the services which follow that require running the engine in gear.
17	17	*Unusual noises.*
		Engine, belts, and accessories. Accelerate and decelerate the engine momentarily and listen for any unusual noises in these units that might indicate damaged, loose, or excessively worn engine parts, drive belts, or accessories. Also be sure to locate, correct, or report any unusual engine noises heard during road test.
		ENGINE AND ACCESSORIES
18	18	*Cylinder head and gaskets.* Look 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 a definite indication of looseness or leaks. If tightening is necessary, use a torque-indicating wrench and tighten in the sequence as explained in paragraph 96*e*. If necessary to tighten cylinder head bolts, adjust the valve clearance as indicated in item 19 below.
19	19	*Valve mechanism.* Check valve clearances while hot (par. 94). Rocker arms, shafts, and springs should appear in good condition, correctly assembled and secure (fig. 31). Oil should be delivered properly. Also make sure that the valve cover gaskets are in good condition.
19		*Adjust.* Adjust valve clearances as explained in paragraph 94, taking care that the lock nuts are secure when the clearances are last noted during adjustments.
	20	*Spark plugs.* Examine the spark plugs to see that their insulators are in good condition and clean, and that there is no leakage around the insulators. When operating conditions require, the spark plugs may be removed for service (par. 109).
20		*Remove.* Remove the spark plugs (par. 109) and examine for adjustment and condition, paying particular attention to broken insulators, excessive carbon deposits, and to electrodes which are burned thin. Replace unserviceable plugs. Report excessive deposits or damaged insulators, as these conditions may indicate incorrect heat range.

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		ENGINE AND ACCESSORIES—Continued
20		*Clean.* Clean deposits from electrodes and insulators and again check for cracks. Install new plugs (par. 109) if there are any indications of cracks or burned insulators.
20		*Adjust.* Adjust gaps to specifications and by method described in paragraph 109. After completing item 21 below, install the plugs (par. 109).
21		*Compression test.* With all spark plugs out, make compression test as described in paragraph 93*b*. Record the readings on the space provided on back of work sheet Form 461.
22	22	*Batteries (cables, hold-downs, carrier, record gravity, and voltage).* Inspect battery case for cracks and leaks. Clean top of battery. Inspect cables, terminals, bolts, posts, straps, and hold-downs for condition and looseness. Test specific gravity (par. 141*b*) and record on DA AGO Form 461. Normal specific gravity readings below 1.215 indicate battery should be recharged or replaced. Electrolyte level should be as described in paragraph 141*c*.
22		*Test.* Perform high-rate discharge test according to instructions for test which accompany test instrument, and record voltage on DA AGO Form 461. Cell variation should not be more than 30 percent for meters reading in percentages of charge. *Note.* Normally, specific gravity must be above 1.215 to make this test.
22	22	*Clean and serve.* Bring electrolyte to proper level by adding distilled or clean water (par. 141*c*). Clean entire battery and carrier. Repair carrier if corroded. Clean battery cable terminals, terminal bolts and nuts, and battery posts. Tighten terminals and hold-downs carefully to avoid damage to battery. Make certain that terminal and cable connectors are covered with waterproofing material.
23	23	*Crankcase.* With engine idling, examine crankcase, valve cover, and timing gear cover for oil leaks. Stop the engine and after oil has drained into crankcase, see whether the oil is at the proper level (par. 59*b*).
23	23	*Note.* If an oil change is due, service crank-case according to lubrication chart (par. 57) and instructions in paragraph 59*b*. Do not start engine again until items 24, 35, and 34 are completed.

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		ENGINE AND ACCESSORIES—Continued
24	24	*Oil filter and lines.* Inspect filter and external oil lines to see that they are in good condition, secure, and not leaking.
24		*Clean and serve.* Remove oil filter drain plug. Drain off any accumulated dirt and sludge. Replace element (par. 59*c*).
35	35	*Crankcase breather and filler cap.* Inspect crankcase breather and filler cap to see that they are in good condition, correctly assembled, secure, and that ventilator tubes are open.
35		*Clean and serve.* Clean and refill crankcase breather oil reservoir as explained in lubrication chart (par. 57) and in paragraph 59*d*.
35		*Clean.* Disassemble and clean crankcase ventilation valve (par. 99*c*).
34	34	*Air cleaners.* See that all gaskets, clamps, air lines, and hoses are present and in good condition. Observe condition of the cleaning element in body. Examine oil in reservoir of cleaner paying particular attention to the amount of dirt present in the oil. Also see that the oil level is satisfactory (par. 59*e*).
34	34	*Clean and serve.* Service air cleaners in accordance with instructions on lubrication order (par. 57). After servicing cleaner, note that the connecting hoses are in good condition and properly clamped to air cleaner.
27	27	*Generator, starter, and switch.* Note whether these items are in good condition, securely mounted, and whether the wiring connections are clean and secure. See that the starter linkage is in good condition and secure.
27		*Generator.* Remove the generator inspection plug and inspect commutator for dirty condition, roughness, high mica, or thrown solder. If any of these conditions are evident, generator must be replaced (par. 137).
27		*Starter.* Starter must be removed from vehicle before inspection cover can be readily removed (par. 135*a*). Remove inspection cover and see that the commutator and brushes are in good condition and not excessively worn; that the brushes are free in holders and have sufficient spring tension to hold them in contact with commutator; and that the brush connecting wires are secure and not chafing. Clean the commutator as described in paragraph 135*b*. **Caution:** When replacing starter inspection cover, be sure seal ring is properly installed to prevent leakage (par. 135*b*).

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		ENGINE AND ACCESSORIES—Continued
27		*Tighten.* Tighten the starter mounting studs securely (par. 135*c*).
39	39	*Starter (action, noise, and speed).* Start engine and observe whether the general action of the starter is satisfactory, particularly, whether it engages and operates properly without excessive noise and has adequate cranking speed. Note whether the engine starts readily. Also, as soon as the engine starts, note whether the oil pressure gage and battery charge indicator readings are satisfactory (pars. 30 and 28).
40	40	*Leaks.* Look in the engine compartment and under the vehicle for engine oil, fuel, and water leaks. Trace all leaks to their source and report or correct them.
31	31	*Distributor.* Observe if distributor and ignition coil housing and external attachments are in good condition, water-tight, and secure. Examine other parts of the distributor as follows:
31		*Cap, rotor, and points.* Remove cover from distributor. Inspect cover, both inside and out, rotor, and breaker plate assembly to see that they are in good condition, correctly assembled, secure, and serviceably clean. Examine closely for cracks in cap and rotor, corrosion of terminals and connections, and for burned rotor bar or contact points. Also see that points are in good condition, well alined and adjusted to 0.022 inch (par. 108*a*). If the points are pitted, burned, or worn to an unserviceable condition, install new set of points (par. 108*b*). If points are badly pitted, also replace the capacitator (condenser) (par. 108*c*), as it is probably the cause of the pitting. Install the new points so that they are well alined and engaged squarely. If points are slightly pitted or burned, face them with a contact point facer or grade 2/0 flint paper (do not use emery cloth), and remove the filings with compressed air. Adjust points after they are dressed.
31		*Shaft.* Examine shaft, feeling for looseness to determine if there is excessive wear in shaft or bearings.
31		*Centrifugal advance.* Install rotor on shaft and note if the camshaft can be rotated manually to the normal range of movement which is permitted by the centrifugal advance mechanism. Note if it returns to original position, when released, without binding or hanging up.
31		*Special lubrication.* Refer to lubrication chart (par. 57) and instructions in paragraph 59*h*.

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		ENGINE AND ACCESSORIES—Continued
31		*Adjust.* Adjust distributor point gaps to 0.022 inch in accordance with paragraph 108*a*. *Note.* Do not install distributor cover until item 32 is completed.
32	32	*Coil and wiring.* Examine the coil to see that it is in good condition and securely mounted. Also make sure spring-loaded terminals on built-in cable make good contact with coil and distributor rotor. Install distributor unit cover. **Caution:** When installing cover be sure gasket is properly placed and in good condition. Replace gasket if hard or cracked. Be sure high tension couplings are properly made up. Inspect all low-voltage wires in engine compartment to see that the wires, including shielding on conduits, are in good condition, waterproof, and securely fastened on support mountings and terminals.
41	41	*Ignition timing (advance).* With engine running, check timing as described in paragraph 107.
41		*Adjust.* Adjust the ignition timing as described in paragraph 107.
43	43	*Regulator unit (connections, voltage, current, and cut-out).* Inspect generator-regulator to see that it is in good condition, watertight, secure, and undamaged.
43		*Test.* The enclosed construction of the charging system components and the wiring harness and fittings used prohibit the normal methods of test. If suitable adapters are available, connect low voltage circuit tester and observe whether the voltage regulator, current regulator, and cut-out control the generator output properly. Follow instructions which accompany test instrument. Replace regulator if test shows faulty operation (par. 138). **Caution:** This test should be made only after regulator unit has reached normal operating temperature.
25	25	*Radiator (core, shell, mountings, hose, cap, and gasket).* See that these items are in good condition, correctly assembled, securely mounted and connected, and do not leak. Note whether the core air passages are obstructed with dirt, insects, or trash, and whether the core fins are badly bent. Examine the coolant to see whether it is so contaminated with rust, oil, or other foreign matter that the cooling system should be cleaned.

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		ENGINE AND ACCESSORIES—Continued
		If cleaning is necessary, clean according to instructions in paragraph 128. Refill radiator with coolant (par. 126*a*), adding specified inhibitor (par. 128*f*).
25	25	*Antifreeze.* If antifreeze is in use, determine its protective value and record in space provided on reverse side of work sheet Form 461.
25	25	*Clean.* Clean the dirt, insects, and trash from exterior of core and blow out with compressed air or with stream of water applied carefully from the rear side of core (do not use steam).
		Caution: Use only suitably shaped piece of wood or blunt instrument in straightening fins; otherwise tubes may be punctured.
25		*Tighten.* Tighten all loose radiator mountings and hose clamps.
26	26	*Water pump, fan, and shroud.* Observe water pump to see that it is in good condition, not leaking, and securely installed. Loosen drive belt and leave it loose until adjustment is made (item 29). Inspect fan blades to see whether they are in good condition and properly secured to hub. See that the fan shroud is in good condition and securely mounted.
28	28	*Air compressor.* Examine the air compressor to see that it is in good condition, properly alined to its drive pulley, and secure. See that all the compressor water, oil, and air lines within the engine compartment are in good condition and secure, and that the oil and water lines do not leak.
28	28	*Special lubrication.* Refer to lubrication chart (par. 57).
28		*Adjust.* Adjust compressor governor as described in paragraph 228*b*.
29	29	*Drive belts and pulleys.* Observe all drive belts for evidence of fraying condition, excessive wear, and deterioration. See that all drive pulleys and hubs are in good condition and securely mounted.
29	29	*Adjust.* Adjust all drive belts to specified tension (pars. 129*b* and 229*a*).
33	33	*Manifolds and heat control.* Observe the intake and exhaust manifold to see that they are in good condition, secure, and that the manifold gaskets appear to be in good condition and not leaking. Check manually-operated manifold heat control and determine if it is

Table IV—Continued

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		ENGINE AND ACCESSORIES—Continued
		in good condition, secure, and that the control adjusting point is in place, and set at the correct seasonal position (fig. 63).
33		*Tighten.* Tighten all manifold assemblies, mountings, exhaust pipe, and carburetor connecting flange nuts, evenly and securely.
36	36	*Carburetor (choke, throttle, linkage, and governor).* See that these items are in good condition, correctly assembled, and securely installed; that the carburetor does not leak; that the control linkage, including choke and throttle shaft, is not excessively worn; that the choke valve opens fully when control is in its released position; that the throttle valve opens fully when the accelerator is fully depressed; and that the governor is secure and properly sealed.
		ENGINE IDLE AND VACUUM TEST
42	42	*Engine idle.* With a vacuum gage, adjust carburetor idling speed and mixture adjustments as described in paragraph 112*b*.
42	42	*Vacuum test.* Perform vacuum test with engine running at normal idling speed as described in paragraph 93*c*.
		CHASSIS, BODY, AND ATTACHMENTS
47	47	*Tires and rims.* Inspect as follows:
		Valve stems and caps. Observe whether all valve stems are in good condition and in correct position and that all valve caps are present and installed securely. Do not tighten with pliers.
		Condition. Examine all tires for cuts, bruises, breaks, and blisters. Remove embedded glass, nails, or stones from tires. All tires with cuts or injuries extending to or into the cord body and those worn smooth in center of tread must be removed and exchanged for reconditioned or new ones. Look for irregular tread wear or any signs of flat spots, cupping, feather edges, and one-sided wear. Any mechanical deficiency causing such conditions should be determined and corrected or reported. The wheel positions of tires with irregular wear should be changed to even up the wear. Front tires worn irregularly should be moved to rear wheel position.
		Matching. With the tires properly inflated (par. 240*a*), inspect them to see that they are matched according to over-all circumference (par. 240*c*) and type of tread.

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals: 6,000 Miles or 6 Months	Intervals: 1,000 Miles or 60 Days	Procedure
		CHASSIS, BODY, AND ATTACHMENTS—Continued
		Spare tire carrier. See that the spare tire carrier is in good condition and secured properly (fig. 143).
		Rims. All rims and their lock rings should be in good condition and secure.
47	47	*Serve.* With all the tires properly inflated, measure the over-all circumference of tire, including spare (par. 240*c*). Select the tires to be mounted on the different axles so they will not have differences in over-all circumference exceeding the limit specified in paragraph 240*c* and in current directives and bulletins. *Note.* The spare must be matched properly and mounted for use on one of the road wheels at intervals not exceeding 90 days. A convenient time to do this is during these maintenance services. After performing the tire matching service, do not install wheels until wheel bearing services are completed, as well as other services which require removal of wheels.
48		*Rear brakes.* Remove the rear wheels, hubs, and drums and inspect and service the brakes as follows: *Note.* On the semiannual maintenance service, the several rear wheel bearings and brake items (48, 49, and 52) are group services and overlap. Perform these services in the best order for economy of mechanic's time and for orderly reassembly.
48		*Drum and backing plates.* Clean all dirt and grease from these parts thoroughly, keeping dry-cleaning solvent or volatile-mineral-spirits paint thinner away from the brake linings and wheel cylinder boots. Examine the drum and backing plate to see that they are in good condition, securely mounted, and not excessively worn or scored.
48		*Wheel cylinders.* Observe whether wheel cylinders are in good condition and securely mounted, paying particular attention to end covers to see that the rubber covers are not deteriorated. Look for leaks by slightly pulling the lower part of the wheel cylinder end cover away from the cylinder. *Note.* Hub and drum assembly must be removed in order to thoroughly inspect the wheel cylinders.
48		*Tighten.* Tighten drum mounting bolts (par. 222*c*).
	49	*Rear brake shoes (linings).* Forward rear wheel and drum should be removed for inspection of the brake linings. Examine the linings to see whether they are so

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		CHASSIS, BODY, AND ATTACHMENTS—Continued
		worn that the rivet heads may contact the drums within the next month of operation. If the lining inspected requires replacement, remove all wheels and drums and check their brakes, and service if necessary. This operation should also be performed if the vehicle has been operated in deep water, mud, or loose sand.
	49	*Adjust.* Adjust as described in paragraph 220.
49		*Inspect (hubs and drums removed).* Observe whether linings are in good condition, tightly secured to the brake shoes, in good wearing contact with the drum, free of lubricant or brake fluid, and not excessively worn. Also see that the brake shoes are in good condition, properly secured, and guided by the guide bolts and springs, and properly returned against their anchors by the retracting springs. The thickness of the lining above the rivet heads at the most worn section should be sufficient for at least a month of safe operation. If the linings are badly contaminated with lubricant or brake fluid, replace all linings on both brakes of that particular axle. If the linings are only slightly contaminated with lubricant or fluid, clean them thoroughly.
49		*Clean.* Clean all dirt and grease from linings with wire brush, clean cloth, or compressed air.
49		*Adjust.* After items 49, 52, 53, 54 and 60 are completed, adjust shoes as directed in paragraph 220.
52	52	*Rear wheels (bearings, seals, drive flanges, and nuts).* Inspect and service these items as follows:
52	52	*Wheels.* Inspect wheels for good condition.
52	52	*Bearings and seals.* Inspect for looseness of wheel bearing adjustment (par. 244*a*). Revolve the wheels and listen for indications of dry or damaged wheel bearings. Inspect the drive flanges and around the brake supports and drum for lubricant and brake fluid leaks.
52	52	*Axle shaft flanges and nuts.* Note whether these items are in good condition.
	52	*Tighten.* Tighten all axle shaft flange nuts securely (par. 205*c*).
52		*Clean.* Disassemble wheel bearings and oil seals (par. 246*a*). Clean thoroughly and check the rollers and cups to see that they are in good condition, and that the cups are secure. If the cups appear to be in good condition, it is not necessary to remove them from the hubs unless the bearings must be replaced, in which case new cups

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		CHASSIS, BODY, AND ATTACHMENTS—Continued
		should be installed. Also see whether the machined surfaces upon which the bearings are assembled are in good condition.
52		*Special lubrication.* When all of the related items have been performed to the point where the wheel bearings are to be reinstalled, lubricate the bearings according to instructions on lubrication chart (par. 57) and in paragraph 59*l*.
52		*Adjust.* After lubricating the wheel bearings (pars. 57 and 59*l*), reassemble the hub and drum assemblies (par. 246*e*), and adjust the wheel bearings (par. 244*b*).
		Note. Proper adjustment of the wheel bearings is vital to the life of the bearings and the lubricant retainer seal. If the bearings are adjusted so that they are loose, the lubricant retainer seals cannot seal properly for any extended period. If the bearings are adjusted too tightly, they are likely to become damaged.
50	50	*Torque rods.* Torque rods (both front and rear) must be in good condition, correctly assembled, and secure. Examine the rubber seals at each end of the torque rod. Check tightness of torque rod mounting nuts at axles and at frame brackets (pars. 256 and 262).
51	51	*Rear spring seats and bearings.* Inspect to see that spring seats are in good condition, secure, and not leaking lubricant.
51		*Adjust.* Adjust spring seat bearings as described in paragraph 261*d*.
51		*Special lubrication.* Refer to lubrication chart (par. 57) and paragraphs 59*v* for instructions.
53	53	*Front brakes.* Remove the front wheels, hubs, and drums, and inspect and service the brakes as follows:
		Note. On the 6-month maintenance service, the several front wheel and brake items (53, 54, and 60) are group services and overlap. Perform these services in the best order for economy of mechanic's time and for orderly reassembly.
53		*Drum and backing plates.* Clean and inspect in the same manner as in item 48.
53		*Wheel cylinders.* Inspect in the same manner as in item 48.
	54	*Front brake shoes (linings).* Inspect the brake lining thickness in the same manner as in item 49.
	54	*Adjust.* Adjust as described in paragraph 220.

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		CHASSIS, BODY, AND ATTACHMENTS—Continued
54		*Inspect (hubs and drums removed).* Inspect the brake linings, shoes, etc., as the similar inspection on item 49.
54		*Clean.* Clean all dust from the brake linings with a wire brush, clean cloth, or compressed air.
54		*Adjust.* After items 53, 54, 55, and 60 are completed, adjust brakes as described in paragraph 220.
55	55	*Steering knuckle (joints, bearings, and seals).* Inspect to see that the knuckle housings are in good condition. Inspect steering arms for bent condition. See that housing outer seal and seal flanges are in good condition and secure. Remove lubrication plug and examine sample of lubricant to see if it appears to be contaminated.
55		*Clean.* Remove constant velocity universal joint assembly (par. 199*b*). Wash thoroughly in dry-cleaning solvent or volatile-mineral-spirits paint thinner and without disassembly of universal joint, inspect parts to see that they are in good condition and not excessively worn (par. 199*c*). Pay particular attention to universal joint washers, balls and races, axle splines, and flanges.
55		*Special lubrication.* Refer to paragraph 199*c*(3) for special lubrication instructions.
56	56	*Front springs (clips, leaves, "U" bolts, hangers, and shackles).* See that they are in good condition, correctly assembled, and secure. Spring clips and bolts should be in place; spring leaves should not be shifted out of their correct position. Note if the deflection of both springs is normal and approximately the same. Test the hangers and bolts for excessive wear by means of a pry bar.
56	56	*Tighten.* Tighten all spring "U" bolts securely and uniformly (par. 255*b*).
57	57	*Steering arms, tie rod, drag link, pitman arm, column, and wheel.* Make certain that these items are in good condition, correctly and securely assembled and mounted. Examine steering gear case for lubricant leaks and check lubricant level. Pay particular attention to the pitman arm to see that it is securely mounted and not bent out of its normal shape. Also observe whether the steering system is in good adjustment.
57		*Tighten.* Tighten the pitman arm shaft nut (par. 250*c*). Examine tie rod, drag link, and steering arms for damage, looseness, and wear. Check tightness of ball stud nuts at tie rod ends and at drag link, ends (par.

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		CHASSIS, BODY, AND ATTACHMENTS—Continued
		249*c*). Check tightness of steering case mounting bolt nuts at frame (par. 253).
		Caution: Loosen bolts which attach cowl bracket to spacer (fig. 153) before tightening steering case mounting bolts at frame. This will prevent distortion of column while tightening mounting bolts. Tighten cowl bracket-to-spacer bolts after mounting bolts have been checked.
58	58	*Front shock absorbers and links.* See that the shock absorber bodies are secured to frame, that the links which connect their arms to the axle are in good condition and secure, and that there are no fluid leaks.
58		*Serve.* Fill shock absorbers with specified fluid (pars. 57 and 59*p*). After servicing shock absorbers, check action as described in paragraph 257*a*.
60	60	*Front wheel (bearings, seals, drive flanges, and nuts).* Inspect the front wheels, bearings, seals, drive flanges, and nuts in the same manner as in item 52 for similar rear wheel items.
60		*Clean.* Disassemble wheel bearings and oil seals (par. 245*a*) and clean and inspect in the same manner as described in item 52.
60		*Special lubrication.* When all of the related items have been performed to the point where the wheel bearings are to be installed, lubricate the bearings according to instructions on lubrication order (par. 57) and in paragraph 59*l*.
60		*Adjust.* After lubricating bearings, install and adjust in same manner described in item 52.
61	61	*Front axle (pinion end play, seal, vent, and alignment).* See that the axle housing is in good condition, securely assembled and mounted, and not leaking. Feel by hand to see that the pinion shaft does not have excessive end play and that its seal is not leaking. Alinement of axle can be checked as described in paragraph 264*b*(5).
61	61	*Clean.* See that vent line is in good condition, open, and securely connected.
62	62	*Front propeller shafts (joints, seals, and flanges).* See that these items are in good condition, correctly and securely assembled and mounted; that the universal joints are not excessively worn; that the slip joints are free and not excessively worn, and adequately lubricated (par. 57).

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		CHASSIS, BODY, AND ATTACHMENTS—Continued
62		*Tighten.* Tighten all universal joint flange nuts to 33–43 pound-feet torque.
63	63	*Engine mountings.* Examine all engine power plant mountings (fig. 39) for condition and tightness.
64	64	*Parking brake (pawl and sector, linkage, drum, and lining).* Note whether the parking brake pawl and sector and linkage are in good condition and secure; whether the brake drum is in good condition and not scored or oily; and whether the brake lining is oil-soaked or worn thin.
64		*Adjust.* Adjust the clearance between the brake lining and drum (par. 234*b*). Make sure the adjusting nuts are securely locked when the adjustment is completed.
66	66	*Brake pedal (free-travel, linkage, and return spring).* Examine to see that the pedal free-travel is satisfactory (¼ to ½ inch) and that the pedal is in good condition; that the master cylinder push rod yoke is securely connected to the pedal and that the connection is not excessively worn; and that the pedal return spring returns the pedal to fully released position.
67	67	*Brake master cylinder (leaks, vent, and fluid level).* The cylinder should be in good condition and secure, the boot properly installed, and no indication of fluid leakage. See that vent line connected to filler extension is in good condition, securely connected, and open.
67	67	*Serve.* Remove dirt from and around the filler plug, remove filler plug, and fill the master cylinder reservoir to proper level (pars. 57 and 59*r*). Use only specified brake fluid. Install filler plug, using new gasket when necessary.
68	68	*Air-hydraulic power cylinder (air lines and cylinder).* See that these items are in good condition and securely assembled and mounted. Also note if brake fluid is leaking from the slave cylinder or control valve. Make sure air lines are securely connected and not leaking (par. 227*b*).
70	70	*Compressed-air tanks.* Observe whether they are in good condition and secure (fig. 136). Open drain cocks to expel moisture. Be sure to close drain cocks after draining.
71	71	*Transmission (mounting, seals, and linkage).* Note whether the transmission case is in good condition and securely mounted or whether oil is leaking from its seals

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		CHASSIS, BODY, AND ATTACHMENTS—Continued
		or gaskets. Make sure control linkage is in good condition, properly connected, and secure.
71		*Tighten.* Tighten all transmission mounting and external assembly bolts and cap screws securely.
72	72	*Transfer (mounting, linkage, seals, vent, and power-take-off).* See that transfer case and power-take-off are in good condition and securely mounted; that the control linkage is in good condition and securely connected; that the seals do not leak; and that the transfer vent line is open and securely connected.
72	72	*Tighten.* Tighten all transfer and power-take-off mounting bolts.
72		*Tighten.* Tighten all external transfer and power-take-off assembly bolts and cap screws.
73	73	*Rear propeller shafts.* Inspect in the same manner as item 62.
73		*Tighten.* Tighten the universal joint and companion flange bolt nuts to 33–43 pound-feet torque.
74	74	*Center bearing (pillow block) (seals and mounting).* Examine pillow block for any excessive end play. See that it is adequately lubricated, that its seals are not leaking, and that the mountings are secure.
74	74	*Tighten.* Tighten the center bearing mounting stud nuts to 48–64 pound-feet torque.
75	75	*Rear axles (pinion end play, seals, and vent line).* Inspect these items in same manner as described in item 61.
75	75	*Clean.* Clean rear axle vent lines in same manner as in item 61.
77	77	*Rear springs (clips, leaves, "U" bolts).* Inspect these items in the same manner as in item 56.
77	77	*Tighten.* Tighten main and secondary spring "U" bolts evenly and securely to 375–400 pound-feet torque.
79	79	*Cab and body mountings.* Note whether these mountings are all in good condition and secure. Front corner body mountings are coil spring type; these springs should be neither loose nor compressed until solid.
79	79	*Tighten.* Loosen bolts which attach steering column cowl bracket to spacer, then tighten cab mounting bolts to 25–30 pound-feet torque; shift steering column to instrument panel mounting so that no binding exists, then tighten steering column mounting bolts (par. 253*d*). Tighten body mounting bolts, except spring type front mountings, to 100–120 pound-feet torque. Tighten

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		CHASSIS, BODY, AND ATTACHMENTS—Continued
		spring type front body mounting bolts just enough to partially compress springs.
80	80	*Frame (side and cross members).* Inspect frame, brackets, side rails, and cross members to see that they are in good condition, secure, and correctly alined. If frame appears to be out of line, check alinement (par. 264) and report the condition to ordnance maintenance personnel.
81	81	*Wiring, conduits, and grommets.* Observe these items underneath the vehicle to see that they are in good condition, properly supported, connected, and secure.
82	82	*Fuel tank, fittings, and lines.* Inspect fuel tank to see that it is in good condition and securely mounted. Examine fuel tank and fuel lines for leaks. Examine fuel tank filler cap for defective gasket; make sure cap fits securely. Check fuel lines and fittings to see that they are in good condition, securely supported, and not leaking. See that vent line is in good condition, open, and securely connected.
82		*Fuel tank drain plug.* Remove the fuel tank drain plug and drain off the accumulated water and sediment. Drain only until the fuel starts to run clear. Use necessary precautions against fire.
37		*Fuel filter plates.* Remove fuel pump assembly and clean fuel filter plates (par. 117*d*).
38	38	*Fuel pump.* Test fuel pump for pressure as described in paragraph 117*e*. Replace pump if it does not produce proper pressure, being sure to test the new pump to make sure it is statisfactory.
83	83	*Brake lines (fittings and hose).* Observe brake lines, fittings, and hose underneath the vehicle and on axle housing to see that they are properly supported, securely connected, and not chafing or leaking.
84	84	*Exhaust pipes and muffler.* Examine the exhaust pipe to see that it is securely attached to the exhaust manifold, and the gasket does not show visible evidence of leakage. Examine all joints in exhaust pipe, at muffler, and in tail pipe to make sure they are secure and watertight. Make sure exhaust pipe, muffler, and tail pipe mountings are in good condition and secure. See that tail pipe is unobstructed at its upper end.
85	85	*Vehicle lubrication.* Lubricate all points of the vehicle in accordance with instructions on the lubrication chart (par. 57), specific lubrication information (par. 59), current lubrication bulletins or directives, and the following:

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals: 6,000 Miles or 6 Months	Intervals: 1,000 Miles or 60 Days	Procedure
		CHASSIS, BODY, AND ATTACHMENTS—Continued
		Use only clean lubricant. Keep all lubricant containers and dispensers covered except when withdrawing lubricant.
		Lubrication of items on the Preventive Maintenance Service and Technical Inspection Work Sheet that are marked with an L (special lubrication symbol) should be omitted on this vehicle lubrication service. This will avoid duplication and, in some cases, overlubrication.
		Before applying lubricant, clean the lubrication fitting or plug so that no dirt will enter with the lubricant. If lubrication fittings, flexible lines, vent lines or plugs are missing or damaged, they should be replaced immediately. Clean the hole in which the new fitting is to be installed, install the fittings, and lubricate the unit. On all unsealed bushings or joints, the lubricant should be applied until it appears at the openings. Open any clogged lubrication passages until lubricant is properly delivered.
		When draining oil from the engine, transmission, transfer, or axle housings, always drain the oil immediately after it has been warmed and agitated to a good drainage condition by operation of the engine or vehicle. Refill the units to the correct level with specified lubricant as soon as the draining is completed, so there will be little hazard that they may be operated without lubricant.
		Caution: Do not fill to overflowing. Reinstall all drain and filler plugs securely. Take care that any required gaskets are in good condition and in place on the reinstalled plugs. Wipe off excess lubricant that may drip onto brakes, rubber parts, or detract from the vehicle's appearance.
		Lower Vehicle to Ground
86	86	*Toe-in and turning stops.* With the front wheels on the ground, in a straight-ahead position, and using a toe-in gage (fig. 113), determine whether the front wheel toe-in is within $\frac{5}{32}$ to $\frac{7}{32}$ inch limits (par. 196). See that wheel turning stops (adjusting screws) are in place and securely tack-welded. Turn the front wheels to extreme right and left and see that the turn is limited by the stops. In this position, note whether the tires clear all parts of the vehicle. If there are any indications that the turning angle exceeds the specified limits (par. 6c),

Table IV—Continued

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals: 6,000 Miles or 6 Months	Intervals: 1,000 Miles or 60 Days	Procedure
		CHASSIS, BODY, AND ATTACHMENTS—Continued
		such as loose wheel stops, scuffing of tires against the vehicle, or abnormal front axle universal joint wear, they should be reported for a check of the turning angle by a higher echelon.
		Caution: If toe-in adjustment is necessary, be sure the tie rod is in correct position and well secured after the adjustment is made (par. 196*b*). Toe-in must be kept within 5/32 to 7/32 inch limits to avoid unnecessarily rapid tire wear.
87	87	*Winch (clutch, brakes, drive, shear pin, and cable).* Check these items to see if they are in good condition, correctly assembled, and secure. See that the clutch moves freely to both the engaged and disengaged positions and latches securely. Examine the drag brake lining to see that it is in good condition, secure, and correctly adjusted to stop the drum (par. 286*a* and *b*). Inspect the automatic brake to see that the lining is secure, not excessively worn, and that spring and adjusting nut are properly assembled. Check the propeller shaft in the same manner as in item 62 and also see that shear pin is installed (fig. 187). The propeller shaft front yoke should slide freely on the shaft to insure the safety feature of the shear pin. Check safety collar clearance (fig. 187). Inspect cable for good condition, even winding, and note whether the cable chain and hooks are securely attached and in good condition. Also check the oil level in the worm gear case.
87	87	*Special lubrication.* See lubrication chart (par. 57) and paragraph 59*m* and *n* for instructions.
87		*Clean and serve.* Unwind cable and inspect for broken or frayed strands, flat or rusty spots, and kinks. Clean and oil in accordance with lubrication chart (par. 57) and paragraph 59*o*.
91	91	*Lamps (lights) (head, tail, stop, and blackout).* Operate the switches and note whether the lamps (lights) respond. Note whether any lamps (lights) remain on with the switches off. Be sure to include the stop lights. See that the dimmer switch controls the head light beams properly, and that they are properly aimed so as not to blind oncoming traffic. Examine all lamps (lights) to see that they are in good condition and secure; check for dirty and broken lenses, or discolored reflectors.
91		*Adjust.* Adjust aim of head light beams (par. 143*a*).
92	92	*Safety reflectors.* See that they are all present, in good condition, clean, and secure.

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		CHASSIS, BODY, AND ATTACHMENTS—Continued
93	93	*Front bumper, lifting shackles, and brush guard.* See that these items are in good condition and secure.
94	94	*Hood (hinges and fasteners).* Observe whether 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 securely mounted.
96	96	*Cab (doors, hardware, glass, paulin, curtains and fasteners, seats, trim, floor boards, ventilators, and map compartment).* Inspect these items to see that they are in good condition and secure; that the hardware and ventilators operate properly and are adequately lubricated; and whether or not the doors engage their bumpers and strikers and latch properly in the closed position. See that the doors are properly alined with their openings. *Note.* Glass, even if cracked or if laminated layers are separated, need not be replaced as unserviceable unless its condition constitutes a safety hazard or obstructs the vision of driver or crew.
98	98	*Circuit Breakers.* Observe whether these items are clean, dry, in good condition, secure, and whether any electrical connections are loose (fig. 95).
99	99	*Rear splash guards.* These items should be in good condition and secure.
100	100	*Body (panels, tail gate and chains, floor, stakes, sockets, bows, paulin, and curtains, and troop seats).* See that these items are in good condition and secure; that tail gate is properly alined and fastened securely; that paulin and end curtains, ropes, grommets, and metal hooks on body are all present, in good condition, and secure; and whether or not tail gate and troop seat hinges are adequately lubricated.
101	101	*Rear bumpers and pintle (latch, lock pin, and drawbar).* Observe whether or not these items are in good condition and secure. Test the pintle and latch to see that they operate properly, are adequately lubricated (par. 57) and whether the lock pin is attached with a chain. Pay particular attention to see that the spring is not broken and that the drawbar is not excessively worn.
103	103	*Paint and markings.* Examine the paint of the entire vehicle to see that it is in good condition, paying particular attention to any bright spots in finish that might cause glare or reflection. Inspect vehicle markings and

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		CHASSIS, BODY, AND ATTACHMENTS—Continued
		identification for legibility. Include identification plates and their mountings.
104	104	*Radio interference suppression.* If objectionable radio noise from vehicle has been reported, locate source of noise (par. 78). If remedies prescribed in paragraph 78 do not eliminate the trouble, report the condition to the designated individual in authority.
		TOOLS AND EQUIPMENT
131	131	*Tools (vehicle and pioneer).* Check all the vehicle tools against ORD 7 SNL G–749 to see that they are all present. Inspect to see that tools are in good condition, clean, and properly stowed or securely mounted. Also examine the tools which have cutting edges to see that they are sharp. Any tools mounted on the outside of the vehicle which have bright or polished surfaces should be painted or otherwise treated to prevent rust, glare, or reflection.
132	132	*Fire extinguishers.* See that they are in good condition, securely mounted, and fully charged. The charge may be determined by shaking. Also be sure the nozzles are free from corrosion.
133	133	*Decontaminator.* Note whether decontaminator is in good condition, securely mounted, and fully charged. Make the latter check by removing the filler plug.
		Note. The solution must be replaced every 3 months, as it deteriorates.
134	134	*First aid kit.* See that the kit is in good condition, and that all of its items are present and properly packed. Report any deficiencies immediately.
135	135	*Publications and Standard Form 91.* The vehicle and equipment manuals, lubrication order, Standard Form 91, and DA AGO Form 478 should be present, legible, and properly stowed.
136	136	*Traction devices (chains).* Examine tire chains to be sure they are in good condition, clean, not excessively worn, protected against rust, and properly stowed.
137	137	*Tow (chains cables, rope, and block).* Inspect all provided towing devices to see that they are in good condition, clean, and properly stowed. Tow chains or cables must be properly protected against rust when not in use. If snatch blocks are furnished, check to see that they operate freely.

Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

Intervals		Procedure
6,000 Miles or 6 Months	1,000 Miles or 60 Days	
		TOOLS AND EQUIPMENT—Continued
139	139	*Fuel and water cans, and brackets.* Observe whether they are in good condition and secure; that the caps fit tightly and are secured to the can with a chain. Note if the cans are leaking.
141	141	*Modifications (MWO'S).* Check DA AGO Form 478 to determine whether all modification work orders have been completed. A list of current modification work orders is contained in SR 310–20–4. Enter any modifications or major unit assembly replacements made during this service on DA AGO Form 478.
142	142	*Final road test.* Make a final road test, rechecking items 2 to 16 inclusive; also be sure to recheck the transmission, transfer, and all axles to see that they are not leaking lubricant. Confine this road test to the minimum distance necessary to make satisfactory observations. *Note.* Correct or report all deficiencies found during final road test.
		UNUSUAL CONDITIONS
		Maintenance operations and road tests as prescribed under usual conditions will apply equally under unusual conditions for operations for all occasions except in extreme-cold weather. Intervals are necessarily shortened in extreme-cold weather servicing and maintenance. Vehicles subjected to salt-water immerson or complete submersion are evacuated to ordnance maintenance unit as soon as possible after the exposure.

Section IV. TROUBLE SHOOTING

69. General

a. This section contains trouble shooting information and tests for locating and correcting some of the troubles which may develop in the vehicle. Trouble shooting is a systematic isolation of defective components by means of an analysis of vehicle trouble symptoms; testing to determine the defective component and applying the remedies. Each symptom of trouble given for an individual unit or system is followed by a list of probable causes of the trouble and suggested procedures to be followed.

b. This manual cannot cover all possible troubles and deficiencies that may occur under the many conditions of operation. If a specific trouble, test, and remedy therefor is not covered herein, proceed to isolate the system in which the trouble occurs and then locate the defective component. Do not neglect use of any test instruments such as voltmeter, ammeter, test lamp, hydrometer, and pressure and vacuum gages that are available. Standard automotive theories and principles of operation apply in trouble shooting the vehicle. Question vehicle driver or operator to obtain maximum number of observed symptoms. The greater the number of symptoms of troubles that can be evaluated, the easier will be the isolation of the defect.

70. Engine

a. ENGINE WILL NOT TURN.

(1) *Starter inoperative.* Refer to paragraph 75.

(2) *Incorrect oil viscosity.* Inspect oil. If improper grade, drain crankcase, and refill with correct grade oil (par. 57).

(3) *Mechanical seizure of parts.* Notify ordnance maintenance personnel.

b. ENGINE TURNS BUT WILL NOT START.

(1) *Faulty ignition system.* Remove cable from one spark plug and hold spring contact extending from cable end ¼ inch from cylinder head while cranking engine with starter, with ignition switch turned on. If a spark does not jump the gap between the cable and cylinder head, the ignition system is inoperative. Refer to paragraph 71.

(2) *Faulty fuel system.* Remove fuel inlet line from carburetor and turn ignition switch on. If free flow of fuel is not evident, fuel is not reaching carburetor. Refer to paragraph 72.

(3) *Carburetor choke inoperative.* Remove air inlet elbow from carburetor. Inspect choke controls for proper operation (par. 113*b*). Adjust choke if necessary.

(4) *Improper valve adjustment.* Check valve clearance and adjust as required (par. 94).

(5) *Leak at intake manifold or carburetor gaskets.* Pour a small quantity of oil onto edges of intake manifold and carburetor gaskets. Crank engine with starter. A

sucking sound will be heard if gasket leaks. Replace the manifold gasket (par. 95) or carburetor gasket (par. 112).

(6) *Faulty batteries.* Test battery specific gravity (par. 141). Recharge or replace batteries as required.

(7) *Loose or corroded battery or ground cable connections.* Clean and tighten all connections in starting system circuit (fig. 72).

c. ENGINE DOES NOT DEVELOP FULL POWER.

(1) *Faulty ignition.* Refer to paragraph 71.

(2) *Oil temperature too high.* Improper grade or insufficient oil may cause excessive temperatures. Drain and refill with correct grade to the proper level (par. 57).

(3) *Engine overheats.* Check cooling system (par. 74).

(4) *Improper valve adjustment.* Check valve clearance and adjust as required (par. 94).

(5) *Sticking valves.* Remove cylinder head cover and apply penetrating oil or kerosene to valve stems. If valves still are not free, replace or overhaul cylinder head (par. 96).

(6) *Improper grade of fuel.* Use fuel having octane rating of 70–72.

(7) *Pre-ignition.* With engine temperature at normal operating range (160° to 220° F), rapidly accelerate vehicle with transmission in high range. If preignition or spark knock is present, a pinging sound will be heard during at least a portion of the accelerating period. The intensity of the pinging can be increased by covering the radiator and causing the engine to operate at excessively high temperatures. If correct grade of fuel is being used and the ignition system (par. 71) is functioning satisfactorily, the spark plugs may be of improper heat range or they may be defective. Replace spark plugs (par. 109). If spark plug replacement does not correct the condition, notify ordnance maintenance personnel.

(8) *Leak at intake manifold or carburetor gaskets.* Refer to *b* (5) above.

(9) *Faulty governor operation.* If governor cuts off below the governed engine speed (par. 92*b*), replace carburetor (par. 112) and distributor (par. 108), or notify ordnance maintenance personnel.

(10) *Faulty compression.* Test compression (par. 93*b*). Compression should not vary more than 10 psi between cylinders. If it does, notify ordnance maintenance personnel.

(11) *Dragging brakes.* Adjust brakes (par. 220).

d. ENGINE MISFIRES AT IDLING SPEEDS.

(1) *Faulty ignition system.* Refer to paragraph 71.

(2) *Low or uneven engine cylinder compression.* Test compression of all cylinders (par. 93*b*). If difference of 10 psi pressure between cylinders is noted, notify ordnance maintenance personnel.

(3) *Defective spark plugs.* Remove spark plugs and clean and adjust, or replace (par. 109).

(4) *Broken valve springs.* Remove cylinder head cover and inspect springs. Replace broken springs (par. 96).

(5) *Improper valve adjustment.* Check and adjust valve clearance (par. 94).

(6) *Defective valves.* Check engine vacuum with vacuum gage (par. 93*c*). Erratic readings at constant engine speed are indicative of defective valves or valve operation. Replace valves (par. 96).

(7) *Intake manifold gasket leaks.* Refer to *b* (5) above.

(8) *Leaking cylinder head gasket.* Tighten cylinder head cap screws evenly to 75–80 pound-feet torque (par. 96*e* (2)). If leak persists, replace cylinder head gasket (par. 97).

e. ENGINE MISFIRES AT HIGH SPEED.

(1) *Incorrect spark plug gap.* Adjust spark plug gap (par. 109*b*).

(2) *Incorrect distributor point opening.* Adjust distributor points (par. 108*a*).

(3) *Incorrect valve adjustment.* Check and adjust valve clearance (par. 94).

(4) *Valve springs weak or broken.* Refer to *d* (4) above.

(5) *Leaking cylinder head gasket.* Proceed as in *d* (8) above.

(6) *Defective fuel pump.* Test pump (par. 117*e*). Replace pump if necessary.

f. ENGINE OVERHEATS.

(1) Faulty cooling system. Refer to paragraph 74.

(2) *Late ignition timing.* Check ignition timing (par. 107) and make necessary adjustment.

(3) *Lean fuel-air mixture.* Adjust carburetor (par. 112*b*). Inspect engine for leaks at intake manifold and carbuetor gaskets as in *b* (5) above.

g. EXCESSIVE OIL CONSUMPTION.

(1) *Leaks.* Inspect engine, engine compartment, and ground under engine for oil leaks. Tighten any leak-

ing connections, repair or replace broken lines, or notify ordnance maintenance personnel.

(2) *Engine overheats.* Refer to *f* above.

(3) *Poor compression.* Proceed as in *d* (2) above.

(4) *Oil level too high.* Maintain oil at proper level (par. 57).

(5) *Improper grade and viscosity of oil.* Drain and refill crankcase with oil as specified on lubrication order (par. 57) for prevailing atmosphere temperatures.

(6) *Excessive speeds.* Avoid unnecessary and excessive speeds.

(7) *Excessive low range driving.* Operate vehicle in proper range for desired speed and terrain conditions (par. 40).

71. Ignition System

a. IMPROPER IGNITION.

(1) *Defective distributor.* Remove distributor cover and rotor. Inspect cap (inside of cover) and rotor for cracks or carbonized short paths. Clean contact points in cap and clean rotor segment; replace cover or rotor if points are burned excessively. Clean and adjust distributor points, or replace if burned (par. 108*a* or *b*). Inspect all cables enclosed by distributor cover for bare wires and loose connections. Replace units having defective cables or tighten connections as necessary.

(2) *Moisture on ignition units.* Disconnect cables from distributor cover and remove cover; wipe inside of towers, interior of cap, cables, coil, and spark plugs thoroughly dry with a dry cloth, or with a cloth saturated with carbon tetrachloride. Examine units for cause of moisture entry, such as a defective distributor cover gasket, and make the necessary corrections.

(3) *Ignition secondary circuit inoperative.* With rotor and distributor installed and cables connected to distributor cover, disconnect cable from a spark plug. With the ignition switch turned on and starter cranking engine, hold spring contact extending from end of cable 1/4 inch from cylinder head. If current jumps the gap from the cable to the cylinder head, the ignition circuit is complete through the cable tested. If current does not jump the gap, test all other cables in same manner. If spark is obtained at one or more, but not all cables, replace cables from which no spark was obtained. If spark is

not obtained at any of the six cables, secondary circuit is inoperative; this may be due to defective secondary circuit in ignition coil, or to an inoperative primary circuit. Check primary circuit as a (4) (*a*) below; replace coil (par. 108*d* and *e*) if primary circuit is functioning.

(4) *Ignition primary circuit inoperative.*

(*a*) Remove the distributor cover and rotor. Turn the engine until the breaker points are closed. Turn ignition switch on; then open the points with finger. If there is a spark or arc of current as the points open, the primary circuit is complete and will function if the points open and close properly as engine is cranked.

(*b*) If no current is indicated when points are opened manually, the primary circuit is inoperative. Test primary circuit continuity with voltmeter as directed in *b* below.

b. PRIMARY CIRCUIT CONTINUITY TESTS. With distributor cover and rotor removed, turn the engine until the points are open, or separate points and insert a piece of rubber or other insulating material. Connect the negative lead from a test voltmeter to any part of the chassis that will provide a definite ground, then make the following circuit continuity tests to localize the trouble. Refer to ignition system circuit diagram (fig. 44).

(1) Disconnect cable No. 11 at ignition switch. Touch positive lead from voltmeter to the harness cable terminal. If approximate battery voltage is registered on the voltmeter, the circuit is complete to the switch; connect cable to ignition switch and proceed with test (2). If low or no voltage is obtained, replace instrument panel-to-regulator-and-engine connector wiring harness.

(2) Disconnect cable No. 12 from ignition switch. Turn ignition switch on, then touch positive lead from voltmeter to No. 12 cable terminal on ignition switch. If normal voltage is obtained, circuit is complete through switch; connect cable to switch and proceed with test ((3) below). If low or no voltage is obtained, ignition switch is defective and must be replaced (par. 160).

(3) Disconnect engine wiring harness at engine connector (at side or regulator). Make contact between voltmeter positive lead and "A" terminal in receptacle at engine connector. If normal voltage reading is obtained, connect engine harness at connector and proceed with test

((4) below). If low or no voltage is obtained, replace instrument panel-to-regulator-and-engine connector wiring harness.

(4) Disconnect primary cable connector at front side of distributor. Make contact between voltmeter positive lead and terminal inside of cable connector. If normal voltage reading is obtained, circuit is complete through engine wiring harness; connect cable to distributor and proceed with test ((5) below). If low or no reading is obtained, replace engine wiring harness.

(5) Touch voltmeter positive lead to terminal at top of resistor-choke. If normal voltage is obtained, circuit is complete through primary circuit coaxial capacitor; proceed with test ((6) below). If low or no voltage is obtained, replace coaxial capacitor (par. 169*c*).

(6) Touch voltmeter positive lead to ignition coil negative (—) terminal. If normal voltage is obtained, circuit is complete through resistor-choke; proceed with test ((7) below). If low or no voltage is obtained, disconnect bypass capacitor cable from ignition coil negative (—) terminal and repeat test. If normal voltage is obtained, replace bypass capacitor (par. 169*b*); if voltmeter still shows low or no voltage, replace resistor-choke (par. 169*d*).

(7) Touch voltmeter positive lead to ignition coil positive (+) terminal. If nomal voltage is obtained, primary circuit is complete through ignition coil. If low or no voltage is obtained, disconnect cable from ignition coil positive (+) terminal and repeat test. Normal voltage with cable disconnected indicates short in circuit beyond this point; replace distributor point capacitor (par. 108*c*) and repeat test. If voltmeter still shows low or no voltage, open primary circuit in coil is indicated. Replace coil (par. 108*f*).

72. Fuel and Air Intake System

a. FUEL DOES NOT REACH CARBURETOR.

(1) *Lack of fuel.* Check gage on instrument panel, with ignition switch turned on; also check fuel level in fuel tank to be sure there is sufficient fuel in tank and that gage is operative.

(2) *Inoperative fuel pump.* Disconnect fuel line from inlet side of carburetor. Turn ignition switch on. If

fuel does not flow freely, test fuel pump (par. 117*e*). Clean fuel lines between fuel pump and carburetor.

b. FUEL DOES NOT REACH CYLINDERS.

(1) *Throttle not opening.* Adjust throttle linkage (par. 113).

(2) *Carburetor jets clogged.* Replace carburetor (par. 112).

(3) *Low fuel pump pressure.* Test fuel pump (par. 117*e*), and replace if necessary.

(4) *Clogged vent line.* Fuel tank is vented to vehicle unit vent and breather lines. Make sure vent line is open.

c. EXCESSIVE FUEL CONSUMPTION.

(1) *Fuel leaks.* Examine all components of the fuel system for leaks. Tighten or replace as required.

(2) *Worn carburetor components.* Replace carburetor (par. 112).

(3) *Improper carburetor adjustments.* Adjust carburetor (par. 112).

(4) *Worn engine parts.* Refer to paragraph 93 for compression and vacuum tests.

d. ENGINE STOPS WHEN IDLING.

(1) *Improper carburetor adjustment.* Adjust carburetor (par. 112).

(2) *Sticking choke control.* Free up and lubricate choke shaft and controls.

(3) *Sticking crankcase ventilator valve.* Service ventilator valve (par. 99*c*).

(4) *Carburetor idling circuit clogged.* Replace carburetor (par. 112).

e. ENGINE IDLES TOO FAST.

(1) *Improper carburetor adjustments.* Adjust carburetor (par. 112).

(2) *Improper carburetor control adjustments.* Adjust carburetor controls (par. 113).

f. LOW FUEL PRESSURE.

(1) *Defective fuel pump.* Test fuel pump (par. 117*e*) and replace if necessary.

(2) *Clogged fuel lines.* Clean fuel lines between fuel pump and carburetor.

g. ENGINE FALTERS ON DECELERATION. Clogged or worn carburetor parts will cause this condition. Replace carburetor (par. 112).

73. Exhaust System

a. EXCESSIVE NOISE. Excessively noisy operation is caused by leaking manifold gaskets or broken manifolds, muffler, or tail pipe. Inspect and replace parts as required.

b. ODOR OF EXHAUST FUMES IN CAB. Leaky gaskets or broken exhaust manifold, muffler, or tail pipe will allow exhaust fumes to reach inside of cab.

Caution: Replace defective parts as soon as possible.

74. Cooling System

a. OVERHEATING.

(1) *Lack of water in system.* Replenish water, being sure to add antifreeze solution if required (par. 126).

(2) *Loose or broken fan belt.* Adjust or replace belt (par. 129).

(3) *Defective thermostat.* Remove and test thermostat (par. 131). Replace if necessary.

(4) *Coolant leaks.* Inspect cooling system for leaks. Replace hose, water pump, or radiator if leaking (pars. 130 and 132).

(5) *Clogged cooling system.* Clean and flush system (par. 128).

(6) *Defective water pump.* Replace water pump (par. 132).

b. OVERCOOLING. If thermostat remains open, the system will operate at too low a temperature in cold weather. Remove thermostat and test (par. 131). Replace if defective.

75. Starting System

a. STARTER FAILS TO OPERATE.

(1) *Discharged or defective batteries.* Service or replace batteries (par. 141).

(2) *Loose cable connections.* Tighten all connections in starting system circuit (fig. 72).

(3) *Starter switch contacts not closing.* Adjust starter linkage (par. 135*d*).

(4) *Defective starter switch.* Short across starter switch terminals. If starter operates, switch is defective. Replace switch (par. 135*e*).

(5) *Defective starter.* Replace starter (par. 135).

b. STARTER IS NOISY.

(1) *Loose stater mounting.* Tighten starter mounting stud nuts to 48–64 pound-feet torque.

(2) *Defective starter drive clutch.* Replace starter (par. 135).

(3) *Worn commutator or bushings.* Replace starter (par. 135).

c. SLOW CRANKING SPEED.

(1) *Discharged batteries.* Service batteries (par. 141).

(2) *Loose cable connections.* Clean and tighten all connections in starter circuit (fig. 72).

(3) *Worn starter.* Replace starter (par. 135).

76. Generating System

a. HIGH CHARGING RATE WITH FULLY CHARGED BATTERIES.

(1) *Corroded or loose cable connections.* Clean and tighten all connections in generating circuit (fig. 76).

(2) *Defective generator or regulator.* Replace generator or regulator (par. 137 or 138) or both.

b. LOW BATTERIES AND LOW OR NO CHARGING RATE.

(1) *Corroded terminals.* Check plug and receptacle connectors at generator and regulator for corrosion. Clean terminals or replace wiring harness.

(2) *Loose generator drive belt.* Adjust belt tension (par. 129*a*).

(3) *Defective generator or regulator.* Replace generator or regulator (par. 137 or 138) or both.

c. NOISY GENERATOR.

(1) *Loose mounting.* Tighten generator mounting bolts.

(2) *Defective generator.* Replace generator (par. 137).

77. Batteries and Lighting System

a. GENERAL. Reference to wiring diagram (fig. 90) will show that a single circuit from ignition switch feed cable to light switch is common to all lights on the vehicle. At the light switch, this single circuit is divided into multiple circuits, each of which is common to one, two, or more lights. These circuits are then taken to various junction points where they are divided into individual circuits, each of which is taken to a single light. The return path of each circuit is through ground to battery. Dividing the circuit in this manner provides a convenient and logical method of locating the source of trouble. The use of a voltmeter or trouble light and adhering to the following principles will aid in locating trouble in the lighting system.

(1) Source of trouble common to all lights will be located in that part of the circuit common to all lights.

(2) Source of trouble common to two or more—but not all—lights will be located in that part of the circuit common only to the lights affected.

(3) Source of trouble at a single light will be confined to the individual circuit of the light affected.

b. ONE LIGHT FAILS. This condition is the result of an open circuit or grounded cable between the light ground and the feed cable connection. Open circuit or grounded cable may be caused by a burned out or broken lamp filament; poor ground at light or frame; corroded contacts or terminals; broken cable; frayed cable insulation; defective light switch (if the light which fails is the only light controlled by that circuit.

c. TWO OR MORE LIGHTS FAIL. The cause of this condition will be located between the light switch and the individual light junction. Cause may be defective light switch; defective individual light switch (dimmer or stop light switch); loose or corroded terminals; broken cable.

d. ALL LIGHTS FAIL. The cause of this condition may be at any one of several points in the electrical system.

(1) The cause may be discharged batteries; corroded battery terminals; corroded or broken battery cable or ground cable. These conditions can be checked by cranking engine with starter; if cranking speed is normal, the trouble lies between the battery and the light switch.

(2) Other causes are loose or corroded terminals; defective light switch; defective circuit breaker; short circuit or ground at some point in system which causes circuit breaker to operate. The only remedy is to methodically check the entire system until the fault is located and corrected.

(3) A vehicle not in use for some time may possibly have all lamp contacts corroded to the point where lamps are inoperative. A remote possibility of failure is that all lamp filaments may have been broken by shock.

e. INSUFFICIENT LIGHT. This condition may be caused by excessive resistance in circuit or by discharged batteries. Service batteries (par. 141), then look for loose or corroded terminals and contacts, and frayed insulation on cables.

f. FREQUENT LIGHT FAILURE. Frequent burning out of lamp filaments is the result of high voltage, caused by an improperly adjusted or defective generator-regulator. Replace generator-regulator (par. 138).

g. DISCHARGED BATTERIES.

(1) Discharged batteries may be caused by loose or corroded terminals in any of the electrical circuits. Check for and correct such conditions. Shorted or dry battery cells will result in discharged batteries. Service or replace batteries as necessary (par. 141).

(2) Repeated failure of batteries to hold charge indicates improper generator or generator-regulator operation. Replace generator (par. 137) or generator-regulator (par. 138).

h. OVERHEATED BATTERIES. This condition is caused by a defective or improperly adjusted generator-regulator. Replace generator-regulator (par. 138).

78. Radio Interference

a. LOCATE SOURCE OF NOISE. To locate the source of radio interference emanating from the vehicle, the use of a radio receiver in the vehicle or in an adjacent vehicle will be required. Noting the type of interference present in the receiver will help to determine the cause of the trouble. To determine if the noise is coming from the vehicle itself or from an outside source, drive the vehicle at least 100 feet from other vehicles. Turn engine off and turn radio on. Any noise heard will be from an outside source. Start engine. Any noise heard will come from the vehicle itself.

(1) *Engine.* Operate engine with vehicle not in motion and listen for noises in the receiver. If a crackling or clicking noise is present, accelerate the engine and turn ignition switch off with engine running at high speed. If noise stops immediately, the interference is being caused by the ignition circuit (*b* below). If an irregular clicking or chattering continues for a few seconds after the ignition is turned off, interference is being caused by the generating circuit (*c* below). If the interference is in the form of a whining or whirring noise which varies with engine speed, turn the ignition off. If the tone of the sound lowers in pitch but continues for a few seconds after ignition is turned off, it is caused by the generator (*d* below).

(2) *Vehicle.* Operate the vehicle and note whether there is any interference present in the receiver. If clicking

or scratching noise is present, stop the vehicle but leave the engine running. If noise stops when motion of vehicle stops, it may be attributed to loose cable connections or frayed cable insulation in vehicle wiring (*e* below).

b. IGNITION CIRCUIT. Make sure ignition circuit is functioning properly (par. 71). Improper spark plug gaps, improper distributor point adjustment, or worn parts will affect the suppression system. Clean and tighten all wiring connections. Tighten engine mountings. With engine running, disconnect cables from spark plugs, one at a time; if disconnecting any one of the wires reduces or eliminates the interference, the spark plug resistor or resistor in distributor cap is defective. Replace spark plug (par. 109) or distributor cover (par. 108).

c. GENERATING CIRCUIT. Check generator-regulator mounting bolts and tighten if necessary. Check wiring harness connecting generator to generator-regulator for broken or damaged insulation. Replace generator (par. 137) or generator-regulator (par. 138) if necessary.

d. GENERATOR. Check and tighten generator mounting bolts. If noise is still present, replace generator (par. 137).

e. WIRING. Inspect all wiring for worn, frayed, or otherwise damaged insulation. Replace if defective. Clean and tighten all connections.

79. Transmission and Controls

a. Correction of transmission troubles, except those which may be corrected by external adjustments, are beyond the scope of the using organization. However, most difficulties can be corrected without removing the transmission from the vehicle, and any conditions which cannot be corrected by the using organization should be referred to ordnance maintenance personnel.

b. If oil or coolant leaks are evident, refer to paragraph 175 for analysis and correction. If improper transmission operation is indicated, refer to paragraph 176 for operation tests and analysis.

80. Transfer and Controls

a. HARD SHIFTING.

(1) *Improper driving practices.* Refer to paragraph 39.

(2) *Control linkage binding.* Control linkage may bind or stick due to rust, corrosion, dirt, or need of lubrication. Inspect, clean and lubricate linkage with oil can.

b. SLIPS OUT OF GEAR.

(1) *Gears not fully engaged.* Control linkage improperly adjusted. Adjust linkage (par. 185).

(2) *Weak or broken shift shaft poppet ball spring.* Replace transfer (pars. 187 and 188).

c. LOSS OF LUBRICANT.

(1) *Leaking gaskets.* Tighten bearing cap bolts. If leak persists, replace transfer (pars. 187 and 188).

(2) *Defective oil seals.* Replace transfer (pars. 187 and 188).

d. NOISY OPERATION. Noisy operation is due to worn gears or bearings in transfer or power-take-off. Replace transfer (pars. 187 and 188) or power-take-off (pars. 192 and 193).

81. Power-Take-Off and Controls

a. HARD SHIFTING. Refer to paragraph 80*a* (2).

b. NOISY OPERATION. Noise in power-take-off, which will be reflected through transfer, is due to worn gears or bearings. Replace power-take-off (pars. 192 and 193).

82. Front Axle

a. GENERAL. Refer to paragraph 87 for diagnosis of steering difficulties which may be attributed to the steering gear. Refer to paragraph 83 for diagnosis of excessive axle noise and gear backlash.

b. HARD STEERING.

(1) *Lack of lubrication.* Lubricate front axle steering knuckle, tie rod ends, and drag link ends (par. 57).

(2) *Bind in steering knuckle.* Raise front wheels from ground and disconnect drag link at front axle. Turn wheels and tie rod from side to side. If binding is evident, disconnect one end of tie rod from steering knuckle. Test each steering knuckle separately, turning wheel from side to side. If bind persists, and lubrication does not free up, replace axle (pars. 202 and 203).

(3) *Excessive caster.* Checking front axle caster requires special equipment. Notify ordnance maintenance personnel.

(4) *Tires underinflated, unequally inflated, or mismatched.* Inflate tires to correct pressure (par. 240*a*). Make sure tires are same make and size (par. 240*c*).

(5) *Improper toe-in.* Check front wheel toe-in and adjust if necessary (par. 196).

c. SHIMMY.

(1) *Unevenly worn or unequally inflated tires.* Replace tires or inflate to correct pressure (par. 240).

(2) *Loose or damaged hub bearings.* Adjust or replace bearings (par. 244 or 245).

(3) *Incorrect front wheel alinement.* Check and correct front wheel alinement where possible; otherwise notify ordnance maintenance personnel.

(4) *Worn steering knuckle components.* Replace front axle (pars. 202 and 203).

d. WANDERING.

(1) *Tires unequally inflated.* Inflate to correct pressure (par. 240).

(2) *Incorrect front wheel toe-in.* Check toe-in and correct if necessary (par. 196).

(3) *Front wheel bearings require adjustment.* Adjust (par. 244).

83. Rear Axles

a. CONTINUOUS AXLE NOISE.

(1) *Tires improperly inflated or unevenly worn.* If axle noise is caused by tires, the noise will disappear when vehicle is driven over soft ground. Inflate tires equally (par. 240).

(2) *Wheel bearings worn, out of adjustment, or in need of lubrication.* If noise persists, check wheel bearings for wear and adjustment. Repack wheel bearings (par. 57).

(3) *Lack of lubrication.* Add lubricant to axle (par. 57).

(4) *Worn or improperly adjusted differential gears and bearings.* If axle noise continues on soft ground, replace faulty axle (pars. 202 and 203, or 209 and 210).

b. AXLE NOISE ON DRIVE ONLY OR ON COAST ONLY.

(1) *Pinion and ring gear out of adjustment or worn excessively.* Replace axle (pars. 202 and 203, 207 and 208, or 209 and 210).

(2) *Wheel bearings worn, out of adjustment, or in need of lubrication.* Check wheel bearings for wear and adjustment. Repack wheel bearings (par. 57).

c. EXCESSIVE BACKLASH IN AXLE DRIVING PARTS.

(1) *Axle flange stud nuts loose or worn holes in flanges.* Tighten nuts to 55–65 pound-feet torque. If holes in flanges are worn, replace drive flanges (par. 198) or axle shafts (par. 205).

(2) *Ring gear and pinion out of adjustment or worn excessively.* Replace faulty axle (pars. 202 and 203, 207 and 208, or 209 and 210).

84. Service Brake System

a. EXCESSIVE PEDAL PRESSURE AND POOR BRAKING ACTION.

(1) *Brakes require adjustment.* Adjust brakes (par. 220).

(2) *Low air pressure.* Refer to *i* below.

(3) *Power cylinder not operating.* Test brake system (par. 218).

(4) *Obstructed hydraulic line.* Inspect hydraulic lines for sharp bends or kinks. Replace lines or hose if damaged (par. 227*a*).

(5) *Worn brake linings.* Replace shoe and lining (par. 221).

(6) *Scored brake drums.* Replace drums (par. 222).

b. PEDAL GOES TO FLOOR.

(1) *Brakes require adjustment.* Adjust brakes (par. 220).

(2) *Pedal linkage broken or disconnected.* Replace or connect and adjust linkage (par. 223).

(3) *Linings worn excessively.* Replace shoe and lining (par. 221).

(4) *Air in hydraulic system.* Bleed brake system (par. 219).

c. NOISY BRAKES.

(1) *Dirt in brakes.* Remove hub and drum (pars. 245 and 246) and clean out dirt.

(2) *Linings loose on shoes.* Replace shoe and lining (par. 221).

(3) *Broken return spring.* Replace brake shoe return spring (par. 221).

(4) *Distorted brake drum.* Replace distorted drum (par. 222).

(5) *Backing plate bent.* Notify ordnance maintenance personnel.

d. SPRINGY, SPONGY PEDAL ACTION.

(1) *Brakes require adjustment.* Adjust brakes (par. 220).

(2) *Air in hydraulic system.* Bleed brake system (par. 219).

e. ONE BRAKE DRAGS.

(1) *Brake needs adjustment.* Adjust brake (par. 220).

(2) *Brake shoe binding or corroded.* Remove hub and drum (par. 245 or 246), inspect brake mechanism, and make necessary correction.

(3) *Wheel bearings out of adjustment.* Adjust bearings (par. 244).

(4) *Broken return spring.* Replace broken brake shoe return spring (par. 221).

(5) *Defective wheel cylinder.* Replace defective wheel cylinder (par. 226).

f. ALL BRAKES DRAG.

(1) *Brakes adjusted when drums were hot.* Readjust brakes with drums cold (par. 220).

(2) *Pedal linkage improperly adjusted.* Adjust pedal linkage (par. 223*b*).

(3) *Defective master cylinder.* Replace master cylinder (par. 224).

(4) *Defective power cylinder.* Test brake system (par. 218).

g. GRABBING BRAKES.

(1) *Grease or brake fluid on lining.* Replace shoe and lining (par. 221).

(2) *Lining loose on shoes.* Replace shoe and lining (par. 221).

(3) *Loose spring to axle front mounting.* Tighten spring "U" bolts.

(4) *Worn or loose torque rod ends.* Replace torque rods (par. 256 or 262).

h. LOCKED BRAKES. Any of the conditions listed under *f* above may be severe enough to prevent brake release.

i. LOW AIR PRESSURE IN AIR SYSTEM.

(1) *Leakage in air system.* Refer to paragraph 227*b*.

(2) *Compressor governor improperly adjusted.* Adjust governor (par. 228).

(3) *Compressor drive belt loose.* Adjust belt tension (par. 229*a*).

(4) *Worn compressor.* Replace compressor (par. 230).

j. SLOW AIR PRESSURE BUILD-UP. Refer to *i* above.

k. RAPID LOSS OF AIR PRESSURE WHEN ENGINE IS STOPPED.

(1) *Leakage in air system.* Refer to paragraph 227*b*.

(2) *Compressor discharge valves leaking.* Replace compressor (par. 230).

l. EXCESSIVE AIR PRESSURE.

(1) *Compressor governor improperly adjusted.* Adjust governor (par. 228).

(2) *Compressor governor plunger sticking.* Lubricate governor (par. 57).

(3) *Compressor governor diaphragm leaking.* Replace compressor (par. 230).

(4) *Restricted air line leading to governor.* Replace air line.

85. Parking Brake System

a. Parking brake does not hold parked vehicle.

(1) *Adjustment required.* Adjust (par. 234).

(2) *Brake lining worn.* Replace band and lining (par. 235).

(3) *Grease on lining.* Replace band and lining (par. 235).

b. PARKING BRAKE DRAGS AND OVERHEATS.

(1) *Vehicle operated with brake partially applied.* Make sure hand lever is fully released.

(2) *Improperly adjusted.* Adjust (par. 234).

(3) *Brake drum out-of-round.* Replace drum (par. 236).

86. Wheels, Tires, and Hubs

a. EXCESSIVE OR UNEVEN TIRE WEAR.

(1) *Unequal pressure in tires.* Inflate all tires to same pressure (par. 240*a*).

(2) *Tires of unequal rolling radii used on same axle.* Match tires (par. 240*c*).

(3) *Front wheels misalined.* Check alinement (par. 195).

(4) *Hub bearings need adjusting.* Adjust bearings (par. 244).

(5) *Wheel bent.* Replace bent wheel (pars. 239 and 241).

b. WHEELS POUNDING.

(1) *Hub bearings need adjusting.* Adjust bearings (par. 244).

(2) *Hub bearings damaged.* Replace bearings (par. 245 or 246).

(3) *Wheel bent.* Replace damaged wheel (pars. 239 and 241).

87. Steering Gear

a. GENERAL. Many complaints of steering difficulty are falsely charged to the steering gear assembly. In order, therefore, to isolate the steering gear from the front axle, the drag link should be disconnected from the pitman arm at the gear housing. This will permit unobstructed diagnosis of the unit. Refer to paragraph 82 for diagnosis of steering difficulties which may be attributed to the front axle. In general, steering complaints rightfully traceable to the steering gear are as follows:

b. HARD STEERING.

(1) *Lack of lubricant.* Lubricate steering gear (pars. 57 and 59*k*).

(2) *Worm bearings or pitman arm shaft adjusted too tight.* Adjust steering gear (par. 248).

(3) *Worn or damaged worm nut or balls.* Replace steering gear assembly (pars. 252 and 253).

(4) *Steering column misalined, causing binding.* Loosen steering column mounting at instrument panel. If binding condition is relieved, hold steering column in position and tighten mounting.

c. WANDER OR WEAVING.

(1) *Loose steering gear mounting.* Tighten steering gear mounting bolts.

(2) *Excessive pitman arm shaft lash.* Adjust pitman arm shaft lash (par. 248*d*).

(3) *Steering parts worn.* Replace steering gear assembly (pars. 252 and 253).

d. OIL LEAKS.

(1) *Defective pitman arm shaft seal.* Replace steering gear assembly (pars. 252 and 253).

(2) *Loose side cover or defective gasket.* Tighten side cover bolts or replace gasket.

88. Front Spring Suspension

a. HARD RIDING.

(1) *Insufficient spring shackle lubrication.* Lubricate spring shackle pins and bolts (par. 57).

(2) *Spring shackles frozen.* Free-up shackles and lubricate (par. 57).

(3) *Defective shock absorbers.* Check shock absorber action and replace if necessary (par. 257).

b. EXCESSIVE FLEXIBILITY.

(1) *Insufficient fluid in shock absorbers.* Refill shock absorbers (pars. 57 and 59*p*).

(2) *Defective shock absorbers.* Check shock absorber action and replace if necessary (par. 257).

(3) *Broken spring leaves.* Examine springs for broken leaves and, if found, replace spring assembly (par. 255).

c. EXCESSIVE NOISE.

(1) *Worn shackle pins and bolts, or worn spring and shackle bushings.* Use pry bar to test wear of pins, bolts, or bushings. Replace pins, bolts, shackles, or spring assembly as necessary (par. 255).

(2) *Worn or broken shock absorber links.* Replace links (par. 255).

(3) *Defective shock absorbers.* Check shock absorber action and replace if necessary (par. 257).

(4) *Loose torque rod ends.* Tighten or replace torque rods (par. 256).

d. SPRING LEAF FAILURE.

(1) *Spring leaf failures at spring eye.* Failures at this point are generally caused by frozen shackle pins or bolts. Free-up and lubricate shackle (par. 57), or replace (par. 255).

(2) *Spring leaf failures at center section of spring.* Breakage of spring leaves at the center bolt section are generally caused by loose spring "U" bolts. Replace spring and tighten "U" bolts to recommended torque (par. 255).

(3) *Grabbing brakes.* Grabbing brakes cause extreme strains on springs. Refer to paragraph 84*g*.

(4) *Loose torque rod ends.* Tighten or replace torque rods (par. 256).

89. Rear Spring Suspension

a. EXCESSIVE NOISE.

(1) *Loose spring "U" bolts.* Tighten main and secondary spring "U" bolt nuts to 375–400 pound-feet torque.

(2) *Loose torque rod ends.* Tighten torque rod end pin nuts or replace torque rods (par. 262).

(3) *Loose or worn spring seat bearings.* Adjust or replace bearings (par. 261).

b. SPRING LEAF FAILURE.

(1) *Overloading and overspeeding.* Breakage of rear spring leaves is most commonly caused by overloading the vehicle or by driving at excessive speed over rough terrain. Refer to vehicle identification plate (fig. 5) for maximum load, and reduce vehicle speed over rough terrain when possible.

(2) *Loose spring "U" bolts.* Tighten main and secondary spring "U" bolt nuts to 375–400 pound-feet torque.

90. Propeller Shafts

a. GENERAL. Any mechanical movement has vibration periods which do not result in noise until they tune in with some other part or unit. In this connection, loose or broken fenders, running boards, body or cab hold-down bolts, etc, should be checked as possible sources of noise if noise cannot be traced to propeller shafts.

b. EXCESSIVE NOISE OR VIBRATION.

(1) *Universal joints require lubrication.* Lubricate propeller shaft universal joints (par. 57).

(2) *Loose pillow block mounting.* Tighten pillow block mounting stud nuts to 48–64 pound-feet torque.

(3) *Worn universal joint bearings or sprung propeller shaft.* Replace propeller shaft and universal joint assembly (pars. 212 and 213), or repair universal joint (par. 214).

(4) *Worn pillow block bearings.* Replace pillow block assembly (par. 215).

91. Winch

a. WINCH FAILS TO OPERATE WHEN SHIFTED INTO GEAR.

(1) Drum clutch disengaged. Engage sliding jaw clutch (par. 46).

(2) *Shear pin sheared.* Replace shear pin (par. 285).

b. WINCH FAILS TO HOLD LOAD. This condition is caused by automatic brake lining being in need of adjustment or worn excessively. Adjust automatic brake (par. 286*c*.), or replace automatic brake band and lining assembly (par. 287).

c. EXCESSIVE HEAT AT BREAK COVER.

(1) *Automatic brake adjusted too tight.* Adjust automatic brake (par. 286*c*).

(2) *Wrong type lining installed.* Replace automatic brake band and lining assembly (par. 287).

d. WINCH DRUM OVERRUNS CABLE WHEN CABLE IS PULLED OFF BY HAND. Winch drag brake requires adjustment. Adjust drag brake (par. 286*b*).

e. NOISY OPERATION.

(1) *Insufficient lubrication.* Lubricate winch (pars. 57 and 59*m* and *n*).

(2) *Worn winch components.* Replace winch assembly (pars. 289 and 290).

Section V. ENGINE DESCRIPTION AND MAINTENANCE IN VEHICLE

92. Description and Data

a. DESCRIPTION. The engine is a water-cooled, six-cylinder, valve-in-head type with manifolds installed on the cylinder head.

(1) *Engine mountings.* Engine is mounted in conjunction with the radiator and transmission which, together with accessories, comprise the power plant (fig. 41). The power plant can be replaced as a unit. Two cushion type mountings are used to support the front end of engine. Rear end of the transmission rests on two mountings. The radiator is installed in a support which is mounted at the frame front cross member. Refer to figure 39 for location and type of mountings used.

(2) *Engine accessories.* Accessories installed on the engine include starter, generator, oil filter, and distributor on right side; and air compressor, carburetor, and manifolds on left side. Water pump and fan are installed at front of cylinder block. Pulley at front end of engine crankshaft drives air compressor, generator, and water pump. Fan blades are installed on water pump pulley hub.

(3) *Engine lubrication.* Engine is pressure lubricated by a gear-type oil pump which is driven from the engine camshaft. Oil is drawn through a floating inlet screen located in the oil pan cover on bottom of oil pan. The crankshaft is drilled for lubrication of main bearings and connecting rod bearings. Connecting rods are drilled to provide oil under pressure at piston pins. Engine valve mechanism is lubricated by oil which passes from fitting at left side of cylinder block through external oil line and enters cylinder head oil passage through restricted fitting at front of cylinder head. Timing gears receive lubrication from nozzle in engine front end plate which directs oil against gear teeth. Engine is equipped with replaceable-element-type oil filter. Pressure in engine lubrication system is indicated on gage in instrument cluster in driver's compartment. Gage for checking crankcase oil level is provided at right side of engine near oil filter.

b. ENGINE DATA.

Make	GMC
Model	302
Type	valve-in-head
Number of cylinders	6
Cylinder bore	4 in
Piston stroke	4 in
Piston displacement	301.6 cu in
Engine governed speed (no load)	3,600 rpm
Engine governed speed (full load)	3,400 rpm
Engine idling speed	375 rpm
Crankshaft rotation (viewed from front end)	clockwise
Firing order	1-5-3-6-2-4
Valve clearance (at operating temperature)	
Intake valves	0.012 in
Exhaust valves	0.020 in
Wrench torque for cylinder head bolts	75 to 80 lb-ft

93. Engine Tune-up

a. GENERAL. Engine tune-up is an orderly process of checking engine and accessory equipment to determine if various units are within original specifications, and to make any adjustments and repairs necessary to restore engine performance. Tune-up procedure can be accomplished at regular intervals or whenever engine performance indicates need for tune-up operations.

b. COMPRESSION TEST. Use conventional type compression gage to check compression at each cylinder.

(1) Remove all spark plugs (par. 109*a*).

(2) Pull out hand throttle to wide-open position.

(3) Take compression reading at each cylinder while engine is cranked with starter. Reset compression gage at zero after checking each cylinder. Record pressure for each cylinder.

(4) Compare readings which should be uniform within 20 psi.

Note. Engine need not be disassembled immediately if readings vary 20 to 25 psi. Perform other tune-up operations, and recheck compression after vehicle has been operated for at least 100 miles. Then, if compression is not uniform within 20 psi, make necessary repairs.

c. MANIFOLD VACUUM TEST. Use of vacuum gage before and after engine tune-up is helpful in checking engine performance. When engine is operating properly, vacuum gage indicator will be steady, and will show highest reading when engine is idling.

(1) Remove plug from tee at center of intake manifold below carburetor and attach vacuum gage.

(2) Start engine and run at idling speed to warm engine to minimum operating temperature (160° F). Check carburetor adjustment (par. 112*b*). With engine running at normal idling speed, vacuum gage should show reading of 18 to 21 inches and pointer should be steady. Pointer fluctuating between 10 and 15 inches may indicate leaking valve or defective cylinder head gasket. Abnormally low reading with steady pointer may indicate leak in intake manifold or gasket.

(3) Accelerate and decelerate engine quickly. Vacuum should drop to approximately 2 inches with rapid opening of throttle, and should rise to 24 inches as throttle is closed quickly with engine running fast. If this action is not obtained, diluted engine oil, defective or worn piston rings, or abnormal restriction in carburetor, air cleaner, or exhaust system may be indicated.

Note. Above readings are for sea-level operation. Vacuum gage readings will be lowered approximately 1 inch for each 1,000 feet increase in altitude.

d. ENGINE TUNE-UP SEQUENCE. Perform operations in the order listed to properly tune engine. Paragraphs in which specific instructions occur are given for reference.

(1) *Compression and manifold vacuum tests.* Perform cylinder compression and manifold vacuum tests as outlined in *b* and *c* above.

(2) *Spark plugs.* Remove, clean, and inspect spark plugs (par. 109). Refer to paragraph 106*b* for spark plug specifications.

(3) *Battery and ignition cables.* Check battery water level, cell voltage, and specific gravity (par. 141). Inspect ignition wiring. Refer to wiring diagram (fig. 90) and paragraph 149 for circuits and connections.

(4) *Distributor and ignition timing.* Inspect ignition distributor points for condition and for proper gap (par. 108). Check and if necessary set ignition timing (par. 107).

(5) *Valve clearance.* Check cylinder head bolts for proper tension (par. 92*b*) and check valve clearance and adjust if necessary (par. 94).

(6) *Carburetor.* Check carburetor mounting stud nuts for tightness. Adjust carburetor idling mixture and idling speed (par. 112).

(7) *Manifold stud nuts and heat control valve.* Tighten manifold stud nuts to prevent leaks at manifold gaskets.

Set manifold heat-control valve to suit prevailing climatic conditions (par. 119).

(8) *Fuel pump.* Check fuel pump operation, referring to paragraph 117*e* for method of testing fuel pump.

(9) *Carburetor air cleaner.* Service carburetor air cleaner in accordance with instructions in paragraph 59*e*.

94. Valve Clearance Adjustment

a. WARM UP ENGINE. Start engine and allow to run at fast idle until temperature rises to normal operating range (160°–220° F). Warm-up time may be shortened by covering front of radiator to prevent passage of air through radiator core; however, covering must be removed as soon as engine reaches normal operating temperature.

b. REMOVE CYLINDER HEAD COVER. Raise hood, and disconnect crank-case ventilation flexible tube at cylinder head cover. Use wrench to loosen tube nut at shut-off valve elbow. Remove two nuts which retain cover on cylinder head and remove cover and gasket.

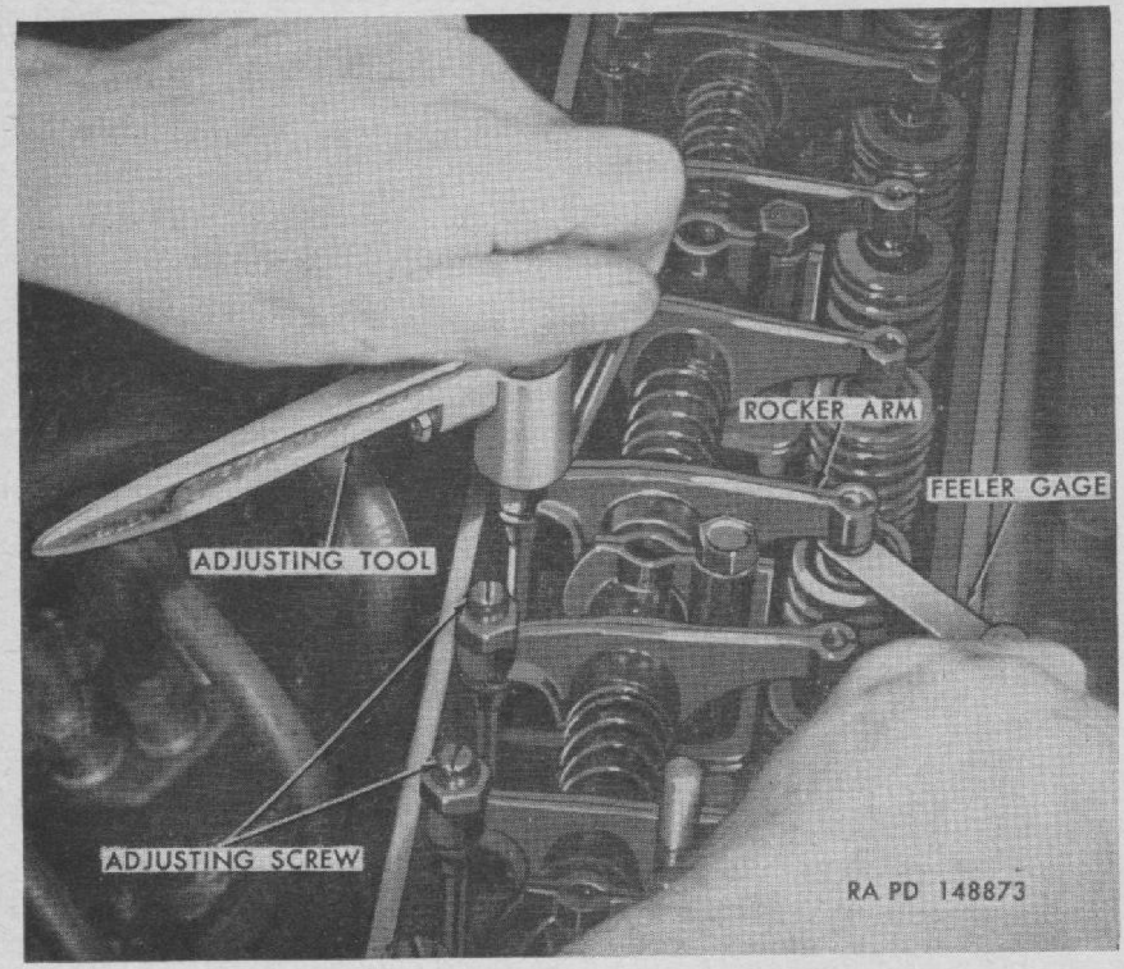


Figure 28. Valve clearance adjustment.

c. CHECK CYLINDER HEAD BOLTS. Use torque wrench and adapter (fig. 35) to check cylinder head bolt tension before adjusting valve clearance. Cylinder head bolts should be tightened to 75 to 80 pound-feet torque.

d. ADJUST VALVE CLEARANCE.

Note. Valve adjustment should be made with engine running at idling speed.

Use feeler gage to check clearance between rocker arm and end of valve stem (fig. 28). Correct clearance is 0.012 inch for intake valves and 0.020 inch for exhaust valves. Loosen lock nut and turn adjusting screw in end of rocker arm to obtain correct clearance, then tighten lock nut to lock the adjustment. Recheck clearance after tightening each lock nut.

e. INSTALL CYLINDER HEAD COVER. Lay new cover gasket on cylinder head. Set cover in place on gasket and install stud nuts to retain cylinder head cover. Connect crankcase ventilation flexible tube at shut-off valve elbow on cover.

95. Intake and Exhaust Manifolds

a. GENERAL. Intake and exhaust manifolds are each one-piece type. Manifolds are bolted together and installed on engine assembly as a unit. Manifold heat-control valve is installed in exhaust manifold. Carburetor assembly is mounted directly to intake manifold and exhaust pipe is connected to outlet at exhaust manifold.

b. MANIFOLD ASSEMBLY REMOVAL.

(1) Disconnect exhaust pipe from exhaust manifold. *Figure* 65 illustrates arrangement of parts at exhaust pipe to manifold connection.

(2) Remove carburetor assembly (par. 112*c*).

(3) Remove idler shaft, levers, and bracket from manifold as an assembly. Refer to figure 57 for arrangement of carburetor controls.

(4) Disconnect crankcase ventilation tube at ventilator valve. Remove ventilator valve from tee, then remove tee from intake manifold.

(5) Disconnect engine primer line at fitting at rear of intake manifold.

(6) Remove stud nuts and washers from two studs at each end of manifold assembly. Pull governor line clip off rear stud and slide back on lines. Loosen balance of manifold stud nuts sufficiently to permit clamps to be turned into vertical position (fig. 30). Pull manifold

assembly away from cylinder head and remove from vehicle. Remove gaskets and manifold pilots.

Note. When removing manifolds, if manifold interferes with air compressor, remove belt from compressor pulley and swing compressor away from engine to provide clearance.

(7) To separate manifolds, remove stud nuts and bolts, separate the manifolds, and remove gasket. Engine primer fittings and connecting lines also may be removed from intake manifold if necessary.

c. MANIFOLD ASSEMBLY INSTALLATION.

(1) Inspect manifolds for evidence of cracks and use straight edge to check exhaust manifold flanges for alinement (fig. 29). Flanges should be in line within 1/32 inch. Clean gasket surfaces and pilot counterbores at cylinder head and manfolds. Check condition of heat-control valve in exhaust manifold.

(2) Assemble manifolds using new gasket between intake and exhaust manifolds. Tighten attaching stud nuts and bolts finger-tight.

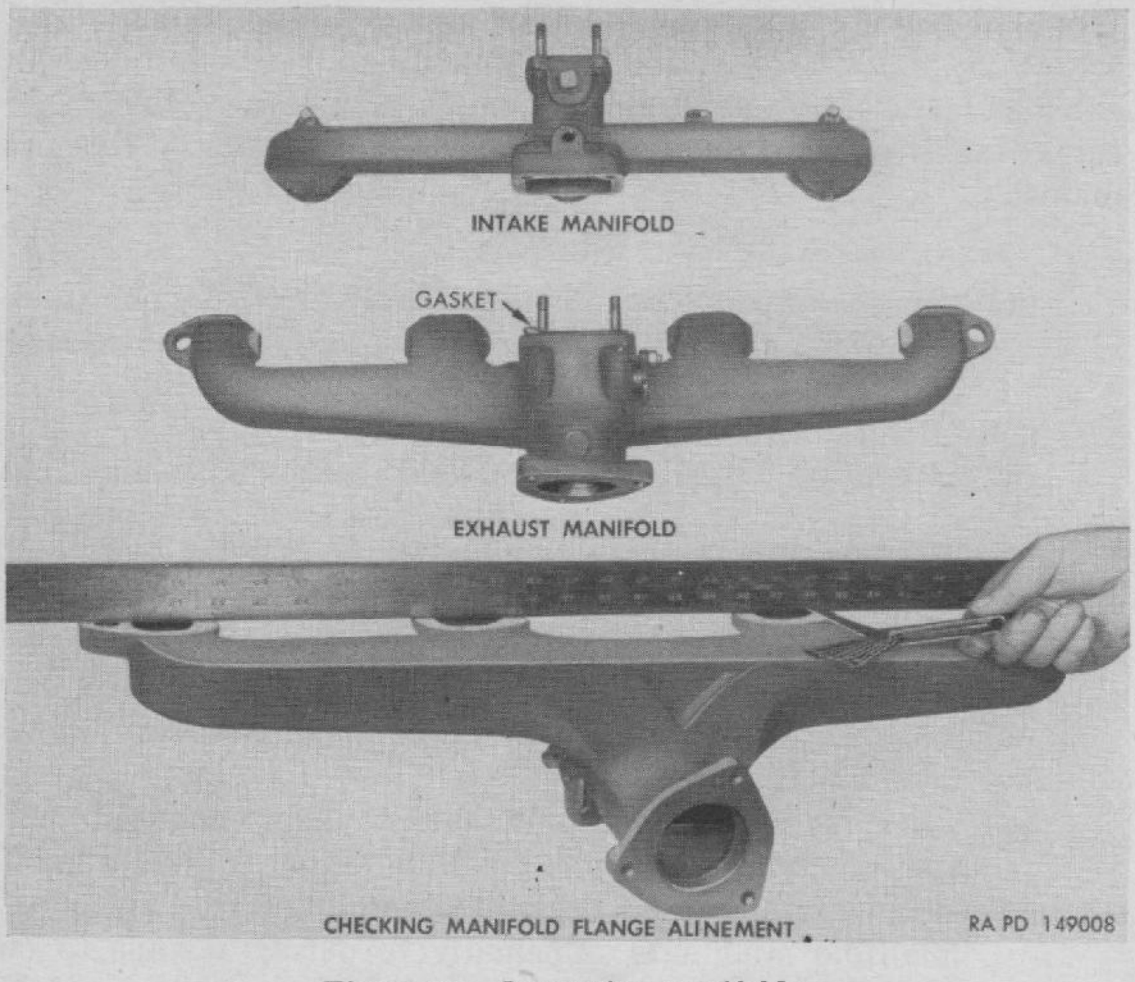


Figure 29. Inspecting manifolds.

(3) Insert three manifold pilots in cylinder head and place gaskets at cylinder head as shown in figure 30. Place four clamps on manifold studs and start nuts on threads. Lift manifold into position at cylinder head and turn clamps to hold manifold assembly in place. Install washers and nuts on two studs at each end of manifold.

Note. Governor line clip must be installed on rear stud. Tighten all manifold stud nuts to draw manifolds evenly and firmly against gaskets.

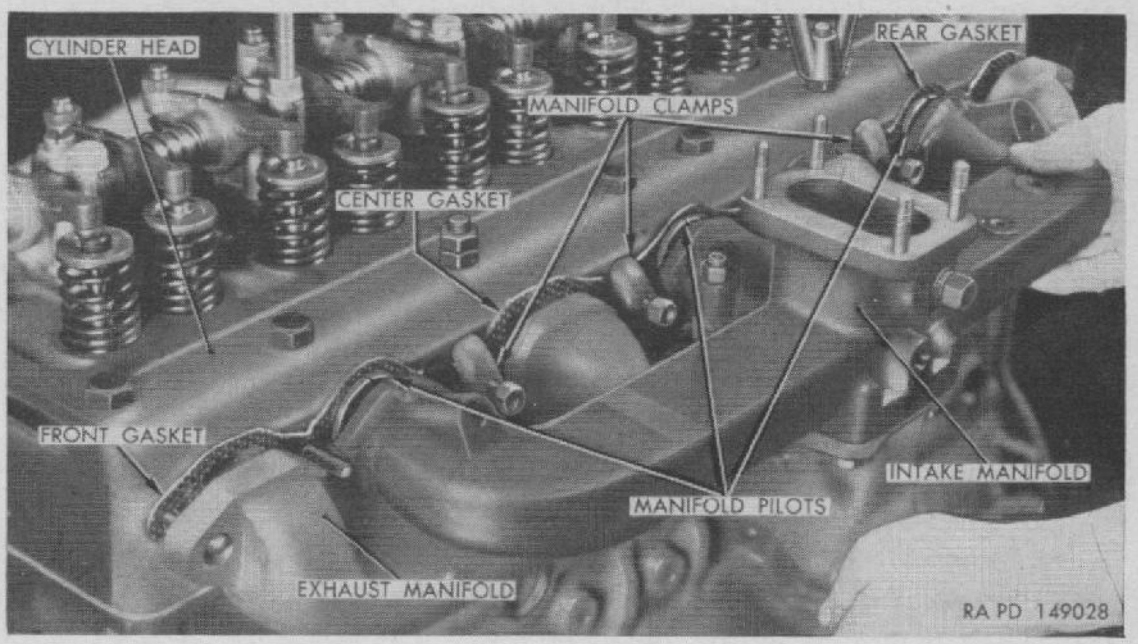


Figure 30. Installing manifolds.

(4) Tighten intake-to-exhaust manifold stud nuts and bolts firmly.

(5) If engine primer lines and fittings have been removed, install these parts and connect pump-to-primer line at rear fitting.

(6) Connect exhaust pipe to flange on exhust manifold. Refer to figure 65 for arrangement of gasket, seal, and bolts at this location. Paragraph 122*b* covers detailed procedure for connecting exhaust pipe to manifold.

(7) Install crankcase ventilation valve fitting at intake manifold. Install valve assembly and connect ventilation tube at valve.

(8) Install carburetor control idler shaft, levers, and bracket assembly on manifold.

(9) Install carburetor (par. 112*d*).

(10) If it has been necessary to move air compressor during manifold replacement, adjust drive belt as instructed in paragraph 229*a*.

96. Cylinder Head

a. GENERAL. Cylinder head is held to top surface of engine cylinder block by 15 bolts. Valves and spark plugs are installed in cylinder head, and valve rocker arms are assembled on hollow shaft supported by six brackets bolted to top of cylinder head. Rocker arms are enclosed by cylinder head cover. Intake and exhaust manifold assembly is mounted on left side of cylinder head. *Figure* 31 illustrates valve and rocker arm installation as well as other items related to valve operation. Exhaust valves are equipped with rotator (free valve) mechanism, which permits valves to turn while valves are open.

b. COORDINATION WITH ORDNANCE MAINTENANCE UNIT. Replacement of cylinder head with new or rebuilt cylinder head is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, providing authority for performing this replacement is obtained from appropriate commander. Tools needed for the operation which are not carried in the using organization may be obtained from the supporting ordnance maintenance unit.

c. CYLINDER HEAD ASSEMBLY REMOVAL.

(1) Open drain cock at bottom of radiator core and drain cooling system to point below cylinder head. Complete draining of system is not necessary.

(2) Remove water by-pass line installed between cylinder head and tee fitting at engine thermostat housing.

(3) Remove manifold assembly (par. 95*b*).

(4) Remove radiator upper hose, loosen clamps at water pump by-pass hose. Remove bolts attaching generator and air compressor adjusting arms to engine thermostat housing. Disconnect engine temperature sending unit cable at connector on unit. Remove two thermostat housing-to-cylinder-head bolts and remove thermostat housing and gasket assembly from engine.

(5) Disconnect oil line at front of cylinder head.

(6) Remove spark plug wires from spark plugs and spark plugs from cylinder head (par. 109*a*).

(7) Remove oil filter assembly (par. 98*c*). Remove transmission cooler front return line and front section of flywheel housing vent line.

(8) Remove screws attaching push rod cover to engine and remove cover and gasket.

(9) Remove cylinder head cover nuts, lift off cover, and remove gasket. Remove eye nut from special head bolt at left side of cylinder head.

(10) Remove rocker - arm - shaft - bracket - to - cylinder - head bolts and washers; remove nuts and washers from cylinder head cover studs. Remove rocker arm, shaft, and bracket from cylinder head. Overflow pipe and gasket are held by long bolt at fourth bracket.

(11) Remove 12 push rods from holes in cylinder head.

(12) Remove 15 cylinder head bolts. Lifting handles for cylinder head may be installed on long studs (fig. 33) to facilitate cylinder head removal. Remove cylinder head and gasket from cylinder block.

Note. Exercise care to prevent loss of exhaust-valve rotator caps which are free to fall off valves after rocker arms are removed from cylinder head. Rotator caps must be kept with the valves on which they were originally fitted.

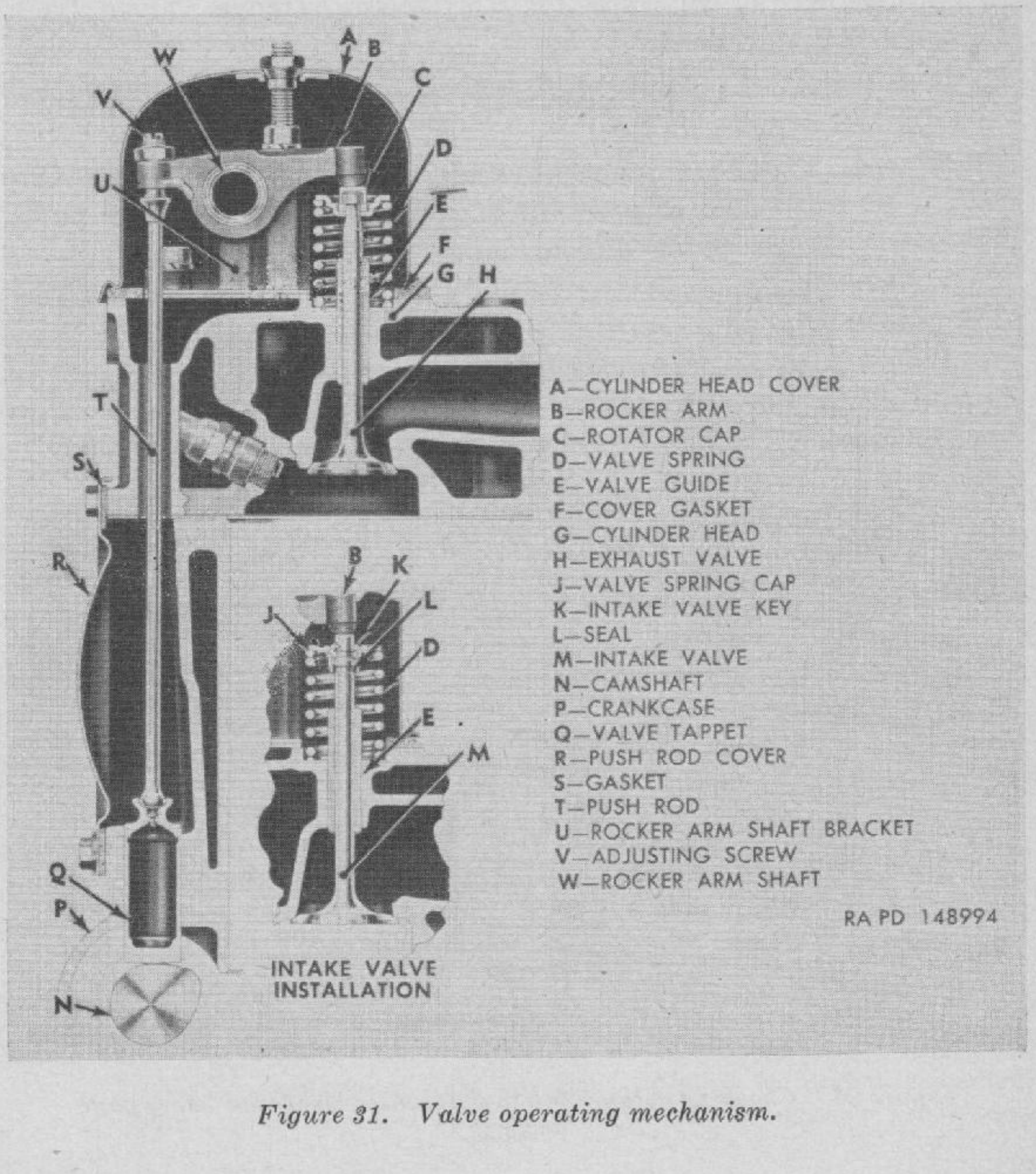


Figure 31. Valve operating mechanism.

d. VALVE REPLACEMENT. Valves can be replaced after cylinder head is removed from engine (*c* above). Holding fixture with attachment for compressing valve springs is required to remove and install valves. Exhaust-valve-cap clearance gage 7950058 for measuring exhaust-valve-stem-to-rotator-cap clearance must be available when installing exhaust valves and/or retaining parts. Provide receptacles in which to place each exhaust valve and retaining parts as valves are removed from cylinder head. Each set of retaining parts should be kept with the exhaust valve with which they have been used.

(1) *Valves removal* (fig. 31). Remove valve rotator caps (C) from exhaust valves (H). Compress valve springs (D). Remove intake valve keys (K) and seals (L). Exhaust valves are retained in similar manner but no seals are used on exhaust valve stems. Remove spring caps (J) and springs (D), then remove valves from cylinder head.

(2) *Inspect parts and check rotator-cap-to-valve-stem clearance.*

(*a*) Clean and inspect cylinder head and valve parts. Obtain new or reconditioned parts to replace any parts found to be damaged or worn.

(*b*) Using exhaust-valve-cap-clearance gage 7950058 (fig. 32) accurately check clearance between rotator caps and exhaust valve stems. Correct clearance is 0.004 to 0.0045 inch. Use gage as follows:

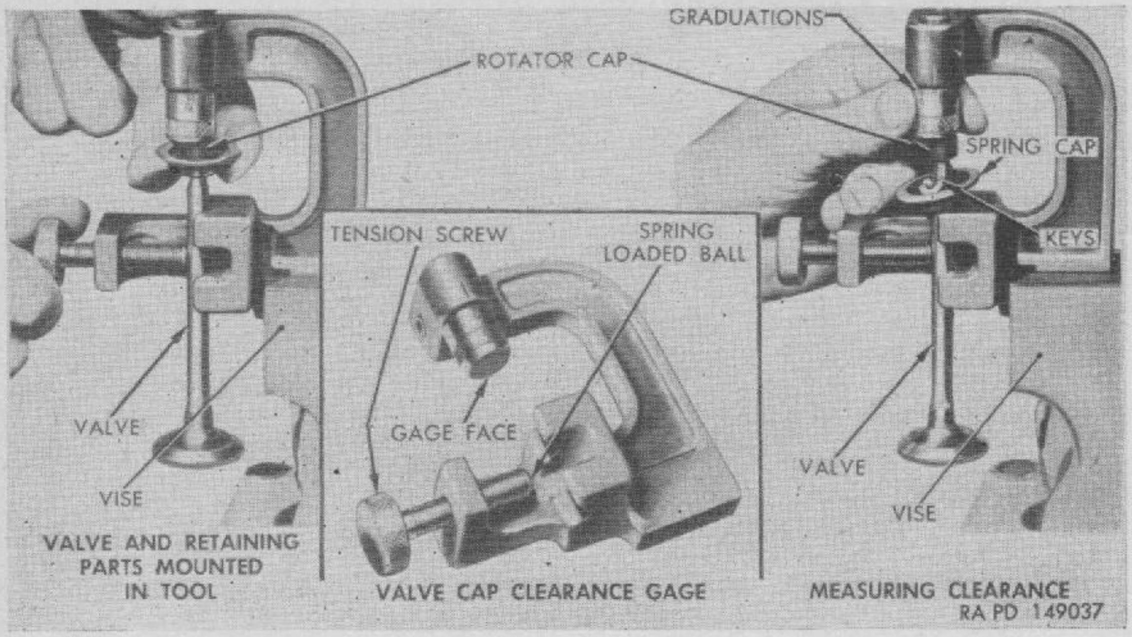


Figure 32. Checking rotator cap to valve stem clearance using gage 7950058.

1. Mount gage in bench vise and set micrometer at zero.

2. Clamp valve stem against vee block with tension screw, using enough pressure to hold valve in place. Assemble spring cap, keys, and rotator cap on valve stem; then using fingers as shown, pull upward on valve spring cap until rotator cap contacts gage face solidly and tighten tension screw to lock valve in position.

3. Release spring cap and keys and allow rotator cap to drop down against end of valve stem. Clearance now existing between rotator cap and face of gage can be measured and will indicate clearance between rotator cap and valve stem when parts are assembled in cylinder head.

4. Turn micrometer head until face of gage contacts rotator cap, then read clearance in thousandths of an inch directly from graduated scale on gage. Each graduation represents one thousandth of an inch.

5. If clearance is less than 0.0045 inch, grind off end of valve stem. If clearance is more than 0.0005 inch, grind off open end of rotator cap. Recheck clearance after grinding parts.

(3) *Valve installation* (fig. 31). Coat valve stems with engine oil and install valves in cylinder head. If head and valves have not been reconditioned, valves should be installed in original position in cylinder head. Place head and valves in fixture and assemble springs, spring caps (J), new seals (L), and keys (K) on intake valves. Assemble springs, spring caps, and keys to exhaust valves, and place rotator cap on each exhaust valve.

Note. Tape rotator caps in place until ready to install rocker arms.

e. CYLINDER HEAD INSTALLATION.

(1) Place new cylinder head gasket on engine cylinder block. Word "TOP" is imprinted on upper side of gasket. Screw two guide pins into bolt holes in cylinder block to hold gasket in position and guide cylinder head into place. Place cylinder head over guide pins (fig. 33) and lower head into place on gasket. Remove guide pins and install cylinder head bolts finger-tight.

Note. Two special bolts are used and must be located correctly. Both special bolts are used at manifold side of cylinder head—one in third hole from front and the other in fourth hole from rear of cylinder head (fig. 30).

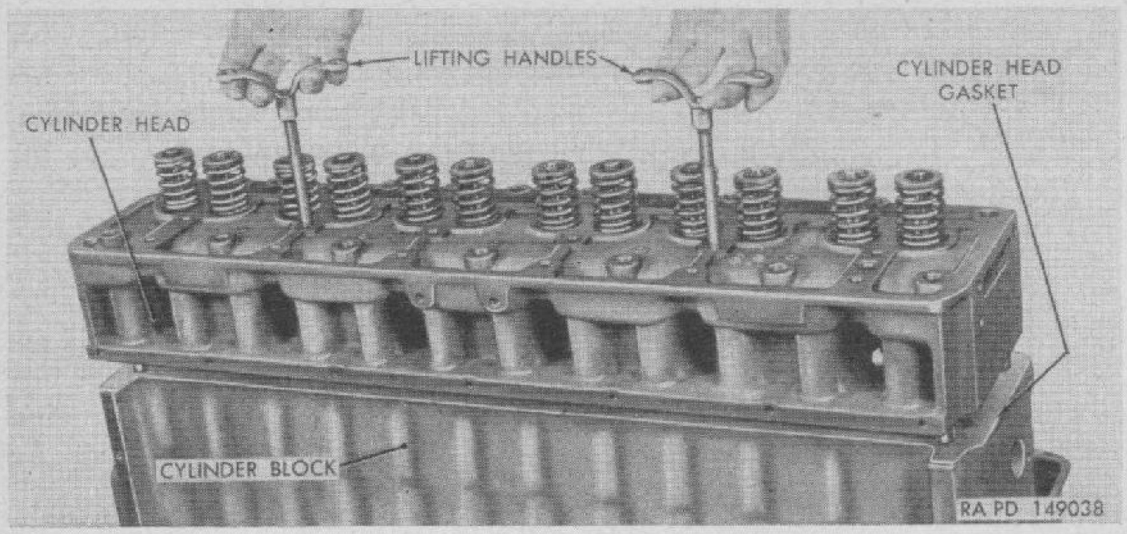


Figure 33. Installing cylinder head.

(2) Using torque wrench, tighten cylinder head bolts following preliminary tightening sequence (fig. 34). Preliminary tightening should be to 35 pound-feet torque; then follow final tightening sequence (fig. 34) and tighten all bolts to 75 to 80 pound-feet torque.

Note. After engine is started, run until minimum normal operating temperature is reached (160° F.); then check head bolts with torque wrench. Use an adapter and torque wrench (fig. 35).

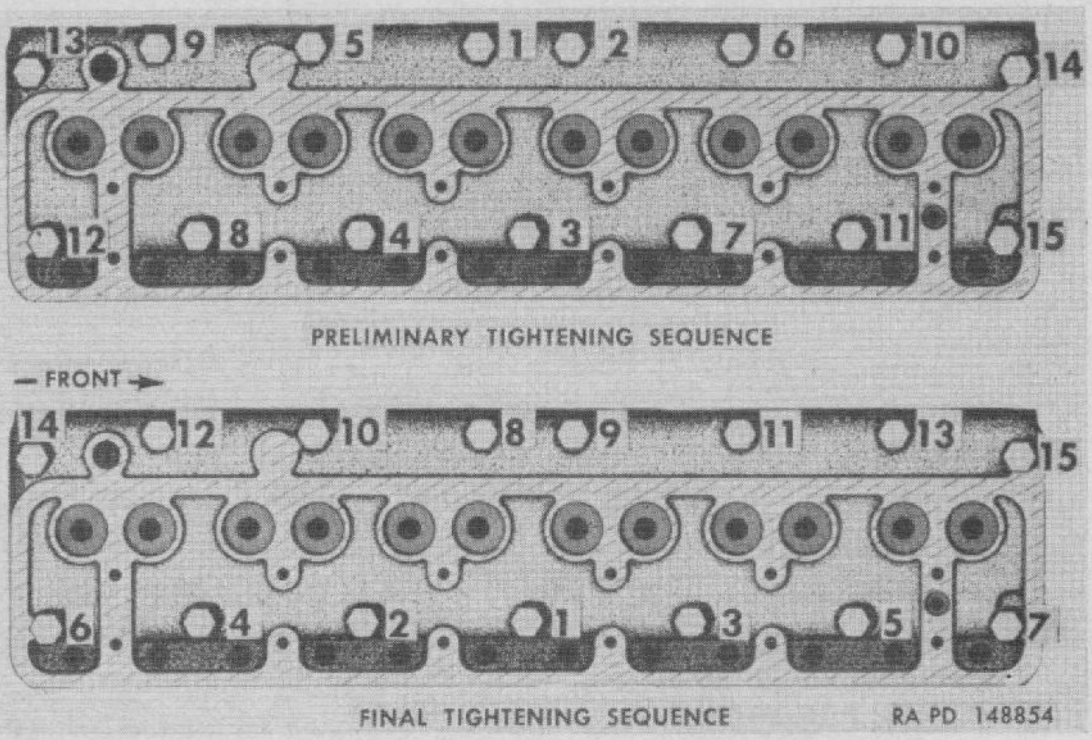


Figure 34. Cylinder head bolt tightening sequence.

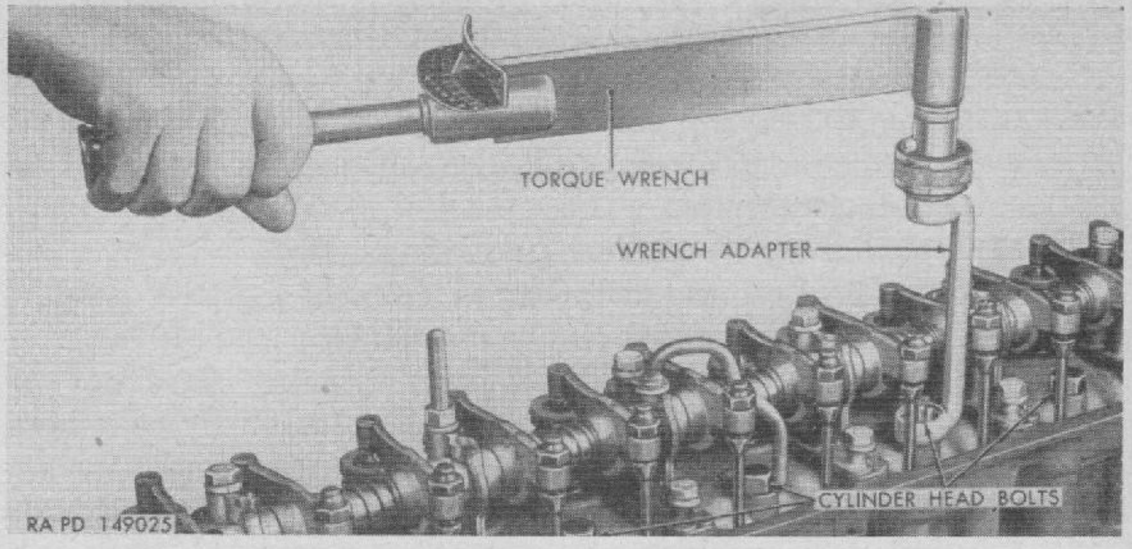


Figure 35. Use of torque wrench and adapter.

(3) Be sure cylinder head cover studs are tightened firmly into cylinder head. Insert push rods through holes in cylinder head with cupped ends upward. Locate lower end of each push rod at valve lifter. Lay annular gasket at oil passage at front of cylinder head where rocker arm shaft front bracket seats on head.

(4) Lower the rocker arm and shaft assembly into place at cylinder head. Fit adjusting screws in push rod sockets. Install washers and nuts on cylinder head cover studs and install bracket-to-cylinder-head bolts and washers. Tighten bolts and nuts alternately to draw brackets down evenly. Oil overflow pipe must be assembled at No. 4 bracket (fig. 36). Place overflow pipe and gasket on bracket; then install bolt with washer to retain pipe assembly.

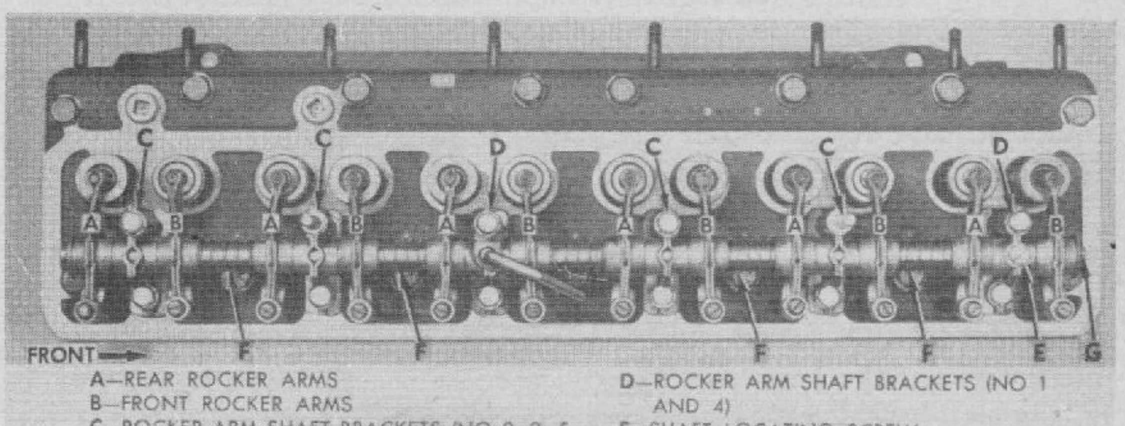


Figure 36. Valve rocker arm arrangement.

(5) Install push rod cover, using new gasket. Leave out screws which attach oil filler pipe bracket and oil filter bracket.

(6) Install transmission cooler front line and assemble oil filler pipe bracket. Install front section of flywheel housing vent line.

(7) Install engine oil filter (par. 98*d*).

(8) Connect oil line at fitting on front of cylinder head.

(9) Install spark plugs and connect cables (par. 109*c*).

(10) Assemble engine thermostat housing to front of cylinder head, using new gasket. Install by-pass hose and upper radiator hose and tighten hose clamps firmly. Install generator and air compressor adjusting arm bolts with lock washers at thermostat housing. Check belt adjustment (par. 129*a* and 229*a*). Connect engine temperature sending unit cable.

(11) Install water by-pass line between fitting at rear of cylinder head and thermostat housing.

(12) Install intake and exhaust manifold assembly (par. 95*c*).

(13) Fill cooling system (par. 126*a*).

(14) Check valve clearance at each cylinder with piston on compression stroke (both valves closed). Make initial adjustment of valves before starting engine. Set intake-valve clearance at 0.012 inch and exhaust-valve clearance at 0.020 inch.

(15) Start engine and run at fast idle until normal minimum operating temperature (160° F) is reached; then check cylinder head bolt tension ((2) above).

(16) Make final check of valve clearance; adjust if necessary and install valve cover (par. 94*d* and *e*).

(17) Install eye nut and lock washer on cylinder head special bolt.

f. RECORD OF REPLACEMENT. Make a record of the replacement on DA AGO Form 478 (MWO and Major Unit Assembly Replacement Records and Organizational Equipment File).

97. Cylinder-Head Gasket Replacement

a. CYLINDER HEAD AND GASKET REMOVAL. Remove cylinder head and gasket (par. 96*c*.)

b. CYLINDER HEAD AND GASKET INSTALLATION. Place new cylinder head gasket in position on cylinder block with side marked "TOP" toward cylinder head and install cylinder head (par. 96*e*).

98. Engine Oil Filter

a. GENERAL (fig. 37). Replacement-element type oil filter is mounted on bracket at right side of engine to rear of ignition distributor. Two band-type clamps attach filter to mounting bracket. A limited quantity of engine oil enters filter through inlet line which is connected to oil gallery at left side of engine. Filtered oil is returned to engine crankcase through filter outlet line installed between fitting at bottom of filter and fitting at engine crankcase. Filter housing is fitted with drain plug.

