

DEPARTMENT OF THE ARMY  
TECHNICAL MANUAL

TM 9-8030

DEPARTMENT OF THE AIR  
FORCE TECHNICAL ORDER

TO 36A-1-411

OPERATION AND  
ORGANIZATIONAL  
MAINTENANCE

$\frac{3}{4}$ -TON 4 x 4

CARGO TRUCK M37

$\frac{3}{4}$ -TON 4 x 4

COMMAND TRUCK M42

$\frac{3}{4}$ -TON 4 x 4

AMBULANCE TRUCK M43

AND  $\frac{3}{4}$ -TON 4 x 4

TELEPHONE INSTALLATION

LIGHT MAINTENANCE

AND CABLE SPLICING

TRUCK V-41 ( )/GT

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DEPARTMENTS OF THE ARMY AND THE AIR FORCE

MAY 1955

TECHNICAL MANUAL  
No. 9-8030  
TECHNICAL ORDER  
No. 36A-1-411

DEPARTMENTS OF THE ARMY AND  
THE AIR FORCE  
WASHINGTON 25, D. C., 2 May 1955

**OPERATION AND ORGANIZATIONAL MAINTENANCE: ¾-TON  
4 x 4 CARGO TRUCK M37; ¾-TON 4 x 4 COMMAND  
TRUCK M42; ¾-TON 4 x 4 AMBULANCE TRUCK M43; AND  
¾-TON 4 x 4 TELEPHONE INSTALLATION LIGHT MAINTENANCE AND CABLE SPLICING TRUCK V-41 ( )/GT**

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\*This manual supersedes TM 9-840, 6 December 1950; TB 9-840-1, 6 June 1952; TB 9-840-2, 8 September 1952; TB 9-840-3, 16 January 1953; TB 9-840-4, 6 November 1952; TB 9-840-7, 13 March 1953; and those portions of TB ORD 487, 3 February 1953, pertaining to materiel covered herein.

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# CHAPTER 1

## INTRODUCTION

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### Section I. GENERAL

#### 1. Scope

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

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

*c.* This manual differs from TM 9-840, as shown in (1), (2), and (3) below.

- (1) Adds information on command truck M42, ambulance truck M43, telescope installation, light maintenance, and cable splicing truck V-41 ( )/GT troubleshooting, and design changes.
- (2) Revises information on shifting transfer, special tools, lubrication, preventive maintenance, troubleshooting, engine description and maintenance in vehicle, engine removal and installation, ignition timing, and starting system.
- (3) Deletes reference to utility truck M42.

#### 2. Organizational Maintenance Allocation

In general, the prescribed organizational maintenance responsibilities will apply as reflected in the allocation of tools and spare parts in the appropriate columns of the current ORD 7 supply manual pertaining to these vehicles and in accordance with the extent of disassembly prescribed in this manual for the purpose of cleaning, lubricating, or replacing authorized spare parts. In all cases where the nature of repair, modification, or adjustment is beyond the scope or facilities of the using organization, the supporting ordnance maintenance unit should be informed, in order that trained personnel with suitable tools and equipment may be provided or other proper instructions issued.

*Note.* The replacement of certain assemblies, that is, the engine, clutch (pressure plate, disk, and release bearing), transmission (with or without power-take-off), transfer, and front and rear axles, is normally an ordnance

maintenance operation, but may be performed in an emergency by the using organization, provided approval for performing these replacements is obtained from the supporting ordnance officer. A replacement assembly, any tools needed for the operation which are not carried by the using organization, any necessary special instructions regarding associated accessories, etc., may be obtained from the supporting ordnance maintenance unit.

### 3. Forms, Records, and Reports

*a. General.* Responsibility for the proper execution of forms, records, and reports rests upon the officers of all units maintaining this equipment. However, the value of accurate records must be fully appreciated by all persons responsible for their compilation, maintenance, and use. Records, reports, and authorized forms are normally utilized to indicate the type, quantity, and condition of materiel to be inspected, to be repaired, or to be used in repair. Properly executed forms convey authorization and serve as records for repair or replacement of materiel in the hands of troops and for delivery of materiel requiring further repair to ordnance shops in arsenals, depots, etc. The forms, records, and reports establish the work required, the progress of the work within the shops, and the status of the materiel upon completion of its repair.

*b. Authorized Forms.* The forms generally applicable to units operating and maintaining these vehicles are listed in the appendix.

For a current and complete listing of all forms, refer to DA Pam 310-20. For instructions on use of these forms, refer to FM 9-10.

*c. Field Report 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 materiel occur.

*d. Report of Unsatisfactory Equipment or Materials.* Any suggestions for improvement in design and maintenance of equipment and spare parts, safety and efficiency of operation, or pertaining to the application of prescribed petroleum fuels, lubricants, and/or preserving materials, or technical inaccuracies noted in Department of the Army publications, will be reported through technical channels, as prescribed in SR 700-45-5, to the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM, using DA Form 468, Unsatisfactory Equipment Report. Such suggestions are encouraged in order that other organizations may benefit.

*Note.* Do not report all failures that occur. Report only REPEATED or RECURRENT failures or malfunctions which indicate unsatisfactory design or material. However, reports will always be made in the event that exceptionally costly equipment is involved. See also SR 700-45-5 and printed instructions on DA Form 468.

## Section II. DESCRIPTION AND DATA

### 4. Description

a. This manual covers the  $\frac{3}{4}$ -ton 4 x 4 cargo truck M37 (fig. 1),  $\frac{3}{4}$ -ton 4 x 4 command truck M42 (fig. 2),  $\frac{3}{4}$ -ton 4 x 4 ambulance truck M43 (fig. 3), and  $\frac{3}{4}$ -ton 4 x 4 telephone installation light maintenance and cable splicing truck V-41 ( )/GT (fig. 4).

b. All models are equipped with a liquid cooled, six-cylinder, "L" headtype gasoline engine, located at the front of the vehicle. Power is transmitted through the clutch and the four-speed transmission. A short propeller shaft connects the transmission to the two-range transfer unit. Power is then transmitted to both front and rear axles by propeller shafts.

c. Front and rear springs are of the semielliptic-type. Hydraulic-type shock absorbers are used to control flexing of both front and rear springs.

d. The steering gear is the worm- and sector-type.

e. A 24-volt electrical system supplies current for starting, ignition, lights, and horn. The electrical system is completely waterproofed. The lighting system includes service headlights, blackout driving light, marker lights, service and blackout tail and stop lights, and instrument panel lights.

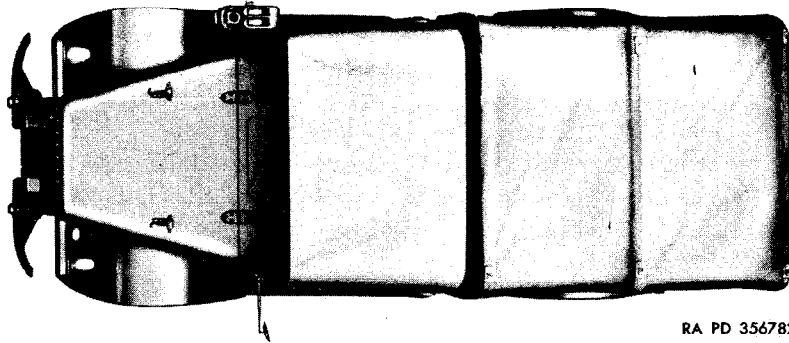
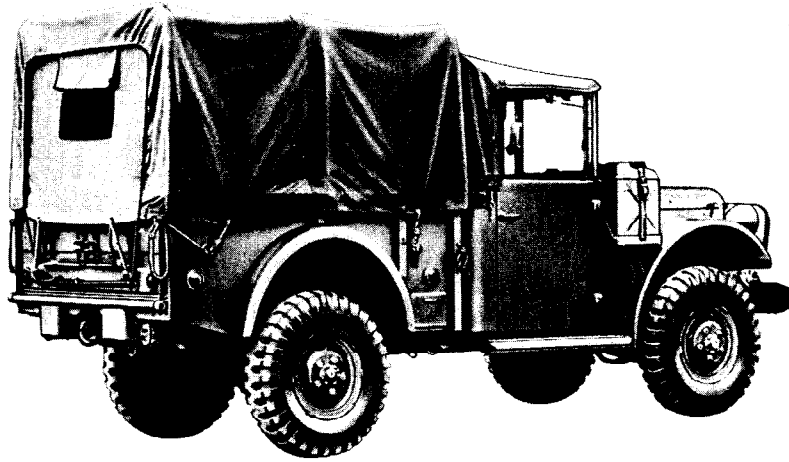
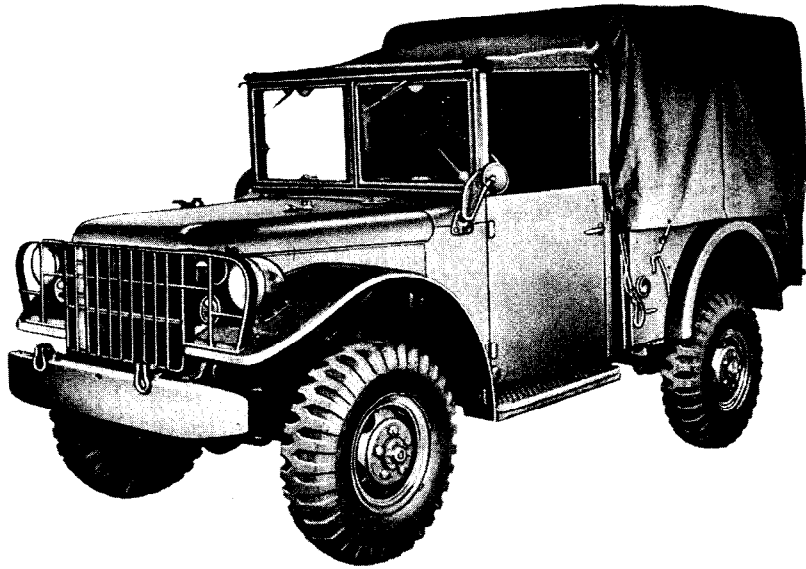
### 5. Differences Between Models

#### a. Chassis.

- (1) *Wheel base.* Wheel base of the cargo truck M37 and the command truck M42 is 112 inches; wheel base of the ambulance truck M43 and the telephone maintenance truck V-41 is 126 inches.
- (2) *Rear propeller shafts.* The rear propeller shaft in the ambulance truck M43 and the telephone maintenance truck V-41 is longer than that used in the cargo truck M37 and command truck M42.
- (3) *Springs.* Front springs for the cargo truck M37, the command truck M42, and the ambulance truck M43 have 7 leaves; front springs for the telephone maintenance truck V-41 have 8 leaves. Rear springs for the cargo truck M37 and the command truck M42 have 11 leaves; rear springs for the ambulance truck M43 and the telephone maintenance truck V-41 have 13 leaves.

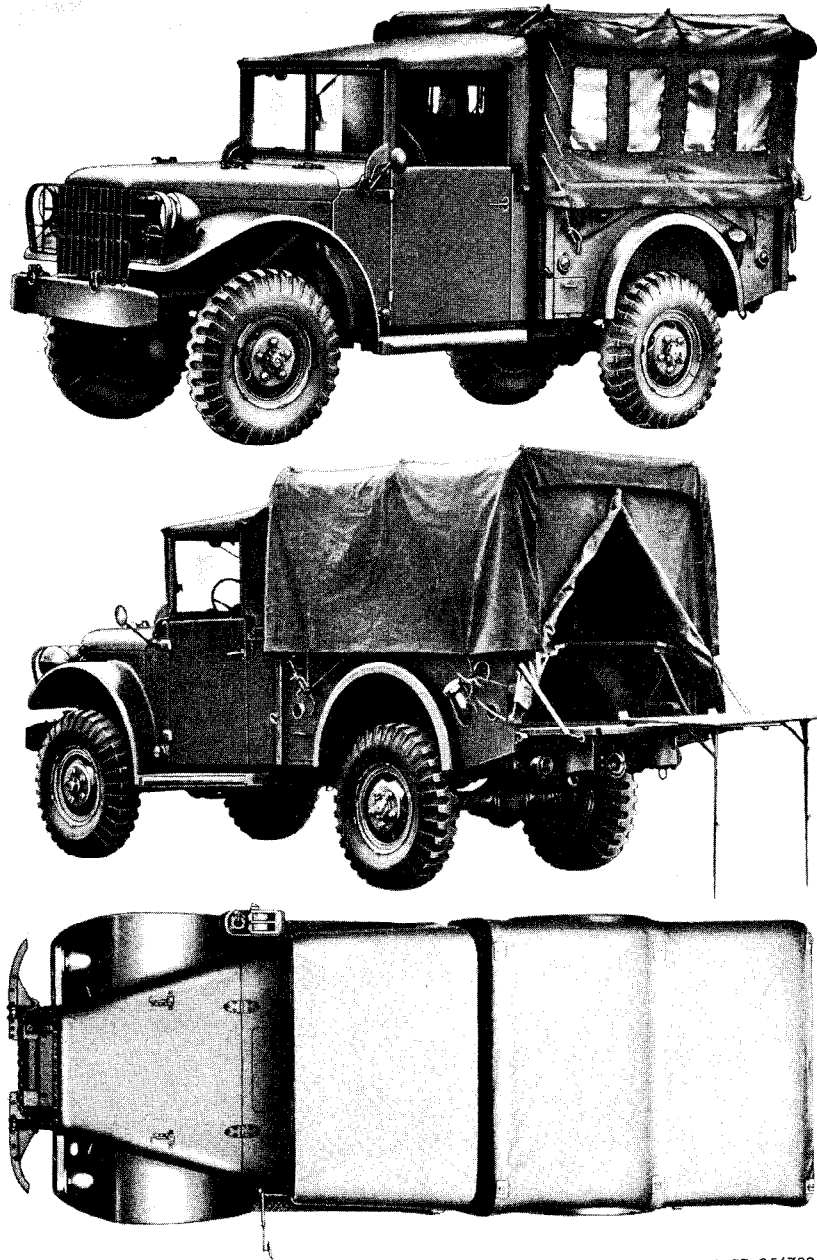
#### b. Cab and Bodies.

- (1) *Cab.* The cargo truck M37, command truck M42, and telephone maintenance truck V-41 are equipped with a steel cab with soft top which is separated from the body.
- (2) *Bodies.*



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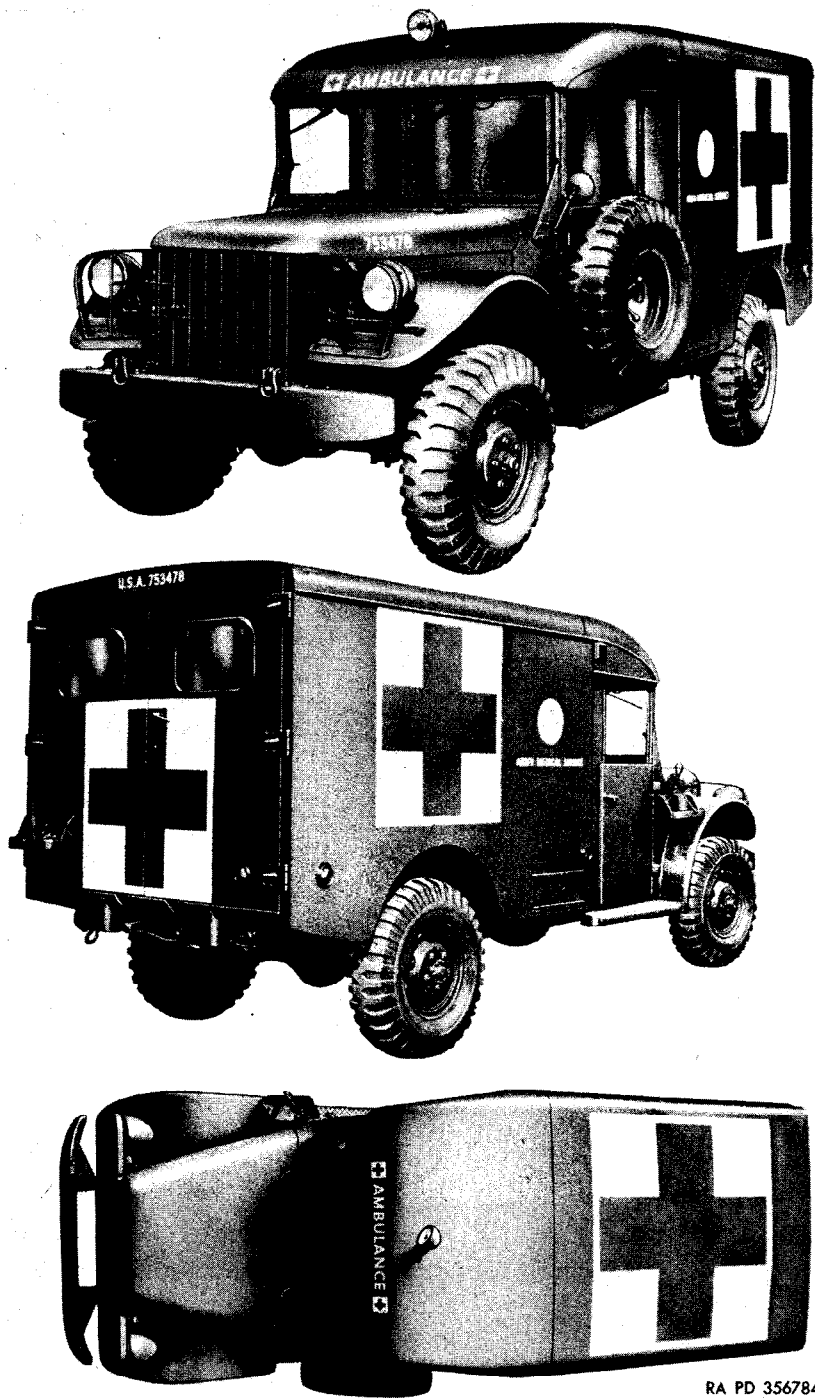
*Figure 1. 1/4-ton 4 x 4 cargo truck M37.*



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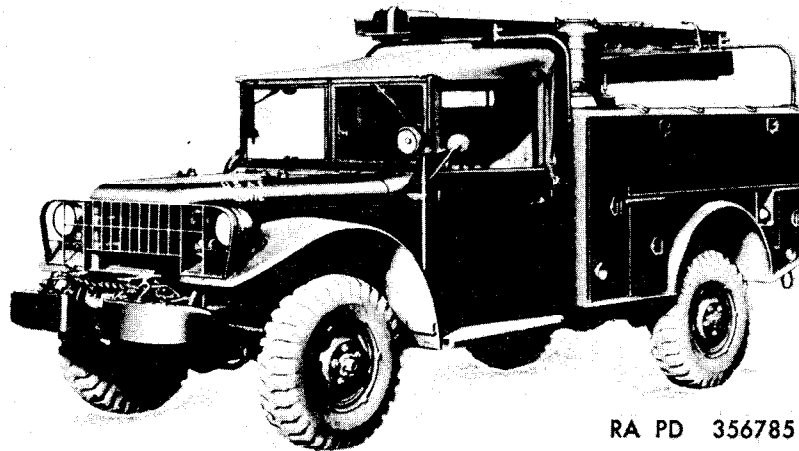
*Figure 2. 1/2-ton 4 x 4 command truck M42.*





RA PD 356784

*Figure 3. 3/4-ton 4 x 4 ambulance truck M43.*



RA PD 356785

Figure 4.  $\frac{3}{4}$ -ton 4 x 4 telephone installation light maintenance and cable splicing truck V-41 ( )/GT.

- (a) *Cargo truck M37.* The cargo truck M37 (fig. 1) has an open-type steel body with folding troop seats, removable front rack, seat back, and supports. The spare wheel is mounted on a bracket attached to the front panel. An auxiliary seat, attached to the front panel at the right of the spare wheel locking bracket (fig. 5), is usable when the spare wheel is removed. A roof paulin, supported by bows, covers the cargo compartment. Canvas front and rear end curtains are provided with windows.
- (b) *Command truck M42* (fig. 2). The command truck M42 is slightly different from the cargo truck M37 ((a) above). This difference is made by the installation of a conversion kit consisting of body side curtains with windows, a split-type rear end curtain, map light, and folding table.
- (c) *Ambulance truck M43.* The ambulance truck M43 (fig. 3) has a panel-type closed steel body consisting of the driver's compartment and the patient's compartment with a connecting partition door. The spare wheel is mounted on a carrier at the left side of the driver's compartment (fig. 6). A spotlight is mounted on the roof of the driver's compartment.
- (d) *Telephone maintenance truck V-41.* The telephone maintenance truck V-41 (fig. 4) has an all steel body which incorporates compartments for stowage of tools and supplies. The spare wheel is located in the right side front compartment of the body (fig. 7). A spotlight is mounted on a support at the left front fender.

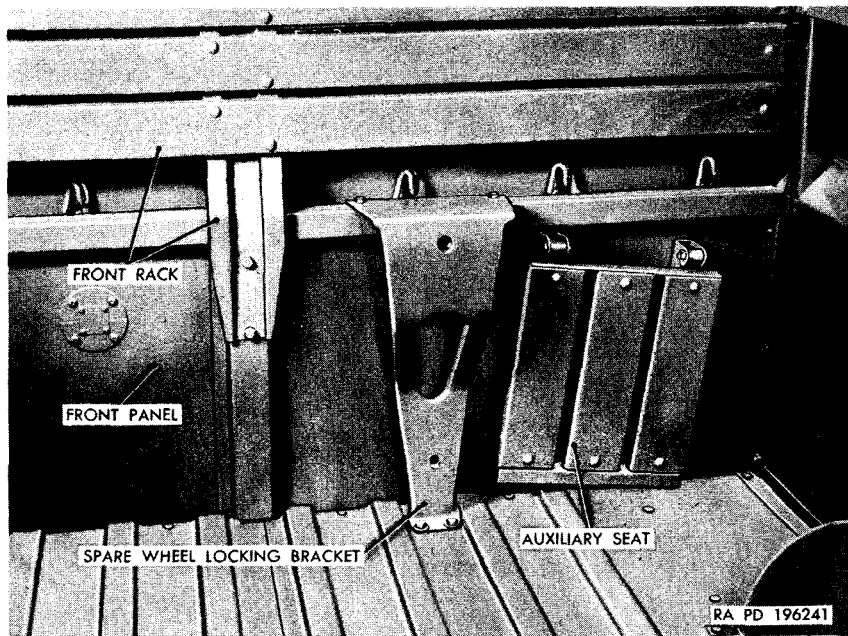


Figure 5. Front body panel and related parts (cargo truck M37)

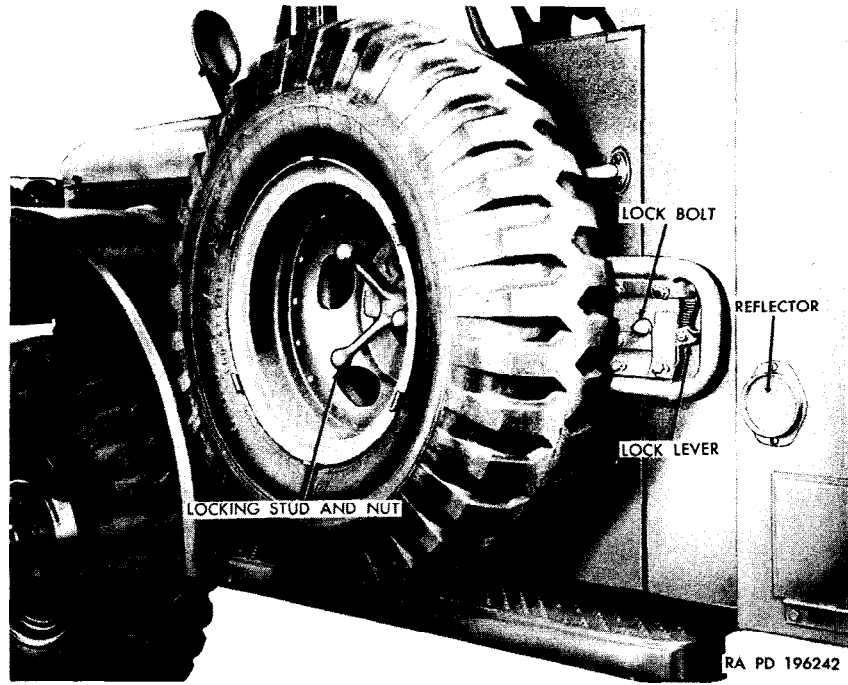
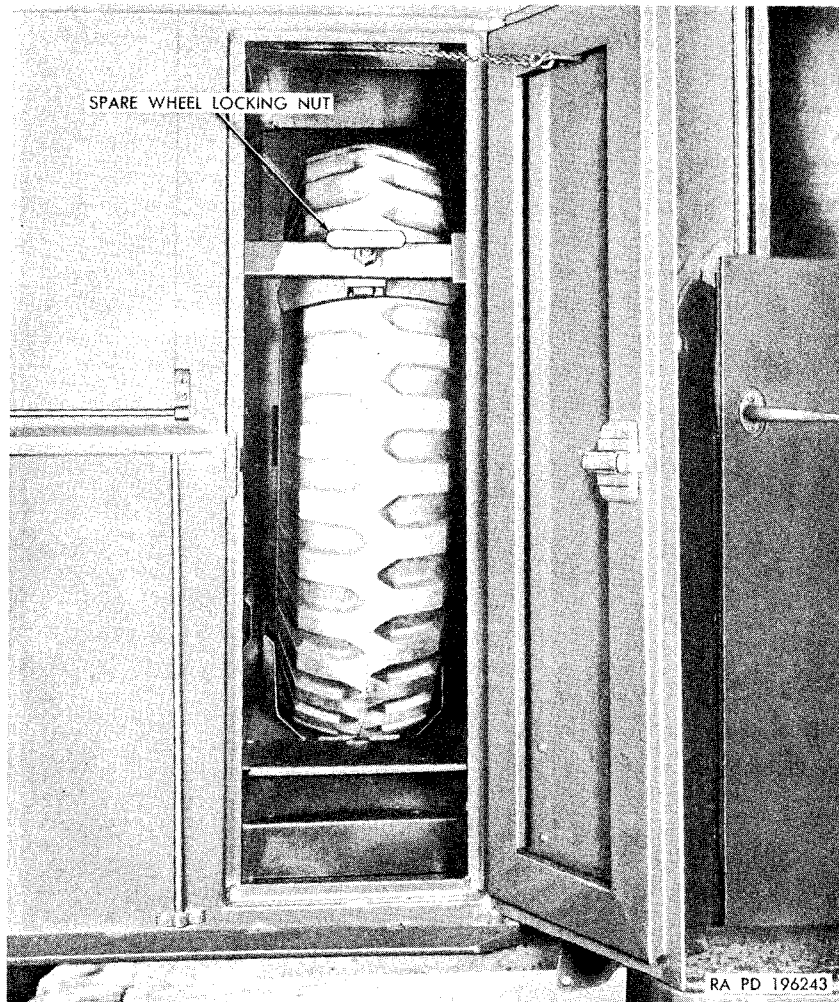


Figure 6. Hinged-type spare wheel carrier (ambulance truck M43).



*Figure 7. Spare wheel stowage compartment (telephone maintenance truck V-41).*

## **6. Design Changes**

*a. General.* A number of design changes have been incorporated in production for improving performance or in the interest of economy. The deleted, changed, or added items are listed in *b*, *c*, and *d* below along with the engine or serial number to which they apply.

*b. Items Deleted.*

- (1) The carburetor air cleaner shroud, crankcase ventilation shutoff valves and controls, throttle fording plate, and crankcase ventilation valve dual control plate were discontinued on all models starting with engine No. T245-34268.

- (2) The battery-to-radio cable and the radio receptacle in the body front panel (cargo truck M37 and command truck M42) were discontinued starting with serial No. 80022762.
- (3) The electrical auxiliary power receptacle, located on the right side of the instrument panel, was discontinued on all models starting with serial No. 80028130.
- (4) The auxiliary power receptacle and cable on the cowl left-side panel was discontinued on all models starting with serial No. 80028262.
- (5) The trailer coupling receptacle on the light switch was discontinued on all models starting with serial No. 80027855.
- (6) The use of sealing compound on battery and starter terminals was discontinued on all models starting with serial No. 80015189.
- (7) The fire extinguisher and bracket were discontinued on all models starting with serial No. 80050153.
- (8) The fuel tank drain plug was discontinued on all models starting with serial No. 80042080.
- (9) The engine priming system was discontinued starting with serial No. 80026807 on cargo truck M37, command truck M42, and telephone maintenance truck V-41, and with serial No. 80027049 on ambulance truck M43.

*c. Items Added.*

- (1) A lubrication elbow and plug were incorporated in the distributor on all models starting with engine No. T245-37442, replacing the 1/8-inch pipe plug in the distributor base.
- (2) The hood safety catch was incorporated on all models starting with serial No. 80017625.

*d. Items Changed.*

- (1) The distributor and brake master cylinder vent line fittings were relocated on the air cleaner elbow on all models starting with engine No. T245-7352.
- (2) The fuel gage, oil pressure gage, water temperature gage, and the water temperature gage sending unit were changed from 6- to 24-volt units on all models starting with serial No. 80009427, replacing the 6-volt units and resistors.
- (3) A clutch housing pan flanged-type drain plug and gasket replaced the 3/4-inch pipe plug on all models starting with engine No. T245-8184.
- (4) An improved clutch housing pan gasket is used on all models starting with engine No. T245-12530.
- (5) An improved clutch housing pan plate and seal assembly is used on all models starting with engine No. T245-11336.
- (6) The fuel tank vent valve is mounted on the fuel tank cover on all models starting with serial No. 80010922, replacing the vent valve in the fuel tank cover.

- (7) The locking-type throttle control handle was incorporated on all models starting with serial No. 80030242, replacing the friction button-type control.
- (8) A new type fuel pump gasket is used on all models starting with engine No. T245-21023.
- (9) A fuel filter was incorporated in the fuel tank starting with serial No. 80042293 on the cargo truck M37 and the command truck M42; and serial No. 80043170 on the ambulance truck M43, replacing the fuel filter located on the generator regulator support bracket.
- (10) An improved starter and starter switch was incorporated on all models starting with engine No. T245-18745.
- (11) The starter pedal bracket was relocated on all models starting with serial No. 80009081.
- (12) An ignition filter was incorporated in the distributor starting with serial No. 80027049 on the cargo truck M37, command truck M42, and telephone maintenance truck V41; and with serial No. 80025704 on the ambulance truck M43, replacing the ignition filter located on the cowl front panel.
- (13) A new type battery holddown cover was incorporated on all models starting with serial No. 80015189.
- (14) The battery location in the ambulance truck M43 was changed from the left side compartment to the space under the attendant's seat in the driver's compartment starting with serial No. 80025984.
- (15) The hinged-type spare wheel carrier was incorporated on ambulance truck M43 starting with serial No. 80019180, replacing the rigid-type carrier.
- (16) The mechanical jack was issued on all models starting with serial No. 80026822, replacing the hydraulic jack.

## **7. Data, Caution, and Instruction Plates**

*a. General.* Various data, caution, and instruction plates provide pertinent information regarding identification and/or operating instructions for the vehicles. These plates are located on the instrument panel in the driver compartment (fig. 8), in the engine compartment (fig. 9), and in the patient compartment of the ambulance truck M43 (figs. 10 and 11).

*b. Winch Caution Plate (A, fig. 8).* This plate provides a diagram of the power-take-off shift lever positions, specifies the winch capacity, and cautions the operator concerning proper operation.

*c. Transmission and Transfer Gearshift Instruction Plate (B, fig. 8).* This plate provides a diagram of the various positions for the transmission and transfer shifting levers, and cautions the operator regarding maximum permissible road speeds.

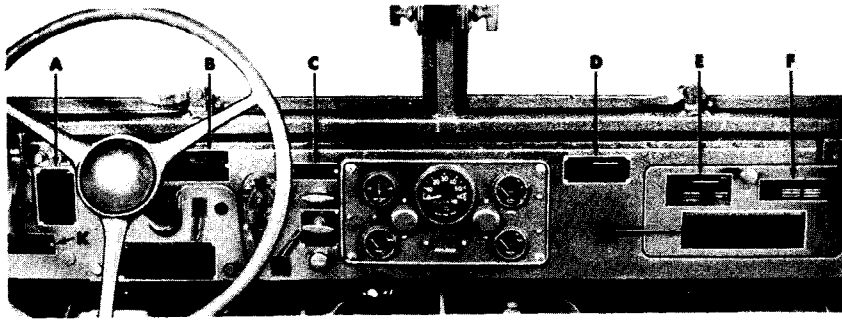


Figure 8. Data, caution, and instruction plates in driver compartment.

d. *Throttle Fording Instruction Plate* (C, fig. 8). This plate (on vehicles so equipped) provides instructions for use of the throttle for fording operation.

e. *U. S. Property Conversion Identification Plate* (D, fig. 8). This plate identifies the command truck M42 and lists the ordnance number. The plate is a component of the conversion kit used for converting a cargo truck M37 to a command truck M42.

f. *U. S. Property Identification Plate* (E, fig. 8). This plate provides the ordnance stock and serial numbers, manufacturer's serial, part, and contract numbers, year and model designation, and date of inspection.

g. *Responsible Agency Plate* (F, fig. 8). This plate indicates the responsible procurement and depot maintenance units for chassis, body, and equipment.

h. *Weight and Dimension Data Plate* (G, fig. 8). This plate provides information on dimensions, weight distribution, payload, and towed load.

i. *Crankcase Ventilation Valve Dual Control Plate* (H, fig. 8). This plate (on vehicles so equipped) fits over the crankcase vent valve control and provides instructions for use of this control for fording operation.

j. *Servicing Data Instruction Plate* (J, fig. 8). This plate provides information on fuel, engine oil, lubricants, and tire inflation requirements.

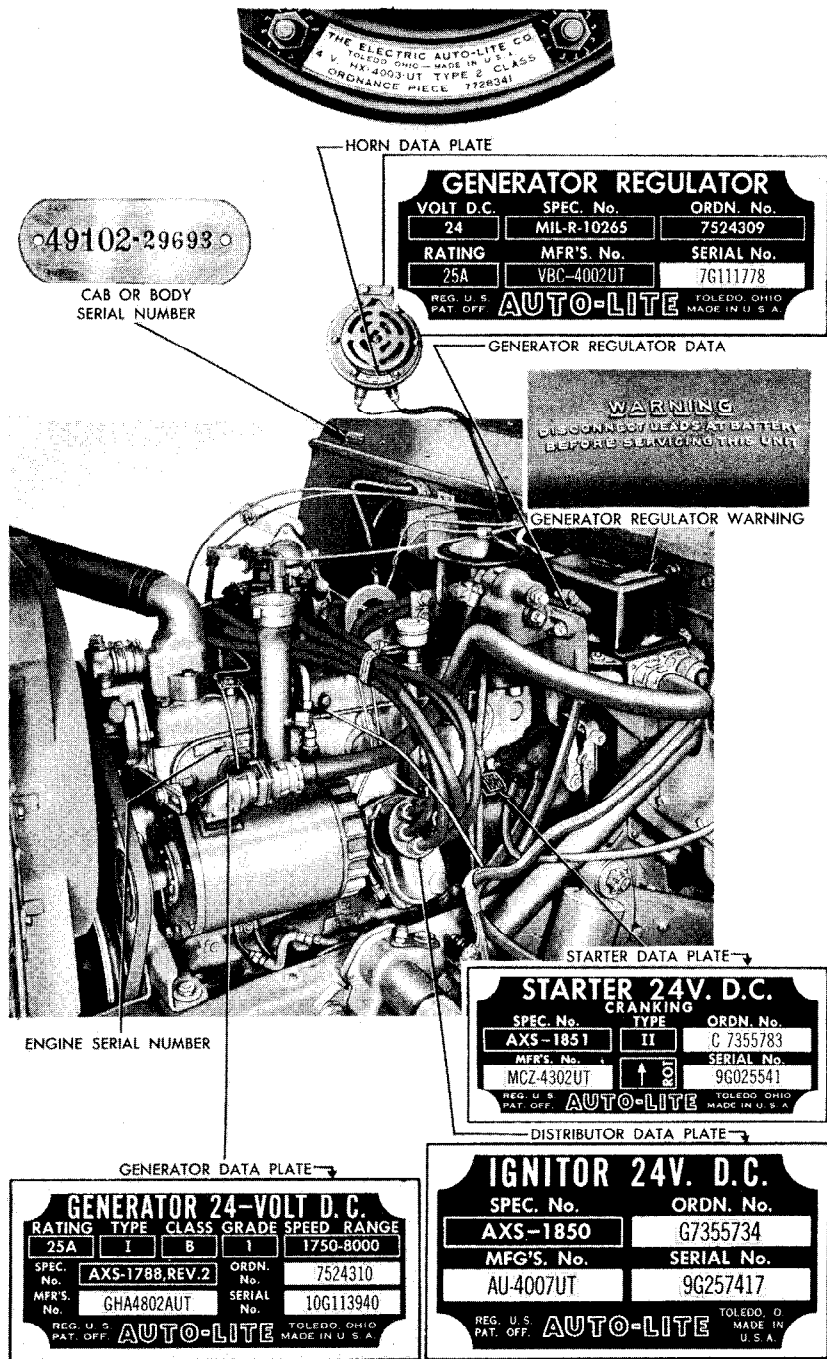
k. *Publications Data Plate* (K, fig. 8). This plate lists publications and lubrication order pertinent to the vehicles.

l. *Horn Data Plate* (fig. 9). This plate provides identification information on the horn.

m. *Starter Data Plate* (fig. 9). This plate provides identification information on the starter and direction of rotation.

n. *Distributor (Igniter) Data Plate* (fig. 9). This plate provides identification information on the distributor.

o. *Generator Regulator Data Plate* (fig. 9). This plate provides identification information on the generator regulator.



THE ELECTRIC AUTO-LITE CO.  
 TOLEDO, OHIO - MADE IN U.S.A.  
 4 V. MFR. 4003-UT TYPE 2 CLASS  
 ORDINANCE PIECE 7726341

49102-29693

CAB OR BODY  
 SERIAL NUMBER

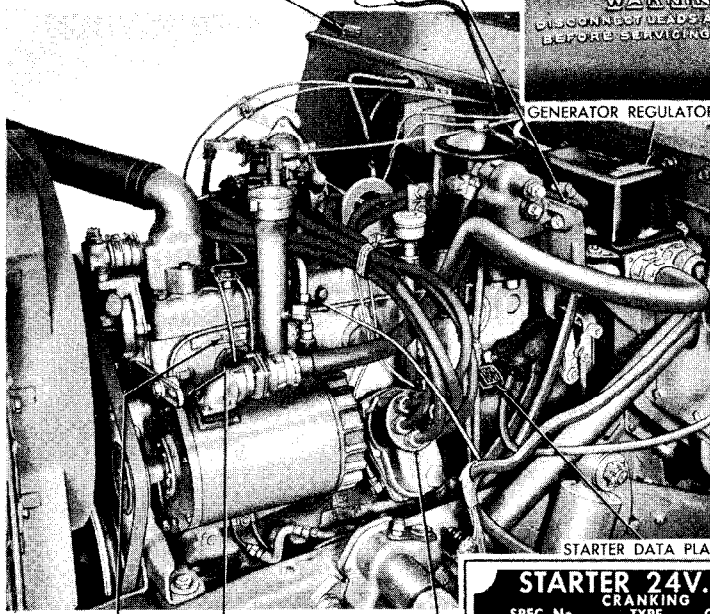
HORN DATA PLATE

GENERATOR REGULATOR		
VOLT D.C.	SPEC. No.	ORDN. No.
24	MIL-R-10265	7524309
RATING	MFR'S. No.	SERIAL No.
25A	VBC-4002UT	7G111778
REG. U. S. PAT. OFF. <b>AUTO-LITE</b>		TOLEDO, OHIO MADE IN U. S. A.

GENERATOR REGULATOR DATA

**WARNING**  
 DISCONNECT DEAD'S AT BATTERY  
 BEFORE SERVICING THIS UNIT

GENERATOR REGULATOR WARNING



STARTER DATA PLATE

STARTER 24V. D.C. CRANKING		
SPEC. No.	TYPE	ORDN. No.
AXS-1851	II	C 7355783
MFR'S. No.		SERIAL No.
MCZ-4302UT		9G025541
REG. U. S. PAT. OFF. <b>AUTO-LITE</b>		TOLEDO, OHIO MADE IN U. S. A.

DISTRIBUTOR DATA PLATE

GENERATOR DATA PLATE

GENERATOR 24-VOLT D. C.				
RATING	TYPE	CLASS	GRADE	SPEED RANGE
25A	I	B	1	1750-3000
SPEC. No.	AXS-1788, REV. 2		ORDN. No.	7524310
MFR'S. No.	GHA4802AUT		SERIAL No.	10G113940
REG. U. S. PAT. OFF. <b>AUTO-LITE</b>		TOLEDO, OHIO MADE IN U. S. A.		

IGNITOR 24V. D.C.		
SPEC. No.	ORDN. No.	
AXS-1850	G7355734	
MFG'S. No.	SERIAL No.	
AU-4007UT	9G257417	
REG. U. S. PAT. OFF. <b>AUTO-LITE</b>		TOLEDO, OHIO MADE IN U. S. A.

RA PD 196245

Figure 9. Data plates, serial numbers, and generator regulator warning in engine compartment.



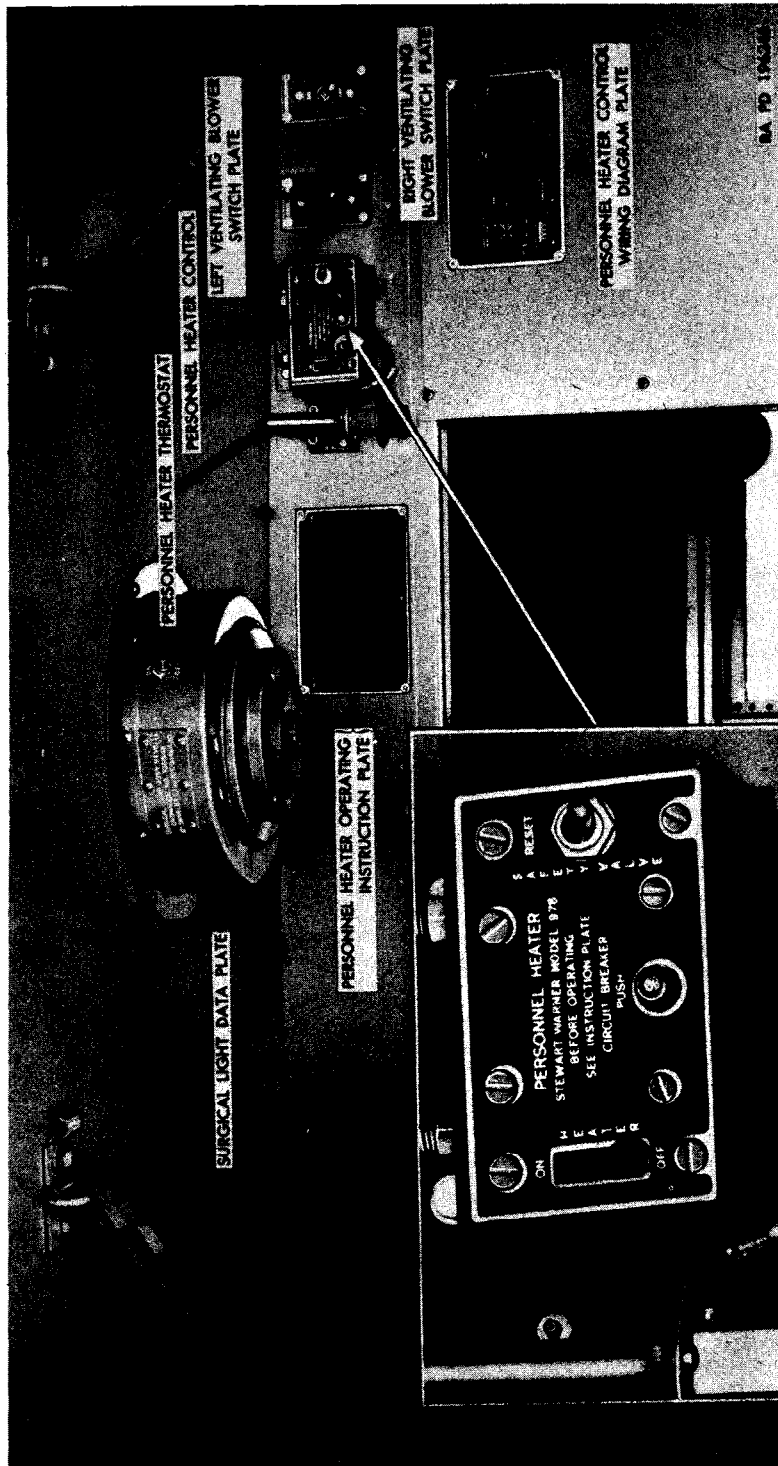


Figure 10. Data and instruction plates in patient compartment (ambulance truck M4S).

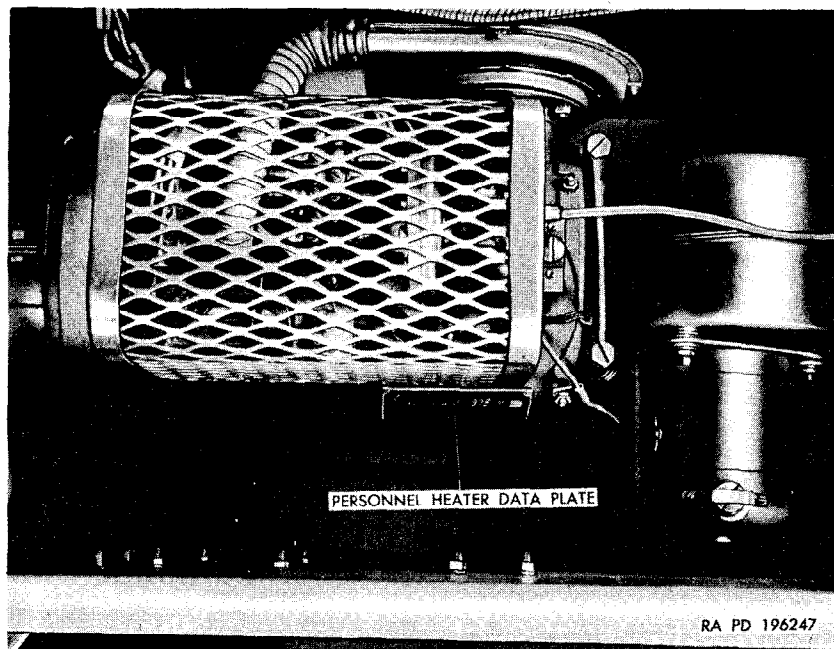


Figure 11. Personnel heater data plate in patient compartment (ambulance truck M43).

*p. Generator Regulator Warning* (fig. 9). This warning reads "WARNING—Disconnect leads at battery before servicing this unit."

*q. Generator Data Plate* (fig. 9). This plate provides identification information on the generator.

*r. Engine Serial Number* (fig. 9). This number identifies the particular engine.

*s. Cab or Body Serial Number Plate* (fig. 9). This plate identifies the cab or ambulance body model and serial number.

*t. Surgical Light Data Plate (Ambulance Truck M43)* (fig. 10). This plate provides identification information on the surgical light.

*u. Personnel Heater Operating Instruction Plate (Ambulance Truck M43 Only)* (fig. 10). This plate provides operating instructions for the personnel heater.

*v. Personnel Heater Control Plate (Ambulance Truck M43 only)* (fig. 10). This plate identifies the heater controls.

*w. Ventilating Blower Switch Plates (Ambulance Truck M43)* (fig. 10). These two plates identify the toggle switch positions.

*x. Personnel Heater Control Wiring Diagram Plate (Ambulance Truck M43)* (fig. 10). This plate illustrates the wiring hook-up of the thermostat and the heater control.

*y. Oil Filter Decalcomania* (fig. 80). This decalcomania provides information on the servicing of the oil filter.

2. *Personnel Heater Data Plate (Ambulance Truck M43)* (fig. 11).  
This plate provides identification information of the personnel heater.

## 8. Tabulated Data

### a. General Data.

#### Capacities:

Cooling system.....	17 qt
Crankcase (refill).....	5 qt
(When replacing oil filter or filter element, add 1 qt.)	
Differential (each):	
Fill.....	3 qt
Refill.....	2½ qt
Fuel tank.....	24 gal
Steering gear.....	1 pt
Transfer.....	5 pt
Transmission:	
With power-take-off (through engine No. T245-3955).....	10½ pt
(after engine No. T245-3955).....	7 pt
Without power-take-off (through engine No. T245-3955).....	9 pt
(after engine No. T245-3955).....	6 pt
Winch clutch housing.....	1 qt
Winch worm housing.....	1 qt
Crew.....	2
Cylinders (in line).....	6
Dimensions:	
Height:	
Cargo truck M37.....	7 ft 2½ in.
Command truck M42.....	7 ft 2½ in.
Ambulance truck M43.....	7 ft 7⅞ in.
Telephone maintenance truck V-41.....	7 ft 9½ in.
Length:	
Cargo truck M37, w/o winch.....	15 ft 4¾ in.
Cargo truck M37, w/winch.....	15 ft 9⅞ in.
Command truck M42, w/o winch.....	15 ft 4¾ in.
Command truck M42, w/winch.....	15 ft 9⅞ in.
Ambulance truck M43.....	16 ft 6¼ in.
Telephone maintenance truck V-41.....	16 ft 6¼ in.
Width (all models).....	6 ft 1½ in.
Electrical system (all models).....	24 volt
Engine.....	Dodge Model T245
Ground clearance.....	10¼ in.
Loading height (fully loaded):	
Cargo truck M37.....	29¼ in.
Command truck M42.....	29¼ in.
Ambulance truck M43.....	30¼ in.
Telephone maintenance truck V-41.....	30½ in.
Number of batteries.....	2
Passengers (including crew):	
Cargo truck M37.....	2
Command truck M42.....	2 to 8
Ambulance truck M43:	
With 4 litter patients.....	6
With 6 seated patients.....	8
Telephone maintenance truck V-41.....	2

Pintle height (all models except ambulance truck M43) :	
Empty .....	25 $\frac{1}{8}$ in.
Loaded.....	21 $\frac{7}{8}$ in.
Weight :	
Gross :	<i>Cross-Country Highway</i>
Cargo truck M37 (w/o winch).....	7,417 lb 7,917 lb
Cargo truck M37 (w/winch).....	7,647 lb 8,147 lb
Command truck M42 (w/o winch).....	7,417 lb 7,917 lb
Command truck M42 (w/winch).....	7,647 lb 8,147 lb
Ambulance truck M43.....	8,550 lb
Telephone maintenance truck V-41.....	8,450 lb 8,950 lb
Net :	
Cargo truck M37 (w/o winch).....	5,687 lb
Cargo truck M37 (w/winch).....	5,917 lb
Command truck M42 (w/o winch).....	5,687 lb
Command truck M42 (w/winch).....	5,917 lb
Ambulance truck M43.....	7,150 lb
Telephone maintenance truck V-41.....	6,950 lb
Payload (all models except ambulance truck M43) :	
Cross-country .....	1,500 lb
Highway.....	2,000 lb
Payload (ambulance truck M43).....	1,400 lb
Wheel base :	
Cargo truck M37, command truck M42.....	112 in.
Ambulance truck M43, telephone maintenance truck V-41.....	126 in.
<i>b. Performance.</i>	
Allowable speed :	
Transfer :	<i>1st 2d 3d 4th Reverse</i>
High range.....	9 18 33 55 7—mph
Low range.....	4 9 17 28 4—mph
Angle :	
Approach :	
Cargo truck M37, command truck M42 (w/o winch).....	44°
Ambulance truck M43, telephone maintenance truck V-41 (w/o winch) .....	47°
Cargo truck M37, command truck M42, telephone maintenance truck V-41 (w/winch).....	38°
Departure.....	32°
Cruising range (loaded).....	225 miles
Engine horsepower (brake hp) :	
At 1,600 rpm.....	57
At 3,400 rpm.....	94
Fording depth (max.) :	
W/o fording kit.....	42 in.
W/fording kit.....	84 in.
Fuel consumption (loaded) (aprx.).....	9 mpg
Grade ascending ability (max.) limited by traction.....	68 percent
Recommended towed load (max.) :	
Cross-country .....	4,000 lb
Highway.....	6,000 lb
Turning circle (diam.) right or left (min.).....	50 ft
Winch capacity.....	7,500 lb

*c. Detailed Data References.* Additional detailed tabular data pertaining to individual components and systems are contained in the following paragraphs:

	<i>Paragraph</i>
Battery and lighting system.....	166b
Brake system.....	213b
Clutch.....	186b
Cooling system.....	147b
Engine.....	109b
Front axle.....	202b
Fuel and air intake and exhaust systems.....	132b
Generating system.....	163b
Ignition system.....	123b
Instruments, gages, and horn.....	177b
Propeller shafts.....	199b
Rear axle.....	209b
Springs and shock absorbers.....	242b
Starting system.....	157b
Steering gear and controls.....	230b
Transfer.....	195b
Transmission and power-take-off.....	190b
Wheels, hubs, and tires.....	225b
Winch and winch drive shaft.....	180b

## CHAPTER 2

### OPERATING INSTRUCTIONS

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#### Section I. SERVICE UPON RECEIPT OF MATERIEL

#### 9. 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 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 (par. 69-72) to be sure every item is present, in good condition, clean, and properly mounted or stowed.

*b.* In addition, perform a break-in of at least 500 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 11.

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

#### 10. Preliminary Services

*a. General procedures.*

- (1) Uncrate vehicle, if crated. Remove metal strapping, plywood, tape, seals, wrapping paper, and dehydrant bags. If any exterior surfaces are coated with rust-preventive compound, remove it with dry-cleaning solvent or volatile mineral spirits.
- (2) Read Processing Record for Storage and Shipment of Vehicles and Boxed Engines (DA Form 9-3) and follow all precautions checked thereon. This tag should be in the driver's compartment attached to the steering wheel or ignition switch.
- (3) Crank engine with the starter at least two revolutions, before turning the ignition on, to test for hydrostatic lock. (This precaution is necessary because there might be an excess of preservative oil in the combustion chambers or possibly, coolant may have leaked into them.)

*Note.* If the vehicle has been driven to the using organization, most or all of the foregoing procedures should have been performed.

- (4) Follow the "before-operation" procedures described in table II.

*b. Specific Procedures.* Perform the "D" (6-month or 6,000-mile) preventive maintenance service (table III), with the variations listed in (1) through (5) below.

- (1) Line out the other services on DA Form 461 and write in "New (or rebuilt) vehicle reception."
- (2) Before starting engine, tighten cylinder-head cap screws with a torque-indicating wrench in sequence prescribed in paragraph 115*b*.
- (3) Perform item 27 (table III) before starting the road test. If a processing tag (*a*(2) above) on the engine or vehicle states that the engine contains oil that is suitable for 500 miles of operation, and of the correct seasonal viscosity, check the level but do not change the oil; otherwise, change the oil. Lubricate all points, regardless of interval, except as noted in (5) below. Check the levels of lubricant in all gear housings. If the gear lubricant is known to be of the correct seasonal grade, do not change it; otherwise, change it.
- (4) When engine has been thoroughly warmed up to operating temperature, check the tightness of the cylinder-head cap screws with a torque-indicating wrench to the torque and in the sequence prescribed in paragraph 115*b*.
- (5) Perform item 39 (table III). Look at the wheel bearings. If lubrication appears to be adequate, do not clean and repack. Do not adjust brakes unless necessary.

## 11. Break-In

*a. General.* After the preliminary service has been performed, the break-in period (500 miles) may be accomplished in normal service of the vehicle under the supervision of a competent driver.

*Note.* If the vehicle was driven to the using organization, include the mileage traveled in the break-in mileage.

*b. Precautions.* Precautions (1) through (4) below will be observed during the break-in period.

- (1) Do not drive at excessive speeds.
- (2) Do not skip speeds when shifting gears.
- (3) Accelerate the engine slowly and gradually.
- (4) Do not load the engine or power train to capacity.

*c. Service After 500 Miles.* After 500 miles of vehicle operation, perform the "C" (1,000-mile) preventive-maintenance service (table III), with the variations listed in (1) and (2) below.

- (1) Line out the other services on DA Form 461 and write in "New (or rebuilt) vehicle 500-mile service."
- (2) Change the engine oil (par. 73).

*d. Service After 1,000 Miles.* When the vehicle has been driven 1,000 miles, it will be placed on the regular preventive-maintenance schedule and will be given the first regular "C" (1,000-mile) preventive-maintenance service (table III).

## **12. Correction of Deficiencies**

*a.* Ordinary deficiencies disclosed during the preliminary inspection and servicing or during the break-in period, will be corrected by the using organization or a higher maintenance echelon.

*b.* Serious deficiencies, which appear to involve unsatisfactory design or material, will be reported on DA Form 468, Unsatisfactory Equipment Report. The commander of the using organization will submit the completed form (in accordance with SR 700-45-5) to the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM, or to the chief of appropriate technical service for other than ordnance equipment.

## **Section II. CONTROLS AND INSTRUMENTS**

### **13. General**

This section describes, locates, and illustrates the various controls and instruments provided for the proper operation of the vehicle.

### **14. Windshield Adjusting Arms and Locking Handles**

*a. Adjusting Arms.* Two windshield adjusting arms (A, fig. 12) are provided for opening and closing each windshield.

*b. Locking Handles.* A windshield locking handle (M, fig. 12) is provided to secure each windshield in the closed position.

### **15. Steering Wheel**

The steering wheel (B, fig. 12), when turned to the left or right, controls the directional movement of the vehicle.

### **16. Horn Button**

Depress the horn button (C, fig. 12) to sound the horn.

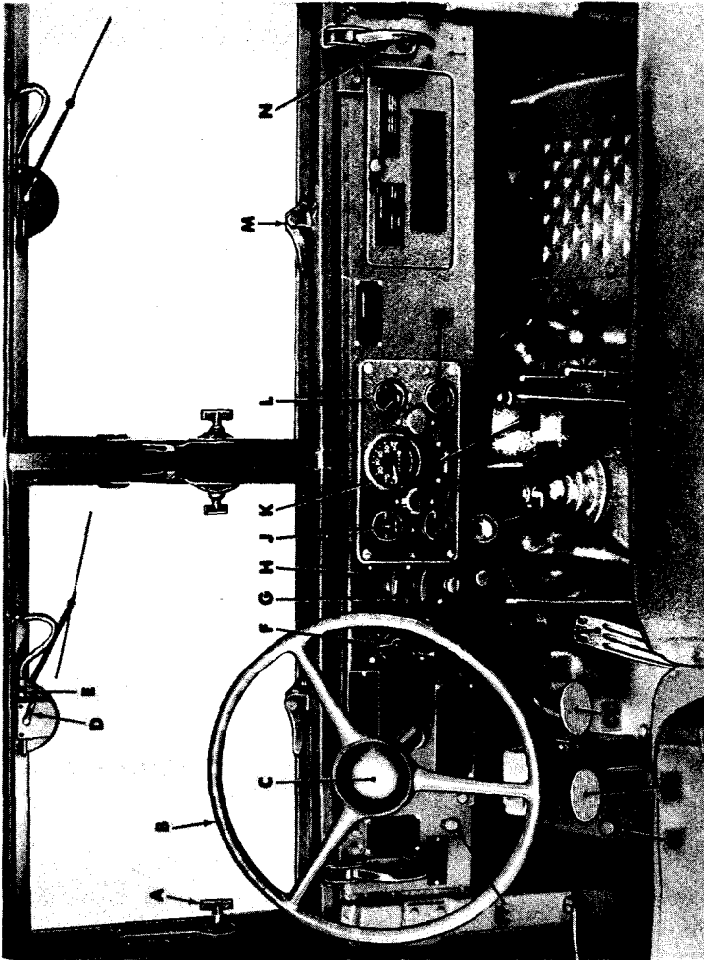
### **17. Windshield Wiper Handle and Control Knob**

The windshield wiper handle (D, fig. 12) is provided for manual operation of the wiper blade. The windshield wiper control knob (E, fig. 12) controls the operation of the wiper motor.

### **18. Light Switch**

*a. General.* The light switch (F, fig. 12) is used to select the vehicle driving lights (fig. 13) for various driving conditions or parking.



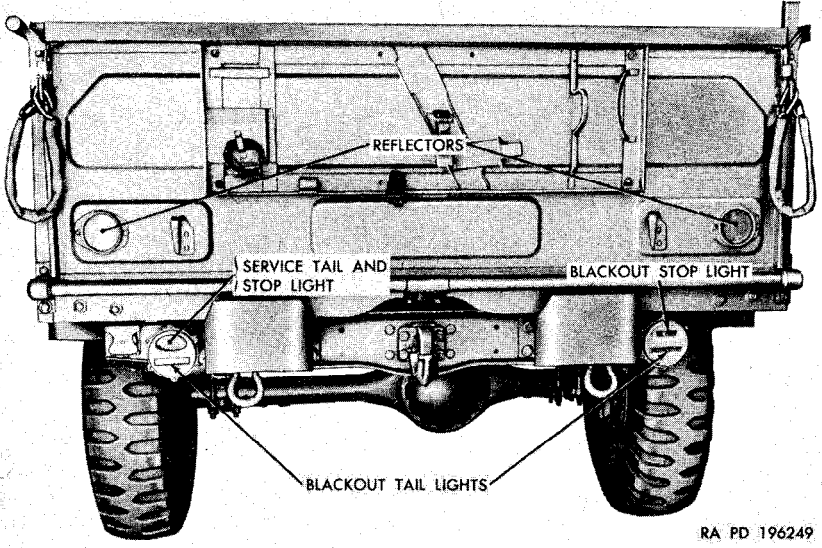
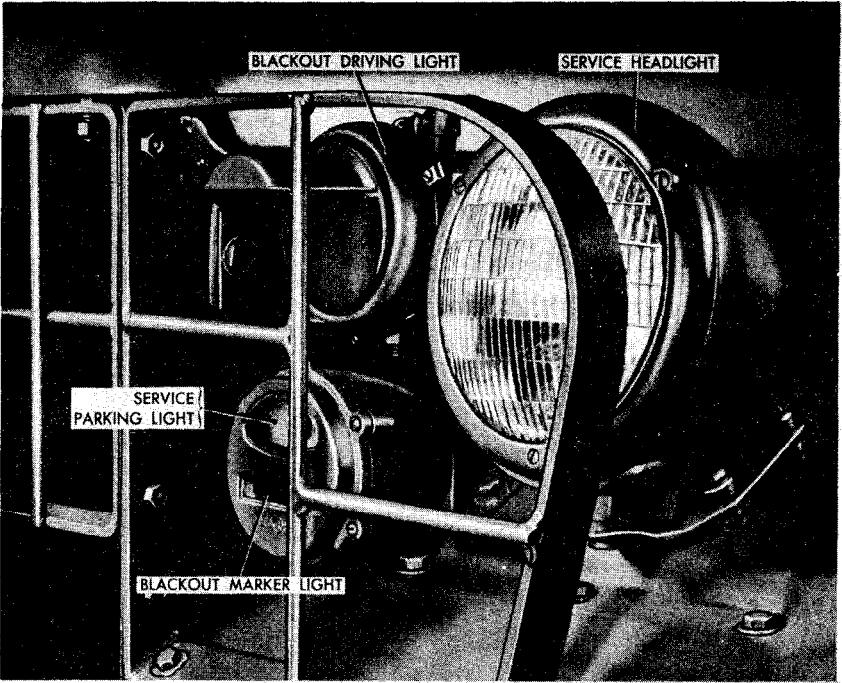


**KEY**

- A—WINDSHIELD ADJUSTING ARM
- B—STEERING WHEEL
- C—HORN BUTTON
- D—WINDSHIELD WIPER HANDLE
- E—WINDSHIELD WIPER CONTROL KNOB
- F—LIGHT SWITCH
- G—CRANKCASE VENTILATION VALVE DUAL CONTROL
- H—THROTTLE CONTROL
- J—AMMETER OR BATTERY GENERATOR INDICATOR
- K—SPEEDOMETER
- L—FUEL GAGE
- M—WINDSHIELD LOCKING HANDLE
- N—WINDSHIELD SUPPORT FRAME CLAMP HANDLE
- P—OIL PRESSURE GAGE
- Q—TRANSFER SHIFT CONTROL LEVER (FRONT)
- R—TRANSFER DE-CLUTCH CONTROL LEVER (REAR)
- S—HAND BRAKE LEVER
- T—SERVICE HEADLIGHT HIGH BEAM INDICATOR
- U—COWL VENTILATOR HANDLE
- V—WATER TEMPERATURE GAGE
- W—TRANSMISSION GEAR SHIFT LEVER
- X—STARTER PEDAL
- Y—CHOKE CONTROL
- Z—POWER-TAKE-OFF SHIFT LEVER
- AA—ACCELERATOR PEDAL
- BB—IGNITION SWITCH
- CC—BRAKE PEDAL
- DD—CLUTCH PEDAL
- EE—DIMMER SWITCH
- FF—ENGINE PRIMER KNOB

*Figure 12. Controls and instruments in driver's compartment.*

RA PD 195248



RA PD 196249

Figure 13. Vehicle driving lights.

## *b. Operation.*

*Note.* The light switch positions are shown in figure 14.

- (1) *Blackout marker lights.* To operate the blackout marker lights (fig. 13), move the light switch upper lever to position B. To turn off the blackout marker lights, move the upper lever to position C.
- (2) *Blackout driving light and blackout taillights.* To operate the blackout driving light and the blackout taillights (fig. 13), raise the light switch lower right lever to position F and simultaneously move the upper lever to position A. To turn off the blackout driving light and the blackout taillights, move the upper lever to position C.
- (3) *Service stop light.*

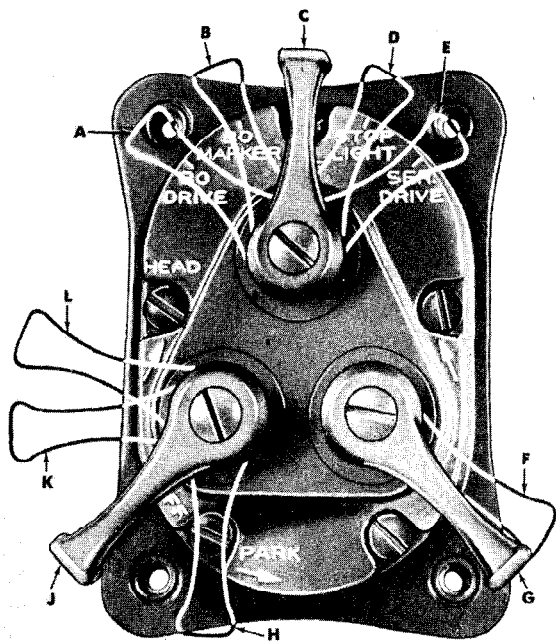
*Note.* The service stop light (fig. 13) is operative only during brake pedal application when the light switch upper lever is in position D (for daytime driving) or in position E ((4) below) (*for night driving*).

To operate the service stop light (fig. 13), raise the light switch lower right lever to position F and simultaneously move the upper lever to position D.

- (4) *Service headlights.* To operate the service headlights (fig. 13), raise the light switch lower right lever to position F and simultaneously move the upper lever to position E. Move the lower left lever to position L. To turn off the headlights, move the light switch upper and lower left levers to positions C and J, respectively. To raise or lower the headlight beam, depress and release the dimmer switch.
- (5) *Instrument panel lights.* With the service headlights in use ((4) above), the instrument panel lights are automatically on bright. With the blackout driving light on ((2) above), the panel lights may be turned to dim or bright. For dim panel lights, move the light switch lower left lever to position K; for bright panel lights, move the lever to position L. To turn off the instrument panel lights, move the lower left lever to position J.
- (6) *Service parking lights.* To operate the service parking lights (fig. 13), raise the light switch lower right lever to position F and simultaneously move the upper lever to position E. Move the lower left lever to position H. To turn off the service parking lights, move the light switch upper and lower left levers to positions C and J, respectively.

## **19. Crankcase Ventilation Valve Dual Control**

The crankcase ventilation valve dual control (G, fig. 12) (on vehicles so equipped) operates the shutoff valves in the crankcase ventilat-



- KEY ITEM**
- A—UPPER LEVER IN BLACKOUT DRIVE POSITION
  - B—UPPER LEVER IN BLACKOUT MARKER POSITION
  - C—UPPER LEVER IN OFF POSITION
  - D—UPPER LEVER IN STOPLIGHT POSITION
  - E—UPPER LEVER IN SERVICE DRIVE POSITION
  - F—LOWER RIGHT LEVER IN UNLOCKED POSITION
  - G—LOWER RIGHT LEVER IN LOCKED POSITION
  - H—LOWER LEFT LEVER IN PARK POSITION
  - J—LOWER LEFT LEVER IN OFF POSITION
  - K—LOWER LEFT LEVER IN DIM PANEL LIGHT POSITION
  - L—LOWER LEFT LEVER IN BRIGHT PANEL LIGHT POSITION

RA PD 196250

Figure 14. Light switch.

ing system. Pull the control out to close the shutoff valves before fording, and push the control in after fording to open the shutoff valves.

## 20. Throttle Control

*a. General.* The throttle control (H, fig. 12) provides hand operation of the carburetor throttle valve. Two types of controls were incorporated in production (par. 6d(7)).

*b. Control Button.* To open the throttle, pull the control button out to obtain the desired engine speed. Friction holds the throttle in the desired position. To decrease engine speed, push the control button in.

*c. Control Handle.* To open the throttle, pull the control handle out to obtain the desired engine speed. To decrease engine speed, turn the handle one-fourth turn counterclockwise, push in and turn the handle one-fourth turn clockwise.

## 21. Windshield Support Frame Clamp Handles and Windshield Holddown Catches (Except Ambulance Truck M43)

*a. General.* The windshield support frame clamp handles (N, fig. 12) draw the windshield support frame lower center weatherstrip

tight against the cowl and hold the windshield support frame in the upright position.

*b. Lowering Windshield Support Frame.*

- (1) Remove cab top cover and related parts (par. 265a).
- (2) Disengage the windshield support frame right and left clamp handles. Lower the windshield support frame and engage the windshield holddown catches (fig. 15) in the support frame brackets.

*c. Raising Windshield Support Frame.*

- (1) Disengage the windshield holddown catches from the windshield support frame brackets. Raise the support frame to the upright position and engage the windshield support frame right and left clamp handles (N, fig. 12). Engage the holddown catches in the catch rests (fig. 15).
- (2) Install cab top cover and related parts (par. 265c).

## **22. Transfer Shift Control Lever**

The transfer shift control lever (Q, fig. 12) is used to shift the transfer into high or low range. For high-range operation, place the lever in the forward position. For low-range operation, pull the lever toward the rear. Refer to paragraph 53 for operating instructions.

## **23. Transfer Declutch Control Lever**

The transfer declutch control lever (R, fig. 12) is used to engage and disengage the front axle drive. To engage the front axle drive, pull the lever back. To disengage the front axle drive, push the lever forward. Refer to paragraph 53 for operating instructions.

## **24. Handbrake Lever**

The handbrake lever (S, fig. 12) is used to hold the vehicle during parking. To apply the handbrake, pull the lever to the rear. To release the handbrake, pull the lever back slightly, depress the button at the top of the lever, and while holding it in the depressed position, push the lever all the way forward.

## **25. Cowl Ventilator Handle**

The cowl ventilator handle (U, fig. 12) admits air to the driver's compartment. To open the ventilator, push the handle forward; to close the ventilator, pull the handle back.

## **26. Transmission Gearshift Lever**

The transmission gearshift lever (W, fig. 12) selects the transmission gears for the various forward speeds or reverse. Refer to paragraph 53 for operating instructions.

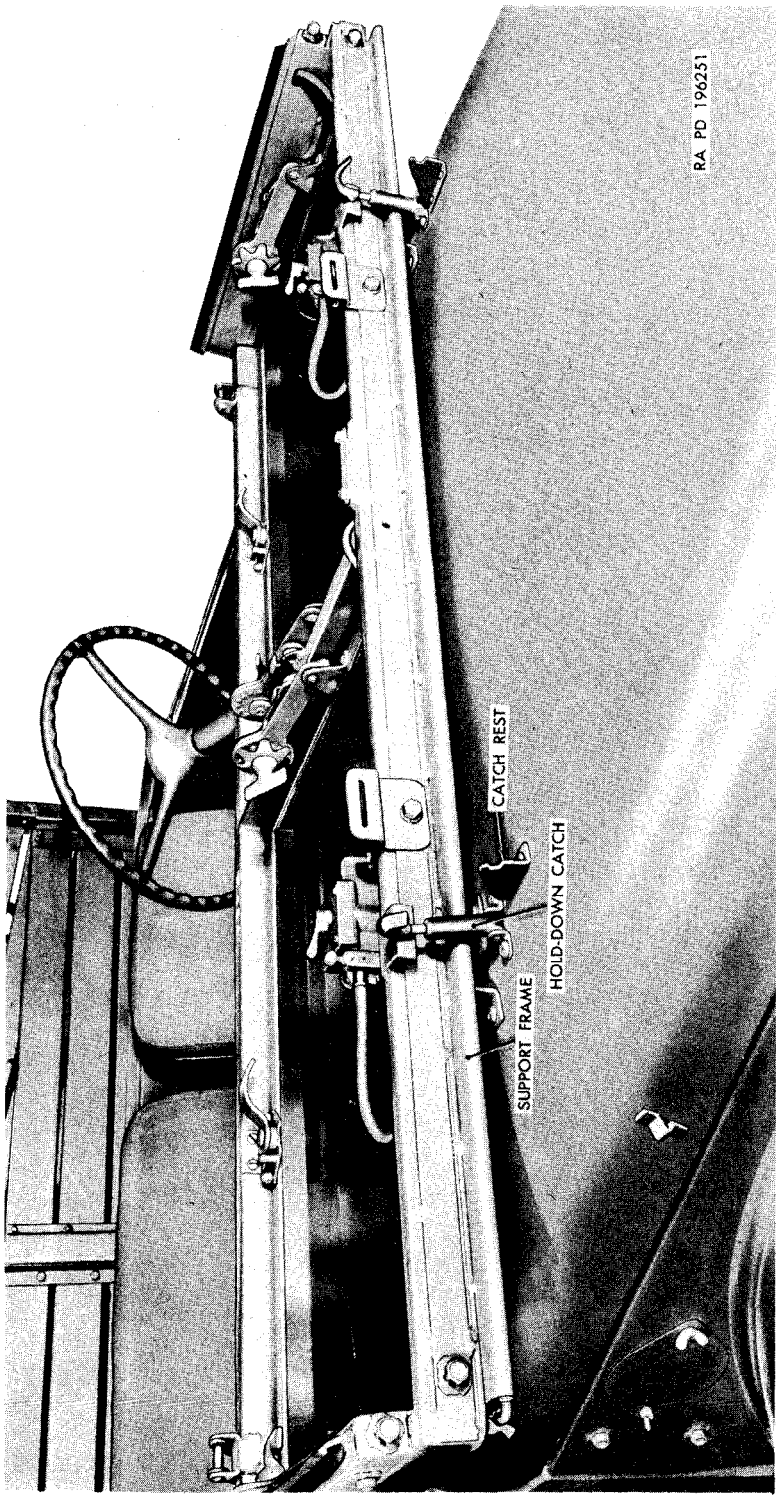


Figure 15. Windshield support frame in lowered position (except ambulance truck M48).

## **27. Starter Switch Pedal**

The starter switch pedal (X, fig. 12) operates the starter. When the pedal is depressed, it engages the starter drive pinion with the flywheel ring gear teeth and closes the starter switch to crank the engine.

## **28. Choke Control**

The choke control (Y, fig. 12) operates the carburetor choke valve. Pull the choke control out to close the choke valve; push the control in to open the valve.

## **29. Power-Take-Off Shift Lever**

The power-take-off shift lever (Z, fig. 12) (on vehicles equipped with a winch assembly) selects gears in the power-take-off for operating the winch drive shaft. A spring-loaded hinged lock secures the lever in neutral position. Refer to paragraph 55 for operating instructions.

## **30. Accelerator Pedal**

The accelerator pedal (AA, fig. 12), connected by linkage to the carburetor throttle lever, controls engine speeds. Depress pedal to increase engine speed; release pedal to decrease engine speed.

## **31. Ignition Switch**

The ignition switch (BB, fig. 12) closes the ignition circuit for engine starting. To turn the ignition on, turn the switch clockwise. To turn the ignition off, turn the switch counterclockwise. When the ignition switch is on, the fuel gage, the ammeter or battery generator indicator, and the water temperature gage register.

## **32. Brake Pedal**

The brake pedal (CC, fig. 12) controls the service brakes. Brake pedal application stops the vehicle and actuates the stop light switch. Refer to paragraph 53 for operating instructions.

## **33. Clutch Pedal**

The clutch pedal (DD, fig. 12) engages and disengages the engine from the transmission. Refer to paragraph 53 for operating instructions.

## **34. Dimmer Switch and High Beam Indicator**

The dimmer switch (EE, fig. 12), operated by foot, controls the beam of the service headlights. Depress and release the switch to change the headlight beam. Use the high beam for open-road night driving when there is no approaching traffic. Use the low beam for

driving in heavy traffic or when approaching on-coming traffic. The service headlight high beam indicator (T, fig. 12) lights when the service lights are on high beam.

### 35. Engine Primer Knob

The engine primer knob (FF, fig. 12) (on vehicles so equipped) actuates the engine primer pump for cold-weather starting. Two full strokes of this pump should be sufficient to start the engine in subzero weather.

### 36. Hood Controls

*a. Hood Locks.* A hood lock (fig. 17), attached to each radiator side support, secures the hood in the closed position.

*b. Hood Holder.* The hood holder secures the hood in the wide open position (fig. 16). To use the holder, disengage it from the hood holder clip (fig. 16), raise the hood, and engage the holder in the hood holder socket.

**Warning:** Never leave the hood in the open position without securing it with the hood holder. A gust of wind or jar may cause an unsupported hood to fall, resulting in serious or fatal injury to personnel.

*c. Hood Supports.* A hinged hood support, mounted on each radiator tie rod, holds the hood in a partially open position. Refer to warning (b above).

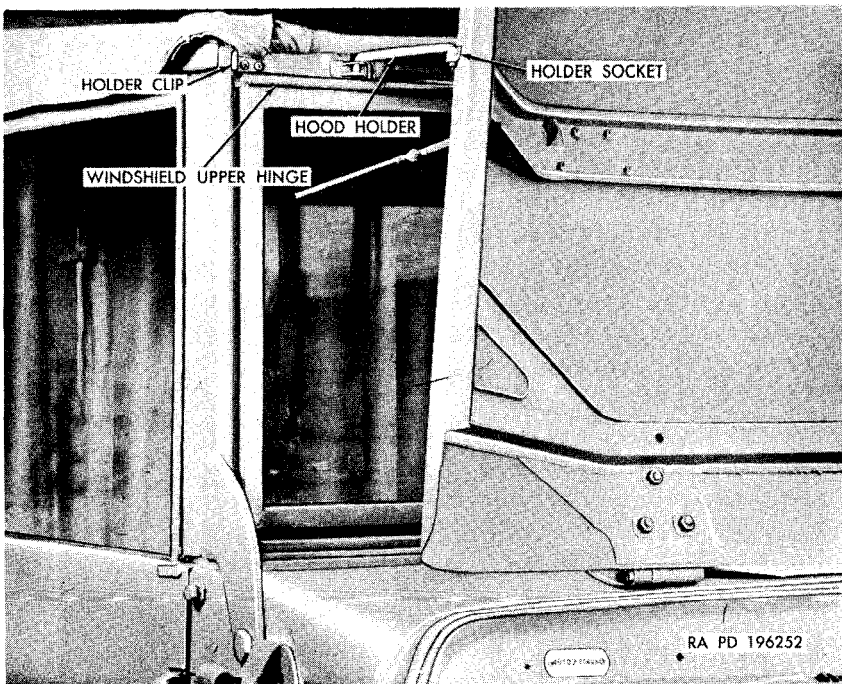


Figure 16. Hood in open position.



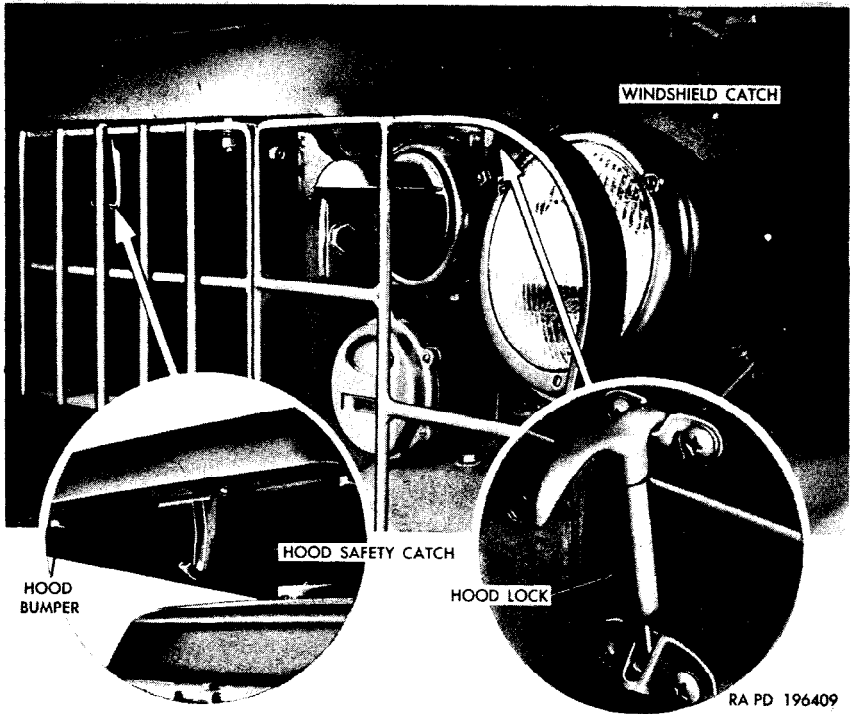


Figure 17. Hood lock and safety catch.

d. *Hood Safety Catch* (fig. 17). The spring-loaded hood safety catch (on vehicles so equipped) prevents the hood from opening in the event the hood locks become disengaged. When the safety catch is held toward the radiator, the hood is released; the catch engages automatically when the hood is closed.

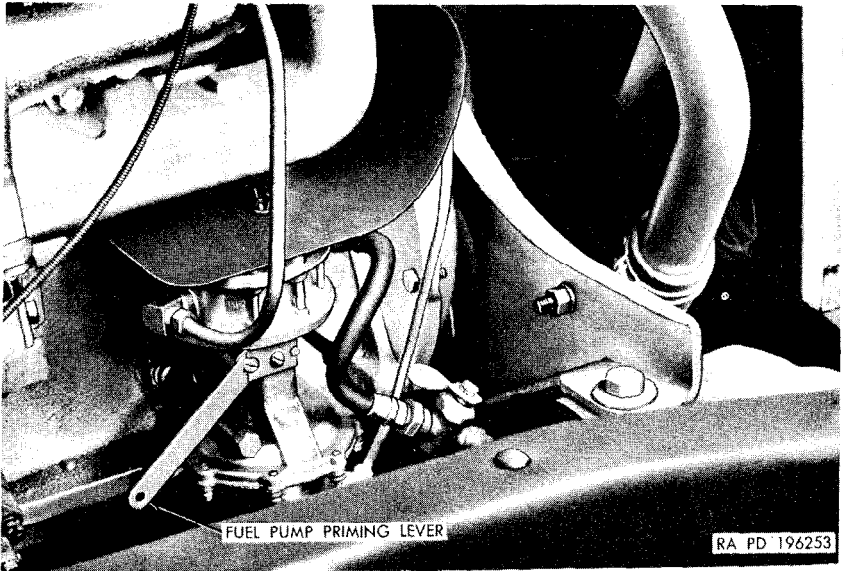
### 37. Fuel Pump Priming Lever

The fuel pump priming lever (fig. 18) fills the fuel system without unnecessary use of the starter and drain on the batteries. If the engine has been run until the fuel supply is exhausted, fill the tank and operate the fuel pump priming lever 30 or 40 strokes, or until the lever works freely, indicating that the carburetor float chamber and fuel line are full. The engine can then be started (par. 52).

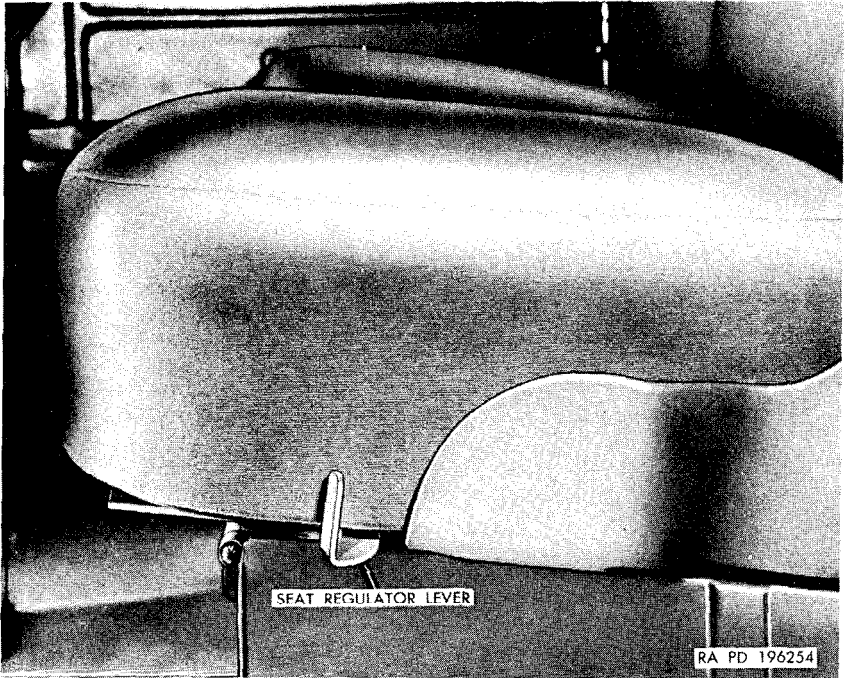
*Note.* If the priming lever moves freely without operating the diaphragm, crank the engine one revolution to move the fuel pump rocker arm from the high point of the cam on the camshaft.

### 38. Driver's Seat Regulator Lever

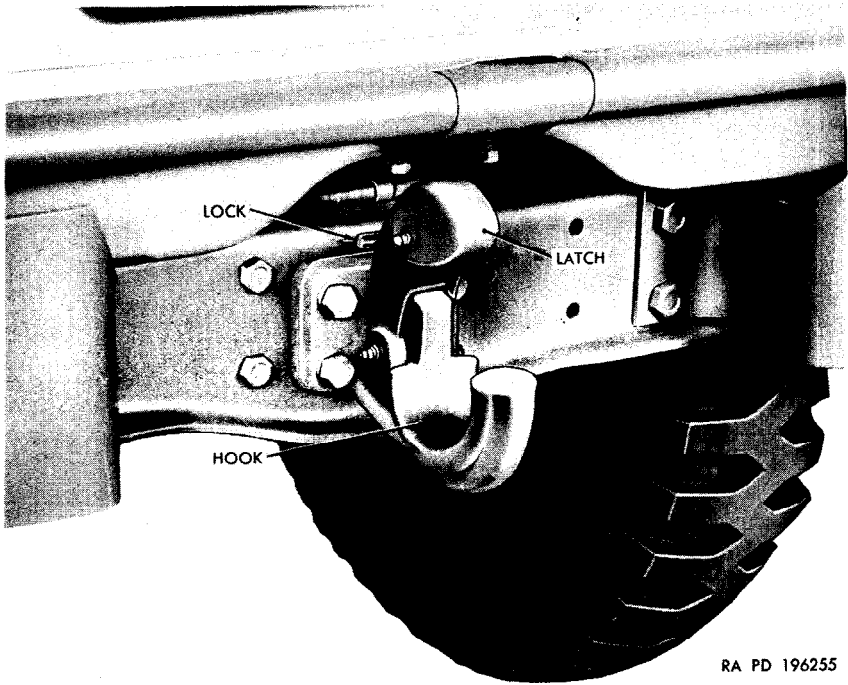
The driver's seat regulator lever (fig. 19) releases the seat regulator to permit seat adjustment. When the lever is held forward, the seat can be moved forward or back to the desired position.



*Figure 18. Fuel pump priming lever.*



*Figure 19. Driver's seat regulator lever.*



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*Figure 20. Pintle (open position).*

### **39. Pintle (Except Ambulance Truck M43)**

The pintle (fig. 20), provided for towing purposes, consists essentially of a hook and hinged latch. A spring-loaded lock secures the pintle latch in the closed position. To open the pintle, pull the lock toward the rear and raise the latch; to close the pintle, push the latch down.

### **40. Hinged-Type Spare Wheel Carrier Lock Levers (Ambulance Truck M43)**

The hinged-type spare wheel carrier (fig. 6) (on ambulances so equipped) can be unlocked from either the inside or outside, thus providing full use of the driver's compartment left door. To open the door from the outside, press the spare wheel carrier lock lever (fig. 6) down, swing the carrier out, and open door. To open the door from the inside, raise the spare wheel carrier inside lock lever to the unlocked position (fig. 21), unlatch the door, and push both the door and the spare wheel carrier open.

### **41. Partition Door Ventilator (Ambulance Truck M43)**

The partition door ventilator (R, fig. 22) is opened or closed by the ventilator knob.

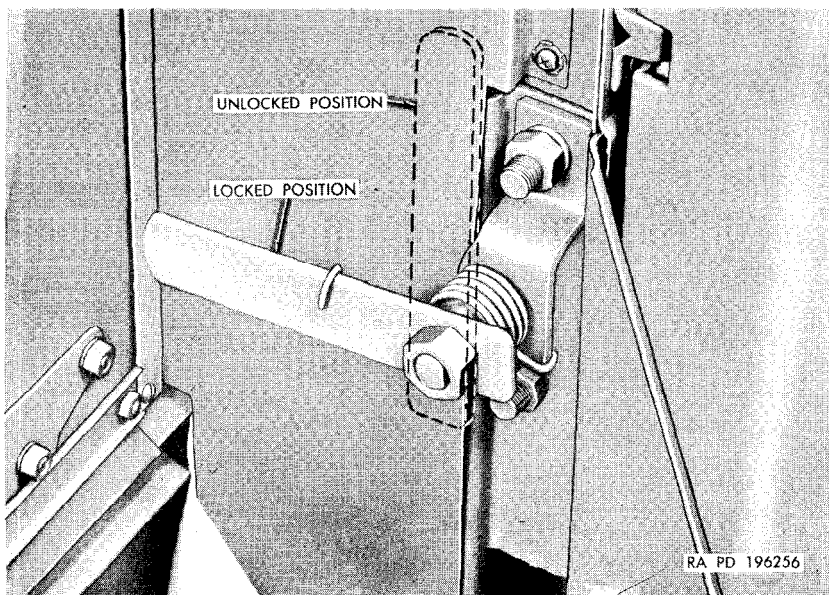


Figure 21. Hinged-type spare wheel carrier inside lock lever (ambulance truck M43).

## 42. Surgical Light and Dome Light (Ambulance Truck M43)

*a. Surgical Light.* The surgical light (C, fig. 22) is provided with a toggle switch to turn the lamp on or off. To direct the light beam, loosen the knurled thumb screw that secures the lamp in the shell and swing the lamp in the desired direction. When the lamp is not in use, position it in the shell and tighten the thumb screw.