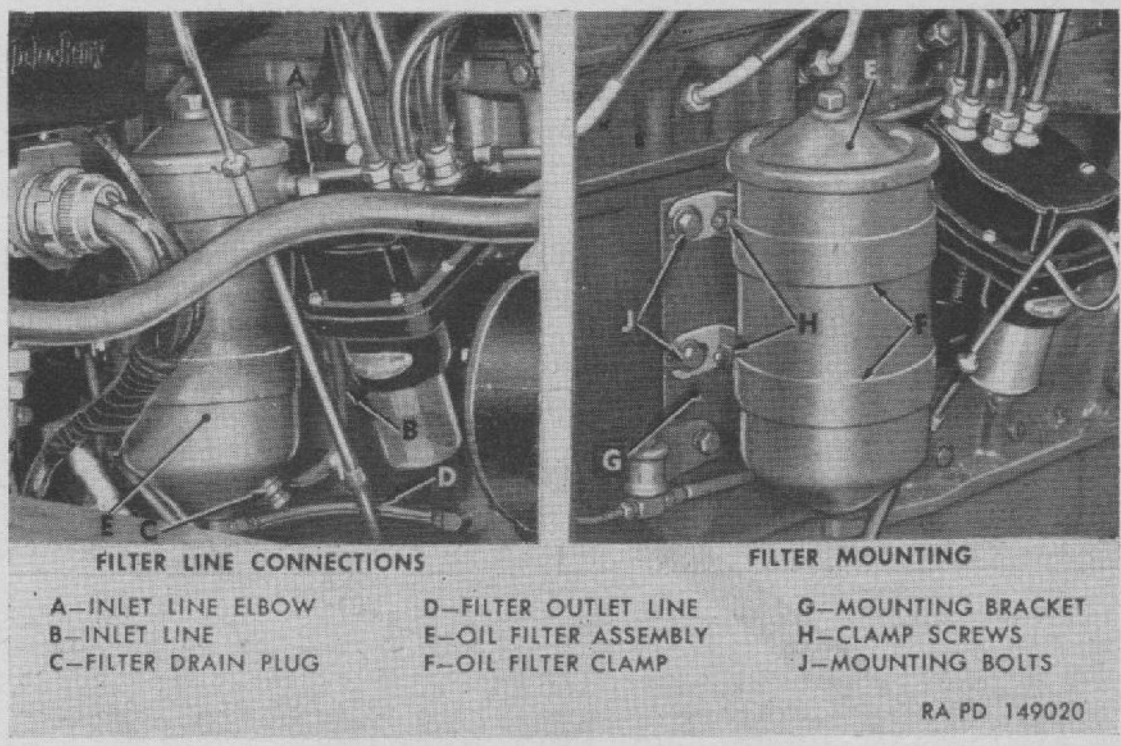


Figure 37. Oil filter installed.

b. ELEMENT REPLACEMENT. Procedure for replacing oil filter element is given in paragraph 59*c*.

c. FILTER REMOVAL (fig. 37).

(1) Remove drain plug from filter and drain out oil.

(2) Disconnect inlet and outlet lines at fittings on filter.

(3) Remove four filter mounting bolts. Remove filter and clamp assembly from engine.

(4) To remove clamps from filter, loosen clamp screws and slide clamps off lower end of filter housing.

(5) Remove two filter bracket-to-cylinder-block bolts at lower edge of bracket. One bolt also holds oil-pressure-sending-unit bracket and other holds oil-level-gage-tube bracket. Remove governor line clip from top of bracket. Remove filter bracket and push rod cover screws at top of bracket and remove filter bracket from engine.

d. FILTER INSTALLATION (fig. 37).

(1) Hold oil filter mounting bracket at side of engine and install bracket and push rod cover screws and lock washers at top of bracket. Attach governor line clip at top of bracket.

(2) Insert oil-pressure sending unit and filter bracket bolt with lock washer into place and screw bolt into boss at cylinder block. Insert bolt with lock washer through oil level tube bracket and oil filter bracket and screw bolt into tapped hole at crankcase. Tighten bolts firmly.

(3) Assemble clamps on filter housing and tighten clamp screws to hold clamps in place.

Note. Clamp screws should not be completely tightened until mounting bolts have been loosely installed.

(4) Set filter assembly at mounting bracket and install mounting bolts with lock washer and flat washer on each bolt and leave bolts loose until after clamp screws have been tightened.

(5) Connect filter inlet and outlet lines and tighten drain plug firmly. Position filter assembly in clamps and tighten clamp screws firmly.

(6) Tighten mounting bolts. Start engine, and with engine running, check oil lines and filter cover gaskets for leakage.

99. Crankcase Ventilation System

a. DESCRIPTION (fig. 38). Ventilation of crankcase for removal of fuel and water vapors is accomplished by circulation of air actuated by manifold vacuum. Air enters engine crankcase after passing through crankcase ventilator air cleaner located at right side of engine. Gases from crankcase move upward through push rod compartment and into rocker arm cover where they are drawn out through ventilator hose which connects cover with ventilator valve at intake manifold. Ventilator valve acts automatically to cause steady flow of air regardless of variations in manifold vacuum.

b. CRANKCASE VENTILATOR AIR CLEANER. Engine crankcase and flywheel housing are vented through ventilator (breather) at right side of engine. Ventilator incorporates an oil-bath type air cleaner with removable element. All air entering engine crankcase must pass through air cleaner. Air enters ventilator through opening in side of outer shell. Refer to paragraph 59*d* for specific information on servicing crankcase ventilator air cleaner.

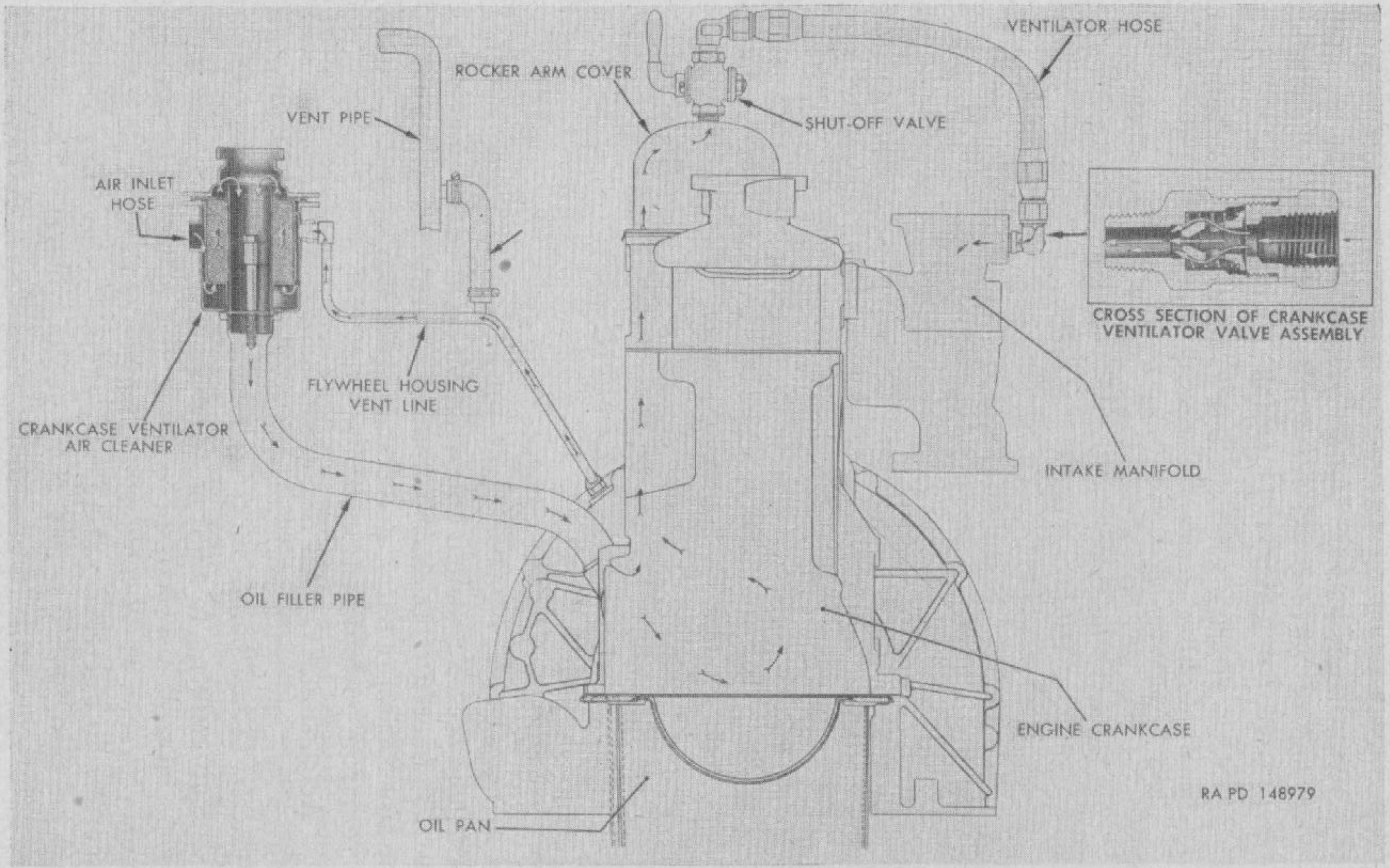


Figure 38. Crankcase ventilation system.

c. CRANKCASE VENTILATOR VALVE (fig. 38). Crankcase ventilator valve assembly is mounted on tee fitting installed in center section of intake manifold below carburetor.

(1) *Remove valve.* Disconnect flexible hose from elbow at ventilator valve. Using wrench on hex at manifold end of valve body, remove valve and elbow assembly from fitting at intake manifold.

Note. If elbow interferes with carburetor governor body, turn manifold fitting counterclockwise to provide clearance. Elbow may be screwed out of valve when necessary.

(2) *Disassemble valve.* Grip valve body in vise, then turn valve retaining nut out of body. Remove valve and spring assembly. Wash valve parts in dry-cleaning solvent or volatile-mineral-spirits paint thinner. Be sure all orifices in valve and body are clean.

(3) *Assemble valve.* When assembling spring on valve, be sure spring coil fits into groove in valve. Place valve and spring in valve body and install retaining nut. Tighten nut firmly into body.

(4) *Install valve.* Screw valve into fitting at intake manifold. Install elbow in valve if elbow has been removed. Connect flexible hose to elbow on valve.

Section VI. POWER PLANT REMOVAL AND INSTALLATION

100. General

a. DESCRIPTION. Power plant assembly consists of radiator, engine and accessories, and transmission. The entire power plant must be removed from chassis in order to replace engine; but engine accessories, radiator, and transmission can be replaced without removing power plant.

b. ACCESSIBILITY. All disconnect points are accessible with hood raised and with transmission controls and cover removed from cab. Some points must be reached from beneath vehicle.

c. EQUIPMENT. In addition to mechanics common hand tools, two special tools are required to accomplish power plant removal. Spanner wrench 41-W-3249-900 is necessary to uncouple various connectors in electrical wiring, and engine lifting sling 7950170 must be used to lift power plant out of vehicle. The special bracket attached to flywheel housing at right side of engine above starter, and lifting eye installed on cylinder head special bolt are provided at proper location for balance when sling is used to lift power plant.

101. Coordination with Ordnance Maintenance Unit

Replacement of the power plant or engine with a new or rebuilt assembly is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, providing authority for performing this replacement is obtained from the appropriate commander. Tools needed for the operation which are not carried in the using organization may be obtained from the supporting ordnance maintenance unit.

102. Power Plant Removal

a. PRELIMINARY. Transmission controls and transmission cover must be removed from inside cab to allow access to disconnect points at transmission. It is not necessary to drain cooling system, engine crankcase, or transmission when removing the power plant assembly. Disconnect cables (*C*, fig. 43) from batteries and open drain cock at each air storage tank to exhaust air from system before performing other operations for power plant removal.

Note. Key letters in following text identify disconnect points shown in figure 43.

b. OPERATIONS AT FRONT OF VEHICLE. Remove two fender-to-side-baffle bolts (K) which hold brush guard and radiator side baffles to front fenders. Loosen, but do not remove, two bolts (L) which hold baffles to fender skirts.

c. RIGHT SIDE OF ENGINE COMPARTMENT.

(1) Using spanner wrench 41-W-3249-900 (fig. 78), disconnect wiring harnesses at head light wiring connector ((Q), at right side of radiator), generator wiring connector (R), and engine wiring connector (T).

(2) Remove engine ground strap bolt (S) at frame side rail.

(3) Loosen hose clamp and disconnect engine pressurizing hose (U) at vent line nipple near No. 6 spark plug.

d. LEFT SIDE OF ENGINE COMPARTMENT.

(1) Loosen hose clamp at carburetor end of air-cleaner-to-carburetor hose (B) and pull hose off elbow at carburetor.

(2) At air compressor, disconnect air compressor discharge line (G) and detach discharge line clip at base of air compressor. Also disconnect air-compressor-governor line (F) at air compressor governor on top of compressor.

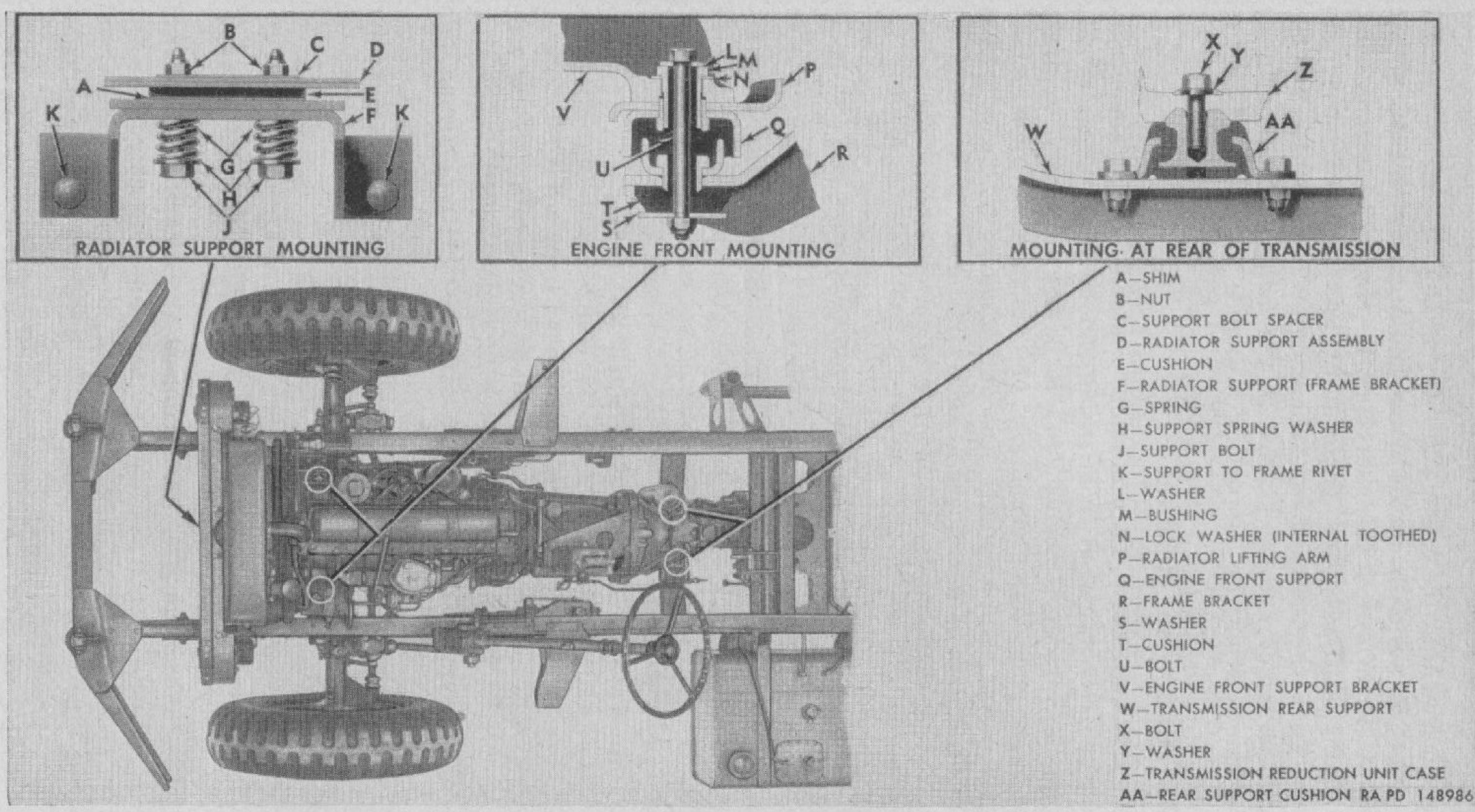


Figure 39. Power plant mountings.

(3) Disconnect two blackout driving light wiring connectors (J) at left side of radiator.

(4) Disconnect engine primer line (D) at rear of intake manifold.

(5) Disconnect choke control (A) from carburetor.

(6) Disconnect accelerator rod at accelerator lever (E) mounted under cab toe board.

(7) Disconnect fuel line (H) at carburetor flexible line.

(8) Remove three bolts which hold exhaust-pipe flange to exhaust manifold.

e. INSIDE CAB.

(1) Remove transmission manual shift control linkage (par. 177).

(2) Disconnect transmission vent connection (V) at transmission.

(3) Remove bolts which hold power plant on rear mountings (X).

f. UNDER VEHICLE.

(1) Remove four bolts connecting transmission-to-transfer universal joint flanges (Y).

(2) Remove bolt from front-to-rear-exhaust-pipe clamp at support; then remove exhaust-pipe-to-muffler clamp (W). Move exhaust pipe away from muffler and pull upper end of pipe free from exhaust manifold and remove exhaust pipe from vehicle.

(3) Remove two bolts from radiator support mounting (P) at bracket riveted to front cross member.

g. RAISE POWER PLANT FROM VEHICLE (fig. 40).

(1) Engage short hook of engine lifting sling 7950170 with eye nut and long hook with lower lifting bracket. Attach hoist to engine sling cross bar.

(2) Inspection should be made to see if all disconnect operations have been completed before power plant is raised off mountings.

(3) Remove radiator brace rod from clip on radiator support cross bar and swing brace into position at special cylinder head bolt. Install nut to hold lower end of brace at cylinder head (fig. 41).

(4) Raise power plant slowly, using several short lifts until free from mountings.

Note. As power plant is raised, be sure radiator lifting arms engage brackets on radiator support assembly.

Pull power plant slowly forward-raising as necessary to clear front cross member.

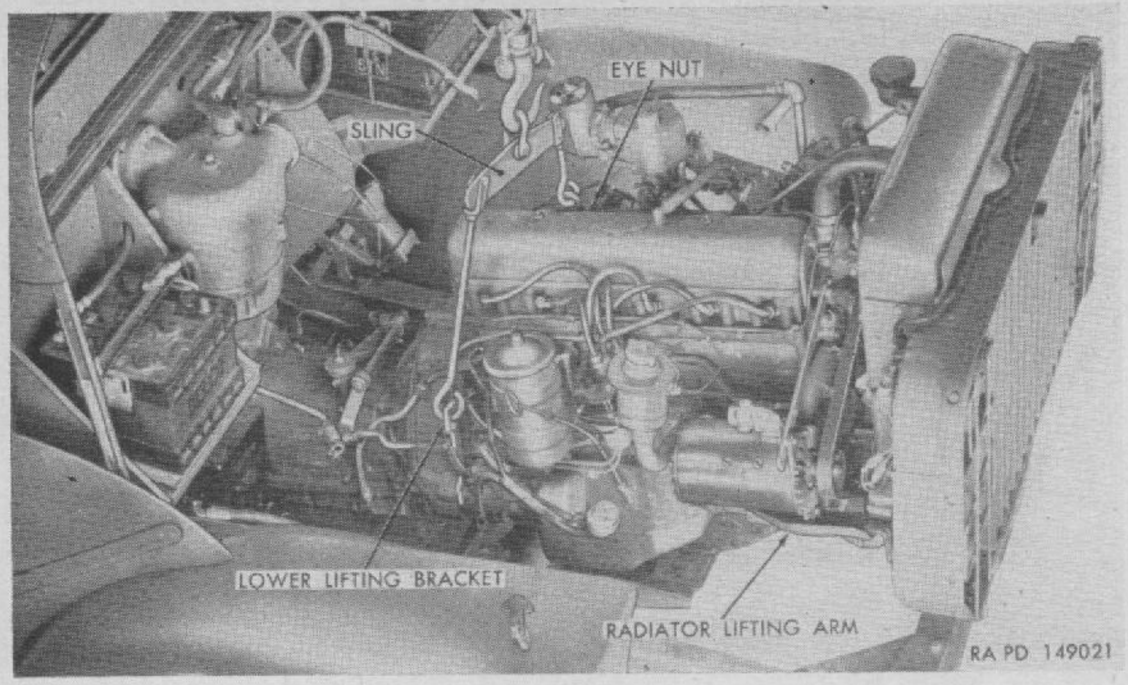


Figure 40. Removing power plant with sling—7950170.

(5) When power plant is out of vehicle, support in manner which will permit access to drain plugs in transmission case and drain plug in oil pan cover.

Caution: Do not permit weight of power plant to rest on oil pan or radiator support.

103. Engine Removal

a. GENERAL. The complete power plant assembly must be removed from chassis (pars. 101 and 102) in order to replace engine.

Note. Two-piece flywheel housing is part of engine assembly and both halves must remain with engine on which they were originally installed.

b. RADIATOR, SUPPORT, AND BRUSH GUARD REMOVAL.

(1) Remove nut holding radiator steady brace (fig. 41) to cylinder head special bolt. Remove lower end of rod from cylinder head and place rod in clip at radiator support.

(2) Loosen upper and lower radiator hose clamps. Tip radiator and brush guard assembly forward to free upper hose from radiator.

(3) Lift radiator and brush guard assembly off lifting arms and remove from engine.

Figure 41. Removing power plant showing radiator brace.

c. ENGINE FRONT SUPPORT REMOVAL (fig. 39).

(1) Remove bushing (M) and lock washer (N) which attach engine from support (Q) and radiator lifting arms (P) to brackets at front of engine. Bushings are threaded into metal part of engine mountings.

(2) To remove bushing (M) and bolt (U) from engine left front mounting bracket, swing air compressor toward engine to provide clearance.

d. TRANSMISSION REMOVAL.

(1) Refer to paragraph 181*c* and remove transmission from engine.

(2) Remove flywheel housing rear half from transmission assembly and bolt rear half of housing in place on front half. A pair of matched parts are furnished on replacement engine assemblies.

e. ENGINE WIRING HARNESS REMOVAL.

(1) Remove ground cable and battery cable from terminals on starter housing and starter switch.

(2) Detach harness from connectors at temperature and oil-pressure-gage sending units, and from connector at distributor. Remove harness from clips and remove from engine assembly.

104. Engine Installation

a. General. Transmission, radiator, engine mountings, and wiring harness must be assembled to engine and complete power plant installed in vehicle as a unit (fig. 42).

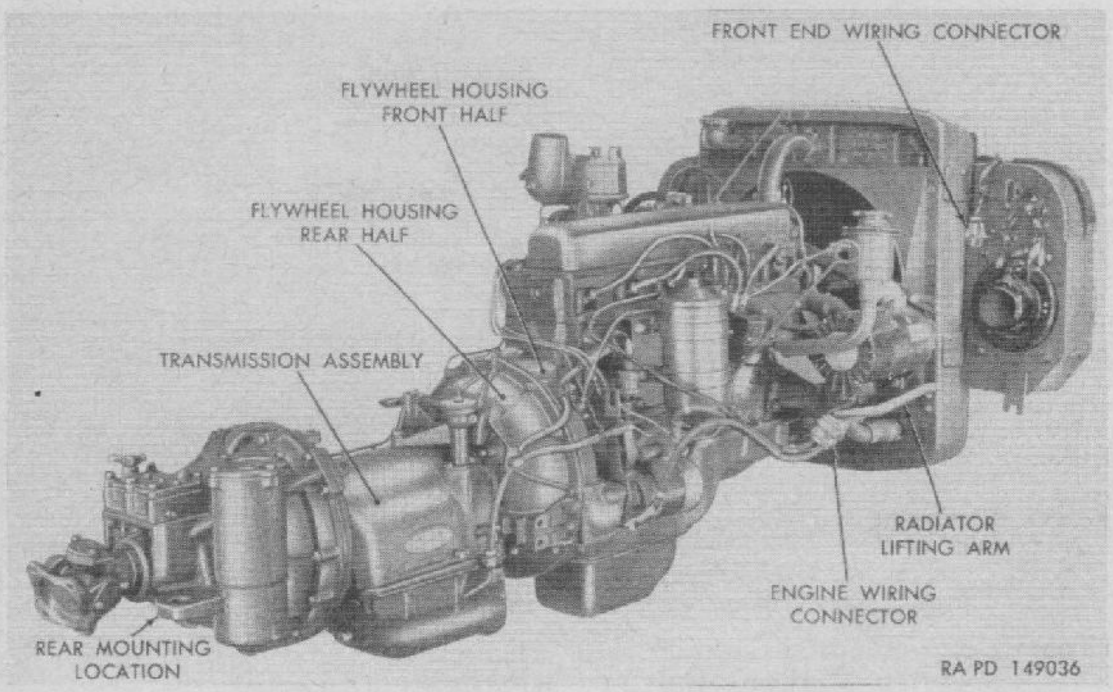


Figure 42. Power plant removed from vehicle.

b. Engine Wiring Harness Installation.

(1) Connect wiring harness at distributor, and at oil pressure and temperature sending units. Arrange harness at clips and bend clips to hold harness at push rod cover on right side of engine.

(2) Coat terminals on battery cables and terminal on starter switch with waterproofing material. Connect longer cable (No. 7) to ground terminal on starter drive housing and connect shorter cable (No. 82) to terminal on starter switch.

c. Transmission Installation.

(1) Remove flywheel housing rear half from engine assembly and assemble to transmission.

(2) Install transmission assembly on engine.

Note. Instructions for replacing flywheel housing on transmission, and for installing transmission on engine are covered in paragraph 182*b* and *c*.

d. Engine Front Support Installation (fig. 39).

(1) Locate engine left front support (Q) and radiator lifting arm at engine front support bracket (V); then

thread bushing (M) with lock washer through engine support bracket and into mounting.

(2) Loosen air compressor mounting bolt and belt adjusting arm bolt. Swing compressor toward engine as far as possible to provide clearance for bushing (M) and bolt (U) installation. Place lock washer (N) on bushing and drop bolt (U) with washer (L) through bushing. Insert this assembly downward through hole in engine-support left bracket. Locate radiator lifting arm (P) and front mounting at support bracket and screw bushing into mounting.

(3) Use box type wrench to firmly tighten bushing to lock mountings securely on engine front support brackets (V).

(4) Swing air compressor back into position to provide correct belt tension (par. 229); then tighten mounting bolt and adjusting arm bolt.

e. RADIATOR, SUPPORT, AND BRUSH GUARD INSTALLATION.

(1) With upper and lower radiator hose installed on engine, lift radiator support and brush guard into position at front of engine with lifting brackets on radiator support engaged with lifting arms on engine. Work radiator hose into place but do not tighten hose clamps until power plant is installed in vehicle.

(2) Connect radiator steady brace at cylinder head special bolt (fig. 41).

f. RECORD OF REPLACEMENT. Make a record of the replacement on DA AGO Form 478 (MWO and Major Unit Assembly Replacement Records and Organizational Equipment File).

105. Power Plant Installation

a. GENERAL. Make careful inspection of all engine accessories such as starter, generator, distributor, air compressor, and water pump to see that all attaching bolts and line connections are properly tightened. Seals must be in place on governor vacuum line connections as shown in figure 58.

Note. Key letters used in this paragraph identify respective keyed items in figure 43.

b. RAISE POWER PLANT INTO VEHICLE.

(1) Hook engine lifting sling 7590170 into eye nut and lower lifting bracket on engine. Attach sling to hoist (fig. 40).

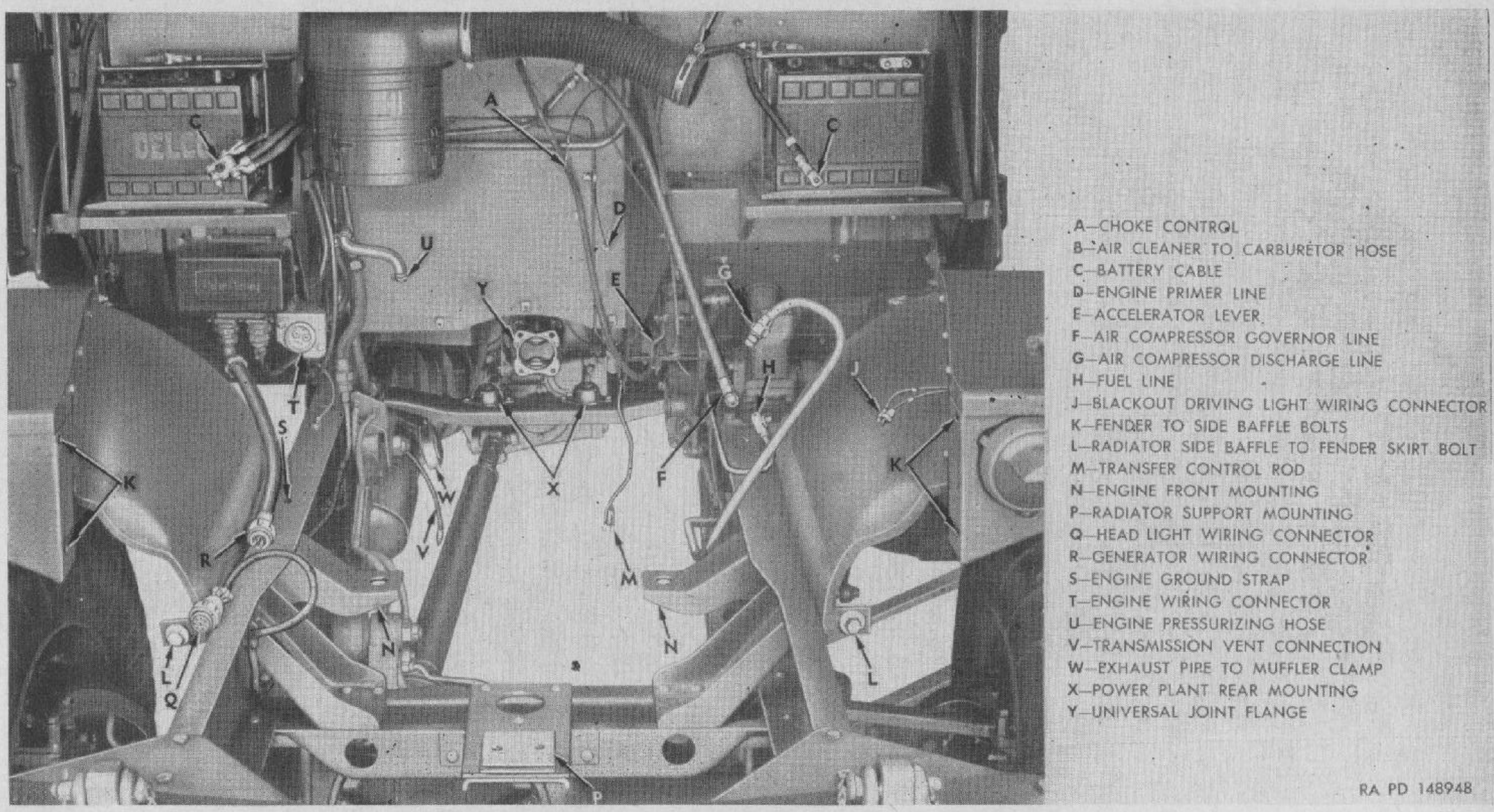


Figure 43. Power plant removed showing disconnect points.

(2) Raise power plant assembly high enough to clear vehicle frame, then move into position in engine compartment. Carefully lower power plant as it is moved rearward, taking care to avoid damage to lines, wiring, etc. Do not rest power plant solidly on mountings until two shims and cushion at radiator support (fig. 39) are in place and bolt holes are alined. Drop mounting bolt with flat washer through right front engine mounting assembly.

c. UNDER VEHICLE OPERATIONS.

(1) Aline holes in universal joint flanges (Y) at rear of transmission and install four bolts.

(2) Assemble cushions, flat washers, and nuts on engine front mounting bolts (fig. 39) and tighten nuts firmly.

(3) Assemble washers and springs on radiator support mounting bolts, then insert bolts upward through bracket and install spacer and nuts on bolts. Tighten nuts firmly.

(4) Assemble gasket and seal on exhaust pipe as shown in figure 65, and position front and rear exhaust pipe; assemble at manifold and muffler. New seal ring must be in place at exhaust pipe to muffler connection (fig. 64). Install bolt through front-to-rear-exhaust-pipe clamps and support. Assemble exhaust pipe-to-muffler clamp and tighten clamp bolt firmly.

(5) Remove engine sling from power plant.

d. INSIDE CAB.

(1) Install bolts with new lock washers to anchor power plant to rear mountings (X).

(2) Connect transmission vent connection (V) at transmission.

(3) Install and adjust transmission manual control linkage (par. 177).

e. LEFT SIDE OF ENGINE COMPARTMENT.

(1) Install bolts, nuts, and lock nuts (fig. 65) to attach exhaust pipe to manifold.

(2) Connect engine primer line (D) at fitting at rear of intake manifold.

(3) Connect choke control (A) at carburetor, and connect accelerator rod to accelerator lever (E) on bell crank mounted below cab toe board.

(4) Connect fuel line (H) at carburetor flexible fuel line.

(5) Connect air-compressor discharge line (G) at air compressor and clip line at base of compressor. Connect air compressor governor line (H) at top of compressor.

(6) Connect carburetor air intake hose to elbow on carburetor. Tighten clamp securely.

(7) Connect front end wiring at blackout-driving-light-wiring connectors (J) at left front fender.

(8) Disconnect brace (fig. 41) at engine cylinder head and position brace at clip on radiator support.

f. RIGHT SIDE OF ENGINE COMPARTMENT.

(1) Connect engine pressurizing hose (U) at tee in line at side of engine. Tighten hose clamp to secure hose to nipple at number six spark plug.

(2) Connect wiring at generator wiring connector (R), front end wiring at head light wiring connector (Q), and at engine wiring connector (T). Use spanner wrench 41-W-3249-900 as shown in figure 78 to tighten connector nuts. Attach engine ground strap (S) to frame side rail.

g. OPERATIONS AT FRONT OF VEHICLE.

(1) Install bolts (K) which hold brush guard and radiator side baffles to fenders.

(2) Tighten bolts (L) which attach baffles to fender skirts.

(3) Tighten radiator hose clamps firmly.

h. CONNECT BATTERY CABLES AND CHECK OPERATION OF ELECTRICAL EQUIPMENT.

(1) Connect cables (C) at batteries and coat exposed metal parts with waterproofing material.

Note. When attaching cables to battery terminals, look for sparks which would indicate closed circuit or grounded wiring or electrical units. Be sure all switches are turned off.

(2) Check operation of all lights and other electrical equipment.

Caution: *Do not attempt to start engine until checks and inspections listed in* i *and* j *below have been made.*

i. FINAL CHECK AND INSPECTIONS. Before attempting to start engine, proceed with following checks and inspections.

(1) Check fuel supply. When certain there is sufficient fuel in tank, turn on ignition switch which will cause fuel pump to operate. With fuel pump operating, check fuel line for leaks at connections and for leaks at carburetor.

(2) Check oil level in engine crankcase, crankcase ventilator (breather), carburetor air cleaner, and transmission. Refer to paragraph 59 for lubrication information for respective units.

(3) Close drain cocks and fill cooling system, following procedure given in paragraph 126*a*. Check all cooling system hose, lines, and fittings for leaks.

(4) Close drain cocks in air supply tanks.

j. START ENGINE AND CHECK OPERATION. Refer to paragraph 37*a* and start engine.

(1) Check action of gages.

Note. If oil gage does not show pressure when engine is started, stop engine immediately and locate trouble before starting engine again.

(2) Refer to paragraph 176 and perform transmission operation tests before attempting to move vehicle.

Section VII. IGNITION SYSTEM

106. Description and Data

a. DESCRIPTION.

(1) *General.* The ignition system consists of the source of power (battery or generator), ignition switch, distributor, coil, spark plugs, and primary and secondary circuit wiring. The ignition system produces and delivers high voltage surges to the spark plugs at timed intervals. Each high voltage surge produces a spark at the spark plug gap to which it is delivered, igniting the mixture of air and fuel in the cylinder. Ignition system is completely shielded for radio interference suppression, and sealed for submerged operation.

(2) *Distributor and ignition coil assembly.* The distributor and ignition coil assembly is a unit designed to convert low voltage (primary circuit) into high voltage (secondary circuit); to distribute the high voltage to the spark plugs; and to vary the timing of the spark automatically to provide efficient operation of engine. Distributor mechanism and ignition coil, together with three capacitors (condensers), primary circuit resistor, and governor spinner valve are assembled in the distributor housing. Distributor is mounted on right-hand side of engine. Distributor shaft is driven from engine camshaft by spiral cut gears. Lower end of distributor shaft is tongued and engages a slot in upper end of oil pump shaft to drive oil pump. Operation of governor centrifugal type valve, which is driven by distributor shaft, is described in paragraph 114.

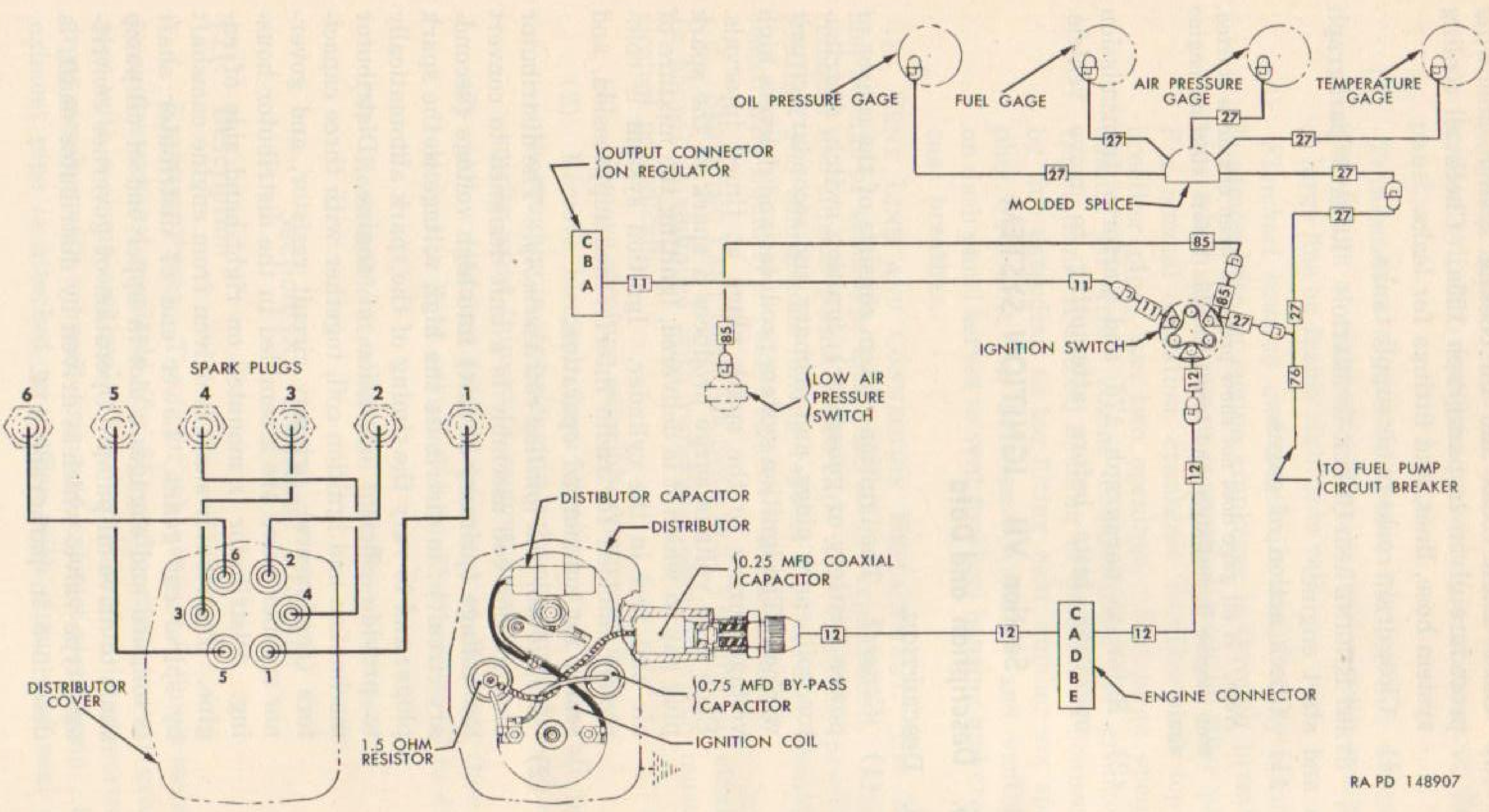


Figure 44. Ignition system circuit diagram.

(3) *Spark plugs.* Each spark plug consists of a shell, insulator, and center electrode. The center electrode is completely insulated from the shell by the insulator. A grounded electrode is integral with the shell. When high voltage surge is delivered to the spark plug center electrode, it jumps the gap to the grounded electrode, producing a spark which ignites the air-fuel mixture in the cylinder.

(4) *Circuits* (fig. 44). There are two distinct electrical circuits in the ignition system, the *primary* and the *secondary.* The primary, or low voltage circuit, includes the source of electrical energy (battery or generator), ignition switch, distributor contact points and circuit breaker mechanism, primary winding of the ignition coil, and coil capacitor (condenser). The secondary, or high voltage circuit, includes the secondary winding of the ignition coil, distributor rotor and cap, spark plugs, and spark plug cables.

b. DATA.

Distributor and ignition coil assembly:	
Make	Delco-Remy
Model number	1111565
Ordnance number	7350410
Rotation (viewed at rotor end)	clockwise
Breaker point opening	0.022 in
Cam angle (degrees with 0.022-in point opening)	31 to 37°
Breaker lever spring tension	17 to 21 oz
Centrifugal advance:	
Starts at 400 engine rpm	2°
Maximum at 2,000 engine rpm	26°

Note. Low limits 4 degrees less.

Firing order	1-5-3-6-2-4
Ignition coil:	
Model	1915992
Voltage	24
Spark plugs:	
Size	44 mm
Gap	0.028-0.032 in
Capacitors (condensers):	
Primary circuit capacitor	0.25 mfd
Ignition coil capacitor	1 mfd
Distributor capacitor	0.25 mfd
Primary circuit resistor:	
Resistance	6 ohms

107. Ignition Timing

a. GENERAL. Timing the ignition system comprises

(1) intial timing setting distributor mechanism to cause opening of points at correct firing intervals, and

(2) manual advance adjustment-retarding or advancing the point opening to compensate for various grades of fuel which may be used. These timing factors require checking and adjusting at engine tune-up periods, or when performance of engine necessitates such action. Ignition timing mark is a notch on crankshaft pulley (fig. 46). Timing pointer is attached to engine timing gear cover. Due to the sealed design of the ignition system, an adapter is required for connecting timing light (fig. 45).

b. INITIAL TIMING.

(1) Note location of No. 1 spark plug cable in distributor cover and scribe a mark on distributor housing at this point.

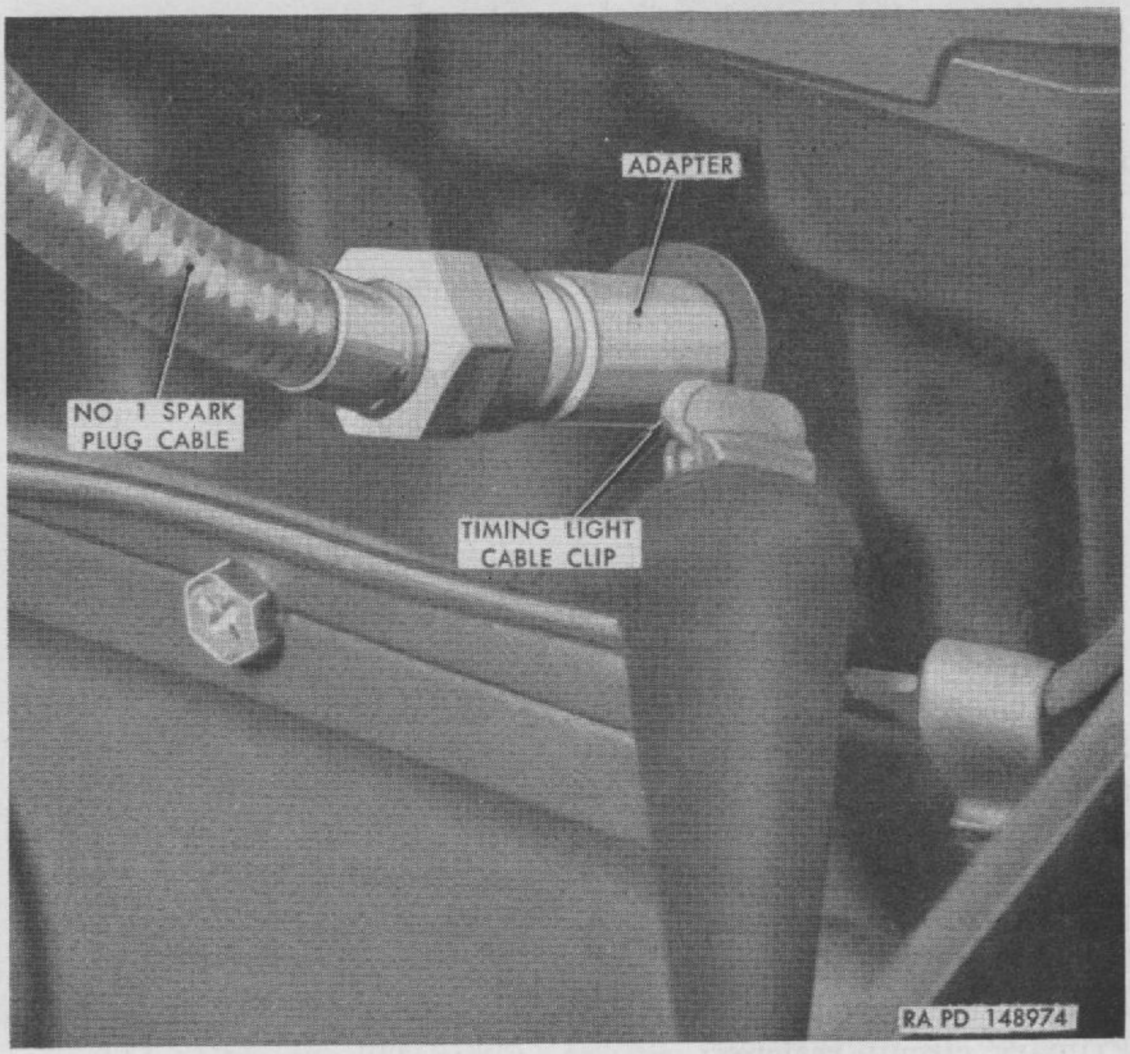


Figure 45. Timing light adapter installed.

(2) Remove eight screws attaching cover to housing. Remove cover. Clean and adjust or replace distributor points if necessary (par. 108).

(3) Do not turn ignition switch on. Slowly turn engine over by intermittently operating starter until timing mark (notch on crankshaft pulley) is alined with timing pointer on timing gear cover (fig. 46). If rotor segment points toward mark indicating No. 1 spark plug cable location, proceed with (4) below. If rotor segment points to No. 6 spark plug cable location, turn engine over one complete revolution until rotor points to No. 1 position with timing mark and pointer alined.

(4) Install distributor cover, making sure gasket is in good condition and in place. Tighten cover attaching screws.

(5) Remove No. 1 spark plug cable from spark plug, using spark plug conduit nut wrench 41-W-3297-760 (fig. 53). Thread adapter onto spark plug; then connect No. 1 spark plug cable to adapter.

(6) Connect one terminal of timing light to adapter and connect other terminal to ground.

(7) Start engine and run at a slow idle. Direct beam of timing light toward upper edge of timing pointer. Timing light flashes make timing mark on crankshaft pulley appear stationary. Loosen distributor clamp bolts

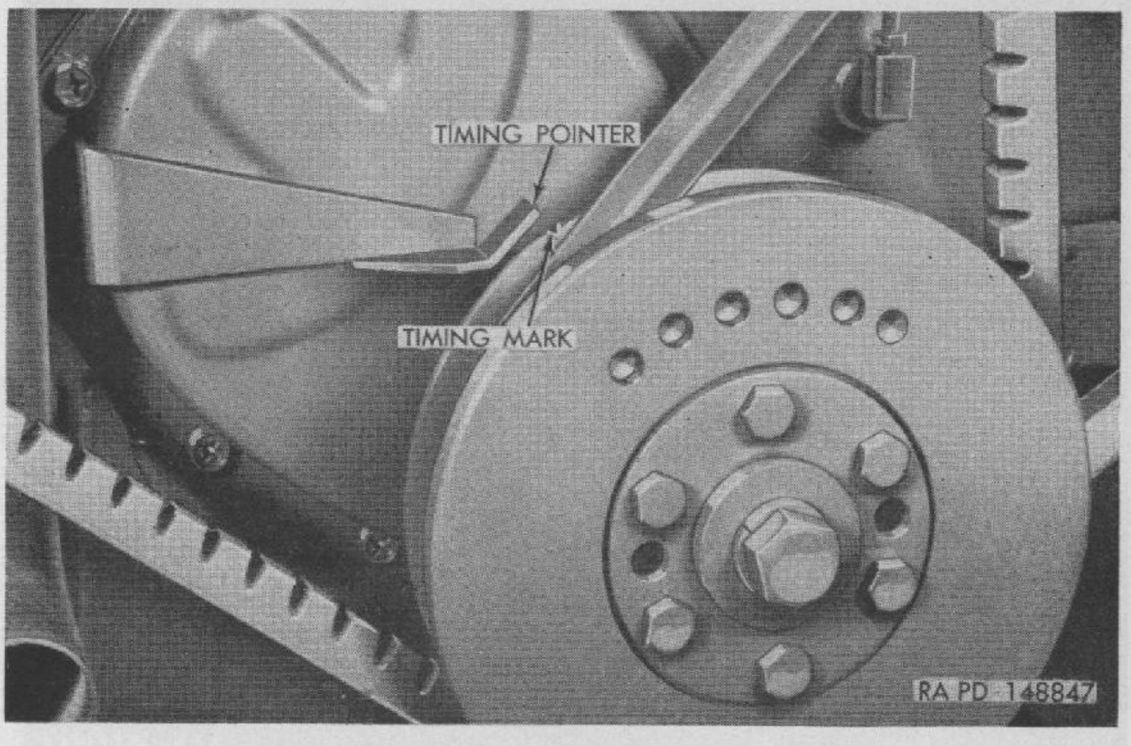


Figure 46. Ignition timing mark and pointer.

(fig. 47) and turn distributor housing clockwise or counterclockwise as necessary to synchronize flashes with timing mark when it is alined with pointer. Tighten distributor clamp bolts.

(8) Disconnect No. 1 spark plug cable from adapter, remove adapter, then connect spark plug cable to spark plug.

c. Manual Advance Adjustment.

(1) After engine has been thoroughly warmed up, drive the vehicle, using grade of fuel expected to be used in service. Engine should not ping or knock excessively under load and full throttle.

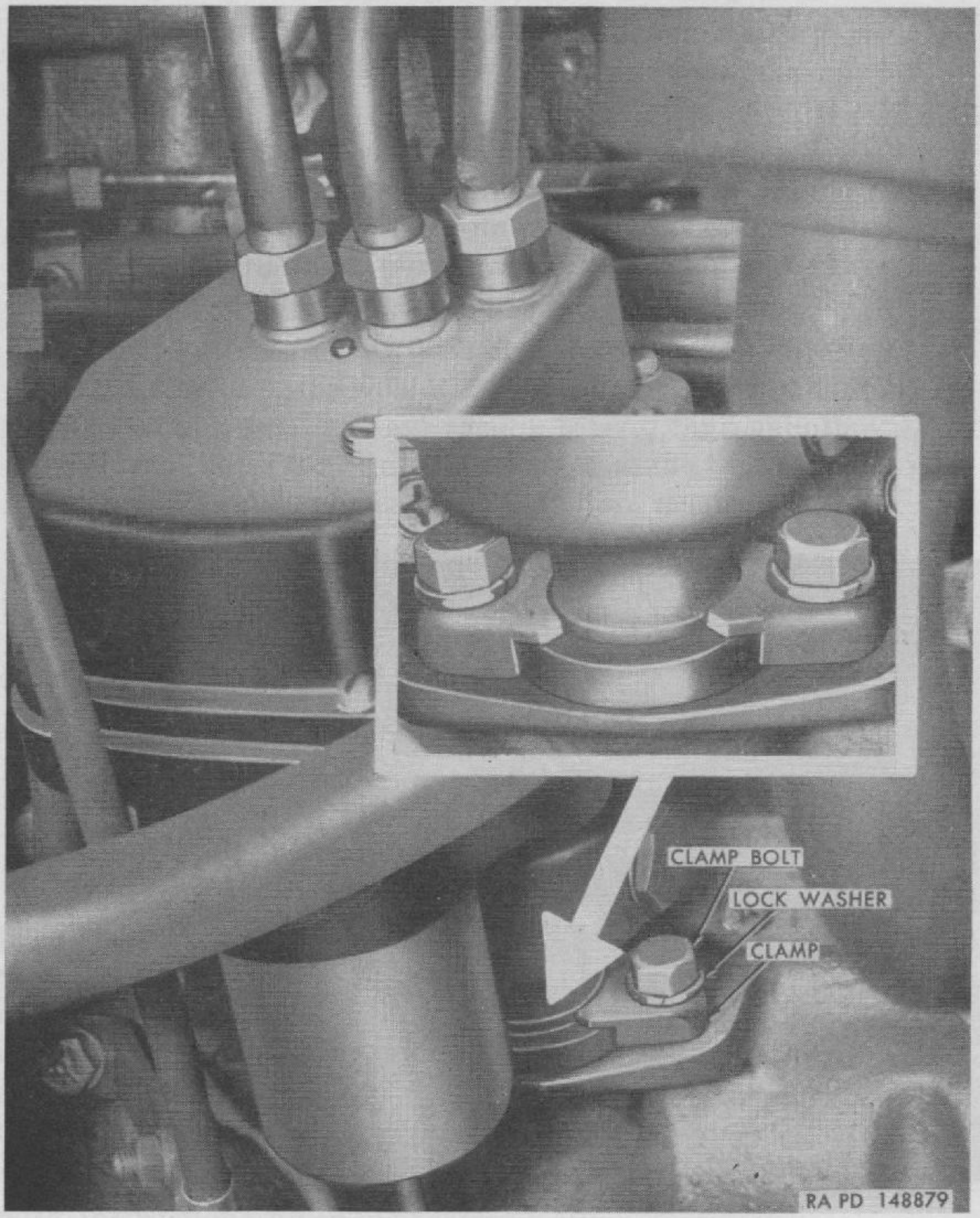


Figure 47. Distributor mounting clamps and bolts.

(2) A slight amount of ping is not objectionable. If knock is excessive, loosen distributor clamp bolts, (fig. 47) and turn distributor housing clockwise slightly until knock is minimized. Tighten distributor clamp bolts.

108. Distributor and Ignition Coil Assembly

a. POINT ADJUSTMENT.

(1) Remove distributor cover. Pull rotor off distributor cam. Clean points, using a contact point dresser. If points are badly pitted or burned, replace points (*b* below).

(2) Turn engine over in small stages by intermittently operating starter until distributor cam comes to rest with breaker lever pad on flat of cam (points closed). Using contact spring gage as shown in figure 48, check pull required to open points. If not within 17 to 21 ounces,

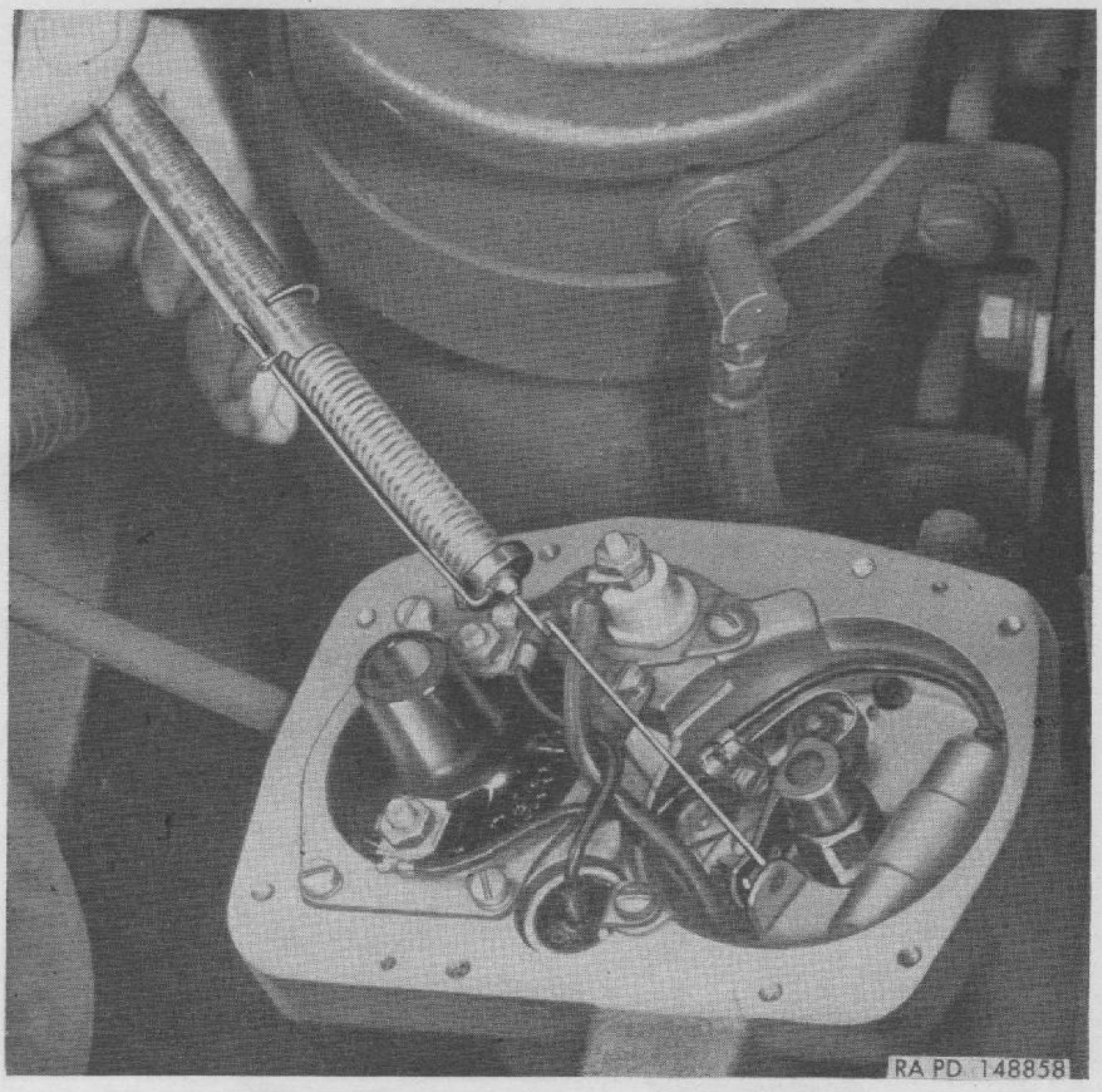


Figure 48. Checking breaker lever spring tension with gage.

adjust spring tention by bending breaker lever spring slightly.

(3) Turn engine over until distributor cam comes to rest on high point on cam (points open). Measure point opening with feeler gage. If not 0.022 inch, loosen clamp screw and turn adjusting screw to obtain opening of 0.022 inch (fig. 49). Tighten clamp screw. Install rotor and distributor cover.

b. POINT REPLACEMENT (fig. 50).

(1) *Removal.*

(*a*) Remove distributor cover. Pull rotor off distributor cam. Remove clamp screw attaching stationary point support to breaker plate. Lift stationary point support and breaker lever, with cables attached, up off pivot pin.

(*b*) Remove screw and nut attaching cables and breaker lever spring to stationary point support.

(2) *Installation.*

(*a*) Before positioning new points on breaker plate, connect cables and breaker lever spring to stationary point support. Breaker lever spring must be on inside of lug on point support.

(*b*) Place two drops of preservative lubricating oil on pivot pin. Position stationary point support and breaker lever over pivot pin, with center hole in support over adjusting screw in breaker plate. Install clamp screw.

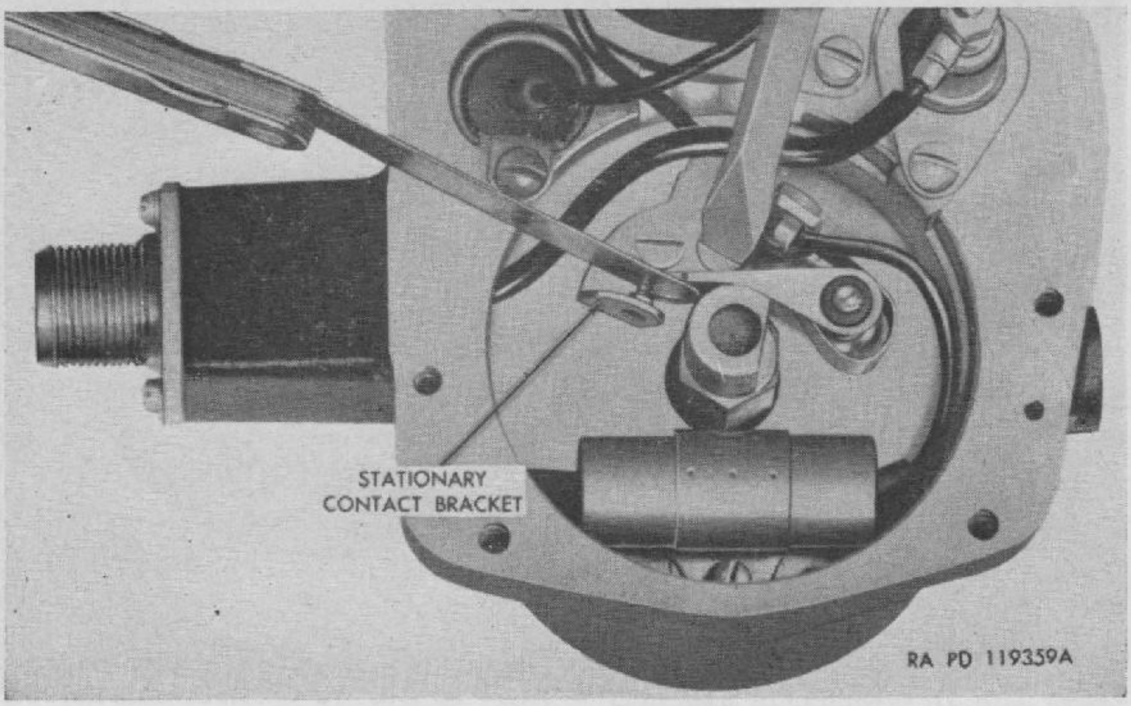


Figure 49. Adjusting distributor points.

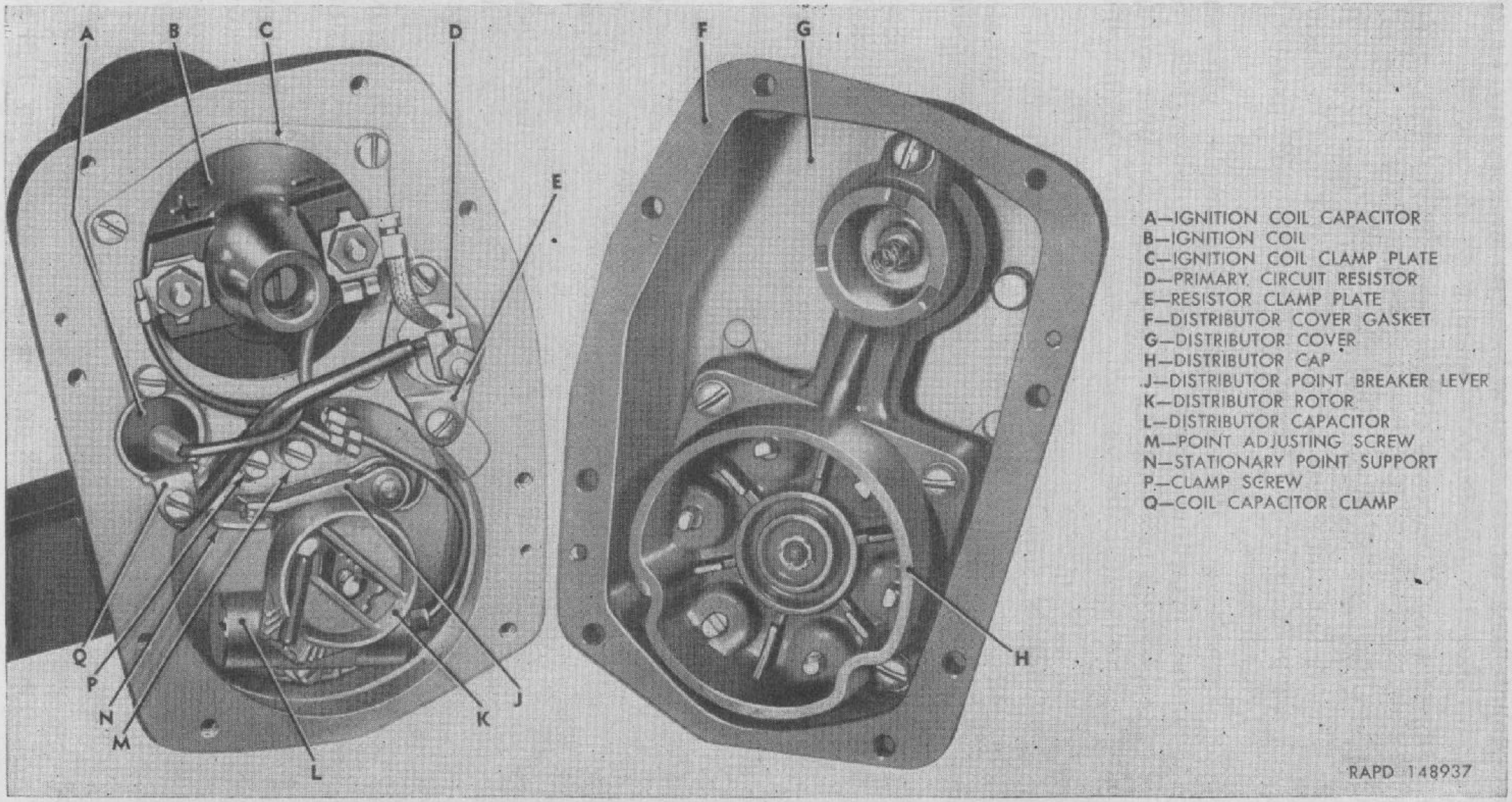


Figure 50. Distributor with cover removed.

(*c*) Check tension of new breaker lever spring (*a* (2) above). Adjust point opening (*a* (3) above).

c. DISTRIBUTOR CAPACITOR (CONDENSER) REPLACEMENT (fig. 50).

(1) *Removal.* Remove distributor cover and rotor. Remove nut and screw attaching capacitor lead to stationary points support. Remove screw attaching capacitor to breaker plate.

(2) *Installation.* Position capacitor on breaker plate and install attaching screw. Connect capacitor lead, together with coil primary lead and breaker lever spring, to stationary point support. Install rotor and distributor cover.

d. DISTRIBUTOR AND IGNITION COIL ASSEMBLY REMOVAL.

(1) Note position of No. 1 spark plug cable on distributor cover and scribe a mark on distributor housing at this point.

(2) Disconnect spark plug cables from distributor cover and remove cover. Disconnect primary circuit cable from front side of distributor housing.

(3) Turn engine over by intermittently operating starter until notch on crankshaft pulley is alined with pointer (fig. 46) and rotor segment is pointing to mark on housing indicating No. 1 spark plug cable location.

(4) Disconnect air vent and vacuum lines from fittings at rear side of distributor body. Remove two clamp bolts and clamps attaching distributor housing to cylinder block (fig. 47).

(5) Carefully lift distributor straight out of cylinder block, observing that rotor turns clockwise a few degrees as gears disengage; mark this position of rotor on distributor housing.

e. DISTRIBUTOR AND IGNITION COIL ASSEMBLY INSTALLATION.

(1) If engine has not been turned over since removal proceed as follows:

(*a*) Remove distributor cover. Turn rotor so segment points to mark made after distributor was withdrawn from cylinder block. If distributor is new, No. 1 firing position of rotor can be determined by marks made on old distributor housing at time of removal.

(b) As distributor is lowered into place and gears engage, rotor will turn back (counterclockwise), and should point toward mark on housing indicating No. 1 firing position. It may be necessary to insert the assembly several times to find the correct position to bring rotor to No. 1 firing position.

(2) If engine has been turned over since removal, remove valve rocker arm cover from engine. Turn engine over by intermittently operating starter and observe movement of No. 1 intake valve (second from front). When No. 1 intake valve starts to close (raise up), continue

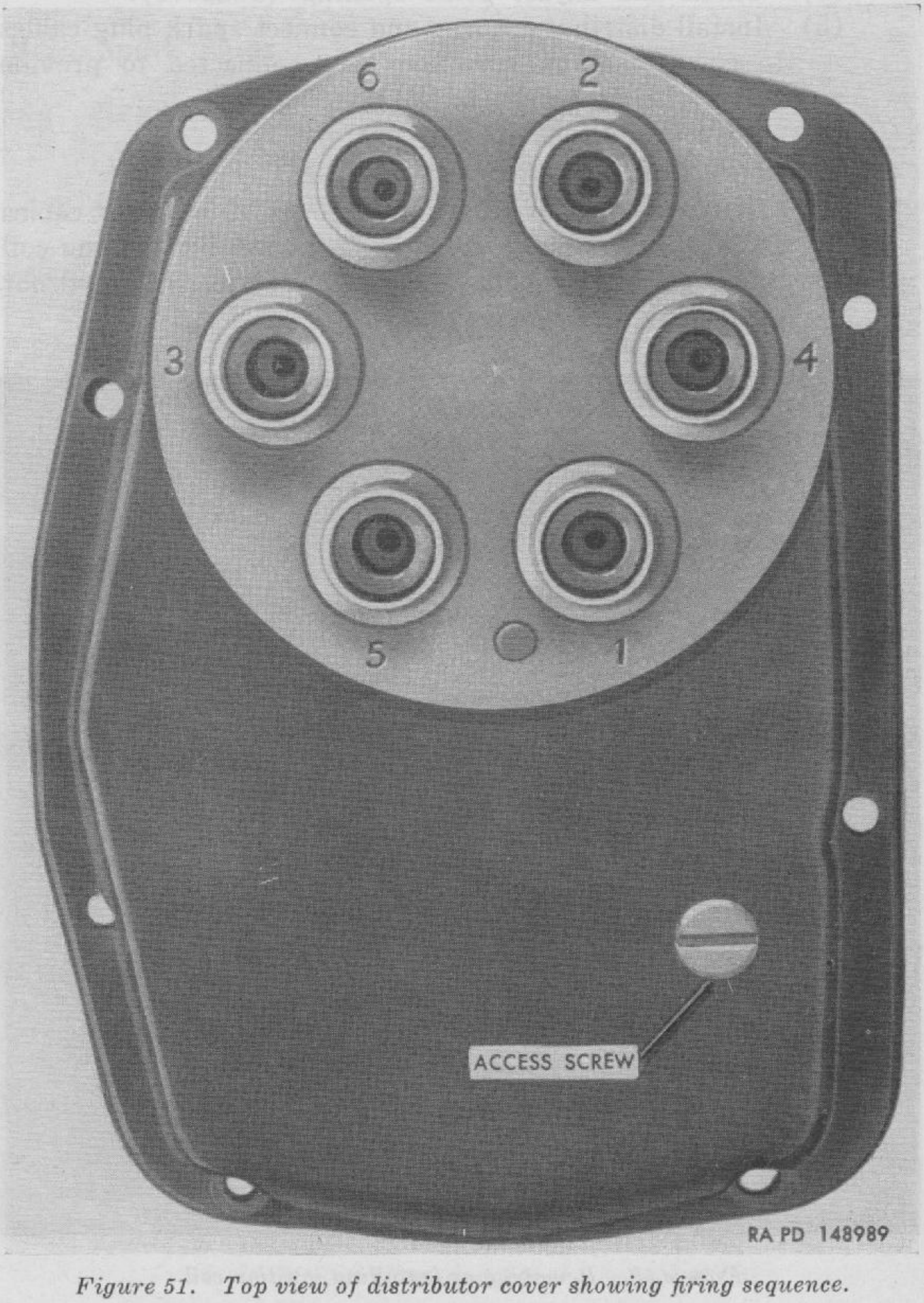


Figure 51. Top view of distributor cover showing firing sequence.

to turn engine slowly until notch on crankshaft pulley is alined with pointer (fig. 46). Engine is then in No. 1 firing position and distributor may be inserted as directed in (1) above.

(3) Install clamps and clamp bolts securing distributor to cylinder block (fig. 47). Connect air vent and vacuum lines to distributor. Connect primary circuit cable to distributor.

(4) Check and adjust point opening (*a* above).

(5) Install distributor cover and connect spark plug cables to cover, making sure they are connected to provide correct firing order (fig. 51).

(6) Adjust ignition timing (par. 107).

f. IGNITION COIL REPLACEMENT (fig. 52).

(1) *Removal.* Remove distributor cover. Disconnect cables from coil terminals. Remove four screws attaching coil clamp plate to housing and remove plate. Lift coil out of housing and remove gasket.

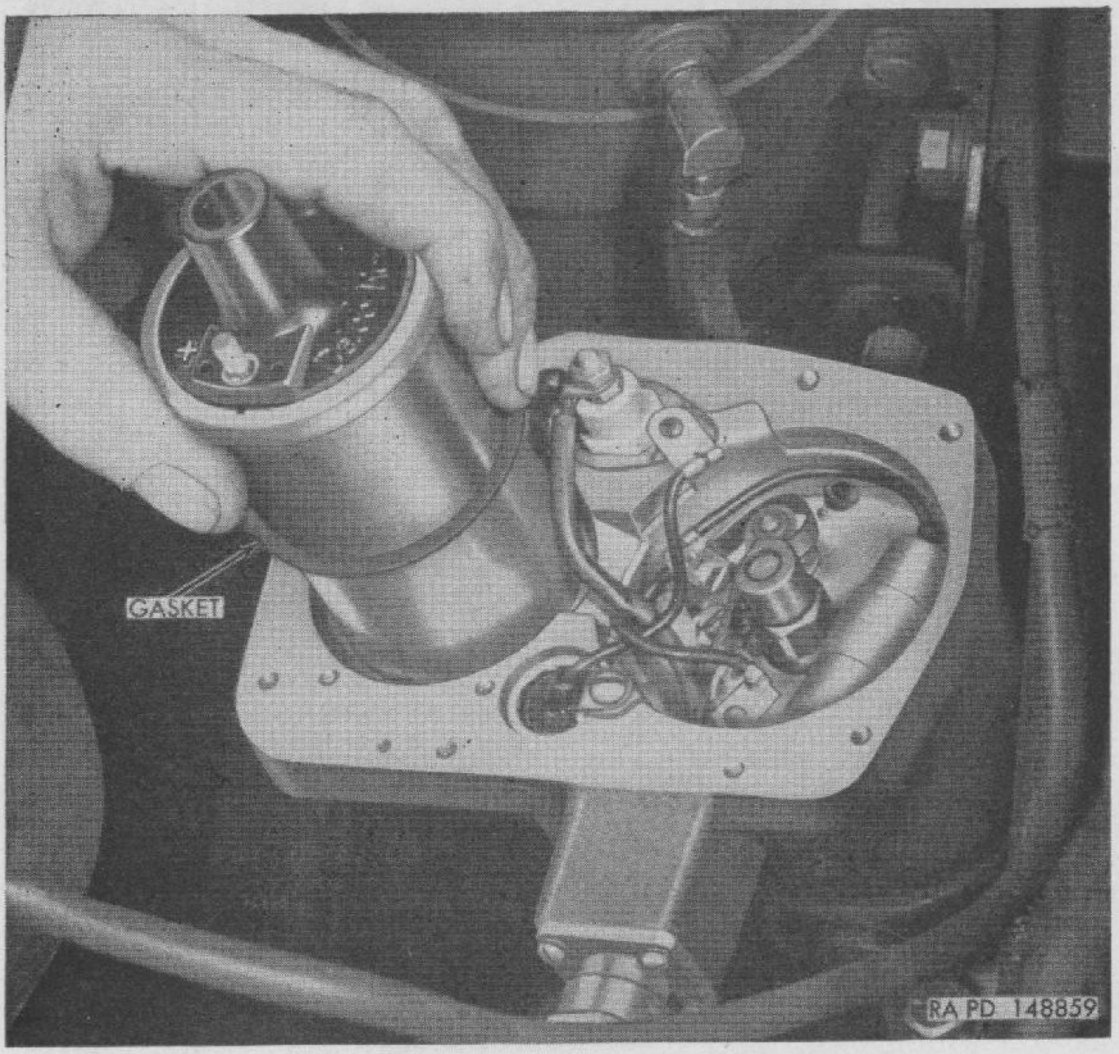


Figure 52. Removing or installing ignition coil.

(2) *Installation.* Install a new gasket on coil and insert coil into distributor housing.

Note. The coil negative (−) terminal must be next to the primary circuit resistor (fig. 50). Install clamp plate and attach with four screws. Connect lead from breaker plate support to coil positive (+) terminal. Connect leads from primary circuit resistor and coil capacitor to coil negative (−) terminal. Install distributor cover.

109. Spark Plugs

a. REMOVAL.

(1) Disconnect cable from spark plug, using spark plug conduit nut wrench 41–W–3297–760 (fig. 53). Pull cable out of plug end.

(2) Use spark plug wrench 41–W–3335–30 with wrench 41–W–3297–760 to unscrew spark plug from cylinder head (fig. 54).

Figure 53. Disconnecting cable from spark plug using wrench 41–W–3297–760.

b. Cleaning and Adjustment.

(1) Clean spark plugs, using sandblast cleaning equipment. If electrodes or porcelain insulator are badly burned, install new spark plugs.

(2) Using a round feeler gage, check gap between electrodes. If not within 0.028–0.032 inch, adjust gap to 0.030 inch by bending grounded (side) electrode only. Do not bend center electrode.

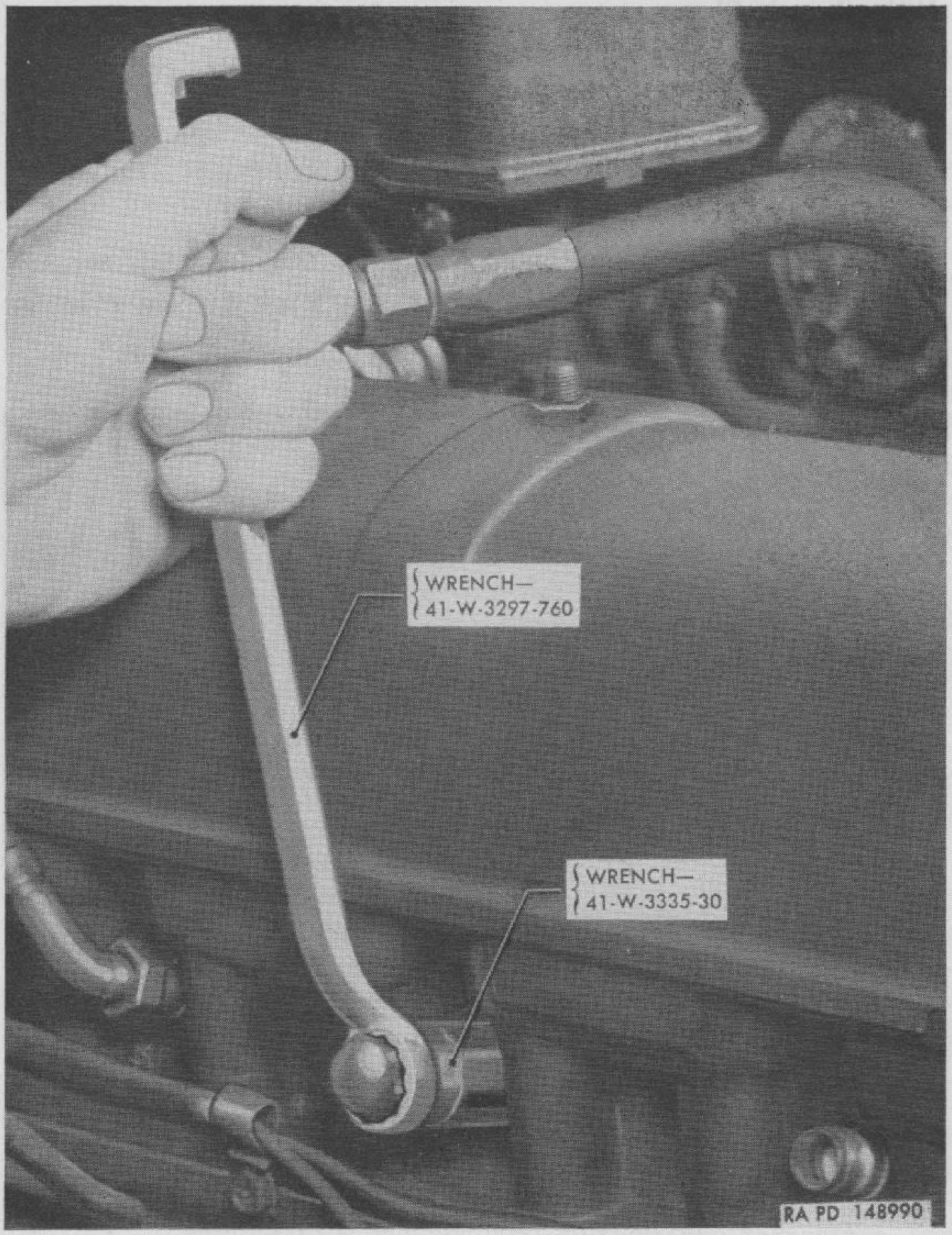


Figure 54. Removing spark plug from cylinder head.

c. INSTALLATION.

(1) Place new gasket on spark plug and thread plug into cylinder head. Be sure gasket does not drop off when positioning plug. Using spark plug wrench 41-W-3335-30 with spark-plug-conduit-nut wrench 41-W-3297-7601 tighten plug until it bottoms on gasket, then tighten one quarter to one half turn to partially compress gasket (fig. 54). Do not tighten enough to crush gasket.

(2) Insert spring in end of cable into spark plug shell, press cable in, then thread cable nut onto spark plug shell. Tighten cable nut handtight, using wrench 41-W-3297-760 (fig. 53). Do not use additional leverage on wrench.

Section VIII. FUEL AND AIR INTAKE SYSTEM

110. Description and Operation

a. DESCRIPTION. Units which comprise fuel and air intake system include: carburetor and governor system, carburetor controls, air cleaner assembly, fuel tank and lines, electric fuel pump assembly, and engine primer pump and lines. General arrangement of fuel system major items is shown in figure 55. Manifold heat control and chassis unit vent and breather line system, which are related to fuel and air intake system operation, are also described in this section. Electric fuel gage indicates fuel level in tank.

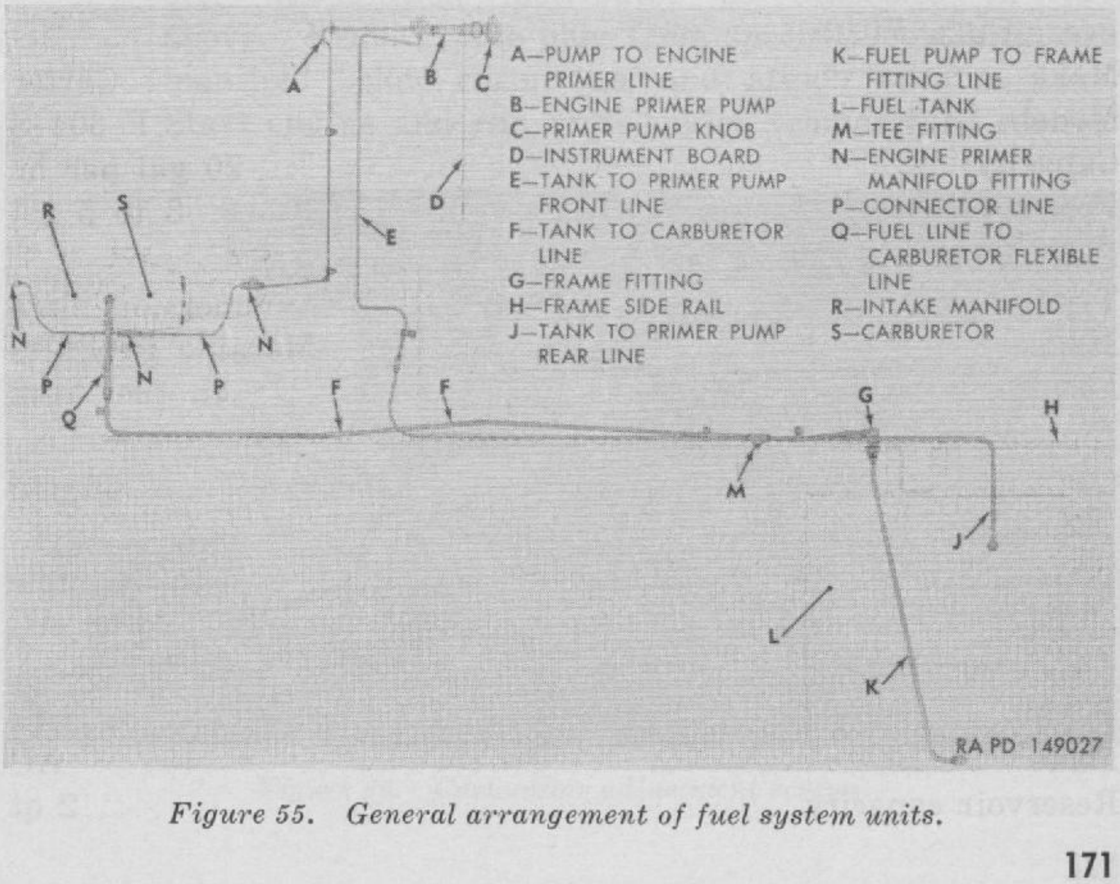


Figure 55. General arrangement of fuel system units.

b. OPERATION. Fuel pump and hanger assembly, installed in fuel tank, incorporates an electric fuel pump which draws fuel through filter plates mounted on fuel pump hanger. Fuel pump discharges fuel into line connected to carburetor bowl inlet fitting which contains a removable filter screen. Engine primer pump is installed on instrument panel and when pump is operated manually, fuel is drawn from tank and discharged through line connected to three primer fittings at intake manifold. Air supply for carburetor passes through oil bath air cleaner and is carried through hose which connects air cleaner outlet to inlet elbow on carburetor. Carburetor mixes air and fuel in proper ratio for combustion in engine. Manifold heat control valve serves to direct exhaust gases into intake manifold heat chamber to aid in fuel vaporization in cold weather, or to deflect heat away from intake manifold in hot weather. Valve must be set manually (par. 119).

111. Data

a. CARBURETOR

Make	Holley
Model	885–FFG
Number	R–683–A

b. GOVERNOR

Make	Holley
Type	vacuum activated
Governor valve location	in ignition distributor

c. FUEL PUMP

Make	Carter
Model	P–604–S
Capacity	20 gal per hr
Pressure	3 to 5 psi

d. FUEL FILTER

Type	immersion plate
Make	Moraine Products
Location	in fuel tank

e. FUEL TANK

Capacity	56 gal

f. FUEL GAGE

Type	electric
Make	AC

g. AIR CLEANER

Type	oil bath
Make	AC
Reservoir capacity	2 qt

112. Carburetor

a. DESCRIPTION. Carburetor is double-venturi, down-draft type with side air intake. Governor throttle unit, incorporated in carburetor assembly, operates in conjunction with governor centrifugal type valve in ignition distributor to control engine maximum speed. Carburetor is stud-mounted on engine intake manifold and is manually controlled by linkage (fig. 57). Carburetor is completely sealed and calibrated to provide proper fuel mixture under all operating conditions.

b. ADJUSTMENTS. One screw is provided at carburetor for setting engine idling speed and idling mixture is controlled by two adjustable screws (fig. 56). Electric type tachometer designed to operate from ignition primary circuit must be available for use in making idling speed adjustment. Vacuum gage must be used as well as tachometer when adjusting carburetor idling mixture.

(1) *Idling speed adjustment.* Remove access screw from top of ignition distributor cover (fig. 51), install an adapter in place of screw and attach tachometer clamp to adapter. With transmission control lever in neutral and engine temperature within normal operating range (160° to 220° F), turn idle speed adjusting screw so engine idles at 375 rpm. Remove tachometer clamp and adapter. Install access screw.

(2) *Idling mixture adjustment.* Connect electric tachometer at ignition distributor as described in (1) above. Remove pipe plug from special elbow in intake manifold below carburetor and attach vacuum gage. Start engine and run until engine temperature reaches

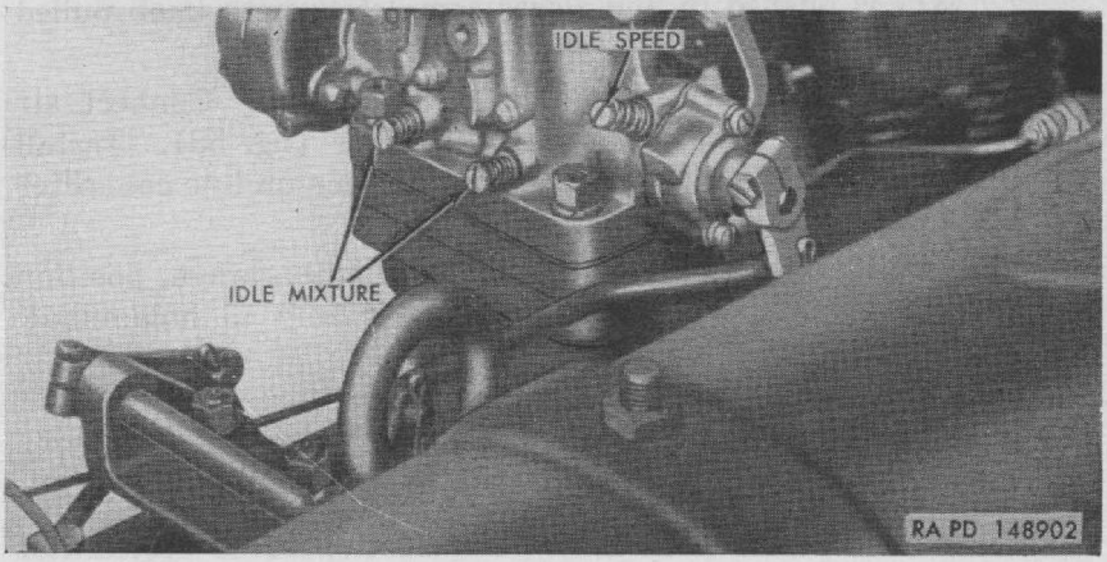


Figure 56. Carburetor adjustment screws.

160° to 220° F. Turn idling mixture screws at rear of carburetor body one at a time to obtain highest reading on vacuum gage with steady indicator. Recheck engine speed indicated on tachometer and readjust idling speed if necessary. Remove tachometer, adapter, and vacuum gage. Install tachometer access screw in distributor cover, and pipe plug in intake manifold elbow.

c. REMOVAL.

(1) Remove clamp which connects air inlet elbow to carburator.

(2) Remove seal wire from vacuum line connector nut at carburetor, and disconnect vacuum line and air bleed line at carburetor (fig. 58).

(3) Disconnect fuel flexible line at carburetor.

(4) Disconnect choke control wire at carburetor choke lever (BB, fig. 57) and loosen choke control clip. Remove inner-idler-lever-to-carburetor rod (CC, fig. 57). Remove carburetor mounting stud nuts and lock washers; then lift carburetor assembly off intake manifold and remove from engine.

d. INSTALLATION.

(1) Place new gasket on each side of insulator on manifold; then set carburetor in position and install stud nuts and lock washers on carburetor mounting studs.

(2) Install inner-idler-lever-to-carburetor rod (CC, fig. 57). Connect choke control wire at choke lever (BB, fig. 57) and tighten choke control clip at choke control clip bracket (Z, fig. 57). Check operation of choke control to be sure valve is open when choke control knob (A, fig. 57) is pushed in and closes completely with knob pulled out.

(3) Connect fuel flexible line at carburetor. Connect air bleed and vacuum line at carburetor (fig. 58). Install seal wire to hold seal in place over vacuum line connector nut.

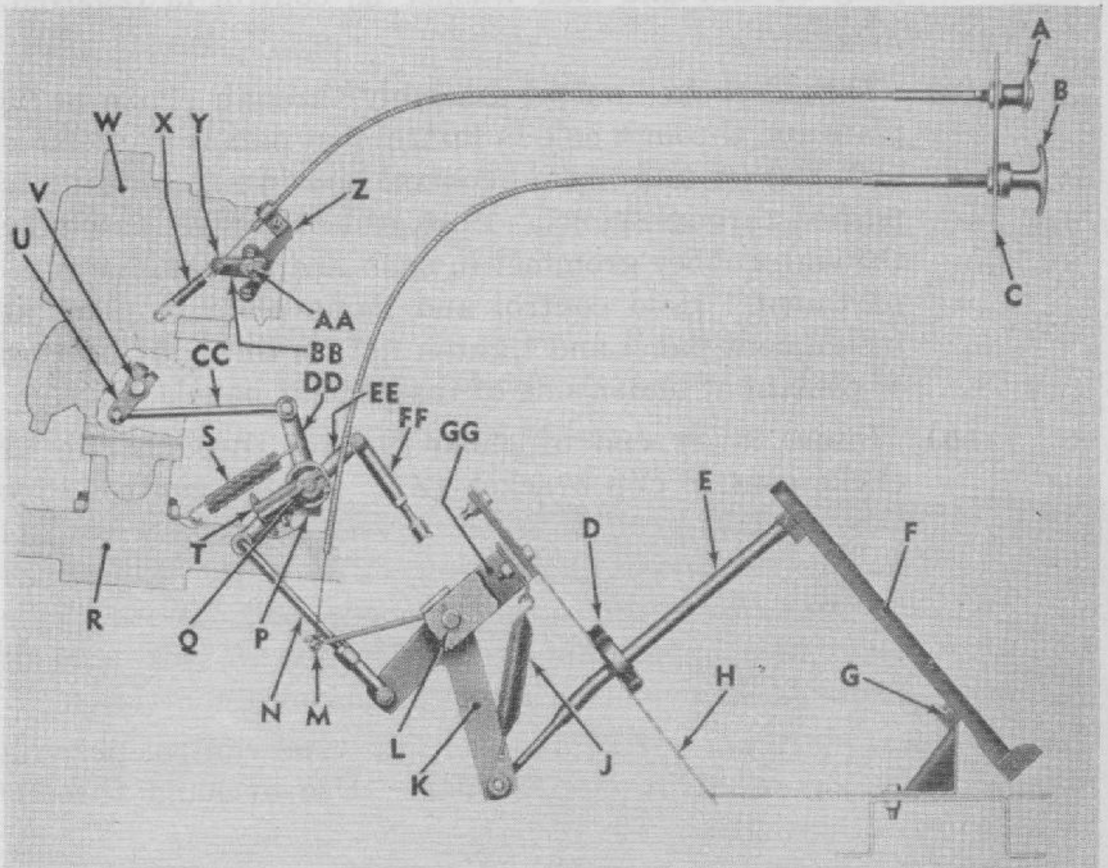
(4) Place new seal at carburetor air inlet flange, position elbow at carburetor, and install clamp to hold elbow to carburetor.

113. Carburetor Controls

a. GENERAL. Carburetor controls consist of hand-operated choke control and throttle control, and foot-operated accelerator pedal and connecting linkage (fig. 57). Lever at transmission throttle valve (fig. 102) is inter connected with accelerator linkage through adjustable rod.

Note. Key letters in this paragraph identify respective items in figure 57.

b. CHOKE CONTROL. Conventional type wire and housing is used to operate choke valve at carburetor air inlet. Choke return spring (X) attached to choke lever (BB) holds choke valve in open position when choke control knob (A) is released.



A—CHOKE CONTROL KNOB
B—HAND THROTTLE
C—INSTRUMENT PANEL
D—ACCELERATOR ROD SEAL
E—ACCELERATOR ROD
F—ACCELERATOR PEDAL
G—ACCELERATOR PEDAL PIN
H—TOE BOARD
J—ACCELERATOR PULL BACK SPRING
K—ACCELERATOR LEVER
L—ACCELERATOR LEVER SHAFT
M—THROTTLE WIRE COLLAR
N—ACCELERATOR LEVER TO PICK-UP LEVER ROD
P—IDLER LEVER SHAFT BRACKET
Q—IDLER SHAFT
R—INTAKE MANIFOLD
S—THROTTLE LEVER RETURN SPRING
T—IDLER SHAFT OUTER LEVER
U—THROTTLE SHAFT LEVER
V—THROTTLE SHAFT
W—CARBURETOR ASSEMBLY
X—CHOKE RETURN SPRING
Y—CHOKE LEVER SWIVEL
Z—CHOKE CONTROL CLIP BRACKET
AA—CHOKE VALVE SHAFT
BB—CHOKE LEVER
CC—INNER IDLER LEVER TO CARBURETOR ROD
DD—IDLER SHAFT INNER LEVER
EE—PICK-UP LEVER
FF—PICK-UP LEVER TO TRANSMISSION VALVE LEVER ROD
GG—ACCELERATOR LEVER SHAFT BRACKET

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Figure 57. Carburetor controls.

(1) *Removal.*

(*a*) Loosen screw at choke lever swivel (Y) and loosen bolt which holds housing clip to choke control clip bracket (Z). Pull control wire and housing away from carburetor.

(*b*) Use wrench to remove nut from threaded portion of choke control at instrument panel. Pull choke control assembly out through instrument panel and dash, stripping off nut and lock washer as control is removed.

(2) *Installation.*

(*a*) Thread choke control assembly through choke name plate and through hole in instrument panel. Assemble lock washer and nut on control housing as housing is pushed through panel. Push end of control assembly through rubber grommet in dash and into engine compartment. Hold control and name plate in place at instrument panel and tighten nut on threaded portion of control at under side of instrument panel.

(*b*) Insert lower end of choke control through clip at choke control clip bracket (Z). Thread control wire through hole in choke lever swivel (Y). Locate control housing to permit choke lever (BB) to move to closed position, then tighten housing clip bolt. With choke lever in open position, tighten screw to lock wire at choke lever swivel. Check operation of control.

c. HAND THROTTLE. Wire and housing type control permits manual operation of carburetor throttle. Use of hand throttle is described in paragraph 19.

(1) *Removal.*

(*a*) Remove throttle wire collar (M) at accelerator lever (K) in engine compartment. Remove control housing from two clips—one at front of cab in engine compartment and one at dash panel inside cab.

(*b*) Remove nut from threaded part of control assembly at upper end of throttle control, then pull control assembly out through dash and instrument panel, stripping off nut and lock washer as control is removed. Remove name plate from control.

(2) *Installation.*

(*a*) Insert hand throttle control assembly through name plate and through hole in instrument panel, and assemble lock washer and nut on control. Push end of control through rubber grommet in dash panel and thread end of control wire through hole in accelerator lever (K).

(*b*) Install lock washer and nut on threaded portion of control at under side of instrument panel, locate throttle name plate, and tighten control retaining nut. Install throttle wire collar (M) on control wire, then clip control housing to cab in engine compartment and at dash panel inside cab. Check control operation.

d. ACCELERATOR PEDAL AND LINKAGE. Accelerator pedal (F) in cab is connected to accelerator lever (K) in engine compartment by accelerator rod (E). Accelerator lever-to-pick-up lever rod (N) transmits movement from accelerator lever (K) to pick-up lever (EE), held in contact with idler shaft outer lever (T) by wind-up type spring. Outer lever (T) is clamped to idler shaft (Q). Idler shaft inner lever (DD), clamped to inner end of idler shaft, is connected to carburetor throttle shaft lever (U) by inner idler lever-to-carburetor rod (CC). The accelerator pull-back-spring (J) and throttle lever return spring (S) serve to return accelerator pedal (F) and linkage to idle position when foot pressure is removed from pedal.

(1) *Removal.* Instructions are given for removing accelerator pedal and linkage progressively beginning at accelerator pedal. Parts may be replaced individually if so desired.

(*a*) Remove cotter pin and remove pin which holds accelerator rod (E) to accelerator pedal (F). Remove accelerator pedal pin (G), and remove pedal.

(*b*) Remove cotter pin and flat washer attaching accelerator rod (E) to accelerator lever (K), then remove rod and accelerator rod seal (D).

(*c*) Remove clevis pin attaching accelerator-lever-to-pick-up-lever rod (N) to accelerator lever (K). Unhook and remove spring (J). Remove throttle wire collar (M) from hand throttle wire. Remove accelerator lever shaft and remove lever (K) from accelerator lever shaft bracket (GG). Remove bolts which mount bracket (GG) on toe board (H) and remove bracket and spring anchor from vehicle.

(*d*) Remove clevis pin from yoke on end of pick-up-lever-to-transmission-valve-lever-rod (FF) to detach rod from pick-up lever (EE). Unhook and remove throttle lever return spring (S). Remove cotter pin from each end of inner-idler-lever-to-carburetor rod (CC) and remove rod.

(e) Remove two stud nuts and washers attaching idler lever shaft bracket (P) to intake manifold (R). Remove idler shaft bracket with shaft and levers as an assembly.

(2) *Installation.*

(a) Place idler lever shaft bracket (P), with shaft and levers assembled, on studs at intake manifold (R). Install inner-idler-lever-to-carburetor rod (CC) using cotter pin at carburetor throttle shaft lever (U) and cotter pin at idler shaft inner lever (DD). Hook throttle lever return spring (S) to anchor at manifold stud and at hole in idler shaft inner lever.

(b) Attach accelerator lever-to-pick-up-lever rod (N) to pick-up lever (EE), using flat washer and cotter pin.

(c) Bolt accelerator lever shaft bracket (GG) to toe board (H), placing spring anchor on lower bolt. Assemble accelerator lever (K) to bracket (GG) with accelerator lever shaft (L) retained by cotter pin. Connect rod (N) to lever (K) with clevis pin and hook accelerator pull-back spring (J) to lever and anchor. Insert hand throttle control wire through hole in lever and install throttle wire collar (M).

(d) Place accelerator rod seal (D) at retainer on toe board (H), insert accelerator rod (E) through seal, and connect lower end to accelerator lever (K) using flat washer and cotter pin.

(e) Install pedal pin to attach accelerator pedal (F) to bracket. Install clevis pin to connect accelerator rod (E) to pedal. Connect and adjust pick-up-lever-to-transmission-valve-lever rod (FF) (par. 178).

114. Governor

a. GENERAL. Governor for limiting engine maximum speed consists of two units connected by a vacuum line. A diaphragm unit is incorporated into carburetor assembly and is interconnected with carburetor throttle valve shaft. Other unit consists of a centrifugal type valve which is part of ignition distributor assembly (fig. 58).

b. GOVERNOR SEALS. Governor units are adjusted and sealed and seals must be removed only by personnel authorized and equipped to make repairs and adjustments at governor units.

Caution: Value adjustment at distributor and governor spring calibration at carburetor are set when these assemblies are assembled and these settings must not be changed, as automatic shifting of transmission will be affected. A seal is installed at each connection in vacuum line.

c. GOVERNOR OPERATION (fig. 58). Air bleed line (N) is installed between distributor and carburetor body, and vacuum line (B) connects passages in diaphragm unit at carburetor with passages at distributor which lead to centrifugal valve assembly (Q). During normal low speed operation a limited amount of air circulates through air bleed line (N) to distributor, through passage to valve chamber, through valve orifice, and returns to carburetor through vacuum line (B) entering carburetor throat through passages near throttle plate (K). When engine speed has increased to point at which orfice in centrifugal valve is re-

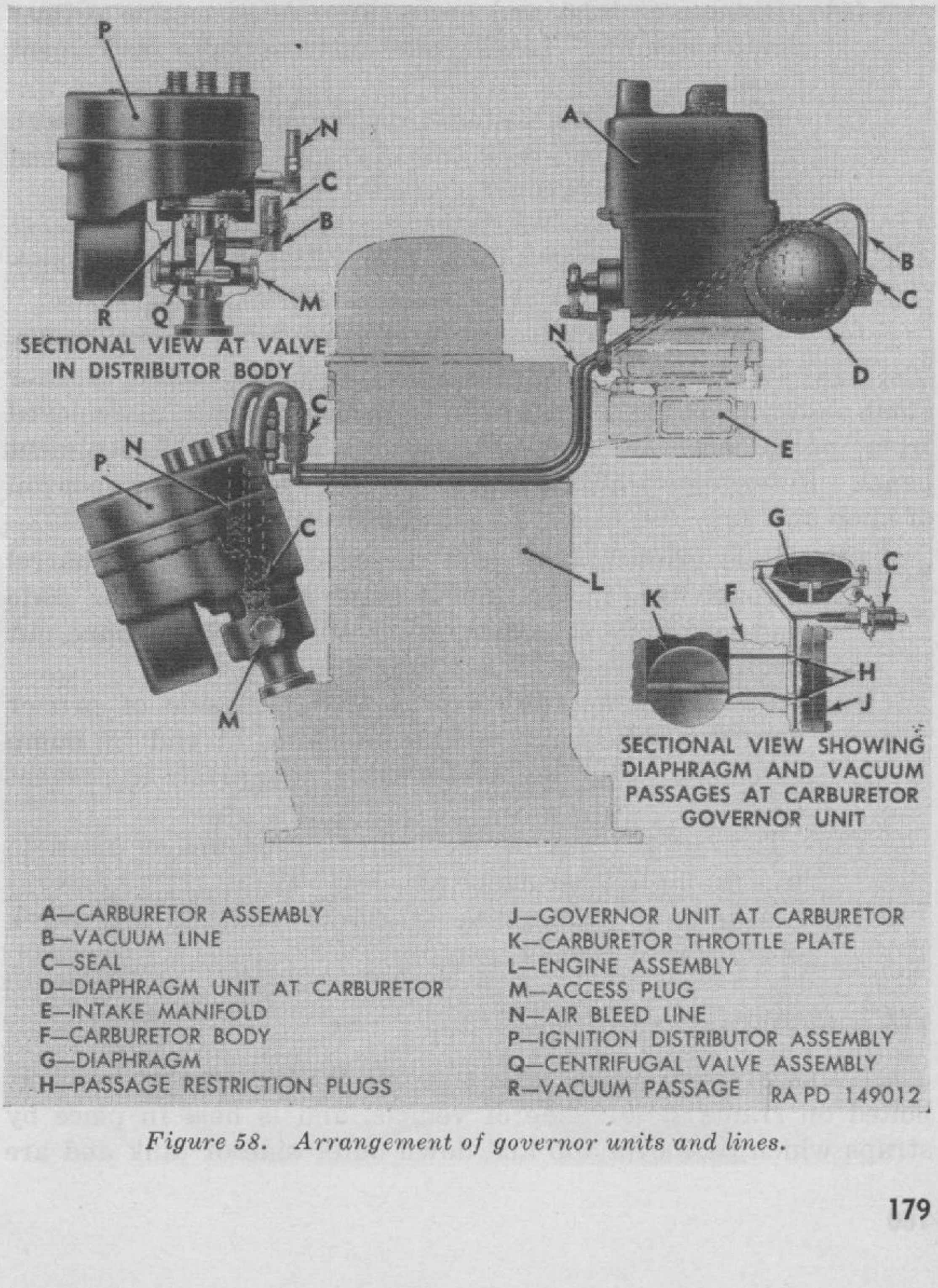


Figure 58. Arrangement of governor units and lines.

stricted, vacuum in passages (R) through diaphragm unit (D) begins to act on diaphragm (G). Movement of diaphragm begins to close throttle plate (K); hence driver cannot accelerate engine above speed at which governor mechanism overrules manual throttle control. Connection between carburetor throttle valve shaft and diaphragm unit is so designed as to allow diaphragm movement to overrule manual control linkage.

115. Primer Pump

a. REMOVAL. Primer pump is installed at instrument panel and layout of lines from fuel tank and to engine manifold is shown in figure 55.

(1) Disconnect inlet and outlet lines from engine primer pump assembly. Line connections are under instrument panel.

(2) Hold pump plunger stem from turning by using wrench on flattened portion of stem at knob. Grip knob and turn counterclockwise to remove it from stem.

(3) Use wrench to loosen hex nut at back side of instrument panel; then, while holding pump barrel with one hand, remove round nut and name plate from pump.

(4) Remove pump assembly from under instrument panel.

b. INSTALLATION. When installing new or rebuilt primer pump assembly, the knob and round mounting nut must be removed from pump before pump can be assembled to instrument panel. Refer to pertinent instructions under *a* above for removal of knob and nut.

(1) Hold primer pump with threaded end of pump barrel through hole in instrument panel and place name plate and round mounting nut on threads. Tighten round nut firmly.

(2) Connect pump inlet line at fitting on side of primer pump. Connect outlet line to fitting at end of pump assembly. Tighten line-to-fitting nuts firmly to prevent leaks.

(3) Tighten hex nut at back side of instrument panel to lock pump to instrument panel.

(4) Disconnect primer line at intake manifold and check operation of primer pump.

116. Fuel Tank and Lines

a. DESCRIPTION. Fuel tank (fig. 59) is supported by brackets bolted on frame at left side of vehicle, and is held in place by straps which pass over top and down outer side of tank and are

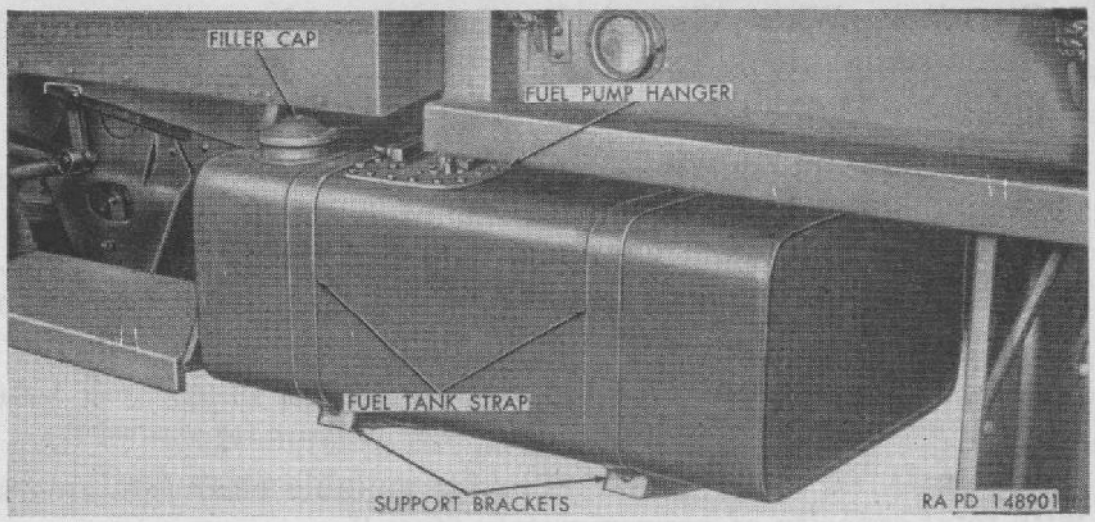


Figure 59. Fuel tank installed.

anchored to support brackets. Fuel tank is equipped with filler cap and drain plug and is vented to atmosphere through chassis unit vent system (par. 120). Fuel gage sending unit (par. 155) and fuel pump assembly (par. 117) are installed in fuel tank. Fuel lines to supply fuel to carburetor and to engine primer pump are arranged as shown in figure 55.

b. FILLING FUEL TANK (fig. 60). Fuel tank filler cap assembly incorporates a relief valve which opens at pressure of 2½ psi. Filler cap is attached to tank by chain to prevent loss of cap. Wire mesh strainer located at lower end of metal filler tube prevents large dirt particles from entering fuel tank.

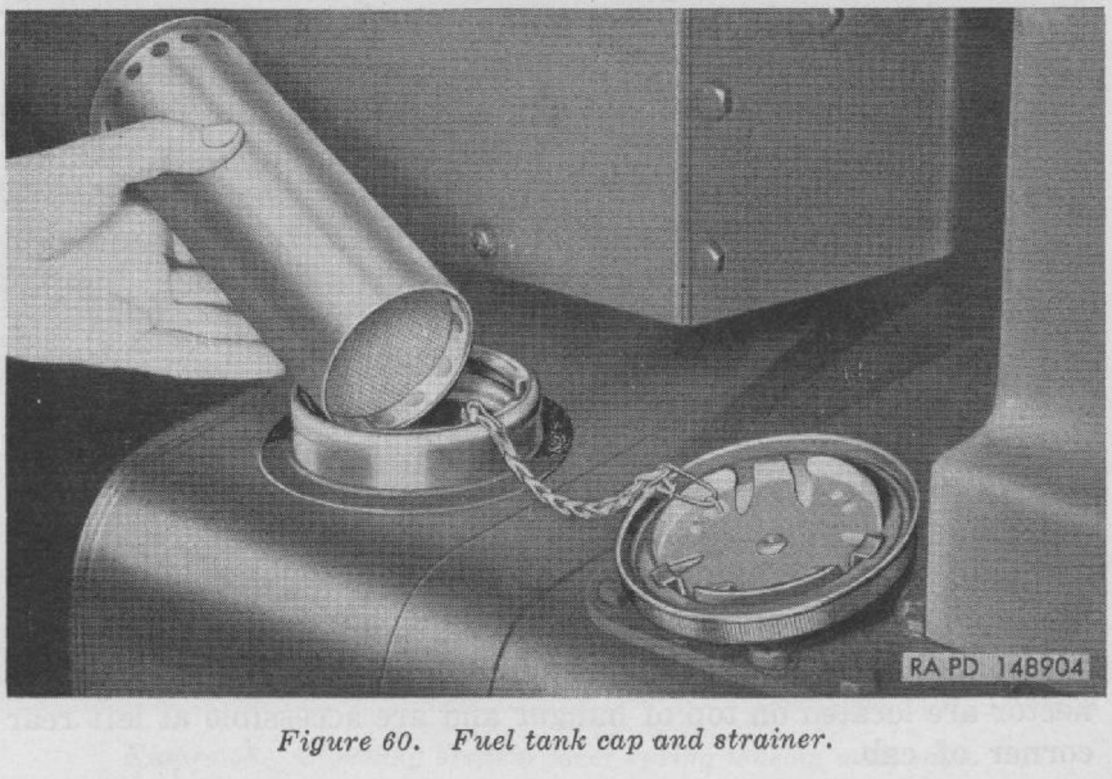


Figure 60. Fuel tank cap and strainer.

Warning: When filling fuel tank, be sure pump hose nozzle or container is clean, and that dispenser contacts filler neck to carry off static electricity.

(1) Wipe filler cap and surrounding area with clean cloth before removing filler cap.

(2) Fill fuel tank with fuel having correct octane rating. Refer to vehicle identification plate (fig. 5) attached to instrument panel.

Note. Do not overfill fuel tank. Fuel level should be at least two inches below tank filler neck to provide space for expansion.

c. DRAINING FUEL TANK. Provide suitable clean containers with total capacity of approximately 60 gallons.

(1) Place container under drain opening in bottom of fuel tank and remove drain plug.

(2) After fuel tank is drained, install drain plug with new drain plug gasket.

Caution: Electric fuel pump in fuel tank operates whenever ignition switch is turned on. Do not operate fuel pump for prolonged periods with fuel tank empty as damage to fuel pump may result.

d. LINES AND CONNECTIONS.

(1) *Description.* Fuel lines and connections are shown in figure 55. Lines of special metal having inverted flared type fittings are used for making line connections. Lines are securely clipped in position to prevent vibration and resultant chafing. A flexible line assembly is used between carburetor and fitting at frame side rail.

(2) *Replacement.* Use lines of same size and material as original lines when making replacements. Install new lines in same position as that occupied by lines they are replacing and clips must be installed as required. When replacing elbows and tee connections, coat threads with liquid type gasket cement before installation.

117. Fuel Pump

a. DESCRIPTION. Electric fuel pump is motor driven, centrifugal type, mounted inside and at bottom of fuel tank. Pump and attaching parts are installed inside metal hanger assembly which is equipped with two filter plates through which fuel must pass before reaching pump. Hanger and pump assembly is attached to tank by 18 cap screws which hold hanger flange to top of fuel tank. Fuel outlet line connection and electrical connector are located on top of hanger and are accessible at left rear corner of cab.

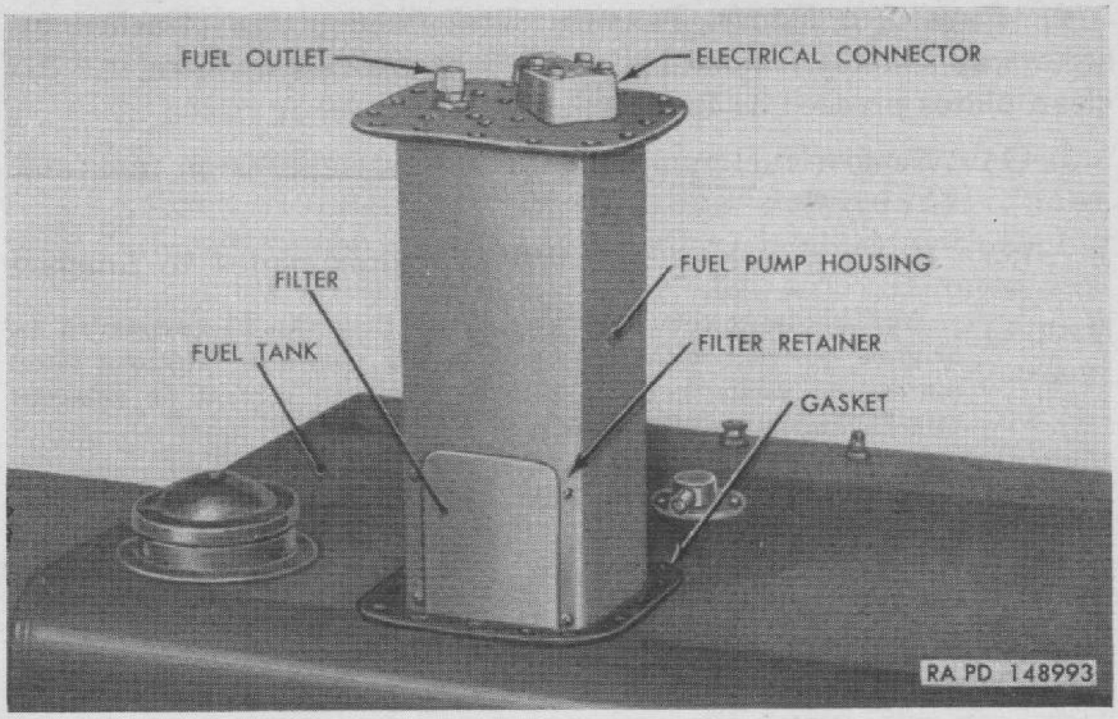


Figure 61. Removing fuel pump assembly.

b. REMOVAL (fig. 61).

Caution: Before performing any other fuel pump removal operations, disconnect cable from electrical connector and wrap with insulating tape to prevent possibility of electrical spark igniting fumes in fuel tank.

(1) Be sure ignition switch is turned off. Remove connector-to-hanger screw to which ground cable is attached. Disconnect electrical cable from connector and tape end of cable.

(2) Disconnect fuel line from fuel outlet fitting.

(3) Remove 18 hanger-to-fuel tank cap screws and lock washers. Note location of wiring harness clip, attached by one cap screw.

(4) Lift fuel pump hanger assembly out of fuel tank (fig. 61) and remove gasket.

c. INSTALLATION (fig. 61).

(1) Place new gasket at opening in fuel tank, then lower fuel pump and hanger assembly through opening in tank. Pilot in bottom of tank locates lower end of hanger.