*b. Dome Light.* The dome light (E, fig. 22), fitted with a ruby lens, is controlled by a toggle switch.

## 43. Spotlight (Ambulance Truck M43 and Telephone Maintenance Truck V-41)

*a.* The spotlight for the ambulance truck M43 (A, fig. 23) is mounted on the roof of the driver's compartment. The controls are operated by the driver or attendant.

*b.* The spotlight for the telephone maintenance truck V41 is mounted on a support attached to the left front fender and cowl (B, fig. 23), and is operated by the driver.

*c.* To operate either spotlight, turn the vehicle light switch to the SERVICE DRIVE position (E, fig. 14) and push the spotlight switch forward. Either spotlight can be elevated and rotated by the control handle.

- | KEY | ITEM                                   |
|-----|--|
| A   | SEAT BACK (RAISED POSITION)            |
| B   | LITTER RACK CATCH                      |
| C   | SURGICAL LIGHT                         |
| D   | SAFETY STRAP                           |
| E   | DOME LIGHT                             |
| F   | VENTILATOR BLOWER CONTROL VALVE HANDLE |
| G   | SEAT BACK CATCH HOOK                   |
| H   | SEAT BACK (LOWERED POSITION)           |
| J   | SEAT BACK CATCH                        |
| K   | RIGHT LITTER RACK                      |
| L   | LITTER STOWAGE STRAP                   |
| M   | FLOOR PANEL INSPECTION HOLE COVER      |
| N   | HEAT DEFLECTOR HANDLE                  |
| P   | LITTER HOLD-DOWN STRAP                 |
| Q   | LEFT LITTER RACK                       |
| R   | PARTITION DOOR VENTILATOR              |

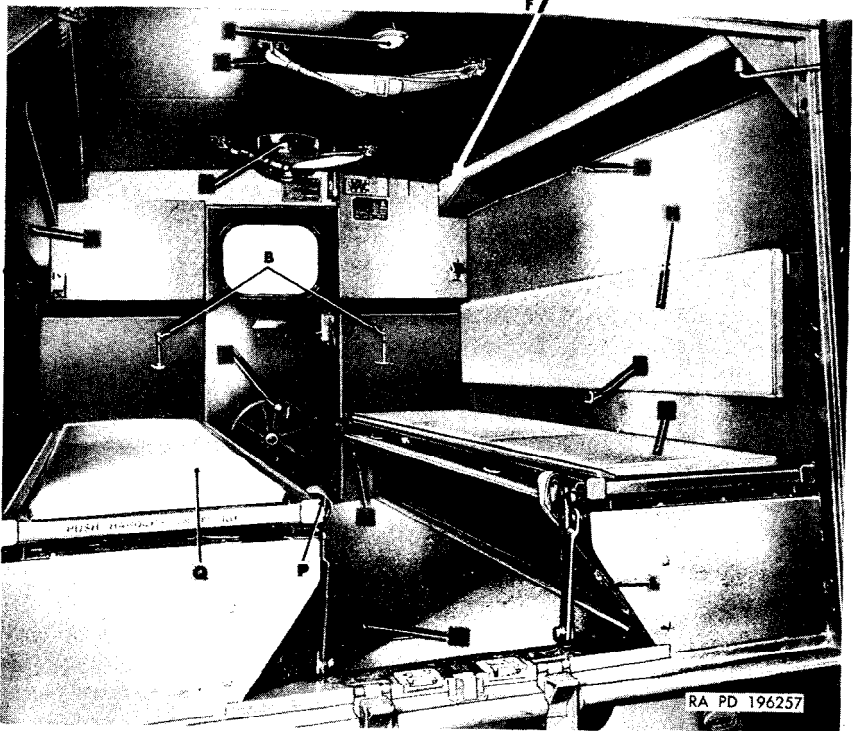
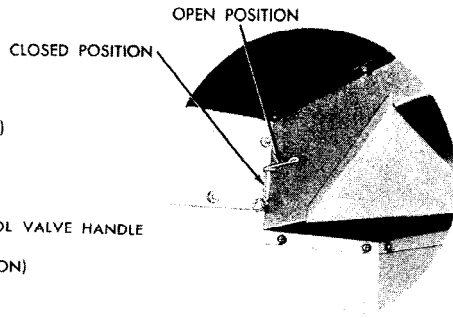
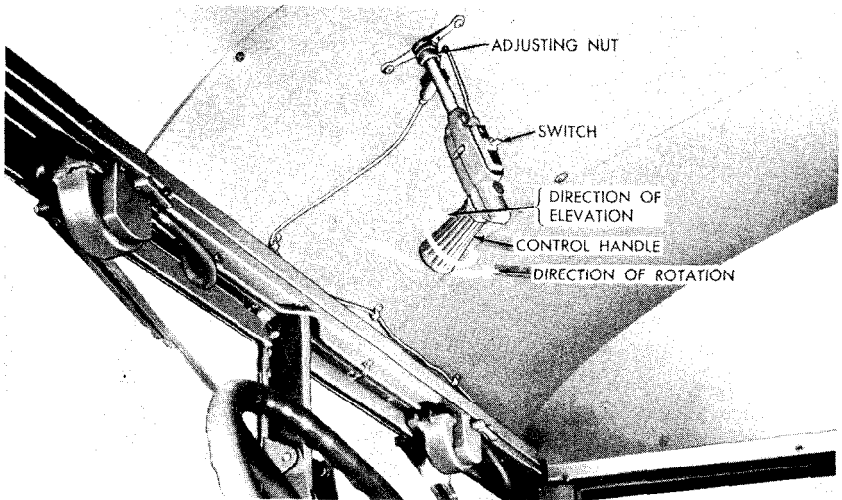


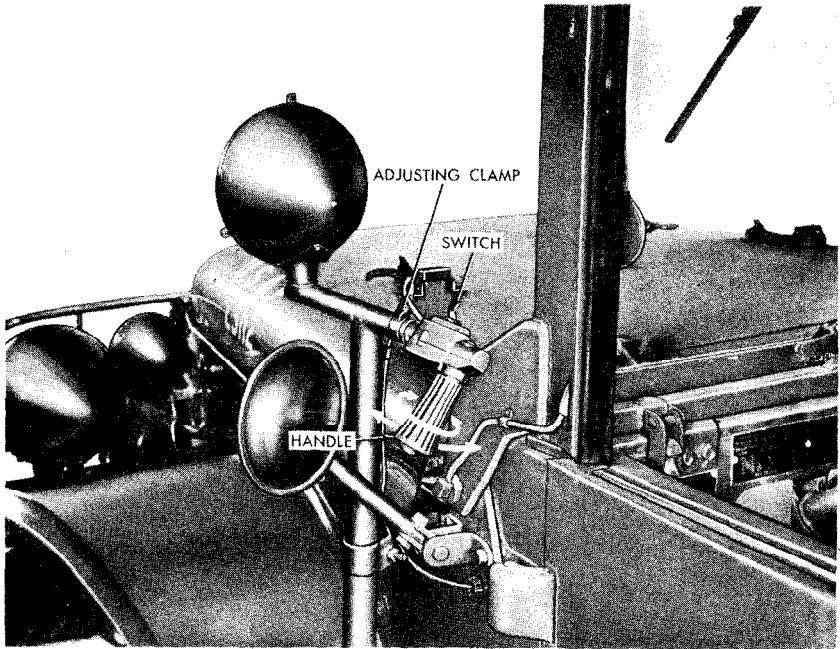
Figure 22. Interior of patient compartment (ambulance truck M43).

#### 44. Litter Racks and Seat Back Cushions (Ambulance Truck M43)

*a. Description.* Two litter racks, provided in the patient compartment (K and Q, fig. 22), may be raised or lowered. With both racks in the raised position, four litter patients can be transported. With the litter racks and seat back cushions in the lower position,



(A) AMBULANCE TRUCK M43



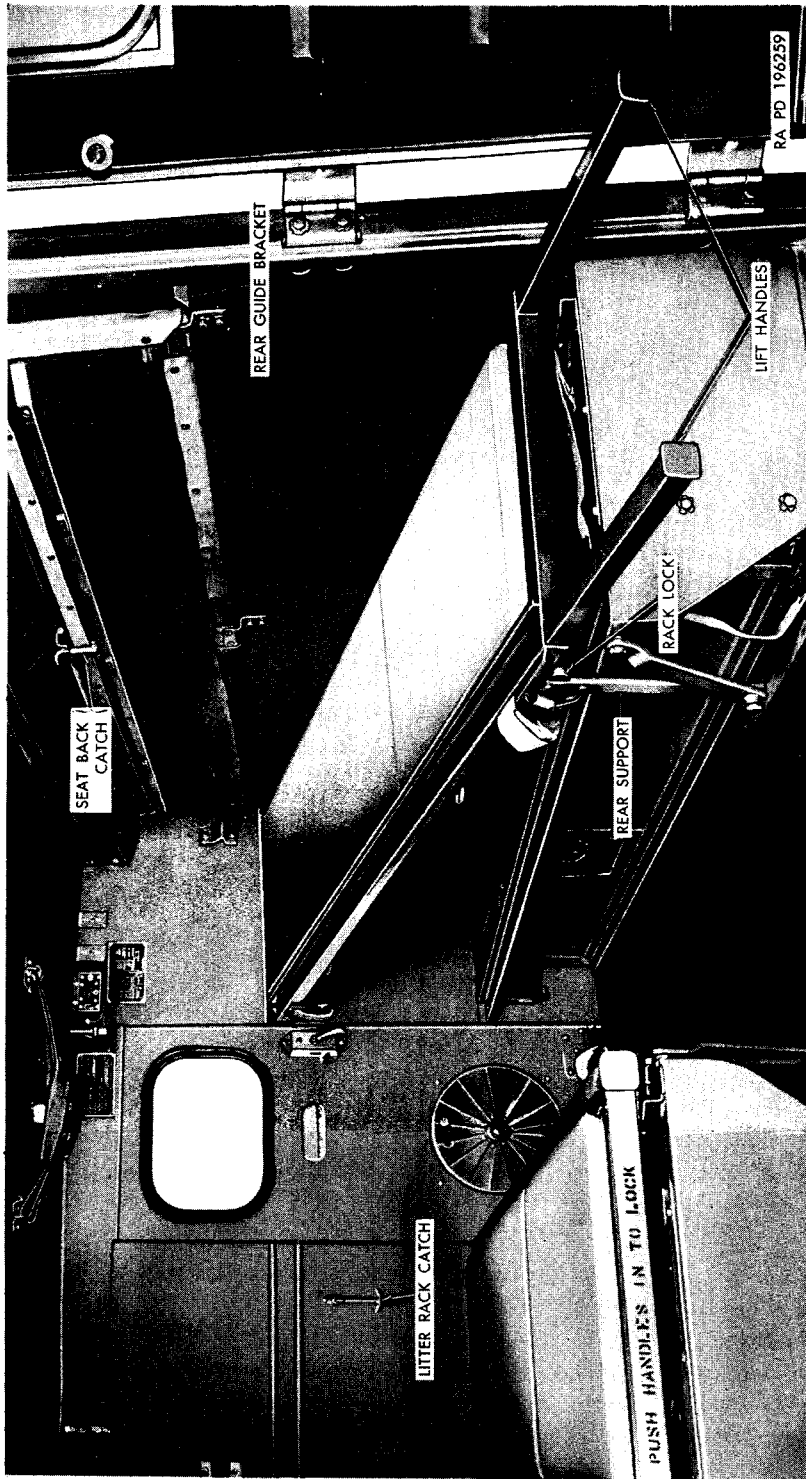
(B) TELEPHONE MAINTENANCE TRUCK V41

RA PD 196258

Figure 23. Spotlight controls.

six seated patients can be accommodated. Safety and litter holddown straps are provided.

*b. Lowering Litter Rack* (fig. 24). The litter rack catch must be disengaged from the catch bracket to provide clearance for lowering the rack. Pull out both litter rack lift handles to disengage the litter rack locks. Push both rack supports forward and lower the



*Figure 24. Raising or lowering litter rack.*

rear of the rack. Lift the front end of the rack from the partition, and lower the rack. Push the two lift handles in.

*c. Raising Litter Rack* (fig. 24). Raise the seat back cushion and engage the seat back catch. Pull out the two litter rack lift handles. Raise the front end of the litter rack and engage the rack pins in the partition openings. Raise the rear of the litter rack and engage with the litter rack rear guide bracket. Push the two lift handles in to lock the litter rack in the raised position.

*Note.* If the litter rack supports are not in the fully raised position, the lift handles cannot be pushed in.

Engage the litter rack catch.

## **45. Ammeter or Battery Generator Indicator**

(J, fig. 12)

*a. Ammeter.* The ammeter (on vehicles so equipped) registers the amperage flowing to or from the batteries. When the generator output exceeds the current drawn by electrical units, the indicator will show CHG (charge). When the current drawn by electrical units exceeds that of the generator, the ammeter will show DIS (discharge). When the batteries are fully charged, the generator regulator reduces the current to the batteries, thereby, protecting them from overcharging; at such times, the indicator may show a zero reading, or slight charge. The ammeter is operative only when the ignition switch is on.

*b. Battery Generator Indicator.* The battery generator indicator (on vehicles so equipped) indicates whether the generator is charging, regardless of the battery condition. The dial is divided into three sections, red, yellow, and green. When the ignition switch is off, the indicator pointer will be in the red section, indicating an open circuit to the batteries. When the ignition switch is on, the indicator pointer moves to the yellow section, indicating a closed circuit to the batteries. When the generator is charging, the indicator pointer moves to the green section.

## **46. Speedometer**

(K, fig. 12)

The speedometer registers the speed in miles per hour of a moving vehicle, and records the total number of miles the vehicle has been driven. A flexible shaft connects the speedometer to the speedometer drive pinion in the transfer.

## **47. Fuel Gage**

(L, fig. 12)

The fuel gage registers the fuel level in the fuel tank. It is connected electrically to the fuel gage sending unit in the fuel tank cover and is operative only when the ignition switch is on.



## 48. Oil Pressure Gage

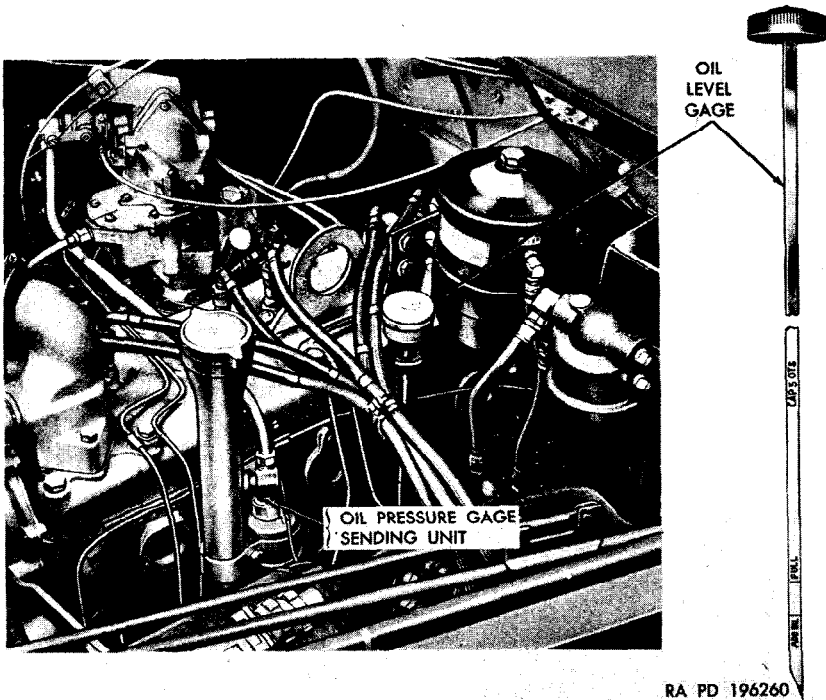
The oil pressure gage (P. fig. 12) registers the pressure in the engine oiling system. It is connected electrically to the oil pressure gage sending unit (fig. 25). Normal pressure at idling speed is 40 psi. Slightly higher pressure should register at increased engine speeds.

**Caution:** If no pressure is registered within 30 seconds after the engine is started, stop the engine and investigate and correct the cause (par. 95*d*).

## 49. Oil Level Gage

(fig. 25)

The bayonet-type oil level gage indicates the oil level in the engine crankcase. Two marks, FULL and ADD OIL, are scribed on the gage. To remove the gage, turn the gage cap counterclockwise to disengage the cap from the gage pipe and pull the gage from the pipe. Wipe the oil from the gage, insert it in the pipe carefully and engage the cap so that an accurate reading will be obtained. Remove the gage again and note the oil level. When installing the gage, turn the cap clockwise to secure it to the gage pipe.



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Figure 25. Oil level gage and oil pressure gage sending unit.

## 50. Water Temperature Gage

(V, fig. 12)

The water temperature gage registers the coolant temperature in the cooling system in degrees Fahrenheit. It is electrically connected to the water temperature gage sending unit in the cylinder head. Gage reading with the engine at normal operating temperature should be between 160° and 165° F. The gage is operative only when the ignition switch is on.

### Section III. OPERATION UNDER USUAL CONDITIONS

#### 51. General

This section contains instructions for the mechanical steps necessary to operate all models of the ¾-ton, 4 x 4 vehicles covered in this manual under conditions of moderate temperatures and humidity. For operation under unusual conditions, refer to paragraphs 63 through 68.

#### 52. Starting the Engine

*a. Starting.* Before starting the engine, make certain the “before-operation” services outlined in table II have been performed.

- (1) Place the transmission gearshift lever in neutral position. Make certain the power-take-off shift lever (on vehicles so equipped) is locked in neutral position.
- (2) Apply the hand brake.
- (3) Pull out the throttle control (H, fig. 12) about one-third of the travel distance.

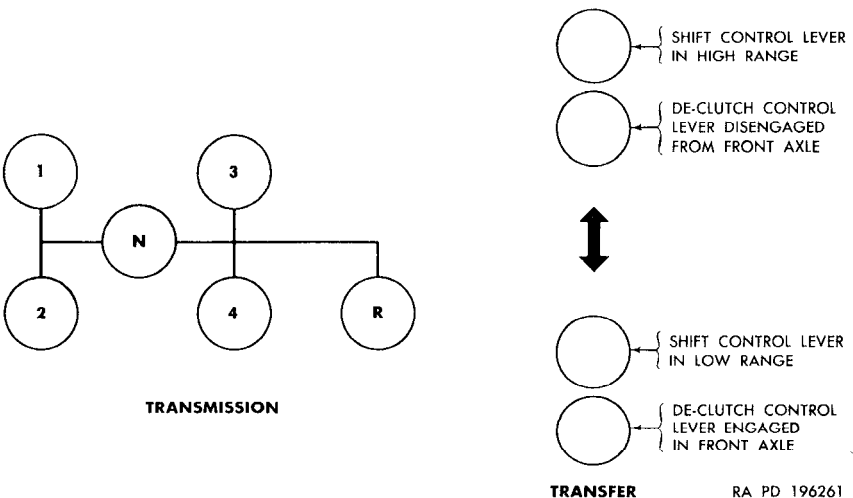


Figure 26. Transmission and transfer shift diagram.

- (4) If the engine is cold, pull out the choke control (Y, fig. 12) all the way (if engine is warm, do not use the choke).
- (5) Depress the clutch pedal (DD, fig. 12).
- (6) Turn the ignition switch (BB, fig. 12) to the ON position and depress the starter switch pedal (X, fig. 12). Release the pedal as soon as the engine starts.

*Note.* Do not operate the starter continuously for more than 30 seconds. If the engine fails to start within 30 seconds, wait 10 to 15 seconds before trying again. If the engine fails to start after a reasonable time, investigate and correct the cause (par. 85b).

- (7) After the engine has started, release the clutch pedal, push the throttle control part way in to reduce engine speed, and push the choke control in until the engine runs smoothly.

*Note.* Push the choke control all the way in, as soon as the engine will operate without stalling.

Observe the engine oil pressure gage reading.

**Caution:** If no pressure is indicated within 30 seconds after the engine is started, stop the engine and investigate and correct the cause (par. 95d).

*b. Warming Up Engine.* Run the engine at idle speed or slightly faster, until the water temperature gage indicates a rise in temperature before operating the vehicle. Avoid high engine speeds during warmup period. Observe the oil-pressure gage, the water temperature gage, and the ammeter or battery generator indicator for proper functioning.

## 53. Driving the Vehicle

*a. Use of Clutch.* To disengage the clutch, depress the clutch pedal (DD, fig. 12) all the way. To engage the clutch, release the clutch pedal.

**Caution:** Avoid "riding" the clutch pedal, as this practice causes unnecessary wear of the clutch parts.

*b. Double-Clutching.* Driving instructions referred to in *c* below are based on the double-clutching procedure while the vehicle is in motion. This procedure consists of momentarily engaging the clutch with the transmission gear shift in the neutral position while shifting gears.

*c. Driving Instructions.*

*Note.* Before driving the vehicle in the daytime, turn the light switch upper lever to STOP LIGHT position (par. 18b (3)). This step is important; otherwise the stop light is inoperative.

- (1) Depress the clutch pedal and place the transmission gearshift lever in first speed position (1, fig. 26).
- (2) Place the transfer shift control lever in high range position and the transfer declutch lever in the disengaged position (fig. 26).

- (3) Release the hand brake lever (S, fig. 12).
- (4) Depress the accelerator pedal (AA, fig. 12) and, at the same time, release the clutch pedal with a steady, gradual motion to prevent sudden engagement, thus, avoiding jerky vehicle movement. As the vehicle moves forward, accelerate the engine gradually until road speed indicated on the transmission and transfer gearshift instruction plate (B, fig. 8) is attained.
- (5) Momentarily, depress the clutch pedal and, at the same time, release the accelerator pedal, move the transmission gearshift lever to the next higher gear position (fig. 26).
- (6) Repeat (4) and (5) above until the vehicle is moving in fourth speed (direct drive).

*d. Use of Reverse.* Before attempting to drive in reverse, first bring the vehicle to a complete stop. Depress the clutch pedal, place the gearshift lever in the reverse position (R, 26), and engage the clutch slowly while depressing the accelerator pedal enough to maintain engine speed.

*e. Stopping Vehicle.* Release the accelerator pedal and apply the brake pedal (CC, fig. 12). As the vehicle slows to a stop, depress the clutch pedal and move the transmission gearshift lever to the neutral position, release the clutch pedal, apply the hand brake, and release the brake pedal.

**Caution:** When applying the brakes, avoid severe application of the brake pedal.

*f. Stopping Engine.* Allow the engine to run a few minutes at idling speed, then turn the ignition switch (BB, fig. 12) to the OFF position.

*g. Use of Transfer.*

- (1) *General.* The transfer may be operated in high range with the front axle engaged or disengaged. When the front axle is engaged, torque is divided equally between the front and rear axles. When the transfer is in low range, the front axle is also engaged, preventing excessive strain on the rear axle.

**Caution:** Front axle should be engaged only in off-the-road operation, on slippery roads, steep grades, or during hard pulling. Disengage front axle when operating on average roads under normal conditions, to prevent excessive tire wear.

- (2) *High range (front axle disengaged).* For operation on a smooth level highway, place the transfer in high range and be sure that the front axle is disengaged. With the vehicle stopped, depress the clutch pedal (DD, fig. 12) and place the transmission gearshift lever (W, fig. 12) in first gear (I, fig. 26). Move the transfer shift control lever (Q, fig. 12) and

the transfer declutch control lever (R, fig. 12) to the forward positions (fig. 26). If difficulty is encountered in shifting the shift control lever, release the clutch pedal slightly to allow the gears to mesh. With the transfer engaged, proceed with the driving operations (c(4) through (6) and *d* above).

**Caution:** Do not attempt to shift either of the transfer control levers with the vehicle in motion, as serious damage to the transfer gears or other internal parts will result.

- (3) *High range (front axle engaged).* To engage the front axle while operating in high range, stop the vehicle, depress the clutch pedal, move the shift control lever to the high range position, and move the declutch control lever to the engaged position (fig. 26). Proceed with driving operations (c(4) through (6) and *d* above).
- (4) *Low range (front axle engaged).* For transporting heavy loads over rough terrain or up steep grades, or for operating through mud, sand, snow, or ice, use low range. With the vehicle stopped, depress the clutch pedal (DD, fig. 12), place the transmission gearshift lever (W, fig. 12) in first gear (1, fig. 26), and move the transfer shift control lever (Q, fig. 12) to the low range position (fig. 26). As the shift control lever is placed in low range position, it engages the transfer declutch control lever (R, fig. 12), moving it to the engaged position. If difficulty is encountered in operating the shift control lever, release the clutch pedal slightly to permit the gears to mesh. With the transfer engaged, proceed with driving operations (c(4), (5), and (6) and *d* above).

*h. Driving up Steep Grades.* When driving up a steep grade, shift the transmission to the next lower gear (fig. 26) to prevent excessive engine laboring or stalling. If it becomes necessary to shift to a still lower gear with the vehicle in motion, depress the clutch pedal and move the gear shift lever to neutral position, quickly release the clutch pedal and, at the same time, accelerate the engine to governed speed, depress the clutch pedal, move the gearshift lever to the lower gear position (fig. 26) and release the clutch pedal, accelerating the engine, as necessary, to prevent loss of speed.

*Note.* The entire procedure must be accomplished quickly and smoothly to be effective.

*i. Driving Down Steep Grades.* When driving down long, steep grades, shift the transmission to a lower gear to permit the engine to assist in slowing the vehicle. The gear selected will be determined by the length and steepness of the grade. Usually the second speed gear is preferred to any other.

**Caution:** Avoid constant and severe application of the brakes to prevent burning or excessive wear of brake linings.

*j. Road Speeds.* The transmission and transfer gearshift instruction plate (B, fig. 8) shows maximum permissible road speeds in various gears. Do not exceed these speeds unless tactical conditions demand it. A new or rebuilt vehicle should be driven carefully during the first 500 miles of operation and should not be driven at sustained high speed during the first 2,000 miles of operation. Operation in fourth speed should not exceed 28 mph during the initial 500-mile breaking-in period.

**Caution:** Avoid careless operation in the lower gears, as it will result in high engine speed.

In the lower gears, the speeds comparable to 28 mph in fourth gear are third gear 17 mph; second gear 9 mph; and first gear 4 mph. After the first 500 miles, speeds may be increased slightly for brief periods until the breaking-in process (2,000 miles) is completed.

*k. Maintenance.* See table II for before operation, during operation, at-the-halt, and after-operation maintenance services to be performed by the driver or operator.

## 54. Towing the Vehicle

### *a. Towing to Start Engine.*

**Caution:** Do not attempt to tow the vehicle until the reason for not starting has been determined.

- (1) Attach a towing cable or chain from the pintle (fig. 20) of the towing vehicle to the lifting shackles (fig. 27) at the front of the stalled vehicle.
- (2) Prepare stalled vehicle for towing. Pull out the choke control (Y, fig. 12) and throttle control (H, fig. 12) about one-third of its travel. Turn the ignition switch (BB, fig. 12) on. Depress the clutch pedal (DD, fig. 12) and place the transmission gear shift lever (W, fig. 12) in fourth gear position (fig. 26). Place the transfer shift control lever (Q, fig. 12) in the high range position and the transfer declutch control lever (R, fig. 12) in the disengaged position (fig. 26). **Keep the clutch pedal depressed until the vehicles are moving at a speed sufficient to start the stalled engine ((4) below).**
- (3) Operate the towing vehicle in first gear, starting slowly to avoid unnecessary strain.
- (4) As both vehicles attain a speed of approximately 5 mph, carefully release the clutch pedal of the towed vehicle.

*b. Towing a Disabled Vehicle.* The method of towing a disabled vehicle must be determined by the nature of the disability. The instructions in (1) through (6) below will serve as a guide in selecting the method of towing.

- (1) If no damage exists in the power train from the wheels through the transfer, the vehicle may be towed with the four

wheels on the ground. Place the transmission gear shift lever in neutral and the transfer control levers in the forward positions (fig. 26). This method of towing requires a driver in the towed vehicle to steer and to operate the brakes. Keep the towing cable taut by applying the brakes as necessary.

- (2) If damage is within the transfer assembly, disconnect both axle propeller shafts at the differentials and secure them to the frame. The vehicle may then be towed with all four wheels on the ground ((1) above).
- (3) If the damage is within the rear axle, remove the rear axle drive shafts (par. 210*a*). Secure a piece of tin or cardboard over the flange openings to retain the grease in the axle. The vehicle may then be towed with all four wheels on the ground, ((1) above).
- (4) If the damage is within the front axle or the universal drive parts have been damaged, remove the drive flanges (par. 205*a*). The vehicle may then be towed with all four wheels on the ground, ((1) above).
- (5) If the vehicle must be towed with the front wheels off the ground, make certain that the transfer control levers are in the forward position (fig. 26).
- (6) Avoid towing the vehicle with the rear wheels off the ground, unless other methods are impossible.

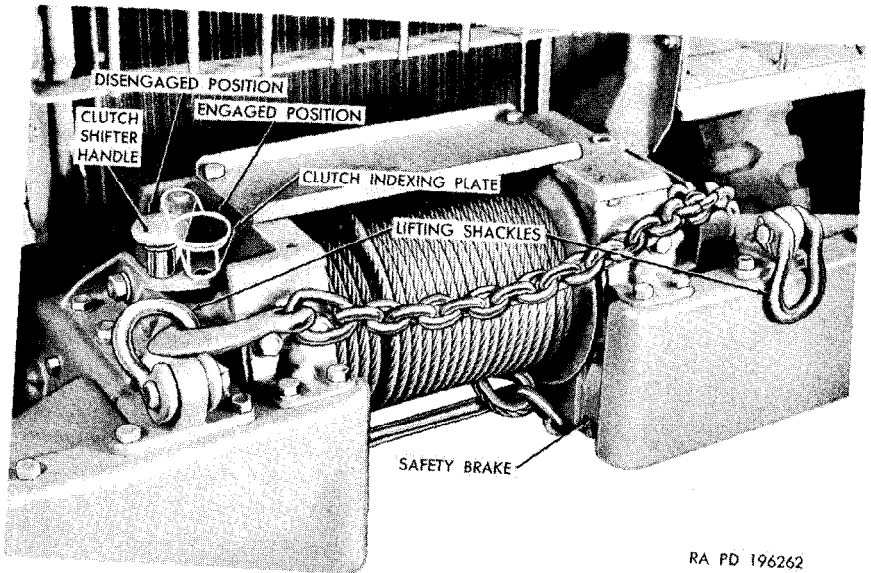
#### **Section IV. OPERATION OF MATERIEL USED IN CONJUNCTION WITH MAJOR ITEM**

##### **55. Winch and Power-Take-Off (On Vehicles So Equipped)**

*a. General.* The winch (fig. 27), mounted at the front of the vehicle, is operated by power transmitted through the transmission and power-take-off and the winch drive shaft. The winch clutch shifter handle controls engagement and disengagement of the winch clutch with the winch cable drum. The power-take-off shift lever (fig. 28) controls direction of winch drum rotation when the clutch shifter handle is in the engaged position. A safety brake operates on the winch worm shaft to hold the load.

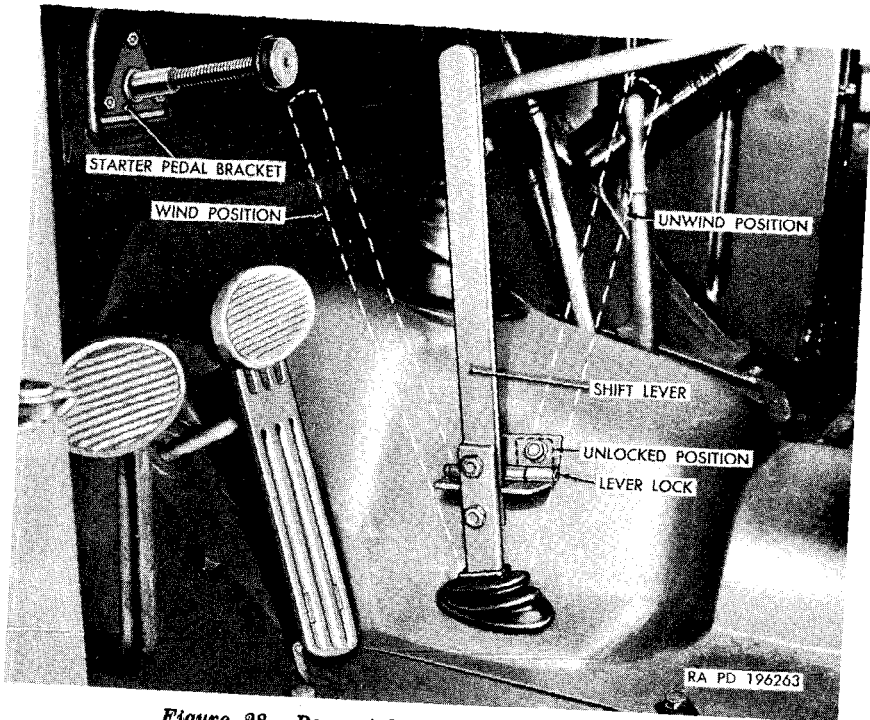
##### *b. Controls.*

- (1) To operate the winch clutch shifter handle (fig. 27), raise the handle knob to disengage the knob shaft from the clutch indexing plate, move the handle to the engaged or disengaged position, and release the handle knob. The knob shaft spring holds the handle in position on the indexing plate.
- (2) To operate the power-take-off shift lever (fig. 28), raise the lever lock, and move the shift lever to the desired position. The lock is spring-loaded to hold the lever in neutral position and prevent accidental winch drive shaft engagement.



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Figure 27. Winch installed.



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Figure 28. Power-take-off shift lever positions.



*c. Unwinding Cable.* To unwind winch cable, move the winch clutch shifter handle to the disengaged position, and pull cable from the drum until the required length of cable has been unreeled.

*d. Unwinding Cable Under Load.*

- (1) Start the engine and run at idle speed or slightly faster until normal operating temperature is reached.
- (2) Place the winch clutch shifter handle in the engaged position (*b*(1) above).
- (3) Apply the hand brake lever (S, fig. 12).
- (4) Depress the clutch pedal (DD, fig. 12) and move the power-take-off shift lever to the unwind (rear) position (*b*(2) above).
- (5) Release the clutch pedal and depress the accelerator pedal. Operate the engine at an even speed to wind the cable.
- (6) To stop the cable, depress the clutch pedal and release the accelerator pedal. The winch safety brake will hold the load.

*e. Winding Cable.* Procedure for winding the cable is the same as for unwinding under load, with the exception of *d*(4) above. To wind the cable, place the power-take-off shift lever in the wind (forward) position. If all the cable has been unreeled from the drum, guide the cable as it winds to keep the first layer of coils as close together as possible, thus preventing the next layer from pressing in between the coils of the preceding layer.

**Caution:** Do not wind the cable too far, as serious damage may result if it is wound beyond the thimble that attaches the chain to the cable.

Clean and lubricate the drum and cable. Refer to lubrication order (figs. 33 and 34).

## **56. Ventilator Blowers (Ambulance Truck M43)**

*a. General.* Two ventilator blowers are provided to draw hot air or odors from the patient compartment. Each blower motor is controlled by a switch (fig. 10). Openings in the blower ducts are controlled by the ventilator blower control valve handles (F, fig. 22).

*b. Operation.* To operate either blower, turn the blower switch (fig. 10) on. Turn the ventilator blower control valve handles (F, fig. 22) to the desired position to regulate the valve. When the valve handles are in the horizontal positions the valves are fully open; when the handles are in the vertical position, the valves are fully closed.

## **57. Personnel Heater (Ambulance Truck M43)**

*a. General.* Personnel heater operation in the patient compartment is controlled by the heater control. Compartment temperature is regulated by the personnel heater thermostat (fig. 10).

*b. Operation.* Specific instructions for operating the heater and thermostat are provided on the personnel heater operating instruction plate (fig. 10). To deflect the stream of warm air from the heater outlet, move the heat deflector handle (N, fig. 22).

## **58. Ladder Rack Lock Control (Telephone Maintenance Truck V-41)**

The ladder rack lock control (fig. 29) secures ladders and other equipment on the rack. To open the lock, move the control forward. To close the lock, move the control toward the rear.

## **59. Pole Rack Lock Control (Telephone Maintenance Truck V-41)**

The pole rack lock control secures pike poles during transit. To open the rack, pull the control outward as shown in figure 29. To close the rack, move the control down.

## **60. Water Cask Fasteners (Telephone Maintenance Truck V-41)**

Two spring-loaded water cask fasteners secure the water cask (fig. 29) in position. To engage or disengage the fasteners, pull against spring tension and hook or unhook from the fastener catches.

## **61. PR Reel (Telephone Maintenance Truck V-41)**

*Note.* The key letters noted in parentheses are in figure 30.

*a. General.* The PR reel (C) is supported in a frame mounted on three support brackets (A, E, and F) in the truck body. The expansion lock pin (B) secures the outer section of the reel in one of four positions on the reel shaft to accommodate different sizes of cable or varying loads on the reel. Reel braking is controlled by the brake wing nut (D). The support bracket lock lever (G) locks the reel frame in the support brackets.

*b. Removal.* Move the support bracket lock lever (G) upward to the unlocked position. Lift the PR reel (C) from the brackets.

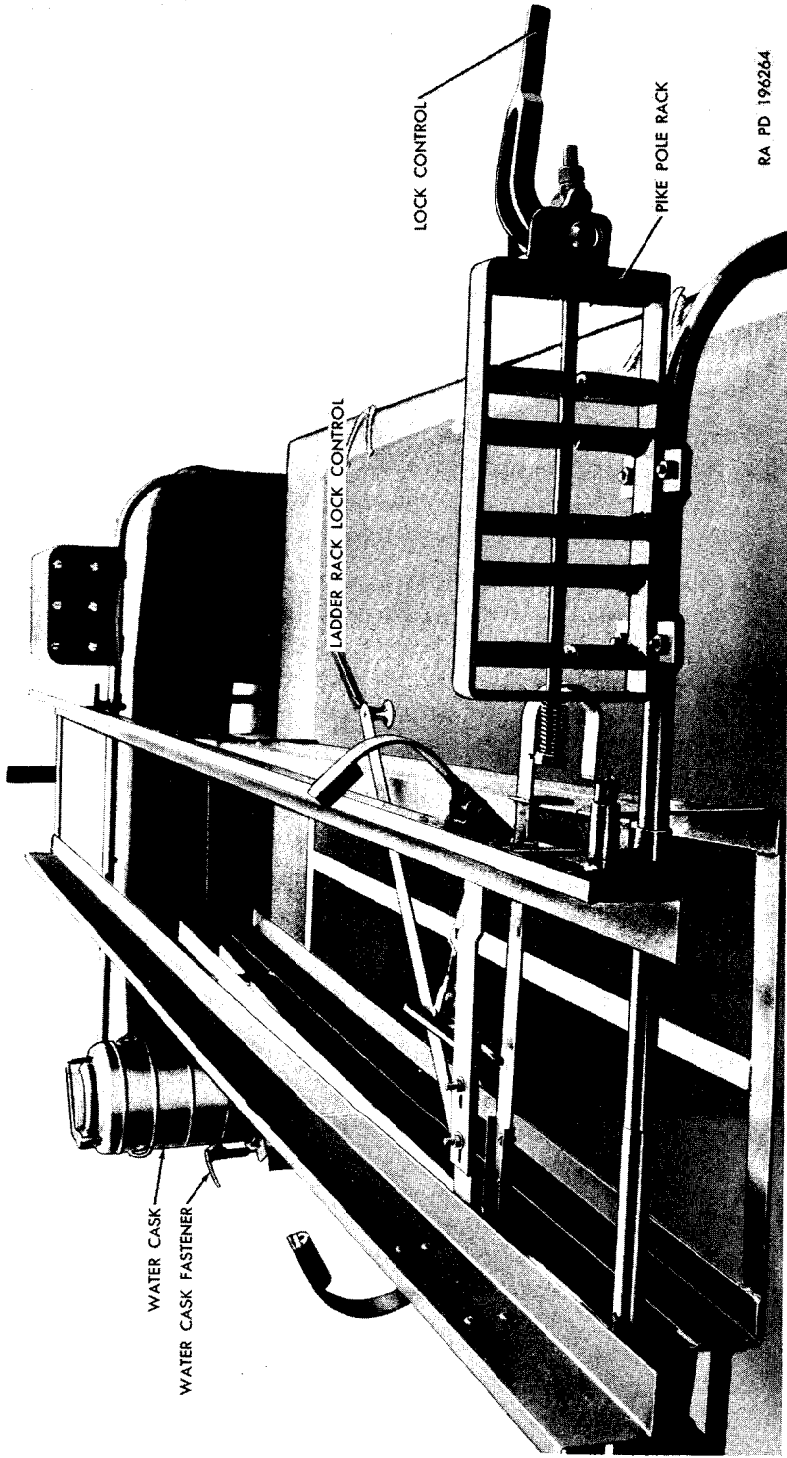
*c. Installation.* With the support bracket lock lever (G) in the unlocked position, mount the PR reel (C) in the three support brackets. Pull the lock lever down to the locked position.

## **62. Fire Extinguisher**

fig. 31

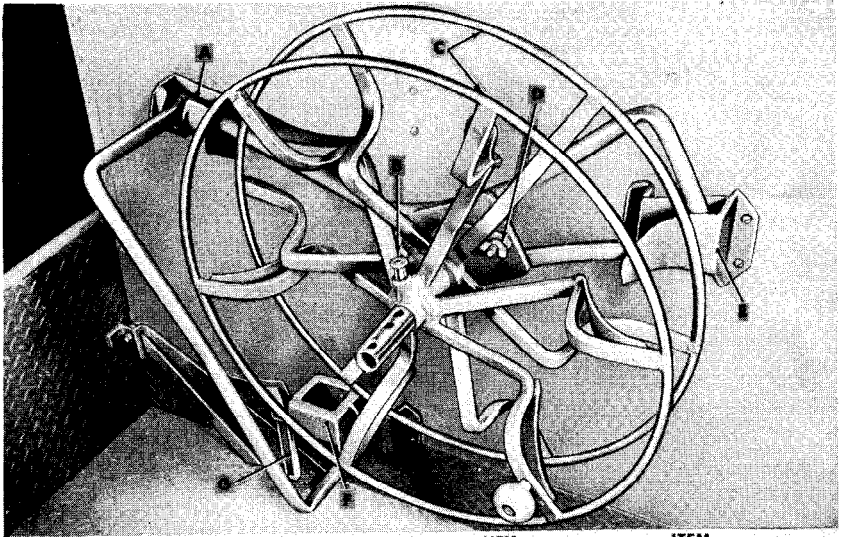
*a. Location.* The fire extinguisher is mounted in a bracket on the right cowl inside panel of the cab (cargo truck M37, command truck M42, and telephone maintenance truck V41) or to the rear of the right door inside the driver's compartment (ambulance truck M43).

*b. Operation.* Remove the extinguisher from the bracket. Turn the handle counterclockwise to the released position and work with a pumping motion. For best results, direct the discharge toward the base of the flames. To extinguish burning liquid in a container, direct the discharge against the inside of the container just above the burning liquid.



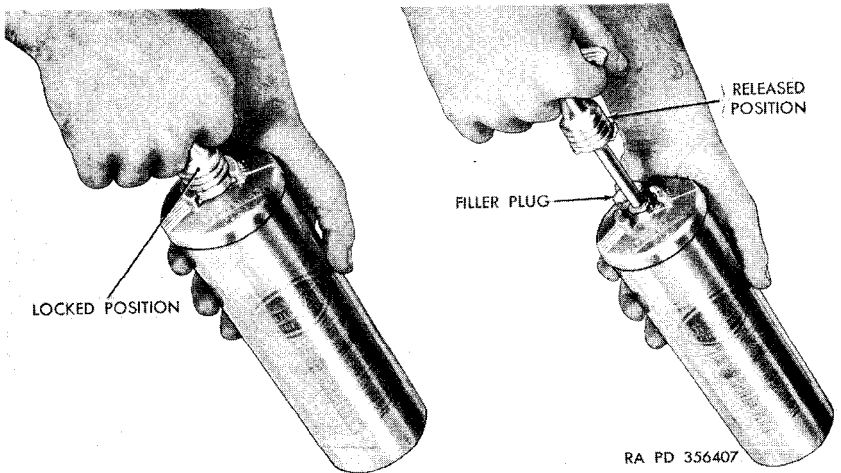
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Figure 29. Ladder rack lock control, pole rack lock control, and water cask fastener (telephone maintenance truck V-41).



- | KEY | ITEM                        | KEY | ITEM                         |
|-----|-----------------------------|-----|------------------------------|
| A   | —UPPER REAR SUPPORT BRACKET | E   | —UPPER FRONT SUPPORT BRACKET |
| B   | —EXPANSION LOCK PIN         | F   | —LOWER SUPPORT BRACKET       |
| C   | —PR REEL                    | G   | —LOCK LEVER                  |
| D   | —BRAKE WING NUT             |     |                              |
- RA PD 196265

*Figure 30. PR reel installed (telephone maintenance truck V-41).*



*Figure 31. Operation of fire extinguisher.*

*c. Maintenance.* Each time the extinguisher is used, refill with fire extinguisher liquid through the filler plug opening. After filling, turn the handle to the locked position. Keep the extinguisher clean, fully charged, and properly stowed.

## **Section V. OPERATION UNDER UNUSUAL CONDITIONS**

### **63. General Conditions**

*a.* In addition to the operating procedures described for usual conditions, special instructions of a technical nature for operating and servicing these vehicles 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 materials.

*b.* TM 21-300 contains very important instructions on driver 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 technical manuals is essential for use of this materiel under unusual conditions.

*c.* Refer to paragraph 75 for lubrication under unusual conditions; to table II and table III for preventive maintenance checks; and to par. 278-282 for maintenance procedures.

*d.* When recurrent failure of materiel results from subjection to extreme conditions, report the condition on DA Form 468 (par. 3*d*).

### **64. Extreme-Cold Weather Conditions**

#### *a. General Problems.*

- (1) Extensive preparation of materiel scheduled for operation in extreme-cold weather is necessary. Generally, extreme cold will cause lubricants to thicken, freeze batteries or prevent them from furnishing sufficient current for cold-weather starting, crack insulation and cause electrical shortcircuits, prevent fuel 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) The cooling system must be prepared and protected for temperatures below +32° F. in accordance with instructions in TM 9-2855 on draining and cleaning the system and the selection, application, and checking of antifreeze compounds to suit the anticipated conditions.

- (3) TM 9-2855 also describes the method of correcting specific gravity readings for batteries exposed to extreme cold.
- (4) For description of operations in extreme cold, refer to FM 31-70 and FM 31-71 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 specifically applicable to these vehicles 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.* Special equipment is provided for the vehicles when protection against extreme-cold weather (0° to -65° F.) is required. This equipment is issued as specific kits. Each kit contains a technical bulletin which provides information on description, installation instructions, and methods of use. TM 9-2855 contains general information on winterization equipment and processing.

*c. Fuels, Lubricants, and Antifreeze Compounds (Storage, Handling, and Use).*

- (1) 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.
- (2) In arctic operations, contamination with moisture is a source of many difficulties. Moisture can be the result of snow getting into the product, condensation due to "breathing" of a partially filled container, or moisture condensed from warm air in a partially filled container when a product is brought outdoors from room temperature. Other impurities will also contaminate fuels and lubricants so their usefulness is impaired.
- (3) Refer to TM 9-2855 for detailed instructions on storage, handling, and use.

## **65. Extreme-Cold Weather Operation**

*a. General.*

- (1) The driver must always be on the alert for indications of the effect of cold weather on the vehicle.
- (2) The driver must be very cautious when placing the vehicle in motion after a shutdown. Thickened 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 clutch surfaces. After warming up the engine thoroughly, place transmission

in first gear and drive vehicle slowly about 100 yards, being careful not to stall the engine. This should heat gears and tires to a point where normal operation can be expected.

- (3) Constantly note instrument readings. If instrument reading consistently deviates from normal, stop the vehicle and investigate the cause. A special engine thermostat provided in the arctic winterization kit opens at 180° F., and at this temperature, the engine will give best results. If temperature gage reading consistently exceeds 200° F., adjust flap on radiator winterfront cover to admit more air.

*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, park so that the vehicle does not face into the wind. For long shutdown periods, if high ground is not available, prepare a footing of planks or brush. Chock in place if necessary.
- (2) When preparing a vehicle for shutdown periods, 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 II for detailed after-operation procedures. If the winter front and side covers are not 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 heater is present, the batteries should be removed (par. 168*b*) and stored in a warm place.
- (5) Refuel immediately in order to reduce condensation in the fuel tank. Prior to refueling, open fuel tank drain cock and drain off any accumulated water.
- (6) Immediately after engine "shutdown," start the power plant heater and check to be sure it operates effectively. The heater should avoid the necessity of removing the batteries to warm storage, and is designed to operate unattended during overnight stops. Instructions for operation of winterization equipment are contained in the pamphlet packed with the kit.
- (7) Correct tire inflation pressure is prescribed in paragraph 67*b*.
- (8) When drain cocks have been opened to remove liquid from the cooling system, inspect both drain cocks to be sure they are not obstructed. If the drain cocks are obstructed by foreign material, remove the two cocks. This is particularly

important before leaving a vehicle that has had the engine drained to protect the block from freezing. The draining of an engine cooling system to prevent freezing will be done only when no approved antifreeze solution is available.

## **66. Operation in Extreme-Hot Weather Conditions**

*a. General.* Continuous operation of the vehicle at high speeds or long hard pulls in low gear positions on steep grades or in soft terrain may cause the water temperature gage to register overheating. Avoid the continuous use of low gear ratios whenever possible. Continually watch the temperature and halt the vehicle for a cooling-off period whenever necessary and the tactical situation permits. Frequently inspect and service cooling unit, oil filter, and air cleaner. If the engine temperature consistently rises above 200° 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 (par. 149). Also, check that the correct type thermostat is installed. If a 180° thermostat is in use, replace it with a 160° unit (par. 151).

*b. At Halt or Parking.*

- (1) Do not park the vehicle in the sun for long periods, as the heat and sunlight will shorten the life of the tires. If possible, 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 window glass against sand etching, and protect engine compartment against entry of sand.
- (3) Correct tire inflation pressure is prescribed in paragraph 67*b*.
- (4) Vehicles inactive for long periods in hot humid weather are subject to rapid rusting and accumulation of fungi growth. Make frequent inspections and clean and lubricate to prevent excessive deterioration. Be sure that the cooling system is protected with rust inhibitor compound and that the paint is in good condition. Remove the batteries (par. 168*b*) and store in a cool place. See SB 9-4 for detailed instructions on limited storage.

## **67. Operation on Unusual Terrain**

*a. General.*

- (1) Vehicle operation on snow or ice and in deep mud requires the use of tire chains. Tire chains must be installed in pairs (front and rear) to prevent power train damage and wear. Select a gear ratio low enough to move vehicle steadily and without imposing undue driving strain on engine and power train. However, racing of the engine for extended periods must be avoided.

*Note.* Avoid excessive clutch slippage.



- (2) Operators must at all times know the position in which the front wheels are steering, as the vehicle may travel straight-ahead even though the wheels are cramped right or left. A piece of string or friction tape attached to the front portion of the steering wheel rim in "straightahead" 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 others spin, it may be necessary for the vehicle to be winched or towed by a companion vehicle, or to jack up the wheel which is mired and insert planking or matting beneath it. Do not jam sticks or 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. Engine vents and other exposed vents should be covered with cloth.
- (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. Recommended Tire Pressures.* Pressure in all tires is 40 psi for driving cross-country or on highways. For operation in mud, sand, or snow, reduce tire pressure to 15 psi. Be sure to increase tire pressure to 40 psi after operating in mud, sand, or snow.

*c. After-Operation Procedures.* Remove accumulations of snow, ice and mud from under the fenders and from the radiator core, engine compartment, steering knuckles and arms, brake cylinder boots and hoses, air cleaner, and electrical connections.

**Caution:** Exercise care when removing such accumulations to prevent damage to the affected areas.

## **68. Fording Operation**

*a. General.* In fording, vehicles may be subjected to water varying in depth from only a few inches to a depth 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.* Maximum vehicle fording depth is 42 inches in the standard vehicle provided with waterproofing protection provided for critical units during manufacture, but without a deep-water fording kit. Observe the precautions listed in (1) through (6) below before and during fording.

- (1) Make sure the battery cell vent caps are snug.
- (2) Verify depth of water to be forded and do not exceed the known fording limits of the vehicle.

- (3) The engine must be operated at maximum efficiency before attempting to ford.
- (4) Shift the transmission into first speed position, and engage the transfer shift lever in low range (this will engage the front axle). On vehicles so equipped, close the crankcase ventilation shutoff valves by pulling out the crankcase ventilation valve dual control (G, fig. 12). Pull out the throttle control (H, fig. 12) to overcome the possibility of a "stall" when the cold water chills the engine. Enter the water slowly. Should the engine stall while submerged, it may be started in the usual manner.
- (5) All normal fording should be at speeds of from 3 to 4 mph to avoid forming a "bow wave." Avoid using the clutch, if possible, because frequent use while submerged may cause the clutch to slip. If the ford is deep enough for the spinning fan blades to catch water, loosen the fan belt before crossing; otherwise, they may throw water over the electrical units. The brakes will usually be "lost" but in some cases may "grab" after vehicle emerges. Applying the brakes a few times after dry land has been reached will help dry the brake linings.
- (6) If accidental complete submersion occurs, the vehicle will be salvaged, temporary preservation applied as outlined in paragraph 279 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, descriptions, and methods of use of deep-water fording kits, and for general procedures for the operation of vehicles so equipped.

*d. After-Fording Operations.* Immediately after vehicle emerges from the water, push in the crankcase ventilation valve dual control (G, fig. 12), mounted on the instrument panel (on vehicle so equipped), to allow the crankcase ventilating system to operate normally and relieve crankcase pressure. Push in the throttle control (H, fig. 12). Open all drain holes in body. Check the condition of all tools and equipment carried on the vehicle. Clean and dry all items and stowage compartments as soon as possible. Also, at the earliest opportunity, check the engine oil level and check for presence of water in the crankcase. Heat generated by driving will evaporate or force out most water which has entered at various points. Also, any *small* amount of water which has entered the crankcase either through leakage or due to condensation will usually be dissipated by the ventilating system. Refer to paragraph 279 for maintenance operations after fording.

## CHAPTER 3

### ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

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

##### 69. General

Tools, equipment, and spare parts are issued to the using organization for maintaining the materiel. Tools and equipment should not be used for purposes other than prescribed and, when not in use, should be properly stored in the compartment and/or roll provided for them.

##### 70. Parts

Spare parts are supplied to the using organization for replacement of those parts most likely to become worn, broken, or otherwise un-serviceable, providing replacement of these parts is within the scope of organizational maintenance functions. Spare parts, tools, and equipment supplied for the  $\frac{3}{4}$ -ton cargo truck M37, command truck M42, ambulance truck M43, and telephone maintenance truck V41 are listed in Department of the Army Supply Manual ORD 7 SNL G-741, which is the authority for requisitioning replacements.

##### 71. Common Tools and Equipment

Standard and commonly used tools and equipment having general application to this materiel are listed for issue to first echelon by ORD 7 SNL G-741. Common tools and equipment for second echelon are listed in ORD 6 SNL J-7, Sections 1, 2, and 3; ORD 6 SNL J-10, Section 4; and are authorized for issue by T/A and T/OE.

##### 72. Special Tools and Equipment

Certain tools and equipment (fig. 32) specially designed for operation and organizational maintenance, repair, and general use with the materiel are listed in table I for information only. This list is not to be used for requisitioning replacements.

Table I. Special Tools and Equipment for Operation and Organizational Maintenance

Item	Identifying No.	References		Use
		Fig.	Par.	
ADAPTER, puller...	41-A-18-173	32, 196	233	To remove steering wheel (used with PULLER 41-P-2954).
ADAPTER, puller...	41-A-18-241	32, 197	234, 243	To remove steering idler arm (used with PULLER 41-P-2957).
DRIFT, oil seal. . . .	41-D-1535-25	32, 191	228c	To remove hub bearing oil seals.
HANDLE, remover and replacer.	41-H-1397	32, 191	228c	Used with DRIFT 41-D-1535-25.
REPLACER, hub bearing oil seal.	41-R-2392-405	32, 193	228e	To install hub bearing oil seals.
WRENCH, bearing adjusting nut.	41-W-1991-17	32, 189	205d, 226	To remove, install, and adjust hub bearing adjusting nuts.

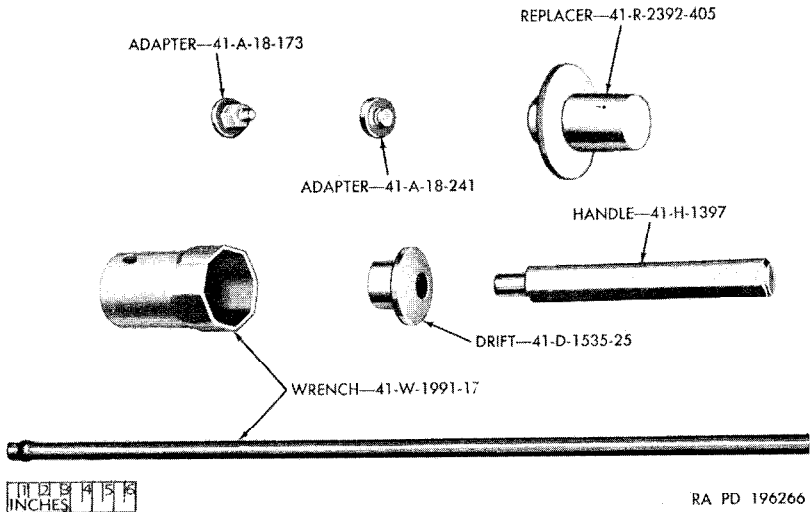


Figure 32. Special tools and equipment for operation and organizational maintenance

## Section II. LUBRICATION AND PAINTING

### 73. Lubrication Order

LO 9-8030 order (figs. 33 and 34) prescribes cleaning and lubrication procedures as to locations, intervals, and proper materials for these vehicles. This order is issued with each vehicle and is to be

# LUBRICATION ORDER

LC 19-75AA-9

# LO 9-8030

2 December 1953 (Supersedes LO 9-840, 29 May 1951)

**TRUCK, 3/4-TON, 4 x 4, M37, M42, M43, V-41 ( )/GT**

References: TM 9-840; ORD 7 5N1 G-741

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.

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. Re lubricate after washing or fording.

LUBRICANT • INTERVAL

- C, Fig 35 → Winch Worm Case Level (Check level) W
- D, Fig 35 → Winch Worm Case Drain (Drain and refill) (Cap. 1 qt.) A
- A, Fig 35 → Winch Worm Case Fill GO
- G, Fig 35 → Winch Universal Joint and Propeller Shaft Yoke GAA M
- L, Fig 35 → Spring Bolt GAA 1
- H, Fig 35 → Steering Idle Arm GAA 1
- J, Fig 35 → Steering Drag Links GAA 1
- M, Fig 36 → Universal Joint and Steering Knuckle Bearings (See note 6) GAA 1

INTERVAL • LUBRICANT

- OE Winch Cable (See note 7) B, Fig 35
- W Winch Drum and Shaft Case Level (Check level) C, Fig 35
- A Winch Drum and Shaft Case Drain (Drain and refill) (Cap. 1 qt.) D, Fig 35
- W GO Winch Drum and Shaft Case Fill A, Fig 35
- GAA Winch Propeller Shaft Shear Pin (See note 8) G, Fig 35
- 1 WP Water Pump OQ, Fig 39
- 12 Front Differential Drain (Drain and refill) (Cap. 2 1/2 qts.) (See note 5) E, Fig 35

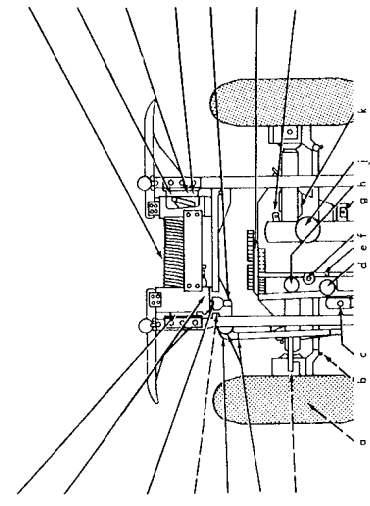
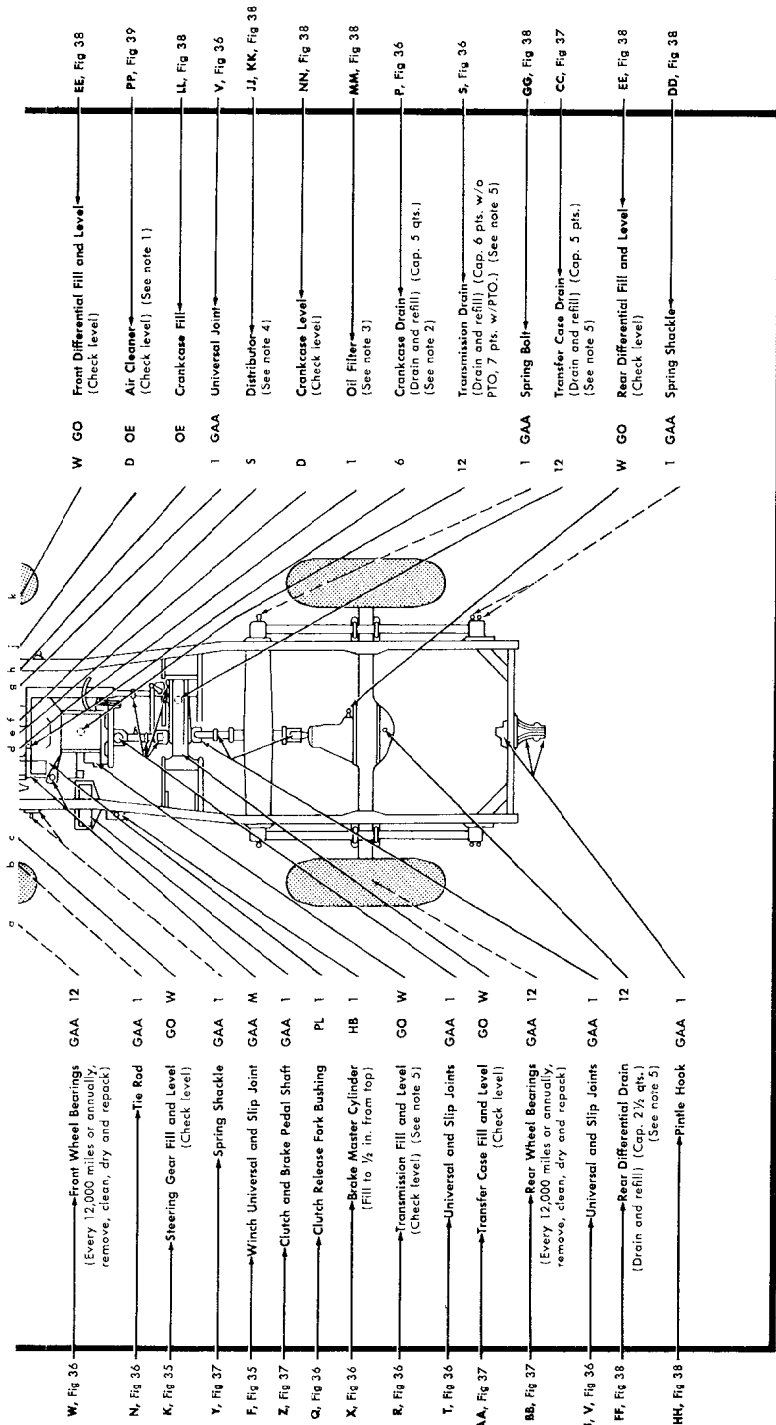


Figure 33. Lubrication order—LO 9-8030.



RA PD 196267

Figure 33—Continued.

LUBRICANTS	EXPECTED TEMPERATURES		INTERVALS
	above +32° F	+40° F to -10° F 0° F to -65° F	
OE-Oil, lubr, engine	OE 30	OE 10	D-Daily W-Weekly M-Monthly S-Semi-annually A-Annually
GO-Lubricant, Gear, universal	GO 90	GO 75	1-1,000 Miles 6-6,000 Miles
GAA-Grease, lubr, automotive and artillery	GAA	GAA	
HB-Fluid, hydraulic, brake	HB	HB	
PL-Oil, lubr, preservative	PL (Med)	PL (Special)	

LUBRICANTS	INTERVALS
OE5-Oil, lubr, engine, sub-zero	D-Daily
GO5-Lubricant, gear, universal, sub-zero	W-Weekly
HBA-Fluid, hydraulic, brake, arctic	M-Monthly
CW-Lubricant, chain, exposed gear and wire rope	S-Semi-annually
WP-Grease, lubr, water pump	A-Annually
	1-1,000 Miles
	6-6,000 Miles
	12-12,000 Miles

KEY	NOTES
Arctic Operation Refer to TM 9-2855	7. 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. After each use, coat with oil. Coat with oil at all points of contact. Coat with oil at all points of a bush with PL (Special) wipe off excess and coat cable with CW. Coat winch drum also with CW before rewinding cable or drum.
	8. WINCH PROPELLER SHAFT SHEAR PIN—Semiannually, disassemble front universal joint, remove shear pin and universal joint from propeller shaft; dry and coat end of shaft and inside of universal joint collar with GAA to prevent rusting.
	9. OIL CAN POINTS—Every 1,000 miles or monthly, lubricate hinges and latches, clutch and brake pedal linkage, parking brake linkage, transfer controls, winch shifter shaft with PL.
	10. DO NOT LUBRICATE—Shock absorbers, springs, clutch release bearing.
	11. LUBRICATE AT TIME OF DISASSEMBLY BY ORDINANCE PERSONNEL—Generator, starter, clutch pilot bearing, speedometer flexible shaft.

**BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:**

**OFFICIAL:** WM. E. BERGIN,  
Major General, United States Army,  
The Adjutant General.

M. B. RIDGWAY,  
General, United States Army,  
Chief of Staff.

**OFFICIAL:** K. E. THEBAUD,  
Colonel, United States Air Force,  
Air Adjutant General.

N. F. TWINING,  
Chief of Staff,  
United States Air Force.

LO 9-8030

Figure 34. Lubrication order notes.

RA PD 359235

carried with it at all times. In the event the vehicle is received without a copy, the using organization will immediately requisition one. See DA Pam 310-4 for lubrication order of current date. Lubrication which is to be performed by ordnance maintenance personnel is listed in the lubrication order NOTES.

## 74. General Lubrication Instructions

*a. General.* Any special lubricating instructions required for specific mechanism or parts are covered in the pertinent section.

*b. Usual Conditions.* Service intervals specified on the lubrication order are for normal operation and where moderate temperature, humidity, and atmospheric conditions prevail.

*c. 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.

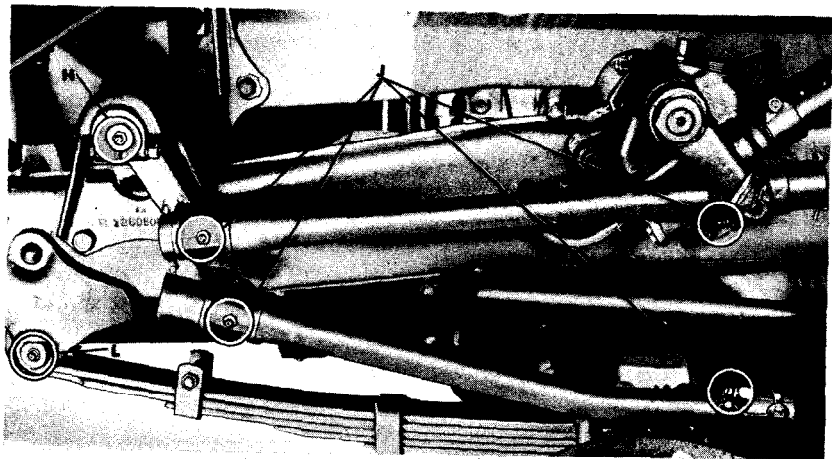
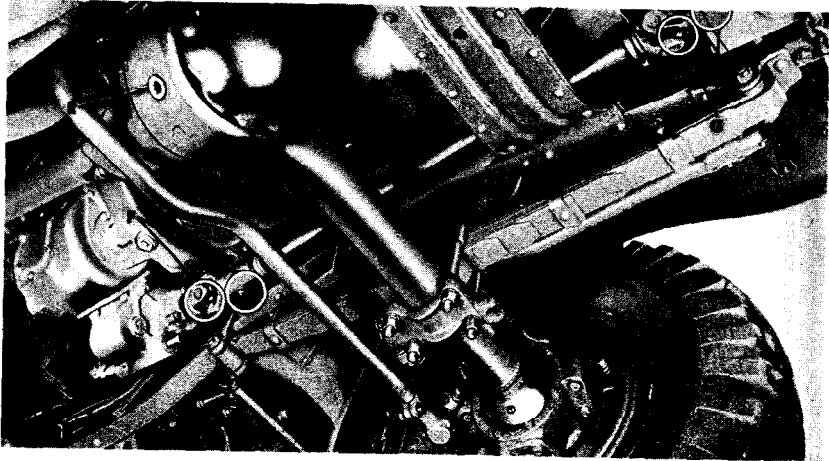
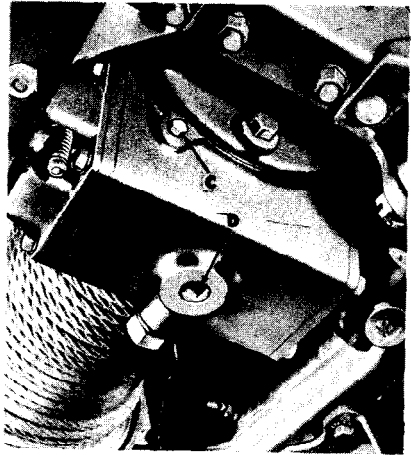
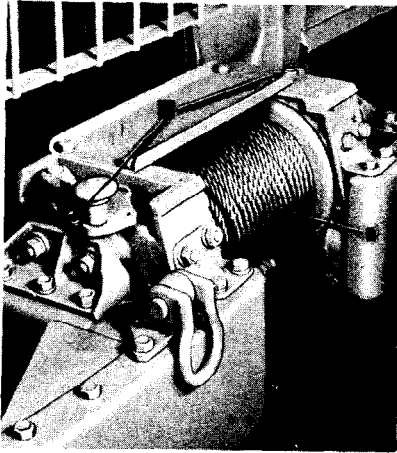
*d. Points of Application.*

- (1) Lubricating fittings, grease cups, filler and drain plugs, and oilholes are shown in figures 35 through 39 and are referenced to the lubrication order. Wipe these devices and the surrounding surfaces clean before and after lubricant is applied.
- (2) A  $\frac{3}{4}$ -inch red circle should be painted around all lubricating fittings and oilholes.
- (3) Clean and lubricate unsealed bearings ((*a*), (*b*), and (*c*) below).
  - (*a*) Wash all of the old lubricant out of the bearings and from the inside of the hubs with volatile mineral spirits or dry-cleaning solvent and dry the parts thoroughly.

**Caution:** Bearings must not be dried or spun with compressed air. See TM 37-265 for care and maintenance of bearings.

- (*b*) Pack the bearings by hand or with a mechanical packer, introducing the lubricant carefully between the rollers. Do not smear grease only on the outside of the bearings and expect it to work in. Great care must be exercised to insure that dirt, grit, lint, or other contaminants are not introduced into the bearings. If the bearings are not to be installed immediately after repacking, wrap them in clean oilproof paper to protect them from contaminants.
- (*c*) After the bearings are properly lubricated, pack the hubs with a sufficient amount of lubricant to uniformly fill them to the inside diameters of the inner and outer bearing races. Coat the steering knuckles or spindles and drive flanges with a thin layer of lubricant (not over one-sixteenth inch) to prevent rusting. Do not fill the drive





RA PD 196268

Figure 35. Localized lubrication points (A through L).

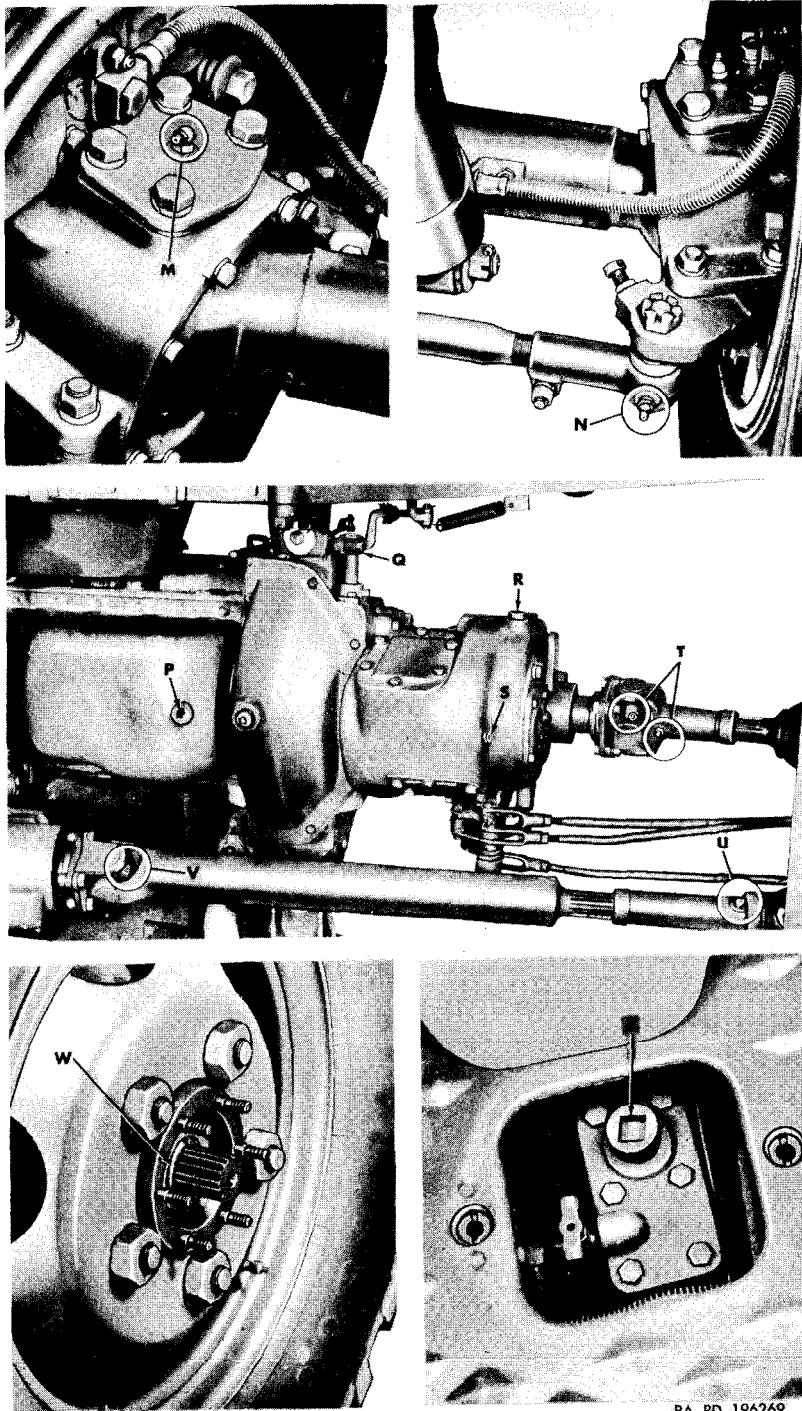
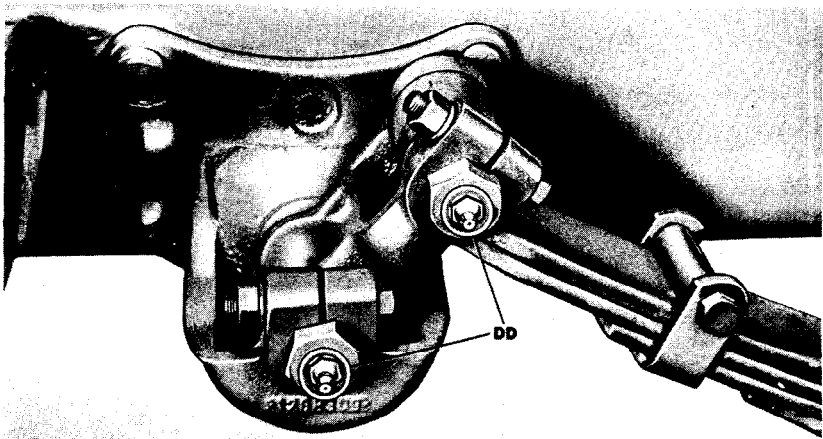
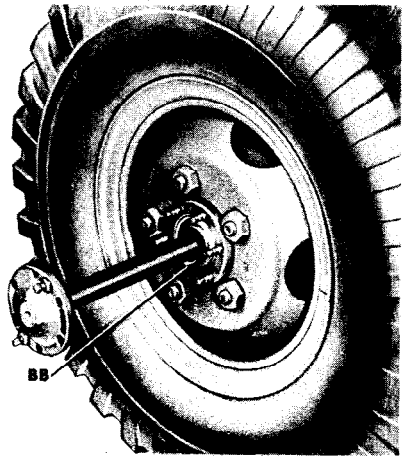
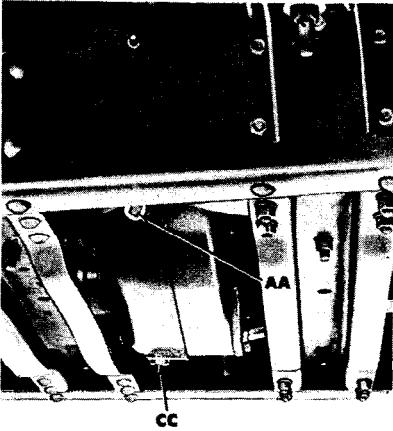
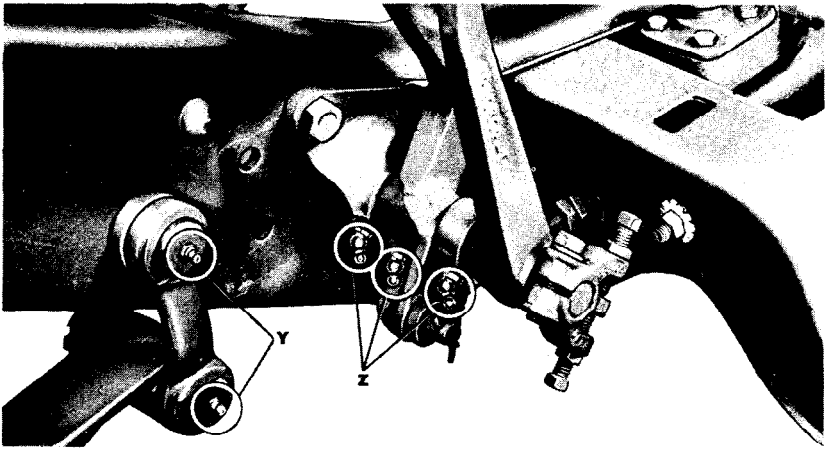


Figure 36. Localized lubrication points (M through X).



RA PD 196270

Figure 37. Localized lubrication points (Y through DD).

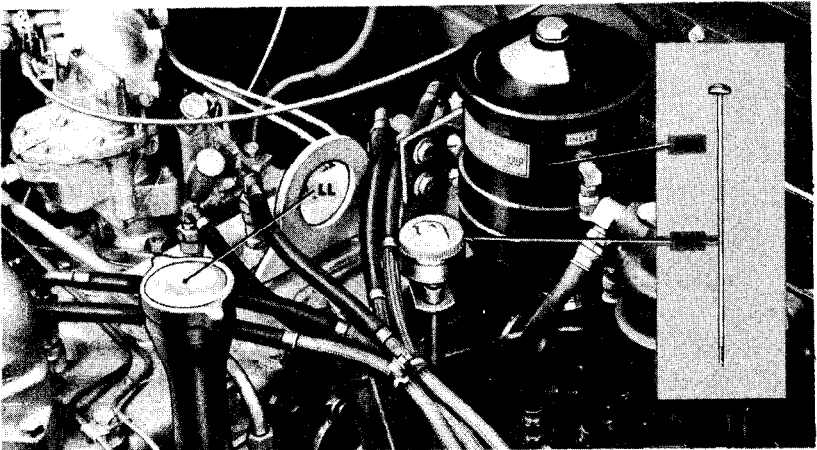
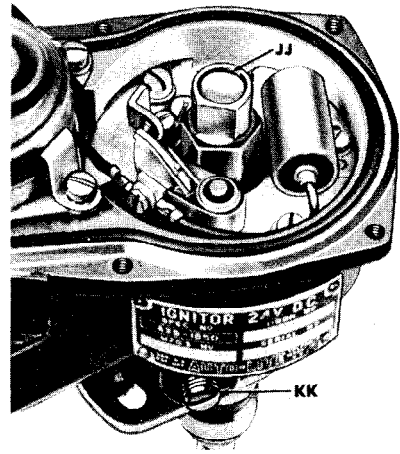
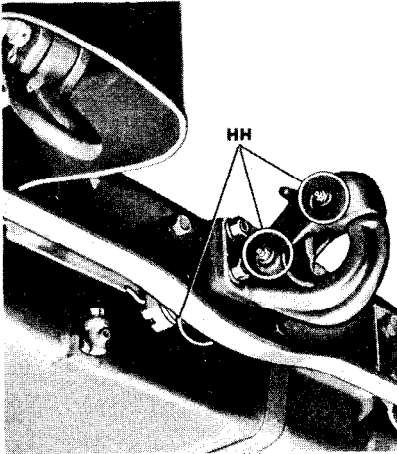
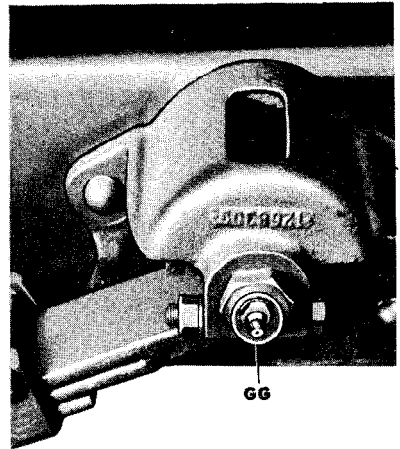
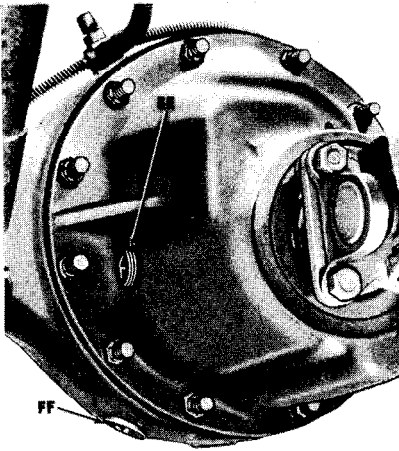
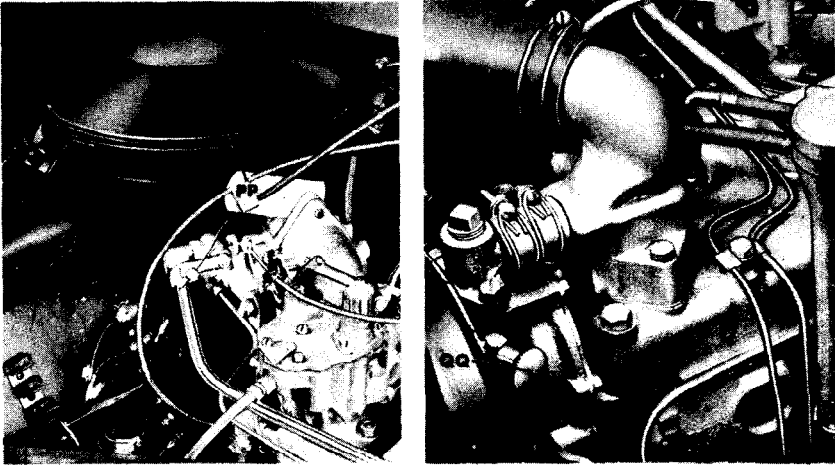


Figure 38. Localized lubrication points (EE through NN).



RA PD 196272

**Figure 39.** Localized lubrication points (PP and QQ).

flanges to serve as grease cups under any circumstances. They should be lightly coated, however, to prevent rusting.

*Note.* For normal operation, lubricate wheel bearings at 12,000 miles or at annual intervals, whichever comes first.

*e. Reports and Records.*

- (1) Report unsatisfactory performance of prescribed petroleum fuels, lubricants, or preserving materials, using DA Form 468, Unsatisfactory Equipment Report.
- (2) Maintain a record of lubrication of the vehicle on DA Form 461, Preventive Maintenance Service and Inspection for Wheeled and Half-Track Vehicles.

## **75. 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 or dust, immersion in water, or exposure to moisture. Any one 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.

*b. Changing Grade of Lubricants.* Lubricants are prescribed in the "Key" (fig. 34) 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 thicken-

ing 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.

## **76. Lubrication for Continued Operation Below 0° F.**

Refer to TM 9-2855 for instructions on necessary special preliminary lubrication of the vehicle, and to TB 9-2855-5, -6 and -7 for instructions on installation of winterization kits.

## **77. Lubrication After Fording Operations**

*a.* After any fording operation, in water 12 inches or over, lubricate all chassis points to cleanse bearings of water or grit as well as any other points required in accordance with paragraph 281 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 ((1), (2), and (3) below).

- (1) Perform a complete lubrication service (par. 74).
- (2) Inspect engine crankcase oil. If water or sludge is found, drain the oil and flush the engine with preservative engine oil PL-30. Before putting in new oil, drain the oil filter and install a new filter element (par. 116b).

*Note.* If preservative engine oil is not available, engine lubricating oil OE-30 may be used.

- (3) Operation in bodies of salt water enhances the rapid growth of rust and corrosion, especially on unpainted surfaces. 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.

## **78. Lubrication After Operation Under Dusty or 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.

## 79. Painting

Instructions for the preparation of the materiel 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. Materials for painting are listed in ORD 7 SNL G-741.

### Section III. PREVENTIVE MAINTENANCE SERVICES

#### 80. General

*a. Responsibilities and Intervals.* Preventive maintenance services are the responsibility of the using organization. These services consist generally of daily operator's services (daily A services) performed by the operator or crew, and of biweekly services (biweekly B services) performed by the crew (under supervision of the squad, section, and platoon leaders); and of the scheduled services to be performed by organizational maintenance personnel (C and D services). Intervals are based on normal operations. Reduce intervals for abnormal operations or severe conditions. Intervals during inactive periods may be extended accordingly.

*b. Daily A Preventive-Maintenance Services.* Each tactical vehicle will be inspected by its assigned operator and crew, each day it is operated. This service is divided into four parts—

- (1) *Before-operation service.* This is a brief service to ascertain that the vehicle is ready for operation; it is mainly a check to see if conditions affecting the vehicle's readiness have changed since the last after-operation service.
- (2) *During-operation service.* This service consists of detecting unsatisfactory performance. While driving, the driver or crew should be alert for any unusual noises or odors, abnormal instrument readings, steering irregularities, or any other indication of malfunction of any part of the vehicle. Every time he applies the brakes, shifts gears, or turns the vehicle, the driver should instinctively consider it a test and note any unusual or unsatisfactory performance.
- (3) *At-the-halt service.* This service consists of investigating any deficiencies noted during operation and repeating part of the before-operation service.
- (4) *After-operation service.* This is the basic daily service for tactical vehicles. It consists of correcting, so far as possible, any operating deficiencies, so that the vehicle is prepared to roll again, upon a moment's notice, should the tactical situation so require.

*c. Biweekly B Preventive-Maintenance Services.* These services supplement the daily A preventive-maintenance service and are applied as indicated in table II. They provide for cleaning the vehicle

more thoroughly and for servicing certain items that do not require daily attention. The biweekly B service is applied to wheel vehicles once in 2 weeks by organizational maintenance personnel assisted by the operator.

*d. Round-the-Clock Operation.*

- (1) *Delegation of after-operation service.* Certain units, such as Transportation Corps truck companies, may operate almost continuously and this may require the operators to be on duty so long that it is not reasonable to expect them to perform the after-operation service. Under such circumstances, the after-operation service, usually performed by the driver, may be delegated to additional drivers or to second-echelon personnel. It may also be desirable to organize a fleet-maintenance crew.
- (2) *Fleet-maintenance crew.* When the vehicle has completed its daily run, the operator makes a report of the condition of the vehicle and is relieved. The vehicle is turned over to the fleet-maintenance crew and is readied for the next period of operation. Economy of personnel is accomplished by specialization, and several inspection stations are established to perform the after-operation service. Augmentation of drivers and/or organization-maintenance personnel may be accomplished by the employment of local civilian labor or by augmentation cells of military personnel. Normally, an operation that will justify the organization of a fleet-maintenance system to perform the after-operation service will also require the organization of a production-line maintenance system to accomplish the C and D (table I) preventive-maintenance services. Under these circumstances, the scope of each service should be integrated with the other.

*e. General Procedures for All Services and Inspections.*

- (1) The general procedures ((2), (3), and (4) below) apply to both first-and-second-echelon preventive-maintenance services and to all inspections and are just as important as the specific procedures.
- (2) Inspections to see if items are in good condition, correctly assembled or stowed, secure, not excessively worn, not leaking, and adequately lubricated apply to most items in the preventive-maintenance and inspection procedures. Any or all of these checks that are pertinent to any item (including supporting, attaching, or connecting members) will be performed automatically as general procedures, in addition to any specific procedures given.



- (a) Inspection for good condition is usually visual inspection to determine if the unit is safe or serviceable. Good condition is explained further as meaning: not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, not deteriorated.
  - (b) Inspection of a unit to see if it is correctly assembled or stowed is usually a visual inspection to see if the unit is in its normal position in the vehicle and if all its parts are present and in their correct relative positions.
  - (c) Inspection of a unit to see if it is secure is usually a visual, hand-feel, pry-bar, wrench, or screwdriver inspection for looseness in the unit. This inspection will include any brackets, lockwashers, locknuts, locking wires, and cotter pins as well as any connecting tubes, hoses, or wires.
  - (d) Excessively worn is understood to mean worn beyond serviceable limits, or likely to fail if not replaced before the next scheduled inspection. Excessive wear of mating parts or linkage connections is usually evidenced by too much play (lash or lost motion). It includes illegibility as applied to markings, data and caution plates, and printed matter.
- (3) Where the instruction "tighten" appears in the procedures, it means tighten with a wrench, even if the item appears to be secure.
  - (4) Such expressions as "adjust if necessary" or "replace if necessary" are not used in the specific procedures. It is understood that whenever inspection reveals the need of adjustments, repairs, or replacements, the necessary action will be taken.

## 81. Cleaning

*a. General.* Any special cleaning instructions required for specific mechanisms or parts are contained in the pertinent section. General cleaning instructions are as shown in (1) through (4) below.

- (1) Use dry-cleaning solvent or volatile mineral spirits 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 may be used for dissolving grease and oil from engine blocks, 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 (fig. 33).

*b. Nameplates.* Nameplates, caution plates, and instruction plates made of steel rust very rapidly. When they are found to be in a rusty condition, they should be thoroughly cleaned and heavily coated with an application of lacquer. Refer to TM 9-2851.

*c. General Precautions in Cleaning.*

- (1) Dry-cleaning solvent and volatile mineral spirits 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, engine fuels, or lubricants on rubber parts as they will deteriorate the rubber.
- (4) The use of diesel fuel oil, gasoline, or benzene (benzol) for cleaning is prohibited.

## **82. Preventive Maintenance by Driver or Operator(s)**

*a. Purpose.* To insure efficient operation, it is necessary that the vehicle be systematically inspected at intervals every day it is operated and also biweekly, 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 defect 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.* Driver's or operator's preventive maintenance services are listed in table II. Every organization must thoroughly school its personnel in performing the maintenance procedures for these vehicles as set forth in this manual.

Table II. Driver's or Operator's Preventive Maintenance Services

Intervals					Procedure
Daily A				Biweekly B	
Before-operation	During-operation	At-the-halt	After-operation		
<b>USUAL CONDITIONS</b>					
					<p><b>Caution:</b> Place all tags describing condition of vehicle in the driver's compartment in a conspicuous location so that they will not be overlooked.</p>
X		X	X	X	<p><i>Fuel, oil, water.</i> Check fuel, oil, and water levels. Look for leaks in engine compartment. Check spare containers for contents. If water is added in cold weather, test solution with a hydrometer to determine if there is sufficient antifreeze (par. 64a(2)).</p>
X		X	X	X	<p><i>Tires.</i> Gage tires for correct pressure (par. 67b). Remove penetrating objects such as nails or glass. Note any apparent loss of air, unusual wear, or missing valve caps.</p>
X		X	X	X	<p><i>Leaks, general.</i> Look under vehicle and in engine compartment for indications of fuel, engine-oil, water, gear-oil, or brake-fluid leaks.</p>
X				X	<p><i>Vehicle equipment.</i> Visually inspect fire extinguishers (on vehicles so equipped) and vehicle publications, including Standard Form 91 and DA Form 614.</p>
				X	<p>See that fire extinguishers are charged and sealed (if vehicle is so equipped).</p>
X			X	X	<p>Operate lights, horn (if tactical situation permits), and windshield wipers. Visually inspect rear view mirror, reflectors, cab and body, pintle (on vehicle so equipped), lifting shackles, doors (including door locks, window regulators, and blackout curtains where used). Check canvas items (cab and body covers and curtains). Check the key locks and keys (ambulance truck M43 rear door and telephone maintenance truck V41 compartment doors).</p>
X				X	<p>Check tools and equipment to see that all items are in good condition and properly stowed.</p>
X				X	<p>Check the operation of the personnel heater, ventilating blowers, surgical light, spotlight, and litter racks (ambulance truck M43).</p>
X				X	<p>Check the ladder rack, pike pole front rack, pike pole clamp, PR reel and frame and support brackets, and spotlight (telephone maintenance truck V-41).</p>
X				X	<p>Check for any tampering or damage that may have occurred since last inspection.</p>

Table II. Driver's or Operator's Preventive Maintenance Services—Continued

Intervals					Procedure
Daily A				Biweekly B	
Before-operation	During-operation	At-the-halt	After-operation		
USUAL CONDITIONS—Continued					
X			X	X	<i>Brakes</i> Check the service brakes for adequate pedal (par. 217) and the hand brake for proper adjustment (par. 219).
X			X	X	<i>Wheel and drive flange stud nuts.</i> Check the wheel and drive flange stud nuts for tightness.
X	X				<i>Instruments</i> (fig. 12). Observe instruments and gages for normal readings during warm-up and during operation of the vehicle.
	X				<b>Caution:</b> If it is necessary to add coolant to the radiator while the engine is overheated, run the engine at idling speed and slowly add the coolant. See paragraph 147a for precaution to be observed when removing pressure radiator cap. If no oil pressure is registered, stop the engine immediately, investigate the cause, and correct (par. 95d).
					<i>General operation.</i> Be alert for any unusual noises or improper operation of steering, clutch, brakes, or gear shifting.
		X	X	X	<i>Operating faults.</i> Investigate and correct or report any faults noted during operation.
		X	X	X	<i>Springs and shock absorbers.</i> Inspect springs, spring bolts, shackles, shock absorbers, and attaching parts for damage.
			X	X	<i>Lubricate.</i> Lubricate daily or weekly items specified on lubrication order.
			X	X	<i>Clean.</i> Clean glass, vision devices, and inside of cab and body. Wipe dust from the exterior of the body.
				X	Wash vehicle, clean the engine and engine compartment. Refer to paragraph 81.
				X	<i>Batteries.</i> Clean (par. 167a). Check water level, inspect terminals for tightness and coating of grease. On vehicles so equipped, see that the insulator is installed on the positive (+) post of the inner battery between cover and terminal.
				X	<i>Assemblies and belts.</i> Inspect assemblies such as carburetor, starter, generator, and water pump for looseness of mountings or connections. Press fan and generator drive belts to determine if tension is correct (par. 152a).

Table II. Driver's or Operator's Preventive Maintenance Services—Continued

Intervals					Procedure
Daily A				Biweekly B	
Before-operation	During-operation	At-the-halt	After-operation		
					USUAL CONDITIONS—Continued
X			X	X	<i>Electrical wiring.</i> Inspect visually electrical wiring, conduits, connectors, and shielding.
				X	<i>Steering gear and steering controls.</i> Check the steering gear, steering tie rod, and drag links for loose or damaged parts.
				X	<i>Axle and transfer vent.</i> Inspect for clogging.

### 83. Preventive Maintenance by Organizational Maintenance Mechanics

*a. Intervals.* The indicated frequency of the prescribed preventive maintenance services is considered a minimum requirement for normal operation of 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 operators should accompany vehicles 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 shown in (1) through (5) below.

- (1) *Adjust.* Make all necessary adjustments in accordance with instructions contained in the pertinent section of this manual and information contained in changes to the subject publication or technical bulletins.
- (2) *Clean.* Clean the unit as outlined in paragraph 81 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 but which should be performed in connection with the maintenance operation 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 re-filling units with oil, replacing oil filter, element and cleaning filter, cleaning fuel filter and air cleaner.
- (5) *Tighten.* All tightening operations should be performed with sufficient torque (force on the wrench handle) to tighten the unit according to good mechanical practice. Use a torque-indicating wrench where specified. Do not over-tighten, as this may strip threads or cause distortion. Tightening will always be understood to include the correct installation of lockwashers, locknuts, locking wires, or cotter pins to secure the tightened parts.

*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. DA Form 461.* The numbers of the preventive maintenance procedures that follow are identical with those outlined on DA Form 461, Preventive Maintenance Service and Inspection for Wheel and Half-Track Vehicles. Certain items on the form that do not apply to these vehicles are not included in the procedures in this manual. In general, the sequence of items on the form is followed, but in some instances there is deviation for conservation of the mechanic's time and effort.

*f. Procedures.* Table III lists the services to be performed by organizational mechanic or maintenance crew at the designated intervals. Each page of the table has two columns at the left for designated intervals of every 1,000 miles (C service) and 6 months or 6,000 miles, whichever occurs first (D service). Very often it will be found that a particular procedure does not apply to both scheduled intervals. In order to determine which procedure to follow, look down the column corresponding to the maintenance procedure and whenever an item number appears, perform the operations indicated opposite the number.

Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
<b>INSPECTION AND ROAD TEST</b>		
<p><i>Note.</i> When the tactical situation does not permit a full road test, perform only those items that require little or no movement of the vehicle.</p> <p><i>Before operation: Fuel, oil, water, antifreeze, tires, instruments, leaks, general visual inspection of vehicle and equipment. Perform the before-operation service (par. 82).</i></p>		
1	1	<p><i>Dash instruments, switches, and gages, oil pressure, fuel and temperature, ammeter or battery generator indicator, speedometer, and other controls.</i> Note generator output on the ammeter or battery generator indicator immediately after starting engine, before generator regulator has reduced the charging rate. Observe all instruments for normal readings. Note whether the ignition switch and light switch assembly operate freely and make positive contact. Check all other controls for normal operation.</p>
2	2	<p><i>Horn, rear view mirror, and windshield wipers.</i> Sound horn to determine if signal is normal (if tactical situation permits). Test windshield wipers for satisfactory operation. Examine mirror and reflectors.</p>
3	3	<p><i>Engine—idle, acceleration, power, noise, governed speed.</i> In warming up the engine, observe if it starts easily and if choke and throttle controls operate satisfactorily. Note if idling speed is correct. Listen for any unusual noises at idle and higher speeds. When operating the vehicle, note if it has normal power and acceleration in each speed. Listen for any unusual noises when the engine is under load. Speed up the vehicle, on a level stretch, to see if it will reach, but not exceed, the specified governed speed.</p>
4	4	<p><i>Steering—free-play, bind, wander, shimmy, side pull, column, and wheel.</i> With the vehicle moving straightahead, determine if the steering wheel has excessive free play and if there is any tendency to wander, shimmy, or pull to one side. Turn the steering wheel through its entire range and note any bind. Examine steering column and wheel.</p>
5	5	<p><i>Clutch—free travel, drag, noise, chatter, grab, slip.</i> Note if the clutch pedal has 1 inch of free travel and if action of the pedal return spring is satisfactory. Note whether clutch disengages completely or has a tendency to drag. Observe smoothness of engagement and tendency to chatter, grab, or slip and any unusual noise. With transmission in neutral, depress and release clutch pedal, listening for a defective release bearing.</p>

Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service—Continued

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
<b>INSPECTION AND ROAD TEST—Continued</b>		
7	7	<i>Brakes (service and hand)—braking effect, feel, side pull, noise, chatter, pedal travel, hand control.</i> Note if the brake pedal has correct free travel (par. 217) and if action of return spring is satisfactory. Observe if pedal goes too close to floor. Make several stops, noting side pull, noise, chatter, grabbing, or any other abnormal condition. Observe if the hand brake lever ratchet holds and if the lever requires more than three-quarters travel for full application. Stop the vehicle on an incline and apply the hand brake to determine if it holds the vehicle.
8	8	<i>Generator, starter, and starter switch—action, noise, speed.</i> Note if the starter engages smoothly without unusual noise and turns the engine with adequate cranking speed. Watch the ammeter or battery generator indicator to note whether generator is charging properly.
9	9	<i>Transmission and transfer—lever action, declutching, vibration, noise.</i> Shift transmission into all speeds and transfer into high and low ranges, observing any unusual stiffness of the shift levers, tendency to slip out of gear, unusual noise, or excessive vibration. Make similar observations of the transfer declutch lever.
10	10	<i>Unusual noises—attachments, cab, body and wheels, power train.</i> At all times during the road test, be alert for unusual or excessive noises that may indicate looseness, defects or deficient lubrication at any point.
11	11	<i>Lamps—head, tail, marker, body, stop, spot, and blackout.</i> During stops in the road test, test the operation of exterior and interior lights and light switches. Note whether the headlights appear to be properly aimed. Note condition of all lights and reflectors. Test the spotlight switch and handle for proper operation (ambulance truck M43 and telephone maintenance truck V-41). Test the surgical light and dome light switches and the operation of the surgical light (ambulance truck M43).
<b>AFTER ROAD TEST</b>		
25	25	<i>Temperatures—brake drums, hubs, axles, transmission, transfer, differentials.</i> Immediately after the road test, feel these units cautiously. An overheated wheel hub and brake drum indicates an improperly adjusted, defective or dry wheel bearing or a dragging brake. An abnormally cool condition indicates an inoperative brake. An overheated gear case indicates lack of lubrication, internal maladjustment, or defective parts.  <i>Note.</i> It is normal for hypoid axles and transfer assemblies to run quite hot after the vehicle has been operated a considerable distance. If the axle housings or transfer are too hot for the hand to be placed upon them, it is not necessarily an indication of malfunctioning. If lubricant levels are correct and there were no unusual noises during the road test, assume they are all right.



Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
<b>AFTER ROAD TEST—Continued</b>		
25		Inspect propeller shaft assemblies. Tighten universal joint companion flange nuts.
26	26	<i>Leaks—engine oil, fuel, water, axle housings, transmission, transfer, steering gear, brake system, exhaust.</i> Make general observations in the engine compartment and underneath the vehicle for evidence of oil, water, fuel, lubricant, or exhaust leaks. Inspect the vents in the front and rear axle, transfer, and steering gear housing for clogging. Inspect spark-plug, manifold, and cylinder-head gaskets. <b>Caution:</b> Do not tighten the cylinder head or exhaust manifold unless there is evidence of looseness or leakage. If cylinder head requires tightening, use a torque-indicating wrench and tighten in the correct sequence (fig. 78) and to proper torque (par. 115 b). <i>Lubrication.</i> Inspect vehicle for proper lubrication. See lubrication order (figs. 33 and 34).
27	27	Lubricate vehicle in accordance with lubrication order. Coordinate with inspection and disassembly operations to avoid duplication.
27	27	During lubrication, inspect tires for unusual wear, penetrating objects, and proper matching.
	27	Rotate and match tires according to tread design and degree of wear. See TM 31-200 for acceptable limits in matching tires. Tighten axle drive flange nuts.
<b>MAINTENANCE OPERATION</b>		
28	28	<i>Batteries—specific gravity.</i> Make hydrometer test of electrolyte in each cell of both batteries (par. 167), and record the readings in space provided on DA Form 461.
29	29	<i>Batteries—voltage.</i> Perform starting motor cranking voltage test (par. 90e), using test meter. Record the voltage registered in space provided on DA Form 461.
29		After battery test, clean tops of batteries, coat terminals lightly with grease, and repaint carrier if corroded. Inspect the level of water to see that it covers the tops of the plates. <i>Note.</i> If distilled or approved water is not available, clean water, preferably rain water, may be used.
30		<i>Compression.</i> Test compression in each cylinder (par. 112), with throttle and choke wide open, and record in space provided on DA Form 461. Perform the compression test with the engine at normal operating temperature.

Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service—Continued

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
MAINTENANCE OPERATION—Continued		
31		<i>Crankcase ventilation.</i> Inspect carburetor air cleaner and air cleaner elbow, and the crankcase ventilation metering valve for cleanliness and good condition (par. 117). On vehicles so equipped, inspect operation of the ventilation shutoff valve dual control (par. 118c).
31		Clean and service these items in accordance with lubrication order and paragraph 133b.
32		<i>Radiator—core, shell, pressure cap, and gasket.</i> Inspect these items, noting particularly if the radiator core is clogged with foreign matter or if fins are bent. Check the gasket on the pressure cap. Observe coolant level and examine coolant for contamination. In cold weather, test coolant with a hydrometer to see if it contains sufficient antifreeze.
32		If need is indicated, drain cooling system (par. 149), clean and fill, adding corrosion inhibitor, unless antifreeze, which contains inhibitor, is used. Tighten radiator mountings and hose clamps.
33		<i>Water pump, fan, drive belt, and pulleys.</i> Inspect pulleys and fan for alinement and belt for tension (par. 152a). Inspect water pump for leaks.
34		<i>Valve mechanism—clearance, cover gaskets.</i> Gage valve tappet clearance (par. 113) and inspect for weak or broken valve springs, low compression or tappet noise. If clearance is incorrect, adjust, and recheck compression. Inspect cover gaskets.
35		<i>Spark plugs—clean and adjust, distributor, cap, rotor, points, shaft, automatic advance and wiring, ignition timing.</i> Remove and inspect spark plugs (par. 124). Remove and inspect the distributor, distributor cap, rotor, and breaker points and test operation of automatic advance mechanism by hand. Test distributor shaft for looseness by hand feel. Install distributor and check the ignition timing with timing light for correct timing and proper advance (par. 126). Test generator regulator with low-voltage circuit tester (par. 92f, i, and j).
35		Clean spark plugs and adjust gap to 0.028 to 0.033 inch (par 124e). Dress distributor breaker points and adjust gap to 0.018 to 0.022 inch (par. 129). If points are badly pitted, replace both points and capacitor (par. 128).
36		<i>Manifolds and heat control valve.</i> Inspect these items. Look particularly for leakage signs at the manifold gaskets. Check the manifold heat control valve seasonal adjustment (par. 114g).

Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service—Continued

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
<b>MAINTENANCE OPERATION—Continued</b>		
37	37	<i>Carburetor, choke, throttle, linkage, fuel filter, strainer, lines.</i> Inspect these items, noticing particularly if the shafts and linkage operate freely and are not excessively worn. Observe if the choke valve opens fully when the control is released and if the throttle valve opens fully when the accelerator is fully depressed or the hand throttle control is all the way out.
	37	Perform an engine vacuum test and adjust carburetor idle mixture (par. 111). Test that fuel pump pressure (par. 138a) is between 4 and 5½ psi at idling speed.
	37	Clean the strainer in the fuel tank filler pipe (par. 142c) and sediment bowl of the fuel filter (par. 139b). Drain water and sediment from fuel tank if there is evidence of contamination, using a container to catch the drainings.
	38	<i>Exhaust pipe and muffler.</i> Inspect; listen for excessive or unusual noises and look for exhaust leaks.
	38	Tighten mountings.
	39	<i>Brake shoes—linings, anchor pins, shoe return springs, cylinders, and lines.</i> Test the brake linkage or freedom of action. Inspect brake lines for leaks.
	39	Check operation of brake master cylinder (par. 217).
	39	Remove wheels and hubs (par. 205d) and examine brake drums, shoe assemblies, anchor pins, supports, and shoe return springs. Check brake wheel and master cylinders for leakage (pars. 220 and 221). Clean and inspect wheel bearings (par. 228d).
	39	Wheel bearings will be disassembled, cleaned and repacked at every second 6,000-mile inspection, or annually. If the wheel bearings are due for repacking, remove wheels and hubs and inspect the brake internal components as outlined in the preceding paragraph.
	40	<i>Cab and/or body—doors, hardware, glass, top and frame, curtains and fasteners, seats, upholstery, safety straps, and paint.</i> Inspect these items, paying particular attention to cab or body mountings; include springs. Test operation of doors, windows, windshield, ventilator, hood hinges and fasteners. Observe seat mountings and upholstery. Inspect the litter racks and personnel heater (ambulance truck M43). Inspect PR reel, ladder and pole racks and clamps, and all compartments (telephone maintenance truck V41). Make a general inspection of body, including glass, panels, tops, fenders, running boards, tailgate, chains, stakes, bows, paulins, curtains, and radiator and lamp guards. Examine condition of paint and legibility of markings and identification and caution plates.

Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service—Continued

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
MAINTENANCE OPERATION—Continued		
	40	Tighten body and hold-down bolts (figs. 210 and 211).
	42	<i>Bumpers—front and rear, pintle, and lifting shackles.</i> Inspect these items. Test operation of pintle assembly and note whether it locks securely.
	44	<i>Winch—power-take-off.</i> Inspect power-take-off, winch drive shaft, and shear pin. Inspect winch cable. Test winch operation (par. 55). Inspect vent in the worm housing for clogging.
	44	Clean and oil winch cable in accordance with the lubrication order (figs. 33 and 34).

## Section IV. TROUBLESHOOTING

### 84. General

a. This section contains troubleshooting information and tests for locating and correcting some of the troubles which may develop in the vehicle. Troubleshooting 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 that may occur under the many conditions of operation. If a specific trouble, test, and remedy therefor are 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 the low voltage circuit tester, carbon pile resistor and rheostat, adapter set, test lamp, hydrometer, and pressure and vacuum gages that are available (par. 89). Standard automotive theories and principles of operation apply in troubleshooting the vehicle. Question vehicle driver 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.

## 85. Engine

### a. Engine Will Not Turn.

- (1) *Starter inoperative.* Refer to paragraph 91a.
- (2) *Damaged starter pinion or flywheel ring gear.* If the starter hums but will not engage, remove the starter (par. 158a) and inspect the starter pinion and the flywheel ring gear. Replace starter (par. 158) or notify ordnance maintenance personnel.
- (3) *Mechanical seizure of parts.* Remove spark plugs (par. 124d). Place the transmission in fourth gear, jack up rear wheel, and attempt to turn the engine by turning the rear wheel. If the engine still cannot be turned, notify ordnance maintenance personnel.

### b. Engine Turns but Will Not Start or Starts Hard.

- (1) *Ignition system faulty.* Refer to paragraph 93a.
- (2) *Fuel system faulty.* Refer to paragraph 86a.
- (3) *Valves faulty.* Check compression (par. 112) to determine if valves are faulty. Adjust valve tappets (par. 113) or notify ordnance maintenance personnel.

### c. Engine Does Not Idle Properly or Misfires on Acceleration.

- (1) *Fuel system faulty.* Refer to paragraph 86d.
- (2) *Ignition system faulty.* Refer to paragraph 93d.
- (3) *Crankcase ventilation shutoff valves closed (on vehicles so equipped).* Open valves. Check operation of both shutoff valves and dual control (par. 118 c and e).
- (4) *Intake manifold or manifold gasket leaks.* Replace manifold or gaskets (par. 114).
- (5) *Compression low.* Check compression (par. 112) to determine if valves are faulty. Adjust valves (par. 113) or notify ordnance maintenance personnel.
- (6) *Exhaust system restricted.* Refer to paragraph 87b.

### d. Engine Does Not Develop Full Power.

- (1) *Ignition system faulty.* Refer to paragraph 93e.
- (2) *Fuel system faulty.* Refer to paragraph 86c.
- (3) *Compression low.* Refer to c (5) above.
- (4) *Exhaust system restricted.* Refer to paragraph 87b.

### e. Engine Misfires at High Speed.

- (1) *Ignition system faulty.* Refer to paragraph 93f.
- (2) *Valves faulty.* Refer to b(3) above.

### f. Excessive Oil Consumption.

- (1) *Leaks.* Visually inspect the engine for external oil leaks. Service as necessary. If servicing does not correct the condition, notify ordnance maintenance personnel.
- (2) *Crankcase ventilation shutoff valves closed (on vehicles so equipped).* Refer to c(3) above.

(3) *Fuel pump main body oil seal defective.* Check the fuel pump main body oil seal by disconnecting the fuel pump-to-manifold vacuum line (A, fig. 105). If oil is evident, replace the fuel pump (par. 138).

(4) *Compression low.* Refer to *c*(5) above.

*g. Excessive Fuel Consumption.*

(1) *Fuel system faulty.* Refer to paragraph 86e.

(2) *Ignition system faulty.* Refer to paragraph 93g.

(3) *Valves faulty.* Refer to *b*(3) above.

(4) *Exhaust system restricted.* Refer to paragraph 87b.

*h. Engine Overheats.*

(1) *Cooling system faulty.* Refer to paragraph 88a.

(2) *Ignition system faulty.* Refer to paragraph 93e.

(3) *Cylinder-head gasket or carburetor mounting gasket defective.* To check for damaged cylinder-head gasket, remove the thermostat (par. 151b) and fan belt (par. 152b(1)), run the engine and observe coolant in the outlet elbow opening. If air bubbles appear in the coolant, replace cylinder-head gasket (par. 115c through *g*). Replace a defective carburetor mounting gasket (par. 137).

*i. Engine Noises.*

(1) *Spark knock or ping.* (A sharp metallic knock occurring on acceleration or when operating under heavy load.)

(a) *Ignition timing too early.* Check with timing light and adjust (par. 126).

(b) *Carbon accumulation in combustion chamber.* Remove cylinder head and clean carbon (par. 115c).

(c) *Engine overheats.* Refer to *h* above.

(d) *Distributor automatic advance not functioning properly.* Check spark advance with timing light (par. 126). Replace distributor if automatic advance is faulty (par. 125).

(2) *Piston slap.* (A clear metallic knock heard when engine is under load but not always audible at high speeds or at idle.) Notify ordnance maintenance personnel.

*Note.* This condition may be considered normal if piston slap is evident when engine is cold and diminishes as engine temperature increases.

(3) *Piston pin noise.* (A metallic knock usually occurring, when idling, with engine hot.) Notify ordnance maintenance personnel.

(4) *Main or connecting rod bearing knock.* (A sharp metallic knock heard momentarily during rapid acceleration.) Notify ordnance maintenance personnel.

(5) *Fan belt noisy.* (A partially broken or loose fan belt will

- cause a rhythmic noise. A glazed fan belt will cause an intermittent squeal.) Adjust or replace fan belt (par. 152).
- (6) *Flywheel ring gear noise.* (A loud grating noise heard after servicing.) Flywheel ring gear noise may be caused by insufficient clearance between flywheel ring gear and clutch housing drain plug (on vehicles equipped with a  $\frac{3}{4}$ -inch pipe plug). Correction can be made by removing the pipe plug and cutting one-eighth inch from the thread end of plug.

## 86. Fuel System

### a. *Engine Turns but Will Not Start or Starts Hard.*

- (1) *Lack of fuel.* Fill fuel tank.
- (2) *Fuel filter to fuel pump shutoff cock closed.* Open fuel line shutoff cock (H, fig. 86).
- (3) *Fuel filter plugged.* Remove and clean filter element or replace filter as required (par. 139).
- (4) *Fuel pump faulty.* Check fuel pump pressure. Replace fuel pump if necessary (par. 138).
- (5) *Fuel lines plugged.* Check fuel lines for restriction (par. 141).
- (6) *Choke inoperative.* Check operation of choke control and lever. Adjust control if necessary (par. 134a).
- (7) *Throttle inoperative.* Check throttle control and accelerator linkage for proper operation. Service or adjust as necessary (par. 134b).
- (8) *Carburetor air cleaner oil level too high.* Service air cleaner (par. 133b).
- (9) *Carburetor floods.* Refer to b below.
- (10) *Carburetor and governor faulty.* If (1) through (4) above do not correct the condition, replace carburetor (par. 137).

b. *Carburetor Floods.* If carburetor flooding is evidenced, push the choke control all the way in, pull the throttle control out, and crank the engine with the starter to force excess fuel from the engine.

- (1) *Choke stuck.* Refer to a(6) above.
- (2) *Fuel pump pressure excessive.* Check fuel pump pressure and replace fuel pump if pressure exceeds  $5\frac{1}{4}$  psi (par. 138).
- (3) *Carburetor and governor faulty.* If (1) and (2) above do not correct the condition, replace carburetor (par. 137).

### c. *Engine Does Not Develop Full Power.*

- (1) *Throttle linkage incorrectly adjusted, worn, or damaged.* Adjust throttle control or bellcrank to carburetor rod (par. 134b). Replace worn or damaged throttle linkage parts as required (par. 144).
- (2) *Carburetor governor incorrectly adjusted.* Check governor operation by operating vehicle in second speed and observe

the speedometer reading. If a speed of 17 mph cannot be reached in second speed, replace carburetor (par. 137) or notify ordnance maintenance personnel.

- (3) *Ignition system faulty.* Refer to paragraph 93e.
- (4) *Valves faulty.* Refer to paragraph 85b(3).
- (5) *Exhaust system restricted.* Refer to paragraph 87b.
- (6) *Other causes.* If causes of trouble cannot be located by performing (1) through (5) above, notify ordnance maintenance personnel.

*d. Engines Does Not Idle Properly or Misfires on Acceleration.*

- (1) *Carburetor incorrectly adjusted.* Adjust carburetor (par. 111).
- (2) *Fuel filter restricted.* Clean or replace fuel filter as required (par. 139).
- (3) *Carburetor air cleaner restricted.* Service air cleaner (par. 133b).
- (4) *Carburetor faulty.* Replace carburetor (par. 137).
- (5) *Ignition system faulty.* Refer to paragraph 93d.
- (6) *Valves faulty.* Refer to paragraph 85b(3).
- (7) *Other causes.* If cause of trouble cannot be located by performing (1 through 6) above, notify ordnance maintenance personnel.

*e. Excessive Fuel Consumption.*

- (1) *Fuel leaks.* Check for fuel leaks and service as required.
- (2) *Carburetor air cleaner restricted.* Service air cleaner (par. 133b).
- (3) *Choke control incorrectly adjusted.* Check operation of choke control and lever. Adjust control if necessary (par. 134a). If carburetor choke valve is inoperative, replace carburetor (par. 137).
- (4) *Ignition system faulty.* Refer to paragraph 93g.
- (5) *Valves faulty.* Refer to paragraph 85b(3).
- (6) *Exhaust system restricted.* Refer to paragraph 87b.
- (7) *Other causes.* If cause of trouble cannot be located by performing (1 through 6) above, notify ordnance maintenance personnel.

## **87. Exhaust System**

*a. Exhaust Leaks.*

- (1) *Damaged muffler, tail pipe, or exhaust pipes.* Inspect muffler, tail pipe, and exhaust pipes for corrosion or other visual damage. Replace parts as necessary (par. 146).
- (2) *Exhaust manifold gasket leaks.* Inspect manifold gaskets for leaks. Replace gaskets if necessary (par. 114).
- (3) *Manifold flanges cracked.* Inspect manifold flanges for cracks. Replace manifold if necessary (par. 114).



- (4) *Leaks at exhaust pipes, muffler, or tail pipe connections.* Inspect exhaust pipes, muffler, or tail pipe attaching screws and gaskets. Service or replace as necessary (par. 146).

**Warning:** Correct exhaust leaks as soon as possible to prevent illness of driver and passengers resulting from exhaust fumes.

*b. Engine Does Not Develop Full Power.*

- (1) *Exhaust system restricted.* Remove obstruction from tail pipe, replace damaged or restricted muffler, tail pipe, or exhaust pipes (par. 146).
- (2) *Ignition system faulty.* Refer to paragraph 93e.
- (3) *Fuel system faulty.* Refer to paragraph 86c.
- (4) *Compression low.* Refer to paragraph 85c(5).
- (5) *Other causes.* If cause of trouble cannot be located by performing (1) through (4) above, notify ordnance maintenance personnel.

## 88. Cooling System

*a. Engine Overheats.*

- (1) *Insufficient cooling solution.* Replenish solution.
- (2) *External leaks.* Inspect hoses, clamps, radiator core, water pump, drain cocks, cylinder outlet elbow, engine block expansion plugs, and water temperature gage sending unit fitting for leaks. Service as necessary.
- (3) *Radiator fins clogged.* If foreign matter is lodged between radiator fins, blow out with compressed air and flush with a hose from engine side.
- (4) *Fan belt loose or broken.* Adjust loose fan belt. Replace broken fan belt (par. 152).
- (5) *Radiator core and/or engine block restricted.* Clean and flush cooling system (par. 149).
- (6) *Thermostat defective, missing, or incorrectly installed.* Install or replace thermostat (par. 151).
- (7) *Water pump faulty.* To check operation of water pump, drain cooling system to a level below the water pump bypass elbow, remove bypass elbow and hose (par. 150d); turn the fan by hand and note if water pump impeller turns. If impeller does not turn, replace water pump (par. 154d and f).
- (8) *Water temperature gage or gage sending unit faulty.* Refer to paragraph 95a.
- (9) *Ignition system faulty.* Refer to paragraph 93e.
- (10) *Exhaust system restricted.* Refer to paragraph 87b.

*b. Engine Runs Too Cold.*

- (1) *Water temperature gage or sending unit faulty.* Refer to paragraph 95a.

- (2) *Thermostat stuck in open position.* Check thermostat and replace if necessary (par. 151).
  - (3) *Thermostat missing.* Install correct thermostat (par. 151).
- c. *Loss of Coolant.*
- (1) *Hose or hose connections faulty.* Tighten hose clamps or replace hose as required (par. 150).
  - (2) *Water pump or water pump gasket faulty.* Replace water pump and/or gasket as required (par. 154).
  - (3) *Radiator leaks.* Replace radiator (par. 153).
  - (4) *Cylinder head loose or cylinder-head gasket faulty* Tighten cylinder-head cap screws or replace cylinder head or gasket as required (par. 115).
  - (5) *Radiator cap or radiator cap gasket faulty.* Replace radiator cap or gasket as required.
  - (6) *Cylinder block leaks.* Notify ordnance maintenance personnel.
  - (7) *Cylinder-head outlet elbow on gasket faulty.* Replace elbow and/or gasket.

## 89. Electrical Testing Equipment

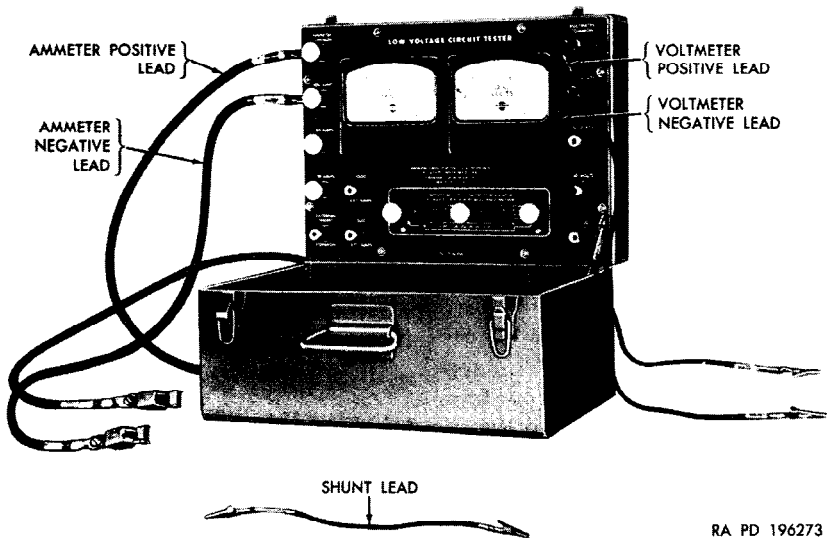
a. *General.* Troubleshooting of components of the electrical system may be accomplished with the use of testing equipment available to organizational maintenance crews. This equipment includes the low voltage circuit tester (fig. 40), the carbon pile resistor and field rheostat (fig. 41), and the adapter set (fig. 42).

### b. *Hook-up of Low Voltage Circuit Tester.*

- (1) All leads of the low voltage circuit tester affected by polarity are identified either by a red or black protector over the connecting clip or by the symbols + or - at the end of the test lead. Red indicates a positive (+) connector and black indicates a negative (-) connector.
- (2) To insure correct meter readings, the positive (+) test lead clip for either the test voltmeter or the test ammeter must always be connected at the emanating source of current flow. For example, if the current is flowing from the batteries, the positive (+) test lead must be connected to the battery side of the circuit; however, if current is flowing from the generator to the batteries, the positive (+) test lead must be connected to the generator side of the circuit.

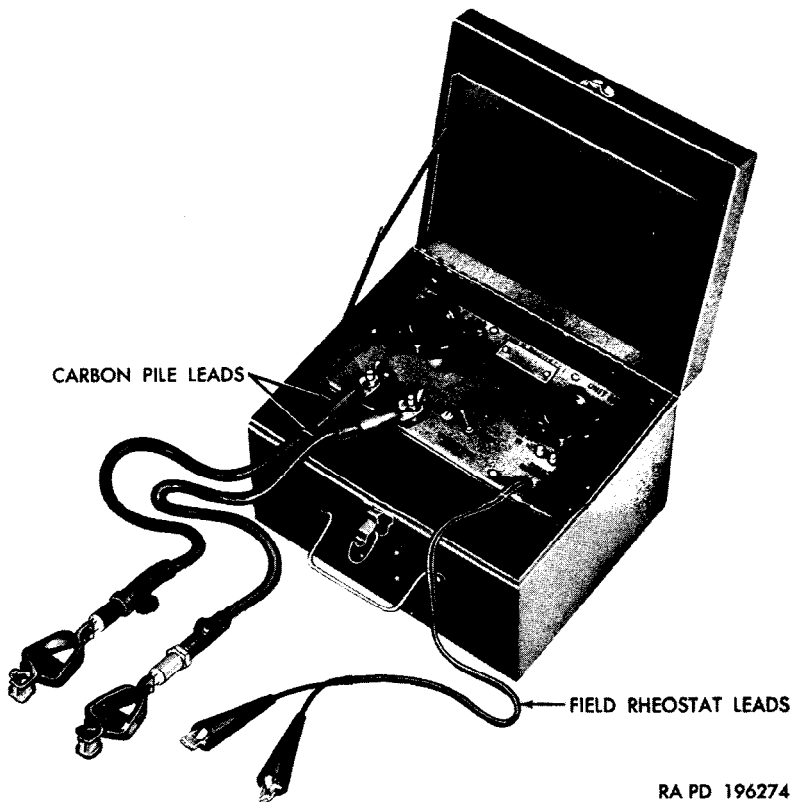
## 90. Batteries

a. *Batteries Damaged.* Check batteries for damaged case, terminals, or cell cover plates. If any of these conditions are noted, replace batteries (par. 168).



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Figure 40. Low voltage circuit tester.



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Figure 41. Carbon pile resistor and field rheostat.

KEY	ITEM
A	ADAPTER—17-A-2967-50
B	ADAPTER—17-A-1375-50
C	ADAPTER—17-A-2975
D	ADAPTER—17-A-2987-50
E	ADAPTER—17-A-2987-75

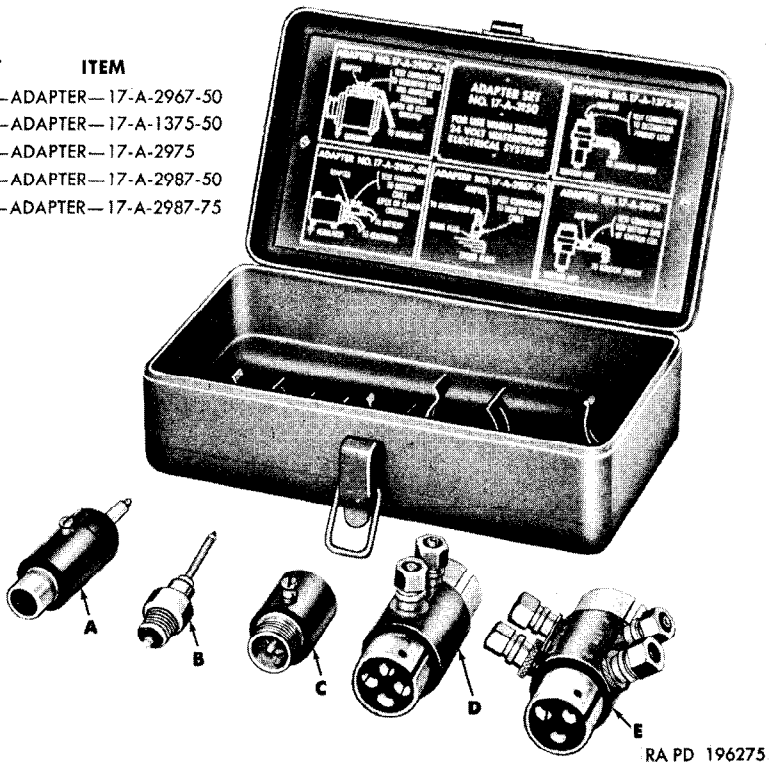


Figure 42. Adapter set 17-A-3150.

*b. Batteries Discharged.*

- (1) *Excessive use of starter.* Avoid unnecessary use of starter.
- (2) *Ignition switch or vehicle lights left on for long periods.* Turn ignition and light switches off when vehicle is not in operation.
- (3) *Battery to starter cable short circuiting on battery hold down cover.* Remove, clean, and install insulator and cover (par. 168).
- (4) *Generator voltage regulator faulty.* Check voltage regulator (par. 92f through i) and correct as necessary.
- (5) *Lack of periodic battery inspection.* Check batteries at specified intervals (refer to table III.).

*c. Check Battery Specific Gravity.* Refer to paragraph 167.

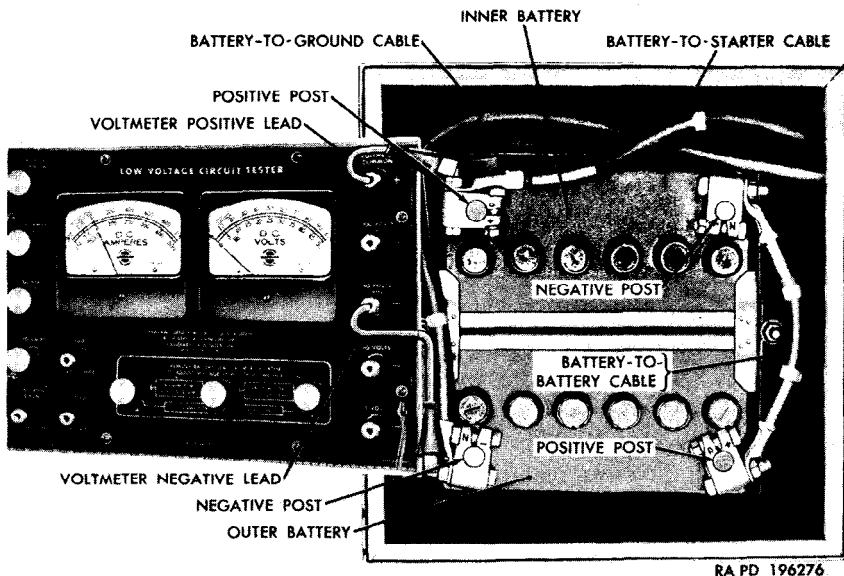
*d. Check Battery Voltage* (fig. 43). The battery voltage check is to determine the battery condition.

- (1) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the positive (+) terminal of the inner battery.

- (2) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the negative (-) post of the outer battery.
- (3) *Read voltmeter.* Observe the reading on the lower scale of the tester voltmeter. This reading should be at least 23 volts, with the batteries at a temperature of 70° F. Voltage reading will be lower at lower temperatures and higher at higher temperatures. If the combined voltage of the two batteries is less than 23 volts (at 70° F.), check each battery. Replace battery (par. 168) if voltage reading shows less than 11.5 volts.
- (4) *Remove testing equipment.* When the check has been completed, remove the testing equipment.

*e. Check Battery Voltage Drop (Starter Cranking Engine).* The check of the battery voltage drop with the starter cranking the engine is to determine the condition of the batteries and the starter. The engine must be at normal operating temperature for this check.

- (1) *Connect voltmeter test leads.* Connect the voltmeter test leads (d (1) and (2) above) and note the combined voltage reading of the batteries.
- (2) *Read voltmeter.* Crank the engine with the starter (ignition switch off) and observe the voltmeter lower scale reading. The reading should not drop below 22 volts. A reading of less than 22 volts with the starter cranking the engine indi-



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Figure 43. Testing battery voltage.

cates partially discharged or defective batteries or a faulty starter. Check each battery individually ((3) and (4) below) to determine whether one or both batteries are at fault.

- (3) *Check voltage of outer battery* (fig. 44). Connect the positive (+) test lead clip to the positive (+) post of the outer battery and the negative (-) test lead clip to the negative (-) post of the outer battery. Crank the engine with the starter (ignition switch off) and note the reading on the voltmeter lower scale.
- (4) *Check voltage of inner battery* (fig. 45). Connect the positive (+) test lead clip to the positive (+) post of the inner battery and the negative (-) test lead clip to the negative (-) post of the inner battery. Crank the engine with the starter (ignition switch off) and note the reading on the voltmeter lower scale.
- (5) *Compare voltage readings of the two batteries.* The reading for each battery should be not less than 11 volts and variation between the two batteries should not exceed 1 volt. If voltage reading of one battery is low, replace the low battery (par. 168) and repeat the check described in (1) and (2) above.

*f. Check Battery-to-Battery Cable Resistance* (fig. 46). Testing the resistance in the battery to battery cable is to isolate excessive resistance between the batteries. When making this check, the test leads

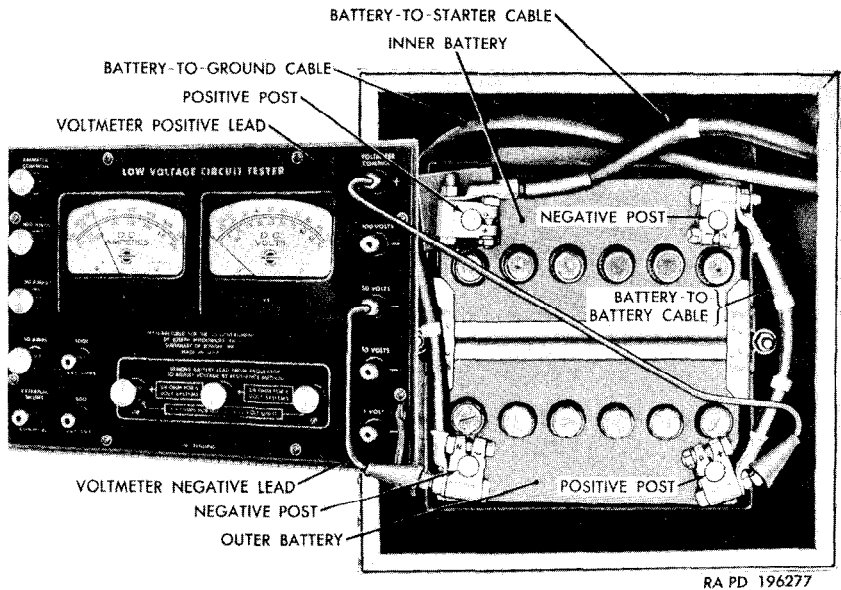


Figure 44. Testing voltage of outer battery.

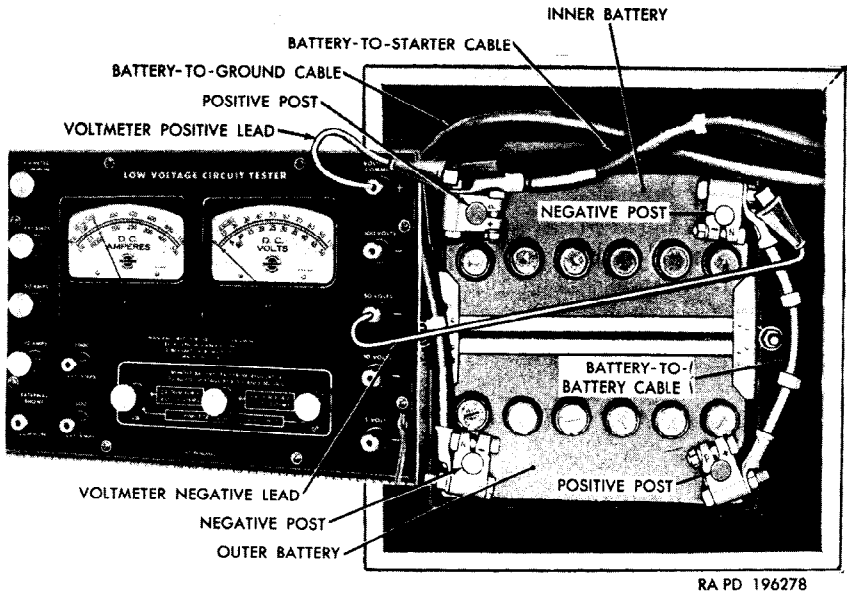
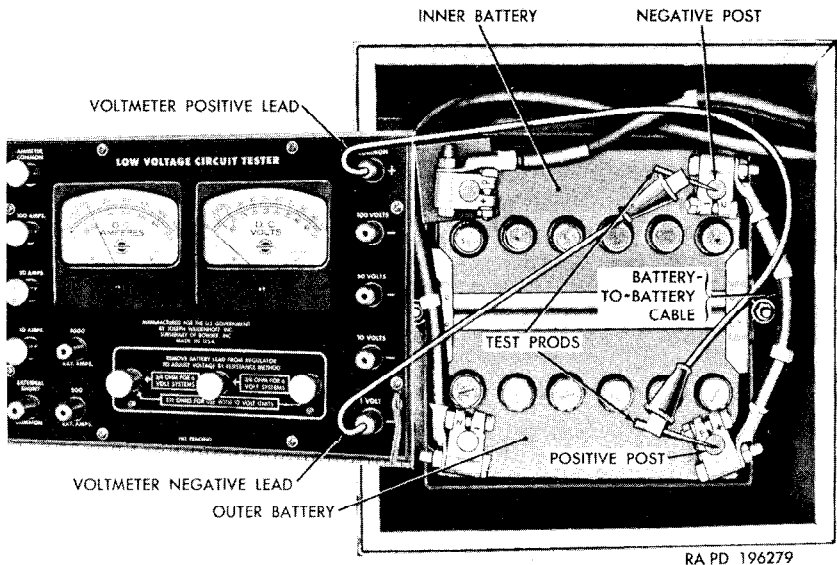


Figure 45. Testing voltage of inner battery.

must be attached to test prods in the battery posts, rather than to the battery cable terminals, to insure accurate readings.

*Note.* To make a test prod, use a short length of 1/8-inch welding rod and grind one end to a sharp, long point. Two prods will be required. Using a light hammer, drive the prods into the center of the battery posts.

- (1) *Warm up engine.* Start the engine and run at idling speed until normal operating temperature is reached. Stop the engine.
- (2) *Install test prods in battery posts.* Drive a test prod into the positive (+) post of the outer battery and the negative (-) post of the inner battery.
- (3) *Connect voltmeter positive (+) test lead.* Connect the positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the test prod in the positive (+) post of the outer battery.
- (4) *Connect voltmeter negative (-) test lead.* Connect the negative (-) test lead to the 1 VOLT terminal of the tester and attach the clip end of the lead to the test prod in the negative (-) post of the inner battery.
- (5) *Read voltmeter.* Crank the engine with the starter (ignition switch) and observe the upper scale of the voltmeter. The voltage reading should not exceed 0.1 volt. If the reading exceeds 0.1 volt, check for corroded battery terminals or a loose cable in the cable terminals. Clean corrosion from terminals. Replace a defective cable (par. 169c).



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Figure 46. Testing battery-to-battery cable resistance.

- (6) *Remove testing equipment.* When the test has been completed, remove the testing equipment and the test prods.

## 91. Starting System

### a. Starter Inoperative.

- (1) *Batteries discharged.* Test batteries for specific gravity and condition (pars. 90 and 167). Replace battery if necessary (par. 168).
- (2) *Battery cables loose, corroded, or broken.* Clean and tighten all electrical connections at battery, ground, and starter. Replace broken or defective cables (par. 169).
- (3) *Starter switch faulty.* Connect a suitable jumper cable from the battery to starter cable terminal to the other starter switch terminal, to bypass the starter switch. Scrape lacquer from the switch terminal to insure a good connection. If the starter runs, it indicates that the starter switch is defective. Replace the starter switch (par. 159).
- (4) *Starter faulty.* If starter is inoperative after checking or replacing switch, replace starter (par. 158).

### b. Starter Spins But Does Not Crank Engine.

- (1) *Flywheel ring gear broken.* Remove the starter (par. 158a) and inspect flywheel ring gear teeth. If teeth are broken or damaged, report to ordnance maintenance personnel.
- (2) *Starter pinion damaged.* Replace starter (par. 158).



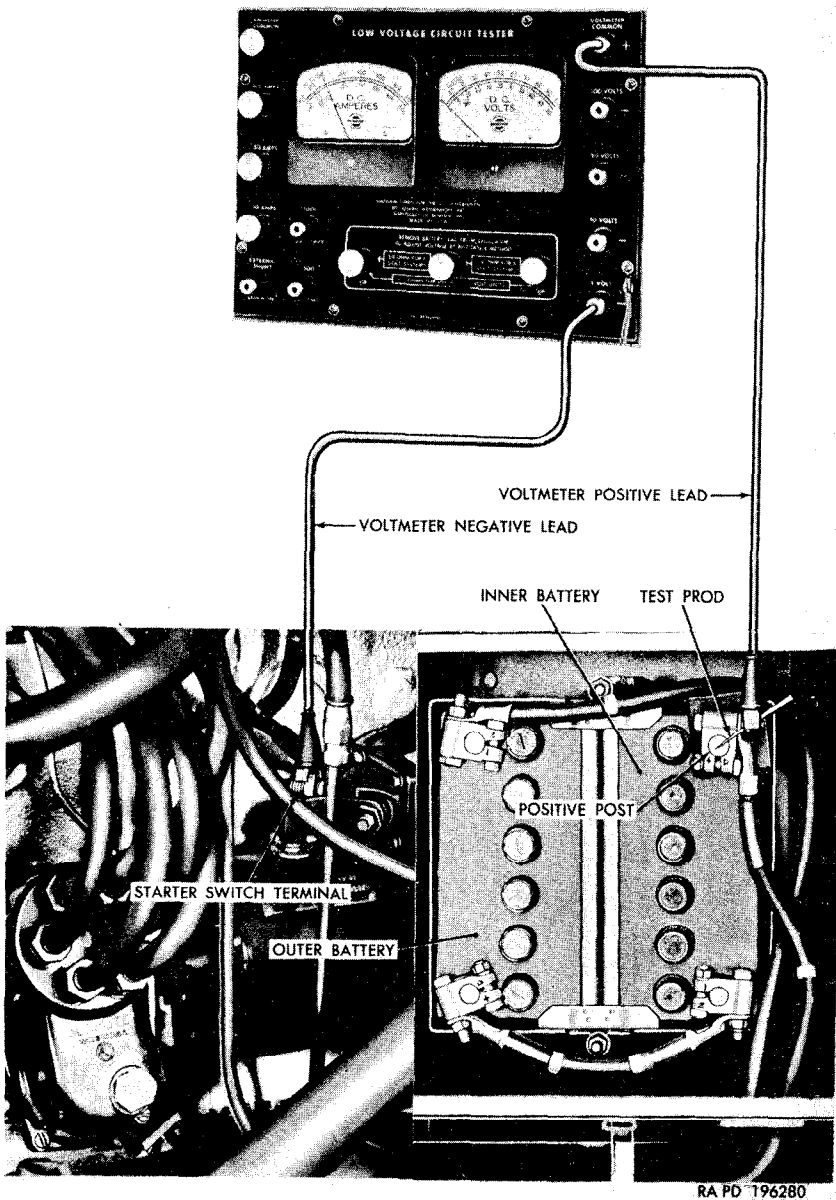
c. *Starter Cranks Engine Slowly (Batteries Satisfactory)*. Check voltage drop (resistance) in circuits between starter and battery with starter cranking engine (par. 90f). If voltage drop is not excessive, replace starter (par. 158).

d. *Check Battery-to-Starter Cable Resistance* (fig. 47). Check for excessive resistance (voltage drop) in the battery-to-starter cable to determine cause of malfunction of the starting system. The engine must be at normal operating temperature.

- (1) *Install test prod in battery post*. Drive a test prod into the positive (+) post of the inner battery (par. 90f).
- (2) *Connect voltmeter positive (+) test lead*. Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the test prod.
- (3) *Connect voltmeter negative (-) test lead*. Connect the voltmeter negative (-) test lead to the 1 VOLT terminal of the tester and attach the clip end of the lead to the starter switch terminal.
- (4) *Crank engine and read voltmeter*. Crank the engine with the starter (ignition switch off) and observe the reading on the upper scale of the tester voltmeter. The reading should not exceed 0.2 volt.
- (5) *Clean connections or replace battery-to-starter cable*. If reading exceeds 0.2 volt, check for loose or dirty connections at the starter switch and battery, a corroded battery terminal, or a loose cable in cable terminals. Clean and tighten connections. Replace a defective battery to starter cable (par. 169f and g).
- (6) *Remove testing equipment*. After completing the check, remove the testing equipment and the prod from the battery post.

e. *Check Starting System Ground Circuit Resistance* (fig. 48). The resistance check of the starting system ground circuit is to determine cause of malfunction of the starting system. The engine must be at normal operating temperature.

- (1) *Install test prod in battery post*. Drive a test prod into the negative (-) post of the outer battery (par. 90f).
- (2) *Connect voltmeter positive (+) test lead*. Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and connect the clip end of the lead to the starter frame.
- (3) *Connect voltmeter negative (-) test lead*. Connect the voltmeter negative (-) test lead to the 1 VOLT terminal of the tester and attach the clip end of the lead to the prod in the negative (-) post of the outer battery.



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*Figure 47. Checking battery-to-starter cable resistance.*

- (4) *Read voltmeter.* Crank the engine with the starter (ignition switch off) and observe the reading of the upper scale of the tester voltmeter. The reading should not exceed 0.1 volt. If voltage reading exceeds 0.1 volt, check for a loose starter, a loose or damaged ground strap, a loose or corroded ground cable connection at frame, loose or corroded cable terminal at battery, or loose cable in cable terminal. If all

connections are clean and tight and the cables are in good condition, it indicates that the starter is at fault. Replace defective starter (par. 158).

- (5) *Remove testing equipment.* After completing the check, remove the testing equipment and the test prod from the battery post.

## 92. Charging System

*a. General.* Troubleshooting of the charging system includes checking of the generator, generator regulator, and cables.

*b. Ammeter or Battery Generator Indicator Does Not Indicate Charge.* Check generator operating voltage (*e* below).

*c. Excessive Evaporation of Water in Batteries.* Generator voltage regulator setting too high. Check voltage at generator regulator (*i* below).

*d. Batteries Require Frequent Recharging.* Generator voltage regulator setting too low. Check voltage at generator regulator (*i* below).

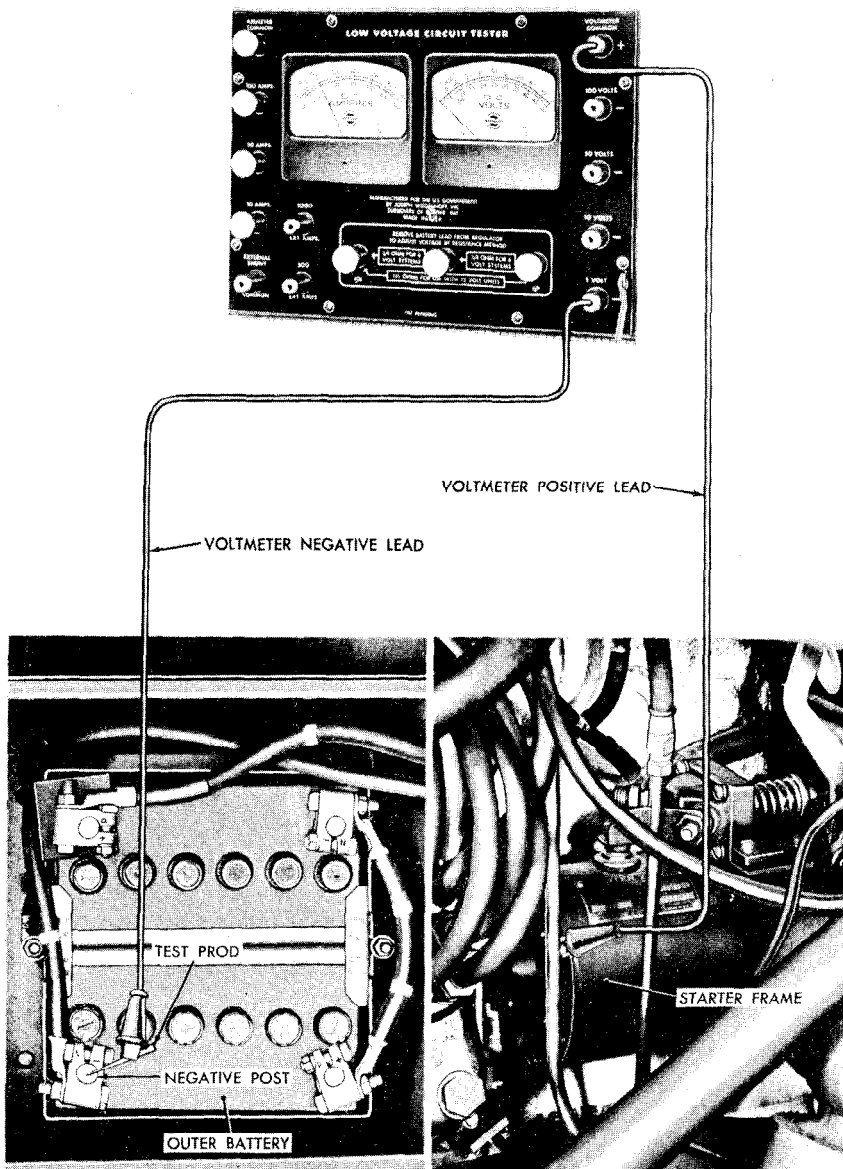
*e. Check Generator and Generator Regulator for No-Charge* (fig. 49). The generator and generator regulator check is to determine the cause of a no-charge reading of the ammeter or battery generator indicator. In order to obtain accurate readings, the engine must be at normal operating temperature to idle properly during the test.

- (1) *Warm up engine.* Start the engine and run until normal operating temperature is reached. Stop the engine.
- (2) *Disconnect generator-to-regulator cable and install adapter.* Disconnect the generator-to-regulator cable from the receptacle on the generator by unscrewing the cable connector nut with a spanner wrench. Install adapter 17-A-2987-75 (E, fig. 42) in the generator receptacle. Close both links of the adapter.

*Note.* Do not connect the cable to the adapter.

- (3) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to one of the adapter ARM terminals.
- (4) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the generator adjusting arm.
- (5) *Connect tester shunt lead.* Connect the tester shunt lead to the other ARM terminal of the adapter and to one of the adapter FIELD terminals.

**Caution:** Do not perform any tests with the shunt lead connecting the ARM and FIELD terminals of the generator



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Figure 48. Checking starting system ground circuit resistance.

adapter when the generator is connected to the battery, as the resulting high voltage will be detrimental to the entire electrical system and cause failure of parts.

- (6) *Run engine and read voltmeter.* Start the engine and operate at idle speed. Observe the voltmeter lower scale reading.

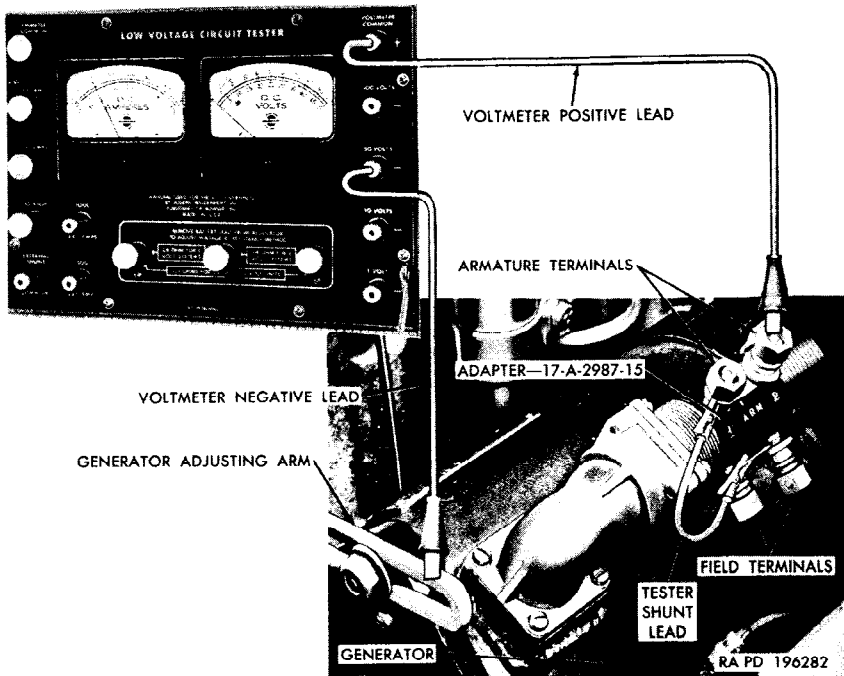


Figure 49. Troubleshooting generator.

The voltage reading should be 30 volts with the engine at idling speed or slightly faster.

- (7) *Source of trouble.* If voltage reading is low or no reading is shown on voltmeter, the generator is probably at fault. Replace the generator (par. 164). If the voltage reading is 30 volts or more, the generator is functioning properly, and a faulty generator regulator is probably the cause of the “no charge” condition. Replace the generator regulator (par. 165).

- (8) *Remove testing equipment and connect generator-to-regulator cable.* Remove testing equipment. Connect generator-to-regulator cable to receptacle on generator and tighten nut with a spanner wrench.

f. *Check Maximum Charge* (fig. 50). Checking the maximum charge is to determine whether the current regulator of the generator regulator is functioning properly.

- (1) *Disconnect battery-to-ground cable.* Disconnect the battery-to-ground cable from the negative (–) post of the outer battery to prevent an accidental ground while connecting test leads.
- (2) *Install adapter in generator terminal receptacle.* Disconnect the generator to regulator cable from the receptacle on the generator and install adapter 17-A-2987-75 (E, fig. 42) in

receptacle. Make certain that the link between adapter ARM terminals is closed. Insert the cable in the adapter.

- (3) *Connect voltmeter test leads.* Connect tester voltmeter positive (+) and negative (-) test leads as instructed in e(3) and (4) above.

*Note.* Do not connect the tester shunt lead.

- (4) *Install adapter at generator regulator.* Unscrew the cable connector nut from the generator regulator rear receptacle and remove the cable. Install adapter 17-A-2987-50 (D, fig. 42) in the receptacle and connect the cable to the adapter. Open the link on the adapter.
- (5) *Connect ammeter positive (+) test lead.* Connect the ammeter positive (+) test lead to the AMMETER COMMON terminal of the low voltage circuit tester and attach the clip end of the lead to the inner terminal of the adapter in the generator regulator.
- (6) *Connect ammeter negative (-) test lead.* Connect the ammeter negative (-) test lead to the 50 AMPS terminal of the tester and attach the clip end of the lead to the outer terminal of the adapter in the generator regulator.

**Caution:** Insert clean wiping cloth or other suitable insulation between the two ammeter lead clips and around each clip to prevent accidental grounding when the battery is connected to the circuit.

- (7) *Connect battery-to-ground cable.* Connect the battery-to-ground cable to the negative (-) post of the outer battery.
- (8) *Position carbon pile resistor and field rheostat in vehicle.* Place the carbon pile resistor and field rheostat 17-R-6249 (fig. 41) in the driver's compartment convenient to the batteries (on ambulance truck M43 with batteries under the left litter rack, place the resistor in the patient compartment).
- (9) *Connect carbon pile resistor leads to battery.* Connect one of the carbon pile resistor leads to the positive (+) terminal of the inner battery and the other lead to the negative (-) terminal of the outer battery.
- (10) *Start engine and read test meters.* Start the engine and operate at a speed equivalent to 20 mph for 15 minutes. Observe the reading on the lower scale of the tester ammeter. If the ammeter reading is less than 24 amperes, hold the carbon pile switch in the ON position and turn the carbon pile knob clockwise until the tester voltmeter lower scale shows a reading of not less than 25 volts. Observe the ammeter lower scale reading. The ammeter should indicate a charge of 24 to 27 amperes.

*Note.* Avoid turning the carbon pile knob clockwise further than is necessary to produce the full charging rate.

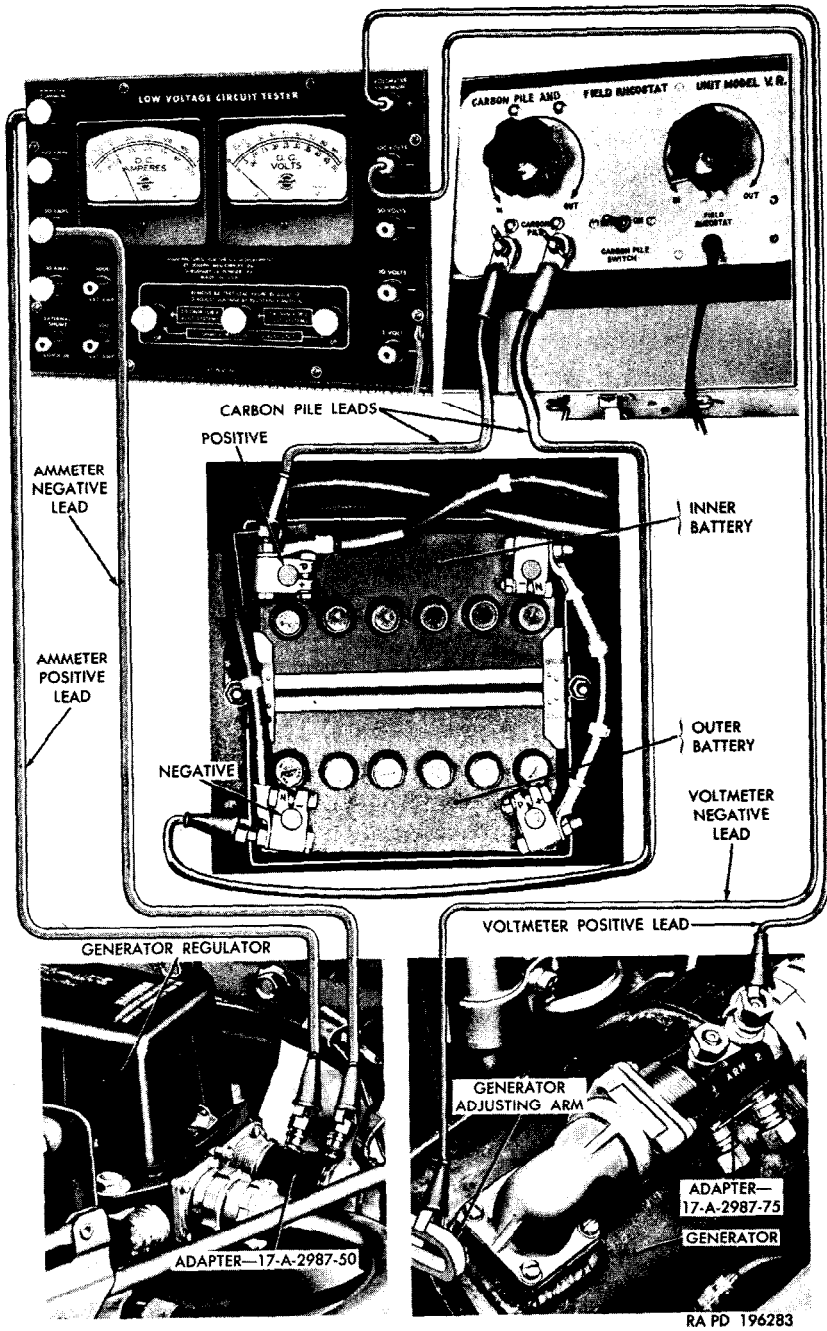


Figure 50. Checking maximum charge.

- (11) *Stop engine and perform necessary repairs.* Stop the engine. If the ammeter reading is less than 24 amperes, replace the generator regulator (par. 165), or notify ordnance maintenance personnel.
- (12) *Remove testing equipment.* When the check has been completed, disconnect battery-to-ground cable from the negative (-) post of the outer battery and remove the testing equipment. Connect battery-to-ground cable to battery. Connect generator-to-regulator cable to the generator and generator regulator.

*g. Check Charging System Insulated Cables Resistance* (fig. 51). Checking resistance in the charging system insulated cables is to determine malfunctions which affect the operation of the voltage regulator. With the exception of the voltmeter test leads, all connections are the same as those described in *f* above.

- (1) *Disconnect battery-to-ground cable.* Remove the battery-to-ground cable from the negative (-) post of the outer battery.
- (2) *Install test prod in battery post.* Drive a test prod into the positive (+) post of the inner battery.
- (3) *Connect voltmeter positive (+) lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to one of the "ARM" terminals of the adapter in the generator receptacle.
- (4) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 1 VOLT terminal of the tester.

*Note.* Do not attach the clip end of the lead at this time.

- (5) *Start engine.* Start the engine and operate at a speed equivalent to 20 mph.
- (6) *Connect voltmeter negative (-) test lead to battery.* Attach the clip end of the voltmeter negative (-) lead to test prod in the positive (+) post of the inner battery.

**Caution:** Do not attach the voltmeter negative (-) test lead to the battery until the engine is running, to prevent full battery voltage from being impressed across the voltmeter of the low voltage circuit tester, causing an inaccurate scale reading or damage to the tester.

- (7) *Operate carbon pile resistor and read voltmeter.* Operate the carbon pile switch and knob (*f* (10) above) and observe the upper scale of the voltmeter. The voltage reading should not exceed 1 volt when the generator is charging 24 to 27 amperes.

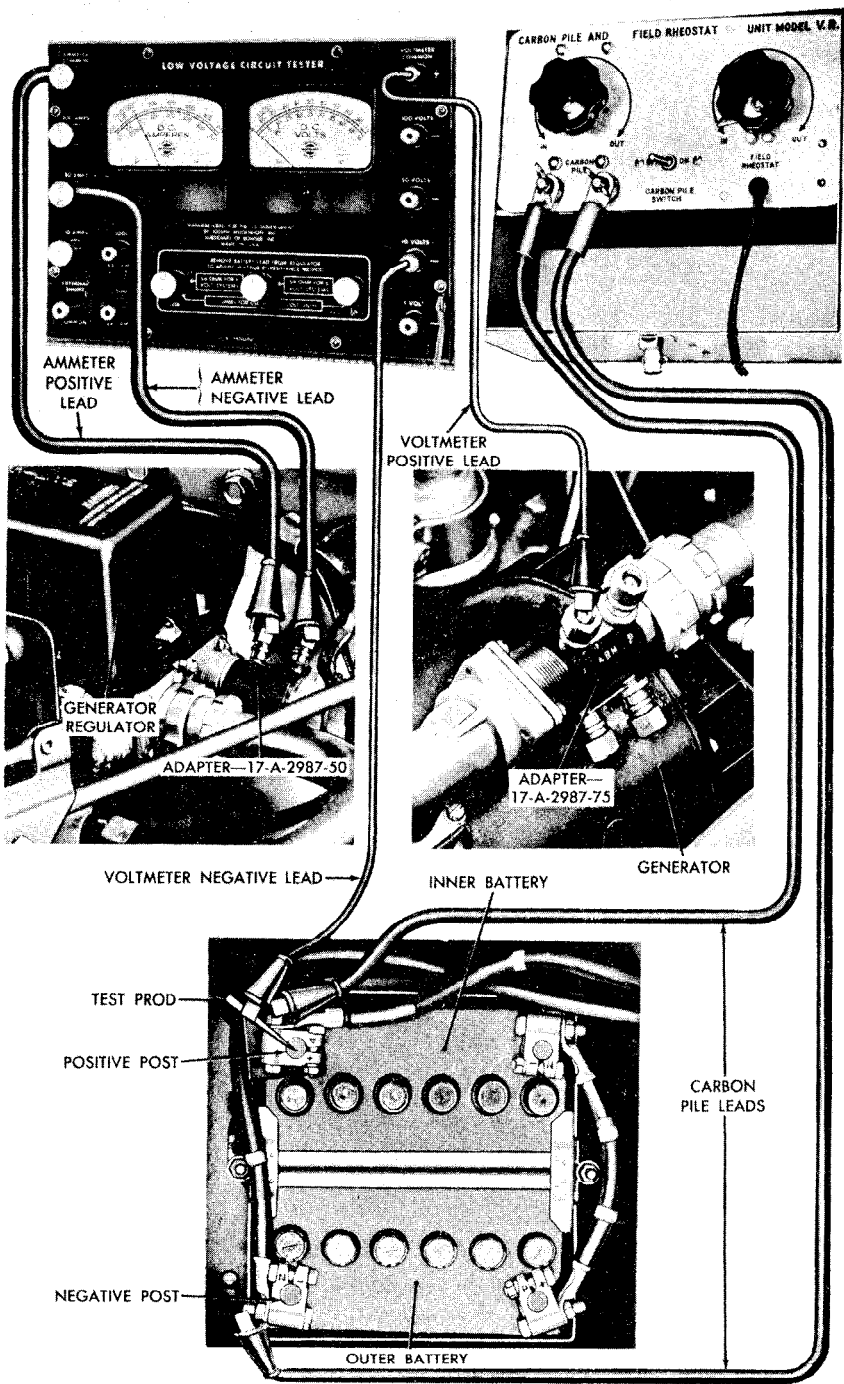


- (8) *Remove testing equipment and perform necessary repairs.* If voltage reading exceeds 1 volt, check for loose or corroded connections at the starter switch and battery terminal, and check for loose or damaged terminals on the battery-to-starter cable. Clean and tighten connections. Replace a damaged cable (par. 169*f* and *g*). Repeat the test. If resistance in the cable is satisfactory, remove the testing equipment (*f*(12) above) and test prod. Connect the cable to the generator and generator regulator.

*h. Check Charging System Ground Circuit Resistance* (fig. 52). Checking the charging system ground circuit resistance is to determine malfunctions which affect the operation of the voltage regulator. The generator must be operating properly and the engine must be at normal operating temperature. With the exception of the voltmeter test lead connections, the testing equipment connections are the same as those described in *f* above.

- (1) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the negative (-) post of the outer battery.
- (2) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 1 VOLT terminal of the tester and attach the clip end of the lead to the generator adjusting arm.
- (3) *Connect ammeter test leads.* Connect the ammeter test leads (*f*(5) and (6) above).
- (4) *Connect carbon pile resistor leads to battery.* Connect the carbon pile resistor leads (*f*(9) above).
- (5) *Start engine and read test meters.* Start the engine and operate at a speed equivalent to 20 mph to obtain an ammeter reading of 24 to 27 amperes. Operate the carbon pile switch and knob (*f*(10) above) and observe the reading on the upper scale of the voltmeter. The reading should not exceed 0.1 volt. Stop the engine after noting the voltage.
- (6) *Perform necessary repairs.* If voltage reading exceeds 0.1 volt, check for loose generator or generator mounting bracket, corroded battery terminal, or a loose or dirty battery ground cable connection at the frame. Tighten generator bolts and generator mounting bracket bolts. Clean and tighten connections.
- (7) *Remove testing equipment.* Remove the testing equipment (*f*(12) above) and connect the cables to the generator and generator regulator.

*i. Check Voltage Regulator Setting* (fig. 53). The purpose of checking the setting of the voltage regulator is to determine the cause



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Figure 51. Checking charging system insulated cables resistance.

of inadequate battery charge and/or excessive evaporation of water from the batteries.

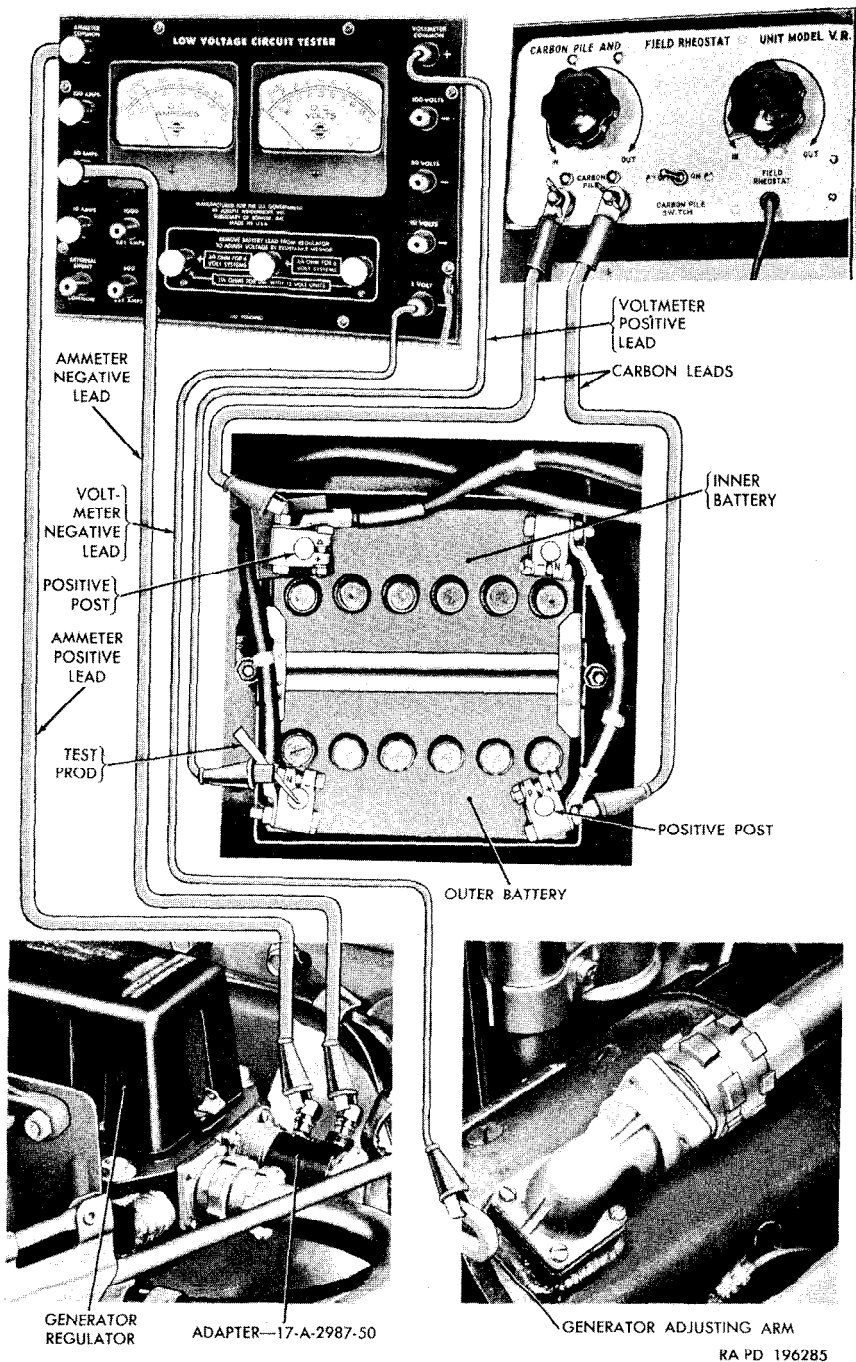
- (1) *Warm up engine and disconnect battery-to-ground cable.* Run the engine until normal operating temperature is reached, stop the engine, and disconnect the battery-to-ground cable from the negative ( - ) post of the outer battery.
- (2) *Install adapter in generator regulator.* Remove the cable from the generator regulator rear receptacle and install the adapter - 17-A-2987-50 (D, fig. 42) in the receptacle.

*Note.* Do not connect the cable to the adapter.

- (3) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the inner terminal of the adapter.
- (4) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the regulator mounting stud nut.
- (5) *Connect battery-to-ground cable.* Connect the battery-to-ground cable to the negative ( - ) post of the outer battery and start the engine.
- (6) *Cycle voltage regulator.* Operate the engine at a speed equivalent to 20 mph for several seconds; then reduce the engine speed to cycle the voltage regulator.
- (7) *Read voltmeter.* Repeat (6) above three or four times, then increase engine speed to the equivalent of 20 mph and read the voltage on the lower scale of the voltmeter. Voltage reading should be from 27 to 28 volts for hot climate or summer months, and 28 to 29 volts for cold climates or winter months.
- (8) *Perform necessary repairs.* If the voltage is not within the specified limits, replace the generator regulator (par. 165) or notify ordnance maintenance personnel.
- (9) *Remove testing equipment.* After completing the test, remove the testing equipment (*f*(12) above) and connect the cable to the generator regulator rear receptacle.

*j. Check Circuit Breaker Unit Closing Voltage* (fig. 54). The circuit breaker unit check is to determine whether the circuit breaker unit in the generator regulator functions properly. In order to obtain an accurate diagnosis of circuit break unit performance, the generator voltage regulator must be functioning properly (*i* above).

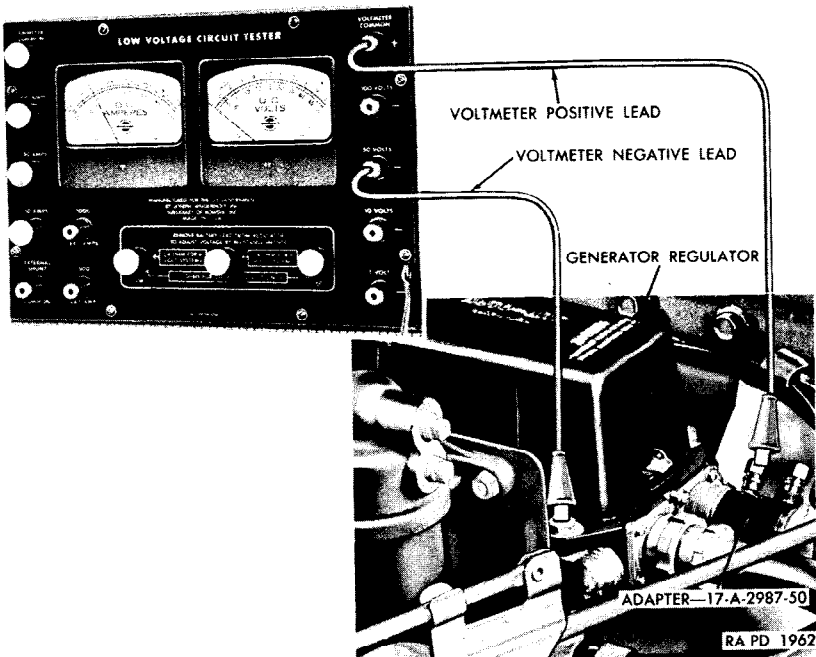
- (1) *Disconnect battery-to-ground cable.* Disconnect the battery-to-ground cable from the negative ( - ) post of the outer battery.



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Figure 52. Checking charging system ground circuit resistance.

- (2) *Install adapter in generator terminal receptacle.* Disconnect the generator-to-generator regulator cable from the generator receptacle and install adapter 17-A-2987-75 (E, fig. 42) in the generator receptacle. Connect the cable to the adapter, close the link between the adapter ARM terminals, and open the link between the adapter FIELD terminals. Tighten terminal nuts.
- (3) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to one of the ARM terminals of the adapter in the generator terminal receptacle.
- (4) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the generator adjusting arm.
- (5) *Install adapter in generator regulator.* Disconnect the generator to regulator cable from the regulator rear receptacle. Install adapter 17-A-2987-50 (D, fig. 42) in the receptacle, and connect the cable to the outer end of the adapter. Open the link between the two adapter terminals and tighten the terminal nuts.



*Figure 53. Checking voltage regulator setting.*

- (6) *Connect ammeter test leads.* (Connect the ammeter leads (*f* (5) and (6) above).
- (7) *Connect field rheostat.* Connect the field rheostat leads of the resistor to the two "FIELD" terminals of the adapter in the generator receptacle.
- (8) *Connect battery-to-ground cable and start engine.* Connect the battery-to-ground cable to the negative (–) post of the outer battery and start the engine. Set the throttle control at fast idle.
- (9) *Cycle circuit breaker unit.* Turn the field rheostat knob clockwise until the ammeter indicates that the generator is charging. Turn the field rheostat back and forth two or three times to cycle the circuit breaker unit.

*Note.* If the circuit breaker unit points do not open (ammeter hand returns to zero) when the field rheostat knob is turned counterclockwise as far as it will go, reduce the engine speed. Adjust engine speed so that the circuit breaker points open and close when the knob is turned back and forth.

- (10) *Operate field rheostat and read test meters.* Turn the field rheostat knob clockwise slowly until the ammeter hand just flickers, indicating that the circuit breaker unit points are closing. Observe the voltage reading on the voltmeter lower scale. The voltage reading should be not less than 24.5 volts, or at least 1 volt under the voltage regulator setting (*i* (7) above).
- (11) *Perform necessary repairs.* If the voltage reading is not within the specified limits, replace the generator regulator (par. 165) or notify ordnance maintenance personnel.
- (12) *Remove testing equipment.* When the test has been completed, remove the testing equipment (*f* (12) above) and connect the cables to the generator and generator regulator.

### 93. Ignition System

#### *a. Engine Turns but Will Not Start or Starts Hard.*

- (1) *Spark plugs fouled, incorrectly adjusted, or defective.* Remove one of the spark plug cables (par. 124*a*). Crank engine with starter (ignition switch on), while holding the spark plug cable one-fourth inch from the cylinder head. If the spark jumps the gap between the cable and cylinder head, remove all plugs, clean, and inspect. Adjust the gap if necessary. Install the plugs, replacing defective plugs (par. 124). If spark does not jump the gap, proceed with check outlined in (2) through (12) below.
- (2) *Breaker points incorrectly adjusted.* Adjust breaker points (par. 129).

*Note.* Servicing the distributor requires its removal (par. 125*a*).

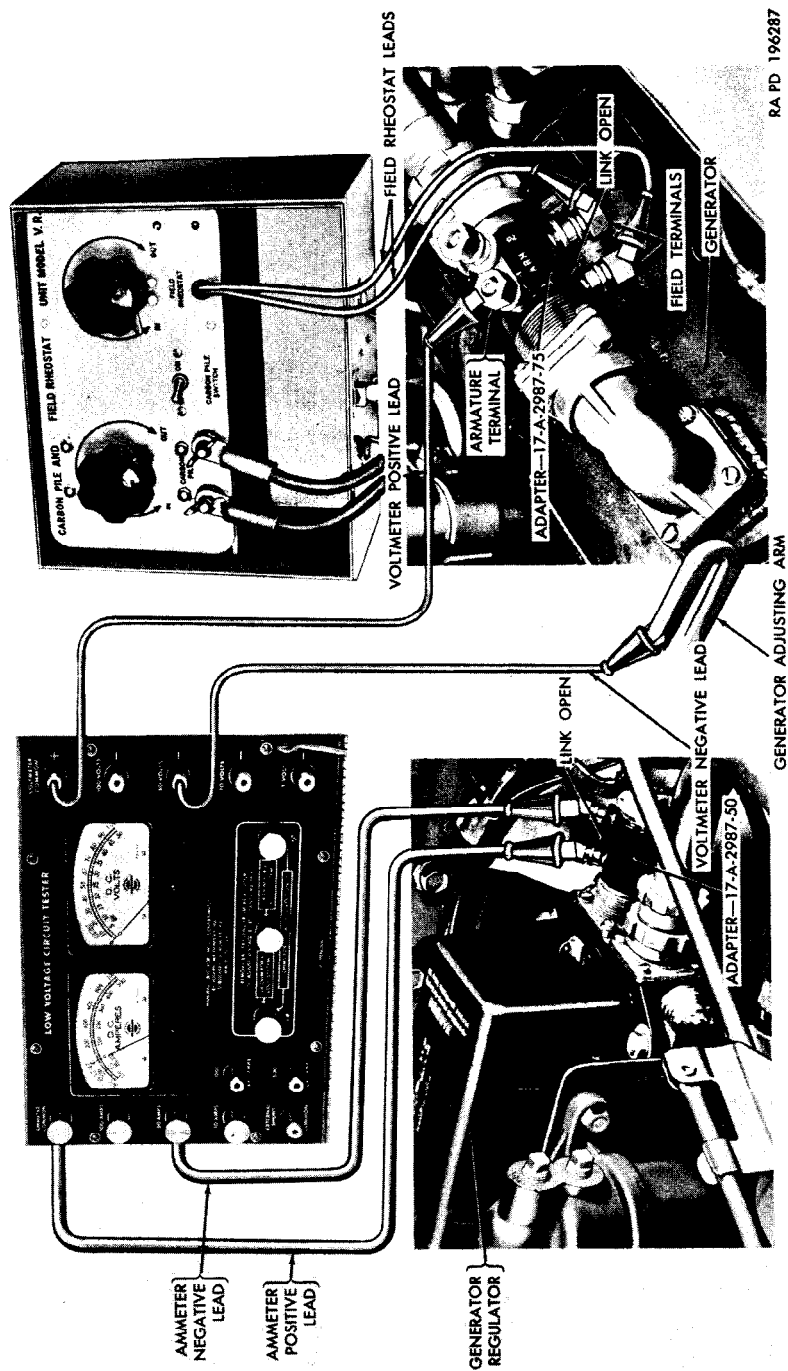


Figure 54. Checking circuit breaker unit.

- (3) *Breaker points burned, pitted, oxidized, or oily.* Clean or replace breaker points and capacitor (par. 128).

*Note.* Oxidation of breaker points is caused by high charging voltage or oil.

Refer to paragraph 92*i* for checking charging voltage. If distributor parts are oily, clean parts or replace distributor as required (par. 125).