(2) Install cap screws and lock washers which hold hanger to fuel tank. Place wiring harness clip on cap screw in original location (*b* (3) above).

(3) Connect fuel line to fuel outlet fitting on fuel pump hanger. Connect electrical cable at connector. Remove one connector-to-hanger screw and attach ground cable with same.

d. CLEANING FILTER PLATES. Two filter plates attached by screws and metal frame are installed on fuel pump hanger. To clean plates proceed as follows:

(1) Remove fuel pump and hanger assembly from fuel tank (*b* above).

(2) Remove screws which attach filter plates to hanger.

Note. Plates should be marked so they can be reinstalled in original position with same side facing outward. Remove filter plates and wash thoroughly in dry-cleaning solvent or volatile-mineral-spirits paint thinner.

(3) Install filter plates and retaining frames, tightening attaching screws firmly.

(4) Install fuel pump and hanger assembly in fuel tank (*c* above).

e. TESTING. Test fuel pump pressure with pump installed in tank and with tank at least one-quarter full of fuel. Pressure gage, line, and adapter for connecting gage to fuel outlet fitting at fuel tank are required to perform test.

(1) With ignition switch turned off, disconnect fuel line from fuel outlet fitting at tank. Connect pressure gage to fitting.

(2) Turn ignition switch on and observe reading on gage. For satisfactory operation, pressure should be $3\frac{1}{4}$ to 5 pounds.

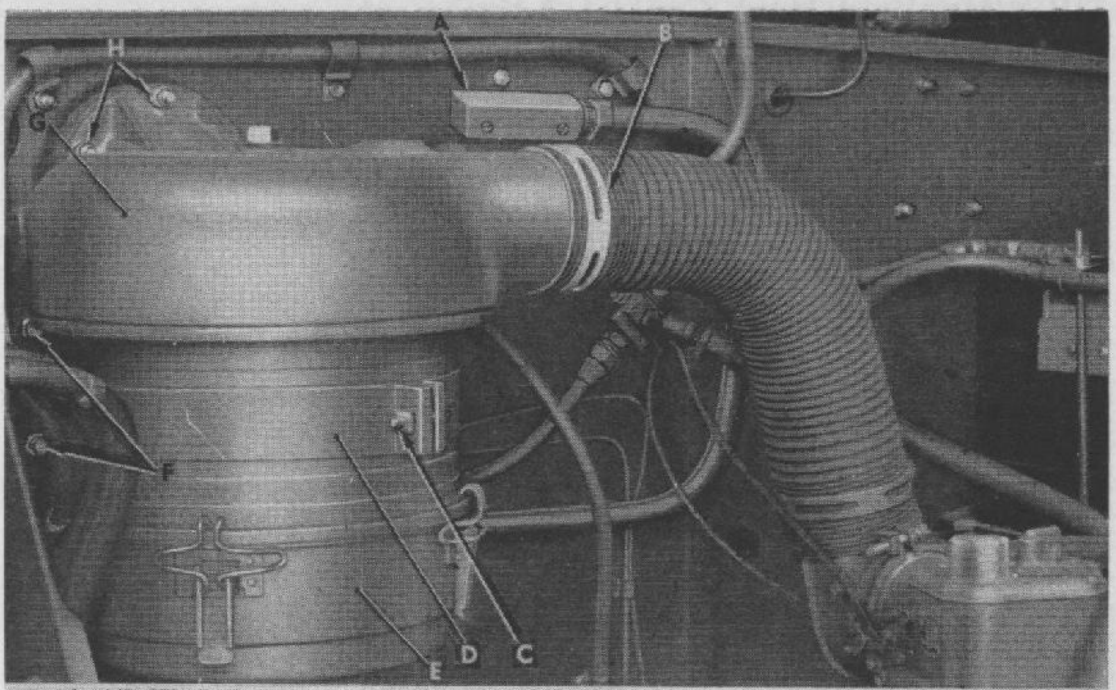
Note. If fuel pump pressure is low, check condition of batteries (par. 141*b*) and be sure electrical connections in fuel pump circuit are clean and tight.

(3) Low pressure may be caused by clogged filter plates at fuel pump housing. Refer to *d* above for instructions for cleaning filter plates.

118. Air Cleaner

a. DESCRIPTION. Carburetor air cleaner is oil bath type (fig. 62). Mounting strap (D) is clamped around air cleaner assembly to hold the assembly to bracket on front side of dash panel. Air cleaner outer shell is bolted to air cleaner manifold (G) which is bolted to dash panel. Oil reservoir (E) is held to bottom of air cleaner by four clamps. Flexible hose connects air cleaner manifold to carburetor inlet elbow.

b. SERVICING. Service carburetor air cleaner in accordance with instructions given in paragraph 59*e*.



A—AIR STRAINER
B—AIR CLEANER TO CARBURETOR HOSE CLAMP
C—CLAMP BOLT
D—MOUNTING STRAP
E—OIL RESERVOIR
F—AIR CLEANER BRACKET BOLTS
G—AIR CLEANER MANIFOLD
H—MANIFOLD TO DASH PANEL BOLTS

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Figure 62. Air cleaner installed.

c. REMOVAL (fig. 62).

(1) Loosen hose air cleaner-to-carburetor clamp (B) and pull hose off manifold outlet.

(2) Remove five nuts and lock washers from manifold-to-dash panel bolts (H). Support air cleaner assembly while removing clamp bolt (C); then remove assembly from engine compartment. Remove gasket from bolts at dash panel. Strap and bracket may be removed after four air cleaner bracket bolts (F) have been removed.

d. INSTALLATION (fig. 62).

(1) Mount bracket and strap on dash panel with four air cleaner bracket bolts (F), nuts, and lock washers.

(2) Set air cleaner assembly in place at mounting bracket with gasket between manifold and dash panel. Install five manifold-to-dash panel bolts (H) and lock washers which hold manifold at front side of dash panel.

(3) Install and tighten clamp bolt (C) at mounting strap (D).

(4) Attach hose to manifold outlet and tighten air cleaner-to-carburetor hose clamp (B).

(5) Check oil level in reservoir (par. 59*e*).

119. Manifold Heat Control Adjustment

a. PURPOSE. Adjustable valve in exhaust manifold is provided to control temperature at intake manifold center section where incoming fuel mixture is preheated. There are three positions for heat control lever (fig. 63). Correct setting is important to efficient engine operation and fuel economy.

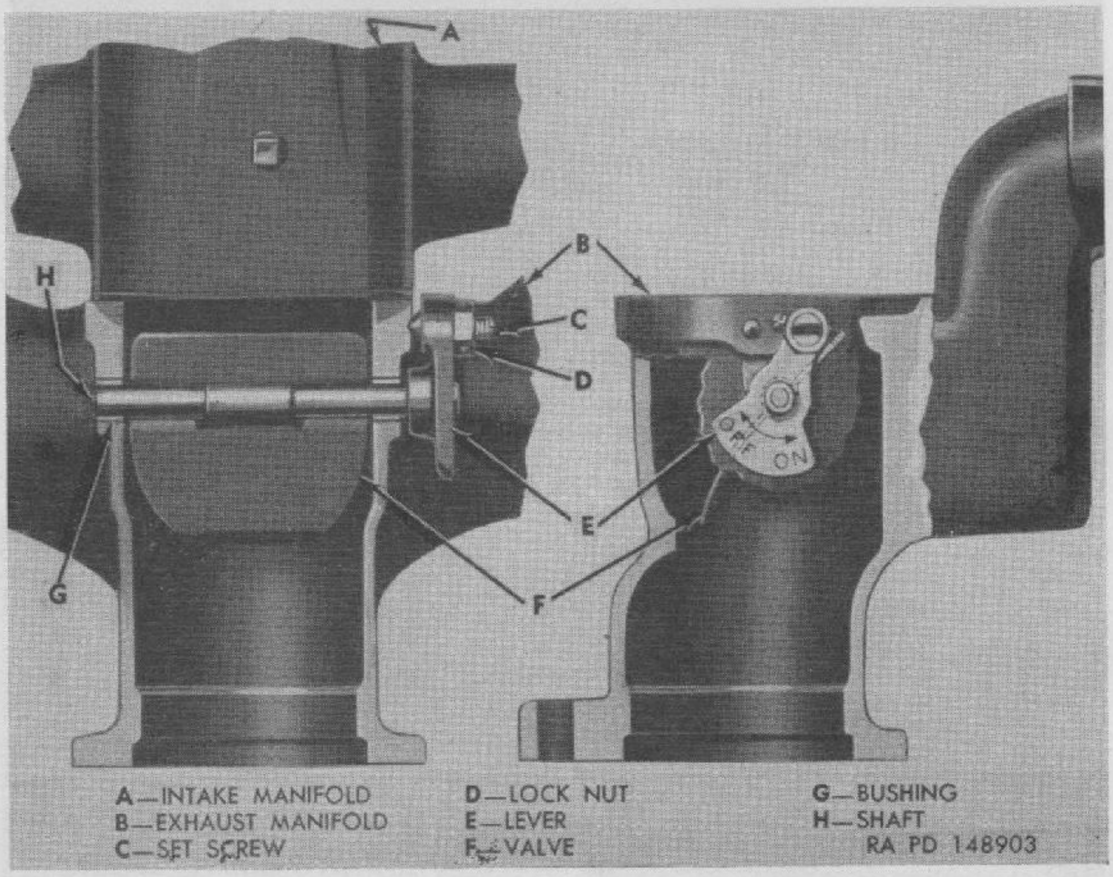


Figure 63. Manifold heat control.

b. ADJUSTMENT. The adjustment of manifold heat control valve must be made manually. Two extreme positions are indicated by arrows on lever as "ON" and "OFF" Intermediate setting is obtained by locating lever at detent in casting half way between extreme positions. Set screw and lock nut in lever; hold lever in desired position. Tighten set screw only enough to prevent rattling; overtightening may distort valve lever or shaft. Tighten lock nut firmly after adjustment is completed.

Note. It is not expected that control valve setting will be changed each time conditions vary. Valve should be set for average operating conditions consistent with air temperature.

(1) *Summer operation.* At air temperature of 60° F or above, adjust valve lever to "OFF" position.

(2) *Winter operation.* At air temperature of 30° F and below, adjust valve to "ON" position.

(3) *Spring and fall operation.* At air temperatures of 30° to 60° F and also at lower temperatures when in heavy duty operation (heavy loads, high speeds, and extensive operation in lower gear range), adjust valve lever to intermediate position.

Note. Intermediate position should be used whenever "OFF" position does not furnish sufficient heat or if "ON" position supplies too much heat, depending on type of operation or weather conditions.

120. Unit Vent and Breather Lines and Connections

a. DESCRIPTION. All vehicles are equipped with system of lines for venting various chassis units to atmosphere. Small lines connected to individual chassis units lead to larger line which is mounted at frame right side rail. Another large vent line assembly is installed in engine compartment on cab dash panel, and is connected by flexible line to large vent line on frame. Vent line on dash panel opens into separate air strainer located near top center of dash panel. Following is a list of units which are connected to vent system: rear rear axle, forward rear axle, brake power cylinder, transfer, fuel tank, transmission, front axle, and brake master cylinder. In addition to units mentioned above, engine flywheel housing and crankcase breather are connected to vent line on dash panel by flexible line attached to tee fitting near number six spark plug and nipple on vent line at dash panel.

b. LINES AND CONNECTIONS.

(1) *Axle vent lines.* Hydraulic fluid lines and vent lines are attached to each axle assembly at a junction with threaded openings for attaching lines. A short line is installed between junction and fitting in axle housing. Flexible lines supported at axle upper torque rods are used to connect axle vent lines to fitting at frame.

(2) *Air power cylinder vent line.* Vent line connects vent fitting on air power cylinder to vent line junction at frame right side rail.

(3) *Fuel tank and transfer vent line.* Vent line extends from top of fuel tank to fitting at frame. From frame fitting, line crosses transfer support cross member to converge with transfer vent line at tee fitting above right side of transfer. Single line is used between tee fitting and vent line junction at right side rail.

(4) *Brake master cylinder vent line.* Line from master cylinder extends forward along frame left side rail

to point below front of cab. Flexible line connects master cylinder vent line to vent line at front of dash panel.

(5) *Transmission vent line.* Short flexible line connects vent fitting at right side of transmission with junction at large line on frame right side rail.

(6) *Flywheel housing and crankcase vent.* Only opening to atmosphere in engine crankcase is through breather pipe which has common connection with oil filler pipe. For normal operation, crankcase breather (on top of breather pipe) has two openings. One large opening admits air from engine compartment for crankcase ventilation. A second opening in breather is connected by line extending to tee fitting near number six spark plug. Flexible line between tee fitting and vent line on dash panel serves to vent flywheel housing and crankcase breather.

c. VENT LINE AND CONNECTION REPLACEMENT. Use lines and fittings of same type and material for replacement. Always reinstall line clips at points where clips were originally provided. Fittings and connections having regular pipe threads should be coated with liquid type gasket cement when assembling.

d. SERVICING VENT LINE AIR STRAINER. Vent line air strainer (*a* above) is equipped with removable element which must be cleaned periodically.

(1) Remove strainer assembly from vent line.

(2) Remove element from strainer and wash all parts thoroughly in dry-cleaning solvent or volatile-mineral-spirits paint thinner to remove all dirt.

(3) Allow cleaning fluid to drain out of element; then dip element in light engine oil and allow excess oil to drain off.

(4) Reassemble strainer and install on vent line.

Section IX. EXHAUST SYSTEM

121. Description

a. EXHAUST PIPES. The front exhaust pipe is flange mounted to engine exhaust manifold (fig. 65) and secured to rear exhaust pipe with a clamp and seal. Rear exhaust pipe is supported to cross member with support strap and exhaust pipe clamp. Rear exhaust pipe is attached to muffler with clamp and seal (fig.

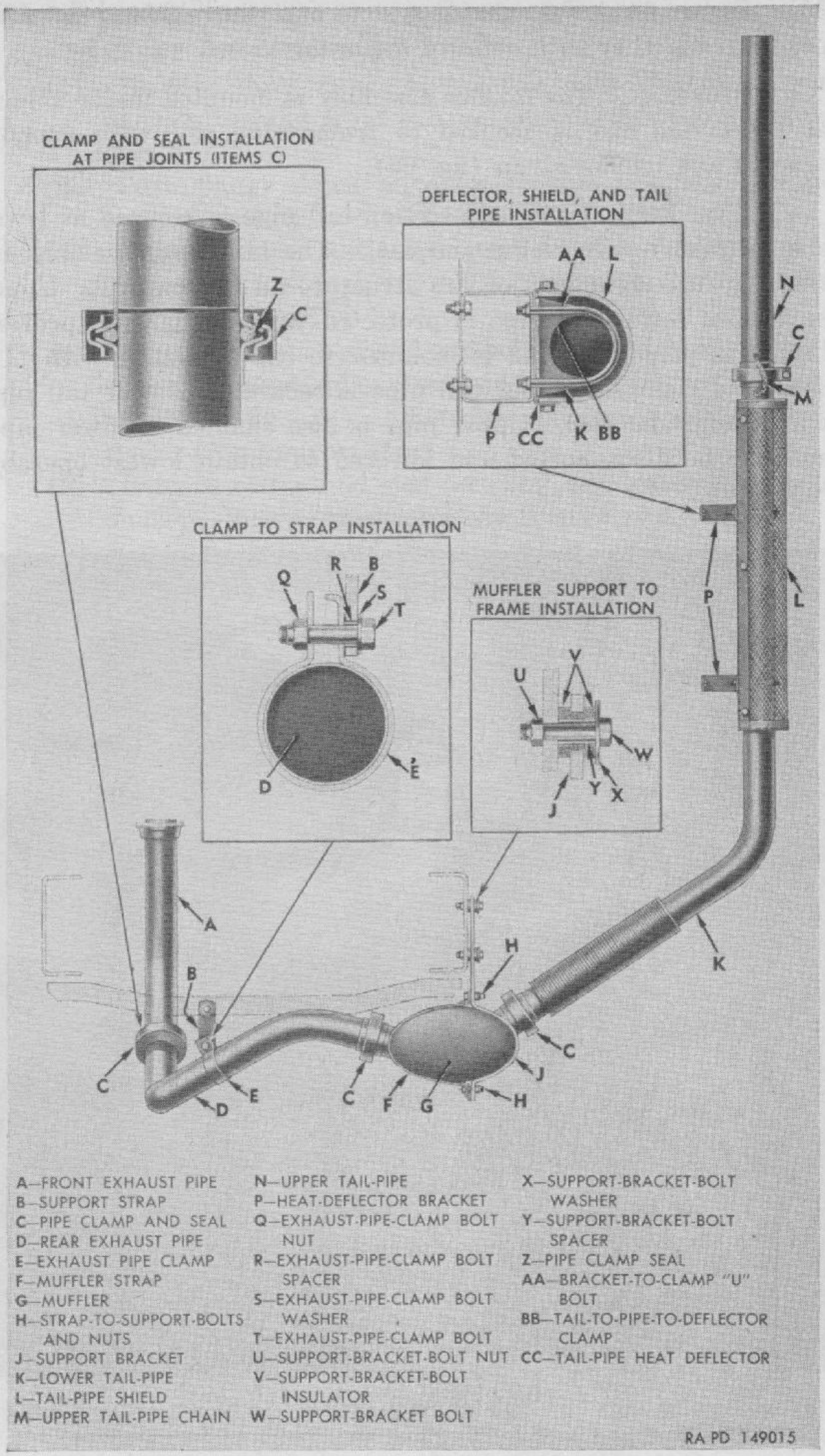
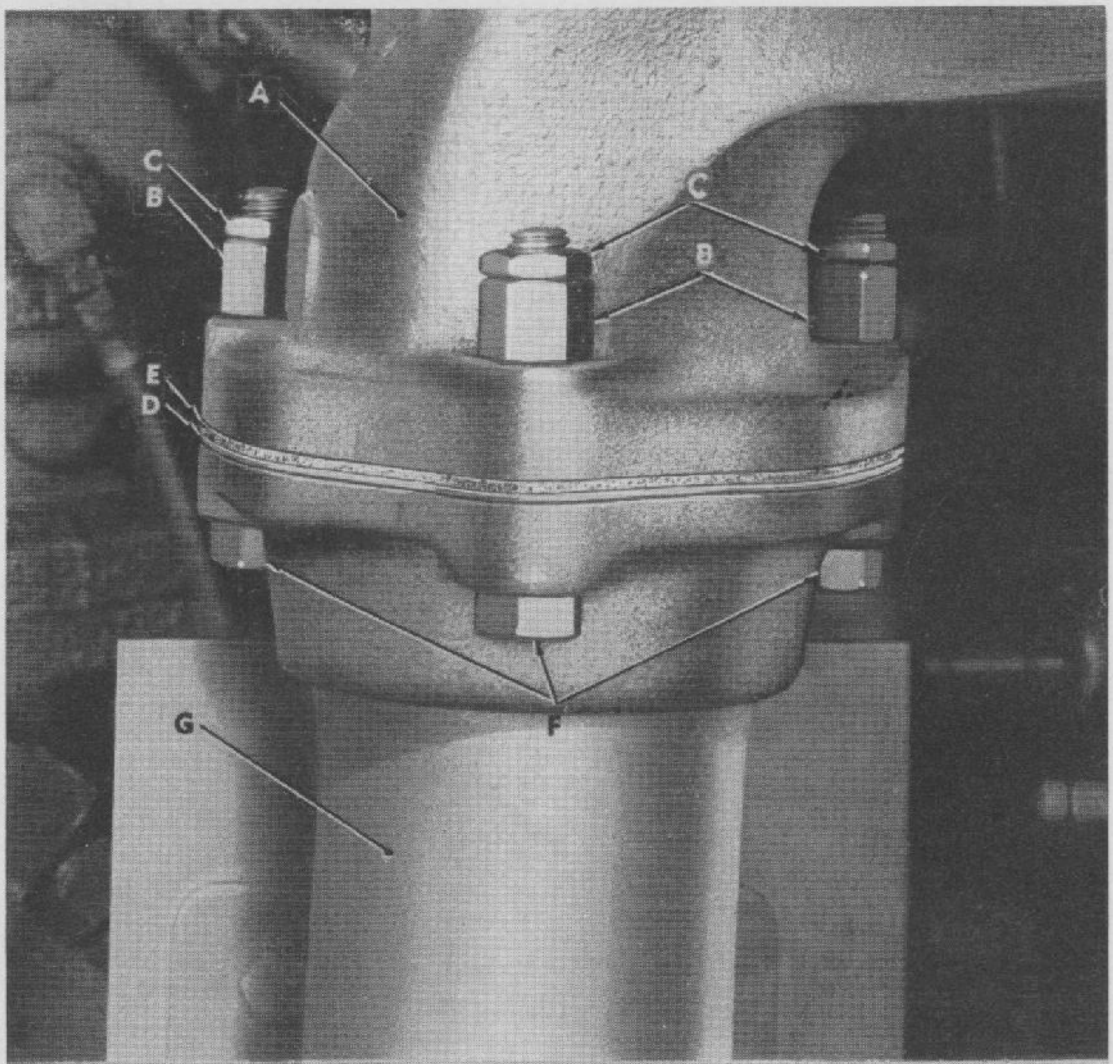


Figure 64. General arrangement of exhaust system units.

66). Figure 64 shows exhaust system parts in relative assembled positions together with detailed mounting views.

b. MUFFLER. The muffler assembly is mounted under vehicle at right side and is secured to frame side rail with support bracket and muffler strap (fig. 66).

c. TAIL PIPES. The two-section tail pipe is secured at lower end to muffler with clamp and seal. The tail pipe assembly extends up the right side of cab structure on the outside. Upper portion of lower tail pipe is protected with a guard to prevent injury to personnel, and is mounted to cab structure with "U" bolts and clamps. Upper tail pipe is secured to lower tail pipe with clamp and seal. Upper pipe is also chained to lower pipe, and can be disconnected and lowered to obtain lowest operable cab height.



A—EXHAUST MANIFOLD
B—FLANGE BOLT NUTS
C—LOCK NUTS
D—FLANGE SEAL
E—FLANGE GASKET
F—FLANGE BOLTS
G—FRONT EXHAUST PIPE
RA PD 148968

Figure 65. Exhaust pipe to manifold connection.

122. Exhaust Pipes

a. EXHAUST PIPE REMOVAL.

(1) Remove three flange bolts, nuts, and lock nuts from flange attaching front exhaust pipe to exhaust manifold (fig. 65).

(2) Push flange down on exhaust pipe. Remove flange seal and gasket.

(3) Remove clamp and seal attaching front exhaust pipe to rear exhaust pipe (fig. 64). Front exhaust pipe can then be removed.

(4) Remove exhaust-pipe-clamp bolt, nut, and washer which attach exhaust pipe clamp to support strap at cross member (fig. 64). Remove exhaust-pipe-clamp-bolt spacer from support strap.

(5) Remove clamp and seal securing rear exhaust pipe to muffler. Rear exhaust pipe can then be removed.

b. EXHAUST PIPE INSTALLATION.

(1) Attach rear exhaust pipe to muffler with pipe clamp and seal using new seal if old seal is damaged to such an extent that leaks may occur. Position seal as shown in figure 64 (item C). Tighten clamp bolt just sufficiently to prevent leakage.

(2) Place washer and spacer on exhaust pipe clamp bolt in the order named (fig. 64). Line up exhaust pipe clamp holes with hole in support strap, insert bolt, and install nut. Do not tighten nut at this time.

Note. Exhaust pipe clamp does not come as part of the exhaust pipe assembly. Place clamp in position on pipe before performing (1) above.

(3) Attach front exhaust pipe to rear exhaust pipe with clamp and seal in same manner as explained in (1) above.

(4) At exhaust manifold (fig. 65), install flange seal and new flange gasket. Lift exhaust pipe flange against manifold and install three flange bolts and nuts. Tighten nuts evenly and firmly. Install and tighten lock nuts. At cross member, position exhaust pipe clamp on support strap so that no bind exists; then tighten clamp bolt nut firmly.

123. Muffler

a. MUFFLER REMOVAL (fig. 66).

(1) Loosen exhaust pipe clamp bolt nut at the support strap.

(2) Remove pipe clamps and seals which attach rear exhaust pipe and lower tail pipe to muffler. Pull pipes clear of muffler.

(3) Remove two upper and two lower bolts and nuts which attach muffler strap to support bracket. Muffler assembly can then be removed.

b. MUFFLER INSTALLATION (fig. 66).

(1) Position muffler into place in support bracket. Install muffler strap around muffler and attach strap to support bracket with two upper and two lower bolts and nuts. Tighten the two upper bolts and nuts firmly. Tighten the lower two bolts and nuts just enough to support muffler until exhaust pipe and tail pipe can be connected.

(2) Install rear exhaust pipe to muffler with pipe clamp and seal, using new seal if old one is damaged to such an extent that leaks may occur. Install lower tail pipe to muffler with clamp and seal. Tighten clamp bolt nuts sufficiently to prevent leakage. Tighten bolt and nut which secures exhaust pipe clamp to support strap on cross member.

(3) Tighten lower bolts and nuts in muffler strap to hold muffler firmly in place in the support bracket.

124. Tail Pipes

a. TAIL PIPE REMOVAL (fig. 64).

(1) The two-section tail pipe, together with the heat deflector and shield, can be removed from cab and muffler

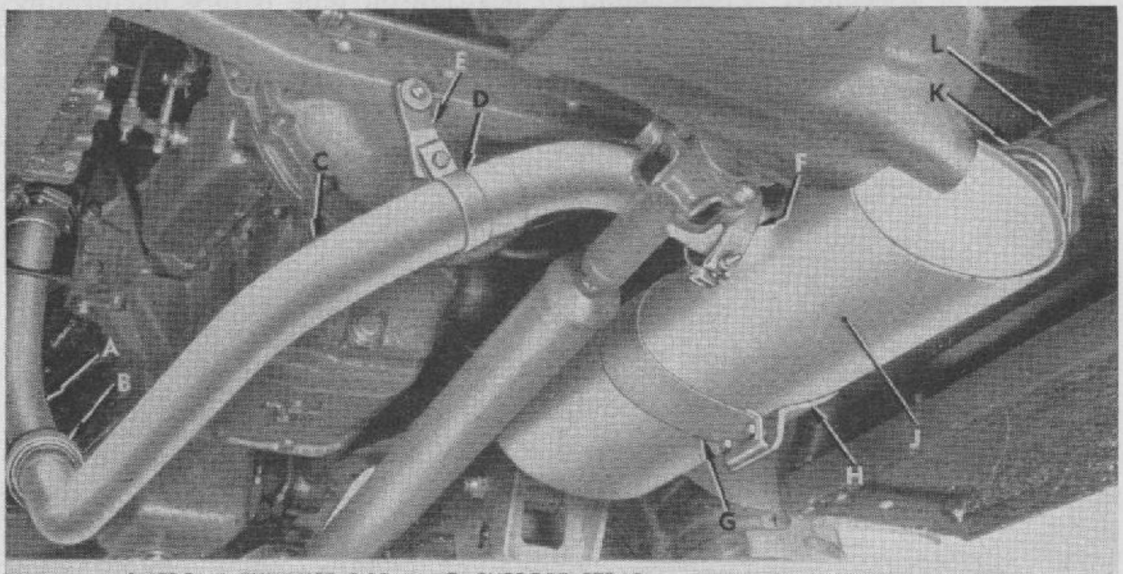


Figure 66. Exhaust pipe and muffler installed.

as an assembly. The assembly can then be disassembled into component parts.

(2) Remove clamp and seal attaching lower tail pipe to muffler.

(3) Remove four bolts and nuts which attach heat deflector brackets to cab structure. Tail pipe assembly can then be removed from vehicle.

(4) Remove six cap screws and washers which attach tail pipe shield to heat deflector. Shield can then be removed.

(5) Remove nuts from "U" bolts which attach lower tail pipe to heat deflector.

(6) Remove clamp and seal which connect upper tail pipe to lower tail pipe. Spread open retaining link at each end of upper tail pipe chain on upper and lower tail pipes if necessary to separate the two sections.

b. TAIL PIPE INSTALLATION (fig. 64).

(1) Position heat deflector on lower tail pipe. Install two "U" bolts and clamps around tail pipe. Insert the threaded ends of "U" bolts through heat deflector; then install two heat deflector brackets. Tighten "U" bolt nuts just finger-tight.

(2) Connect upper tail pipe to lower tail pipe with pipe clamp and seal, using new seal if old one is damaged to such an extent that leaks may occur. Tighten clamp bolt nut sufficiently to prevent leakage.

(3) Connect flexible end of lower tail pipe to muffler with pipe clamp and seal, using a new seal if necessary.

(4) Position tail pipe assembly on cab structure, and install four bracket-to-cab bolts and nuts. Tighten nuts firmly; then tighten clamp "U" bolts firmly.

(5) Install the shield on heat deflector with three cap screws and lock washers on each side. Tighten cap screws firmly.

Section X. COOLING SYSTEM

125. Description and Data

a. DESCRIPTION. The cooling system is the sealed pressure type and consists of the following units: water pump, fan, drive belt, radiator, thermostat, pressure valve, and water hose, lines, and fittings connecting radiator, water pump, cylinder block, air compressor, and transmission cooler. These units, when properly maintained, automatically control temperature of cooling liquid.

Water pump draws liquid from the bottom of the radiator by action of the water pump impeller and forces it through the engine water jackets and passages and through the upper connection to the radiator. Liquid is cooled, as it passes downward through radiator core, by action of fan drawing air through radiator. A pressure valve in radiator top tank maintains a pressure of approximately 6½ pounds in the cooling system when the engine is at operating temperature.

b. DATA.

Cooling system capacity (qt)	22
Radiator:	
Type	fin and tube
Thickness	2⅞ in
Frontal area (sq. in.)	526
Pressure valve:	
Opening range	6¼ to 7½ lb
Thermostat:	
Starts to open	160° F.
Fully open	175° F.
Fan Blades:	
Diameter (in)	18½
No. of blades	5
Drive	Belt in conjunction with water pump and generator
Drive belt:	
Quantity	1
Type	V

126. Filling and Draining System

a. FILLING SYSTEM (fig. 67).

Caution: Be sure that drain plug at bottom of transmission is installed and that drain cocks at the left rear of cylinder block and at bottom of radiator are closed. Open level cock at top front of radiator. Remove threaded filler cap from filler neck and fill system until water is visible in filler neck. Close level cock and continue to add water until no more air bubbles can be seen. Run engine a few minutes to further expel air, then add more water to bring level up to level cock.

Caution: Do not pour water into cooling system when engine is above 200° F. Also, cold water poured into the cooling system regardless of engine temperature, will close the thermostat and not allow the engine water passages to completely fill. Whenever filling system with cold water, always run engine until normal operating temperature is reached (thermostat opens), then add water until level with level cock.

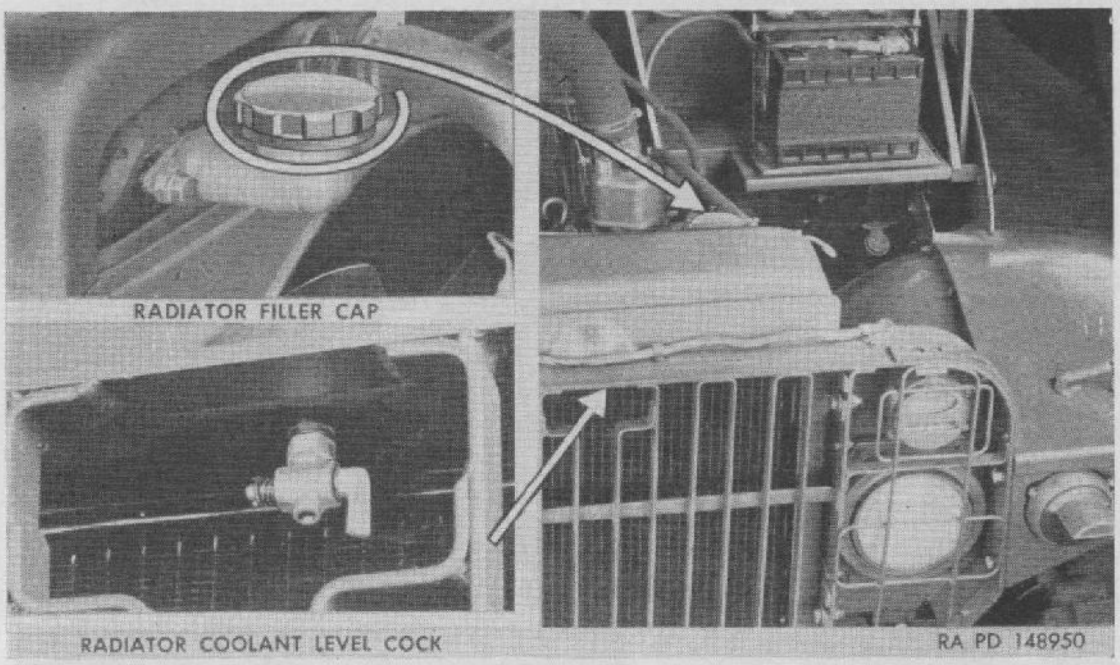


Figure 67. Radiator filler cap and level cock.

b. DRAINING SYSTEM. Run engine at fast idle until normal engine operating temperature is reached (thermostat opens) to stir up any loose rust, scale, etc. Open level cock to relieve system pressure. Remove plug at bottom of transmission, marked "WATER," also open drain cocks at left rear side of cylinder block and at bottom front of radiator core (figs. 68 and 69).

127. Testing System

a. GENERAL. Air circulating through the cooling system, as well as exhaust gas leakage into the system, causes rapid corrosion and rust formation which will eventually clog the system and cause overheating and loss of cooling liquid. The air may be drawn into the system due to low liquid level in the radiator, leaky water pump, or loose fittings and hose connections. Exhaust gas may be blown into the cooling system past the cylinder head gasket or through cracks in the cylinder head or block.

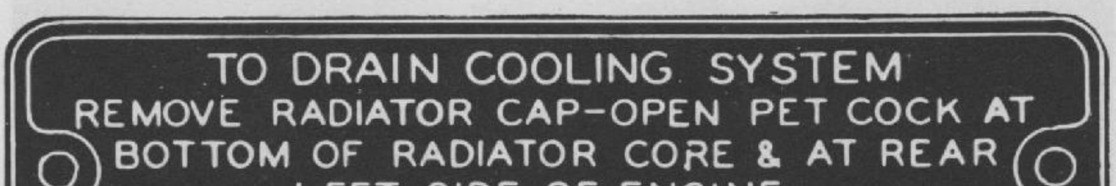


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Figure 68. Cooling system draining instruction plate.

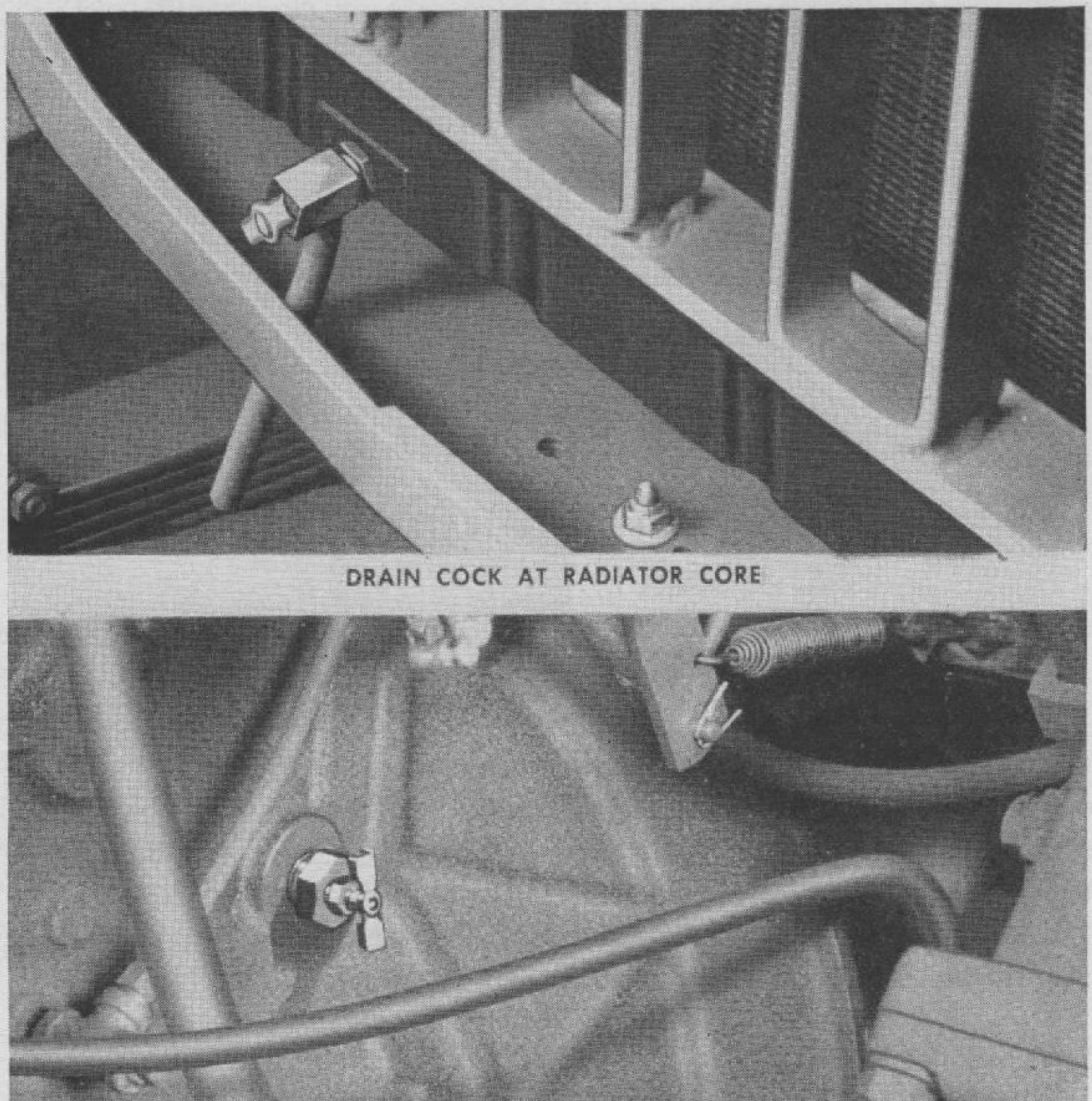


Figure 69. Cooling system draining points.

b. AIR SUCTION TEST. Adjust level of cooling liquid in radiator, allowing room for expansion so as to avoid any overflow loss during test. Remove pressure valve cap assembly (par. 130*d*) and temporarily install backwards (with valves outward). Attach a length of rubber hose to lower end of overflow tube (this connection must be airtight). Run engine, with transmission in neutral, until water temperature gage stops rising and remains stationary. Without changing engine speed, place end of rubber tube in a bottle of water, avoiding kinks and sharp bends that might restrict flow of air. Watch for bubbles in bottle of water. The continuous appearance of bubbles indicates that air is being sucked into the cooling system. Correct condition by tightening cylinder head bolts, water pump mounting bolts, hose clamps, and fitting connections. Also examine all hose carefully and if cracked, swollen, or deteriorated in any way, replace with a new part.

c. EXHAUST GAS LEAKAGE TEST. Start test with engine cold. Remove drive belt (par. 129*c*) to prevent operation of water pump. Drain cooling system until cooling liquid level is at top of thermostat housing. Remove thermostat (par. 131*b*). Make sure thermostat housing is full of liquid (add if necessary). Start engine and accelerate it several times. Watch for bubbles in water in thermostat housing while accelerating engine, also when engine speed drops back to normal. The appearance of bubbles or a sudden rise of cooling liquid indicates exhaust gas leakage into cooling system. Make test quickly before boiling starts as steam bubbles will give misleading results. If exhaust gas leakage is indicated by this test, replace cylinder head gasket (par. 97) and test again. If leaks are still evident, it indicates that cylinder head or block is cracked. Report to higher authority. Install thermostat (par. 131*d*). Install and adjust drive belt (par. 129*c*) and fill radiator with cooling liquid (par. 126*a*).

128. Cleaning and Flushing System

a. GENERAL. In order for cooling system to function properly, it is important that system be properly maintained. Water within radiator, cylinder block, cylinder head, and hose must flow freely without restrictions due to rust, scale, etc. Radiator must be clean externally to permit unrestricted air flow.

b. DRAIN SYSTEM. Drain cooling system (par. 126*b*).

c. CLEAN SYSTEM. Install drain plug at bottom of transmission; also close drain cocks at left rear side of cylinder block and at bottom front of radiator. Be sure temperature of engine is below 200° F. Pour cleaning compound, (one container to each 16 quarts of cooling system capacity) into radiator, then fill system with water. Install radiator filler cap. Start engine and run at a fast idle to heat solution to at least 180° F. Cover radiator if necessary, but do not allow to boil. Continue to run engine for at least 30 minutes. Stop engine and drain system (par. 126*b*).

d. NEUTRALIZE SYSTEM. Install drain plug at bottom of transmission; also close drain cocks at left rear side of cylinder block and at bottom front of radiator. Pour neutralizer (one container to each 16 quarts of cooling system capacity) into radiator; then fill system with water and install radiator filler cap. Start engine and run it at a fast idle to heat solution to at least 180° F. Continue to run engine for at least 10 minutes. Stop engine and drain system (par. 126*b*).

e. FLUSH SYSTEM.

Caution: Do not flush system by inserting a hose in the radiator with the engine running and drain cocks open. This procedure will close the thermostat and stop circulation of the water through the engine. Fill cooling system (par. 126*a*) with clean fresh water; then install radiator filler cap. Start engine and run at a fast idle to bring engine operating temperature up to at least 180° F. Continue to run engine for at least 5 minutes. Stop engine and drain system (par. 126*b*). If water is discolored to any extent, repeat the flushing operation.

f. RUST PREVENTIES. Use of inhibitors or rust preventives is recommended to retard corrosion of metals and prevent formation of scale. Inhibitors are not cleaners and do not remove rust or scale already formed. Treat the cooling system with inhibitor corrosion compound after cleaning, neutralizing, and flushing system.

g. CLEAN RADIATOR. Clean out dirt, insects, or other accumulated material imbedded in the air passages of the radiator core, using compressed air or a stream of water, but do not use steam.

Caution: Do not hold air or water hose too close to the radiator or use excessive pressure, as damage to the radiator may result. Clean any obstructions from overflow hose with a soft wire.

129. Fan and Belt

a. GENERAL. A five-bladed fan, mounted on water pump drive pulley hub, is driven by a "V" type belt from the crankshaft pulley in conjunction with water pump and generator.

b. FAN BELT ADJUSTMENT.

(1) Loosen adjusting arm to generator cap screw and, if necessary, loosen nuts on two generator mounting bolts (fig. 77).

(2) Move generator toward or away from engine as necessary to obtain correct belt tension. A light pressure on belt midway between generator and water pump pulleys must cause a deflection of one-half to three-fourths inch.

(3) When proper belt tension is obtained, tighten adjusting arm to generator cap screw; also tighten two generator mounting bolt nuts, if loosened.

c. FAN BELT REPLACEMENT.

(1) *Removal.*

(*a*) Remove air compressor drive belt (par. 229*b*).

(*b*) Loosen adjusting arm to generator cap screw and, if necessary, loosen nuts on two generator mounting bolts (fig. 77).

(*c*) Push generator toward engine until belt can be removed from generator, water pump, and crankshaft pulleys; then work belt over fan blades to complete removal.

(2) *Installation.*

(*a*) Thread belt over fan blades and onto crankshaft inner pulley. Locate belt in water pump and generator pulleys.

(*b*) Adjust belt tension as described in *b* above.

(*c*) Install and adjust air compressor drive belt (par. 229).

d. FAN REPLACEMENT.

(1) *Removal.* Remove six core and shroud attaching bolts holding fan shroud to radiator; loosen, but do not remove, four lifting bracket bolts (fig. 70), then move shroud away from radiator. Remove four cap screws and lock washers attaching fan blades to hub; then remove fan blade assembly.

(2) *Installation.* Position fan blades to fan hub and install four lock washers and cap screws. Tighten cap screws. Locate fan shroud against radiator and install six core and shroud attaching bolts. Tighten all bolts, including four lifting bracket bolts.

130. Radiator Assembly

a. DESCRIPTION. The radiator assembly (fig. 70) is fin and tube type core with upper and lower tanks. Radiator upper tank

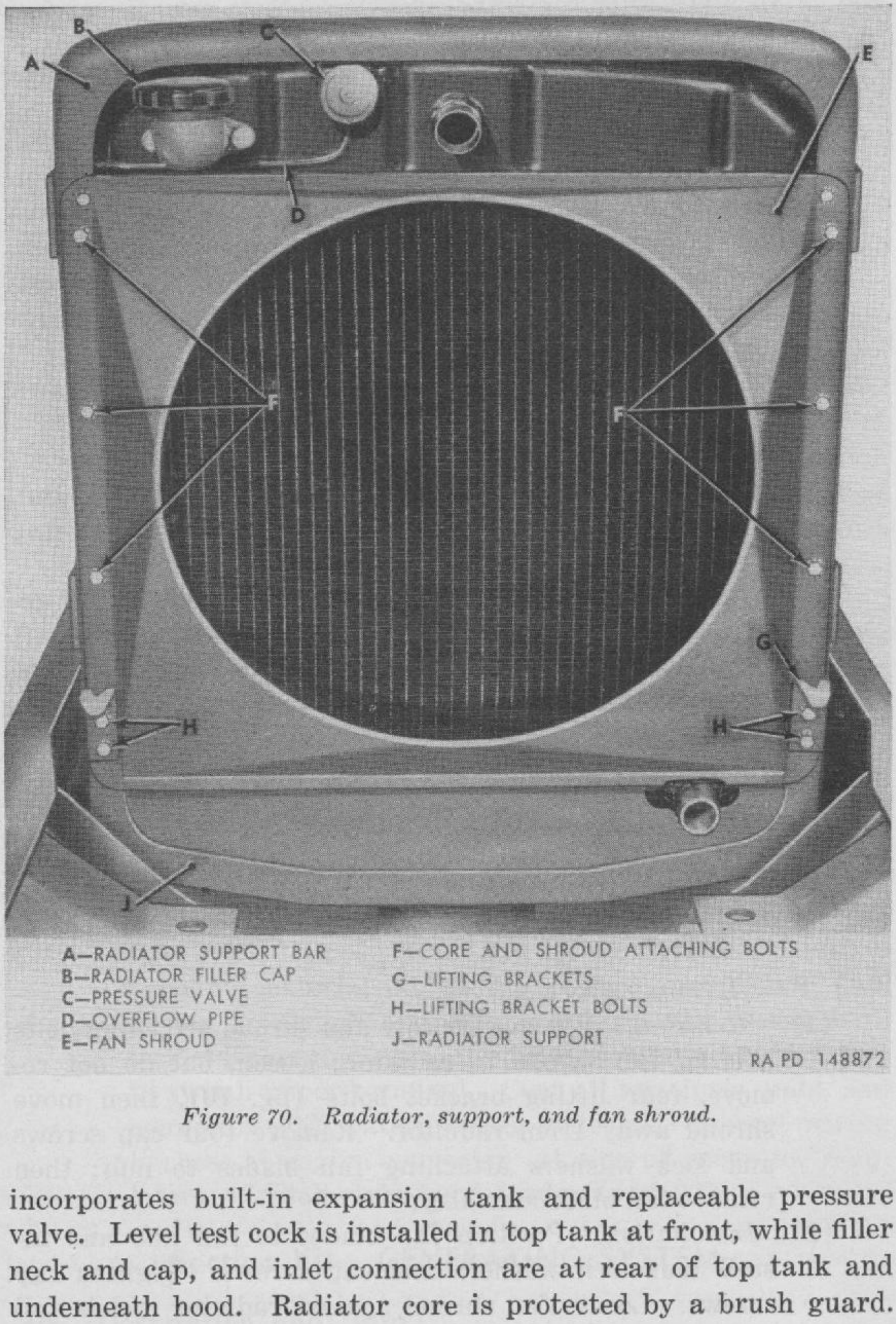


Figure 70. Radiator, support, and fan shroud.

incorporates built-in expansion tank and replaceable pressure valve. Level test cock is installed in top tank at front, while filler neck and cap, and inlet connection are at rear of top tank and underneath hood. Radiator core is protected by a brush guard.

b. REMOVAL.

(1) Open drain cock at bottom of radiator core to allow cooling liquid to drain (fig. 69).

(2) Loosen hose clamps and remove inlet and outlet hose from upper and lower tanks.

(3) Remove three cap screws at each side attaching upper cross bar support to side support; then lift off upper cross bar.

(4) Remove five bolts and lock washers attaching fan shroud, lifting brackets, and core to each radiator support.

(5) Move shroud toward engine until clear of outlet at lower tank.

(6) Remove two cap screws and lock washers attaching upper baffle to grille braces; then remove baffle.

(7) Lift radiator core straight up and out of support, using care to guide lower tank inlet fitting past fan blades without damage. Remove fan shroud.

c. INSTALLATION.

(1) Position shroud assembly over fan blades. Be sure shroud to radiator seals are in place and are in good condition.

(2) Lower radiator core into support, using care to guide lower tank inlet fitting past fan blades without damage.

(3) Move shroud assembly into place against radiator support; then install bolts and lock washers attaching shroud and lifting brackets to support. Do not tighten bolts until upper cross bar support is installed.

(4) Install upper cross bar support and secure to side support with three cap screws and lock washers at each side. Tighten shroud and lifting bracket bolts.

(5) Install inlet and outlet hose at upper and lower tanks; then secure with hose clamps.

(6) Install upper baffle between grille and upper cross bar support and secure to grille braces with two cap screws and nuts.

(7) Fill cooling system (par. 126*a*).

d. PRESSURE VALVE REPLACEMENT.

(1) *Removal.* Open level cock to drain system below pressure relief valve. Pry out valve retaining ring and remove valve assembly from tank. Remove and discard gasket.

(2) *Installation.* Place new gasket on pressure valve seat. Locate valve assembly in place and install retaining ring. Be sure retaining ring enters groove all the way around.

131. Thermostat

a. DESCRIPTION. The thermostat is of the positive acting type and is mounted between the thermostat housing and cylinder head water outlet. Thermostat is a thermostatically operated restriction valve and is calibrated to open gradually as the engine temperature increases. The valve in the thermostat starts to open at approximately 160° F. and is fully opened at 175° F. When the temperature of the cooling liquid in the engine is below the calibration of the thermostat, the valve in the thermostat remains closed, restricting the flow of the cooling liquid through the radiator. However, a by-pass around the thermostat permits circulation of the cooling liquid through the engine water passages until normal operating temperature is reached. The thermostat is then open and permits full circulation of the cooling liquid.

b. THERMOSTAT REMOVAL. Drain cooling system (par. 126*b*) until liquid level is below thermostat housing. Loosen two hose clamps and remove radiator inlet hose. Remove two cap screws and lock washers attaching cylinder head water outlet to thermostat housing; then lift water outlet off thermostat housing and remove gasket. Remove thermostat from thermostat housing.

c. TESTING THERMOSTAT. Remove all accumulated rust, scale, or other foreign material from thermostat assembly. Make visual inspection of valve to be sure bleed hole is open and that valve flange is fully seated and that the assembly is not bent. Test in the following manner.

(1) *Check full open temperature.* Heat a pan of water to 175° F. Check water temperature with an accurate thermometer. Submerge thermostat in water. Valve should travel approximately one-fourth inch to the fully open position.

(2) *Check closing temperature.* Submerge thermostat in a pan of water at a temperature of 150° F. Under these conditions valve should be in fully closed position.

(3) *Check "Start-to-open" temperature.* Submerge thermostat in a pan of water and heat to 10° F. above the rated temperature (marked on thermostat valve). Valve should be approximately half open.

Note. Do not attempt to repair thermostat. Units which fail to function properly as indicated by the above tests must be discarded and replaced with new units.

d. THERMOSTAT INSTALLATION. Clean thermostat seat in housing; then position thermostat in housing with arrow pointing upward. Install water outlet to thermostat housing, using new gasket, and secure with two cap screws and lock washers. Install radiator inlet hose and two clamps. Tighten clamps securely. Fill cooling system (par. 126*a*).

132. Water Pump

a. Description. A centrifugal type water pump (fig. 71) is mounted on cylinder block at front end of engine. The water pump is packless type and leakage around shaft is controlled by a carbon washer and seal assembly. The impeller action of the water pump forces the cooling liquid to circulate through engine water passages, air compressor, transmission cooler, radiator, and connections.

b. Pulley Replacement.

(1) *Removal.* Remove fan blades (par. 129*d*). Loosen fan belt (par. 129*b*) until belt can be lifted from pulley. Remove six cap screws and lock washers attaching pulley to hub; then remove water pump pulley (fig. 71).

(2) *Installation.* Position pulley to fan hub and secure with six cap screws and lock washers. Locate fan belt in pulley sheave and adjust belt tension (par. 129*b*). Install fan blades (par. 129*d*).

c. Water Pump Removal.

(1) Drain cooling system (par. 126*b*). Remove pulley (*b* above).

(2) Loosen hose clamp attaching radiator outlet hose at water pump; then remove hose from pump inlet. Loosen hose clamps connecting water pump by-pass inlet to thermostat housing by-pass tee.

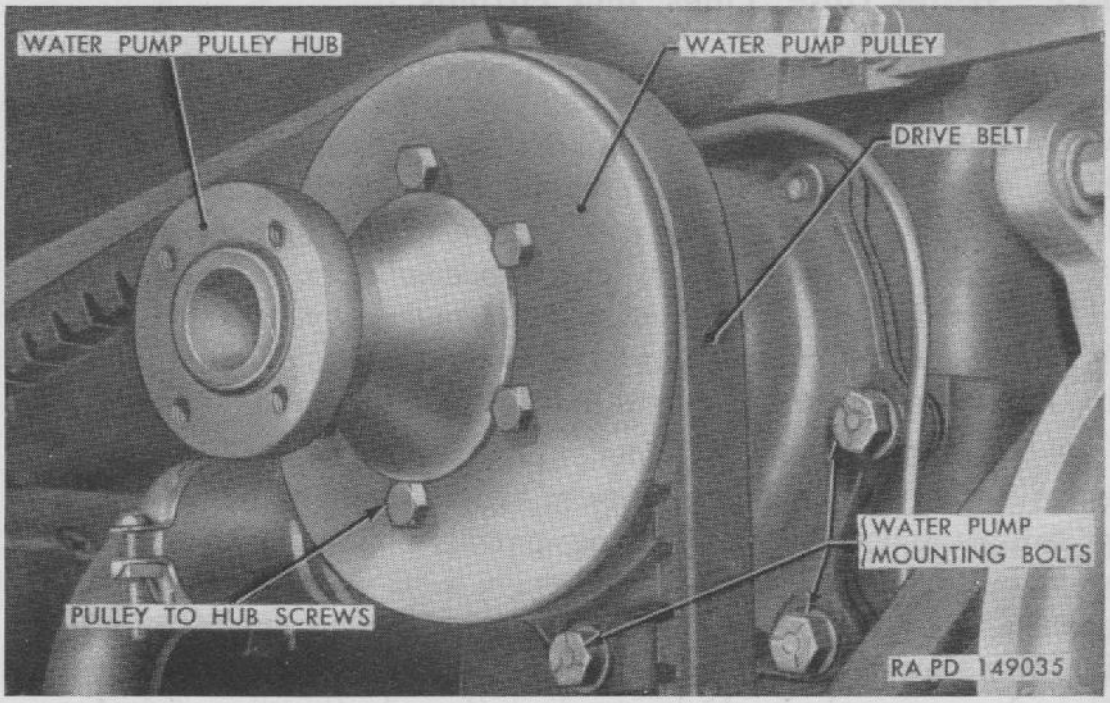


Figure 71. Water pump installed.

(3) Remove four cap screws attaching water pump to cylinder block; then remove pump assembly. Remove and discard pump to cylinder block gasket. If pump is to be replaced, remove water by-pass inlet elbow from pump.

d. WATER PUMP INSTALLATION.

(1) Coat water by-pass inlet elbow threads with joint and thread compound; then install elbow tightly into water pump. Install by-pass hose to inlet elbow but do not tighten hose clamps until pump is installed.

(2) Use a new water pump to cylinder block gasket; then locate pump assembly in position on engine, directing water by-pass hose into thermostat housing tee. Install one 1⅞-inch cap screw and lock washer into water pump bolt hole just above water pump inlet and tighten finger tight. Install remaining three cap screws and lock washers; then tighten all four screws evenly and alternately until tight. Position fan pulley on hub and secure with six cap screws.

(3) Attach radiator outlet hose to water pump inlet; then tighten hose clamps. Tighten water by-pass hose clamps.

(4) Install fan belt (par 129*c*) and adjust (par. 129*b*). Install fan (par. 129*d*). Fill cooling system (par. 126*a*); then start and warm up engine. Inspect hose and water pump-to-cylinder-block gasket for leaks.

133. Water Hose, Lines, and Fittings

a. DESCRIPTION. Flexible hose, held by clamps, are provided at radiator inlet and outlet, water pump inlet, and cylinder head water outlet. Flexible line with fittings is used between cylinder block and air compressor. Transmission cooler water inlet line assembly extends from air compressor to left side of transmission. Transmission water outlet line assembly extends from right side of transmission to thermostat housing by-pass fitting tee. Water by-pass line assembly extends from rear of cylinder head to thermostat housing by-pass fitting tee.

b. MAINTENANCE. Whenever hose are removed they should be carefully inspected for evidence of cracks, cuts, or other evidence of failure and replaced with new parts whenever necessary. Always be sure hose clamps are properly located and tightened sufficiently to prevent leaks. Whenever cooling system fittings having pipe threads are being installed, a small quantity of joint and thread compound should be used at threads to prevent leakage, and fittings should be tightened firmly.

Section XI. STARTING SYSTEM

134. Description and Data

a. GENERAL. Starting system consists of batteries, starter switch, control linkage, and interconnecting cables. The slave battery receptacle and cables are a part of the starting system when slave battery is being used to assist in starting engine. Starting system circuit diagram is shown in figure 72. Starter drive pinion is shifted into mesh with flywheel ring gear teeth and starter switch contacts are closed manually through operation of starter hand control lever and interconnecting linkage. Dash to engine ground cable is connected to stud in starter drive end head.

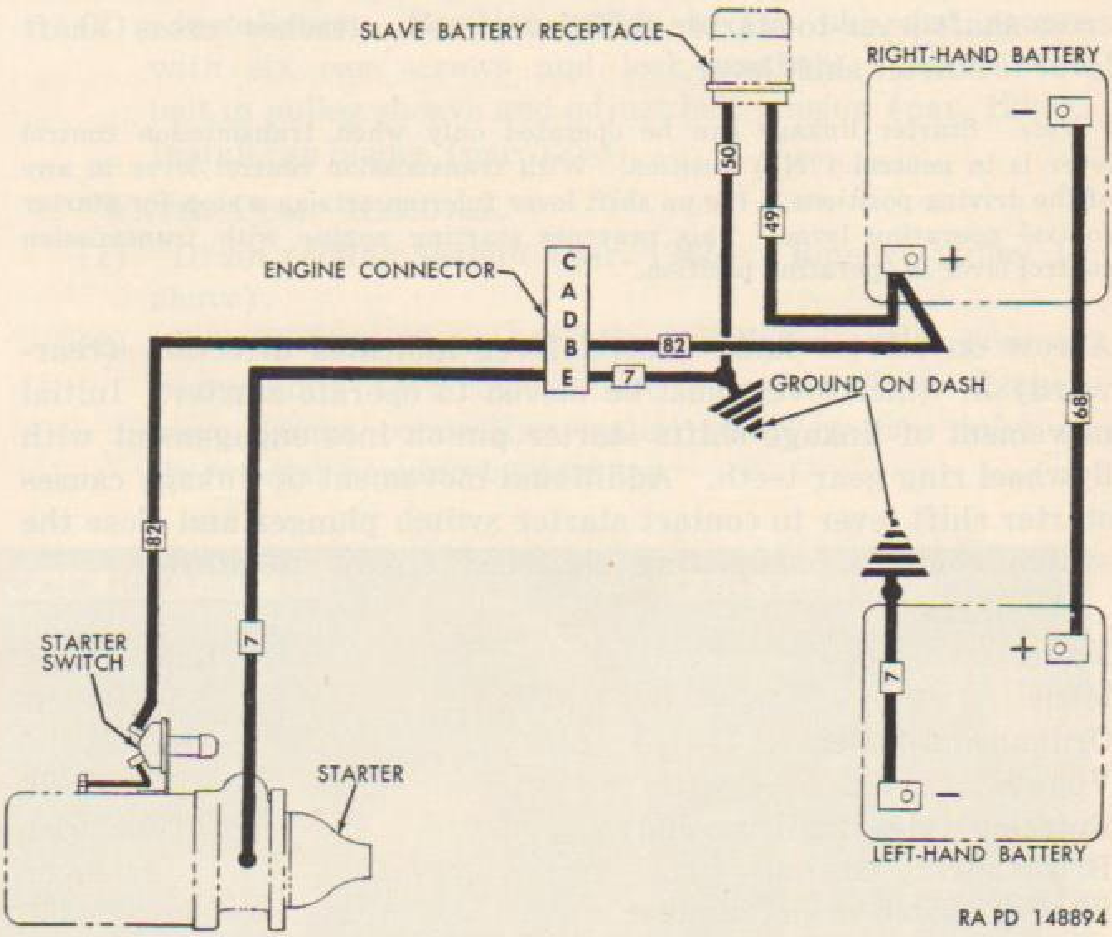


Figure 72. Starting system circuit diagram.

b. STARTER. Starter is a four-pole, four-brush unit with three field coils connected in series and one in shunt. The series field windings and insulated brushes are grounded to commutator end head through a capacitor (condenser). Starter is equipped with overrunning clutch type drive, and is mounted on right-hand side of engine flywheel housing (fig. 73). Starter switch is mounted on top of starter field frame; starter switch terminal is connected to field terminal by a strap type connector. Terminals and connector are coated with waterproofiing material after assembly. Commutator end of starter is completely enclosed by a cover installed over end of field frame and held in place by two retaining clips. A seal ring, between field frame and cover, seals out moisture. Sealing of shift lever opening in drive end head is accomplished by a packing ring, shaft retaining nut, and gasket.

c. STARTER CONTROL LINKAGE (fig. 75). Starter hand control lever and shaft is mounted on right-hand side of transmission control tower. Starter control operating lever is attached to end of hand control lever shaft. Operating lever-to-pick-up-lever rod attached to operating lever extends down to cross shaft pick-up lever. Cross shaft, extending across to right-hand side of transmission, has a cross-shaft lever attached to right-hand end. A cross-shaft-lever-to-starter-shift-lever rod attaches cross shaft lever to starter shift lever.

Note. Starter linkage can be operated only when transmission control lever is in neutral ("N") position. With transmission control lever in any of the driving positions, a lug on shift lever fulcrum acts as a stop for starter control operating lever. This prevents starting engine with transmission control lever in operating position.

Arrow on starter hand control lever indicates direction (rearward) in which lever must be moved to operate starter. Initial movement of linkage shifts starter pinion into engagement with flywheel ring gear teeth. Additional movement of linkage causes starter shift lever to contact starter switch plunger and close the switch contacts, completing electrical circuit to starter.

d. DATA.

Make	Delco-Remy
Model	1108581
Ordnance number	7350454
Voltage	24
Rotation (viewing drive end)	Clockwise
Brush spring tension	24-28 oz
Starter switch model number	1996466

135. Starter

a. STARTER REMOVAL (fig. 73).

(1) Remove right-hand fender (par. 277). Disconnect engine wiring harness at engine connector (at side of generator-regulator on dash) to prevent a short circuit when cable is removed from starter switch. Use spanner wrench 41-W-3249-900 for loosening connector nut.

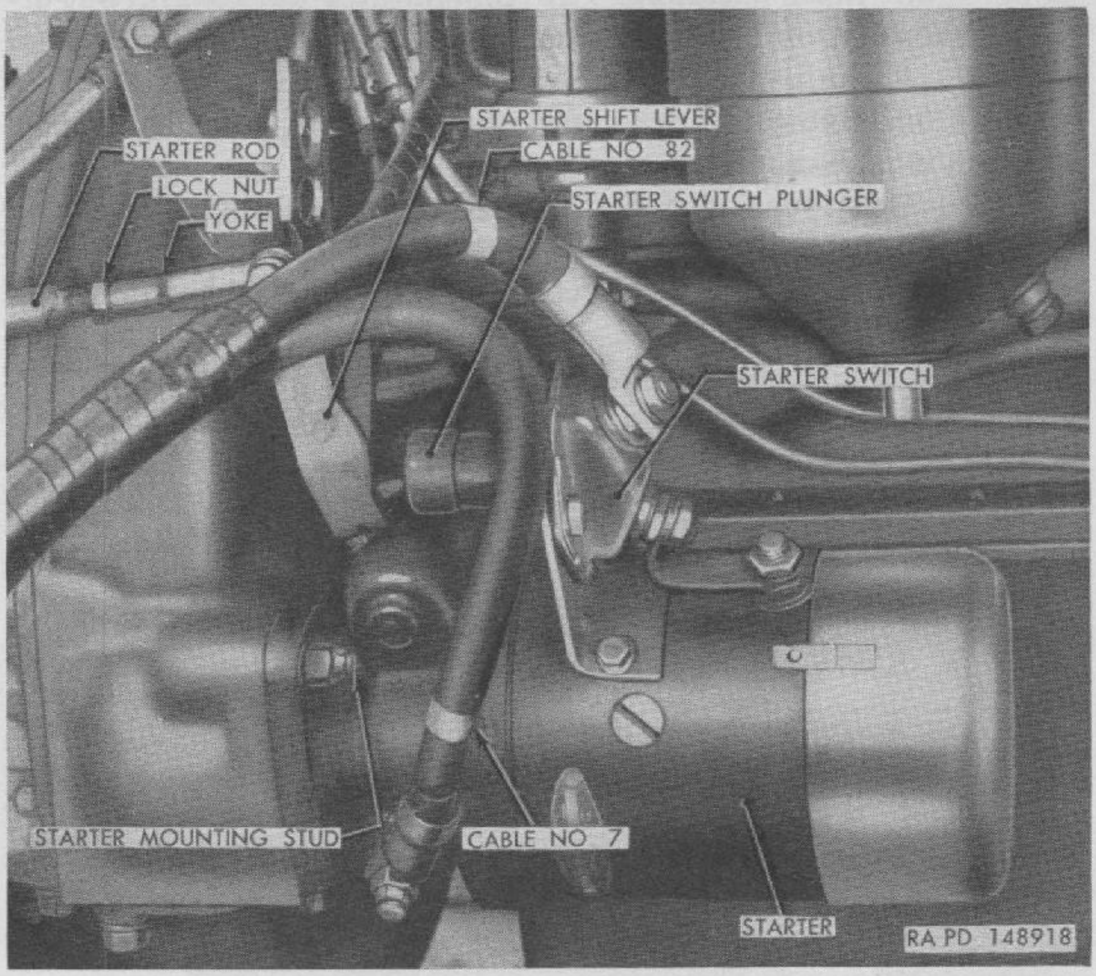


Figure 73. Starter installed on engine.

(2) Disconnect starter cable (No. 82) from starter switch upper terminal.

(3) Disconnect ground cable (No. 7) from stud on starter drive end head.

(4) Disconnect starter rod yoke from starter shift lever by removing cotter pin, clevis pin, and two flat washers.

(5) Remove nuts from two starter mounting studs attaching starter to clutch housing. Move starter forward to remove from flywheel housing.

b. CLEANING AND INSPECTION.

(1) Remove starter (*a* above). Wipe all dirt from exterior of starter.

(2) Disengage two cover retaining clips from pins in starter field frame. Pull cover off end of starter; then remove seal ring from groove in field frame (fig. 74).

(3) Inspect commutator for dirty condition, roughness, high spots, and high mica. If commutator is dirty, clean with grade 2/0 flint paper. *Do not use emery cloth for cleaning commutator.* Blow out dust with compressed

air after cleaning. If commutator is rough, out-of-round, or has high mica, starter must be replaced.

(4) Examine brushes for wear. If brushes are worn to five-sixteenth inch, measured on stamped side, starter must be replaced.

(5) Coat seal ring with high temperature ball bearing grease and place in groove in field frame. Install end cover, making sure retaining clips engage pins in field frame.

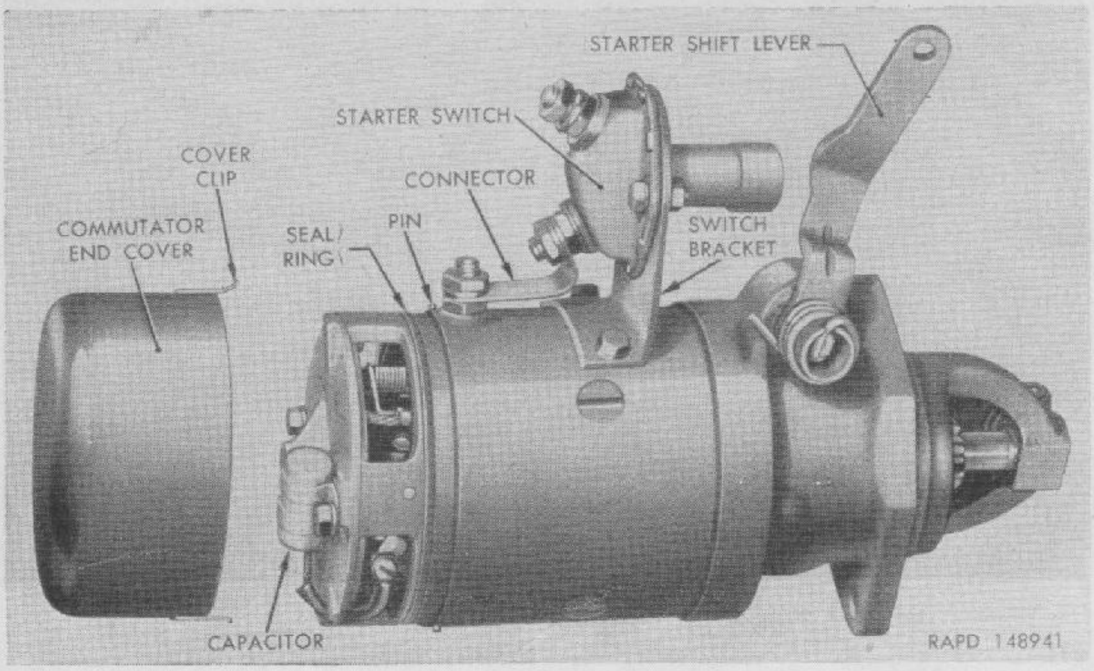


Figure 74. Starter with end cover removed.

c. STARTER INSTALLATION (fig. 73).

(1) Position starter on flywheel housing, with holes in drive end head over starter mounting studs. Install self-locking nut on each stud and tighten to 48–64 pound-feet torque.

(2) Connect ground cable (No. 7) to stud on starter drive end head. Connect starter cable (No. 82) to starter switch terminal. Tighten terminal nuts firmly; then coat both cable ends and terminals with waterproofing material.

(3) Connect engine wiring harness at engine connector (at side of generator-regulator).

(4) Connect starter rod yoke to starter shift lever; use a flat washer on each side of shift lever and secure with clevis pin and cotter pin.

(5) Check starter linkage adjustment and correct if necessary (*d* below). Install right-hand fender (par. 277).

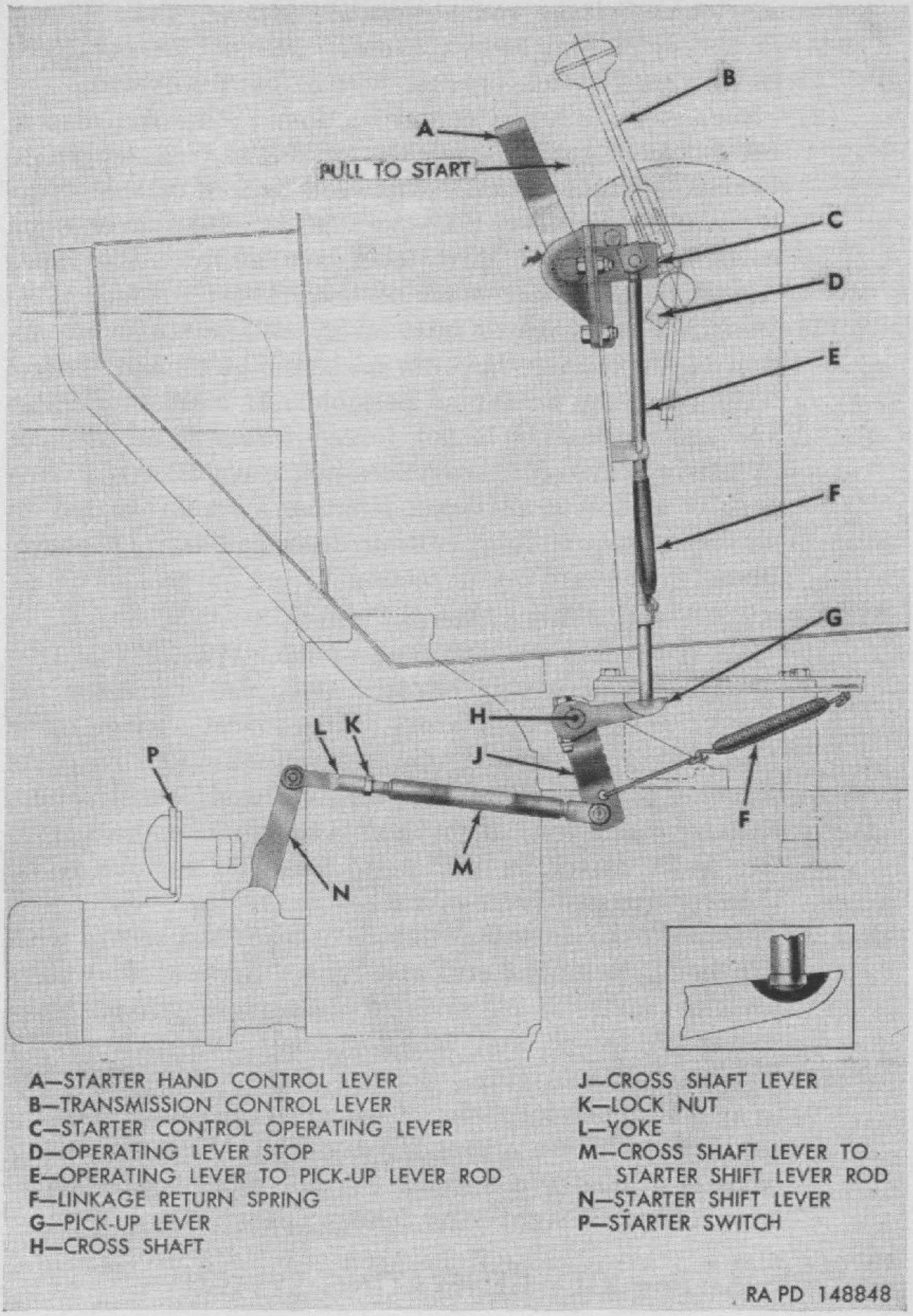


Figure 75. Starter control linkage.

d. STARTER LINKAGE ADJUSTMENT (fig. 75).

(1) Starter linkage should be adjusted so that shift lever will cause starter switch contacts to close without bending switch bracket forward when hand control lever is pulled rearward to its limit. Adjustment is made by lengthening or shortening cross-shaft-lever-to-

starter-shift-lever rod at the adjustable yoke. If rod is too short, full switch contact will not be obtained; if too long, switch bracket will be bent forward.

(2) Remove floor board center section. With rod disconnected from starter shift lever, adjust rod length to provide a slight clearance between bottom of operating-lever-to-pick-up-lever rod and cup in pick-up lever when holes in yoke and shift lever are alined. Clearance cannot be seen, but must be determined by feel.

(3) Connect rod yoke to shift lever. While observing action of shift lever, have an assistant pull hand control lever rearward as far as possible. If starter operates and switch bracket is not forced forward, adjustment is satisfactory. If starter does not operate, or if switch bracket is forced forward, lengthen or shorten rod as necessary to obtain condition described in (1) above. Install floor board center section.

e. STARTER SWITCH REPLACEMENT (fig. 73).

(1) *Removal.* Remove right-hand fender (par. 277). Disconnect engine wiring harness at engine connector (at side of generator-regulator). Disconnect starter cable (No. 82) from switch upper terminal. Remove nuts securing connector to switch terminal and field terminal. Remove connector. Remove nuts and lock washers from two bolts attaching switch to bracket, remove bolts, then remove switch from bracket.

(2) *Installation.* Install switch in bracket and secure with two bolts, lock washers, and nuts. Scrape old waterproofing material off ends of connector. Install connector on switch and field terminals and secure with lock washers and nuts. Connect starter cable (No. 82) to switch upper terminal. Coat all terminals, nuts, and connector with waterproofing material. Connect wiring harness at engine connector (at side of generator-regulator). Install right-hand fender (par. 277).

Section XII. GENERATING SYSTEM

136. Description and Data

a. GENERAL. Generating system consists of the generator, generator-regulator, batteries, and interconnecting cables and wires. Generating system is completely sealed for submerged operation. One capacitor (condenser) is used in generator and two in generator-regulator for suppression of radio interference noise. Generating system circuit diagram is shown in figure 76.

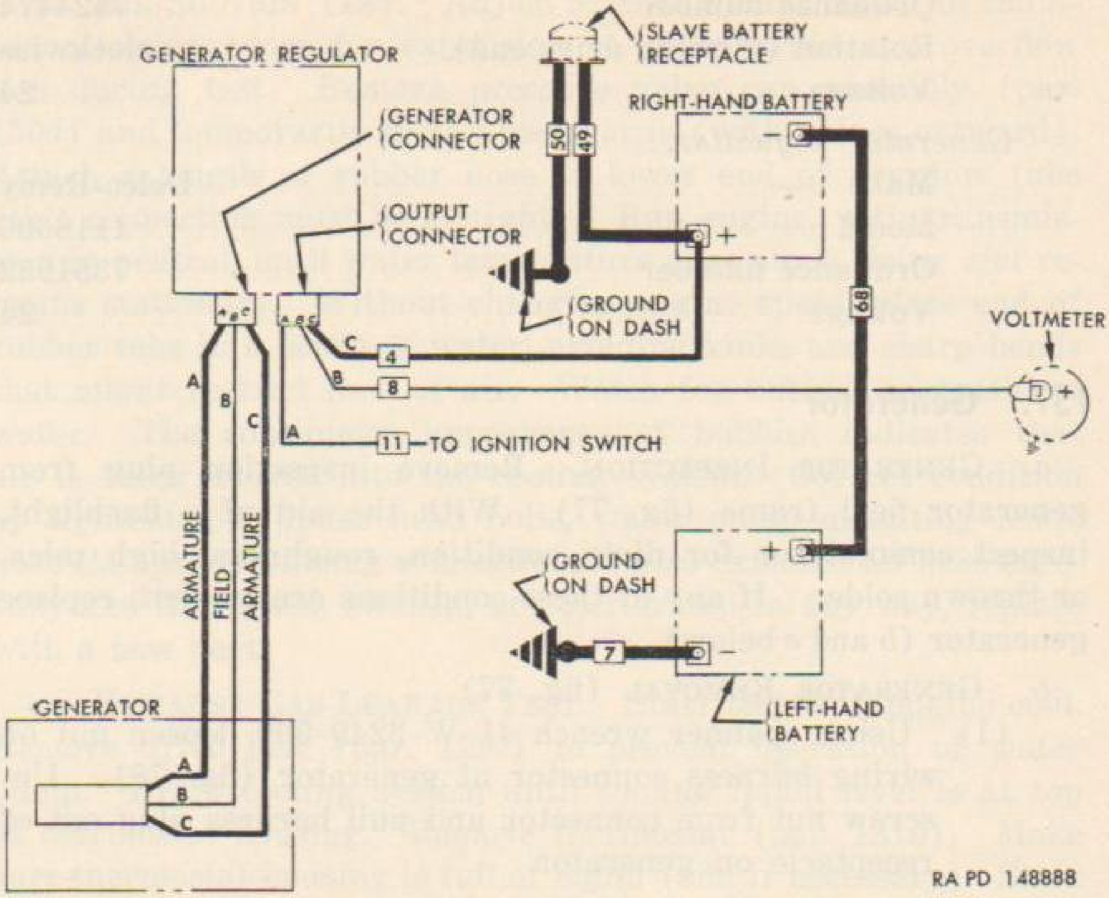


Figure 76. Generating system wiring circuits.

b. GENERATOR. Generator is a four-brush, four-pole, shunt type unit. Generator is mounted on right-hand side of engine and is driven by a belt, in conjunction with the engine water pump and fan, from the engine crankshaft pulley (fig. 77). Inspection plug in generator field frame provides a means of inspecting commutator. Generator mounting permits positioning generator to provide proper drive belt tension. All external wiring connections are made through a three-prong plug and receptacle type connector.

c. GENERATOR-REGULATOR. Generator-regulator is mounted on engine side of dash panel below right-hand battery. Generator-regulator contains a cut-out relay which automatically opens and closes the circuit between generator and battery, a voltage regulator which controls generator voltage, and a current regulator which controls generator amperage output. Wiring connections at regulator are made through two plug and receptacle type connectors.

d. DATA.

Generator.

Make .... Delco-Remy

Model 1117486

Ordnance number	7524474
Rotation (viewing drive end)	clockwise
Voltage	24

Generator regulator.

Make	Delco-Remy
Model	1118606
Ordnance number	7351952
Voltage	24

137. Generator

a. GENERATOR INSPECTION. Remove inspection plug from generator field frame (fig. 77). With the aid of a flashlight, inspect commutator for dirty condition, roughness, high mica, or thrown solder. If any of these conditions are evident, replace generator (*b* and *c* below).

b. GENERATOR REMOVAL (fig. 77).

(1) Using spanner wrench 41-W-3249-900, loosen nut on wiring harness connector at generator (fig. 78). Unscrew nut from connector and pull harness plug out of receptacle on generator.

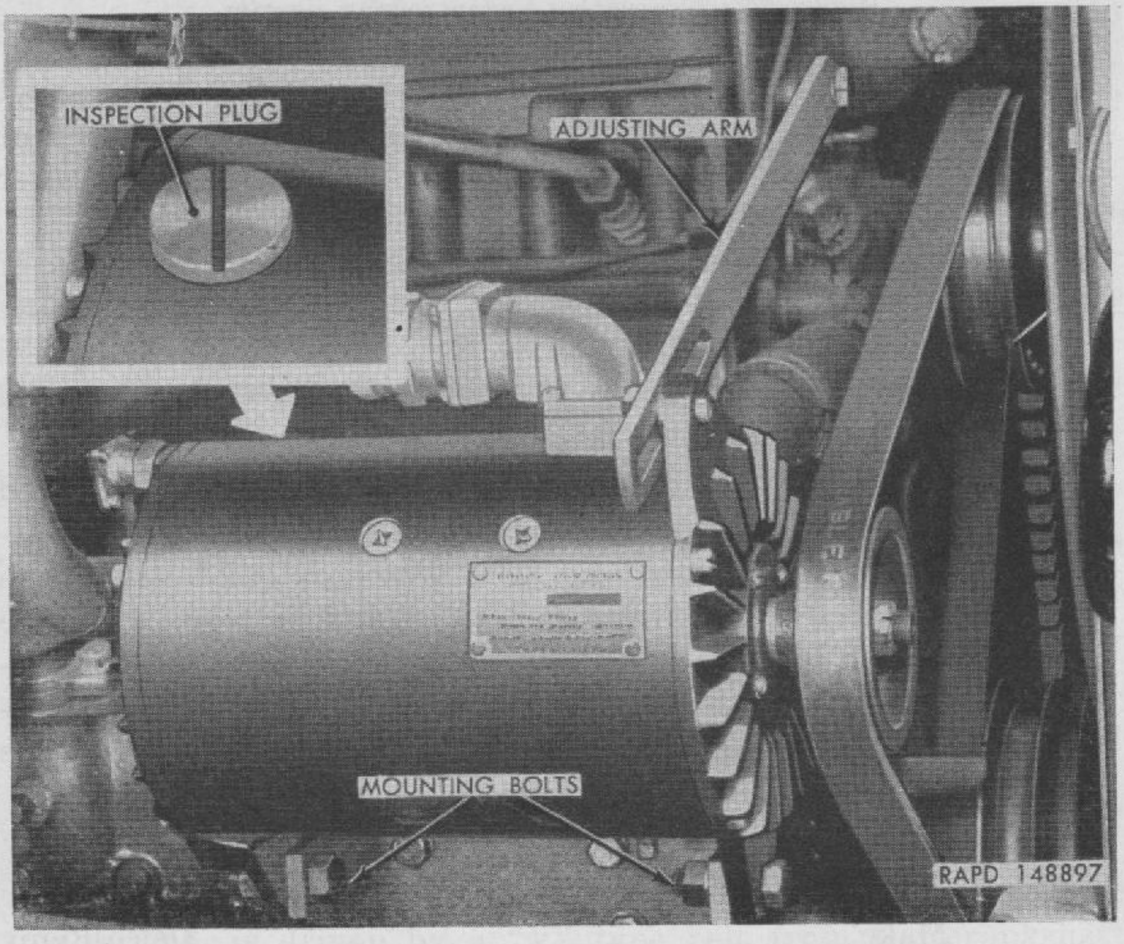


Figure 77. Generator installed.

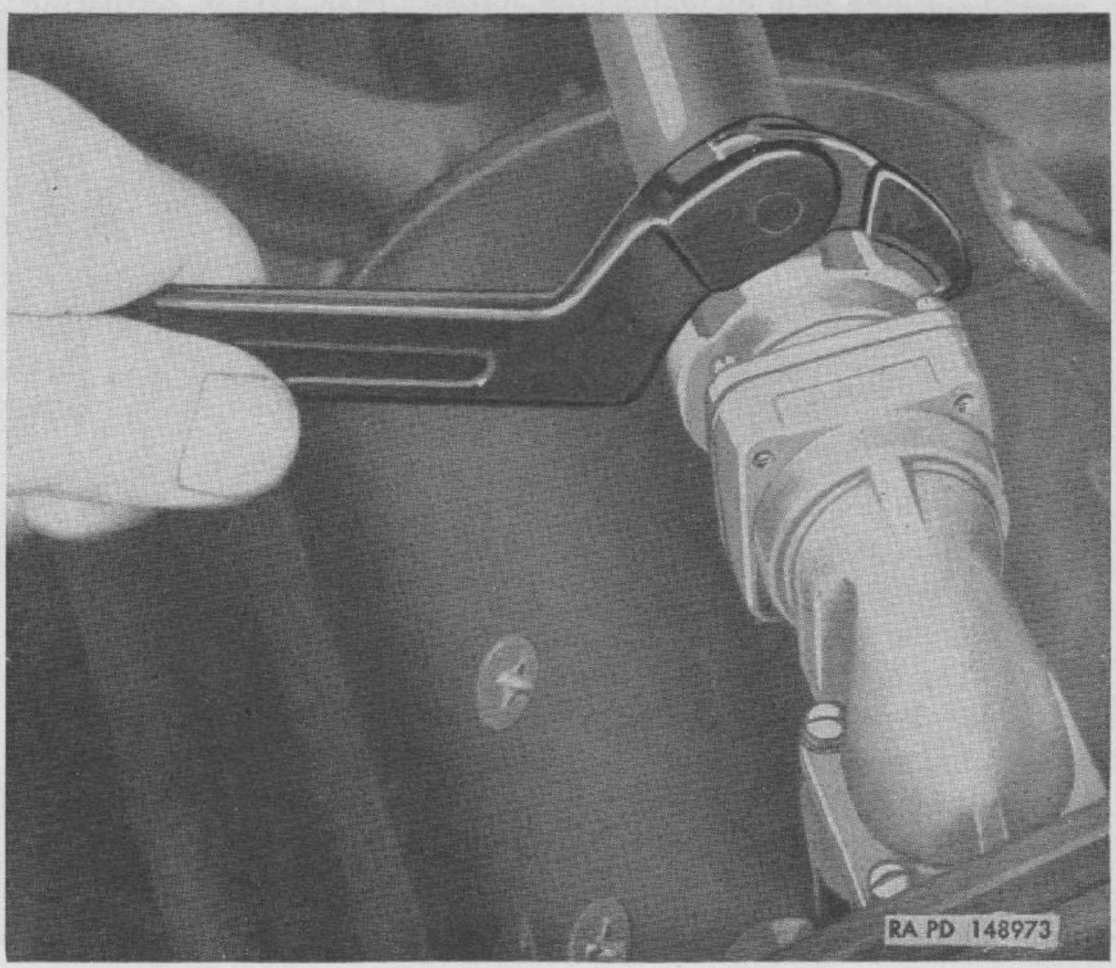


Figure 78. Use of spanner wrench —41-W-3249-900.

(2) Loosen bolt attaching generator adjusting arm to engine thermostat housing. Remove bolt, lock washer, and flat washer attaching adjusting arm to generator. Loosen two mounting bolts attaching generator to mounting bracket. Swing generator in and remove belt from generator pulley.

(3) Remove two mounting bolts, nuts, and lock washers attaching generator to mounting bracket and remove generator.

(4) Remove nut and washer securing generator pulley on armature shaft. Remove pulley from shaft, using a suitable puller. Remove key from shaft. Pulley, key, nut, and washer must be installed on replacement unit.

c. Generator Installation (fig. 77).

(1) Install key in keyway in armature shaft, install pulley on shaft, and secure with flat washer and self-locking nut.

(2) Position generator at mounting bracket and install two mounting bolts, lock washers, and nuts.

(3) Place belt on generator pulley; then attach adjusting arm to generator with bolt, lock washer, and flat washer.

(4) Polarize generator (*d* below). Insert wiring harness plug into receptacle on generator, making sure locating key and keyway on the two parts are alined. Thread nut onto connector and tighten with spanner wrench 41-W-3249-900 (fig. 78).

(5) Adjust generator drive belt tension (par. 129*a*); then tighten generator mounting bolts and adjusting arm bolts.

d. POLARIZING GENERATOR. When a new or rebuilt generator or generator-regulator has been installed, generator must be polarized *before engine is started.* Disconnect wiring harness from connector at generator, using spanner wrench 41-W-3249-900. Using a jumper wire with suitable prods, *momentarily* connect field terminal "B" at generator to positive (+) terminal in slave battery receptacle. This connection allows a momentary surge of battery current to flow through generator field windings, which automatically gives generator the correct polarity with respect to batteries. Connect harness at generator using spanner wrench 41-W-3249-900.

138. Generator-regulator

a. TESTING. Because of the watertight construction of the charging system components, wiring harnesses, and connectors, normal methods of testing the generator-regulator are not applicable. The generator-regulator should be replaced if the battery charge indicator on instrument panel shows a high charging rate with batteries fully charged, low or no charging rate with low batteries, or if burned resistances, windings, or contact points are evident.

b. GENERATOR-REGULATOR REMOVAL.

(1) Disconnect both wiring harnesses at regulator, using spanner wrench 41-W-3249-900 to loosen nuts. Pull harness plugs out of receptacles on regulator.

(2) Remove four nuts and bolts attaching regulator brackets to support brackets on dash and remove regulator.

c. GENERATOR-REGULATOR INSTALLATION.

(1) Install regulator on dash support brackets and attach with four bolts and self-locking nuts.

(2) Insert wiring harness plugs into receptacles on regulator, making sure locating keys and keyways are alined. Thread connector nuts onto regulator connectors and tighten with spanner wrench 41-W-3249-900. Before starting engine, generator must be polarized (par. 137*d*).

Section XIII. BATTERIES AND LIGHTING SYSTEM

139. Description

a. GENERAL. Battery and lighting system is a 24-volt, submersible type system. Wiring connections at lights are made through bayonet type connectors, held together by interlocking sleeves. Rubber grommets inside of sleeves protect the connections from moisture. All light circuits are controlled by light switch on instrument panel. Use of lights and operation of light switch is explained in paragraph 42. Circuit to light switch is protected by a 15-amp automatic reset type circuit breaker mounted on steering column brace (fig. 95). Refer to wiring circuit diagram (fig. 90) for all light circuits and for each wire identification numeral. Head lights and blackout driving light are equipped with sealed-beam lamp units; all other lights are equipped with replaceable bulb-type lamp units.

b. BATTERIES. Two 12-volt batteries are connected in series to provide 24-volt electrical current for operation of vehicle electrical system. Batteries are submersible type with special cell vent plugs which prevent entrance of water into battery cells. Batteries are mounted on engine side of dash panel, one at each side, and are accessible after raising hood (fig. 79). Negative (−) terminal of left-hand battery is grounded at dash Postive (+) terminal of left-hand battery is connected to right-hand battery negative (−) terminal by a waterproof cable. Regulator-to-battery cable, starter cable, and slave battery receptacle cable are connected to right-hand battery positive (+) terminal. Battery terminals are waterproofed by packing with waterproofing material after cables are connected.

c. SLAVE BATTERY RECEPTACLE. Slave battery receptacle is installed at right side of cab at rear of fender (fig. 80). Receptacle is connected in parallel with the batteries. Receptacle is used to charge the batteries from an external source, or to connect a slave battery to assist in starting engine. Receptacle also provides a convenient source of battery current for polarizing generator or for operating external electrical accessories.

d. SERVICE HEAD LIGHTS. Service head lights are mounted in radiator side baffles on each side of radiator and are protected by head-light-grille doors hinged to radiator brush guard (fig. 86). Head lights are equipped with double-filament sealed-beam lamp units to provide high and low light beams for driving under normal conditions. Upper and lower beams are selected with foot-operated dimmer switch when head light circuit is energized by main light switch (par. 42). Head lights are secured to mounting plates which are attached to radiator side baffles through shockproof mountings consisting of studs with integral rubber insulators. Studs are secured in radiator side baffles by lock washers and nuts at rear side baffles. Head light mounting plates are secured on studs by lock washers and nuts.

e. Blackout Driving Light. Blackout driving light is mounted in a panel below front end of left-hand fender (fig. 86). This light produces a diffused light beam to permit limited illumination when driving under blackout conditions. Blackout driving light is controlled by main light switch (par. 42).

f. Front Marker Lights. Front marker lights are mounted above each head light at sides of radiator (fig. 86). Each marker light contains three lamps (bulbs) (fig. 88); however, only two lamps in each marker light are used on these vehicles. The upper half of each light serves as a service parking light; the lower half, having a special lens which produces a diffused light beam, is used as a blackout marker light. Marker lights are controlled by main light switch (par. 42).

g. Stop and Tail Lights. One light is mounted at each rear corner of vehicle outside of frame side rails. Light at right-hand side contains two lamps, and serves as a blackout stop and tail light (fig. 89). Light at left-hand side contains three lamps, and serves as a service stop and tail light, and blackout tail light. This light is same as front marker light (fig. 88), except each cable has only one number (Nos 21, 22, and 24). Circuits to stop and tail lights are controlled by main light switch and stop light switch (par. 42).

h. Instrument Panel Lights. Three lights are used in instrument panel cluster, two for illuminating face of gages and instruments and one for indicating when head light high beam is being used. Instrument lights are controlled by main light switch, and high beam indicator light is controlled by dimmer switch when service head lights are being used (par. 42).

i. Trailer Receptacle. A 12-pin receptacle, installed above left-hand stop and tail light, provides a means of connecting trailer lights and auxiliary power circuit to the truck electrical system. Only six terminals in this connector are used on these vehicles. Trailer lights are controlled in conjunction with the truck lights by the main light switch. Receptacle cover is held close by a spring when receptacle is not in use.

140. Battery Data

Make	Delco-Remy
Model	6TN23
Voltage	12
Quantity	2 connected in series
Plates per cell	23
Ampere hour capacity at 20 hour rate	100
Specific gravity	
Fully charged (at 80° F.)	1.275–1.290
Recharge at	1.215

141. Batteries

a. CLEANING. Battery terminals and top of batteries must be kept clean. Tighten vent plugs and clean top of batteries with a brush dipped in an alkaline solution such as ammonia or a solution of bicarbonate of soda and water. After foaming stops, flush top of battery with clean water. If terminals and terminal bolts are corroded, disconnected cables, remove terminals, and clean in same manner. After installing terminals and connecting cables, waterproof terminals and cable connectors by packing and waterproofing material.

b. TESTING.

(1) *Specific gravity test.* Using an accurate reading hydrometer, check specific gravity of electrolyte in each cell of both batteries. A fully charged battery should test between 1.275 and 1.290 (at 80° F.). Refer to paragraph 293 for extreme hot weather correction and to paragraph 292 for extreme cold weather maintenance. If specific gravity is less than 1.215, battery should be recharged or replaced with a fully charged battery.

(2) *Cell voltage.* Due to the sealed construction of submersible type batteries, cell voltage tests cannot be made.

c. FILLING BATTERIES. Instructions on top of each battery read: FILL TO SLOTS IN BOTTOM OF VENT WELLS (fig. 79). The battery cell covers are molded with long, circular, tapered vent wells which extend below the inside surface of the cover to the proper electrolyte level. A narrow vertical slot is molded into the side-wall of each vent well. As water is added to the cell, the surface of the rising liquid contacts the slotted lower

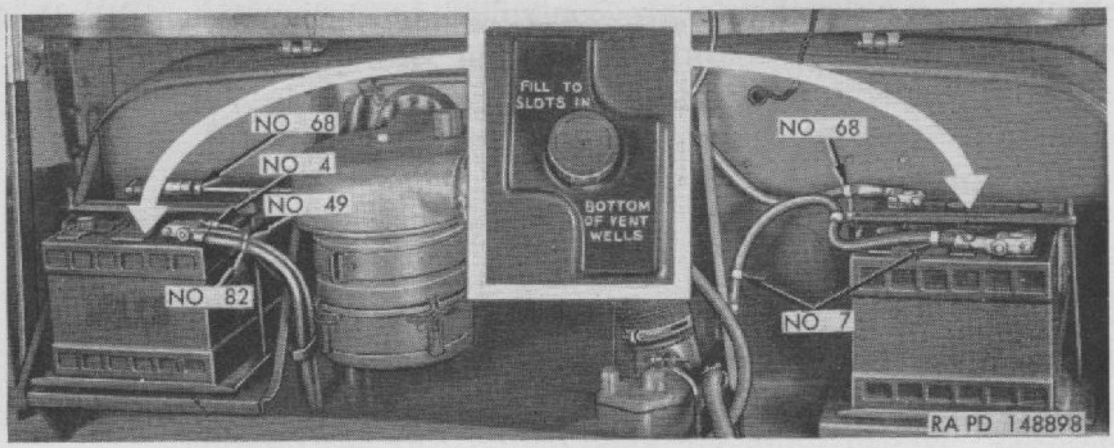


Figure 79. Batteries installed.

end of the vent well, causing a distortion of the reflecting surface which is readily discernible. Add pure (preferably distilled) water to each cell as required to bring electrolyte level up to bottom of vent wells. Refer to paragraphs 292 and 293 for battery filling instructions under extreme hot weather or cold weather conditions.

d. CHARGING BATTERIES. Fill battery cells to proper level (*c* above). Charging circuit can be connected at slave battery receptacle (fig. 80). Batteries should be supplied with a charging current of 11 amperes which is equal to 1 amp per positive plate per cell. Charging should continue for two hours after specific gravity shows no further rise. Electrolyte temperature should not be permitted to exceed 110° F. while charging.

e. BATTERY REPLACEMENT. Instructions which follow cover removal and installation of either right- or left-hand battery.

(1) *Battery removal (fig. 79).*

Caution: Before starting removal of either battery, disnect both ends of cable (68) connecting the two batteries to prevent accidental short circuit.

(*a*) It is not necessary to disconnect cables from terminals; loosen clamp bolts attaching terminals to battery posts, spread terminals at split, and lift terminals off battery posts.

(*b*) Remove nut and lock washer from each battery hold-down bolt, and lift battery retainer off bolts; then lift battery off support.

(2) *Battery installation (fig. 79).*

(*a*) Clean all dirt off battery support and position battery on support.

(*b*) Install battery retainer over hold-down bolts. Make sure battery lifting handles are positioned as shown in figure 79 to prevent battery retainer from resting on top of battery. Install lock washer and nut on each hold-down bolt and tighten firmly.

(*c*) Install battery terminals on battery posts and tighten clamp bolts. If cables were disconnected from terminals, refer to figure 79 for number identification of cables connected to each terminal. After terminals are installed and tightened, pack terminals and cable connectors with waterproofing material.

142. Slave Battery Receptacle and Cables

a. REMOVAL.

(1) Remove right-hand fender (par. 277).

(2) Disconnect slave receptacle positive (+) cable (No. 49) from right-hand battery positive (+) terminal (fig. 79). Disconnect slave receptacle negative (−) cable (No. 50) from ground at dash behind generator-regulator.

(3) Remove nut and bolt attaching two cable clips to floor sill. Remove clip from each cable.

(4) Remove four nuts and bolts attaching slave battery receptacle to side of cab (fig. 80). Withdraw receptacle and cables from hole in cab.

b. INSTALLATION.

(1) Insert cables through hole in cab and position receptacle against cab. Attach receptacle to cab with four bolts and self-locking nuts. Tighten nuts to 5 to 7 pound-feet torque.

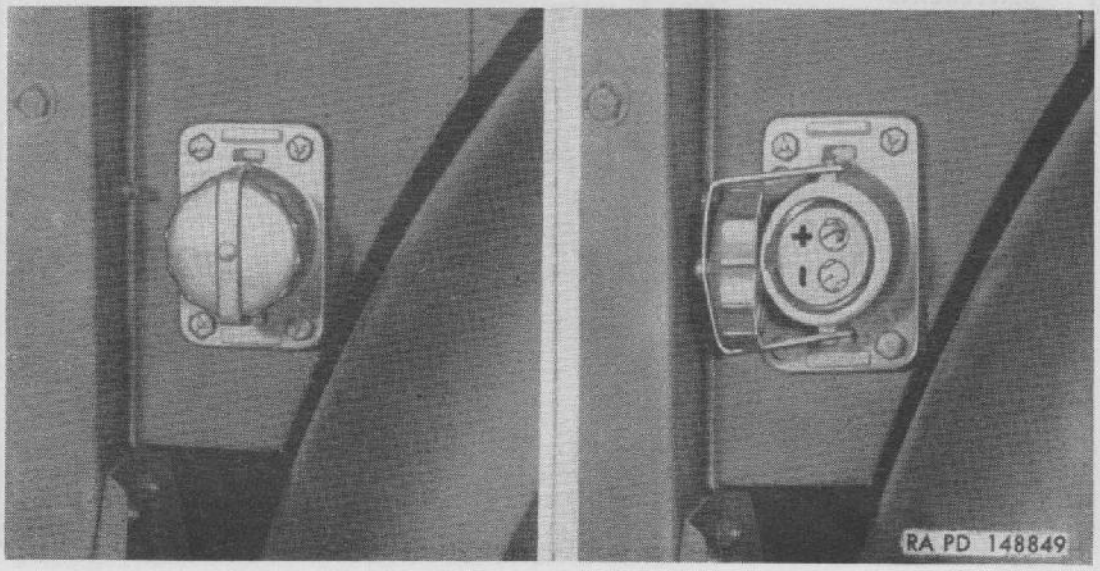


Figure 80. Slave battery receptacle with cover closed and open.

(2) Connect cable No. 49 to right-hand battery positive (+) terminal (fig. 79). Connect cable No. 50 to ground on dash (behind generator-regulator) in conjunction with cable No. 7.

(3) Install clip on each cable and attach both clips to floor sill below right-hand battery.

(4) Install right-hand fender (par. 277).

143. Service Head Lights

a. HEAD LIGHT BEAM ADJUSTMENT.

(1) Head light beams must be accurately aimed. When aiming head lights, replace sealed-beam lamp unit (*b* below) if beam pattern is distorted. Beam distortion is usually due to a sprung or dented reflecter, a condition sometimes caused by careless handling.

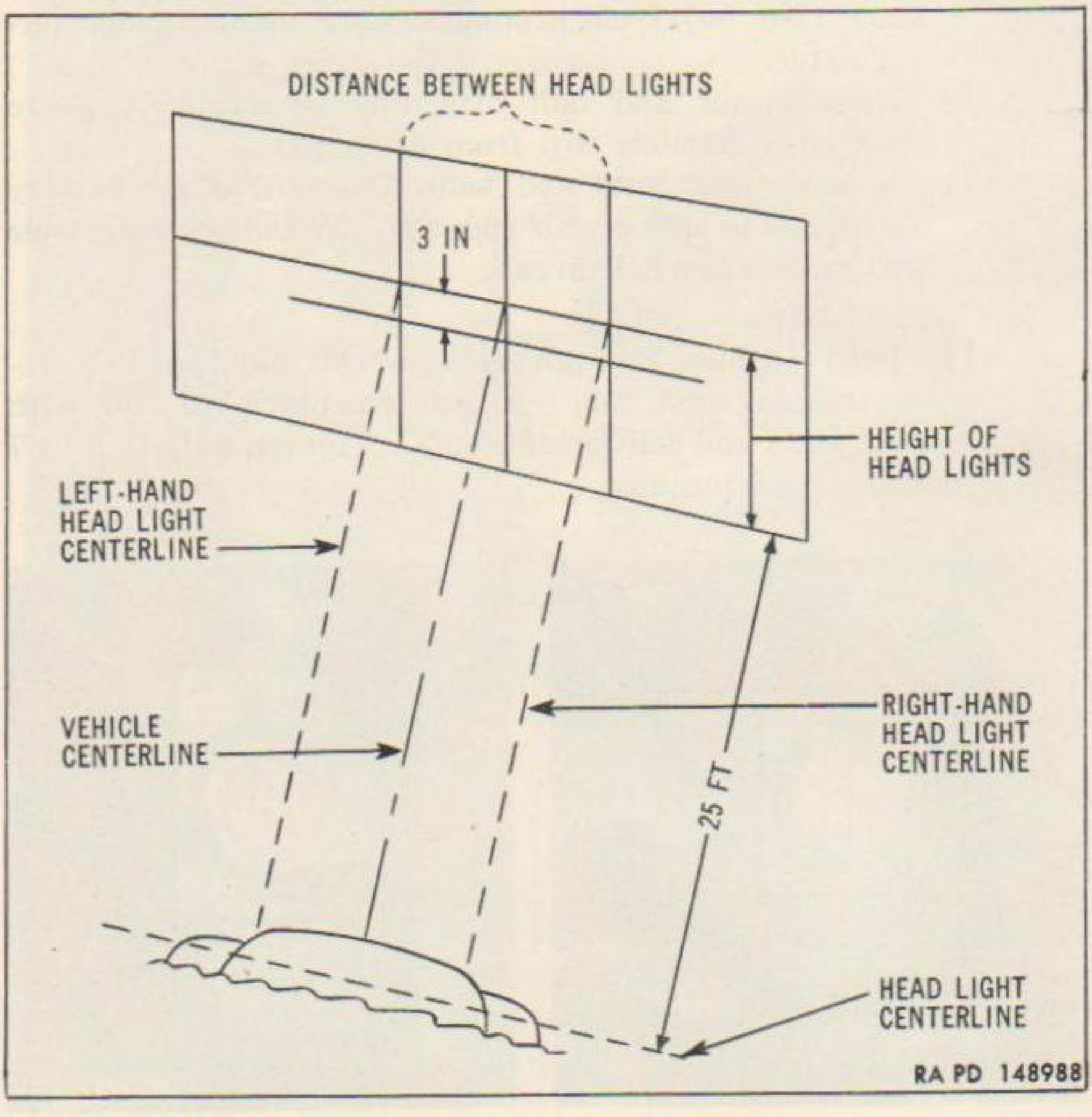


Figure 81. Head light aiming chart.

(2) Conventional aiming equipment should be used when aiming head lights; however, head light beam can be accurately adjusted as follows:

(*a*) Position unloaded vehicle on level floor with head lights 25 feet from a smooth vertical surface such as a wall or door, preferably of light color. Centerline of vehicle must be perpendicular to the vertical surface (fig. 81).

(*b*) Measure height of head light center from floor; then draw a horizontal line on vertical surface at this height. Draw a second line parallel with and three inches below the first line.

(*c*) Locate point at which projected centerline of vehicle intersects these lines. Measure distance between head light centers; then divide this distance equally on both sides of center mark. Draw a verical line through each of these ponts (fig. 81).

(*d*) Unlatch head light grille door at top and swing door down. Remove three screws attaching head light door (rim) to head light body and remove door.

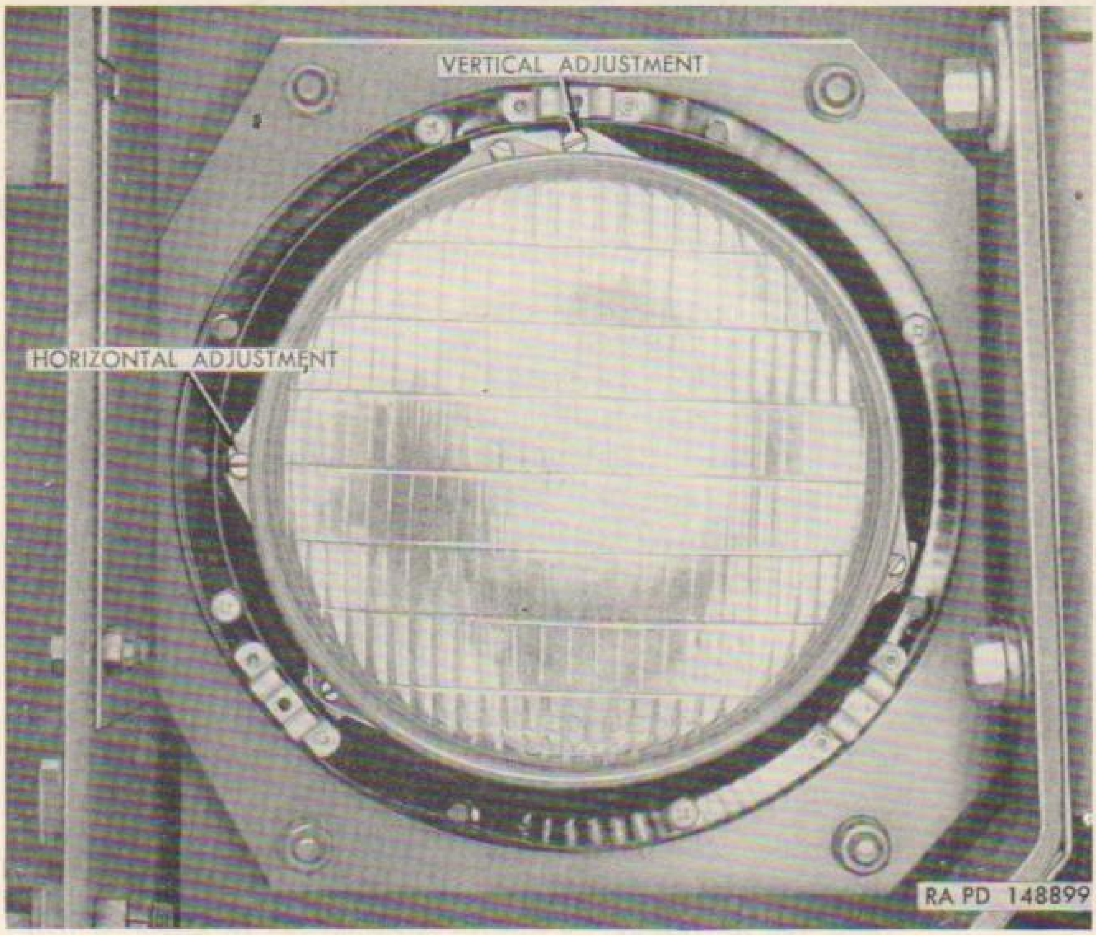


Figure 82. Head light beam adjusting screws.

Turn head lights on (par. 42) and select high beam with dimmer switch.

(*e*) Cover one head light while adjusting the other. Aim light beam with two adjusting screws (fig. 82). Top screw provides vertical adjustment and side screw provides horizontal adjustment. Turn adjusting screws as necessary to obtain a beam pattern as near as possible to that shown in figure 83.

(*f*) Install head light door (rim) and attach to body with three screws. Close head light grille door. Cover head light on which adjustment is completed while adjusting the other head light.

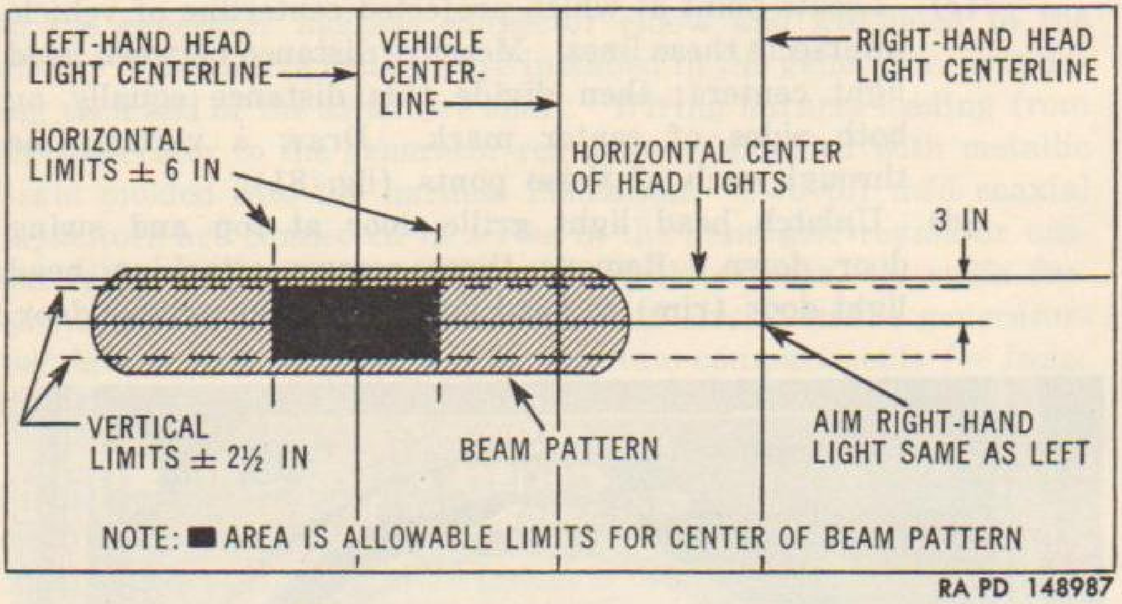


Figure 83. Head light beam pattern.

b. SEALED-BEAM LAMP UNIT REPLACEMENT.

(1) *Removal* (fig. 84).

(*a*) Unlatch head light grille door at top and swing door down. Remove three screws attaching head light door (rim) to head light body and remove door.

(*b*) Remove three screws attaching sealed-beam lamp unit retaining ring to head light body and remove ring.

(*c*) Pull sealed-beam lamp unit from body, disengage connectors from clips in body, and disconnect cables at bayonet type connectors.

(2) *Installation* (fig. 84).

(*a*) Connect cables on new sealed-beam lamp unit to cables in light body, making sure numbers on cable tags are matched. Engage connectors in clips in light body.

(b) Position sealed-beam lamp unit in light body, install retaining ring, and attach with three screws.

(c) Adjust head light beam (*a* above); then install head light door (rim) and attach with three screws. Close head light grille door.

c. HEAD LIGHT ASSEMBLY REPLACEMENT.

(1) *Removal.*

(a) Disconnect two head light cables (Nos. 17 and 18) at bayonet type connectors (fig. 85). Remove front

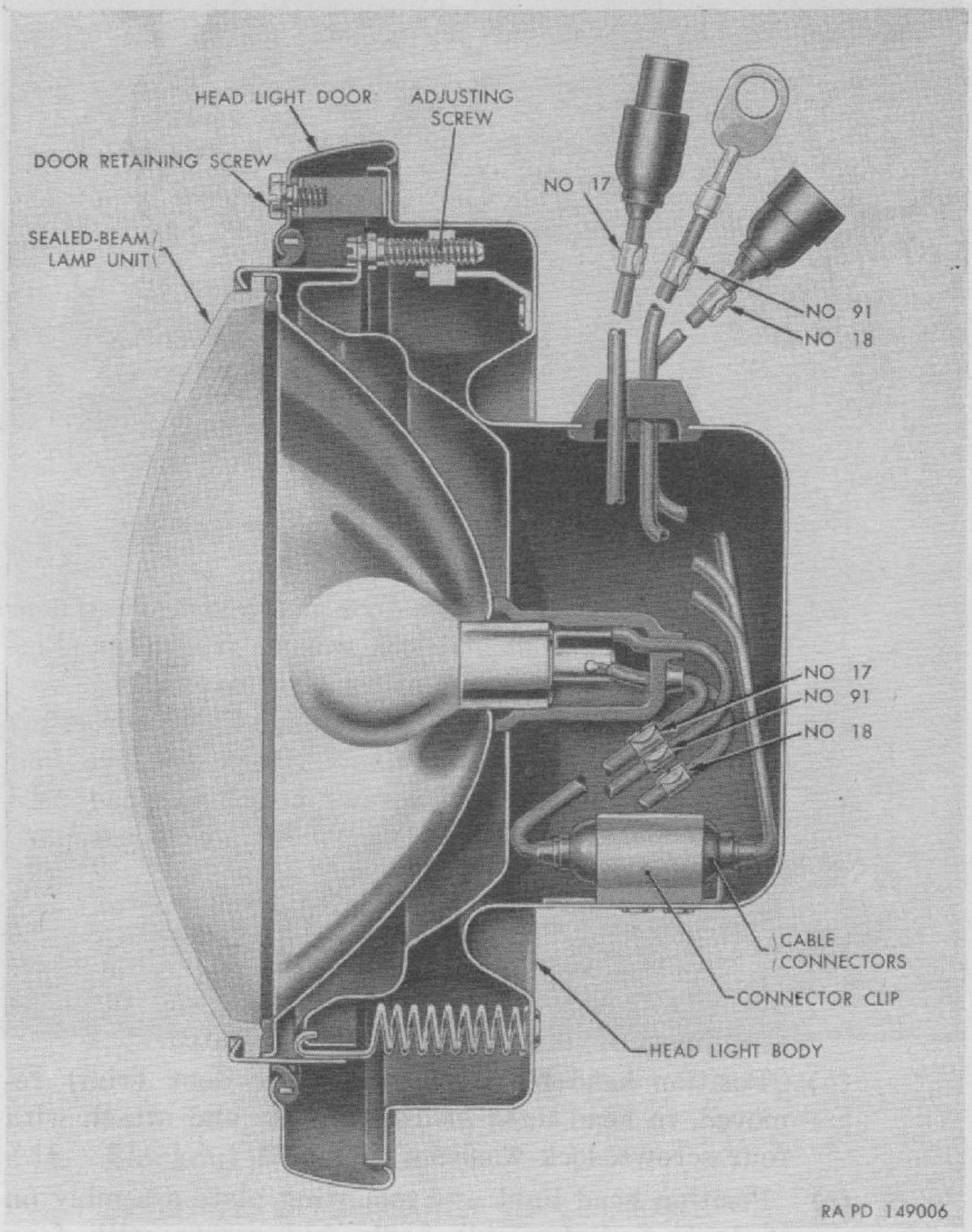


Figure 84. Sectional view of head light.

marker light mounting cap screw and lock washer attaching head light ground cable (No. 91) to radiator side baffle. Disengage ground cable from clip on radiator side baffle.

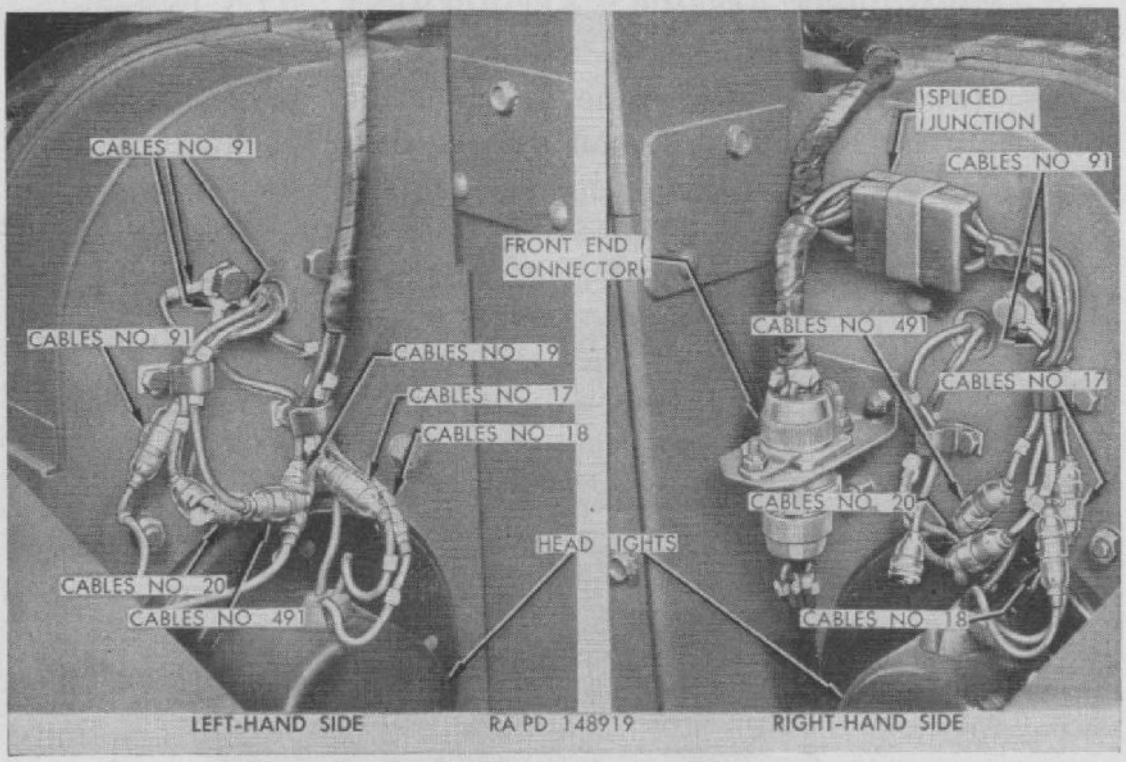


Figure 85. Head light and marker light wiring connections.

(*b*) Unlatch head light grille door at top and swing door down. Remove nut and lock washer from four studs securing head light mounting plate assembly.

(*c*) Remove three screws attaching head light door (rim) to head light body and remove door. Remove four nuts, lock washers, and screws attaching head light body to mounting plate. Remove head light assembly from mounting plate.

(2) *Installation.*

(*a*) Examine insulators on head light mounting studs in radiator side baffle. Replace stud and insulator assemblies if insulators are deteriorated.

(*b*) Position head light assembly, with door (rim) removed, in head light mounting plate and attach with four screws, lock washers, and nuts.

(*c*) Position head light and mounting plate assembly on studs in radiator side baffle and secure with four nuts and lock washers (fig. 86).

(d) Attach head light ground cable (No. 91) under head of front marker light mounting cap screw, using toothed lock washer under cap screw head (fig. 85). Connect the other two headlight cables (Nos. 17 and 18) to harness cables having same numbers. Secure cables in clip on radiator side baffle.

(e) Adjust head light beam (*a* above); then install head light door (rim) and attach with three screws. Close head light grille door.

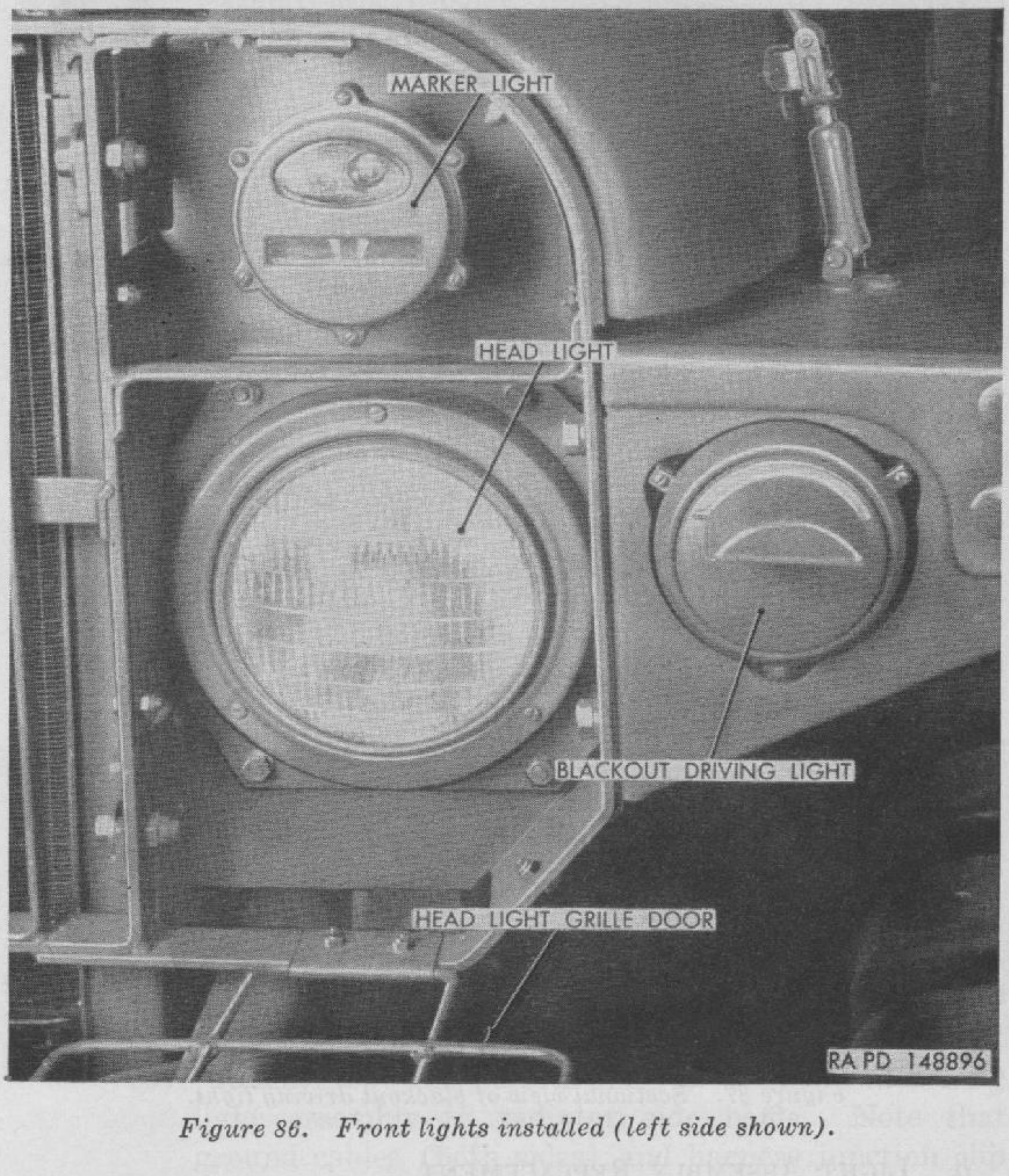


Figure 86. Front lights installed (left side shown).

144. Blackout Driving Light

a. SEALED-BEAM LAMP UNIT REPLACEMENT.

(1) *Removal* (fig. 87). Unscrew three screws attaching door to light body and remove door. Pull sealed-beam

unit out of body, disengage connectors from clips in body, and disconnect cables at connectors.

(2) *Installation* (fig. 87). Connect cables on new sealed-beam unit to cables in body, making sure numbers on cables are matched. Engage connectors in clips in body. Position sealed-beam unit in body, install door, and attach with three screws.

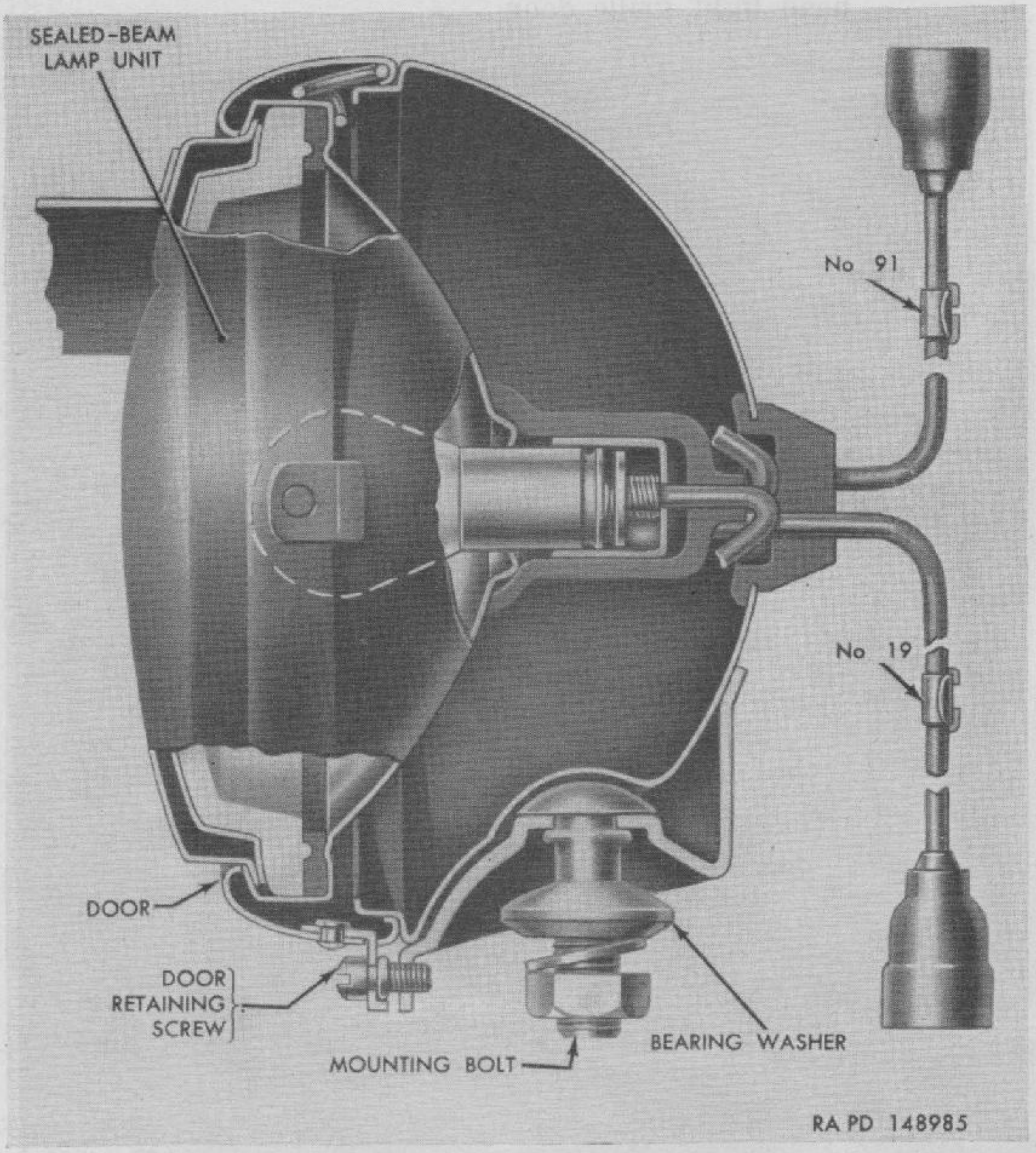


Figure 87. Sectional view of blackout driving light.

b. LIGHT ASSEMBLY REPLACEMENT.

(1) *Removal.*

(*a*) Disconnect light cables from harness cables at rear of left-hand radiator side baffle (cable Nos. 91 and 19, fig. 85). Remove grommet from fender skirt, pull cables through hole in skirt, and disengage cables from clip on skirt.

(*b*) Remove nut, lock washer, and bearing washer from light mounting bolt under fender. Remove light assembly from fender socket.

(2) *Installation.*

(*a*) Insert light cables through hole in light socket and position light assembly in socket with mounting bolt through bottom hole in socket. Install bearing washer, lock washer, and nut on bolt. Hold light with beam visor horizontal and pointing straight ahead while tightening nut.

(*b*) Insert cables through hole in fender skirt, place grommet around cables, and install in hole in skirt. Engage cables in clip on fender skirt.

(*c*) Connect light cables to harness cables at rear of radiator side baffle (fig. 85), making sure numbers on cables are matched.

145. Front Marker Lights

a. Door and lamp replacement (fig. 88).

(1) Removal. Unscrew six door retaining screws; then remove door and lens assembly and door sealing gasket. Press lamp in and turn counterclockwise to remove from socket.

(2) *Installation.* Press new lamp into socket and turn clockwise to lock in place. Examine door sealing gasket. If not in good condition, place new gasket in groove in door. Install door and lens assembly and attach with six screws.

b. MARKER LIGHT ASSEMBLY REPLACEMENT.

(1) *Removal.*

(*a*) Disengage marker light cables from clip on back of radiator side baffle; then disconnect cables from harness at bayonet connectors (fig. 85).

(*b*) Remove two cap screws and lock washers attaching light assembly to radiator side baffle. Note that ground cables (both sides) and harness junction clip (right side) are secured under cap screw heads.

(2) *Installation.*

(*a*) Insert light cables through hole in radiator side baffle and position light assembly against baffle. Attach light assembly to baffle with two cap screws and toothed lock washers, making sure ground cables (both sides) and harness junction clip (right side) are secured under cap screw heads.

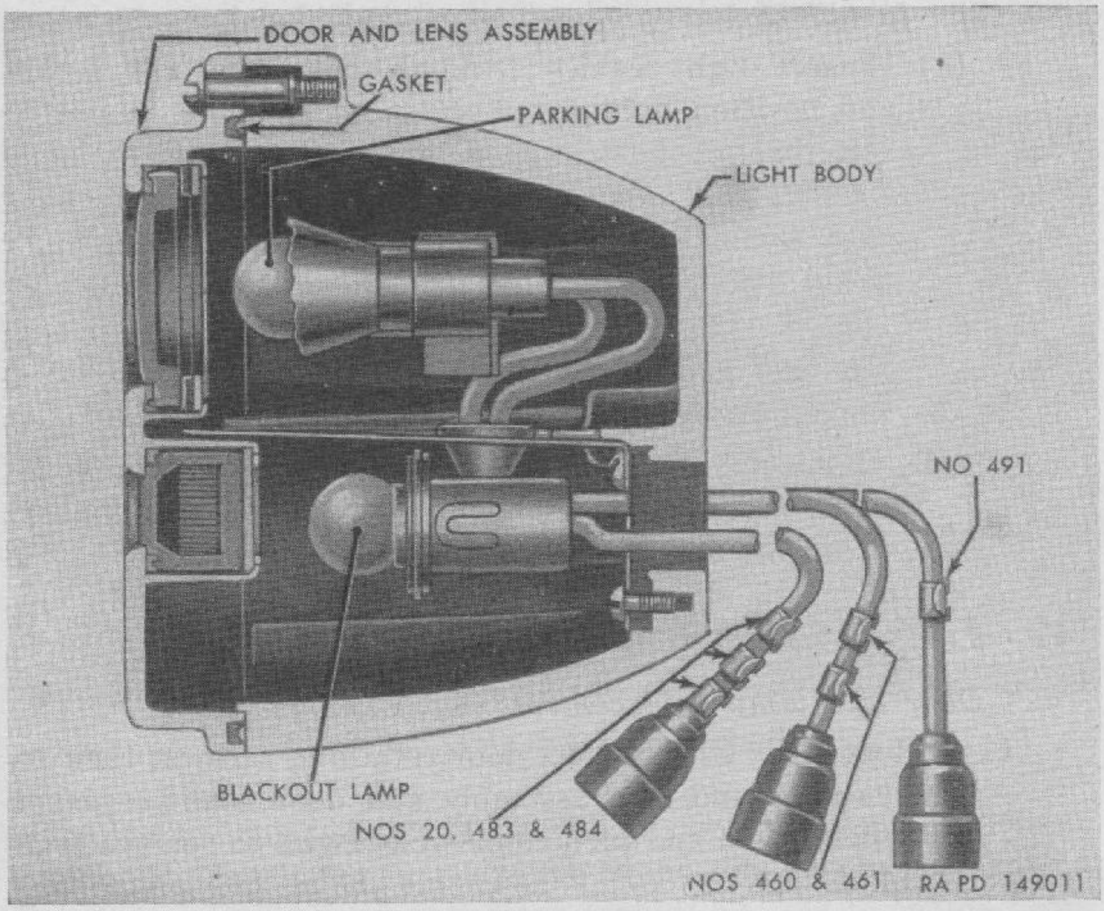


Figure 88. Sectional view of front marker light.

(*b*) Connect cable having three tags (Nos. 20, 483, and 484) (fig. 88) to harness cable No. 20 (fig. 85). Connect cable having one tag (No. 491) to harness cable No. 491. Other cable (Nos. 460 and 461) is not used. Secure cables in clip on back of radiator side baffle.

146. Stop and Tail Light

a. Door and Lamp Replacement (fig. 89). Door and lamp replacement is same as described for front marker lights (par. 145*a*).

b. Stop and Tail Light Assembly Replacement.

(1) *Removal.* Disengage light cables from clip. Disconnect light cables from harness at bayonet type connectors. Remove two cap screws and lock washers attach-

ing light assembly to bracket. Note that cable and harness clips are secured under cap screw heads.

(2) *Installation.* Insert cables through hole in bracket, position light assembly against bracket, and attach with two cap screws and toothed lock washers. Make sure cable and harness clips are installed under each cap screw head. Connect light cables to harness, making sure cable numbers are matched. There are three light cables on left-hand light and two on right-hand lamp.

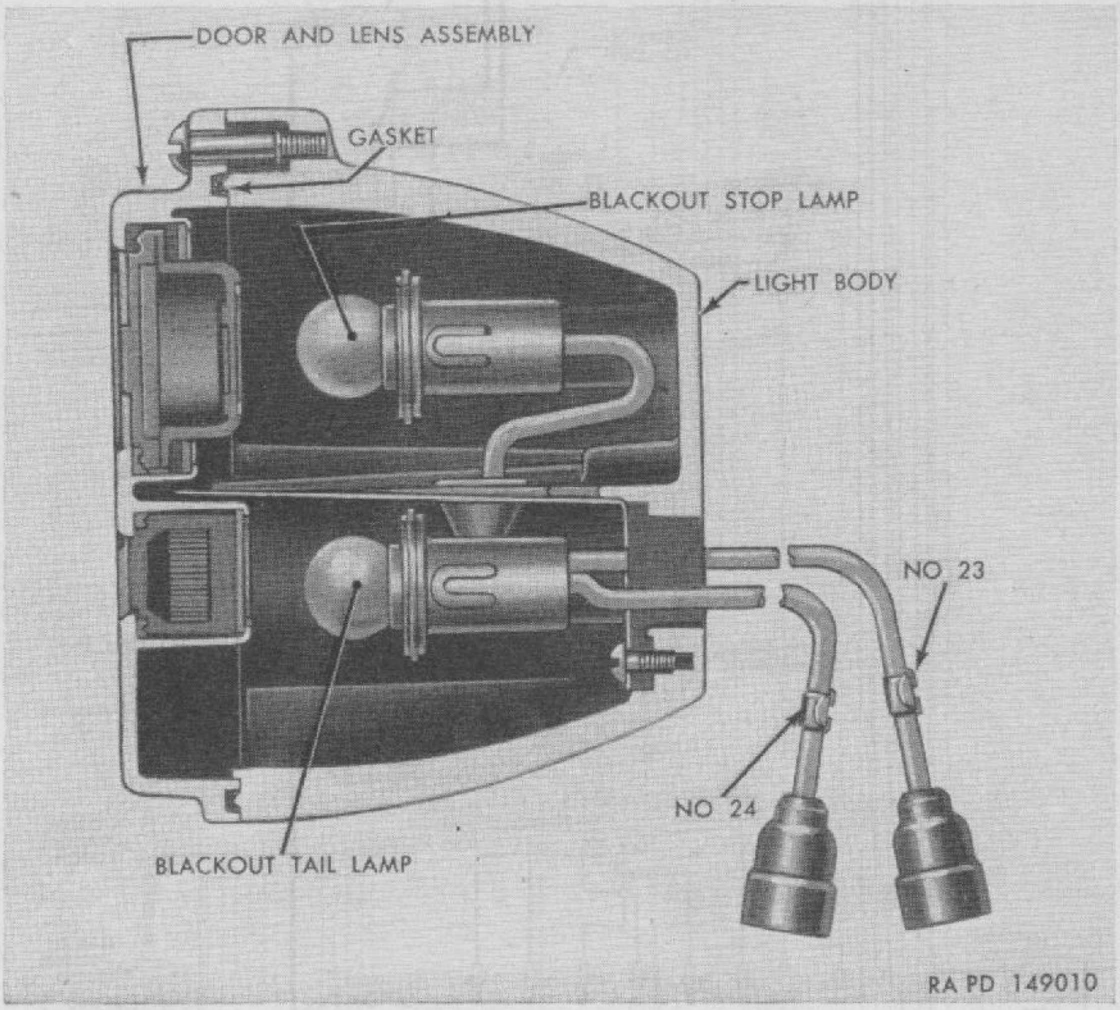


Figure 89. Sectional view of blackout stop and tail light.

147. Instrument Panel Lamps

a. REMOVAL. Remove four bolts attaching instrument cluster (fig. 91) to instrument panel and tip cluster down. To remove either of the three lamps, press back shell in and turn counterclockwise to release from body. With backshell removed, lamp is exposed. Press lamp in and turn counterclockwise to release from socket.

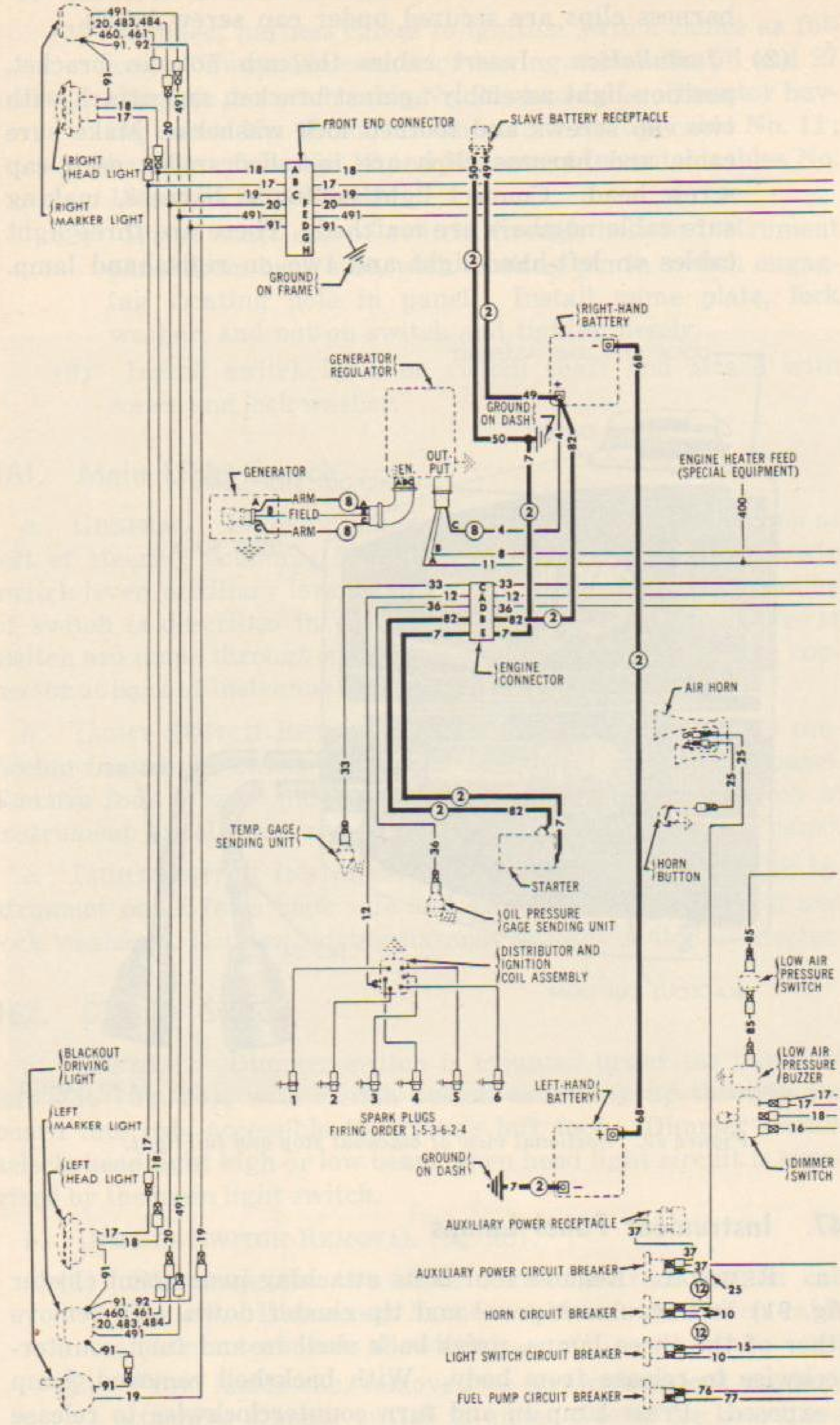


Figure 90. Wiring circuit diagram.

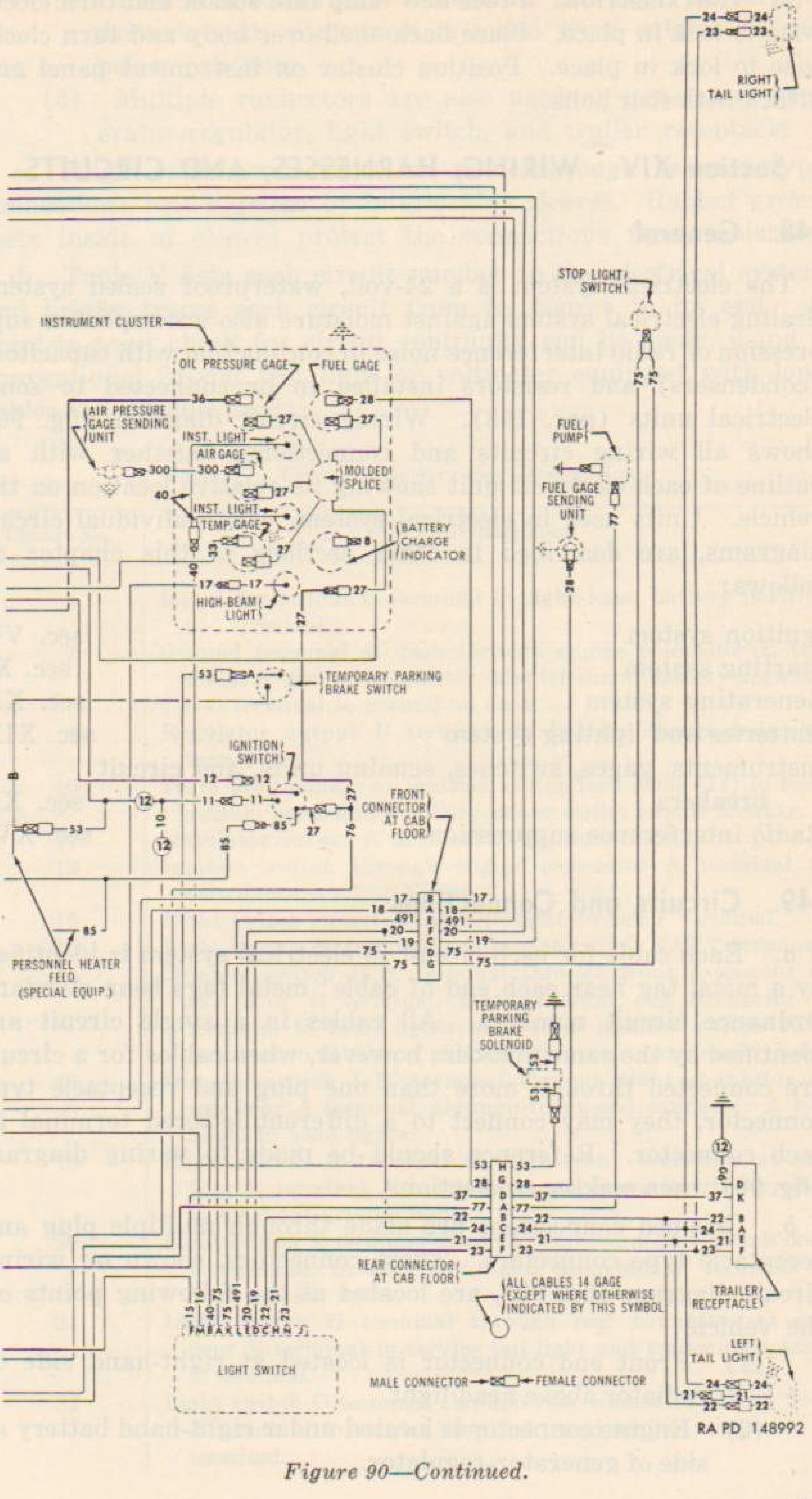


Figure 90—Continued.

b. INSTALLATION. Press new lamp into socket and turn clockwise to lock in place. Place back shell over body and turn clockwise to lock in place. Position cluster on instrument panel and attach with four bolts.

Section XIV. WIRING, HARNESSES, AND CIRCUITS

148. General

The electrical system is a 24-volt, waterproof sealed system. Sealing electrical system against moisture also accomplishes suppression of radio interference noise in conjunction with capacitors (condensers) and resistors installed in or connected to some electrical units (par. 168). Wiring circuit diagram (fig. 90) shows all wiring circuits and connections, together with an outline of each electrical unit showing its relative location on the vehicle. Units used in electrical system, with individual circuit diagrams, are described in other sections of this chapter as follows:

Ignition system .... sec. VII
Starting system .... sec. XI
Generating system .... sec. XII
Batteries and lighting system .... sec. XIII
Instruments, gages, switches, sending units, and circuit
breakers .... sec. XV
Radio interference suppression .... sec. XVI

149. Circuits and Connections

a. Each cable for each circuit in electrical system is identified by a metal tag near each end of cable; metal tags bear standard Ordnance circuit numbers. All cables in a single circuit are identified by the same number; however, when cables for a circuit are connected through more than one plug and receptacle type connector, they may connect to a different lettered terminal at each connector. Reference should be made to wiring diagram (fig. 90) when making connections.

b. Grouped connections are made through multiple plug and receptacle type connectors. These connectors, shown on wiring circuit diagram (fig. 90), are located at the following points on the vehicle:

(1) Front end connector is located at right-hand side of radiator above head light.

(2) Engine connector is located under right-hand battery at side of generator-regulator.

(3) Two connectors are located in cab floor at left of driver's seat; disconnect is made from outside of cab below cab floor.

(4) Multiple connectors are also used at generator, generator-regulator, light switch, and trailer receptacle.

c. Single cable connections are made through bayonet type connections, held together by interlocking sleeves. Rubber grommets inside of sleeves protect the connections from moisture.

d. Table V lists each circuit number in the electrical system and briefly traces each circuit from its source to its end. A point-to-point check for circuit continuity can be made, using a conventional 24-volt test light or voltmeter equipped with long cables and suitable prods.

Table V. Circuit Numbers and Descriptions

Circuit No.	Circuit description
4	Regulator output C terminal to right-hand battery positive (+) terminal.
7	Ground terminal at dash through engine connector E terminal to ground on starter; also left-hand battery negative (−) terminal to ground on dash.
8	Regulator output B terminal to battery charge indicator terminal.
10	From tap junction on ignition switch feed cable (11) to light switch, horn, and auxiliary power outlet circuit breaker.
11	Regulator output A terminal to ignition switch.
12	Ignition switch through engine connector A terminal to distributor.
15	Light switch circuit breaker to light switch F terminal.
16	Light switch M terminal to dimmer switch BATT terminal.
17	Dimmer switch H.B. terminal through front connector at cab floor B terminal, through front end connector B terminal to head lights; also from dimmer switch H.B. terminal to Hi-Beam indicator lamp on instrument panel.
18	Dimmer switch L.B. terminal through front connector at cab floor A terminal, through front end connector A terminal to head lights.
19	Light switch D terminal through front connector at cab floor C terminal, through front end connector C terminal to blackout driving light.
20	Light switch E terminal through front connector at cab floor F terminal, through front end connector F terminal to front marker lights.
21	Light switch H terminal through rear connector at cab floor E terminal to service tail light and trailer receptacle E terminal.
22	Light switch C terminal through rear connector at cab floor B terminal to service stop light and trailer receptacle B terminal.

Table V—Continued

Circuit No.	Circuit description
23	Light switch N terminal through rear connector at cab floor F terminal to right blackout tail light and trailer receptacle F terminal.
24	From tap junction in front marker light feed cable (20) near front connector at cab floor through rear connector at cab floor C terminal to blackout tail lights and trailer receptacle A terminal.
25	Horn circuit breaker through horn solenoid valve to horn button.
27	Ignition switch through molded splice to all gages.
28	Fuel gage through rear connector at cab floor G terminal to fuel gage sending unit.
33	Temperature gage through engine connector C terminal to temperature gage sending unit.
36	Oil pressure gage through engine connector D terminal to oil pressure gage sending unit.
37	Auxiliary power circuit breaker to auxiliary power outlet and auxiliary power circuit breaker through rear connector at cab floor D terminal to trailer receptacle K terminal.
40	Light switch B terminal to instrument panel lights.
49	Right battery positive (+) terminal to slave battery receptacle positive (+) terminal.
50	Slave battery receptacle negative (−) terminal to ground on dash.
53	From junction in ignition switch feed (No. 11) to temporary parking brake switch; from temporary parking brake switch through rear connector at cab floor H terminal to temporary parking brake solenoid.
68	Right-hand battery negative (−) terminal to left-hand battery positive (+) terminal.
75	Light switch A terminal through front connector at cab floor D terminal to stop light switch, then back through front connector at cab floor G terminal to light switch K terminal.
76	From tap junction on cable No. 27 near ignition switch to fuel pump circuit breaker.
77	Fuel pump circuit breaker through rear connector at cab floor A terminal to fuel pump in fuel tank.
82	Right-hand battery positive (+) terminal through engine connector B terminal to starter switch.
85	Ignition switch through low air pressure switch to low air pressure buzzer.
90	Trailer receptacle D terminal to ground.
91	From all front end lights through front end connector D terminal to ground on frame.
300	Air pressure gage to air gage sending unit.
460 and 461	Front marker light signal lamps—Not used on these vehicles.
491	Light switch L terminal through front connector at cab floor E terminal, through front end connector E terminal to front marker lights.

e. Terminals at plug and receptacle type connectors are identified by letters which appear on both halves of the connector. Table VI which follows lists the lettered terminals at each connector, the circuit number of the cable connected at each terminal, and the name of the circuit carried through each terminal.

Table VI. Connector Tabulation

Plug and receptacle letter	Cable number	Circuit
(1) *Front end connector.*		
A	18	Head light low beam
B	17	Head light high beam
C	19	Blackout driving light
D	91	Ground on frame for all front end lights
E	491	Front parking lights
F	20	Front blackout marker lights
G and H	...	Open
(2) *Engine connector.*		
A	12	Distributor feed
B	82	Starter
C	33	Engine temperature gage
D	36	Oil pressure gage
E	7	Dash to starter ground
(3) *Front connector at cab floor.*		
A	18	Head light low beam
B	17	Head light high beam
C	19	Blackout driving light
D	75	Stop light switch feed
E	491	Front parking lights
F	20	Front blackout marker lights
G	75	Stop light switch return
H	...	Open
(4) *Rear connector at cab floor.*		
A	77	Fuel pump
B	22	Service stop light
C	24	Blackout tail light
D	37	Auxiliary power
E	21	Service tail light
F	23	Blackout stop light
G	28	Fuel gage
H	12	Temporary parking brake

Table VI—Continued

Connector Tabulation

Plug and receptacle letter	Cable number	Circuit
(5) *Light switch.*		
A	75	Stop light switch feed
B	40	Instrument lights
C	22	Service stop light
D	19	Blackout driving light
E	20	Front blackout marker lights
F	15	Light switch feed
H	21	Service tail light
J	...	Open
K	75	Stop light switch return
L	491	Front parking lights
M	16	Dimmer switch
N	23	Blackout stop light
(6) *Regulator output.*		
A	11	Ignition switch feed
B	8	Battery charge indicator
C	4	Regulator to battery

150. Wiring and Harnesses

a. WIRING. All cables are covered with rubber insulation and cable ends are soldered to their connecting plug or receptacle. All cables are 14 gage unless otherwise noted on wiring circuit diagram (fig. 90). Numeral within circle indicates gage size of cable. When replacing any cable, always use 14 gage unless otherwise indicated on wiring circuit diagram. Never replace a cable with one of a smaller size. Cable ends must be soldered to their connecting plug or receptacle, using rosin flux solder. Never use acid flux solder on electrical connections.

b. HARNESS.

(1) When a group of cables lead from one general location on the vehicle to another, these cables are grouped together to form a harness. Harnesses are wound with waterproof electrical tape. Ends of harnesses usually terminate at multiple plug and receptacle type connectors; however, one or more cables may branch out from various points on a harness.

(2) Any harness is readily replaceable by disconnecting each end and single cables leading from the harness, and disengaging harness from clips securing the harness at

various points on the vehicle. On multiple connectors, make sure locating key and keyway are alined before attempting to insert plug. Do not force plug into receptacle. If properly alined, plug will enter receptacle under light pressure. Make sure rubber sealing gasket or ring is in place before tightening connector nuts.

(3) Following is a list of harnesses used on these vehicles, together with a brief description of their location on the vehicle.

(a) *Head light wiring harness.* This harness leads from front end connector at right side of radiator through a spliced junction, with cables leading to right front lights and across top of radiator to left front lights.

(b) *Engine wiring harness.* Engine harness carries cables from engine connector (at side of generator-regulator) to starter, distributor, and temperature and oil pressure gage sending units.

(c) *Instrument panel-to-regulator-and-engine-connector wiring harness.* This harness, having single cable bayonet type connectors connected to various units under instrument panel, terminates at two multiple plug and receptacle type connectors, one connecting to generator-regulator output connector, the other connecting to engine connector at side of regulator.

(d) *Instrument panel-to-cab-floor wiring harness.* This harness leads from light switch to two connectors at cab floor at left of driver's seat.

(e) *Cab-to-head-light wiring harness.* This harness carries cables from front connector at cab floor, under back of cab to right-hand frame side rail, then forward inside of frame side rail to front end connector at right side of radiator.

(f) *Chassis wiring harness.* This harness leads from rear connector at cab floor rearward inside of frame left side rail. Near rear end of vehicle, it is divided at a spliced junction, with one group of cables leading to right stop and tail light, and one group leading to left stop and tail light and to trailer receptacle.

151. Auxiliary Power Outlet

Auxiliary power outlet (fig. 95) is an electrical receptacle mounted on steering column brace in cab. Circuit to auxiliary power receptacle in cab and to auxiliary power terminal (K) at trailer receptacle is fed from hot terminal on ignition switch through a 15 amp circuit breaker which is also mounted on steering column brace in cab. When not in use, a sealing cap is screwed onto receptacle. Cap is secured to dash by a ball-type chain.

Section XV. INSTRUMENTS, GAGES, SWITCHES, SENDING UNITS, AND CIRCUIT BREAKERS

152. General

a. INSTRUMENT CLUSTER. The instrument cluster, located in center of instrument panel, contains the voltmeter, engine temperature gage, oil pressure gage, fuel gage, air pressure gage, and speedometer. Instrument lights and high-beam indicator light are mounted on back of instrument cluster (fig. 91). Instrument cluster may be replaced as a complete unit (par. 153), or each unit may be replaced separately as described in individual paragraphs.

b. GAGES AND SENDING UNITS. All gages except the speedometer are electrically operated, and are activated only when the ignition switch is turned on. Circuits to all gages are fed through the ignition switch; circuits are grounded at the sending units which control the gage actions. Sending units are actually rheostat type resistance units which automatically increase or decrease resistance in gage circuits according to the condition existing in the system controlling each circuit. Gage and sending unit replacement procedures are described in individual paragraphs.

c. SWITCHES. Ignition switch, light switch, dimmer switch, and horn switch (button) are manually operated. Stop light switch is automatically controlled by the hydraulic brake system, and low air pressure switch is automatically controlled by air pressure in the air system.

d. CIRCUIT BREAKERS. Four automatic reset type circuit breakers are used in the electrical system, protecting the fuel pump, light, horn, and auxiliary power circuits. Circuit breakers are mounted on under side of steering column brace (fig. 95). Connections at all circuit breakers are made through bayonet type connectors.

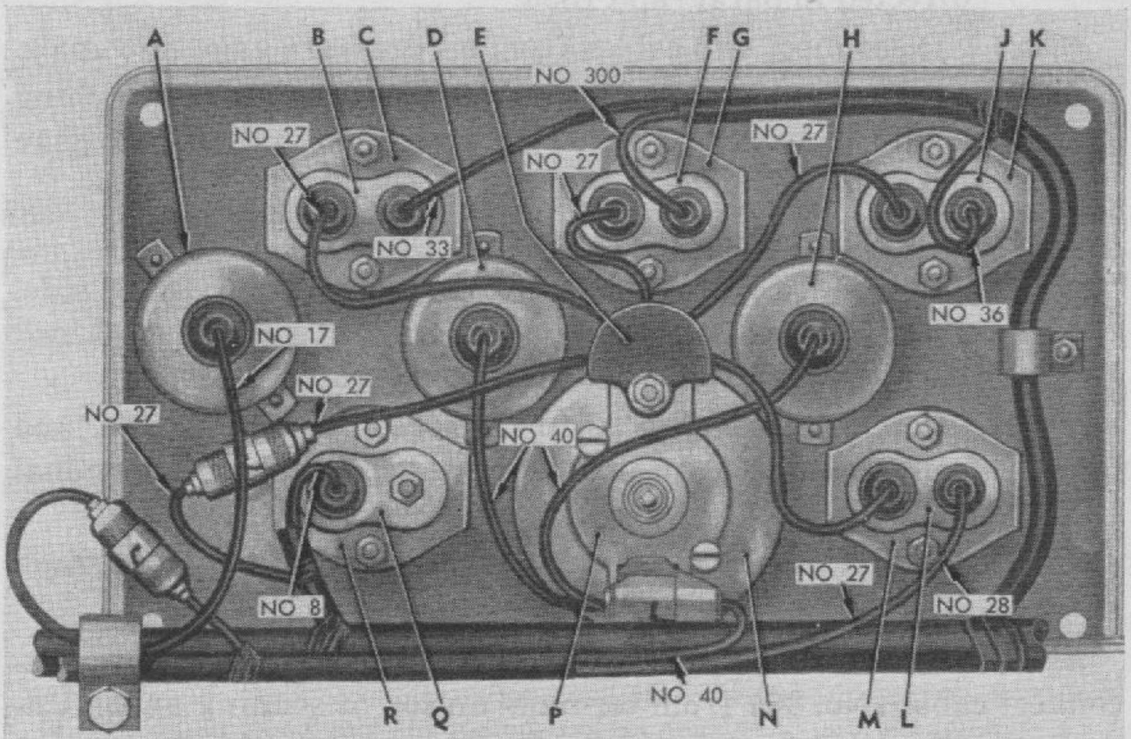
153. Instrument Cluster

a. INSTRUMENT CLUSTER REMOVAL (fig. 91).

(1) Disconnect speedometer flexible shaft from speedometer at rear of instrument cluster.

(2) Remove four bolts attaching instrument cluster to instrument panel. Tip cluster out from instrument panel, disengaging harness from clip at right side of cluster.

(3) Replacement of individual units in instrument cluster can be made with cluster in this position. To remove complete cluster assembly, disconnect all harness cables from units on cluster.



A—HIGH BEAM INDICATOR LIGHT
B—TEMPERATURE GAGE
C—TEMPERATURE GAGE CLAMP
D—INSTRUMENT LIGHT
E—MOLDED SPLICE
F—AIR PRESSURE GAGE
G—AIR PRESSURE GAGE CLAMP
H—INSTRUMENT LIGHT
J—OIL PRESSURE GAGE
K—OIL PRESSURE GAGE CLAMP
L—FUEL GAGE
M—FUEL GAGE CLAMP
N—SPEEDOMETER
P—SPEEDOMETER CLAMP
Q—VOLTMETER
R—VOLTMETER CLAMP

RA PD 148975

Figure 91. Instrument cluster—rear view.

b. INSTRUMENT CLUSTER INSTALLATION (fig. 91).

(1) If instrument cluster assembly was completely removed, position cluster at instrument panel and connect harness cables to instrument cluster units. Refer to figure 91 or to wiring diagram (fig. 90) to identify number on each cable and unit to which it connects.

(2) Engage harness in clip at right-hand end of instrument cluster, position cluster against instrument panel, and attach with four bolts.

(3) Connect speedometer flexible shaft to speedometer at rear of cluster.

154. Oil Pressure Gage and Sending Unit

e. GENERAL. Oil pressure gage registers oil pressure in engine main oil gallery. Gage circuit is controlled by a sending-unit mounted on right-hand side of engine above starter and connected to oil line leading from engine oil gallery to oil filter (fig. 92).

b. Oil Pressure Gage Removal (fig. 91).

(1) Remove instrument cluster from instrument panel as directed in paragraph 153*a*.

(2) Disconnect two cables from oil pressure gage terminals.

(3) Remove nut and lock washer from two studs attaching clamp to back of gage. Remove clamp; then pull gage out front of cluster.

c. Oil Pressure Gage Installation (fig. 91).

(1) Position gage in instrument cluster from front side. Place clamp over two studs on back of gage, install lock washer and nut on each stud, and tighten nuts.

(2) Connect cable No. 36 to female terminal on gage, and connect cable No. 27 from molded splice to male terminal on gage.

(3) Install instrument cluster as directed in paragraph 153*b*.

d. Oil Pressure Gage Sending Unit Removal (fig. 92). Disconnect cable (No. 36) from terminal on top of sending unit. Unscrew sending unit from bracket on engine cylinder block.

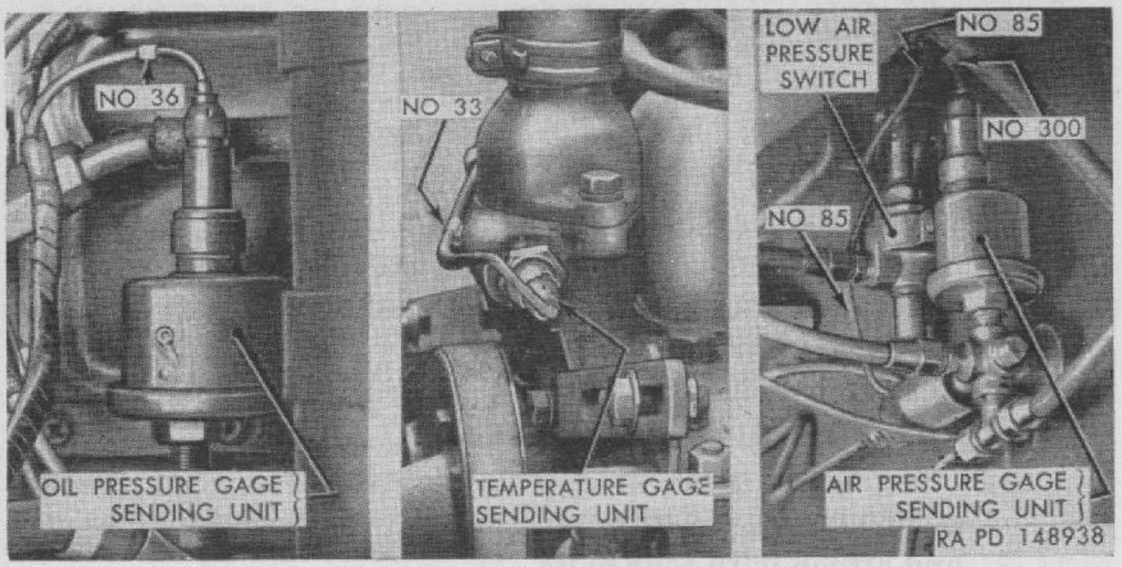


Figure 92. Sending units and low air pressure switch installed.

e. Oil Pressure Gage Sending Unit Installation (fig. 92). Coat threads of sending unit with plastic type gasket cement and thread unit into bracket on engine cylinder block. Connect cable No. 36 to terminal on top of sending unit.

155. Fuel Gage and Sending Unit

a. GENERAL. Fuel gage in instrument cluster registers level of fuel in fuel tank. Fuel gage circuit is controlled by a sending unit installed in fuel tank. Sending unit action is controlled by a float and linkage mechanism which extends down into tank.

b. FUEL GAGE REPLACEMENT (fig. 91). Fuel gage replacement procedure is same as previously described for oil pressure gage (par. 154). Cable No. 27 from molded splice connects to gage male terminal, and cable No. 28 connects to gage female terminal.

c. FUEL GAGE SENDING UNIT REMOVAL. Disconnect cable from sending unit terminal on top of fuel tank. Remove five screws and gaskets attaching sending unit to tank. Lift complete sending unit and float mechanism out of tank.

d. FUEL GAGE SENDING UNIT INSTALLATION. Coat new gasket with liquid type gasket cement and place gasket on tank. Insert float mechanism into tank and position with sending unit terminal pointing toward frame side rail. Install five screws, with new gaskets, and tighten securely. Connect cable No. 28 to sending unit terminal.

156. Temperature Gage and Sending Unit

a. GENERAL. Temperature gage in instrument cluster registers temperature of engine coolant in degrees Fahrenheit. Temperature gage circuit is controlled by a temperature-gage sending-unit installed in engine thermostat housing (fig. 92).

b. TEMPERATURE GAGE REPLACEMENT (fig. 91). Temperature gage replacement procedure is same as previously described for oil pressure gage (par. 154). Cable No. 27 from molded splice connects to gage male terminal, and cable No. 33 connects to gage female terminal.

c. TEMPERATURE GAGE SENDING UNIT REMOVAL (fig. 92). Disconnect cable from sending unit terminal. Unscrew sending unit from engine thermostat housing.

d. TEMPERATURE GAGE SENDING UNIT INSTALLATION (fig. 92). Coat threads on sending unit with plastic type gasket cement and thread sending unit into engine thermostat housing. Connect cable No. 33 to sending unit terminal.

157. Air Pressure Gage and Sending Unit

a. GENERAL. Air pressure gage in instrument cluster registers air pressure in air system. Air pressure gage circuit is controlled by a sending unit. Sending unit is mounted on dash inside cab and is connected to air system at air line junction fitting on dash (fig. 92).

b. Air Pressure Gage Replacement (fig. 91). Air pressure gage replacement procedure is same as previously described for oil pressure gage (par. 154). Cable No. 27 from molded splice connects to gage male terminal, and cable No. 300 connects to gage female terminal.

c. Air Pressure Gage Sending Unit Removal (fig. 92). Exhaust air pressure from air system. Disconnect cable from sending unit terminal. Unscrew sending unit from air line junction fitting on dash.

d. Air Pressure Gage Sending Unit Installation (fig. 92). Coat threads of sending unit with plastic type gasket cement and thread unit into top of air line junction fitting on dash. Connect cable No. 300 to sending unit terminal.

158. Battery Charge Indicator

The battery charge indicator installed in instrument cluster, indicates charging activity of generating circuit. Replacement procedure is same as previously described for oil pressure gage (par. 154). Cable No. 8 connects to indicator terminal.

159. Speedometer and Flexible Shaft

a. General. Speedometer, in top center of instrument cluster, indicates truck speed in miles-per-hour, and records accumulated mileage. The LOW and HIGH RANGE markings around speedometer face are important with regard to driving the vehicle (ch. 2, sec. III). Speedometer is driven by a flexible shaft which is connected to an adapter at the transfer.

b. Speedometer Removal (fig. 91).

(1) Remove instrument cluster from instrument panel as directed in paragraph 153*a*.

(2) Disengage cable connector from clip on speedometer clamp.

(3) Remove nut and lock washer from two speedometer clamp studs. Remove cable connector clip from one stud and remove molded splice from other stud.

(4) Remove long stud and lock washer securing clamp to speedometer. Remove clamp, then remove speedometer from front of panel.

c. SPEEDOMETER INSTALLATION (fig. 91).

(1) Position speedometer in instrument cluster from front side. Position clamp over speedometer at back of cluster; install long stud and lock washer, and nut and lock washer attaching clamp to speedometer.

(2) Place molded splice on long stud and secure with lock washer and nut. Place cable connector clip on short stud and secure with lock washer and nut. Engage cable connector in clip.

(3) Install instrument cluster in instrument panel as directed in paragraph 153*b*.

d. SPEEDOMETER FLEXIBLE SHAFT REMOVAL.

(1) Disconnect speedometer flexible shaft from speedometer and from speedometer adapter at transfer.

(2) Remove three flexible shaft clips, one at front of dash above engine and two at floor sills under cab. Withdraw shaft through hole in dash and remove from under cab.

e. SPEEDOMETER FLEXIBLE SHAFT INSTALLATION.

(1) The square end of the flexible shaft connects to the speedometer, and tongued end connects to adapter at transfer. Insert square end of flexible shaft through hole in dash and position grommet around shaft in dash.

(2) Connect flexible shaft at speedometer and at adapter on transfer.

(3) Install three flexible shaft clips, one on dash above engine and two on floor sills under cab.

160. Ignition Switch

a. GENERAL. Lever type ignition switch is mounted at extreme left side of instrument panel. With ignition switch turned on, ignition circuit, gage circuits, and fuel pump circuit are energized.

b. IGNITION SWITCH REMOVAL.

(1) Remove screw and lock washer attaching switch lever to switch shaft. Pull lever off shaft.

(2) Remove nut and lock washer from ignition switch; then remove switch from under instrument panel. Ignition switch name plate will come off instrument panel.

(3) Disconnect harness cables No. 10 and 11 from switch cable No. 11; then disconnect other harness cables from switch cables.

c. IGNITION SWITCH INSTALLATION.

(1) Connect harness cables to ignition switch cables as follows: Two-cable connector having cables No. 76 and 27 connects to switch cable No. 27; two-cable connector having cables No. 10 and 11 connects to switch cable No. 11; harness cables No. 12 and 85 connect to switch cables No. 12 and 85 respectively.

(2) Insert shaft end of switch through hole in instrument panel from back side, with locating pin in switch engaging locating hole in panel. Install name plate, lock washer, and nut on switch and tighten firmly.

(3) Install switch lever on switch shaft and attach with screw and lock washer.

161. Main Light Switch

a. GENERAL. Light switch is mounted on instrument panel at left of steering column. Switch is three lever type, with main switch lever, auxiliary lever, and switch locking lever. Operation of switch is described in paragraph 42. Wiring connections at switch are made through a multiple plug and receptacle type connector at back of instrument panel.

b. LIGHT SWITCH REMOVAL. Disconnect wiring harness connector from light switch connector at back of instrument panel. Remove four screws and lock washers attaching light switch to instrument panel, then remove light switch from back of panel.

c. LIGHT SWITCH INSTALLATION. Position light switch in instrument panel from back side and attach with four screws and lock washers. Connect wiring harness to light switch connector.

162. Dimmer Switch

a. GENERAL. Dimmer switch is mounted under toe board at left side (fig. 93), with switch button extending up through toe board into cab, accessible to driver's left foot. Dimmer switch selects head light high or low beam when head light circuit is energized by the main light switch.

b. DIMMER SWITCH REMOVAL (fig. 93).

(1) Disengage the two cable connector from clip on cab floor sill. Disconnect harness cables from switch cable and from terminals at switch.

(2) From inside cab, remove two screws and lock washers attaching dimmer switch to under side of toe board and remove switch.

c. DIMMER SWITCH INSTALLATION (fig. 93).

(1) Position switch under toe board, with switch plunger extending up through toe board. Attach switch to toe board with two screws and lock washers, installed from inside cab.

(2) Connect the two-cable harness connector (cables No. 17) to switch cable connector; engage connector in clip on floor sill. Connect harness cable No. 16 to switch BATT terminal, and connect cable No. 18 to switch low-beam (L) terminal.

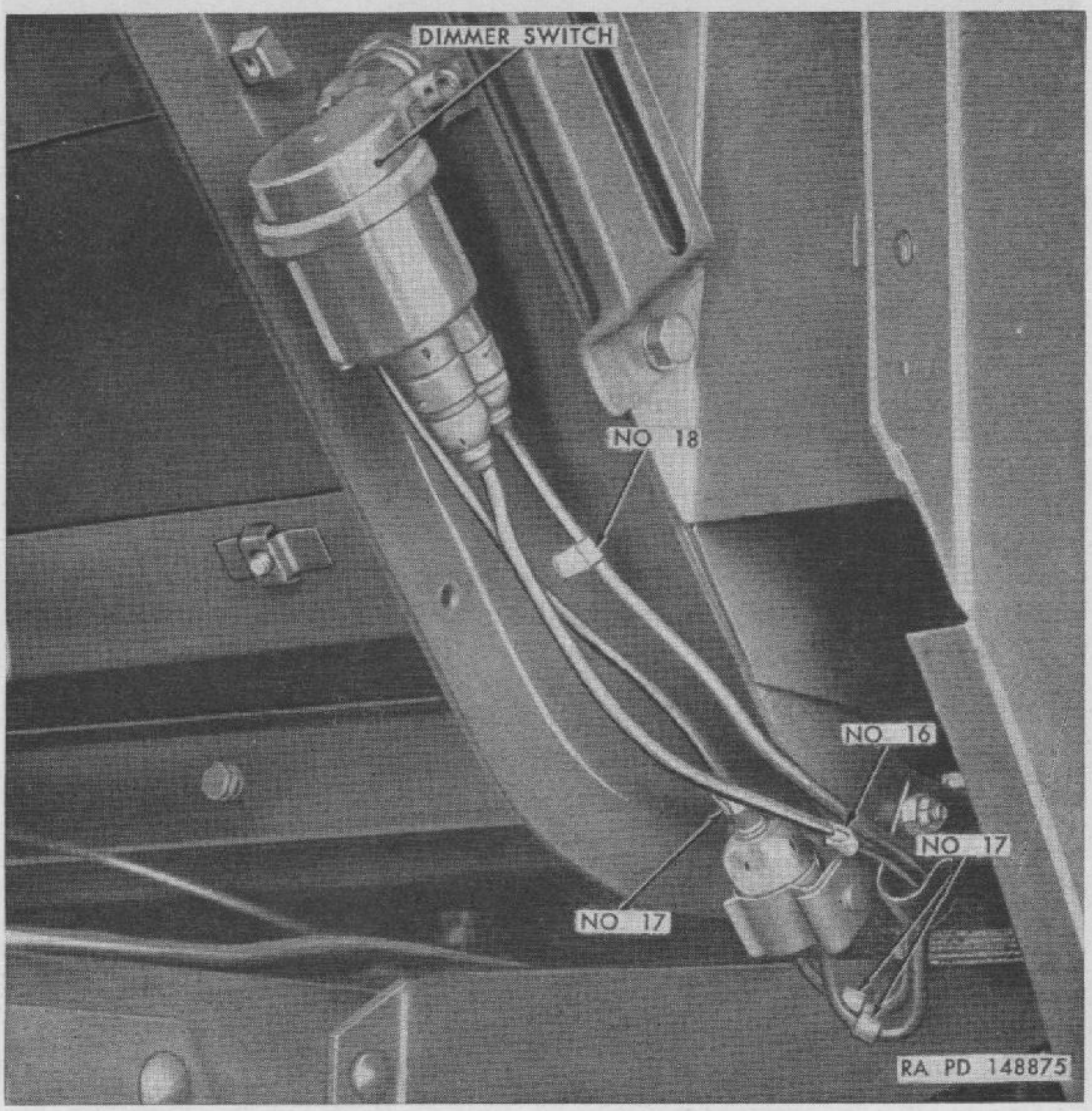


Figure 93. Dimmer switch installed.

163. Stop Light Switch

a. GENERAL. Hydraulically-operated stop light switch is connected into hydraulic brake line at frame right side rail ahead of right air tank (fig. 94). When brakes are applied, hydraulic pressure closes switch contacts, completing circuit to blackout or service stop light, depending upon which circuit is energized through the main light switch (par. 42).

b. STOP LIGHT SWITCH REMOVAL (fig. 94). Disconnect wiring harness connector from stop light switch terminals. Unscrew switch from tee fitting in hydraulic brake line. *Do not apply brakes with stop light switch removed.*

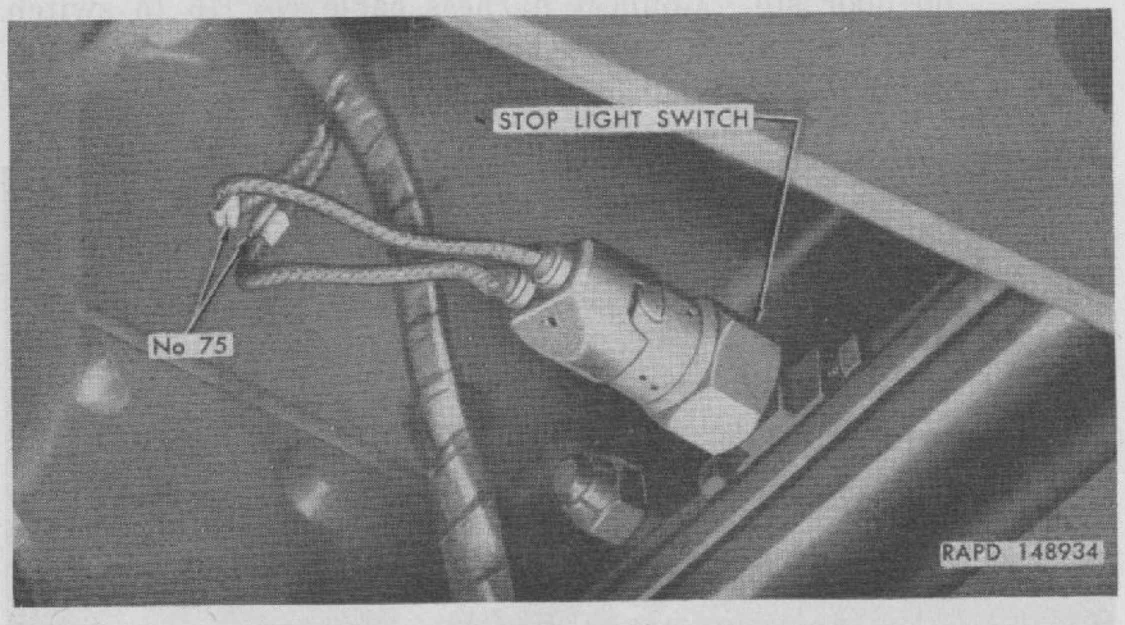


Figure 94. Stop light switch installed.

c. STOP LIGHT SWITCH INSTALLATION (fig. 94). Thread switch into tee fitting in hydraulic brake line and tighten firmly. Connect wiring harness connector (cables No. 75) to switch terminals. Bleed brakes (par. 219).

164. Circuit Breakers

a. GENERAL. Four automatic reset type circuit breakers are used in electrical system; protecting the fuel pump, light, horn, and auxiliary power circuits. Circuit breakers are mounted on under side of steering column brace (fig. 95). All connections at circuit breakers are made through bayonet type connectors.

b. CIRCUIT BREAKER REMOVAL (fig. 95). Disconnect wiring harness cable connectors from circuit breaker terminals. Remove two screws, nuts, and lock washers attaching circuit breaker to steering column brace and remove circuit breaker.

c. CIRCUIT BREAKER INSTALLATION (fig. 95). Position circuit breaker on steering column brace and attach with two screws, lock washers, and nuts. Connect wiring harness cables to circuit breaker terminals, referring to figure 95 for identification of cables connecting to each circuit breaker.

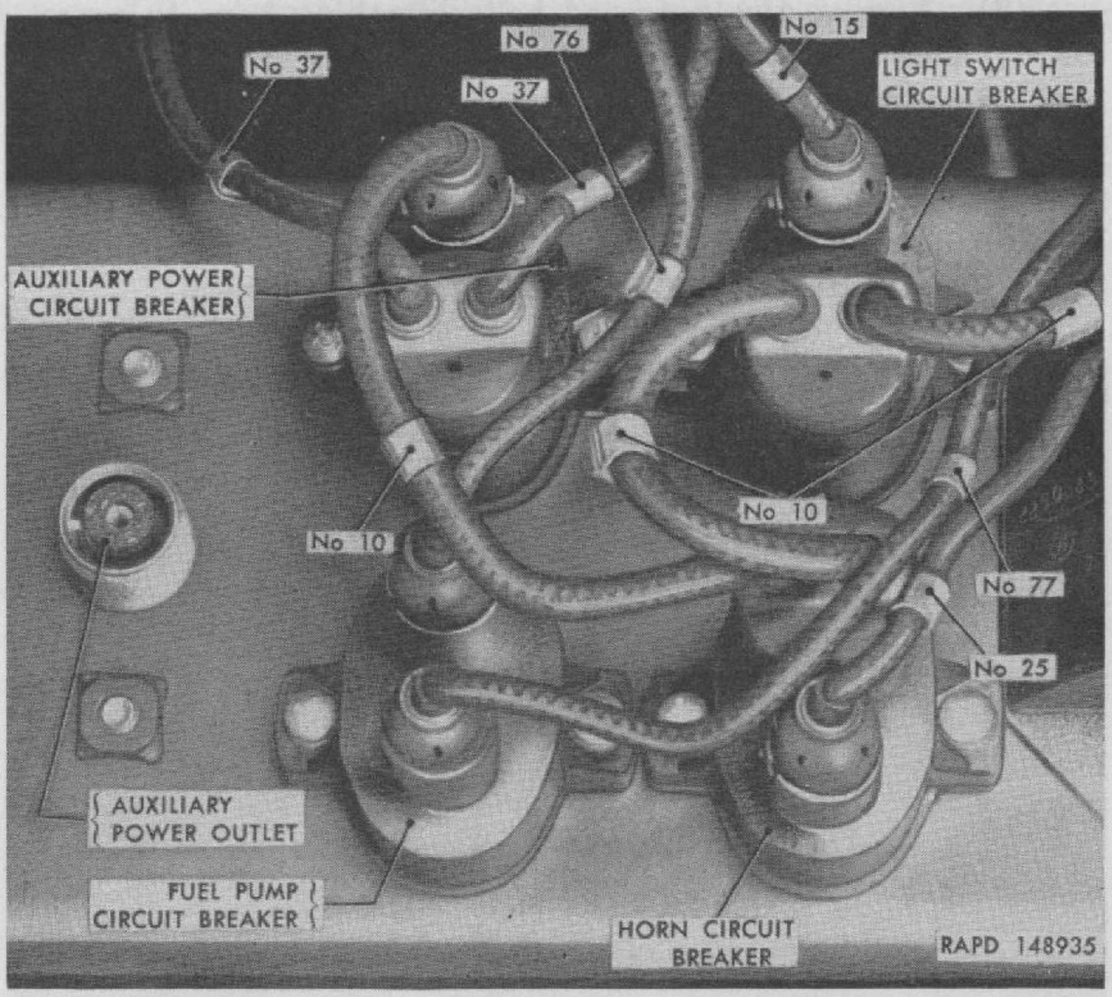


Figure 95. Circuit breakers and auxiliary power outlet installed.

165. Horn and Horn Button

a. GENERAL. Electrically - controlled, air - operated horn is mounted on under side of hood brace above engine (fig. 96). Horn is accessible with hood in raised position (par. 36). Flexible air line from junction fitting at engine side of dash connects to air inlet at horn operating solenoid. When circuit through solenoid is completed by the horn button in center of steering wheel (fig. 97), solenoid admits air pressure into the vibrating diaphragm type horn, causing horn to sound. Wiring connections at horn are made through bayonet type connectors; connectors are secured in clips attached to horn solenoid clamp. Horn circuit is protected by a 15 amp circuit breaker mounted on steering column brace (fig. 95).

b. HORN REMOVAL (fig. 96).

(1) Disengage wiring harness from clip on horn mounting bracket. Disengage cable connectors from clips on horn solenoid bracket and disconnect cables.

(2) Remove two nuts and bolts attaching horn to mounting bracket then disconnect air line from horn solenoid.

c. HORN INSTALLATION (fig. 96).

(1) Coat threads of air line fitting with plastic type gasket cement and connect air line to horn solenoid. Install horn on mounting bracket and attach with two bolts and nuts. Install harness clip under one bolt head.

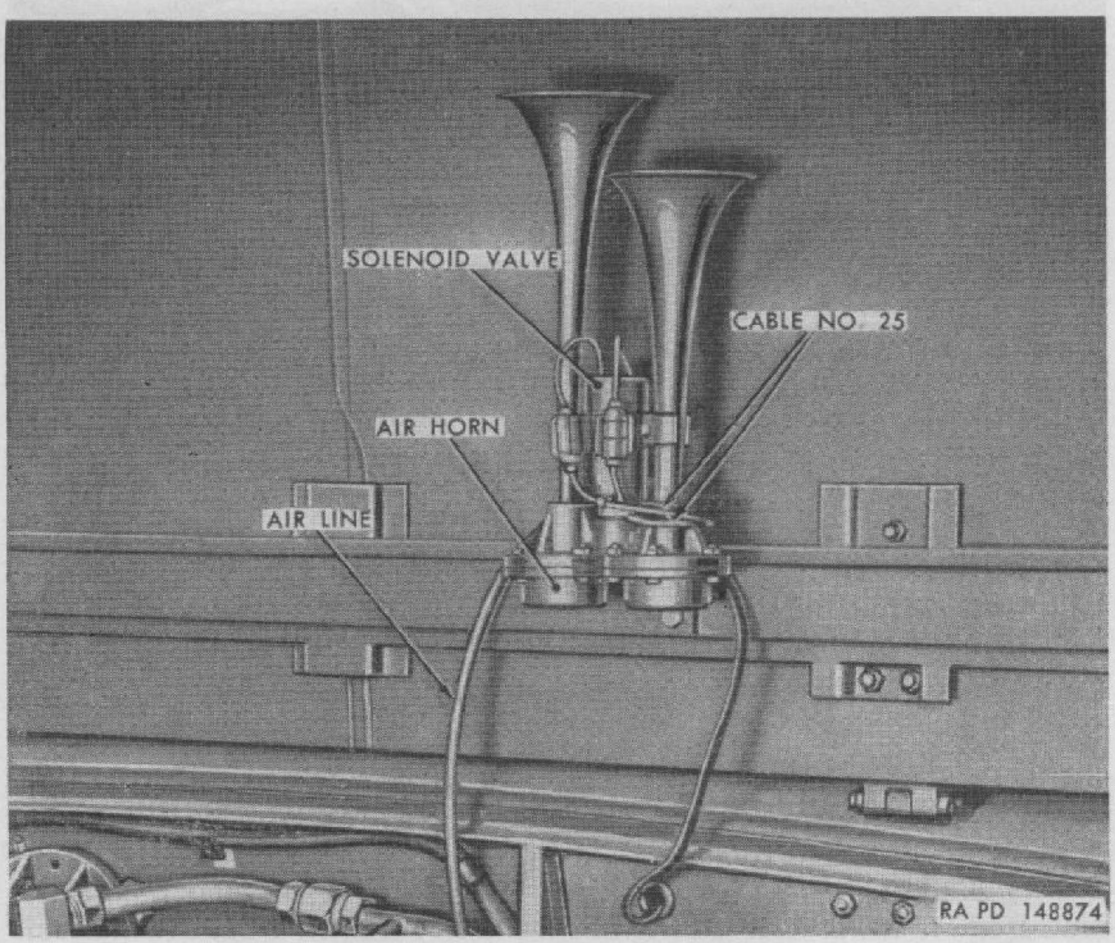


Figure 96. Horn installed.

(2) Connect harness cables (No. 25) to horn solenoid cables, then engage connectors in clips on horn solenoid clamp. Secure wiring harness in clip on horn bracket.

d. HORN BUTTON REMOVAL (fig. 97). Remove four screws attaching horn button retaining ring to steering wheel. Remove retaining ring, horn button, and contact and spring assembly.

e. HORN BUTTON INSTALLATION (fig. 97). Make sure end of contact and terminal on end of steering shaft are clean. Position contact and spring assembly on steering shaft nut, install horn button and retaining ring, and attach retaining ring to steering wheel with four screws.

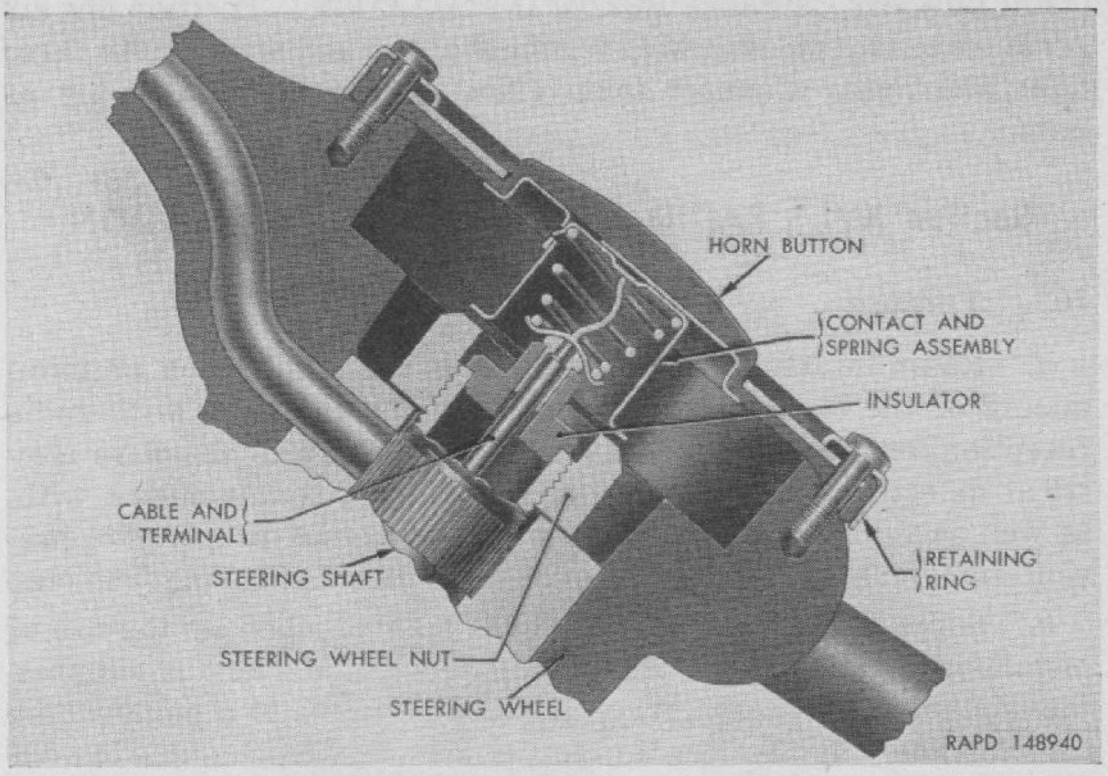


Figure 97. Horn button and contact installed.

166. Low Air Pressure Switch and Buzzer

a. GENERAL. Low air pressure switch is a safety device designed to automatically give a warning when pressure in air system falls below a safe limit (60 psi) for brake operation. Low air pressure switch is actually an air-controlled switch in an electrical circuit, automatically controlling the circuit to an alarm buzzer in cab. Low air pressure switch is mounted on dash inside cab, and is connected to air system at air line junction fitting on dash (fig. 92). Alarm buzzer is mounted on left side of dash inside cab. Switch and buzzer circuit is fed through ignition switch and grounded through the alarm buzzer mounting.

b. LOW AIR PRESSURE SWITCH REMOVAL (fig. 92). Disconnect cables from terminals at top and bottom of low air pressure switch. Disconnect air line from fitting on switch body. Remove two bolts and nuts attaching switch to dash; then remove switch.

c. LOW AIR PRESSURE SWITCH INSTALLATION (fig. 92). Position low air pressure switch on dash and attach with two bolts and nuts. Coat air line fitting threads with plastic type gasket cement; then connect air line to switch. Connect cables (No. 85) to terminals at top and bottom of switch.

d. LOW AIR PRESSURE BUZZER REMOVAL. Disconnect cable from terminal at top of buzzer. Remove three bolts and nuts attaching buzzer to dash, then remove buzzer.

e. LOW AIR PRESSURE BUZZER INSTALLATION. Position low air pressure buzzer on dash with terminal at top and attach with three bolts and nuts. Connect cable (No. 85) to terminal at top of buzzer.

Section XVI. RADIO INTERFERENCE SUPPRESSION

167. Purpose

a. Radio interference suppression is the elimination or minimizing of the electrical disturbances which interfere with radio reception, or disclose the location of the vehicle to sensitive electrical detectors. It is important, therefore, that vehicles with, as well as vehicles without, radios be suppressed properly to prevent interference with radio reception of neighboring vehicles.

b. Suppression of these vehicles is accomplished by the use of metalic shielding, capacitors (condensers), and resistor suppressors. Wiring that may carry interfering surges to a point where interference will affect radio reception is shielded.

168. Description

a. IGNITION SYSTEM. Radio interference suppression in the ignition system (fig. 44) is accomplished by a coaxial capacitor, a bypass capacitor, and a resistor-choke connected into the primary circuit; resistors in distributor rotor, distributor cap, and spark plugs; and shielded spark plug cables.

b. GENERATING SYSTEM. The generating system is suppressed by static collector brushes at each end of generator armature shaft; a coaxial capacitor in generator output cable; two coaxial capacitors connected in series in the regulator output cable; a radio frequency choke coil in field circuit in regulator; and a shielded generator-to-regulator wiring harness.

c. STARTER. The starter is suppressed by a capacitor connected into the field circuit.

d. FUEL PUMP. The electric fuel pump is suppressed by a coaxial capacitor in input cable and a shielded capacitor-to-motor cable.

169. Ignition System Radio Suppression

a. DESCRIPTION AND DATA (fig. 44). The primary connection at the distributor terminal is equipped with a 0.25 mfd coaxial capacitor which is grounded to the distributor housing. A 1.5 ohm resistor-choke is connected into the primary circuit ahead of the ignition coil. A 0.75 mfd bypass capacitor is connected to ignition coil negative (−) terminal and grounded to the distributor housing. A 10,000 ohm resistor is built into the distributor rotor, and each output tower in the distributor cover is equipped with a 5,000 ohm resistor. Spark plug cables are shielded with a metallic braid molded into the cable insulator. A 10,000 ohm resistor is built into each spark plug. Spark plugs are shielded by the metal shells to which the cables connect. Defective capacitors and resistor-choke can be replaced; rotor, distributor cover, and spark plugs, must be replaced if resistors are defective.

b. DISTRIBUTOR IGNITION COIL CAPACITOR REPLACEMENT (fig. 50).

(1) *Removal.* Remove distributor cover. Disconnect capacitor cable terminal from ignition coil negative (−) terminal. Remove screw and clamp securing capacitor in distributor housing. Lift capacitor out of distributor housing.

(2) *Installation.* Make sure curved spring is clean and in place in bottom of capacitor opening in distributor housing, with convex side up. Insert capacitor into housing and secure in place with clamp and screw and lock washer assembly. Connect capacitor cable to ignition coil negative (−) terminal. Install distributor cover.

c. DISTRIBUTOR COAXIAL CAPACITOR REPLACEMENT (fig. 44).

(1) *Removal.* Remove distributor cover. Disconnect primary cable from connector at distributor. Remove four screw and lock washer assemblies attaching connector to distributor housing. Remove connector and gasket. Disconnect capacitor cable from resistor terminal.

(2) *Installation.* Place spring over capacitor cable with convex side next to capacitor. Thread capacitor cable through opening in distributor housing and insert capacitor into housing. Install connector and gasket on distributor housing and attach with four screw and lock washer assemblies. Connect capacitor cable to resistor terminal, and connect primary circuit cable to primary connector. Install distributor cover.

d. DISTRIBUTOR PRIMARY CIRCUIT RESISTOR REPLACEMENT (fig. 50).

(1) *Removal.* Remove distributor cover. Disconnect cable from resistor terminal, and disconnect resistor cable from ignition coil negative (−) terminal. Remove two screw and lock washer assemblies attaching resistor clamp to distributor housing. Remove clamp, then lift resistor and insulator out of distributor housing.

(2) *Installation.* Make sure curved spring is in place in resistor opening in distributor housing with convex side up. Position resistor and insulator in distributor housing and secure with clamp and two screw and lock washer assemblies. Connect resistor cable to ignition coil negative (−) terminal, and connect primary circuit coaxial capacitor cable to resistor terminal. Install distributor cover.

170. Generating System Radio Suppression

a. DESCRIPTION AND DATA. A 0.1 mfd coaxial capacitor is connected into the generator output cable; capacitor is installed in the generator harness connector elbow and grounded to the elbow. Conductive brushes are installed in the generator, grounding each end of the armature shaft. Wiring harness leading from the generator to the generator-regulator is shielded with metallic braid molded into the harness insulation. Two 0.1 mfd coaxial capacitors are connected in series in the generator-regulator output cable and are grounded to the regulator base. A radio frequency choke coil is connected into field circuit in the generator-regulator. Regulator base is divided into compartments for isolation of the leads.

b. REPLACEMENT. Since replacement of the suppression units in the generator and regulator requires disassembly of the generator and regulator, they cannot be replaced by the using troop organization. If radio interference is originating in the generator or regulator, the complete generator or regulator must be replaced (par. 137 or 138).

171. Starter Radio Suppression

a. DESCRIPTION AND DATA. Starter series field windings and insulated brushes are grounded to commutator end head through a 0.5 mfd capacitor. Capacitor (fig. 74) is mounted on commutator end head and is grounded through its mounting.

b. STARTER CAPACITOR REPLACEMENT (fig. 74).

(1) *Removal* Remove starter (par. 135*a*). Disengage two cover retaining clips from pins in starter field frame and pull end cover off starter. Disconnect capacitor cable from field and brush terminals. Remove through-bolt attaching capacitor to end head and remove capacitor.

(2) *Installation.* Insert through-bolt through capacitor clamp and commutator end head and thread bolt into drive

end head. Connect capacitor cable to starter field and brush terminals. Install starter end cover as directed in paragraph 135*b*. Install starter (par. 135*c*).

172. Fuel Pump Radio Suppression

a. DESCRIPTION AND DATA. A 1.5 mfd capacitor is installed in fuel pump terminal housing and connected to the fuel pump input cable. Cable from capacitor to fuel pump motor is shielded with metallic braid molded into the cable insulation.

b. FUEL PUMP CAPACITOR REPLACEMENT.

(1) *Removal.* Disconnect feed and ground cables from terminals on fuel pump motor terminal cover. Remove four bolts and lock washers attaching terminal cover to fuel pump hanger. Remove cover, then disconnect capacitor cable from fuel pump motor cable terminal. Remove four screws and lock washers attaching capacitor to terminal cover and remove capacitor.

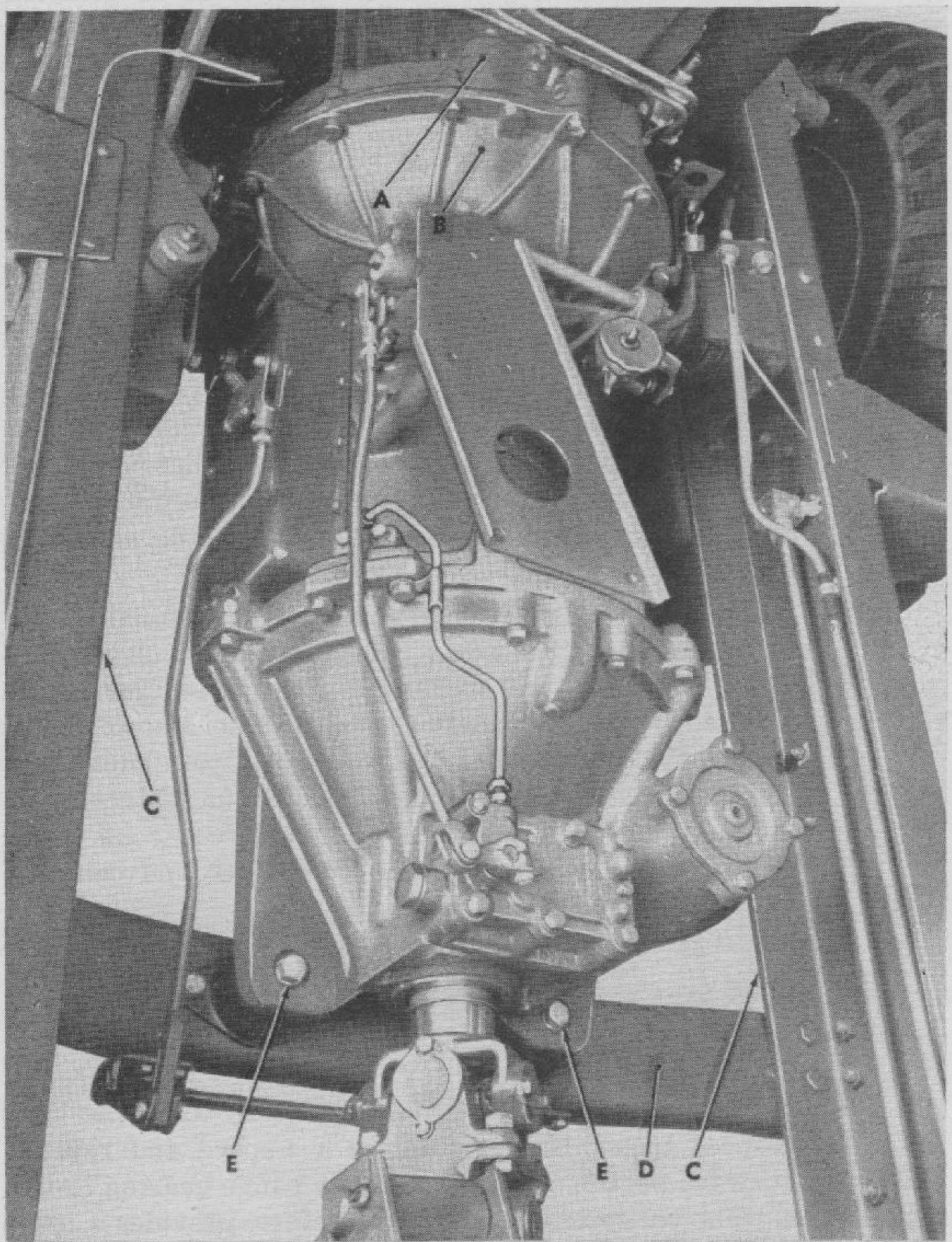
(2) *Installation.* Install new capacitor in terminal cover, using new gasket between capacitor flange and cover. Attach capacitor to cover with four screws and lock washers. Connect capacitor cable to fuel pump motor terminal with screw and lock washer. Install terminal cover and gasket on fuel pump hanger and attach with four bolts and lock washers. Connect feed cable (No. 77) to capacitor terminal and connect ground cable to other terminal on cover.

Section XVII. TRANSMISSION AND CONTROLS

173. Description

a. Hydra-Matic transmission is coupled directly to engine (fig. 98). The 8-speed transmission combines a 4-speed and reverse unit in the forward portion and high and low range gearing in the rear section. The entire transmission, therefore, provides a total of eight forward ratios and two reverse. Rear of transmission is supported by frame cross member through two flexible mountings. Transmission mountings serve also as power plant rear mountings.

b. When operating with transmission control lever in F–1 position (either range), automatic shift is said to be "throttle-conscious" as well as "speed conscious." By that is meant that transmission shifts occur at varying speeds, depending on amount of throttle opening. This is accomplished by connecting throttle



A—FLYWHEEL HOUSING—FORWARD HALF
B—FLYWHEEL HOUSING—REAR HALF
C—FRAME SIDE RAIL
D—FRAME CROSSMEMBER
E—TRANSMISSION MOUNTING BOLT
RA PD 148924

Figure 98. Transmission installed.

linkage to T-V (throttle valve) lever on transmission (fig. 102). Hydra-Matic transmission requires a minimum of attention, if lubricant level is maintained and linkage and front band are kept in adjustment.

c. Coolant from engine is circulated through cooler located in bottom of oil pan. Purpose of cooler is to maintain viscosity of transmission oil for proper functioning.

174. Data

a. RATIOS.

Gear	*High Range*	*Low Range*
1st	4.07:1	15.55:1
2d	2.63:1	10.05:1
3d	1.55:1	5.92:1
4th	1:1	3.82:1
Reverse	4.52:1	17.3:1

b. LUBRICANT CAPACITY. Refer to paragraph 57.

175. Leakage Tests

a. GENERAL. The Hydra-Matic transmission does not "use" or "burn" oil, as an engine does. Consequently, any appreciable loss of oil from transmission is due to leakage and cause must be determined and condition corrected to avoid damage to transmission. Conversely, if transmission fluid level raises, cause is due leakage into transmission of engine coolant.

b. OIL LEAKAGE.

(1) From underneath truck, carefully examine rear end of transmission case, at propeller shaft flange, for evidence of leakage.

(2) Remove flywheel housing cover (underpan). Wash flywheel and torus cover with dry-cleaning solvent or volatile-mineral-spirits paint thinner and dry completely.

(3) Spread a clean piece of white or brown paper under flywheel and cover.

(4) Run engine at speed of 700 rpm for several minutes, or until spray appears on paper; then stop engine.

(5) Check for leaks in line with spray marks on paper; also examine flywheel and torus cover carefully (fig. 99). Report condition to ordnance maintenance personnel.

c. COOLANT LEAKAGE.

(1) If oil level is found to be high at inspection periods, cause may be leakage from cooler core.

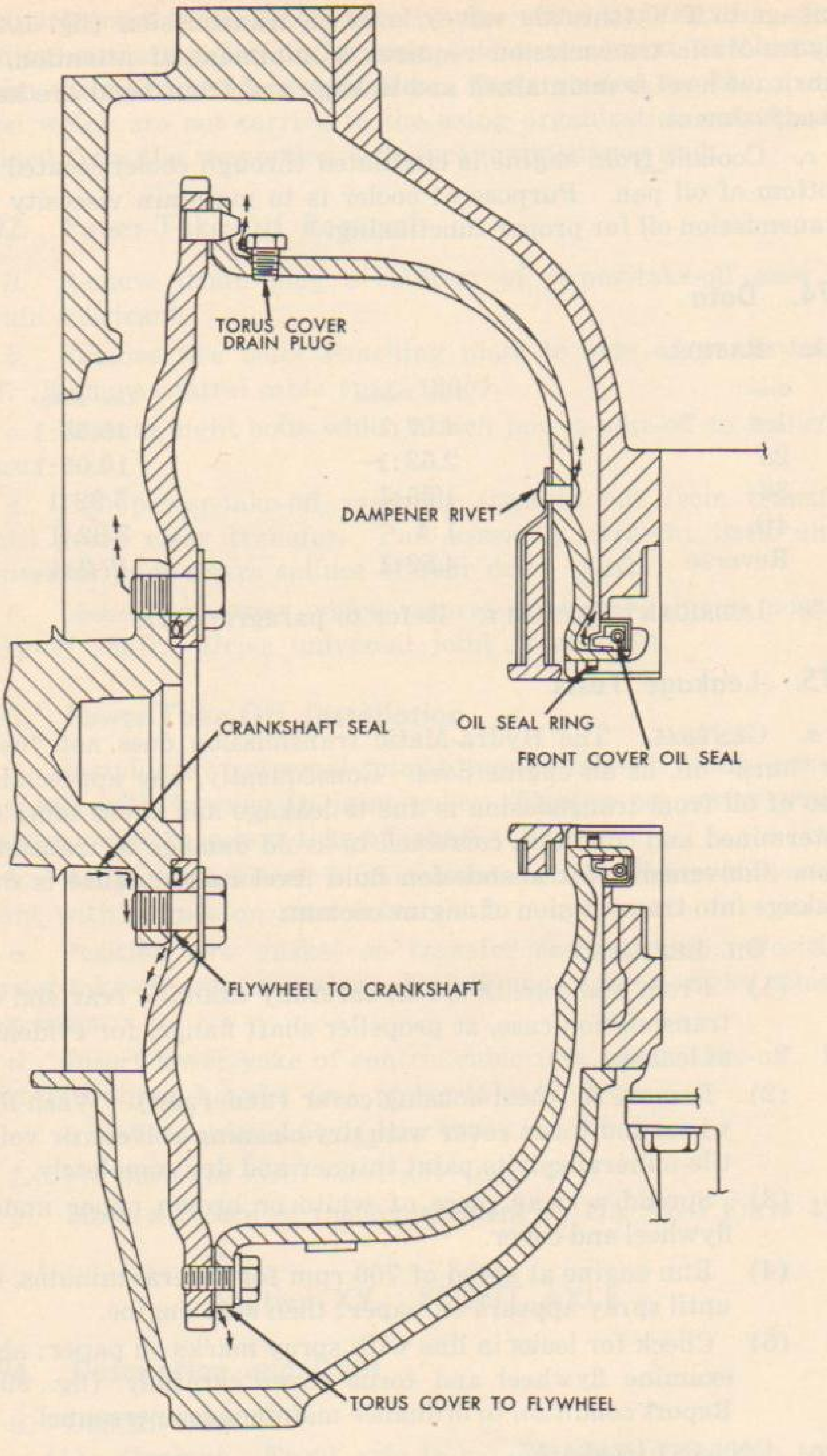


Figure 99. Location of possible leaks.

(2) If leakage from cooler core is indicated, drain oil from transmission into a clean container. Examine drainage for presence of water; if evidence of leakage is found, report to ordnance maintenance personnel. If leakage does not exist, fill transmission as directed in paragraph 59*f*.

176. Operation Tests

a. GENERAL. A systematic method of checking external adjustments is included in this paragraph. While many of the corrections are beyond the scope of the using organization, tests should be made to determine necessity for replacement of the transmission. It should be kept in mind that directions should be followed carefully and that a complete diagnosis be made. Perform all tests; if any are omitted, an incorrect diagnosis will probably result.

b. PURPOSE. Two types of tests are described—stall speed test and road test. Stall speed test is designed to provide an overall performance check of engine and transmission efficiency. Road test provides an accurate check of transmission operation under actual service conditions.

c. PRELIMINARY OPERATIONS. Before performing either stall speed test or road test, the following operations *must* be accomplished:

(1) Warm engine and transmission to normal operating temperatures.

(2) Check transmission oil level (par. 59*f*) and replenish if necessary.

(3) Check engine idling speed and adjust (par. 112*b*), if necessary. If stall speed test is to be performed, leave tachometer connected to engine, since this instrument is used in test.

(4) Remove pipe plug, located immediately rearward of front band adjusting screw, and install a fluid pressure gage (capable of registering 250 psi pressure). Start engine and, while holding brakes applied, note pressure readings in all four "HIGH RANGE" positions, with engine running at 1,000 rpm.

(5) With transmission oil warm, pressures should be 170–200 psi in reverse, and 95–110 psi in each of the other positions.

(6) If pressures are appreciably less than shown, notify ordnance maintenance personnel. Disconnect pressure gage and install pipe plug.

d. STALL SPEED TEST. Stall speed is the greatest engine revolutions per minute, with transmission in gear and truck stationary. Test should be made at intervals, after repair or replacement of engine or transmission, and whenever power plant appears to be operating at less than peak efficiency.

(1) Perform preliminary operations described in *c* above.

(2) Block wheels, or position truck with front bumper against a solid object, to prevent injury to personnel if brakes are accidentally released.

(3) Station an assistant inside truck to apply and hold brakes during test.

(4) Move transmission lever into F-1 HIGH RANGE position; then open throttle completely. Tachometer should show engine speed within ranges shown in table VII. Reduce engine speed to normal idle, move control lever to N (neutral) position, and shut off engine.

Caution: Do not hold throttle open for longer than 15 seconds. Immediately close throttle if engine speeds up to 2,000 rpm, to avoid damaging transmission.

(5) Block wheels to prevent reverse movement of truck. Repeat stall-speed test, but with transmission control lever in R HIGH RANGE position. If slipping does not now occur (engine speed in normal range) rear band is not holding properly. Report condition to ordnance maintenance personnel. If slipping still occurs (engine rpm above maximum) adjust front band (par. 179); then repeat stall-speed test in R HIGH RANGE and R LOW RANGE. If slipping still occurs, report condition to ordnance maintenance personnel.

Table VII. Stall-Speed Test Data

Engine RPM

Minimum	Maximum
1,550	1,750

(6) If engine speed is within range given, engine and transmission are operating within normal efficient limits. Remove tachometer as described in paragraph 112.

(7) If engine speed is appreciably *below minimum* shown, engine is probably not developing full power. Tune engine (par. 93); then repeat stall speed test. If engine rpm is still below minimum, transmission malfunction is indicated. Report condition to ordnance maintenance personnel.

(8) If engine stall speed is appreciably *above maximum* rpm shown, excessive slippage in torus or in transmission is probable cause.

(9) Recheck transmission oil level (par. 59*f*) and replenish, if necessary; then shut off engine. After 10 minutes, and with engine not running, recheck oil level. If level has risen more than one-half inch in 10 minutes, driven torus check valve or front pump relief valve are at fault. Report condition to ordnance maintenance personnel.

e. ROAD TEST.

(1) Before making road-test on transmission, perform preliminary operations described in *c* above.

(2) When making road-test on transmission, perform tests in sequence listed in table VIII. Check minimum throttle upshifts first, and make each test several times to be sure shift events consistently occur at same speeds.

Note. When testing, be on the alert for any indications of irregular or improper performance. Note these; then, when test is completed, refer to *f* below.

Table VIII. Transmission Automatic Shift Pattern

Upshifts

Shift	Minimum Throttle	Full Throttle	
	(F-1 LEVEL HIGH RANGE) mph	(F-1 LEVEL HIGH RANGE) mph	(F-2 HILLY HIGH RANGE) mph
1st to 2d	8–9	13–15	13–15
2d to 3d	13–15	21–24	
3d to 4th	18–20	35–38	35–38

Downshifts

Shift	Full Throttle	Closed Throttle	Closed Throttle
	(F-1 LEVEL HIGH RANGE) mph	(F-1 LEVEL HIGH RANGE) mph	(F-2 HILLY HIGH RANGE) mph
4th to 3d	20–18 (to detent)	15–13	35–33
3d to 2d	18–16 (past detent)	14–12	
2d to 1st	11–9 (past detent)	10–7	11–9
4th to 3rd	Full throttle (past detent) (F-1 HIGH RANGE) 34 MPH		

(3) Tests for full-throttle downshifts can be made on a steep hill. If steep hill is not available, condition can be simulated on level road by light, continuous brake application.

f. DIAGNOSIS. When road test is completed and all irregular or improper operation noted, refer to table IX. Various improper operating conditions which may be found, their possible causes, and suggested remedies, together with paragraph references are included in table. However, possible causes and remedies beyond scope of the using organization are not specifically identified.

Note. Conditions and causes are listed in order of probability; therefore always check causes in sequence given.

Table IX. Improper Operation, Possible Causes, and Suggested Remedies

Oil level should be correct (par. 59 *f*) before making these tests

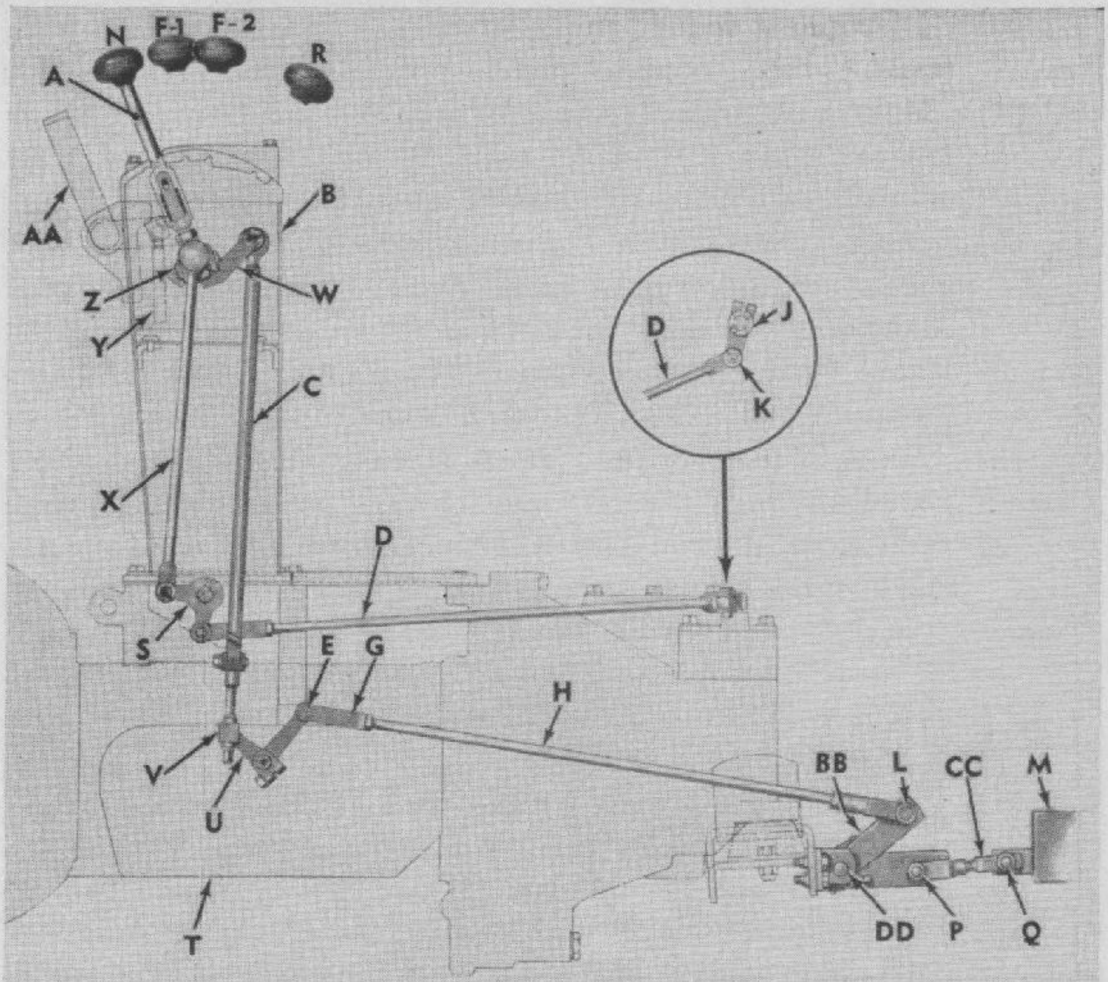
Condition	*Possible Causes*
All shifts occur too high	C*
All shifts occur too low	C*
Shifts vary (inconsistent)	C*
Transmission hunts between two ratios	C*
Misses one or more shifts	C*
Throttle downshift improper	C–D*
Engine speeds up; band apply rough	C–E*
Violent shifting	C–D–E*
Shifts above 2d in F–2 position	C*
No shifts—stays in same gear	C–D*
Excessive creeping	B*
Slipping	A–C–D–E*
No drive forward	A–C–D*
Locks up on reverse coast	D*
Moves forward when in reverse	(*)
No drive in reverse	A–C–D–E*
Drives in reverse only	A–C–D–E*

Key	*Possible Cause*	*Suggested Remedy*
A	Improper oil level.	Correct oil level as described in paragraph 59 *f*.
B	Improper engine idle speed.	Check and adjust engine idling speed (par. 112 *b*).
C	Linkage out of adjustment.	Check and adjust control linkage (pars. 177 and 178).
D	Improper oil pressure.	Check as described in *C* above. If not within limits, notify ordnance maintenance personnel.
E	Servo bands not adjusted.	Check and adjust front band (par. 179).
	*Other causes, beyond scope of using organization.	Notify ordnance maintenance personnel.

177. Manual-Shift Control Linkage

a. GENERAL. Manual-shift linkage is shown in figure 100; however (TV) lever and linkage is omitted for purposes of clarity. Shift linkage performs two functions—to select Hydra-Matic range positions and to shift transfer front axle clutches for forward and reverse operation.

Note. Key letters in text refer to figure 100. Also see figure 101 for view of linkage installed. On both illustrations, note that throttle linkage is omitted to clarify illustrations.



A—TRANSMISSION CONTROL LEVER
B—TOWER
C—SHIFT LEVER ROD
D—REDUCTION UNIT ROD
E—CLEVIS PIN
F-1—FORWARD-SPEED SHIFT POSITION (LEVEL)
F-2—FORWARD-SPEED SHIFT POSITION (HILLY)
G—ADJUSTABLE YOKE
H—TRANSFER REVERSE ROD
J—REDUCTION UNIT LEVER
K—CLEVIS PIN
L—CLEVIS PIN
M—TRANSFER
N—NEUTRAL SHIFT POSITION
P—CLEVIS PIN
Q—CLEVIS PIN
R—REVERSE SHIFT POSITION
S—IDLER LEVER
T—TRANSMISSION
U—TRANSMISSION SHIFT LEVER
V—SHIFT LEVER TRUNNION
W—SELECTOR LEVER
X—SELECTOR LEVER ROD
Y—STARTER ROD
Z—CONTROL SELECTOR LEVER FULCRUM
AA—STARTER HANDLE LEVER
BB—TRANSFER REVERSE CROSS SHAFT LEVER
CC—TRANSFER REVERSE ADJUSTABLE YOKE
DD—TRANSFER REVERSE CROSS SHAFT

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Figure 100. Transmission and transfer linkage arrangement.

b. ADJUSTMENT. Adjust linkage in sequence described. Both transmission and transfer incorporate internal detents to locate control positions. In addition, control also has detents for control lever; however, detents in transmission govern adjustment of linkage.

(1) Remove front floor pan assembly. Press down on control lever (A) and move into F–2 LOW RANGE position. Unscrew nut from trunnion (V) and disconnect trunnion from transmission shift lever (U).

(2) Disconnect transfer reverse rod (H) from transmission shift lever (U) by removing clevis pin (E).

(3) Disconnect reduction unit rod (D) from reduction unit lever (J) by removing clevis pin (K).

(4) Make sure control lever (A) is in F–2 position. Position transmission shift lever (U) by rotating all the way counterclockwise; then move back one detent position.

(5) Insert trunnion in transmission shift lever (U), adjusting trunnion nuts, as necessary, to provide free pin. Make sure pin does not bind in other positions of control lever; then return control lever to F–2 LOW RANGE position, and install trunnion stud nut.

(6) Make sure lever (A) is in N LOW RANGE position reduction unit (lever (J) in forward position). Connect reduction unit rod (D) to reduction unit lever (J) with clevis pin (K), adjusting yoke as necessary to provide free pin. Pin should also be free with control lever (A) in N HIGH RANGE position; however, if impossible to obtain free pin in both ranges, adjust to obtain free pin N LOW RANGE position.

(7) Move control lever (A) into F–1 HIGH RANGE position. With transfer reverse rod pushed in (rearward), adjust transfer reverse rod (H) so that cross shaft lever stop is against clevis with rod connected to transmission shift lever (U). Make sure all pins are secured with cotter pins.

c. REPLACEMENT. Each linkage rod is connected with a pin at each end, as shown in figures 100 and 101. Linkage rods are easily replaced by removing connecting pins; levers are removed after loosening clamping bolts.

d. TOWER REMOVAL. Remove front floor pan assembly. Unscrew nut from shift-lever trunnion (V) and disconnect from transmission shift lever (U). Remove clevis pin to disconnect reduction unit rod (D) from idler lever (S). Remove four cap screws which attach tower to transmission; then remove tower.

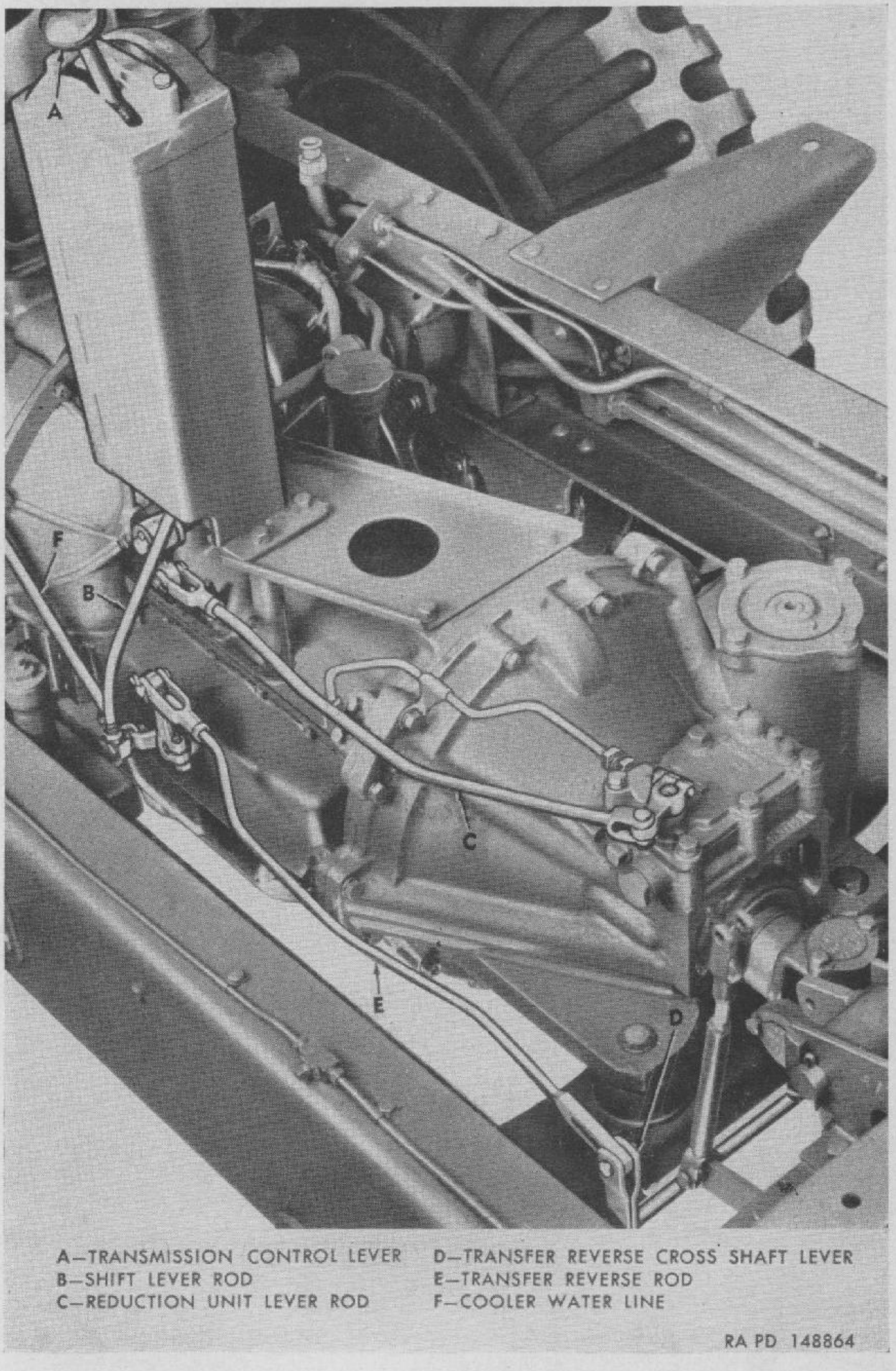


Figure 101. Shift linkage installed.

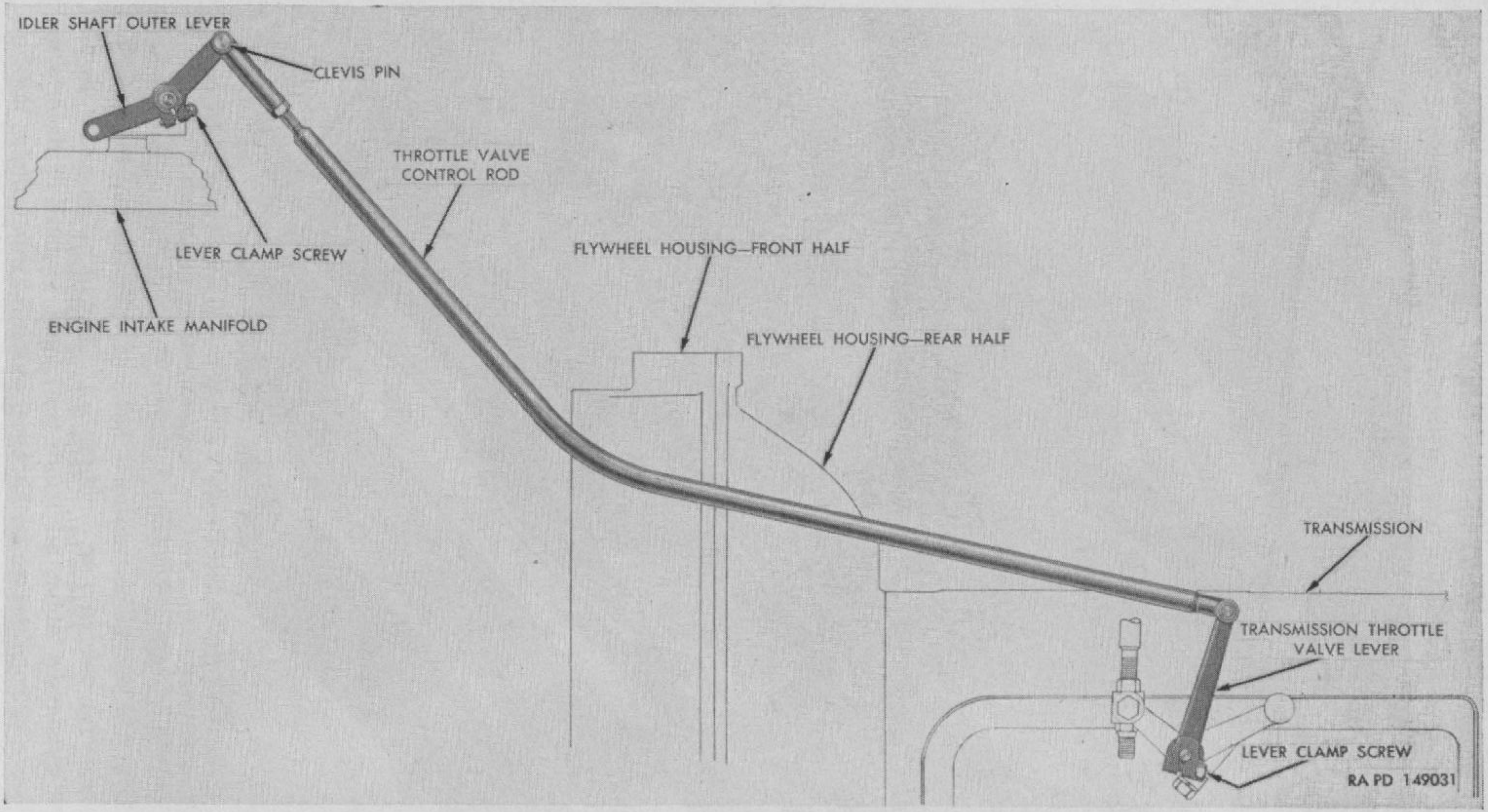


Figure 102. Throttle linkage arrangement.

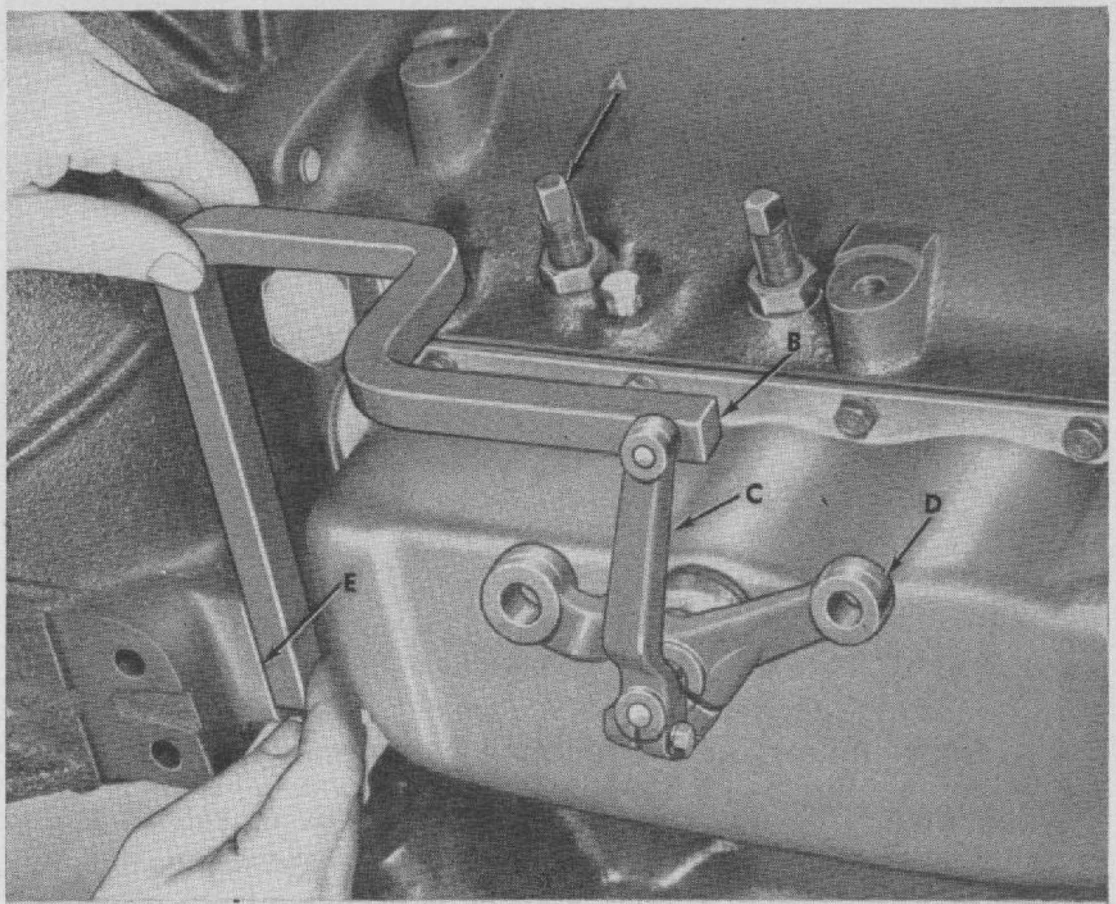
e. Tower Installation. Position control tower to transmission and install attaching bolts. Position shift lever trunnion (V) to transmission shift lever (U) and install nut. Adjust trunnion nuts as described in *b* above. Connect reduction unit rod (D) to idler lever (S) with clevis pin. Adjust yoke, if required, as described in *b* above.

178. Throttle Linkage

a. Adjustment. Throttle lever and linkage must be carefully adjusted in order that shift pattern will be correct. Throttle valve lever is connected to accelerator linkage as shown in figure 102.

Caution: Do not pry against, or twist lever, since lever is supported only by die-cast control valve body.

(1) Hold transmission throttle valve gaging fixture 7950168 against machined surface of flywheel housing rear half, as shown in figure 103. Using clevis pin, check for free



A—FRONT BAND ADJUSTING SCREW
B—GAGING FIXTURE
C—THROTTLE VALVE LEVER
D—TRANSMISSION SHIFT LEVER
E—GAGING SURFACE

RA PD 149047

Figure 103. Adjusting throttle linkage using fixture 7950168.

pin in closed position of throttle valve lever. Bend throttle valve lever with bending tool 7950171, as required to obtain free pin.