- (4) *Ignition coil faulty.* Check the ignition coil with the distributor removed (par. 125*a*) from the engine and held in a vise. Remove the cap cover and connect a test lead from the positive (+) terminal of the coil to the positive (+) terminal of one of two 12-volt batteries connected in series. Connect a second test lead from the negative (-) post of the opposite battery to a suitable ground on the distributor base. Insert a third test lead in the high tension terminal of the coil and hold the end of the lead one-fourth inch from the distributor base while rotating the distributor shaft. If a spark jumps the  $\frac{1}{4}$ -inch gap, the coil is satisfactory. If a spark does not jump the gap, replace the coil (par. 130).
- (5) *Rotor faulty.* Check the rotor for burred or broken parts. Replace if defective (par. 128).
- (6) *Cap spring broken or missing.* Replace or install spring (par. 127*c*).
- (7) *Cap faulty.* Remove cap and check for cracks or other damage. Replace a defective cap (par. 127).
- (8) *Ignition switch faulty.* Check ignition switch (*b*(7) below). Replace defective switch (par. 131).
- (9) *Excessive resistance in primary circuit or through breaker points.* Check resistance in primary circuit (*b* below) and breaker points (*c* below) and correct as necessary.
- (10) *Fuel system faulty.* Refer to paragraph 86*a*.
- (11) *Valve faulty.* Refer to paragraph 85*b*(3).
- (12) *Other causes.* If cause of trouble cannot be located by performing (1) through (11) above, notify ordnance maintenance personnel.

*b. Check Primary Circuit Resistance* (fig. 55). Primary circuit resistance check is to determine the resistance through the ignition switch and the primary circuit.

- (1) *Install adapter 17-A-2975 in distributor receptacle.* Disconnect the primary cable from the distributor at the receptacle. Install the adapter 17-A-2975 (C, fig. 42) in the receptacle and connect the cable to the adapter.
- (2) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the



lead to the battery-to-starter cable at the starter switch terminal.

- (3) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the terminal of the adapter in the distributor.
- (4) *Start engine.* Start the engine and operate at idle speed.
- (5) *Change voltmeter negative (-) test lead connection.* Change the voltmeter negative (-) test lead from the 50 VOLTS terminal on the tester to the 1 VOLT terminal.
- (6) *Read voltmeter.* Observe the voltage reading on the voltmeter upper scale. This reading should not exceed 0.2 volt.
- (7) *Check ignition switch.* If voltage reading exceeds 0.2 volt, check for loose or corroded connections at the starter switch terminal, ignition switch, and the cable connector at the left splash shield or at the filter on the dash (vehicles so equipped). If the connections are clean and tight, eliminate the switch from the circuit and repeat the test. To do this, remove the instrument cluster far enough to provide access to the ignition switch. Disconnect the two cables (11 and 12) at the cable connectors and connect cable (11) to cable (12). Start the engine and observe the voltage reading on the upper scale of the voltmeter. If voltage reading is satisfactory with the ignition switch bypassed, replace the switch (par. 131).
- (8) *Remove testing equipment.* When the test has been completed, remove the testing equipment and connect the cable to the distributor.

*c. Check Breaker Points Resistance (fig. 56).* Breaker points resistance check is to determine whether excessive resistance exists through the breaker points because of oil, burning, or oxidation.

- (1) *Install adapter in cap cover.* Remove the cap cover plug and the O-ring packing and install adapter 17-A-1375-50 (B, fig. 42) in the plug opening.
- (2) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the terminal on the adapter in the cover.
- (3) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal on the tester and attach the clip end of the lead to one of the cap cover screws.
- (4) *Check voltage.* Turn the ignition switch on and observe the voltmeter. If the voltmeter shows battery voltage reading (approximately 24 volts) on lower scale, engage the starter momentarily to close the breaker points (voltmeter reading practically zero).

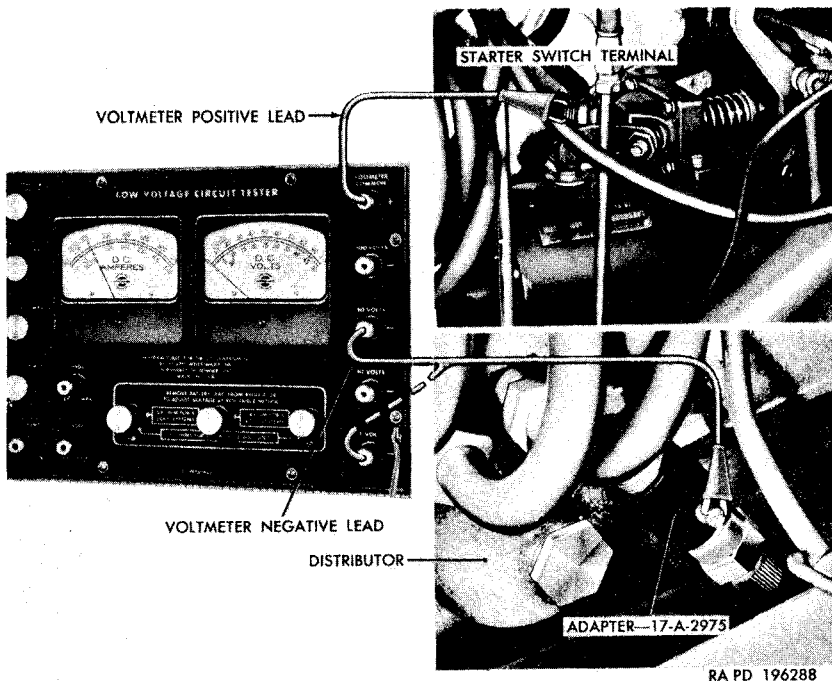


Figure 55. Checking ignition primary circuit resistance.

- (5) *Change voltmeter negative (-) test lead.* Change the voltmeter negative (-) test lead from the 50 VOLTS terminal on the tester to the 1 VOLT terminal.
  - (6) *Observe voltmeter reading and perform necessary repairs.* Observe the voltage reading on the upper scale of the voltmeter. The reading should not exceed 0.2 volt. If the voltage reading exceeds 0.2 volt, remove the distributor (par. 125a), and clean or replace breaker points, as required (par. 128).
- d. *Engine Does Not Idle Properly or Misfires on Acceleration.*
- (1) *Spark plugs faulty.* Remove spark plugs. Inspect spark plugs for incorrect gap and cracked porcelain. Clean, adjust, or replace spark plugs (par. 124).
  - (2) *Spark plug cables faulty.* Disconnect spark plug cables from spark plugs and check each cable for electrical leakage by holding each cable terminal one-fourth inch from the cylinder head. Turn on ignition switch, crank engine with starter and, if missing is evident, replace faulty cables (par. 124).
  - (3) *Distributor breaker points faulty.* Remove distributor (par. 125a) and inspect breaker points. If breaker points are faulty, replace points (par. 128).
  - (4) *Cap cracked.* Remove distributor (par. 125a) and inspect

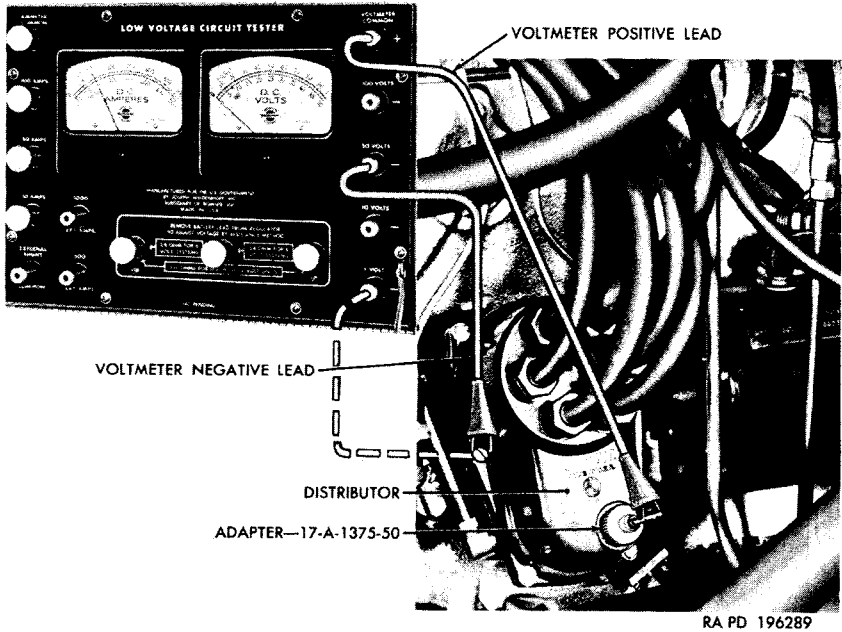


Figure 56. Checking resistance through breaker points.

the cap for cracks and burning. Replace cap if necessary (par. 127).

- (5) *Coil faulty.* Refer to a(4) above.
- (6) *Fuel system faulty.* Refer to paragraph 86d.
- (7) *Valves faulty.* Refer to paragraph 85b(3).
- (8) *Other causes.* If cause of trouble cannot be located by performing (1) through (7) above, notify ordinance maintenance personnel.

e. *Engine Overheats or Does Not Develop Full Power.*

- (1) *Ignition timing late.* Check ignition timing with timing light and adjust if necessary (par. 126).
- (2) *Automatic advance faulty.* Check automatic advance with a timing light. Accelerate engine and note if pointer at fan drive pulley indicates advance as engine speed is increased. If no advance is noted, replace distributor (par. 125).
- (3) *Fuel system faulty.* Refer to paragraph 86c.
- (4) *Valves faulty.* Refer to paragraph 85b(3).
- (5) *Exhaust system restricted.* Refer to paragraph 87b.
- (6) *Other causes.* If cause of trouble cannot be located by performing (1) through (5) above, notify ordinance maintenance personnel.

f. *Engine Misfires at High Speed.*

- (1) *Spark plugs faulty.* Refer to d(1) above.

- (2) *Spark plug cables faulty.* Refer to *d*(2) above.
- (3) *Breaker points faulty.* Refer to *d*(3) above.
- (4) *Coil faulty.* Refer to *a*(4) above.
- (5) *Fuel system faulty.* Refer to paragraph 86*d*.
- (6) *Valves faulty.* Refer to paragraph 85*b*(3).
- (7) *Other causes.* If cause of trouble cannot be located by performing (1) through (6), notify ordnance maintenance personnel.

*g. Excessive Fuel Consumption.*

- (1) *Spark plugs faulty or incorrectly adjusted.* Refer to *d*(1) above.
- (2) *Ignition timing incorrect.* Check timing with timing light and adjust if necessary (par. 126).
- (3) *Fuel system faulty.* Refer to paragraph 86*e*.
- (4) *Valves faulty.* Refer to paragraph 85*b*(3).
- (5) *Other causes.* If cause of trouble cannot be located by performing (1) through (4) above, notify ordnance maintenance personnel.

## 94. Lighting System

*a. General.* Troubleshooting of the lighting system includes checking of the various lamps, lamp-units, light switch, circuit breaker, dimmer switch, and connecting cables.

*b. All Lights Out (Engine Starts).* If no vehicle lights are operative when the light switch is at SER DRIVE position and the batteries are known to be fully charged, proceed with (1) below.

- (1) *Check for current at blackout marker light (fig. 57).*
  - (a) Remove the lower lamp (par. 171*c*) from one of the marker lights.
  - (b) Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester.
  - (c) Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to one of the lamp socket screws.
  - (d) Turn the light switch to BO MARKER position.
  - (e) Touch the clip end of the positive (+) test lead to the terminal in the lamp socket, being careful not to touch any metal parts of the light body with the lead, as contact with such parts will cause the circuit breaker to open.
  - (f) Observe the lower scale of the tester voltmeter. If the voltmeter shows battery voltage (approximately 24 volts), current is reaching the light. Replace the lamp. If no voltage reading is indicated, the difficulty may be in the light switch circuit breaker, or the light switch. Proceed with (2) below.

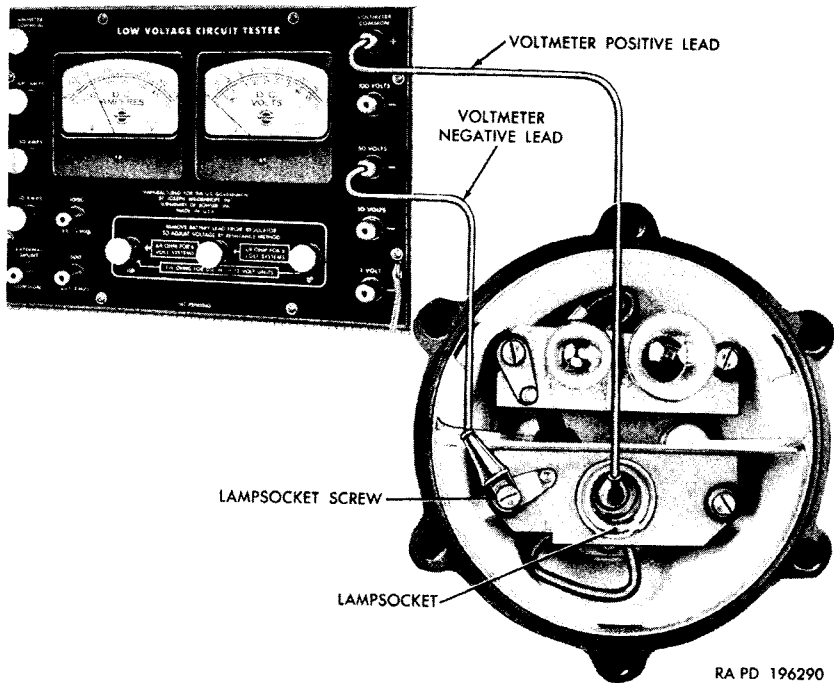
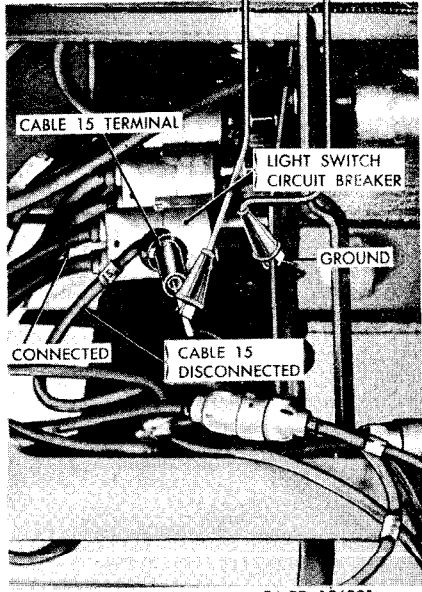
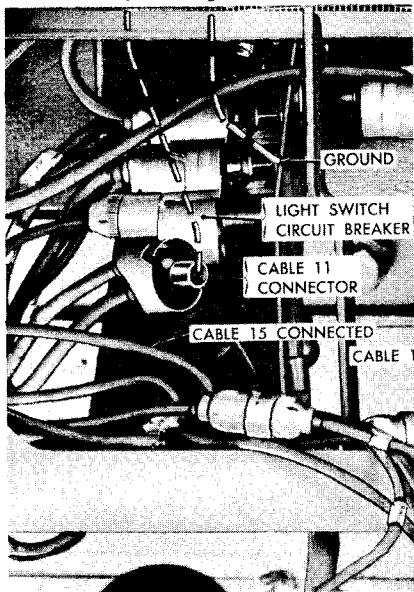
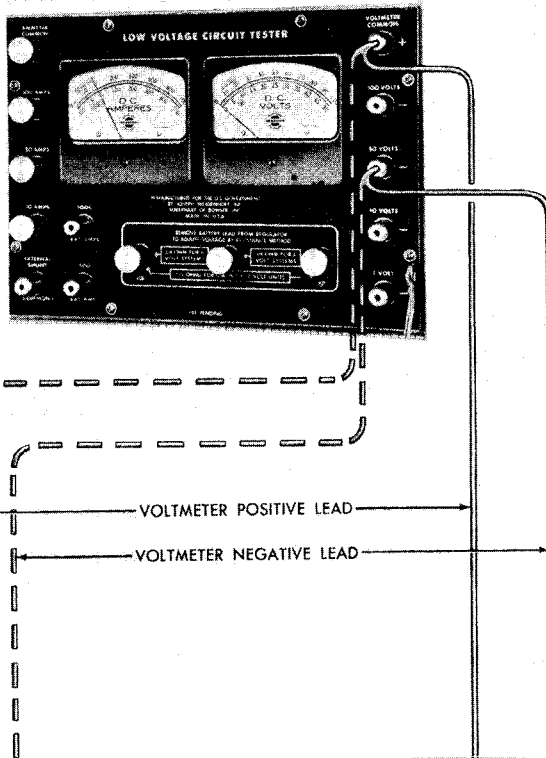


Figure 57. Checking for current at blackout marker light.

- (g) Remove testing equipment and install the lamp and blackout marker light door (par. 171c).

*Note.* All other lights on the vehicle, with the exception of the headlights, may be checked in the same manner as the blackout marker light.

- (2) Check for current through light switch circuit breaker (fig. 58).
- (a) Disengage the four instrument cluster studs and lower the instrument cluster to permit access to the circuit breakers.
  - (b) Disconnect cable (15) from the light switch circuit breaker. Install the connector sleeve to the terminal of the circuit breaker.
  - (c) With the test leads connected to the low voltage circuit tester ((1) (b) and (c) above), attach the clip end of the negative (-) test lead to a suitable ground on the instrument panel.
  - (d) Touch the positive (+) test lead to the connector sleeve in the circuit breaker, making certain that the clip touches the metal in the sleeve. Observe the reading on the lower scale of the voltmeter. The voltmeter should show battery voltage (approximately 24 volts). If voltmeter reading is normal, replace the light switch (par. 173). Remove



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Figure 58. Checking for current at circuit breaker.

testing equipment and connect cable (15) to the circuit breaker. If no voltage reading is indicated, proceed with (3) below.

- (3) *Check current to circuit breaker* (fig. 58).
  - (a) Disconnect cable (11) from the light switch circuit breaker.
  - (b) Connect the voltmeter negative (−) test lead to the low voltage circuit tester and the instrument panel ((2) (c) above).
  - (c) Connect the voltmeter positive (+) test lead to the voltmeter positive (+) terminal of the tester and touch the clip end of the lead to the terminal of cable (11).
  - (d) Observe the voltmeter lower scale reading. The voltmeter should show battery voltage (approximately 24 volts). If voltage reading is normal, the circuit breaker is at fault. Replace the circuit breaker (par. 174). If no voltage reading is indicated, notify ordnance maintenance personnel.
  - (e) When the checks have been completed and necessary correction accomplished, remove the testing equipment, install the instrument cluster in position, and engage the four instrument cluster studs.

*c. Both Headlights Inoperative, or Operate in Only One Beam Position.*

- (1) *Lamp units faulty.* Check for current to the lamp units, using the low voltage circuit tester (fig. 59). Circuits to both headlights are checked in the same manner.
  - (a) Remove the lamp unit (par. 171a).
  - (b) Connect the voltmeter positive (+) test lead to the positive (+) terminal of the tester and attach the clip end of the lead to the terminal of cable (17) (high beam) in the headlight body.
  - (c) Connect the voltmeter negative (−) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the terminal of cable (91) (ground) in the headlight body.
  - (d) Turn the light switch to SER DRIVE position and observe the reading on the voltmeter lower scale. If no reading is indicated, operate the dimmer switch and again observe the voltmeter. The voltmeter should show battery voltage (approximately 24 volts).
  - (e) Check the circuit for low beam in the same manner, attaching the voltmeter positive (+) test lead to cable (18).
  - (f) If the voltmeter reading is normal for both high and low beam circuits, replace the lamp unit. If no voltage reading is indicated in either high or low beam circuit, check for current through the circuit breaker and light switch (b(2) above), and the dimmer switch ((2) below).

- (g) When the check has been completed, remove the testing equipment and install the lamp unit and headlight door (par. 171c).
- (2) *Dimmer switch faulty.* Check for current through the dimmer switch, using the low voltage circuit tester (fig. 60).
- (a) Remove the left front fender rear splash shield (par. 250h).
- (b) Disconnect cables (17C and 18A) at the dimmer switch.
- (c) Connect the voltmeter test leads to the low voltage circuit tester ((1) (b) and (c) above).
- (d) Attach the clip end of the voltmeter negative (-) test lead to the dimmer switch housing.
- (e) Turn the light switch to SER DRIVE position and connect the clip end of the voltmeter positive (+) test lead to the terminal of cable (17) which is attached to the dimmer switch. Operate the dimmer switch and observe the voltmeter lower scale reading. The voltmeter reading should be approximately 24 volts with the dimmer switch in high beam position.
- (f) Check the current at the terminal for cable (18A) on the dimmer switch housing (low beam) in the manner described for the high beam circuit ((e) above).

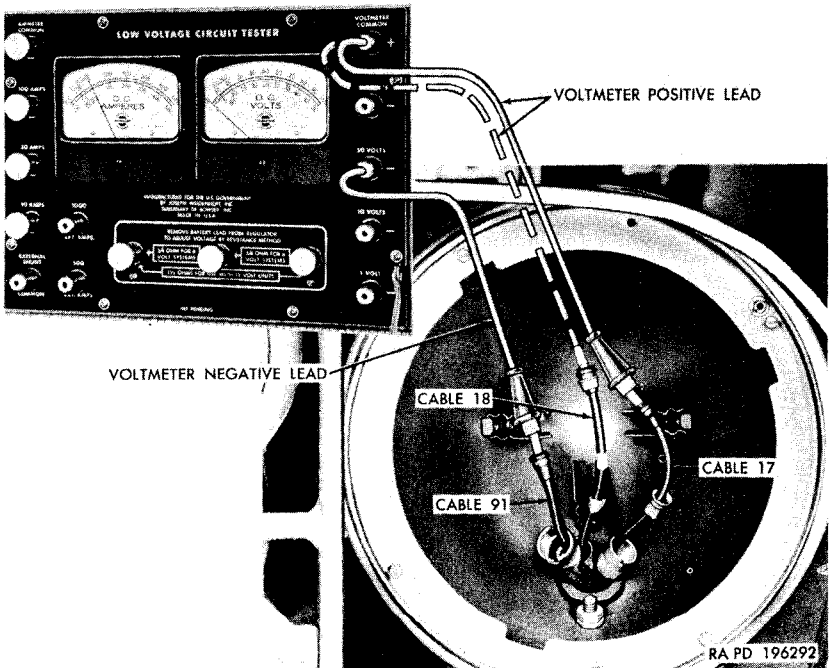


Figure 59. Checking for current to headlight.



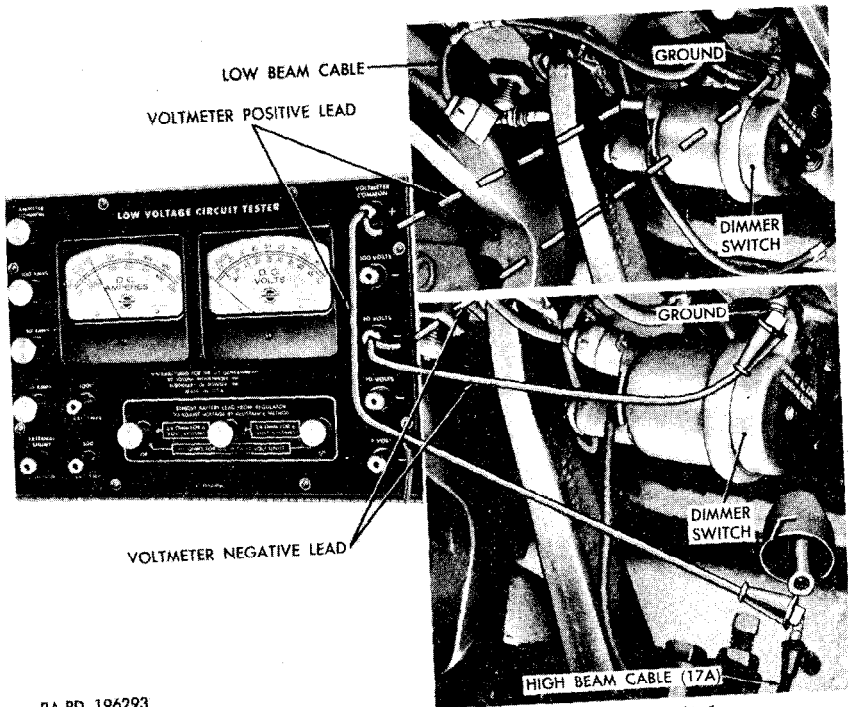
- (g) If the voltmeter readings indicate that current is flowing through the dimmer switch in one circuit, but not in the other, replace the dimmer switch (par. 173c and d). If both circuits show no voltage readings, determine whether current is reaching the dimmer switch ((i) below).
- (h) If voltmeter reading is normal for both circuits, the difficulty must be in the wiring harness, cable connections, or headlight cables. Check the cable connectors at the splash shields for loose or corroded terminals. If cable connections are satisfactory, replace headlight (par. 172) or notify ordnance maintenance personnel.
- (i) Disconnect cable (16) from the dimmer switch. With the voltmeter negative (-) test lead connected ((c) and (d) above), attach the clip end of the positive (+) test lead to the terminal of cable (16, fig. 61). Turn the light switch to SER DRIVE position and observe the voltmeter lower scale reading. If voltmeter shows battery voltage (approximately 24 volts), replace the dimmer switch (par. 173c and d). If no voltage reading is indicated, notify ordnance maintenance personnel.
- (j) When the check has been completed and corrections accomplished, remove the testing equipment and install the rear splash shield (par. 250i).

*d. Lights Flash On and Off.*

- (1) *Cable connections faulty.* Check for loose or damaged connections at cable connectors, light switch circuit breaker, and light switch assembly. Service as required.
- (2) *Wiring harness faulty.* Notify ordnance maintenance personnel.

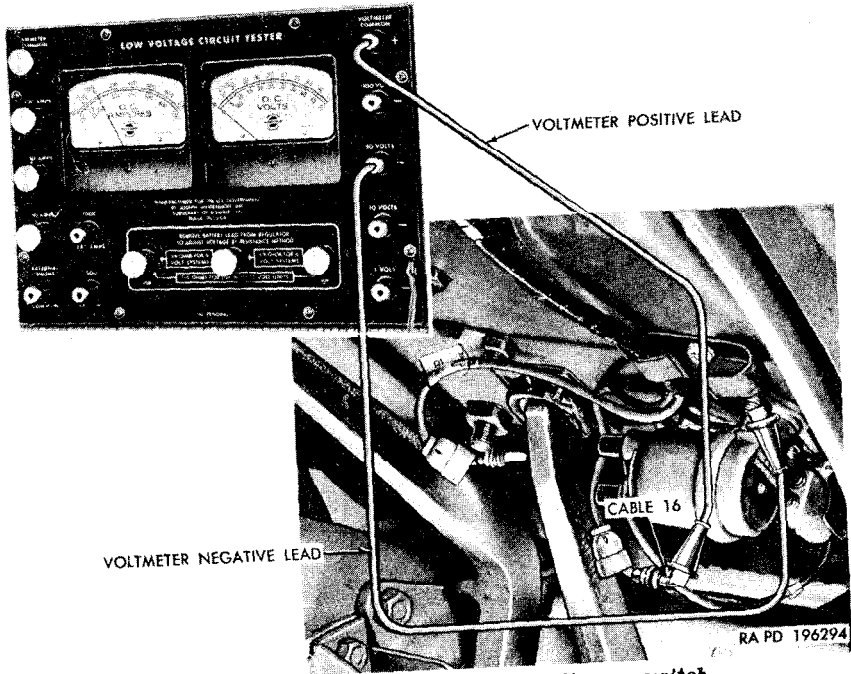
*e. Service Headlights Dim.* High resistance in headlight cables or ground circuit. Check cable and ground resistance ((1) and (2) below).

- (1) *Check headlight cables resistance* (fig. 62).
  - (a) Remove lamp unit from headlight body (par. 171a), but do not disconnect lamp-unit cables.
  - (b) Disengage the cable connector for cable (17) from the connector clip and separate the connector shells. Move one shell, the grommet bushing, and rubber grommet along the lamp unit cable to expose the cable terminal. Do not pull the terminal from the connector sleeve.
  - (c) Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the battery starter cable at the starter switch.
  - (d) Connect the voltmeter negative (-) test lead to the 50



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**Figure 60.** Checking for current through dimmer switch.



**Figure 61.** Checking for current to dimmer switch.

VOLTS terminal on the tester and attach the clip end of the lead to the exposed lamp unit cable terminal.

- (e) Turn on the headlights and observe the voltmeter. If the voltmeter indicates battery voltage (approximately 24 volts on lower scale), operate the dimmer switch to high beam (voltage reading should be practically zero).
- (f) Move the voltmeter negative (-) test lead from the 50 VOLTS terminal on the tester to the 10 VOLT terminal and observe the voltmeter upper scale reading. The reading should not exceed 1 volt. Note the reading and turn the headlights off.

**Caution:** Exercise proper precaution in making voltmeter connections, to prevent battery voltage from being impressed across the voltmeter on the 10-volt scale. With the connections described above, battery voltage passes through the circuit when the headlight is off or on the low beam. Resistance in the circuit registers when the headlight high beam is on.

- (g) Remove the voltmeter negative (-) test lead from cable (17) and move the lead from the 1 VOLT terminal to the 50-VOLTS terminal of the tester. Attach the negative (-) test lead to cable (18) ((b) and (d) above).
  - (h) Turn on the headlights and operate the dimmer switch to low beam. Check cable (18) ((e) and (f) above).
  - (i) If voltage reading for either the high or low beam circuit exceeds 1 volt, check for dirty or corroded connections at the lamp unit cables, and cable connectors at the fender splash shield, a loose or corroded connection at the starter switch, or at the light switch. Clean and tighten connections. Replace a defective light switch (par. 173).
- (2) *Check headlight ground circuit resistance.*
- (a) To check resistance in the headlight ground circuit, attach the clip end of the voltmeter positive (+) test lead to the exposed terminal of cable ((91) (1) (b) above). Connect the voltmeter negative (-) test lead to the frame side rail. Scrape paint from the metal to insure a good connection. Connect the negative (-) test lead to the 1 VOLT terminal of the tester, turn the headlights on and observe the voltmeter upper scale. The reading should not exceed 0.1 volt.
  - (b) If the voltage reading exceeds 0.1 volt, check for faulty ground cable connection at the fender splash shield (fig. 204), or loose attaching parts at the splash shield and fender support. Clean and tighten ground cable connection. Tighten splash shield and fender support lock-washer screws.

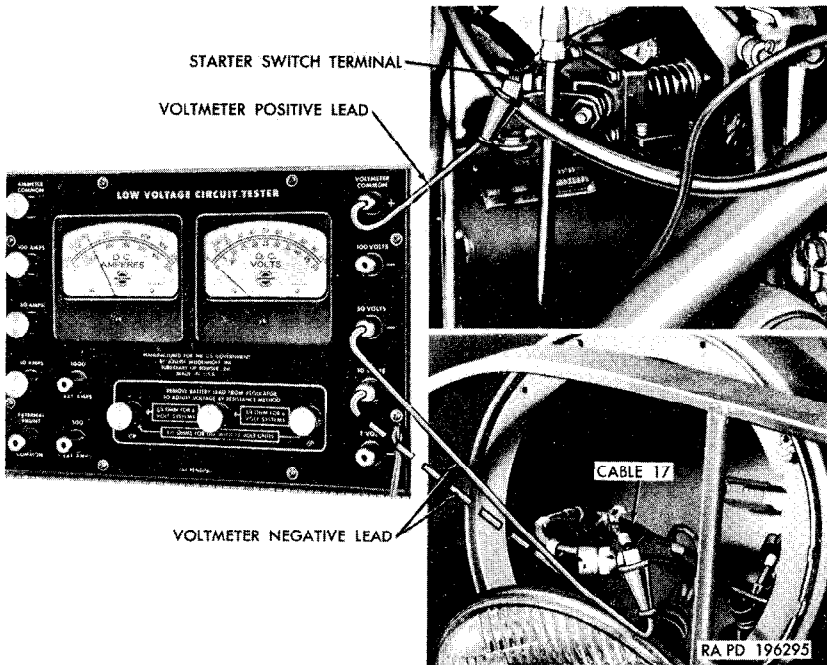


Figure 62. Checking headlight circuit resistance.

- (c) When the checks have been completed, remove the testing equipment, complete all cable connections and engage the cable connectors in the connector clips. Install lamp unit (par. 171a).

## 95. Instrument Cluster, Gages, and Horn

### a. Water Temperature Gage or Gage Sending Unit Faulty.

- (1) Start the engine and run until warm.
- (2) Remove the radiator filler cap and insert a thermometer. If the thermometer reading is reasonably the same as that of the water temperature gage, it indicates that the temperature gage is operating satisfactorily.
- (3) If there is considerable variation between the thermometer and gage readings, replace the gage (par. 178c).
- (4) If replacement of the gage does not effect a correction, replace the gage sending unit (par. 155).

### b. Fuel Gage or Gage sending Unit Faulty.

- (1) *Fuel gage defective.* To test the fuel gage, disconnect the fuel gage sending unit cable at the sending unit in the fuel tank and ground the sending unit cable on the bare metal of the frame. Turn the ignition switch on and observe the fuel gage. If the gage registers **FULL**, it is evident that it is satisfactory. Replace the gage if it fails to register (par. 178c).

- (2) *Fuel gage sending unit defective.* If the test described in (1) above indicates that the gage is satisfactory, replace the fuel gage sending unit (par. 143b).
- c. *Ammeter or Battery-Generator Indicator Inoperative.*
- (1) *Batteries sulphated (ammeter only).* Replace batteries (par. 168).
  - (2) *Instrument cluster wiring harness connections faulty.* Check connections at instrument cluster wiring harness. Clean and tighten connections or replace instrument cluster wiring harness, as required (par. 178f).
  - (3) *Generator or generator regulator faulty.* Refer to paragraph 92e.
  - (4) *Instrument faulty.* Replace ammeter or battery generator indicator (par. 178a and b).
- d. *Oil Pressure Gage or Gage Sending Unit Inoperative.* Replace oil pressure gage (par. 178c) or gage sending unit (par. 116l and m) as required.
- e. *Speedometer Does Not Register.*
- (1) *Speedometer faulty.* Disconnect speedometer shaft at the speedometer. Drive the vehicle and note if shaft core turns. If the core turns, replace speedometer (par. 178d and e).
  - (2) *Speedometer shaft broken.* Disconnect speedometer shaft at the drive pinion on the transfer (fig. 162). Turn the shaft to determine if it is broken. If broken, replace the shaft or core.
  - (3) *Drive pinion damaged.* If the speedometer and flexible shaft appear to be satisfactory, replace the speedometer drive pinion (par. 197).
- f. *Horn Inoperative.*
- (1) *Batteries discharged.* Check batteries for specific gravity (par. 167b). Replace batteries if necessary (par. 168).
  - (2) *Horn faulty.* Check to determine whether current reaches the horn cable connectors, using the low voltage circuit tester (fig. 63).
    - (a) Disconnect the two horn cables at the cable connectors.
    - (b) Connect the positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the terminal of cable (25).
    - (c) Connect the negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the terminal of cable (25A).
    - (d) Depress the horn button and observe the lower scale of the tester voltmeter. The voltmeter should show battery voltage (approximately 24 volts). If voltage reading is normal, the horn is faulty. Replace the horn (par. 179a).

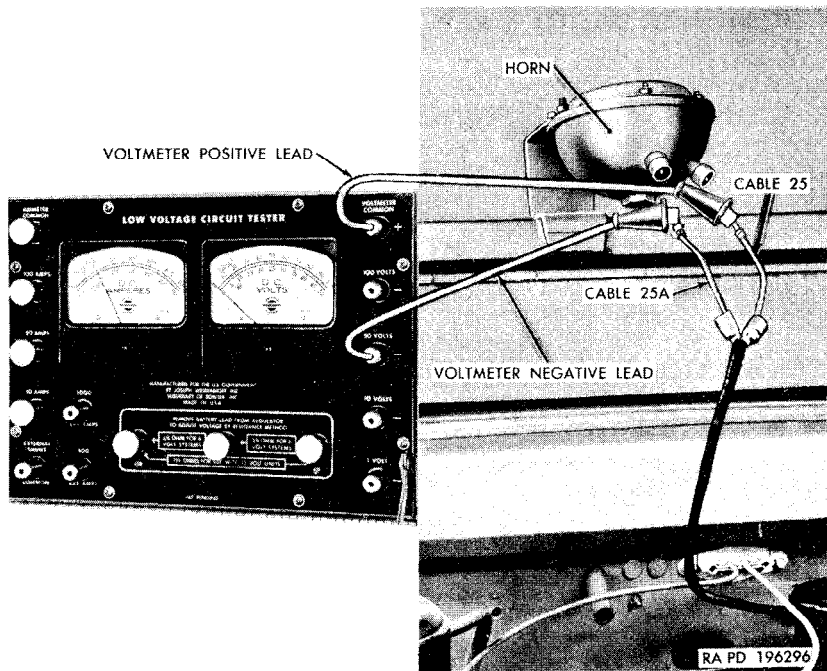


Figure 63. Checking for current at horn connections.

If no voltage reading is indicated, proceed with (3) and (4) below.

- (3) *Horn cable (wiring harness) faulty.* Check the horn cable in the wiring harness, using the low voltage circuit tester (fig. 64).
  - (a) Disconnect the horn button cable at the cable connector on left front fender splash shield.
  - (b) Disconnect the two horn cables at the cable connectors on the horn and connect cable (25) to cable (25A).
  - (c) Connect the positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end to the horn cable at the harness end.
  - (d) Connect the negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to a ground on the engine.
  - (e) Observe the voltmeter lower scale. The voltmeter should show battery voltage (approximately 24 volts). If no voltage reading is indicated, the horn cables in the wiring harness are probably defective. Notify ordnance maintenance personnel. If voltage reading is normal, proceed with (4) below.
- (4) *Horn button cable or horn button parts faulty.* Check the horn button cable, using the low voltage circuit tester (fig. 64).

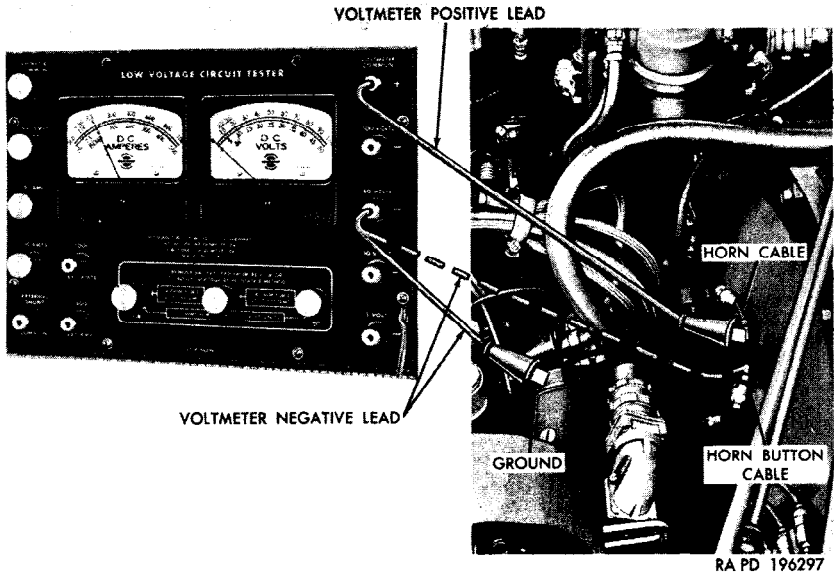


Figure 64. Checking for current through horn cables.

- (a) Connect the voltmeter positive (+) test lead ((3) (c) above).
- (b) Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the horn button cable terminal at the engine end.
- (c) Remove the horn button (par. 179b) and ground the upper terminal of the horn button cable to the horn button lower retaining plate. Observe the lower scale of the voltmeter. The voltmeter should show battery voltage (approximately 24 volts). If no voltage is indicated, replace the horn button cable. If voltage reading is normal, replace horn button and/or other parts as necessary (par. 179d).

*g. Horn Operates Continually.* Stop horn operation by disconnecting one of the horn cables at the horn. Check the horn cable, horn button cable, and horn button parts (f(2), (3) and (4) above), and correct as necessary.

## 96. Radio Interference Suppression

*a. General.* Radio interference may arise from one or more sources on the vehicle. If no testing equipment is available for checking such sources, perform the checks described below progressively until interference has been eliminated, or notify ordnance maintenance personnel.

*b. Loose or Missing Lockwasher Screws.* Check all lockwasher screws attaching fender splash shields, fenders, radiator guard side supports, and fender to hood side panels. Service or replace as required.

*c. Spark Plugs Faulty.* Replace spark plugs (par. 124).

*d. Spark Plug Cables Faulty.* Replace spark plug cables (par. 124).

*e. Ground Straps Loose.* Check ground straps and attaching parts at the generator regulator and the clutch housing to frame side rail ground straps. On the ambulance truck M43, also check ground straps on the personnel heater and ventilating blower motors. Service as required (pars. 121, 122, and 165).

*f. Starter Faulty.* If radio interference occurs only when the starter is operating, replace the starter (par. 158).

*g. Generator and/or Generator Regulator Faulty.* Temporarily disengage the fan belt from the generator pulley and start the engine. If radio interference is eliminated when the generator is not operating, stop the engine and replace the generator (par. 164) and/or generator regulator (par. 165).

*h. Ignition Filter Faulty.* Replace filter (par. 130).

*i. Distributor Rotor or Cap Faulty.* Replace the distributor rotor or cap if the contacts show evidence of burning (pars 127 and 128).

## **97. Personnel Heater and Ventilating Blowers (Ambulance Truck M43)**

*a. Heater Fails to Start.* Follow instructions on the operating instruction plate (fig. 10). If heater still fails to start, perform the checks described in (1) through (4) below, using the low voltage circuit tester.

(1) *Check for current at heater (fig. 65).*

(a) Remove the guard from top of the heater to provide access to the electrical connections.

(b) Connect the voltmeter positive (+) test lead to the voltmeter positive (+) terminal and attach the clip end of the lead to the No. 3 connection on the heater terminal strip.

(c) Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to a suitable ground on the heater case.

(d) Observe the voltmeter lower scale. If the voltmeter does not show battery voltage (approximately 24 volts), proceed with (2) below.

(2) *Check for current through heater circuit breaker.*

(a) Disconnect cable (400) from the heater circuit breaker.

(b) Refer to paragraph 94b(2) for method of checking for current through the circuit breaker.



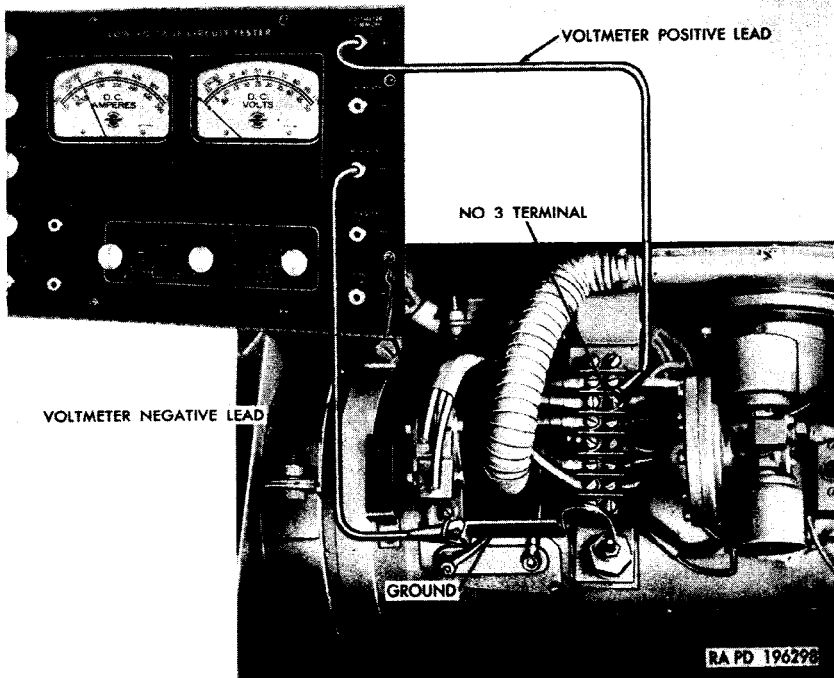


Figure 66. Checking for current at heater.

- (c) If the voltmeter stays at zero and current is not flowing through the circuit breaker, proceed with (3) below. If current is flowing through the circuit breaker, proceed with (4) below.
- (3) *Check for current to circuit breaker.*
  - (a) Remove cable (11) from the heater circuit breaker.
  - (b) Refer to paragraph 94b(3) for method of checking for current to the circuit breaker.
  - (c) If battery voltage is indicated on the lower scale of the voltmeter, replace the circuit breaker. If voltmeter stays at zero and current is not flowing to the circuit breaker, notify ordnance maintenance personnel.
- (4) *Check for current to heater control cable (fig. 66).* If current flows through the heater circuit breaker, but does not reach the heater, proceed as outlined in (a) through (e) below.
  - (a) Remove the right ventilating blower inspection cover at the upper corner of the driver's compartment.
  - (b) Disconnect cable 400-B at the cable connector.
  - (c) Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the terminal of cable 400-B.

- (d) Connect the voltmeter negative (–) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to a suitable ground on the blower.
- (e) Observe the voltmeter lower scale. If the voltmeter indicates battery voltage (approximately 24 volts), an open circuit between the cable connector and the heater is indicated. Notify ordnance maintenance personnel.
- (5) *Check heater control.* If current to the heater is indicated by (1) above, or if it is established by corrective measures prescribed in (2), (3), and (4) above, and the heater will not start, the heater control is faulty. Notify ordnance maintenance personnel.
- (6) *Heater faulty.* If the heater will not start after (1) through (5) above have been performed, replace heater (par. 273a and b).
- (7) *Remove testing equipment.* When the checks have been completed, remove the testing equipment, connect all cables, and install the blower inspection cover, the instrument cluster, and the heater guard.
- b. *Heater Starts but Will Not Burn.*
- (1) *Fuel does not reach heater control valve.* Check for fuel flow to the heater control valve.
- (a) Disconnect the fuel line at the heater control valve and

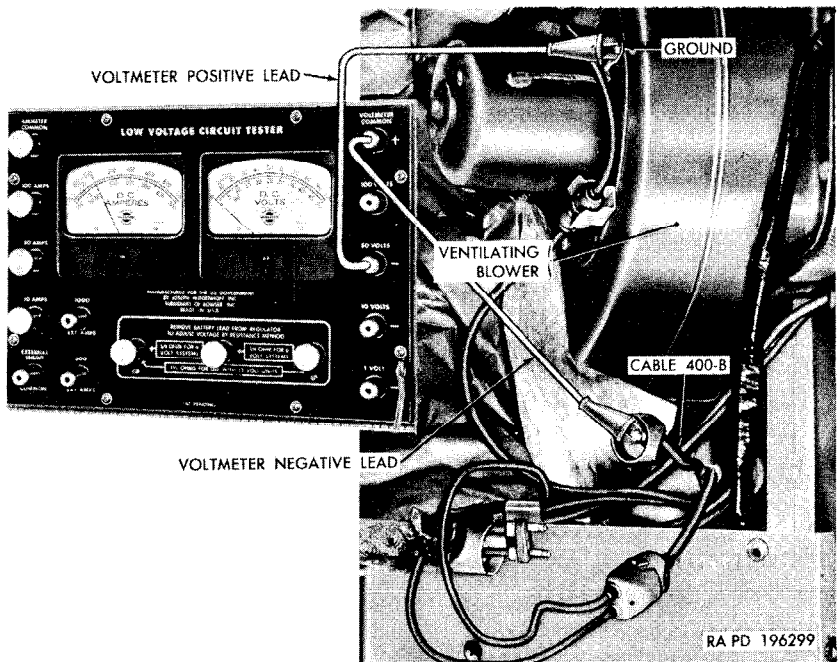


Figure 66. Checking for current at heater cable.

attach a length of hose to the open fuel line. Insert the other end of the hose in a suitable container.

- (b) Turn the heater switch on and note whether fuel flows into the container.
- (c) If no fuel flows or if flow appears to be insufficient, check for restricted fuel filter or fuel lines, or an inoperative fuel pump. Clean or replace the filter (par. 273f), blow out fuel lines, or replace the fuel pump (par. 273g) as required.
- (2) *Igniter faulty.* If sufficient fuel is reaching the control valve, and the combustion motor runs when the switch is turned on, replace the igniter (par. 273c and d).
- (3) *Heater faulty.* If the heater fails to burn after (1) and (2) above have been performed, replace the heater (par. 273a and b).

*c. Thermostat Does Not Control Temperature (Heater Operates Satisfactorily).* Replace thermostat (par. 273h).

*d. Ventilating Blowers Inoperative.* If either ventilating blower fails to start when the motor switch is turned on, perform the checks described below, using the low voltage circuit tester.

- (1) *Check for current to the ventilating blower motor* (fig. 67).
  - (a) Remove the ventilating blower inspection cover at the upper corner of the driver's compartment.
  - (b) Remove the blower motor cable connector from the clip on the blower and disconnect cable (346) (right blower) or (347) (left blower) at the cable connector.
  - (c) Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the cable terminal.
  - (d) Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the motor ground strap screw on the blower.
  - (e) Turn the blower switch on and observe the reading on the voltmeter lower scale. If the voltmeter shows battery voltage (approximately 24 volts), replace blower motor (par. 272b and c). If no voltage reading is indicated, proceed with (2) below.
- (2) *Check for current to blower switch.*
  - (a) Current for both the ventilating blowers and the personnel heater is supplied by cable 400-B. Check for current (a(4) above).
  - (b) Observe the voltmeter lower scale. If the voltmeter shows battery voltage (approximately 24 volts), replace the ventilator blower switch (par. 272d). If no voltage reading is indicated, check for current at the circuit breaker (a(2) above), and correct as necessary.

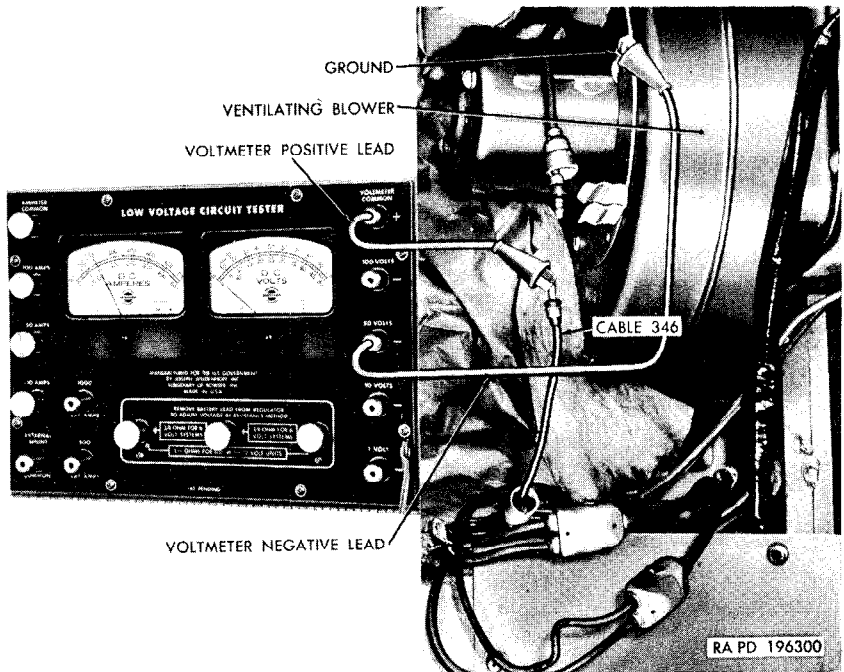


Figure 67. Checking for current to ventilating blower motor and switch.

- (c) When the checks have been completed, remove the testing equipment and install the blower inspection cover.

## 98. Clutch

### a. Clutch Slips.

- (1) *Insufficient clutch pedal free travel.* Adjust clutch pedal (par. 187).
- (2) *Oil on clutch disk facing.* Remove the clutch housing drain plug and check for oil in the housing. If there is oil in the housing, replace the clutch disk (par. 189).

*Note.* On engines equipped with crankcase ventilation shutoff valves, check to see that the valves are open, as operating the engine with the shutoff valves closed will cause a build-up of pressure in the crankcase, forcing oil into the clutch housing.

### b. Clutch Grabs or Chatters.

- (1) *Excessive clutch pedal free travel.* Adjust clutch pedal (par. 187).
- (2) *Clutch disk facing worn or glazed.* Replace clutch disk. If the clutch pressure plate is cracked or scored, replace the pressure plate (par. 189).
- (3) *Clutch disk hub worn or damaged.* Replace the clutch disk (par. 189).
- (4) *Clutch release bearing worn or damaged.* Replace the clutch release bearing (par. 189).

*c. Clutch Noises.*

- (1) *Clutch release bearing noise.* Clutch release bearing noise occurs only when the clutch is released, and is caused by a worn or damaged release bearing. Replace the bearing (par. 189).
- (2) *Clutch pilot bearing noise.* A squealing noise occurring only when the clutch is released indicates a worn or damaged bushing-type bearing at the end of the crankshaft. Notify ordnance maintenance personnel.
- (3) *Clutch disk noise.* Remove the clutch disk (par. 189) and check for broken springs, loose facing rivets, or a worn or damaged hub. Replace faulty clutch disk (par. 189).
- (4) *Clutch pressure plate noise.* Remove the pressure plate and check for worn or damaged parts. Replace faulty pressure plate (par. 189).

## **99. Transmission and Power-Take-Off**

*a. Gears Clash.*

- (1) *Clutch pedal free travel incorrect.* Adjust clutch pedal (par. 187).
- (2) *Insufficient lubricant or incorrect grade of lubricant.* Check lubricant level and grade and replenish or drain and refill transmission as required. Refer to lubrication order (figs. 33 and 34).
- (3) *Clutch disk hub worn or damaged.* Replace clutch disk (par. 189).

*b. Hard Shifting.*

- (1) *Incorrect grade of lubricant.* Drain transmission case and refill with correct grade of lubricant. Refer to lubrication order (figs. 33 and 34).
- (2) *Shifter fork damaged.* Replace transmission top cover (par. 193).
- (3) *Internal parts worn or damaged.* Replace transmission (par. 194).

*c. Transmission Slips Out of Gear.* Replace transmission (par. 194) or notify ordnance maintenance personnel.

*d. Gear Knock.* To determine whether gear knock is in the transmission or in the transfer, temporarily disconnect the intermediate propeller shaft at the rear of the transmission (par. 200*a*), and with the engine running, shift the transmission through all speeds. If the gears knock, replace the transmission (par. 194). If the knock disappears, the difficulty is in the transfer (par. 100*e*). Attach the intermediate propeller shaft to the transmission after performing the check (par. 200*b*).

*e. Lubricant Leaks.*

- (1) *Power-take-off gasket faulty.* Replace gasket or gaskets (par. 192). (Transmission without power-take-off has two covers.)
- (2) *Output shaft oil seal faulty.* Replace the transmission (par. 194) or notify ordnance maintenance personnel.
- (3) *Air vent restricted.* Remove and clean or replace the vent, as required (par. 207a).

*f. Power-Take-Off Gear Noise or Whine.* Incorrect backlash between transmission and power-take-off gears. Replace transmission and power-take-off (par. 194) or notify ordnance maintenance personnel.

## 100. Transfer

*a. Shift Control Lever Jumps Out of Gear.* Incorrect adjustment of the shift control lever rod. Adjust the rod (par. 196c).

*b. Hard Shifting to or From Front Axle.*

- (1) *Declutch control lever rod adjustment incorrect.* (Adjust the rod (par. 196d).
- (2) *Shifter shaft tight in transfer case.* Free the shaft with penetrating oil and lubricate.
- (3) *Internal parts worn or damaged.* Replace transfer (par. 198).

*c. Excessive Noise.*

- (1) *Insufficient lubricant.* Replenish lubricant. Refer to lubrication order (figs. 33 and 34).
- (2) *Internal parts worn or damaged.* Replace transfer (par. 198).

*Note.* Some gear noise is audible under load, with transmission in high gear, at low or medium speeds, and should be considered normal.

- (3) *Gear knock.* Refer to paragraph 99d for checking location of gear knock. Replace transfer (par. 198).

*d. Lubricant Leaks.*

- (1) *Air vent restricted.* Remove and clean or replace the vent, as required (par. 207a).
- (2) *Lubricant level too high.* Drain lubricant to correct level. Refer to lubrication order (figs. 33 and 34).
- (3) *Oil seals faulty.* If excessive lubricant leakage occurs at the input and output oil seals or at the shifter shaft oil seal, notify ordnance maintenance personnel.

## 101. Propeller Shafts and Universal Joints

*a. Universal Joints Noisy.* Worn or damaged universal joint parts. Replace parts as required (par. 201).

*b. Propeller Shaft Vibrates.*

- (1) *Companion flange bolts loose.* Service as necessary (par. 200b).
  - (2) *Propeller shaft yoke or tube splines worn or damaged.* Replace propeller shaft (par 200).
- c. *Propeller Shaft Whips.* Check for bent propeller shaft yoke or tube. Replace propeller shaft (par. 200).

## 102. Front and Rear Axles

### a. *Lubricant Leaks.*

- (1) *Air vent restricted.* Remove and clean or replace air vent, as required (par. 207a).
- (2) *Drive shaft flange gaskets faulty.* Replace flange gaskets (pars. 205c and 206c (front axle) or par. 210 (rear axle)).
- (3) *Wheel bearing oil seals faulty.* Replace wheel bearing oil seals (par. 228).
- (4) *Drive shaft oil seals faulty.* Notify ordnance maintenance personnel.
- (5) *Drive pinion bearing oil seal faulty.* Notify ordnance maintenance personnel.
- (6) *Drive pinion carrier gasket faulty.* Notify ordnance maintenance personnel.

### b. *Gear Noise Under Load or Coast.*

- (1) *Insufficient Lubricant.* Check for lubricant leaks and correct causes (a above). Replenish lubricant. Refer to lubrication order (figs. 33 and 34).
- (2) *Worn or incorrectly adjusted internal parts.* Replace axle (par. 208 or 212) or notify ordnance maintenance personnel.

### c. *Wheel, Hub, or Brakedrum Noise.*

- (1) *Wheel bearings loose or damaged.* Adjust wheel bearings (par. 226a and b) or replace wheel bearings (par. 228), as required.
- (2) *Insufficient lubricant.* Lubricate wheel bearings. Refer to lubrication order (figs. 33 and 34).
- (3) *Brake drum screws loose or damaged.* Service as required (par. 228).
- (4) *Wheels loose.* Tighten wheel hub stud nuts (par. 227).
- (5) *Brake incorrectly adjusted or damaged.* Refer to paragraph 103.

## 103. Service Brakes

### a. *No Brakes.*

- (1) *Brake pedal linkage disconnected or damaged.* Connect the brake pedal to the master cylinder (par. 217).
- (2) *External brake fluid leaks.* Check wheel cylinders, brake lines, and fittings for loose or damaged parts. Service or replace parts as required (pars. 220, 221, and 222).

(3) *Master cylinder faulty.* Replace master cylinder (par 221).

(4) *Brake adjustment incorrect.* Adjust brakes (par. 214).

*b. Brakes Fail on First Pedal Application, but Function After Several Applications.*

(1) *Brake fluid low in master cylinder.* Check for fluid loss and correct as necessary (a(2) and (3) above). Bleed brake system (par. 216) and replenish fluid in master cylinder.

(2) *Air in brake system.* Bleed brake system (par. 216).

(3) *Brake adjustment incorrect.* Adjust brakes (par. 214).

*c. Inadequate Brakes.*

(1) *Brake adjustment incorrect.* Adjust brakes (par. 214).

(2) *Brake pedal rod adjustment incorrect.* Adjust pedal rod (par. 217b).

(3) *Brake linings worn.* Replace brakeshoes (par. 220).

(4) *Brake linings greasy.* Correct cause of lubricant leakage (par. 102a) and replace brakeshoes (par. 220).

*d. Soft or Spongy Pedal.*

(1) *Brake fluid leaks.* Refer to a(2) and (3) above.

(2) *Air in system.* Bleed brake system (par. 216).

(3) *Brake adjustment incorrect.* Adjust brakeshoes (par. 214).

*e. Brakes Drag.*

(1) *Brakeshoe return springs weak or damaged.* Replace return springs (par. 220).

(2) *Grease or brake fluid on brake linings.* Check for defective hub bearing oil seals (par. 228) or damaged wheel cylinders (par. 220) and correct as necessary. Replace brakeshoes (par. 220).

(3) *Brake adjustment incorrect.* Adjust brakes (par. 214).

(4) *Brake pedal return spring weak or broken.* Replace return spring and/or spring extension.

(5) *Wheel bearings loose.* Adjust wheel bearings (par. 226).

(6) *Wheel cylinder piston sticking.* Replace wheel cylinder (par. 220).

(7) *Brake pedal rod adjustment incorrect.* Adjust pedal rod (par. 217).

(8) *Master cylinder faulty.* Replace master cylinder (par. 221).

## 104. Handbrake

*a. Brake Fails to Hold Parked Vehicle.*

(1) *Control lever rod adjustment incorrect.* Adjust rod (par. 219b).

(2) *Brake band adjustment incorrect.* Adjust band (par. 219a).

(3) *Operating lever or sector faulty.* Check for worn or damaged sector, lever rod pawl, or spring. Replace sector or lever as required (par. 224).



- (4) *Brake band lining worn or damaged.* Replace band (par. 223).
- (5) *Brake band lining greasy.* Check and correct lubricant leaks at transfer case (par. 100d) and replace band (par. 223).

b. *Brake Drags.*

- (1) *Brake operating lever not fully released.* Release lever.
- (2) *Control lever rod adjustment incorrect.* Adjust rod (par. 219b).
- (3) *Brake band adjustment incorrect.* Adjust band (par. 219a).
- (4) *Brake band springs weak or broken.* Replace springs (par. 223).

## 105. Wheels and Tires

a. *Abnormal Tire Wear.*

- (1) *Tires underinflated.* Maintain tire pressure at 40 psi for normal operation.
- (2) *Excessive speed on paved highway with front axle engaged.* Keep speed within limits specified in caution on instruction plate (B, fig. 8).
- (3) *Front wheel toe-in incorrect.* Adjust toe-in (par. 203d).
- (4) *Spring clips loose or spring center bolts broken.* Tighten spring clip nuts or replace spring as required (par. 243 (front) or 244 (rear)).

b. *Wheel Noise.*

- (1) *Wheel hub studs or stud nuts loose or damaged.* Replace loose or damaged studs (par. 227). Tighten stud nuts.
- (2) *Wheel bearings loose or damaged.* Adjust (par. 226) or replace bearings (par. 228).
- (3) *Steering knuckle bearings worn or damaged (front wheels).* Replace front axle (par. 208), or notify ordnance maintenance personnel.

## 106. Steering

a. *Excessive Play in Steering.*

- (1) *Steering gear parts worn.* Disconnect the steering gear to idler arm drag link from the pitman arm. With an assistant applying pressure at the pitman arm, turn the steering wheel back and forth and note the amount of play in the steering gear. Replace steering gear (par. 237) if play is excessive.
- (2) *Drag links loose.* Check drag links at pitman arm, idler arm, and steering knuckle arm. Adjust drag links (par. 234b (4)). Replace steering idler arm (par. 234).
- (3) *Tie rod ends loose or worn.* Service or replace tie rod ends as required (par. 204).

b. *Hard Steering.*

- (1) *Tires underinflated.* Maintain tire pressure at 40 psi for normal operation.

- (2) *Steering gear misaligned.* Aline steering gear (par. 231).
- (3) *Drag links and/or tie rod ends binding.* Lubricate drag links and tie rod ends. Refer to lubrication order (figs. 33 and 34).

c. *Shimmy.* (An oscillating motion of the front wheels, causing difficulty in holding the steering wheel steady.)

- (1) *Steering linkage loose.* Inspect tie rod ends (par. 204) or drag links (par. 234b (4)). Replace worn or damaged parts as required.
- (2) *Wheel bearings loose.* Adjust wheel bearings (par. 226).
- (3) *Tires excessively worn.* Replace tires (par. 229).
- (4) *Wheel stud nuts loose.* Service stud nuts.
- (5) *Steering knuckle flange bearings loose.* Adjust steering-knuckle-bearing-preload (pars. 205 and 206).

d. *Steering Wander (a tendency of the Vehicle to Steer Itself from a Straight Course).*

- (1) *Toe-in adjustment incorrect.* Adjust toe-in (par. 203d).
- (2) *One front tire underinflated or excessively worn.* Inflate both tires to 40 psi for normal operation. Replace excessively worn tire (par. 229).
- (3) *Wheel bearings tight or insufficiently lubricated.* Adjust wheel bearings (par. 226) or lubricate bearings. Refer to lubrication order (figs. 33 and 34).

e. *Steering Dive (a Tendency of the Vehicle, when turned in either Direction, to Turn too Rapidly).*

- (1) *Front spring leaves or center bolt broken.* Replace spring (par. 243).
- (2) *Spring clips loose or damaged.* Tighten spring clip nuts or replace clips as required (par. 243).
- (3) *Wheel cylinder faulty.* Replace wheel cylinder (par 220).

## 107. Springs and Shock Absorbers

a. *Vehicle Leans to One Side (Empty).* Check for weak or broken spring. Replace spring (par. 243 (front) or 244 (rear)).

b. *Springs or Spring Shackles Noisy.*

- (1) *Spring leaves or center bolt broken.* Replace spring (par. 243 (front) or 244 (rear)).
- (2) *Lubrication insufficient.* Lubricate spring bolts. Refer to lubrication order (figs. 33 and 34).
- (3) *Spring clips loose or damaged.* Tighten spring clip nuts or replace clips as required (par. 243 (front) or 244 (rear)).
- (4) *Spring bolts or shackle bolts worn or damaged.* Replace bolts (par. 243 (front) or 244 (rear)).
- (5) *Spring bearings (bushing-type) or shackles worn or damaged.* Replace spring or shackle as required (par. 243 (front) or 244 (rear)).

*c. Shock Absorber Loose.* Replace upper and lower shock absorber stud bearings (par. 245).

*d. Shock Absorber Noisy.* Replace shock absorber (par. 245).

*e. Shock Absorber Ineffective.* Replace shock absorber (par. 245).

## 108. Winch

*a. Winch Fails to Operate (Clutch Shifter Handle Engaged).* Winch drive shaft shear pin broken. Replace shear pin (par. 182).

*b. Winch Will not Hold Load.* Winch safety brake faulty. Adjust safety brake band (par. 181b).

*c. Other Causes.* If the winch fails to operate properly after performing *a* and *b* above, replace winch (par. 185).

## Section V. ENGINE DESCRIPTION AND MAINTENANCE IN VEHICLE

### 109. Description and Data

#### *a. Description.*

(1) The engine (figs. 68 and 69) is mounted on a support plate at the front and brackets attached to the frame side rails at the rear. A rubber cushion at the front support and rubber insulators at the rear mountings serve to decrease vibration. A pressure oiling system provides lubrication of internal parts.

(2) This section includes instructions for engine tune-up, manifold vacuum test, compression test, valve tappet adjustment, cylinder head tightening, replacement of cylinder head and/or cylinder head gasket, replacement of intake and exhaust manifolds and/or gaskets, servicing of the engine oiling system, and servicing of the crankcase ventilating system. Refer to paragraph 119 for maintenance operations described in other sections.

#### *b. Data.*

Bore.....	3¼ in.
Compression pressure at 150 rpm (cranking speed).....	90 to 130 psi
Compression ratio.....	6.7:1
Crankshaft rotation (viewed from front).....	clockwise
Cylinder head cap screw torque.....	65 to 70 lb-ft
Engine mounting.....	3 point
Firing order.....	1-5-3-6-2-4
Location of cooling system drain cocks.....	bottom of radiator (1) left side of engine block (1)
Manifold heat control valve setting (winter-summer).....	manual
Manifold vacuum (at sea level).....	17 to 21 in.
Piston displacement.....	230.2 cu in.
Stroke.....	4% in.
Valve tappet clearance:	
Intake (hot).....	0.010 in.
Exhaust (hot).....	0.014 in.

Weight :

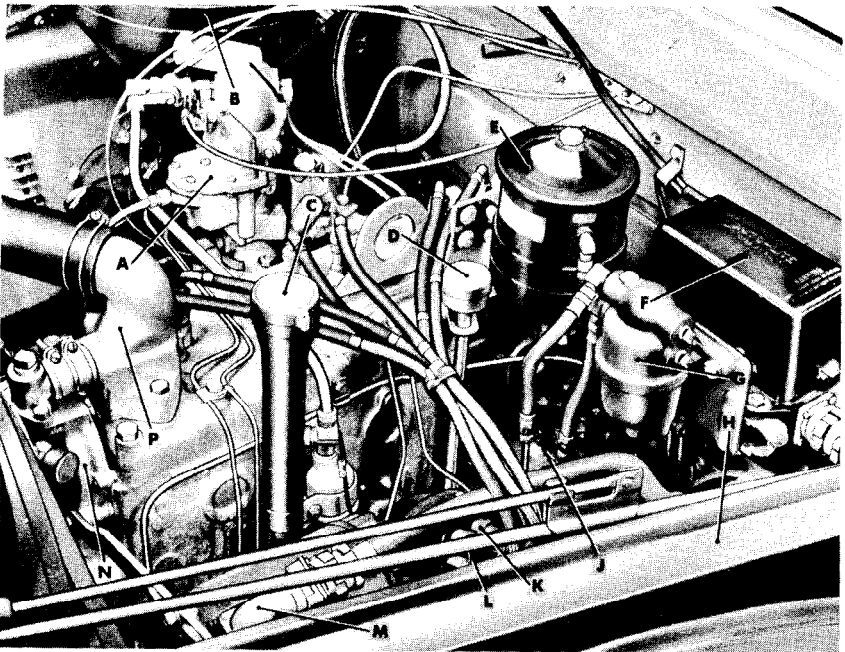
W/transmission and radiator (includes coolant and oil)----- 865 lb  
W/o transmission and radiator (shipping weight)----- 675 lb

## 110. Engine Tune-Up

*a. General.* Engine tune-up is an orderly process of checking the engine to determine whether various units are operating within satisfactory limits, and making necessary adjustments and/or repairs to restore maximum engine performance.

*b. Order of Procedure.* Perform a complete major tune-up of the engine.

- (1) Clean the engine (par. 81).
- (2) Service the carburetor air cleaner (par. 133*b*).
- (3) Test the batteries for specific gravity (par. 167), and voltage (par. 90*d*).
- (4) Clean and adjust spark plugs (par. 124*e*).
- (5) Clean and adjust or replace distributor breaker points and capacitor (pars. 128 and 129).
- (6) Clean and check adjustment of the carburetor (par. 134).



KEY ITEM

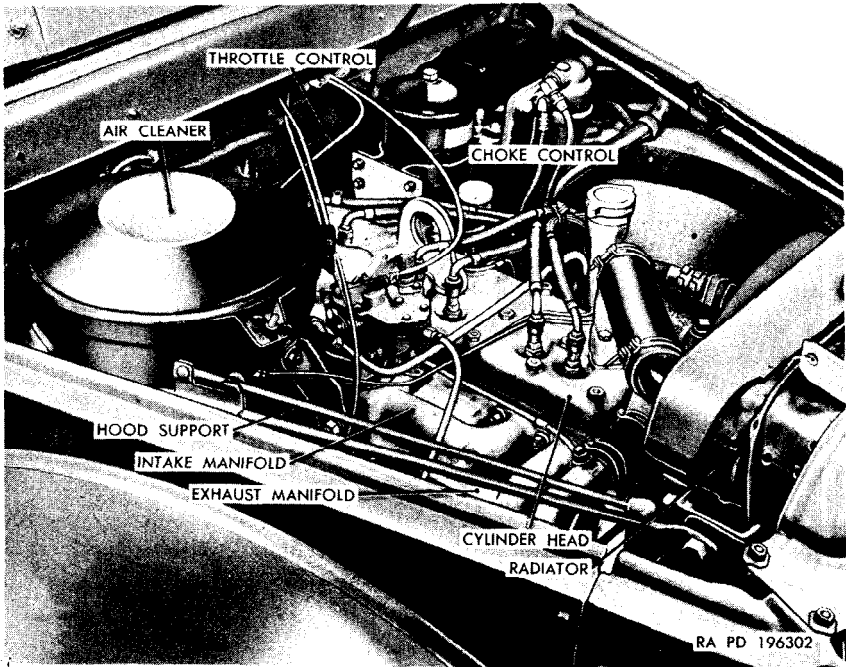
A—CARBURETOR  
B—AIR CLEANER  
C—OIL FILLER PIPE  
D—OIL LEVEL GAGE  
E—OIL FILTER  
F—GENERATOR REGULATOR  
G—FUEL FILTER

KEY ITEM

H—FENDER-TO-HOOD SIDE PANEL  
J—STARTER  
K—DISTRIBUTOR  
L—RADIATOR TIE ROD  
M—GENERATOR  
N—WATER PUMP  
P—WATER OUTLET ELBOW

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Figure 68. Engine—left side.



*Figure 69. Engine—right side.*

- (7) Check engine timing (par. 126).
- (8) Tighten the cylinder head cap screws, using a torque-indicating wrench (par. 115*b*) and following the sequence shown in figure 78.
- (9) Tighten manifold stud nuts (par. 114*f*(8)) and adjust manifold heat control valve (par. 114*g*).
- (10) Check oil pan drain plug.
- (11) Test manifold vacuum (par. 111).
- (12) Test engine compression (par. 112).

*Note.* The manifold vacuum test and compression test determine whether valve tappet adjustment is necessary. If these tests indicate that valves are operating satisfactorily and quietly, (13) below may be omitted.

- (13) Adjust valve tappets (par. 113).
- (14) Check fuel pump (par. 138*a*) and service fuel filter in engine compartment (on vehicles so equipped) (par. 139*b*).

## **111. Manifold Vacuum Test**

*a. General.* The manifold vacuum test is to determine whether vacuum is satisfactory for proper engine performance.

### *b. Procedure.*

- (1) Remove the primer pump inlet line and elbow-type nozzle (on vehicles so equipped) or the pipe plug from the intake manifold and install the vacuum gage hose fitting. Connect

the gage hose to the fitting and hang the gage in a convenient spot for reading, as shown in figure 70.

- (2) Start the engine and run at idling speed until normal operating temperature is reached.
- (3) Adjust the carburetor idle speed adjusting screw (fig. 70) until the desired engine idle speed is obtained. Turn the carburetor idle mixture adjusting screw (fig. 70) in either direction slowly until maximum vacuum gage reading is obtained. It may be necessary to reset the carburetor idle speed after adjusting the idle mixture.

*c. Interpretation of Vacuum Gage Reading.* The pointer of the vacuum gage should be steady and show a reading of 17 to 21 inches at sea level. At higher altitudes, the reading will be less than that at sea level, decreasing approximately  $3\frac{1}{2}$  inches for each 5,000 feet increase in altitude. A fluctuating gage pointed, after (1) through (8) in paragraph 110*b*, and *b*(2) and (3) above have been performed, indicates insufficient valve tappet clearance or a leaky cylinder head gasket. Adjust valve tappets (par. 113), replace the cylinder head gasket (par. 115), or notify ordnance maintenance personnel. An abnormally low reading, with steady pointer, indicates faulty manifold or manifold gaskets. Replace the intake manifold and/or manifold gaskets as required (par. 114).

*d. Remove Gage.* Remove the vacuum gage, hose, and hose fitting from the intake manifold. Install the elbow-type nozzle and connect the primer inlet line (on vehicles so equipped), or install the  $\frac{1}{4}$ -inch pipe plug.

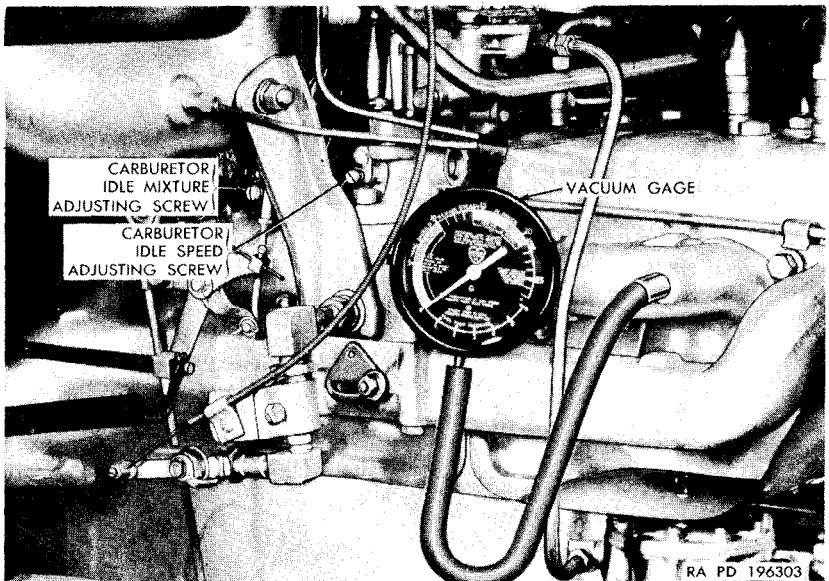


Figure 70. Manifold vacuum test

## 112. Compression Test

*a. General.* The compression test is to determine the condition of the pistons, piston rings, cylinder walls, cylinder head gasket, and valves. This test should be made with the engine at normal operating temperature and fully charged batteries.

*b. Procedure.*

- (1) Remove all spark plugs (par. 124*d*).
- (2) Pull the throttle control out all the way.
- (3) Insert the compression gage in the No. 1 spark plug hole as shown in figure 71. Hold the gage firmly in place while an assistant cranks the engine with the starter long enough to obtain an accurate reading on the gage.
- (4) Record the reading in the space provided on Form 461. Reset the indicator to "0" by pressing the reset valve (fig. 71).
- (5) Test the other five cylinders in the manner described above and record the reading for each cylinder.
- (6) Compare the readings. The variation between cylinders should not exceed 10 psi, with a minimum reading of 90 psi. at a cranking speed of 150 rpm.

*Note.* If readings vary more than 10 psi., or any reading is below 90 psi. notify ordnance maintenance personnel.

*c. Interpretation of Gage Readings.*

- (1) Compression gage readings of 90 psi. or more for each cyl-



Figure 71. Engine compression test.

inder, with variation between cylinders not exceeding 10 psi, may be considered normal.

- (2) If the compression for any cylinder is less than 90 psi., determine whether the low reading is caused by faulty pistons or faulty valves.
  - (a) With the piston down, inject engine oil on top of the piston through the spark plug opening and exercise care to prevent oil from reaching the valves.
  - (b) Wait a few minutes to allow oil to seal the piston rings.
  - (c) Repeat the compression test (b above).
  - (d) A low compression reading on both the first and second tests indicates faulty valves. Adjust the valve tappets (par. 113), or notify ordnance maintenance personnel.
  - (e) A normal compression reading on the second test indicates faulty pistons, piston rings, or cylinder walls. Notify ordnance maintenance personnel.

*d. Install Spark Plugs.* After completing the compression test, install the six spark plugs (par. 124f).

### 113. Valve Tappet Adjustment

- a. Remove Carburetor Air Cleaner.* Refer to paragraph 133c.
- b. Remove Right Front Wheel.* Jack up the wheel, remove the five wheel stud nuts, and remove the wheel and tire.
- c. Remove Right Front Fender Splash Shield.* Refer to paragraph 250b.
- d. Remove Fuel Pump Heat Shield.* Remove the fuel pump heat shield wing nut (fig. 74) and lockwasher from the fuel pump stud. Loosen the exhaust manifold front stud nut sufficiently to remove the heat shield. Tighten the stud nut.
- e. Remove Crankcase Vent Line.* Refer to paragraph 117e.
- f. Loosen Crankcase Metering Valve and Related Parts* (par. 117f). Unscrew valve enough to provide access to the valve cover plates.
- g. Remove Valve Compartment Covers.* Remove the two valve compartment cover screws and screw gaskets from each cover, and remove the two covers and cover gaskets.
- h. Adjust Valve Tappets* (fig. 72).

- (1) Start the engine and run until normal operating temperature is reached.

*Note.* Keep the engine running at idle speed while adjusting the tappets.

- (2) Hold each intake valve tappet with a 1/2-inch tappet wrench and turn the valve tappet adjusting screw with a 7/16-inch tappet wrench to provide a clearance of 0.010 inch, as measured with a thickness gage inserted between the adjusting screw and the valve stem.



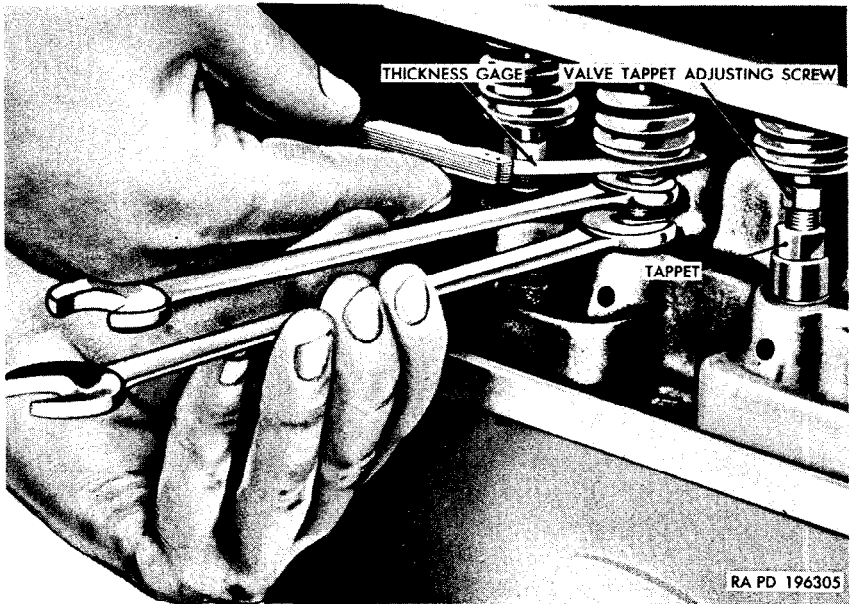


Figure 72. Adjusting valve tappets.

(3) Adjust the exhaust valve tappets ((2) above), using a 0.014-inch thickness gage.

(4) Stop the engine and allow it to cool before assembling parts.

*i. Install Valve Compartment Covers.* Install new valve compartment cover gaskets on the covers and position the covers on the cylinder block. Install a new gasket on each of the four cover screws, install the screws, and tighten.

*j. Position Crankcase Metering Valve and Related Parts.*

(1) Swing the crankcase metering valve and related parts clockwise to correct position (fig. 73).

(2) On engines equipped with crankcase ventilation shutoff valves, install the shutoff valve control in the control clip and valve lever swivel. Adjust the control (par. 118e).

*k. Install Crankcase Vent Line.* Refer to paragraph 117m.

*l. Install Fuel Pump Heat Shield.* Loosen the exhaust manifold front stud nut enough to insert the slotted portion of the heat shield between the stud nut washer and the manifold, and position the heat shield over the fuel pump heat shield stud. Install the No. 10 lock-washer and No. 10-32NF wing nut on the heat shield stud. Tighten the manifold stud nut and the wing nut.

*m. Install Right Front Fender Splash Shield.* Refer to paragraph 250f.

*n. Install Right Front Wheel.* Install the right front wheel and tire. Install the five  $\frac{3}{4}$ -16NF wheel nuts (par. 227b). Remove jack.

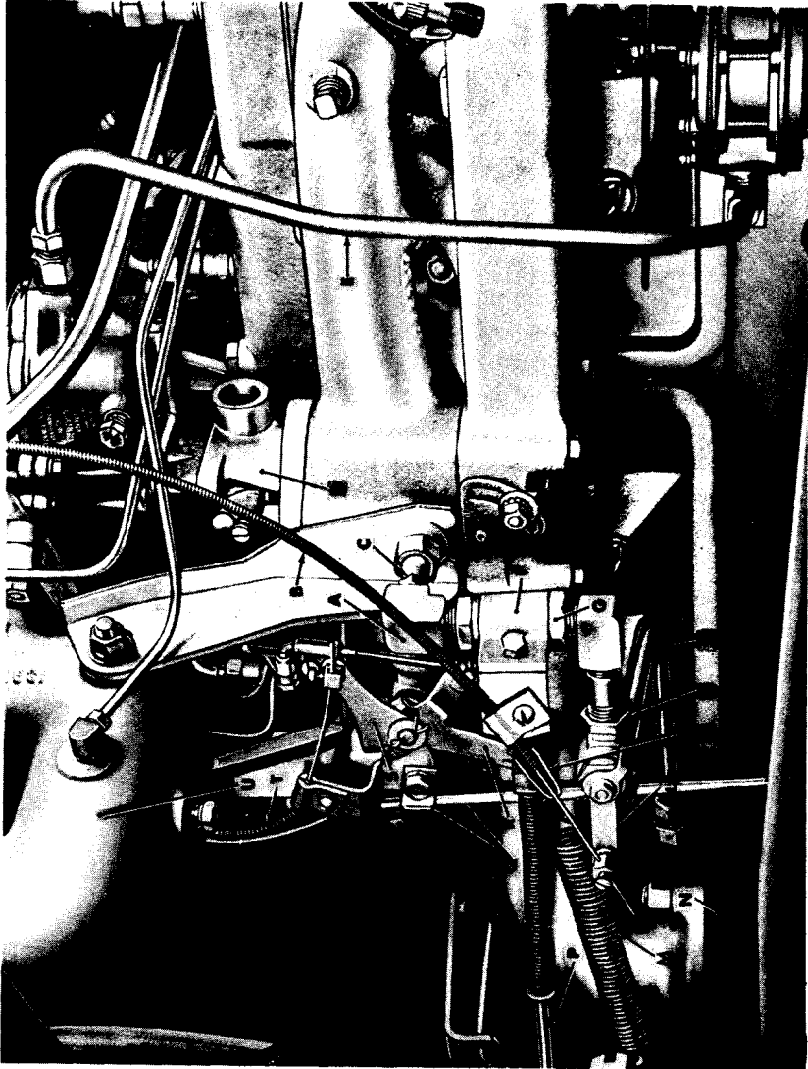
*o. Install Carburetor Air Cleaner.* Refer to paragraph 133e.

## 114. Intake and Exhaust Manifolds

*a. General.* Organizational maintenance of the intake and exhaust manifolds includes replacement of either manifold and the manifold gaskets and adjustment of the manifold heat control valve.

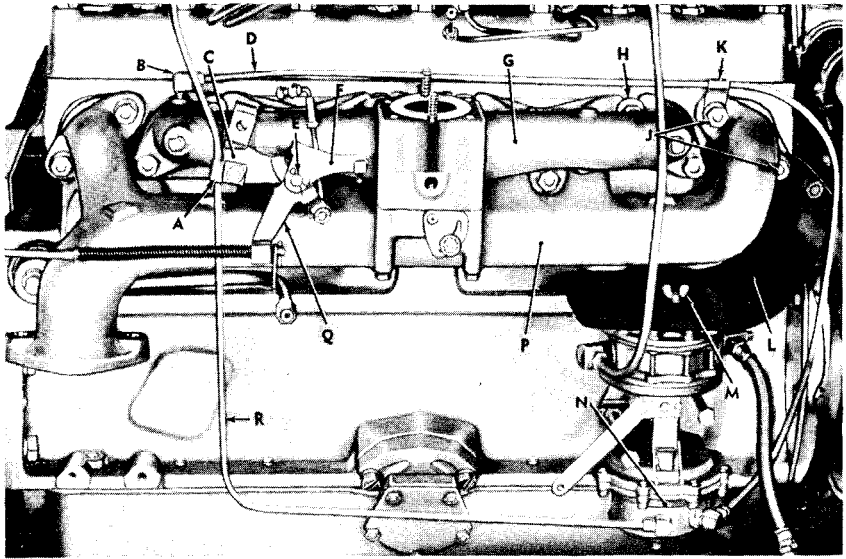
### *b. Removal.*

- (1) Remove the four screws that secure the right front fender to hood side panel and remove the panel.
- (2) Loosen the right radiator tie rod at the tie rod bracket on the dash panel and raise the rod to an upright position.
- (3) Remove the carburetor air cleaner (par. 133*c*).
- (4) Remove the air cleaner elbow (U, fig. 73) and carburetor (D, fig. 73) as a unit (par. 136*b*).
- (5) Disconnect the upper exhaust pipe (N, fig. 73) from the lower exhaust pipe by loosening the nuts on the two eyebolts and swinging the eyebolts out from the pipe flange.
- (6) Disconnect the outer end of the crankcase vent line (H, fig. 73) by unscrewing the tube nut from the elbow (L, fig. 73).
- (7) On engines equipped with crankcase ventilation shutoff valves, detach the valve control (B, fig. 73) and remove the shutoff valve (J, fig. 73), the crankcase metering valve (G, fig. 73), and support clamp (F, fig. 73) and fittings as a unit by unscrewing the metering valve upper elbow (A, fig. 73) from the metering valve nipple (C, fig. 73) or nipple bushing. On engines not so equipped, remove the vent line elbow, union, nipple, the metering valve, and two elbows as a unit in the same manner.
- (8) On engines equipped with a priming system, disconnect the primer pump to intake manifold line from the tee-type nozzle in the rear port of the intake manifold.
- (9) Disconnect the fuel pump to intake manifold line (D, fig. 74) from the elbow (B, fig. 74) in the intake manifold.
- (10) Unhook the throttle return spring (M, fig. 73) from the return spring clip (K, fig. 73) on the bellcrank rod. Remove the cotter pin from the front end of the accelerator shaft to throttle control bellcrank rod (P, fig. 73) and remove the return spring clip. Disengage the rod from the throttle control bellcrank (R, fig. 73) and temporarily install the cotter pin in the end of the rod to hold the rod spring and washer on the rod. Detach the throttle control (T, fig. 73) from the clip and swivel.
- (11) Disconnect the fuel pump to wiper hose line (R, fig. 74) at the fuel pump (N, fig. 74) and remove the wiper hose from the line. Remove the screw and lockwasher from the throttle control clip bracket (C, fig. 74) and remove the line and the wiper hose line clip (A, fig. 74).



- KEY
- A—METERING VALVE UPPER ELBOW
  - B—CRANKCASE VENTILATION SHUT-OFF VALVE CONTROL
  - C—METERING VALVE NIPPLE
  - D—CARBURETOR
  - E—FUEL PUMP-TO-CARBURETOR FUEL LINE
  - F—SUPPORT CLAMP
  - G—CRANKCASE METERING VALVE
  - H—CRANKCASE VENT LINE
  - J—CRANKCASE VENTILATION SHUT-OFF VALVE
  - K—RETURN SPRING CLIP
  - L—ELBOW
  - M—THROTTLE RETURN SPRING
  - N—UPPER EXHAUST PIPE
  - P—ACCELERATOR SHAFT TO THROTTLE CONTROL BELLCRANK ROD
  - Q—FUEL PUMP TO WINDSHIELD WIPER HOSE LINE AND CLIP
  - R—THROTTLE CONTROL BELLCRANK
  - S—THROTTLE CONTROL LEVER
  - T—THROTTLE CONTROL
  - U—AIR CLEANER ELBOW

Figure 73. Right side of engine—partial view.



KEY	ITEM	KEY	ITEM
A	—WIPER HOSE LINE CLIP	J	—MANIFOLD STUD NUTS
B	—ELBOW	K	—VACUUM LINE CLIP
C	—THROTTLE CONTROL CLIP BRACKET	L	—FUEL PUMP HEAT SHIELD
D	—FUEL PUMP TO INTAKE MANIFOLD LINE	M	—HEAT SHIELD WING NUT
E	—BELLCRANK STUD	N	—FUEL PUMP
F	—THROTTLE CONTROL LEVER	P	—EXHAUST MANIFOLD
G	—INTAKE MANIFOLD	Q	—THROTTLE CONTROL BELLCRANK
H	—WASHER	R	—FUEL PUMP TO WIPER HOSE LINE

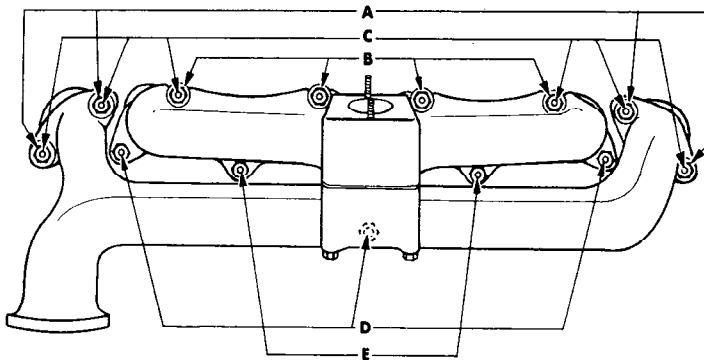
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Figure 74. Manifold disconnect points.

- (12) Remove the 13 manifold stud nuts and 8 washers (fig. 75). Remove the vacuum line clip (K, fig. 74) and move the line out of the way.
- (13) Remove the assembled manifolds. Remove and discard the manifold gaskets and the upper to lower exhaust pipe gasket.

c. Disassembly (fig. 76).

- (1) Remove the throttle control bellcrank (S), throttle control lever (U), and throttle control clip bracket (V), as a unit by unscrewing the bellcrank stud (T) from the intake manifold.
- (2) Remove the two nuts and bolts that secure the upper exhaust pipe to the exhaust manifold and remove the upper exhaust pipe. Remove and discard the gasket.
- (3) Remove the metering valve nipple (J), with the pipe bushing (M), nut (L), lockwasher (K), and plain washer (H). the two  $\frac{7}{16}$ -20NF x  $1\frac{3}{4}$  cap screws and  $\frac{7}{16}$ -20NF nuts.
- (4) Remove the manifold line elbow (B) from the intake manifold (F).
- (5) On engines equipped with a priming system, remove the two priming system lines (C and E) from the two tee-type nozzles



KEY	ITEM	KEY	ITEM
A	3/8-24NF SEIZE-PROOF NUTS AND THICK WASHERS	D	3/8-16NC (9/16) X 3/8-24NF (13/16) X 1-21/32 HEAT TREATED STUDS
B	MANIFOLD CLAMP WASHERS AND 3/8-24NF NUTS	E	3/8-16 (9/16) X 3/8-24NF (5/8) X 3-5/16 HEAT TREATED STUDS
C	3/8-16NC (9/16) X 3/8-24NF (13/16) X 13/16 HEAT TREATED STUDS		

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Figure 75. Location of manifold studs, nuts, and washers.

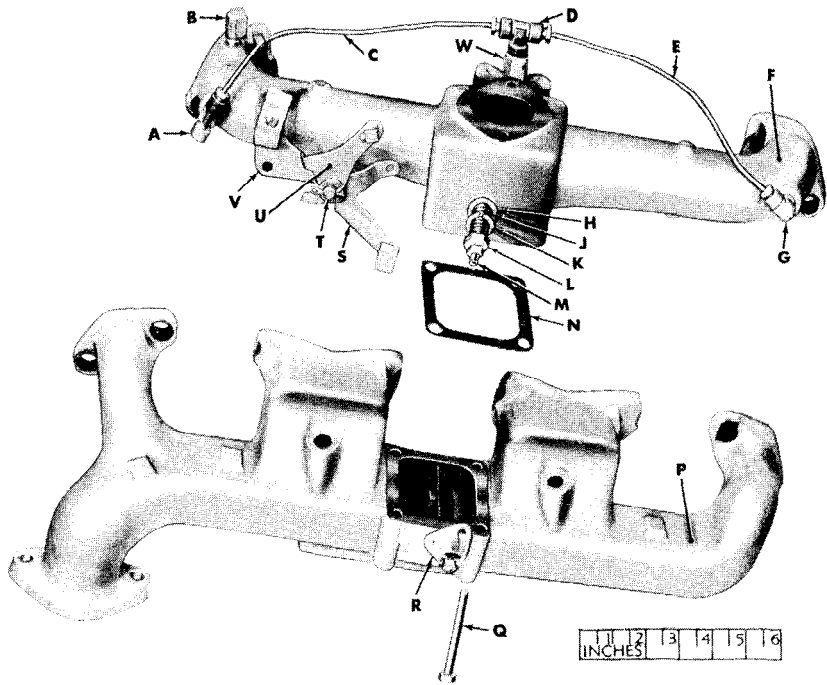
(A and D) and the elbow-type nozzle (G). Remove the three nozzles and the nozzle extension. On engines not so equipped, remove the three pipe plugs from the intake manifold.

- (6) Remove the four screws (Q) that secure the exhaust manifold (P) to the intake manifold (F) and separate the manifolds. Remove and discard the intake to exhaust manifold gasket (N).

*d. Inspection.* Clean the mating surfaces of the manifolds and the engine block. Inspect the manifolds for cracks, damaged flange surfaces, and other visual damage. Inspect the manifold studs for damaged threads and see that all studs are secure. Tighten loose studs; remove damaged studs. Inspect the manifold heat control valve for worn or corroded parts. If the heat control valve is damaged, or inoperative, replace the exhaust manifold. Check all lines and fittings for breaks and damaged threads (fuel, ventilation, and vacuum lines and priming lines if engine is so equipped). Replace all parts that are unfit for further service.

*e. Assembly* (fig. 76).

- (1) Install new intake to exhaust manifold gasket (N) on the exhaust manifold (P) and install the intake manifold (F) on the exhaust manifold. Install the four  $\frac{5}{16}$ -inch screws (Q) fingertight until the manifolds are installed (f(8) below).
- (2) On engines equipped with a priming system, install the elbow-type nozzle (G) in the front port of the intake manifold, the tee-type nozzle (D) with nozzle extension (W) in the center port, and the tee-type nozzle (A) in the rear



KEY	ITEM
A	—TEE TYPE NOZZLE
B	—MANIFOLD LINE ELBOW
C	—PRIMING SYSTEM LINE
D	—TEE TYPE NOZZLE
E	—PRIMING SYSTEM LINE
F	—INTAKE MANIFOLD
G	—ELBOW TYPE NOZZLE
H	—PLAIN WASHER
J	—METERING VALVE NIPPLE
K	—LOCK WASHER
L	—NUT

KEY	ITEM
M	—PIPE BUSHING
N	—INTAKE TO EXHAUST MANIFOLD GASKET
P	—EXHAUST MANIFOLD
Q	—SCREW
R	—HEAT CONTROL VALVE PLATE
S	—THROTTLE CONTROL BELLCRANK
T	—BELLCRANK STUD
U	—THROTTLE CONTROL LEVER
V	—THROTTLE CONTROL CLIP BRACKET
W	—NOZZLE EXTENSION

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*Figure 76. Intake and exhaust manifolds—exploded view.*

port. On engines not so equipped, install the three  $\frac{1}{4}$ -inch pipe plugs in the intake manifold ports.

- (3) Install the  $\frac{1}{4}$ -inch, 90°,  $\frac{1}{8}$ -inch male pipe end, inverted flared tube elbow for the fuel pump to manifold vacuum line in the intake manifold (F).
- (4) Install metering valve nipple (J) in the intake manifold and install the  $\frac{1}{2}$ -inch plain washer (H),  $\frac{1}{2}$ -inch lockwasher (K),  $\frac{1}{2}$ -2ONF nut (L), and  $\frac{1}{4} \times \frac{1}{8}$  pipe bushing (M) on the nipple. Tighten the bushing until both the bushing and nipple are tight.
- (5) Install a new upper exhaust pipe to manifold gasket and install the upper exhaust pipe on the exhaust manifold with the two  $\frac{7}{16}$ -20NF x 1- $\frac{3}{4}$  cap screws and  $\frac{7}{16}$ -20NF nuts.
- (6) Place a  $\frac{5}{16}$ -inch lockwasher, followed by the throttle con-

trol clip bracket (V) on the bellcrank stud (T), and screw the stud into the front hole of the boss on the intake manifold. Tighten the stud.

*f. Installation.*

- (1) If any of the manifold studs were removed, install new studs in their respective locations (fig. 75) and tighten.
- (2) Install a new upper to lower exhaust pipe gasket on the the lower exhaust pipe.
- (3) Install new intake and exhaust manifold gaskets over the manifold studs.
- (4) Position the manifold assembly on the manifold studs. As the manifold is being pushed onto the studs, install a manifold clamp washer and a  $\frac{3}{8}$ -24NF nut on each of the two upper center studs.

*Note.* Nuts cannot be installed after the manifold is in position against the cylinder block.

- (5) Connect the fuel pump to intake manifold line (D, fig. 74) to the elbow (B, fig. 74) in the intake manifold and install the vacuum line clip (K, fig. 74) on the exhaust manifold upper front stud. Position the fuel pump heat shield (L, fig. 74) over the exhaust manifold lower front stud.
- (6) Install the four thick brass washers (chamfered side out) and four seize-proof nuts (A, fig. 75) (tapered side toward washer) on the exhaust manifold studs.
- (7) Install the other two manifold clamp washers and two  $\frac{3}{8}$ -24NF nuts (B, fig. 75) on the upper studs. Install the five  $\frac{3}{8}$ -24NF nuts on the lower studs (D and E, fig. 75).
- (8) Tighten all manifold stud nuts lightly and evenly until the manifolds are snug against the cylinder block. Tighten the four screws that secure the intake manifold to the exhaust manifold. Tighten the manifold stud nuts.
- (9) Connect the wiper-hose line (R, fig. 74) at the fuel pump (N, fig. 74). Position the wiper hose line clip (A, fig. 74) over the throttle control clip bracket hole, and install a  $\frac{5}{16}$ -inch lockwasher and  $\frac{5}{16}$ -18NC x  $\frac{5}{8}$  cap screw. Connect the windshield wiper hose to the line.
- (10) Remove the cotter pin from the front end of the accelerator shaft to throttle control bellcrank rod and insert the rod through the bellcrank swivel. Install the return spring clip (K, fig. 73) and a new  $\frac{3}{32}$  x  $\frac{3}{4}$  cotter pin. Attach the throttle return spring (M, fig. 73) to the clip.
- (11) On engines equipped with a priming system, connect the primer pump to intake manifold line to the tee-type nozzle at the rear port of the intake manifold.
- (12) Install the crankcase metering valve (G, fig. 73) and as-

sembled fittings by screwing the metering valve upper elbow (A, fig. 73) to the bushing on the metering valve nipple (C, fig. 73).

- (13) Connect the crankcase vent line (H, fig. 73) to the elbow (L, fig. 73).
- (14) Position the two eye bolts that secure the upper exhaust pipe to the lower exhaust pipe and tighten the eye bolt nuts.
- (15) Install the carburetor (D, fig. 73) and carburetor air cleaner elbow (U, fig. 73) as a unit (par. 136e). Connect and adjust the throttle control (par. 134b).
- (16) Install the carburetor air cleaner (par. 133e).
- (17) On engines equipped with crankcase ventilation shutoff valves, connect and adjust the shutoff valve control (par. 118e).
- (18) Install the radiator right tie rod in the tie rod bracket on the dash panel with the bracket between the two plain washers, and tighten the two tie rod nuts.
- (19) Position the right front fender to hood side panel and install the four lockwasher screws.

*g. Adjust Manifold Heat Control Valve.* Loosen the control valve adjusting plate stud nut and move the heat control valve plate (R, fig. 76) to the proper position for prevailing ambient temperature. Set the plate at SUMMER position for ambient temperatures consistently above 60° F. and at WINTER position for ambient temperatures consistently below 30° F. (fig. 77). Be sure to tighten the stud nut after adjusting the plate.

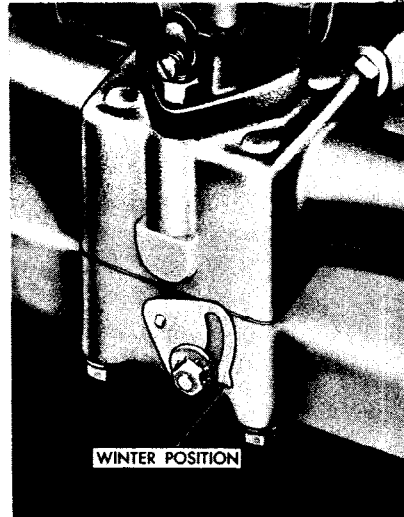
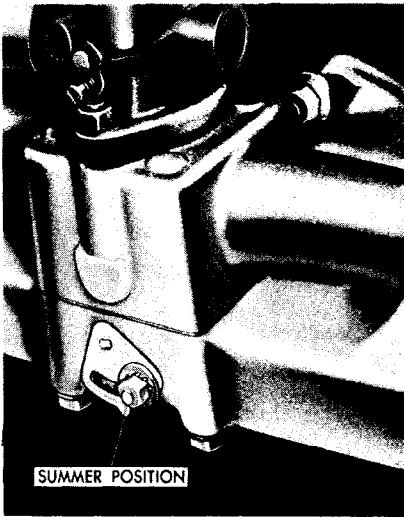
## 115. Cylinder Head and Gaskets

*a. General.* Organizational maintenance operations include tightening cylinder head cap screws, replacement of the cylinder head gasket, and/or the cylinder head.

### *b. Tighten Cylinder Head.*

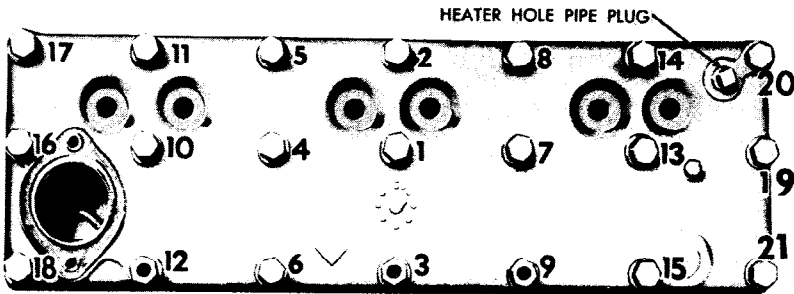
- (1) Run the engine until normal operating temperature is reached. While waiting for the engine to warm up, proceed with (2), (3), and (4) below.
- (2) Remove the bolts and lockwashers attaching the two vent line clips (W, fig. 79) to the cylinder head cap screws. Remove the clips or push them along the lines and out of the way.
- (3) Remove the bolt and lockwasher attaching the oil level gage pipe support (T, fig. 79) to the cylinder head cap screw. Move the support out of the way.
- (4) Remove the cap screws (M, fig. 79) and move the oil filter sufficiently to provide access to the cylinder head cap screw located under the filter.
- (5) Stop the engine.





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Figure 77. Manifold heat control valve.



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Figure 78. Tightening sequence for cylinder head screws.

- (6) Tighten the cylinder head cap screws, following the sequence shown in figure 78. Tighten each screw to 65–70 pound-foot torque.
- (7) Install a  $\frac{5}{16}$ -inch plain washer on each of the four  $\frac{5}{16}$ -24NF x  $\frac{3}{4}$  cap screws (M, fig. 79). Position the oil filter clamps on the bracket and install the four cap screws and plain washers (from clamp side). Install the four  $\frac{5}{16}$ -inch lockwashers and  $\frac{5}{16}$ -24NF nuts. Tighten the nuts.
- (8) Position the oil level gage pipe support (T, fig. 79) and install a  $\frac{3}{8}$ -inch lackwasher and  $\frac{3}{8}$ -24NF x  $\frac{1}{2}$  bolt and tighten.
- (9) Position the two vent line clips (W, fig. 79) with the two vent lines engaged in each clip, and install a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -24NF x  $\frac{1}{2}$  bolt for each clip.

### *c. Removal.*

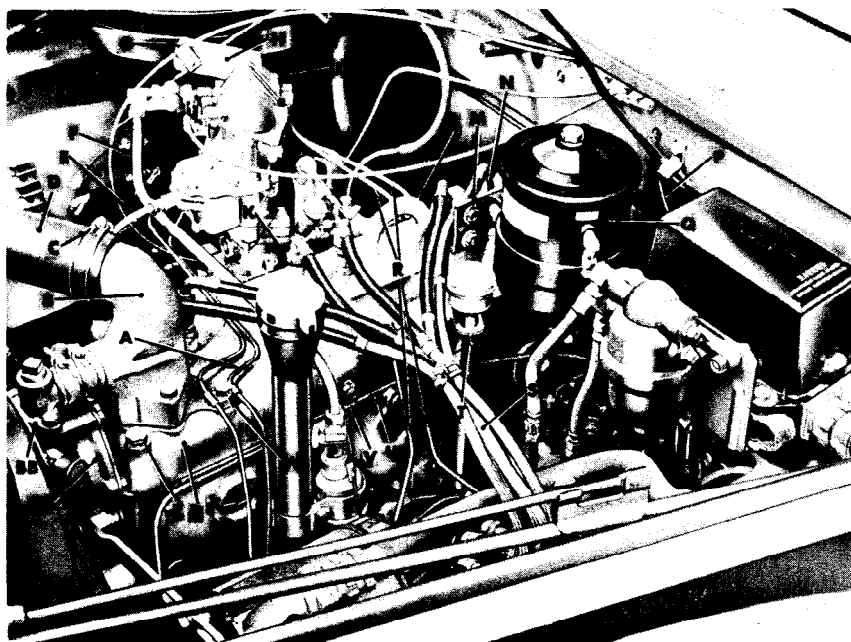
*Note.* The key letters noted in parentheses are in figure 79.

- (1) Drain the cooling system (par. 148*a*) and disconnect the battery around cable from the outer battery.
- (2) Loosen the hose clamp (C) that secures the upper hose (D) to the water outlet elbow (B) and remove the hose from the elbow.
- (3) Remove the two bolts and lockwashers that secure the bypass elbow (BB) to the water pump (AA).
- (4) Unscrew the spark plug cable elbow nuts (K) and remove the cables (S) from the spark plugs.
- (5) Remove the two bolts and lockwashers attaching the two vent line clips (W) to the cylinder head cap screws.
- (6) Disconnect the fuel tank vent line (X) and the master cylinder vent line (A). Remove the two distributor vent lines (R) at the elbows in the air cleaner elbow (J) and at distributor.
- (7) Disconnect the oil filter pipe vent line (F) and remove the line.
- (8) Disconnect the fuel pump to carburetor fuel line (E) at carburetor and move out of way.
- (9) Remove the nuts, lockwashers, plain washers, and cap screws (M) attaching the oil filter clamps to the oil filter bracket (N).
- (10) Remove the bolt and lockwasher that attach the oil level gage pipe support (T) to the cylinder head cap screw and move the support out of the way.
- (11) Disconnect the temperature gage sending unit cable (P) from the sending unit.
- (12) Remove the bolt and lockwasher attaching the oil filter inlet line clip (V) to the left side of the cylinder head.
- (13) Move fuel tank vent line and master cylinder vent line to the left out of the way. Remove the 21 cylinder head cap screws (Z) and remove the oil filter bracket (N), the engine lifting bracket (L), and the cylinder head (Y). Remove and discard the cylinder head gasket and the bypass elbow gasket.
- (14) Remove all carbon from the cylinder block and the cylinder head mating surfaces.

*Note.* If the cylinder head was removed only for replacement of the cylinder head gasket, remove the carbon and install a new gasket and the cylinder head (*f* below).

### *d. Disassembly.*

- (1) Remove the heater hole pipe plug (fig. 78).
- (2) Remove the temperature gage sending unit.
- (3) Remove the spark plugs and gaskets.



**KEY ITEM**

- A—MASTER CYLINDER VENT LINE
- B—WATER OULTET ELBOW
- C—HOSE CLAMP
- D—UPPER HOSE
- E—FUEL PUMP-TO-CARBURETOR FUEL LINE
- F—OIL FILLER PIPE VENT LINE
- G—TENSION CLIP
- H—CONTROL SUPPORT PLATE
- J—AIR CLEANER ELBOW
- K—SPARK PLUG CABLE ELBOW NUT
- L—ENGINE LIFTING BRACKET
- M—CAP SCREWS
- N—OIL FILTER BRACKET

**KEY ITEM**

- P—TEMPERATURE GAGE SENDING UNIT CABLE
- Q—OIL FILTER
- R—DISTRIBUTOR VENT LINES
- S—SPARK PLUG CABLES
- T—OIL LEVEL GAGE PIPE SUPPORT
- U—OIL INLET LINE
- V—OIL FILTER INLET LINE CLIP
- W—VENT LINE CLIPS
- X—FUEL TANK VENT LINE
- Y—CYLINDER HEAD
- Z—CYLINDER HEAD CAP SCREW
- AA—WATER PUMP
- BB—BY-PASS ELBOW

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*Figure 79. Cylinder head disconnect points.*

- (4) Remove the two cap screws attaching the outlet elbow to the cylinder head. Remove the outlet elbow, gasket, and thermostat. Discard the outlet elbow gasket.

*e. Inspection.*

- (1) Inspect the cap screws, lockwashers, plain washers, spark plug cable elbow nuts, and pipe plug and vent line connections for damaged threads, corrosion, or other visual damage. Replace parts as necessary.
- (2) Inspect the cylinder head for cracks, damaged machined surfaces, damaged threads, or other visual damage. Replace cylinder head if necessary.

- (3) Inspect the temperature gage sending unit for corrosion, damaged threads, or other visual damage. Replace sending unit if necessary.
- (4) Inspect the outlet elbow, bypass elbow, and connecting parts for cracks, damaged machined surfaces, deteriorated hose, damaged clamps, or other visual damage. Replace parts as necessary.
- (5) Inspect the thermostat for proper closing and for visual damage. Valve will be closed at/or below temperature indicated on thermostat. Replace thermostat, if necessary (par. 151).

*f. Assembly.*

- (1) Install the thermostat, gaskets, outlet elbow, and bypass elbow (par. 151*e*).
- (2) Clean and inspect the spark plugs and adjust spark plug gap (par. 124*e*). Install the spark plugs, using new gaskets. Tighten the plus to 30 pound-feet torque.
- (3) Coat the threads of the water temperature gage sending unit with liquid-type gasket cement and install the sending unit. Tighten the unit.
- (4) Coat the threads of the 1/2-inch pipe plug with liquid-type gasket cement and install plug in the heater hole (fig. 78).

*g. Installation.*

*Note.* The key letters noted N in parentheses are in figure 79 except, where otherwise indicated.

- (1) Coat both sides of a new cylinder head gasket with a film of liquid-type gasket cement. Clean the mating surfaces of the cylinder head and block thoroughly. Position the cylinder head gasket on the block with the side marked "THIS SIDE DOWN" next to the cylinder block. Coat a new bypass elbow gasket with liquid-type gasket cement and install the gasket on the water pump.
- (2) Place the cylinderhead on the gasket, alining screw holes with those in the gasket and block. Install the cylinder head cap screws with the exception of cap screw Nos. 1, 3, 7, 9, 12, and 15.

*Note.* Temporarily install cap screws fingertight.

Position the engine lifting bracket (L) (flange holes toward spark plugs) over holes 1 and 7 and install the two cap screws. Position the oil filter bracket (N) (flange holes toward left edge of cylinder head) over holes 9 and 15. Install a plain-head cap screw in hole 15 and tapped-head cap screws in holes 3, 9, and 12. Install the two 5/16-inch lockwashers and 5/16-18NC x 3/4 cap screws attaching the bypass elbow (BB) to the water pump (AA). Tighten the screws.

- (3) Tighten the cylinder head cap screws (*b*(6) above).
- (4) Connect the upper hose (D) to the water outlet elbow (B) and tighten the hose clamp screw.
- (5) Connect the fuel tank vent line (X) and the master cylinder vent line (A). Install the two distributor vent lines (R) to air cleaner elbow (J) and distributors (par. 135*d*(11) and (12)).
- (6) Connect the spark plug cables to the spark plugs and tighten the cable elbow nuts.
- (7) Connect the temperature gage sending unit cable (P) to the sending unit, and connect the fuel pump to carburetor fuel line (E).
- (8) Fill the cooling system with proper solution of coolant (par. 148*b*). Connect battery ground cable to outer battery.
- (9) Start the engine and run until normal operating temperature is reached. Stop the engine and again tighten the cylinder head cap screws (*b*(6) above).
- (10) Install a  $\frac{5}{16}$ -inch plain washer on each of the four  $\frac{5}{16}$ -24NF x  $\frac{3}{4}$  cap screws (M). Position the oil filter (Q) on the oil filter bracket (N) and install the cap screws with plain washers from the clamp side. Install a  $\frac{5}{16}$ -inch lock washer and  $\frac{5}{16}$ -24NF nut on each screw. Tighten the nuts.
- (11) Position the oil level gage pipe support (T) on the No. 9 tapped-head cap screw and install a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -24NF x  $\frac{1}{2}$  bolt. Tighten the bolt.
- (12) Install the oil filler pipe vent line (F) and tighten the tube nuts.
- (13) Position the fuel tank and master cylinder vent line clip (W) on No. 12 tapped-head cap screw and install a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -24NF x  $\frac{1}{2}$  bolt. Tighten the bolt.
- (14) Position the clip for the distributor vent lines (R) on No. 3 tapped-head cap screw and install a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -24NF x  $\frac{1}{2}$  bolt. Tighten the bolt.
- (15) Position the oil filter inlet line clip (V) over the tapped hole at the left side of the cylinder head and install a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -16NC x  $\frac{1}{2}$  bolt. Tighten the bolt.

## 116. Engine Oiling System

### *a. Remove Oil Filter Element* (fig. 80).

*Note.* Two makes of filters are supplied and are interchangeable only as an assembly. No attempt should be made to interchange parts.

- (1) Remove the drain plug from the bottom of the filter body and drain the oil into a suitable container. Discard the oil.
- (2) Unscrew the cover screw and remove the cover and the cover gasket. Remove the filter element from the body.

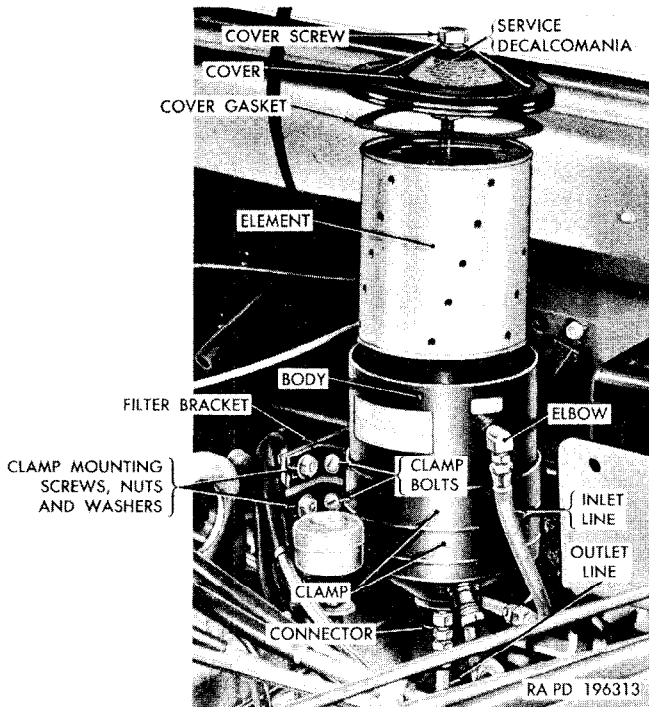


Figure 80. Replacing oil filter element.

- (3) Clean the inside of the filter body and the cover with dry-cleaning solvent or volatile mineral spirits and wipe with a clean cloth.

*b. Install Oil Filter Element (fig. 80).*

- (1) Install the  $\frac{1}{4}$ -inch pipe plug in the drain opening of the filter body.
- (2) Install a new filter element in the body.

*Note.* Be sure to install the same type of filter element as the original; refer to note in *a* above.

- (3) Install a new cover gasket in the cover.
- (4) Make certain the cover screw spring and gasket are in place. Position the cover on the filter body and tighten the cover screw.

**Caution:** Check oil level and replenish as necessary.

*c. Remove Oil Filter, Oil Line Fittings, and Filter Clamps (fig. 80).*

- (1) Drain oil filter (*a*(1) above).
- (2) Disconnect inlet line from the elbow.
- (3) Disconnect outlet line from the connector at the bottom of the filter body.
- (4) Remove oil filter clamp mounting nuts, lockwashers, bolts, and plain washers and remove the oil filter and filter clamp

or clamps. (One type of filter is mounted in one clamp, while the other type is mounted in two clamps.)

- (5) Remove elbow from the side of the filter body.
- (6) Remove connector from the bottom of the filter body.
- (7) Remove filter clamp or clamps. Remove nut and bolt from each clamp and remove the clamp from the filter body.
- (8) If the inlet oil lines and the outlet oil line are to be replaced, remove them at this time (*f* below).

*d. Inspect Oil Filter and Fittings.*

- (1) Inspect oil filter body for leaks and damaged threaded surfaces. Replace a damaged oil filter.
- (2) Inspect the elbow (inlet line) and the connector (outlet line) for damaged threads or cracks. Replace damaged fittings.

*e. Install Oil Filter, Oil Line Fittings and Filter Clamps (fig. 80).*

- (1) If the filter inlet and outlet lines were removed, install lines (*h* below).
- (2) Install filter clamp (or clamps) on the oil filter body. For the Fram filter, install a  $\frac{1}{4}$ -20NC x  $2\frac{1}{4}$  clamp bolt through each clamp and install a  $\frac{1}{4}$ -20NC square nut on each bolt. For the Purolator filter, install a  $\frac{5}{16}$ -18NC x  $2\frac{1}{2}$  clamp bolt and  $\frac{5}{16}$ -18NC square nut in the manner described above.
- (3) Install the  $\frac{1}{4}$ -inch,  $\frac{1}{8}$ -inch male pipe end, inverted flared tube connector in the filter body outlet opening.
- (4) Install the  $\frac{1}{4}$ -inch, 90°, inverted flared tube elbow in the inlet opening of the filter body.
- (5) Install the  $\frac{1}{4}$ -inch pipe plug in the filter body drain opening.
- (6) Install a  $\frac{5}{16}$ -inch plain washer on each of the four  $\frac{5}{16}$ -24NF x  $\frac{3}{4}$  clamp mounting bolts. Position the oil filter and clamp (or clamps) on the filter bracket and install the four clamp mounting screws,  $\frac{5}{16}$ -inch lockwashers, and  $\frac{5}{16}$ -24NF nuts. Do not tighten the nuts.
- (7) Position the filter so that clearance exists between the bottom of the filter and the filter bracket. Tighten each clamp bolt. Tighten the nuts on the four clamp mounting screws.
- (8) Connect the outlet line to the connector in the bottom of the filter body.
- (9) Connect the inlet line to the elbow.
- (10) Replenish the engine oil. Refer to lubrication order (figs. 33 and 34).

*f. Remove Oil Filter Lines.*

- (1) Drain oil filter (*a*(1) above).
- (2) Disconnect two upper (flexible) lines from the oil filter inlet elbow and oil filter outlet connector, and from the lower inlet line and lower outlet line; remove the upper (flexible) lines.
- (3) Disconnect the lower inlet line from the elbow at the cylinder block, back of the generator mounting bracket. Disengage

the line from the oil filter inlet line clip (V, fig. 79) on the cylinder head and remove the line. Remove the elbow from the crankcase.

- (4) Disconnect the lower outlet line from the elbow in the crankcase near the oil level gage pipe, and remove the line. Remove the elbow from the crankcase.

*g. Inspect Oil Filter Lines.*

- (1) Inspect the upper (flexible) lines for damaged fittings and damaged or deteriorated hose. Replace lines as required.
- (2) Inspect the inlet and outlet lower lines for cracks, kinks, or other visual damage. Replace lines as required.
- (3) Inspect the two oil line elbows for cracks and damaged threads. Replace elbows as required.

*h. Install Oil Filter Lines.*

- (1) Install a 1/4-inch, 90°, inverted flared tube elbow in each oil line opening in the crankcase.
- (2) Install the outlet lower line and connect the line to the outlet line elbow in the cylinder block.
- (3) Install the inlet lower line in position and connect the front end of the line to the inlet line elbow in the cylinder block. Engage the line in the clip on the side of the cylinder head.
- (4) Install the inlet and outlet upper (flexible) lines, connecting the inlet line to the inlet lower line and the elbow in the filter body. Connect the outlet line to the outlet lower line and the connector in the outlet opening of the filter body.
- (5) Install the filter drain plug and replenish the engine oil.

*i. Remove Oil Filler Pipe.*

- (1) Loosen the generator adjusting arm bolt, remove the fan belt from the pulley on the generator, and move the generator away from the engine as far as possible.
- (2) Disconnect the filler pipe vent line from the elbow in the oil filler pipe (fig. 81).
- (3) Remove the nut, lockwasher, and bolt that secure the two oil pressure gage sending unit clamps, and remove the clamps from the filler pipe.
- (4) Remove the nuts and lockwashers from the filler pipe studs in the cylinder block and remove the filler pipe and filler pipe gasket. Discard the gasket.
- (5) Remove the filler cap and cap gasket.
- (6) Remove the vent line elbow from the filler pipe.

*j. Inspect Oil Filler Pipe.*

- (1) Inspect the filler pipe for cracks, damaged flange surface, and damaged threads in the vent line elbow opening. Replace a damaged filler pipe.
- (2) Inspect the filler pipe cap and cap gasket for damage. Replace the cap and/or gasket as required.



- (3) Inspect the studs in the cylinder block for looseness or damaged threads. Tighten loose studs; replace damaged studs.
- (4) Inspect the elbow (vent line) for cracks or damaged threads. Replace if necessary.

*k. Install Oil Filler Pipe (fig. 81).*

- (1) If the studs for the filler pipe were removed, install the two  $\frac{5}{16}$ -18NC ( $\frac{1}{2}$ ) x  $\frac{5}{16}$ -24NF x  $1\frac{1}{8}$  studs with the 18NC thread in the cylinder block and tighten.
- (2) Install the  $\frac{7}{16}$ -inch, 90°,  $\frac{1}{4}$ -inch male pipe end, inverted flared tube (vent line) elbow in the vent line opening in the filler pipe.
- (3) Install the filler cap and cap gasket.
- (4) Install the filler pipe gasket over the studs and install the filler pipe on the cylinder block. Install the  $\frac{5}{16}$ -inch lockwashers and  $\frac{5}{16}$ -24NF nuts on the two studs and tighten the nuts.
- (5) Position the clamp (two-halves) on the filler pipe and pressure gage sending unit and install the  $\frac{1}{4}$ -20NC x  $1\frac{1}{2}$  bolt,  $\frac{1}{4}$ -inch lockwasher, and  $\frac{1}{4}$ -20NC nut. Tighten the nut.
- (6) Connect the filler pipe vent line to the vent line elbow on the filler pipe.
- (7) Move the generator back into position, install the fan belt on the generator pulley, and adjust the fan belt (par. 152a).

*l. Remove Oil Pressure Gage Sending Unit and Oil Line (fig. 81).*

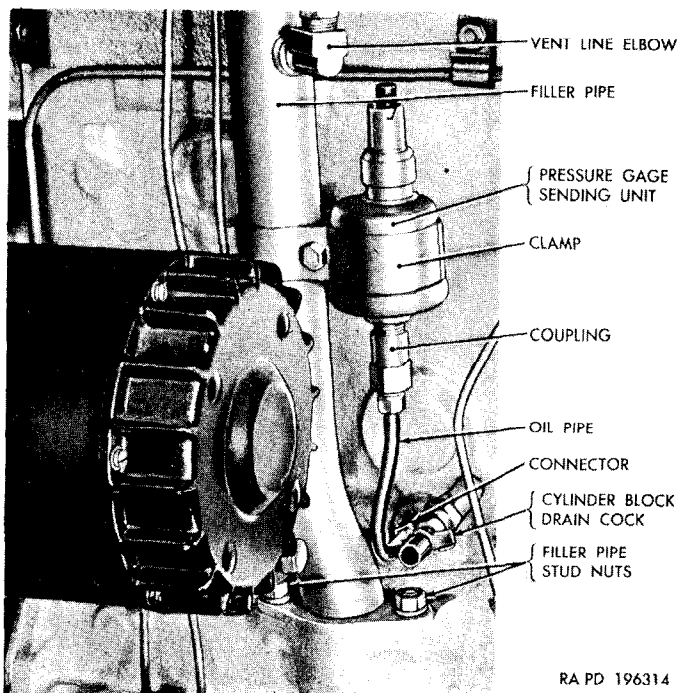
- (1) Disconnect the sending unit cable from the oil pressure gage sending unit.
- (2) Move the generator (*i*(1) above) to provide access to the parts.
- (3) Disconnect the sending unit oil line from the coupling on the oil pressure gage sending unit.
- (4) Remove the sending unit clamp nut, lockwasher, and bolt and remove the clamp. Remove the sending unit.
- (5) Disconnect the sending unit oil line from the connector in the cylinder block and remove the oil line. Remove the connector from the cylinder block.
- (6) Remove the coupling from the sending unit.

*m. Inspect Oil Pressure Gage Sending Unit and Oil Line.*

- (1) Inspect the coupling, the connector, the sending unit oil line, and nuts for cracks, damaged threads or restrictions. Replace parts as required.
- (2) Inspect the oil pressure gage sending unit for damage, worn threads, and corrosion at the cable connector. Replace the sending unit if necessary.

*n. Install Oil Pressure Gage Sending Unit and Oil Line (fig. 81).*

- (1) Install a  $\frac{5}{16}$ -inch,  $\frac{1}{8}$ -inch male pipe end, inverted flared-tube connector in the cylinder block opening.



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Figure 81. Oil filler pipe and oil pressure gage sending unit.

- (2) Install the  $\frac{1}{4} \times \frac{1}{8}$  pipe coupling on the oil pressure gage sending unit.
  - (3) Connect the sending unit oil line to the connector in the cylinder block.
  - (4) Install the sending unit on the oil line and tighten the nuts.
  - (5) Position the clamp (two-halves) on the filler pipe and the sending unit, and install the  $\frac{1}{4}$ -20NC x  $1\frac{1}{2}$  bolt,  $\frac{1}{4}$ -inch lockwasher, and  $\frac{1}{4}$ -20NC nut. Tighten the nut.
  - (6) Install the fan belt on the generator pulley and adjust the fan belt (par. 152a).
  - (7) Connect the sending unit cable to the sending unit.
- o. Remove Oil Level Gage Pipe.*
- (1) Remove the oil level gage.
  - (2) Unscrew the oil level gage pipe from the cylinder block with pliers. Remove the pipe by pulling it up through the pipe support.
  - (3) Remove the pipe support bolt and lockwasher, and remove the support.
- p. Install Oil Level Gage Pipe.*
- (1) Install the oil level gage pipe support in position on the cylinder head and install the  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -24NF x  $\frac{1}{2}$  bolt. Do not tighten the screw until the pipe has been installed.

- (2) Install the oil level gage pipe through the support and screw it into the cylinder block. Tighten the pipe support bolt.
- (3) Install the oil level gage in the pipe. Be sure that the gage cap gasket is in place and in good condition.

## 117. Crankcase Ventilating System

*Note.* The key letters noted in parentheses are in figure 82, except where otherwise indicated.

### *a. General.*

- (1) Crankcase ventilation is provided by the crankcase vent line and metering valve and the vent line from the carburetor air cleaner elbow to the oil filler pipe. On some vehicles, shutoff valves are provided in each vent line to close the lines during fording operation (par. 68*b*(4)). Organizational maintenance of the system includes replacement of the vent lines and fittings, the metering valve, and replacement and adjustment of the shutoff valve controls on vehicles so equipped.
- (2) Servicing of the metering valve is required every 6,000 miles to remove carbon formation that may impair its operation. Servicing of the metering valve is described in *f* through *l* below.

### *b. Remove Oil Filler Pipe Vent Line and Fittings.*

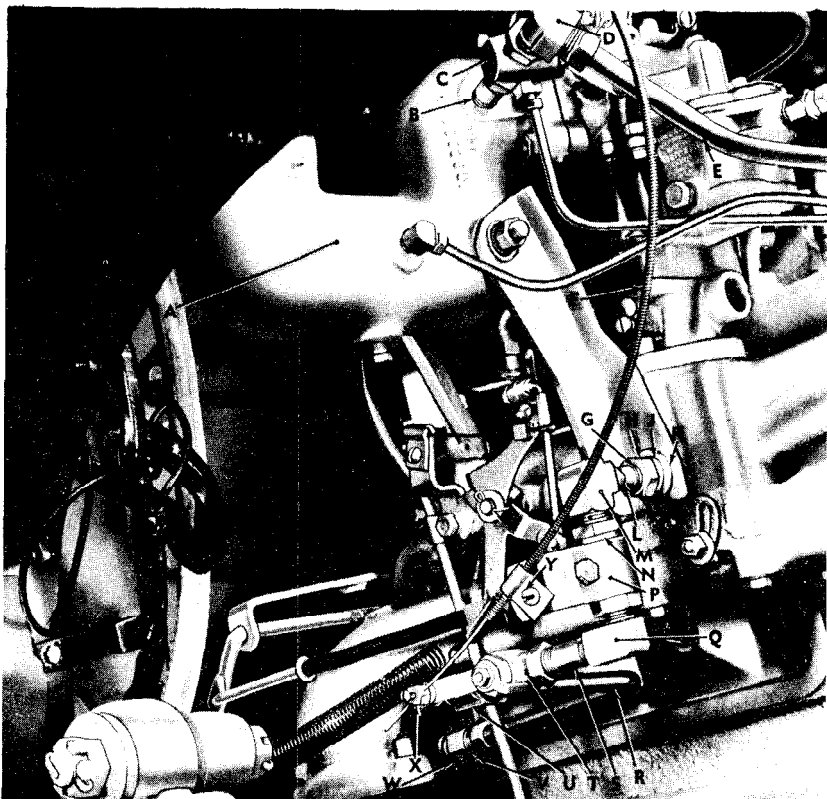
- (1) On vehicles equipped with ventilation shutoff valves, loosen the filler pipe shutoff valve lever swivel screw at the upper shutoff valve (C) and pull out the crankcase ventilation valve dual control (G, fig. 12) to disengage the control from the swivel.
- (2) Remove the oil filler pipe vent line (E).
- (3) Remove the elbow (D), from the upper shutoff valve (C) or from the union.
- (4) Remove the upper shutoff valve (C) or union and remove the pipe nipple (B)
- (5) Remove the vent line elbow from the oil filler pipe.

### *c. Inspect Oil Filler Pipe Vent Line and Fittings.*

- (1) Inspect the oil filler pipe vent line for cracks and kinks; inspect the nuts for cracks or damaged threads. Replace line if necessary.
- (2) Inspect the elbows, nipple, and union (on vehicles so equipped) for cracks or damaged threads. Replace parts as necessary.
- (3) Inspect the shutoff valve for damaged threads. Check the operation of the shutoff valve. Replace the valve if unsatisfactory.

### *d. Install Oil Filler Pipe Vent Line and Fittings.*

- (1) If vehicle is equipped with a shutoff valve, install a  $\frac{1}{4}$  x  $1\frac{5}{8}$



KEY	ITEM
A	AIR CLEANER ELBOW
B	PIPE NIPPLE
C	SHUT-OFF VALVE (UPPER)
D	ELBOW
E	OIL FILLER PIPE VENT LINE
F	SHUT-OFF VALVE CONTROL
G	METERING VALVE NIPPLE
H	NUT
J	LOCK WASHER
K	PLAIN WASHER
L	PIPE BUSHING
M	ELBOW

KEY	ITEM
N	METERING VALVE
P	CONTROL SUPPORT CLAMP
Q	STREET ELBOW
R	CRANKCASE VENT LINE
S	PIPE NIPPLE
T	SHUT-OFF VALVE (LOWER)
U	ELBOW (VENT LINE)
V	CRANKCASE FITTING
W	CONNECTOR
X	LEVER SWIVEL
Y	CLIP

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*Figure 82. Crankcase ventilating system.*

pipe nipple (B) in the air cleaner elbow. If the vehicle is not equipped with a shutoff valve, install a  $\frac{1}{4}$  x  $2\frac{3}{8}$  pipe nipple and  $\frac{1}{4}$ -inch union in the air cleaner elbow.

- (2) Install the upper shutoff valve (C) on the nipple (valve lever opposite air cleaner elbow). When the shutoff valve is tightened, the lever must be toward the engine.
- (3) Install a  $\frac{7}{16}$ -inch, 90°, inverted flared tube elbow (D) in the upper shutoff valve or union.
- (4) Install a  $\frac{7}{16}$ -inch, 90°, inverted flared tube elbow in the oil filler pipe (fig. 81).

- (5) Position the oil filler pipe vent line (E) and tighten both flared-tube elbows to the proper angle to permit connection of the vent line. Install the vent line and tighten the nuts.
- (6) Adjust shutoff valve control (par. 118e).

*e. Remove Crankcase Vent Line and Related Parts.*

- (1) Disconnect the crankcase vent line (R) from the elbow (U).
- (2) Remove the bolt, gasket, flat washer, and lockwasher that secure the crankcase fitting (V) to the cylinder block and remove the vent line fitting and fitting gasket. Discard the gaskets.

*f. Remove Metering Valve and Related Parts.*

- (1) Loosen the vent line shutoff valve lever swivel screw at the lower shutoff valve (T). Loosen the screw in the clip (Y) and move the control out of the way.
- (2) Unscrew the elbow (M) with metering valve and related parts from the pipe bushing (L).

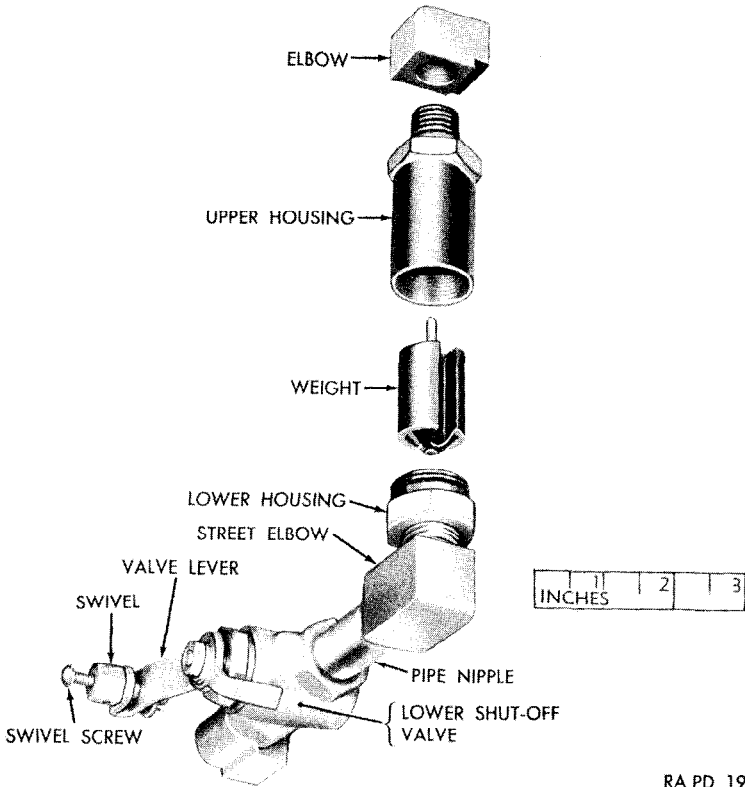
*g. Disassemble Crankcase Vent Line and Related Parts.* Remove the crankcase vent line (R) from the connector (W) and remove the connector from the fitting.

*h. Disassemble Metering Valve and Related Parts.*

- (1) Remove the elbow from the shutoff valve (fig. 83) or union. Remove the shutoff valve or union, and remove the pipe nipple from the street elbow. Remove the street elbow from the metering valve lower housing. Remove the elbow from the metering valve upper housing.
- (2) Unscrew the metering valve upper housing from the lower housing and remove the weight. Loosen the control support clamp nut, and slide the support clamp off the metering valve upper housing.

*i. Inspect Crankcase Vent Line and Related Parts, and Metering Valve and Related Parts.*

- (1) Inspect the crankcase fitting, connector, elbows, and pipe nipple for damaged threads, cracks, or other visual damage. Replace parts as necessary.
- (2) Inspect the shutoff valve for damaged threads. Check operation of the shutoff valve. Replace valve if unsatisfactory.
- (3) Clean the metering valve parts in dry-cleaning solvent or volatile mineral spirits and dry with compressed air. Inspect the metering valve weight and metering valve lower housing seating surfaces for pitting or corrosion. Replace metering valve if either condition exists.
- (4) Inspect the control support clamp for distortion or other visual damage. Straighten or replace as necessary.
- (5) Inspect the pipe bushing (L) and metering valve nipple



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Figure 83. Metering valve and related parts.

(G) for damaged threads or other visual damage. Replace the bushing or nipple (par. 114f) as necessary.

*j. Assemble Crankcase Vent Line and Related Parts.*

- (1) Install a  $\frac{7}{16} \times \frac{1}{4}$  male pipe end inverted flared tube connector (W) in the crankcase fitting (V).
- (2) Install the crankcase vent line in the connector.

*k. Assemble Metering Valve and Related Parts (fig. 83).*

- (1) With the metering valve upper housing in an upright position, install the control support clamp (on vehicles so equipped) with the offset toward the left. Install the weight (shaft end first) in the upper housing. Install the lower housing and tighten.
- (2) Install metering valve (upper housing) in the  $\frac{1}{4}$ -inch, 90° elbow and tighten.
- (3) Install a  $\frac{1}{4}$ -inch, 90° street elbow in the metering valve (lower housing). When the street elbow is tightened, it must be at a right angle to the elbow on the metering valve upper housing (fig. 82).

- (4) If vehicle is equipped with a shutoff valve, install a  $\frac{1}{4}$  x  $1\frac{5}{8}$  pipe nipple in the street elbow. Tighten the nipple. If vehicle is not equipped with a shutoff valve, install a  $\frac{1}{4}$  x  $2\frac{3}{8}$  pipe nipple and a  $\frac{1}{4}$ -inch union.
- (5) Install the lower shutoff valve ((4) above) on the nipple (valve lever opposite the pipe nipple). When the shutoff valve is tightened, the lever must be at a right angle to the metering valve (N).
- (6) Install a  $\frac{7}{16}$ -inch,  $90^\circ$ ,  $\frac{1}{4}$ -inch male pipe end, inverted flared-tube vent line elbow (U) in the shutoff valve or union. When the elbow is tightened, it must be parallel with the elbow on the metering valve upper housing.

*l. Install Metering Valve and Related Parts.*

- (1) Install the elbow at the metering valve upper housing on the pipe bushing (L). When tightened, the metering valve must be in the vertical position.
- (2) Position the control support clamp (P) on the metering valve so that the clip (Y) is parallel with the vent line shut-off valve lever. Install the shutoff valve control (F) in the clip (Y) and tighten the clip screw lightly. Insert the control wire in the lever swivel (X). Adjust the lower shut-off valve control (par. 118e.)

*m. Install Crankcase Vent Line and Related Parts.*

- (1) Install a  $\frac{5}{16}$ -inch lock washer and a  $\frac{3}{8}$ -inch flat washer on a  $\frac{5}{16}$ -18NC x 3 bolt.
- (2) Position the crankcase fitting gasket on the crankcase fitting, and insert the bolt through the hole provided in the fitting. Position the fitting with related parts to the cylinder block, and tighten the bolt lightly. Aline the crankcase vent line with the elbow attached to the lower shutoff valve or union, and tighten both vent line nuts. Tighten the crankcase fitting bolt.

## **118. Crankcase Ventilation Valve Dual Control**

*a. General.* The crankcase ventilation shut-off valves must operate properly to protect the engine during deep water fording and insure maximum engine performance. The shutoff valve dual control, operated from the instrument panel, controls both shutoff valves. Both valves must be fully closed when the control (G, fig. 12) is pulled all the way out, and must be fully opened when the control is pushed in.

*b. Removal (on Vehicles so Equipped).*

- (1) Disconnect the crankcase ventilation valve dual control at the shutoff valve control lever swivels. Remove the control from each control clip by loosening the clip screws.

- (2) Disconnect the instrument cluster from the instrument panel by turning the four studs counterclockwise, and lower the cluster to provide access to the dual control retaining nut in back of the instrument panel.
- (3) Unscrew the nut that secures the control at the back of the instrument panel. Withdraw the control from the instrument panel while holding the nut and lockwasher.

*c. Inspection.*

- (1) Inspect the control for binding, broken control handle, kinked conduits, broken control wires, damaged threads, or corrosion. Replace the dual control if any of the above conditions exist.
- (2) Inspect the control grommets in the cowl front panel for deterioration. Replace grommets if necessary.

*d. Installation.*

- (1) Insert both controls through the hole provided in the instrument panel and thread both controls through a  $\frac{5}{8}$ -inch, external-teeth lockwasher and a  $\frac{5}{8}$ -18NF nut. Thread the long control through the right grommet in the cowl front panel and the short control through the left grommet. Insert the control in the instrument panel, and tighten the nut on the control.
- (2) Position the instrument cluster in the instrument panel opening and turn the four studs clockwise to secure the cluster to the instrument panel.
- (3) Engage the long control in the upper portion of the tension clip (G, fig. 79), located on the control support plate (H, fig. 79). Engage the short control in the lower portion of the clip. Engage the long control in the clip (Y, fig. 82).
- (4) Insert the control wires in the shutoff valve lever swivels. Adjust the controls (*e* below).

*e. Adjustment.*

- (1) Push the dual control (G, fig. 12) all the way in, and position each shutoff valve lever in the fully open position (against the lever stop and parallel with the valve). Tighten both swivel screws.
- (2) Pull the dual control all the way out to make certain the valves close completely (levers at  $90^\circ$  from the open position and against the stop). Operate the control to make certain both valve levers work freely, and that sufficient clearance exists between the control conduits and the valve levers. Tighten the clip screws.



## 119. Maintenance Operations

Organizational maintenance operations that may be performed with the engine in the vehicle include the services listed below, in addition to those described in this section.

- a. *Air Cleaner*. Service or replace (par. 133).
- b. *Air Cleaner Elbow*. Replace (par. 135).
- c. *Carburetor*. Adjust or replace (pars. 134 and 137).
- d. *Carburetor Controls and Linkage*. Adjust or replace (par. 144).
- e. *Cooling System*. Clean and service (pars. 148 and 149).
- f. *Distributor Breaker Points*. Adjust or replace (pars. 128 and 129).
- g. *Distributor Timing* (par. 126).
- h. *Distributor Capacitor*. Replace (par. 128).
- i. *Distributor*. Replace (par. 125).
- j. *Exhaust Pipe, Muffler, and Tail Pipe*. Replace (par. 146).
- k. *Fan and Fan Belt*. Adjust or replace (par. 152).
- l. *Fuel Filters*. Service or replace (pars. 139 and 140).
- m. *Fuel Pump*. Test or replace (par. 138).
- n. *Fuel Lines and Fittings*. Replace (par. 141).
- o. *Generator*. Replace (par. 164).
- p. *Generator Regulator*. Replace (par. 165).
- q. *Ignition Coil*. Replace (par. 130).
- r. *Ignition Wiring*. Replace (pars. 123 and 277).
- s. *Radiator and Hoses*. Replace (pars. 150 and 153).
- t. *Spark Plugs*. Clean, adjust, or replace (par. 124).
- u. *Starter*. Replace (par. 158).
- v. *Thermostat*. Replace (par. 151).
- w. *Water Pump*. Replace (par. 154).

## Section VI. ENGINE REMOVAL AND INSTALLATION

### 120. Coordination With Ordnance Maintenance Unit

Replacement of the engine 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 responsible commander. A replacement engine and tools needed for the operation, which are not carried by the using organization, may be obtained from the supporting ordnance maintenance unit.

### 121. Engine Removal

a. *General*. Items removed with the engine are the radiator, clutch, transmission with or without power-take-off, and accessories such as

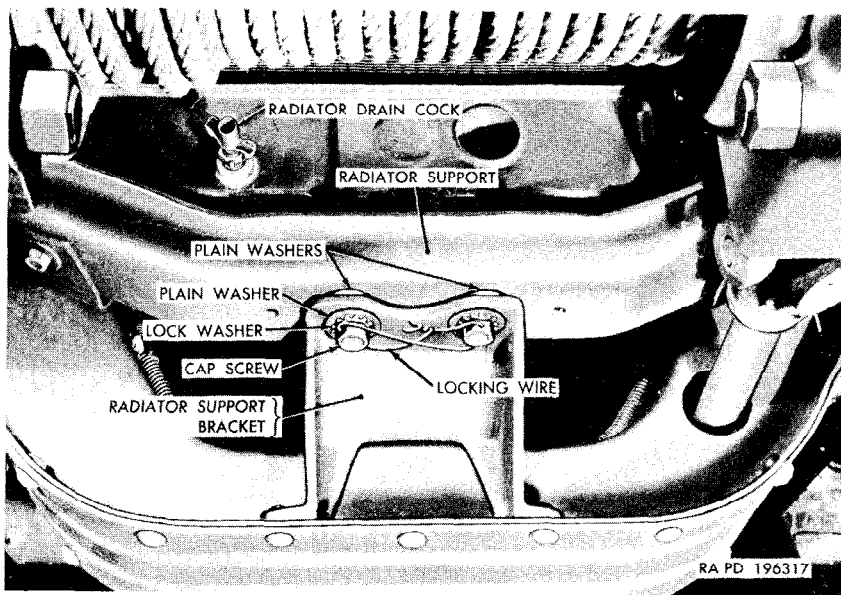
the generator, distributor, starter, and carburetor. It is not necessary to drain the engine oil, cooling system, or transmission.

*b. Preliminary Operation.*

- (1) Place the vehicle under suitable engine-lifting equipment. Arrange to have tools, wood blocking, and supports available for use when needed. Block the wheels to prevent the vehicle from moving.
- (2) Disconnect the battery ground cable from the outer battery.
- (3) Open the hood to the wide open position and secure the windshield support frame hood holder in the hood holder socket (fig. 16).

*c. Remove Front Fenders, Radiator Guard, and Headlight Guards as a Unit.* Refer to paragraph 248a.

*d. Disconnect Radiator Support.* Remove the locking wire (fig. 84) from the two radiator support bolts. Remove the two bolts, lock-washers, and plain washers.



*Figure 84. Disconnect points at radiator support.*

*e. Disconnect Points at Left Side of Engine.*

*Note.* The key letters noted in parentheses are in figure 85.

- (1) Disconnect the generator to regulator cable (A) at the generator, using a suitable spanner wrench. Loosen generator adjusting cap screw and move generator toward engine.
- (2) Disconnect the oil pressure gage sending unit cable (B) and the water temperature gage sending unit cable (D) at the cable connectors.
- (3) Disconnect the brake master cylinder vent line (N) and the fuel tank vent line (P) at the flexible lines.
- (4) Disconnect the distributor primary cable (M) at the distributor.
- (5) Disconnect the cables (E, F, and G) from the starter switch terminal.

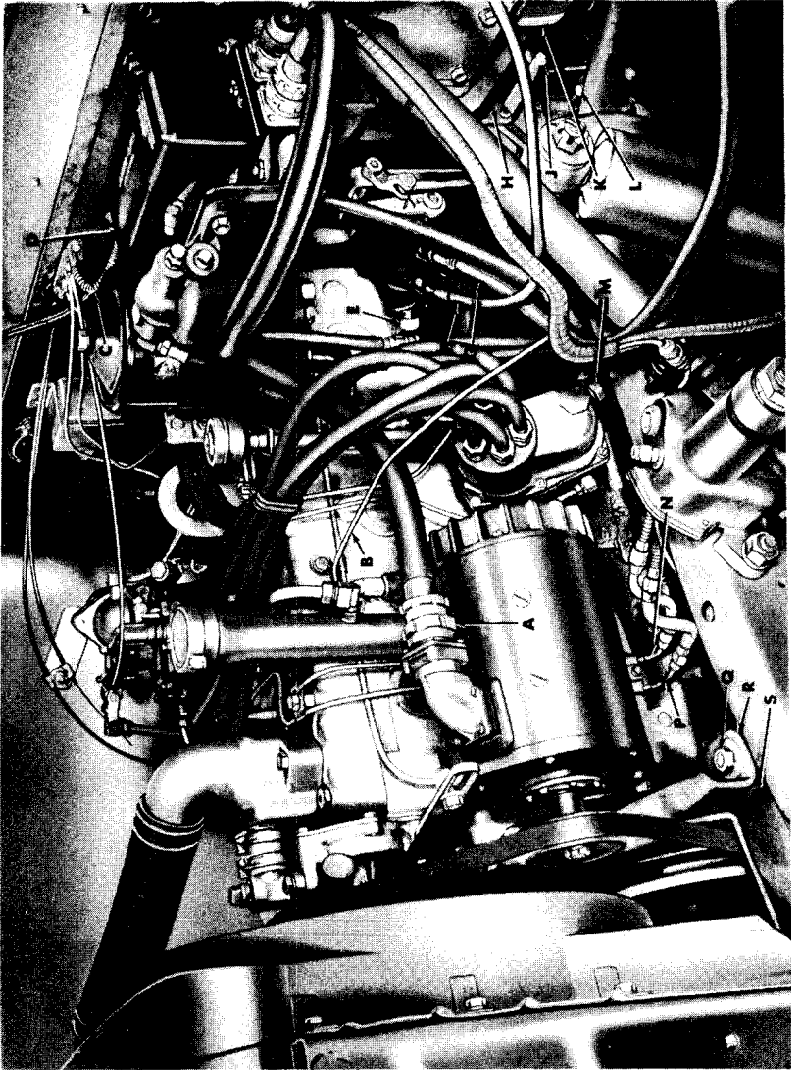
*Note.* On vehicles not equipped with a slave receptacle, only two cables are attached to the starter switch.

- (6) Remove the cotter pin and clevis pin that secure the clutch operating rod to the clutch release fork lever (K).
- (7) Disconnect the accelerator pedal rod at the accelerator bell-crank lever (H) by removing the cotter pin and clevis pin (J).
- (8) Remove the nut, lockwasher, engine front mounting screw (Q), and plain washer that secure the engine front support plate (R) to the support plate bracket (S).
- (9) On engines equipped with a priming system, disconnect the priming system inlet line (C) at the fuel filter (if connected).
- (10) Remove the cotter pin, slotted nut (L), and plain washer from the engine rear support mounting bolt. Remove the bolt, plain washer, and lower insulator. Discard the insulator.

*f. Disconnect Points at Right Side of Engine.*

*Note.* The key letters noted in parentheses are in figure 86.

- (1) Disconnect the choke control (D) and throttle control (T) at the lever swivels and clips.
- (2) Disconnect the crankcase ventilation shutoff valve controls (B) at the tension clips (C and J) and shutoff valve lever swivels (E and L) (on engines so equipped).
- (3) Remove the windshield wiper hose (A) from the fuel pump vacuum line (S).
- (4) Disengage the throttle return spring extension (M) from the cowl.
- (5) Close the fuel line shutoff cock (H) and disconnect the flexible line from the shutoff cock.

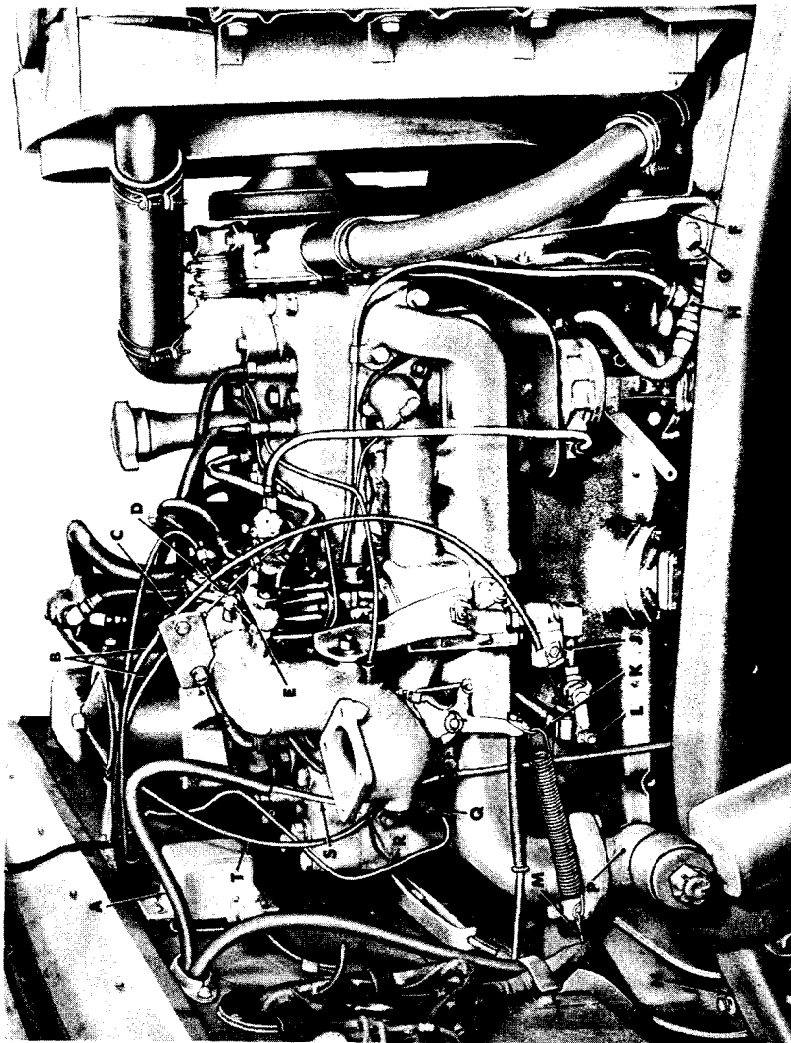


**KEY ITEM**

- A—GENERATOR TO REGULATOR CABLE
- B—OIL PRESSURE GAGE SENDING UNIT CABLE
- C—PRIMING SYSTEM INLET LINE
- D—TEMPERATURE GAGE SENDING UNIT CABLE
- E—BATTERY-TO-STARTER CABLE
- F—STARTER-TO-REGULATOR CABLE
- G—STARTER-TO-SLAVE RECEPTACLE CABLE
- H—ACCELERATOR BELLCRANK LEVER
- J—ACCELERATOR PEDAL ROD CLEVIS PIN
- K—CLUTCH RELEASE FORK LEVER
- L—SLOTTED NUT
- M—DISTRIBUTOR PRIMARY CABLE
- N—MASTER CYLINDER VENT LINE
- P—FUEL TANK VENT LINE
- Q—FRONT MOUNTING SCREW
- R—FRONT SUPPORT PLATE
- S—SUPPORT PLATE BRACKET

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*Figure 85. Disconnect points at left side of engine.*



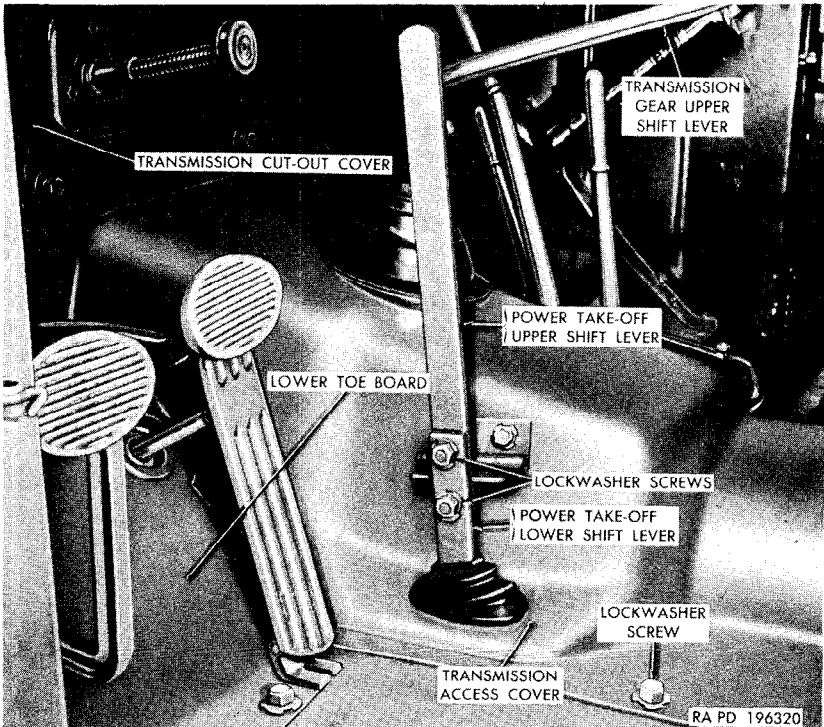
**KEY**      **ITEM**

- A—WINDSHIELD WIPER HOSE
- B—CRANKCASE VENTILATION SHUT-OFF VALVE CONTROLS
- C—TENSION CLIP
- D—CHOKE CONTROL
- E—SHUT-OFF VALVE LEVER SWIVEL
- F—ENGINE FRONT SUPPORT PLATE
- G—ENGINE FRONT MOUNTING SCREW
- H—FUEL LINE SHUT-OFF COCK
- J—TENSION CLIP
- K—THROTTLE RETURN SPRING
- L—SHUT-OFF VALVE LEVER SWIVEL
- M—THROTTLE RETURN SPRING EXTENSION
- N—SLOTTED NUT
- P—UPPER EXHAUST PIPE
- Q—TEE TYPE NOZZLE
- R—PRIMING SYSTEM LINE
- S—FUEL PUMP VACUUM LINE
- T—THROTTLE CONTROL

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*Figure 86. Disconnect points at right side of engine.*

- (6) On engines equipped with a priming system, disconnect the priming system line (R) from the tee-type nozzle (Q) at the intake manifold rear port.
  - (7) Disconnect the upper exhaust pipe (P) from the lower exhaust pipe by loosening the eyebolt nuts and disengaging the two eye bolts.
  - (8) Remove the nut, lockwasher, screw, and plain washer that secure the engine front support plate (F) to the support plate bracket.
  - (9) Remove the cotter pin, slotted nut (N), and plain washer from the engine rear support bolt. Remove the bolt, plain washer, and lower insulator. Discard the insulator.
- g. Remove Transmission Access Covers (fig. 87).*
- (1) Remove the two lockwasher screws that secure the power-take-off upper shift lever to the lower shift lever and remove the upper lever (on vehicles so equipped).
  - (2) Remove the transmission gearshift upper lever from the lower lever by removing the nut, lockwasher, and bolt.
  - (3) Remove the 18 lockwasher screws that secure the transmission access cover and the transmission cut-out cover, and remove both covers.



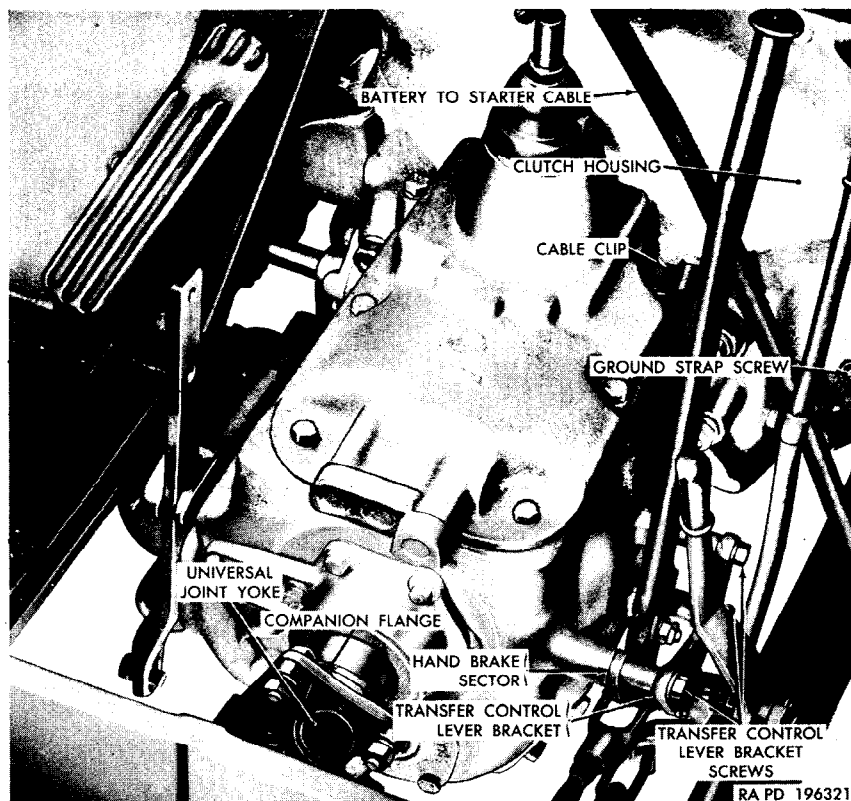
*Figure 87. Items removed in driver's compartment.*

*h. Disconnect Points in Driver's Compartment (fig 88).*

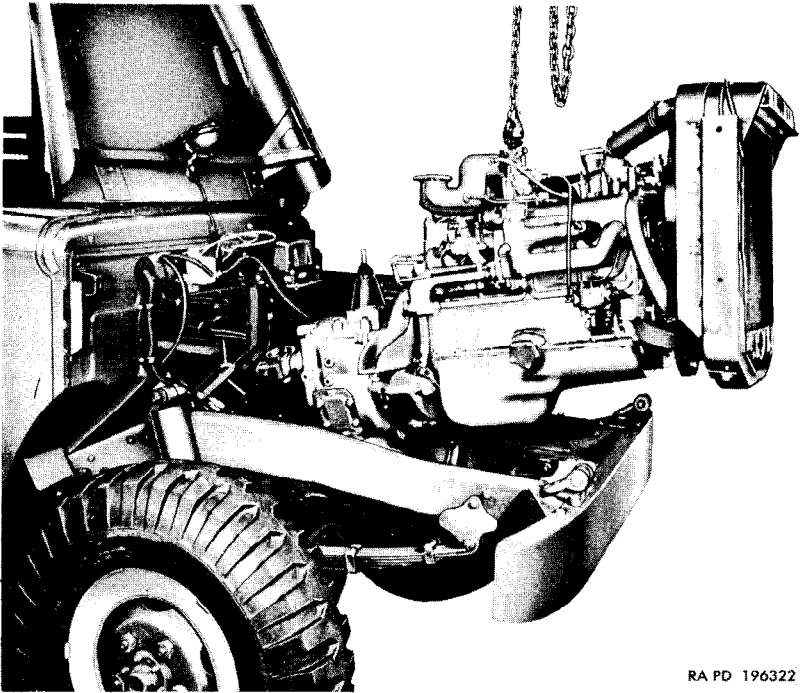
- (1) Disengage the battery-to-starter cable from the cable clip on the transmission case cover and pull the cable back from the engine compartment.
- (2) Remove the three screws and lockwashers that secure the transfer control lever bracket to the transmission.
- (3) Remove the four nuts, lockwashers, and bolts that secure the universal joint yoke at the companion flange. Slide the yoke back on the shaft. Secure the propeller shaft to keep it off the floor.
- (4) Remove the screw and lockwasher that secure the ground strap to the clutch housing.

*i. Disconnect Winch Drive Shaft (on Vehicles so Equipped).*

Working underneath the vehicle, remove the locking wire from the setscrew in the drive shaft rear universal joint and from the drive shaft collar setscrew, if a collar is used. Loosen both setscrews and push the universal joint and collar forward to disengage the universal joint from the power-take-off drive shaft.



*Figure 88. Disconnect points in driver's compartment.*



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*Figure 89. Removing or installing engine.*

*j. Remove Engine.*

- (1) Each engine is supplied with an engine eyebolt. Place hook of chain in eyebolt and raise the engine enough to place a small amount of strain on the chain.
- (2) At this point, check to be sure that all disconnect operations have been completed. Raise the power plant slowly, using a number of short lifts, until radiator, oil pan, and transmission are clear of crossmember. Check again to see that all lines and accessories are clear as power plant is being removed upward and forward.
- (3) Remove the upper insulator and spacer from each of the engine rear support brackets (fig. 90). Discard the insulator.
- (4) Remove and discard the upper exhaust pipe to lower exhaust pipe gasket.

*k. Remove Radiator and Related Parts.*

- (1) Drain cooling system (par. 148a).
- (2) Detach the radiator inlet and outlet hoses from the radiator and the engine (par. 150a).
- (3) Remove the screws, lockwashers, and plain washers that secure the radiator left and right support brackets to the engine and remove the radiator, radiator support, support brackets, and fan shroud.



- (4) Cover the hose openings in the water outlet elbow and the water pump to exclude dirt from the engine.

*l. Remove Transmission.*

- (1) Remove the four bolts and lockwashers that secure the transmission to the clutch housing and remove the transmission.
- (2) Cover the transmission shaft opening in the clutch housing to exclude dirt from the housing.

## 122. Engine Installation

*a. Install Transmission.*

- (1) Clean the machined surfaces of the clutch housing and the transmission case thoroughly and clean the pilot bearing in the end of the crankshaft.
- (2) Aline the clutch parts (par. 189g(2)).
- (3) Position the transmission on the clutch housing, engaging the transmission shaft in the clutch. Install the four  $\frac{9}{16}$ -inch lockwashers and  $\frac{9}{16}$ -12NC x  $1\frac{3}{4}$  bolts. Tighten the bolts evenly.

*b. Install Radiator and Related Parts.*

- (1) Position the assembled radiator, radiator support, support brackets, and fan shroud, alining the screw holes in the support brackets with their respective holes in the engine front support plate. Install the  $1\frac{3}{32}$ -inch plain washer,  $\frac{3}{8}$ -inch lockwasher, and  $\frac{3}{8}$ -24NF x 1 cap screw for each bracket. Tighten the screws.
- (2) Install the radiator inlet and outlet hoses (par. 150c).

*c. Install Engine.*

- (1) Install a new upper exhaust pipe to lower exhaust pipe gasket on the lower exhaust pipe flange.
- (2) Assemble a new upper insulator on each spacer (fig. 90). Install the assembled parts on each engine rear support bracket.
- (3) Position the correct number of  $\frac{9}{16}$ -inch ID,  $1\frac{3}{8}$  OD-inch, 0.109-inch thick plain washers on the radiator support bracket. Refer to paragraph *j*(2) above.
- (4) Make certain the generator to regulator cable and the carburetor and shutoff valve controls are properly located to prevent interference with engine installation.
- (5) Install the engine (fig. 89), making certain that the spacers, insulators, and plain washers remain in correct alinement with their respective holes.
- (6) Temporarily install a suitable drift in each of the engine front and rear mounting screw holes. Remove the hoist hook from the engine lifting bracket.

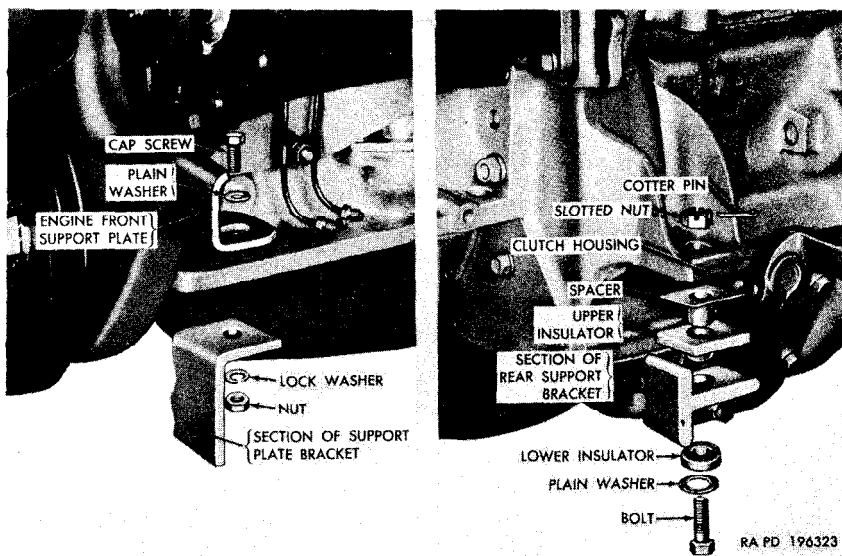


Figure 90. Engine mounting parts—exploded view.

*d. Connect Winch Drive Shaft (Vehicles so Equipped).*

- (1) Install the winch drive shaft rear universal joint on the power-take-off drive shaft, (aligning the keyway in the universal joint yoke with the key in the shaft. Tighten the universal joint setscrew and secure the screw with locking wire.
- (2) If the drive shaft is equipped with a collar, position the collar to provide a clearance of five-eighths of an inch between the rear of the collar and the front of the universal joint. Tighten the collar setscrew and secure the screw with locking wire.

*e. Connect Points in Driver's Compartment (fig. 88).*

- (1) Position the ground strap on the clutch housing and install the  $\frac{3}{8}$ -16NC x 1 screw and  $\frac{3}{8}$ -inch internal-external-teeth lockwasher. Tighten the screw.
- (2) Align the intermediate propeller shaft universal joint yoke flange holes with the holes in the companion flange at the rear of the transmission. Install the four  $\frac{7}{16}$ -20NF x  $1\frac{1}{4}$  bolts through the companion flange and yoke. Install the four  $\frac{7}{16}$ -inch lockwashers followed by the  $\frac{7}{16}$ -20NF nuts. Tighten the nuts evenly.
- (3) Position the transfer control lever bracket and assembled parts at the right side of the transmission, aligning the screw holes in the bracket with those in the transmission case. Install the three  $\frac{3}{8}$ -inch lockwashers and  $\frac{3}{8}$ -16NC x  $2\frac{5}{8}$  cap screws. Tighten the screws evenly.
- (4) Install the battery-to-starter cable through to the engine compartment and engage the cable in the cable clip on the transmission.

*f. Install Transmission Access Covers (fig. 87).*

- (1) Position the transmission cutout access cover on the dash panel and install the three  $\frac{7}{16}$ -20NF x  $\frac{7}{8}$  external-teeth lockwasher screws in three upper holes.
- (2) Install the transmission access cover and the fourteen  $\frac{7}{16}$ -20NF x  $\frac{7}{8}$  external-teeth lockwasher screws. Tighten the screws.
- (3) Install the transmission gearshift upper lever on the lower lever and install the  $\frac{7}{16}$ -20NF x 2 bolt,  $\frac{7}{16}$ -inch lockwasher, and  $\frac{7}{16}$ -20NF nut. Tighten the nut.
- (4) Position the power-take-off upper shift lever on the lower shift lever with the screw holes alined. Install the two  $\frac{7}{16}$ -20NF x  $\frac{7}{8}$  external-teeth lockwasher screws. Tighten the screws.

*g. Connect points at Right Side of Engine*

*Note.* The key letters noted in parenthesis are in figure 86, except where otherwise indicated.

- (1) Remove the drifts from the engine and support brackets. Install a  $\frac{9}{16}$ -inch ID,  $1\frac{7}{8}$ -inch OD, 0.109-inch thick plain washer on the engine rear support bolt, followed by a new lower insulator (fig. 90). Install the engine rear support bolt from the under side of the rear support bracket and install the  $\frac{1}{2}$ -inch plain washer and  $\frac{1}{2}$ -20NF slotted nut (fig. 90). Tighten the nut enough to hold the parts.
- (2) Install a  $\frac{1}{2}$ -inch plain washer on the  $\frac{1}{2}$ -20NF x  $1\frac{1}{4}$  cap screw. Install the cap screw through the front support plate and front support plate bracket. Install the  $\frac{1}{2}$ -inch lockwasher and  $\frac{1}{2}$ -20NF nut (fig. 90). Tighten the nut enough to hold the parts.
- (3) Connect the upper exhaust pipe (P) to the lower exhaust pipe by engaging the two eyebolts. Do not tighten the eyebolt nuts at this time.
- (4) On engines equipped with a priming system, connect the priming system line (R) to the tee-type nozzle (Q) in the intake manifold rear port.
- (5) Connect the flexible line from the fuel pump to the fuel line shutoff cock (H) and open the shutoff cock.
- (6) Attach the throttle return spring extension (M) to the cowl.
- (7) Install the windshield wiper hose (A) on the fuel pump vacuum line (S).
- (8) Connect the crankcase ventilation shutoff valve controls (B). Adjust the controls (par. 118e).
- (9) Connect the choke control (D) and throttle control (T). Adjust the controls (par. 134).

*h. Connect points at left side of engine.*

*Note.* The key letters noted in parentheses are in figure 85.

- (1) Remove the drifts from the engine and support brackets, and install the engine mounting parts (g(1) and (2) above).
- (2) Connect the engine priming system inlet line (C) at the fuel filter (on engines so equipped and if previously connected).
- (3) Aline the accelerator pedal rod with the accelerator bell-crank lever (H) and install a  $\frac{5}{16}$  x  $1\frac{3}{16}$  clevis pin (J) and  $\frac{3}{32}$  x  $\frac{3}{4}$  cotter pin.
- (4) Aline the clutch operating rod with the clutch release fork lever (K) and install the clevis pin and  $\frac{3}{32}$  x  $\frac{3}{4}$  cotter pin.
- (5) Connect the battery-to-starter cable (E), the starter-to-regulator cable (F), and the starter-to-slave receptacle cable (G) (on vehicles so equipped) at the starter switch front terminal. Tighten the terminal nut.
- (6) Connect the distributor primary cable (M) at the distributor.  
**Caution:** Use extreme care when tightening the connector nut to prevent breakage.
- (7) Connect the brake master cylinder vent line (N) and the fuel tank vent line (P) at the flexible lines.
- (8) Connect the oil pressure gage sending unit cable (36) (B) to the oil pressure gage sending unit and the water temperature gage sending unit cable (33D) to the water temperature gage sending unit.
- (9) Connect the generator-to-regulator cable (A) at the generator and tighten the connector nut with a suitable spanner wrench.

*i. Tighten Engine Mounting Parts and Exhaust Pipe.* Tighten the nuts on the engine mounting screws and bolts evenly. Install a  $\frac{3}{32}$  x  $1\frac{1}{8}$  cotter pin in each rear bolt. Tighten the nuts on the exhaust pipe eye bolts.

*j. Connect Radiator Support.* Install a  $\frac{1}{2}$ -inch lockwasher and a  $\frac{9}{16}$ -inch ID,  $1\frac{3}{8}$ -inch OD, 0.109-inch thick plain washer on each radiator support bolt. Aline the plain washers between the radiator support bracket and the radiator support with a drift, and install the two radiator support bolts. Tighten the bolts and secure them with locking wire (fig. 84).

*k. Install Front Fenders, Headlight Guards, and Radiator Guard.* Refer to paragraph 248b.

*l. Connect Battery Ground Cable* (fig. 136).

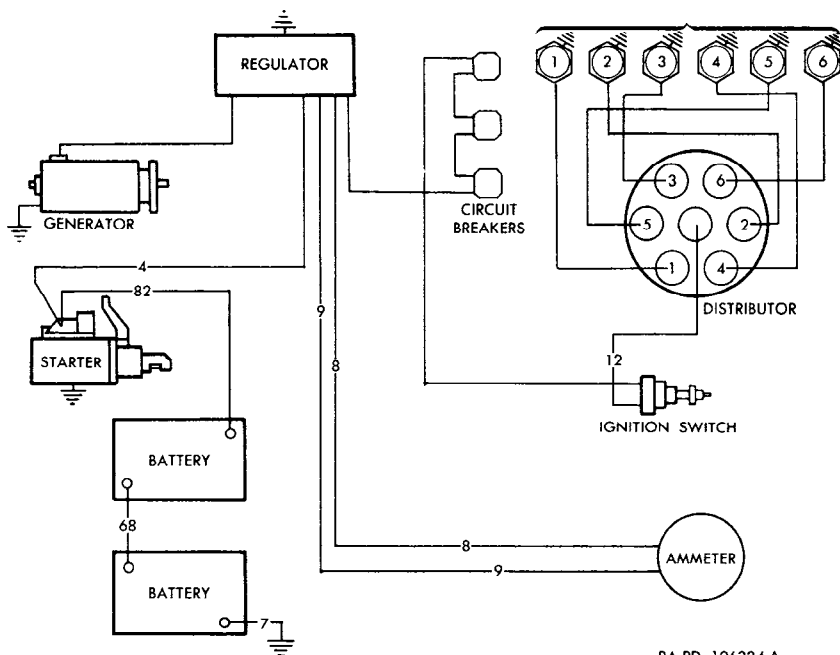
*m. Fill the Cooling System.* Refer to paragraph 148b.

*n. Record of Replacement.* Record the engine replacement on DA Form 478, Organizational Equipment File.

## Section VII. IGNITION SYSTEM

### 123. Description and Data

*a. Description.* The ignition system (fig. 91) includes the distributor and coil assembly, the spark plugs, ignition switch, and the necessary connecting cables and wiring. A 24-volt system operates on current from the two 12-volt batteries. The ignition switch, when turned on, completes the circuit to the ignition system. All components of the ignition system are waterproofed for fording operation.



*Figure 91. Ignition system wiring diagram.*

### *b. Data.*

Distributor and coil assembly :

Automatic spark advance.....	18° to 22° at 2,250 rpm
Breaker arm spring tension.....	17 to 20 oz
Breaker point gap.....	0.018 to 0.022 in.
Capacitor.....	23 to 28 mfd
Direction of rotation.....	clockwise
Distributor shaft end play.....	0.003 to 0.010 in.
Drive.....	camshaft gear
Firing order.....	1-5-3-6-2-4
Ignition timing.....	2° ATDC
Make.....	Auto-Lite
Model.....	IAU-4005-UT or IAU-4007-UT

Spark plugs:

Gap.....	0.028 to 0.033 in.
Make.....	Auto-Lite
Size.....	14-mm
Tightening torque.....	30 lb-ft
Type.....	Resistor (AR5S)

## 124. Spark Plugs and Cables

### *a. Remove Spark Plug Cables.*

- (1) Unscrew the spark plug cable elbow nuts and remove the cables from the spark plugs.
- (2) Remove the nut, lockwasher, and bolt from the spark plug conduit clamp and remove the clamp.
- (3) Unscrew the spark plug cable nuts at the distributor cap cover and remove the cables.

*b. Inspect Spark Plug Cables.* Inspect cables (fig. 92) for frayed conduits, broken or missing terminal sleeve springs, missing or deteriorated terminal sleeve grommets, damaged nut threads, or other visual damage. Replace cables as necessary.

### *c. Install Spark Plug Cables.*

- (1) Insert the straight end of each spark plug cable terminal in the distributor cap cover and tighten the nuts fingertight. Aline the cable elbows so that all are facing opposite the distributor cap cover plug (fig. 85).
- (2) Insert each spark plug cable elbow terminal in its spark plug. Be sure to connect each cable to the correct plug, following the firing order shown in figure 91. Tighten cable elbow nuts.
- (3) Install the conduit clamp around the cables and install a  $\frac{1}{4}$ -20NC x  $\frac{1}{2}$  bolt,  $\frac{1}{4}$ -inch lockwasher, and  $\frac{1}{4}$ -20NC nut. Tighten the nut.

### *d. Remove Spark Plugs.*

*Note.* All plugs are removed in the same manner.

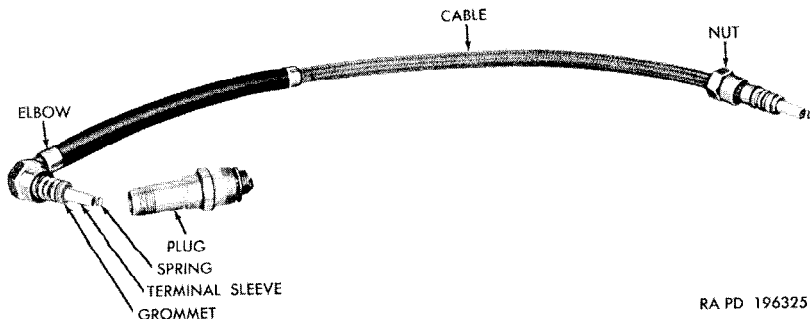


Figure 92. Spark plug and cable.

- (1) Unscrew the spark plug cable elbow nut and remove the cable from the spark plug.
- (2) Unscrew the spark plug with a deep socket wrench. Remove the spark plug and gasket. Discard the gasket.