(2) Holding lever against stop, loosen yoke lock nut on rod and adjust yoke on rod as necessary to obtain free installation of clevis pin through yoke and idler lever. Connect yoke with clevis pin and secure with cotter pin. Tighten lock nut against yoke.

b. REPLACEMENT. Remove clevis pins which attach rod to levers (fig. 102) to remove rod. Make sure yokes and pin are not unduly worn, when installing, since worn parts will not permit accurate adjustment. Throttle valve lever is attached to throttle valve shaft by means of a clamp screw. Serrations position the lever in relation to the shaft. Do not force lever onto shaft in wrong position.

179. Front Band Adjustment

a. INSPECTION.

Note. Do not attempt adjustment of rear band, since this band adjusts automatically. Rear band adjuster screw is used only for initial adjustment at assembly.

(1) Clean indicator pin plug (B, fig. 104) and adjacent surface of transmission; then run engine at idling speed, with control lever in F–1 HIGH RANGE position.

(2) Unscrew indicator pin plug (B, fig. 104). Indicator pin should be flush with machined surface of case. Use straightedge to check pin position.

b. ADJUSTMENT (fig. 104).

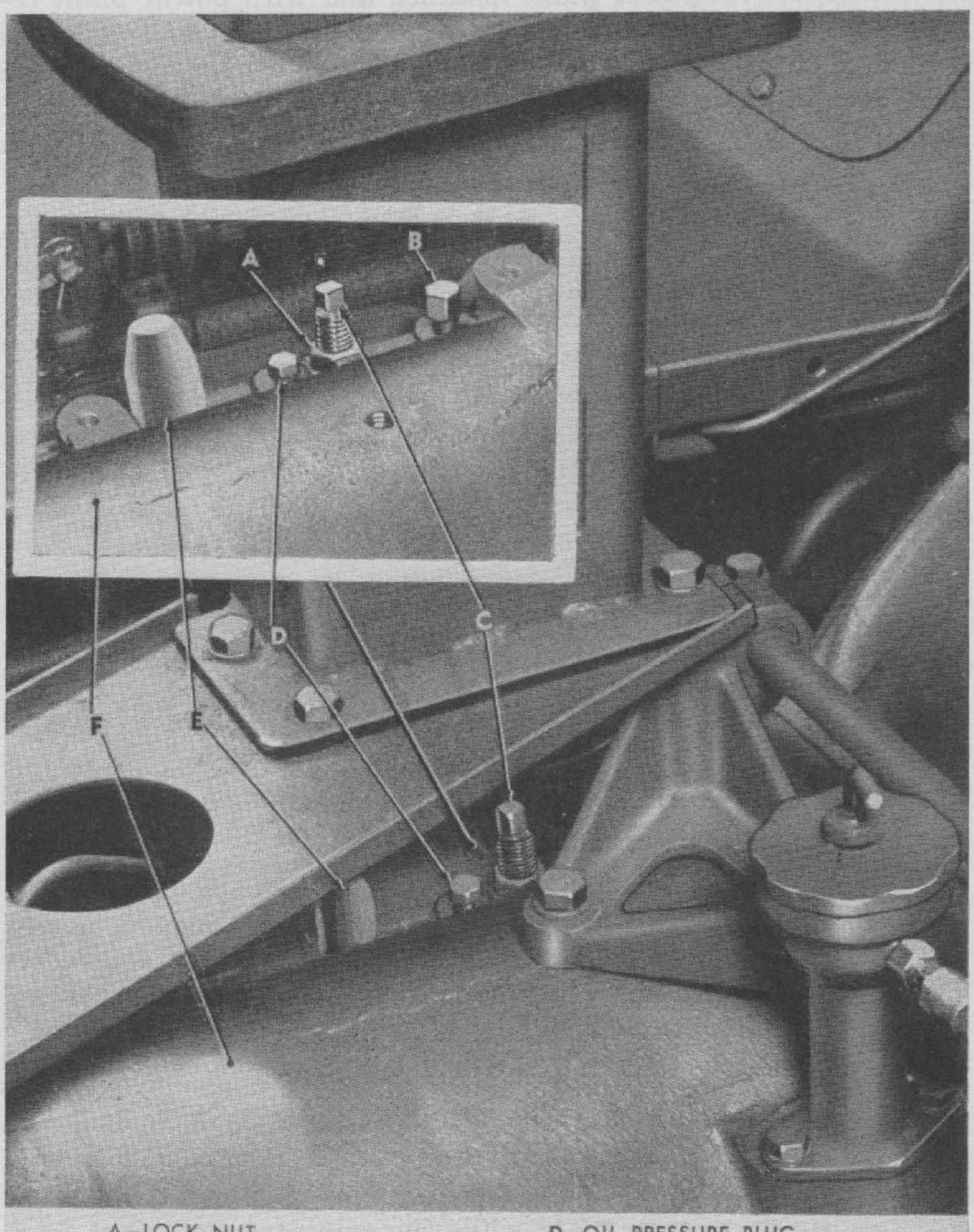
(1) Loosen adjusting screw lock nut (A).

(2) Turn adjusting screw (C) until indicator pin is exactly flush with machined surface of case.

(3) While holding adjusting screw stationary, tighten lock nut firmly; then install indicator pin plug (B).

180. Coordination with Ordnance Maintenance Unit

Replacement of the transmission with a new or rebuilt transmission is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, providing authority for performing this replacement is obtained from the appropriate commander. Tools needed for the operation, which are not carried in the using organization, may be obtained from the supporting ordnance maintenance unit.



A—LOCK NUT
B—INDICATOR PIN PLUG
C—ADJUSTING SCREW
D—OIL PRESSURE PLUG
E—REAR BAND STOP CAP
F—TRANSMISSION

RA PD 148997

Figure 104. Front band adjustment.

181. Transmission Removal

a. GENERAL. Operations necessary to remove transmission from engine with power plant installed and with power plant removed are covered in this paragraph. After the operations given in *b* below have been accomplished, remaining operations are same regardless of whether power plant is installed or removed. Before deciding to replace transmission, perform all tests suggested in paragraph 176 to locate cause of trouble.

b. INITIAL OPERATIONS (REQUIRED WITH POWER PLANT INSTALLED).

(1) *Disconnect linkage and remove control tower.* Disconnect control linkage and remove control tower (pars. 177 and 178). Disconnect transfer control linkage at transmission support cross member and remove TV control rod (fig. 102). Remove transfer reverse control lever cross shaft from transmission rear support cross member.

(2) *Remove exhaust pipe rear section.* Remove exhaust pipe support bracket to transmission cross member bolt. Loosen exhaust pipe clamp nuts at each end of exhaust pipe rear section; then remove clamps and rear section of exhaust pipe.

(3) *Remove propeller shaft.* Remove four bolts, nuts, and lock washers used to connect yoke to flange on transmission and on transfer; then remove transmission-to-transfer propeller shaft assembly.

(4) *Detach power plant from rear mountings.* Remove two cap screws and lock washers which hold transmission to rear mountings (fig. 39).

(5) *Raise power plant.* Using engine sling and overhead hoist or suitable jack, raise rear end of power plant just enough to relieve load from cross member under rear of transmission. Place blocking securely under engine to support power plant while removing transmission.

(6) *Drop front axle propeller shaft.* Remove four front propeller shaft to transfer flange bolts; then lower rear end of propeller shaft to floor.

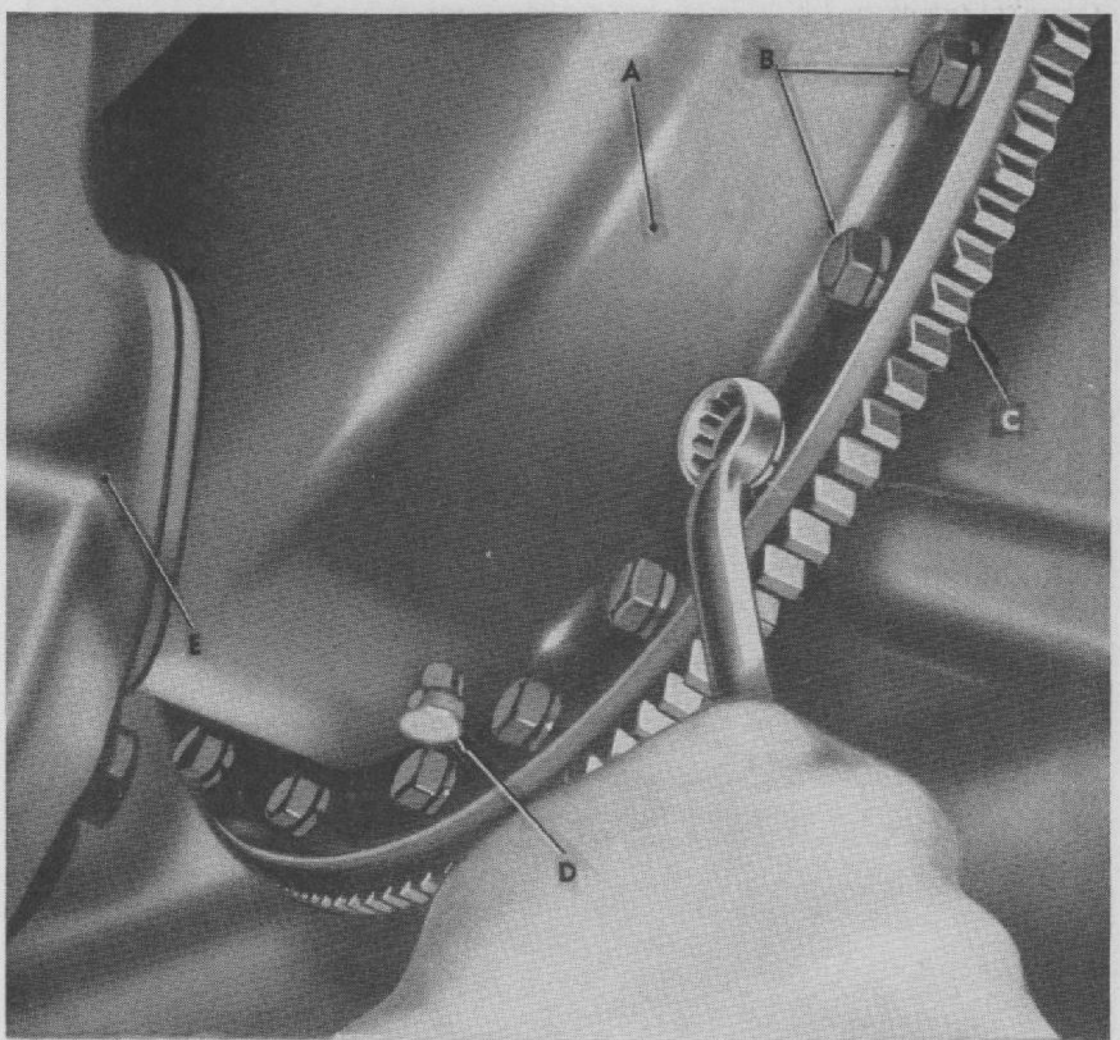
(7) *Remove transmission support cross member.* Remove bolts at each frame side rail and remove cross member at rear of transmission.

(8) *Disconnect starter control.* Disconnect starter shift lever rod at cross shaft lever (fig. 75).

c. REMOVE TRANSMISSION FROM ENGINE.

Caution: Make sure transmission is securely supported, with no danger of dropping on a workman underneath.

(1) *Drain coolant and disconnect cooling lines.* Drain engine cooling system (par. 126*b*). Unscrew cooling line nuts at transmission and pull lines free from fittings at transmission.



A—TRANSMISSION-TORUS COVER
B—TORUS COVER TO FLYWHEEL BOLTS
C—ENGINE FLYWHEEL
D—TORUS DRAIN PLUG
E—TRANSMISSION
RA PD 148929

Figure 105. Removing torus cover bolts.

(2) *Drain transmission oil.* Drain oil from transmission as instructed in paragraph 59*f*, using suitable receptacle to catch oil at each drain point.

(3) *Remove torus cover bolts.* Using wrench as shown in figure 105, remove torus-cover-to-flywheel bolts.

(4) *Remove flywheel housing bolts.* Use either a suitable transmission jack with saddle or an overhead support to

carry weight of transmission, and remove bolts attaching flywheel housing rear half to front half which is bolted to engine.

(5) *Remove transmission.* Move transmission assembly away from engine (fig. 106) and mount in repair stand. Remove spacer from front end of transmission mainshaft.

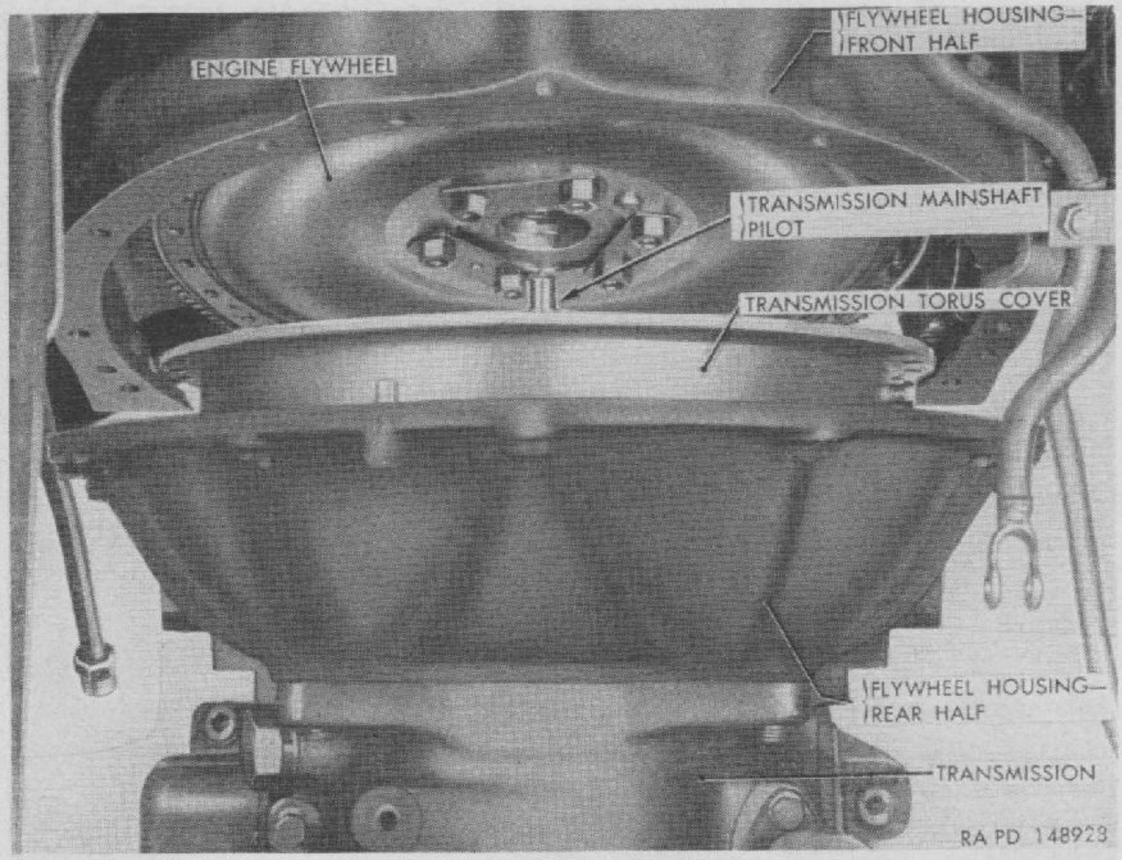


Figure 106. Removing transmission.

d. FLYWHEEL HOUSING REAR HALF REMOVAL. Flywheel housing rear half, installed on transmission case, is matched with front half installed on engine.

Note. Flywheel housing front and rear halves must remain with engine on which they were originally installed. A plate attached to each half of flywheel housing bears engine serial number. The operation described in (1) and (2) below must be performed if transmission is not to be installed on engine from which it was removed, or if it is necessary to remove flywheel housing from transmission.

(1) Bend lock plate away from mainshaft nut. Use 1-7/16-inch deep socket to remove nut from mainshaft. Use suitable tool to hold torus.

(2) Grasp hub and pull driven torus off mainshaft. If torus sticks, strike end of mainshaft lightly with rawhide or plastic hammer.

(3) Using snap ring pliers, remove driving torus snap ring; then remove driving torus and torus cover together by sharp straight pull on cover.

Caution: Do not rock cover from side to side to remove, as damage to oil seal or seal ring may result.

(4) Remove four cap screws and lock washers which attach flywheel housing rear half to transmission; then remove flywheel housing.

182. Transmission Installation

a. GENERAL. Operations for installing flywheel housing rear half on transmission (*b* below) are accomplished with transmission in suitable repair stand. Procedure for installing transmission on engine (*c* below) is same regardless of whether power plant is in vehicle or removed. If transmission is to be installed with power plant in vehicle, perform operations given under *d* below in addition to operations under *b* and *c*. Before installing torus cover on transmission, bolt cover to flywheel and with dial indicator mounted at flywheel housing front half, check runout at torus cover hub sealing surface. Runout must not exceed 0.005 inch. If runout is excessive, remove torus cover from flywheel and check flywheel runout at rearward side. If flywheel runout does not exceed 0.005 inch, replace torus cover. If flywheel runout exceeds 0.005 inch, report to ordnance maintenance personnel. A final check for runout at torus cover hub should be made if new cover is used.

b. FLYWHEEL HOUSING REAR HALF INSTALLATION. Front and rear halves of flywheel housing each have a metal plate attached, on which the engine serial number is imprinted.

Note. Number on flywheel housing rear half must correspond with number on front half, and with engine serial number plate on engine cylinder block (fig. 7).

(1) Locate flywheel housing at transmission and install four cap screws and lock washers, and tighten firmly to mount housing on transmission.

(2) Push torus cover into place on splines at transmission front drive gear, using care to avoid damaging oil seal and seal rings as cover is pushed into place.

(3) Install driving torus on intermediate shaft splines. Using snap ring pliers, install new snap ring to retain driving torus.

(4) Install driven torus on mainshaft splines. Place new mainshaft nut lock plate on mainshaft, then install nut on threads. Tighten nut to 50–60 pound-feet, using torque wrench and 1 7/16-inch deep socket and using suitable tool to hold torus. Bend lock plate against nut to hold nut tight. Install spacer on front end of transmission mainshaft.

c. INSTALL TRANSMISSION ON ENGINE.

(1) Clean torus cover gasket surface at flywheel thoroughly, coat torus cover gasket lightly with general purpose grease, and place gasket at flywheel with all holes in gasket alined with holes in flywheel.

Note. Gasket must be free from creases and wrinkles, and there must be no nicks or burrs at gasket surface on torus cover.

(2) Use transmission jack and saddle or overhead hoist and raise transmission into position at engine, with pilot on mainshaft alined with pilot bearing (fig. 106); then turn torus cover or flywheel until large dowel in flywheel is alined with large dowel hole in torus cover.

(3) Move transmission toward engine so mainshaft pilot enters pilot bearing and dowel holes in flywheel housing rear half fit over dowels in housing front half. Install bolts and cap screws which hold halves of flywheel housing together.

(4) Install torus cover to flywheel cap screws with new lock washers. Tighten all cap screws finger-tight at first. Tighten cap screws at each dowel pin with wrench, tighten screws alternately to avoid distorting torus cover. Finally tighten all screws with torque wrench to 20–25 pound-feet torque.

(5) Check to see that drain plug in torus cover is tight; then install flywheel housing underpan.

(6) Connect transmission cooler line at each side of transmission.

d. FINAL OPERATIONS (REQUIRED WHEN POWER PLANT IS INSTALLED).

(1) *Connect starter control.* Connect cross-shaft-lever-to-starter shift lever rod at cross shaft lever (fig. 75).

(2) *Install transmission control cross member.* Locate transmission support cross member at frame and install bolts at each end of cross member. Install transfer reverse cross shaft and bracket on cross member.

(3) *Lower power plant and install rear mounting bolts.* While supporting power plant, remove blocking from under engine; then lower power plant so weight rests on mountings on transmission support cross member. Install two bolts with lock washers which hold power plant on rear mountings.

(4) *Install propeller shaft.* Install propeller shaft at rear end of transmission, using new lock washers on the eight bolts used to connect flanges at transmission and transfer.

(5) *Connect front axle propeller shaft.* Lift front axle propeller shaft into place at flange on transfer; then install universal joint flange bolts.

(6) *Install exhaust pipe rear section.* Using new exhaust pipe joint seal (fig. 64), assemble exhaust pipe rear section and clamps. Install bolt to attach exhaust pipe support bracket to transmission support cross member. Tighten nuts on clamp bolts firmly.

(7) *Install transmission control tower and connect linkage.* If control levers have been removed from transmission, install levers and connect transfer reverse rod. Check throttle valve lever position with gage, and install and adjust throttle valve rod (par. 178). Mount transmission control tower on transmission and connect manual-shift control linkage (par. 177).

(8) *Fill cooling system.* Fill cooling system as directed in paragraph 126 *a*.

(9) *Fill transmission with oil.* Fill transmission with oil, following directions given in paragraph 59 *f* (4).

(10) *Record of replacement.* Make a record of replacement on DA AGO Form 478.

Section XVIII. TRANSFER AND CONTROLS

183. Description and Data

a. DESCRIPTION. Transfer is essentially a single-speed auxiliary unit, consisting of a case, gears, and output shafts for transferring power to each of the three driving axles (fig. 107). Mounted on frame cross member directly rearward of transmission, transfer is driven from transmission by a short-coupled propeller shaft. Transfer includes a neutral position for disconnecting axles from power plant when winching (when vehicle is so equipped), and for towing when truck is disabled. Transfer incorporates a double jaw-type clutch in front axle drive gearing, to provide automatic engagement and disengagement of front driving axle. Except when required for tractive effort, front axle runs free, reducing tire wear and steering effort.

b. DATA.

Type	single-speed with automatic front axle declutching.
Make	GMC Truck and Coach.
Number	2278438
Ratio	1.16 to 1

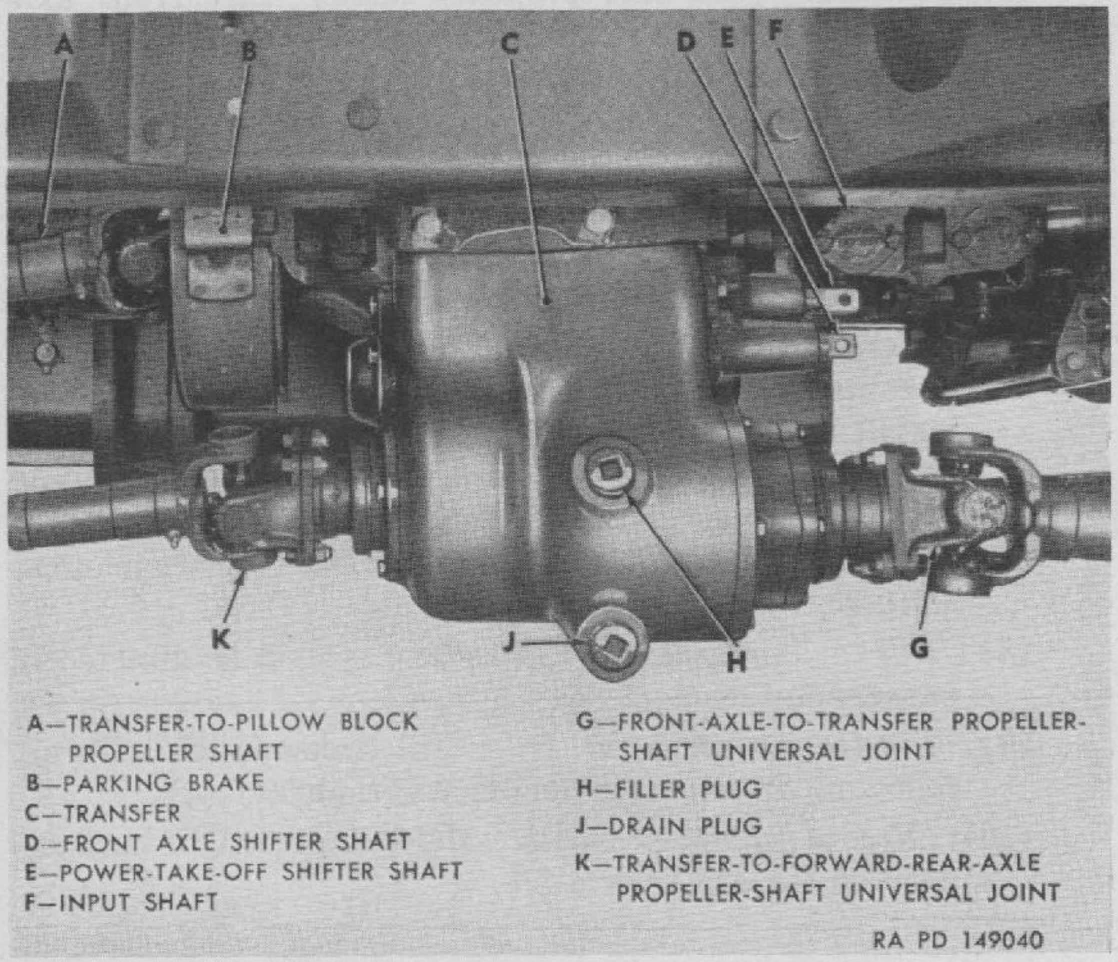


Figure 107. Transfer installed.

184. Front-Axle Drive Shift Linkage

a. GENERAL. Mechanism for positioning front axle drive jaw clutch for forward or reverse operation is interconnected to transmission shift linkage (fig. 100). Consequently, from driver's view point, operation of transfer is automatic except when winching or when being towed. Adjustment of transfer forward and reverse shift linkage (fig. 100) must be made whenever transmission manual-shift linkage is adjusted or replaced.

b. LINKAGE ADJUSTMENT. Since transfer forward and reverse linkage is interconnected with transmission manual-shift linkage, refer to paragraph 177 for adjustment information.

c. LINKAGE REPLACEMENT.

(1) *Removal.* Remove clevis pin at each end of rod; then remove transfer reverse rod (H, fig. 100). Remove clevis pin at each clevis; then remove cross shaft lever to transfer rod. Remove two bolts and nuts which attach cross shaft bracket to transmission rear support; then remove cross shaft as a unit with lever and bracket.

(2) *Installation.* Position cross shaft, as a unit with lever and bracket, at transmission rear support. Install two bolts and nuts attaching cross shaft bracket to support, and tighten firmly. Position cross shaft lever to transfer rod in vehicle and connect with clevis pin at each end (fig 100). Do not install cotter pins. Position transfer reverse rod in vehicle and connect with clevis pin at each end, but do not install cotter pins. Adjust forward and reverse shift linkage as described in *b* above; then secure each of the four clevis pins with a cotter pin.

185. Manual-Shift Linkage

a. GENERAL. Transfer is placed into neutral and driving operation with manually-operated transfer lever, located above floor slightly to right of driver's seat (H, fig. 108). Through linkage, manually-operated lever actuates power-take-off shifter shaft in transfer. With transfer lever raised to "UP-ENGAGED" position, transfer is in driving position. When transfer lever is lowered to DOWN-NEUTRAL position, transfer is in neutral.

b. LINKAGE ADJUSTMENT. With hand-operated transfer lever in UP-ENGAGED position, and with lever resting on lower edge of guide slot, make sure shifter shaft in transfer is pulled out (forward) to detent stop. Adjust clevis (E, fig. 108) to center clevis pin vertically in elongated holes in clevis. Tighten lock nut firmly and secure all clevis pins with cotter pins.

c. LINKAGE REPLACEMENT.

(1) *Removal.* Remove cotter pin and clevis pin which connect transfer-lever-to-cross-shaft rod (F, fig. 108) to transfer lever (H, fig. 108). Remove cotter pins, retaining washer, and shaft which connect transfer lever to bracket; then remove transfer lever. Remove cotter pin, two washers, and clevis pin from lower end of

transfer lever-to-cross-shaft rod (F, fig. 108); then remove rod. Remove cotter pin, two washers, and clevis pin which connect cross shaft lever to transfer shifter shaft. Remove two nuts and bolts which attach each cross shaft bracket to frame crossmember; then remove cross shaft and brackets from vehicle.

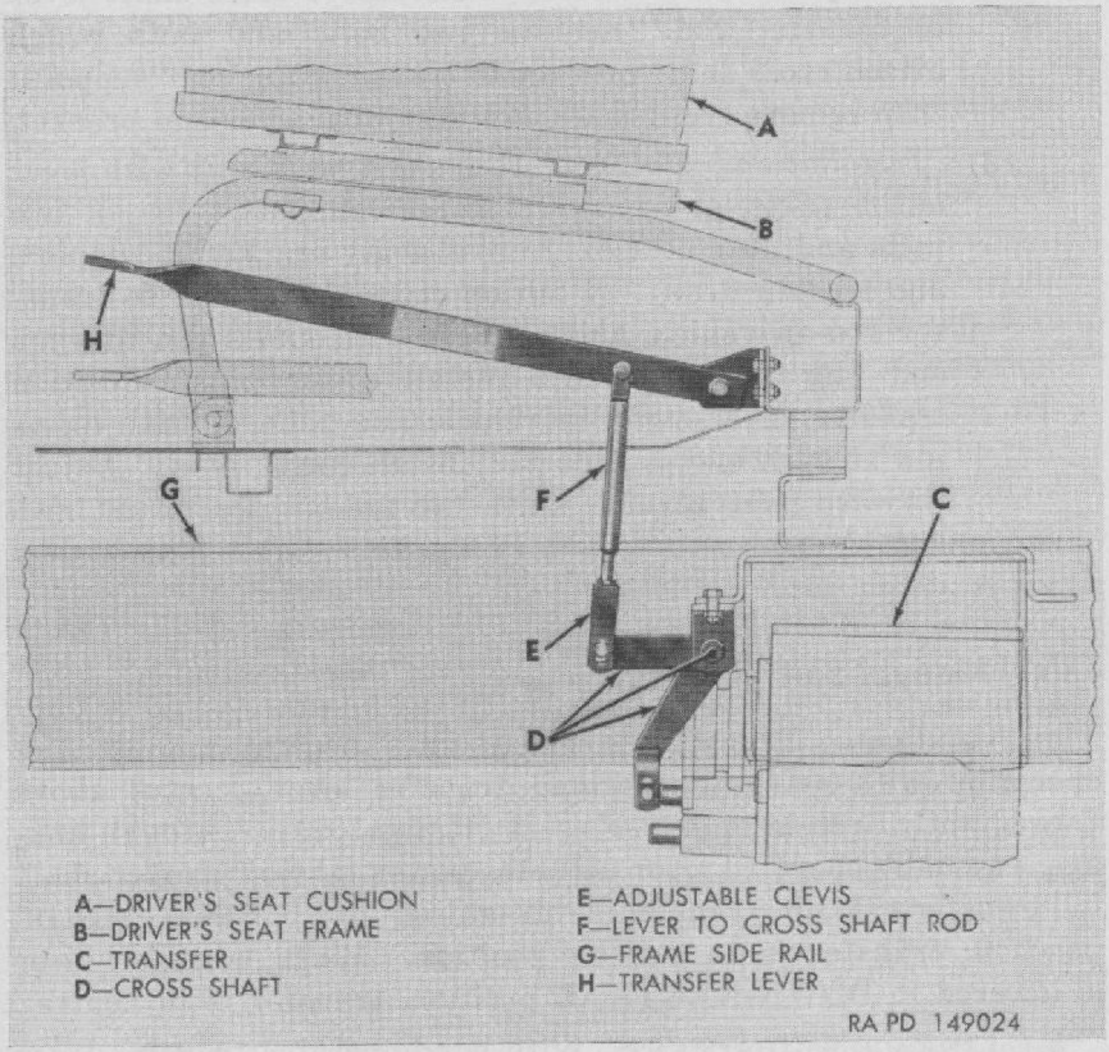


Figure 108. Transfer lever linkage.

(2) *Installation.* Position cross shaft and brackets to frame cross member. Attach each bracket with two bolts and nuts, tightening nuts firmly. Install clevis pin and two washers connecting cross shaft lever to transfer shifter shaft. Position transfer lever (H, fig. 108) to bracket and attach with shaft and retaining washer; then secure with cotter pins. Position transfer-lever-to-cross-shaft rod (F, fig. 108) and attach to transfer lever with clevis pin; then secure with cotter pin. Adjust linkage, as described in *b* above; then connect rod

(F, fig. 108) to cross shaft lever with clevis pin, two washers, and cotter pin.

186. Coordination with Ordnance Maintenance Unit

Replacement of the transfer with a new or rebuilt transfer is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, providing authority for performing this replacement is obtained from the appropriate commander. Tools needed for the operation, which are not carried in the using organization, may be obtained from the supporting ordnance maintenance unit.

187. Transfer Removal

a. DRAIN LUBRICANT. Remove drain and filler plugs (fig. 109), and allow lubricant to drain. Install and tighten plugs when drainage is complete.

b. DISCONNECT CONTROL LINKAGE. Disconnect control linkage by removing cotter pins and clevis pins from front axle shifter shaft and power-take-off shifter shaft (figs. 107 and 109). If winch is used, disconnect control at power-take-off (par. 190).

c. DISCONNECT VENT LINE. At top of transfer, unscrew tubing nut to disconnect vent line. Cover opening with tape.

d. DISCONNECT SPEEDOMETER FLEXIBLE SHAFT. Unscrew knurled nut with pliers and pull flexible shaft out of speedometer driven gear shaft.

e. DISCONNECT PARKING BRAKE CONTROL. Remove cotter pin and clevis pin which attach parking brake rod to brake cam levers.

f. DISCONNECT PROPELLER SHAFTS. Disconnect propeller shafts at transfer, two at front and two at rear, by removing bolts and nuts attaching propeller shaft flanges to transfer companion flanges. If equipped with winch, disconnect drive shaft at power-take-off (par. 288).

g. REMOVE TRANSFER. Roll dolly jack under vehicle and raise into position to support transfer. Bend cap screw lock plates away from screw heads and remove four mounting screws from each side. Lower transfer on jack and withdraw from under vehicle.

h. REMOVE ACCESSORIES. Remove parking brake assembly from rear of transfer (pars. 235*a* and 236*a*). Remove power-take-off (when used) as described in paragraph 192.

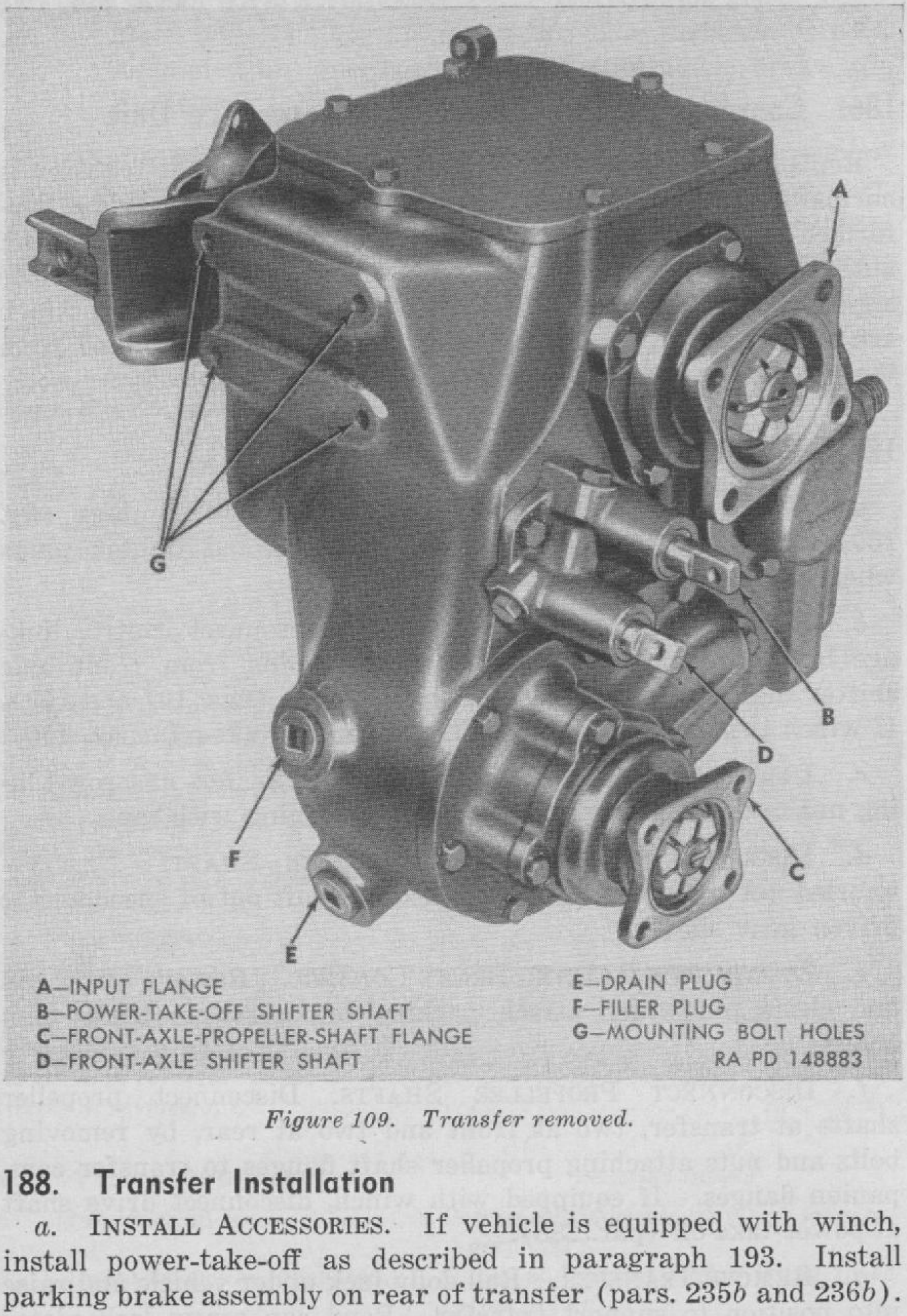


Figure 109. Transfer removed.

188. Transfer Installation

a. INSTALL ACCESSORIES. If vehicle is equipped with winch, install power-take-off as described in paragraph 193. Install parking brake assembly on rear of transfer (pars. 235*b* and 236*b*).

b. INSTALL TRANSFER. Place transfer on dolly jack and roll into position under vehicle. Raise transfer into position between supports and aline holes in supports with threaded holes in case. With lock plates under cap screw heads, install eight cap screws, four on each side. Tighten cap screws to 60 to 85 pound-feet torque and bend lock plates against cap screw heads. Lower dolly jack and remove from under vehicle.

c. CONNECT PROPELLER SHAFTS. Connect propeller shafts to transfer, two at front and two at rear. If equipped with winch, connect drive shaft to power-take-off (par. 288).

d. CONNECT PARKING BRAKE CONTROL. Install clevis pin connecting parking brake rod to brake cam levers. Secure clevis pin with new cotter pin. Adjust parking brake (par. 234).

e. CONNECT SPEEDOMETER FLEXIBLE SHAFT. Connect speedometer flexible shaft to transfer. Make sure that tongue on cable meshes with speedometer gear shaft. Tighten knurled nut with pliers.

f. CONNECT VENT LINE. Connect vent line at top of transfer. Tighten tubing nut firmly.

g. CONNECT CONTROL LINKAGE. Install clevis pins connecting linkage to shifter shafts. Secure clevis pins with new cotter pins. If winch is used, connect control to power-take-off (par. 190).

h. LUBRICATE. Examine condition of drain plug and replace if necessary. Install lubricant as described in paragraph 59*j*. Make sure drain and filler plugs are tight.

i. RECORD REPLACEMENT. Make a record of the replacement on DA AGO Form 478.

Section XIX. POWER-TAKE-OFF AND CONTROLS

189. Description

Single-speed power-take-off assembly is mounted to left side of transfer (fig. 110). Output shaft of power-take-off drives winch

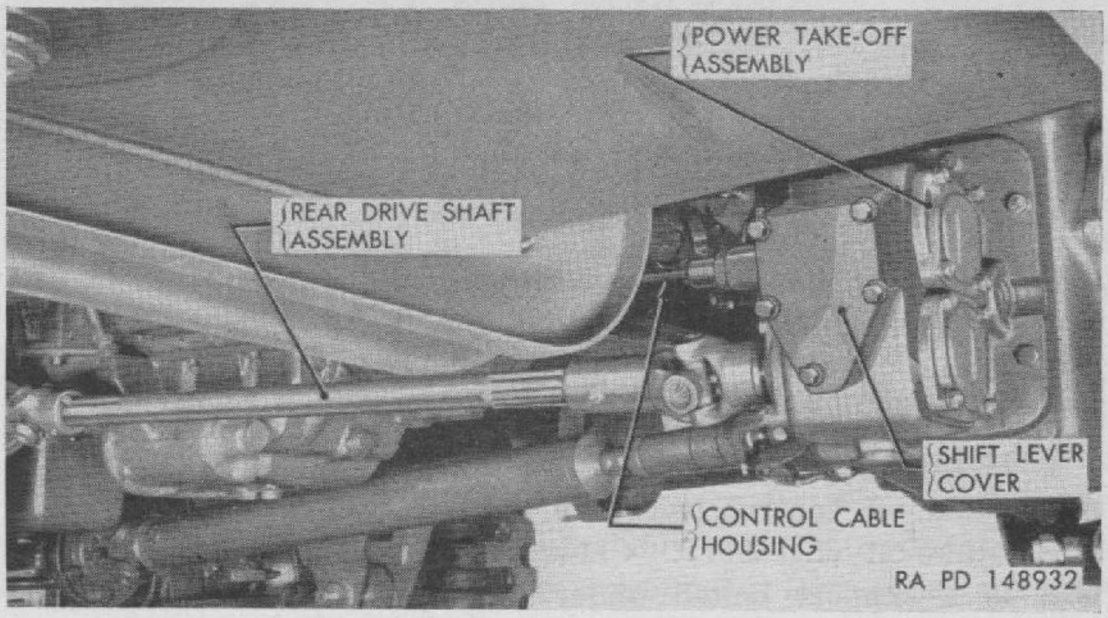


Figure 110. Power-take-off installed.

through drive shafts and universal joints. Power-take-off mechanism is placed into neutral, forward, and reverse driving positions by means of a manually-operated control lever, mounted under driver's seat. Lever is connected by cable linkage to shift lever on power-take-off (fig. 111). Operation of the power-take-off in conjunction with the winch is explained in paragraph 46.

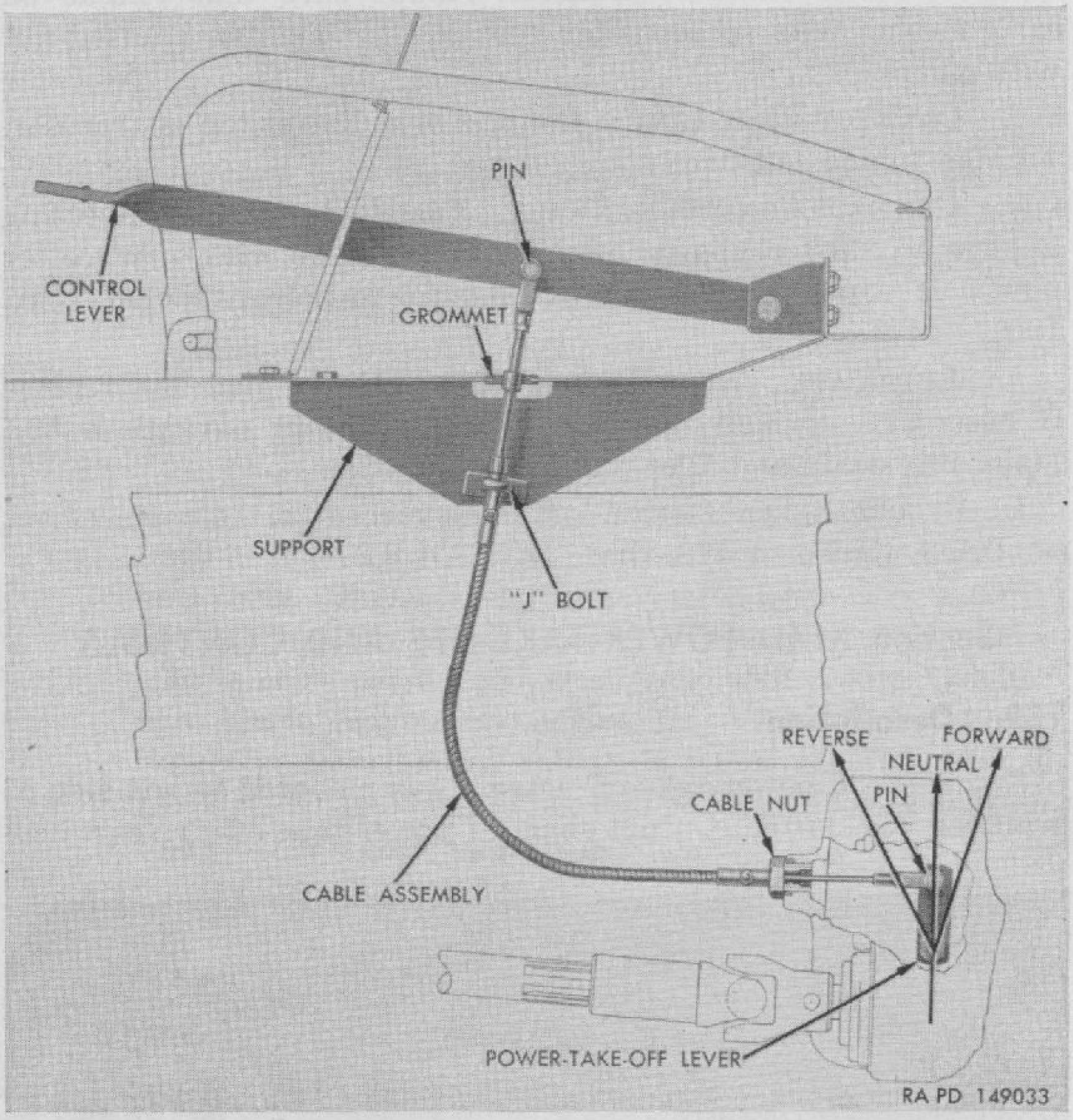


Figure 111. Power-take-off control linkage.

190. Controls and Linkage

a. GENERAL. The control cable assembly is connected to power-take-off control lever (in cab) and to shifting lever in power-take-off (fig. 111). Cable assembly is attached with a J bolt to a support bolted under floor pan. Cable assembly is equipped with an adjustable yoke at control lever (fig. 111).

b. Linkage Removal (fig. 111).

(1) Remove J bolt and nut attaching cable assembly to support under floor pan.

(2) Remove pin from yoke at control lever.

(3) Pull cable assembly down through rubber grommet in floor pan (under driver's seat).

(4) Remove five bolts attaching cover plate to power-take-off. Reach in and remove clevis pin from yoke at take-off lever.

(5) Loosen cable nut at power-take-off. Turn cable housing to remove cable assembly from power-take-off.

c. Linkage Installation (fig. 111).

(1) Place nut and lock washer on lower end of housing; then insert lower end of cable into power-take-off. Install pin through yoke and take-off lever. Turn cable housing to thread housing into power-take-off case; then tighten cable nut securely.

(2) Push cable assembly up through grommet in floor pan.

(3) Attach cable assembly to support (under floor pan) with J bolt and nut. Make certain that J bolt engages groove in cable assembly.

(4) With control lever in center slot of lock plate in cab (NEUTRAL) and shifting lever on power-take-off in vertical position (NEUTRAL), adjust yoke at control lever and at power-take-off lever for free entry of clevis pins without bind. Tighten jam nut at yoke.

(5) Check action of linkage by placing control in lower slot in lock plate (FORWARD). Lever at power-take-off should move toward rear to engage power-take-off for pulling or winding in cable on winch (par. 46*b*). Place control lever in upper slot of lock plate (REVERSE). Lever at power-take-off should move forward to engage power-take-off for paying-out or unwinding cable on winch (par. 46*c*).

(6) Install plate on side of power-take-off with five attaching bolts.

(7) Lubricate cable through lubrication fittings in cable assembly (par. 57).

191. Coordination with Ordnance Maintenance Unit

Replacement of the power-take-off with a new or rebuilt power-take-off is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, providing authority for performing this replacement is obtained from the appropriate commander. Tools needed for the operation which are not carried in the using organization may be obtained from the supporting ordnance maintenance unit.

192. Power-Take-Off Removal

a. Remove drain plug at bottom of power-take-off case to drain lubricant.

b. Remove five bolts attaching plate to side of power-take-off. Remove control cable (par. 190*b*).

c. Remove eight bolts which attach power-take-off to transfer case.

d. Pull power-take-off assembly straight out from transfer until gears clear transfer. Pull assembly straight back until universal joint clears splines of rear drive shaft.

e. Loosen set screw which secures universal joint to power-take-off shaft. Drive universal joint from shaft.

193. Power-Take-Off Installation

a. Install rear universal joint to power-take-off shaft, engaging key with keyway in joint yoke. Tighten set screw which secures joint to power-take-off shaft.

b. As power-take-off is raised into place, engage universal joint with splines on rear drive shaft.

c. Position new gasket on transfer case opening. Position power-take-off into transfer. Install and tighten eight attaching bolts.

d. Insert lower yoke of control cable into power-take-off. Insert pin through yoke and power-take-off lever.

e. Install control cable (par. 190*c*).

f. Fill transfer with lubricant (par. 57).

g. Make a record of the replacement on DA AGO Form 478.

Section XX. FRONT AXLE

194. Description and Data

a. DESCRIPTION.

(1) *General.* Front axle is hypoid, single-reduction type, using conventional differential and carrier assembly to transmit drive to front wheels through constant-velocity

Bendix-Weiss universal joints. Power to differential is transmitted from transfer through conventional propeller shaft.

(2) *Mounting.* Axle is attached to front springs in the usual manner using U bolts. Axle position is also held in exact location by the use of three torque rods between axle housing and frame brackets, which absorb all drive and braking torque and allow much easier riding of front springs.

b. DATA.

Type	hypoid, single-reduction.
Ratio	6.17 to 1.
Type of constant-velocity joints	Bendix-Weiss.

195. Front-Wheel Alinement

a. ALINEMENT FACTORS. Front-wheel alinement factors, such as camber, caster, turning angle, and toe-in, have a major effect on steering from a standpoint of control, ease of steering, and safety. Front wheel misalinement is a major cause of premature and uneven tire wear.

b. CASTER. Front-axle caster is the inclination of the center line through the upper and lower steering knuckle trunnions toward the rear of the vehicle (L, fig. 112). Caster is established by design, therefore no adjustment can be made.

c. CAMBER. Front wheel camber is the outward inclination of the wheels as viewed from the front of the vehicle; that is, the wheels are farther apart at the top than at the bottom (J, fig. 112). There is no adjustment for camber; however, loose wheel bearings, loose steering knuckle trunnion bearings, bent steering knuckle, or bent axle housing will affect camber.

d. TURNING ANGLE. Front wheel turning angle is the maximum angle through which the wheels may be turned from the straight-ahead position. This angle is greater for the inside wheel (C, fig. 112) than for the outside wheel (D, fig. 112).

e. TOE-IN. Front wheel toe-in is the amount by which the wheels are closer together at the front than at the rear, with the wheels in a straight-ahead position (A minus B, fig. 112). Camber causes both wheels to have a tendency to turn outward from the vehicle. Toe-in counteracts this tendency and causes the wheels to roll straight ahead with no scuffing action.

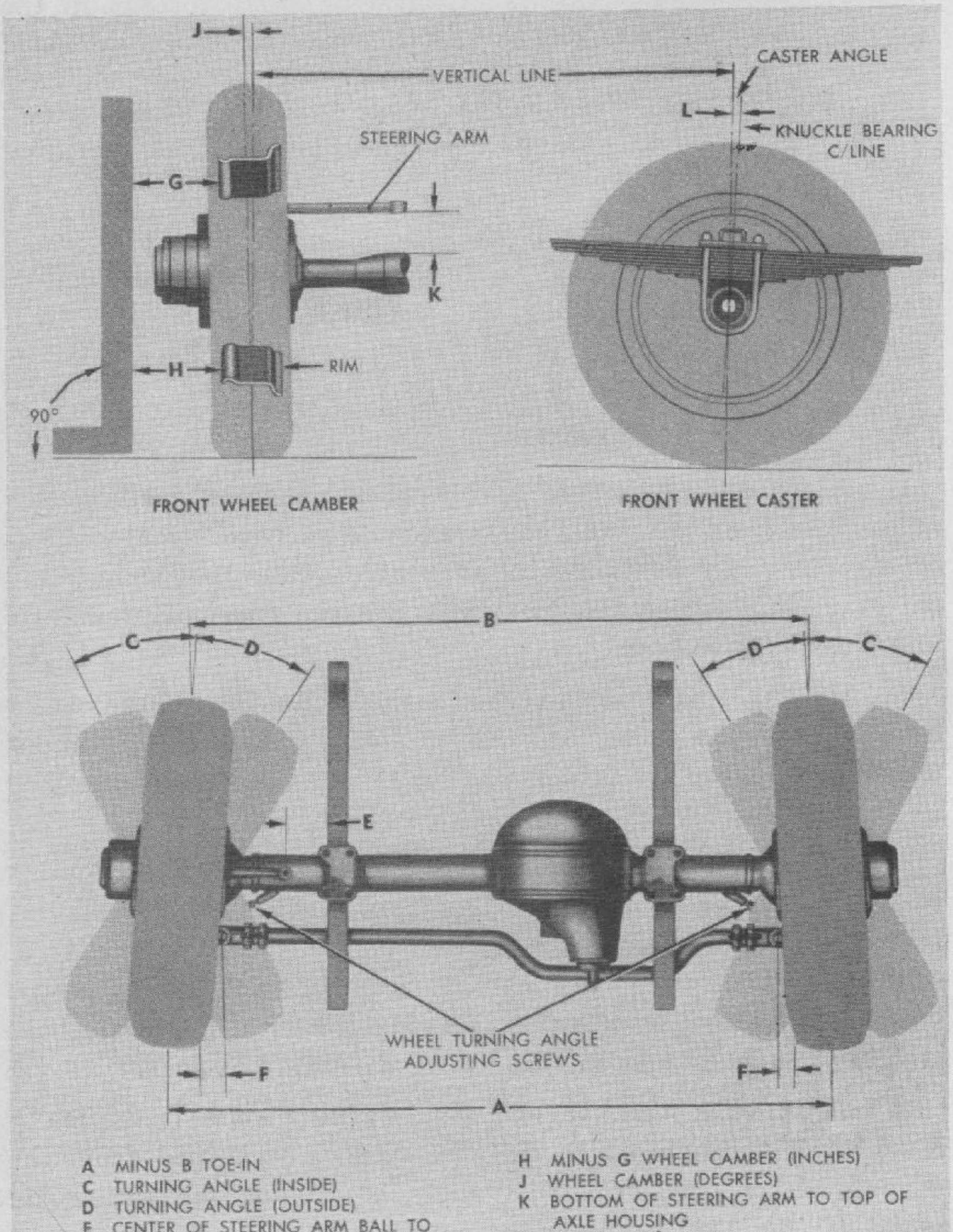


Figure 112. Front-wheel-and-axle-alinement chart.

f. Alinement Data.

A minus B	Toe-in (at hub C/L)	5/32 in to 7/32 in.
C	Turning angle—inside	28 deg + 1 deg − 0 deg.
D	Turning angle—outside	26 deg.
E	Center line of steering arm ball to outside of spring	3¼ in.
F	Backing plate to center of tie rod end pin	2⅞ in.
H minus G	Wheel camber	27/64 in to 0 in.
J	Wheel camber	¾ deg to 0 deg.
K	Bottom of steering arm to top of axle housing	3⅜ in.
L	Caster angle	1 deg 45 min.

196. Toe-In Adjustment

a. Toe-in Check (fig. 113). Inflate tires to correct pressure (par. 240*a*), check for proper wheel bearing adjustment (par. 244); then place vehicle on a smooth, level surface with the wheels in straight-ahead position. Place a toe-in wheel alinement gage between the wheels ahead of the axle at hub height with the ends of the gage bearing against the tire side walls and with ends of both pendant chains an equal distance from ground. Set gage so pointer registers zero. Remove gage and place at same relative position at rear of tire and with ends of pendant chains same distance from ground as at front. The pointer will indicate the amount of toe-in or toe-out. Correct toe-in is 5/32 inch to 7/32 inch.

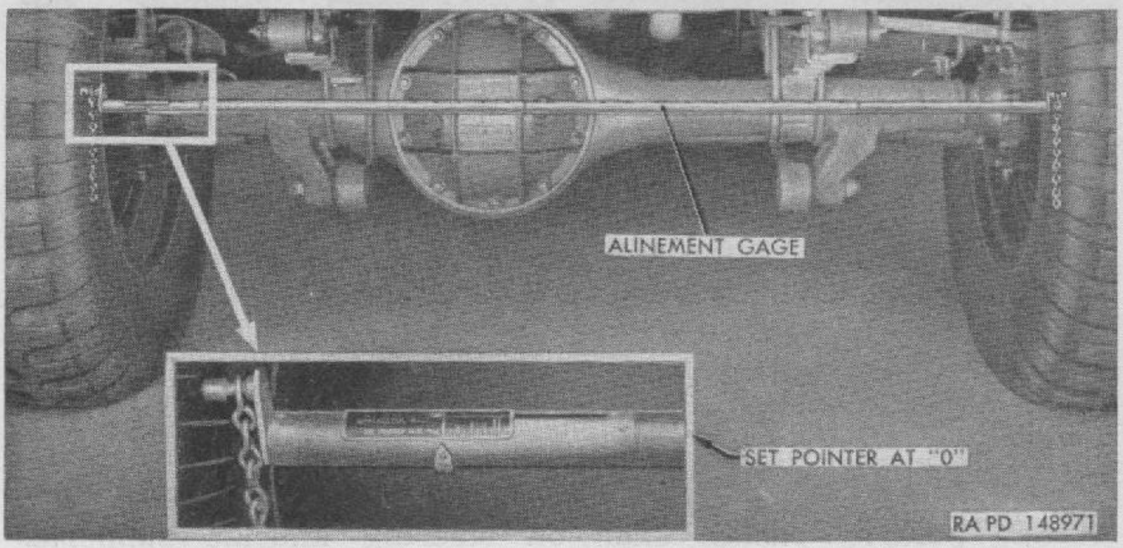


Figure 113. Checking toe-in (Gage 41–G–510).

b. TOE-IN ADJUSTMENT. Loose wheel bearings, worn steering knuckle bushings, loose steering knuckle support trunnion bearings, damaged wheels, and bent steering knuckle, housing, and tie-rod will affect toe-in. Replace damaged parts, and adjust wheel bearings (par. 244), before adjusting the tie rod to correct toe-in.

(1) *Remove tie rod* (fig. 114). Position vehicle with wheels in straight-ahead position and remove tie rod (par. 197*b*).

(2) *Adjust tie rod.* Loosen tie rod end clamp bolt nuts at each end of tie rod. Remove inner clamp bolt and tie-rod-in lock (fig. 115) at tie rod left end. Screw tie rod ends onto or off of tie rod as required to obtain correct toe-in.

Note. Tie rod right end has coarse threads, while tie rod left end has fine threads. This construction permits a finer adjustment than would be possible if both threads were same size. Toe-in will be changed about one-eighth inch by each revolution of right (coarse thread) end, and slightly less by turning left (fine thread) end. In some instances it may be necessary to adjust both ends to obtain correct toe-in.

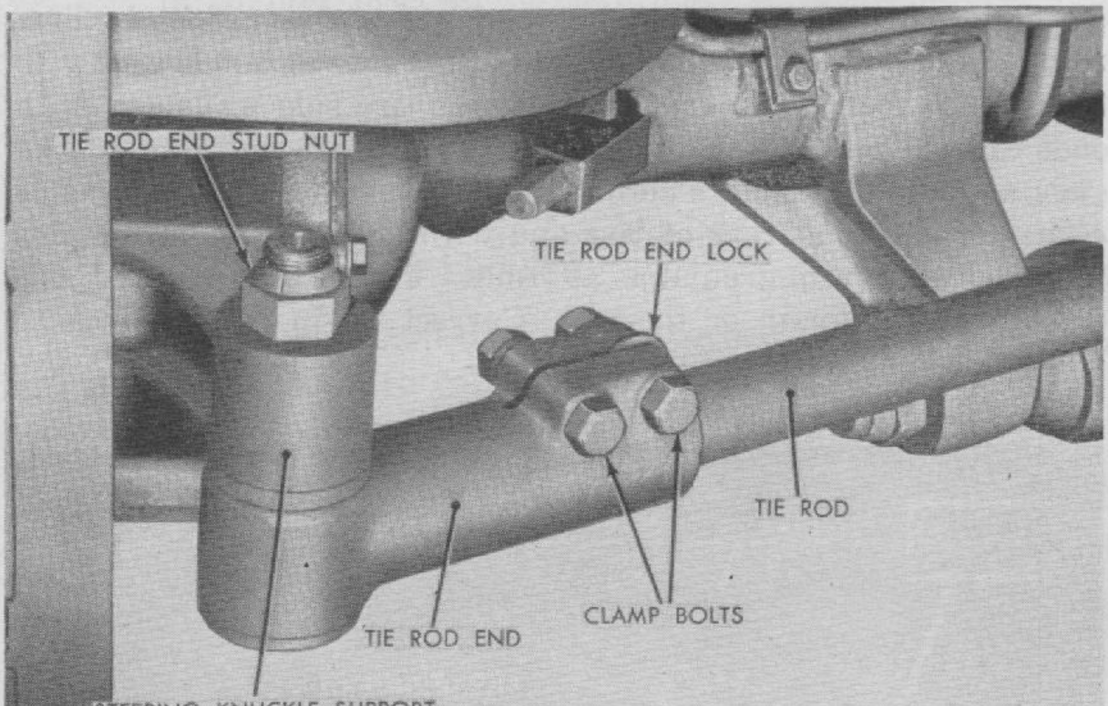


Figure 114. Tie rod installed.

(3) *Check adjustment.* After adjusting tie rod ends, temporarily install ends on steering knuckle supports. Measure toe-in as instructed in *a* above, and readjust if necessary until measurement is correct.

(4) *Install tie rod.* When adjustment is correct reinstall tie rod ends permanently to steering knuckle support. Install lock in tie rod left end (fig. 115), making certain that lock is seated in keyway in tie rod. Aline lock with bolt hole in tie rod end; then install clamp bolt and nut. Tighten two clamp bolt nuts at each tie rod end.

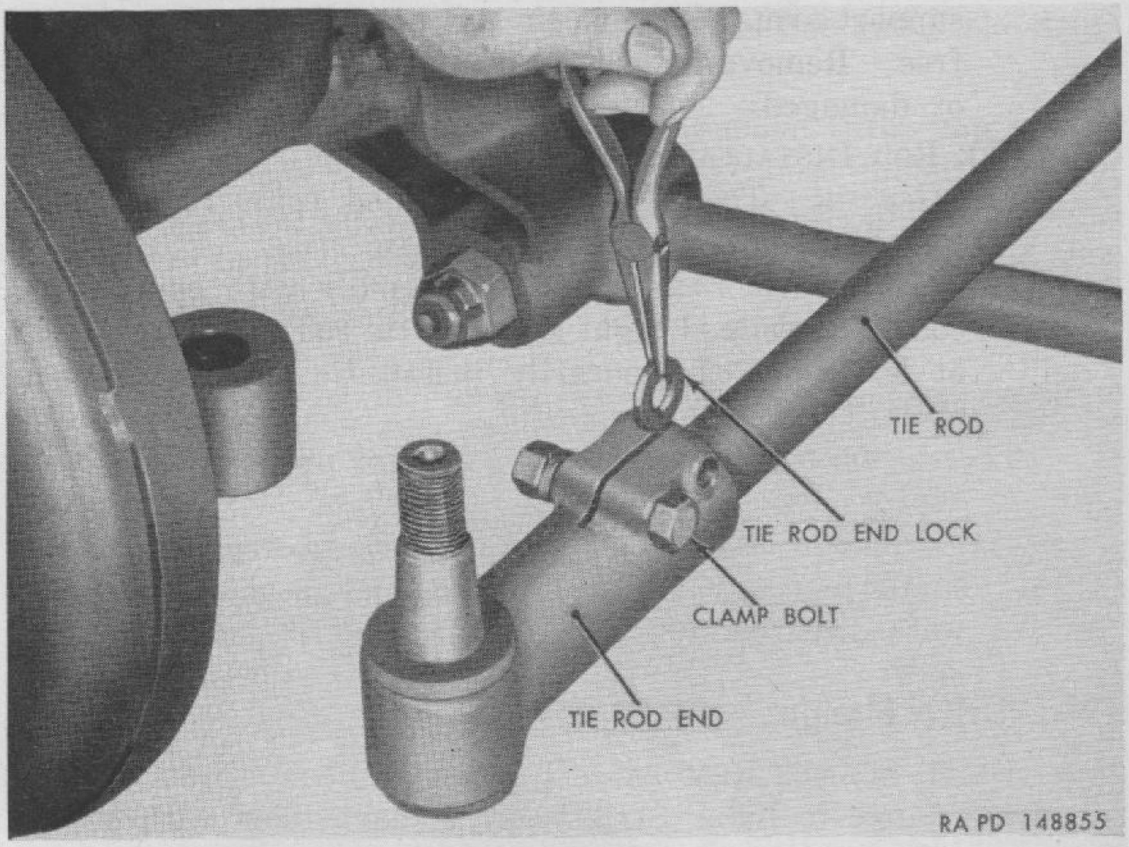


Figure 115. Installing tie rod end lock.

197. Tie Rod

a. GENERAL. Tie rod is solid type with double offset to clear differential carrier and is connected to steering knuckle supports by tie rod ends which are threaded onto tie rod and held by two clamps bolts at each end. Left end of tie rod has fine threads while right end has coarse threads, which permits a fine degree of toe-in adjustment. Tie rod ends incorporate a tapered pin mounted in material requiring no lubrication. Tapered pin is held in steering knuckle support by a nut.

b. TIE ROD REMOVAL.

(1) *Position vehicle.* Place vehicle on a level surface and apply parking brake. Place a jack under front axle and raise enough to take weight of vehicle off front wheels.

(2) *Remove tie rod.* Loosen two tie rod end clamp bolt nuts at each end of tie rod, also remove inner clamp bolt and lock (fig. 115) at tie rod left end. Remove tie-rod-end-tapered-pin nut at each end of tie rod. Tap steering-knuckle-support arm a sharp blow with hammer as downward pressure is applied to tie rod end with a pinch bar. Move each tie rod end down an at same time twist forward until free from steering-knuckle-support arm. Remove tie rod end when both ends are free. Remove and discard rubber seals if deteriorated or damaged.

c. TIE ROD INSTALLATION.

(1) *General.* Toe-in must be adjusted (par. 196*b*) when installing new or reconditioned tie rod.

(2) *Position tie rod.* Position assembly with end having coarse threads at right side and tie rod end having lock at left side. Temporarily install tie rod until toe-in check (par. 196*a*) is made.

(3) *Adjust tie rod.* Adjust tie rod for proper toe-in (par. 196*b*).

(4) *Install tie rod.* Install tie rod ends to steering knuckle supports (par. 196*b* (4)), using new seals if old parts were discarded.

198. Drive Flange

a. DRIVE FLANGE REMOVAL. Remove eight stud nuts attaching drive flange to hub. Strike hub a sharp blow with a soft hammer to loosen tapered split dowels; then remove dowels from studs. Install two cap screws (½-20 NF) in the tapped holes in drive flange. Turn screws evenly and alternately until flange is removed. Remove and discard flange to hub gasket.

b. DRIVE FLANGE INSTALLATION. Install drive flange over splined outer end of axle shaft, using a new gasket between flange and hub. Aline holes in flange with hub studs; then push flange in against hub. Install eight split tapered dowels and nuts on studs and tighten nuts to 55–65 pound-feet torque. When nuts have been tightened, inspect for slight clearance (aprx. 1/16 in) between nut and flange. If no clearance exists, it indicates that dowels, tapered holes in flange, or studs are worn excessively and must be replaced with new parts.

199. Axle Shaft and Universal Joints

a. GENERAL. Axle shafts are full-floating type with a Bendix-Weiss constant-velocity universal joint at each steering knuckle. Each axle shaft is splined at inner end in differential side gear, and at outer end in drive flange which is attached to wheel hub.

b. AXLE SHAFT AND UNIVERSAL JOINT REMOVAL.

(1) *Remove wheel.* Jack up axle; then remove wheel stud nuts and remove tire and wheel assembly.

(2) *Remove drive flange, hub, and drum.* Remove drive flange (par. 198*a*). Remove wheel hub and brake drum assembly (par. 245*a*).

(3) *Loosen brake hose shield.* Remove three cap screws and lock washers attaching brake hose shield to top of steering knuckle support, to permit utilizing full length of brake flexible hose when brake backing plate and shoe assembly is removed.

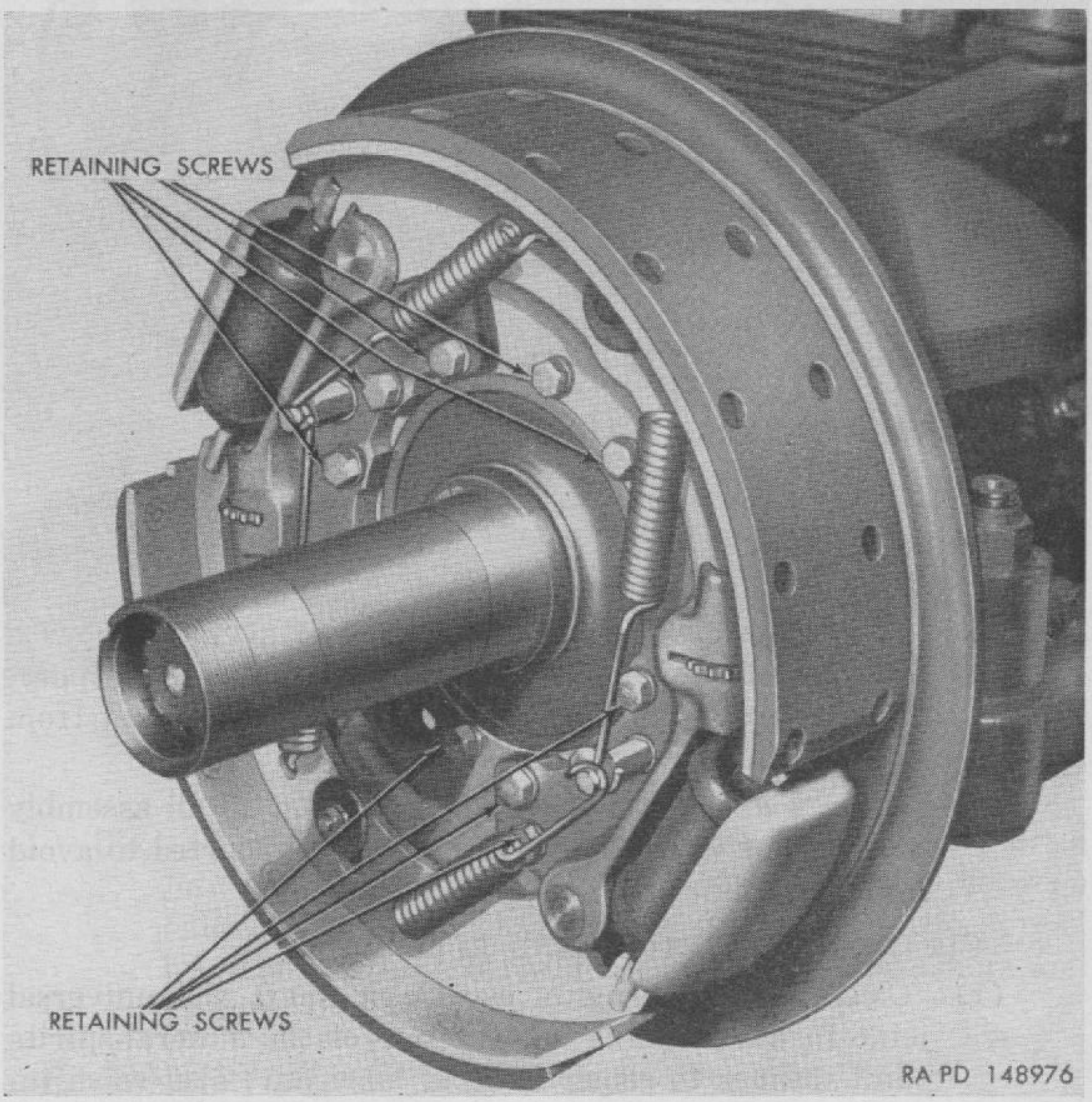


Figure 116. Brake backing plate and shoe assembly installed.

(4) *Remove brake backing plate and shoe assembly.* Remove 12 retaining screws and lock washers (fig. 116) attaching brake backing plate to steering knuckle.

Note. Observe installed position of backing plate so that it can be reinstalled in its original location.

Remove backing plate and shoe assembly from steering knuckle and swing over end of steering knuckle (fig. 117). Remove old gasket from backing plate and steering knuckle.

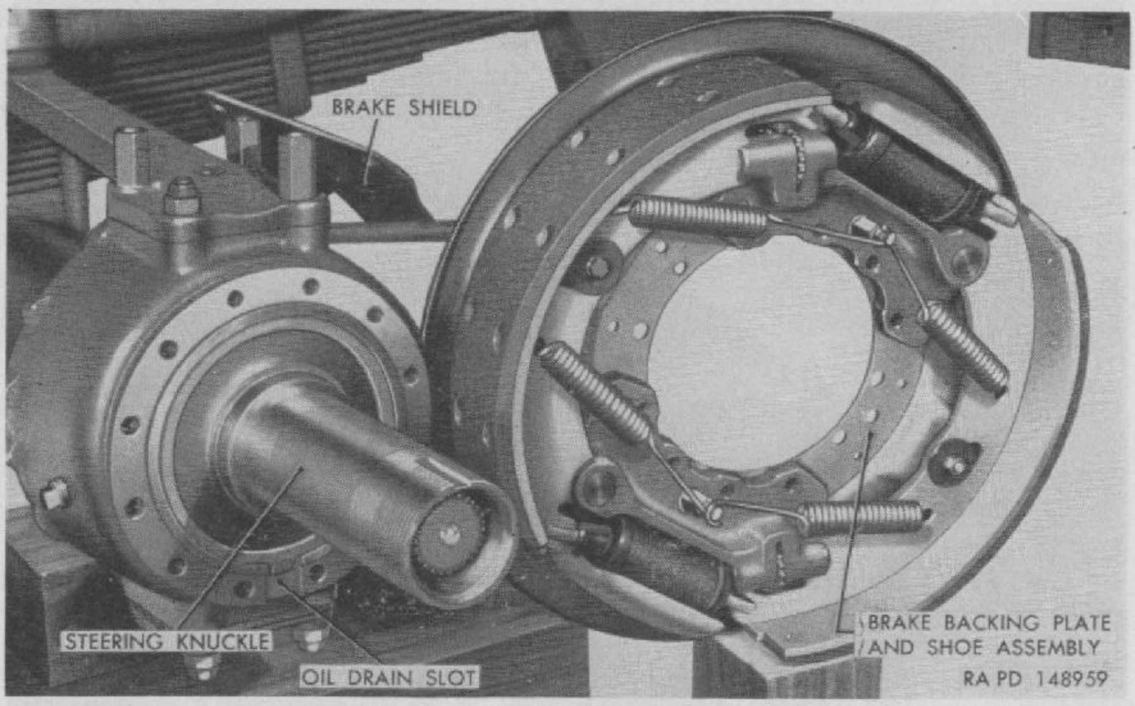


Figure 117. Brake backing plate and shoe assembly removed showing steering knuckle.

(5) *Remove steering knuckle.* Tap steering knuckle with soft hammer to loosen from steering knuckle support; then remove steering knuckle. Remove old gasket from steering knuckle and knuckle support.

(6) *Remove axle shaft and universal point.* Pull assembly straight out (fig. 118) as assembly is supported to avoid damage to axle shaft oil seal in housing.

c. CLEANING, INSPECTION, AND LUBRICATION.

(1) *Cleaning.* Thoroughly wash axle shaft and universal joint in dry-cleaning solvent or volatile-mineral-spirits paint thinner to remove all old lubricant; also wash inside of steering knuckle support, steering knuckle, and housing outer end.

(2) *Inspection.* Inspect balls and ball races for grooved, scratched, or pitted condition. To determine if excessive play or backlash exist in the universal joint, place the assembly in a vise, having soft jaws, in a vertical position with the outer (short) shaft up, and with vise jaws gripping the inner shaft below the universal joint. Firmly push down on outer shaft so that it rests on center ball, and at the same time attempt to twist the joint in both directions. If any play or backlash is evident, report to ordnance maintenance personnel. Inspect axle shaft thrust washers in steering knuckle and axle housing for excessive wear or damage. Examine axle shaft splines for nicks, cracks, or other damage. Inspect oil seal in axle housing for wear or cuts in lip of seal. Report all worn or damaged conditions to ordnance maintenance personnel.

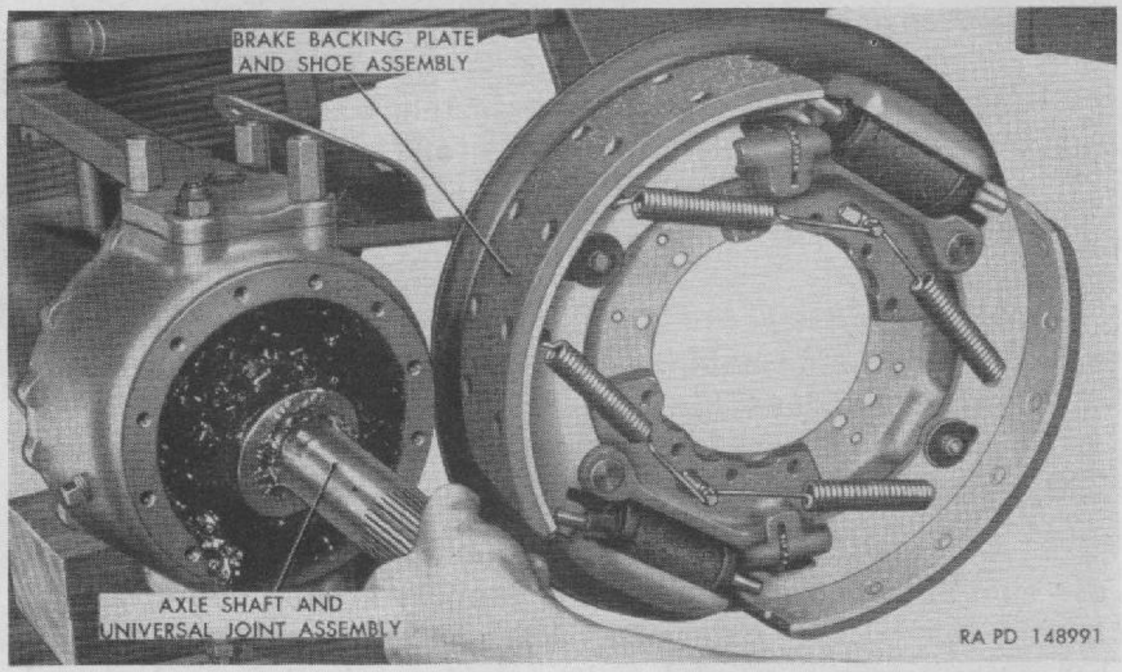


Figure 118. Removing axle shaft and universal joint assembly.

(3) *Lubrication.* Pack new lubricant well into universal joint and around balls until if fills all space between balls and universal joint yokes (par. 57). Also spread lubricant on surfaces which contact thrust washers and bushing in steering knuckle.

d. AXLE SHAFT AND UNIVERSAL JOINT INSTALLATION.

(1) *Install axle shaft and universal joint.* Use care not to damage axle shaft seal in housing, and insert axle shaft

and universal joint assembly into axle housing, guiding splined end of inner shaft into splined differential side gear.

(2) *Install steering knuckle.* Carefully install new gasket to steering knuckle support. Place steering knuckle over outer end of axle shaft and position against steering knuckle support with bolt holes in alinement.

Note. Milled oil drain slot in steering knuckle flange must be at bottom (fig. 117).

(3) *Install backing plate and shoe assembly.* Carefully install new gasket to steering knuckle. Swing backing plate and shoe assembly over end of steering knuckle and into place against steering knuckle, being sure plate is properly located at noted at time of removal (fig. 116). Aline bolt holes in plate with those in steering knuckle and install 12 retaining screws and lock washers. Tighten screws. Install brake flexible hose shield at top of steering-knuckle-arm studs, using three cap screws and lock washers.

(4) *Install hub and drum.* Install wheel hub and brake drum assembly (par. 245) and adjust hub bearings (par. 244).

(5) *Install drive flange.* Install axle drive flange (par. 198*b*).

(6) *Install wheel.* Install wheel and tire on hub, install wheel stud nuts, and tighten. Lower jacks and remove from under vehicle.

200. Housing Outer Seal

a. GENERAL. Axle housing outer end seals are installed on inner side of each steering knuckle support around spherical surface of axle housing outer end. Each assembly consists of a gasket, outer retainer, oil seal (felt), spring seal retainer, dust seal, seal retainer, and inner retainers (fig. 119). The oil seal is composition of felt and neoprene to prevent leakage of lubricant. The dust seal is spring loaded and bears tightly against spherical surface. When seals are in good condition and properly installed, lubricant leakage is prevented and entrance of dirt, water, or other contaminants is prevented.

b. REMOVAL.

(1) *Remove inner retainers.* Remove 12 caps and screws and lock washers attaching two inner retainers, seal retainer, and outer retainer to steering knuckle support (fig. 119).

(2) *Remove oil seals* (fig. 119). Oil seal (felt) is split and can be replaced with new part. Dust seal (neoprene) and spring seal retainer are not split and cannot be replaced at this time. Report worn or damaged conditions to ordnance maintenance personnel.

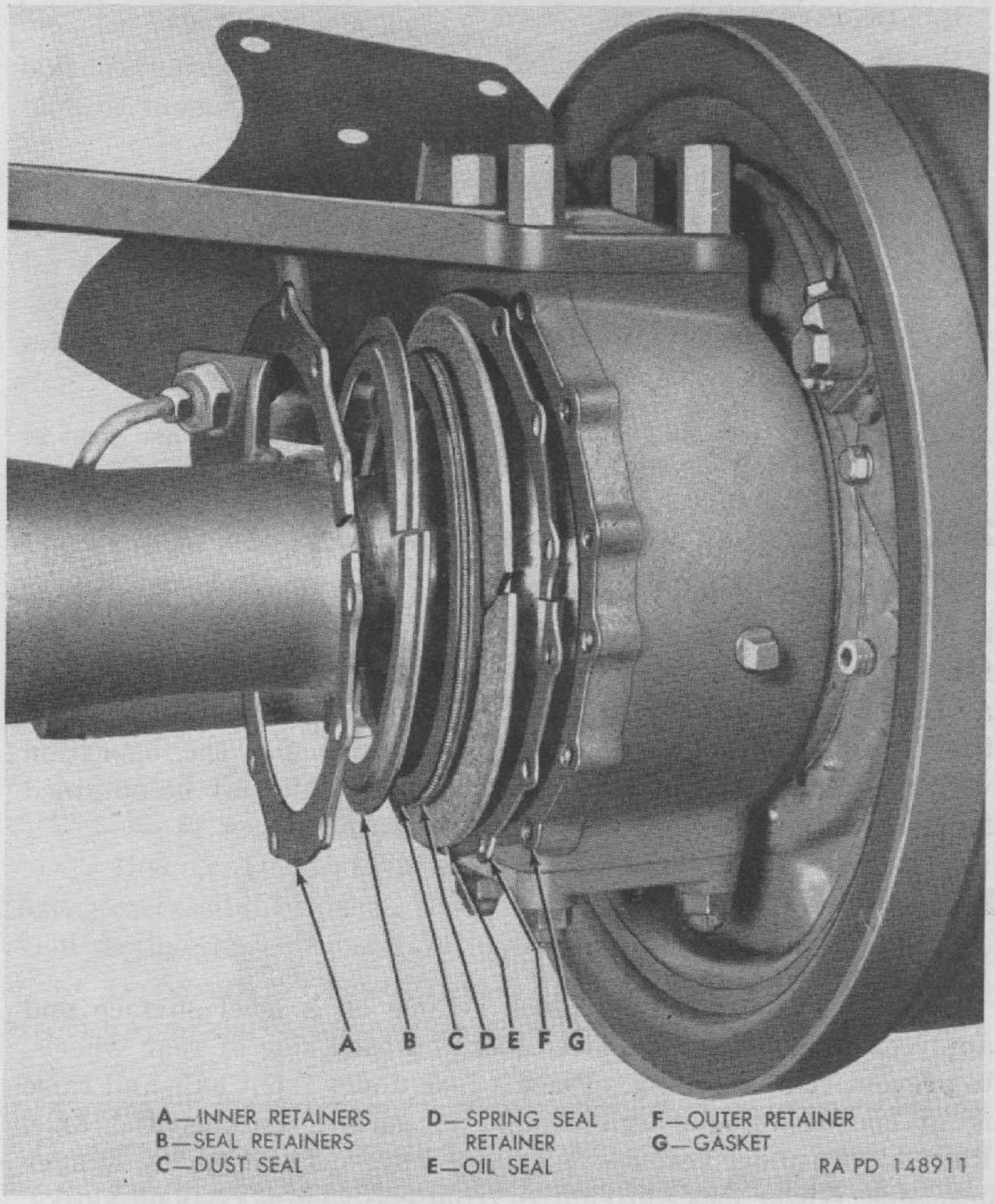


Figure 119. Housing outer seal components.

c. CLEANING AND INSPECTION.

(1) *Cleaning.* Clean steering knuckle support and outer retainer to remove all gasket material. Clean axle housing spherical surface and retainers, using dry-cleaning

solvent or volatile-mineral-spirits paint thinner. Clean spherical surface with fine flint paper if surface is pitted or rusty.

(2) *Inspection.* Inspect oil seal to determine if continued use is advisable. Report all worn or damaged conditions to ordnance maintenance personnel.

d. INSTALLATION.

(1) *Install gasket.* Install new gasket to steering knuckle support, using small quantity of gasket cement to hold gasket in place.

(2) *Install seal and retainers.* Install remaining parts in order illustrated in figure 119 as follows: Outer retainer, oil seal (felt), dust seal and spring, seal retainer, and two inner retainers. When the above parts are properly positioned, secure with 12 cap screws and lock washers.

Note. Felt side of oil seal must be toward outside and joint at top; also, install outer seal joint toward front.

201. Coordination with Ordnance Maintenance Unit

Replacement of the front axle with a new or rebuilt front axle is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, providing authority for performing this replacement is obtained from the appropriate commander. Tools needed for the operation which are not carried in the using organization may be obtained from the supporting ordnance maintenance unit.

202. Front Axle Removal

(fig. 120)

a. POSITION VEHICLE. Place vehicle on a level surface and apply parking brake, or place blocks on each side of rear wheels, to prevent vehicle rolling. Place a jack under front axle and raise front end of vehicle high enough to permit withdrawing axle. Place blocks under frame side rails at rear of front spring hanger brackets. Lower jack until entire front end weight rests on blocks.

b. REMOVE WHEELS. Remove wheel stud nuts and remove wheel and tire from each side.

c. DISCONNECT PROPELLER SHAFT. Remove four bolts and nuts attaching propeller shaft universal joint flange to differential pinion flange. Tie propeller shaft up to prevent universal joint becoming damaged or filled with dirt.

b. CONNECT UPPER TORQUE ROD. Insert upper torque rod tapered pin into axle bracket and install nut and washer. Tighten nut to 350–400 pound-feet torque.

c. CONNECT FLEXIBLE HOSE. Connect hydraulic brake and axle vent flexible hose at junction on top of axle housing.

d. CONNECT AXLE TO SPRINGS. Lift axle until spring center bolt is located in hole of spring seat on top of axle. Install "U" bolts and spring bumper block with shock absorber link eye at front. Install "U" bolt nuts and tighten nuts to 170–200 pound-feet torque.

e. CONNECT SHOCK ABSORBER LINKS. Install shock absorber link stud in spring bumper block and install nut. Tighten nut to 48–64 pound-feet torque.

f. CONNECT LOWER TORQUE RODS. Insert lower torque rod tapered pins into axle brackets and install washers and nuts. Tighten nuts to 350-400 pound-feet torque.

g. CONNECT DRAG LINK. Install drag link tapered stud in steering arm and install nut. Tighten nut securely.

h. CONNECT PROPELLER SHAFT. Position propeller shaft joint flange to differential pinion flange and install four bolts and nuts attaching these two flanges. Tighten four nuts to 33–43 pound-feet torque.

i. INSTALL WHEELS. Install wheels on hub and install stud nuts. Tighten nuts to 300–350 pound-feet torque.

j. BLEED BRAKES. Perform brake bleeding operation (par. 219).

k. LUBRICATE. Check lubricant level in axle differential and universal joints at outer end of housing (par. 57).

l. REMOVE BLOCKS AND JACK. Raise front of vehicle with jack sufficiently to permit removal of blocks from under frame side rails. Lower jack and withdraw from under vehicle. Recheck spring U bolts nuts for 170–200 pound-feet torque with full weight of vehicle resting on springs.

m. RECORD REPLACEMENT. Make a record of the replacement on DA AGO Form 478.

Section XXI. REAR AXLES

204. Description and Data

a. DESCRIPTION.

(1) *General.* Rear axles are hypoid, single-reduction type, using conventional differential and carrier assembly to

transmit drive to rear wheels through full-floating axle shafts. Housing is forged banjo type with cast cover which provides maximum strength and accessibility to differential.

(2) *Mounting.* Each axle is positioned and attached to frame by three torque rods, which transmit all of the drive and braking torque to the frame. Vehicle load is transmitted to axle through main and secondary springs which contact axle housings through brackets welded to axle housing. Springs contact at housing is slipper action on brackets welded to axle housings.

b. DATA.

Type .... hypoid, single-reduction.
Type axle shafts .... Full-floating.
Ratio .... 6.17 to 1.

205. Axle Shafts

a. GENERAL. Axle shafts are full-floating type with forged flange having integral lifting and hold-down eye at outer end and splines at differential end. Flanged end of shaft is attached to hub by studs, tapered dowels, and nuts. Inner end of shaft is splined to differential side gear.

b. AXLE SHAFT REMOVAL. Remove eight stud nuts at hub. Strike end of axle shaft (fig. 121) with hammer to loosen tapered

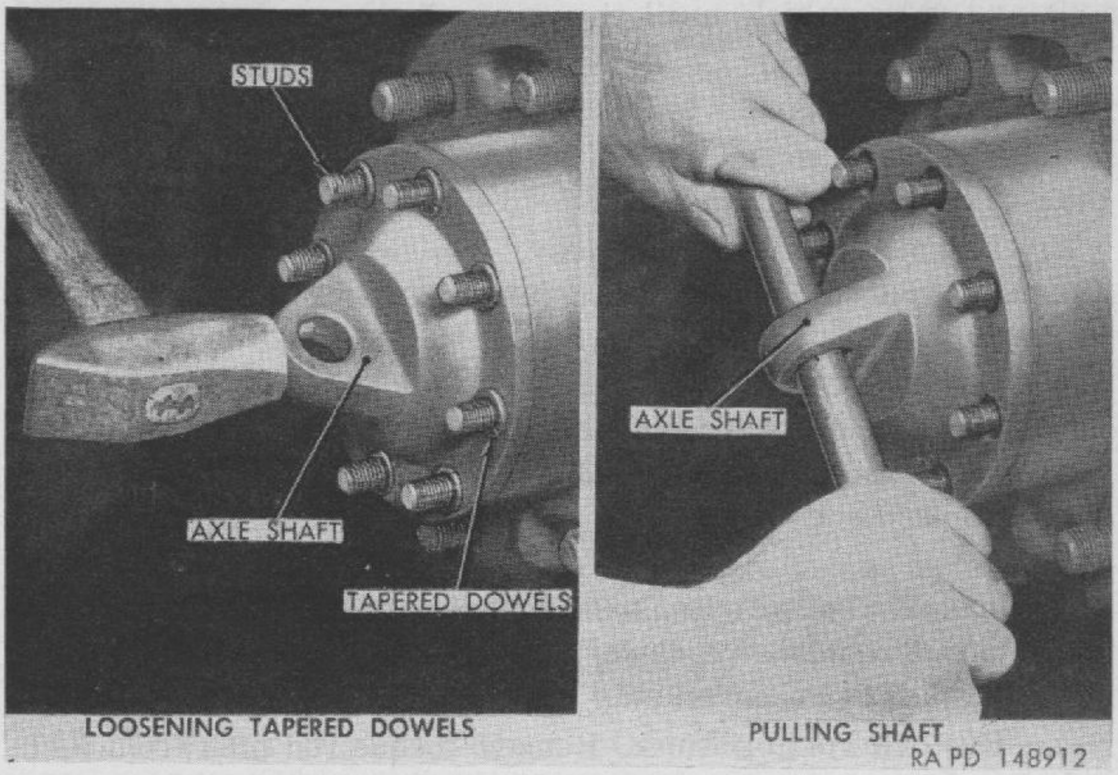


Figure 121. Removing axle shaft.

dowels; then remove dowels. Insert small steel bar through eye in end of axle shaft (fig. 121) and pull shaft out of axle.

c. AXLE SHAFT INSTALLATION. Clean shaft to remove any dirt; then dip splined end in axle lubricant. Insert splined end into hub, guiding splines into differential side gear. Rotate shaft or wheel hub as necessary to aline hub studs with holes in shaft flange; then press shaft into place. Install split tapered dowels and nuts on each stud and tighten nuts to 55–65 pound-feet torque. There should be slight clearance (apprx. 1/16 in.) between nut and shaft flange. If no clearance exists, studs, dowels, or holes in flange are worn excessively, and new parts must be installed.

206. Coordination with Ordnance Maintenance Unit

Replacement of the real axles with new or rebuilt rear axles is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, providing authority for performing this replacement is obtained from the appropriate commander. Tools needed for the operation which are not carried in the using organization may be obtained from the supporting ordnance maintenance unit.

207. Forward Rear Axle Removal

a. POSITION VEHICLE. Place vehicle on a level surface and block front wheels to prevent vehicle rolling. Place a jack under axle and raise vehicle until tires are off the ground.

b. REMOVE WHEELS. Remove wheel stud nuts and remove wheel and tire from each side.

c. BLOCK VEHICLE. Place blocks under torque rod support bracket at spring seat on each side to support vehicle.

d. DISCONNECT FLEXIBLE HOSE. Disconnect hydraulic brake and axle vent flexible hose at junction block on top of axle housing.

e. DISCONNECT PROPELLER SHAFTS. Remove four bolts and nuts attaching propeller-shaft-universal-joint flange to differential pinion flange. Remove bolts and nuts attaching propeller shafts to each end of propeller shaft pillow block on top of axle housing.

f. LOOSEN TORQUE RODS. Remove nuts and washers from three torque rods; then use soft metal hammer to loosen torque-rod taper pins in axle brackets.

g. REMOVE TORQUE RODS. Remove torque rod pins from each axle bracket.

Caution: Be sure axle is safely supported to prevent rolling off jack and resulting in injury to personnel.

h. REMOVE AXLE. Lower axle with jack and pull forward as necessary to disengage main spring ends from axle brackets; then completely remove assembly.

i. REMOVE PILLOW BLOCK. Remove four stud nuts and tapered dowels attaching pillow block to bracket on axle housing; then remove pillow block assembly.

Note. If same axle assembly is to be reinstalled, it is not necessary to remove pillow block assembly.

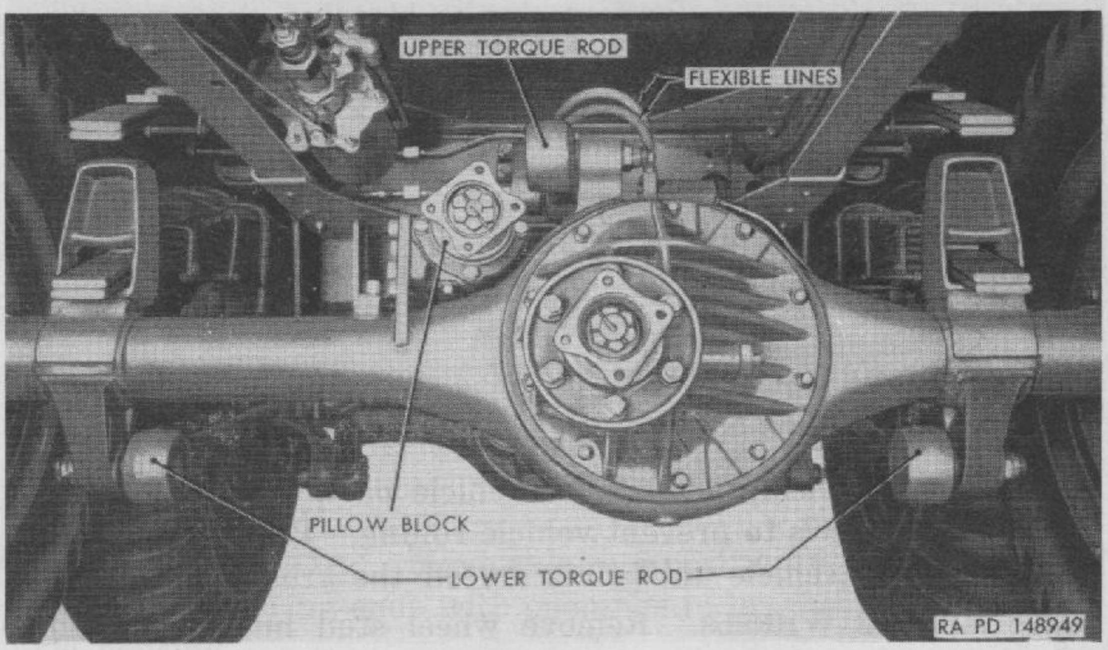


Figure 122. Forward rear axle installed.

208. Forward Rear Axle Installation

(fig. 122)

a. INSTALL PILLOW BLOCK. Position pillow block to axle bracket; then install four tapered dowels and stud nuts. Tighten nuts to 48–64 pound-feet torque.

b. POSITION AXLE. Move axle into position under vehicle and engage main spring ends with openings in brackets at each end of axle housing.

c. CONNECT TORQUE RODS. Attach three torque rods to axle brackets by installing tapered pins in axle brackets. Install washer and nut on each pin and tighten to 350–400 pound-feet torque.

d. CONNECT FLEXIBLE HOSE. Connect hydraulic brake and axle vent flexible hose at junction on top of axle housing.

e. CONNECT PROPELLER SHAFTS. Position respective propeller shafts to differential pinion flange and to each end of pillow block assembly, with lubrication fittings in same plane as other shafts; then install four bolts and nuts at each location. Tighten nuts to 33–43 pound-feet torque.

f. INSTALL WHEELS. Install wheels on hubs; then install wheel stud nuts. Tighten nuts to 300–350 pound-feet torque.

g. REMOVE BLOCKS AND JACK. Raise vehicle with jack as necessary in order that blocks under each torque rod support bracket at spring seat can be removed; then lower jack and withdraw from under vehicle.

h. BLEED BRAKES. Perform brake bleeding operation (par. 219).

i. LUBRICATE. Check lubricant level in axle differential (par. 59*i*). Lubricate propeller shaft universal joints and pillow block (par. 57).

j. RECORD REPLACEMENT. Make a record of the replacement on DA AGO Form 478.

209. Rear Rear Axle Removal

(fig. 123)

a. POSITION VEHICLE. Place vehicle on a level surface and block front wheels to prevent vehicle rolling. Place a jack under axle and raise vehicle until tires are off the ground.

b. REMOVE WHEELS. Remove wheel stud nuts and remove wheel and tire assembly from each side.

c. BLOCK VEHICLE. Place blocks under torque rod support bracket at spring seat at each side to support vehicle after axle is removed.

d. DISCONNECT FLEXIBLE HOSE. Disconnect hydraulic brake and axle vent flexible hose at junction block on top of axle housing.

e. DISCONNECT PROPELLER SHAFTS. Remove four bolts and nuts attaching propeller shaft universal joint flange to differential pinion flange.

f. LOOSEN TORQUE RODS. Remove nuts and washers from three torque rods; use soft metal hammer to loosen torque rod pins in axle brackets.

g. REMOVE TORQUE RODS. Remove torque rod pins from each axle bracket.

Caution: Be sure axle is safely supported to prevent rolling off jack and resulting in injury to personnel.

h. REMOVE AXLE. Lower axle with jack and pull assembly rearward as necessary to disengage main spring ends from axle brackets; then completely remove assembly.

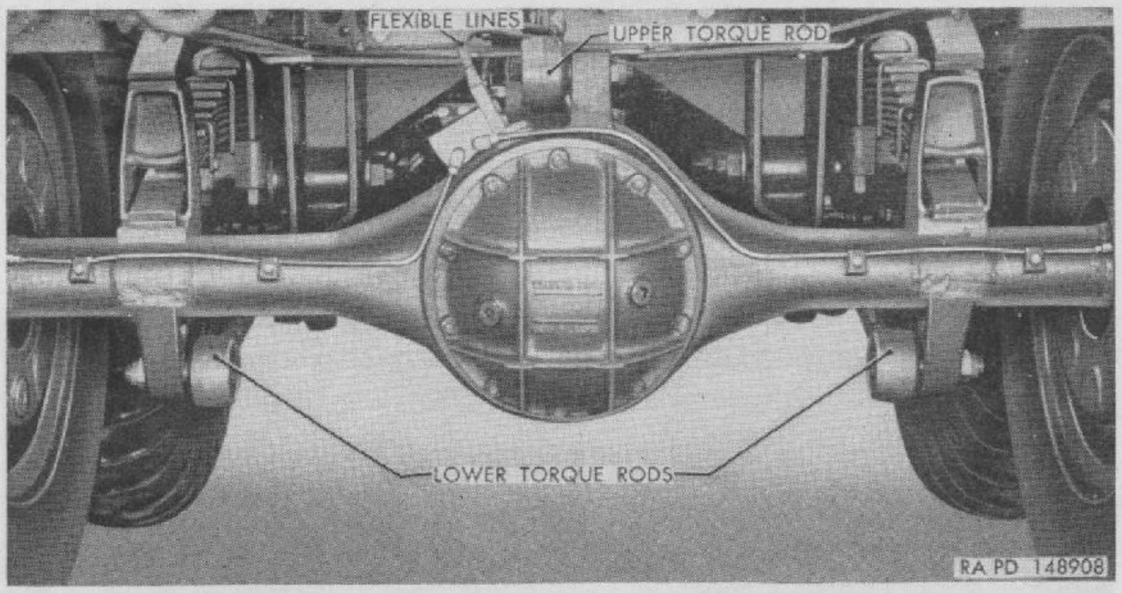


Figure 123. Rear Rear axle installed.

210. Rear Rear Axle Installation

(fig. 123)

a. POSITION AXLE. Move axle into position under vehicle and engage main spring ends with openings in bracket at each end of axle housing.

b. CONNECT TORQUE RODS. Attach three torque rods to axle brackets by installing tapered pins in axle brackets. Install nut and washer on each pin and tighten to 350–400 pound-feet torque.

c. CONNECT FLEXIBLE HOSE. Connect hydraulic brake and axle vent flexible hose at junction on top of axle housing.

d. CONNECT PROPELLER SHAFT. Position propeller shaft joint flange to differential pinion flange, with lubrication fittings in same place as other shafts; then install four bolts and nuts. Tighten nuts to 33–43 pound-feet torque.

e. INSTALL WHEELS. Install wheels on hub, then install wheel stud nuts. Tighten nuts to 300–350 pound-feet torque.

f. REMOVE BLOCKS AND JACK. Raise vehicle with jack as necessary in order that block under each torque rod bracket can be removed; then lower jack and withdraw from under vehicle.

g. BLEED BRAKES. Perform brake bleeding operation (par. 219).

h. LUBRICATE. Check lubricant level in axle differential (par. 59*i*). Lubricate propeller shaft universal joint (par. 57).

i. RECORD REPLACEMENT. Make a record of the replacement on DA AGO Form 478.

Section XXII. PROPELLER SHAFTS AND UNIVERSAL JOINTS

211. Description

a. GENERAL. Propeller shafts, pillow block, and drive and driven units arrangement is illustrated in figure 124. Drive between transmission and transfer is transmitted through two universal joint assemblies. Drive from transfer to axles is through conventional tubular type propeller shafts.

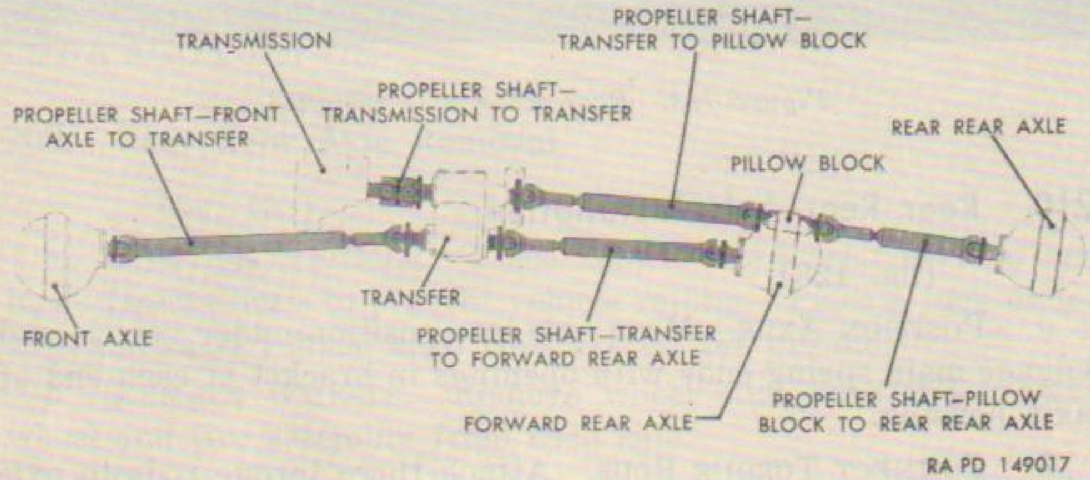


Figure 124. Propeller shafts and universal joint arrangement.

b. AXLE PROPELLER SHAFTS. Each of the four tubular propeller shafts has a universal joint at each end of shaft. In addition, each shaft has a slip joint at one end to permit telescopic action of shaft during operation. One half of slip joint is a splined solid stub shaft, having one blank spline for alinement, and is welded to tubular shaft, while opposite half is incorporated in universal joint yoke.

c. TRANSMISSION-TO-TRANSFER PROPELLER SHAFT (fig. 125). Power from transmission to transfer is through two universal joint assemblies which are bolted together thus eliminating shaft usually used. Slip joint between transmission and transfer is through splined yoke which engages transmission output shaft.

d. UNIVERSAL JOINTS. Universal joints permit angular movement of shaft during rotation. Movement between the shaft yoke and flange yoke is through bearings over each arm of journal or cross. Seal at each journal arm prevents loss of lubricant or entry of dirt, water, or other foreign matter.

e. PILLOW BLOCK. Pillow block assembly, mounted on top of forward rear axle, connects and supports the two propeller shafts required to transmit power from transfer to rear rear axle (fig. 124).

212. Propeller Shaft and Universal Joint Removal

a. GENERAL. Propeller shafts used between transfer and respective drive units can be completely removed by disconnecting both ends; also, when service requirments permit, only one end can be disconnected from its respective unit.

b. AXLE PROPELLER SHAFT REMOVAL. Remove four bolts and nuts at each end of shaft, attaching joint flange to drive or driven unit flange; then remove complete shaft.

c. TRANSMISSION-TO-TRANSFER SHAFT REMOVAL. Remove four bolts and nuts attaching two universal joints together; also remove four nuts and bolts attaching rear joint flange to transfer flange (fig. 125). Remove rear universal joint. Slide front universal joint toward rear and off transmission output shaft.

d. SLIP JOINT REMOVAL. Slip joint removal can be accomplished while complete shaft is removed; also when only slip joint end of shaft is disconnected from its respective unit flange. Loosen knurled cap, threaded to slip joint; then slide slip joint and universal joint from splined stud shaft.

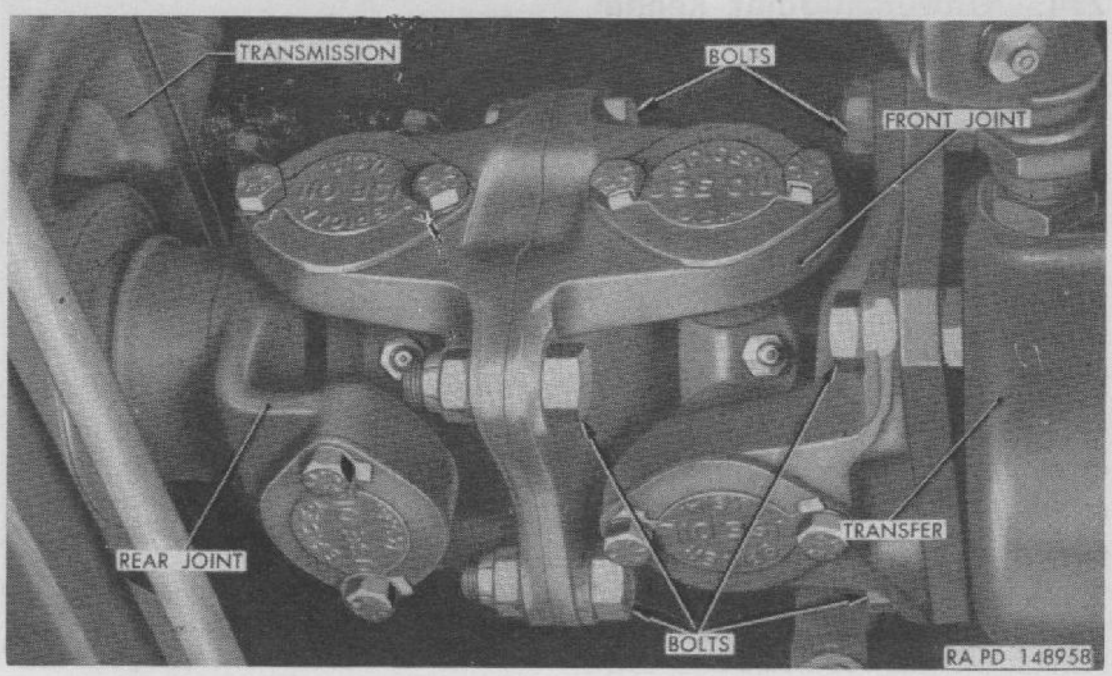


Figure 125. Transmission-to-transfer propeller shaft installed.

213. Propeller Shaft and Universal Joint Installation

a. SLIP JOINT INSTALLATION. If slip joint has been removed, clean splines and apply lubricant; then slide slip joint over stub shaft.

Note. One splined tooth in slip joint yoke and stub shaft is blank, which assures proper universal joint alinement. Thread knurled cap tightly to slip joint yoke.

b. AXLE PROPELLER SHAFT INSTALLATION. Position shaft between flanges of connecting units with lubrication fittings in same plane as other shafts; then install four bolts and nuts at each end. Tighten nuts to 33–43 pound-feet torque.

Note. Propeller shafts are installed with slip joint toward front of vehicle except shaft used between front axle and transfer, which is installed with slip joint toward rear of vehicles (fig. 124).

c. TRANSMISSION-TO-TRANSFER SHAFT INSTALLATION. Apply lubricant (par. 57) to slip joint wear sleeve; then slide joint over transmission output shaft, being careful that transmission rear seal is not damaged during installation. Move joint toward transmission to provide sufficient space to install rear universal joint. Locate rear joint between front joint and transfer flange with lubrication fittings in alinement; then install four bolts and nuts attaching two universal joint together; also install four bolts and nuts attaching rear joint to transfer flange. Tighten eight nuts to 48–64 pound-feet torque.

214. Universal Joint Repair

a. GENERAL. Universal joints should be repaired whenever excessive wear is indicated by looseness in bearings between journal and yoke flanges. Universal joint repair kits are available and consist of one journal w/seals, four needle bearings, and retaining parts.

b. UNIVERSAL JOINT DISASSEMBLY. On axle propeller shaft universal joints, pinch ends of four snap rings together and remove rings. On transmission-to-transfer universal joints, bend ears of cap screw lock away from cap screw; then remove eight cap screws, four locks, and four bearing caps. Strike journal sharply to force each bearing far enough out of flange yoke to permit removal of bearings. Remove journal by moving it sideways as far as possible; then tilt to clear side of yoke.

c. UNIVERSAL JOINT ASSEMBLY. Insert one arm of journal into yoke, tilt journal until opposite arm clears yoke and journal is in position. Work lubricant (par. 57) into bearings until they are thoroughly lubricated. Position bearings in yoke; then press or squeeze into place with vise. On axle propeller shafts joints, install snap rings, being sure they are seated in groove, or on transmission-to-transfer joints, install bearing caps, locks, and cap screws. Install yoke flange to journal; then install bearings as instructed previously in this paragraph. Install snap rings or bearing caps, locks, and cap screws as also previously instructed in this paragraph. Lubricate universal and slip joints (par. 57).

215. Pillow Block

a. GENERAL. Pillow block consists of a shaft supported by two ball bearings mounted in a housing. Double lip oil seals, supported in retainers, are used at each end to prevent loss of lubricant and entry of dirt, water, and other foreign matter. All detail parts, except housing and shaft, are identical with those used in transfer.

b. PILLOW BLOCK REMOVAL. Remove propeller shafts at front and rear of pillow block by removing four bolts and nuts at each

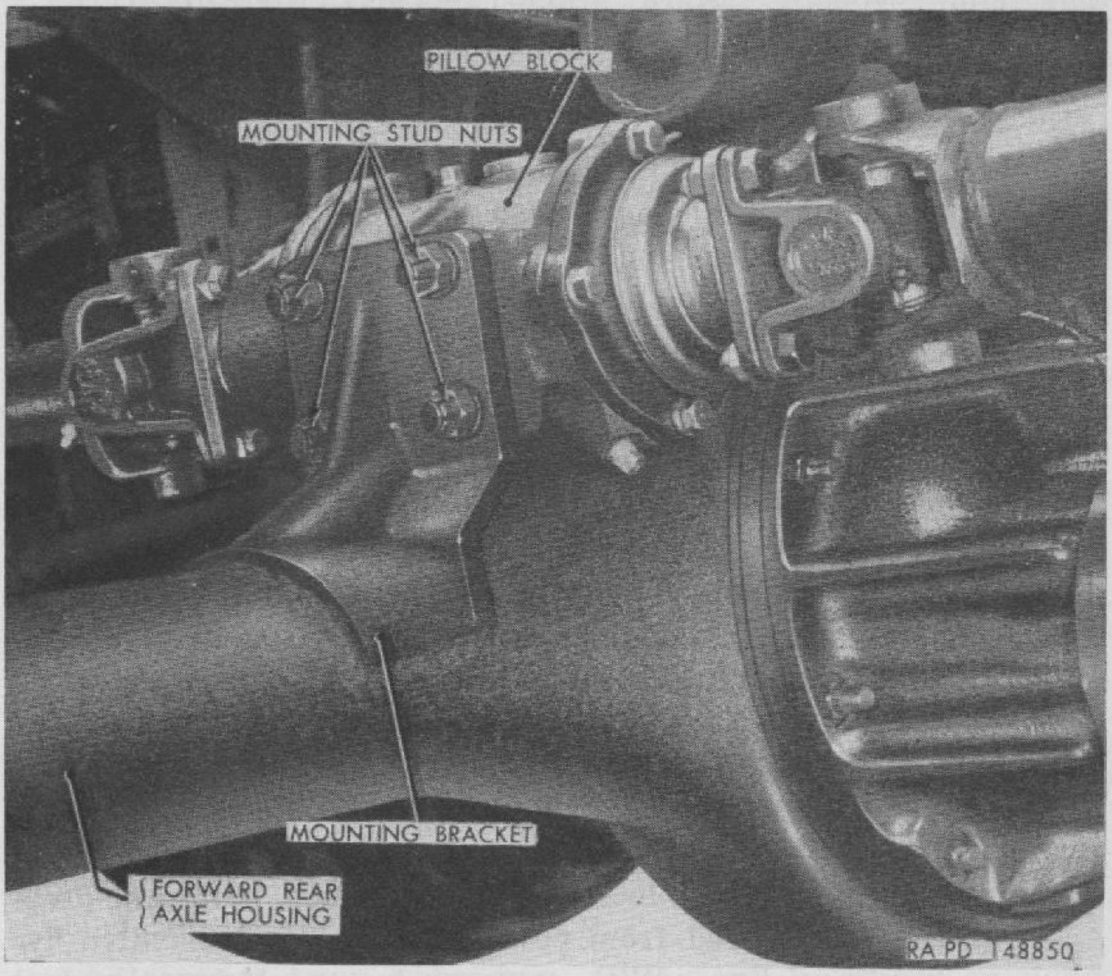


Figure 126. Pillow block installed.

end. Remove four mounting stud nuts and split tapered dowels (fig. 126) attaching pillow block to mounting bracket; then remove pillow block.

c. PILLOW BLOCK INSTALLATION. Position pillow block assembly on inside (differential side) of mounting bracket (fig. 126) with drain plug toward front. Install four tapered split dowels and four mounting stud nuts. Tighten nuts to 48–64 pound-feet torque. Install propeller shafts (par. 213). Lubricate pillow block and propeller shaft universal joints (par. 57).

Section XXIII. SERVICE BRAKE SYSTEM

216. Description and Operation

a. DESCRIPTION. The combined air-hydraulic service brake system consists primarily of a pedal, interconnected to a hydraulic master cylinder to build up the initial hydraulic pressure; an air power cylinder to increase the hydraulic pressure; hydraulic wheel cylinders to transmit the hydraulic pressure to the brake assemblies at each wheel; compressed air system which maintains a supply of compressed air for operation of the air power cylinder; and interconnecting lines, fittings, and linkage.

b. OPERATION.

(1) *Application.* When brake pedal is depressed, hydraulic brake fluid is displaced from the master cylinder into the power cylinder, and through the power cylinder slave cylinder into the lines leading to the wheel cylinders. When hydraulic pressure against the power cylinder control valve hydraulic piston reaches a certain point, control valve functions to admit compressed air into the power cylinder behind the air piston, causing piston to move forward in the cylinder. Forward movement of air piston forces slave cylinder piston forward in slave cylinder, displacing hydraulic brake fluid under high pressure in to the lines leading to the wheel cylinders. Hydraulic brake fluid entering wheel cylinders forces wheel cylinder pistons apart; outward movement of wheel cylinder pistons is transmitted to the brake shoes through push rods, forcing brake shoes into contact with brake drums.

(2) *Release.* When brake pedal is released, hydraulic pressure is removed from power cylinder control valve hydraulic piston. With pressure removed from control valve hydraulic piston, control valve functions to exhaust

air pressure from power cylinder into the air vent system. With air pressure removed from behind power cylinder air piston, piston return spring forces air piston to rear of cylinder, at the same time pulling slave cylinder piston to rear of slave cylinder, removing pressure from hydraulic brake fluid in wheel cylinders. With hydraulic pressure removed from wheel cylinder pistons, brake shoe return springs pull brake shoes away from brake drums, forcing wheel cylinder pistons together. Hydraulic brake fluid is displaced from wheel cylinders and returns to the master cylinder via the power cylinder slave cylinder.