*e. Clean, Inspect, and Adjust Spark Plugs.*

- (1) Clean the spark plugs, using spark plug cleaning equipment.
- (2) Inspect the plugs for burned or damaged electrodes, broken insulation, or damaged threads. Replace spark plugs if any of the above conditions are evident.
- (3) Measure the gap between the two electrodes with a spark plug gage. Increase or decrease the gap as required by bending the outer electrode until the gap is 0.028 to 0.033 inch.

*f. Install Spark Plugs.*

*Note.* All plugs are installed in the same manner.

- (1) Install a new gasket on the spark plug and install the plug in the cylinder head. Tighten the plug to 30 pound-feet torque.
- (2) Connect the spark plug cable (*c*(2) above).

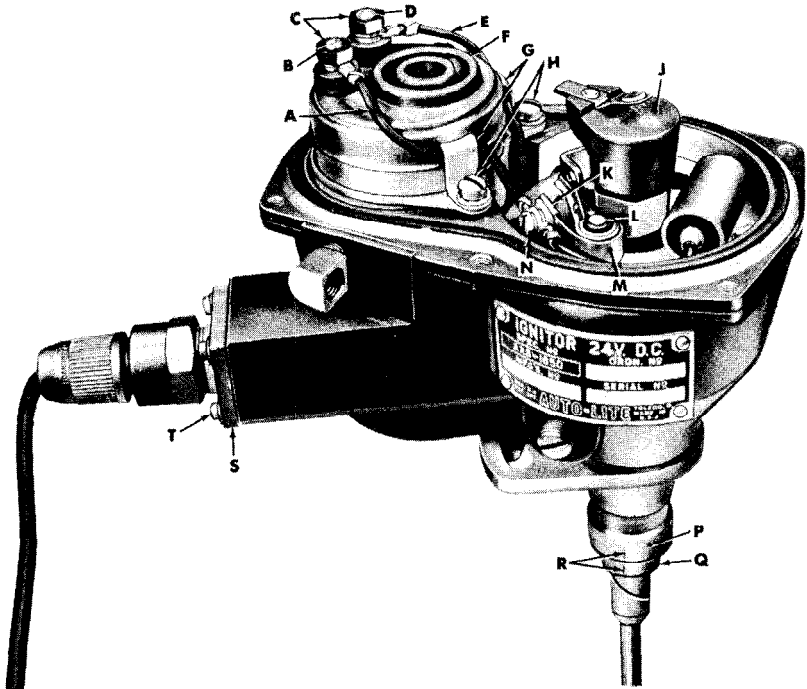
## **125. Distributor and Vent Lines**

*a. Remove Distributor.*

- (1) Disconnect all spark plug cables at the spark plugs and remove the No. 1 spark plug. Apply sufficient pressure to the fan belt and turn the fan drive pulley by moving the fan. Turn the fan until the timing indicator points to DC on the drive pulley (on compression stroke).
- (2) Disconnect the two vent lines at the elbows in the distributor base.
- (3) Remove the lockwasher screw that attaches the spark advance arm to the cylinder block. Withdraw the distributor sufficiently to disconnect the primary cable at the distributor. Remove the distributor and the mounting gasket.
- (4) Scribe alining marks on the distributor base and the drive shaft collar (P and Q, fig. 93) to insure proper engagement of the drive shaft end with the distributor drive gear slot when installing the distributor.

*b. Install Distributor.*

- (1) With the timing indicator pointing to DC on the drive pulley (*a*(1) above), connect the primary cable at the distributor, exercising extreme care to prevent breakage of the connector nut.
- (2) Install a new distributor mounting gasket on the distributor base. Aline the scribe marks (*a*(4) above) and insert the distributor in the cylinder block.



KEY	ITEM	KEY	ITEM
A	BREAKER PLATE CABLE	K	BREAKER SPRING CLIP
B	COIL NEGATIVE TERMINAL	L	PIVOT PIN
C	TERMINAL NUTS	M	BREAKER POINT SPRING
D	COIL POSITIVE TERMINAL	N	SPRING CLIP SCREW
E	RECEPTACLE OR FILTER CABLE	P	BASE
F	IGNITION COIL	Q	DRIVE SHAFT COLLAR
G	CABLE CLIPS	R	ALIGNING MARKS
H	COIL BRACKET SCREWS	S	RECEPTACLE
J	ROTOR	T	RECEPTACLE SCREWS

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Figure 93. Aligning marks on distributor.

- (3) Install the spark advance arm screw through the slot in the spark advance arm and into the tapped hole in the cylinder block. Tighten the screw fingertight.
- (4) Connect the two vent lines at the elbows in the distributor base, tightening the vent line nuts.
- (5) Install the No. 1 spark plug. Insert the spark plug cable elbow terminals in the spark plugs. Be sure to connect each cable to the correct plug, following the firing order shown in figure 91. Tighten the cable elbow nuts. Adjust the ignition timing (par. 126).

c. Remove Distributor Vent Lines.

- (1) Remove the bolt and lockwasher that secure the distributor vent line tension clip to the cylinder head cap screw.
- (2) Disconnect the distributor vent lines at the elbows in the distributor base and the air cleaner elbow by unscrewing



the vent line nuts. Remove vent lines. Separate the vent lines from the tension clip.

*d. Inspect Distributor Vent Lines and Related Parts.*

- (1) Inspect distributor vent lines for cracks, kinks, damaged threads, or other visual damage. Replace lines as necessary.
- (2) Inspect the two vent line elbows at the air cleaner elbow and the two vent line elbows at the distributor base for damaged threads or other visual damage. If either of the elbows in the distributor require replacement, remove the damaged elbow and install a new  $\frac{3}{16}$ -inch, 90°,  $\frac{1}{8}$ -inch male pipe end, inverted flared tube elbow. If the elbows in air cleaner elbow require replacement, replace them (par. 135*d*). Tighten.

*e. Install Distributor Vent Lines.*

- (1) Install the two distributor vent lines, connecting them to the elbows in the distributor base and the air cleaner elbow (fig. 101 or 103). Tighten the vent line nuts.
- (2) Engage the two vent lines in the tension clip, position the clip over the cylinder head cap screw, and install the  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -24NF x  $\frac{1}{2}$  bolt. Tighten the bolt.

## 126. Ignition Timing

*a. General.* Efficient performance of the engine depends upon correct ignition timing. Under ideal conditions, the spark should occur at two degrees after top dead center on the compression stroke of the piston. However, in extremely high or extremely low altitudes, ignition timing may be changed to occur as early as two degrees before top dead center, or as late as six degrees after top dead center. Under no conditions should these limits be exceeded.

*b. Connect Timing Light.* Remove the spark plug cable from the No. 1 spark plug and install the timing light adapter 17-A-2967-50 (fig. 94) on the threaded end of the spark plug. Connect the spark plug cable to the adapter. If the timing light is of the two-lead-type, attach one of the leads to the adapter terminal (fig. 94) and attach the other lead to one of the cylinder head cap screws for a ground.

*Note.* If the timing light is of the three-lead-type, connect the primary lead of the light to an outside 6 or 12-volt battery and connect the secondary leads as described above.

*c. Time Ignition.* With the timing light (fig. 95) connected (*b* above), make a narrow chalk mark 2 degrees before the DC mark on the fan drive pulley.

- (1) Start the engine and run at idle speed.
- (2) Aim the timing light at the timing pointer (fig. 95). Observe the chalk mark on the fan drive pulley with respect to the timing pointer at the instant the timing light flashes. The

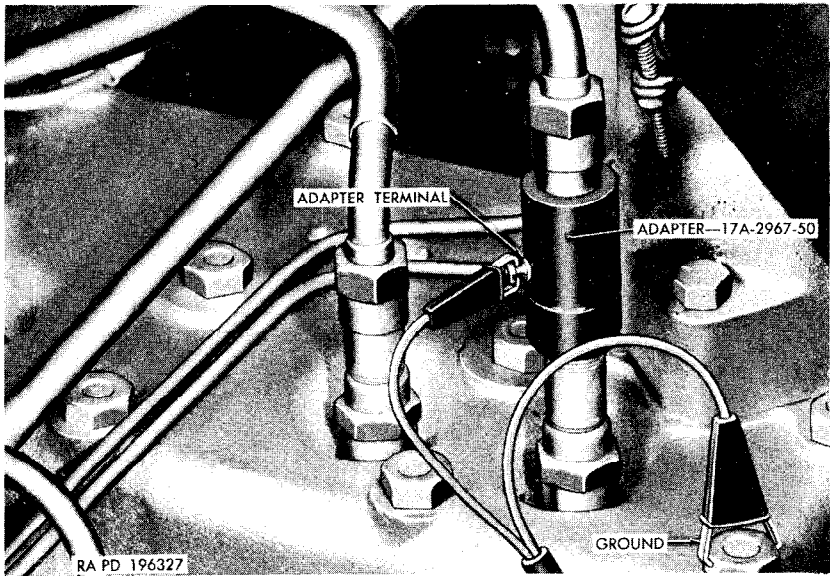


Figure 94. Timing light adapter 17-A-2967-50 installed.

light should flash the instant the chalk mark is directly under the timing pointer. If the timing light indicates adjustment is necessary, loosen the screw that secures the spark advance arm to the cylinder block and rotate the distributor clockwise to retard the spark, or counterclockwise to advance the spark. Tighten the spark advance arm screw after correct adjustment has been made.

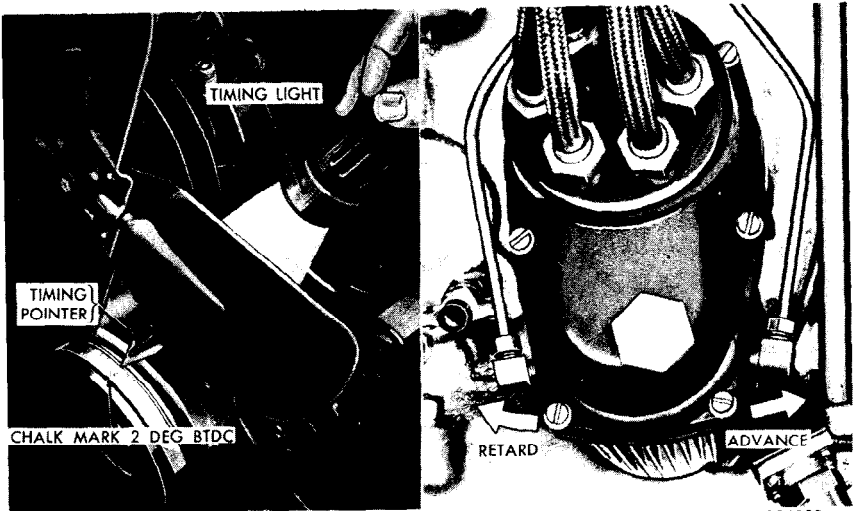
*d. Check Automatic Spark Advance.* Accelerate the engine and observe the chalk mark on the fan drive pulley. As the engine speed increases, the timing light flash should occur before the chalk mark is opposite the pointer, indicating that the automatic spark advance is satisfactory. If the spark advance is not satisfactory, replace the distributor (par. 125).

## 127. Distributor Cover and Cap

*Note.* The key letters noted in parentheses are in figure 96.

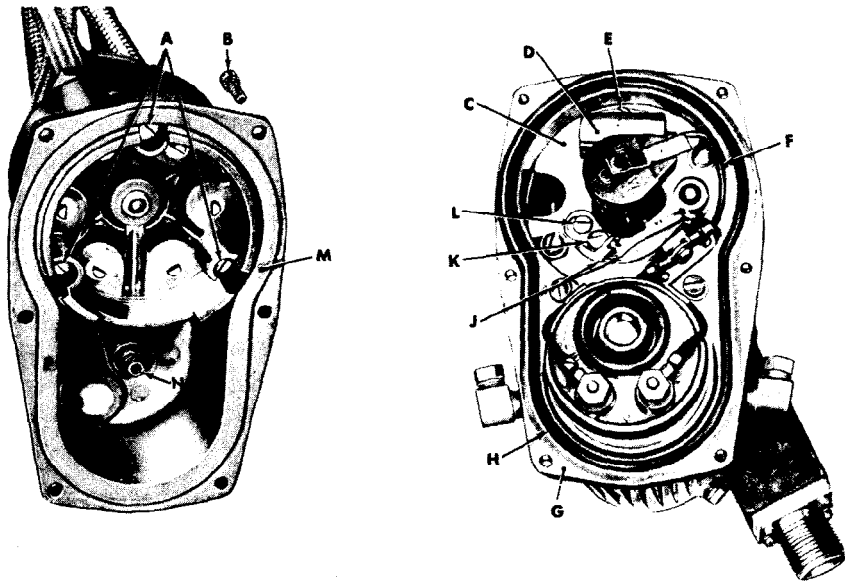
### *a. Removal.*

- (1) Remove the distributor (par. 125a).
- (2) Remove the six cap cover lockwasher screws (B) and separate the cover (M) from the base (G). Remove the cover O-ring packing (H). Remove the cover plug and the plug O-ring packing.
- (3) Unscrew the spark plug cable nuts from the cover and remove the cables.



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Figure 95. Checking ignition timing.



- | KEY | ITEM                       |
|-----|----------------------------|
| A   | CAP LOCKWASHER SCREWS      |
| B   | COVER LOCKWASHER SCREWS    |
| C   | BREAKER PLATE              |
| D   | CAPACITOR                  |
| E   | CAPACITOR LOCKWASHER SCREW |
| F   | CAPACITOR CABLE            |
| G   | BASE                       |
| M   | CAP COVER                  |

- | KEY | ITEM                           |
|-----|--------------------------------|
| H   | COVER "O" RING PACKING         |
| J   | BREAKER POINTS                 |
| K   | BREAKER POINT LOCKWASHER SCREW |
| L   | BREAKER POINT ADJUSTING SCREW  |
| N   | CAP SPRING                     |
| P   | CAP                            |

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Figure 96. Distributor base and cover.

- (4) Remove the three distributor cap lockwasher screws (A) and remove the cap (P) from the cover. Remove the cap spring (N) and the six cap sealing washers (fig. 97).

*b. Inspection.*

- (1) Inspect the cap cover for cracks or damaged threads. Replace cover if necessary.
- (2) Inspect the cap for cracks, excessively burned rotor contact surfaces, or other visual damage. Inspect the cap sealing washers for damage or deterioration. Replace the washers and cap if necessary.
- (3) Inspect the cap spring for breaks or distortion. Replace spring if necessary.
- (4) Inspect cover O-ring packing for deterioration or other visual damage. Replace packing if necessary.
- (5) Inspect the cap cover plug for damaged threads. Replace cover plug and O-ring packing if necessary.

*c. Installation.*

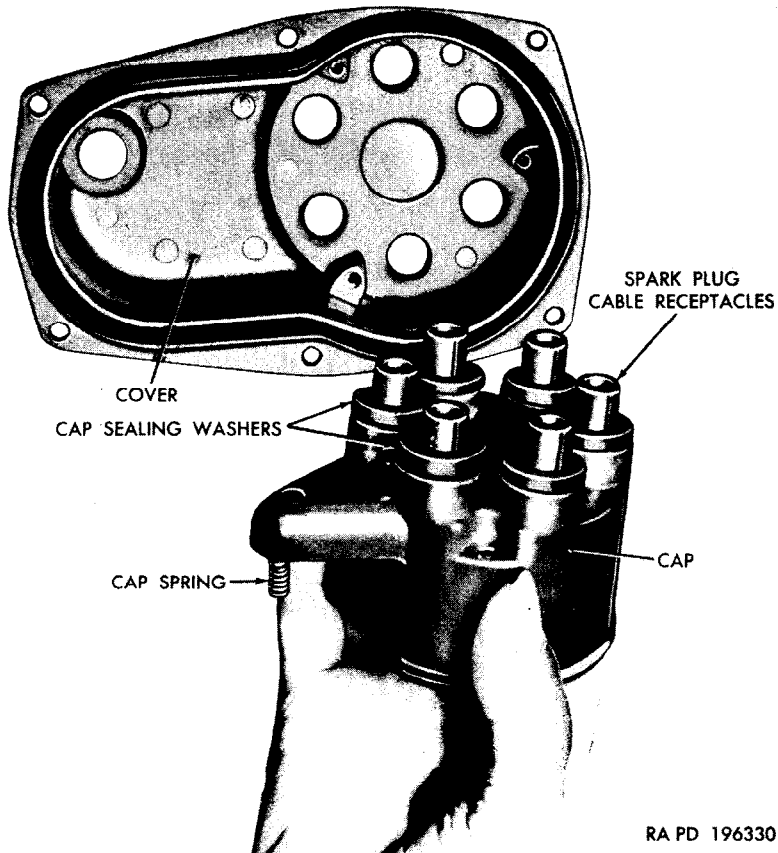
*Note.* The key letters noted in parentheses are in figure 96, except where otherwise indicated.

- (1) Install the cap spring (N) on the spring retainer.
- (2) Place a cap sealing washer on each of the six spark plug cable receptacles (fig. 97). Install the cap cover over the distributor cap. Invert the cover and install the three No. 8-32 NC x 1 internal-teeth lockwasher screws (A) in the cap (P). Tighten the screws.
- (3) Install spark plug cables in distributor cap cover (par. 124 *c* (1)).
- (4) Position the cover O-ring packing (H) on the base (G).
- (5) Position the cap cover (M) on the base and install the six cover lockwasher screws (B). Tighten the screws evenly.
- (6) Install the cap cover plug O-ring packing and plug. Tighten the plug.
- (7) Install distributor (par. 125*b*).
- (8) Adjust ignition timing (par. 126).

## **128. Distributor Rotor, Breaker Points, and Capacitor**

*a. Removal.*

- (1) Remove distributor (par. 125*a*).
- (2) Remove cap cover (par. 127*a*(2)).
- (3) Pull the rotor (J, fig. 93) from the distributor shaft.
- (4) Remove the spring clip screw (N, fig. 93), lockwasher, and plain washer that secure the breaker spring clip to the breaker plate and remove the breaker spring clip (K, fig. 93). Remove the breaker point lockwasher screw (K, fig. 96) and remove the breaker points.



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*Figure 97. Installing distributor cap in cover.*

- (5) Remove the capacitor lockwasher screw and capacitor (D and E, fig. 96). Discard the capacitor.

*b. Inspection.*

- (1) Inspect the rotor for cracks, broken contact, or excessive burning. Replace the rotor if necessary.
- (2) Inspect the breaker points for pitting, burning, or oxidation. Recondition the points or replace as necessary.

*c. Installation.*

- (1) Position the capacitor as shown in figure 96, and install a No. 6-32NC x  $\frac{3}{16}$  internal-teeth lockwasher screw. Tighten the screw.
- (2) Install the adjustable breaker point with elongated hole over the breaker point adjusting screw (L, fig. 96). Install a No. 8-32NC x  $\frac{3}{16}$  internal-teeth lockwasher screw. Tighten the screw.
- (3) Apply a drop of light engine oil to the pivot pin (L, fig. 93) and install the stationary breaker point on the breaker plate

pivot pin, with the spring at the inner side (rotor-cam side) of the clip post.

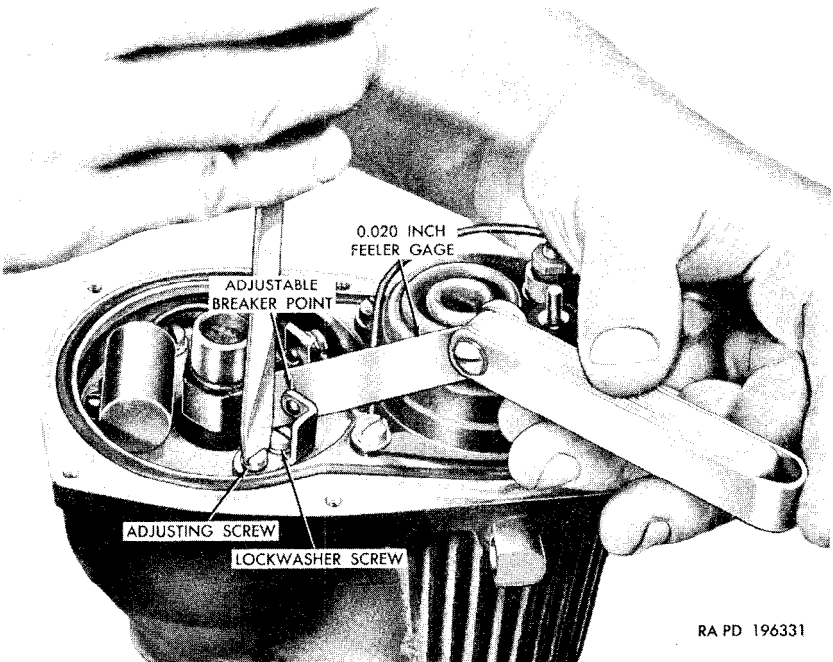
- (4) Position the breaker spring clip (K, fig. 93) over the breaker point spring (M, fig. 93), alining the holes in the clip, the spring, and the clip post. Aline the capacitor cable terminal and the breaker point cable terminal with the clip post hole. Install a No. 6 lockwasher on a No. 6-32NC x  $\frac{5}{16}$  screw, followed by a No. 6 flat washer. Install the spring clip screw (N, fig. 93) with washers through the cable terminals, clip post hole of the breaker spring clip (K) and the breaker point spring, and tighten the screw into the clip.
- (5) Install the rotor (J) on the distributor shaft.
- (6) Adjust breaker point gap (par. 129).
- (7) Install cap cover (par. 127c(5)).
- (8) Install distributor (par. 125b).
- (9) Adjust ignition timing (par. 126c).

## 129. Distributor Breaker Point Adjustment

*a. General.* Whenever adjustment of the ignition distributor breaker points is necessary, remove the distributor (par. 125a).

*b. Adjustment* (fig. 98).

- (1) Remove distributor (par. 125a).
- (2) Remove cap cover (par. 127a(2)).



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Figure 98. Adjusting distributor breaker points.

- (3) Rotate the distributor drive shaft until the points are at maximum open position. Loosen the adjustable breaker point lockwasher screw enough to permit movement of the adjustable breaker point. Insert a 0.020-inch thickness gage between the breaker point contacts. Turn the breaker point adjusting screw in either direction to obtain the 0.020-inch clearance. Tighten the breaker point lockwasher screw.
- (4) Install cap cover (par. 127c(5)).
- (5) Install distributor (par. 125b).
- (6) Adjust ignition timing (par. 126c).

### 130. Ignition Coil, Filter, and Receptacle

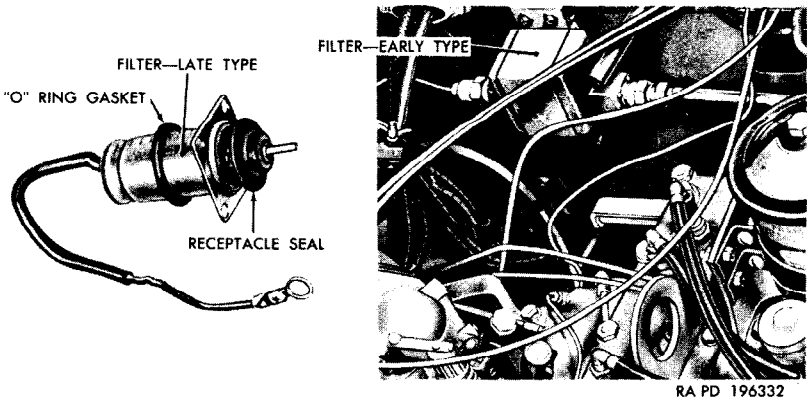
*a. General.* Two types of ignition filters (fig. 99) have been used in the vehicles (par. 6(12)). The service information contained herein includes the removal and installation of the filter which is assembled into the distributor. For replacement of the filter located on the cowl, refer to paragraph 277.

*b. Remove Ignition Coil (fig. 93).*

- (1) Remove the distributor (par. 125a).
- (2) Remove cap cover (par. 127a(2)).
- (3) Remove the two nuts and lockwashers from the ignition coil positive (+) and negative (-) terminals (B and D). Remove the two cables (A and E) from the terminals.
- (4) Remove the two lockwasher screws that secure the coil. Remove the two cable clips (if provided) and the ignition coil (F).

*c. Remove Receptacle and Filter.*

- (1) Remove the four lockwasher screws attaching the receptacle to the distributor base (P, fig. 93). Remove the receptacle. On vehicles equipped with the ignition filter on the dash, remove the receptacle gasket.



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Figure 99. Ignition filters.

- (2) Remove the ignition filter, if vehicle is so equipped. Remove the receptacle seal and the O-ring gasket from the filter (fig. 99).

*d. Inspect Ignition Coil, Receptacle, and Filter.*

- (1) Inspect the ignition coil for cracked or damaged casing, loose or damaged bracket, damaged terminal threads, or corrosion damage. Clean the terminals or replace coil as necessary.
- (2) Inspect the receptacle for cracks, damaged threads, or other visual damage. Inspect the cable and insulation for breaks or deterioration. Replace receptacle if necessary.
- (3) On vehicles so equipped, inspect the filter cable and insulation, and receptacle seal and gasket for breaks or deterioration. Inspect the filter for damaged casing or distorted flange. Replace filter, gasket, or seal if necessary.
- (4) Inspect the cable clips (on vehicles so equipped) for distortion or other visual damage. Replace clips if necessary.

*e. Install Ignition Coil, Receptacle, and Filter.*

- (1) On vehicles with the filter in the distributor (fig. 93), install the O-ring gasket and receptacle seal on the filter. Insert the filter cable into the distributor base and position the filter flange on the base. Install the receptacle and the four No. 6-32NC x  $\frac{3}{8}$  internal-teeth lockwasher screws. Tighten the screws.
- (2) On distributors without the filter, position the receptacle gasket on the distributor base, insert the receptacle cable in the base, and position the receptacle and gasket. Install the four lockwasher screws ((1) above).
- (3) Arrange the cable in the base so that it will not interfere with installation of the coil.
- (4) Install the coil in the base, aligning the screw holes in the bracket with those in the distributor base (P, fig. 93). Connect the cable from the filter or receptacle to the positive (+) terminal of the coil (D, fig. 93) and connect the breaker plate cable to the negative (-) terminal of the coil (B, fig. 93). Install a No. 10 lockwasher and No. 10-32NF nut on each terminal.
- (5) Position a cable clip (G, fig. 93) over each cable, aligning the clips with the screw holes in the coil bracket. Install the two No. 10-32NF x  $\frac{7}{16}$  internal-teeth lockwasher screws through the holes in the cable clips and coil bracket. Tighten the screws.
- (6) Install distributor cap cover (par. 127c).
- (7) Install distributor (par. 125b).



## 131. Ignition Switch

### *a. Removal.*

- (1) Disconnect the battery-to-ground cable from the negative (-) post of the outer battery to prevent accidental grounding.
- (2) Remove the screw and lockwasher that attach the ignition switch (BB, fig. 12) to the switch and remove the lever.
- (3) Remove the nut and lockwasher that secure the ignition switch to the instrument panel.
- (4) Disconnect cables 11, 12, and 27 at the cable connectors and remove the switch.

### *b. Installation.*

- (1) Connect cables 11, 12, and 27 to the ignition switch cables, matching the cable numbers.
- (2) Insert the switch in the opening in the instrument panel, aligning the switch housing pin with the hole in the instrument panel, and install the 1/2-inch internal-teeth lockwasher and 1/2-20NF nut. Tighten nut.
- (3) Install the ignition switch (BB, fig. 12) on the switch and install the No. 8 lockwasher and No. 8-32NC x 3/8 screw. Tighten screw.
- (4) Connect the battery-to-ground cable to the negative (-) post of the outer battery.

## Section VIII. FUEL AND AIR INTAKE AND EXHAUST SYSTEMS

### 132. Description and Data

#### *a. Description.*

- (1) The fuel and air intake system includes the fuel tank, carburetor, carburetor air cleaner, air cleaner elbow, fuel filter, fuel pump, connecting fuel and vent lines, and carburetor controls and linkage. Vent lines from the air cleaner elbow to the oil filler pipe, distributor, fuel tank, and brake master cylinder provide filtered air and protection from water for these units.
- (2) The exhaust system includes the upper and lower exhaust pipes, the muffler, and tailpipe, with supports and attaching parts.
- (3) Organizational maintenance includes adjustment of the carburetor, carburetor controls and linkage, servicing of the air cleaner, and replacement of unsatisfactory parts or assemblies in the systems.

*b. Data.*

**Exhaust system :**

Exhaust pipes (upper and lower)

Connections :

Inside diameter----- 2 in.  
Outside diameter----- 2 in.

**Muffler :**

Diameter----- 5 $\frac{1}{16}$  in.  
Length (including connections)----- 20 $\frac{1}{2}$  in.  
Make----- Noblitt Sparks  
Type----- straight through with restrictor

**Tail pipe :**

Connections (inside diameter)----- 1 $\frac{3}{4}$  in.  
Length :  
Cargo truck M37, command truck M42----- 42 $\frac{7}{8}$  in.  
Ambulance truck M43, telephone maintenance truck V-41----- 28 $\frac{7}{8}$  in.

**Fuel and air intake system :**

**Air cleaner :**

Make----- AC  
Model----- AC D-82072  
Type----- oil bath

**Carburetor :**

Adjustments----- idle mixture, idle speed  
Make----- Carter  
Model----- ETW-1  
Nominal size----- 1 $\frac{1}{2}$  in.  
Type----- downdraft

**Fuel filter :**

**Location :**

Early vehicles----- regulator mounting bracket  
Late vehicles----- in fuel tank

**Make :**

Early vehicles----- Zenith  
Late vehicles----- Skinner

**Model :**

Early vehicles----- F363X2-2  
Late vehicles----- R-32-63

**Fuel pump :**

Drive----- camshaft  
Make----- AC  
Model----- GP21181  
Pressure----- 4 to 5 $\frac{1}{4}$  psi  
Type----- mechanical

**Fuel tank :**

Capacity----- 24 gal  
Fillercap----- pressure-type  
Filler pipe----- telescopic-type  
Location----- rear of frame  
Vent----- line to air cleaner elbow

**Governor :**

Factory setting----- 3,400 rpm  
Type----- velocity—integral with carburetor

### 133. Carburetor Air Cleaner

*a. Description.* The carburetor air cleaner is an oil bath-type with a replaceable element (fig. 100). Its purpose is to remove dirt and other foreign matter from the air before it enters the carburetor. The air cleaner shroud provided on vehicles of early manufacturers was discontinued on later vehicles (par. 6). Maintenance of both types of air cleaner is described in this section.

*b. Servicing.* Servicing of the carburetor air cleaner is part of the lubrication service. It should be performed as frequently as operating conditions require.

- (1) On air cleaners equipped with a shroud, loosen the three shroud wing nuts attaching the shroud cover to the shroud base. Disengage the eye bolts from the retainer brackets and remove the shroud cover with gasket.
- (2) Loosen the wing nut on top of the air cleaner element and remove the reservoir and element as a unit.
- (3) Lift the element from the reservoir.
- (4) Remove the oil from the reservoir and clean both the element and the reservoir with volatile mineral spirits or dry-cleaning solvent and dry with compressed air.
- (5) Install the reservoir on the air cleaner retainer.

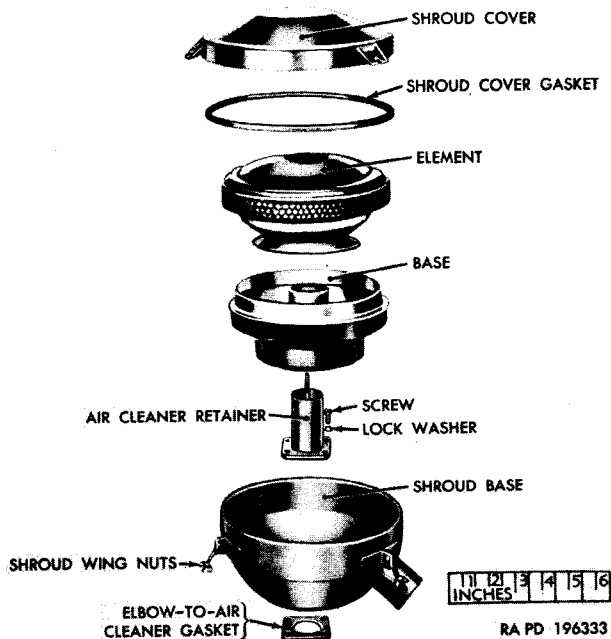


Figure 100. Carburetor air cleaner with shroud—exploded view.

- (6) Fill the reservoir to the oil level mark with specified lubricant. Refer to lubrication order (figs 33 and 34).
- (7) Install the element in the reservoir and tighten the wing nut on top of the element.
- (8) On vehicles so equipped, install a new shroud cover gasket, if necessary, and position cover on shroud base, alining the cover retainer brackets with the eyebolts attached to the base, and tighten the three wing nuts.

*c. Removal.*

- (1) Remove the air cleaner element and reservoir (b (1) and (2) above).
- (2) Remove the four screws and lockwashers attaching the air cleaner retainer, shroud base (on vehicles so equipped), and gasket to the air cleaner elbow. Remove the retainer, shroud base, and gasket. Discard the gasket.

*d. Inspection.* Inspect the air cleaner and related parts for distortion, corrosion damage, or other visual damage. Replace parts as necessary.

*e. Installation.*

- (1) Install a new elbow-to-air cleaner gasket (fig. 100) on the air cleaner elbow, alining the screw holes.
- (2) On vehicles so equipped, position the shroud base on the gasket with the snorkel extension toward the right fender.
- (3) Position the air cleaner retainer in the shroud base or on the elbow-to-air cleaner gasket, alining screw holes. Install four  $\frac{5}{16}$ -inch external-teeth lockwashers and  $\frac{5}{16}$ -18NC x  $\frac{3}{4}$  fillister-head screws. Tighten screws.
- (4) Install the air cleaner reservoir, element, and shroud cover (b(7) and (8) above).

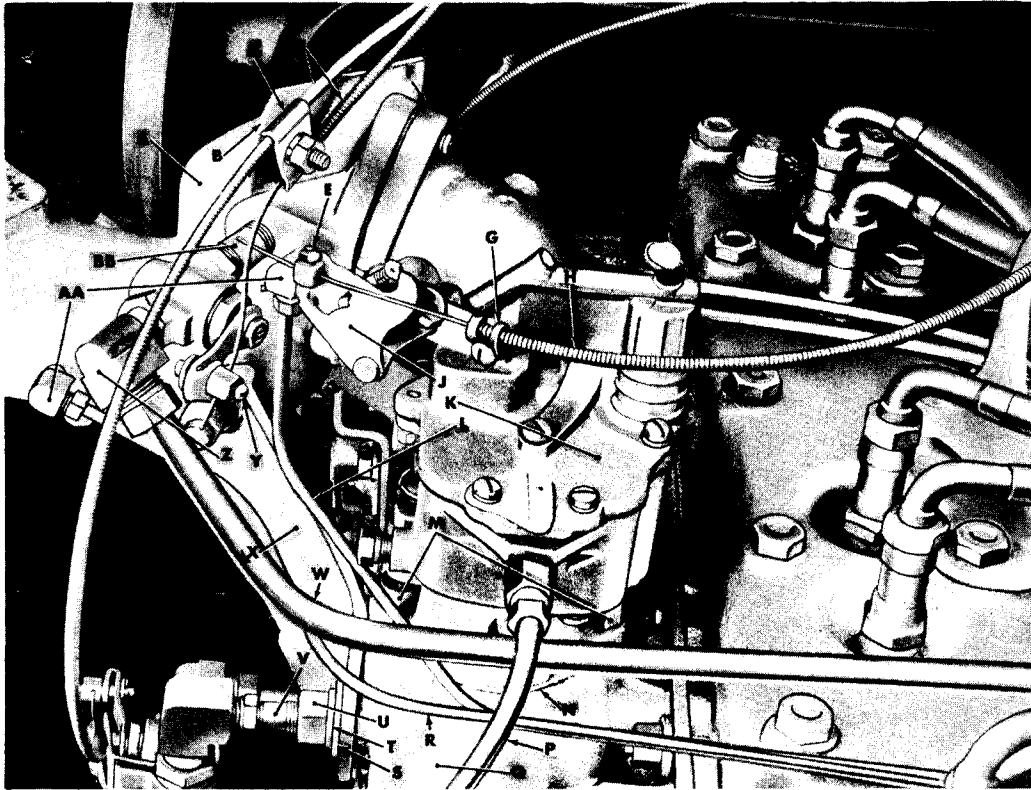
### 134. Carburetor Adjustments

*a. Adjust choke control.* Loosen the choke control swivel screw (E, fig. 101). Push the choke control bracket to the fully closed position and if sufficient clearance does not exist between bracket and control conduit, loosen the screw at the choke control clip (G, fig. 101) and push the conduit back. Tighten screw. Push the choke control (Y, fig. 12) all the way in. Hold the choke control bracket (J, fig. 101) to the fully open position (toward air cleaner) and tighten the choke control swivel screw (E, fig. 101).

*b. Adjust Throttle Control.*

*Note.* The key letters noted in parentheses are in figure 102.

- (1) Loosen the nut (K) on the throttle control bellcrank to carburetor rod (M). Disengage the bellcrank rod by removing the cotter pin (Q) and plain washer (P).
- (2) Push the throttle control (H, fig. 12) all the way in and loosen the lever swivel screw (L).



KEY	ITEM
A	AIR CLEANER ELBOW
B	CONTROL SUPPORT PLATE
C	TENSION CLIP
D	CRANKCASE VENTILATION SHUT-OFF VALVE CONTROLS
E	CHOKE CONTROL SWIVEL SCREW
F	GASKET
G	CHOKE CONTROL CLIP
H	CHOKE CONTROL
J	CHOKE CONTROL BRACKET
K	CARBURETOR
L	CYLINDER VENT LINE
M	NUTS
N	CARBURETOR MOUNTING GASKET
P	FUEL PUMP-TO-CARBURETOR FUEL LINE
Q	INTAKE MANIFOLD
R	FUEL TANK VENT LINE
S	PLAIN WASHER
T	LOCK WASHER
U	NUT
V	METERING VALVE NIPPLE
W	OIL FILLER PIPE VENT LINE
X	ELBOW FRONT SUPPORT BRACKET
Y	SHUT-OFF VALVE LEVER SWIVEL SCREW
Z	INVERTED FLARED TUBE ELBOW
AA	INVERTED FLARED TUBE ELBOW
BB	PIPE NIPPLE

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*Figure 101. Carburetor (late type) and air cleaner elbow.*

- (3) Unscrew idle speed adjusting screw until throttle is fully closed.
- (4) Hold throttle lever at carburetor in closed position and turn the carburetor rod (M) either in or out of the ball joint (J) until the offset of the rod is one-sixteenth of an inch above the hole in the bellcrank (N).

*Note.* The carburetor rod must be adjusted one-sixteenth of an inch above the hole in the bellcrank to insure spring tension on the throttle controls in the closed position.

- (5) Attach the rod to the bellcrank and secure with a  $\frac{7}{32}$ -inch plain washer (P) and  $\frac{3}{32} \times \frac{3}{4}$  cotter pin (Q). Tighten the nut (K) on the throttle control bellcrank to carburetor rod (M). Start the engine and adjust the idle speed (par. 111b).
- (6) Hold the throttle hand control lever toward the front of the engine until it contacts the stop; tighten the lever swivel screw (L). Pull the throttle control (H, fig. 12) all the way out to make certain there is sufficient clearance between the control conduit and the lever swivel. Adjust the conduit in the throttle control clip (S), if necessary.

*c. Adjust Carburetor.* Adjustment of the carburetor idle mixture and idle speed must be accomplished with the use of a vacuum gage (par. 111).

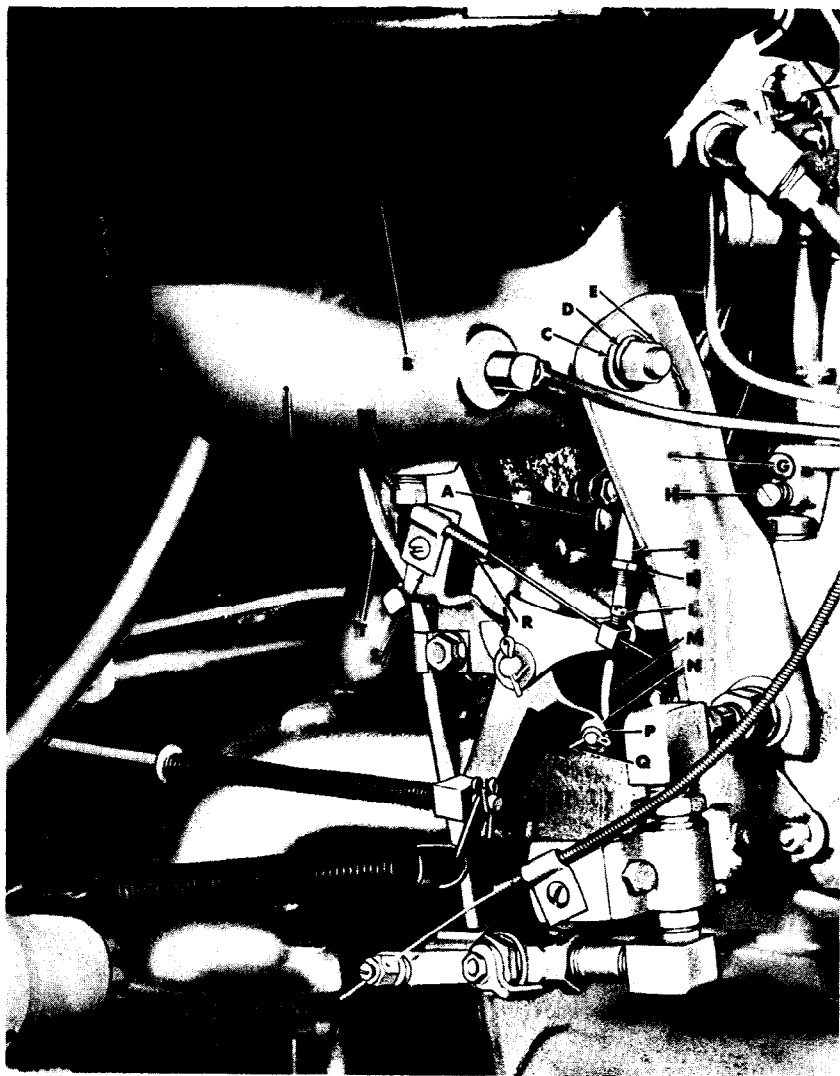
### 135. Air Cleaner Elbow

*Note.* The key letters noted in parentheses are in figure 101, except where otherwise indicated.

*a. General.* The air cleaner elbow connects the air cleaner to the carburetor. Two types of elbow have been used. The design of the air cleaner elbow was changed to relocate vent line connections (par. 6). Figure 103 shows the early-type elbow, with the various fittings and their locations. When servicing the vent lines or connecting fittings, make certain that correct fittings are used and that the lines are connected to their respective fittings.

#### *b. Removal.*

- (1) Remove air cleaner (par. 133c).
- (2) Disconnect the oil filter pipe vent line (W) at the inverted flared tube elbow (Z).
- (3) On engines equipped with crankcase ventilation shutoff valves, loosen the shutoff valve lever swivel screw (Y) and the screw that secures the tension clip (C), and disengage the control from the oil filler pipe vent line shutoff valve lever swivel.
- (4) Disconnect the brake master cylinder vent line (L) and the fuel tank vent line (R) from the inverted flared-tube elbows (AA) or from the special two-opening elbow (fig. 103).



KEY	ITEM
A	—IDLE SPEED ADJUSTING SCREW
B	—AIR CLEANER
C	—PLAIN WASHER
D	—LOCK WASHER
E	—NUT
F	—STUD
G	—ELBOW FRONT SUPPORT BRACKET
H	—IDLE MIXTURE SCREW
J	—BALL JOINT
K	—NUT

KEY	ITEM
L	—LEVER SWIVEL SCREW
M	—BELLCRANK TO CARBURETOR ROD
N	—BELLCRANK
P	—PLAIN WASHER
Q	—COTTER PIN
R	—THROTTLE CONTROL
S	—THROTTLE CONTROL CLIP
T	—ELBOW SUPPORT BRACKET
U	—PIPE PLUG
V	—AIR CLEANER ELBOW

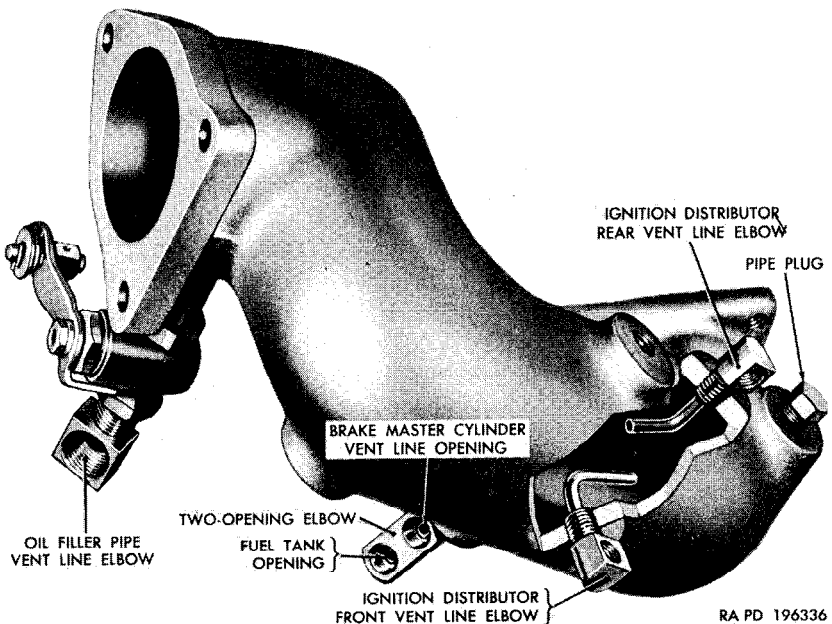
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*Figure 102. Throttle controls.*

- (5) Disconnect the distributor front and rear vent lines (E and F, fig. 104) at the inverted flared tube elbows (D and P, fig. 104, and fig. 103).
- (6) Remove the screw, lockwasher, and plain washer attaching the elbow support bracket (T, fig. 102) to the intake manifold.
- (7) Remove the three nuts and lockwashers (B, fig. 104) from the studs (C, fig. 104) attaching the elbow to the carburetor air horn (G, fig. 104). If the engine is equipped with crankcase ventilation shutoff valves, remove the control support plate (B), with attached controls.
- (8) Loosen the nut (U) on the metering valve nipple (V) sufficiently to free the elbow front support bracket (X). Remove the air cleaner elbow and support brackets. Remove and discard the carburetor air horn to air cleaner elbow gasket (F).

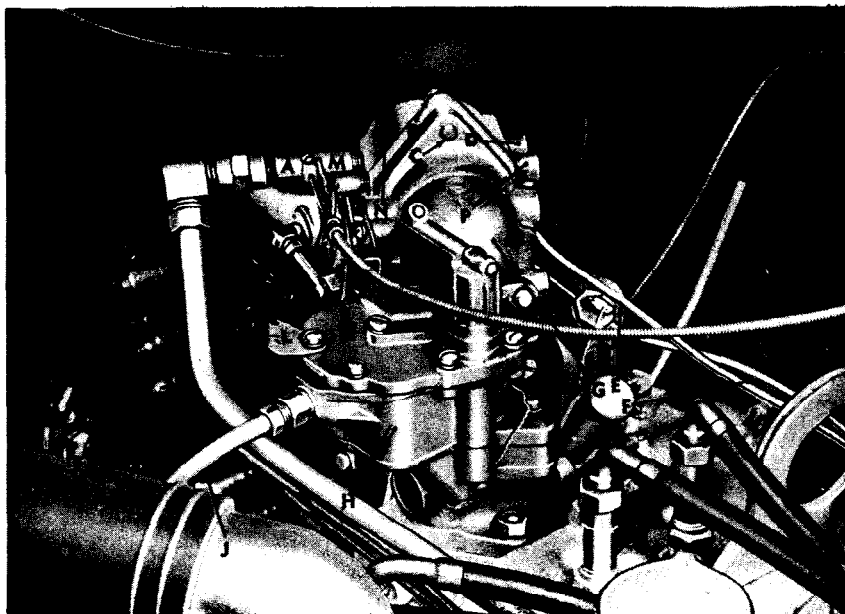
*c. Inspection.*

- (1) Clean the machined surfaces of the air cleaner elbow and the carburetor air horn, and inspect for scratches and other visual damage. Inspect the three studs in the air horn for damaged threads or looseness. Tighten loose studs; remove damaged studs. If the carburetor air horn machined support surface is damaged, replace the carburetor (par. 137).



*Figure 103. Early-type air cleaner elbow, with fittings.*





KEY	ITEM	KEY	ITEM
A	AIR CLEANER	H	CARBURETOR
B	NUT AND LOCK WASHER	J	FUEL PUMP-TO-CARBURETOR FUEL LINE
C	STUD	K	MASTER CYLINDER VENT LINE
D	INVERTED FLARED TUBE ELBOW	L	OIL FILLER PIPE VENT LINE
E	DISTRIBUTOR FRONT VENT LINE	M	FUEL TANK VENT LINE
F	DISTRIBUTOR REAR VENT LINE	N	AIR CLEANER ELBOW
G	CARBURETOR AIR HORN	P	INVERTED FLARED TUBE ELBOW

RA PD 196337

*Figure 104. Air cleaner elbow disconnect points.*

- (2) Inspect the two air cleaner support brackets for broken welds and distortion. If either support bracket or bracket stud must be replaced, remove the nut, lockwasher, and plain washer that attach each bracket and remove the elbow front support bracket (G, fig. 102).
- (3) Inspect the air cleaner elbow for cracks and loose or damaged support bracket studs. Tighten loose studs; remove damaged studs. Replace a damaged air cleaner elbow.
- (4) Inspect the pipe nipple (BB) and other parts that connect the oil filler pipe vent line to the air cleaner elbow. These items are described in paragraph 117.
- (5) Inspect the vent line inverted flared tube elbows for cracks and other damage. Inspect the offset tubes in the air cleaner elbow which are part of the distributor vent line inverted flared tube special elbows for restriction, damage, cracks, or unsatisfactory welds. Remove any elbows that are unfit for further service.
- (6) If the pipe plug (U, fig. 102 or fig. 103) is damaged, remove the plug.

*d. Installation.*

- (1) If the pipe plug (U, fig. 102 or fig. 103) was removed (c(6) above), install a  $\frac{1}{8}$ -inch pipe plug.
- (2) Install the two inverted flared tube special elbows for the distributor front and rear vent lines (D and P, fig. 104). The elbows for the late-type air cleaner elbow are not interchangeable. When the elbows are installed, the tubes extending inside the air cleaner elbow must face in opposite directions.
- (3) For the late-type air cleaner elbow, install the two  $\frac{3}{16}$ -inch, 90°,  $\frac{1}{8}$ -inch male pipe end inverted flared tube elbows (AA) for the brake master cylinder and fuel tank vent lines. For the early-type air cleaner elbow, install the special two-opening elbow (fig. 103) for these vent lines.
- (4) If the pipe nipple (BB, fig. 101) and other fittings were removed (c(5) above), install the parts. Refer to paragraph 117.
- (5) If the support bracket studs were removed (c(2) above), install the two  $\frac{3}{8}$ -16NC x  $\frac{3}{8}$ -24NF x  $1\frac{5}{16}$  studs, and tighten. Install the elbow support bracket (T, fig. 102) on the rear stud, and install the  $1\frac{3}{32}$ -inch plain washer and  $\frac{3}{8}$ -24NF nut. Install the front support bracket in the same manner.
- (6) If the three studs were removed from the carburetor air horn (c(1) above), install the three  $\frac{5}{16}$ -18NC x  $\frac{5}{16}$ -24NF x  $1\frac{3}{8}$  studs, and tighten.
- (7) Install a new air horn to air cleaner elbow gasket over the three studs on the air horn. Install the air cleaner elbow in position on the air horn, with the slotted end of the front support bracket (X) over the metering valve nipple (V) between the plain washer (S) and the intake manifold (Q).
- (8) If the engine is equipped with crankcase ventilation shutoff valves, install the control support plate (B) on the upper air horn stud and install the three  $\frac{5}{16}$ -inch lockwashers and  $\frac{5}{16}$ -24NF nuts (B, fig. 104).
- (9) Position the elbow support bracket (T, fig. 102) on the intake manifold and install a  $\frac{3}{8}$ -16NC x  $\frac{3}{4}$  cap screw,  $\frac{3}{8}$ -inch lockwasher, and  $1\frac{3}{32}$ -inch plain washer.
- (10) Tighten the cap screw that secures the elbow support bracket, the nut (U) that secures the front support bracket, and the three nuts that secure the elbow to the carburetor air horn.
- (11) Connect the distributor front vent line (E, fig. 104) to the inverted flared tube elbow (P, fig. 104 or fig. 103). Connect the distributor rear vent line (F, fig. 104) to the inverted flared tube elbow (D, fig. 104 or fig. 103). Tighten the vent line nuts.

- (12) Connect the master cylinder vent line (L) to the inverted flared tube elbow (AA) or to the inner opening of the special two-opening elbow (fig. 103). Connect the fuel tank vent line (R) to the other inverted flared tube elbow (AA) or to the outer opening of the special two-opening elbow (fig. 103). Tighten the vent line nuts.
- (13) On engines equipped with crankcase ventilation shutoff valves, insert the control wire for the oil filler pipe vent line shutoff valve in the swivel on the valve lever. Engage the two shutoff valve controls in the tension clip (C) on the control support plate (B). Adjust the shutoff valve controls (par. 118e) before tightening the swivel screw or the tension clip screw.
- (14) Connect the oil filler pipe vent line (W) to the inverted flared tube elbow (Z). Tighten the vent line nut.
- (15) Install the air cleaner (par. 133e).

### 136. Carburetor and Air Cleaner Elbow

*Note.* The key letters noted in parentheses are in figure 101, except where otherwise indicated.

*a. General.* If replacement of the manifolds or manifold gaskets is necessary, remove the carburetor, air cleaner elbow, and related parts, as a unit.

*b. Removal.*

- (1) Remove the air cleaner (par. 133c).
- (2) Remove heat shield (par. 138b(5)).
- (3) Remove the fuel pump to carburetor fuel line (J, fig. 104).
- (4) On engines equipped with crankcase ventilation shutoff valves, loosen the swivel screw (Y) and the screw securing the tension clip (C) to the control support plate (B). Disengage the two shutoff valve controls (D) from the tension clip and remove the control wire from the swivel on the oil filler pipe vent line shutoff valve lever.
- (5) Loosen the choke control swivel screw (E) and the screw in the choke control clip (G). Move the choke control out of the way.
- (6) Remove the oil filler pipe vent line (W).
- (7) Disconnect the fuel tank vent line (R), master cylinder vent line (L), and the distributor front and rear vent lines (E and F, fig. 104) at the air cleaner elbow.
- (8) Disengage the throttle control bellcrank to carburetor rod (M, fig. 102) by removing the cotter pin (Q, fig. 102) and plain washer (P, fig. 102) at the bellcrank.
- (9) Remove the cap screw, lockwasher, and plain washer that attach the elbow support bracket (T, fig. 102) to the intake

manifold. Loosen the nut (U) on the metering valve nipple (V).

- (10) Remove the two nuts (M) that secure the carburetor on the studs in the intake manifold. Raise the carburetor slightly as the outer nut is removed, to provide clearance for the nut. Lift the carburetor and attached parts from the engine. Remove and discard the carburetor mounting gasket (N).
- (11) Inspect the two carburetor studs in the intake manifold for looseness and damaged threads. Tighten loose studs; replace damaged studs.

*c. Installation.*

- (1) Clean the mating surfaces of the carburetor and the intake manifold thoroughly.
- (2) If the studs in the intake manifold were removed (b(10) above), install the two  $\frac{3}{8}$ -16NC x 24NF x  $1\frac{1}{16}$  studs.
- (3) Install a new carburetor mounting gasket (N) on the intake manifold studs.
- (4) Place the carburetor and assembled parts in position, with the slotted end of the elbow front support bracket (X) over the metering valve to manifold nipple (V, fig. 101) between the plain washer (S) and the intake manifold (Q). Start the two  $\frac{3}{8}$ -24NF nuts (M) on the carburetor studs before lowering the carburetor all the way, as there is insufficient clearance for the outer nut. Do not tighten the nuts until the elbow support brackets have been secured.
- (5) Aline the elbow support bracket (T, fig. 102) over the screw hole in the intake manifold, and install the  $\frac{3}{8}$ -16NC x  $\frac{3}{4}$  cap screw,  $\frac{3}{8}$ -inch lockwasher, and  $1\frac{1}{32}$ -inch plain washer.
- (6) Tighten the nut (U) on the metering valve to intake manifold nipple (V) to secure the elbow front support bracket (X, fig. 101).
- (7) Tighten the cap screw that secures the elbow support bracket to the intake manifold and the two carburetor stud nuts M.
- (8) Connect the throttle control bellcrank to carburetor rod (M, fig. 102) to the bellcrank (par. 134b(5)).
- (9) Connect the two distributor vent lines, the master cylinder vent line, and the fuel tank vent line (135d(11) and (12)).
- (10) Install the oil filler pipe vent line (W). Tighten vent line nuts.
- (11) Install the choke control (H) through the control clip (G) and the control wire in the swivel on the choke control bracket (J). Adjust the choke control (par. 134a) before tightening the choke control swivel screw (E).
- (12) On vehicles so equipped, engage the crankcase ventilation shutoff valve controls (D) in the tension clip (C), and in-

sert the control wire in the swivel on the oil filler pipe shutoff valve lever. Adjust the shutoff valve dual control (par. 118e) before tightening the shutoff valve lever swivel screw (Y) and the tension clip screw.

- (13) Install the fuel pump-to-carburetor fuel line (J, fig. 104).
- (14) Install heat shield (par. 138d(7)). Tighten fuel line nuts.
- (15) Install the air cleaner (par. 133e).

## 137. Carburetor

### a. Removal.

- (1) Remove the carburetor, air cleaner elbow, and related parts (par. 136b).
- (2) Remove the three carburetor air horn to air cleaner elbow stud nuts and lockwashers (B, fig. 104). On vehicles equipped with crankcase ventilation shutoff valves, remove the control support plate (B, fig. 101). Remove the air cleaner elbow and gasket. Discard the gasket.

### b. Installation.

- (1) Position a new gasket on the carburetor air horn to air cleaner elbow studs.
- (2) Install the air cleaner elbow on the carburetor air horn studs. On vehicles equipped with crankcase ventilation shutoff valves, install the control support plate (B, fig. 101) on the upper stud. Install the three  $\frac{3}{8}$ -inch lockwashers and  $\frac{3}{8}$ -24NF nuts. Tighten nuts.
- (3) Install the carburetor, air cleaner elbow, and related parts (par. 136c).

## 138. Fuel Pump

*Note.* The key letters noted in parentheses are in figure 105.

*a. Test.* The fuel pump should deliver a pressure of 4 to  $5\frac{1}{4}$  psi. To measure the pressure, proceed as outlined below.

*Note.* On vehicles equipped with crankcase ventilation shutoff valve, dual control is pushed all the way in before making the test.

- (1) Disconnect the fuel pump to carburetor line at the carburetor, and install a tee fitting between the fuel line and the carburetor.
- (2) Attach a pressure gage to the tee.
- (3) Start the engine and run at idle speed. Observe the pressure registered by the gage. Pressure should be not less than 4 psi and should not exceed  $5\frac{1}{4}$  psi.
- (4) If fuel pump pressure is not within the specified limits, replace the fuel pump (b, c, and d below).
- (5) After performing the test, remove the gage and tee fitting and connect the fuel pump to carburetor fuel line.

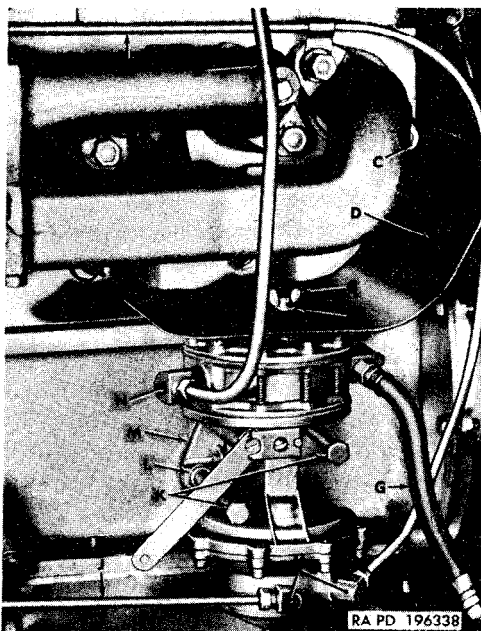
*b. Removal.*

- (1) Close the fuel line shutoff cock and remove the fuel pump to carburetor fuel line (B).
- (2) Remove the wing nut (E) and lockwasher (F) from the fuel pump heat shield stud. Loosen the manifold stud nut (C) that secure the heat shield (D) and remove the heat shield.
- (3) Disconnect the fuel-pump-to-windshield wiper hose line (J) at the elbow in the fuel pump.
- (4) Disconnect the fuel-pump-to-manifold line at the elbow in the fuel pump.
- (5) Disconnect and remove the fuel flexible line (G) or lines at the fuel pump inlet elbow.
- (6) Remove the two screws (K) and lockwashers (L) that secure the fuel pump to the cylinder block. Remove the fuel pump and the pump mounting gasket. Discard the gasket.
- (7) Remove the four fuel line and vacuum line fittings from the fuel pump if the fuel pump requires replacement.

*c. Inspection.*

- (1) Inspect the four fuel line and vacuum line fittings for damaged threads, cracks, distortion, or other visual damage. Replace fittings as necessary.
- (2) Inspect the fuel lines, vacuum lines, and nuts for cracks or damaged threads. Replace lines as necessary.
- (3) Inspect the flexible line or lines for damaged or deteriorated

KEY	ITEM
A	PUMP-TO-MANIFOLD LINE
B	PUMP-TO-CARBURETOR FUEL LINE
C	MANIFOLD STUD NUT
D	HEAT SHIELD
E	WING NUT
F	LOCK WASHER
G	FLEXIBLE LINE
H	INVERTED FLARED TUBE ELBOWS
J	PUMP-TO-WINDSHIELD WIPER HOSE LINE
K	SCREWS
L	LOCK WASHER
M	FLANGE GASKET
N	OUTLET ELBOW



*Figure 105. Fuel pump and lines.*

hose and damaged fittings. Replace flexible line if necessary.

- (4) Clean and inspect the machined surfaces of the engine block and fuel pump. Replace fuel pump if mounting flange is damaged.

#### *d. Installation.*

- (1) Install the two 90°, ¼-inch, ⅛-inch male pipe end inverted flared tube elbows in the fuel pump. Tighten the elbows.
- (2) Install the outlet elbow (N).
- (3) Install the inlet elbow (or elbows). When tightened, the elbow opening (or openings) must be opposite the flange.
- (4) Install the fuel flexible line (G) and fuel pump to heater flexible line (ambulance truck M43). Tighten flexible line nuts.
- (5) Apply a thin coating of liquid-type gasket cement to both sides of the pump mounting gasket and position the gasket on the cylinder block, aligning the holes.
- (6) Install a ⅝<sub>16</sub>-inch lockwasher on each of the two special fuel pump screws. Position the fuel pump on the cylinder block with the pump rocker arm through the opening in the cylinder block. Insert the screws through the fuel pump flange and gasket. Tighten screws.
- (7) Connect the fuel pump-to-windshield wiper hose line (J) and the fuel pump to manifold line (A). Tighten nuts.
- (8) Install the fuel-pump-to-carburetor fuel line (B) and tighten nuts.
- (9) Connect the fuel flexible line to the shutoff cock. Tighten nut.
- (10) Connect the fuel pump-to-heater flexible line to the heater fuel line (ambulance truck M43). Tighten the flexible line nut (or nuts). Open the shutoff cock.
- (11) Install the heat shield (D) on the stud in the fuel pump and over the manifold stud between the manifold and the stud washer. Install the No. 10 lockwasher and No. 10-32NF wing nut (E) on the heat shield stud. Tighten the manifold stud nut (C).
- (12) Operate the fuel pump primer handle to fill the pump and lines with fuel (par. 37).

### **139. Fuel Filters**

*a. General.* There are two types of fuel filters (par. 6). One is located on the generator regulator mounting bracket in the engine compartment (fig. 106) and the other is located in the fuel tank (fig. 108). Servicing of both types of filters is included in this section.

*b. Service Fuel Filter (Engine Compartment).*

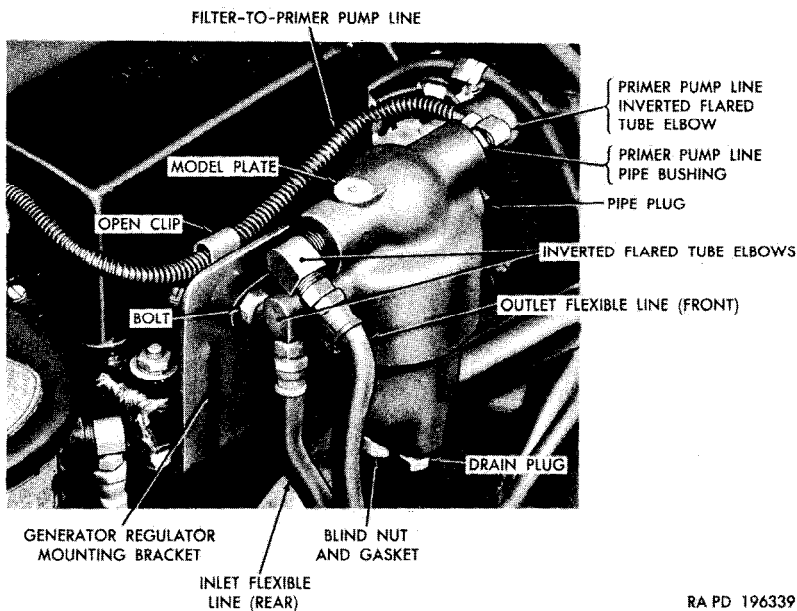


Figure 106. Fuel filter (engine compartment).

- (1) Remove the sediment bowl blind nut and gasket and remove the sediment bowl and bowl gasket (fig. 107). Discard the gaskets.
- (2) Unscrew the cup and nut from the stud and remove the element.
- (3) Clean all parts in dry-cleaning solvent or volatile mineral spirits and allow to dry.

**Caution:** Do not use compressed air on the element, as it would damage the element.

- (4) Install the element on the stud, followed by the cup and nut. Tighten the nut.
- (5) Install a new bowl gasket on the sediment bowl.
- (6) Install the sediment bowl, sediment bowl nut gasket, and the blind nut. Tighten nut.

*c. Service Fuel Filter (Fuel Tank).*

- (1) Remove the four floor panel fuel gage inspection hole cover screws and remove the cover (fig. 108).
- (2) Clean area around the fuel tank cover and disconnect the fuel tank to air cleaner rear vent line at the fuel tank cover.
- (3) Disconnect the rear fuel line at the fuel tank cover.
- (4) Remove the 10 lockwasher screws that secure the fuel tank cover to the tank, and lift the fuel tank cover with attached filter from the tank.



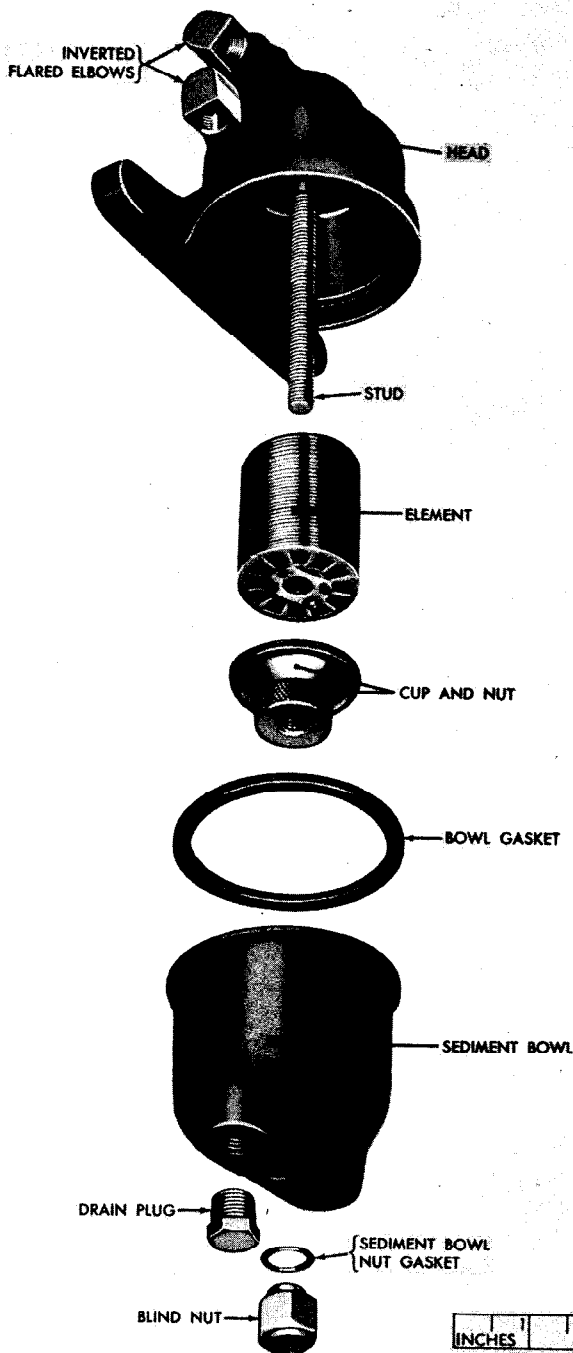
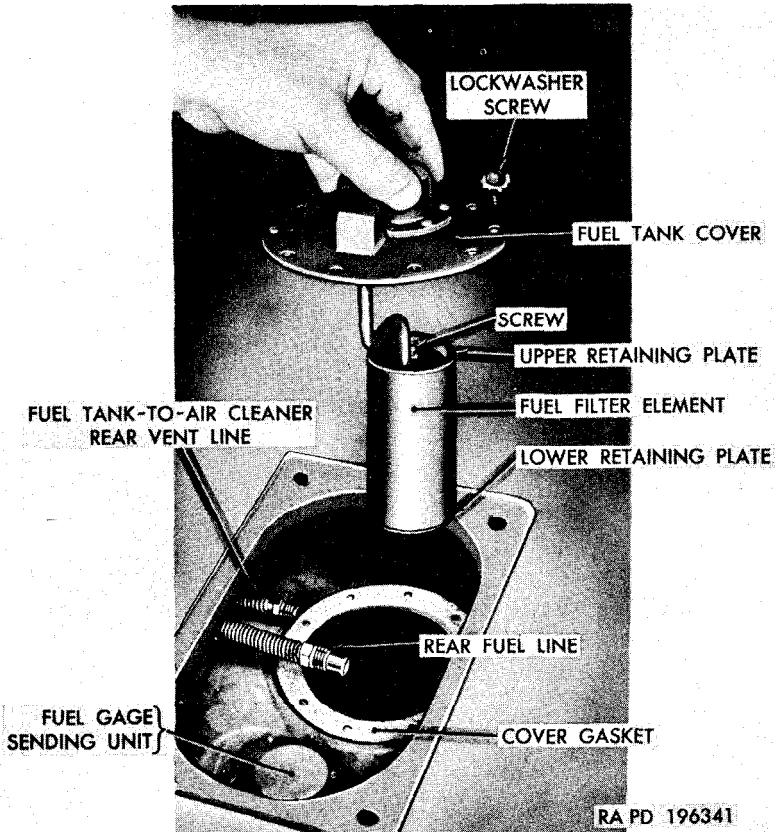


Figure 107. Fuel filter (early-type)—exploded view.



**Figure 108. Fuel filter (fuel tank).**

- (5) Remove and discard the cover gasket. Cover the fuel tank opening to prevent dirt from entering the fuel tank.
- (6) Remove the screw which holds the upper and lower retaining plates to the fuel filter element.
- (7) Remove the retaining plates and element.
- (8) Wash all parts in dry-cleaning solvent or volatile mineral spirits and let dry. If foreign particles are evident on the fuel filter element, drain and clean the fuel tank, if necessary.
- (9) Slide the upper retaining plate on the fuel tank cover pipe (cupped side up), followed by the fuel filter element and the lower retaining plate (cupped side down).
- (10) Install the upper and lower retaining plate screw, lockwasher, and nut. Tighten screw.
- (11) Remove the temporary cover from the fuel tank opening. Make certain that the gasket surfaces are clean. Coat cover gasket lightly with liquid-type gasket cement and position the gasket on the fuel tank, aligning the screw holes.
- (12) Insert the filter element into the tank, aligning the screw

holes, the vent line, and fuel line with their respective fittings on the cover. Install the ten No. 12-24NC x  $\frac{9}{16}$  cross-recess-head, external-teeth lockwasher screws. Tighten screws evenly.

- (13) Connect the fuel tank to air cleaner rear vent line and rear fuel line to the fuel tank cover fittings. Tighten nuts.
- (14) Apply a coating of sealing compound—51-C-1616 around the floor panel fuel gage inspection hole cover opening. Position the inspection hole cover over the opening and install the four  $\frac{5}{16}$ -24NF x  $\frac{7}{8}$  internal-external-teeth, cross-recess-head, lockwasher screws. Tighten screws.

## 140. Fuel Filter (Engine Compartment)

### *a. Removal.*

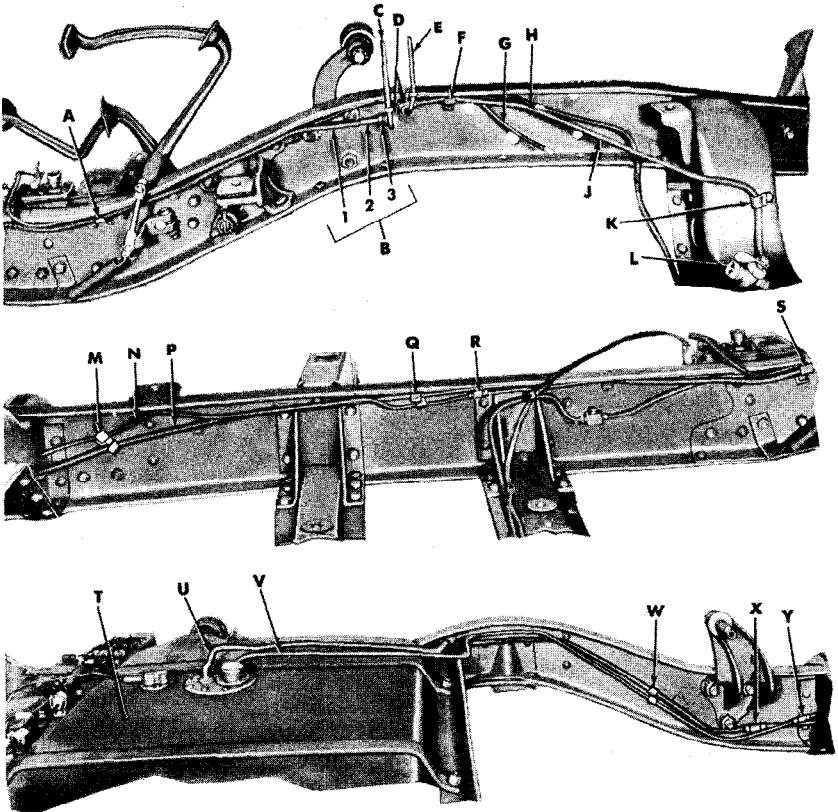
- (1) Disconnect the outlet flexible line, the inlet flexible line, and the priming system line (if connected) at the fuel filter (fig. 106).
- (2) Remove the two nuts, lockwashers, and bolts attaching the fuel filter to the generator regulator mounting bracket and remove the fuel filter.
- (3) If the filter requires replacement, remove the inlet and outlet elbows and the drain plug. On engines equipped with a priming system, remove the primer pump line elbow and the pipe bushing from the upper opening at the fender side. If the priming system has been disconnected from the filter, remove the pipe plug and pipe bushing. On engines not equipped with a priming system, remove the pipe plugs from the two openings at the fender side.

*b. Inspection.* Inspect the elbows, bushing, drain and pipe plugs, and the priming system line for cracks or damaged threads. Inspect the elbows for distortion or other visual damage. Inspect the flexible line hoses for damage or deterioration. Replace parts as necessary.

### *c. Installation.*

- (1) Install the two  $\frac{5}{16}$ -inch, 90-degree,  $\frac{1}{4}$ -inch male pipe end, inverted flared tube elbows in the inlet and outlet openings in the fuel filter (model plate side). Tighten elbows. Refer to figure 106 for correct positioning of elbows.
- (2) If the engine is equipped with a priming system, install a  $\frac{1}{4}$  x  $\frac{1}{8}$  pipe bushing in the opposite upper opening of the fuel filter. If the engine is not equipped with a priming system, install a  $\frac{1}{4}$ -inch pipe plug in the opening.
- (3) Install a  $\frac{1}{4}$ -inch pipe plug in the lower opening of the fuel filter. Tighten plug or plugs.
- (4) Position the filter on the generator regulator mounting bracket. Install two  $\frac{3}{8}$ -24NF x  $1\frac{1}{4}$  bolts through the filter

- and bracket. Install a  $\frac{3}{8}$ -inch lockwasher and a  $\frac{3}{8}$ -24NF nut on each bolt. Tighten nut.
- (5) Connect the inlet (rear) flexible line to the lower elbow. Tighten nut.
  - (6) Connect the outlet (front) flexible line to the upper elbow. Tighten nut.
  - (7) If the priming system line is to be connected to the filter,



KEY	ITEM	KEY	ITEM
A	CLIP	L	SHUT-OFF COCK
B	INTERMEDIATE FUEL LINE	M	DOUBLE CLIP
1	FLEXIBLE CONDUIT	N	TANK INTERMEDIATE VENT LINE
2	TUBING	P	INTERMEDIATE FUEL LINE
3	FITTING NUT	Q	DOUBLE CLIP
C	TANK-TO-FILTER LINE	R	UNION (VENT LINE)
D	INVERTED FLARED TUBE ELBOWS	S	CLIP
E	FILTER-TO-PUMP LINE	T	FUEL TANK
F	CLIP	U	REAR FUEL LINE
G	MASTER CYLINDER REAR VENT LINE	V	TANK REAR VENT LINE
H	TANK FRONT VENT LINE	W	DOUBLE CLIP
J	FRONT FUEL LINE	X	UNION (FUEL LINE)
K	CLIP	Y	UNION (VENT LINE)

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Figure 109. Fuel lines, fuel tank vent lines, and related parts.

install a  $\frac{3}{16}$ -inch,  $90^\circ$ ,  $\frac{1}{8}$ -inch male pipe end, inverted flared tube elbow in the pipe bushing ((2) above) and connect the priming system line to the elbow. If the line is not to be connected, install a  $\frac{1}{8}$ -inch pipe plug in the bushing.

## 141. Fuel Lines and Fuel Tank Vent Lines

*a. General.* Replacement of the fuel lines or the fuel tank vent lines (fig. 109) is seldom necessary. If a fuel line is restricted as a result of dirt or other foreign matter in the fuel system, disconnect each line in turn at both ends and blow the line out with compressed air. Start with the fuel pump-to-carburetor line and work toward the fuel pump. If obstructions cannot be removed with compressed air, or if a line is cracked or damaged, replace the affected lines as instructed below. If replacement fuel lines are not available as assemblies, use  $\frac{5}{16}$ -inch seamless tubing, flexible conduit, and  $\frac{5}{16}$ -inch inverted flared tube fitting nuts. Double flare the tube at each end, using a flaring tool.

*b. Replace Fuel Pump to Carburetor Line.* Unscrew the fitting nuts from the elbow in the fuel pump (fig. 105) and the carburetor (fig. 101) and remove the line. Install a new line, screwing the fitting nuts firmly into place.

*c. Replace Flexible Fuel Lines.* A flexible fuel line (G, fig. 105) is used to connect the shutoff cock (L, fig. 109) to the fuel pump. On vehicles with the fuel filter (fig. 106) in the engine compartment, flexible lines are also used to connect the fuel filter to the intermediate and front lines. To replace any of the flexible lines, disconnect the line at both ends and remove. Install a new flexible line, screwing both fitting nuts into place. The three lines are interchangeable.

*d. Replace Shutoff Cock.* Disconnect the flexible line and the front fuel line at the shutoff cock (L, fig. 109) by unscrewing the fitting nuts. Remove the shutoff cock. Install a new shutoff cock, screwing the two fitting nuts into place.

*e. Replace Front, Intermediate, and Rear Fuel Lines* (fig. 109). To replace the front, intermediate, or rear fuel line, disconnect both ends of the line to be replaced by unscrewing the two fitting nuts. Disengage the line from clips on the frame and remove. When installing the lines, screw the fitting nuts to their respective fittings and engage the line in the clips on the frame. On vehicles equipped with a fuel filter in the fuel tank, a union connects the intermediate and front lines. Figure 109 shows the fuel lines, connections, and clips.

*f. Replace Fuel Tank Vent Lines.* Replacement of the fuel tank vent lines (fig. 109) may be accomplished in the same manner as described in *e* above for the fuel lines. If replacement vent lines are not available as assemblies, use suitable lengths of  $\frac{3}{16}$ -inch seamless tubing,  $\frac{3}{16}$ -inch flexible conduit, and  $\frac{3}{16}$ -inch inverted flared tube fitting nuts. Double flare tube at each end, using a suitable flaring tool.

## 142. Fuel Tank, Filler Pipes, and Hoses

### a. Remove Fuel Tank.

- (1) Drain the fuel tank.
- (2) Remove the inspection hole cover from the floor panel and disconnect the fuel tank rear vent line (fig. 114), the rear fuel line, and the fuel gage sending unit cable.
- (3) Loosen the clamps on the filler pipe hose and the filler pipe vent hose (fig. 110) and separate both hoses from the tank.
- (4) Support the fuel tank, and remove the nuts and lockwashers that secure the two tank support straps (fig. 110) and hold-down straps to the fuel tank support frame crossmember.

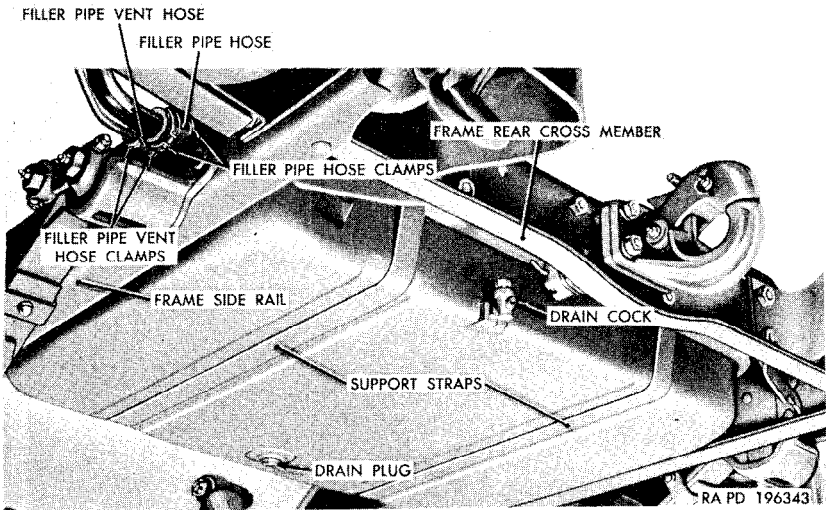


Figure 110. Fuel tank—bottom view.

- Swing the two support straps down and toward the rear, out of the way.
- (5) Remove the tank by lowering the right end first and working the left side from between the frame side rail and the vehicle body, being careful to avoid damage to the lower filler pipe and filler pipe vent line.
  - (6) Remove and discard the filler pipe hose and the filler pipe vent hose.
  - (7) If the fuel tank is to be replaced, remove the fuel tank cover complete with all related parts, the cover gasket, and fuel

gage sending unit. Unscrew lower filler pipe and discard gasket. Unscrew nut and vent lower line, the drain cock, and drain plug (if so equipped).

*b. Install Fuel Tank.*

- (1) Install the parts that were removed from the tank (a(7) above), using new gaskets for the lower filler pipe, the fuel gage sending unit (fig. 111), and the fuel tank cover and replacing any parts that are unfit for further service.
- (2) Apply a coating of liquid-type gasket cement to the upper and lower filler pipes and the upper and lower filler pipe vent lines and install new hoses on the upper filler pipe and upper vent line. Use a 3-inch length of  $2\frac{1}{4}$ -inch (ID) hose for the filler pipe and a  $2\frac{7}{8}$ -inch length of  $\frac{1}{2}$ -inch (ID) hose for the vent line. Install the two hose clamps on each hose, and push hoses on lower filler pipe and lower vent line as far as they will go.
- (3) Install the tank in position under the two holddown straps, raising the left end first to position it between the frame left side rail and the vehicle body. Raise the right end of the tank into place and support it from the bottom between the support straps. Position the two support straps with the

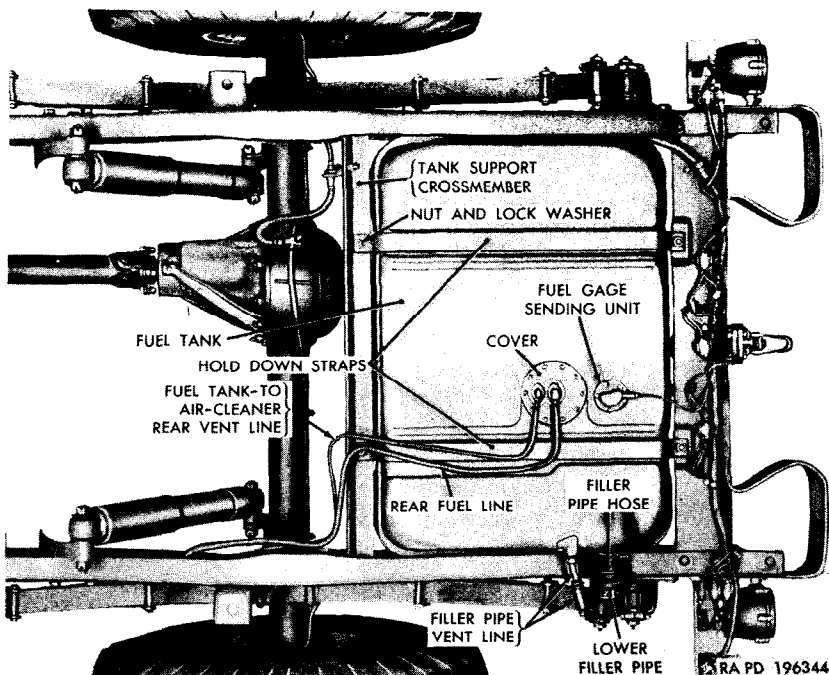


Figure 111. Fuel tank—top view (vehicle body removed).

strap ends inserted through the openings in the tank support cross member and the holddown straps. Install a  $\frac{7}{16}$ -inch lockwasher and a  $\frac{7}{16}$ -20NF nut on each support strap end. Tighten the nuts.

- (4) Position the two hoses on the upper and lower filler pipes and upper and lower vent lines. Position the hose clamps and tighten the hose clamp screws.
- (5) Working through the inspection hole in the floor, connect the fuel tank rear vent line, the rear fuel line, and the fuel gage sending unit cable (fig. 111).
- (6) Install the inspection hole cover (par. 139c(14)).
- (7) Close the drain cock and fill the fuel tank.

**Caution:** When filling the tank, always hold the pump hose nozzle firmly against the strainer tube, to prevent static sparks. Do not fill the upper filler pipe, as room must be provided for expansion of fuel.

*c. Replace Filler Pipe Strainer and/or Cap.* Remove the filler cap, unhook the safety chain, and remove the strainer from the filler pipe (fig. 112). Install a new strainer in the filler pipe, attach the safety chain to the cap, and install the cap.

*d. Replace Upper Filler Pipe.*

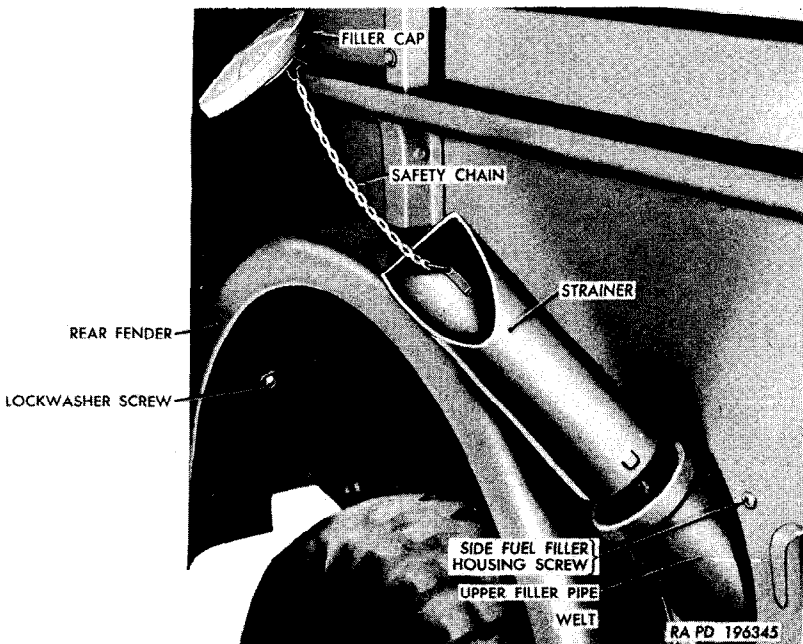


Figure 112. Fuel filler cap, strainer, and upper filler pipe.



- (1) Loosen the lower hose clamps on the filler pipe hose (fig. 110) and the filler pipe vent hose, and free the two hoses from the lower filler pipe and the lower vent line.
- (2) On cargo truck M37 or command truck M42, remove the eight nuts, lockwashers, and screws that secure the side filler fuel housing, and remove the housing. Remove the two nuts, lockwashers, and screws that attach the upper filler pipe support bracket to the left rear wheel housing (fig. 113).
- (3) On the ambulance truck M43 or telephone maintenance truck V-41, remove the two lockwasher screws that secure the upper filler pipe support bracket, working from the under side of the left rear fender.
- (4) Remove the filler pipe and attached hoses by pulling them from the opening in the side of the vehicle.
- (5) Loosen the two hose clamps and remove the hoses and clamps from the filler pipe and the vent line. Discard the hoses. Replace the hose clamps if they are damaged.
- (6) Clean the hose contacting surfaces of both the upper and lower filler pipes and the upper and lower vent lines and apply a coating of liquid-type gasket cement to the surfaces. Install the filler pipe hose on the upper filler pipe, using a 3-inch length of 2¼-inch (ID) hose. Install the

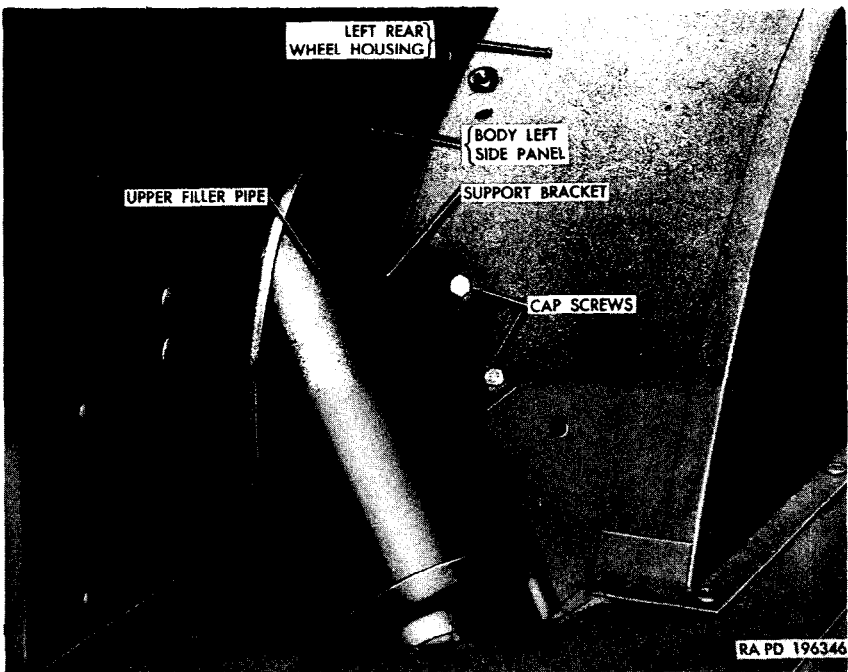


Figure 113. Upper fuel filler pipe (cargo truck M37 or command truck M42).

vent line hose on the upper vent line, using a  $2\frac{7}{8}$ -inch length of  $\frac{1}{2}$ -inch (ID) hose. Install the two clamps loosely on each hose.

- (7) Install the upper filler pipe and attached hoses, guiding the hoses over the lower filler pipe and the lower vent line, and alining the screw holes in the support bracket with those in the wheel housing or left rear fender.
- (8) Install the filler pipe support bracket retaining screws. For the cargo truck M37 or command truck M42, install the two  $\frac{3}{8}$ -24NF x  $\frac{3}{4}$  capscrews,  $\frac{3}{8}$ -inch lockwashers, and  $\frac{3}{8}$ -24NF nuts (fig. 113). For the ambulance truck M43 or telephone maintenance truck V-41, install the two special lockwasher screws from the under side of the fender into the weld nuts on the bracket. Tighten the parts.
- (9) Position the filler pipe hose so it extends an equal distance over the upper and lower filler pipes, position the two clamps, and tighten the clamp screws. Position the vent line hose and hose clamps in the same manner and tighten the clamp screws.
- (10) For the cargo truck M37 or command truck M42, install the side fuel filler housing. Apply body sealing compound to the flanged edges of the housing and install it in position. Install the five special screws that secure the housing to the rear wheel housing and the floor from the housing side, and install the three special screws that secure the housing to the body panel from outside the body (fig. 112). Install a  $\frac{5}{16}$ -inch lockwasher and  $\frac{5}{16}$ -24NF nut on each screw and tighten all nuts.

### 143. Fuel Gage Sending Unit and Air Cleaner Inlet Valve

*a. General.* The fuel gage sending unit and the air cleaner inlet valve are located at the top of the fuel tank. Both are accessible when the inspection hole cover is removed from the floor panel. The air inlet valve, on vehicles of early production, is a part of the fuel tank cover. On later vehicles, the air cleaner inlet valve (fig. 114) is a separate unit mounted on the fuel tank cover (par. 6).

*b. Replace Fuel Gage Sending Unit* (fig. 114).

- (1) Remove the four lockwasher screws that secure the inspection hole cover to the floor panel and remove the cover.
- (2) Disconnect the sending unit cable at the cable connector.
- (3) Remove the five screws and washers that secure the sending unit to the fuel tank. Lift the sending unit and tilt it toward the rear to remove the float. Remove and discard the sending unit gasket and clean the gasket surface of the tank.
- (4) Apply a light coating of liquid-type gasket cement to both sides of a new sending unit gasket, and install the gasket on the fuel tank.

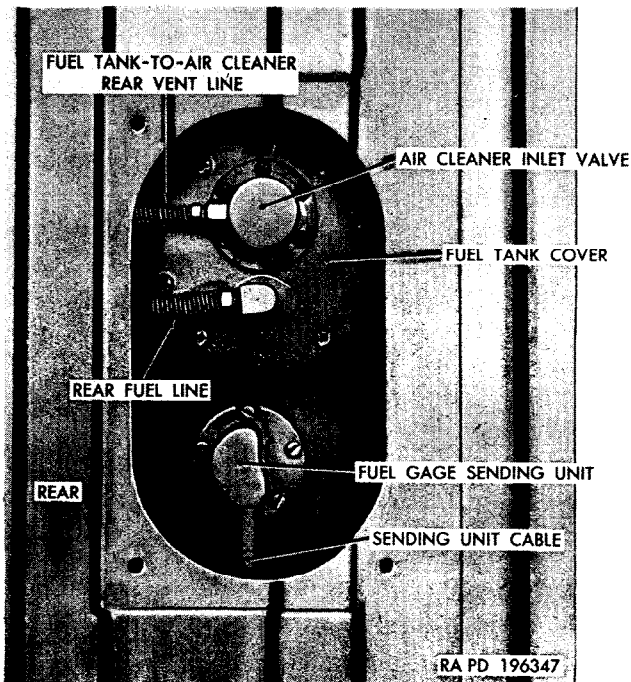


Figure 114. Fuel tank cover, air cleaner inlet valve, and fuel gage sending unit.

- (5) Install the fuel gage sending unit, inserting the rear end of the float first. Position the unit on the tank with the cable connector toward the rear. Install the five special lead washers and special screws. Tighten the screws evenly.
- (6) Apply body sealing compound around the inspection hole, and install the inspection hole cover and four  $\frac{5}{16}$ -24NF x  $\frac{7}{8}$  cross-recess-head, internal-external-teeth lockwasher screws.

c. *Replace Air Cleaner Inlet Valve.*

- (1) Remove the floor panel inspection hole cover (b(1) above).
- (2) Disconnect the fuel tank to air cleaner rear vent line at the air cleaner inlet valve fitting.
- (3) On vehicles with the inlet valve in the fuel tank cover, disconnect the rear fuel line at the elbow in the cover (fig. 111).
- (4) If the inlet valve is a separate unit, remove the six screws and lockwashers that secure the inlet valve to the fuel tank cover (fig. 114). If the inlet valve is a part of the cover, remove the 10 lockwasher screws that secure the cover. Remove the air cleaner inlet valve or the cover. Remove and discard the inlet valve gasket or the cover gasket.
- (5) Clean the gasket surface of the cover on the fuel tank, being careful to prevent dirt from dropping into the fuel tank.

- (6) If the vent line fitting in the air inlet valve (or cover) is not damaged, remove the fitting. If the fuel line was disconnected for removal of the cover, also remove the fuel line elbow.
- (7) Apply a light coating of liquid-type gasket cement to both sides of a new gasket (air inlet valve or fuel tank cover, as required) and install the gasket.
- (8) If the inlet valve is a separate unit, install the valve on the cover, and install the six lockwashers and screws.
- (9) If the inlet valve is a part of the fuel tank cover, install the cover on the tank with the fuel and vent line openings in proper position for connecting the lines (fig. 111). Install the 10 special lockwasher screws.
- (10) Install a  $\frac{3}{16}$ -inch, 90°,  $\frac{1}{8}$ -inch male pipe end, inverted flared tube elbow in the cover or a  $\frac{3}{16}$ -inch,  $\frac{1}{8}$ -inch male pipe end, inverted flared tube connector in the air cleaner inlet valve. Tighten fittings. If the fuel line elbow was removed, install a  $\frac{5}{16}$ -inch, 90°,  $\frac{1}{4}$ -inch male pipe end, inverted flared tube elbow in the cover.
- (11) Connect the rear vent line to the elbow in the fitting in the inlet valve or cover. If the fuel line was disconnected ((3) above) connect the rear fuel line to the fuel line elbow. Tighten the line nuts.
- (12) Install the floor panel inspection hole cover (*b*(6) above).

#### **144. Carburetor Controls and Linkage**

##### *a. Description.*

- (1) Carburetor controls include the hand-operated choke and throttle controls and the foot-operated accelerator. Linkage from the accelerator pedal rod connects the rod to the throttle control bellcrank which is connected to the carburetor throttle by means of an adjustable rod. The throttle control operates the throttle control lever which engages the throttle control bellcrank.
- (2) Organizational maintenance of the controls and linkage includes adjustment of the choke control (par. 134*a*) and the throttle control (par. 134*b*), and replacement of the two controls and linkage.

##### *b. Replace Choke Control (fig. 69).*

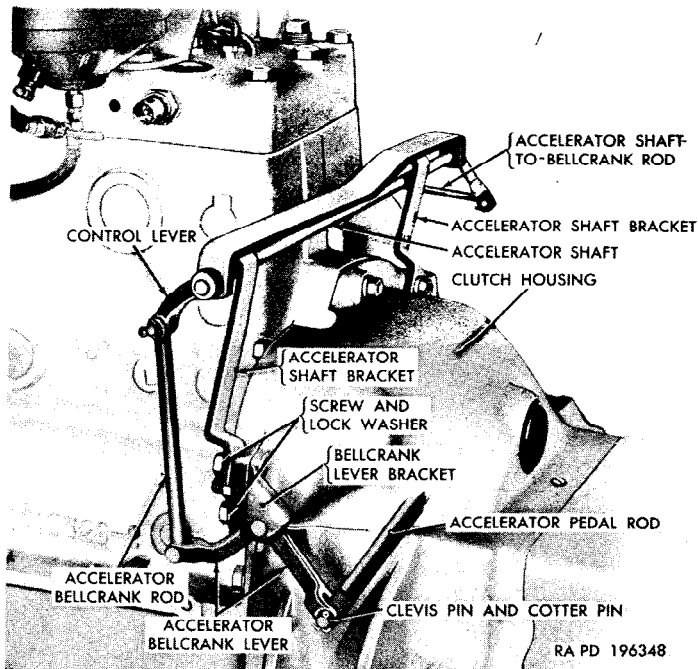
- (1) Loosen the choke control swivel screw (E, fig. 101) and the screw in the choke control clip (G, fig. 101) and withdraw the control from the clip and swivel.
- (2) Loosen the two screws that secure the control clamp to the bracket on the dash.
- (3) Unscrew the nut that secures the choke control to the instru-

ment panel. Hold the nut and lockwasher and pull the control from the opening.

- (4) Thread the new choke control through the opening in the instrument panel and slip a  $\frac{3}{8}$ -inch internal-external-teeth-lockwasher and  $\frac{3}{8}$ -24NF nut over the control. Continue to push the control through the dash between the dash bracket and the clamp.
- (5) Position the control in the instrument panel and screw the retaining nut into place.
- (6) Insert the choke control through the choke control clip (G, fig. 101) and the control wire in the swivel on the choke lever (E, fig. 101). Adjust the choke control (par. 134a) before tightening the swivel screw and choke control clip screw.
- (7) Tighten the two dash bracket clamp screws.

*c. Replace Throttle Control.* Procedure for replacement of the throttle control (H, fig. 12) is the same as that for the choke control (b above). Figure 102 shows the throttle control connections in the engine compartment. Adjust the throttle control (par. 134b).

*d. Remove Accelerator Linkage.* Removal of various components of the accelerator linkage (fig. 115) may be accomplished without removing all of the linkage from the vehicle. However, if the accelerator shaft and connecting linkage requires replacement, remove the assembled parts as a unit.



*Figure 116. Accelerator shaft and linkage.*

- (1) Detach the accelerator pedal rod from the accelerator bellcrank lever (fig. 115) by removing the cotter pin and clevis pin.
- (2) Disconnect the throttle return spring from the return spring clip (fig. 102).
- (3) Disconnect the right end of the accelerator shaft from the throttle control bellcrank rod by removing the cotter pin and flat washer, and pulling the rod from the end of the shaft.
- (4) Remove the two screws and lockwashers that secure the accelerator shaft bracket and the accelerator bellcrank lever bracket to the left side of the clutch housing (fig. 115).
- (5) Remove transmission access covers (par. 121g).
- (6) Remove the cap screw and lockwasher that secure the accelerator shaft bracket to the right side of the clutch housing (fig. 115).
- (7) Remove the accelerator shaft with assembled parts from the opening in the driver's compartment.
- (8) Remove the two screws that secure the accelerator hinge to the left floor panel in the driver's compartment, and remove the accelerator pedal and pedal rod.

*e. Inspect Accelerator Linkage.*

- (1) Inspect the accelerator pedal, pedal hinge, and pedal rod for binding, distortion, or worn or damaged parts. Replace parts as necessary. Inspect the pedal rod weatherseal for deterioration or damage. Replace the weatherseal, if necessary.
- (2) Inspect the accelerator shaft and shaft bracket for broken welds, distortion, and worn parts. Replace the shaft and bracket, if necessary.
- (3) Inspect the bellcrank lever, lever bracket, bellcrank rod, and the throttle control bellcrank rod and rod spring for wear, distortion, or other damage. Replace parts as necessary.

*f. Install Accelerator Linkage.*

- (1) If the weatherseal for the accelerator rod was removed (*e*(1) above), install a new weatherseal in the floor panel.
- (2) Insert the accelerator pedal rod through the weatherseal and position the pedal in the floor panel. Install the two self-locking washers and screws.
- (3) Insert the accelerator shaft and assembled parts through the opening in the driver's compartment, and position the shaft bracket on the clutch housing (fig. 115) with the screw holes in the bracket aligned with those in the clutch housing. Secure the shaft bracket to the right side of the clutch housing with a  $\frac{3}{8}$ -16NC x  $1\frac{1}{2}$  cap screw and  $\frac{3}{8}$ -inch lockwasher. Do not tighten the screw at this time.

- (4) Position the accelerator bellcrank lever bracket between the accelerator shaft bracket and the left side of the clutch housing (fig. 115), align the screw holes, and install the two  $\frac{3}{8}$ -24NF x  $1\frac{1}{4}$  cap screws and  $\frac{3}{8}$ -inch lockwashers. Tighten the screws.
- (5) Tighten the cap screw that secures the shaft bracket to the right side of the clutch housing.
- (6) Install the transmission access covers (par. 122f).
- (7) Attach the throttle control bellcrank rod to the right end of the accelerator shaft, and install the  $\frac{1}{4}$ -inch flat washer and  $\frac{3}{32}$  x  $\frac{3}{4}$  cotter pin.
- (8) Attach the throttle return spring to the return spring clip (fig. 102).
- (9) Align the accelerator pedal rod with the bellcrank lever and install the  $\frac{5}{16}$  x  $1\frac{3}{16}$  clevis pin and  $\frac{3}{32}$  x  $\frac{3}{4}$  cotter pin.

## 145. Engine Priming System and Primer Pump (Vehicles So Equipped)

### a. General.

- (1) The engine priming system and primer pump were provided on early type vehicles (par. 6) to facilitate starting the engine during extreme cold weather operation. On some vehicles equipped with the system, the line from the fuel filter to the primer pump has been disconnected, rendering the system inoperative.
- (2) Organizational maintenance of the components of the priming system includes replacement of the lines from the fuel filter to the primer pump, and from the primer pump to the intake manifold; replacement of the three priming nozzles, the primer pump, and the primer pump inlet and outlet check valve balls.
- (3) The most common cause for failure of the priming system is gum or varnish formation in the lines, nozzles, or fittings. When servicing the system, clean all parts in dry-cleaning solvent or volatile mineral spirits and blow out with compressed air.

### b. Replace Line from Fuel Filter to Primer Pump.

- (1) Disconnect the line from the fuel filter by unscrewing the primer line nut from the elbow in the fuel filter (fig. 106). Disconnect the opposite end of the line from the primer pump body by unscrewing the inlet nut and sleeve.
- (2) Loosen the two dash bracket clamp screws. Cut the inlet line at the front side of the dash bracket and remove the two sections of the line. Remove the cover from the front section of the line, and discard the two sections of line and the nuts.

- (3) Cut a 25-inch length of  $\frac{3}{16}$ -inch seamless tubing. Insert one end of the tubing through the extreme left opening in the dash, between the dash bracket and the bracket clamp. Install the cover over the front portion of the tubing and install a  $\frac{3}{16}$ -inch inverted flared tube fitting nut. Double flare the end of the tubing, with a flaring tool.
  - (4) Form the line as required to align the fitting nut with the elbow in the fuel filter and screw the nut to the elbow.
  - (5) Install the inlet line nut and sleeve on the inner end of the tubing, flare the tubing ((3) above), and screw the inlet line nut to the inlet valve connector in the primer pump body.
  - (6) Tighten the two dash bracket clamp screws.
- c. Replace Line from Primer Pump to Intake Manifold.*
- (1) Disconnect the priming system line (R, fig. 86) from the tee-type nozzle in the rear port of the intake manifold by unscrewing the line nut from the nozzle. Disconnect the opposite end of the line from the connector in the primer pump body by unscrewing the line nut.
  - (2) Loosen the two dash bracket clamp screws. Cut the line at the front side of the dash bracket and remove the two sections of the line.
  - (3) Cut a 48-inch length of  $\frac{1}{8}$ -inch seamless tubing and insert one end of the tubing through the extreme right opening in the dash, between the dash bracket and the clamp.
  - (4) Install a  $\frac{1}{8}$ -inch tube nut with sleeve on each end of the tubing, flare the tubing ends, and screw the tube nuts to the tee-type nozzle in the intake manifold rear port and the connector in the primer pump body, forming the line as necessary to align the parts.
  - (5) Tighten the two dash bracket clamp screws.
- d. Replace Manifold Inlet Lines and Nozzles.*
- (1) Disconnect the manifold inlet lines from the three nozzles in the intake manifold by unscrewing the tube nuts. Remove the lines.
  - (2) Remove the elbow-type nozzle from the front port, the tee-type nozzle and extension from the middle port, and the tee-type nozzle from the rear port of the intake manifold.
  - (3) Clean the parts as described in *a*(3) above. Replace parts as necessary.
  - (4) Install the tee-type nozzle in the intake manifold rear port, the tee-type nozzle and extension in the center port, and the elbow-type nozzle in the front port.
  - (5) For replacing manifold lines, cut two suitable lengths of  $\frac{1}{8}$ -inch seamless tubing, install two  $\frac{1}{8}$ -inch tube nuts on



each section of tubing, and double flare both ends of each section with a flaring tool.

- (6) Install the two manifold inlet lines, screwing the nuts to the nozzles in the intake manifold. Connect the line from the primer pump to the tee-type nozzle in the manifold rear port.

*e. Remove Primer Pump.*

- (1) Disconnect the two fuel lines from the pump by unscrewing the fuel line nuts from the connectors.
- (2) Pull the primer knob out enough to provide access to the two flat spots on the pump plunger stem. Hold the stem with a small wrench at the flat spots and unscrew the primer knob from the stem. Remove the lockwasher.
- (3) Remove the packing nut from the pump.
- (4) Loosen the inner locknut securing the pump body at the front (engine) side of the instrument panel and remove the mounting nut from the rear (driver's compartment) side of the instrument panel. Push the pump forward until the stem clears the instrument panel and remove the pump.
- (5) Remove the fuel inlet check valve connector, the fuel outlet connector, and the outlet check plug, spring, and ball. Remove the inner locknut from the pump body if the nut is damaged.

*f. Inspect Primer Pump.*

- (1) Clean the fuel inlet and outlet connectors, the outlet check plug, ball, and spring in dry-cleaning solvent or volatile mineral spirits. Inspect the parts for damaged threads, cracks, and abrasions. Replace parts as necessary.
- (2) Inspect the pump body for damaged threads, cracks, and distortion. Operate the plunger stem and check for distortion and damaged or worn packings. Replace the pump, if necessary.

*g. Install Primer Pump.*

- (1) Install the fuel inlet check valve connector, the fuel outlet connector, and the ball, spring, and outlet check plug in the pump body. Install the inner locknut on the pump body if the nut was removed.
- (2) Insert the stem end of the pump in the opening in the instrument panel from the cowl side. Position the pump so that the fuel inlet connector is down. Install the pump mounting nut on the rear of the pump body at the driver's compartment side of the instrument panel. Tighten the nut until it bottoms on the pump body. Tighten the inner locknut at the front side of the panel against the panel.
- (3) Install the packing nut over the plunger stem and tighten

the nut fingertight. Install a 1/8-inch lockwasher in the opening in the knob, and install the knob on the plunger stem. Hold the stem with a small wrench at the flat spots and tighten the knob.

- (4) Connect the fuel inlet and outlet lines to the inlet and outlet connectors, respectively, tightening the line nuts.

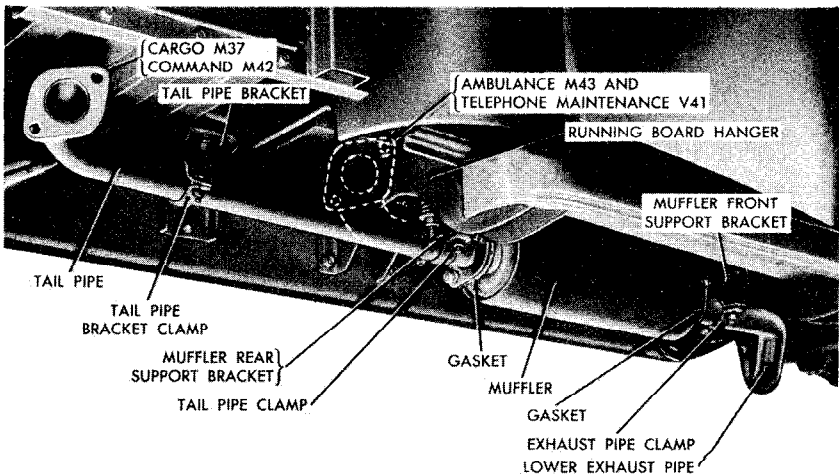
#### 146. Exhaust Pipes, Muffler, and Tailpipe

##### a. Replace muffler.

- (1) Remove the two nuts, lockwashers, and bolts which attach the lower exhaust pipe to the muffler (fig. 116).
- (2) Support the muffler and remove the two nuts, lockwashers, and bolts which attach the tailpipe to the muffler. Remove and discard the muffler and two gaskets.
- (3) Position new gaskets on the front and rear flanges of the muffler and position the muffler between the lower exhaust pipe and tailpipe with the large opening of the muffler forward. Aline the screw holes in the gaskets and flanges and install the two 7/16-20NF x 1 1/8 machine bolts and the 7/16-20NF nuts for each flange. Tighten nuts.

##### b. Remove Upper and Lower Exhaust Pipes and Related Parts.

- (1) Remove the two nuts and bolts that attach the upper exhaust pipe to the exhaust manifold.
- (2) Remove the two nuts and bolts that attach the lower exhaust pipe to the muffler.
- (3) Remove the two nuts, lockwashers, bolts, and plain washers that secure the exhaust pipe clamp to the muffler front sup-



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Figure 116. Muffler, tailpipe, and exhaust pipes.

port bracket and remove the clamp. Remove the assembled upper and lower exhaust pipes from the under side of the vehicle. Remove and discard the upper exhaust pipe to manifold gasket and the lower exhaust pipe to muffler gasket.

- (4) Loosen the nuts on the two eye bolts that attach the upper exhaust pipe to the lower exhaust pipe, disengage the eye-bolts, and separate the pipes. Discard the upper-to-lower exhaust pipe gasket.
- (5) Remove the cotter pin and clevis pin that secure each eyebolt to the upper exhaust pipe and remove the eyebolts, nuts, and flat washers.
- (6) If the muffler front support bracket (fig. 116) requires replacement, remove the two nuts, lockwashers, and bolts that secure the support bracket to the running board front hanger, and remove the bracket.

*c. Install Upper and Lower Exhaust Pipes and Related Parts.*

- (1) If the muffler front support bracket was removed (b (6) above), position a new bracket on the running board front hanger and install the two  $\frac{5}{16}$ -24NF x 1 bolts,  $\frac{5}{16}$ -inch lockwashers, and  $\frac{5}{16}$ -24NF nuts.
- (2) Install the  $1\frac{15}{32}$ -inch (ID) flat washer and nut on each exhaust pipe eyebolt and attach the two eyebolts to the upper exhaust pipe with the clevis pins and  $\frac{3}{32}$  x  $\frac{3}{4}$  cotter pins.
- (3) Install a new upper to lower exhaust pipe gasket on the lower exhaust pipe, install the upper exhaust pipe, and engage the two eyebolts. Tighten the eyebolt nuts lightly.
- (4) Install new gaskets on the flange of the upper exhaust pipe and on the front flange of the muffler. Install the assembled exhaust pipes, aligning them with the exhaust manifold and the muffler.
- (5) Install the two  $\frac{7}{16}$ -20NF x  $1\frac{3}{4}$  bolts and  $\frac{7}{16}$ -20NF nuts to secure the upper exhaust pipe to the exhaust manifold.
- (6) Install the two  $\frac{7}{16}$ -20 NF x  $1\frac{1}{8}$  bolts and  $\frac{7}{16}$ -20 NF nuts to secure the lower exhaust pipe to the muffler.
- (7) Tighten the four nuts and the two eyebolts nuts evenly.
- (8) Install a  $\frac{3}{8}$  (ID) flat washer on each of the  $\frac{5}{16}$ -24NF x 1 machine bolts for the exhaust pipe clamp. Install the clamp, aligning the bolt holes in the clamp with those in the muffler front support bracket. Install the two bolts from the bracket side and install the two  $\frac{5}{16}$ -inch lockwashers and  $\frac{5}{16}$ -24NF nuts. Tighten the nuts.

*d. Remove Tailpipe and Related Parts.*

- (1) Remove the two nuts, lockwashers, bolts, and plain washers

that secure the tailpipe clamp to the muffler rear support bracket, and remove the clamp (fig. 116).

- (2) For the cargo truck M37 or command truck M42, remove the two nuts, lockwashers, and bolts, that secure the tailpipe bracket clamp to the tailpipe bracket, and remove the clamp.
- (3) Remove the two nuts and bolts that secure the tailpipe to the rear flange of the muffler, and remove the tailpipe. Remove and discard the muffler-to-tailpipe gasket.
- (4) If the muffler rear support bracket requires replacement, remove the two nuts, lockwashers, and bolts that secure the bracket to the running board rear hanger, and remove the bracket.
- (5) If the tailpipe bracket (cargo truck M37 or command truck M42) requires replacement, remove the nut, lockwasher, and bolt that secure the bracket to the frame side rail, and remove the bracket.

*e. Install Tailpipe and Related Parts.*

- (1) Position the tailpipe bracket (fig. 116) (cargo truck M37 or command truck M42) on the frame side rail and install the  $\frac{3}{8}$ -24NF x 1 bolt,  $\frac{3}{8}$ -inch lockwasher, and  $\frac{3}{8}$ -24 NF nut. Tighten the nut.
- (2) Position the muffler rear support bracket on the running board rear hanger and install the two  $\frac{5}{16}$ -24NF x 1 bolts,  $\frac{3}{8}$ -inch lockwashers, and  $\frac{5}{16}$ -24 NF nuts. Tighten the nuts.
- (3) Install a new muffler to tailpipe gasket on the rear flange of the muffler. Install the tailpipe on the muffler and install the two  $\frac{7}{16}$ -20NF x  $1\frac{1}{8}$  bolts and  $\frac{7}{16}$ -20NF nuts. Tighten the nuts.
- (4) Install a  $\frac{3}{8}$ -inch flat washer on each of the two  $\frac{5}{16}$ -24NF x 1 bolts, position the clamp and install the two bolts with washers from the bracket side. Install the two  $\frac{5}{16}$ -inch lockwashers and two  $\frac{5}{16}$ -24NF nuts. Tighten the nuts.
- (5) For the cargo truck M37 or command truck M42, install the tailpipe bracket clamp and install the two  $\frac{5}{16}$ -24NF x  $1\frac{1}{8}$  bolts,  $\frac{5}{16}$ -inch lockwashers, and  $\frac{5}{16}$ -24NF nuts. Tighten the nuts.

## Section IX. COOLING SYSTEM

### 147. Description and Data

*a. Description.*

- (1) The sealed-type cooling system includes the radiator, fan, water pump, thermostat, water passages in the engine, and connecting hoses. Liquid is drawn from the bottom of the radiator by the belt-driven centrifugal-type water pump,

circulated through passages in the engine, and returned through the upper hose to the radiator. The fan, also belt-driven, draws air through the radiator to cool the liquid in the radiator. The thermostat, located in the outlet elbow on the cylinder head, restricts flow of coolant to the radiator during warmup period. When the coolant reaches the activating temperature for the thermostat, the thermostat opens, permitting full circulation.

- (2) Organizational maintenance of the cooling system includes draining, filling, and preventive cleaning of the system, and replacement of parts such as hoses, fan, fan belt, water pump, thermostat, and radiator.

*b. Data.*

Capacity	-----	17 qt
Fan belt tension	-----	½-in. slack
Hose sizes:		
Radiator to water pump (two pieces):		
Inside diameter	-----	1½ in.
Length (each)	-----	4 in.
Water outlet elbow to radiator:		
Inside diameter	-----	2 in.
Length	-----	10¼ in.
Water pump bypass elbow:		
Inside diameter	-----	1 in.
Length	-----	1½ in.
Pump:		
Capacity	-----	26.1 gpm at 2,000 rpm
Type	-----	centrifugal
Radiator:		
Cap	-----	pressure-type
Make	-----	Fedders or Blackstone
Model	-----	30-J-161A
Type	-----	fin and tube
Thermostat fully open	-----	160° F.

**148. General Service**

*a. Drain Cooling System.*

- (1) If radiator is hot, remove the filler neck cap (fig. 119) slowly to permit pressure to escape through the vent in the cap. Open the radiator drain cock (fig. 152) at front lower right corner of the radiator core. If cooling system contains anti-freeze, drain into a suitable container and save for use again.
- (2) Open the drain cock at the left side of the engine block.

*Note.* Draining the radiator alone will not completely drain the cooling system.

*b. Fill Cooling System.* Close the radiator drain cock and the drain cock at the left side of the engine block. Fill the system with coolant to a level 2¼ inches below the top of the filler neck. Refer to

paragraph 149 for application of corrosion inhibitor or antifreeze compound. Turn the filler neck cap clockwise as far as possible to seal the system.

## 149. Preventive Cleaning

### *a. General.*

- (1) The cooling system must be cleaned at least twice a year, before antifreeze is added and again after it is removed. Rusty or otherwise contaminated coolant or rust and grease deposits inside the radiator indicate that cleaning of the cooling system is necessary. Cleaning at the prescribed intervals will reduce clogging and overheating to a minimum and will largely eliminate the necessity for corrective cleaning by a higher echelon. If the cooling system is very dirty or clogged so that overheating occurs, the conditions must be reported to ordnance maintenance personnel.
- (2) The entire cooling system must be examined for leaks, both before and after cleaning and flushing.
- (3) The cooling system should never be allowed to stay for an extended time without protection, particularly after cleaning. Considerable corrosion may take place in a few hours.

*b. Cleaning Compound.* The prescribed cleaning compound is "COMPOUND, cleaning, with inhibitor (for engine cooling system)." It consists of two separated components (aluminum chloride and oxalic acid); these are intermixed immediately prior to use. The components are packaged in a single container having independent compartments. An inhibitor (borax), is furnished in the same container in a third separate compartment. Use one container for cooling system.

**Caution:** Do not under any circumstances mix the materials with antifreeze compound or corrosion inhibitor compound. Never mix the water and the cleaning compound before putting it into the cooling system. Do not spill the compound on skin, clothing, or painted portions of the vehicle. If spilled, flush affected area with clean water immediately.

*c. Engine Temperature.* During engine idling periods, required in cooling-system cleaning processes, it is important to cover the radiator and keep the cover adjusted so that a temperature of 180° to 200° F. is maintained. The engine develops so little heat while running without load that the thermostat valve remains partially or fully closed. Covering the radiator opens the valve quickly; but if the cover is removed, the valve will close again, even though the temperature gage shows little change.

*Note.* With flow to the radiator restricted by the thermostat valve, cleaning, inhibiting, and flushing are not effective.

#### *d. Cleaning.*

- (1) Drain system by opening drain cocks (par. 148a). Make certain temperature of coolant has dropped considerably below 200° F. before draining and refilling with cold water, to avoid cracking the block and head. If necessary, use a wire to keep open any drain hole which tends to become clogged.
- (2) Close the drain cocks (par. 148b), pour water slowly into the radiator until the level is within 2 inches of overflow pipe.
- (3) Replace the filler neck cap, cover radiator if necessary, start the engine, and run it at idling speed until temperature reaches above 180° F., but not above 200° F. Then pour cleaning components together into hot radiator as specified in *b* above. Allow engine to continue running for 30 to 60 minutes.
- (4) Stop engine and turn the filler neck cap to release pressure. As temperature rise can be expected at shutdown, coolant temperature should be allowed to drop considerably below 200° F. before draining and refilling with cold water, to avoid cracking the block and head. Then remove the cap and drain the system completely.

#### *e. Normal Flushing.*

- (1) With engine stopped and temperature of coolant considerably below 200° F., open both drain cocks.
- (2) Add clean water and, while so doing, run the engine at fast idle (drains open). Flush, continually flooding cooling system with clean water, running engine for 25 minutes.
- (3) Stop engine, close both drain cocks, refill with clean water, leaving sufficient space for the addition of inhibitor or anti-freeze compound.

*f. Inhibition.* Add inhibitor, in amounts specified in *b* above, to the radiator, fill to correct level with clean water, start and run engine at idle until temperature reaches over 180° F., but not above 200° F. Cover the radiator, if necessary.

*Note.* If antifreeze compound is to be added after flushing the radiator, do not add inhibitor; discard it.

#### *g. Pressure Flushing.*

- (1) To flush radiator (fig. 117), proceed as in (*a*) through (*g*) below.
  - (a) Drain the cooling system (par. 148a).
  - (b) Loosen the hose clamps on the radiator inlet hose and outlet hoses and remove the inlet hose and the outlet hoses and outlet tube (fig. 119).
  - (c) Clamp a convenient length of new hose to radiator core

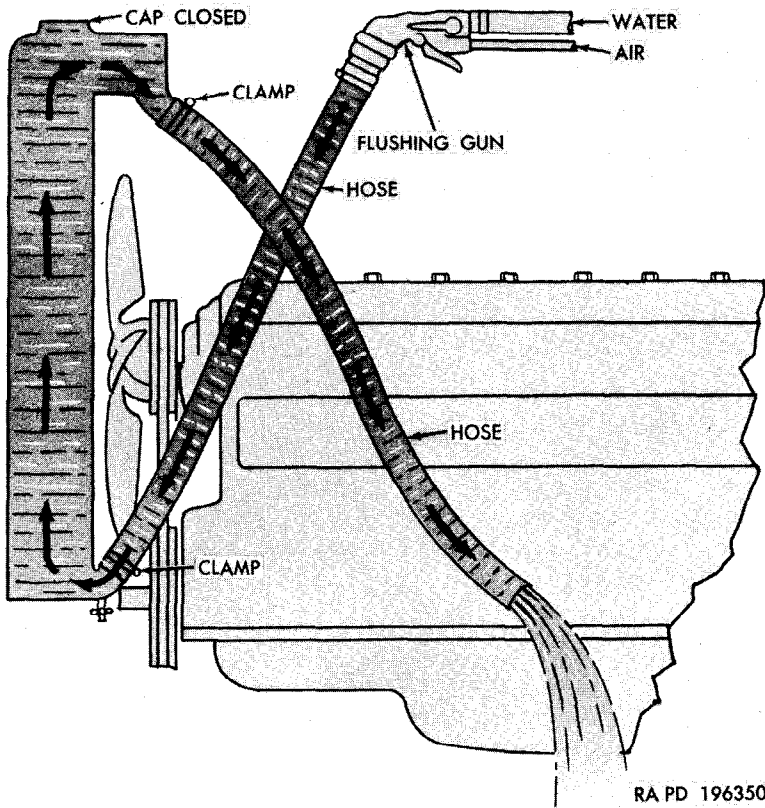


Figure 117. Pressure flushing radiator.

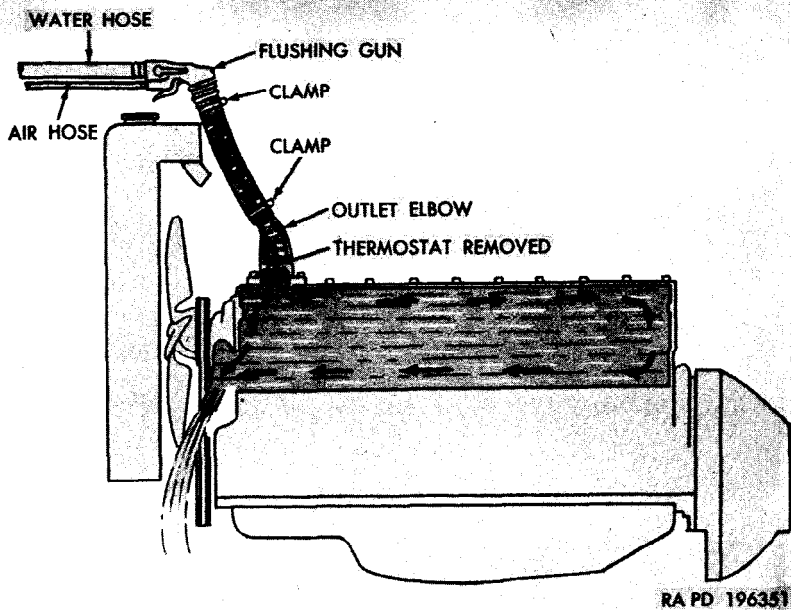
outlet opening and attach another suitable length of hose to radiator inlet opening to carry away flushing stream (fig. 117).

- (d) Connect the flushing gun to compressed air and to water-line and clamp the nozzle of gun in the hose attached to the radiator outlet opening.
- (e) With the filler neck cap on tight, fill core with water and apply compressed air.

**Caution:** Turn on compressed air in short blasts to prevent core damage.

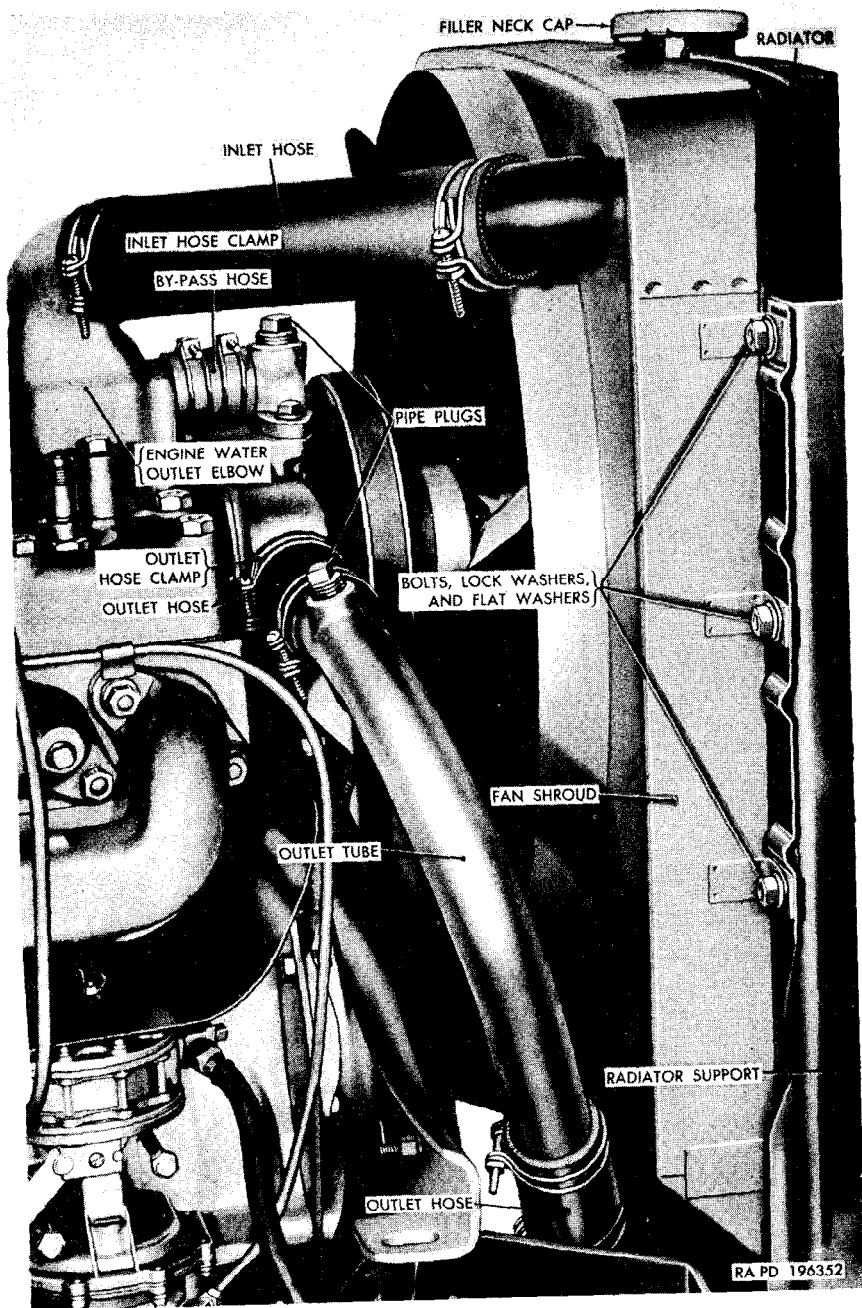
- (f) Allow radiator to fill with water and again apply air pressure as before. Repeat this process until the water comes out clear. Connect the hoses and proceed as in *f* above.
  - (g) Blow insects and dirt from radiator core air passages, using water to soften obstructions.
- (2) To flush engine block (fig. 118), proceed as in (a) through (e) below.





*Figure 118. Pressure flushing engine block.*

- (a) Drain cooling system (par. 148a).
  - (b) Remove the radiator inlet hose (fig. 119), the water outlet elbow, and thermostat (fig. 120). Install the outlet elbow and gasket.
  - (c) Loosen the hose clamp on the radiator outlet hose (fig. 119) and disconnect the hose from the water pump.
  - (d) Clamp the flushing gun nozzle firmly to a length of hose attached securely to the outlet elbow (fig. 118) and fill the engine with water, partially covering the opening in the water pump to insure complete filling.
  - (e) Turn on compressed air to blow out water and loosen sediment. Repeat the process of filling with water and blowing out with compressed air, until flushing stream comes out clean.
- (3) For complete removal of sediment, repeat flushing process of radiator core and engine block in opposite directions.
  - (4) If the engine water jackets are badly clogged so that they do not respond to regular pressure flushing, engine should be replaced (pars. 121 and 122), and higher echelon notified for corrective cleaning.
  - (5) Remove flushing equipment and the water outlet elbow. Clean all hose connections of both radiator and engine block. Clean out the radiator overflow pipe. Inspect and, if neces-



*Figure 119. Radiator and hoses.*

sary, lubricate the water pump. Inspect the thermostat; clean, if necessary, and check for proper operation.

- (6) Install the thermostat (par. 151c). Connect the hoses (par. 150c). Close both drain cocks, test for leaks (*h* below), and proceed as in *f* above.

*h. Leaks.* Pour water slowly into the radiator until the system is approximately half full. Start engine, run at idling speed, and fill the system completely. Stop the engine and examine the entire cooling system for leaks. Carefully check the radiator hose connections, water pump mounting bolts, gasket, water outlet elbow mounting bolts and gasket, bypass elbow mounting bolts and gasket, and the cylinder head bolts and gasket.

*Note.* Inspect the radiator core for leakage. This is important because the cleaning solution may uncover leaks which existed before cleaning but were plugged with rust or corrosion.

Leaks that cannot be corrected by the organizational maintenance unit must be reported immediately to ordnance maintenance personnel.

*i. Coolant Service.*

- (1) When servicing the engine for operation at anticipated temperatures above 32° F., fill the system nearly full with clean water. Add corrosion inhibitor compound in the proportion of one container of inhibitor to each 4 gallons of cooling system capacity. Then complete filling the system with water.
- (2) When servicing the engine for operation at anticipated temperatures below 32° F., use the procedure prescribed for reclaimed or new antifreeze compound, whichever is to be used. Inspect entire cooling system for leaks and replace any hoses not suited for extended use.

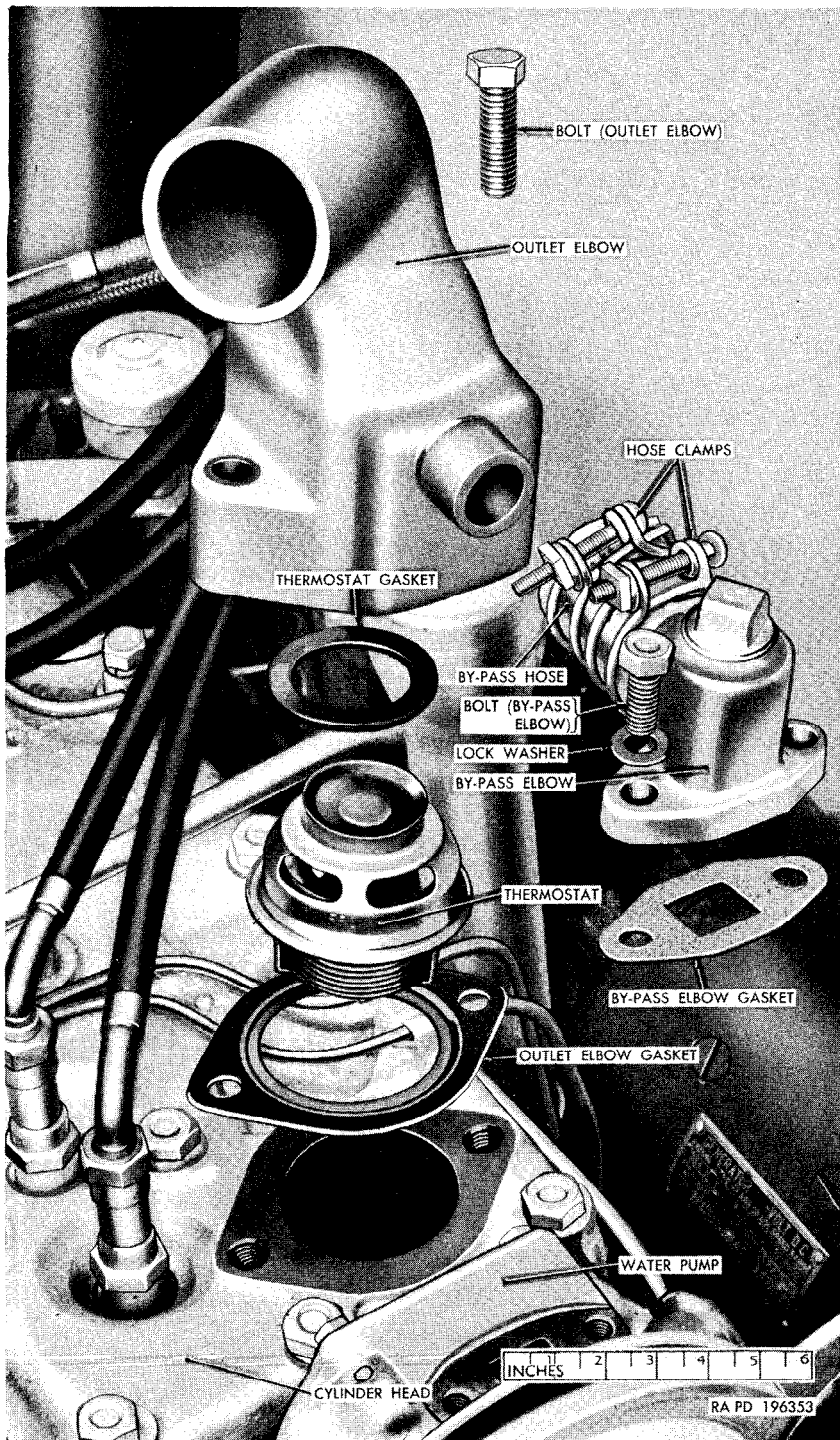
## 150. Hoses

*a. Remove Radiator Inlet and Outlet Hoses and Radiator Outlet Tube (fig. 119).*

- (1) Drain cooling system (par. 148a).
- (2) Loosen the radiator inlet hose clamps by loosening the clamp screws. Remove the hose with clamps. Remove the clamps from the hose, if hose is to be discarded or clamps must be replaced.
- (3) Loosen the radiator outlet hose upper and lower hose clamps. Remove the outlet hoses and the outlet tube. Remove the clamps from the hoses if the hoses, are to be discarded or the clamps must be replaced.

*b. Inspection.*

- (1) Clean rust and scale from the outlet tube. Clean all hose connections.
- (2) Inspect the inlet and outlet hose clamps for distortion, cracks,



*Figure 120. Water outlet elbow, thermostat, and related parts.*

corrosion damage, or stripped threads. Replace clamps as necessary.

- (3) Inspect the outlet tube for corrosion damage, cracked weld around pipe plug boss (on vehicles so equipped), or other visual damage. Replace tube as necessary.

*c. Install Radiator Inlet and Outlet Hoses and Radiator Outlet Tube (fig. 119).*

*Note.* Apply a coating of liquid-type gasket cement around all hose connections and gaskets.

- (1) Install a 4-inch length of 1½-inch (ID) hose on each end of the outlet tube. Install a 1⅞-inch hose clamp on each end of each outlet hose.
- (2) Install the outlet tube with hoses attached to the radiator outlet opening and to the water pump. Position the clamps on the two hoses and tighten the clamp screws.
- (3) Install a 2⅜-inch hose clamp on each end of a 2 (ID) x 10¼ inlet hose. Position the hose on the engine water outlet elbow and on the radiator inlet opening. Position the clamps on the hose and tighten the clamp screws securely.

*d. Replace Water Pump Bypass Hose.*

- (1) Remove the two bolts and lockwashers attaching the water pump bypass elbow to the water pump (fig. 120).
- (2) Loosen the two hose clamps and remove the bypass elbow and hose. Remove the clamps and discard the bypass hose and bypass elbow gasket.
- (3) Install a 1 (ID) x 1½ hose on the water pump bypass elbow. Install a 1⅜-inch hose clamp on each end of the hose.
- (4) Clean both gasket contacting surfaces, and install a new water pump bypass elbow gasket on the water pump. Install the bypass elbow hose on the engine outlet elbow, and align the bolt holes in the elbow flange with those in the gasket and water pump. Install the two ⅝-18NC x ¾ bolts with ⅝-inch lockwashers through the bypass elbow and gasket. Tighten bolts evenly.
- (5) Position both clamps and tighten screws.
- (6) Fill the cooling system (par. 148b).

## 151. Thermostat

*a. General.* Replacement of the thermostat may be necessary if the unit is inoperative, or if it is desired to change the type of thermostat.

*b. Removal.*

- (1) Drain sufficient coolant from the cooling system (par. 148a) to lower the level to below the cylinder head.
- (2) Loosen the hose clamp that secures the radiator inlet hose to the engine water outlet elbow (fig. 113), and remove the hose from the elbow.

- (3) Remove the two bolts and lockwashers that attach the water pump bypass elbow to the water pump (fig. 120).
- (4) Remove the two bolts that secure the engine water outlet elbow to the cylinder head, and remove the outlet elbow and bypass elbow as a unit. Remove and discard the bypass elbow gasket.
- (5) Remove the thermostat, the thermostat gasket, and the outlet elbow gasket. Discard gaskets.

*c. Installation.*

- (1) Clean the gasket contacting surfaces and hose contacting surfaces thoroughly. Apply a coating of liquid-type gasket cement to both sides of a new outlet elbow gasket and a new bypass elbow gasket (fig. 120).
- (2) Install the outlet elbow gasket on the cylinder head and the bypass elbow gasket on the water pump.
- (3) Install a new thermostat gasket on top of the thermostat, and install the thermostat in the cylinder head with the word FRONT toward the radiator and coils of thermostat down into block.
- (4) Mount the assembled elbows in position and install the two  $\frac{3}{8}$ -16NC x 2 bolts in the outlet elbow and the two  $\frac{5}{16}$ -inch lockwashers and  $\frac{5}{16}$ -18NC x  $\frac{3}{4}$  bolts in the bypass elbow. Tighten all bolts evenly.
- (5) Apply liquid-type gasket cement to the outlet elbow at the hose connection. Install the radiator inlet hose on the elbow, and tighten the hose clamp.
- (6) Fill the cooling system (par. 148b).

## 152. Fan and Generator Drive Belt

*a. Adjustment.* Loosen the generator adjusting arm bolt, and move the generator toward or away from the engine to provide  $\frac{1}{2}$ -inch deflection of the belt (fig. 121). Tighten the adjusting arm bolt.

*b. Replacement.*

- (1) Loosen the generator adjusting arm bolt (fig. 121) and push the generator toward the engine as far as possible. Disengage the belt from the generator drive pulley, the crankshaft pulley, and the fan drive pulley and remove the belt over the fan blades.
- (2) Place a new belt over the fan blades, install it in position on the crankshaft pulley, the fan drive pulley, and the generator drive pulley. Adjust the belt (*a* above).

## 153. Radiator

*a. Removal*

- (1) Drain cooling system (par. 148a).
- (2) Remove the radiator inlet and outlet hoses (par. 150a).

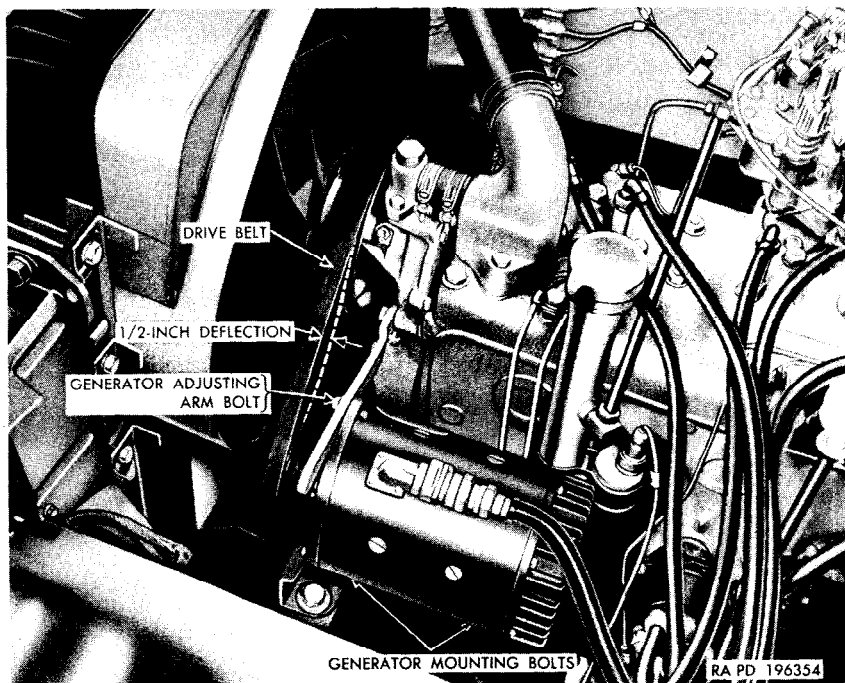


Figure 121. Adjusting fan and generator drive belt.

- (3) Remove fan and fan drive pulley.
- (4) Remove the three bolts, lockwashers, and flat washer which secure each side of the fan shroud and radiator to the radiator support (fig. 119).
- (5) Move the fan shroud back out of the way over the water pump, move the radiator back far enough to clear the upper baffle, and lift out the radiator.

**Caution:** Exercise care to avoid damaging the radiator core against the fan blades.

*b. Installation.*

- (1) Position the radiator in the radiator support.
- (2) Position the fan shroud, aligning the bolt holes in shroud and radiator with those in the radiator support.
- (3) Install a  $\frac{3}{8}$ -inch lockwasher and a  $\frac{3}{8}$ -inch flat washer on each of the six  $\frac{3}{8}$ -24NF x 1 bolts (fig. 119). Insert bolts through the holes in fan shroud and radiator. Tighten the bolts evenly.
- (4) Install the radiator inlet and outlet hose (par. 150*b*).
- (5) Fill cooling system (par. 148*b*).

## 154. Fan, Fan Drive Pulley, and Water Pump

### *a. Remove Fan and Related Parts.*

- (1) Loosen the fan belt (par. 152*b*) and disengage it from the fan drive pulley (fig. 122).
- (2) Remove the four bolts and lockwashers that secure the fan, spacer, and fan drive pulley to the pulley hub and remove the fan, spacer, and fan drive pulley.

*b. Inspection.* Inspect the fan for loose blade rivets, distortion, worn bolt holes, or other damage. Inspect the pulley and spacer for cracks and distortion. Replace worn or damaged parts as necessary.

### *c. Install Fan and Related Parts.*

- (1) Install the fan drive pulley on the pulley hub with the dished side toward the water pump. Position the fan belt over the pulley and install the spacer and fan. Aline the four bolt holes in the fan, spacer, and pulley with those in the pulley hub and install the four  $\frac{5}{16}$ -inch lockwashers and four  $\frac{5}{16}$ -18NC x 1 bolts. Tighten bolts evenly.
- (2) Adjust the fan belt (par. 152*a*).

### *d. Remove Water Pump.*

- (1) Drain the cooling system (par. 148*a*).
- (2) Remove fan and related parts (*a* above).
- (3) Remove the two bolts and lockwashers that secure the bypass elbow to the water pump (fig. 120).
- (4) Remove the three bolts and lockwashers that secure the water pump to the cylinder block, move the generator adjusting arm out of the way, and remove the water pump.
- (5) Remove and discard the water pump gasket and the bypass elbow gasket.
- (6) If the generator adjusting arm is to be replaced, remove the bolt and plain washer that secures the arm to the generator, and remove the arm.

*e. Inspection.* Clean the mating surfaces on the water pump, cylinder block, and bypass elbow. Inspect the water pump for cracks, loose body parts, or other damage. Replace the pump, if necessary.

### *f. Install Water Pump.*

- (1) If the generator adjusting arm was removed (*d*(6) above), position the arm on the generator and install the  $\frac{13}{32}$ -inch plain washer and  $\frac{3}{8}$ -16NC x 1 bolt, tightening the bolt only fingertight.
- (2) Apply a coating of liquid-type gasket cement to both sides of the water pump gasket and the bypass elbow gasket and install the gaskets in position.
- (3) Position the pump on the cylinder block, alining the bolt holes in the pump, gaskets, cylinder block, and bypass elbow.



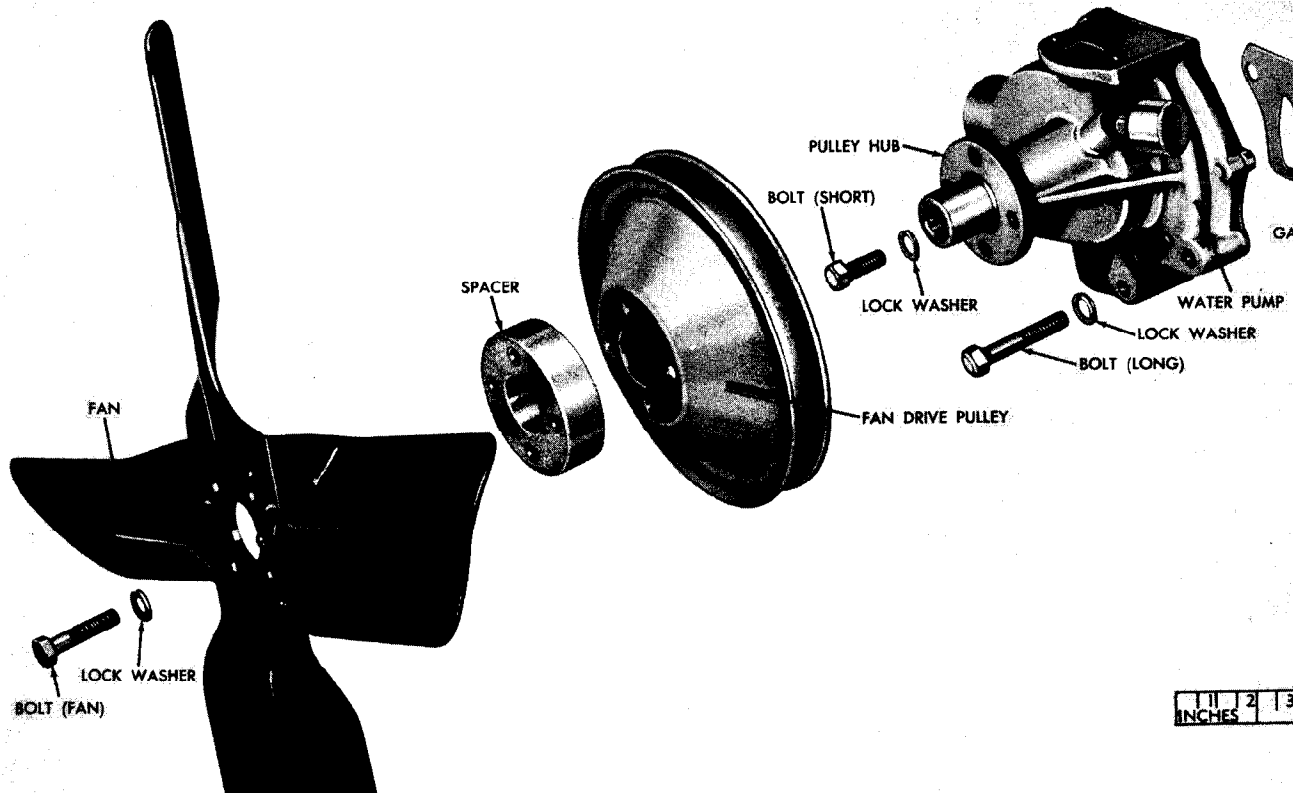


Figure 122. Fan, water pump, and related parts—exploded view.

Install a  $\frac{3}{8}$ -inch lockwasher and a  $\frac{3}{8}$ -16NC x 1 bolt at the right side of the pump. Install a  $\frac{3}{8}$ -inch lockwasher and a  $\frac{3}{8}$ -16NC x 2 bolt in the lower bolt hole. Align the hole in the generator adjusting arm with the bolt hole at the left side of the water pump, and install a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -16NC x 2 bolt. Tighten the three bolts evenly.

- (4) Install the two  $\frac{5}{16}$ -inch lockwashers and  $\frac{5}{16}$ -18NC x  $\frac{3}{4}$  bolts to secure the bypass elbow to the water pump. Tighten the bolts.
- (5) Install the fan and related parts (*c* above).
- (6) Fill the cooling system (par. 148*b*).

## 155. Temperature Gage Sending Unit

*a. General.* When replacing the water temperature gage sending unit, be sure to install the correct type unit for the gage. The temperature gage kit includes a replacement gage and sending unit. If the gage is replaced (par. 178*c*), replace the sending unit also.

*b. Removal.* (fig. 123).

- (1) Drain sufficient coolant from the cooling system to lower the level to below the cylinder head.
- (2) Disconnect the sending unit cable at the cable connector on the sending unit.
- (3) Unscrew the sending unit and remove it from the cylinder head.

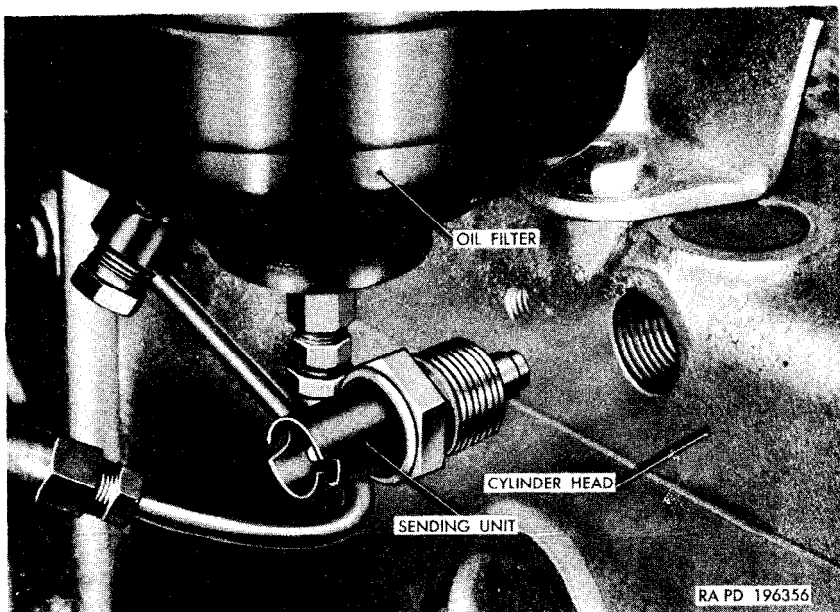


Figure 123. Water temperature gage sending unit removed.

*c. Installation.*

- (1) Coat the threads of the sending unit (fig. 123) with liquid-type gasket cement, install the unit in the cylinder head, and tighten.
- (2) Connect the sending unit cable at the cable connector.

## 156. Drain Cocks

*a. Removal.*

- (1) Drain the cooling system (par. 148a).
- (2) Unscrew the drain cock (fig. 152) from the front of the radiator.
- (3) Unscrew the cylinder block drain cock (fig. 81) from the cylinder block or pipe coupling (on vehicles so equipped) at the left side of the cylinder block. If the coupling or pipe nipple is damaged, unscrew the nipple and coupling from the cylinder block, and discard, as these parts are not required.

*b. Installation.*

- (1) Install the 1/4-inch, male pipe end drain cock in the pipe coupling or cylinder block (fig. 81) and tighten.
- (2) Install the 1/4-inch, male pipe end drain cock in the radiator.
- (3) Close both drain cocks and fill the cooling system (par. 148b).

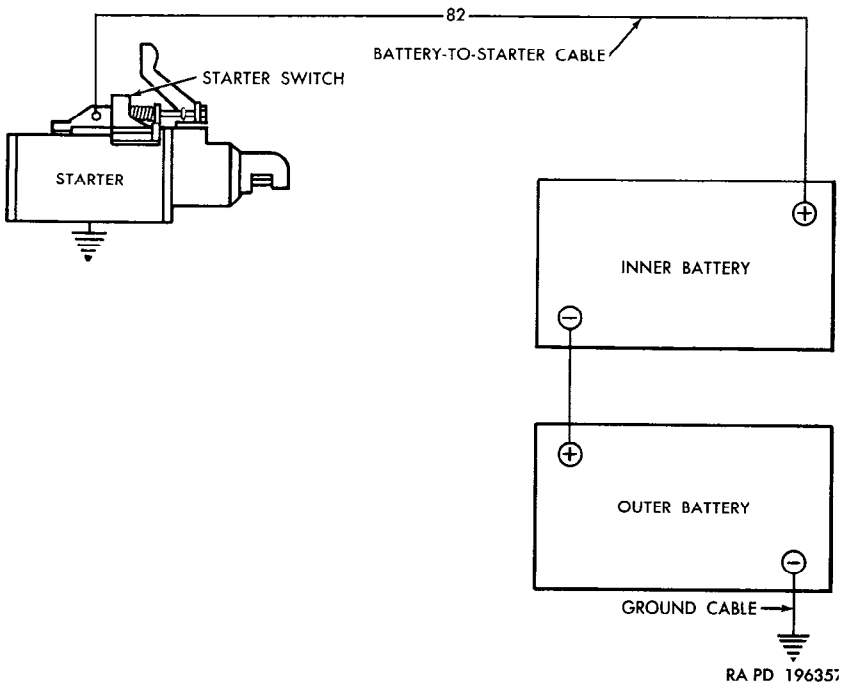


Figure 124. Starting system wiring diagram.

## Section X. STARTING SYSTEM

### 157. Description and Data

#### a. Description.

- (1) The starting system (fig. 124) includes the starter, starter switch, and battery-to-starter cable. Current is supplied by two 12-volt batteries. Engagement of the starter is effected by depressing the starter switch pedal (X, fig. 12).
- (2) On vehicles of early production, a slave receptacle was provided for the introduction of additional current to start the engine (par. 6).
- (3) Two types of starters have been used (par. 6). The principal difference between the two types is in the starter switch. The starters are interchangeable only as assemblies. Early and late type starters are shown in figure 126.
- (4) Organizational maintenance of the starting system includes replacement of the starter, starter switch, starter cable, and slave receptacle and cable (on vehicles so equipped) and adjustment of the starter pinion.

#### b. Data.

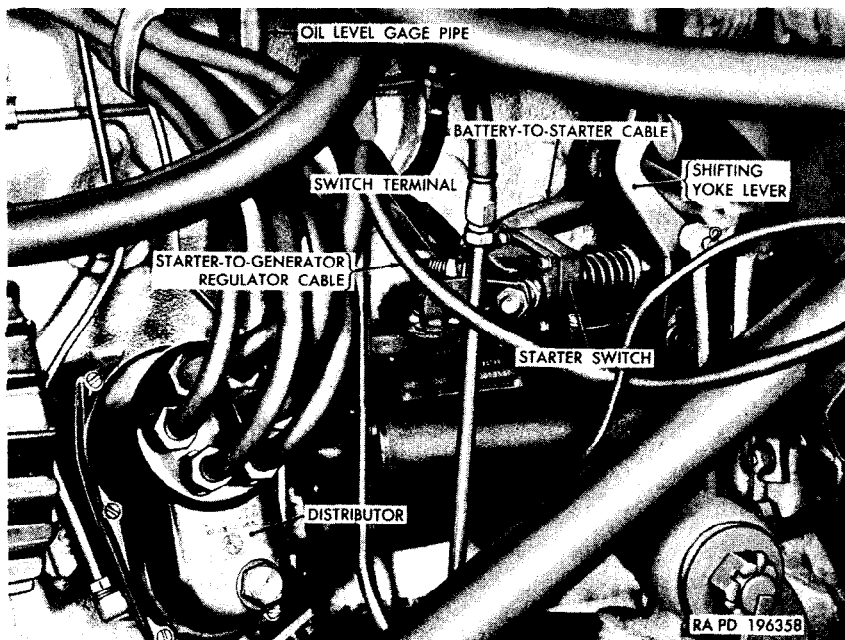
##### Starter:

Clearance between pinion and thrust washer.....	$\frac{3}{32}$ to $\frac{1}{8}$
Direction of rotation.....	clockwise
Drive .....	mechanical shift
Make .....	Auto-Lite
Model.....	MCS-4301-UT, MCZ-4002-UT, or MCS-4301-4
Number of teeth in pinion.....	9
Voltage .....	24
Number of teeth in flywheel ring gear.....	148

### 158. Starter

a. *Removal.* Procedure for removing the starter is the same for all starter models.

- (1) Remove the battery-to-ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Remove the distributor (par. 125a).
- (3) Unscrew the oil level gage pipe (fig. 125) from the cylinder block, and remove the pipe and gage.
- (4) Remove the nut from the starter switch terminal (fig. 125) and remove the battery-to-starter cable, starter-to-regulator cable, and the starter-to-slave receptacle cable (if so equipped) from the starter switch terminal.
- (5) Remove the two nuts and lockwashers that secure the starter to the studs in the clutch housing and remove the starter. Remove and discard the starter mounting seal (fig. 128).



*Figure 125. Starter installed.*

- (6) Inspect the starter mounting studs for looseness or damage. Tighten loose studs; remove damaged studs.
- (7) Inspect the flywheel ring gear for broken or damaged teeth. Report a damaged ring gear to ordnance maintenance personnel.

*b. Installation.* Before installing the starter, check the starter pinion clearance and adjust if necessary (par. 160).

- (1) If the two starter mounting studs were removed (*a*(6) above) install new  $\frac{7}{16}$ -14NC x  $\frac{7}{16}$ -20NF x  $1\frac{11}{16}$  studs in the clutch housing with the coarse thread end in the housing. Tighten the studs.
- (2) Install a new starter mounting seal (fig. 128) and place the starter (fig. 125) in position on the clutch housing. Install the two  $\frac{7}{16}$ -inch lockwashers and  $\frac{7}{16}$ -20NF nuts. Tighten the nuts.
- (3) Connect the battery-to-slave receptacle cable (if so equipped), the starter-to-regulator cable, and battery-to-starter cable to the front terminal of the starter switch (fig. 125) and install the terminal nut. Tighten the nut.
- (4) Install the oil level gage and gage pipe through the pipe support and screw the pipe into the opening in the cylinder block.
- (5) Install the distributor (par. 125*b*).
- (6) Connect the battery-to-ground cable to the negative (-) post of the outer battery (fig. 135).

## 159. Starter Switches

*a. General.* The early- and late-type starters are provided with distinctly different starter switches (fig. 126). When replacing the starter switch, be sure to install the same type of switch as was removed.

*b. Replacement (Late-Type Switch)* (fig. 128).

- (1) Remove the starter (par. 158a).

*Note.* Disconnect all wiring.

- (2) Remove the nut and lockwasher that secure the connector strap to the terminal in the starter frame.
- (3) Remove the four screws and lockwashers that secure the starter switch to the switch mounting bracket, and remove the switch and switch housing gasket (early-type only).
- (4) Remove the nut and lockwasher that secure the connector strap to the starter switch, and remove the strap.
- (5) Position the connector strap on the short terminal of the new starter switch, and install a  $\frac{3}{8}$ -inch lockwasher and special nut.
- (6) Clean the gasket surface of the mounting bracket, and position a new switch housing gasket (early type only) and switch on the bracket with the connector strap over the terminal in the starter frame.
- (7) Install the four No. 10 lockwashers and four No. 10-32NF x  $\frac{1}{2}$  machine screws to secure the switch to the bracket. Install a  $\frac{3}{8}$ -inch lockwasher and special nut on the terminal in the starter frame. Tighten the four screws and the two terminal nuts.
- (8) Adjust the starter pinion clearance (par. 160b).
- (9) Install the starter (par. 158b).

*c. Replacement (Early-Type Switch).*

*Note.* The key letters noted in parentheses are in figure 127.

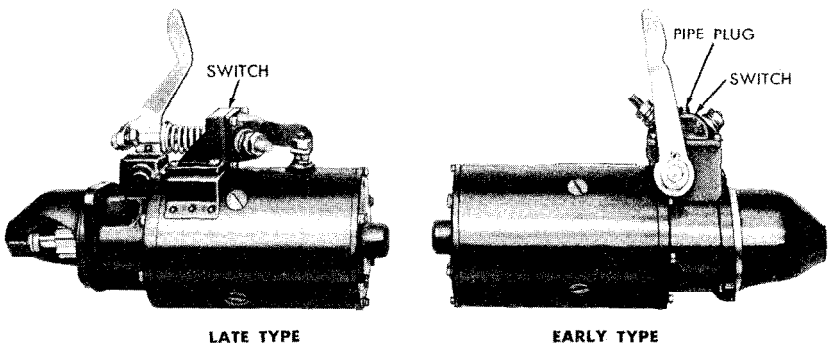
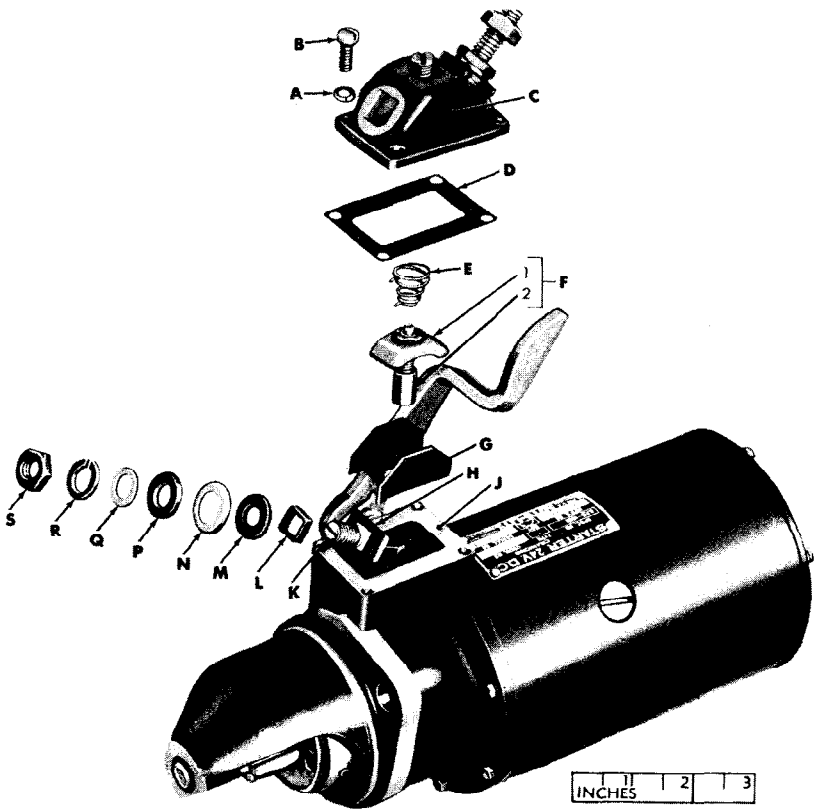


Figure 126. Starters (late- and early-types).

- (1) Remove the starter (par. 158a).
- (2) Remove the nut (S) and lockwasher (R) from the terminal (K), and remove the plain washer (Q), bushing (P), gasket retainer (N), gasket (M), and insulator (L) from the terminal (K).
- (3) Remove the four screws (B) and lockwashers (A) that secure the switch housing (C), and remove the housing and housing gasket (D).
- (4) Remove the spring (E), the switch blade assembly (F), and the cover insulator (G) from the drive housing (J).



KEY	ITEM
A	LOCK WASHER (SMALL)
B	SCREW
C	SWITCH HOUSING
D	HOUSING GASKET
E	SPRING
F	BLADE ASSEMBLY
1	BLADE AND PLUNGER
2	SLEEVE
G	COVER INSULATOR
H	CONNECTOR AND INSULATOR

KEY	ITEM
J	DRIVE HOUSING
K	TERMINAL
L	INSULATOR
M	GASKET
N	GASKET RETAINER
P	BUSHING
Q	PLAIN WASHER
R	LOCK WASHER
S	NUT

RA PD 196360

Figure 127. Starter switch (early type)—exploded view.

- (5) Remove the terminal (K) from the connector and insulator (H).
- (6) Insert a new terminal (K) through the switch connector and insulator (H), positioning the terminal so that the relieved edge of the threaded end is down.

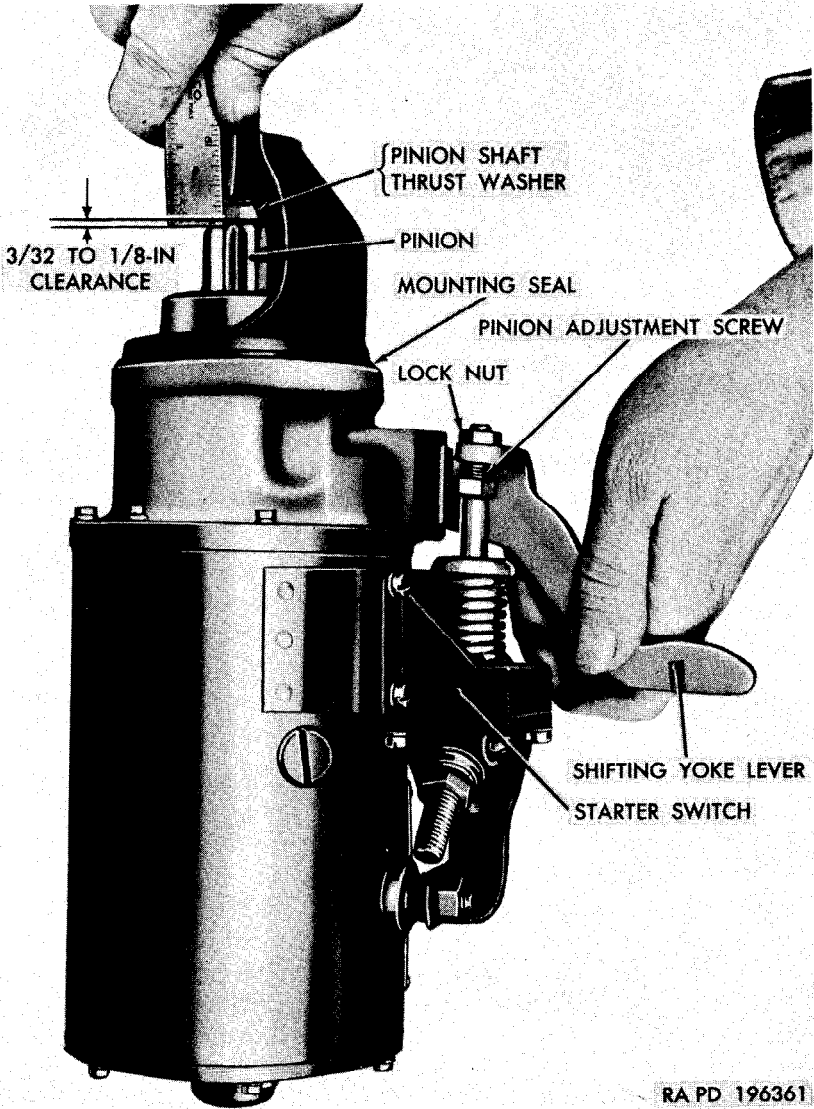


Figure 128. Pinion adjustment for late-type starter.



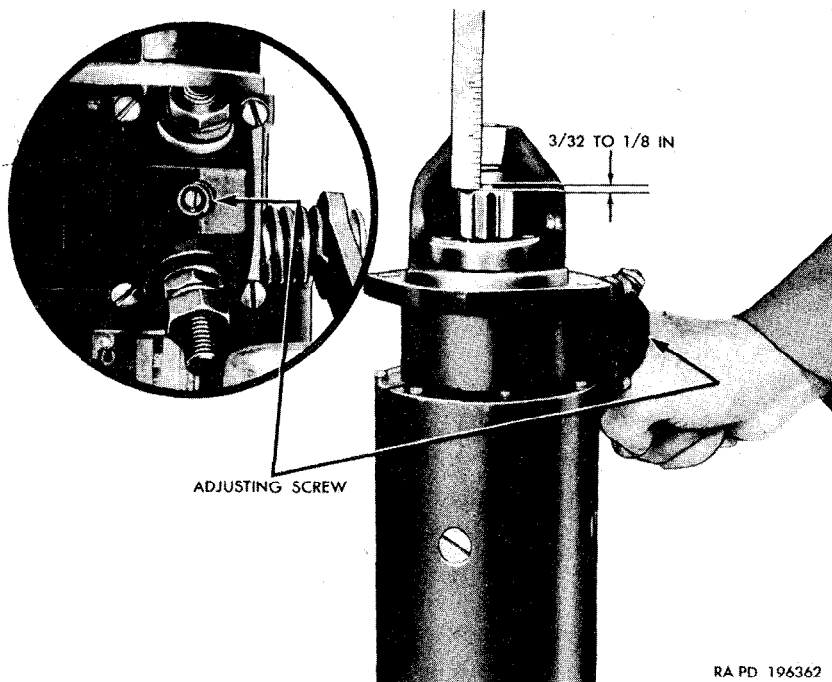
- (7) Make certain that the blade and plunger (F-1) is screwed into the sleeve (F-2). Fit the cover insulator (G) on the blade assembly (F) and position the parts on the starter, fitting the alining bosses of the sleeve (F-2) into the slots in the drive housing (J).
- (8) Install the spring (E) over the blade assembly (F) with the smaller diameter down.
- (9) Position the housing gasket (D) and switch housing (C) on the drive housing (J), and install the four No. 10 lockwashers (A) and No. 10-32NC x 1 $\frac{1}{4}$  fillister-head screws (B).
- (10) Install the insulator (L) over the terminal (K) and into the recess in the switch housing. Fit the gasket (M) into the gasket retainer (N) and install the bushing (P) in the opposite side of the retainer, pressing the smaller diameter of the bushing into the retainer. Install the assembled parts over the terminal (K) with the gasket next to the switch housing.
- (11) Install the  $\frac{3}{8}$ -inch plain washer (Q),  $\frac{3}{8}$ -inch lockwasher (R), and special nut (S) on the terminal. Tighten the nut, with the relieved side of the nut alined with the relieved edge of the terminal.
- (12) Install the starter (par. 158*b*).

## 160. Starter Pinion Adjustment

*a. General.* Proper clearance between the starter pinion and the pinion shaft thrust washer must be established before installing the starter, to insure satisfactory engagement and disengagement of the pinion and the flywheel ring gear and proper performance of the starter switch. Because of the difference in the two types of starters, the adjustment procedure for the late-type starter differs from that for the early-type starter.

*b. Adjust Starter Pinion (Late-Type).* Place the starter in a vertical position and push the shifting yoke lever (fig. 128) to the forward (engaged) position. While holding the lever firmly, measure the distance between the starter pinion and the pinion shaft thrust washer. This measurement should be from  $\frac{3}{32}$  to  $\frac{1}{8}$  inch. If the clearance at this point is not within the specified limits, loosen the locknut on the pinion adjustment screw, and turn the screw as required until correct clearance is obtained. Turning the screw clockwise decreases the clearance and turning it counterclockwise increases the clearance. Tighten the adjusting screwnut after making the adjustment.

*c. Adjust Starter Pinion (Early Type).* Place the starter (fig. 129) in a vertical position, resting on the commutator end. Hold the starter and push the shifting yoke lever down (toward the com-



**Figure 129.** Pinion adjustment for early-type starter.

mutator end) as far as it will go, and measure the distance between the pinion and the pinion shaft thrust washer. This distance should be from  $\frac{3}{32}$  to  $\frac{1}{8}$  inch. If the clearance at this point is not within the specified limits remove the pipe plug from the top of the switch housing (C, fig. 127) and turn the switch blade plunger clockwise to decrease the clearance, or counterclockwise to increase the clearance. Install the  $\frac{1}{8}$ -inch pipe plug in the switch housing after making the adjustment.

## **161. Auxiliary Power Receptacle (Vehicles so Equipped)**

### *a. Removal.*

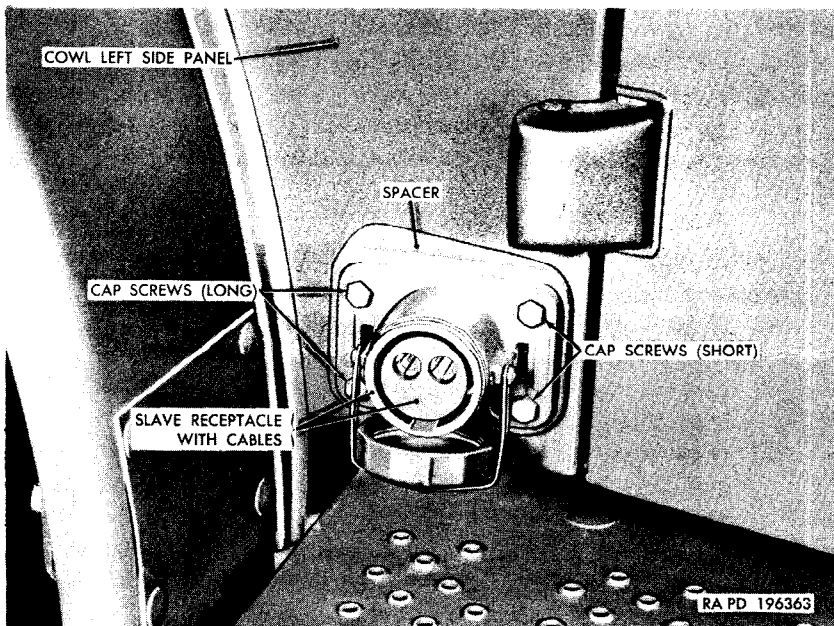
- (1) Disconnect the battery-to-ground cable from the negative (–) post of the outer battery (fig. 135).
- (2) Remove the rear splash shield from the left front fender (par. 250*h*).
- (3) Disconnect the slave receptacle cable (G, fig. 85) from the starter switch terminal, and disengage the cable from the cable clip on the cowl near the dimmer switch.
- (4) Remove the nut, two lockwashers, and bolt that attach the receptacle ground cable to the left running board front hanger.
- (5) Remove the two screws that secure the grommet retainer

to the inner side of the cowl panel, and slide the retainer and the grommet off the cables.

- (6) Remove the four bolts and lockwashers that secure the receptacle to the spacer on the cowl panel (fig. 130), and remove the receptacle with cables.

*b. Installation.*

- (1) Insert the receptacle cables through the opening in the spacer and the cowl panel with the short (ground) cable toward the rear of the vehicle. Position the receptacle on the spacer, and install the two  $\frac{1}{4}$ -inch lockwashers and  $\frac{1}{4}$ -28NF x  $1\frac{1}{4}$  cap screws in the two rear holes, and two  $\frac{1}{4}$ -inch lockwashers and  $\frac{1}{4}$ -28NF x  $1\frac{3}{4}$  cap screws in the two front holes (fig. 130). Tighten the screws.
- (2) Install the grommet over the cables and thread the cables through the grommet retainer with the dished side of the retainer toward the grommet. Position the grommet and retainer on the inner side of the cowl panel and install the two  $\frac{1}{4}$ -20NC x  $\frac{3}{8}$  cap screws. Tighten the screws.
- (3) Attach the receptacle ground cable to the left running board front hanger. Place a  $\frac{3}{8}$ -inch, internal-external-teeth lockwasher at each side of the cable terminal, position the parts over the screw hole in the hanger, and install the  $\frac{3}{8}$ -24NF x 1 cap screw and  $\frac{3}{8}$ -24NF nut. Tighten the nut.



*Figure 130. Auxiliary power receptacle installed.*

- (4) Connect the receptacle cable to the starter switch terminal (fig. 85) and tighten the terminal nut. Engage the cable in the cable clip near the dimmer switch.
- (5) Install the left front fender rear splash shield (par. 250*i*).
- (6) Connect the battery-to-ground cable to the negative (-) post of the outer battery (fig. 135).

## 162. Starter Switch Pedal Alinement

*a. General.* On vehicles of early production, the starter pedal plunger may not be properly alined with the starter shifting yoke leveled when in the fully engaged position, causing the plunger to slip over the yoke lever when the pedal is depressed. This difficulty has been eliminated on later vehicles (par. 6). To correct the condition on early vehicles, proceed as instructed in *b* below.

### *b. Aline Pedal Plunger.*

- (1) Remove the two screws and lockwashers that secure the lower side of the pedal bracket to the transmission cutout cover (fig. 87).
- (2) Insert spacers ( $\frac{1}{4}$ -inch ID flat washers) between the bracket and the cover, alining the holes in the spacers with those in the bracket and cover. Use the same number and thickness washers for each screw hole to the pedal plunger at the shifting yoke lever.
- (3) Install the two  $\frac{1}{4}$ -inch lockwashers and  $\frac{1}{4}$ -28NF x  $\frac{1}{2}$  screws to secure the bracket to the cover.

*Note.* It may be necessary to use longer screws to compensate for the spacers.

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## Section XI. GENERATOR SYSTEM

### 163. Description and Data

#### *a. Description.*

- (1) The 24-volt generating system (fig. 131) includes the generator, generator regulator, batteries, and necessary connecting cables and wiring. The ammeter, or battery generator indicator, on the instrument panel is connected to the generator regulator. Current from the generator flows to the regulator and then to the batteries. The generator regulator controls current output to the batteries according to operation requirements, and prevents overcharging. The system is completely sealed against the entrance of water, to provide for efficient performance during fording operations.
- (2) Organizational maintenance includes replacement of the generator, generator pulley, generator mounting bracket,

generator regulator, generator regulator mounting bracket, ground straps, and generator to generator regulator cable.

*b. Data.*

Generator :

Charging rate :

Amperes..... 25

Watts..... 600

Drive..... belt

Location..... left side of engine

Make..... Auto-Lite or Delco-Remy

Model..... GHA-4802 UT

DR-1117495

Pulley diameter..... 3¼ in.