217. Service Brake Data

Air compressor:	
Make	Midland Steel Products.
Capacity	7¼ cu ft per min @ 1,250 rpm
Master cylinder:	
Cylinder bore	1¾ in.
Piston stroke	1 7/16 in.
Air power cylinder:	
Make	Bendix Products Division.
Model	A35-15-154.
Cylinder shell diameter	4¼ in.
Slave cylinder bore	1⅛ in.
Air piston stroke	3⅞ in.
Slave cylinder piston stroke	3¾ in.
Wheel cylinders:	
Bore diameter	1¼ in.
Brake drums:	
Diameter	15 in.
Brake lining:	
Width	3 in.
Thickness	⅜ in.

218. Brake System Tests

a. PERFORMANCE TESTS.

(1) *Road test.* Road-test brakes by making a brake application at about 20 mph to determine if vehicle stops evenly and quickly. If pedal has a spongy feel when applying brakes, air is present in hydraulic system. Brake system must be bled to remove air (par. 219).

(2) *Check pedal free-travel.* Press brake pedal down with hand until resistance other than that of the pedal return

spring is felt. Pedal movement should not be less than one-fourth inch or more than one-half inch before master cylinder push rod contacts piston and manual stroke commences. If free-travel is not within one-fourth inch to one-half inch, adjust push rod (par. 223*b*).

(3) *Operating test.*

(*a*) Build up air pressure in system to normal operating pressure (100 psi).

(*b*) Apply brakes; then listen for sound of exhausting air pressure as brakes are released. Rapid release of air pressure indicates that power cylinder control valve is operating.

(*c*) Depress brake pedal and hold pressure on pedal. If pedal gradually falls away under pressure, leakage in hydraulic system is indicated. Make hydraulic pressure test (*c* below).

(*d*) If stop washer on pedal shaft goes to within two inches of the toe pan when brakes are applied, brake shoes require adjustment (par. 220) or replacing (par. 221).

b. AIR PRESSURE TESTS. An air pressure test gage is required when making the following tests.

(1) Remove lubrication pipe plug from rear end of air power cylinder and connect air pressure test gage at this point. Build up air pressure in system to normal operating pressure (100 psi).

(2) Coat all air line connections with solution of soap and water to check for leakage. Leakage can sometimes be corrected by tightening the connection. If this fails to correct leakage, air line or fittings must be replaced (par. 227*b*).

(3) Connect a flexible hose or a bent tube to power cylinder exhaust port; hose or tube must be long enough to hang down over side of power cylinder. Hold a jar of water up under exhaust tube so that end of tube is immersed in water. Watch for bubbles to appear in water. The appearance of bubbles indicates a leaking control valve poppet air inlet seal, requiring replacement of air power cylinder (par. 225).

(4) Make a brake application and hold pressure on pedal, and observe action of air pressure test gage at rear of power cylinder. Power cylinder should hold maximum pressure registered on gage without noticeable loss until the brake pedal is released. Loss of air pressure indi-

cates a leaking control valve poppet exhaust seal, or leakage past the power cylinder piston. Replace power cylinder (par. 225).

(5) Depress and momentarily hold brake pedal to several positions between fully released and fully applied positions. Pressure registered on test gage should increase gradually according to brake pedal depression. Failure to graduate the pressure evenly indicates a sticking control valve hydraulic piston. Replace power cylinder (par. 225).

(6) Make a full brake application; then observe action of air pressure test gage when brakes are released. If gage does not return to zero or is slow in returning, a sticking control valve hydraulic piston is indicated. Replace power cylinder (par. 225).

c. HYDRAULIC PRESSURE TEST. A hydraulic pressure test gage capable of registering at least 1,200 psi and an air pressure test gage are required for making this test.

(1) Connect hydraulic pressure gage to one of the wheel cylinder bleeder valve openings or at top of slave cylinder. Connect air pressure test gage to lubrication pipe plug opening at rear of power cylinder.

(2) Apply brakes until approximately 60 psi is registered on air pressure test gage. Observe reading on hydraulic pressure gage. Pressure should be 950 to 1,100 psi with 60 psi air pressure applied to power cylinder. If air pressure applied is higher or lower than 60 psi, hydraulic pressure will be proportionately higher or lower.

(3) Apply brakes and hold applied for at least one minute, observing action of hydraulic pressure gage. A low-pressure reading or a drop in hydraulic pressure indicates leakage in hydraulic lines, wheel cylinders, or air power cylinder. Replace hydraulic lines (par. 227*a*), wheel cylinders (par. 226), or air power cylinder (par. 225) as necessary.

219. Bleeding Brake System

a. GENERAL. Master cylinder filler cap is accessible through hole in left side of floor pan after removing pry-out hole cover. Air power cylinder bleeder valves are accessible from under vehicle (fig. 127); wheel cylinder bleeder valves are accessible at inner side of backing plates (fig. 128). Bleeding brake system may be accomplished by one of two methods, *pressure* or *manual*.

Caution: Engine must not be running and all air pressure must be exhausted from the air system before bleeding brakes.

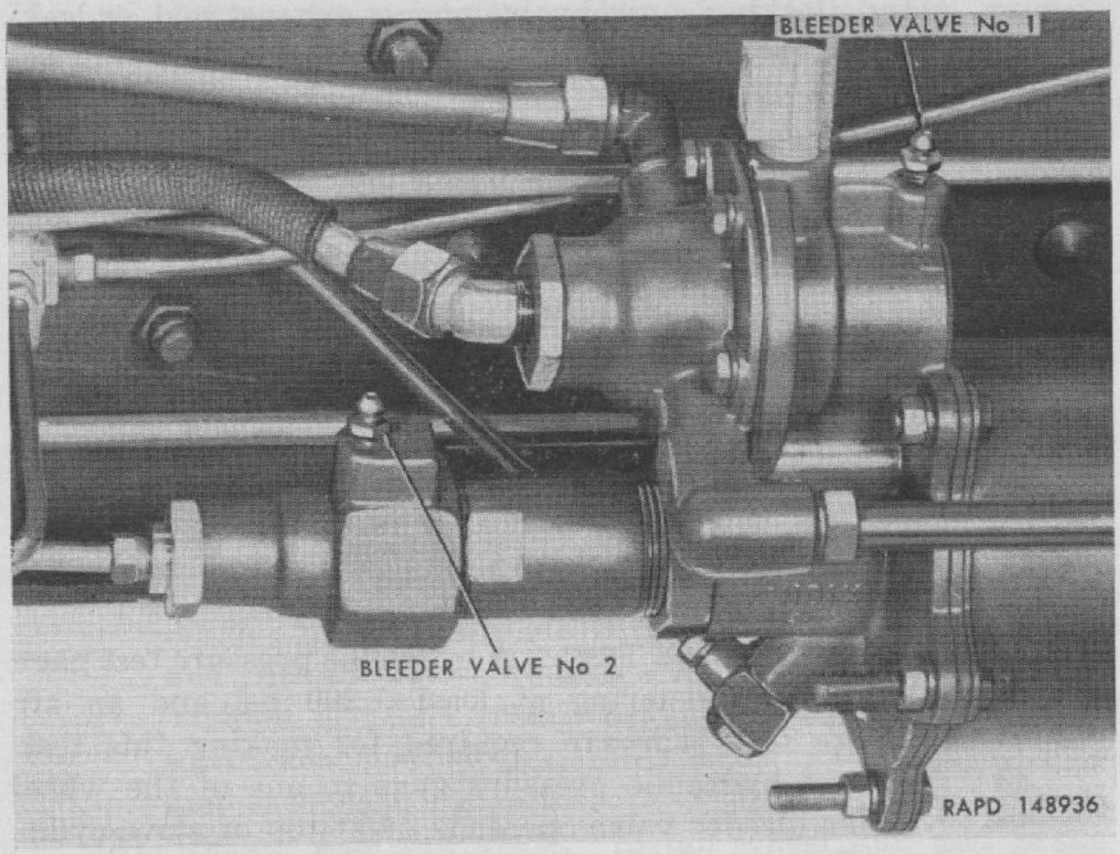


Figure 127. Air power cylinder bleeder valves.

b. PRESSURE BLEEDING.

(1) Clean dirt from around master cylinder filler cap; then remove cap from filler extension.

(2) Make sure fluid level in pressure bleeding tank is up to petcock above outlet, and that tank is charged with 10 to 20 psi air pressure. Connect pressure tank hose to master cylinder filler extension, open valves at both ends of hose to bleed air from hose; then tighten connection.

(3) Bleed air power cylinder first. Slip end of bleeder hose over bleeder valve at top of power cylinder control valve and place other end in a glass jar containing enough hydraulic brake fluid to cover end of hose. Open bleeder valve with wrench and observe flow of fluid from hose. Close bleeder valve as soon as bubbles stop and fluid flows in a solid stream. Repeat this procedure at bleeder valve on top of slave cylinder end fitting.

(4) Bleed both bleeder valves at each wheel, following same procedure used at power cylinder, (3) above. Make sure each bleeder valve is closed tightly after bleeding.

(5) Disconnect bleeder tank hose from master cylinder filler extension. Install filler cap, with new gasket. Install access plug in floor pan.

c. MANUAL BLEEDING. Manual bleeding is the same as pressure bleeding except that the hydraulic brake fluid is forced through the lines by pumping the brake pedal instead of by air pressure. Two persons are required, one to pump brake pedal and replenish fluid in master cylinder, the other to accomplish the bleeding operations at the power cylinder and wheel cylinders. Fluid in master cylinder should be replenished after bleeding at each bleeder valve. When pumping pedal, push it down slowly, let it snap back, and immediately start the downward stroke. After all air is expelled at each bleeder valve, close valve during downstroke of brake pedal.

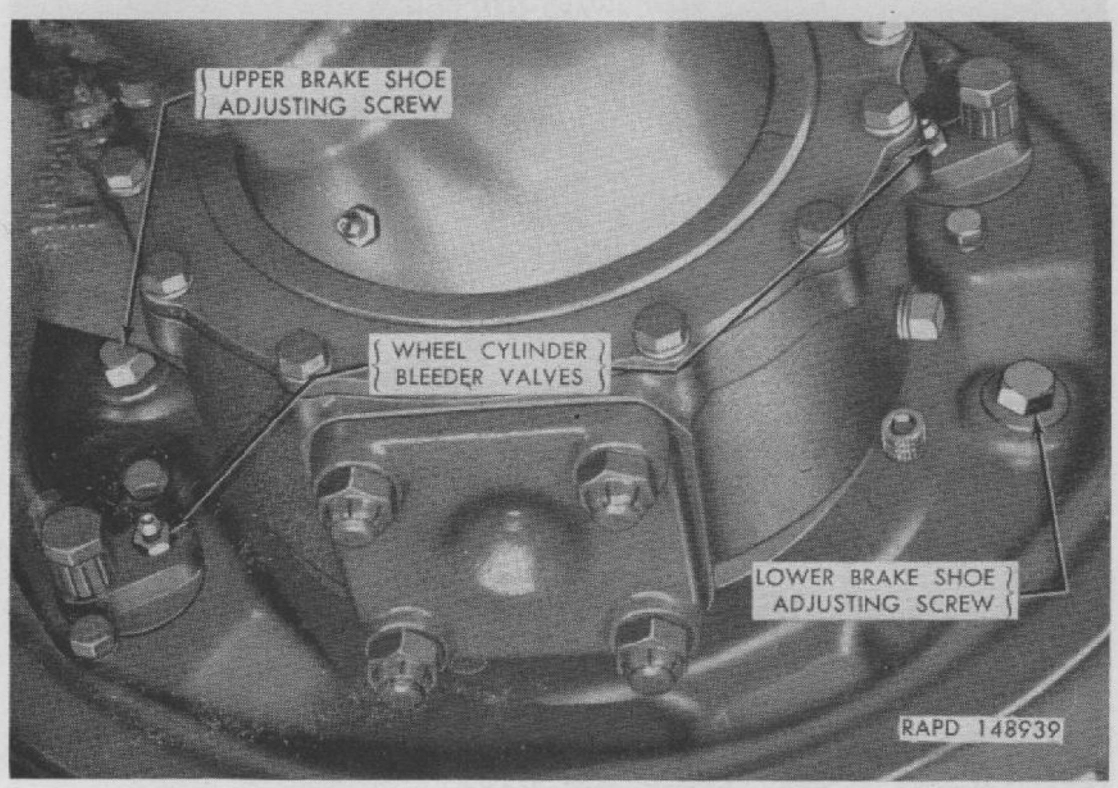


Figure 128. Brake bleeder valves and adjusting studs (left front wheel).

220. Brake Adjustment for Normal Wear

a. GENERAL. Brake adjustments to compensate for normal lining wear are made at the brake shoes. These adjustments should be made before the brake pedal reserve travel becomes less than two inches. Adjustments are made by turning adjusting pinion studs at inner side of backing plates (fig. 128). Always check wheel bearing adjustment (par. 244) before adjusting brake shoes. Do not adjust brake shoes while brake drums are hot.

b. ADJUSTMENT.

(1) Jack up axle; then make a brake application and release to center brake shoes with brake drums.

(2) Using a torque wrench on adjusting pinion studs (fig. 129), turn studs in direction of forward rotation of wheel until a torque wrench reading of 13 to 16 pound-feet torque is obtained; then turn studs in opposite direction one-third turn (120 deg.) to provide running clearance between lining and drum.

(3) After completing adjustment at each wheel, make sure wheel turns freely; then remove jacks from under vehicle.

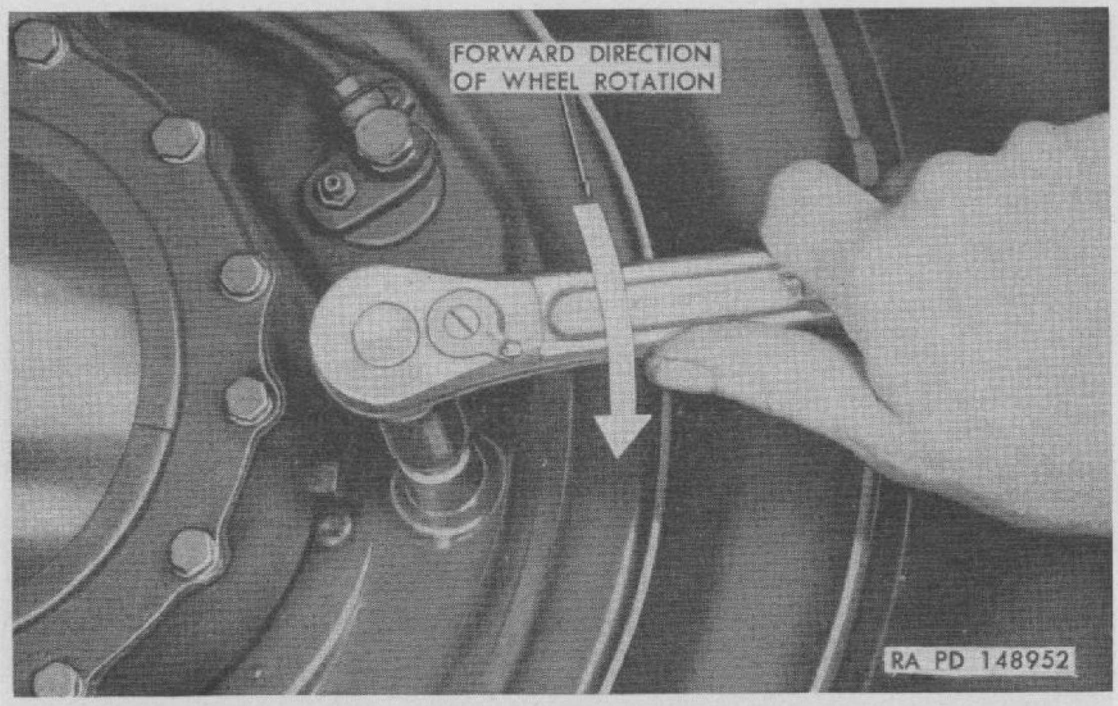


Figure 129. Adjusting brake shoes.

221. Brake Shoes—Front and Rear

a. DESCRIPTION. All brake shoes on vehicle are identical. Two brake shoes are mounted on each backing plate in conjunction with two anchor blocks and two wheel cylinders (fig. 130). Anchor blocks serve as shoe stops and shoe centering points, and provide the fulcrums around which the shoes pivot when brakes are applied. Four brake shoe return springs hold shoe ends firmly against anchors when brakes are released. Heel of each shoe anchors against steel pins installed in anchor blocks. Toe of each shoe anchors against adjusting screws which are threaded into the anchor blocks. Both shoes are always primary shoes, independently self-energized in either direction of brake drum rotation. Shoes anchor either at toe or at heel, depending upon direction of drum rotation when brakes are applied.

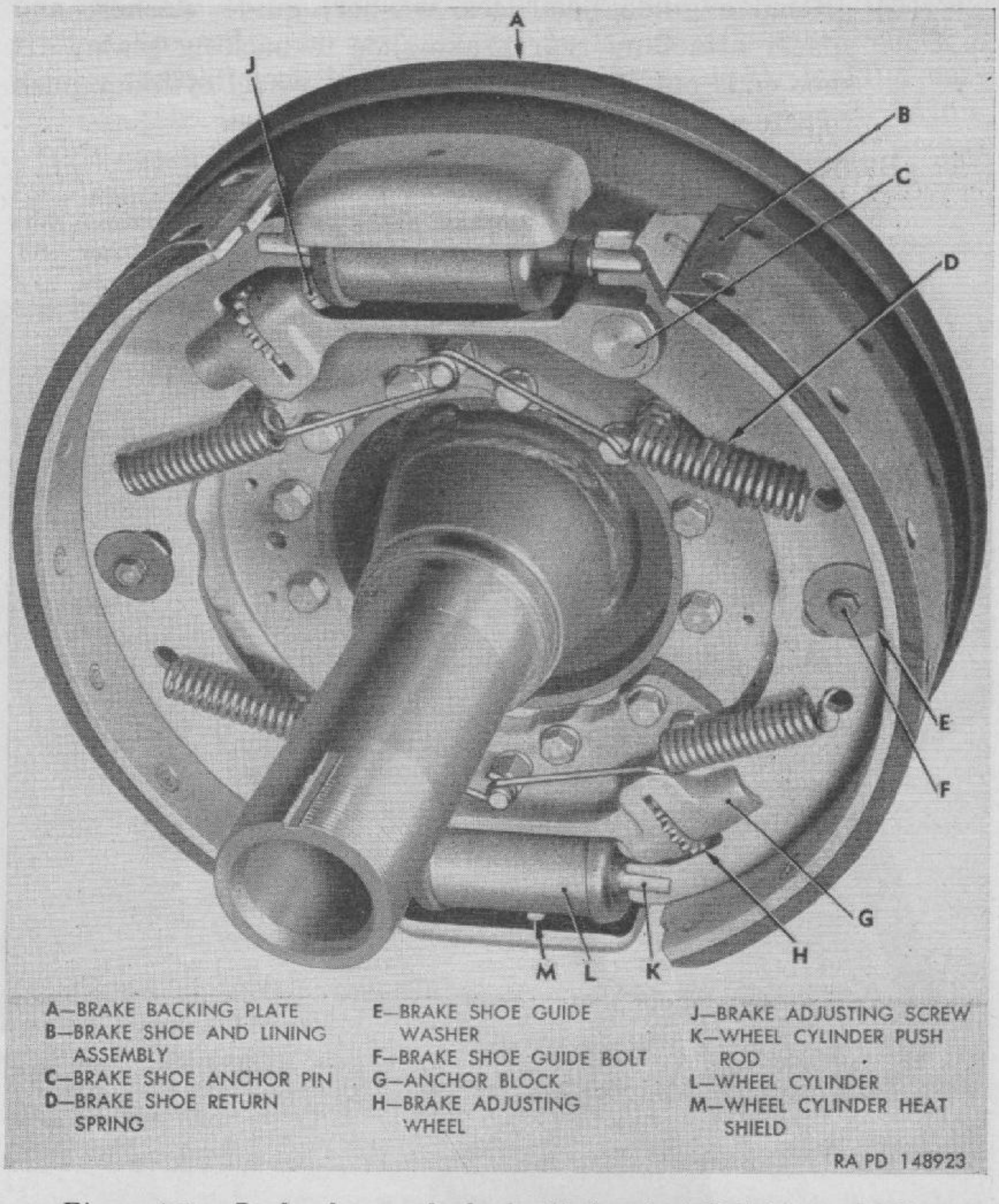


Figure 130. Brake shoes and wheel cylinders installed (rear wheel).

b. BRAKE SHOE REMOVAL (fig. 130).

(1) Jack up axle and remove wheel (par. 239*a*).

(2) At front axle, remove axle shaft drive flange (par. 198*a*) ; at rear axle, remove axle shaft (par. 205*b*).

(3) Remove hub and brake drum (par. 245 or 246).

(4) Using brake spring tool 7950060, unhook brake shoe return springs from spring anchor studs (fig. 131) ; then remove springs from brake shoes.

(5) Remove nut, lock washer, guide washer, and spacer from front brake shoe guide bolt; then lift shoe ends out of anchor blocks and wheel cylinder push rods.

(6) Remove guide bolt, lock washer, guide washer, and spacer attaching rear brake shoe to backing plate; lift shoe ends out of anchor blocks and wheel cylinder push rods to remove shoe.

c. BRAKE SHOE INSTALLATION (fig. 130).

Note. Large portion of brake shoe web which engages slots in anchor blocks is curved at one end and flat at the other end. Shoes must be installed with curved end at adjusting screw and flat end engaging groove in anchor pin in anchor block.

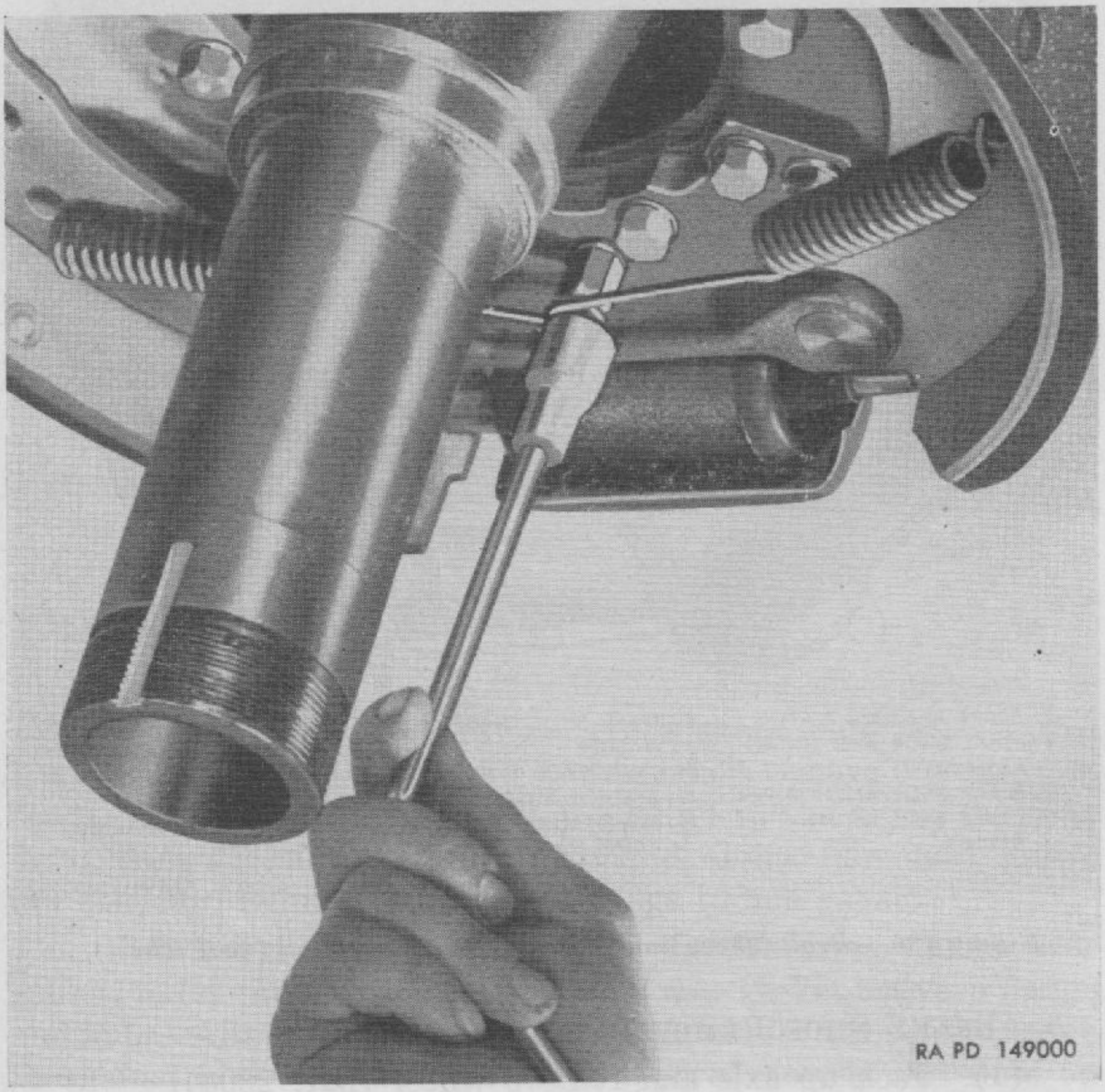


Figure 131. Removing brake shoe return springs using tool 7950060.

(1) Position front brake shoe on backing plate, with shoe web engaging slots in wheel cylinder push rods and anchor blocks, and with elongated hole in center of shoe web over guide bolt. Install spacer, guide washer, lock washer, and nut on guide bolt and tighten firmly.

(2) Position rear brake shoe at backing plate, with shoe web engaging slots in wheel cylinder push rods and

anchor blocks. Install lock washer, guide washer, and spacer on guide bolt, insert bolt through shoe web and backing plate, and thread bolt into hydraulic brake line tee fitting at inner side of backing plate. Tighten bolt firmly.

(3) Install brake shoe return springs, installing end of each spring in brake shoe web, then hooking springs onto anchor studs using brake spring tool 7950060 (fig. 132).

(4) Install hub and brake drum assembly (par. 245 or 246).

(5) At front axle, install axle shaft drive flange (par. 198*b*); at rear axle, install axle shaft (par. 205*c*).

(6) Install wheel (par. 239*b*). Adjust brake shoes (par. 220).

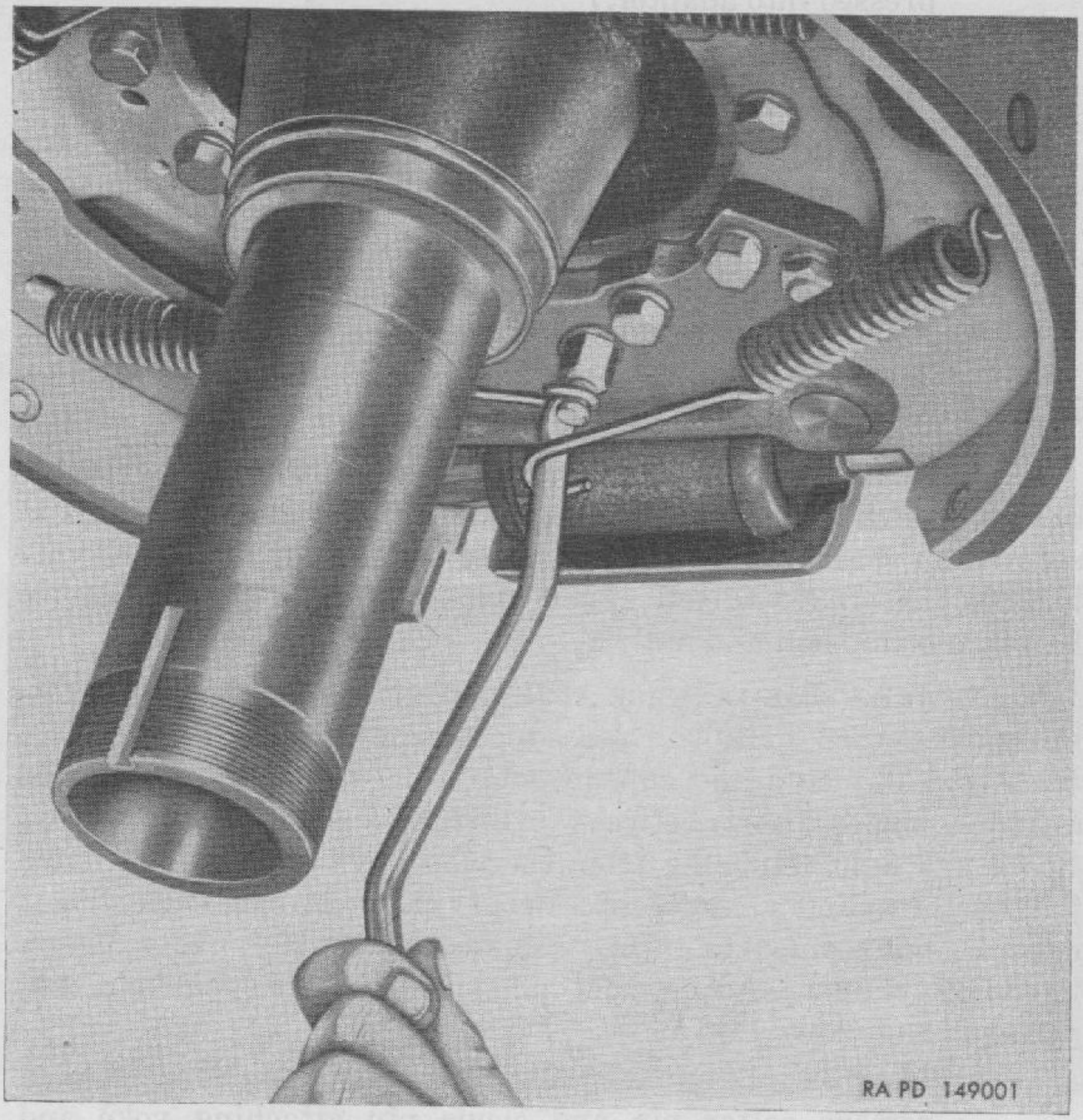


Figure 132. Installing brake shoe return springs using tool 7950060.

222. Brake Drums

a. GENERAL. Brake drums may be either cast iron, or cast iron with steel back. Brake drums are attached to hub flanges by brake drum adapters. Adapters are secured to inner side of hub flanges under heads of wheel studs which are pressed into hub flanges (figs. 144 and 145).

Note. Brake drum removal and installation procedures which follow apply with hub installed on axle; however, the same procedures will apply with hub removed from axle by omitting *b* (1) and *c* (2) below.

b. BRAKE DRUM REMOVAL.

(1) Jack up axle and remove wheel (par. 239*a*).

(2) Remove nuts and flat washers from 18 bolts securing brake drum to brake drum adapter. Tap drum to loosen from adapter; then lift drum off adapter. (Bolts are pressed into adapter.)

c. BRAKE DRUM INSTALLATION.

(1) Install brake drum on brake drum adapter, with bolts in adapter inserted through holes in drum flange. Install flat washer and nut on each bolt, and tighten nuts to 20–27 pound-feet torque.

(2) Install wheel (par. 239*b*). Adjust brake shoes (par. 220).

223. Brake Pedal and Linkage

a. GENERAL. Brake-pedal shaft is welded to master cylinder bracket which is riveted to frame side rail. Pedal lower half is secured on shaft by master cylinder-to-pedal-shaft brace and cotter pin (fig. 133). Pedal upper half is secured in pedal lower half by a clamp bolt and nut.

b. BRAKE-PEDAL-LINKAGE ADJUSTMENT. Master-cylinder piston must return to fully released position when brake pedal is released. If piston and cup do not return completely to end of cylinder, bypass port between cylinder and reservoir will be closed and fluid returning from the wheel cylinders cannot enter the master cylinder reservoir. Proper pedal linkage adjustment must be maintained to insure return of master cylinder piston to end of cylinder. Adjustment is made at master cylinder piston push rod as follows (fig. 133):

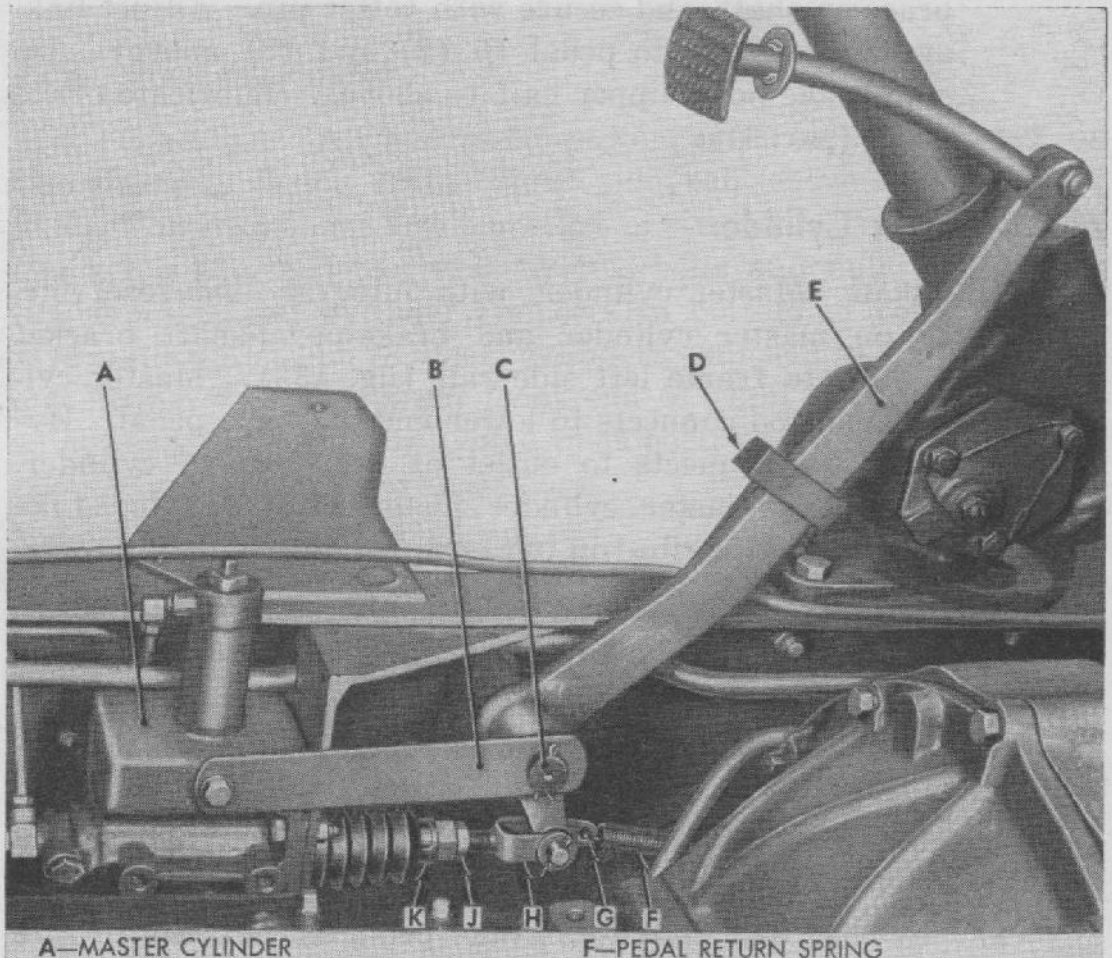
(1) Loosen lock nut on master-cylinder-push-rod yoke; then remove cotter pin and clevis pin attaching yoke and return spring clip to brake pedal.

(2) With brake-pedal bumper against pedal plates on toe board and master-cylinder piston at extreme front end of cylinder, adjust yoke in push rod as necessary to aline holes in yoke and pedal; then turn yoke into push rod an additional one-half turn to provide slight clearance between push rod and piston.

(3) Install clevis pin attaching push rod yoke to brake pedal, with return spring clip installed under head of clevis pin, and secure with cotter pin. Tighten lock nut against push rod.

c. Brake Pedal Upper Half Replacement.

(1) *Removal.* Remove nut from clamp bolt securing pedal upper half in pedal lower half (fig. 133) and remove clamp bolt. Pull pedal upper half up out of pedal lower half and hole in pedal plate.



A—MASTER CYLINDER
B—MASTER CYLINDER TO PEDAL SHAFT BRACE
C—BRAKE PEDAL SHAFT
D—PEDAL TO TOEBOARD BUMPER
E—BRAKE PEDAL LOWER HALF
F—PEDAL RETURN SPRING
G—RETURN SPRING CLIP
H—MASTER CYLINDER PUSH ROD YOKE
J—LOCK NUT
K—MASTER CYLINDER PUSH ROD

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Figure 133. Brake pedal and master cylinder installed.

(2) *Installation.* Insert pedal upper half down through felt seal in pedal plate and into end of pedal lower half. Aline notch in pedal upper half with clamp bolt hole in pedal lower half, install clamp bolt and nut, and tighten nut to 20–27 pound-feet torque.

d. BRAKE PEDAL LOWER HALF REPLACEMENT (fig. 133).

(1) *Removal.* Remove brake pedal upper half (*c* above). Remove cotter pin and clevis pin attaching master cylinder push rod yoke and return spring clip to pedal lower half. Remove cotter pin securing pedal shaft brace on pedal shaft. Loosen bolt attaching brace to master cylinder, remove brace from end of pedal shaft; then slide pedal lower half off shaft. Remove rubber bumper from pedal lower half.

(2) *Installation.* Install rubber bumper on pedal lower half. Place pedal lower half on pedal shaft, position brace on shaft, and secure with cotter pin. Adjust linkage and connect to pedal (*b* (2) and (3) above). Install brake pedal upper half (*c* above). Lubricate brake pedal (par. 57).

224. Master Cylinder

a. GENERAL. Master cylinder, with integral fluid reservoir, is mounted on master cylinder and brake-pedal-shaft bracket which is riveted to frame left side rail (fig. 133). Master cylinder piston push rod connects to lower end of brake pedal. Hydraulic brake line connects to outlet at rear end of cylinder. Linkage connecting master cylinder piston push rod to brake pedal is adjusted as described in paragraph 223*a*.

b. MASTER CYLINDER REMOVAL (fig. 133).

(1) Remove bolt and gaskets attaching hydraulic brake line connector to rear end of master cylinder.

(2) Remove cotter pin and clevis pin attaching master cylinder piston push rod to brake pedal.

(3) Disconnect air vent line from master cylinder filler extension.

(4) Remove bolt attaching brake pedal shaft brace to side of master cylinder.

(5) Remove four nuts and bolts attaching master cylinder to bracket; then remove master cylinder from bracket.

(6) Remove yoke and lock nut from master cylinder piston push rod.

c. MASTER CYLINDER INSTALLATION (fig. 133).

(1) With lock nut threaded onto push rod yoke, thread yoke into end of master cylinder piston push rod.

(2) Position master cylinder at bracket, with push rod and yoke inserted through hole in bracket. Attach master cylinder to bracket with four bolts and nuts. Tighten nuts to 20-27 pound-feet torque.

(3) Attach brake pedal shaft brace to side of master cylinder with bolt and lock washer.

(4) Insert hydraulic brake line connector bolt through connector, with gasket on both sides of connector, and thread bolt into rear end of cylinder. Tighten bolt firmly.

(5) Connect air vent line to master cylinder filler extension.

(6) Connect piston push rod yoke to brake pedal, making adjustment as described in paragraph 223*b*.

(7) Bleed brake system (par. 219).

225. Power Cylinder

a. GENERAL. Air-hydraulic power cylinder is mounted on two brackets inside frame right side rail above forward rear axle. Power cylinder front bracket is riveted to frame, and rear bracket is attached to frame by two bolts and nuts. Hydraulic line from master cylinder connects to bottom of control valve. Hydraulic outlet line to wheel cylinders connects to slave cylinder end fitting. Air line from front end of right air tank connects to power cylinder control valve inlet port, and air vent line connects to control valve exhaust port.

b. POWER CYLINDER REMOVAL.

(1) Exhaust air pressure from air system; then disconnect air line from control valve inlet port. Disconnect air vent line from control valve exhaust port.

(2) Disconnect hydraulic brake lines from slave cylinder end fitting and from bottom of control valve.

(3) Remove nuts from two bolts securing power cylinder to front mounting bracket.

(4) Remove two nuts and bolts attaching rear bracket to frame side rail. Remove power cylinder and rear bracket; then remove rear bracket from stud on back of cylinder.

c. POWER CYLINDER INSTALLATION.

(1) Install rear bracket on stud at rear of power cylinder and secure with flat washer and nut. Do not tighten nut.

(2) Position power cylinder at frame side rail, with two end plate bolts inserted through front mounting bracket. Install nut on each bolt and tighten to 9½–13 pound-feet torque.

(3) Position rear bracket at frame and secure with two bolts and nuts, attaching hydraulic brake line clip under nut on front bolt. Tighten nuts to 20–27 pound-feet torque; then tighten nut attaching bracket to rear end of cylinder to 9½–13 pound-feet torque.

(4) Connect hydraulic lines to slave cylinder end fitting and to bottom of control valve. Tighten connections firmly.

(5) Connect air line to control valve inlet port, and connect air vent line to exhaust port.

(6) Bleed brake system (par. 219). Build up air pressure in system and perform brake system tests (par. 218).

226. Wheel Cylinders

a. GENERAL. Two double-end wheel cylinders are mounted on each backing plate between ends of brake shoes (fig. 130). Bleeder valve and hydraulic inlet openings extend through backing plate. Each cylinder is attached to backing plate by two bolts and lock washers. Push rods transmit movement of wheel cylinder pistons to brake shoes. In each wheel cylinder, the piston which operates the toe end of brake shoe has a longer stroke than the piston in the other end to compensate for the increased piston travel made necessary when brakes are adjusted to compensate for normal lining wear. Rubber boot at each end of cylinder keeps out water and dirt, and a heat shield at each cylinder deflects heat, created during brake application, away from cylinder.

b. WHEEL CYLINDER REMOVAL.

(1) Remove brake shoes (par. 221*b*).

(2) At inner side of backing plate, remove bolt attaching hydraulic brake line connector to wheel cylinder.

(3) Remove two bolts and lock washers attaching wheel cylinder to backing plate; then remove wheel cylinder and heat shield from backing plate. Remove heat shield from wheel cylinder.

c. WHEEL CYLINDER INSTALLATION.

(1) Install heat shield on wheel cylinder; then place wheel cylinder and heat shield on backing plate with long end of cylinder adjacent to adjusting screw in anchor block.

Attach wheel cylinder to backing plate with two bolts and lock washers, threading bolts into wheel cylinder from inner side of backing plate.

(2) Insert hydraulic brake line connector bolt through connector, with new copper washers on bolt on both sides of connector, and thread bolt into wheel cylinder.

(3) Install brake shoes and complete the installation (par. 221*c*).

(4) Bleed brake system (par. 219).

227. Hydraulic and Air Lines and Connections

a. HYDRAULIC BRAKE LINES. Metal lines are used to carry hydraulic brake fluid from master cylinder to air power cylinder, from power cylinder outlet to tee fitting at frame side rail, and from frame tee fitting to front and rear axle flexible hose connections; also from flexible hose junctions at each axle to wheel cylinders at rear brakes and to flexible hose connections at front brakes. Flexible hose are used between frame connections and axles and from axle to wheel cylinders at front brakes due to constant flexing during vehicle operation. Brake lines are made of special metal tubing with flared type connections, designed to withstand high pressure and to resist corrosion; ordinary copper tubing is not satisfactory for use as hydraulic brake lines. When replacing brake lines, be sure replacement line is the same size as the one removed. Whenever a hydraulic brake line has been replaced or disconnected, make sure connections are tight, then bleed brake system (par. 219).

b. AIR-LINES. Air lines are of seamless copper tubing with three-piece compression-type fittings. Air lines may be tested for leakage by building up air pressure in system to normal operating pressure; then coating all air lines connections with a solution of soap and water. Leakage will be evidenced by the appearance of soap bubbles. Leakage can sometimes be corrected by tightening the connection. If tightening fails to correct leakage, new air line or connection must be installed. When replacing air lines, tubing must be free of burs, copper cuttings, and dirt. Blow line out with compressed air before installing. Any of the above mentioned particles will destroy sealing seats in power cylinder control valve. Replacement lines must be of the same size as the ones removed. Whenever air lines have been replaced or disconnected, tighten connections firmly; then check for leakage.

228. Air Compressor Governor

a. GENERAL. Air compressor governor controls pressure in air system by starting or stopping compression of air when system pressure reaches the desired minimum or maximum. Governor, mounted on compressor cylinder head, consists primarily of a diaphragm-operated plunger which actuates a trigger to hold the air inlet valves off their seats, stopping compression, when system pressure reaches maximum limit (100 psi). When pressure is reduced to minimum (75 psi), trigger releases inlet valves and compression of air is resumed. Governor diaphragm is connected to air system at air line junction fitting on engine side of dash.

b. AIR COMPRESSOR GOVERNOR ADJUSTMENT. Adjustment points and method of checking and making adjustments are shown in figure 134. Adjustments must be made in the sequence given. Make sure cylinder head bolts are firmly tightened before adjusting governor.

(1) With engine stopped and no air pressure in system, remove top cover from governor. Depress trigger by pressing with finger on end of trigger opposite adjusting screw (fig. 134). Adjust trigger stop screw to provide 0.044-inch clearance between trigger and adjusting screw with trigger depressed. Tighten adjusting screw lock nut.

(2) Insert a screw driver between plunger housing and governor body and pry up on plunger housing until the plunger slides over the nose of the trigger and depresses the trigger (fig. 134). Hold plunger in this position and bend the plunger housing stop to obtain 0.020-inch clearance between plunger housing and stop.

(3) Start engine and build up air pressure in system. Adjust cut-out pressure to 100 psi by turning the adjusting screw (fig. 134). Turn screw clockwise to increase cut-out pressure and counterclockwise to reduce cut-out pressure. One complete turn of adjusting screw will change pressure setting 14 psi. Correct cut-out pressure setting should provide a cut-in pressure of 75 psi.

(4) Reduce air pressure in system and check cut-in pressure. If not within 20–25 psi below cut-out pressure; recheck all adjustments.

(5) Install cover on governor; then lubricate governor (par. 57).

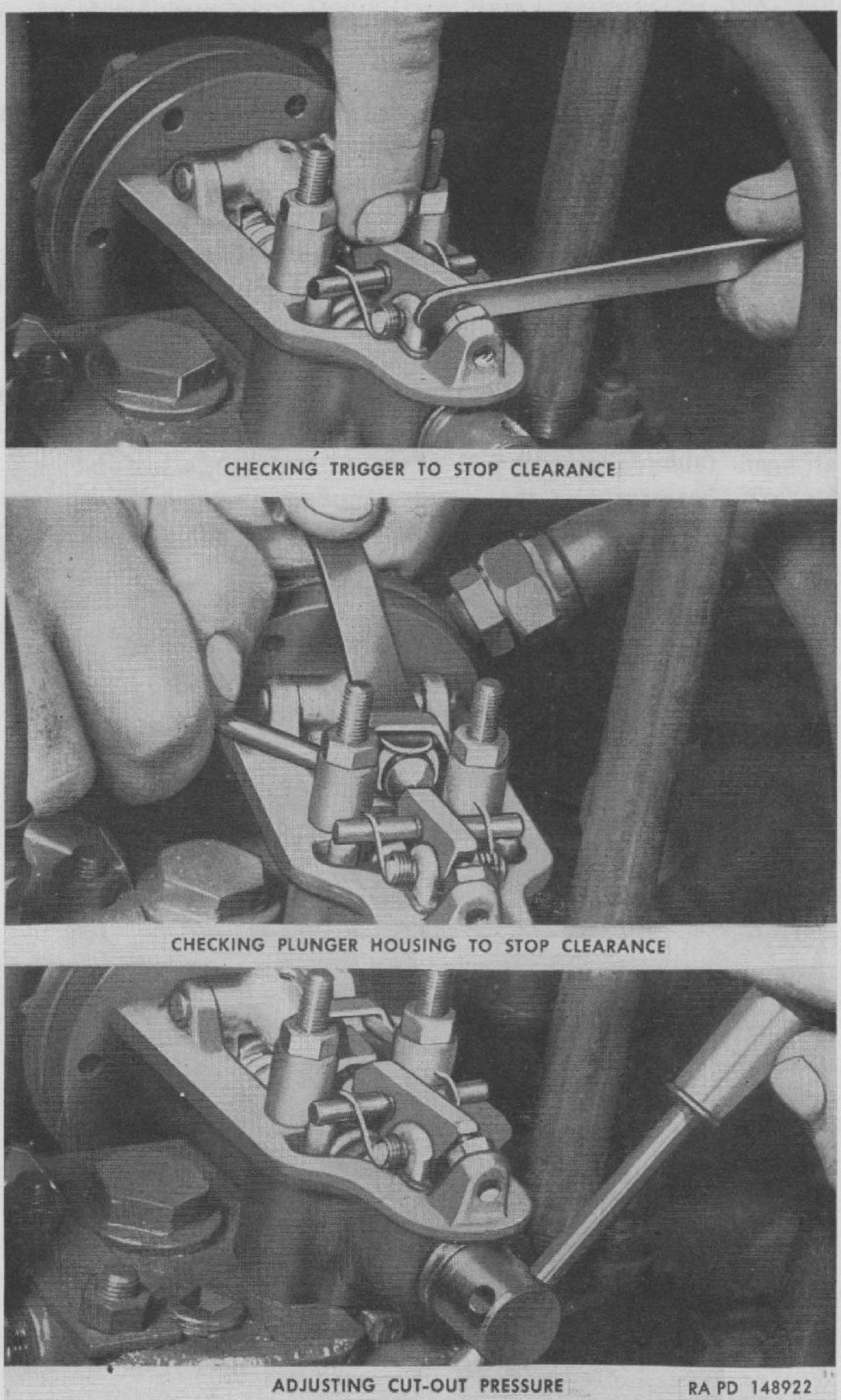


Figure 134. Air compressor governor adjustments.

229. Air Compressor Drive Belt

a. AIR COMPRESSOR DRIVE BELT ADJUSTMENT (fig. 135).

(1) Loosen bolts attaching air compressor adjusting arm to engine thermostat housing and to bracket on compressor cylinder head.

(2) Loosen nut on air compressor pivot bolt.

(3) Move compressor toward or away from engine as necessary to provide correct belt tension; tension is correct when a light pressure on belt midway between pulleys will cause ½- to ¾-inch deflection of belt.

(4) When correct belt tension is obtained, hold compressor in position and tighten adjusting arm bolts and pivot bolt nut.

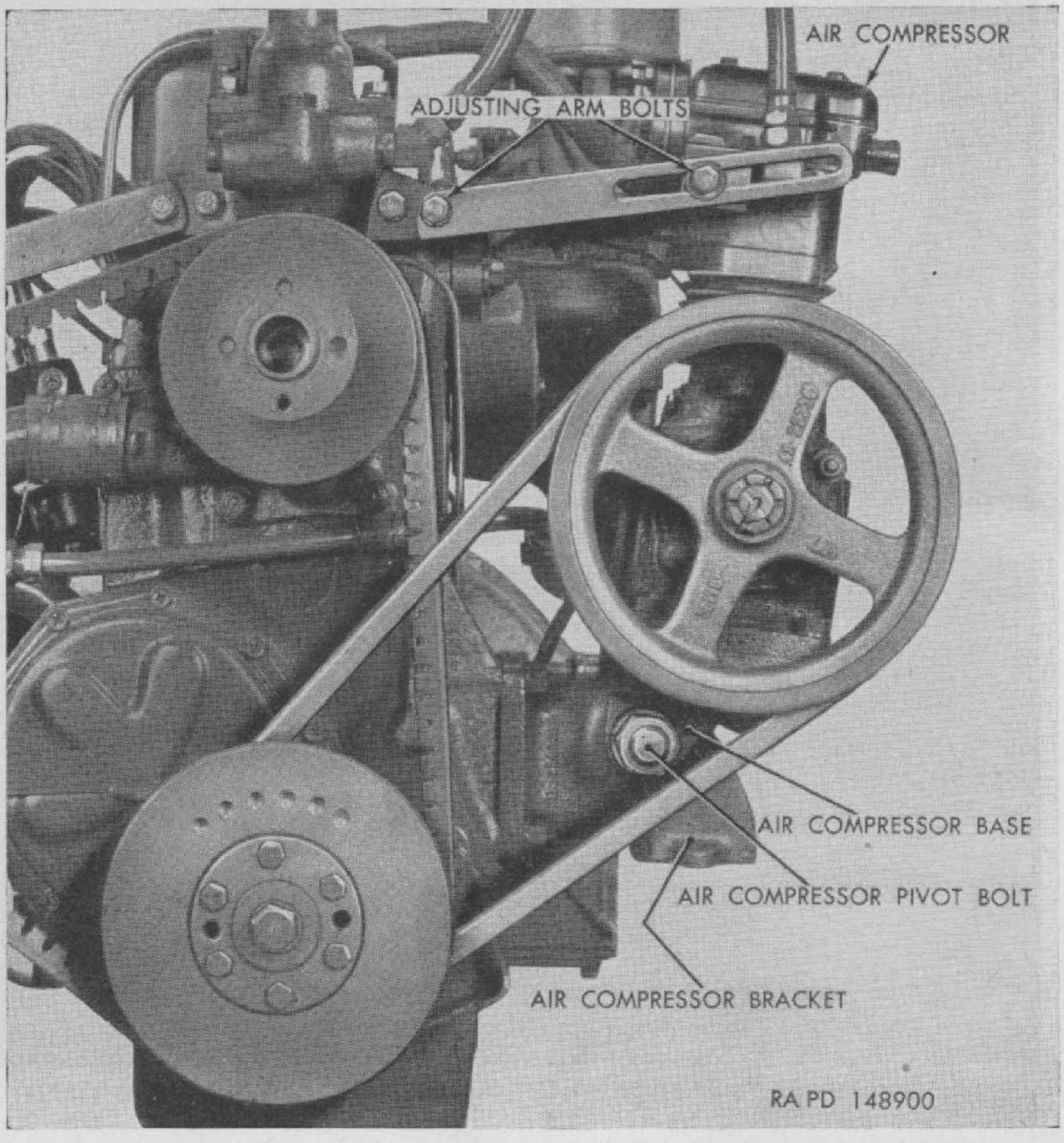


Figure 135. Air compressor drive belt adjustment points.

b. AIR COMPRESSOR DRIVE BELT REPLACEMENT (fig. 135).

(1) Loosen air compressor adjusting arm bolts and pivot bolt nut.

(2) Swing compressor toward engine; then remove belt from compressor pulley and from crankshaft pulley.

(3) Position new belt in groove in crankshaft pulley and in air compressor pulley.

(4) Adjust belt tension ((3) and (4) above).

230. Air Compressor

a. GENERAL. Air compressor, mounted on left front side of engine, is a two-cylinder reciprocating-type unit. Compressor is driven by belt from the engine crankshaft, lubricated by the engine lubricating system, and the compressor cylinder head is cooled by the engine cooling system. Air compressor crankshaft turns continuously while engine is running, but actual compression of air is controlled by the compressor governor which is mounted on the compressor cylinder head. Air compressor air intake port is connected to engine air intake system at the carburetor air inlet elbow. Oil is carried from the engine main oil gallery to the compressor crankshaft rear end cover by a flexible hose, and is forced through the drilled crankshaft, lubricating connecting rods, piston pins, and cylinder walls. Oil drains into compressor mounting and returns to the engine crankcase through the oil return hose.

b. AIR COMPRESSOR REMOVAL (fig. 135).

(1) Exhaust air pressure from air system.

(2) Disconnect oil inlet and oil return hose from compressor crankcase rear end cover and compressor base.

(3) Disconnect water inlet and outlet hose from compressor cylinder head.

(4) Disconnect air inlet hose and air discharge line from compressor cylinder head, and disconnect compressor governor air hose from governor end cover.

(5) Remove bolt and lock washer attaching compressor adjusting arm to bracket on compressor cylinder head. Move compressor toward engine and remove belt from compressor pulley.

(6) Remove nut, lock washer, and pivot bolt attaching compressor base to bracket. Lift compressor and base away from engine.

(7) Remove four bolts and lock washers attaching compressor to base and remove base.

(8) Remove cotter pin and nut securing pulley on compressor crankshaft; then remove pulley from crankshaft, using a suitable puller.

(9) Remove all air, oil, and water line connectors from compressor for installation on replacement unit.

(10) Remove compressor adjusting arm bracket from cylinder head studs for installation on replacement unit.

c. AIR COMPRESSOR INSTALLATION (fig. 135).

(1) Install air, oil, and water line connectors on compressor, coating threads of each connector with plastic-type gasket cement. Tighten connectors firmly, leaving elbows pointing in proper direction for connecting hose.

(2) Install pulley on compressor crankshaft, making sure key is in place in keyseat in crankshaft. Secure pulley on shaft with nut and cotter pin.

(3) Remove nuts from two cylinder head studs at front of compressor, install adjusting arm bracket on studs, and secure with lock washers and nuts.

(4) Install mounting base on bottom of compressor and attach with four bolts and lock washers. Tighten bolts firmly.

(5) Position compressor at engine with base over bracket, and install pivot bolt through base and bracket. Install lock washer and nut on bolt.

(6) Attach adjusting arm to bracket on compressor cylinder head with bolt and lock washer. Do not tighten bolt at this time.

(7) Connect oil inlet and oil return hose to compressor crankcase rear and cover and to compressor mounting base, using plastic-type gasket cement on hose connector threads.

(8) Connect air discharge line and air inlet hose to compressor cylinder head, and connect governor air hose to governor end cover, using plastic-type gasket cement on connector threads.

(9) Connect water inlet and outlet hose to compressor cylinder head, using plastic-type gasket cement on hose connectors.

(10) Adjust air compressor drive belt tension (par. 229*a*). Adjust air compressor governor if necessary (par. 228*b*).

231. Air Tanks and Safety Valve

a. GENERAL.

(1) *Air tanks.* Two air tanks are mounted inside of frame side rails ahead of forward rear axle (fig. 136). The

purpose of the air tanks is to provide a place to store compressed air so there will always be an ample supply available for immediate use for brake operation. They also provide storage for sufficient compressed air to permit several brake applications with engine stopped. Another purpose of the air tanks is to provide a place where the air, heated during compression, may cool and the oil and water vapors condense. Drain cocks are provided in bottom of air tanks for draining condensation from tanks.

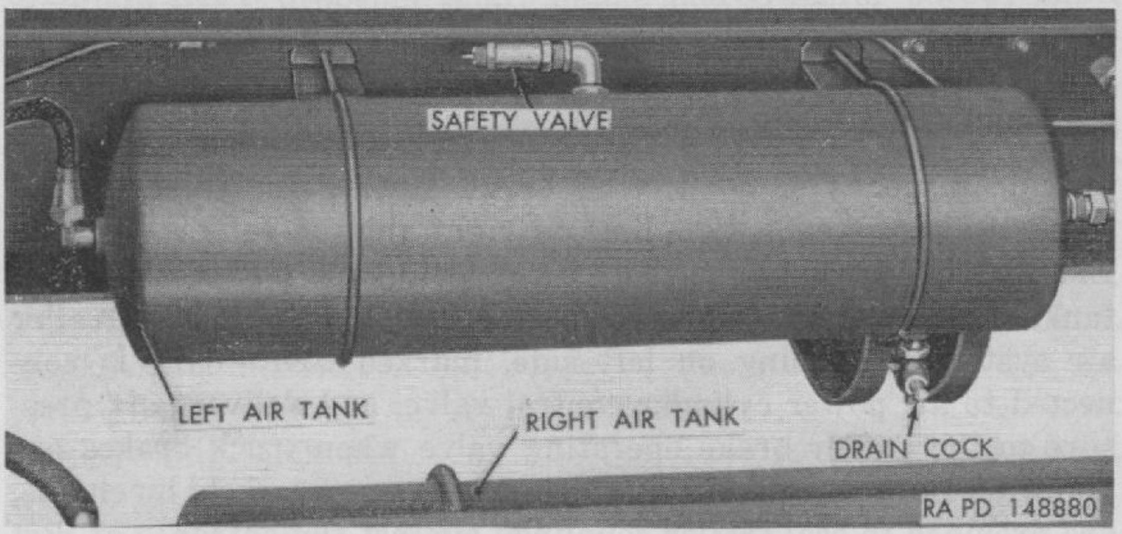


Figure 136. Air tanks, drain cock, and safety valve.

(2) *Safety valve.* Safety valve, installed on top of left air tank (fig. 136), is provided to eliminate the possibilty of air pressure building up in the system beyond a safe maximum in the event of failure of the compressor control valve. Safety valve permits air pressure in excess of 150 psi to escape.

b. AIR TANK REPLACEMENT. The following procedures cover replacement of either air tank.

(1) *Air tank removal.* Exhaust air pressure from air system. Disconnect air lines from air tank. Remove nuts from air tank "U" bolts and remove tank, U bolts, and tank supports. Remove U bolts and supports from tank. Remove drain cock and air line connectors from tank for installation on replacement tank.

Note. If left tank is removed, remove safety valve and elbow from top of tank.

(2) *Air tank installation.* Install air line connectors and drain cock on tank, using plastic-type gasket cement

on all threads. Install safety valve and elbow on left-hand tank. Position U bolts on tank, place tank supports on U bolts, and install on frame side rail. Install nuts on "U" bolts and tighten to 9½-13 pound-feet torque. Connect air lines to tank and tighten connections firmly. Build up air pressure in system; then test connections for leakage using soap and water solution.

c. SAFETY VALVE REPLACEMENT (fig. 136). Unscrew safety valve from elbow on top of left air tank. Coat threads of new or rebuilt safety valve with plastic-type gasket cement and thread into elbow on air tank. Tighten firmly.

232. Trailer Service Connections

a. GENERAL. Two air line couplings at rear end of vehicle provide a means of connecting brake system on trailer to the truck brake system. Coupling on right side of vehicle, marked EMERGENCY, is connected to tee fitting on top of right air tank, and delivers a constant supply of air pressure to the trailer air system. Coupling on left side, marked SERVICE, is connected to air power cylinder control valve, and delivers air pressure to the trailer brake operating valve when truck brakes are applied. Dummy couplings, attached to frame brackets by chains, are provided to seal trailer couplings against the entrance of dirt when not in use. A shut-off cock at each trailer coupling provides a means of shutting off the trailer brake air lines when not connected to trailer.

b. TRAILER COUPLING REPLACEMENT.

(1) *Removal.* Shut-off cock must be closed. Remove dummy coupling from trailer coupling; then unscrew trailer coupling from pipe nipple.

(2) *Installation.* Coat threads of pipe nipple with plastic-type gasket cement, thread trailer coupling onto pipe nipple, and tighten firmly. Assembly dummy coupling to trailer coupling.

c. TRAILER LINE SHUT-OFF COCK REPLACEMENT.

(1) *Removal.* Exhaust air pressure from air system. Disconnect air line from shut-off cock. Unscrew shut-off cock from pipe nipple.

(2) *Installation.* Coat threads of pipe nipple with plastic-type gasket cement. Thread shut-off cock onto pipe nipple and tighten firmly. Connect air line to shut-off cock, using plastic-type gasket cement on air line connector threads. Build up air pressure in air system;

then test connections for leakage, using soap and water solution. Truck brakes must be applied when testing left (SERVICE) connection.

Section XXIV. PARKING BRAKE SYSTEM

233. Description and Data

a. DESCRIPTION. Parking brake is an external-contracting one-piece band-type brake, located at rear of transfer assembly (fig. 137). Parking brake drum is installed between transfer-to-pillow-block propeller shaft flange and transfer output shaft flange. Brake band and lining assembly is supported by a support bracket and anchor support attached to the transfer housing. Parking brake hand lever, located at right of driver in cab, operates brake band through a relay lever and interconnecting rods (fig. 138).

b. DATA.

Type	external-contracting band.
Brake drum diameter	9½ in.
Brake lining width	3 in.
Brake lining thickness	5/16 in.

234. Parking-Brake Adjustment

a. GENERAL. Parking-brake adjustment is required when hand lever reserve travel is less than one-half the ratchet range. Adjustments are made at the brake band at rear of transfer, and at forward end of brake rod connecting brake cams to relay lever.

b. ADJUSTMENT PROCEDURE.

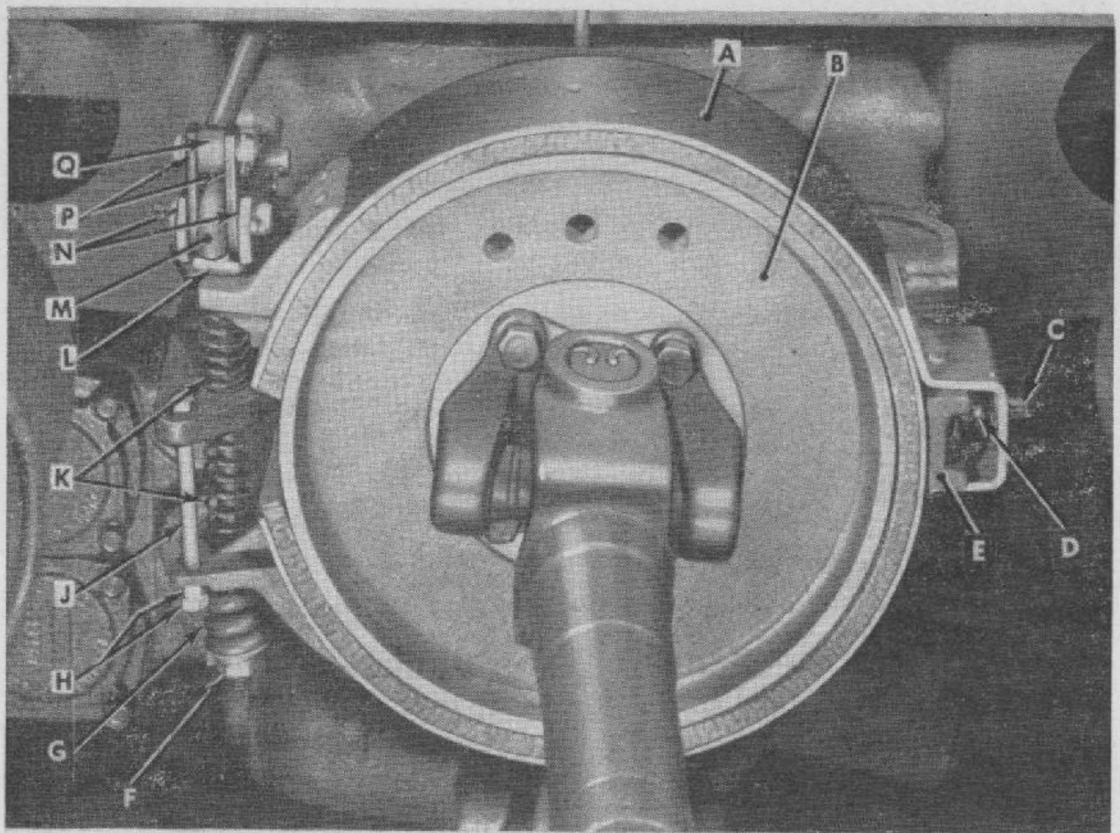
(1) Block wheel to prevent vehicle moving. Place hand lever in fully released position. Disconnect brake rod adjustable yoke from relay lever by removing cotter pin and clevis pin.

(2) Remove lock wire from anchor adjusting screw (C, fig. 137). Turn anchor adjusting screw as necessary to obtain a clearance of 0.015 inch between lining and drum. Install lock wire.

(3) Loosen lock nut on locating bolt (J, fig. 137). Draw up locating bolt until there is a clearance of 0.020 inch between lower end of lining and brake drum. Measure clearance about 1½ inches from end of lining. Tighten lock nut on locating bolt.

(4) Loosen lock nut on adjusting bolt (M, fig. 137). Draw up adjusting bolt to obtain a clearance of 0.020 inch between upper end of lining and brake drum. Measure clearance about 1½ inches from end of lining. Tighten lock nut on adjusting bolt.

(5) Adjust yoke on brake rod at relay lever (K, fig. 138) so that clevis pin may be freely inserted through yoke and lever. Install clevis pin and cotter pin; then tighten lock nut against yoke. Remove blocks from wheel.



A—BRAKE BAND AND LINING
B—BRAKE DRUM
C—ANCHOR ADJUSTING SCREW
D—ANCHOR ADJUSTING SCREW SPRING
E—ANCHOR SUPPORT BRACKET
F—ADJUSTING BOLT NUT
G—TENSION SPRING
H—LOCATING BOLT NUTS
J—LOCATING BOLT
K—RELEASE SPRINGS
L—CAM SHOE
M—ADJUSTING BOLT
N—LINKS
P—CAMS
Q—RELAY LEVER TO BRAKE ROD

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Figure 137. Parking brake drum and band installed on transfer.

235. Brake Band and Lining

a. BRAKE BAND AND LINING REMOVAL (fig. 137).

(1) Block wheels to prevent vehicle moving. Disconnect brake rod from cams by removing cotter pin and clevis pin. Remove cotter pin, clevis pin, and cams from upper end of adjusting bolt.

(2) Remove nuts, washers, and spring from lower end of adjusting bolt. Lift adjusting bolt straight up out of brake band brackets and support bracket, stripping release springs and cam shoe off bolt as bolt is removed.

(3) Remove nuts from locating bolt and remove bolt. Remove lock wire from anchor screw; then back screw out of anchor support.

(4) Slide band and lining assembly rearward off brake drum and anchor support, removing anchor screw spring as band is removed. Pull band and lining assembly off over propeller shaft.

b. BRAKE BAND AND LINING INSTALLATION (fig. 137).

(1) Place brake band and lining over propeller shaft. Place anchor screw spring in depression in anchor support, and compress spring as brake band and lining assembly is placed over brake drum and anchor support.

(2) Thread anchor screw into anchor support until it contacts brake band. Insert locating bolt down through hole in support bracket and brake band lower bracket. Install two nuts on locating bolt.

(3) Install cams between links and install clevis pin and cotter pin.

(4) Insert threaded end of adjusting bolt down between cam levers with hook toward rear of vehicle; as bolt is lowered into place, it must pass through cam shoe, band upper bracket, upper release spring, support bracket, lower release spring, and band lower bracket. Install tension spring, flat washer, and two nuts on adjusting bolt.

(5) Connect brake rod to cam levers, using clevis pin and cotter pin. Adjust lining to drum clearance (par. 234*b*).

236. Parking Brake Drum

a. PARKING BRAKE DRUM REMOVAL (fig. 137).

(1) Remove parking brake band and lining assembly (par. 235*a*).

(2) Remove four nuts and bolts attaching propeller shaft flange and brake drum to transfer shaft flange. Slide slip yoke back on propeller shaft and lower front end of propeller shaft to floor.

(3) Remove parking brake drum from transfer shaft flange. Do not drop locating ring out of inside of drum.

b. Parking Brake Drum Installation (fig. 137).

(1) Make sure shoulder on transfer shaft flange and mating surface on brake drum web are clean and smooth. Make sure locating ring is in place in center of drum. Position drum on flange with bolt holes alined.

(2) Raise propeller shaft, position propeller shaft flange against brake drum, and install four bolts. Install nuts on bolts and tighten to 33–43 pound-feet torque.

(3) Install parking brake band and lining (par. 235*b*).

237. Parking Brake Linkage

a. Parking Brake Hand Lever Replacement (fig. 138).

(1) *Removal.* Remove cotter pin, clevis pin, and two flat washers (spacers) attaching brake rod to hand lever adapters. Remove nut from clamp bolt securing hand lever on lever pin, remove clamp bolt, and then remove hand lever from pin.

(2) *Installation.* Install hand lever on lever pin, with clamp bolt hole alined with groove in pin. Install nut on clamp bolt and tighten to 20–27 pound-feet torque. Connect brake rod to hand lever adapters, using clevis pin, two flat washers, and cotter pin; one flat washer must be installed on each side of brake rod eye between adapters. Apply parking brake; if hand lever reserve

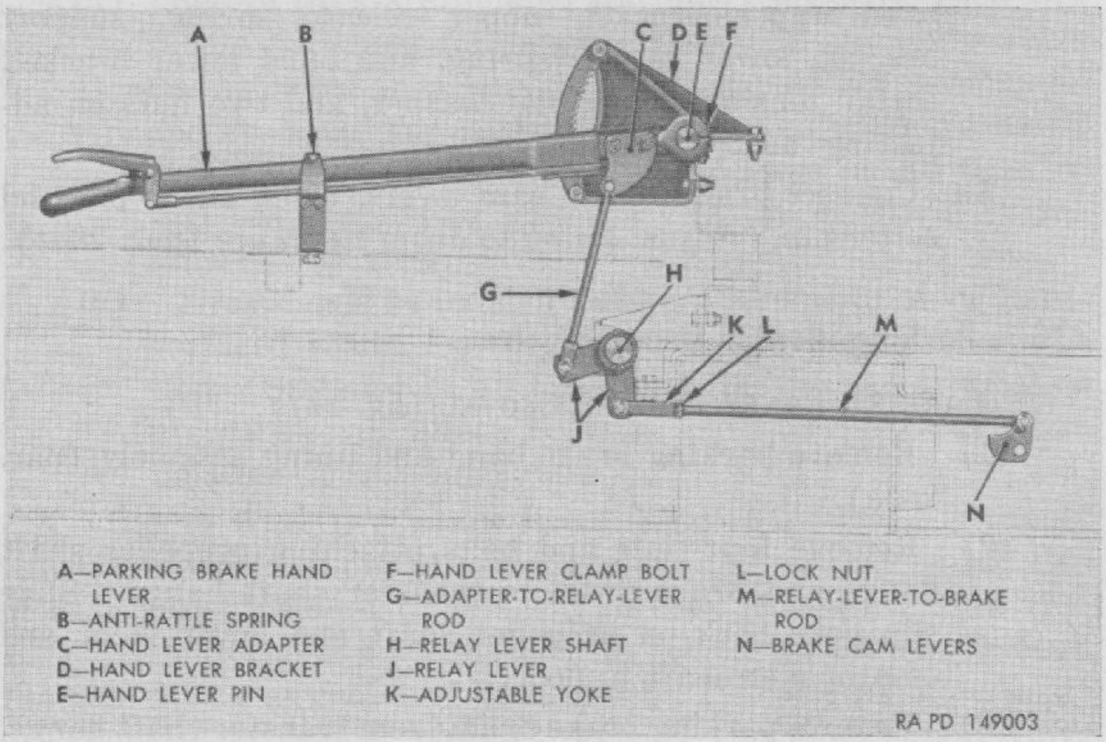


Figure 138. Parking brake linkage.

travel is less than one-half the ratchet range, adjust parking brake (par. 234*b*).

b. PARKING BRAKE RELAY LEVER REPLACEMENT (fig. 138).

(1) *Removal.* Disconnect brake rods from relay lever arms by removing cotter pins and clevis pins. Remove cotter pin from both ends of relay lever shaft; then remove shaft and lever from bracket.

(2) *Installation.* Position relay lever in bracket and insert relay lever shaft through bracket and lever. Install cotter pin in both ends of shaft. Connect brake rods to relay lever, using clevis pins and cotter pins. Apply parking brakes; if hand lever reserve travel is less than one-half the ratchet range, adjust parking brake (par. 234*b*).

Section XXV. WHEELS AND TIRES

238. Description and Data

a. DESCRIPTION.

(1) *Wheels.* Each wheel is secured on hub by six studs and nuts. Studs are pressed into hub flange. Wheels do not pilot on hub; taper on wheel nuts engage chamfered holes in wheel, positioning wheel concentric with hub. This permits clearance between the wheel bore and the hub for easier removal and installation of wheels. Wheel studs and nuts on left side of vehicle all have left-hand threads; studs and nuts on right side have right-hand threads. One tire bead seat and flange is integral with the wheel rim. The removable lock ring forms the other tire bead seat and flange.

(2) *Tires.* Tires are designed for either high or low pressure operation. Tire bead clips hold tire beads out against rim flanges during low pressure operation or in the event of loss of air pressure from tire.

b. DATA.

Wheels:

Ordnance number	7389617.
Rim size	20 x 7.50.
Offset	$5\frac{1}{8}$ in.
Bolt circle diameter	8.755–8.745 in.
Wheel bore diameter	6.479–6.469 in.

Tires:

Type	military
Size	11.00/20

Operating pressure:

For operation on hard-surfaced roads .... 70 psi.

For cross-country operation .... 35 psi.

239. Wheels

a. WHEEL REMOVAL.

(1) Jack up axle until tire clears floor; block opposite wheel to prevent vehicle rolling.

(2) Remove six nuts from wheel studs, using wheel stud nut wrench 41-W-3838-40 and wrench handle 41-H-1541-10; turn nut on right side of vehicle counterclockwise to remove, and turn nuts on left side clockwise to remove. Lift wheel and tire off hub.

b. WHEEL INSTALLATION.

(1) Make sure mating surfaces of wheel and hub flange are clean, and that wheel studs and nuts are free of grease or oil.

(2) Install wheel on hub; then install nuts on wheel studs. Tighten nuts alternately with torque wrench to 300-350 pound-feet torque. Turn nuts on right side of vehicle clockwise to tighten; turn nuts on left side counterclockwise to tighten.

240. Tires and Tubes

a. GAGING AND INFLATING TIRES.

(1) Before tires are inflated to correct pressure, each tire should be gaged for pressure loss. If any appreciable loss is noted in a tire, that tire should be dismounted and examined for cause of pressure loss. When making pressure loss check, use the same gage on all tires so that any element of inaccuracy in the gage will be the same for all tires.

(2) Tires should be inflated to 70 psi for operation on hard-surfaced roads, and to 35 psi for cross-country operation. Pressure in all tires must be the same; unequal pressures will affect braking and steering. Use tire inflation hose (*b* below).

b. USE OF TIRE INFLATION HOSE (fig. 139). Two air supply valves are provided, one at extreme right and another at left side of dash panel inside cab, adjacent to cowl side ventilators (fig. 139). Supply valves are connected to vehicle air system through junction fitting at center of dash panel. Two tire inflation hoses are provided in vehicle tool kit. Remove cap from supply valve at either side and thread hose fitting onto valve. Open valve

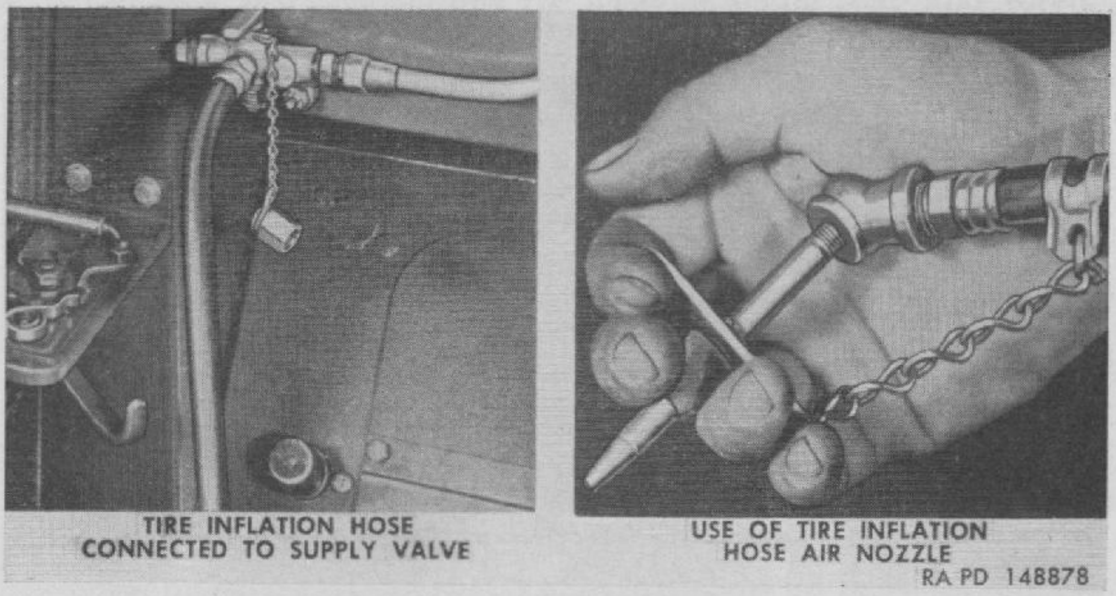


Figure 139. Use of tire inflation hose.

by turning valve handle parallel to hose outlet. Air nozzle is attached to hose by a chain. Nozzle may be used for cleaning and drying parts.

c. MATCHING TIRES. Replacement tires should be of the same design and tread as other tires on the vehicle. Differences in design and tread in some instances result in unequal rolling radii. If tires do not have the same outside diameter within one-eighth inch, excessive tread scuffing will result. When replacement tire is selected, one should be selected with outside diameter within one-eighth inch of other tires on the vehicle, particularly on the same axle. Measure outside diameter of tires with a conventional tire measuring gage.

d. VALVE STEM REPLACEMENT (fig. 140). The valve stem is threaded onto an adapter which is vulcanized into the tube. This permits replacing the valve stem in the event it becomes broken or damaged and the tube is still serviceable. A new valve stem, or one removed from a damaged tube, can be installed.

(1) To remove valve stem, position tube over vise (fig. 140); place foot inside tube at bottom and press down to stretch tube over vise. Turn valve stem counterclockwise to remove.

(2) Make sure tube is clean around valve stem adapter. Wet area of tube contacted by valve stem with water to act as a lubricant while installing valve stem. Thread valve stem onto adapter. Stretch tube over vise while tightening valve stem. Do not use a pipe over valve stem to tighten.

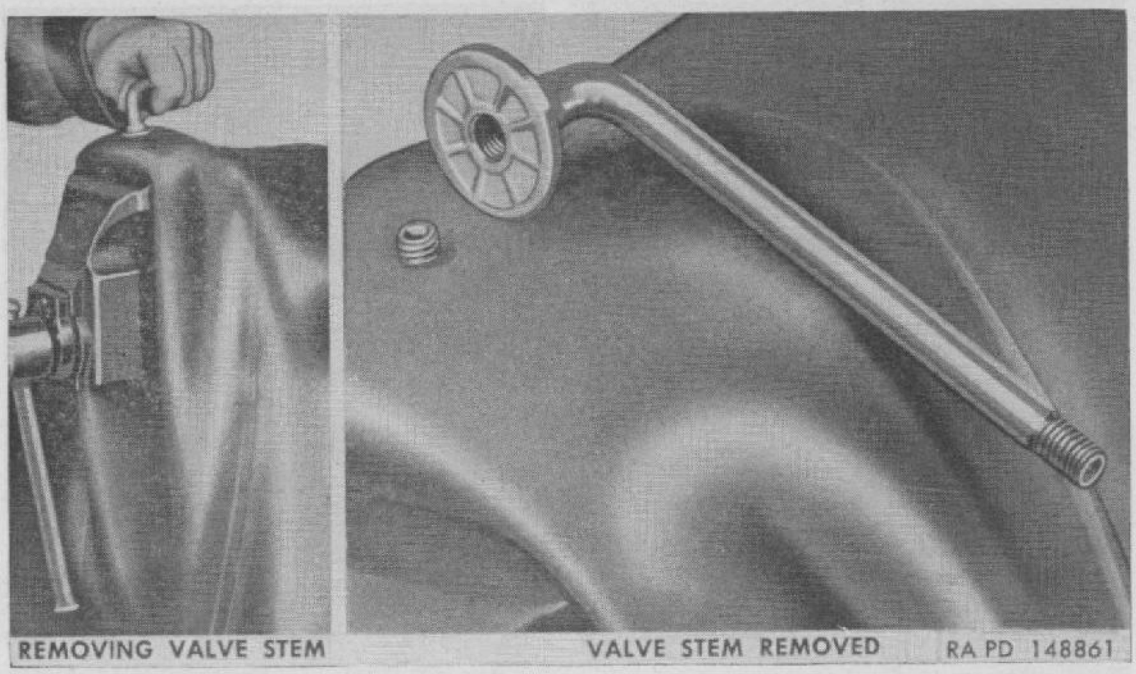


Figure 140. Valve stem replacement.

241. Tire Replacement

a. TIRE REMOVAL (fig. 141).

(1) Lay wheel and tire on floor with lock ring up. Completely deflate tube by removing valve core.

(2) Drive a "goose-neck" type tire tool between the tire bead and lock ring, next to one of the bead clips (A fig. 141).

(3) Pry sideways on tool to cause wide part of tool between tire bead and lock ring to force bead away from lock ring. While prying sideways with tool, tap bead clip loose from lock ring (B, fig. 141). Repeat this procedure at all six bead clips.

(4) Pry tire bead down off lock ring, using tire tool progressively around wheel (C, fig. 141).

(5) Insert straight end of tire tool into pry notch next to split in lock ring; then, using the wheel rim as a fulcrum, pry lock ring up out of rim gutter (D, fig. 141).

(6) While pulling up on free end of lock ring, use tire tool progressively around wheel to free lock ring from rim (E, fig. 141).

(7) Turn wheel and tire over. Free bead clips from rim flange and pry tire bead away from rim flange in same manner ((2) through (6) above).

(8) Place a block of wood on floor; block must be small enough to permit tire to encircle it and about 8 or 10

inches high. Drop wheel and tire over block with wheel centered on block. Tire will drop off rim (F, fig. 141).

(9) Remove flap and tube from tire. If bead clips are broken or rusty, replace with new parts.

b. Tire Installation.

(1) Remove all dirt and dust from inside tire. Make sure tube and flap are clean. Clean all dirt and rust from wheel rim, using a wire brush if necessary.

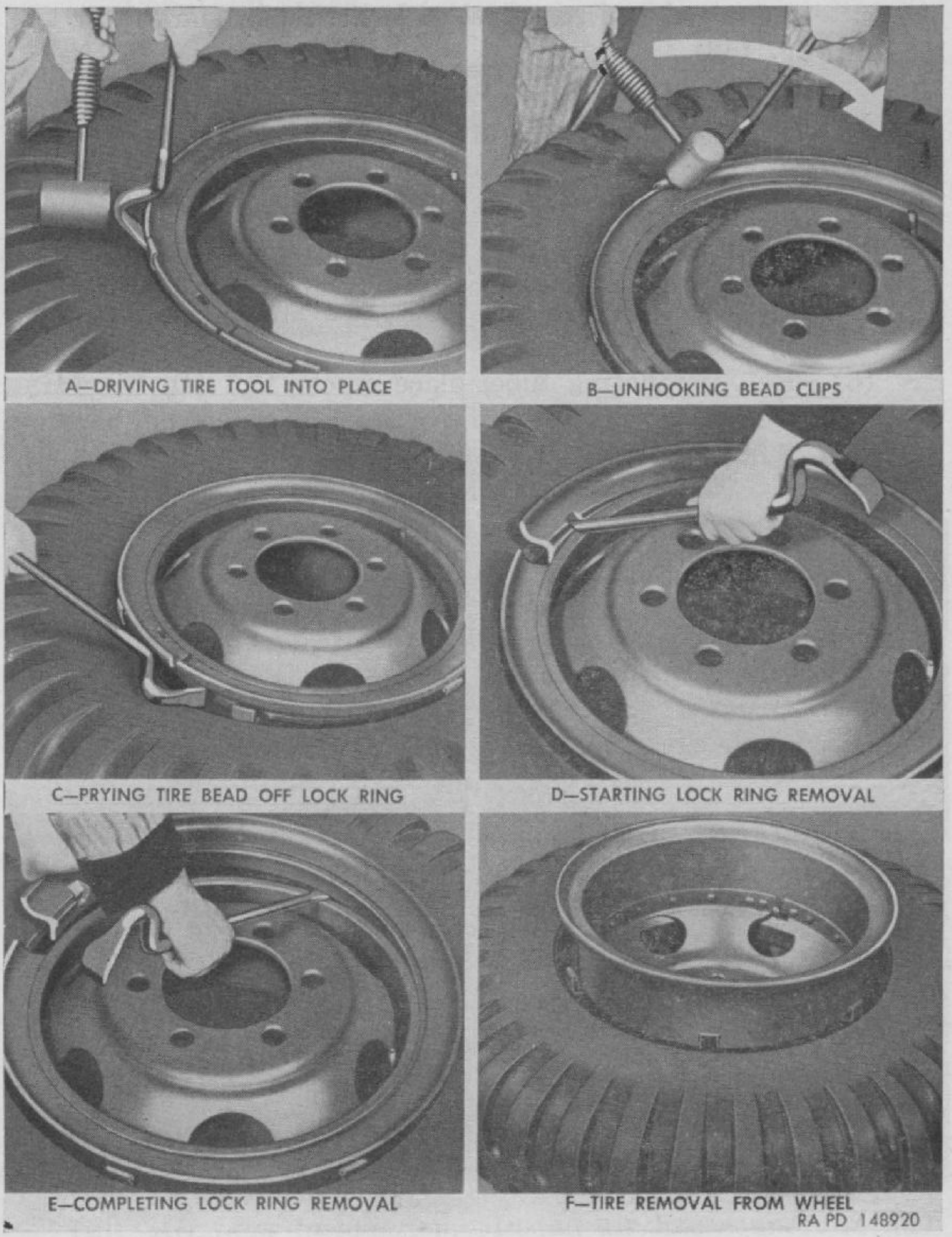


Figure 141. Removing tire.

(2) Install tube and flap in tire, with valve stem inserted through hole in flap. Place bead clips on tire beads, six on each bead (A, fig. 142). Spaces between clips should be equal within one inch.

(3) Lay wheel on floor, lock ring side up. Place tire and tube over wheel rim, forcing valve stem down and inserting it through hole in rim as tire is lowered into place.

(4) Place lock ring on tire with split in ring opposite valve stem. Force toe of lock ring between tire bead and rim at one end and seat heel of lock ring in rim gutter (B, fig. 142).

(5) Using tire tool in wheel spoke openings, work progessively around wheel prying lock ring down into rim gutter (C, fig. 142). Make sure lock ring is fully seated all the way around.

Note. Do not attempt to pry bead clips into place over lock ring or rim flange. Air pressure will force bead clips into place when tire is inflated.

(6) Before inflating tube, place safety bar (D, fig. 142), through wheel spokes to prevent lock ring from blowing off in the event it is not fully seated.

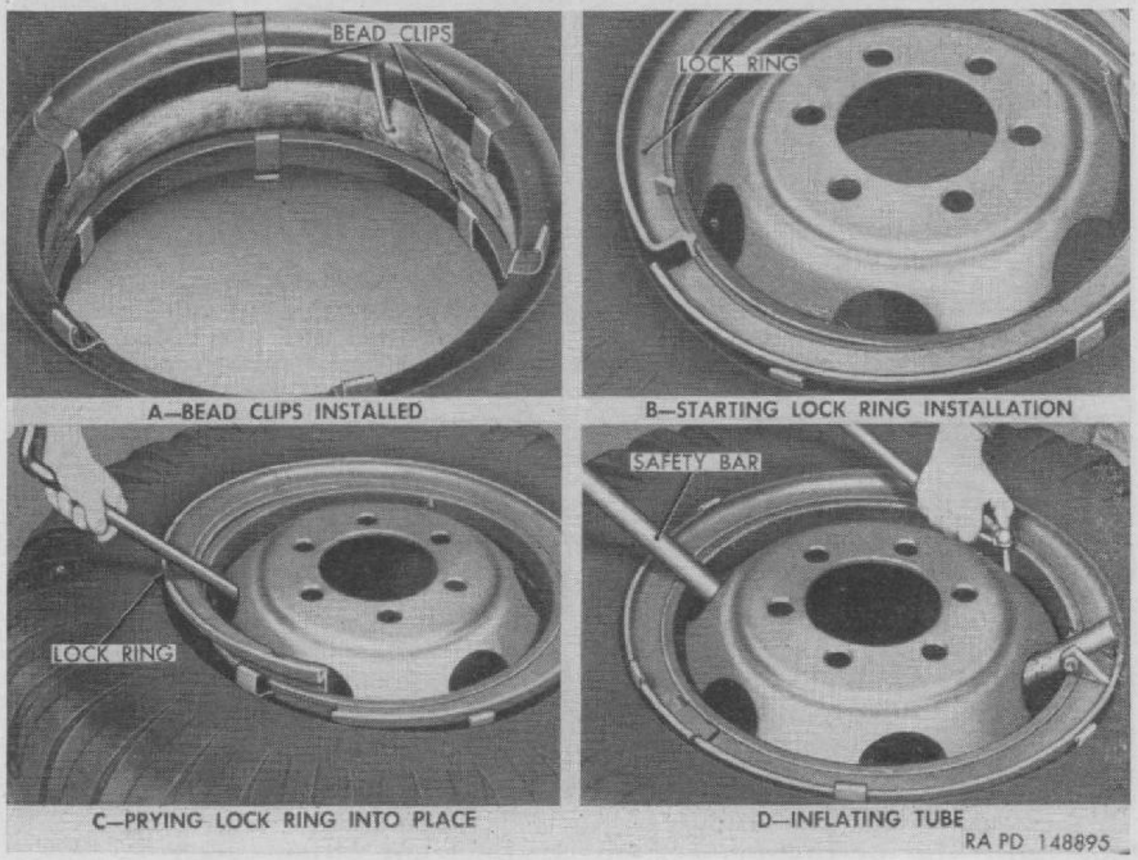


Figure 142. Installing tire.

(7) Inflate tube to full operating pressure (70 psi). Note that the bead clips snap into place over lock ring and rim flange as tube is inflated. Completely deflate tube by removing valve core; then install valve core and reinflate tube to correct pressure (par. 240*a*). This procedure permits tube to position itself in tire and prevents stretching the tube thin in the tire bead and rim region.

242. Spare Wheel and Carrier

a. GENERAL. Spare wheel and tire are mounted on carrier on frame right side rail at rear of cab (fig. 143). Carrier swings outward and wheel tilts down for easy removal and installation.

b. SPARE WHEEL AND TIRE REMOVAL FROM CARRIER (fig. 143).

(1) Remove two nuts attaching spare-wheel support bracket to frame bracket. Swing carrier and wheel out from under vehicle body and tip wheel and tire to upright position.

(2) Remove four nuts attaching wheel to support bracket; then remove wheel and tire from support bracket.

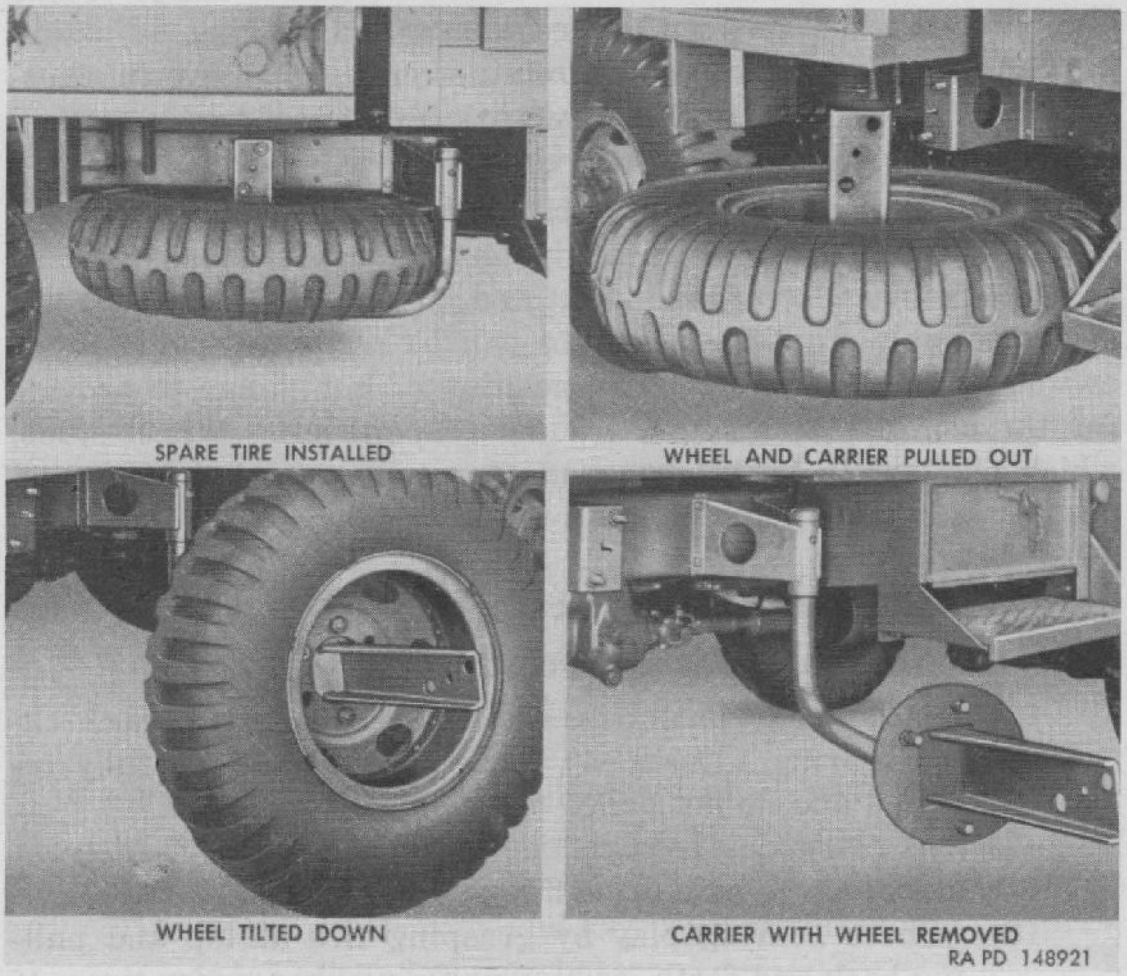


Figure 143. Spare wheel and tire carrier.

c. SPARE WHEEL AND TIRE INSTALLATION ON CARRIER (fig. 143).

(1) Position wheel and tire on support bracket and attach with four nuts. Tighten nuts firmly.

(2) Tip wheel and tire to horizontal position and swing in under vehicle body, with support bracket in place against frame bracket. Install nuts on two attaching studs and tighten firmly.

Section XXVI. WHEEL HUBS AND BEARINGS

243. Description

a. MOUNTING AND OIL SEALS. Front and rear hubs are mounted on opposed tapered roller bearings. Front hub bearings (fig. 144) are carried on steering knuckle spindles, and rear hub bearings (fig. 145) are carried on axle housing tubes. A spring-loaded lip-type seal is pressed into inner end of each hub to prevent wheel bearing lubricant leaking into the brake mechanism. Oil seal sleeves (wear rings) are pressed onto steering knuckle spindle (front) and on axle housing (rear). Seal lips wipe on these sleeves. Seals are also used at outer ends of hubs. Outer seals are installed between outer bearing and bearing adjusting nut. A tongue on inside of seal retainer engages groove in steering knuckle spindle or axle housing to prevent seal turning. Seal lip wipes on inside of hub as hub revolves.

b. HUBS. Front and rear hubs and brake drums are identical; however, different brake drum adpaters and wheel studs are used to make front and rear, and right and left assemblies. Hubs are also reversible; that is, rear hubs can be assembled with either end out. This changes relative position of hub flange to provide for the use of either single or dual rear wheels. Wheel studs, which also retain brake drum adapters, are serrated type, and are pressed through hub flange from inner side.

244. Wheel Bearing Adjustment

a. BEARING ADJUSTMENT CHECK.

(1) Jack up axle until tires are clear of floor. Before checking bearing adjustment, make sure brakes are fully released and do not drag.

(2) At rear axles, remove axle shaft (par. 205*b*). At front axle, remove axle drive flange (par. 198*a*).

(3) Check bearing play by grasping tire at top and pulling back and forth, or by using a pry bar under tire. If

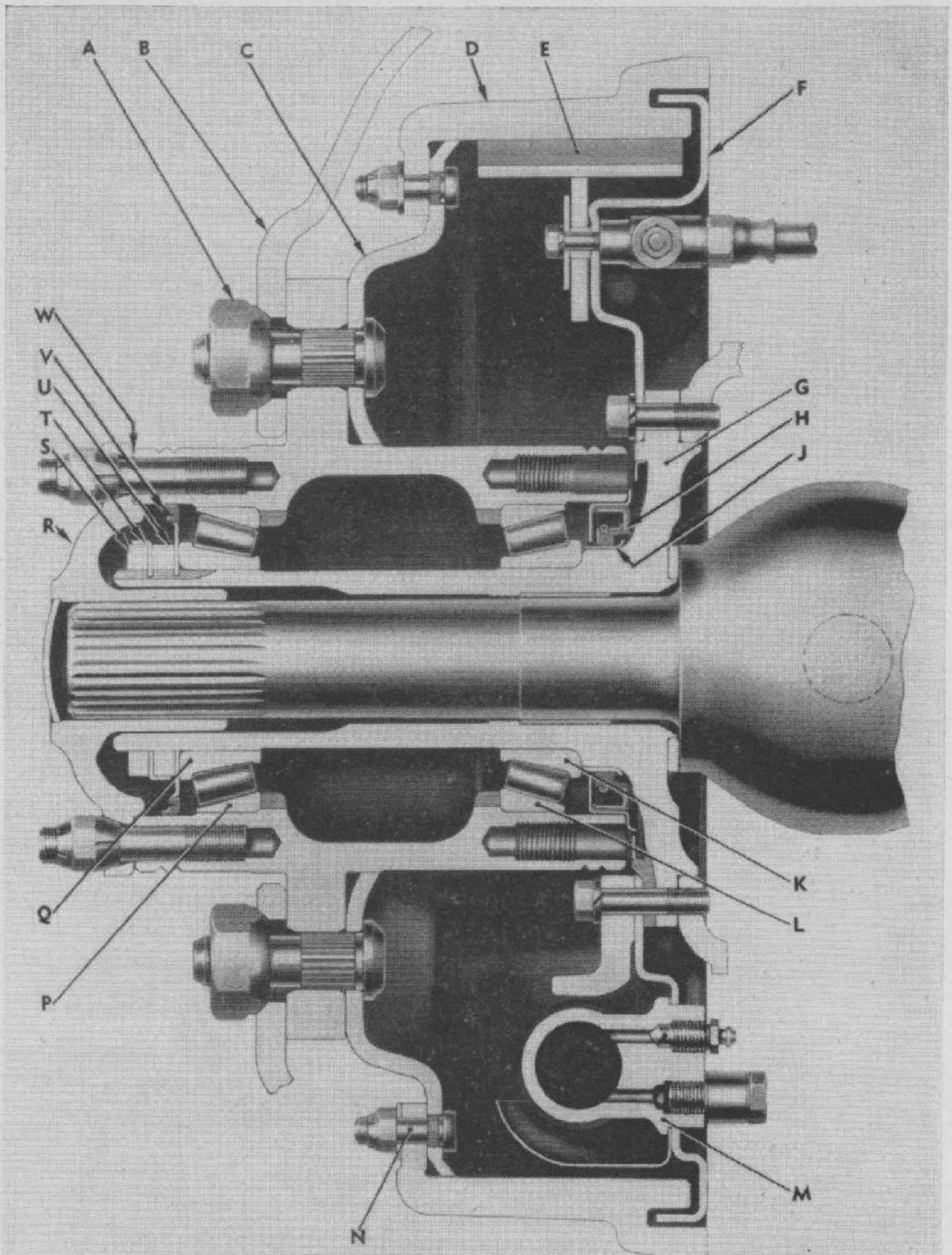


Figure 144. Front hub, bearings, and oil seals.

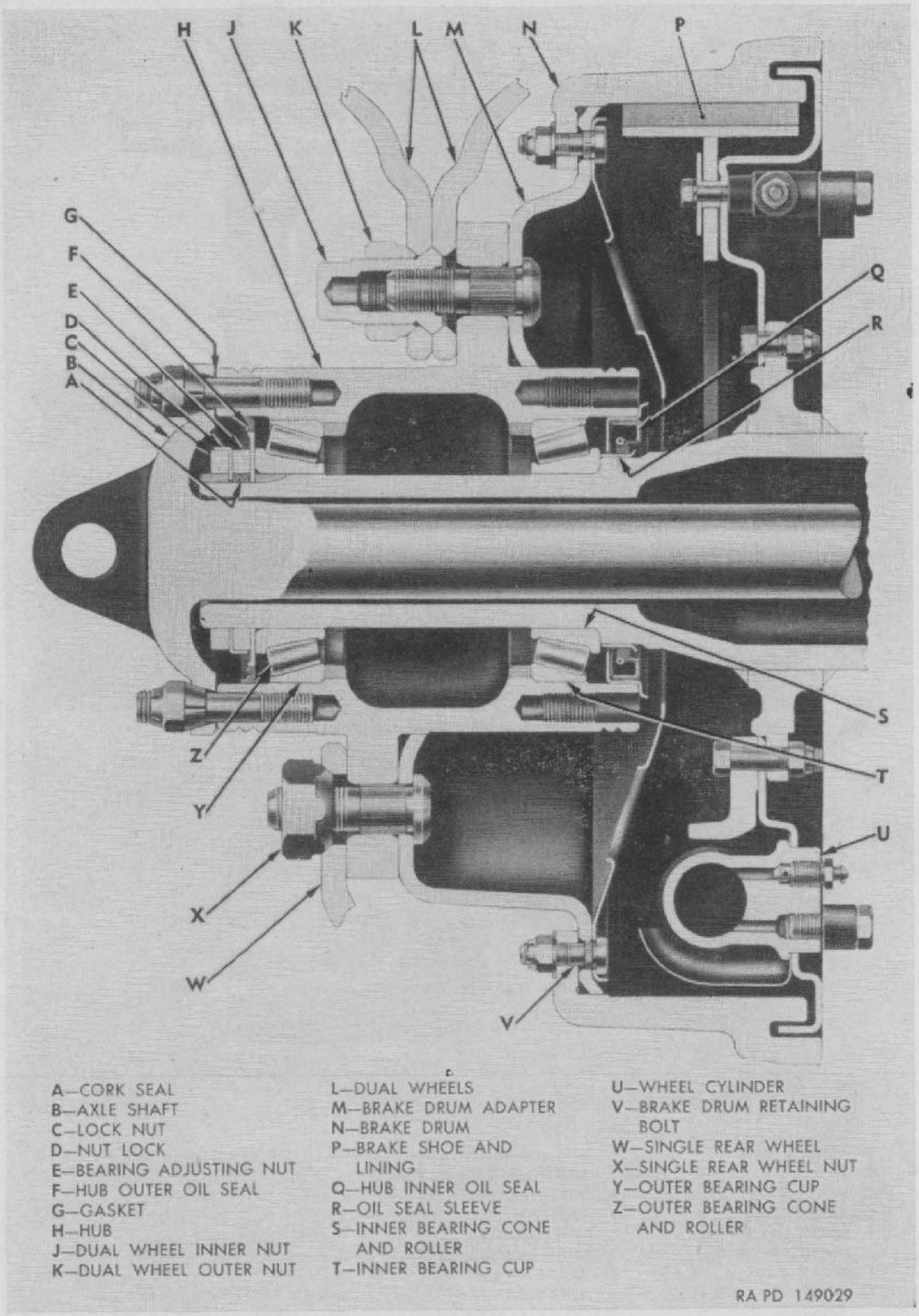


Figure 145. Rear hub, bearings, and oil seals.

bearings are properly adjusted, movement will be just noticeable and wheel will turn freely; bearing play can be seen by observing movement of brake drum in relation to backing plate. If bearing play is excessive, adjust bearings (*b* below).

b. Bearing Adjustment.

(1) Axle will have been jacked up and axle shaft or drive flange removed (*a* above).

(2) Bend tangs of nut lock away from lock nut. Remove lock nut and nut lock.

(3) Using wheel bearing nut wrench 7950169 adapted to torque wrench, tighten adjusting nut to 150–170 pound-feet; turn wheel to make sure bearings are properly seated, then recheck torque.

(4) Back off adjusting nut one-eighth to one-quarter turn.

Note. At rear, make sure cork seal is in place inside adjusting nut in groove in axle housing. Install nut lock and lock nut, and tighten lock nut firmly using wrench. Bend one tang of nut lock over flat on adjusting nut and one over flat on lock nut.

(5) At rear axles, install axle shaft (par. 205*c*). At front axle, install axle drive flange (par. 198*b*).

245. Front Hubs and Bearings

a. Front Hub and Bearing Removal (fig. 144).

(1) Jack up axle and remove wheel (par. 239*a*).

(2) Remove axle drive flange (par. 198*a*)

(3) Bend tangs of nut lock away from lock nut and bearing adjusting nut. Using wheel bearing nut wrench 75950169 and wrench handle 41–H–1541–10, remove lock nut, nut lock, and bearing adjusting nut from steering knuckle spindle.

(4) Pull hub and brake drum straight off steering knuckle spindle. Bearings and oil seals will remain in hub.

(5) Lift outer oil seal and outer bearing cone and roller out of outer end of hub.

(6) Using a suitable driver through outer end of hub to exert force on inner bearing cone, force inner bearing cone and roller and inner oil seal out of inner end of hub.

b. Bearing Cup Replacement. Examine bearing cups in hub. If cups are pitted or cracked, they must be replaced. Drive each cup out of hub, using a soft medal drift against edge of cup from opposite end of hub. Drive new cups into hub, using a suitable driver which will exert force on outer edge of cup without damaging bearing surface. Make sure cups enter hub straight and are fully seated against shoulder in hub.

c. OIL SEAL SLEEVE REPLACEMENT.

(1) Examine surface of oil seal sleeve on steering knuckle spindle. If grooved or rough, sleeve must be replaced.

(2) To remove sleeve, tap sleeve with hammer all the way around the steering knuckle spindle to stretch the metal; then use a blunt chisel to cut into the sleeve inner flange. Partially cut through the flat surface of the sleeve with a blunt chisel; use extreme caution not to cut all the way through the sleeve and mar the surface of the steering knuckle spindle. This should loosen the sleeve sufficiently to permit removal.

(3) Install new seal, driving it into place with oil seal sleeve replacer 7950063 (fig. 146). Replacer positions sleeve with outer edge flush with bearing shoulder on spindle.

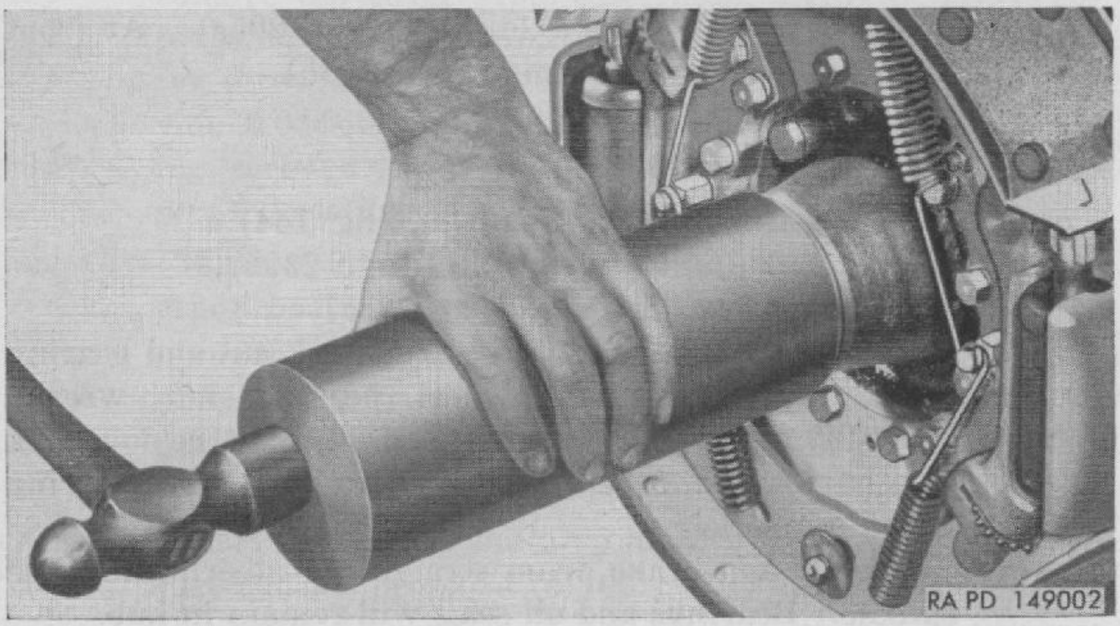


Figure 146. Installing oil seal sleeve (rear shown) using replacer 7950063.

d. BEARING INSPECTION AND LUBRICATION. Clean, inspect, and lubricate bearings, inside of hub, and steering knuckle spindle (par. 59*l*).

e. FRONT HUB AND BEARING INSTALLATION.

(1) Place inner bearing cone and roller in hub. Press new inner oil seal squarely into hub until flange on seal case seats against end of hub.

(2) Install hub and brake drum on steering knuckle spindle, using care not to damage inner oil seal. Place outer bearing cone and roller and outer oil seal on steering knuckle spindle and push into hub with fingers.

(3) Install bearing adjusting nut. Adjust bearings and complete the installation (par. 144*b*).

246. Rear Hubs and Bearings

a. REAR HUB AND BEARING REMOVAL (fig. 145).

(1) Jack up axle and remove wheel (par. 239*a*).

(2) Remove axle shaft (par. 205*b*).

(3) Bend tangs of nut lock away from lock nut and bearing adjusting nut. Using wheel bearing nut wrench 7950169, remove lock nut, nut lock, and adjusting nut from axle housing. Remove cork seal from groove in axle housing.

(4) Pull hub and brake drum straight off axle housing. Bearings and oil seals will remain in hub.

(5) Lift outer oil seal and outer bearing cone and roller out of outer end of hub.

(6) Using a suitable driver through outer end of hub to exert force on inner bearing cone, force inner bearing cone and roller and inner oil seal out of inner end of hub.

b. BEARING CUP REPLACEMENT. Rear hub bearing cups are replaced in same manner as front hub bearing cups. (par. 245*b*).

c. OIL SEAL SLEEVE REPLACEMENT. Oil seal sleeve on rear axle housing is replaced in same manner as sleeve on front axle steering kunckle spindle (par. 245*c*).

d. BEARING INSPECTION AND LUBRICATION. Clean, inspect, and lubricate bearings, inside of hub, and axle housing (par. 59*l*).

e. REAR HUB AND BEARING INSTALLATION (fig. 145).

(1) Place inner bearing cone and roller in hub. Press new inner oil seal squarely into hub until flange on seal case seats against end of hub.

(2) Install hub and brake drum on axle housing, using care not to damage inner oil seal. Place outer bearing cone and roller and outer oil seal on axle housing and push into hub with fingers.

(3) Place cork seal in groove in axle housing; then thread bearing adjusting nut onto housing over cork seal. Adjust bearings and complete the installation (par. 244*b*).

Section XXVII. STEERING SYSTEM

247. Description and Data

a. DESCRIPTION. The recirculating-ball type steering gear assembly is flange-mounted on left-hand frame side rail (fig. 148). The pitman arm, mounted on steering gear pitman arm shaft, is interconnected with steering arm on left steering knuckle of front axle by a steering drag link (fig. 147). Steering wheel is mounted to steering gear wormshaft. Center of steering wheel includes horn button and contacts. Upper portion of steering column is supported at dash with a rubber spacer and a cowl bracket and cap (fig. 153).

b. DATA.

Steering gear make and model Saginaw-552-D-L
Ratio .... 28.14 to 1
Steering wheel diameter .... 20 in.

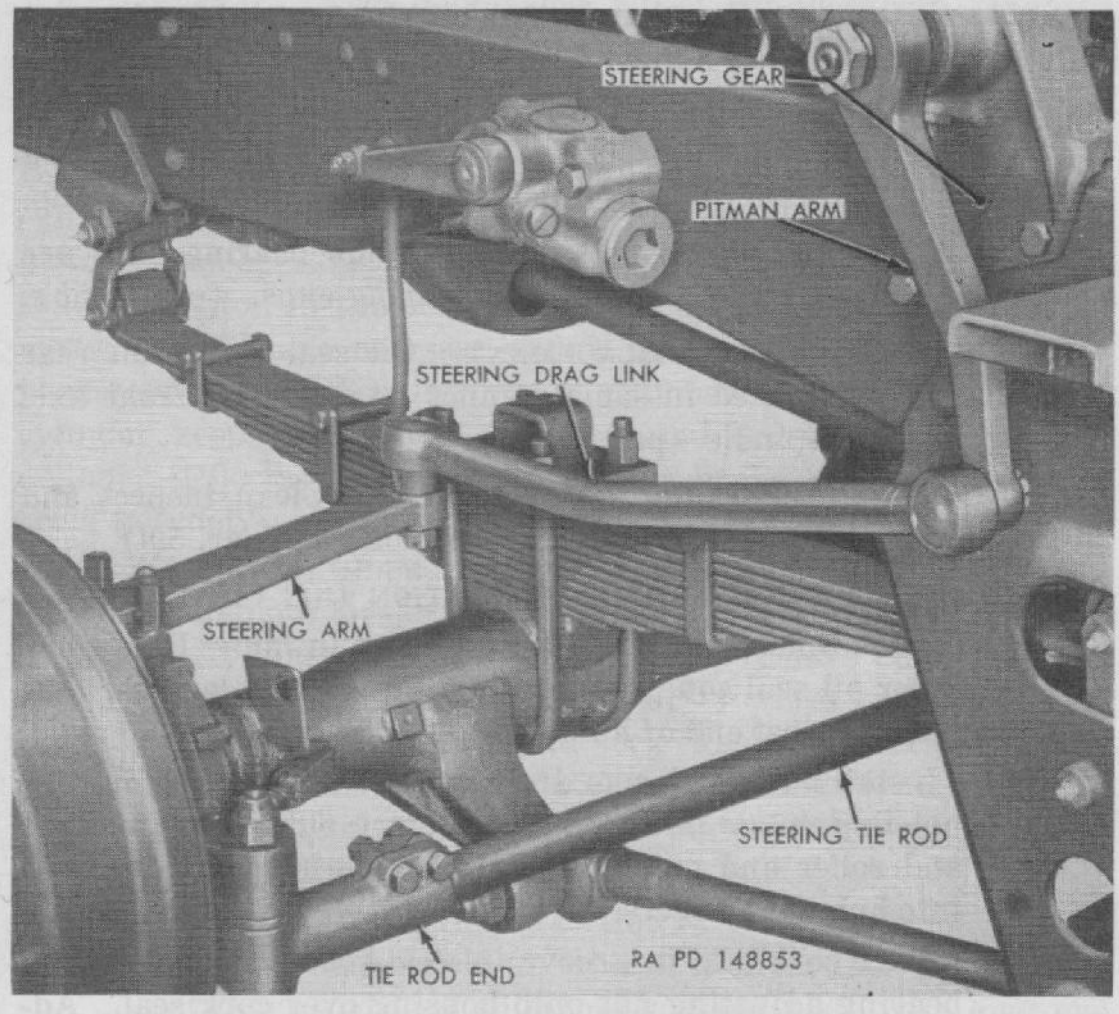


Figure 147. Steering linkage installed.

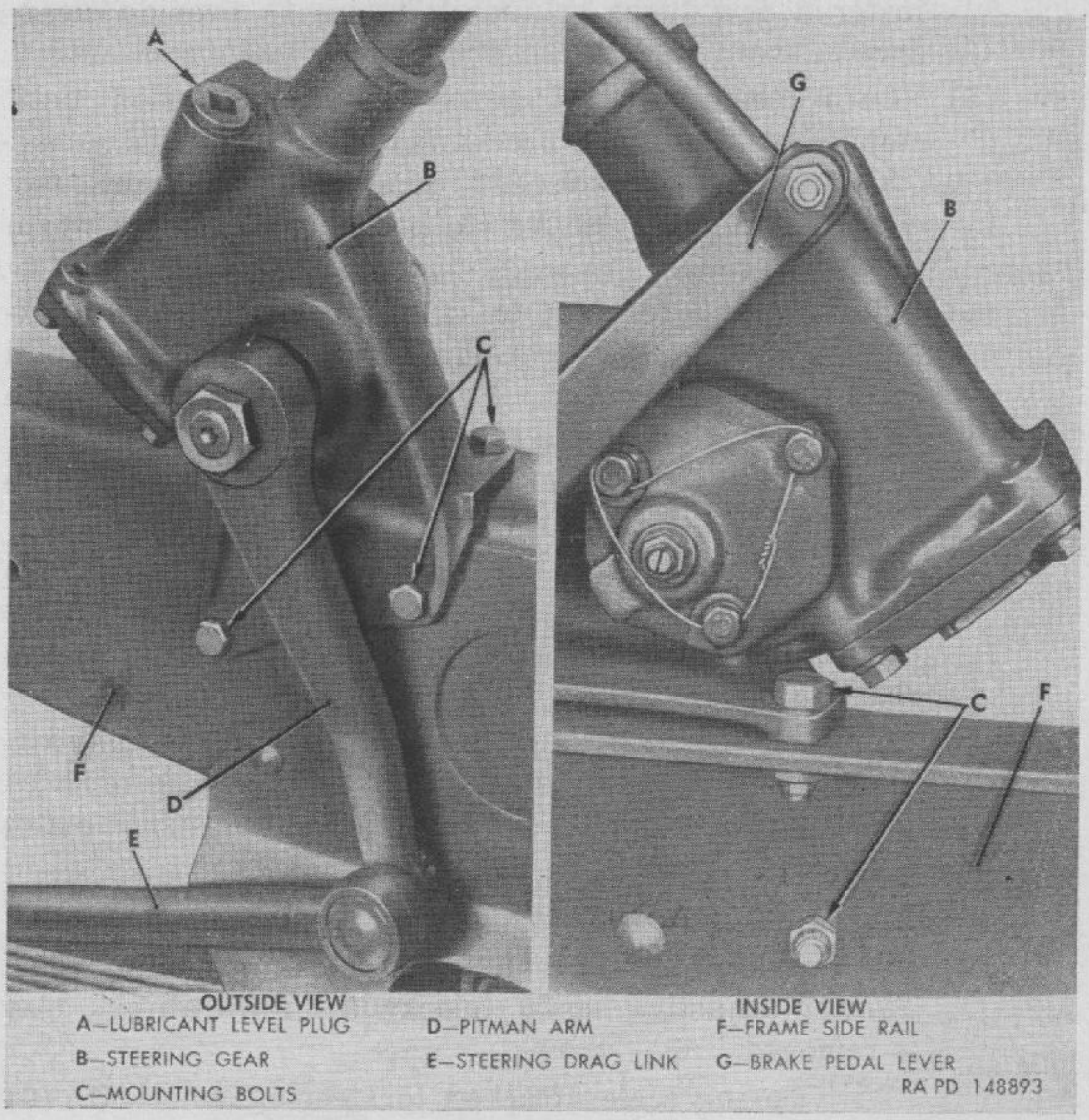


Figure 148. Steering gear mounted at frame.

248. Steering Gear Adjustments

a. General. The steering gear is designed to provide for adjustments to compensate for normal wear at worm bearings, and at pitman arm shaft and mating parts. If steering action necessitates adjustment (par. 87), procedures for checking and adjusting steering gear must be performed in sequence outlined in *b* through *d* below.

b. Checking Worm Bearing Adjustment.

(1) Check lubricant in housing and fill to proper level if necessary (par. 57).

(2) Check mounting bolt nuts for tightness (par. 253*c*).

(3) Disconnect drag link from pitman arm (par. 249*b*). Loosen two bolts and nuts on cowl bracket cap (fig. 153).

(4) Check end cover bolts for tightness. Loosen lock nut on pitman arm shaft adjuster (fig. 149), and turn ad-

juster a few turns counterclockwise to provide clearance between pitman arm shaft sector and worm nut.

(5) Turn steering wheel gently in one direction until stopped by gear; then back away about one turn.

Caution: Approach end of gear travel cautiously either to the right or left to prevent damage to worm nut.

(6) Measure pull required to keep wheel in motion by attaching a spring scale to rim of steering wheel; then pull on scale to turn wheel. Pull on scale should be made on a line at right angle to wheel spoke.

(7) If bearings are properly adjusted, the pull should be between 1½ to 2 pounds.

(8) If pull is not within limits of 1½ to 2 pounds, worm bearings should be adjusted (*c* below). If bearings are in proper adjustment, proceed to adjust pitman arm shaft (*d* below).

(9) If rough or "lumpy" action is noted during worm bearing check, the steering gear assembly should be replaced (pars. 252 and 253) and report made to ordnance maintenance personnel.

c. Worm Bearing Adjustment.

(1) Loosen lock nut at bottom of end cover (fig. 149). Tighten adjusting screw (clockwise) until all end play is removed.

(2) With spring scale attached to steering wheel (*b* (6) above), check wheel pull. Readjust by turning adjusting screw as necessary to obtain 1½ to 2 pounds pull. Tighten nut lock and check again.

Note. After adjusting worm bearing, pitman arm shaft lash adjustment must always be made (*d* below).

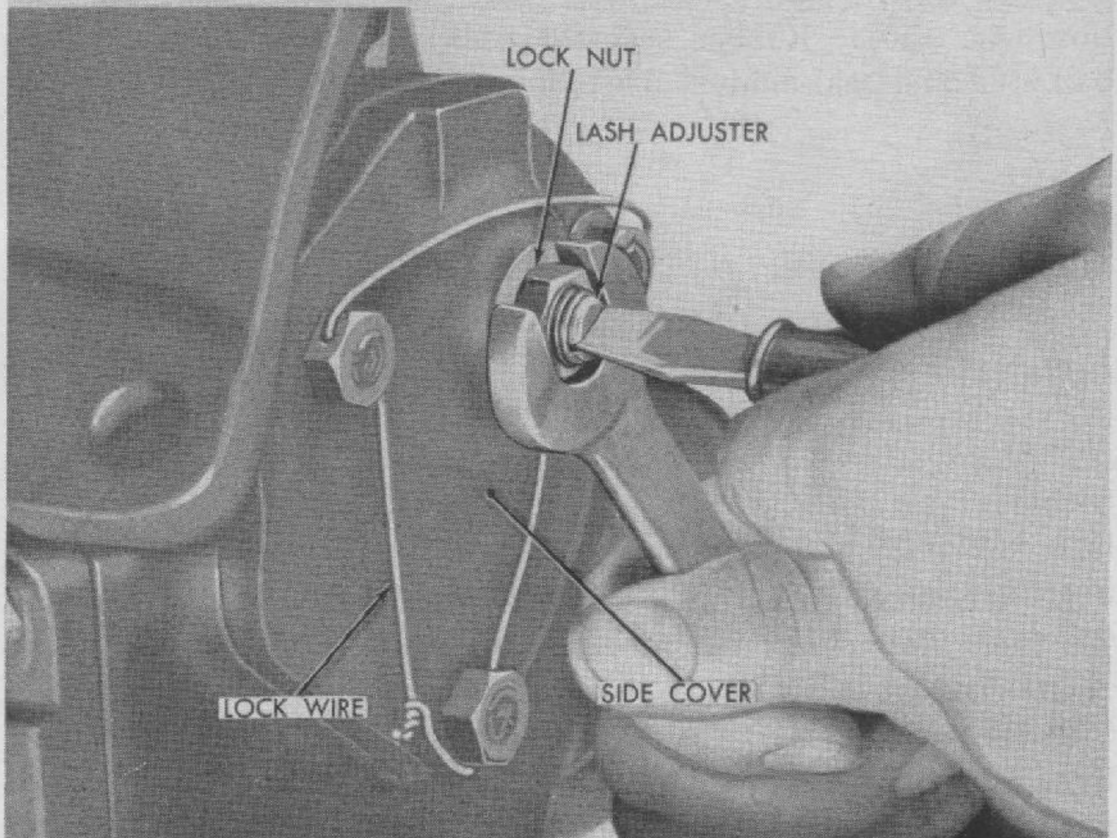
d. Pitman Arm Shaft Lash Adjustment.

(1) Remove lock wire from side cover screws (fig. 149) and check tightness of screws.

(2) Center steering mechanism by gently turning wheel from right to left extreme position, *being careful to approach end position lightly.* Count number of turns of wheel while turning to extreme left. Turn wheel back exactly half-way; then mark position on top or bottom of wheel with a piece of tape.

(3) Turn lash adjuster (fig. 149) in to remove all lash between gear teeth. Amount of backlash can be deter-

WORM BEARING ADJUSTMENT



PITMAN ARM SHAFT LASH ADJUSTMENT RA PD 148891

Figure 149. Steering gear adjustments.

mined by pushing backward and forward on lower end of pitman arm. When all backlash has been removed, tighten adjuster lock nut.

(4) Check pull of steering wheel with a spring scale. Measure pull as wheel is pulled through center position. Pull should be $2\frac{1}{2}$ to 3 pounds.

(5) If pull is not within proper limits ($2\frac{1}{2}$ to 3 lb), loosen lock nut and turn adjuster as necessary to obtain proper pull. Retighten lock nut and again check pull. Always recheck pull after tightening lock nut.

(6) Install lock wire in heads of side cover screws (fig. 148).

(7) Install drag link end to pitman arm (par. 249*c*).

(8) Tighten two bolts and nuts on cowl bracket cap (fig. 153).

249. Steering Drag Link

a. GENERAL. Tubular type steering drag link connects pitman arm and steering arm on left steering knuckle of front axle with tapered ball studs and nuts (fig. 147). Ball studs are mounted in drag link ends in bearings which require no lubrication (fig. 150). Rubber seals fit tightly around taper of each ball stud and seal against drag link ends.

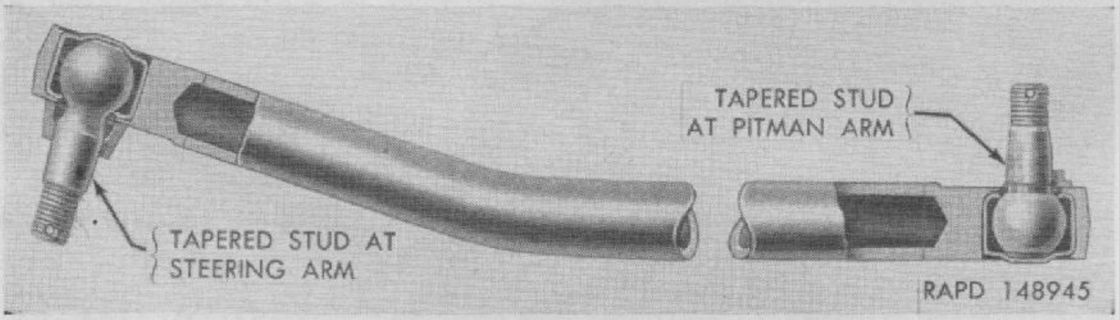


Figure 150. Steering drag link.

b. STEERING DRAG LINK REMOVAL (fig. 147). Remove cotter pin from slotted hex nut at each ball stud. Remove stud nuts; then drive out ball studs from pitman arm and steering arm.

c. STEERING DRAG LINK INSTALLATION (fig. 147). Position drag link ball studs into pitman arm and steering arm. Make sure that rubber seal at each stud is in good condition and fits snugly over stud taper and drag link end. Install slotted hex nut on each stud, and tighten to 75–100 pounds-feet torque. Install new cotter pins and bend into place.

250. Pitman Arm

a. GENERAL. Pitman arm is retained to pitman arm shaft with nut and washer. Blank serration in pitman arm registers with blank serration on shaft.

b. PITMAN ARM REMOVAL. Pitman arm can be removed more readily if drag link is disconnected at steering arm at front axle; then disconnect drag link at pitman arm after arm is removed. Remove nut and lock washer which retains arm to pitman shaft. With puller 41-P-2952, remove arm from shaft (fig. 151). Remove drag link end from arm.

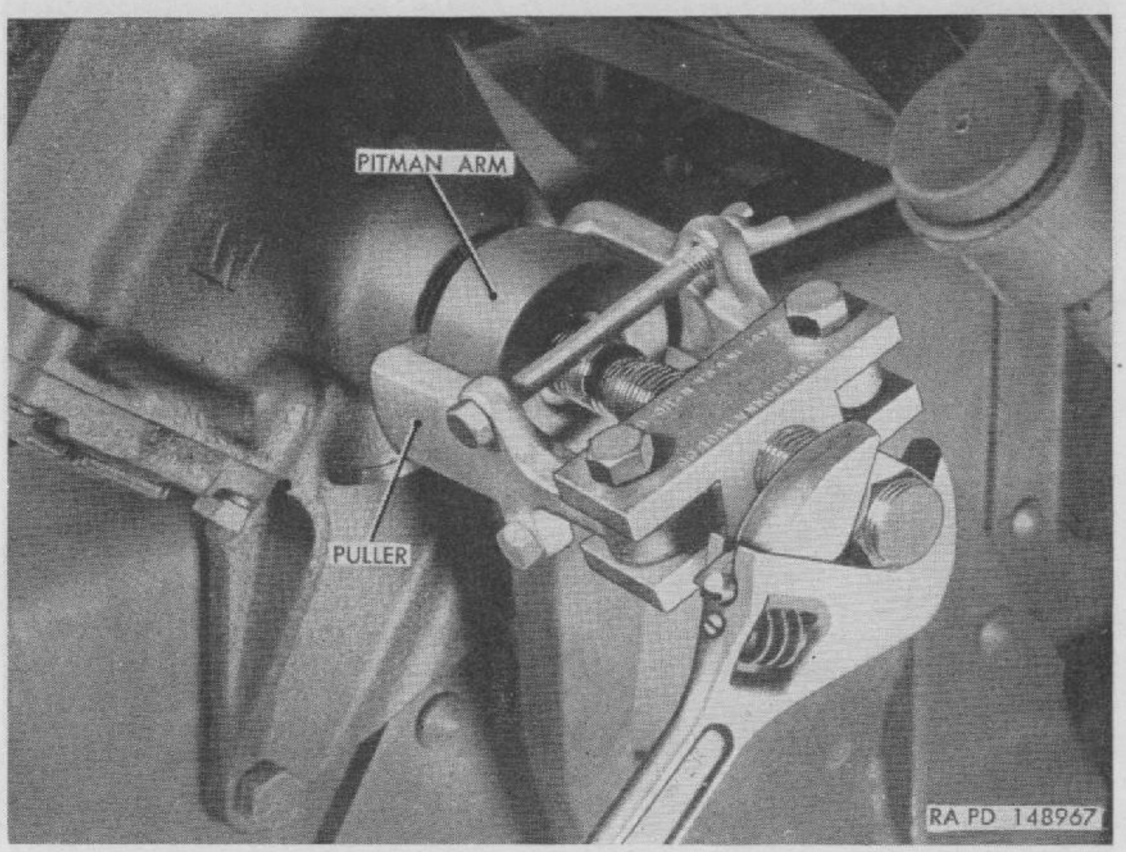


Figure 151. Removing pitman arm using puller 41-P-2952.

c. PITMAN ARM INSTALLATION. If drag link was removed with pitman arm, install link stud to pitman arm. Tighten stud nut to 75-100 pound-feet torque. Position pitman arm on pitman arm shaft, matching blank serration on shaft with blank serration in arm. Install lock washer and nut to shaft. Tighten nut to 115-155 pound-feet torque. Connect drag link to steering arm at axle. Tighten drag link stud nut to 75-100 pound-feet torque.

251. Steering Wheel

a. GENERAL. Steering wheel is retained to shaft with a nut. Horn button and contact fit in recess in center of wheel.

b. Steering Wheel Removal.

(1) Remove horn button and contact (par. 165*d*).

(2) Remove nut which retains steering wheel to shaft.

(3) Position steering puller wheel 41-P-2954 and puller adapter 7950054 at wheel. Pull wheel from shaft (fig. 152).

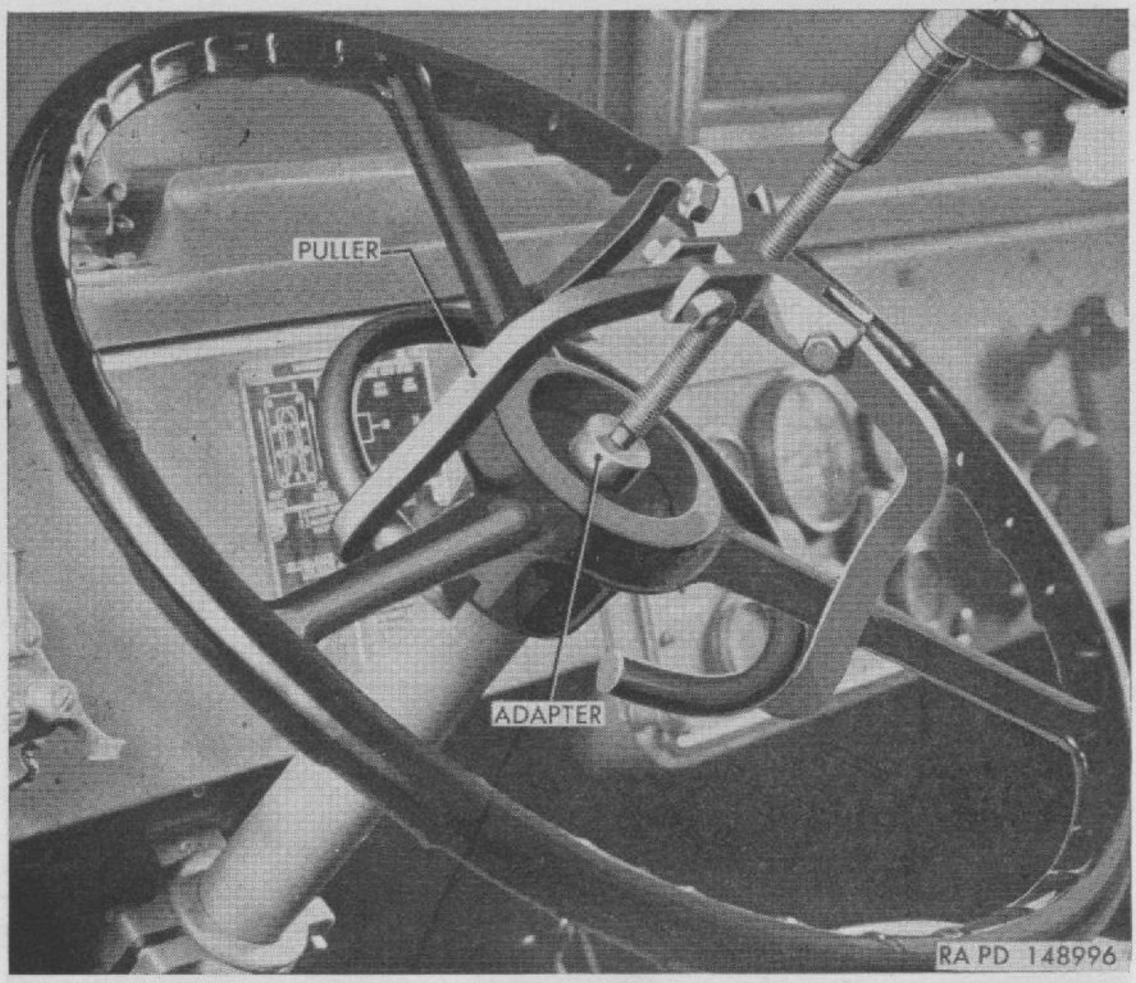


Figure 152. Removing steering wheel with puller 41-P-2954 and adapter 7950054.

c. Steering Wheel Installation.

(1) Position steering wheel over shaft. Install nut and tighten to 40-55 pound-feet torque.

(2) Install horn button and contact (par. 165*e*).

252. Steering Gear Removal

a. In cab, remove two floor plates. Remove cowl bracket cap. Remove horn cable connector from steering column.

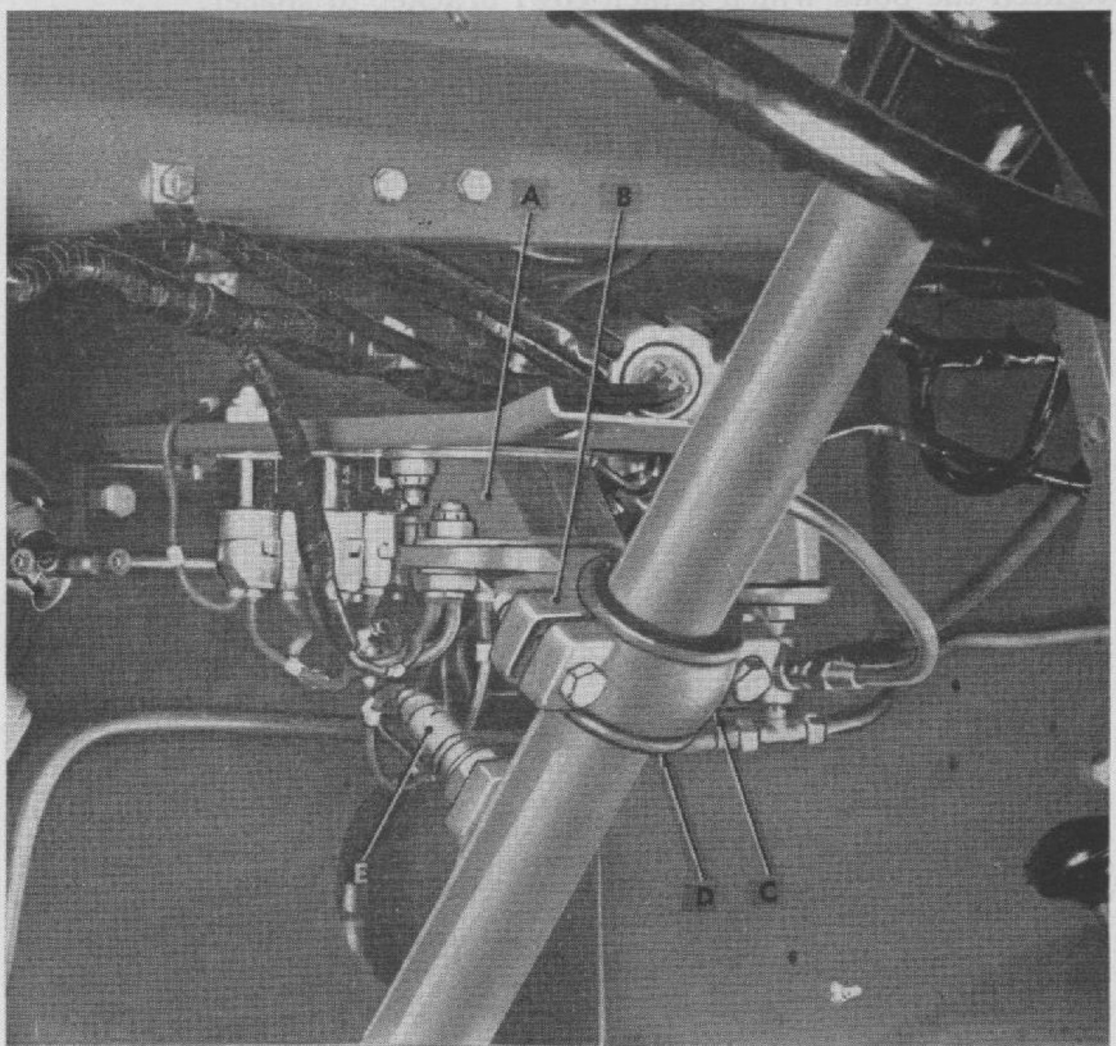
b. Steering wheel may remain on steering gear during removal; however, if only steering gear is to be replaced, remove horn button (par. 165*d*) and steering wheel (par. 251*b*) with steering gear mounted in vehicle.

c. Disconnect drag link at steering arm on front axle (par. 249*b*).

d. Remove four bolts and nuts which mount steering gear to frame side rail (fig. 148).

e. In cab, pull steering gear down until it clears cowl bracket (fig. 153). Pull steering gear straight up through floor and out through left door.

f. After steering gear is removed, remove drag link from pitman arm (par. 249*b*), and then remove pitman arm (par. 250*b*).



A—SPACER C—COWL BRACKET CAP E—HORN WIRE CONNECTOR
B—COWL BRACKET D—GROMMET
RA PD 148965

Figure 153. Steering column mounting at cowl.

253. Steering Gear Installation

a. Install pitman arm on shaft (par. 250*c*). Connect drag link ball stud to pitman arm (par. 249*c*). Tighten ball stud nut to 75–100 pound-feet torque.

b. Guide drag link and pitman arm end of steering gear through opening in cab floor inside cab.

c. Position steering gear on frame side rail and install four mounting bolts and nuts (fig. 148). Tighten nuts to 48–64 pound-feet torque.

d. Loosen the bolts which attach cowl bracket to spacer (fig. 153). Position steering column in cowl bracket, and install rubber grommet and cap. Install two bolts and nuts which retain cap to bracket. Tighten cap-to-cowl-bracket nuts to 20–27 pound-feet torque. With steering column positioned without bind, tighten the bolts which attach cowl bracket to spacer.

e. Install floor plates around steering column and attach plates to floor. Place rubber floor seal over steering column and position against floor plates. Install steering wheel (par. 251*c*) and horn button (par. 165*c*). Connect horn cable at connector on steering column.

f. Worm bearing and pitman arm shaft lash adjustments should be checked and adjusted if necessary (par. 248).

g. Connect drag link ball stud to steering arm. Tighten ball stud nut to 75–100 pound-feet torque.

h. Check lubricant level and replenish if necessary (par. 57).

Section XXVIII. FRONT SPRING SUSPENSION

254. Description

a. FRONT SPRINGS AND SHACKLES (fig. 154). Semi-elliptic-type front springs carry only vertical and lateral loads and are secured to frame brackets through shackles at both ends. Shackles are secured in frame brackets by bolts and self-locking nuts. Each spring eye is secured in shackle with a straight pin which is held in place with a clamp bolt at one side of shackle. Shackle bolts and pins are drilled to direct lubricant to spring eye and shackle bushings. Springs are mounted on axle housing and held in place with "U" bolts and spring bumper blocks.

b. TORQUE RODS. Three torque rods, two lower and one upper, transmit driving and braking forces to frame. Lower torque rod frame brackets are integral with front spring rear shackle brackets (fig. 155). Upper torque rod frame bracket is mounted on inside of right frame side rail just ahead of spring rear frame bracket. Axle end of torque rods are equipped with tapered ball studs mounted in material requiring no lubrication. Frame ends of torque rods are also equipped with replaceable bearings made of the same material. Rods are secured to frame brackets with bolts and self-locking nuts.

c. SHOCK ABSORBERS. Double-acting shock absorber on each side, is mounted to frame side rail (fig. 154). Shock absorber arms are connected to axle with links which attach to spring bumper blocks. Tapered studs, mounted in rubber, attach link ends to shock aborber arms and spring bumper blocks.

255. Front Springs and Shackles

a. FRONT SPRING AND SHACKLE REMOVAL (fig. 154).

(1) Place jack under frame and raise enough to remove all tension from springs.

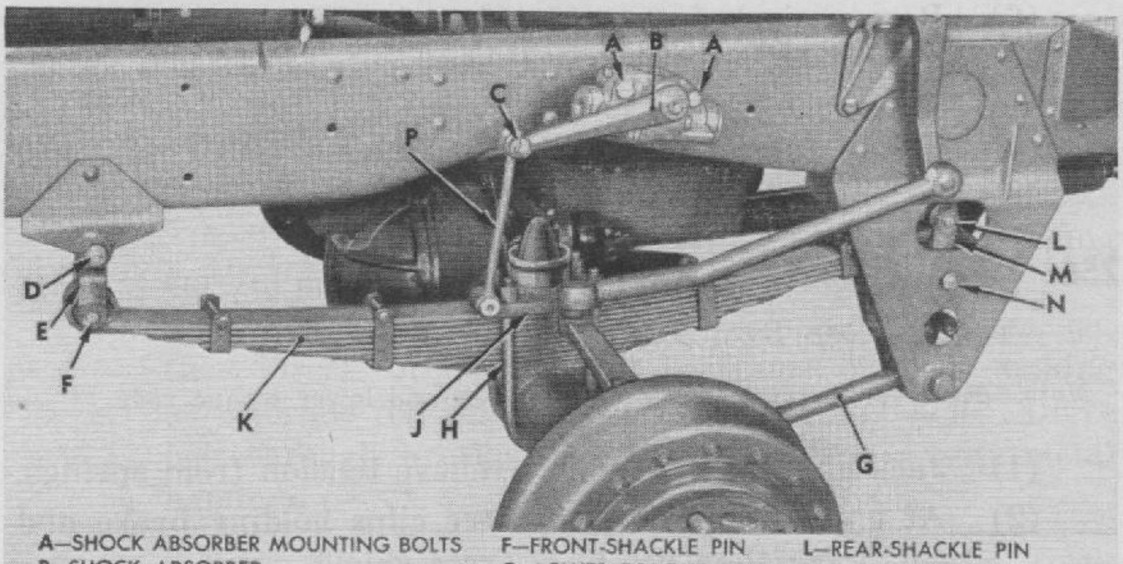
(2) Front shackle can be removed from spring and frame bracket without removing spring by jacking up frame to relieve spring tension, and then removing shackle bolt and spring pin. Spring should be removed as explained below before attempting to remove rear shackle.

(3) Disconnect shock absorber link from eye at spring bumper block.

(4) Remove nuts from spring "U" bolts; then remove spring bumper block and "U" bolts.

(5) At each end of spring, remove clamp bolt nut and bolt which secures shackle pin at inner side of shackle. Remove lubrication fitting from outer end of each pin.

(6) From inside, drive pin out of shackle and spring eye at each end. Spring can then be removed from axle housing.



A—SHOCK ABSORBER MOUNTING BOLTS
B—SHOCK ABSORBER
C—SHOCK ABSORBER-ARM-TO-LINK BOLT
D—FRONT-SHACKLE BOLT
E—FRONT SHACKLE
F—FRONT-SHACKLE PIN
G—LOWER TORQUE ROD
H—"U" BOLT
J—SPRING BUMPER BLOCK
K—FRONT SPRING
L—REAR-SHACKLE PIN
M—REAR SHACKLE
N—REAR-SHACKLE BOLT
P—SHOCK ABSORBER LINK

RA PD 148980

Figure 154. Left front spring installed.

(7) If necessary to remove shackles, remove shackle bolt nuts at each shackle; then drive shackle bolts out of frame brackets and shackles.

b. Front Spring and Shackle Installation (fig. 154).

(1) If shackles have been removed at each shackle, install shackle bolt through frame bracket and shackle. Shank of bolt at outer end is serrated. Drive shackle bolt in from outer end, seating bolt firmly in frame bracket. Install nut on bolt at each shackle and tighten until shackles bind; then loosen nuts until shackle swings free.

(2) Position spring on spring seat on axle housing with center bolt head engaging locating hole in seat, and with spring eyes in place in shackles.

(3) At each end of spring, aline holes in shackle with spring eye. Insert shackle pin with flat milled portion of pin registering with clamp bolt hole in shackle. Install clamp bolt through shackle; install nut on bolt; then tighten nut to 9½-13 pound-feet torque.

(4) Install "U" bolts and spring bumper block, with shock absorber link eye in bumper block toward the front. Install nuts on "U" bolts and tighten firmly. Final tightening should be made with weight of vehicle on spring.

(5) Insert shock absorber link stud through eye in spring bumper block. Install and tighten stud nut to 48-64 pound-feet torque.

(6) Remove jack from under frame. With weight of vehicle on springs, tighten "U" bolt nuts to 170-200 pound-feet torque.

(7) Install lubrication fittings in shackle bolts and pins, and lubricate shackles (par. 57).

256. Torque Rods

a. Torque Rod Removal (fig. 155).

Note. Removal instructions apply to upper and lower torque rods.

(1) Jack up frame enough to relieve tension from springs.

(2) At upper torque rod, remove clips holding brake and vent lines; then lift lines from shield.

(3) At frame bracket end of torque rod to be removed, remove nut from bolt. Drive bolt out of lower bracket and torque rod bearing, using a soft metal hammer and

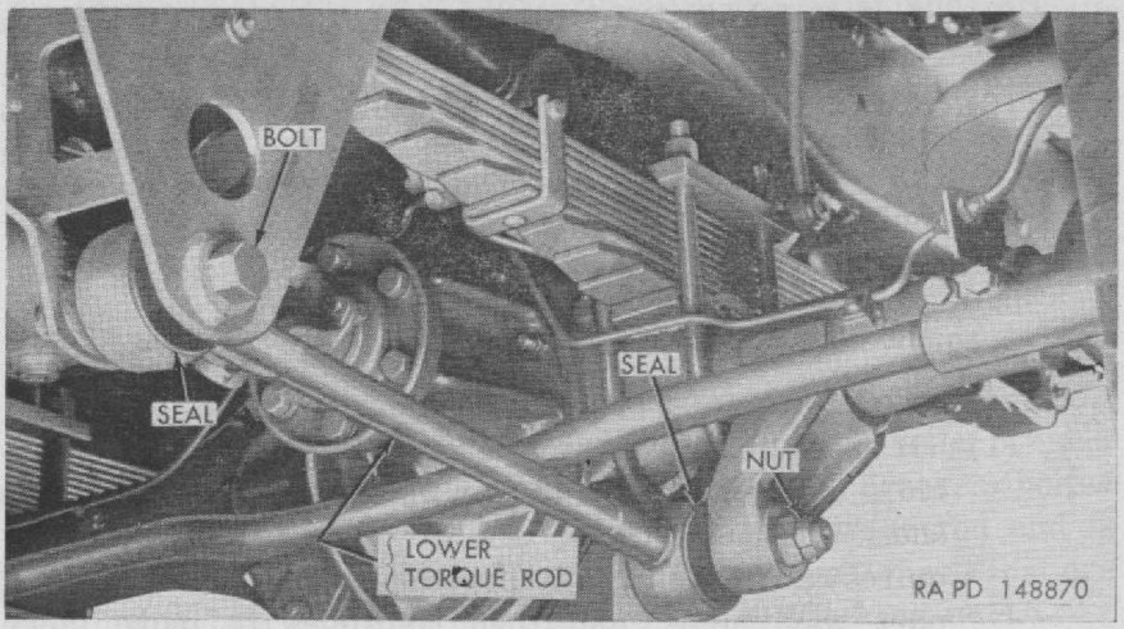


Figure 155. Right front spring lower torque rod installed.

drift. Head of upper bolt is drilled and tapped for use of slide hammer to facilitate bolt removal.

(4) At axle end of torque rod to be removed, remove nut and flat washer from torque rod tapered end pin. With soft metal hammer, drive pin out of axle bracket.

Note. Rubber dust seals are used on both ends of torque rod bearings at frame brackets, and also between rod end and brackets at axle ends.

b. TORQUE ROD INSTALLATION (fig. 155).

Note. Following procedures apply to each upper and lower torque rod.

(1) Place dust seal on both ends of bearing at frame bracket end. Position dust seal over end pin at axle end of rod.

(2) Position torque rod tapered pin in axle bracket, being careful not to dislodge dust seal from bearing.

(3) Position torque rod end with seals in frame bracket, then insert torque rod bolt in frame bracket, making sure torque rod bearing is alined with bolt hole. Drive bolt through bracket and bearing, using a soft metal hammer.

Note. Flat washer must be installed under bolt head at frame bracket on upper torque rod only.

(4) Install washer and nut on frame bracket bolt and tighten nut to 350–400 pounds-feet torque.

(5) Install flat washer and nut on torque rod tapered pin at axle end, and tighten to 350–400 pound-feet torque.

(6) On upper torque rod only, position brake and vent lines in shield on top of torque rod. Secure lines in shield with two clips.

Note. Torque rod ends require no lubrication.

257. Shock Absorbers

a. CHECKING ACTION.

(1) If shock absorber action is not satisfactory (over flexible), disconnect link at spring bumper block. Move shock absorber arm up and down. Normal action requires resistance in both directions. If arm drops easily part way, stops, and then continues to move down slowly, refill with fluid (par. 59*p*).

(2) If leaks are evident around end caps or filler plug, replace gaskets. If unit has been operated with low fluid level, leaks may appear around shaft. Shock absorber should then be replaced.

b. SHOCK ABSORBER REMOVAL (fig. 154).

(1) Remove nut on link pin at shock absorber arm and drive out pin from arm. If link also must be replaced, remove at spring bumper block.

(2) Remove two mounting bolts and nuts securing shock absorber to frame.

c. SHOCK ABSORBER INSTALLATION (fig. 154).

(1) Position shock absorber at frame; then insert two attaching bolts through shock absorber and frame side rail.

(2) Place a reinforcing spacer between inner side of frame side rail and each bolt nut. Install bolt nuts and tighten to 63–84 pound-feet torque.

(3) Connect link to shock absorber arm. Tighten link pin nut to 48–64 pound-feet torque.

(4) Fill absorber with fluid if necessary (par. 59*p*).

(5) Connect link to spring bumper block. Tighten link pin nut to 48–64 pound-feet torque.

Section XXIX. REAR SPRING SUSPENSION

258. Description

a. REAR SPRING. Rear spring suspension consists of an articulated main spring assembly and a fixed secondary spring assembly on each side (fig. 156). Both spring assemblies are inverted semi-elliptic type with slipper-type ends. The main spring is mounted with "U" bolts on a spring seat which in turn is mounted on a trunnion shaft with tapered roller bearings (fig. 157). The secondary spring assembly is mounted rigidly to frame side rail on bracket and seat with "U" bolts. Slipper ends of main spring are inserted in axle housing brackets, while secondary spring ends contact top of brackets under heavy loaded conditions.

b. Torque Rods. Lower torque rods, two at each axle, connect to brackets welded to axle housings and to spring seat trunnion brackets. Upper torque rods, one at each axle, connect to brackets welded to top of axle housing, and to brackets bolted to frame crossmember. Tapered pin at each torque rod end is mounted in bearing which requires no lubrication. Pins are retained in brackets with flat washers and self-locking nuts.

259. Secondary Spring

a. Secondary Spring Removal (fig. 156).

(1) Jack-up frame enough to relieve tension on springs. Jack-up both rear axles to remove both wheels (par. 293*a*).

(2) Remove nuts and spacers from "U" bolts which attach spring to seat and frame bracket. Remove "U" bolts.

(3) While supporting spring, remove four bolts and nuts which attach secondary spring seat to frame bracket. Remove spring.

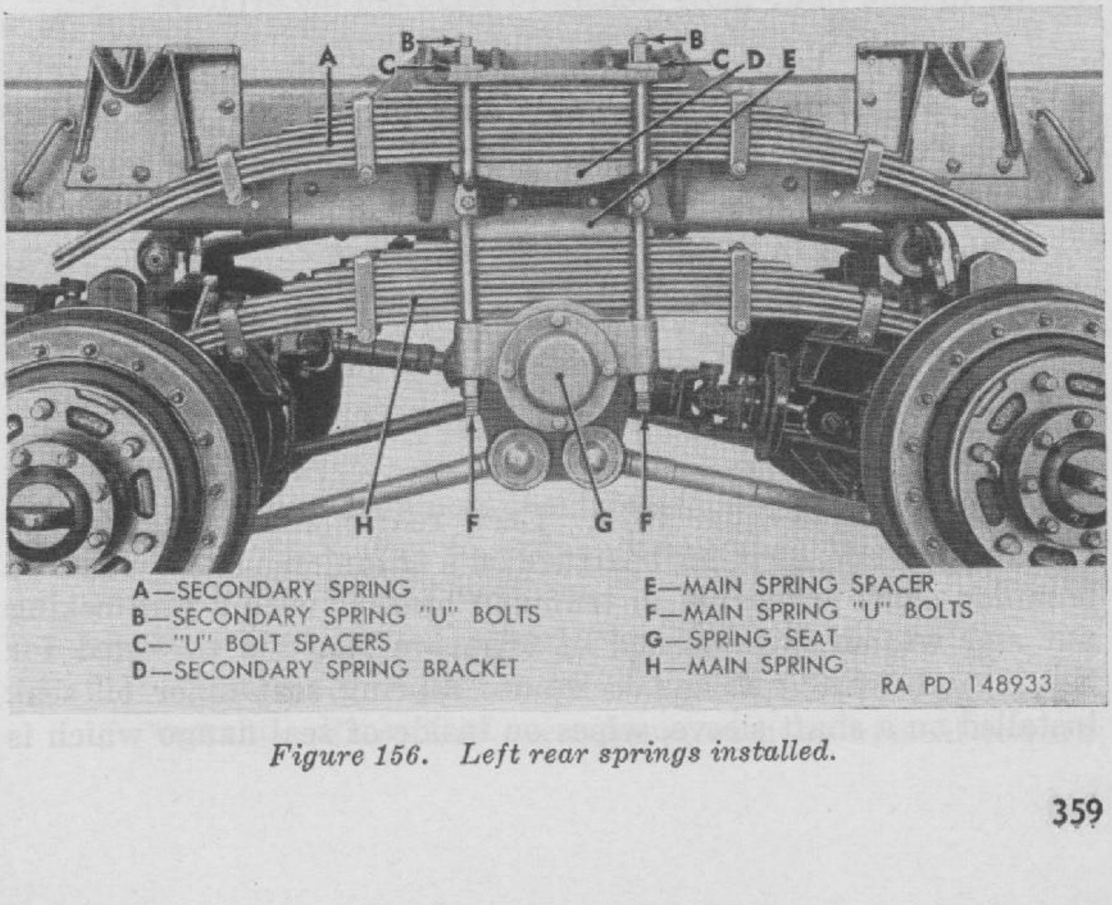


Figure 156. Left rear springs installed.

b. SECONDARY SPRING INSTALLATION (fig. 156).

(1) Position spring seat under spring, engaging spring center bolt in locating hole in seat.

(2) Position spring and seat at frame bracket. Hold spring in position by blocks placed between spring ends and axle brackets.

(3) Install "U" bolts, spacers, and nuts. Push spring against locating ribs and parallel to frame. Tighten nuts to 375–400 pound-feet torque. Install four bolts and nuts which attach spring seat to frame and bracket. Tighten nuts to 33–43 pound-feet torque. Install wheels (par. 239*b*). Remove jack from under frame and axles. Recheck tightness of "U" bolt nuts.

260. Main Spring

a. MAIN SPRING REMOVAL (fig. 156).

(1) Jack up frame to relieve tension from springs. Jack up both rear axles to remove wheels on side to be serviced.

(2) Remove "U" bolt nuts. Remove "U" bolts and spacer.

(3) Move spring forward or rearward into guide bracket until one end disengages bracket. Move free end toward brake drum and slide opposite end out of guide.

b. MAIN SPRING INSTALLATION. (fig. 156).

(1) Insert one end of spring as far as possible through guide bracket on either axle. Move opposite end of spring toward guide bracket; then slide spring to engage bracket.

(2) With both ends of spring inserted into guide brackets, position spring assembly on spring seat with spring center bolt engaging locating hole in seat.

(3) Position spacer on spring, then install "U" bolts and nuts. Tighten nuts to 375–400 pound-feet torque.

(4) Install wheels (par 239*b*).

(5) Lower frame and axles and recheck tightness of "U" bolt nuts (375–400 pound-feet torque).

261. Spring Seats

a. DESCRIPTION (fig. 157). Each rear main spring seat is mounted on tapered roller bearings on a trunnion shaft. Tapered trunnion shaft is secured in trunnion bracket with a self-locking nut and washer. Outer end of trunnion shaft is threaded for bearing adjusting nut and lock nut. Spring seat inner oil seal, installed on a shaft sleeve, wipes on inside of seal flange which is pressed into inner side of spring seat. In addition to retaining grease in seat, seal also excludes water and dirt. Outer end of each spring seat is sealed with a gasket and dust cap.

b. SPRING SEAT REMOVAL (figs. 156 and 157).

(1) Remove secondary spring (par 259*a*) and main spring (par. 260*a*).

(2) Remove four bolts and lock washers which attach seat dust cap to seat.

(3) Bend tangs of nut lock away from lock nut. Remove lock nut, nut lock, adjusting nut, and washer from shaft.

(4) Slide seat assembly off shaft. Inner and outer bearing cones and seal flange will be removed with seat. Remove outer cone from seat housing. With suitable puller, remove inner cone and sleeve flange. Oil seal and sleeve will remain on shaft.

(5) Pull seal from sleeve if necessary to replace (*c* (4) below).

(6) Remove bearing cups if necessary (*c* (3) below), with suitable puller or soft drift.

c. SPRING SEAT CLEANING AND INSPECTION.

(1) Immerse bearing cone and roller in dry-cleaning solvent or volatile-mineral-spirits paint thinner (refer to paragraph 66*b* for general precautions). Clean bearings with a stiff brush to remove old lubricant. Dry bearings thoroughly.

(2) Clean all old lubricant out of spring seat and wipe dry. Remove old particles of gasket from outer side of spring seat. Wipe oil seal clean with a cloth dampened in dry-cleaning solvent or volatile-mineral-spirits paint thinner. Wash all mounting parts in cleaning fluid.

(3) Inspect bearing rollers for wear or chipped edges. Examine bearing cups for pits and cracks. Polished lines will appear in cups indicating resting position of rollers. These lines are not harmful. Bearing cups should not be replaced unless cracked or pitted.

(4) Examine oil seal. If lip is worn or deteriorated, replace seal. If inner diameter of seal flange is grooved, replace part.

(5) Examine trunnion shaft for damaged threads or distortion. Report to ordnance maintenance personnel if parts requires replacement.

d. SPRING SEAT INSTALLATION (figs. 156 and 157).

(1) Coat inner diameter of seal with plastic-type gasket cement. Press seal over sleeve with lip of seal toward

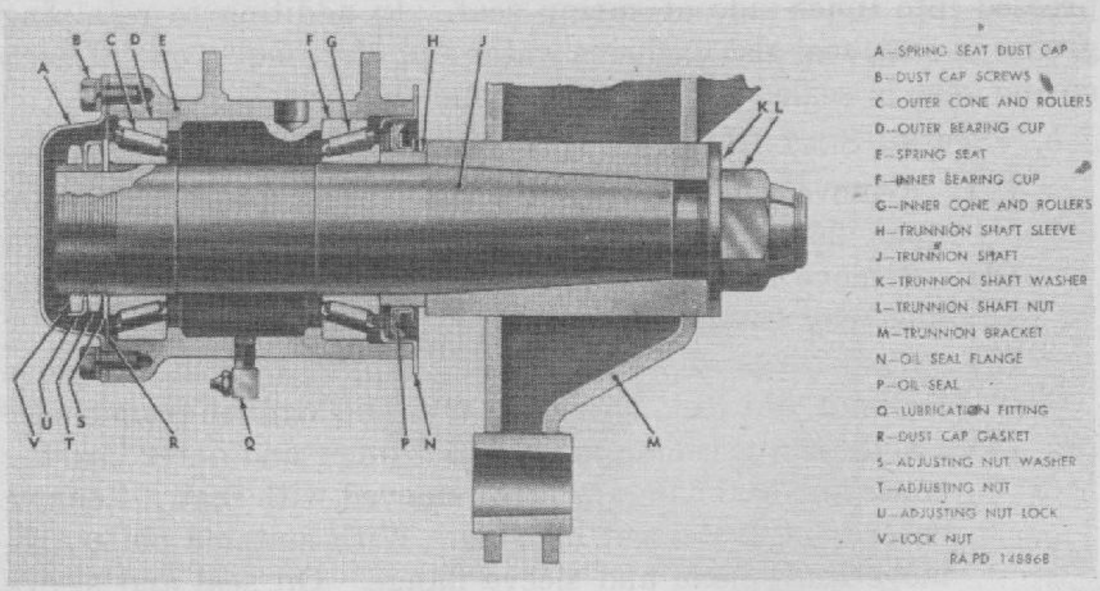


Figure 157. Sectional view of rear spring seat.

trunnion bracket. Press on sleeve until inner edge of seal is ¼ inch from inner edge of sleeve (fig. 157).

(2) Install bearing cups (if removed) in seat, making certain that cups seat firmly against shoulders in seat.

(3) Lubricate bearing rollers thoroughly with lubricant (par. 59*v*). Install inner bearing in spring seat.

(4) Press oil seal flange into spring seat.

(5) Position outer bearing into spring seat. Slide spring seat and bearings over trunnion shaft, with oil seal flange over oil seal lip.

(6) Install adjusting nut washer over trunnion shaft threads. Install adjusting nut and tighten to 90–110 pound-feet torque while oscillating spring seat to make sure bearings are properly seated.

Note. Do not back off.

(7) Install nut lock and lock nut. Tighten lock nut to 90–110 pounds-feet torque; then bend tangs of nut lock over flats on adjusting nut and lock nut.

Note. Inner edge of trunnion shaft sleeve must be tight against trunnion bracket when seat is installed and adjusted.

(8) Install spring seat cap, using new gasket. Tighten cap bolts firmly.

(9) Fill spring seat with lubricant through lubrication fitting, until lubricant appears at seal on inner side (par. 59*v*).

(10) Replace main spring (par. 260*b*).

262. Torque Rods

a. TORQUE ROD REMOVAL (fig. 158).

Note. Procedures following apply to each rear axle torque rod.

(1) Remove clips retaining brake and vent lines in shield on upper torque rod. Lift lines out of shield.

(2) Jack up frame enough to relieve all strain from springs.

(3) Remove nut and flat washer from pin at both ends of torque rod being removed. Drive pins from brackets with soft metal hammer. Note that rubber dust shields are installed over pins between rod ends and brackets.

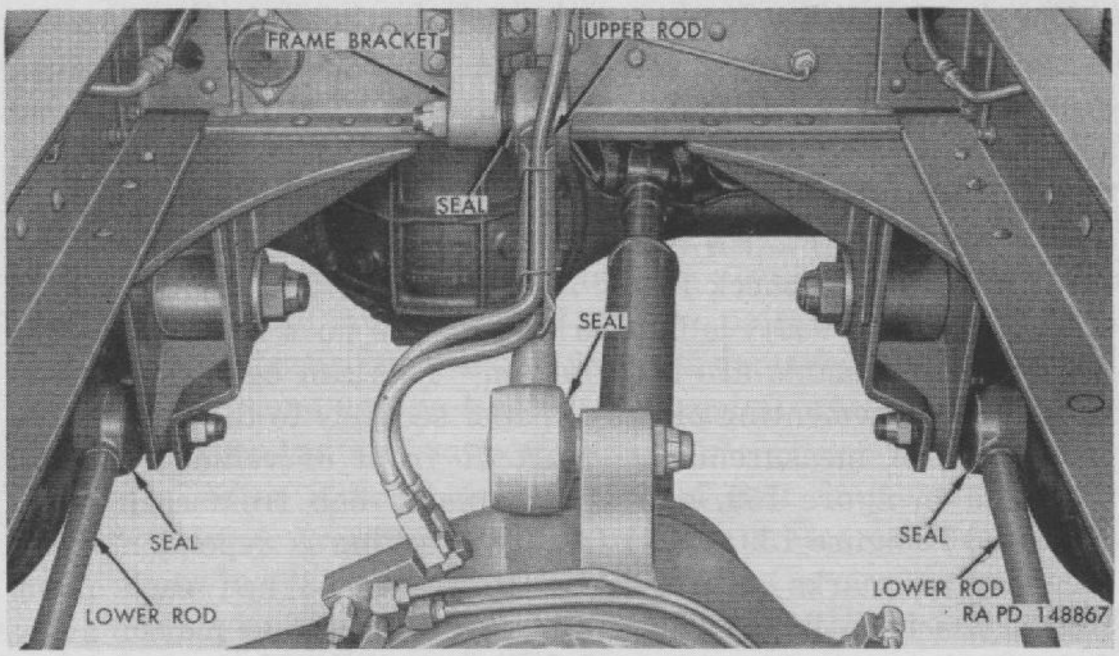


Figure 158. Rear torque rods installed (rear rear axle shown).

b. TORQUE ROD INSTALLATION (fig. 158).

Note. Procedures following apply to each rear axle torque rod.

(1) Place dust seals over torque rods at both ends of rod being installed.

(2) Insert pins through frame bracket and axle bracket. Install flat washers and nuts on pins. Tighten nuts to 300–350 pound-feet torque.

(3) Position brake and vent lines into shield on upper torque rod only. Secure lines in shield with clips.

Note. Torque rod ends do not require lubrication.

Section XXX. FRAME

263. Description

The frame assembly consists of frame side rails, crossmembers, gussets, and various brackets. Side rails, crossmembers, gussets, and many other parts are pressed steel formed to meet their particular requirement. Parts which normally do not require removal are held in place by cold riveting; however, other parts which may require more frequent removal are held by bolts and self-locking nuts. In some instances several pressed metal pieces are welded together to form a part.

264. Frame Alinement

a. GENERAL. Since the frame forms the foundation of the entire vehicle, proper functioning of the vehicle and its components is greatly dependent upon correct frame alinement. If vehicle has been in a collision, or if there is any reason to believe that frame is sprung, twisted, or otherwise misalined, report condition immediately to proper authority.

b. CHECKING FRAME ALIGNMENT (fig. 159). The most convenient method to check frame alinement, particularly on vehicle equipped with a body, is by marking on the floor all points from which measurements are to be taken. This can be accomplished by tacking or cementing pieces of paper securely to the floor under each point of measurement. Start at front of vehicle, at "M" indicated in figure 159, and drop a plumb bob from each point indicated in figure 159. Satisfactory checking is dependent upon accuracy of marks with relation to frame. When each point shown has been marked carefully and the vehicle moved away from the layout on the floor, proceed as directed in the following paragraphs.

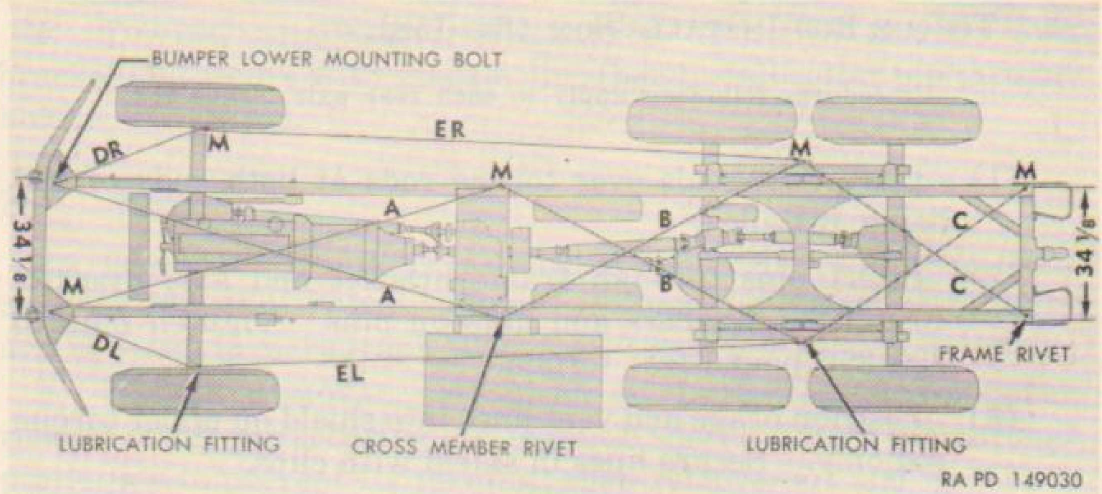


Figure 159. Method of checking frame alinement.

attaching gusset and bumper to frame side rails. Pull bumper and gusset forward to remove complete bumper. If necessary to remove gussets, remove three bolts and nuts attaching each gusset to bumper.

(2) *Front bumper installation.* If removed, attach gussets to bumper using three bolts and nuts. Locate bumper in place on front of frame side rails with attaching bolt holes in alinement. Install eight bolts and nuts and tighten all nuts to 95–127 pound-feet torque.

Note. On vehicles equipped with winch, front bumper is installed with cable opening at top; however, on vehicles not equipped with winch, cable opening in bumper is down.

b. REAR BUMPERS. Two rear bumperettes are formed from pressed steel and are attached to each rear corner of frame (fig. 160).

(1) *Rear bumper removal.* Remove six bolts and nuts attaching each bumper to frame side rail and rear crossmember; then remove bumper.

(2) *Rear bumper installation.* Position rear bumper against frame side rail and rear crossmember with bolt holes in alinement. Install six bolts and nuts. Tighten nuts to 48–64 pound-feet torque.

266. Towing Shackles

a. GENERAL. Four towing shackles are used, one at each corner of vehicle. Front shackles are attached to bracket welded to front bumper gusset; rear shackles are attached to brackets riveted to frame rear crossmember and protected by rear bumperettes.

b. TOWING SHACKLE REMOVAL. Remove cotter pin holding shackle pin to bracket; then remove shackle pin and shackle.

c. TOWING SHACKLE INSTALLATION. Position shackle over bracket and secure with shackle pin; then install cotter pin through hole in shackle pin.

267. Pintle

a. GENERAL. Pintle is installed at center of frame rear crossmember (fig. 160). Instructions necessary for operation of pintle are covered in paragraph 43*c*.

b. PINTLE REMOVAL. At inside of frame rear crossmember, remove cotter pin securing nut to pintle shaft. Insert bar through pintle jaw to prevent its turning; then remove nut and washer at end of pintle shaft. Pull pintle toward rear to complete removal.

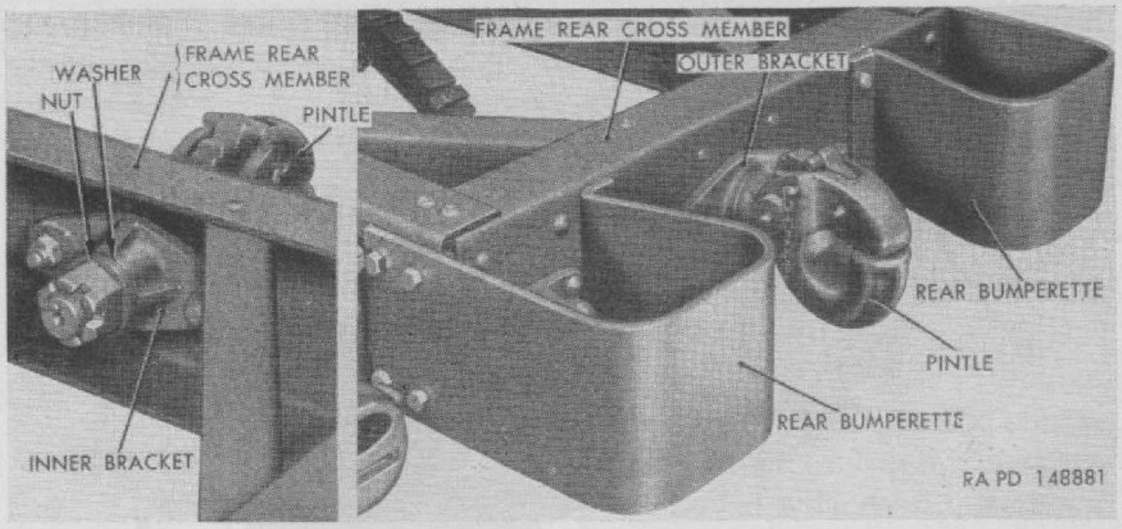


Figure 160. Pintle and rear bumperette installation.

c. PINTLE INSTALLATION. Lubricate pintle shaft and insert shaft through crossmember and brackets. Install washer and nut on shaft. Use bar through pintle jaw to prevent turning as nut is tightened. Tighten until pintle binds; then back off nut until cotter pin can be installed and pintle can be turned by hand.

Section XXXI. CAB AND ASSOCIATED PARTS

268. General

a. Cab consists of an open-top structure enclosing driver's compartment. Of all-steel construction, cab consists of several subassemblies bolted together into a unit assembly. Basic subassemblies include cowl and dash unit, sides, rear panel, and floor pan. Design of cab facilitates replacement of damaged subassemblies, using only standard tools.

b. Weather protection is provided by windshield, top deck, rear curtain, and doors. Cab is equipped with an inside and two outside rear view mirrors, two windshield wipers, and includes provision for rifle holders and gun mount ring.

c. Design of cab requires that cab be regularly inspected for loose bolts and nuts. All bolts and nuts must be kept properly tightened.

269. Cab Mountings

a. DESCRIPTION. Three-point-type mounting (fig. 161) is used to attach cab to chassis frame. Both front corners of cab are flexibly mounted, by means of cushions, to frame mounting bracket. Rear mounting consists of a single through-bolt and cushions, at

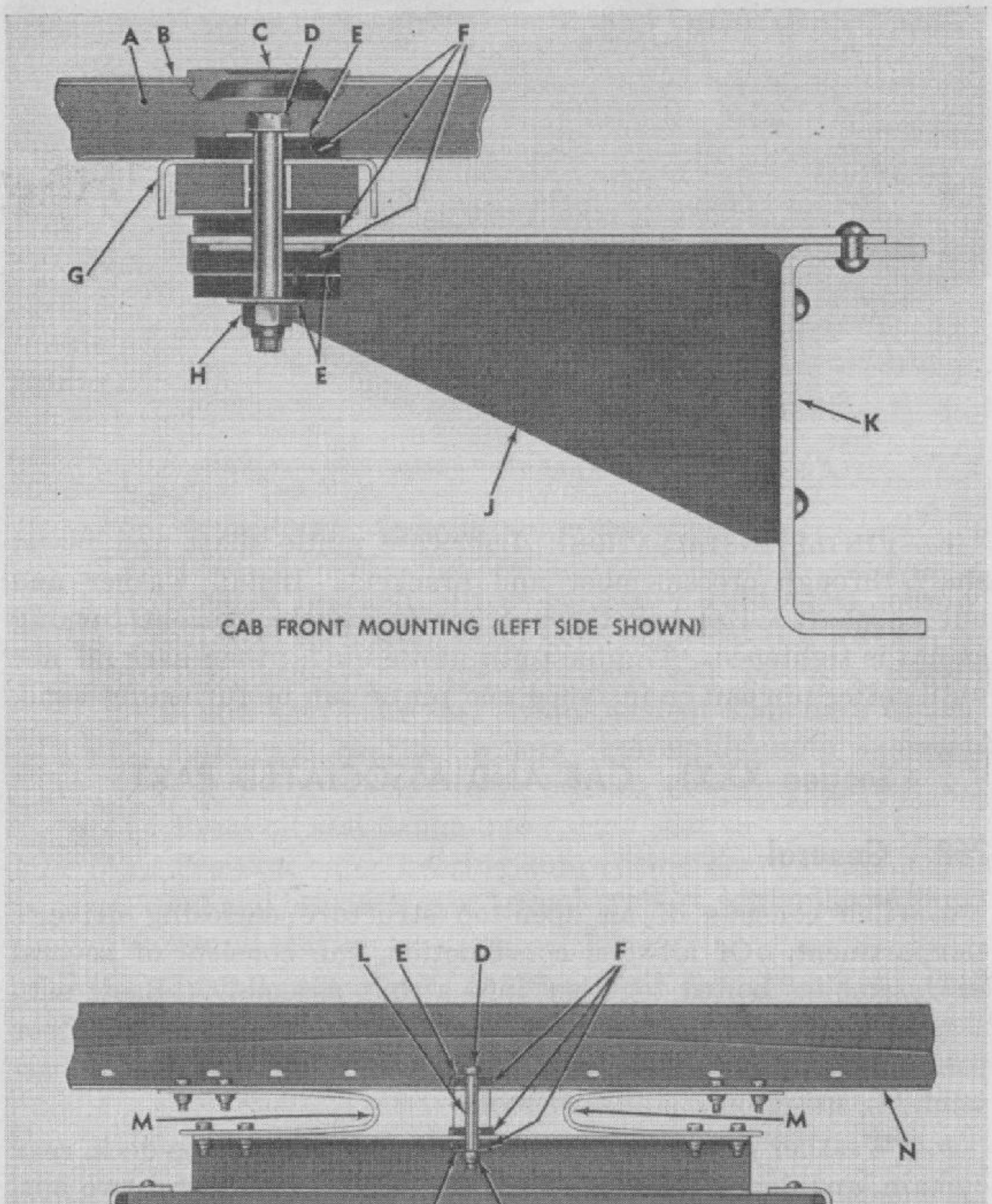


Figure 161. Cab mounting.

rear center of cab, attaching cab to frame crossmember. A heavy, U-shaped spring is mounted between cab and frame crossmember at each side of rear center mounting bolt to prevent excessive rocking movement of cab.

b. MOUNTING ADJUSTMENT. Should mounting bolts be permitted to loosen sufficiently to allow cab to shift, steering gear may bind. If this condition exists, tightening procedure must be followed in sequence to insure correct mounting.

(1) Loosen four bolts which attach rubber spacer to dash brace and stering column bracket.

(2) Firmly tighten bolts which attach steering gear to frame.

(3) Shift cab to proper position on frame; then tighten three mounting bolt nuts to 25–30 pound-feet torque.

Note. Heads of front mounting bolts are accessible after removable of rubber plug in floor at each front corner.

(4) Shift steering gear to cab mountings so that no binding of steering gear exists. Tighten four bolts attaching rubber spacer to dash brace and steering column clamp.

c. MOUNTING REMOVAL. Removal operations cover only removal of the three cab mounting bolts, cushions, and spacers.

(1) *Remove either front mounting bolt.* Pry up clearance hole plug from cab floor. Remove nut, steel washer, and lower cushion from mounting bolt. Withdraw mounting bolt, with steel washer and upper cushion. Raise corner of cab to relieve pressure on mounting cushion and withdraw cushion from between cab side sill and cab front support bracket.

(2) *Remove cab rear center mounting bolt.* From underneath vehicle, remove nut, steel washer, and lower cushion from mounting bolt. Remove two nuts, washers, and bolts which attach one mounting spring to frame crossmember. From inside cab, remove rear center mounting bolt, steel washer, and upper cushion. Raise rear corner of cab at which spring is disconnected, and withdraw mounting cushion and steel spacer.

d. MOUNTING INSTALLATION.

(1) *Install cab rear center mounting bolt.* Raise rear corner of cab at which spring is disconnected and position cushion and steel spacer, with holes alined. Install steel washer and mounting cushion on mounting bolt; then insert bolt through cab floor, steel spacer, mounting cushion, and frame crossmember. Lower rear corner of

cab; then install two bolts, washers, and nuts attaching mounting spring to frame crossmember. Install cushion, steel washer, and nut on mounting bolt. Tighten nut to 25–30 pound-feet torque.

(2) *Install either front mounting bolt.* Raise front corner of cab and insert mounting cushion between cab sill and cab front support bracket. Install steel washer and cushion on mounting bolt; then, from inside cab, insert bolt through cab, mounting cushion, and support bracket. Lower cab; then install lower cushion, steel washer, and nut on mounting bolt. Tighten nut firmly against shoulder on bolt.

270. Top Deck and Rear Curtain

a. TOP DECK. Canvas top deck is one-piece type, supported by windshield, roof panels, and rear bow. Deck is secured to windshield by a bead which slides into retaining channel on windshield. Top deck is further secured by lashing rope to windshield, roof panels, cab rear panel, and top bow ring bolt nuts.

Note. Do not roll or stow top deck and rear curtain when canvas is wet.

(1) *Removal.* Untie top deck lashing rope from top bow ring nut at each side of cab. Pull ropes from loops in sides of rear curtain; then disengage ropes from hooks on roof panels. Unhook rope from lashing hooks on back of cab rear panel. Lift top deck over top bow and windshield onto engine hood. From either side, pull bead of canvas top deck from channel at upper-front side of windshield frame (fig. 162).

(2) *Installation.* Slide bead of top deck into channel on upper-frontward side of windshield frame. Draw deck over windshield and top bow into position. Engage rope in lashing hooks on back of cab rear panel. Pull rear lashing rope taut; then tie rope ends to ring nuts. Engage each side rope in hooks in roof panels, thread ropes through loops in ends of rear curtain, and engage ropes in hooks on side panels. Pull each rope taut; then tie to ring nuts.

b. REAR CURTAIN. Rear curtain is one-piece type, attached to top bow by means of screws and washers. Each leg of top bow fits into socket at inside rear corner of cab. Bow is held in position by top bow ring nut at each side. Lashing rope, threaded through loops on lower inside of curtain, is engaged in hooks on cab rear panel back of seats. Ends of lashing ropes are tied to

Figure 162. Removing top deck from windshield channel.

bow ring nut on each side. Front edges of rear curtain are secured to side panels with top deck lashing rope, threaded through loops and engaging hooks on side panel.

(1) *Removal.* With top deck removed or rolled forward, untie rear curtain lashing rope from each bow ring nut. Disengage lashing rope from hooks at inside of cab rear panel. Loosen both top bow ring nuts; then pull top bow, with rear curtain, straight upward out of sockets.

(2) *Installation.* Insert legs of bow through sockets. Holding bow fully upward, tighten ring nut on each side of cab. Engage rear curtain lashing rope in hooks on inside of cab rear panel. Pull rope taut and tie each end to bow ring nut.

c. Positioning deck and curtain. To meet demands of a wide variety of operating conditions, top deck and rear curtain, in connection with windshield and door windows, may be positioned in several ways. Varying degrees of visibility and protection may thus be obtained.

(1) *Top deck rolled.* Untie top deck side ropes and rear rope from top bow ring nuts. Disengage ropes from hooks on roof panels and inside of cab rear panel. Roll

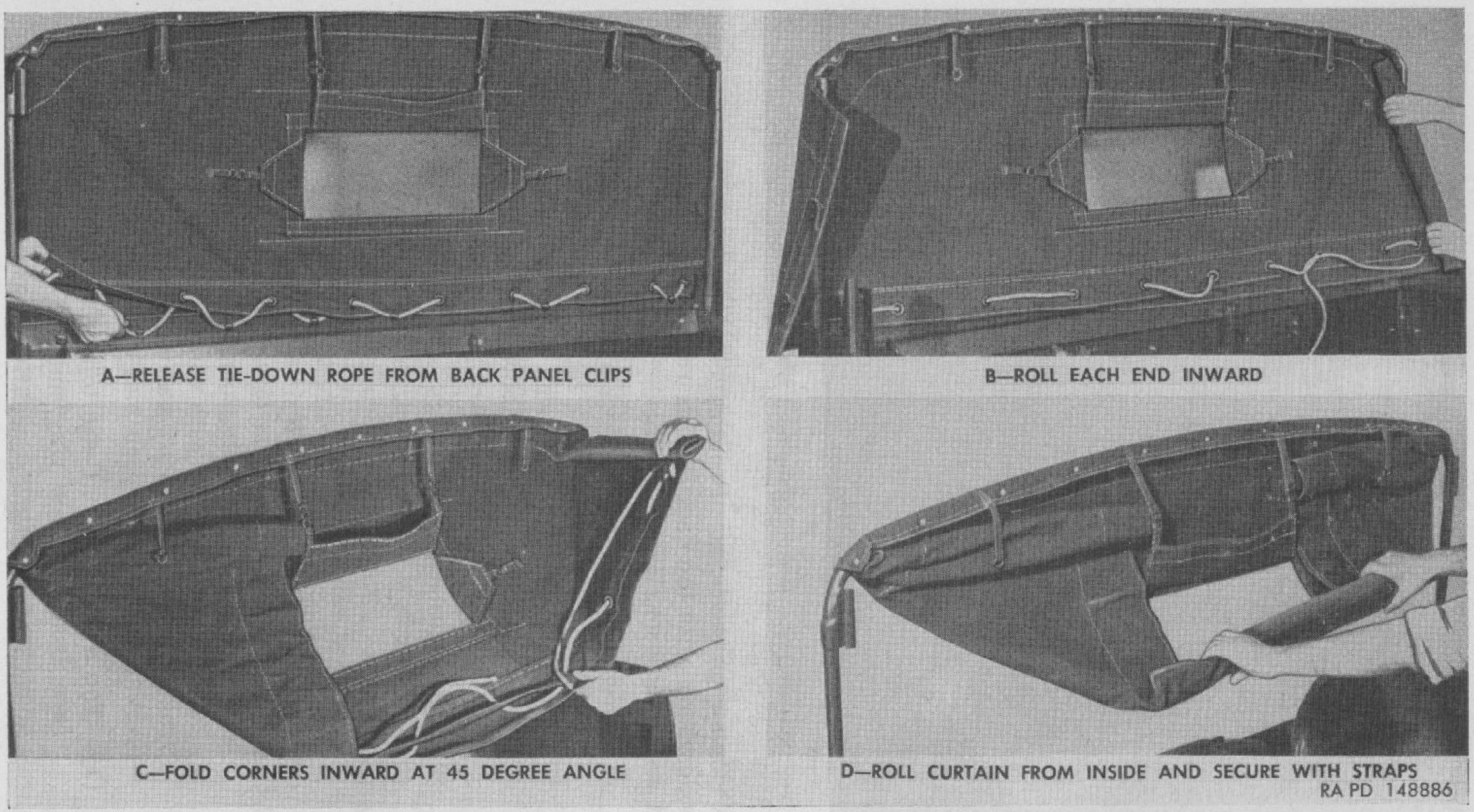


Figure 163. Rolling up rear curtain.

top deck under, from inside cab, into a tight roll, and secure to windshield top frame with roll-up straps.

(2) *Back curtain rolled.* Roll top deck and secure to windshield ((1) above). Untie ends of rear curtain lashing rope from bow ring nuts; then release rope from clips on inside of rear panel (A, fig. 163). Roll each end of rear curtain inward (B, fig. 163); then fold each corner inward (C, fig. 163). Roll curtain up, from inside cab, and secure to top bow with roll-up straps (D, fig. 163).

(3) *Top deck rolled and top bow down.* Roll top deck and rear curtain ((1) and (2) above). Push each roof panel straight upward to disengage from windshield and top bow anchors and from side panel studs (fig. 164). Lift each side panel straight upward to disengage studs; then remove from cab. Bolt roof panels together and bolt rear quarter panels together, using existing holes and special bolts provided for that purpose. After bolting together, stow roof and side panels back of companion seat and secure with strap (fig. 165). Loosen both top bow ring nuts and lower top bow to stops; then tighten ring nuts firmly.

(*a*) *Maximum visibility with wind protection.* Vehicle may now be driven with windows cranked up (A, fig.

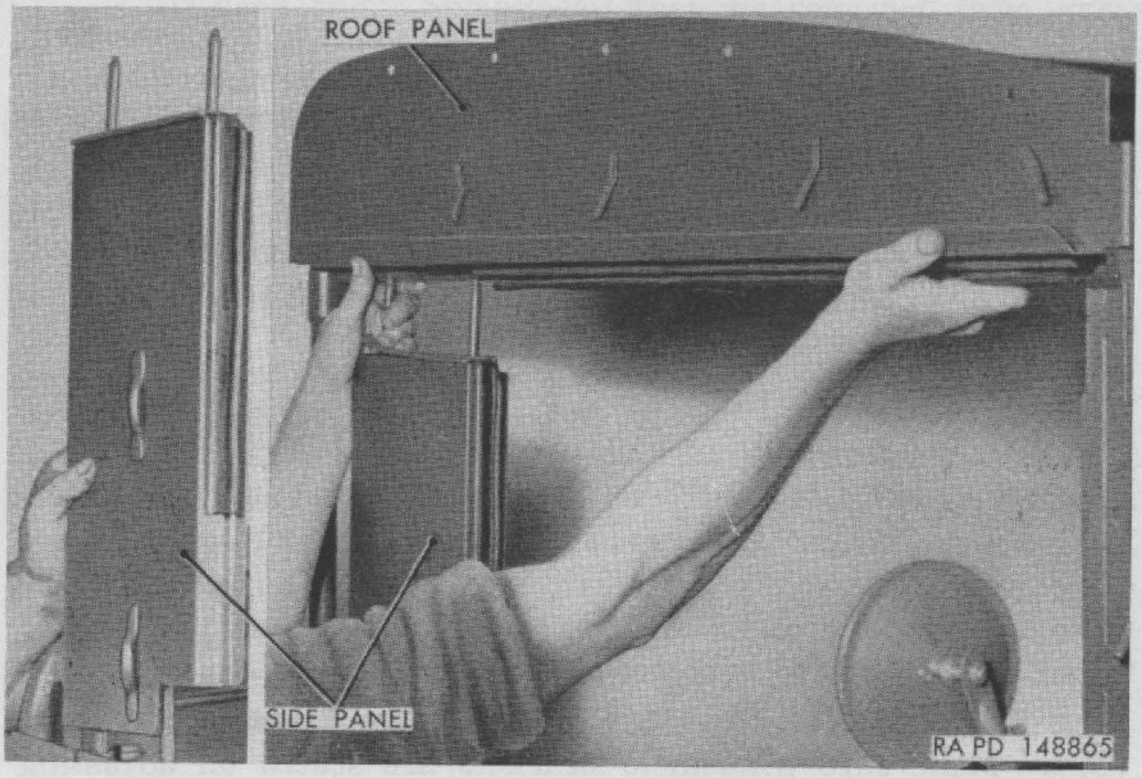


Figure 164. Removing roof and side panels (right-side shown).

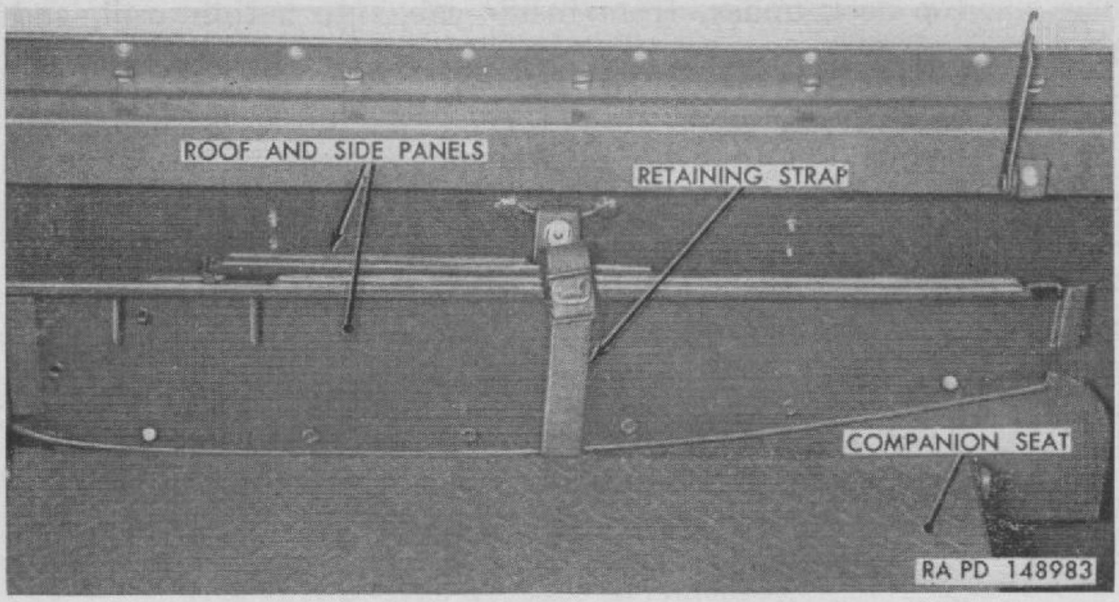


Figure 165. Roof quarter and side panel stored.

166), thus obtaining maximum visibility consistent with protection from wind. Door windows may be cranked down for slightly increased visibility.

(*b*) *Maximum visibility.* Increased visibility is obtained by folding windshield down over hood (B, fig. 166) as described in paragraph 271*c*.

Note. Do not drive with door windows raised when windshield is lowered.

(*c*) *Maximum visibility with minimum glare reflection.* With windshield positioned for maximum visibility ((*b*) above), objectionable glare may be reflected from windshield glass. Reflected glare can be avoided by covering lowered windshield with top deck. Unroll top deck from windshield frame, fold over windshield, and lash in place as shown in C, figure 166.

271. Windshield

a. DESCRIPTION. Windshield consists of two frame and glass assemblies hinged to tubular outer support frame at top by interlocking metal strips. Outer frame is hinged to cab cowl by means of bolts in brackets (fig. 167). Either half of windshield may be tilted outward for ventilation or entire windshield may be lowered to horizontal position over hood.

b. ADJUSTMENT. Remove top deck and roof panels (par. 270*c* (3)). Make sure windshield brackets are seated on adjusting nuts (fig. 168) and that lock bolt wing nuts are tight. Check fit

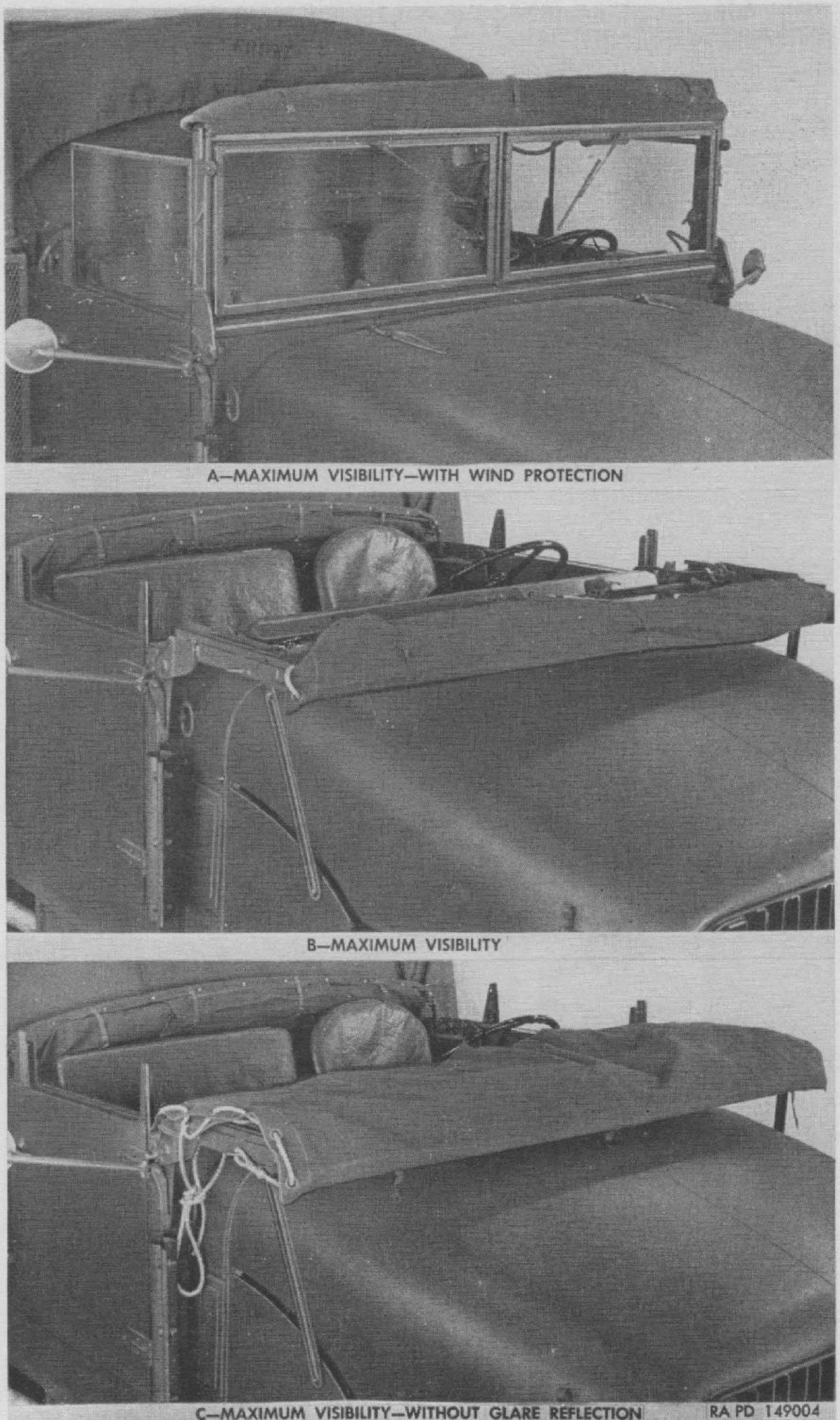


Figure 166. Top deck, rear curtain, and windshield positions.

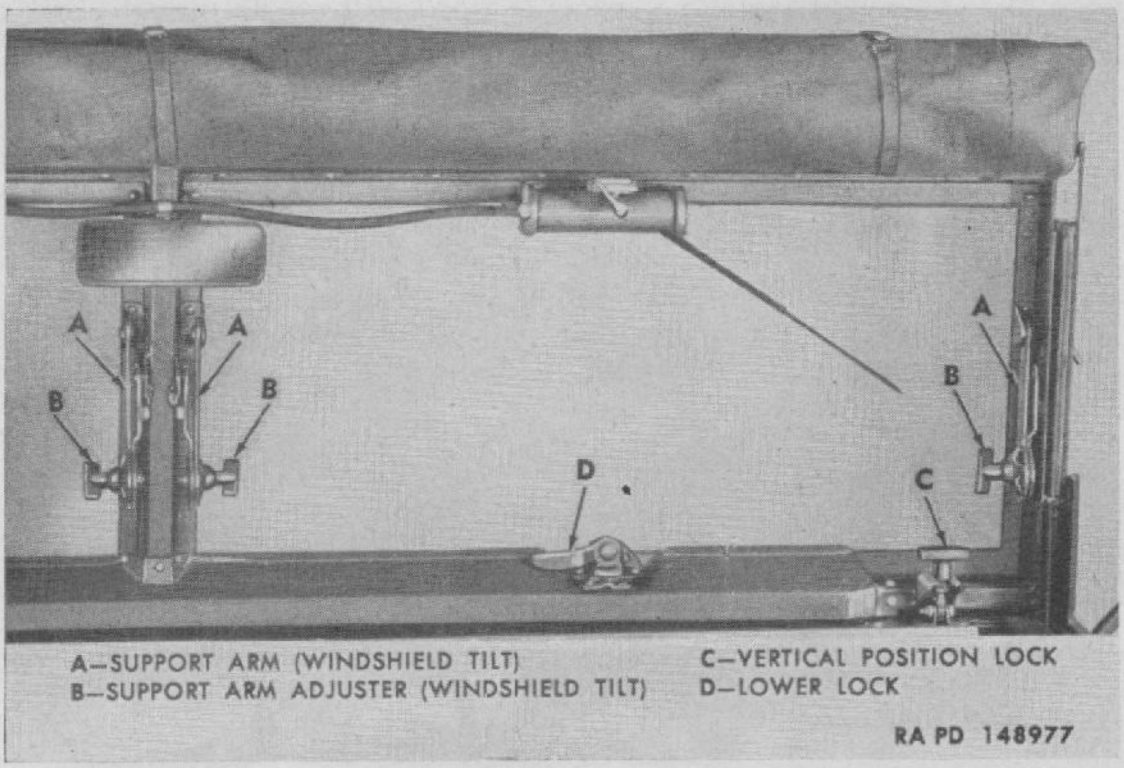


Figure 167. Windshield controls.

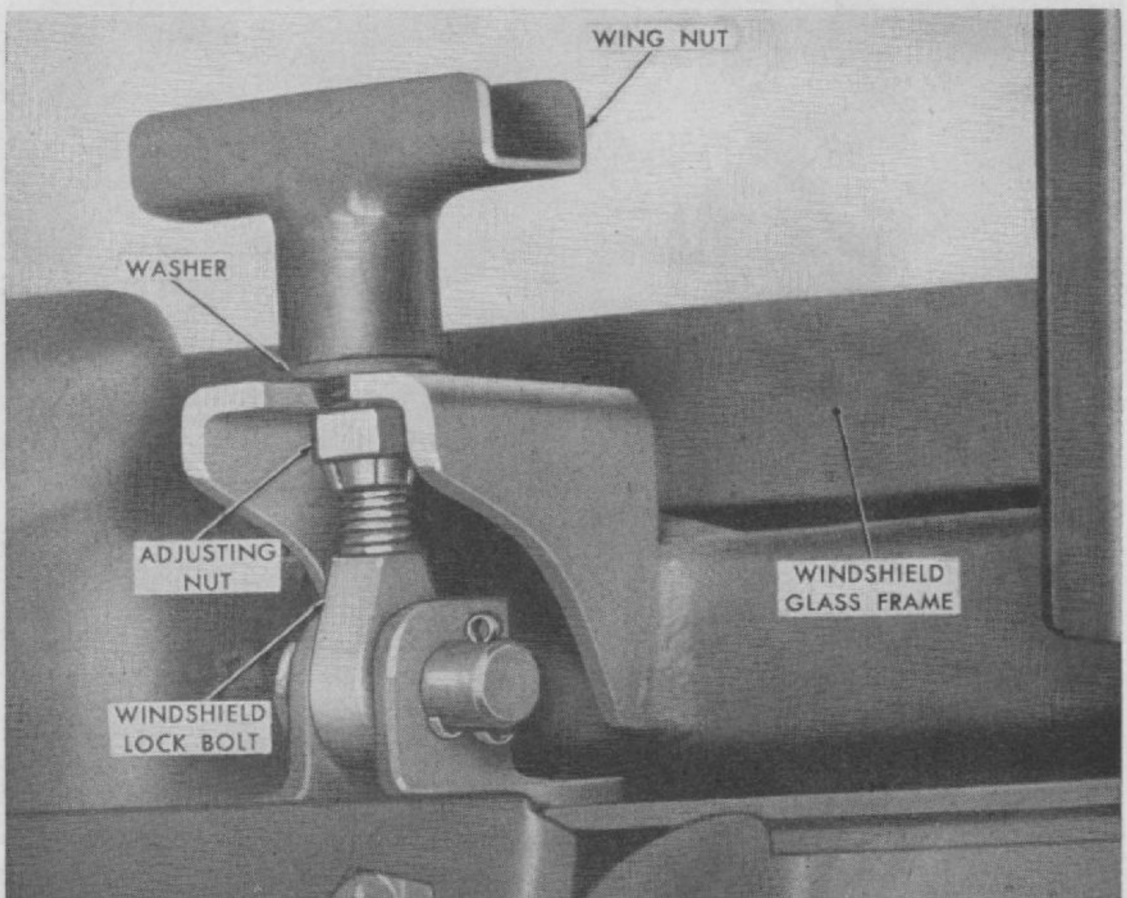


Figure 168. Windshield frame vertical adjustment.

of windows against windshield frame. Windows should seal against windshield without binding. If windshield requires adjustment, loosen wing nut and turn adjusting nut. Recheck for proper fit with windows. Install roof panels and top deck.

c. POSITIONING WINDSHIELD. Windshield may be positioned in various ways to provide protection, visibility, and ventilation.

(1) *Windshield upright.* While holding windshield in vertical position, engage lock bolts in windshield brackets. Tighten lock bolt wing nuts firmly.

(2) *Windshield tilted.* Each windshield half is separately hinged at top to windshield outer frame. To open either windshield half, unlatch lock at bottom center of section to be opened (fig. 167). Loosen clamp screw on adjusting arm at each side and tilt section forward and upward. While supporting section in desired position, tighten clamp screw at each side of section.

(3) *Windshield lowered.* Roll up top deck and rear curtain; then remove and stow roof panels and side panels (par. 270*c* (3)). While supporting windshield, unscrew wing nuts from lock bolts (fig. 168) and swing lock bolts downward and inward. Lower windshield forward over hood. Disengage windshield support arm, on each side, from clip and hook to windshield bracket bolt. Tighten bracket bolt nuts firmly.

d. WINDSHIELD REMOVAL. Either windshield frame with glass can be replaced without loosening or removing tubular outer frame.

(1) *Disconnect adjusting arms at brackets.* Loosen clamp screw at each side of section which is to be opened. Remove two screws which attach adjusting arm to brackets. Disengage adjusting arms from brackets and remove.

(2) *Remove wiper motor.* Remove windshield wiper blade, arm, and motor, if desired, (par. 272). Otherwise disconnect air supply hose from wiper motor.

(3) *Remove windshield frame and glass assembly.* While supporting windshield, remove seven screws and washers which attach upper hinge strip to tubular outer frame (fig. 169). Remove frame and glass assembly from tubular outer frame.

e. WINDSHIELD INSTALLATION.

(1) *Position frame and glass.* Position frame and glass in outer frame and *start* seven screws, with washers, through upper hinge strip and into tubular frame.

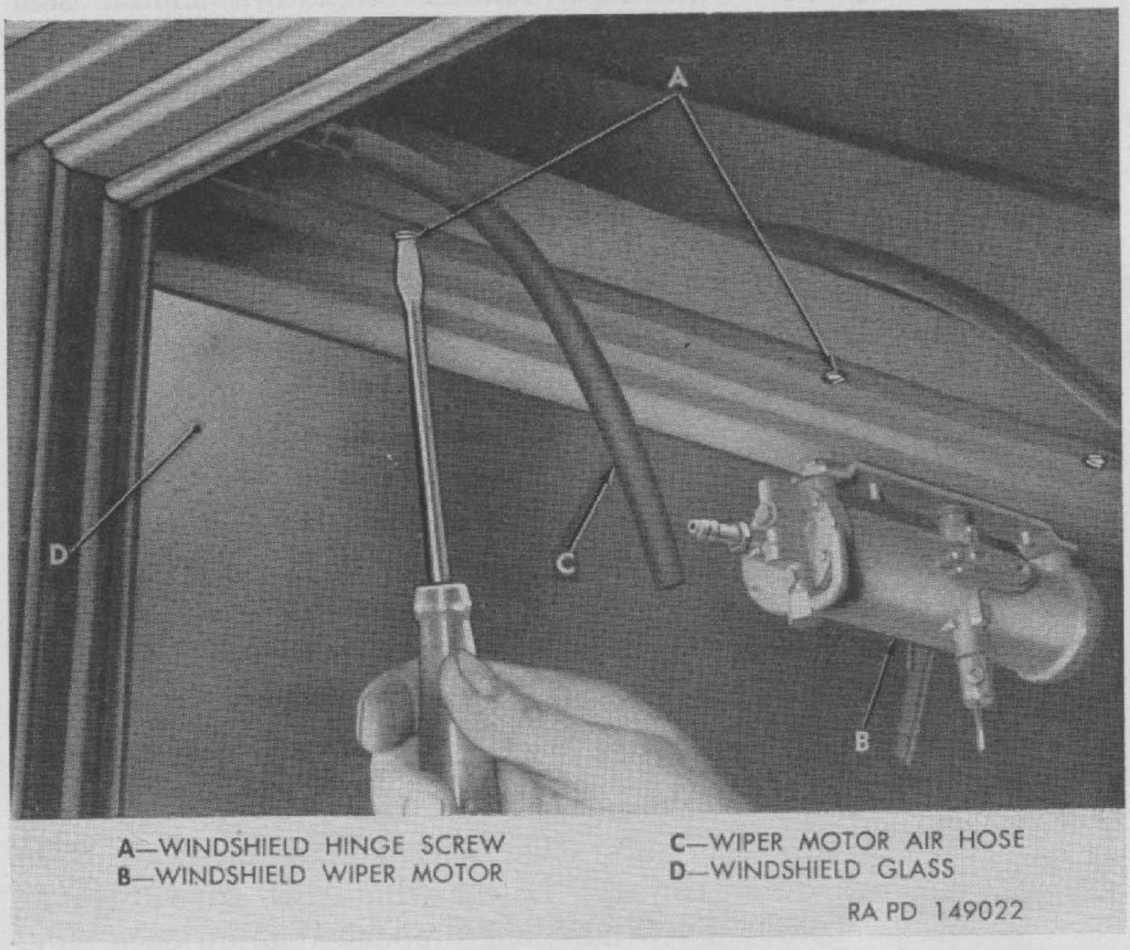


Figure 169. Removing windshield frame and glass.

(2) *Attach frame and glass.* Center frame and glass laterally in opening; then tighten seven screws firmly.

(3) *Connect adjusting arms.* Open windshield as required to position adjusting arms on windshield brackets. Attach arms to brackets with screws.

(4) *Install wiper motor.* Install windshield wiper motor, if previously removed, (par. 272). Otherwise connect air supply hose to windshield wiper motor.

272. Windshield Wipers and Control

a. DESCRIPTION. Two identical air-operated windshield wiper motors are used, one mounted at top center of each windshield half. Motors are controlled by a single valve, mounted on instrument panel at left side. Valve is pressure-regulating type, permitting wiper motors to operate at constant speed, regardless of normal fluctuations of pressure in vehicle air system.

Note. Windshield wiper control valve must be properly adjusted to limit speed of wiper motors. Excessive motor speed will cause rapid wear of motors and depletion of air supply, with no gain in visibility through windshield.

b. CONTROL VALVE ADJUSTMENT. Both windshield glasses must be kept thoroughly wetted during adjustment. With system pressure of 35 psi or more, open control valve completely. If motors operate between 60 and 70 complete cycles (120 to 140 strokes) per minute, valve is correctly adjusted. (Count as one stroke each time blade reaches end of travel.) If motor speed is not in this range, adjust valve. Loosen two set screws and pull stop knob off regulator knob (fig. 170). Turn regulator knob to operate motors at 120 to 140 strokes per minute (preferably 120 strokes) on thoroughly wetted windshield. Without disturbing adjustment, install stop knob on regulator knob and, while holding stop knob tight against valve body, tighten two set screws firmly. If adjustment is properly made, stop knob will "bottom" on valve body with motors operating at maximum desired speed.

c. WIPER BLADE REPLACEMENT.

(1) *Removal.* Pull wiper arm away from windshield with one hand. With other hand, swing lower end of blade outward and upward through a 180 degree arc. Pull blade straight away from motor shaft to remove.

(2) *Installation.* With hook on blade pointing to motor shalf, and with metal part of blade in contact with forward side of arm, engage hook by pushing blade toward shaft. Hold lower end of arm away from windshield with one hand; with other hand, swing upper end of blade outward and downward into position.

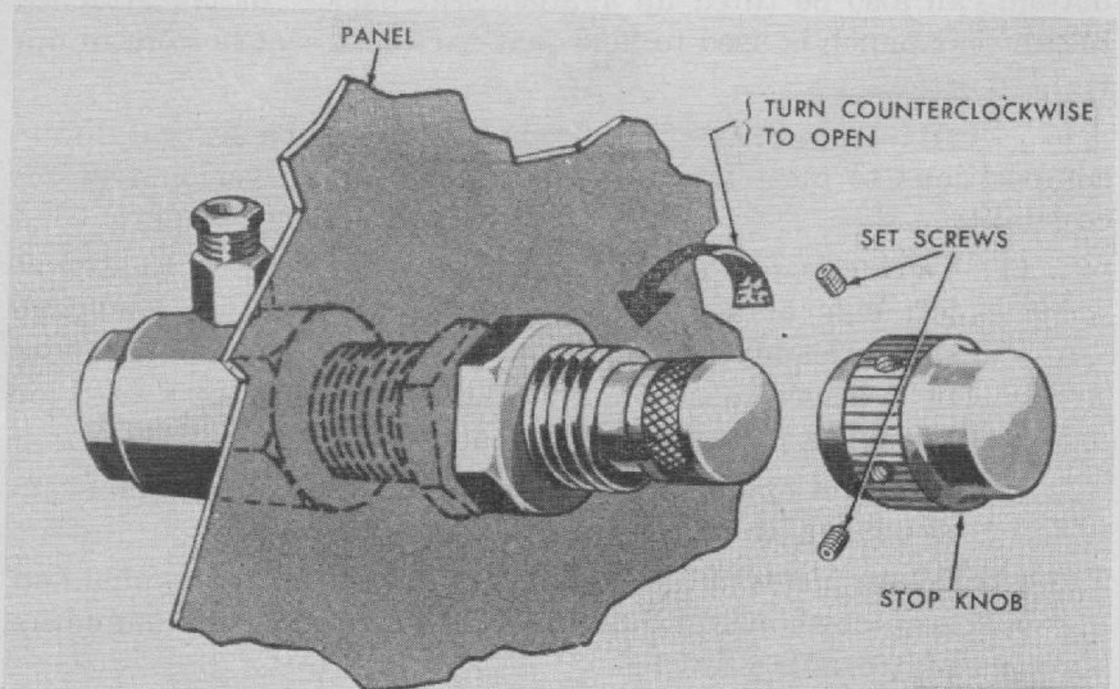


Figure 170. Windshield wiper control adjustment.

d. WIPER MOTOR. If wipers fail to operate properly, with normal pressure in air system, check for leaks in lines, using soapsuds. Source of trouble may be due to maladjusted control valve, or may be caused by plugged air strainer. Strainer is located on inside of dash panel, near center. Make sure of air pressure to wipe motor before replacing motor.

(1) *Wiper motor removal.* Disconnect air hose from wiper motor. Remove wiper blade (*c* above). Unscrew nut from wiper shaft, then pull arm from shaft. Remove two screws which attach motor to glass frame. Pull motor free from rear of windshield.

(2) *Wiper motor installation.* Insert motor shaft through windshield frame from rear of windshield and install two attaching screws. Place wiper arm on motor shaft, making sure arm is correctly positioned for proper wiping arc. Install nut on motor shaft; then install wiper blade (*c* above). Connect air hose to wiper motor.

273. Seats

a. GENERAL. Cab is equipped with two seats, driver's and companion. Driver's seat is adjustable in a fore-and-aft direction, raising as seat is moved forward. Both seats are easily removed, no tools being required for removal of driver's seat. Companion seat is supported on seat risers attached to floor and rear panel of cab. Seat back is hinged to lay forward on seat, and seat bottom can also be tilted up against seat back. Latch, attached to cab rear panel, is used to hold seat back and seat bottom in upright position.

b. POSITIONING SEATS. Seats may be placed in several different positions to meet varying conditions of observation and accessibility.

(1) *Driver's seat adjustment.* Adjuster lever is located at left side of seat bottom. Pull out lever to disengage spring-loaded latch from positioning notch. Hold lever in released position while pushing seat rearward or hunching forward to desired position.

(2) *Normal operation.* For normal driving, position seats as shown in A, figure 171.

(3) *Seat platform.* By folding down back of companion seat, as shown in B, figure 171, a firm, non-skid, standing platform is provided.

(4) *Floor platform.* Companion seat may be folded up (C, fig. 171) to permit standing on floor. Retain seat

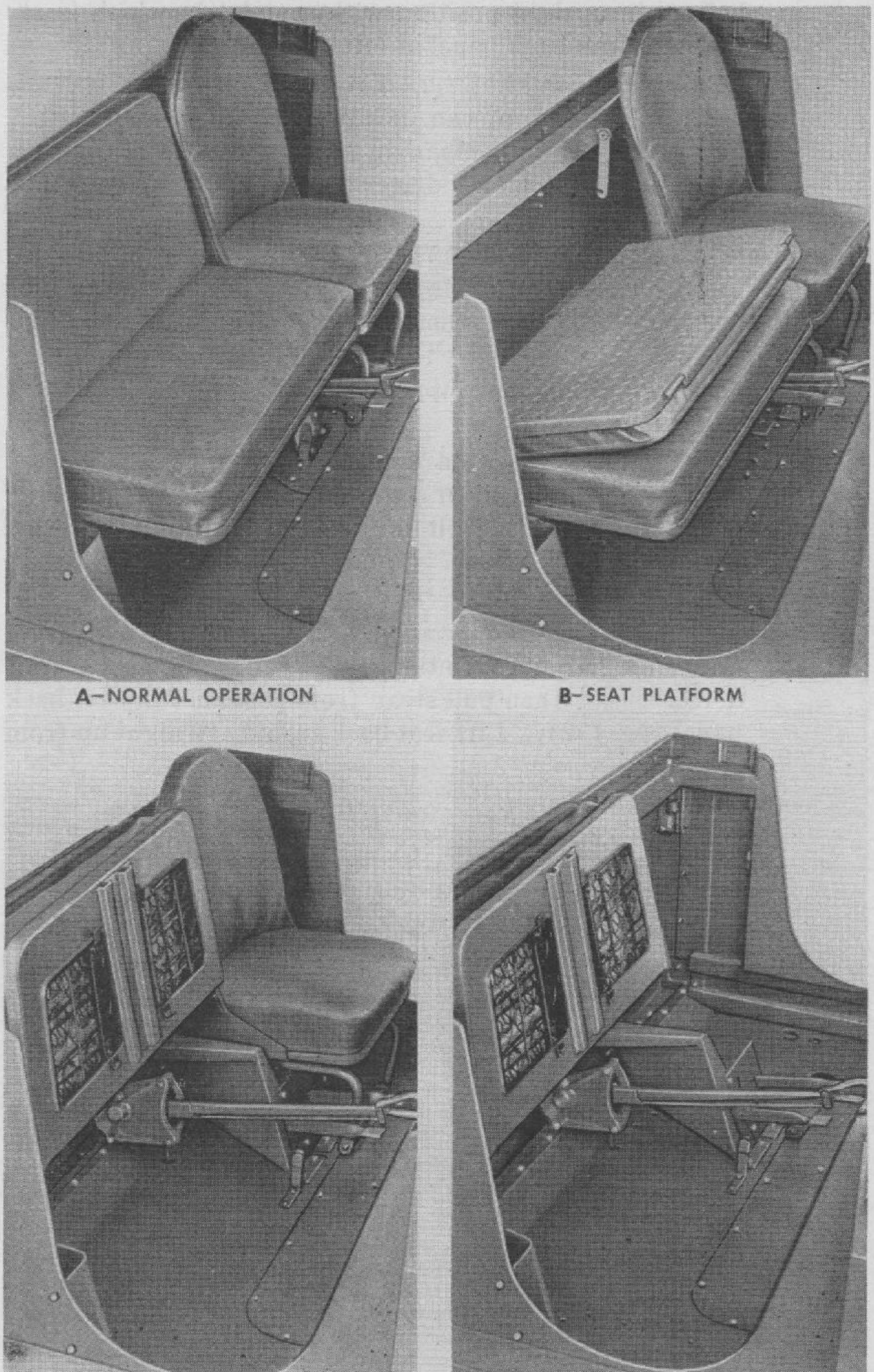


Figure 171. Seat positions.

bottom in upright position with seat latch, which is attached to cab back panel at left side of seat.

(5) *Maximum accessibility.* To obtain maximum accessibility to interior of cab, position seats as shown in D, figure 171. Fold companion seat bottom up and retain with latch. Remove driver's seat from cab (*c* (1) below).

c. DRIVER'S SEAT REPLACEMENT.

(1) *Removal.* Loosen wing nut on lock bolt at rear of driver's seat frame, then swing lock bolt forward and downward. Slide seat rearward to disengage seat support rod from floor support bracket. Remove driver's seat from cab.

(2) *Installation.* Position driver's seat in cab, with seat support rod engaged in seat support brackets. At rear of seat, swing lock bolt upward into engagement with bracket on seat frame. Tighten wing nut firmly.

d. DRIVER'S SEAT CUSHIONS.

(1) *Removal and disassembly.* Raise seat cushion from frame to remove. Untie hold-down strap at back of driver's seat; then pull strap from grommet in seat back panel (fig. 172). Lift seat back cushion straight up from

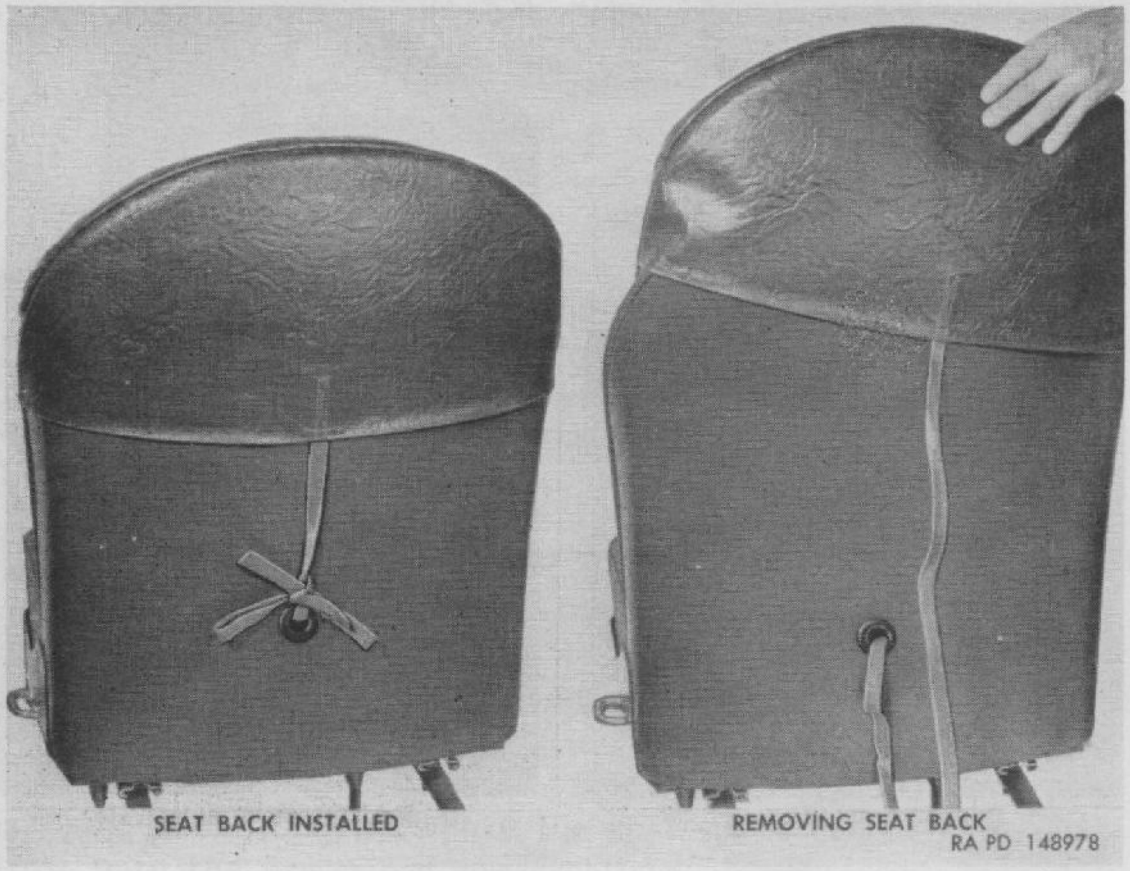


Figure 172. Driver's seat back cushion.

Figure 173. Driver's seat cushion disassembled.

seat frame to remove. Untie straps at back of seat back cushion; then pull padding from cover (fig. 173). Untie lacing cord at bottom of seat cushion; then disengage cord from hooks on seat bottom board. Remove seat cushion cover from springs and padding.

(2) *Assembly and installation.* Position seat cushion cover on padding and springs. Engage lacing cord in hooks on bottom board, pull cord taut, and tie. Insert padding in seat back cushion, fold flap up, and tie outer lacing tapes to loops. Position seat back cushion on seat frame, with lower lacing tape inserted through grommet (fig. 172). Tie tapes together at back of seat frame to hold seat back cushion securely in place. Position seat cushion in seat frame.

e. COMPANION SEAT REPLACEMENT.

(1) *Removal.* Remove three bolts and nuts which attach companion seat hinge bracket to each seat riser. Lift seat from risers to remove from cab.

(2) *Installation.* Position companion seat on seat risers. Install three bolts and nuts which attach each hinge bracket to riser.

Figure 174. Companion seat back cushion removal.

f. COMPANION SEAT CUSHIONS.

(1) *Removal and disassembly.* Pull bottom of seat back cushion forward and upward. Slide seat back cushion to side to disengage bead on cushion from metal channel on seat back (fig. 174). Raise seat bottom frame to vertical position. Disengage seat spring latches by tapping with hammer (fig. 175). Lower seat bottom to horizontal position. Lift seat cushion from seat bottom frame. Untie lacing cord at bottom of seat cushion, disengage cord from hooks on spring, and lift cover from pads and spring (fig. 176). Untie lacing cord at back of seat back cushion, pull cord from loops in cover, and lift pad from cover.

(2) *Assembly and installation.* Position seat back pad in cover, thread cord through loops, pull cord taut and tie. Position seat cushion cover over spring and pad and engage loops of cord in hooks on spring bottom. Pull cord taut and tie. Position seat cushion on seat frame, raise to vertical position, and engage latches by tapping with hammer. Holding seat back cushion upside down, engage bead on seat back cushion in metal channel on seat frame. Slide bead fully into channel; then lower cushion into place.

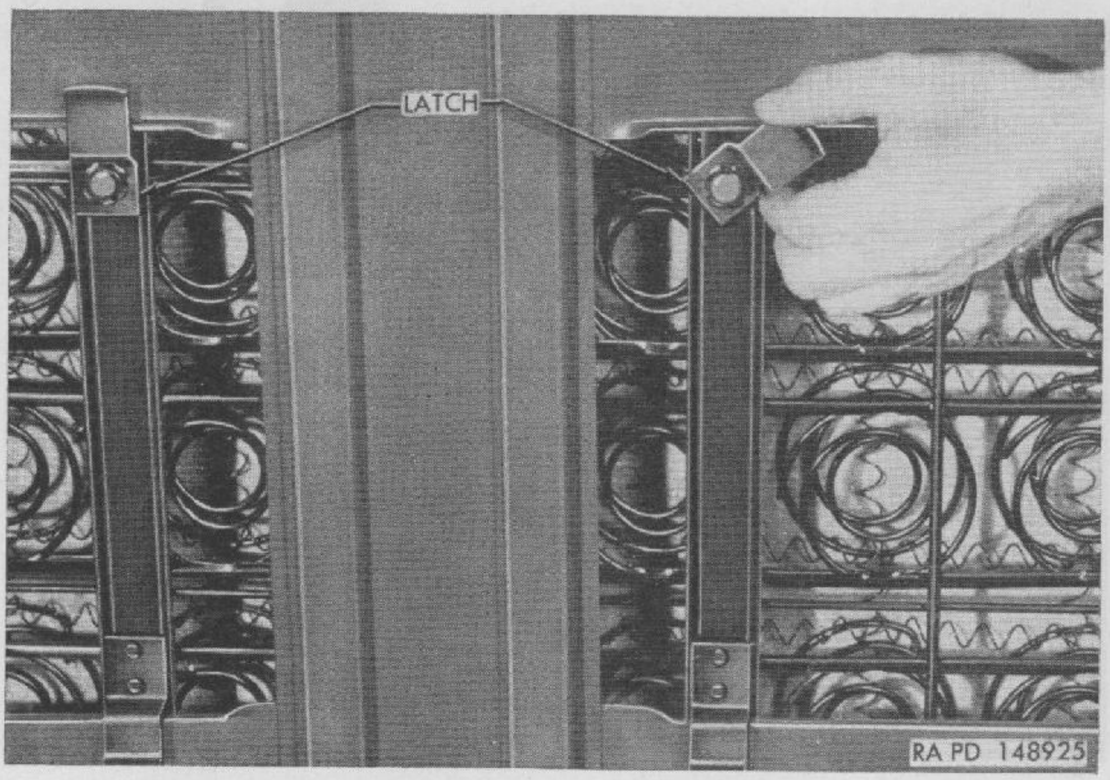


Figure 175. Companion seat cushion removal.

Figure 176. Companion cushions disassembled.

274. Doors

a. GENERAL. Component subassemblies of doors, such as window regulator handle, lock, remote control handle (fig. 178), etc., can be replaced without removing door from vehicle.

b. DOOR ADJUSTMENTS. Provision is made for adjusting door both horizontally and vertically in opening. Door lock striker and door wedge plate (fig. 177) are also adjustable.

(1) *Horizontal adjustment.* Loosen three screws which attach each hinge to door; then shift door forward or rearward, as required. When correct adjustment is obtained, tighten hinge bolts firmly.

(2) *Vertical adjustment.* Loosen two bolts and nuts which attach each hinge to body post. Shift door up or down, as required. When correct adjustment is obtained, tighten nuts firmly.

(3) *Door lock striker adjustment.* Loosen screws which attach striker plate to cab post (fig. 177) and move striker in or out, as required. Tighten screws firmly, then close door to determine if looseness, rattling, or improper latching have been corrected.

(4) *Door wedge plate adjustment.* To move wedge plate on door to center in casing on cab lock post, loosen wedge plate screws (fig. 177). Move wedge plate up or down, as required; then tighten screws firmly. Close and open

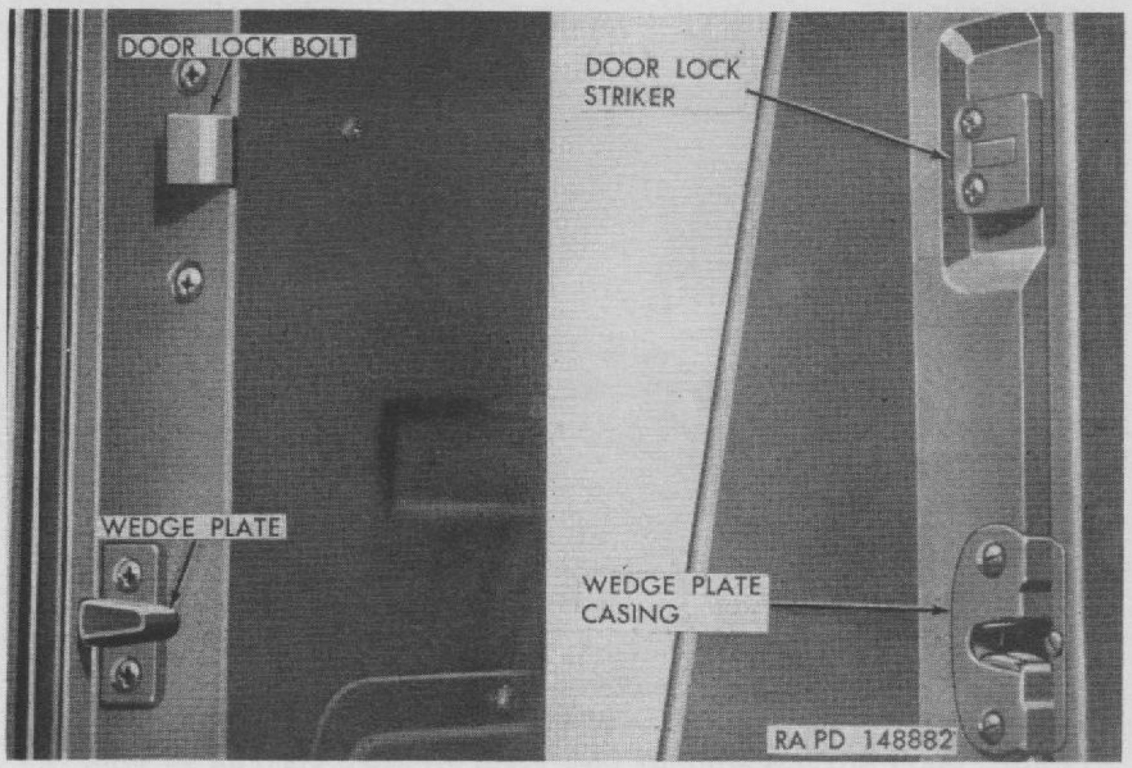


Figure 177. Door striker and wedge plate.

door several times, noting if shoe is properly centered. Repeat adjustment procedure, if necessary.

c. DOOR REPLACEMENT.

(1) *Removal.* Remove door check link pivot pin which connects check link to bracket on body post. While supporting door, drive out hinge pin from each hinge; then remove door.

(2) *Installation.* Position door to cab and, while supporting door, install pin in each hinge. Install pivot pin which connects check link to bracket on cab post.

d. FRAME (WITH GLASS) REPLACEMENT.

(1) *Removal.* Remove screws which attach window regulator cover to door; then remove cover and gasket. Crank window to bottom. Remove two screws which attach each window stop to stop guide rail (fig. 178); then remove both stops. Remove fasteners from both regulator studs; then spring regulator studs from slots in regulator guide rail. Withdraw frame and glass from top of door.

(2) *Installation.* Position frame with glass through opening in top of door. Engage studs of regulator through slots in regulator guide rail and install stud fasteners. Install window glass stop on each end of regulator guide rail, attaching each with two screws. By limiting up-

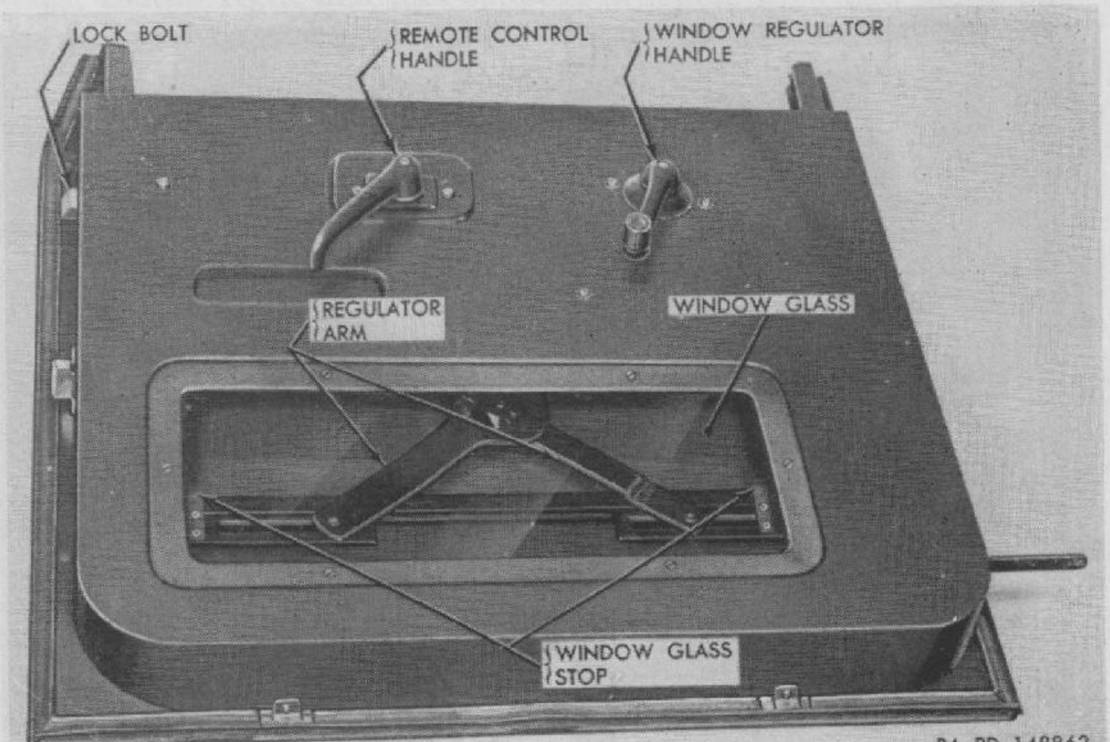


Figure 178. Door with window regulator cover plate removed.

ward travel of frame and glass, stops prevent damage resulting from raising window too high. Crank window up and down to make sure of proper operation; then install window regulator cover and gasket to door.

e. WINDOW REGULATOR REPLACEMENT.

(1) *Removal.* Remove window frame and glass (*b* (1) above). Remove screw which attaches window regulator handle to shaft and remove handle. Remove four screws which attach regulator to door inner panel. Disengage regulator arm from lower retainer and withdraw regulator through opening in inner door panel.

(2) *Installation.* Position window regulator in door, with regulator arm engaged in lower retainer. Start four screws attaching regulator to inner door panel; then tighten screws firmly. Position regulator handle on shaft and install attaching screw. Install window frame and glass (*d* (2) above).

f. LOCK AND REMOTE CONTROL REPLACEMENT. Door lock and remote control are removed and installed as a unit (fig. 178).

(1) *Removal.* Remove six screws which attach window regulator cover to door inner panel; then remove cover and gasket. Remove two screws which attach door outer handle; then remove handle. Crank window up to stops. Remove screw which attaches remote control handle; then remove handle. Remove three screws which attach remote control to door inner panel. Remove three screws which attach lock to door inner panel. Withdraw lock and remote control through opening in door inner panel.

(2) *Installation.* Position lock in door inner panel and start three attaching screws. Swing remote control up into position and start three attaching screws; then tighten all six screws firmly. Install door outer handle, attaching with two screws. Install remote control handle and attach with screw. Make sure lock operates properly; then position window regulator cover and gasket to door inner panel and install attaching screws.

Section XXXII. SHEET METAL

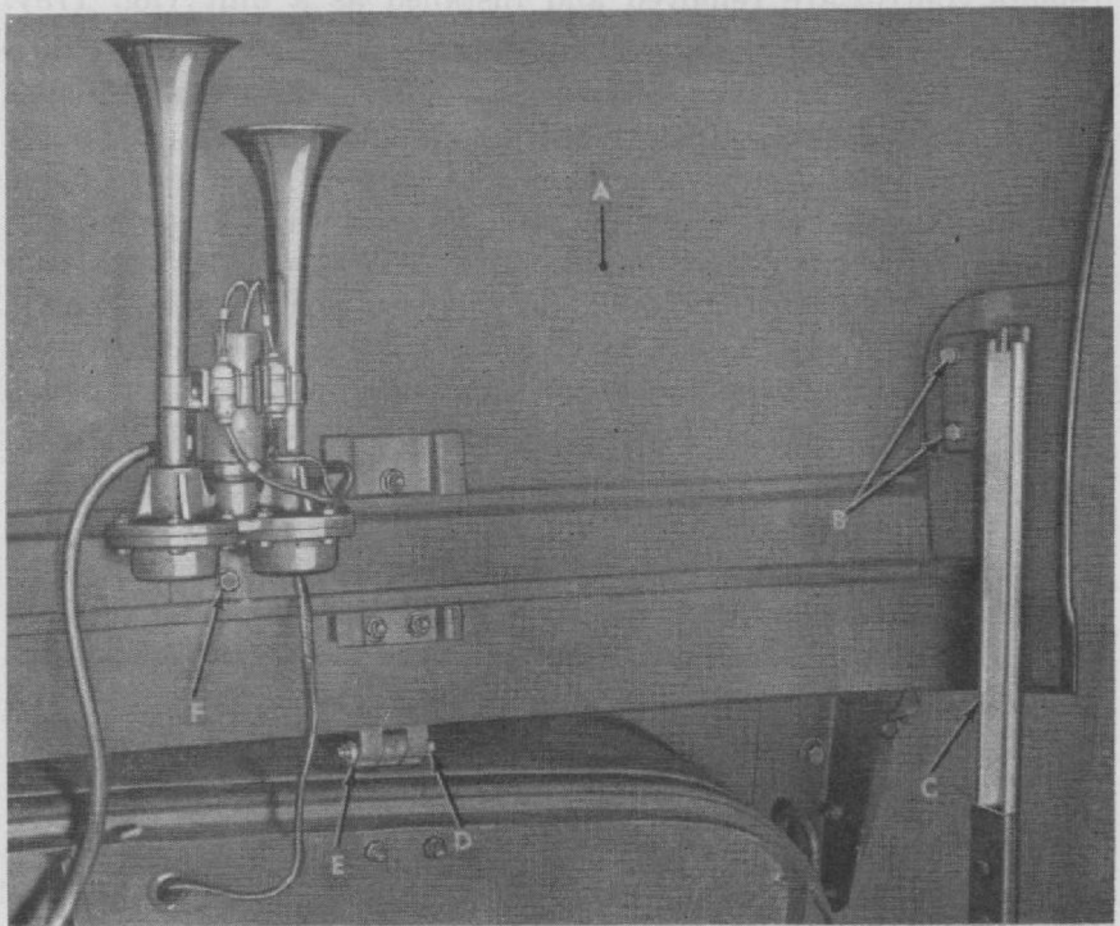
275. Description

Units covered in this section are those items of sheet metal not part of chassis, cab, or body and include engine hood, fenders, shields, brush guard, and running boards.

276. Engine Hood

a. ADJUSTMENT. Disengage hood catches from brackets on hood. Loosen three bolts and nuts which attach each hinge to cab cowl. Shift hood to desired position; then, without disturbing hood adjustment, firmly tighten hinge to cowl bolts and nuts.

b. REPLACEMENT. Disengage hood catches and raise hood to vertical position (fig. 179). Remove bolts which attach horn support bracket to hood panel reinforcement. Lay horns on top of engine. While supporting hood, remove two bolts and nuts which attach each hood prop to hood support bracket. Lower hood to horizontal position. Remove hinge bolt and nut from each hinge; then remove hood. Position hood on vehicle, with hinge holes alined. Install hinge bolt and nut in each hinge; then, while supporting hood in upright position, connect each prop to hood support bracket with two bolts and nuts. With hood in upright position, attach horn bracket (with horns) to hood panel reinforcement with two bolts and nuts. Engage hood catches in hood brackets.



A—HOOD
B—PROP TO HOOD SCREWS
C—TELESCOPIC HOOD PROP
D—HOOD HINGE
E—NUT
F—HORN BRACKET TO HOOD SCREWS

RA PD 148887

Figure 179. Engine hood installed.

277. Fenders and Shields

a. GENERAL. Accessibility to engine and other units under hood is geatly increased by removal of one or both fenders. Removal of fenders is quickly and easily accomplished, and removal procedure is same for either fender except as otherwise indicated in following procedures.

b. FENDER REMOVAL. Raise hood to upright (second) stage.

Note. Disconnect blackout driving light connections at left fender only.

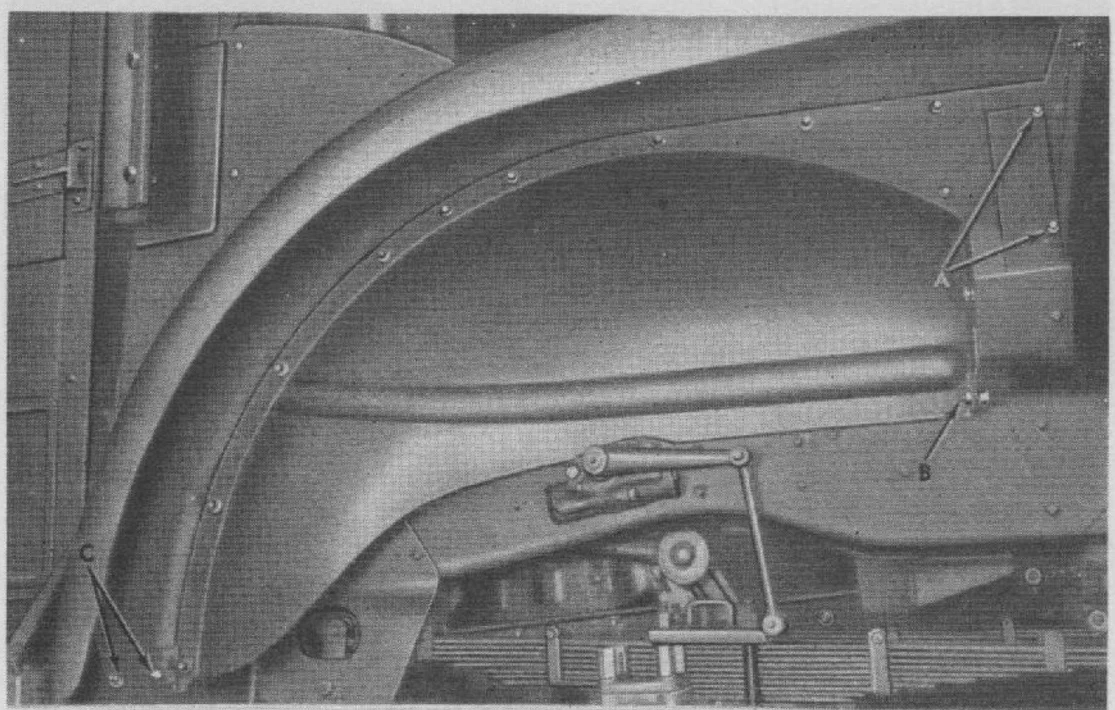
From under hood, loosen bolt which attaches fender to cowl extension panel. Remove five bolts and nuts indicated in figure 180; then lift fender and attacked skirt from chassis.

c. FENDER INSTALLATION. Position fender to vehicle, with slot in fender brace engaged with bolt in bracket of cowl extension panel. Start five bolts and nuts indicated in figure 180; then tighten all nuts and bolts firmly, including bolt in cowl extension bracket.

Note. At left fender, connect blackout driving light connections.

Lower hood to closed position and engage hood catches.

d. COWL EXTENSION PANEL REPLACEMENT. Replacement procedure is same for either left or right panel. Remove bolt which



A—FENDER SUPPORT TO BRUSH GUARD AND BAFFLE BOLT
B—FENDER SKIRT TO RADIATOR SIDE BAFFLE BOLT
C—FENDER TO RUNNING BOARD BOLT
RA PD 148926

Figure 180. Fender installed (right side shown).

attaches windshield support arm to cowl extension panel and support, and remove windshield support arm (fig. 181). Remove three bolts which attach cowl extension panel to cab cowl and remove panel. Start three bolts, attaching cowl extension panel to cab cowl. Insert bolt through windshield support arm; then install through cowl extension panel into extension panel support. Tighten all attaching bolts firmly.

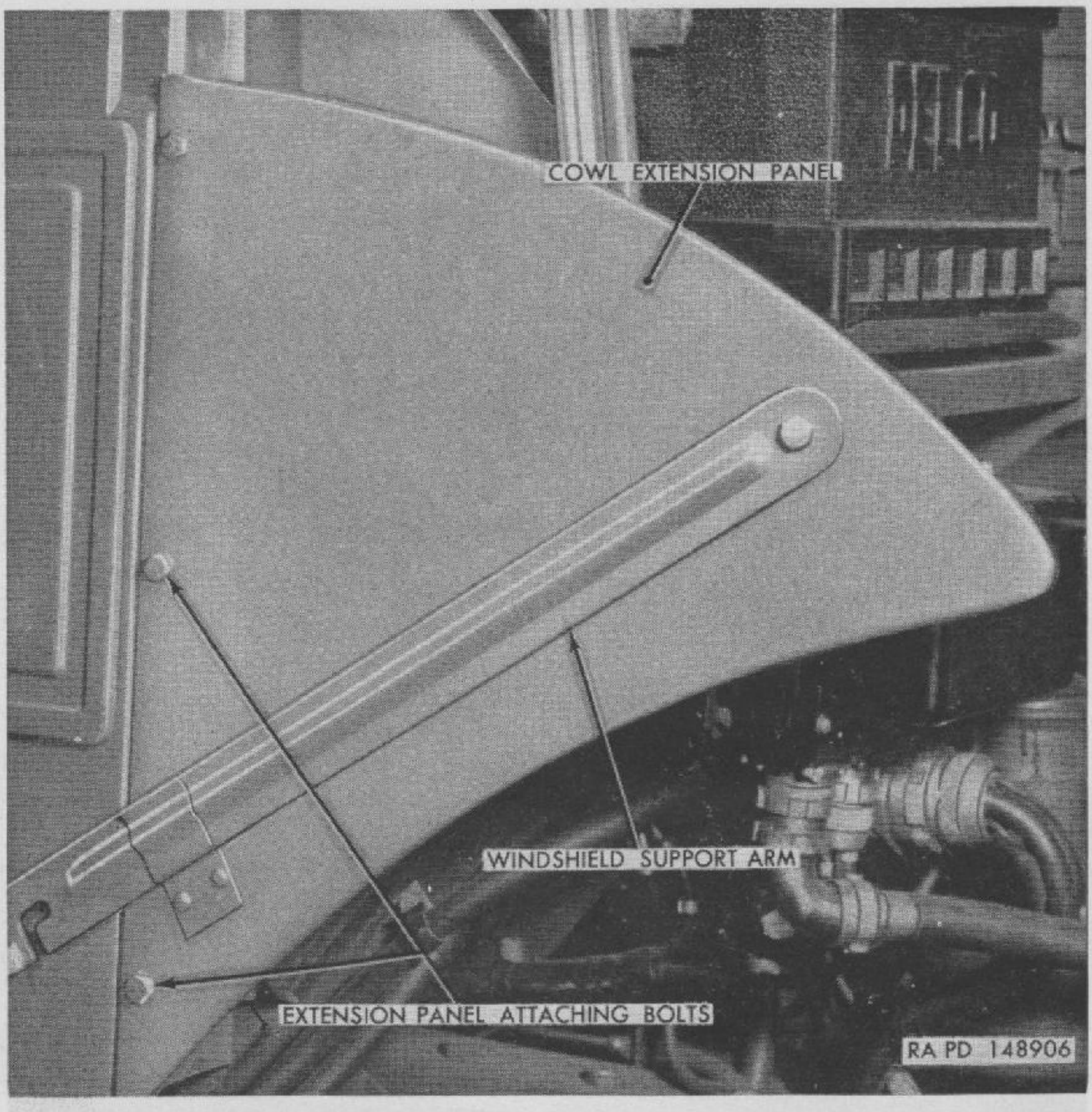


Figure 181. Right cowl extension panel installed.

278. Brush Guard

a. REMOVAL. Remove the ten bolts, nuts, and washers indicated in figure 182; then pull brush guard forward and upward to remove from vehicle.

b. INSTALLATION. Position brush guard to vehicle with holes alined. Start ten bolts, washers, and nuts, indicated in figure 182; then tighten all nuts and bolts firmly.

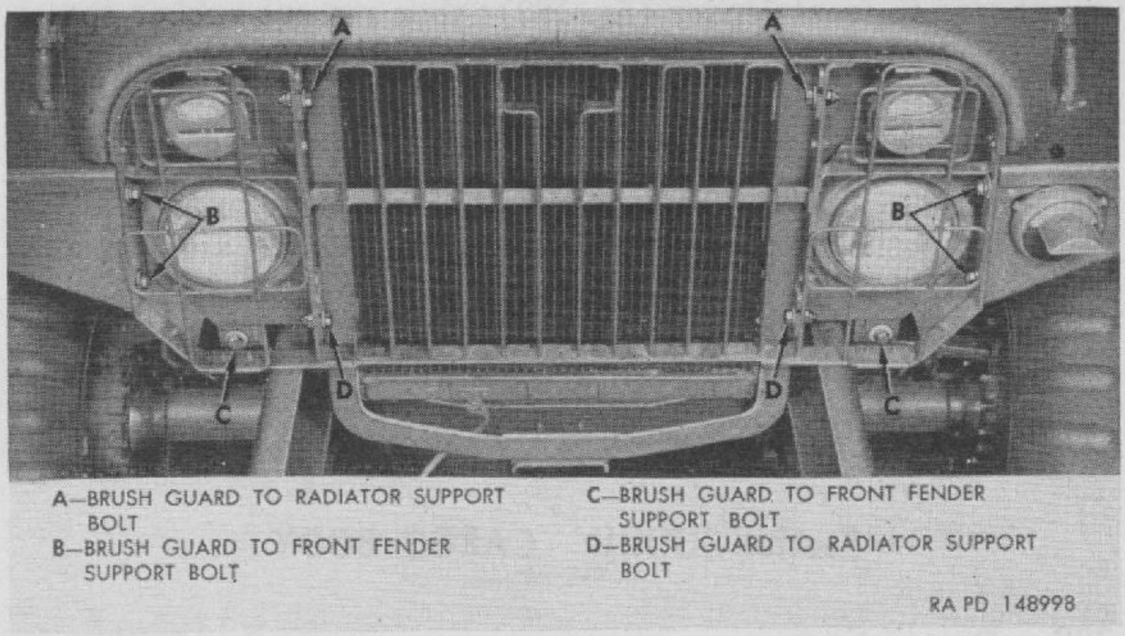


Figure 182. Brush guard installed.

279. Running Boards

a. GENERAL. Running boards are suspended from cab by means of supports bolted to cab pillars. Running boards are attached to supports and to front fenders by bolts. Running boards are similar, but not identical; right running board incorporates a tool box attached to cab and supports. Left running board has a bracket for mounting liquid container.

b. RUNNING BOARD REMOVAL. Remove liquid container from left running board. Remove two bolts and nuts which attach run-

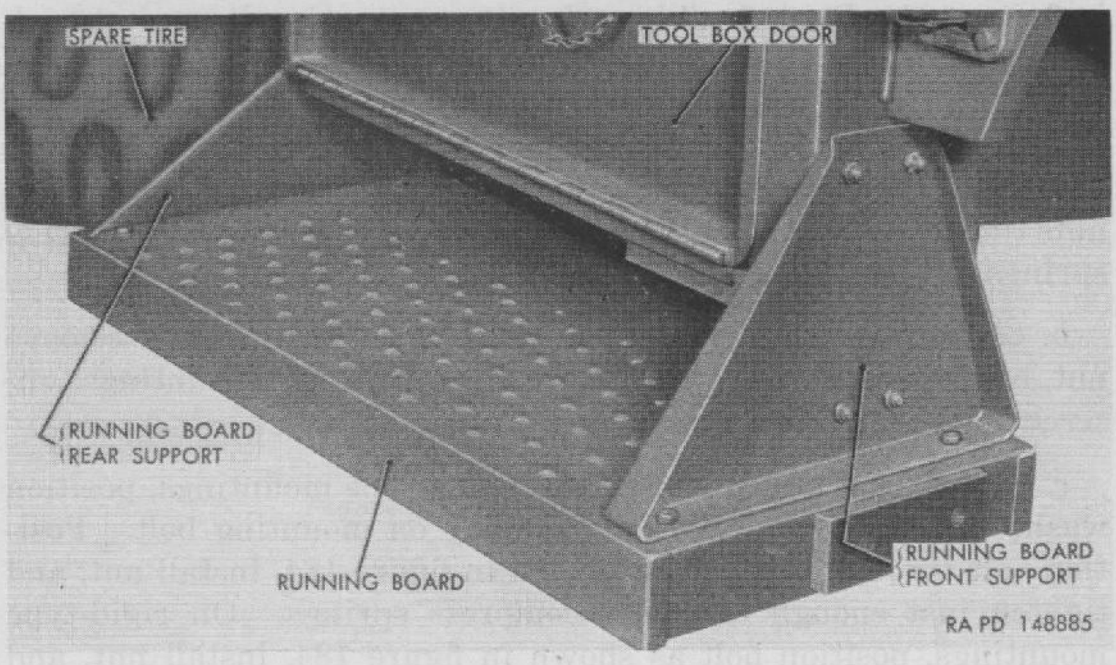


Figure 183. Right running board installed.

ning board to front fender (fig. 183) ; then remove rubber spacer from between running board and fender. Remove four bolts and nuts which attach running board to supports; then remove running board.

c. Running Board Installation. Position running board to supports, position rubber spacer between fender and running board, and start two bolts and nuts attaching running board to fender. Start four bolts and nuts attaching running board to supports; then tighten all bolts and nuts firmlv.

Section XXXIII. CARGO BODY

280. Description

Cargo body, of all-steel construction, is mounted on frame side rails, attached by means of bolts to brackets on frame side rails. Body is equipped with removable wood stake racks, which incorporate folding troop seats. Weather protection is provided by top cover, front end curtain, and rear end curtain. Paulin and curtains are supported by five steel-reinforced, removable wooden bows. Hinged tail gate incorporates a hinged step for use when entering or leaving body, when tail gate is down.

281. Body Mountings

a. Description. Body is mounted to frame side rails as shown in figure 184. Dual, flexible spring-type mounting is used at each front corner, with three rigid-type mountings used on each side. Mounting bolts should be examined periodically for condition and tightness of mounting bolt nuts. Proper tightness for rigid-type nuts is 100–120 pound-feet torque. Front corner mounting bolt nuts should be drawn up just tight enough to partly compress springs.

b. Removal. On front mountings, unscrew nut, and remove nut, bolt, washer, and springs. On rigid-type side mountings, unscrew nut; then remove nut, washer, and bolt.

c. Installation. On flexible spring-type mountings, position washer, inner spring, and outer spring on mounting bolt. Position bolt through brackets as shown in figure 184, install nut, and tighten just enough to partly compress springs. On rigid-type mountings, position bolt as shown in figure 184, install nut, and tighten to 100–120 pound-feet torque.

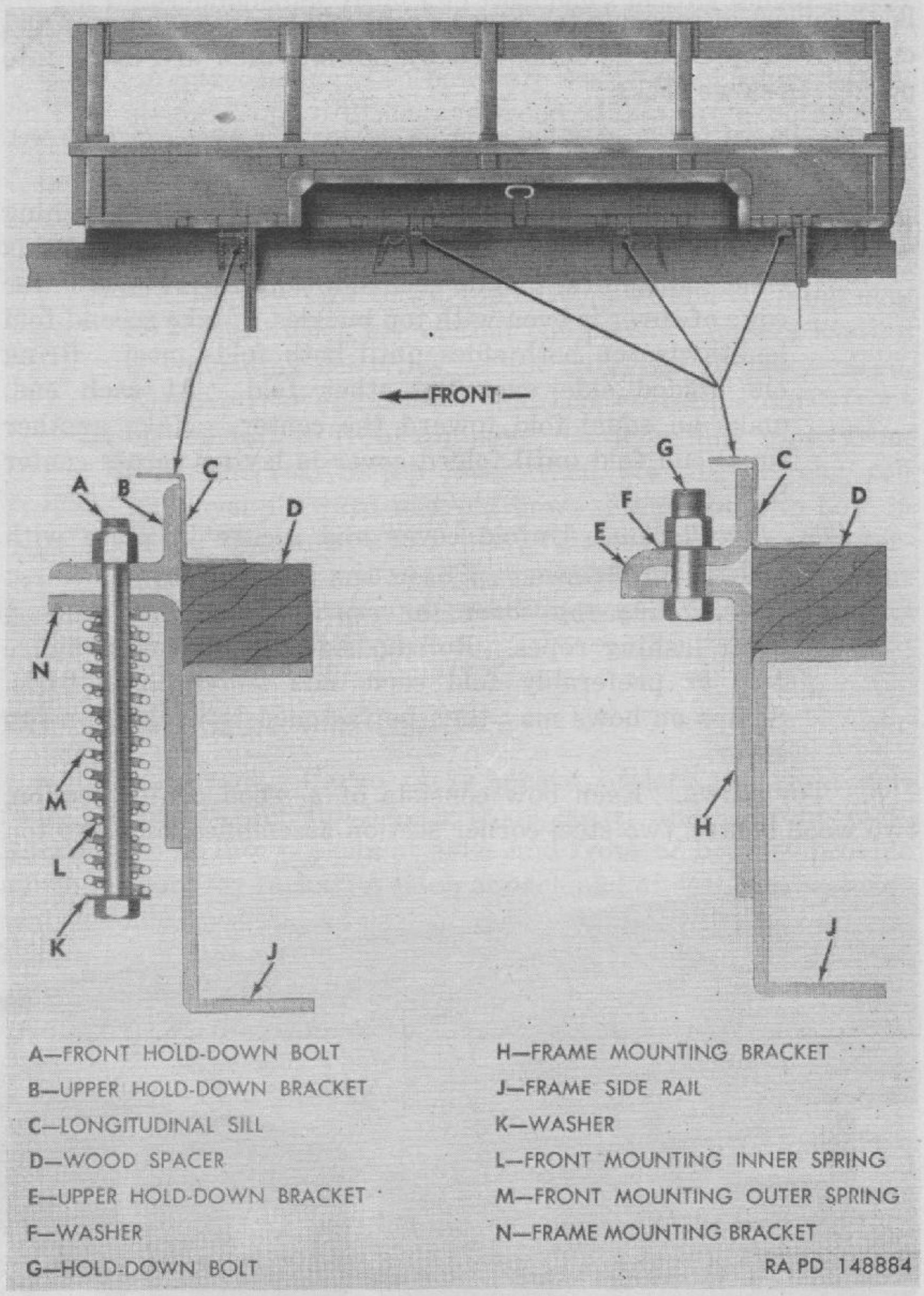


Figure 184. Cargo body mounting.

282. Top Bows and Paulins

a. COVER AND END CURTAINS. Canvas paulins used on cargo body consist of separate top cover, front end curtain, and rear end curtain. Top cover is supported by bows, which are fitted into pockets in cargo racks.

Note. Do not fold or stow top cover or end curtains when canvas is wet. Always make sure canvas is thoroughly dry before folding or stowing.

(1) *Removal.* Untie all side and rear top cover lashing ropes. End curtains may or may not be removed at this time. Make first fold on each side lengthwise until lower edge of cover is even with top buckles. Make second fold lengthwise on both sides until both folds meet. Bring one folded side over the other fold. At each end, make an equal fold toward the center. Make another equal end fold until folded cover is laying across center bow.

(2) *Installation.* Unfold cover and secure in place with lashing ropes.

(3) *Positioning top cover for ventilation.* Untie all top cover lashing ropes. Roll up sides as shown in figure 185, or preferably fold each side *under* three folds. Straps on bows may then be fastened to buckles on top cover.

b. TOP BOWS. Each bow consists of a wood center section, two wood stakes, two steel corner section assemblies, and two top

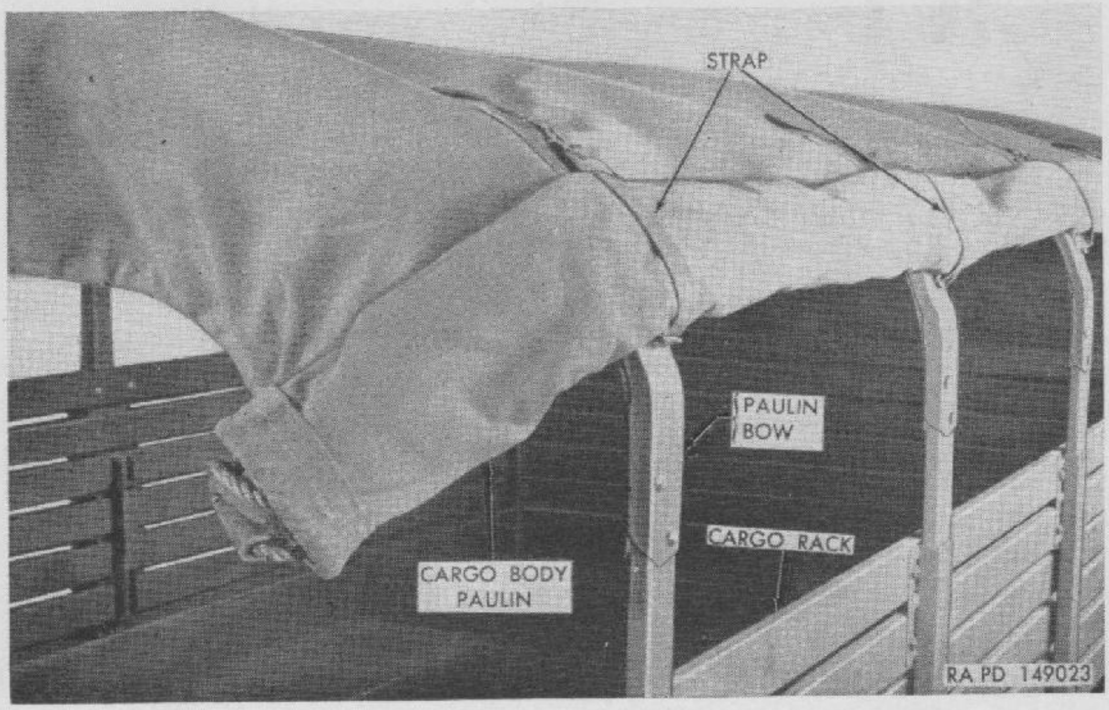


Figure 185. Positioning body paulin.

cover straps. Parts are attached together by means of screws and nuts, and are easily disassembled, when required. All bows are not interchangeable, front and rear bows having longer stakes than intermediate bows.

(1) *Replacement.* Top bows are easily removed by lifting straight up to disengage wood stakes from pockets in stake racks. End curtains must be removed and top cover rolled back to remove front or rear top bows. Top cover must be removed to permit removal of intermediate bows.

(2) *Stowage.* Tow bows, top cover, and end curtains may be stowed, when use of that equipment hampers loading or unloading activities, or the carrying of bulky cargo. Remove rear end curtain and lash curtain against front end curtain to front top bow. Untie lashing ropes from sides and rear of top cover; then, starting at rear, roll top cover forward to front bow. Form cover to bow in shape of an inverted "U." Remove rear and intermediate bows and position bows to top cover and front bow. Lash bows and cover to front bow and to hooks on front sides of body.

283. Racks, Seats, and Tail Gate

a. DESCRIPTION. Cargo racks consist of left and right side racks, incorporating full-length troop seats, and a front rack. Rack stakes fit into pockets at sides and front of body to provide a firm support for racks. A latch at each end of seat section holds seat in folded position as part of rack. When lock plates are released, seats fold down and are supported on hinged legs. Tail gate is hinged to rear of body and incorporates step for use when entering or leaving the body. Step is hinged to inner side of tail gate and is accessible when tailgate is down. Step is unlatched by pulling latching lever at left side of tail gate.

b. CARGO RACK REMOVAL. Cargo racks can be removed without necessity of first removing troop seats.

(1) *Remove troop seats only.* Remove cotter pins and hinge pins from all five hinges attaching each seat to rack stakes. Release lock plates, disengage hinges, and lift troop seat from body.

(2) *Remove front cargo rack.* Paulins and bows must be removed before attempting to remove any of the cargo racks. Lift straight up on front rack, while standing inside body. When rack stakes are clear of front stake pockets, remove rack from body.

(3) *Remove side cargo racks.* Remove front cargo rack ((2) above). Lift each rack straight up to free ends of stakes from pockets at sides of body. Remove racks from vehicle.

c. CARGO RACK INSTALLATION.

(1) *Install side cargo racks.* Position each rack on body with longitudinal slats on inner side of stakes. Engage stakes in pockets and push down on rack until hinge brackets fit down against body side.

(2) *Install front cargo rack.* Position front rack on body and fit rack stakes into front stake pockets. Push down on rack, making sure lock pin at each end of rack engages eye in each side rack.

(3) *Install troop seats only.* Position troop seats on side rack hinge brackets and aline hinge holes with drifts. Install hinge pin and cotter pin in each of five hinges for each troop seat. Fold seat up against side rack and fasten in place with seat latch at each end.

d. TAIL GATE REMOVAL. Unhook tail gate chains and swing tail gate down. Remove cotter pin and flat washer from one end of each hinge shaft. While supporting tail gate, remove four hinge shafts and remove tail gate from body.

e. TAIL GATE INSTALLATION. Position tail gate to body and aline hinges. Install four hinge shafts through hinges and secure with flat washer and cotter pin at each end of each shaft. Swing tail gate up into closed position and hook chains.

Section XXXIV. WINCH AND CONTROLS

284. Description and Data

a. DESCRIPTION. A worm-geared, jaw-clutch, drum winch assembly is mounted at the front of truck on support brackets attached to frame-side-rail extensions (fig. 186). Winch is operated through drive shaft by power-take-off mounted on left side of transfer. The power-take-off is engaged and disengaged to operate winch by a manually operated lever in cab (par. 45). Winch is equipped with a drum clutch lever and drum lock knob (fig. 186). For operation of winch refer to chapter 2, section IV. An automatic safety brake on the worm shaft of the winch sustains the load while power-take-off lever is being positioned. Winch is also equipped with a drag brake which prevents drum from overrunning the cable when cable is pulled from which drum.

b. POWER-TAKE-OFF. Refer to section XIX of this chapter for maintenance information on power-take-off and operating linkage.

c. DATA.

Make	Gar Wood
Model	CA514
Type	horizontal Drum
Drive	drive shaft from power-take-off
Capacity	10,000 lb
Wire rope	200 ft ½ in dia

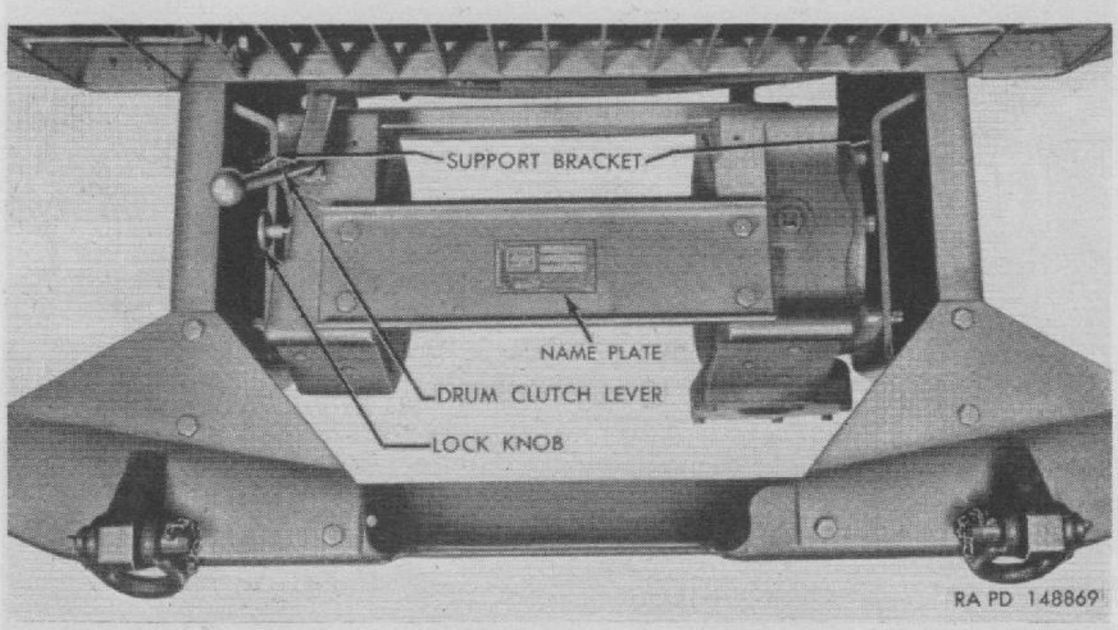


Figure 186. Winch installed (bumper in place).

285. Shear Pin

a. GENERAL. Shear pin is inserted through winch worm shaft and front universal joint yoke (fig. 187). Pin will shear whenever winch is overloaded.

b. SHEAR PIN REMOVAL. Loosen set screw in stop or safety collar (fig. 187), and slide collar toward rear. Pull universal joint toward rear until shear pin is exposed. Drive out broken shear pin.

c. SHEAR PIN INSTALLATION (fig. 187).

Caution: Do not use rivets, bolts, or other pins as substitutes for the standard shear pin. The standard shear pin is designed to shear before damage can occur to winch because of overload.

(1) Position universal joint yoke over winch shaft to aline pin hole in yoke and shaft.

(2) Dip new shear pin in lubricant (par. 57); then insert pin through universal joint yoke and winch shaft. Install and bend cotter pin at each end of shear pin.

(3) Move stop or safety collar toward universal point until 3/8 inch exists between collar and universal joint yoke (fig. 187). Tighten collar set screw firmly.

Note. This adjustment is important to prevent universal joint backing off winch shaft when shear pin is broken.

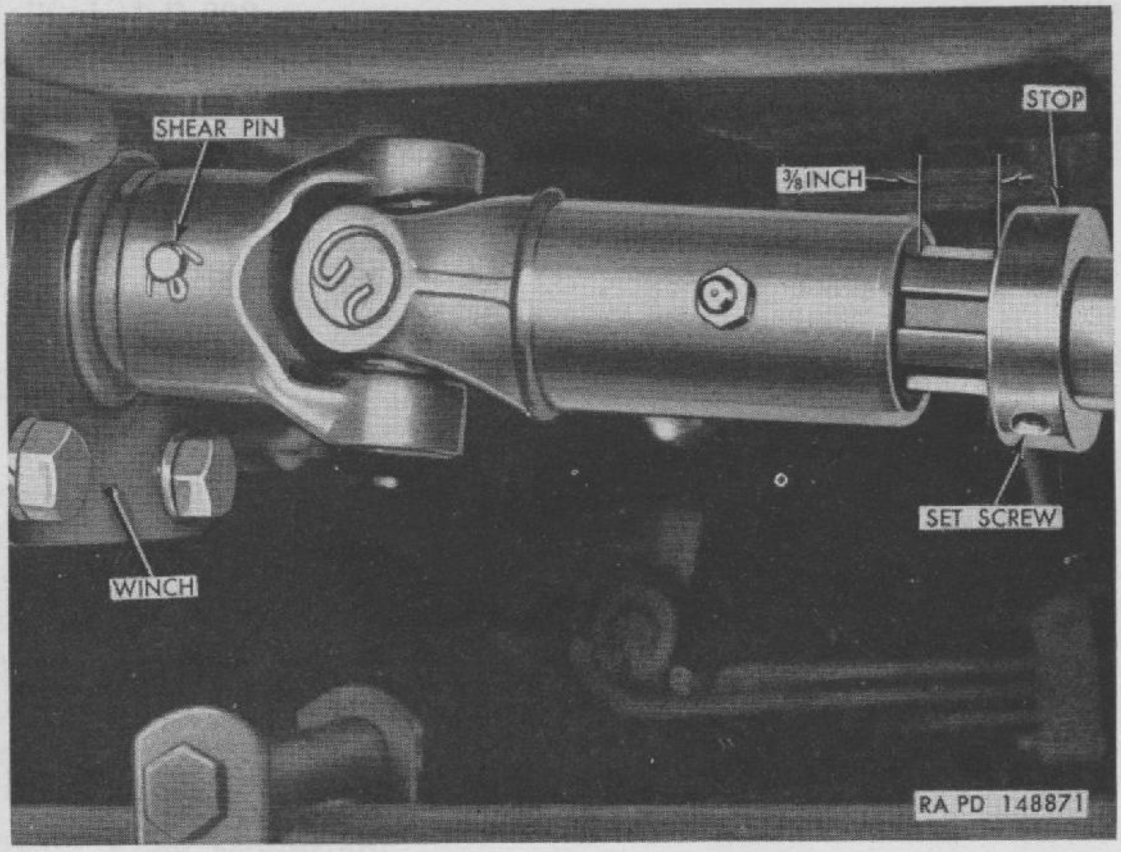


Figure 187. Shear pin installed.

286. Tests and Adjustments

a. ADJUSTMENT TESTS.

(1) *Operation of winch.* Refer to chapter 2, section IV for winch operating instructions before attempting adjustment checks.

(2) *Drag brake test.* At winch, push drum clutch lever in toward winch to disengaged position and release lock knob (par. 45). Start pulling cable off drum. Drum should cease to revolve as soon as cable pull is stopped. If drum overruns cable, then drag brake requires adjustment (*b* below).

(3) *Automatic brake test.* The most convenient method of testing automatic brake is to tow another vehicle up grade with the winch (par. 46 *b*). Tow vehicle up grade part way, release accelerator, and shift power-take-off

lever into "NEUTRAL." Vehicle being pulled by winch should not roll backward. If winch will not hold vehicle, adjust automatic brake (*c* below).

b. DRAG BRAKE ADJUSTMENT (fig. 188). Turn slotted adjusting screw with offset screwdriver. Screw is located at right side of winch. Turn screw clockwise about one-half turn to tighten drag brake. Test adjustment (*a* (2) above).

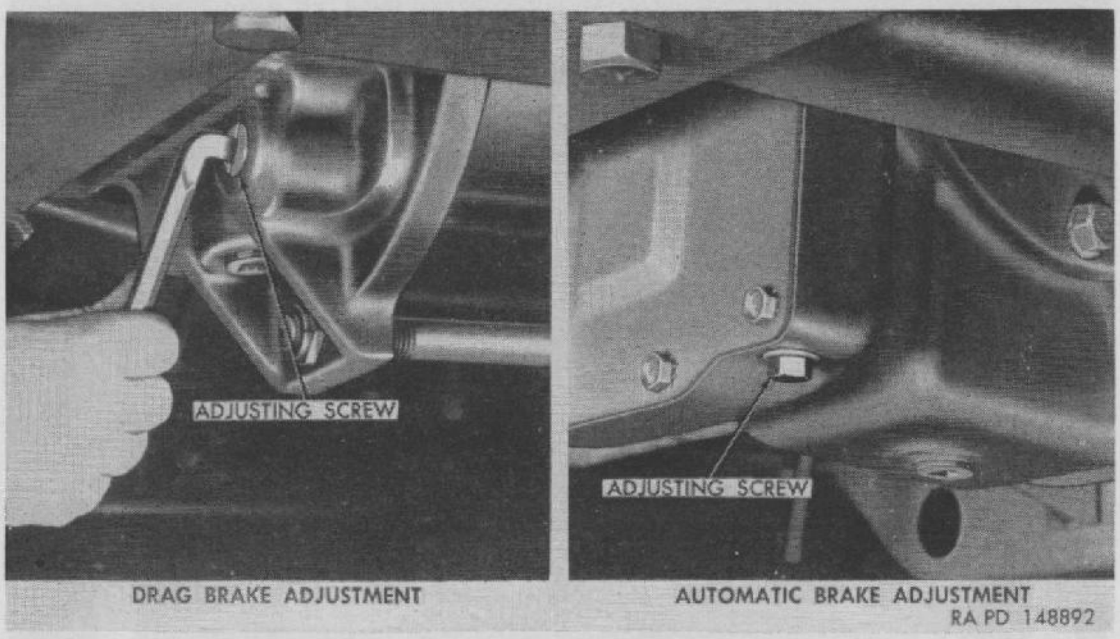


Figure 188. Winch adjustments.

c. AUTOMATIC BRAKE ADJUSTMENT (fig. 188). Adjusting bolt head is located on under side of worm housing at left side. Increase tension of brake by turning adjusting bolt clockwise only one-half turn; test adjustment (*a* (3) above.

Caution: If, after adjustment and using for several minutes, hand cannot be held on brake cover because of heat, loosen adjusting bolt about one-half turn and test again. When brake is correctly adjusted, brake may become warm during use but not too hot to allow hand to be held on brake band cover.

287. Automatic Brake Band

a. BRAKE BAND REMOVAL.

(1) Remove front bumper (par. 265*a*).

(2) Remove six cap screws and lock washers which attach cover to case.

(3) Remove adjusting screw, washer, and brake spring (fig. 189). Pull brake band from brake disk.

b. BRAKE BAND INSTALLATION.

(1) Position brake band on disk. Place washer on adjusting screw; then start screw through case. Position brake spring between case and lower leg of band (fig. 189); then insert screw through spring and both legs of band. Compress upper part of band with pry bar until screw engages nut.

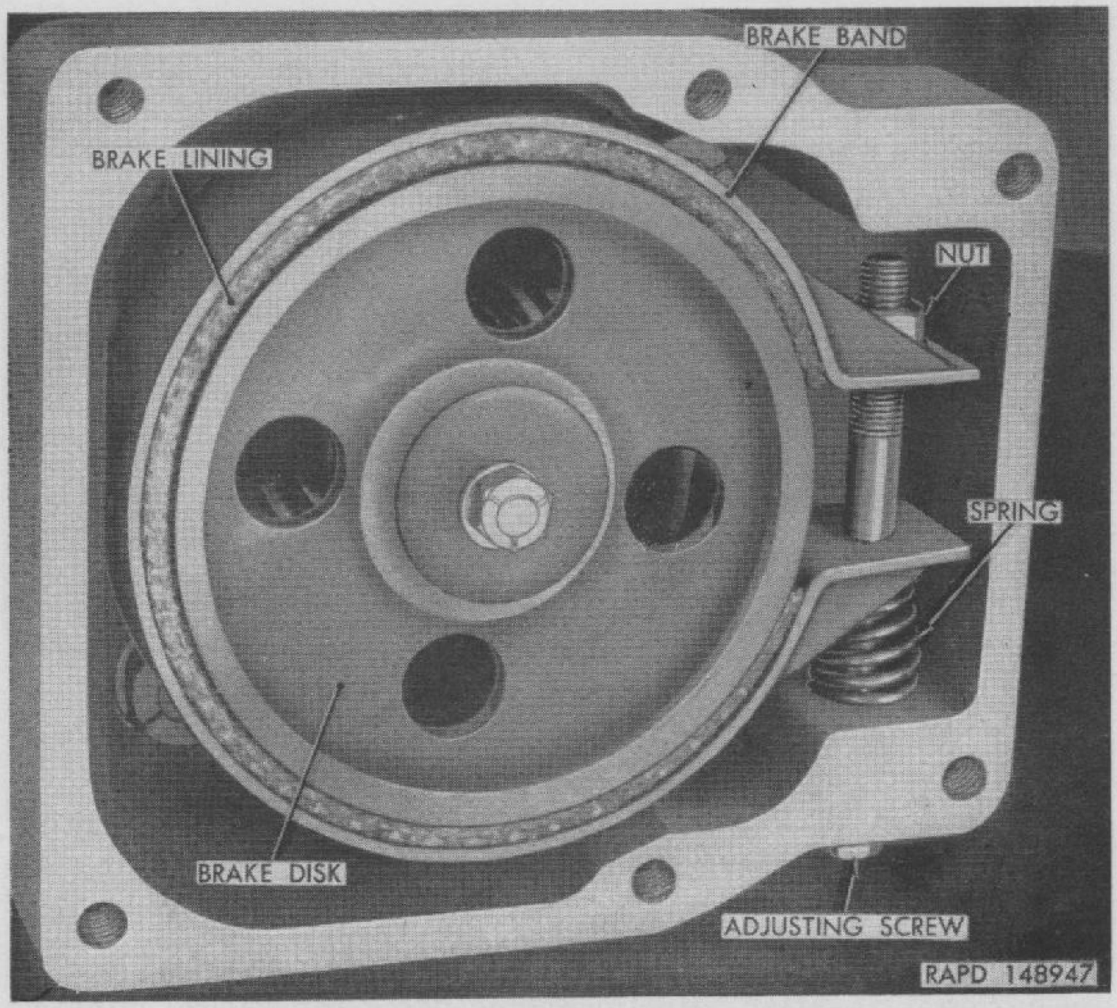


Figure 189. Automatic brake band installed.

(2) Install cover on case, using new gasket. Tighten the six attaching cap screws firmly.

(3) Adjust automatic brake as explained in paragraph 286*c*.

(4) Install front bumper (par. 265*a*).

288. Drive Shafts and Universal Joints

a. DESCRIPTION (fig. 190). The winch is driven from power-take-off with two drive shafts and three universal joints. The universal joint used at front is attached to winch worm shaft with a shear pin and to forward end of front drive shaft by splines

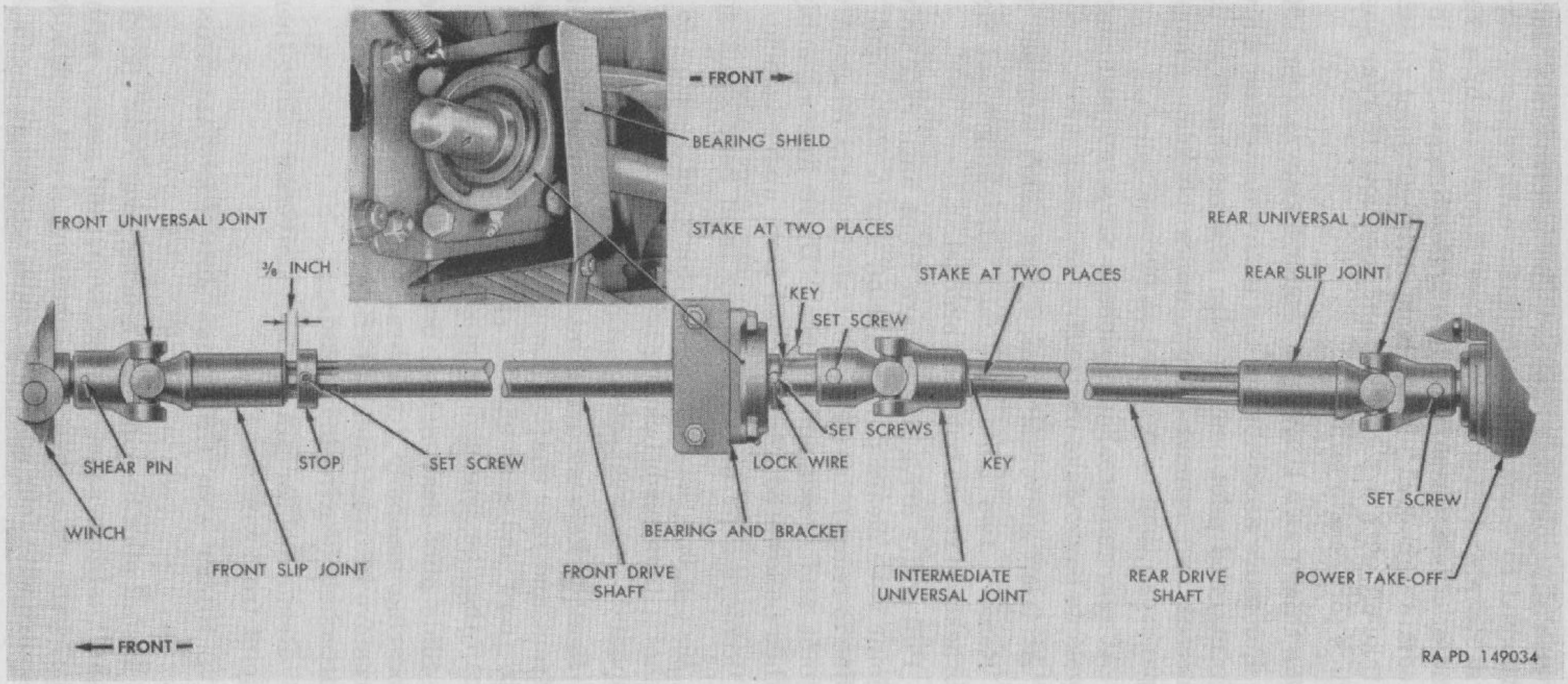


Figure 190. Winch drive shaft and universal joint arrangement.

which form a slip joint (fig. 187). The intermediate universal joint is attached to front and rear shafts with tapered keys and set screws. Rear end of front shaft is supported in a support bracket and pilot bearing mounted on frame bracket just in front of intermediate universal joint. Rear universal joint is attached to power-take-off with a set screw and key, and to rear shaft by splines which form a slip joint.

b. DRIVE SHAFT AND UNIVERSAL JOINT REMOVAL (fig. 190).

(1) For more accessibility, the entire drive line, universal joints, and pilot bearing with bracket should be disconnected and removed from under vehicle. Component parts can then be removed as necessary.

(2) At rear universal joint, loosen set screw securing joint yoke to power-take-off shaft.

(3) At front universal joint, loosen shaft stop set screw.

(4) Remove two bolts and nuts attaching pilot bearing bracket to frame trunnion bracket.

(5) Pull entire drive line toward front until rear universal joint yoke clears power-take-off shaft. Then pull drive line to rear until end of front shaft clears front universal joint and crossmember hole. Drive line assembly can then be lowered and removed from under vehicle.

(6) Remove rear universal joint from rear shaft splines.

(7) Loosen two set screws securing pilot bearing to front shaft; then push bearing and bracket away from intermediate universal joint.

(8) Remove keys securing intermediate universal joint to front and rear shafts. Loosen set screws securing joint to front and rear shafts. Intermediate universal joint can then be removed from shaft.

(9) Slide pilot bearing and bracket off shaft. To remove bearing assembly from bracket, remove four nuts and remove bearing shield; then remove four additional nuts attaching bearing to bracket.

(10) Remove shear pin at front universal joint; then pull joint from winch shaft.

c. DRIVE SHAFT AND UNIVERSAL JOINT INSTALLATION (fig. 190).

(1) Install pilot bearing and bracket over rear end of front shaft with bracket toward front and secure with four bolts and nuts; then install bearing shield over bolts and secure with four additional nuts.

(2) Install intermediate universal joint to ends of front and rear drive shafts. Aline set screw holes in universal joints with depressions in shafts; then install and tighten set screws. Drive keys in firmly; then, again tighten set screw in each joint. Stake shaft at outer end of each key at two places. Also stake yokes at set screws.

(3) Install rear universal joint over splines of rear shaft.

(4) Install front universal joint over winch worm shaft and install shear pin through joint yoke and shaft. Install and bend cotter pin at each end of shear pin.

(5) Guide front end of front shaft through crossmember hole; then position stop on shaft. Insert front shaft into splines of front universal joint.

(6) Push entire drive line assembly toward front until rear universal joint can be installed on power-take-off shaft, alining key in shaft and universal joint yoke. Tighten set screw which secures joint yoke to power-take-off shaft.

(7) Position pilot bearing bracket against frame trunion bracket; then install two attaching bolts and nuts. Tighten nuts to 48–64 pound-feet torque.

(8) Tighten two pilot bearing set screws firmly, and install lock wire through heads of set screws.

(9) Position stop at front universal joint until $\frac{3}{8}$ inch exists between collar and universal joint yoke (fig. 187). Tighten set screw firmly.

289. Winch Removal

a. Remove front bumper (par. 265*a*).

b. Support winch assembly with chain hoist.

Note. Winch should be removed with front universal joint attached to winch shaft, as splined end of joint will slide off shaft splines as winch is being removed.

c. Remove four bolts and nuts which attach each winch support bracket at right and left sides (fig. 191). Do not remove spacer-to-frame bolt at each side.

d. While supporting winch with hoist, pull winch with support brackets attached, toward front and out of frame side member channels. Support brackets can then be removed from winch by removing six bolts and lock washers at each side.

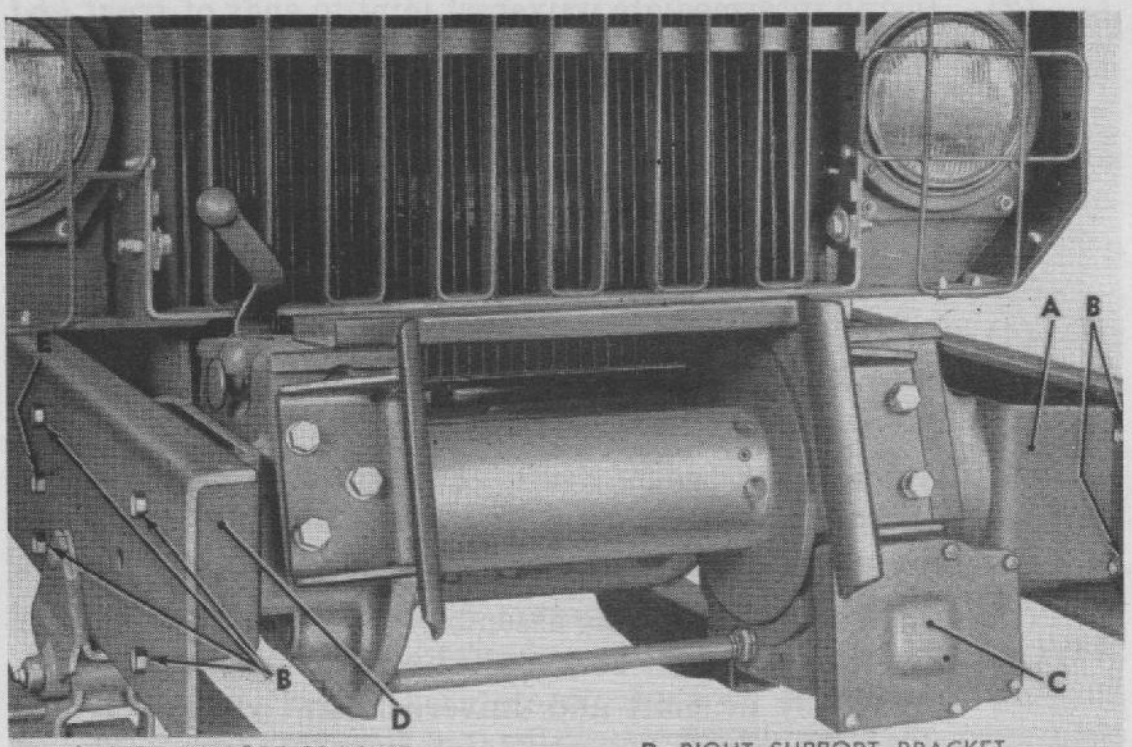


Figure 191. Winch installed (bumper removed).

290. Winch Installation

a. Install right and left support brackets to winch using special bolts. The right bolts are 2 7/32 inches long. The left bolts are 3 3/16 inches long. With lock washers under each bolt, tighten bolts to 60–85 pound-feet torque.

b. Reinstall front universal joint to winch shaft and insert shear pin with cotter pin at each end of pin.

c. Supporting winch with chain hoist, guide winch with support brackets attached between frame side member channels (fig. 191). As winch is pushed toward rear, guide front universal joint splines onto front drive shaft splines.

d. Position support brackets in place in frame. Install four bracket-to-frame bolts and nuts. Tighten bolt nuts to 95–127 pound-feet torque.

e. Check position of stop (fig. 187) and tighten stop set screw firmly.

f. Install front bumper (par. 265*a*).

Section XXXV. MAINTENANCE UNDER UNUSUAL CONDITIONS

291. Extreme-Cold Weather Maintenance Problems

a. The importance of maintenance must be impressed on all concerned, with special emphasis on organizational (preventive) maintenance. Maintenance of mechanical equipment in extreme cold is exceptionally difficult in the field. Even shop maintenance cannot be completed with normal speed because the equipment must be allowed to thaw out and warm up before the mechanic can make satisfactory repairs. In the field, maintenance must be undertaken under the most difficult of conditions. Bare hands stick to cold metal. Fuel in contact with the hands results in super-cooling due to evaporation, and the hands can be painfully frozen in a matter of minutes. Engine oils, except subzero grade, are unpourable at temperatures below $-40°$ F. Ordinary greases become as solid as cold butter.

b. These difficulties increase the time required to perform maintenance. At temperatures below $-40°$ F, maintenance requires up to five times the normal amount of time. The time required to warm up a vehicle so that it is operable at temperatures as low as $-50°$ F may approach two hours. Vehicles in poor mechanical condition probably will not start at all, or only after many hours of laborious maintenance and heating. Complete winterization, diligent maintenance, and well-trained crews are the key to efficient arctic-winter operations.

c. Refer to TM 9-2855 and TB ORD 193 for general information on extreme-cold weather maintenance procedures.

d. Refer to SB 9-16 for information on winterization kit for this vehicle.

292. Extreme-Cold Weather Maintenance

Refer to TM 9-2855 for a general discussion of maintenance problems, the application of antifreeze compounds and arctic type lubrication, handling of storage batteries in extreme cold, and dewinterization procedure.

293. Extreme-Hot Weather Maintenance

a. COOLING SYSTEM. Thoroughly clean and flush the cooling system (par. 128) at frequent intervals and keep system filled with clean water when operating in extremely high temperatures. Formation of scale and rust in the cooling system occurs more often during operation in extremely high temperatures; therefore, corrosion inhibitor compound should always be added to the cooling liquid. Avoid the use of water that contains alkali or other substances which may cause scale and rust formations. Use soft water whenever possible.

b. BATTERIES.

(1) *Electrolyte level.* In torrid zones, check level of electrolyte in cells daily and replenish, if necessary, with pure distilled water. If this is not available, rain or drinking water may be used. However, continuous use of water with high mineral content will eventually cause damage to batteries and should be avoided.

(2) *Specific gravity.* Batteries operating in torrid climates should have a weaker electrolyte than for temperate climates. Instead of 1.280 specific gravity as issued, the electrolyte (sulphuric acid, sp. gr. 1.280) should be diluted to 1.200 to 1.240 specific gravity (TM 9-2857). This is correct reading for a fully charged battery. This procedure will prolong the life of the negative plates and separators. Under this condition, a discharged battery should be recharged at about 1.160 specific gravity.

(3) *Self-discharge.* A battery will self-discharge at a greater rate at high temperatures if standing for long periods. This must be considered when operating in torrid zones. If necessary to park for several days, remove batteries and store in a cool place.

Note. Do not store acid-type storage batteries near stacks of tires, as the acid fumes have a harmful effect on rubber.

c. CHASSIS AND BODY.

(1) In hot, dry climates, a careful watch must be kept for evidence of the presence of moths and termites.

(2) In hot damp climates, corrosive action will occur on all parts of the vehicle and will be accelerated during the rainy season. Evidence will appear in the form of rust and paint blisters on metal surfaces and mildew, mold, or fungus growth on fabrics, leather, and glass.

(3) Protect exterior surfaces from corrosion by touch-up painting and keep a film of engine lubricating oil (OE-10) on unfinished exposed metal surfaces. Cables and terminals should be protected by ignition insulation compound.

(4) Make frequent inspections of idle, inactive vehicles. Remove corrosion from exterior metal surfaces with abrasive paper or cloth and apply a protective coating of paint, oil, or suitable rust preventive.

294. Maintenance After Fording

a. GENERAL. Although the vehicle unit housings are sealed to prevent the free flow of water into the housings, it must be realized that, due to the necessary design of these assemblies, some water may enter, especially during submersion. The following services should be accomplished on all vehicles which have been exposed to some depth of water or completely submerged, especially in salt water. Precautions should be taken as soon as practicable to halt deterioration and avoid damage before the vehicle is driven extensively in regular service.

b. BODY AND CHASSIS. Drain and clean out body, engine, and tool compartment. Clean all exposed surfaces and touch up paint where necessary. Coat unpainted metal parts with engine lubricating oil (OE–10). Lubricate the chassis thoroughly as directed in the lubrication order. Do more than the usual lubrication job, making sure the lubricant is forced into each lubrication point to force out any water present.

c. ENGINE, TRANSMISSION, TRANSFER, AND AXLES. Check the lubricant in the engine, transmission, and final drives (par. 59). Should there be evidence that water has entered, drain, flush, and refill with the correct lubricant. Remove and clean engine oil filter (par. 59*c*).

d. WHEELS AND BRAKES. Remove the front wheels and hubs (pra. 245*a*) and flush out the knuckle housings with a half-and-half mixture of oil (OE–10) and dry-cleaning solvent or volatile-mineral-spirits paint thinner. Refill to filler plug level with correct lubricant (par. 57). Remove rear wheels and hubs (par. 246*a*). Wash all wheel bearings thoroughly with dry-cleaning solvent or volatile-mineral-spirits paint thinner, after which repack, assemble, and adjust. While the wheels are removed, dry out brake linings and clean rust and scum from brake drum face. Check brake system for presence of water.

e. BATTERIES. Check the batteries for quantity and specific gravity of electrolyte to be sure no water entered through the vent caps. This is of special importance should the vehicle have been submerged in salt water.

f. STEERING GEAR. Remove and disassemble steering gear. If the lubricant is contaminated, clean the housing thoroughly with a half-and-half mixture of oil (OE–10) and dry-cleaning solvent or volatile-mineral-spirits paint thinner. Assemble, refill with correct grade of lubricant, and adjust (par. 248).

g. ELECTRICAL CONNECTIONS. Check all electrical connections for corrosion, particularly the bayonet-type connectors.

h. FUEL SYSTEM. Drain fuel tanks of any accumulated water, clean fuel strainer and lines as necessary. If water is found in the air cleaner, clean and refill with oil (par. 59*e*).

i. DISTRIBUTOR. Remove the distributor cap and check to see if any water has entered the distributor. If water is present, drain, clean, and lubricate the distributor as required.

j. CONDENSATION. Although most units are sealed, the sudden cooling of the warm interior air upon submersion may cause condensation of moisture within the cases or instruments. A period of exposure to warm air after fording should eliminate this condition. Cases which can be opened may be uncovered and dried.

k. ALUMINUM OR MAGNESIUM PARTS. If vehicle remains in salt water for any appreciable length of time, aluminum or magnesium parts which were exposed to the water will probably be unfit for further use and must be replaced.

l. DEEP-WATER FORDING. Refer to TM 9-2853 for deep-water fording kit information.

295. Maintenance After Operation on Unusual Terrain

a. MUD. Thorough cleaning and lubrication of all parts affected must be accomplished as soon as possible after operation in mud, particularly when a sea of liquid mud has been traversed. Clean radiator fins and interior of engine compartment. Repack wheel bearings if necessary, clean, oil, and stow the chains in vehicle.

b. SAND OR DUST. Clean engine and engine compartment. Touch up all painted surfaces damaged by sandblasting. Lubricate completely to force out lubricants contaminated by sand or dust. Air cleaners, fuel and oil filters must be cleaned at least daily. Engine grilles and other exposed vents should be covered with cloth at all times.

CHAPTER 4

SHIPMENT AND LIMITED STORAGE AND DESTRUCTION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

296. Domestic Shipping Instructions

a. PREPARATION FOR SHIPMENT IN CONTINENTAL UNITED STATES. When shipping the 2½-ton, 6 x 6 cargo truck M135 interstate or within the continental United States, except directly to ports of embarkation, the officer in charge of preparing the shipment will be responsible for furnishing vehicles to the carriers for transport in a serviceable condition, properly cleaned, preserved, painted, lubricated as prescribed in SB 9–4.

Note. For loading and blocking instructions of vehicles on freight cars, refer to paragraphs 298 and 299.

b. PREPARATION FOR SHIPMENT TO PORTS.

(1) *Inspection.* All used vehicles destined for oversea use will be inspected prior to shipment in accordance with TB ORD 385.

(2) *Processing for shipment to ports.* All vehicles destined to ports of embarkation for oversea shipment will be further processed in accordance with SB 9–4.

Note. Ports of embarkation will supplement any necessary or previously omitted processing upon receipt of vehicle.

c. REMOVAL OF PRESERVATIVES FOR SHIPMENT. Personnel withdrawing vehicles from a limited storage status for domestic shipment must not remove preservatives, other than to insure that the matériels is complete and serviceable. If it has been determined that preservatives have been removed, they must be restored prior to domestic shipment. The removal of preservatives is the responsibility of depots, ports, or field installations (posts, camps, and stations) receiving the shipments.

d. ARMY SHIPPING DOCUMENTS. Prepare all Army shipping documents accompanying freight in accordance with TM 38–705.

297. Limited Storage Instructions

a. GENERAL.

(1) Vehicles received for storage already processed for domestic shipment, as indicated on the vehicle processing record tag (DA AGO Form 9-3), must not be reprocessed unless the inspection performed on receipt of vehicles reveals corrosion, deterioration, etc.

(2) Completely process vehicle upon receipt directly from manufacturing facilities, or if the processing data recorded on the tag indicates that vehicle has been rendered ineffective by operation or freight shipping damage.

(3) Vehicle to be prepared for limited storage must be given a limited technical inspection and be processed as prescribed in SB 9-63. The results and classification of vehicle will be entered on DA AGO Form 461-5.

b. RECEIVING INSPECTIONS.

(1) Report of vehicles received for storage in a damaged condition or improperly prepared for shipment will be reported on DD Form 6 in accordance with SR 745-45-5. Report of vehicles received in an unsatisfactory condition (chronic failure or malfunction of the vehicle or equipment) will be reported on the unsatisfactory equipment report DA AGO Form 468 in accordance with SR 700-45-5.

(2) When vehicles are inactivated, they are to be placed in a limited storage status for periods not to exceed 90 days. Stand-by storage for periods in excess of 90 days will normally be handled by ordnance maintenance personnel only.

(3) Immediately upon receipt of vehicles for storage, they must be inspected and serviced as prescribed in chapter 2, section I. Perform a systematic inspection and replace or repair all missing or broken parts. If repairs are beyond the scope of the unit and the vehicles will be inactivated for an appreciable length of time, place them in a limited storage status and attach tags to them specifying the repairs needed. The reports of these conditions will be submitted by the unit commander for action by an ordnance maintenance unit.

c. INSPECTIONS DURING STORAGE. Perform a visual inspection periodically to determine general condition. If corrosion is found on any part, remove the rust spots, clean, paint, and treat with the prescribed preservatives.

Note. Touch-up painting will be in accordance with TM 9-2851.

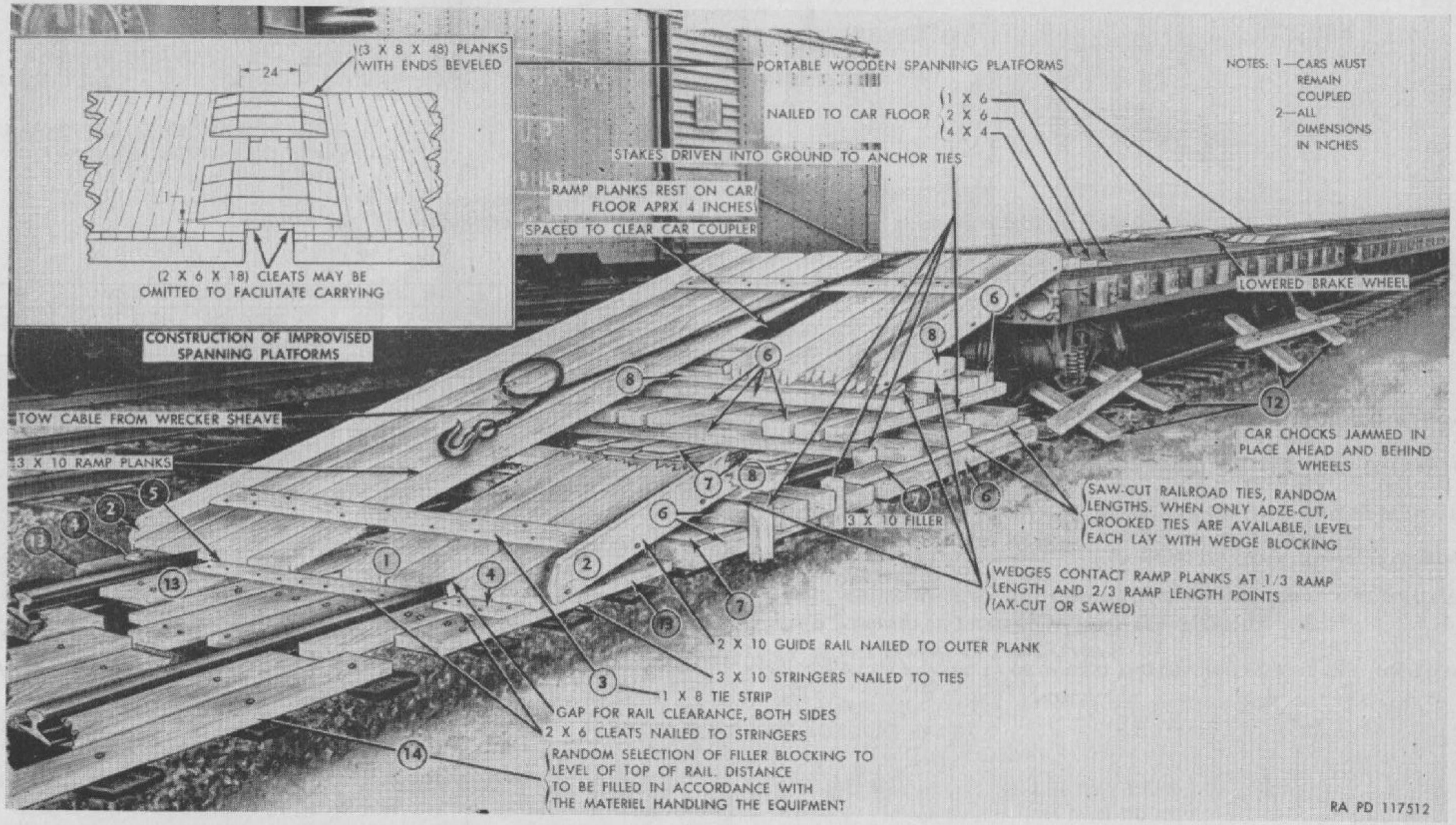


Figure 192. Construction of improvised loading ramp and spanning platforms.

BILL OF MATERIALS FOR RAMP AS ILLUSTRATED					
PART NO	QUANT REQ'D	PART NAME	LENGTH	WIDTH	THICKNESS
1	8	RAMP PLANKS	20 ft	10 in	3 in
2	2	GUIDE RAILS	20 ft	8 in	2 in
3	2	TIE STRIPS	8 ft	8 in	1 in
4	2	CLEATS	18 in	6 in	2 in
5	1	CLEAT	56 in	6 in	2 in
6	31	RAILROAD TIES	8 ft	8 in	8 in
7	AS REQD	FILLERS	AS REQD	10 in	3 in
8	AS REQD	WEDGES (CUT TO FIT)	8 ft	—	—
9	1	STEPDOWN PIECE	8 ft	4 in	4 in
10	1	STEPDOWN PIECE	8 ft	6 in	2 in
11	1	STEPDOWN PIECE	8 ft	6 in	1 in
12	4	CHOCK BLOCKS	AS REQD	4 in	4 in
13	AS REQD	STRINGERS	AS REQD	10 in	3 in
14	AS REQD	GROUND DUNNAGE	AS REQD		

NOTES:

1. RAMP SHOWN IS OF CAPACITY OF LARGEST END-LOADING FREIGHT CAR FOR LESSER LOADS, REDUCE NUMBER OF RAMP PLANKS.
2. WIDTH DETERMINED BY TREAD OF MATERIEL BEING LOADED.
3. FOR LOADING TWO WHEELED ARTILLERY TRAILERS, OR SHORT WHEELBASE MATERIEL, RAMP PLANKS MAY BE SHORTER.

CAUTION: WHEN RAMP IS TOO SHORT, UNDERPINNING OF MATERIEL WILL STRIKE END OF RAMP (EX: 90 MM AA GUN).

4. OPENING AT CENTER MAY BE FILLED UP TO THE CAR COUPLER TO AVOID INJURY TO MANEUVERING PERSONNEL.
5. FOR LOADS OVER 40-TONS, APPROACH END OF FLATCAR MUST BE BLOCKED UP TO AVOID TIPPING OF FLATCAR.
6. THIS TYPE RAMP IS ADAPTABLE TO DROP-END GONDOLA AND AUTO END-DOOR BOX CAR LOADING.
7. WHEN LOADING AN AUTO END-DOOR BOX CAR, IT MAY BE NECESSARY TO LOAD A FLATCAR COUPLED TO THE BOX CAR, TO GAIN OVERHEAD LOADING CLEARANCE.
8. WHEN LOADING BY WRECKER CABLE, WITH PULL AT 90-DEGREES TO TRAIN, USING A SHEAVE, FLATCAR AT POINT OF PULL MUST BE LASHED TO ADJACENT RAILS, CARS, OR OTHER FIXED OBJECT.

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Figure 193. Construction of improvised loading ramp and spanning platforms—legend.

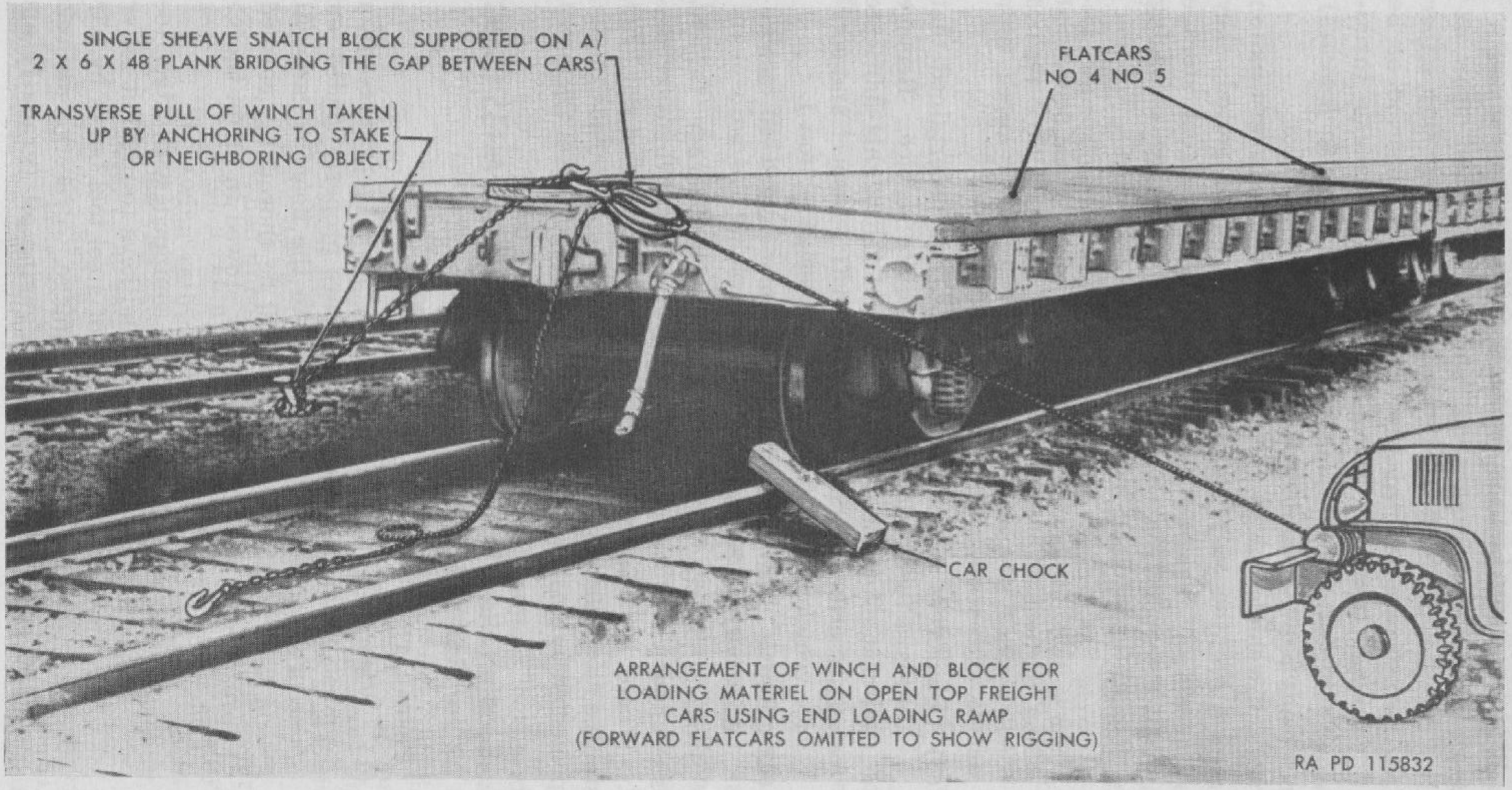


Figure 194. Method of powering the towing cable.

d. REMOVAL FROM LIMITED STORAGE.

(1) If the vehicles are not shipped or issued upon expiration of the limited storage period, they may either be processed for another limited storage period or be further treated for stand-by storage (vehicles inactivated for period in excess of 90 days up to 3 years) by ordnance maintenance personnel.

(2) If vehicles to be shipped will reach their destination within the scope of the limited storage period, they need not be reprocessed upon removal from storage unless inspection reveals it to be necessary according to anticipated in-transit weather conditions.

Note. All matériel being reissued through the depot supply system to troops within the continental limits of the United States must meet the requirements of TB ORD 385. This is NOT required for so-called reissues, exchanges or redistribution among troop units, where the depot supply system is not involved.

(3) Deprocess vehicles when it has been ascertained that they are to be placed into immediate service. Remove all rust preventive compounds and thoroughly lubricate as prescribed in chapter 3, section II. Inspect and service vehicles as prescribed in chapter 2, section I.

(4) Repair and/or replace all items tagged in accordance with *b* (3) above.

e. STORAGE SITE. The preferred type of storage for vehicles is under cover in open sheds or warehouses whenever possible. Where it is found necessary to store vehicles outdoors, the storage site must be selected in accordance with AR 700–105 and protected against the elements as prescribed in TB ORD 379.

298. Loading the 2 1/2-Ton 6 x 6 Cargo Truck M135 (GMC) for Rail Shipment

a. PREPARATION.

(1) When vehicles are shipped by rail, every precaution must be taken to see that they are properly loaded and securely fastened and blocked to the floor of car. All on vehicle matériel (OVM) will be thoroughly cleaned, preserved, packed, and securely stowed in or on the vehicle for transit.

Caution: If matériel is equipped with steel tool boxes, remove all padlocks and keys to prevent pilferage in transit. Secure lids of steel tool boxes by wiring the hasp to prevent damage. Preserve padlocks and keys with preservative engine oil (grade I) and wrap in grease-proof barrier-material for domestic shipment. For oversea shipment seal in a waterproof-greaseproof wrapping or bag. Locate all wrapped padlocks and keys in the shipping container with the accessories or OVM.

(2) Prepare all vehicles for rail shipment in accordance with paragraph 296*a*. In addition, take the following precautions:

(*a*) Disconnect the truck batteries to prevent their discharge by vandalism or accident. This is accomplished by disconnecting the positive leads, taping the ends, and tying them back away from the batteries.

(*b*) Apply the truck parking brake and place the transmission in neutral position after the vehicle has been finally spotted on the freight car. The vehicles must be loaded on the car in such a manner as to prevent the car from carrying an unbalanced load.

(*c*) Increase tire pressure slightly higher than normal except where shipment is to be exposed to extremely hot weather conditions.

b. TYPE OF CARS. Instructions contained herein pertain to the loading of vehicles in gondola cars (an open top car having fixed sides, fixed or drop ends, and solid bottom), and flatcars (cars with wooden floors laid over sills and without sides and ends but equipped with stake pockets).

c. METHOD OF LOADING VEHICLES ON FREIGHT CARS.

(1) *Flatcar loading.*

(*a*) When suitable hoisting equipment is not available for loading vehicles on or for subsequent unloading from a flatcar, an end ramp must be used in cases where the vehicle is not on a level with the flatcar deck. Vehicles on a warehouse platform or loading dock can be pivoted over spanning platforms aboard a flatcar adjacent to the platform, then again pivoted into lateral position on the flatcar.

(*b*) When unboxed vehicles must be loaded from ground level, a ramp may be improvised ((3) below) by borrowing railroad ties normally found stacked in railroad yards and by procuring necessary planking. An end ramp is shown in place in figure 192.

Note. Railroad ties alone, stacked without deck planking and not securely anchored, provide a very unstable ramp and must be rearranged upon each successive use. The torque action of the wheels of self-propelled vehicles will tend to collect and collapse a simple stack of railroad ties and should, therefore, not be attempted except under conditions of extreme emergency.

(*c*) To accomplish loading, the vehicle is towed onto the improvised apron at base of ramp and unhitched. Using a cable laid along the center line of the flatcar, attached to vehicle, the vehicle is pivoted to point towards the ramp. A chock behind one wheel of the vehicle will prevent undesirable rearward travel and assist pivoting.

Caution: Personnel used to assist in pivoting the vehicle into position must be careful to avoid injury by the violent side-whipping action likely to occur when strain is applied to the cable. Follow up forward movement of the vehicle by chocking behind one wheel on the ramp.

(*d*) For powering the towing cable, a vehicle with winch is spotted at *right angles* to the train. It is located at about the third or fourth flatcar to facilitate signaling and because of cable length limits. A single-sheave snatch block located between cars on the train center line will provide the necessary *lateral* pull. A vehicle passing this point can be towed by a vehicle on the ground with personnel guiding its passage. A long tow cable from the towing vehicle will lessen the tendency of the towed vehicle to stray from the center line of the train.

Note. The snatch block fastening chain must be lashed to an adjacent solidly fixed object or stake to offset the cross pull of the powered winch (fig. 194).

(*e*) After the first vehicle is loaded on the flatcar, additional vehicles may be similarly hauled aboard by passing the towing cable beneath the loaded vehicle. When a train of flatcars is being loaded, steel or wooden spanning platforms or bridges are used to cover the gap between cars. Flatcar brake wheels must first be lowered to floor level to permit passage. A pair of improvised spanning platforms are shown in the insert in figure 192. These spanning platforms are moved along the train by hand as the vehicle advances.

(*f*) The above method of train loading requires careful advance planning as to the order of loading, so that vehicles are arranged on each flatcar under prescribed methods and combinations.

(2) *Gondola car loading.*

(*a*) Fixed-end gondola cars may only be loaded when hoisting facilities are available for initial loading and for unloading at destination. Hopper- or drop-bottom gondola cars without false flooring and hoisting facilities are not to be used for shipments of unboxed vehicles.

(*b*) Drop-end gondola cars may be loaded exactly as described for flatcars ((1) above). Height of fixed sides is immaterial. Vehicles may progress through a gondola car by passing over the two inwardly-dropped ends and over spanning platforms. Vehicles selected to remain in a gondola car are first moved to the closed end of the car, then spread out for blocking after the remaining end is closed and latched.

Note. Do not block vehicle flush against ends of gondola car. When ordering gondola cars, specify inside width required as some may be received with gussets along the inner sides which affect clearance.

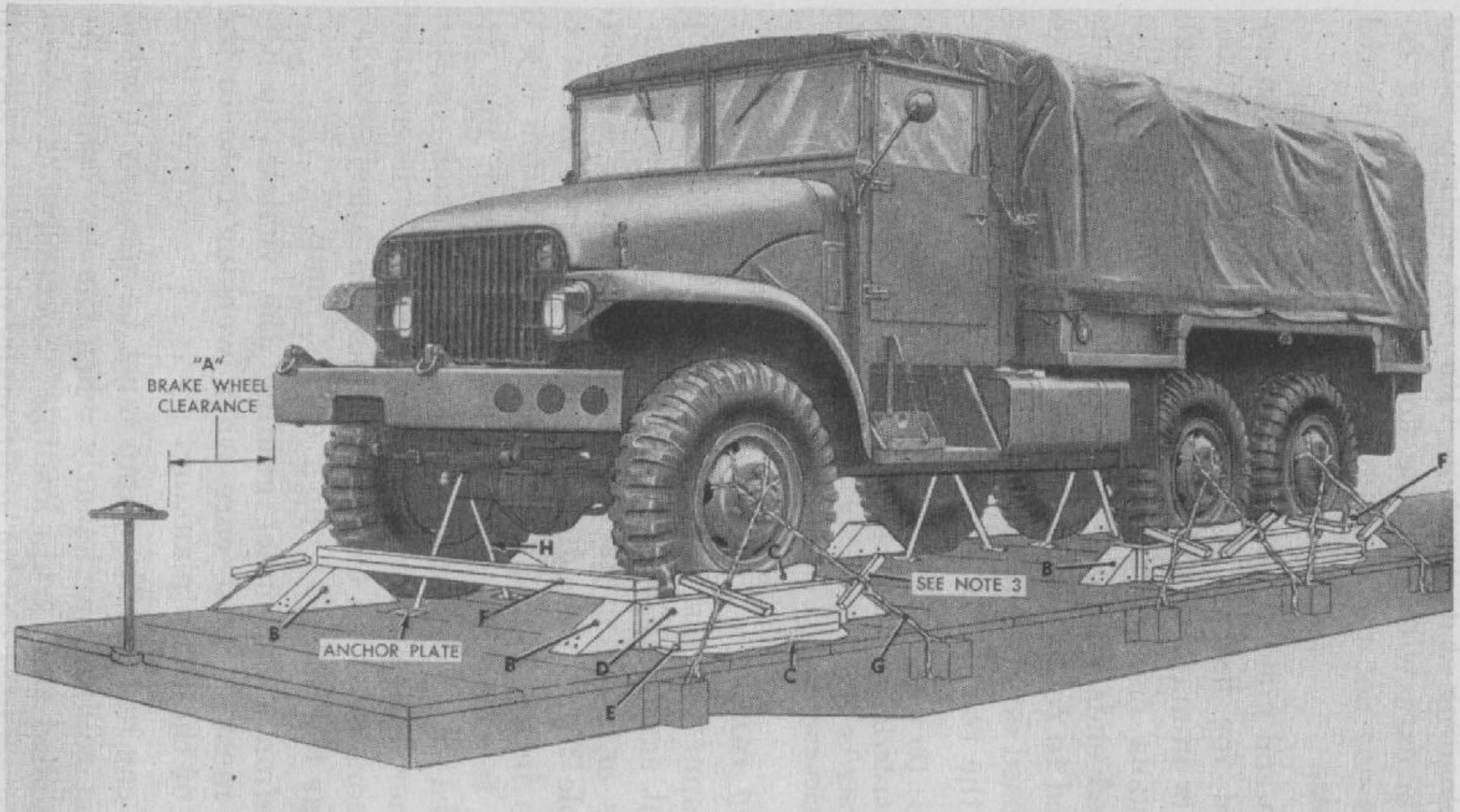
(3) *Loading ramp.*

(*a*) A ramp for end-loading of vehicles on open top freight cars may be improvised when no permanent ramps or hoisting facilities are available. A ramp suitable for the loading of most ordnance items is shown in figure 192. For loading the 2½-ton 6 x 6 cargo truck M135 the width of the ramp may be reduced to two double-plank runways, each cleated together. Length of planking must be determined with consideration to underchassis clearance, in order to clear the hump at upper end of ramp.

Caution: Personnel guiding the vehicle up the ramp must exercise care when working close to the edges of the ramp planking.

(*b*) The car bearing the ramp must be securely blocked against rolling, particularly when the car brakes are not applied as in train loading. Successive cars must remain coupled and be additionally chocked at several points along the train when ground towing of vehicles aboard the train is being affected.

(*c*) Whenever the freight cars are not on an isolated track or blocked siding, each end approach to the



NOTES: 1—THE 2-1 2-TON 6 x 6 CARGO TRUCK M135 (GMC) ILLUSTRATED HAS NOT BEEN PROCESSED FOR DOMESTIC FREIGHT SHIPMENT BUT SIMPLY ILLUSTRATES METHOD OF BLOCKING

2—ITEM REFERENCE LETTERS REFER TO DESCRIPTIONS IN TEXT

3—RANDOM LENGTH 1 x 2 INCH CLEAT LEFT IN CABLE AND NAILED WITH A SIXPENNY NAIL TO CAR FLOOR OR SECURED BY WIRING TO CABLE TO MAINTAIN TIGHTENING TOOL APERTURE FOR SUBSEQUENT TIGHTENING BY TRAIN CREW

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Figure 195. Method of blocking the 2½-ton 6 x 6 cargo truck M135 for rail shipment.

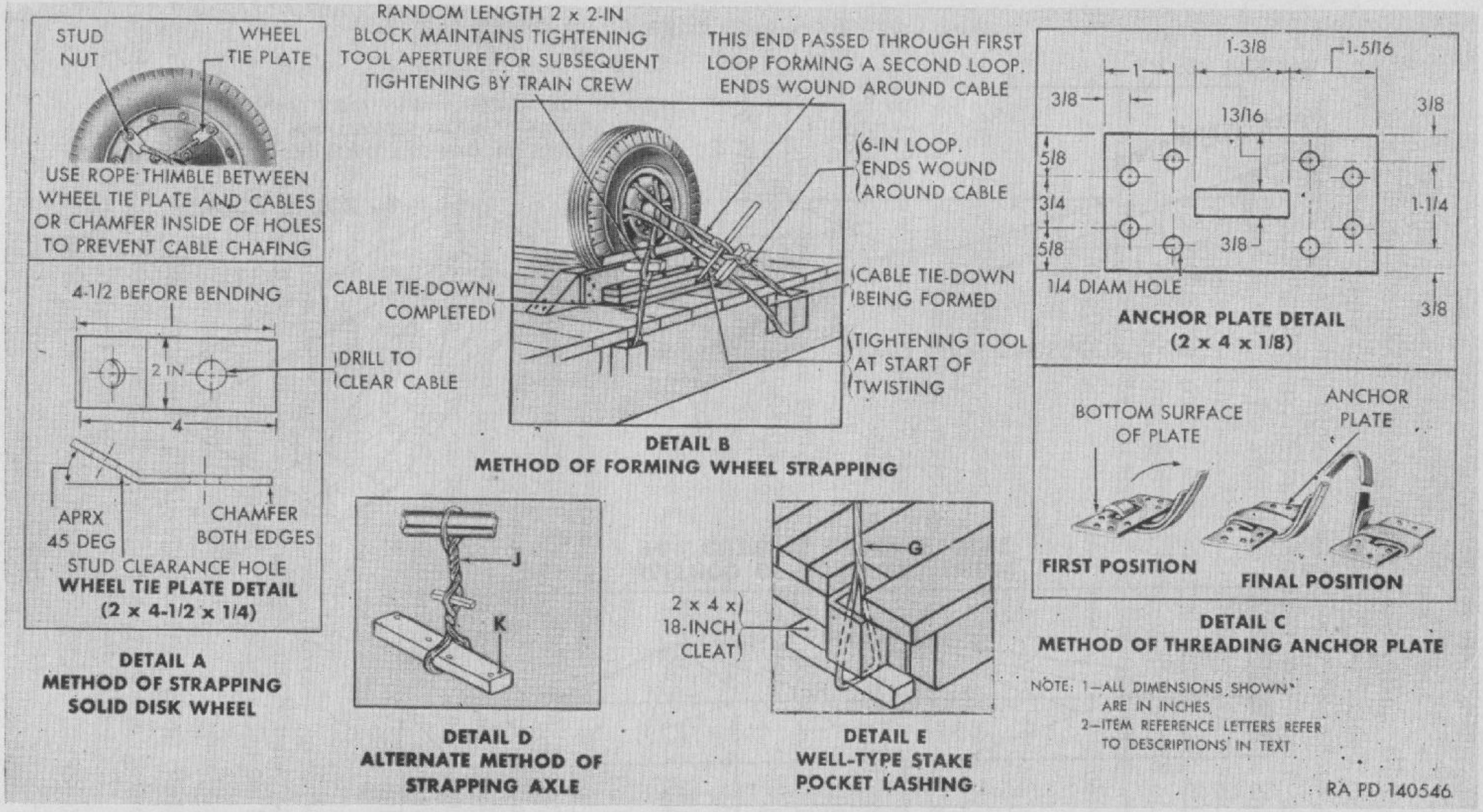

Figure 196. Method of blocking the 2½-ton 6 x 6 cargo truck M135 for rail shipment—blocking details.

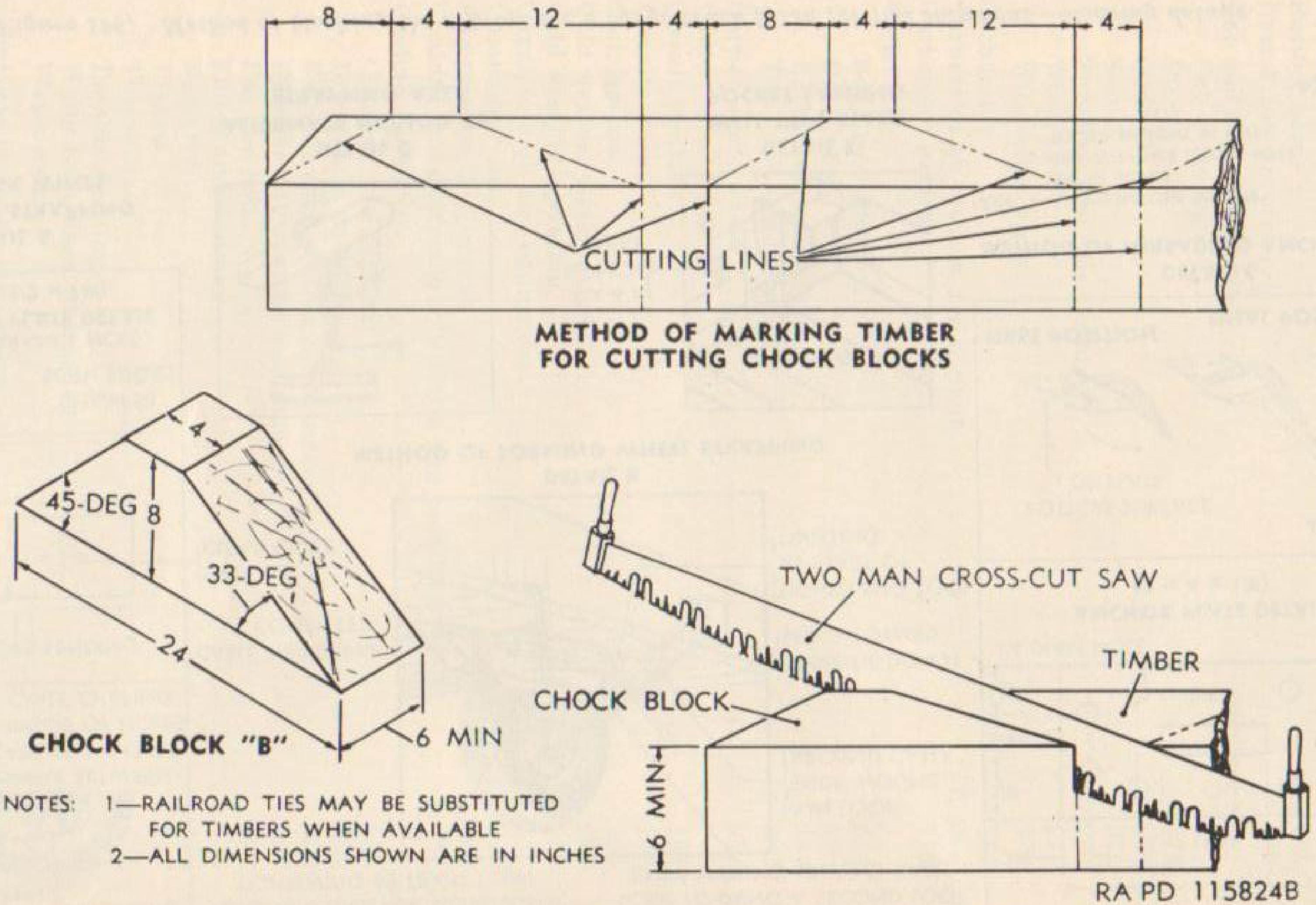

Figure 197. Cutting chock blocks from timbers.

train must be posted with a blue flag or light to advise that men are at work and that the siding may not be entered beyond those points.

(*d*) Upon completion of the loading operation, the ramp planks and bridging devices should be loaded on the train for use in unloading operations. Random sizes of timbers used in building the approach apron up to rail level should be included. All materials should be securely fastened to the car floors, after vehicles are blocked in place, and entered upon the bill of lading (B/L). Railroad ties borrowed for the operation should not be forwarded to the unloading point unless specifically required and only with the consent of the owner.

d. LOADING RULES. For general loading rules pertaining to rail shipment of ordnance vehicles, refer to TB 9–OSSC–G.

Warning: The height and width of vehicles when prepared for rail transportation must not exceed the limitations indicated by the loading table as prescribed in AR 700–105, section II. Whenever possible, local transportation officers must be consulted about the limitations of the particular railroad lines to be used for the movement to avoid delays, danger, or damage to equipment.

299. Blocking the 2 1/2-Ton 6 x 6 Cargo Truck M135 (GMC) for Rail Shipment

a. GENERAL. All blocking instructions specified herein are minimum and are in accordance with the Association of American Railroads "Rules Governing the Loading of Commodities on Open Top Cars." Additional blocking may be added as required at the discretion of the officer in charge. Double-headed nails may be used if available, except in the lower piece of two-piece cleats. All item reference letters given below refer to the details and locations as shown in figure 195.

Note. Any loading methods or instructions developed by any source which appear in conflict with this publication or existing loading rules of the carriers, must be substituted to the Chief of Ordnance, Washington 25, D. C. for approval.

b. BRAKE WHEEL CLEARANCE A. Load trucks on flatcars with a minimum clearance of at least 4 inches below and 6 inches above, behind, and to each side of the brake wheel (fig. 195). Increase clearance as much as is consistent with proper location of load.

Note. Vehicles should be laterally spotted on flatcar so that wheels are centrally positioned between stake pockets in order that wheel strapping "G" (*h* below) provides uniform cross-wiring.

c. CHOCK BLOCKS B (6 x 8 x 24 INCHES, EIGHT REQUIRED PER TRUCK). Locate the 45° face of blocks against the front and rear of each wheel. Blocks are to be positioned in such a manner as to allow flush application of wheel side cleats D (*e* below) when nailed to chock blocks. Nail heel of blocks to car floor with three fortypenny nails and toenail both sides of blocks to car floor with two fortypenny nails each.

Note. Filler cleats may be used between chock blocks and side cleats to centrally locate the chock block against tires. These cleats are not shown on illustrations. Chock blocks may be cut from timbers (or railroad ties, when available) as shown in figure 197.

d. CUSHIONING MATERIAL C. Locate suitable cushioning material, such as waterproof paper or burlap between tires and cleats D. The cushioning material should protrude beyond cleats E at floor and above cleats D.

e. WHEEL SIDE CLEATS D (2 x 8 INCHES, LENGTH TO SUIT, FOUR REQUIRED PER TRUCK). Locate and nail cleats to chock blocks B with four tenpenny nails at each end. (See note in *c* above).

f. FLOOR SIDE CLEATS E (2 x 4 INCHES, LENGTH TO SUIT, EIGHT REQUIRED PER TRUCK). Locate two side cleats against wheel side cleats D with cushioning material protruding underneath. Nail lower cheats to car floor with thirtypenny nails, staggered and upper cleats to lower cleats and car floor with fortypenny nails, staggered.

g. CROSS CLEATS F (2 x 4 INCHES, LENGTH TO SUIT, FOUR REQUIRED PER TRUCK). Locate two cleats across the top of the front chock blocks and two cleats across the rear chock blocks. Nail lower cleats to the top of chock blocks with thirtypenny nails at each end. Nail upper cleats to the lower cleats and top of chock blocks with fortypenny nails, staggered at each end.

h. WHEEL STRAPPING G (NO. 8 GAGE BLACK ANNEALED WIRE, LENGTH TO SUIT).

(1) Cut four lengths of wire to length required according to the location of stake pockets. Twist-tie wires together to form a single cable.

Note. If perforated disk wheels (ventilating type) are used, insert cable through an upper ventilating hole then out an adjoining hole (detail B of figs. 195 and 196). If solid disk wheels are used, remove two upper stud nuts slightly forward and rearward of wheel center. Place a wheel tie plate on each stud for strapping (see detail A of fig. 196). Install stud nuts and tighten securely.

(2) Insert the cable through a ventilating hole (or wheel tie plate), then out an adjacent hole at upper part of front wheel slightly *forward* of center, for a length beyond half the distance to a stake pocket.

(3) Pass the other end of cable through a stake pocket rearward of front wheel and form a 6-inch loop in end, winding *each* of the four wires *tightly* around the cable a few turns. Make certain the loop is positioned well above the span of the cables.

(4) Pass the free end of cable through this loop, hand tight, and again wind end of each wire around cable *tightly* (detail B of fig. 196).

(5) Position a random length 2 x 2-inch cleat between cables.

(6) Insert end of a tightening tool at approximate center of cables and twist-tie cables just taut enough to remove all slack, retaining cleat in its position between cables.

(7) Form another cable and pass end through a ventilating hole (or wheel tie plate) then out an adjacent hole at upper part of front wheel slightly rearward of center crossing initial cable.

(8) Pass other end of cable through a stake pocket *forward* of front wheel and complete and twist-tie as described above.

(9) Repeat above operations for all the other wheels.

Note. During transit, cables will be checked for looseness and retightened if necessary by train personnel.

(10) Cables are passed through stake pockets so that the cable loop lies against the car frame. A short stake driven into each stake pocket will protect the cable loop from chafing and loosening. (These stakes are omitted in figure 195). If flatcars are received where flooring is flush against the top of the well-type stake pockets, a loop of cable is passed through the stake pocket, and a short cleat about 2 x 4 x 18 inches is inserted in the loop below the stake pocket. Subsequent tightening of the cable will cause it to draw the wooden cleat securely against the bottom of stake pocket (detail E of fig. 196).

i. AXLE STRAPPING "H" (FOR GONDOLA CARS ONLY—OPTIONAL FOR FLATCAR STRAPPING). Locate two pieces of $1\frac{1}{4}$ x 0.035-inch hot-rolled steel strapping over each axle close to brakes. Coil strapping around steel anchor plates as shown in detail C of figure

196. Secure by nailing anchor plates to car floor with not less than six twentypenny nails (double-headed nails preferred). As an alternate method of securing axles, form and substitute a cable "J" (consisting of four strands of No. 8 gage black annealed wire or wires of equivalent strength) at each location for steel strapping "H." Pass cables over axle and around wooden cleats "K" (2 x 4 x 18 in). Locate cleats lengthwise of car and nail to car floor with thirtypenny nails in each cleat. Join both ends of cable together, as prescribed in *h* above, and twist taut with tightening tool just taut enough to take up slack detail D of fig. 196).

Section II. DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

300. General

a. Destruction of the 2½-ton 6 x 6 cargo truck M135, when subject to capture or abandonment in the combat zone, will be undertaken by the using arm only when, in the judgment of the unit commander concerned, such action is necessary in accordance with orders of, or policy established by, the army commander.

b. The information which follows is for guidance only. Certain of the procedures outlined require the use of explosives and incendiary grenades which normally may not be authorized items for the vehicle. The issue of these and related materials, and the conditions under which destruction will be effected, are command decisions in each case, according to the tactical situation. Of the several means of destruction, those most generally applicable are—

Mechanical	Requires axe, pick mattock, sledge, crowbar, or similar implement.
Burning	Requires gasoline, oil, incendiary grenades, or other inflammables.
Demolition	Requires suitable explosives or ammunition.
Gunfire	Includes artillery, machine guns, rifles using rifle grenades, and launchers using antitank rockets. Under some circumstances hand grenades may be used.

In general, destruction of essential parts, followed by burning will usually be sufficient to render the 2½-ton 6 x 6 cargo truck M135 useless. However, selection of the particular method of destruction requires imagination and resourcefulness in the utilization of the facilities at hand under the existing conditions. Time is usually critical.

c. If destruction to prevent use is resorted to, the truck must be so badly damaged that it cannot be restored to a usable condition in the combat zone either by repair or cannibalization. Adequate destruction requires that all parts essential to the operation of the matériel, including essential spare parts, be destroyed or damaged beyond repair. However, when lack of time and personnel prevents destruction of all parts, priority is given to the destruction of those parts most difficult to replace. Equally important, the same essential parts must be destroyed on all like matériel so that the enemy cannot construct one complete unit from several damaged ones.

d. If destruction is directed, due consideration should be given to:

(1) Selection of a point of destruction that will cause greatest obstruction to enemy movement and also prevent hazard to friendly troops from fragments or ricocheting projectiles which may occur incidental to the destruction.

(2) Observance of appropriate safety precautions.

301. Method No. 1—Destruction by Burning

a. Remove and empty portable fire extinguisher.

b. Puncture fuel tank as near the bottom as possible, collecting gasoline for use as outlined in *f* below.

c. Using an axe, pick mattock, sledge, or other heavy implement, smash all vital elements such as distributor, carburetor, generator, ignition coil, fuel pump, spark plugs, air cleaner, lights, instruments, and controls. If time permits, and a sufficiently heavy implement is available, smash the engine cylinder block and head, crankcase, and transmission control tower.

d. Slash tires. If tires are inflated, exercise care to prevent injury should the tire blow out while being slashed. Whenever practicable, it is usually preferable to deflate tires before slashing.

e. Explosive ammunition, if present in the vehicle or available nearby, should be removed from packing or other protective material. Place ammunition in and about the vehicle so that it will be fully exposed to the fire and in such locations that the greatest damage will result from its detonation. Remove any safety devices from ammunition.

f. Pour gasoline and oil in and over the entire vehicle. Ignite and take cover. If gasoline and oil are not available, use incendiary grenades.

Caution: Cover must be taken without delay since an early explosion of the explosive ammunition may be caused by the fire. Due consideration should be given to the highly inflammable nature of gasoline and its vapor. Carelessness in its use may result in painful burns.

Elapsed time: about 6 minutes.

302. Method No. 2—Destruction by Demolition

a. Remove and empty portable fire extinguisher.

b. Puncture fuel tank.

c. Prepare two 2-pound charges of EXPLOSIVE, TNT (two 1-lb. blocks or equivalent per charge together with the necessary detonating cord). Set the charges as follows:

(1) The *first* on *top* of the transmission case housing.

(2) The *second* as low on the *left* side of the engine as possible.

(3) Connect the *two* charges for simultaneous detonation with detonating cord.

(4) Provide for dual priming to minimize the possibility of a misfire. For priming, either a nonelectric blasting cap crimped to at least 5 feet of safety fuse (safety fuse burns at the rate of 1 foot in 30 to 45 seconds; test before using) or an electric blasting cap and firing wire may be used. If a nonelectric blasting cap and safety fuse are used, the fuse should be sufficiently long and so positioned that it may be ignited from the outside of the vehicle since gasoline, which is draining from the fuel tank, may be exploded by the burning fuse. Safety fuse, which contains black powder, and nonelectric blasting caps must be protected from moisture at all times. The safety fuse may be ignited by a fuse lighter or a match; the electric blasting cap requires a blasting machine or equivalent source of electricity.

Caution: Keep the blasting caps, detonating cord, and safety fuse separated from the charges until required for use.

Note. For the successful execution of methods of destruction involving the use of demolition materials, all personnel concerned will be thoroughly familiar with the pertinent provisions of FM 5-25. Training and careful planning are essential.

d. Destroy the tires by placing an incendiary grenade under each tire exercising care to prevent early ignition of gasoline or its vapor by the burning grenades. The detonation of the explosive charges should be delayed until the incendiary fires are well started. This will prevent the fires from being extinguished by the blast when the charges are detonated.

e. Detonate the charges. If primed with nonelectric blasting cap and safety fuse, ignite and take cover. If primed with electric blasting cap, take cover before firing the charges.

Caution: Cover must be taken without delay since an early explosion of the charges may be caused by the incendiary fires.

Elapsed time: about 6 minutes.

303. Method No. 3—Destruction by Gunfire

a. Remove and empty portable fire extinguisher.

b. Puncture fuel tank.

c. Destroy the tires as outlined in paragraph 301*d* or 302*d*, above.

d. Destroy the vehicle by gunfire using artillery, machine guns, rifles using rifle grenades, or launchers using antitank rockets. Fire on the vehicle aiming at the engine, axles, and wheels. Although one well placed direct hit may destroy the vehicle, several hits are usually required for complete destruction unless an intense fire is started, in which case the vehicle may be considered destroyed.

Caution: Firing at ranges of 500 yards or less should be from cover.

Elapsed time: about 6 minutes.

APPENDIX

REFERENCES

1. Publication Indexes

The following publication indexes and lists of current issue should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to matériel covered in this manual:

Index of Administrative Publications (Army Regulations, Special Regulations, Joint Army-Air Force Adjustment Regulations, General Orders, Bulletins, Circulars, Commercial Traffic Bulletins, Joint Procurement Circulars, Department of the Army Pamphlets, and ASF Manuals). SR 310-20-5

Index of Army Motion Pictures and Film Strips SR 110-1-1

Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy Air Force Publications, and Combined Communications Board Publications) SR 310-20-3

Index of Blank Forms and Army Personnel Classification Tests .... SR 310-20-6

Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment. .... SR 310-20-4

Introduction and Index .... ORD 1

Military Training Aids .... FM 21-8

2. Supply Catalogs

The following catalogs of the Department of the Army Supply Catalog pertain to this matériel:

a. Destruction to Prevent Enemy Use.

Land Mines and Fuzes, Demolition Material, and Ammunition for Simulated Artillery and Grenade Fire.
ORD 11 SNL R-7

b. MAINTENANCE AND REPAIR.

Cleaners, Preservatives, Lubricants, Recoil Fluids, Special Oils, and Related Maintenance Materials. ORD 3 SNL K-1

Common Tool Sets ORD 6 SNL J-10, Sec. 1 and 4 through 12

Items of Soldering, Metallizing, Brazing and Welding Materials: Gases and Related Items. ORD 3 SNL K-2

Field Maintenance Tool Sets ORD 6 SNL J-8, Sec. 3 and 14

Lubricating Equipment, Accessories and Related Dispensers ORD (*) SNL K-3

Organizational Maintenance Tool Sets ORD 6 SNL J-7, Sec. 1 through 9

Tool-Sets (special), Motor Vehicles ORD 6 SNL G-27, Sec. 1

b. DECONTAMINATION.

Decontamination TM 3-220

Decontamination of Armored Force Vehicles FM 17-59

Defense Against Chemical Attack FM 21-40

c. DESTRUCTION TO PREVENT ENEMY USE.

Explosives and Demolitions FM 5-25

d. GENERAL.

Cooling Systems: Vehicles and Powered Ground Equipment TM 9-2858

Driver Selection, Training, and Supervision, Wheeled Vehicles TM 21-300

Driver's Manual TM 21-305

Instruction Guide: Operation and Maintenance of Ordnance Matériel in Extreme Cold (0° to −65° F). TM 9-2855

Motor Transport FM 25-10

Motor Vehicles AR 700-105

Mountain Operations FM 70-10

Operations in Snow and Extreme Cold FM 70-15

Precautions in Handling Gasoline AR 850-20

Preparation of Ordnance Matériel for Deep-Water Fording TM 9-2853

Principles of Automotive Vehicles TM 9-2700

Spark Plugs TB ORD 313

Storage Batteries, Lead-Acid Type TM 9-2857

Supplies and Equipment: Unsatisfactory Equipment Report SR 700-45-5

e. MAINTENANCE AND REPAIR.

Cleaning, Preserving, Sealing, and Related Materials Issued for Ordnance Matériel TM 9-850

(*) See ORD 1 for published catalogs of the ordnance section of the Department of the Army Supply Catalog.

Hand, Measuring, and Power Tools .... TM 10-590
Maintenance and Care of Hand Tools .... TM 9-867
Maintenance and Care of Pneumatic Tires and Rubber Treads .... TM 31-200
Maintenance of Supplies and Equipment: Maintenance Responsibilities and Shop Operation. .... AR 750-5
Motor Vehicle Inspection and Preventive Maintenance Services .... TM 37-2810
Painting Instructions for Field Use .... TM 9-2851

3. Forms

The following forms are applicable to this matériel:

Standard Form 91, Operator's Report of Motor Vehicle Accident.

Standard Form 91A, Transcript of Operator's Report of Motor Vehicle Accident.

Standard Form 93, Report of Investigating Officer.

Standard Form 94, Statement of Witness.

DA Form 30b, Report of Claims Officer.

DA AGO Form 9-3, Processing Record for Storage and Shipment.

DA AGO Form 9-4, Vehicle Storage and Servicing Record.

DA AGO Form 9-68, Spot Check Inspection Report for Wheeled and Half-Track Vehicles.

DA AGO Form 9-74, Motor Vehicle Operator's Permit.

DA AGO Form 9-75, Daily Dispatching Record of Motor Vehicles.

DA AGO Form 348, Driver Qualification Record.

DA AGO Form 460, Preventive Maintenance Roster.

DA AGO Form 461, Work Sheet for Wheeled and Half-Track Vehicles—Preventive Maintenance Service and Technical Inspection.

DA AGO Form 461-5, Limited Technical Inspection.

DA AGO Form 468, Unsatisfactory Equipment Report.

DA AGO Form 478, MWO and Major Unit Assembly Replacement Records and Organizational Equipment File.

DA AGO Form 811, Work Request and Job Order.

DA AGO Form 811-1, Work Request and Hand Receipt.

DD Form 6, Report of Damaged or Improper Shipment.

DD Form 110, Vehicle and Equipment Operational Record.

DD Form 317, Preventive Maintenance Service Due (Sticker).

4. Other Publications

The following explanatory publications contain information pertinent to this matériel and associated equipment:

e. CAMOUFLAGE.

Camouflage .... TM 5-267
Camouflage, Basic Principles .... FM 5-20
Camouflage of Vehicles .... FM 5-20B
Preparation of Ordnance Matériel for Deep-Water Fording .... TM 9-2853

f. SHIPMENT AND LIMITED STORAGE.

Army Marking Directive .... TM 38-414
Army Shipping Document .... TM 38-705
Inspection, Preservation, and Maintenance in Storage of Small Arms Matériel. .... SB 9-65
Instruction Guide: Ordnance Packaging and Shipping (Posts, Camps, and Stations). .... TM 9-2854
Ordnance Storage and Shipment Chart—Group G, Major Items and Major Combination of Group G .. TB 9-OSSC-G
Preparation of Unboxed Ordnance Matériel for Shipment .... SB 9-4
Protection of Ordnance General Supplies in Open Storage .... TB ORD 379
Shipment of Supplies and Equipment: Report of Damaged or Improper Shipment .... SR 745-45-5
Standards for Oversea Shipments and Domestic Issue of Ordnance Matériel other than Ammunition and Army Aircraft. .... TB ORD 385
Storage, Inspection, and Issue of Unboxed Serviceable Motor Vehicles; Preparation of Unserviceable Vehicles for Storage; and Deprocessing of Matériel Prior to Operation. .... SB 9-63

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