Generator regulator :

Make..... Auto-Lite or Delco-Remy

Model..... AL-VBC-4002 UT

DR-1118546 or

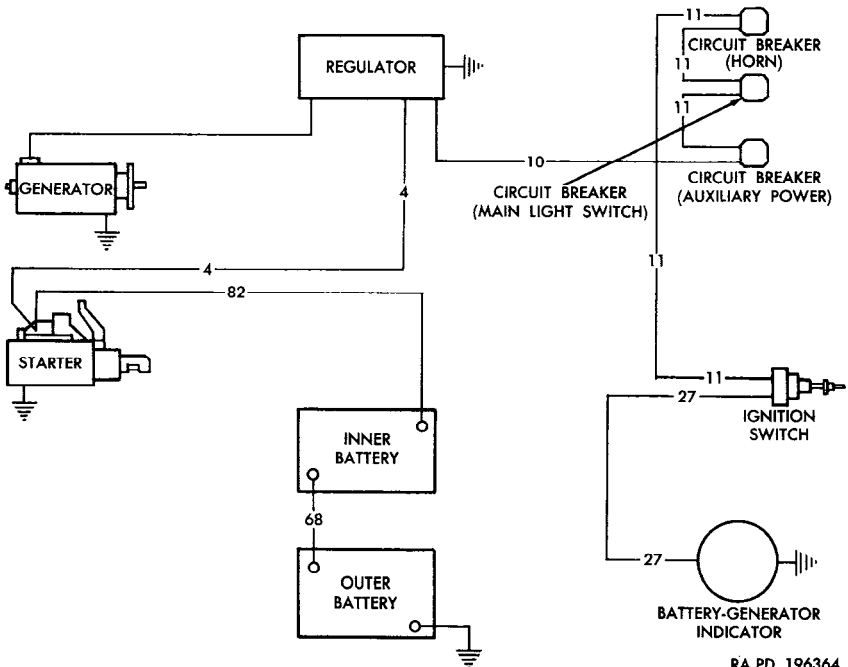
DR-1118606

**164. Generator, Generator Mounting Bracket, and Cable**

*Note.* The key letters noted in parentheses are in figure 132.

*a. Remove generator.*

- (1) Disconnect the battery-to-ground cable from the negative (-) post of the outer battery (fig. 135).



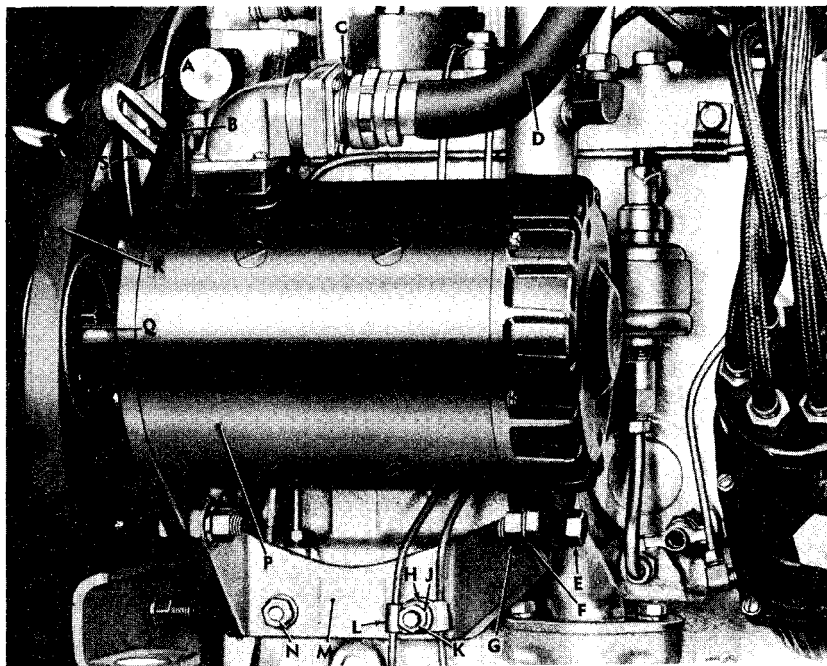
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Figure 131. Generating system wiring diagram.

- (2) Disconnect the generator-to-generator regulator cable (D) from the generator nut in receptacle (C) by unscrewing the cable connector end nut with a suitable spanner wrench.
- (3) Remove the adjusting arm bolt (S) and plain washer (B) and lockwasher that secure the adjusting arm (A) to the generator (P). Push the generator toward the engine, and remove the drive belt (R) from the pulley (Q).
- (4) Remove the two nuts (G), lockwashers (F), and bolts (E) that secure the generator to the mounting bracket (M), and remove the generator.

*b. Remove Generator Pulley.* Remove the cotter pin, castellated nut, and lockwasher that secure the generator pulley (Q) to the armature shaft.

*Note.* On some generators, the pulley is attached with a safety nut and plain washer.



KEY	ITEM	KEY	ITEM
A	ADJUSTING ARM	J	STUD NUT
B	PLAIN WASHER	K	STUD-TYPE SCREW
C	RECEPTACLE	L	TENSION CLIP
D	GENERATOR-TO-GENERATOR REGULATOR CABLE	M	MOUNTING BRACKET
E	BOLT	N	BRACKET BOLT
F	LOCK WASHER	P	GENERATOR
G	NUT	Q	PULLEY
H	LOCK WASHER	R	DRIVE BELT
		S	ADJUSTING ARM BOLT

RA PD 196365

*Figure 132. Generator and mounting bracket.*

With a suitable puller, remove the pulley from the shaft. Remove the woodruff key.

*c. Remove Generator Mounting Bracket.*

- (1) Remove the stud nut (J) and lockwasher (H) from the stud-type screw (K), and remove the tension clip (L) with the two vent lines from the screw. Remove the stud-type screw (K) and lockwasher.
- (2) Remove the bracket bolt (N) and lockwasher attaching the mounting bracket (M) to the cylinder block, and remove the bracket.
- (3) Removal of the generator adjusting arm (A) is described in paragraph 154d.

*d. Install Generator Mounting Bracket.*

- (1) Position the mounting bracket (M) on the cylinder block and install a  $\frac{7}{16}$ -inch lockwasher and the special stud-type screw (K) in the rear bolt hole. Install a  $\frac{7}{16}$ -inch lockwasher and  $\frac{7}{16}$ -14NC x 1 bracket bolt (N) in the front bolt hole. Tighten the bolt and stud-type screw.
- (2) Position the vent line tension clip (L) with vent lines on the stud-type screw, and install the  $\frac{3}{8}$ -inch lockwasher (H) and  $\frac{3}{8}$ -24NF stud nut (J) to secure the clip. Be sure the two vent lines are properly engaged in the clip and tighten the nut.
- (3) If the adjusting arm (A) was removed (*c*(3) above), install the arm (*par.* 154f).

*e. Install Generator Pulley.* Install the  $\frac{1}{8}$  x  $\frac{5}{8}$  woodruff key in the armature shaft and install the pulley (Q) on the shaft (hub extension toward generator), alining the keyway in the pulley with the key. Install the  $\frac{1}{2}$ -inch lockwasher,  $\frac{1}{2}$ -20NF castellated nut, and  $\frac{3}{32}$  x 1 cotter pin, or the special washer and safety nut. (Refer to note in *b* above.)

*f. Install Generator.*

*Note.* Before installing the generator, see that the generator mounting bolts and nuts are thoroughly clean and that the contacting surfaces of the bracket and generator heads are clean to insure a good ground connection.

- (1) Mount the generator in position on the mounting bracket (M) and install the two  $\frac{7}{16}$ -20NF x  $1\frac{3}{8}$  bolts (E),  $\frac{7}{16}$ -inch lockwashers (F), and  $\frac{7}{16}$ -20NF nuts (G). Do not tighten the nuts until the generator has been positioned ((3) below).
- (2) Attach the adjusting arm (A) to the generator with the  $\frac{3}{8}$ -16NC x 1 adjusting arm bolt (S) and  $1\frac{3}{32}$ -inch plain washer (B). Push the generator toward the engine and fit the drive belt (R) on the pulley (Q).
- (3) Position the generator to provide  $\frac{1}{2}$ -inch deflection of the

drive belt, and tighten the adjusting arm bolt (S). Then tighten the two mounting bolt nuts (G).

- (4) Connect the battery-to-ground cable to the negative (-) post of the outer battery (fig. 135).
- (5) Polarize the generator (*g* below).
- (6) Connect the generator-to-regulator cable, turning the connector end nut securely into place with a suitable spanner wrench.

*g. Polarize the Generator.*

*Note.* If a new or rebuilt generator has been installed, the generator must be polarized before the engine is started. This is necessary in order to insure correct polarity of the generator with respect to the batteries.

- (1) Disconnect the generator-to-generator-regulator cable and insert the adapter—17-A-2987-75 of the adapter set 17-A-3150 (fig. 42) in the generator receptacle.
- (2) Connect a jumper wire to one of the FIELD terminals of the adapter (link between the adapter field terminals closed).
- (3) Touch the other end of the jumper wire *momentarily* to the terminal of the starter switch. A flash connection is sufficient to polarize the generator.
- (4) Remove the adapter from the generator receptacle and connect the generator-to-generator-regulator cable (D).

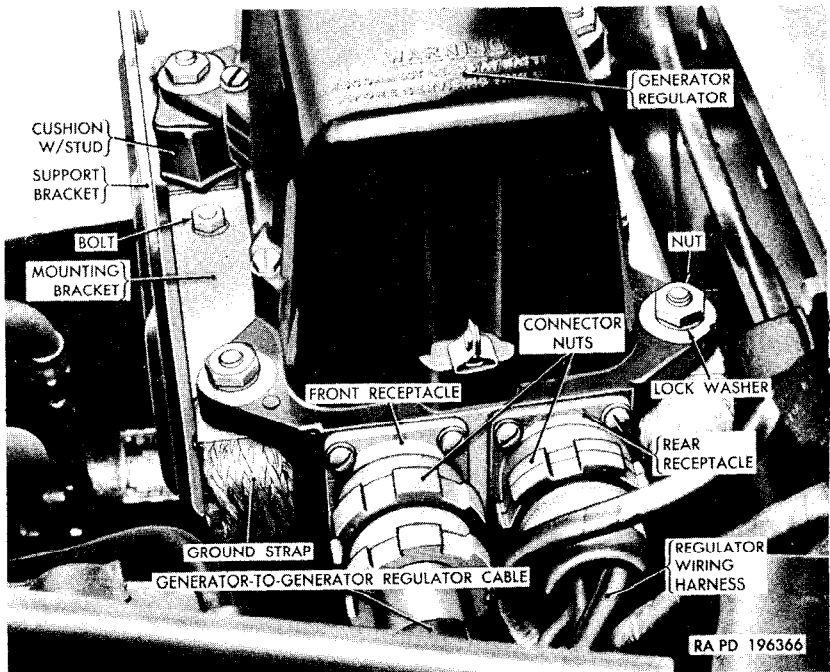


Figure 133. Generator regulator installed



*h. Replace Generator-To-Generator-Regulator Cable.*

- (1) Remove the four lockwasher screws which secure the left fender-to-hood panel and remove the panel.
- (2) Disengage the cable from the cable clip on the left front fender. Unscrew the generator-to-generator-regulator cable connector end nuts from the receptacle (C) and the front receptacle of the generator regulator (fig. 133), and remove the cable.
- (3) Connect the cable to the generator receptacle (C) and the front receptacle of the generator regulator (fig. 133), screwing the connector end nuts to the receptacles. Engage the cable in the cable clip on the left front fender.
- (4) Position the left fender-to-hood panel and install the four lockwasher screws. Tighten the screws.

## **165. Generator Regulator and Bracket**

*a. Remove Generator Regulator (fig. 133).*

- (1) Disconnect the battery-to-ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Remove the left fender-to-hood panel (par. 164h(1)).
- (3) Disengage the generator-to-regulator cable from the cable clip on the left front fender. Disconnect the generator-to-regulator cable and the regulator wiring harness from the generator regulator receptacles, using a suitable spanner wrench.
- (4) Remove the four nuts and lockwashers that secure the regulator, and remove the regulator.

*b. Remove Cushions, Regulator Brackets, and Ground Straps (fig. 133).*

- (1) Unscrew the four cushions with studs from the mounting brackets, and remove the cushions and ground straps.
- (2) Remove the four nuts, lockwashers, and bolts that secure the two mounting brackets to the regulator support bracket, and remove the two brackets.

*c. Inspection.*

- (1) Inspect the support bracket attaching screws for damage, looseness, or missing screws or lockwashers. Tighten loose screws and replace damaged or missing screws or lockwashers.
- (2) Inspect the four ground straps for corrosion or other damage. Replace the straps, if necessary.
- (3) Inspect the four cushions with studs for damage, deterioration, and damaged threads on the studs. Replace damaged cushions.
- (4) Inspect the two mounting brackets for cracks, distortion,

and damaged bolt or stud holes. Replace the brackets if necessary.

*d. Install Regulator Brackets, Cushions, and Ground Straps* (fig. 133).

- (1) Make certain that the contacting surfaces of the mounting brackets and the ground straps are thoroughly clean, to insure a good ground connection.
- (2) Position the two mounting brackets on the support bracket and install the two  $\frac{1}{4}$ -28NF x 1 bolts (from the upper side of the brackets),  $\frac{1}{4}$  x 0.760 internal-external-teeth lockwashers, and  $\frac{1}{4}$ -28NF nuts for each bracket. Tighten the nuts.
- (3) Place one end of a ground strap over each cushion stud opening in the two mounting brackets. Install the four cushions, screwing the short end of each stud into the support bracket hole.

*e. Install Generator Regulator.*

- (1) Place the outer end of each ground strap on the upper end of its cushion stud, position the regulator on the four cushion studs with the two receptacles to the left side of vehicle, and install the four  $\frac{5}{16}$ -inch lockwashers and  $\frac{5}{16}$ -18NC nuts (fig. 133). Tighten the nuts.
- (2) Connect the regulator wiring harness to the rear receptacle and the generator-to-generator-regulator cable to the front receptacle, screwing the connector end nuts to the receptacles. Engage the generator-to-generator-regulator cable in the cable clip on the left front fender.
- (3) Install the left fender-to-hood panel (par. 164h(4)).

## **Section XII. BATTERY AND LIGHTING SYSTEM**

### **166. Description and Data**

*a. Description.*

- (1) Current for the 24-volt lighting system (fig. 134) is supplied by two 12-volt batteries. Batteries (fig. 135) for all models, except the early production models of the ambulance truck M43, are located in a box under the passenger's seat in the driver's compartment. Batteries (fig. 136) for the early production vehicles of the ambulance truck M43 (par. 6) are located in the left front compartment under the patient's seat.
- (2) Organizational maintenance of the batteries and lighting system includes cleaning, inspection, and replacement of the batteries and battery cables, replacement of lamps, lamp-units, lights, light switch, dimmer switch, and circuit breakers.

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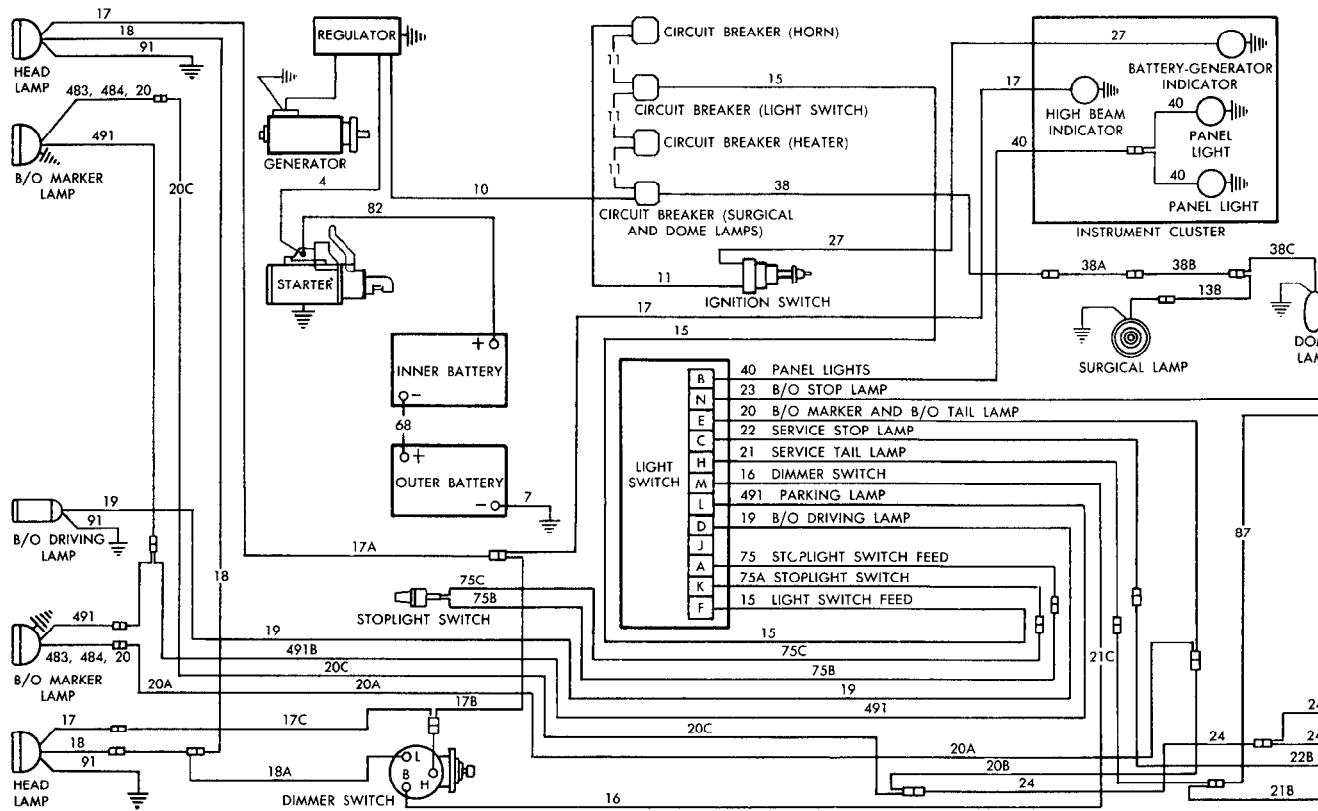


Figure 134. Lighting system wiring diagram.

On vehicles so equipped, it also includes replacement of the trailer coupling receptacle, radio receptacle, and auxiliary power outlet receptacle.

*b. Data.*

Batteries :

Capacity..... 45 amp at 20 hour rate (at 80° F.)  
 Cells (each battery) :  
     Arrangement..... side by side  
     Number..... 6  
 Make..... Auto-Lite or Willard  
 Model..... US2HN  
 Number required..... 2  
 Plates (each battery)..... 11  
 Terminal grounded..... negative  
 Voltage..... 12

Circuit breaker :

Make..... Spencer or Wilcalator  
 Type..... automatic reset  
 Voltage..... 24

Dimmer switch :

Make..... Douglas  
 Voltage..... 24

Lamps and lamp units :

Make..... Auto-Lite  
 Type :  
     Blackout driving..... lamp-unit (sealed beam)  
     Blockout marker, parking, tail and dome lights  
         ambulance truck M43)..... lamp (G-6 bulb)  
     Headlight (two)..... lamp-unit (sealed beam)  
     Spot light (ambulance truck M43, telephone  
         maintenance truck V41)..... lamp-unit (sealed beam)  
     Spot light (blackout and service)..... lamp (S-8 bulb)  
     Surgical light (ambulance truck M43)..... lamp-unit (sealed beam)

Light switch :

Make..... Bendix  
 Voltage..... 24

**167. Battery Cleaning, Servicing, and Specific Gravity Test**

*a. Clean and Service.*

- (1) Clean the batteries and battery cable terminals, removing corrosion and dirt.
- (2) Apply a light coating of petroleum jelly to the battery cable terminals to prevent corrosion accumulation. Corrosion around the battery and terminals causes battery drain and must be avoided.
- (3) Remove the six fillercaps from each battery and inspect the level of the electrolyte. The correct level should be three-eighths of an inch below the top of the cell, or well above the tops of the plates.

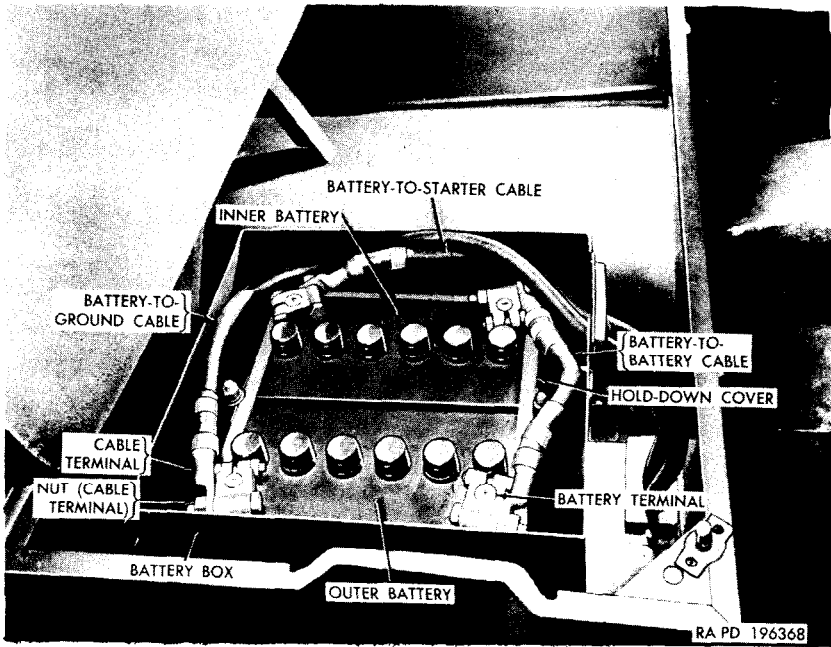


Figure 135. Battery box location (all models except early production ambulance truck M43).

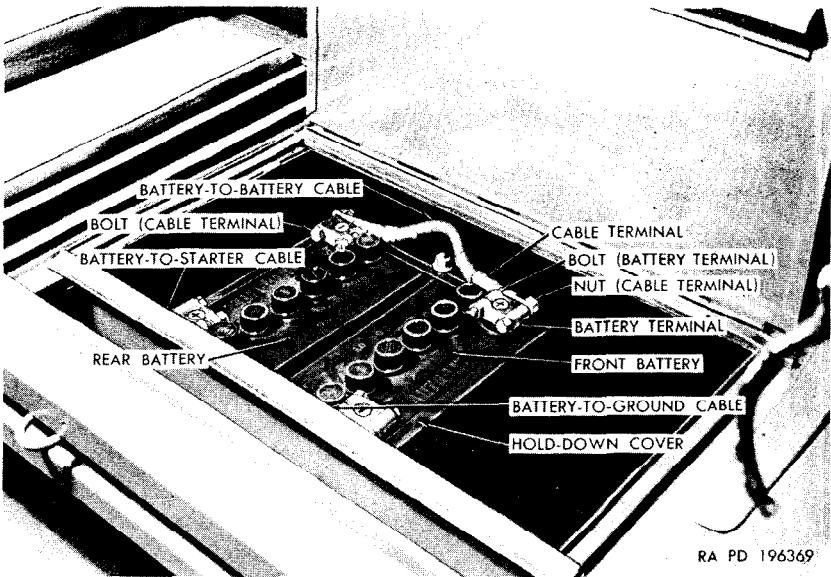


Figure 136. Battery box location (early production ambulance truck M43).

- (4) Check the specific gravity in each cell of each battery (*b* below). If the electrolyte level is too low to permit filling of the hydrometer, add clean distilled water to the proper level and run the engine for approximately 30 minutes before attempting to check the specific gravity.

*Note.* If distilled water is not available, use clean rain water or drinking water. The use of water with high mineral content must be avoided as it causes rapid deterioration of plates and separators.

*b. Check Specific Gravity.*

- (1) Remove the six fillercaps from each battery. Test and note the temperature of the electrolyte and test the specific gravity in each cell, using a hydrometer. Note the readings.
- (2) A specific gravity reading of 1.275 to 1.300 at 80° F. in each cell indicates a fully charged battery. A reading of less than 1.220 is unsatisfactory. Replace a battery if the reading is below 1.220 (par. 168).
- (3) If the temperature of the electrolyte is higher or lower than 80° F., compute the corrected specific gravity in accordance with the correction chart (fig. 137).
- (4) Compare the readings in the cells of the battery. The specific gravity in all cells of either battery should be the same, within 0.025. If variation is greater than this, an abnormal condition within the battery is indicated. Check the battery voltage drop (par. 90*e*). Replace either or both batteries, as required (par. 168).
- (5) Install the six fillercaps for each battery after completing the check.

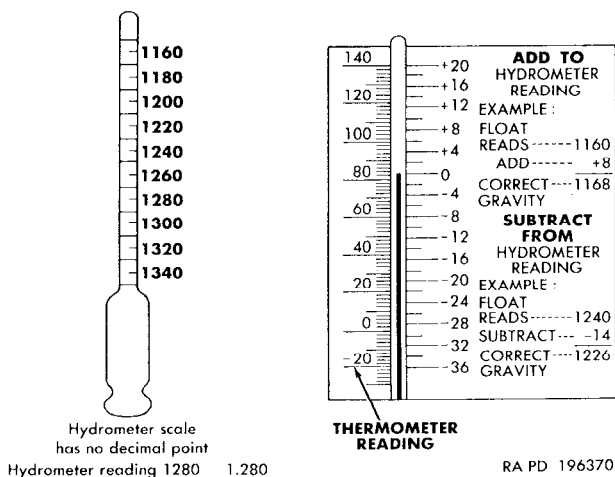


Figure 137. Hydrometer scale and temperature correction chart.

## 168. Battery

*a. General.* Batteries replaced because of a discharged condition or unsatisfactory voltage tests will be reported to ordnance maintenance personnel. Replacement procedure described in *b* and *c* below covers removal and installation of both batteries. If only one battery requires replacement, unnecessary steps may be omitted but, in any case, the battery ground cable must be removed to prevent accidental grounding of the batteries.

### *b. Removal.*

- (1) Loosen the nut on the battery terminal bolt at the negative (−) post of the outer battery (fig. 135) or front battery (fig. 136) and remove the terminal with attached ground cable. Remove the battery-to-battery cable and the battery-to-starter cable in the same manner. Remove the insulator from the positive (+) post of the inner battery (fig. 135) or rear battery (fig. 136) if so equipped.

*Note.* This insulator is required on vehicles of early manufacture (par. 6). On later vehicles, the battery holddown cover eliminates the necessity for the insulator.

- (2) Remove the two holddown cover bolt nuts and flat washers, and remove the holddown cover. Lift the two batteries from the battery box.
- (3) Clean and inspect the inside of the battery box. See that it is dry and free from corrosion. Paint the box if it is rusted or has been damaged by corrosion.

### *c. Installation.*

- (1) For vehicles with the batteries under the passenger seat, install the batteries in the battery box with the negative (−) post of the inner battery toward the front and that of the outer battery (fig. 135) toward the rear. For ambulance truck M43 with batteries in the patient compartment, install the front battery with the negative (−) post toward the center of the vehicle and that of the rear battery toward the left side of the vehicle (fig. 136).

*Note.* If a new battery is to be installed, check the electrolyte level. If the battery is dry, add diluted sulfuric acid to the correct level in each cell (par. 167a).

- (2) Install the holddown cover and install the  $\frac{3}{8}$ -inch flat washers and  $\frac{3}{8}$ -16NC nuts on the two holddown cover bolts. Tighten the nuts.
- (3) Lubricate the battery posts (par. 167a(2)). Install the battery-to-battery cable and battery terminals, being sure to install each terminal on the correct battery post (positive on positive and negative on negative (figs. 135 or 136)).
- (4) Install the rubber insulator on the positive post of the inner

battery (fig. 135), or the rear battery (fig. 136), if required. Refer to NOTE in *b*(1) above. Install the battery-to-starter cable and battery terminal on the battery post.

- (5) Install battery-to-ground cable and battery terminal on the negative (−) post of the outer battery (fig. 135) or front battery (fig. 136).
- (6) Tighten the nuts on the four battery terminal bolts.

## 169. Battery Terminals and Cables

*a. Remove Battery Terminals* (figs. 135 and 136). All battery terminals are serviced in the same manner. Positive and negative terminals are not interchangeable.

- (1) Before removing any of the battery terminals, disconnect the battery-to-ground cable (par. 168*b*(1)) to prevent accidental short circuits.
- (2) Remove the nut from the cable terminal bolt and remove the cable terminal and the bolt.
- (3) Loosen the nut on the battery terminal bolt, and remove the terminal.

*b. Install Battery Terminals* (figs. 135 and 136).

- (1) Clean the battery post, cable terminal, and battery terminal. Lubricate battery posts (par. 167*a*(2)).
- (2) Install a  $\frac{5}{16}$ -18NC x  $1\frac{1}{4}$  squarehead, lead-coated bolt in the battery terminal and install the  $\frac{5}{16}$ -18NC nut loosely on the bolt. Install the terminal on the battery post.
- (3) Install the  $\frac{3}{8}$ -16NC x 2 bolt through the battery terminal, install the cable terminal on the bolt, and install the  $\frac{3}{8}$ -16NC nut. Position the battery terminal on the battery post and tighten both nuts.

*c. Replace Battery-to-Battery Cable* (figs. 135 and 136).

- (1) Remove the nut that secures each battery-to-battery cable terminal and remove the cable from the battery terminals.
- (2) Install the terminals of the new cable on the bolts in the battery terminals, and install the  $\frac{3}{8}$ -16NC nut on each bolt. Tighten the nuts.

*d. Remove Battery-To-Ground Cable* (figs. 135 and 136).

- (1) Remove the nut that secures the battery-to-ground cable at the battery terminal, and remove the cable terminal from the bolt.
- (2) Remove the nut, bolt, and two lockwashers that secure the outer terminal of the cable to the right frame side rail.
- (3) Remove the two screws that secure each of the grommet retainers (one at the front side of the battery box and one at the floor panel). Push the grommet retainers along the two ca-



bles to provide access to the grommets, and remove the grommets.

- (4) Pull the cable from the battery box and grommet retainer up through the opening in the floor panel and the other grommet retainer.

*e. Install Battery-To-Ground Cable (figs. 135 and 136).*

- (1) Insert the battery terminal end of the new battery-to-ground cable through the grommet retainer at the battery box and into the box. Install the split rubber grommet on the cable at the opening in the box.
- (2) Insert the other end of the cable through the grommet retainer at the floor panel and through the opening in the floor panel. Install the other split rubber grommet on the cable at the floor panel.
- (3) Position the two grommet retainers and install the two  $\frac{1}{4}$ -20NC x  $\frac{3}{8}$  screws for each retainer. Tighten the screws.
- (4) Clean the frame side rail at terminal bolt hole and apply a film of lubricant. Attach the terminal of the ground cable to the right frame side rail, with a  $\frac{3}{8}$ -24NF x 1 bolt, two  $\frac{3}{8}$ -inch, internal-external-teeth lockwashers (one at each side of the cable terminal), and a  $\frac{3}{8}$ -24NF nut. Tighten the nut.
- (5) Connect the ground cable terminal to the bolt (cable terminal) at the negative (-) post of the outer battery (fig. 135) or the front battery (fig. 136) and install the  $\frac{3}{8}$ -16NC nut. Tighten the nut.

*f. Remove Battery-to-Starter Cable.*

- (1) Remove the nut that secures the battery-to-starter cable terminal at the battery terminal, and remove the cable terminal (fig. 135) from the bolt.
- (2) Disconnect the other end of the cable from the starter switch terminal (fig. 125).
- (3) Remove the cable grommets at the battery box and floor panel as described in *d* (3) above.
- (4) Disengage the cable from the cable clip (fig. 88) on the transmission.
- (5) Pull the front end of the cable back from the engine compartment. Remove the battery end of the cable from the battery box, two grommet retainers and the floor panel, and remove the cable from underside of vehicle.

*g. Install Battery-To-Starter Cable.*

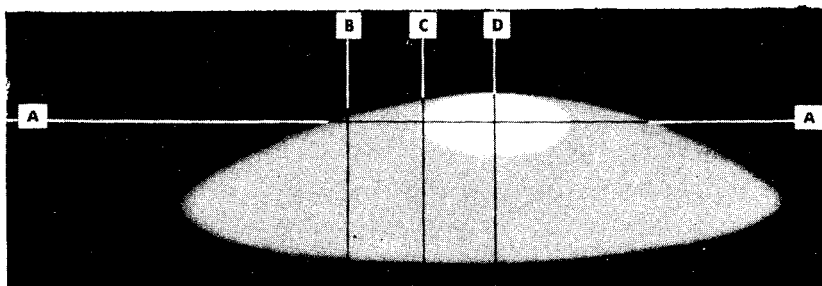
- (1) From the under side of the vehicle, place the battery-to-starter cable over the transmission and push the starter terminal end of the cable into the engine compartment below the accelerator shaft.
- (2) Insert the other end of the cable through the opening in the

floor panel, the two grommet retainers, and the opening in the battery box.

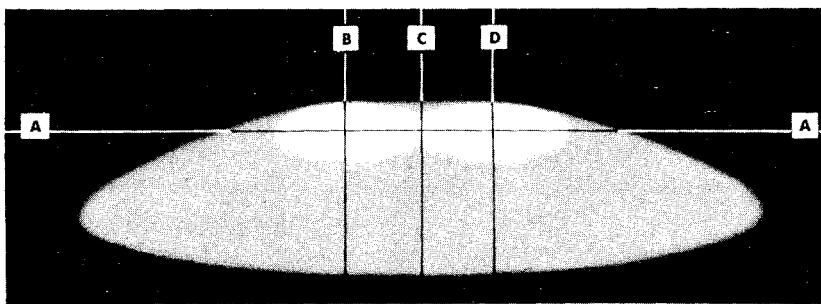
- (3) Install the two grommets and secure the grommet retainers as described in *e*(2) and (3) above.
- (4) Connect the cable to the starter terminal (fig. 125) and install the special terminal nut. Tighten nut. Install the other end of the cable on the bolt (cable terminal) at the positive (+) post of the inner battery (fig. 135) or the rear battery (fig. 136). Install a  $\frac{3}{8}$ -16NC nut on the bolt and tighten. Engage the cable in the cable clip (fig. 88) on the transmission.

## 170. Service Headlight Aiming

*a. General.* The service headlights must be properly aimed to provide adequate visibility for night driving and to prevent glare to approaching traffic. Improperly aimed headlights may be caused by unequal inflation of the front tires or by a difference in tread of the tires, bent fenders or fender supports, or damaged front springs. Check and correct these items before attempting to adjust the headlights.



1. UPPER BEAM OF RIGHT HEADLIGHT



2. UPPER BEAM OF BOTH HEADLIGHTS

**KEY**            **ITEM**  
A—HORIZONTAL LINE 3 INCHES  
BELOW HEADLIGHT CENTERS  
B—VERTICAL LINE, IN LINE WITH  
CENTER OF LEFT HEADLIGHT

**KEY**            **ITEM**  
C—VERTICAL LINE, IN LINE WITH  
WINDSHIELD CENTER STRIP  
D—VERTICAL LINE, IN LINE WITH  
CENTER OF RIGHT HEADLIGHT

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Figure 138. Headlight aiming screen pattern.

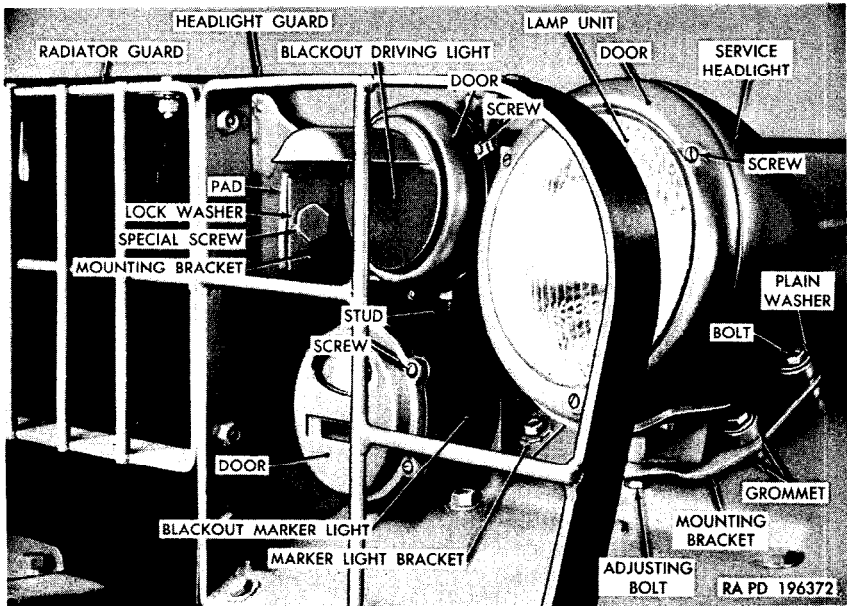


Figure 139. Service headlight, blackout driving light, and blackout marker light.

*b. Procedure.*

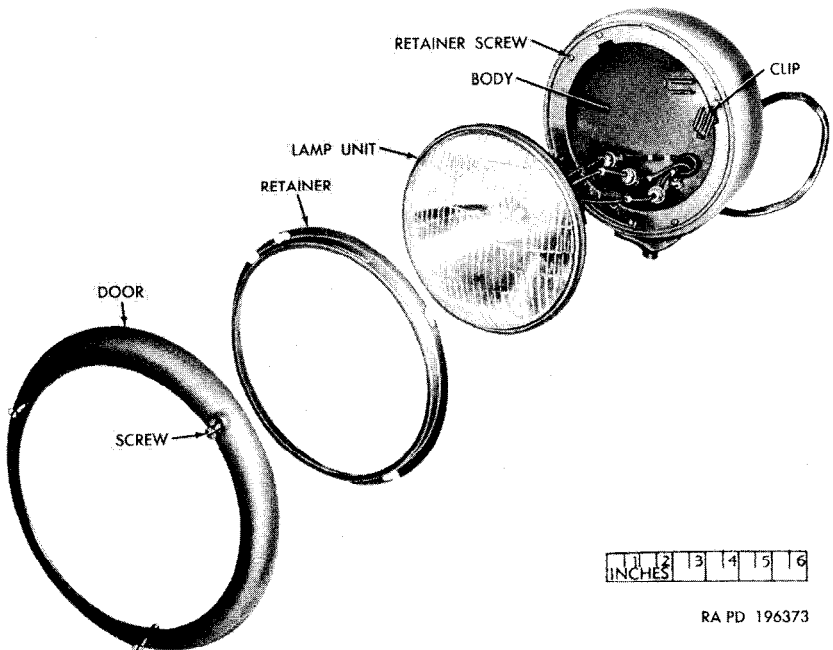
- (1) Position the vehicle on a level floor.
- (2) Locate the screen at right angles to the vehicle exactly 25 feet ahead of the headlights. Move the screen so that line (C, fig. 138) on the screen is directly in line with the center line of the vehicle.
- (3) Measure the distance from the center of the headlights to the floor. Compare this measurement with line (A, fig. 138) on the screen. Raise or lower the screen until line (A, fig. 138) is 3 inches below the measured height of the headlight centers. Lines (B and D, fig. 138) must be directly in line with the vertical center lines of the left and right headlights, respectively.
- (4) Turn the headlights on and operate the dimmer switch (EE, fig. 12) to high beam.
- (5) If either headlight pattern differs from view 2, figure 138, loosen the adjusting bolt attaching the headlight to the fender mounting bracket (fig 139) and move the headlight as required to produce the correct pattern. Then tighten the bolt. Adjust the other headlight if necessary, in the same manner.

## 171. Lamps and Lamp-Units

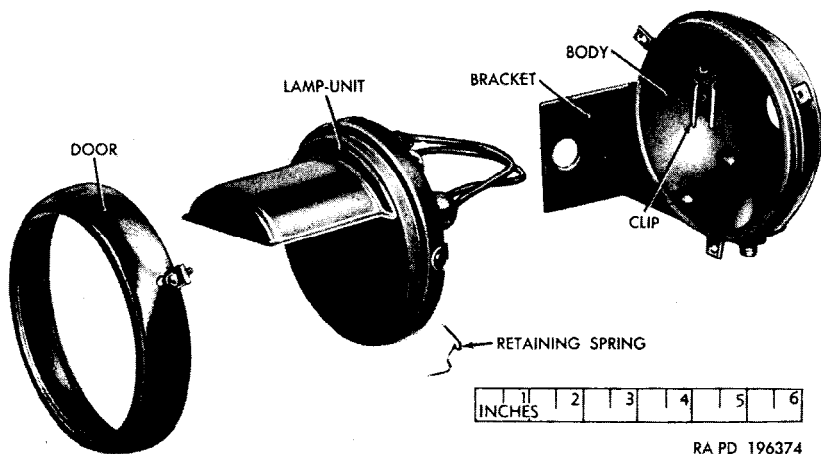
*a. Replace Service Headlight Lamp-Unit* (fig. 140). Both service headlight lamp-units are serviced in the same manner.

- (1) Unscrew the three screws that secure the headlight door and

- remove the door, pulling the lower edge of the door away from the headlight body first.
- (2) Loosen the four lamp-unit retainer screws, turn the retainer clockwise to disengage it from the screws and remove the retainer.
  - (3) Pull the lamp-unit from the headlight body far enough to provide access to the three cable connectors.
  - (4) Remove the three connectors from the clips inside the headlight body, separate the connector shells, and pull the lamp-unit cable terminals from the connector sleeves. Remove the lamp-unit with attached cables.
  - (5) Connect the three lamp-unit cables to the three cables in the headlight body, matching the cable numbers. Connect the cable shells and engage the connectors in the clips inside the headlight body.
  - (6) Position the new lamp-unit in the headlight body with the three projections alined with the three recesses in the body ring. Install the lamp-unit retainer with the enlarged ends of the screw slots over the four retainer screwheads. Turn the retainer counterclockwise to engage the four screws. Tighten screws.
  - (7) Install the headlight door with the inner recess at the top,



*Figure 140.—Service headlight—partial exploded view.*



**Figure 141. Blackout driving light—exploded view.**

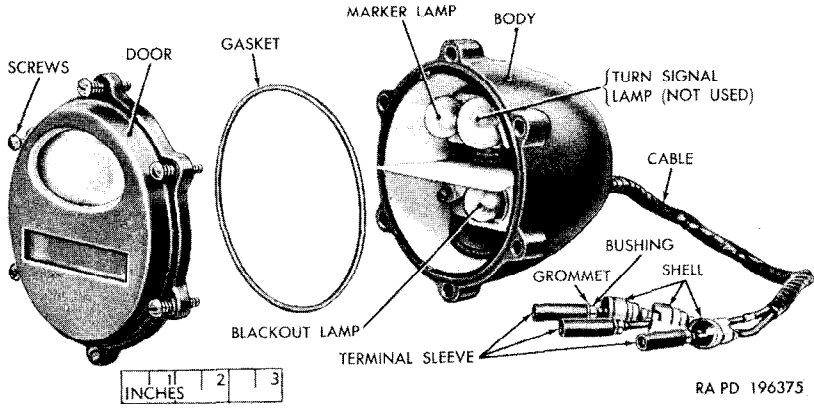
opposite the pad at the top of the body. Tighten the three screws to secure the door.

**b. Replace Blackout Driving Light Lamp-unit.**

- (1) Unscrew the three screws that secure the blackout driving light door to the body, and pull the door and lamp-unit (fig. 141) from the body far enough to expose the lamp-unit cable connectors.
- (2) Remove the two cable connectors from the clips inside the body. Disconnect the cable connectors and cable (a(4) above).
- (3) Remove the three lamp-unit retaining springs and remove the lamp-unit from the door.
- (4) Install the new lamp-unit in the door and install the three lamp-unit retaining springs.
- (5) Connect the two lamp-unit cables to the cables in the headlight body (a(5) above). Engage the cable connectors in the clips.
- (6) Position the door and lamp-unit on the body and tighten the three attaching screws.

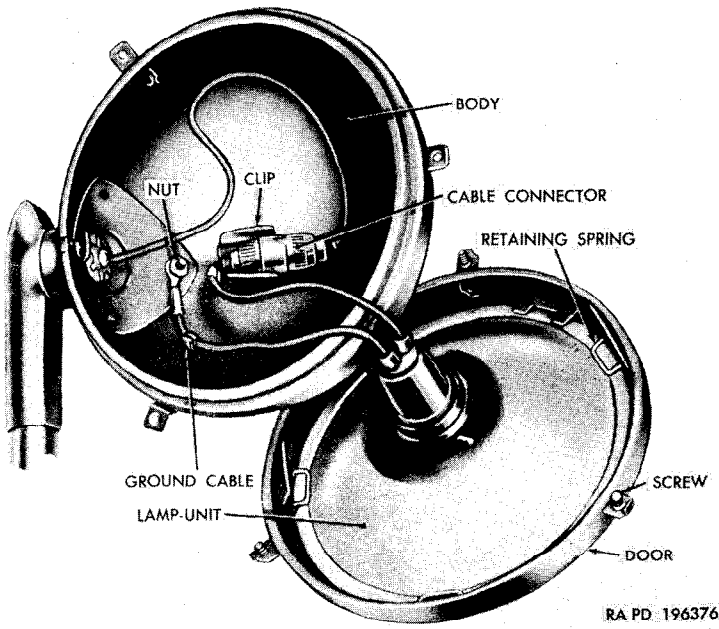
**c. Replace Lamps in Blackout Marker Lights or Taillights (fig. 13).** The same type double tungsten filament lamps are used for the blackout marker lights (fig. 139) and the taillights. The stop light lamps are a single tungsten filament. To replace any of the lamps, unscrew the six screws that secure the door to the body (fig. 142). Remove the door and the door gasket. Remove the lamp to be replaced and install a new lamp of the same type. Install the gasket, replacing it with a new one if necessary, and install the door (fig. 142).

**d. Replace Lamp-Unit in Spotlight (Ambulance Truck M43 or Telephone Maintenance Truck V-41) (fig. 143).**



**Figure 142. Blackout marker light—exploded view.**

- (1) Unscrew the three screws that secure the spotlight door and pull the door and lamp-unit away from the body to provide access to the cables.
- (2) Remove the nut and lockwasher that secure the ground cable to the screw inside the body.
- (3) Remove the cable connector from the clip, separate the cable



**Figure 143. Spotlight lamp-unit (ambulance truck M43 and telephone maintenance truck V41).**

connector shells, and remove the lamp-unit cable from the terminal sleeve.

- (4) Remove the three lamp-unit retaining springs and remove the lamp-unit from the door.
- (5) Position the new lamp-unit in the door and install the three retaining springs, spacing them evenly.
- (6) Connect the cable with the straight terminal to the cable in the spotlight body, engage the connector shells, and install the connector in the clip.
- (7) Secure the ground cable to the screw in the lamp body with a No. 8 internal-teeth lockwasher and No. 8-32NC nut.
- (8) Position the lamp-unit and door and tighten the three screws.

*e. Replace Surgical Light Lamp-Unit (Ambulance Truck M43)*  
(C, fig. 22).

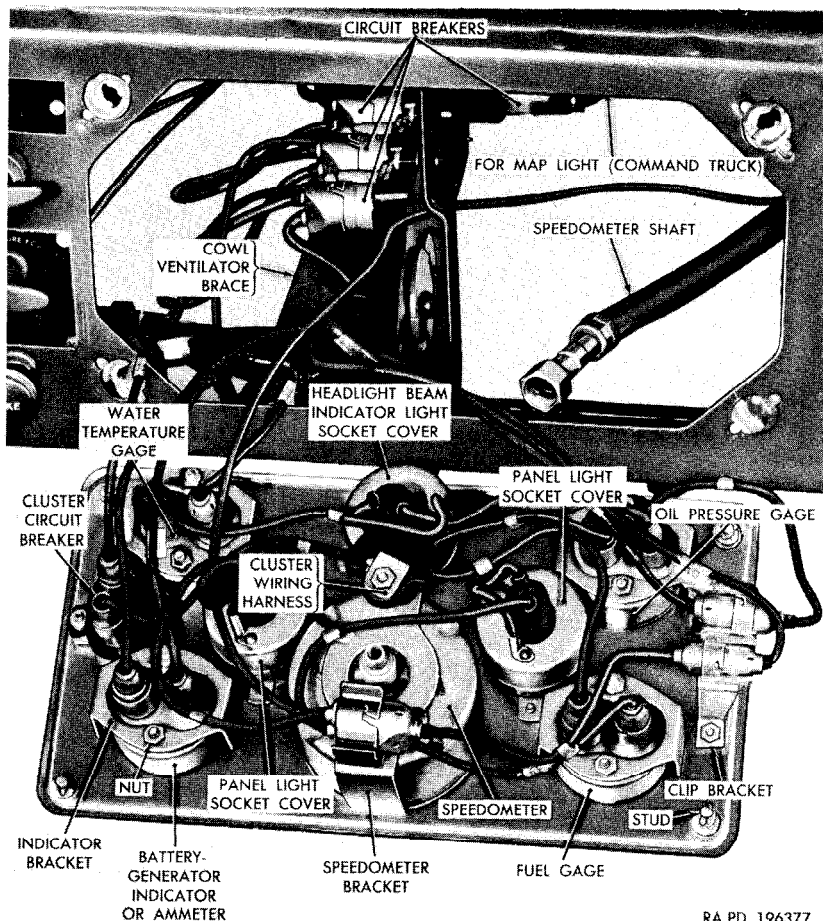
- (1) Loosen the knurled screw and lower the lamp.
- (2) Loosen the two screws which secure the lamp-unit door to the retainer ring, and pull the lamp-unit and door from the ring.
- (3) Remove the screw which secures each lamp-unit cable to the lamp-unit, and remove the lamp-unit and door.
- (4) Loosen the two screws that secure the lamp-unit to the door, and remove the lamp-unit.
- (5) Position the new lamp-unit in the door and tighten the two screws.
- (6) Connect the lamp-unit cable terminals to the lamp-unit using the two terminal screws.
- (7) Position the lamp-unit and door in the retainer ring, and tighten the two retainer ring screws.
- (8) Install the lamp in the shell, and tighten the knurled screw.

*f. Replace Dome Light Lamp and/or Lens (Ambulance Truck M43)*  
(E, fig. 22).

- (1) Remove the two screws that secure the dome light door and remove the door lens. Remove the lamp.
- (2) Install a new lamp of the same type as the one removed. Install the lens in the door, and install the door and two No. 5 x  $\frac{9}{16}$  oval-head tapping screws.

*g. Replace Instrument Panel Light Lamps and/or Headlight High Beam Indicator Lamp.* All lamps are replaced in the same manner.

- (1) Disconnect the speedometer shaft from the speedometer (fig. 144).
- (2) Disengage the four instrument cluster studs and lower the instrument cluster sufficiently to provide access to the headlight beam indicator and panel light socket covers.
- (3) Press the socket cover and turn it counterclockwise to disengage it from the light body. Remove the lens and the lamp.



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*Figure 144. Instrument cluster and circuit breakers.*

- (4) Install a new lamp of the same type as the one removed, and install the lens. Insert the socket cover in the body, press and turn clockwise to engage the socket with the body.
- (5) Install the instrument cluster in the instrument panel and engage the four studs.
- (6) Connect the speedometer shaft to the speedometer.

## 172. Driving Lights and Brackets

*a. General.* Both service headlights are serviced in the same manner. The left and right headlights and mounting brackets are interchangeable. The two blackout marker lights and mounting brackets are serviced in the same manner and are interchangeable. The two tail and stop lights are serviced in the same manner, but are not interchangeable.



*b. Remove Service Headlight and Mounting Bracket (fig. 139).*

- (1) Disconnect the ground cable from the negative ( - ) post of the outer battery (fig. 135).
- (2) Disengage the headlight cable from the cable clips on the splash shield and radiator side support.
- (3) Remove the screw and lockwasher that secure the ground cable 91 to the fender front splash shield (figs. 204 and 205).
- (4) Remove the connectors for cables 17 and 18 from the clips on the fender front splash shield, separate the connector shells and remove the headlight cables from the connector sleeves.
- (5) Remove the three nuts and lockwashers that secure the headlight cable cover to the under side of the fender and remove the cover.
- (6) Remove the two remaining nuts and lockwashers from the headlight bracket bolts, and pull the headlight and mounting bracket away from the fender to provide access to the cable grommet. Remove the grommet.
- (7) Remove the headlight with attached cables and the mounting bracket, withdrawing one cable at a time through the openings in the splash shield and the fender.
- (8) Remove the adjusting bolt, lockwasher, and special washer that secure the headlight to the mounting bracket, and remove the headlight.
- (9) Remove the four mounting bracket bolts and flat washers and the four rubber grommets from the mounting bracket.

*c. Inspection.* Inspect the four bracket mounting bolts and the headlight adjusting bolt for cracks and damaged threads. Inspect the four mounting bracket grommets and the cable grommet for damage or deterioration. Inspect the mounting bracket for damage or distortion. Replace all parts that are unfit for further service.

*d. Install Service Headlight and Mounting Bracket (fig. 139).*

- (1) Install the four rubber grommets in the mounting bracket, engage the groove in each grommet with the bracket. Install a  $\frac{7}{16}$ -inch plain washer on each bracket bolt and install the bolts through the grommets.
- (2) Install the  $\frac{7}{16}$ -inch lockwasher and special washer on the  $\frac{7}{16}$ -20NF x  $1\frac{1}{4}$  bolt, with the radius side of the special washer up. Position the headlight on the bracket and install the bolt with washers. Tighten just enough to hold the parts.
- (3) Thread the three headlight cables through the openings in the fender and in the splash shield. Install the split rubber grommet on the cables and engage it in the fender opening.
- (4) Position the mounting bracket on the fender with the bracket bolts in the bolt holes, position the cable cover, and install

the five  $\frac{3}{8}$ -inch internal-external-teeth lockwashers and  $\frac{3}{8}$ -24NF nuts to secure the bracket and cable cover.

- (5) Connect the headlight cables 17 and 18 to their respective cables. Connect the connector shells and engage the connectors in the clips on the splash shield.
- (6) Attach the ground cable 91 to the splash shield with the  $\frac{1}{4}$ -inch internal-external-teeth lockwasher and  $\frac{1}{4}$ -28NF x  $\frac{5}{8}$  tapping screw.

*Note.* When installing the left headlight, be sure that the blackout driving light ground cable is secured with the same screw.

- (7) Engage the cable in the cable clips on the splash shield and radiator guard support.
- (8) Connect the ground to the negative (-) post of the outer battery (fig. 135).
- (9) Adjust the headlight aiming (par. 170).

*e. Remove Blackout Driving Light and Bracket (fig. 139).*

- (1) Disconnect the ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Remove the headlight cable cover (b(5) above).
- (3) Disengage the blackout driving light cables from the cable clips on the left splash shield and radiator guard left side support.
- (4) Remove the screw and lockwasher that secure the ground cable terminal to the splash shield. (This screw also secures the headlight ground cable.)
- (5) Remove the connector for cable 19 from the clip on the splash shield, separate the connector shells, and pull the cable terminal from the sleeve. Remove the grommet, bushing, and connector shell from the cable.
- (6) Remove the split rubber grommet from the opening in the left front fender, and remove the blackout light cables from the openings in the splash shield and fender.
- (7) Remove the nut, lockwasher, and bearing washer from the blackout light stud, and remove the light from the bracket.
- (8) If the mounting bracket or bracket pad requires replacement, remove the two screws and lockwashers securing the bracket to the radiator guard side support and remove the bracket and pad.

*f. Install Blackout Driving Light and Bracket.*

- (1) Position the bracket pad and bracket (fig. 139) on the radiator guard side support, and install the two special screws and  $\frac{3}{8}$ -inch internal-teeth lockwashers. Tighten the screws.
- (2) Install the blackout light on the bracket and install the bearing washer,  $\frac{3}{8}$ -inch lockwasher, and  $\frac{3}{8}$ -16NC nut on the stud.

- (3) Thread the cables through the openings in the fender and in the splash shield. Install the split rubber grommet on the blackout light cables and blackout marker light cables, and engage the grommet in the opening in the fender.
  - (4) Position the headlight cable cover on the under side of the fender, and install the three  $\frac{3}{8}$ -inch lockwashers and  $\frac{3}{8}$ -24NF nuts. Tighten the nuts.
  - (5) Install the connector shell, bushing, and grommet on the cable 19, position the grommet next to the cable terminal and the bushing next to the grommet. Connect the cable terminal to the connector sleeve, connect the two connector shells, and engage the connector in the clip on the splash shield.
  - (6) Attach the blackout light ground cable and left headlight ground cable to the splash shield with the  $\frac{1}{4}$ -inch internal-external-teeth lockwasher and  $\frac{1}{4}$ -28NF x  $\frac{5}{8}$  tapping screw. Engage the cables in the cable clips on the splash shield and radiator guard side support.
  - (7) Connect the ground cable to the negative (-) post of the outer battery (fig. 135).
- g. Remove Blackout Marker Light and Bracket (fig. 139).*
- (1) Disconnect the ground cable from the negative (-) post of the outer battery (fig. 135).
  - (2) Remove the headlight cable cover (b(5) above).
  - (3) Disengage the cables from the cable clips on the splash shield and radiator guard side support. Remove the connectors for cables 20, 491, 480 from the clips on the splash shield, separate the connector shells, and remove the cable terminals from the connector sleeves.
  - (4) Remove the grommet from the marker light cables and blackout driving light cable (left light only).
  - (5) Remove the nut, lockwasher, and two bolts that attach the marker light bracket to the fender (one nut and lockwasher were removed when the cover was removed). Remove the three cables, one at a time, through the openings in the splash shield and the fender.
  - (6) Remove the two screws and lockwashers that secure the marker light to the bracket, and remove the bracket.
- h. Install Blackout Marker Light and Bracket.*
- (1) Position the marker light on the bracket and install the two  $\frac{3}{8}$ -inch, external-teeth lockwashers and  $\frac{3}{8}$ -16NC x  $\frac{3}{4}$  cap screws. Tighten the screws.
  - (2) Thread the three cables, one at a time, through the openings in the fender and the splash shield. Fit the split rubber grommet on the cables and in the fender opening.
  - (3) Position the marker light bracket on the fender and install

the two  $\frac{3}{8}$ -inch, internal-external-teeth lockwashers and  $\frac{3}{8}$ -24NF x  $\frac{7}{8}$  machine bolts. Position the headlight cable cover, and install the four  $\frac{3}{8}$ -inch, external-teeth lockwashers and  $\frac{3}{8}$ -24NF nuts to secure the bracket and cover. Tighten the nuts.

- (4) Connect the three cable terminals to their respective cable connector sleeves, connect the connector shells, and engage the connectors in the clips on the splash shield. Engage the cables in the cable clips on the splash shield and radiator guard side support.
- (5) Connect the ground cable to the negative (-) post of the outer battery (fig. 135).

*i. Remove Left Taillight and Bracket (fig. 145).*

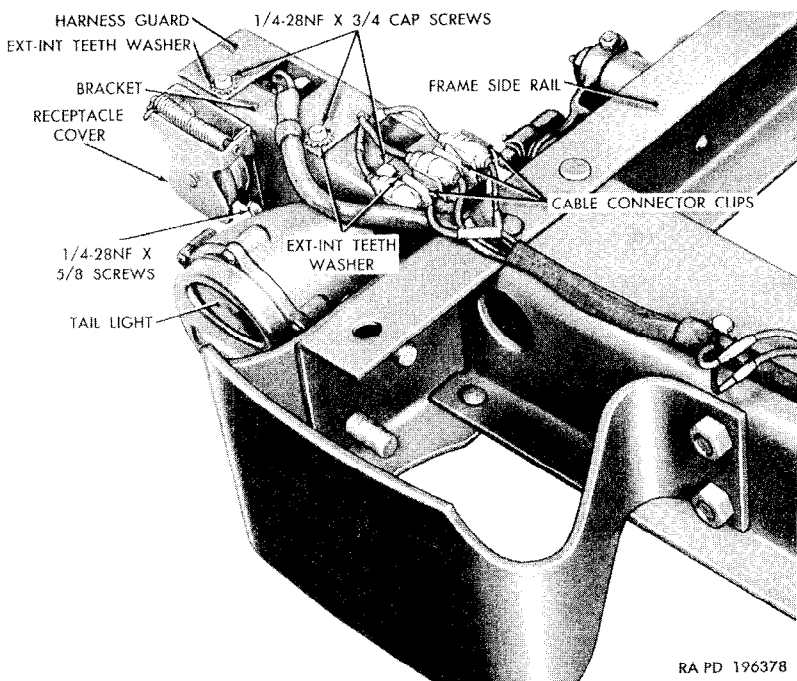
- (1) Disconnect the ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Remove the screws and lockwashers that secure the harness guard to the taillight bracket and remove the guard.

*Note.* There are two screws for the guard on vehicles without a trailer coupling receptacle, three screws for vehicles with a receptacle.

- (3) Remove the three cable connectors from the cable connector clips, separate the connector shells, and disconnect the cables. The clips may be on the bracket or inside the guard.
- (4) Remove the two screws and lockwashers that secure the taillight to the bracket, and remove the taillight with attached cables.
- (5) If the vehicle is equipped with a trailer coupling, unscrew the grommet nut from the coupling receptacle, remove the four nuts and lockwasher bolts that secure the receptacle and receptacle cover to the frame, and pull the cover toward the rear to remove the cables from the opening in the bracket.
- (6) Remove the two nuts, lockwashers, and bolts that secure the bracket and rear bumper to the frame side rail and remove the bracket.

*j. Install Left Taillight and Bracket (fig. 145).*

- (1) Position the bracket on the frame side rail and install the two  $\frac{5}{8}$ -18NF x 2 bolts,  $\frac{5}{8}$ -inch lockwashers, and  $\frac{5}{8}$ -18NF nuts. Tighten the nuts.
- (2) If the vehicle is equipped with a trailer coupling receptacle, position the receptacle and cover on the bracket and install the four  $\frac{1}{4}$ -28NF x  $\frac{5}{8}$  lockwasher bolts and four  $\frac{1}{4}$ -28NF nuts. Tighten the bolts. Screw the grommet nut to the receptacle.
- (3) Thread the taillight cables through the opening in the bracket, position the taillight on the bracket, and install the two  $\frac{3}{8}$ -inch lockwashers and  $\frac{3}{8}$ -16NC x  $\frac{3}{4}$  cap screws. Tighten the screws.



**Figure 145.** Left taillight and trailer coupling receptacle.

- (4) Connect the three cable terminals to their respective cables, connect the shells, and engage the connectors in the clips.
- (5) Position the harness guard on the bracket, aligning the screw holes. Place the taillight ground cable terminal over the inner screw hole and the trailer coupling cable clip over the center screw hole (on vehicles so equipped). Install the  $\frac{1}{4}$ -inch, internal-external-teeth lockwasher and  $\frac{1}{4}$ -28NF x  $\frac{3}{8}$  cap screws (three for vehicles equipped with a trailer coupling, two for vehicles not so equipped).
- (6) Connect the ground cable to the negative (-) post of the outer battery (fig. 135).

*b. Replace Right Taillight and Bracket.* Procedure for replacement of the right taillight and bracket is essentially the same as that described in *i* and *j* above. The only differences are that there are two cables for the right taillight instead of three, neither of the cables is grounded, and there is no trailer coupling.

### 173. Light Switch and Dimmer Switch

#### *a. Remove Light Switch.*

- (1) Remove the four screws and lockwashers that attach the steering column access cover to the instrument panel and remove the cover.

- (2) Unscrew the nut that retains the waterproof grommet to the light switch receptacle (fig. 146) and remove the wiring harness cable plug from the receptacle. If the light switch is provided with the trailer coupling receptacle, disconnect the trailer coupling wiring harness in the same manner.
- (3) Remove the four screws and lockwashers that secure the light switch to the instrument panel. Remove the light switch by pushing it through the panel and removing it from beneath the panel.

*b. Install Light Switch.*

- (1) Install the light switch (fig. 146) from the under side of the instrument panel. Secure with four No. 10 lockwashers and No. 10-32NF x 1/2 roundhead screws.
- (2) Install the wiring harness cable plug in the light switch receptacle, and screw the grommet retaining nut to the receptacle. If the switch is provided with a trailer coupling receptacle, connect the trailer coupling wiring harness in the same manner.
- (3) Install the steering column access cover on the instrument panel with the four lockwashers and screws, being careful to position the cover in such a manner that it does not cause binding at the steering column.

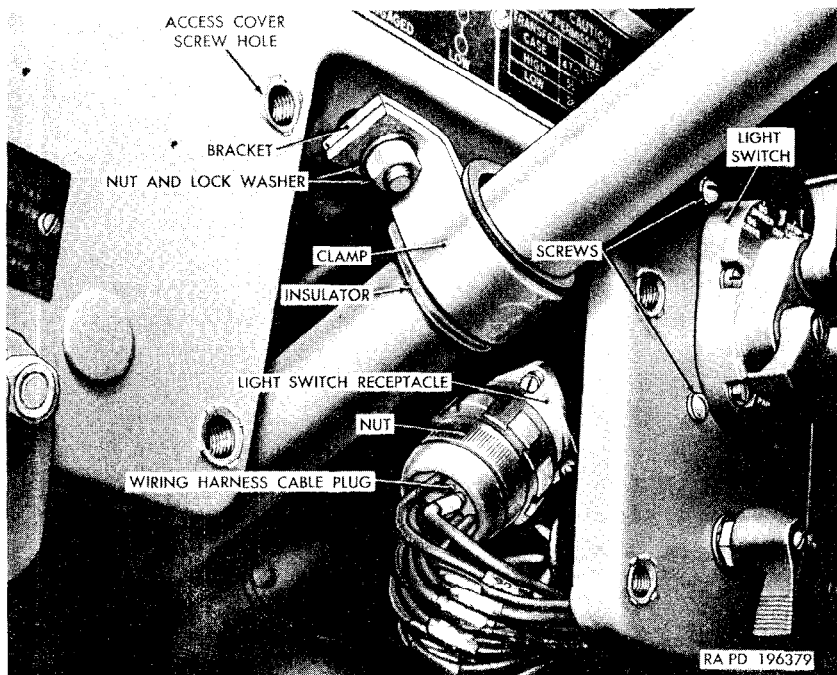


Figure 146. Steering column access cover removed.

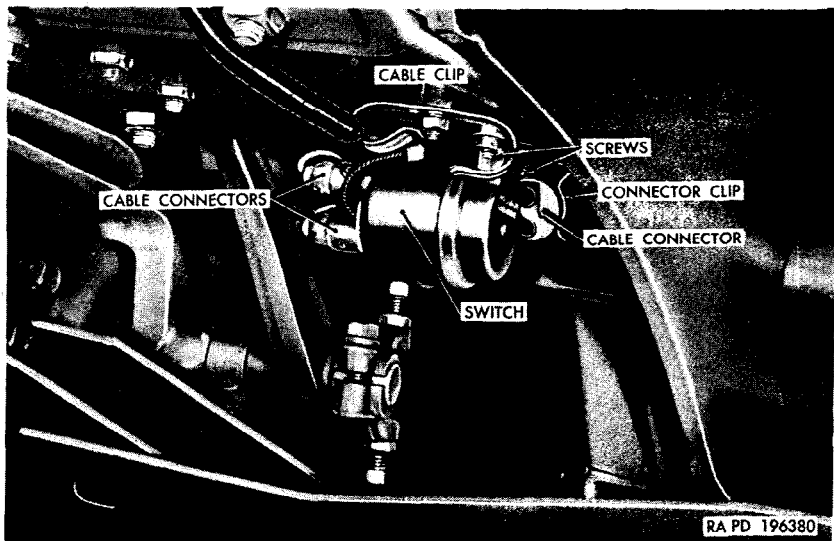


Figure 147. Dimmer switch.

*c. Remove Dimmer Switch.*

- (1) Remove the rear splash shield from the left front fender (par. 250*h*).
- (2) If the vehicle is equipped with a slave receptacle, disengage the receptacle cable from the cable clip near the dimmer switch.
- (3) Remove the large cable connector from the connector clip (fig. 147), separate the connector shells on the three cables, and disconnect the cable terminals.
- (4) From inside the driver's compartment, remove the two screws and lockwashers that secure the switch and remove the switch from the toeboard.

*d. Install Dimmer Switch.*

- (1) Position the dimmer switch (fig. 147) on the under side of the toeboard and install the two  $\frac{3}{8}$ -inch lockwashers and  $\frac{3}{8}$ -16NC x  $\frac{3}{4}$  cross-recess pan-head screws. Tighten the screws.
- (2) Connect the three cable terminals to their respective cables and connect the shells. Engage the large cable connector in the connector clip (fig. 147).
- (3) Engage the slave receptacle cable in the cable clip (on vehicles so equipped).
- (4) Install the left front fender rear splash shield (par. 250*i*).

## 174. Circuit Breakers

*a. General.*

- (1) Circuit breakers are of the automatic reset-type, employing

a bimetal spring which expands when the circuit is overloaded, causing a break in the circuit. As the spring cools, it contracts and again closes the circuit, causing alternate "off" and "on" conditions, informing the operator that an abnormal circuit condition exists.

- (2) With the exception of the instrument cluster circuit breaker on some vehicles, all units are mounted on the cowl ventilator brace (fig. 144). All units are accessible with the instrument cluster removed.

*b. Removal.* Procedure for removal of all circuit breakers is the same.

- (1) Turn the four studs that secure the instrument cluster to the instrument panel and carefully pull the cluster out. Disconnect the speedometer flexible shaft from the speedometer (fig. 144).
- (2) Detach the cables from the circuit breaker to be removed.
- (3) Remove the two screws that secure the circuit breaker to the cowl ventilator brace (fig. 144) and remove the circuit breaker. For the circuit breaker on the instrument cluster, remove the two nuts, lockwashers, and bolts that secure the circuit breaker to the instrument cluster panel and remove the circuit breaker.

*c. Installation.*

- (1) Position the circuit breaker on the cowl ventilator brace (fig. 144) and install the two No. 8 x  $\frac{3}{4}$  sheet metal screws. For the circuit breaker on the instrument cluster (fig. 144), position the circuit breaker on the instrument cluster panel and install the two No. 8-32NC x  $\frac{5}{8}$  machine bolts, No. 8 lockwashers, and No. 8-32NC nuts.
- (2) Connect the cables to the circuit breaker, following the wiring diagram (fig. 134).
- (3) Connect the speedometer flexible shaft to the speedometer, position the instrument cluster in the instrument panel, and engage the four studs by turning them clockwise.

## **175. Auxiliary Outlet Receptacle (on Vehicles so Equipped)**

*a. Removal.*

- (1) Disconnect the receptacle cable at the cable connector under the instrument panel and disengage the cable from the cable clips.
- (2) Remove the four screws which attach the auxiliary outlet receptacle to the instrument panel. Remove the receptacle with cable.

*b. Installation.*



- (1) Thread the receptacle cable through the opening in the instrument panel and position the receptacle on the panel. Install the four No. 8 x  $\frac{3}{4}$  sheet metal screws, attaching the receptacle cover chain with the lower left screw.
- (2) Connect the cable terminal at the cable connector and engage the cable in the cable clips.

## 176. Radio Receptacle (on Vehicles so Equipped)

### *a. Removal.*

- (1) Disconnect the ground cable from the negative ( - ) post of the outer battery, and remove the radio receptacle cable from the terminal.
- (2) Disconnect the other receptacle cable terminal from the positive ( + ) terminal of the inner battery.
- (3) Disengage the cable from the cable clip in the driver's compartment.
- (4) Remove the four small screws that secure the radio receptacle to the wall mounting receptacle (fig. 148) and pull the receptacle and cable from the mounting receptacle. Remove the four screws that secure the mounting receptacle to the body front panel, and remove the receptacle.

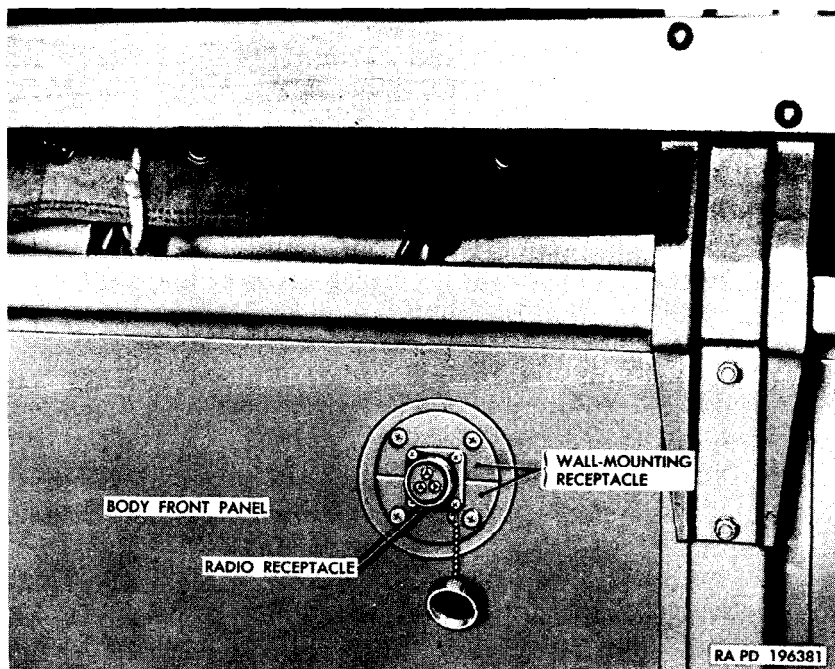


Figure 148. Radio receptacle in body front panel.

*b. Installation.*

- (1) Thread the receptacle cables through the receptacle opening in the body panel and through the weatherseal in the cab rear panel.
- (2) Fit the two sections of the wall mounting receptacle on the body panel and install the four  $\frac{1}{4}$ -28NF x  $\frac{3}{4}$  roundhead lockwasher screws. Position the radio receptacle (fig. 148) and install the four No. 8-32NC x  $\frac{3}{8}$  lockwasher screws, attaching the cover chain with one of the screws.
- (3) Connect the radio receptacle positive (+) cable terminal to the positive (+) terminal of the inner battery, and the negative (-) terminal to the negative (-) terminal of the outer battery.
- (4) Connect the ground cable to the negative (-) post of the outer battery.

### **Section XIII. INSTRUMENTS, GAGES, AND HORN**

#### **177. Description and Data**

*a. Description.*

- (1) The instrument cluster (figs. 8 and 144) contains the speedometer, battery-generator indicator or ammeter, water temperature gage, fuel gage, and oil pressure gage. These gages are electrically operated by means of sending units. Circuits to the gages are controlled through the ignition switch and are closed only when the ignition switch is in the ON position.
- (2) Gages supplied on vehicles of early manufacture are 6-volt gages, each one requiring a resistor when used in the 24-volt system. The 6-volt gage may be identified by the resistor case and elbow on the back side of the gage. The 24-volt gages are supplied with vehicles of later manufacture and may be installed to replace the 6-volt gage-with-resistor units.
- (3) The horn is a vibrator-type, mounted on the under side of the hood.
- (4) Organizational maintenance includes replacement of the gages, speedometer, cluster wiring harness, and the horn and related parts.

*b. Data.*

**Ammeter :**

Make..... AC  
Model..... 1501244  
Voltage..... 24

**Battery-generator indicator :**

Make..... Auto-Lite  
Model..... EO-11218  
Voltage..... 24

Fuel gage:	
Make.....	AC
Voltage:	
With 95-ohm resistor.....	6
Without resistor.....	24
Horn:	
Make.....	Auto-Lite, Delco, or Spark-Withington
Model.....	HX-4003U, 19999881, or D2140A
Type.....	vibrator
Voltage.....	24
Oil pressure gage:	
Make.....	AC
Voltage:	
With 95-ohm resistor.....	6
Without resistor.....	24
Speedometer:	
Drive.....	pinion in transfer
Make.....	Auto-Lite or AC
Water temperature gage:	
Make.....	AC
Voltage:	
With 95-ohm resistor.....	6
Without resistor.....	24

## 178. Instrument Cluster

(fig. 144)

a. *Remove Battery-Generator Indicator or Ammeter.* Procedure is the same for both instruments.

- (1) Turn the four studs that secure the instrument cluster to the instrument panel and pull the cluster out carefully. Disconnect the speedometer flexible shaft from the speedometer.

*Note.* Make certain that the ignition switch is in the OFF position before working on the instrument cluster parts.

- (2) Disconnect the cable or cables from the battery-generator indicator, or ammeter, respectively.
- (3) Remove the two nuts and lockwashers that secure the indicator bracket to the studs in the indicator, and remove the bracket. Remove the indicator from the driver's compartment side.

b. *Install Battery-Generator Indicator or Ammeter.*

- (1) Insert the battery-generator indicator or ammeter from the driver's compartment side of the cluster panel and position it in the panel.
- (2) Install the indicator bracket over the indicator and install the two No. 10-32NF nuts and lockwashers. Tighten the nuts.
- (3) Connect cable 27 (fig. 134) to the terminal of the battery-generator indicator. For the ammeter, connect cable 9 to the

left terminal and cable 8 to the right terminal (fig. 91).

- (4) Connect the speedometer shaft to the speedometer (fig. 144), position the instrument cluster in the instrument panel, and engage the four studs by turning them clockwise.

*c. Replace Fuel Gage, Oil Pressure Gage, and/or Water Temperature Gage.* Procedure for replacement of the fuel gage, oil pressure gage, and water temperature gage (fig. 144) is the same as that for the ammeter (*a* and *b* above). When a 6-volt gage is installed in the 24-volt system, be sure to install the resistor with the gage (par. 177a(2)). If a 24-volt water temperature gage is used to replace the 6-volt gage and resistor, replace the gage sending unit also, which is available as part of the kit.

*d. Remove Speedometer* (fig. 144).

- (1) Remove the instrument cluster and disconnect the speedometer shaft from the speedometer (*a*(1) above).
- (2) Remove the nut, lockwasher, and plain washer that secure the cluster wiring harness, to the speedometer bracket stud and remove the harness from the stud. It is not necessary to disconnect the cables.
- (3) Remove the cable connector from the clip on the speedometer bracket and remove the nut and lockwasher that secure the clip to the stud on the speedometer.
- (4) Remove the speedometer from the driver's compartment side of the panel. Remove the bracket. Be careful not to damage the cables as the bracket is removed.

*e. Install Speedometer.*

- (1) Insert the speedometer (fig. 144) from the driver's compartment side of the instrument cluster panel and position it in the panel.
- (2) Install the speedometer bracket over the speedometer with the stud holes over the two studs on the speedometer. Hold the parts in position and install the cluster wiring harness on the lower stud. Install the special plain washer, No. 10 lockwasher, and No. 10-32NF nut. Tighten the nut.
- (3) Position the connector clip on the upper stud and install the No. 10 lockwasher and No. 10-32NF nut. Tighten the nut. Engage the cable connector in the clip.
- (4) Connect the speedometer flexible shaft to the speedometer and install the instrument cluster (*b*(4) above).

*f. Replace Cluster Wiring Harness.*

- (1) Remove the instrument cluster (*a*(1) above).
- (2) Disconnect the wiring harness cables from the fuel gage, oil pressure gage, and water temperature gage, the instrument cluster circuit breaker or ignition switch, and the battery-generator indicator (on vehicles so equipped).

- (3) Remove the nut, lockwasher, and plain washer that secure the wiring harness to the speedometer stud and remove the wiring harness.
- (4) Install a new wiring harness on the speedometer lower stud (fig. 144), arranging the cables in proper position. Install the plain washer, No. 10 lockwasher, and No. 10-32NF nut. Tighten the nut.
- (5) Connect the wiring harness cables to the fuel gage, the oil pressure gage, the water temperature gage, the instrument cluster circuit breaker or ignition switch cable, and the battery-generator indicator (on vehicles so equipped) (fig. 134).
- (6) Install the instrument cluster (b(4) above).

## 179. Horn and Horn Button Cable

### a. Replace Horn (fig. 149).

- (1) Disconnect the ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Disconnect the two horn cable connectors and pull the cables (Nos. 25 and 25A) and connectors from the horn.
- (3) Remove the two bolts and lockwashers that secure the horn to the bracket on the hood and remove the horn.
- (4) Position a new horn on the bracket, and install the two ¼-

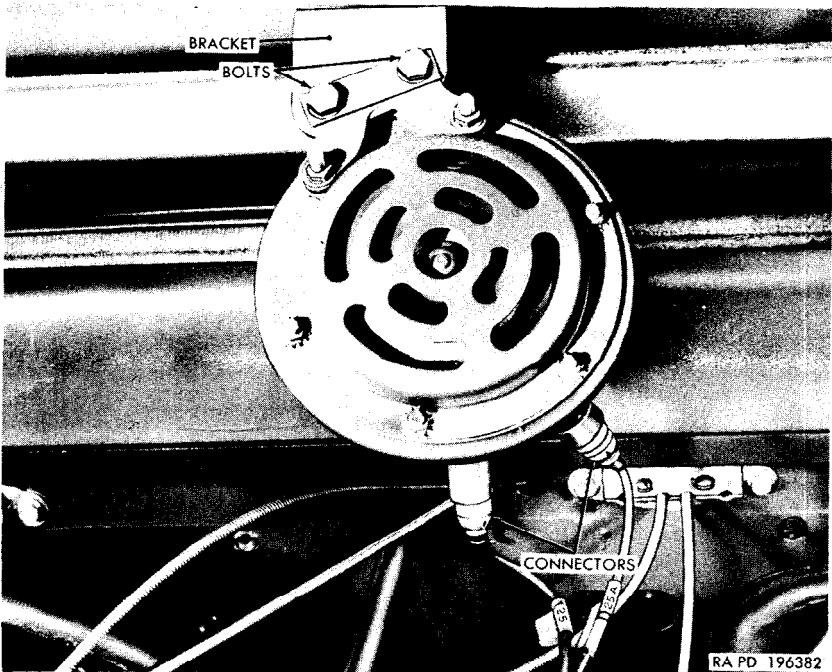


Figure 149. Horn and horn cables.

inch lockwashers and two 1/4-28NF x 1 bolts. Tighten the bolts.

(5) Attach the horn cable connectors to the horn.

*b. Remove Horn Button, Horn Button Cable, and Related Parts.*

*Note.* The key letters noted in parentheses are in figure 151.

- (1) Remove the horn button cable connector from the clip on the left front fender splash shield and disconnect the horn button cable 25A. Pull the cable and cable hose through the opening in the frame left side rail.
- (2) Remove the grommet, bushing, and cable connector shell from the lower end of the cable (A).
- (3) Unscrew the fitting nut from the lower seal plate on the steering gear housing and remove the hose (E), tube (G), and nut (F) from the cable (A). Separate the hose, tube, and nut. Remove the seal washer (H) and seal (J) from the seal plate and from the cable.
- (4) Remove the horn button seal (V). Press the horn button (U) down firmly and turn it clockwise to disengage the upper retaining plates (S) from the lower retaining plate (L). Remove the button, button spring, upper retaining plate, and snap ring as a unit. Remove the plate spring (Q).
- (5) Remove the snap ring (R) from the horn button (U), and

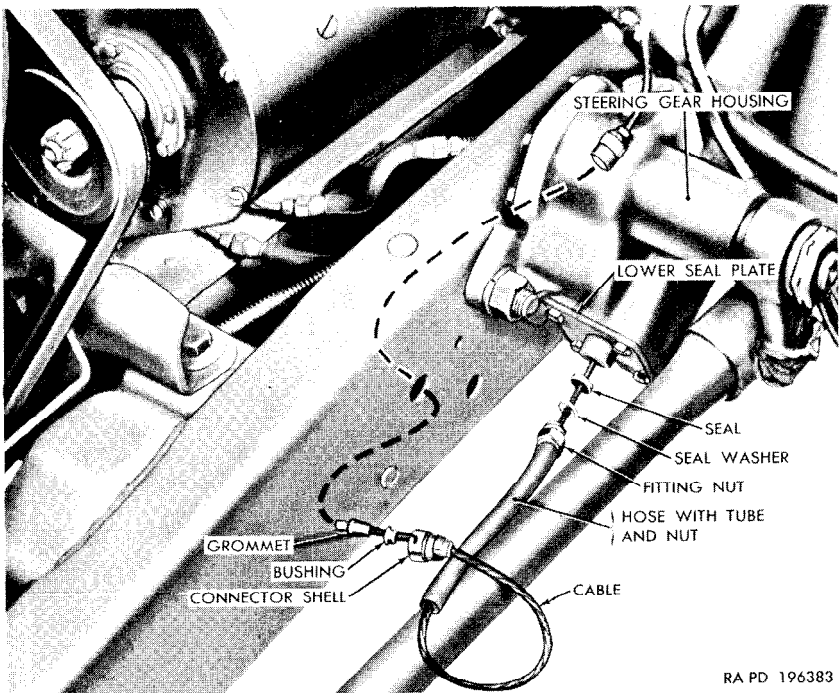


Figure 150. Horn button cable disconnect points.

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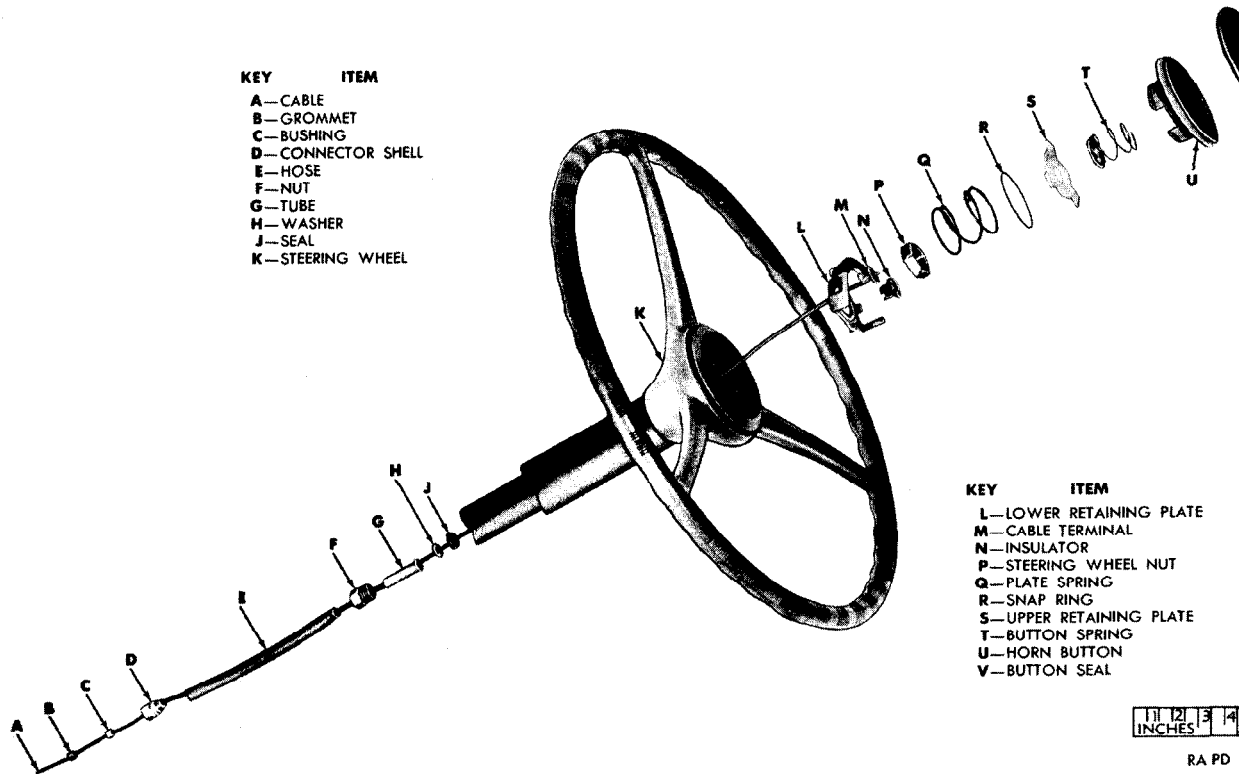


Figure 151. Horn button, cable, and related parts—exploded view.

remove the upper retaining plate (S) and the button spring (T).

- (6) Remove the insulator (N) from the upper end of the cable and pull the cable with cable terminal from the steering gear shaft.
- (7) If the lower retaining plate (L) requires replacement, remove the steering wheel nut (P) and remove the plate.

*c. Inspect Horn Button, Horn Button Cable, and Related Parts.*

- (1) Inspect the button seal (V), seal (J), hose (E), and grommet (B) for damage or deterioration.
- (2) Inspect the cable (A) for loose or damaged terminals, damaged insulation, or broken cable. Inspect the insulator (N) for cracks.
- (3) Inspect the horn button (U), retainer plates (L and S), and springs (Q and T) for cracks and distortion.
- (4) Inspect tube (G), nut (F), connector shell (D), and grommet bushing (C) for cracks or other visual damage.
- (5) Inspect the steering wheel nut (P) for cracks or damaged threads.
- (6) Replace all parts that are unfit for service.

*d. Install Horn Button, Horn Button Cable, and Related Parts.*

- (1) Install the lower retaining plate (L) over the steering gear shaft and install the steering wheel nut (P). Tighten the nut.
- (2) Insert the lower end of the horn button cable (A) in the upper end of the steering gear shaft, and push the cable down through the shaft until the lower end extends through the shaft. Install the insulator (N) on the cable just below the cable terminal.
- (3) Install the button spring (T) and the upper retaining plate (S) in the horn button (U), and install the snap ring (R).
- (4) Install the plate spring (Q) in the steering wheel and install the horn button (U), pressing the button down firmly and turning it clockwise to engage the two retaining plates (L and S). Install the button seal (V).
- (5) Install the cable seal and seal washer over the lower end of the cable and into the lower seal plate (fig. 150). Assemble the hose, tube, and  $\frac{3}{8}$ -inch inverted flared tube fitting nut (fig. 150), and install the parts on the cable. Screw the nut to the lower seal plate on the steering gear housing.
- (6) Install the connector shell, bushing, and grommet on the lower end of the cable (fig. 150). Position the grommet next to the cable terminal with the bushing holding the grommet in place.



- (7) Insert the cable through the opening in the frame left-side rail, connect the cable to cable 25A, and engage the connector in the clip on the splash shield.

## Section XIV. WINCH AND WINCH DRIVE SHAFT

### 180. Description and Data

#### *a. Description.*

- (1) The winch (fig. 152), on vehicles so equipped, is mounted at the front of the vehicle and is supported by brackets attached to the frame side rails and the front bumpers. The drive shaft has a universal joint at each end, with a shearpin in the front universal joint which prevents damage to the driving mechanism in the event the winch is overloaded. A safety brake is provided to hold a load in any desired position or in the event the shearpin breaks.
- (2) Organizational maintenance includes adjustment of the safety brake, replacement of the cable, the drive shaft universal joints and shearpin, and the winch.

#### *b. Data.*

##### Drive shaft:

Make..... Blood Brothers  
 Model..... 4080  
 Universal joints..... cross and trunnion

##### Winch:

Cable size.....  $\frac{7}{16}$  inch x 150 feet  
 Capacity..... 7,500 pounds  
 Make..... Braden  
 Model..... LU-4  
 Weight..... 250 pounds

### 181. Safety Brake Adjustment

#### *a. Disconnect Drive Shaft.*

- (1) If the drive shaft is equipped with a collar, remove the locking wire from the collar setscrew at rear universal joint, loosen the setscrew, and slide the collar forward.
- (2) Remove the locking wire (fig. 153) from the drive shaft shearpin (fig. 153) and remove the shearpin.
- (3) Slide the front universal joint yoke (fig. 153) toward the rear far enough to clear the wormshaft.

#### *b. Adjust Safety Brake.*

- (1) Remove the outer jamnut (fig. 153) from the brake band end.
- (2) Insert a long punch through the shearpin hole in the wormshaft. Oscillate the shaft with the punch and at the same time tighten the inner jamnut on the brake band end until a

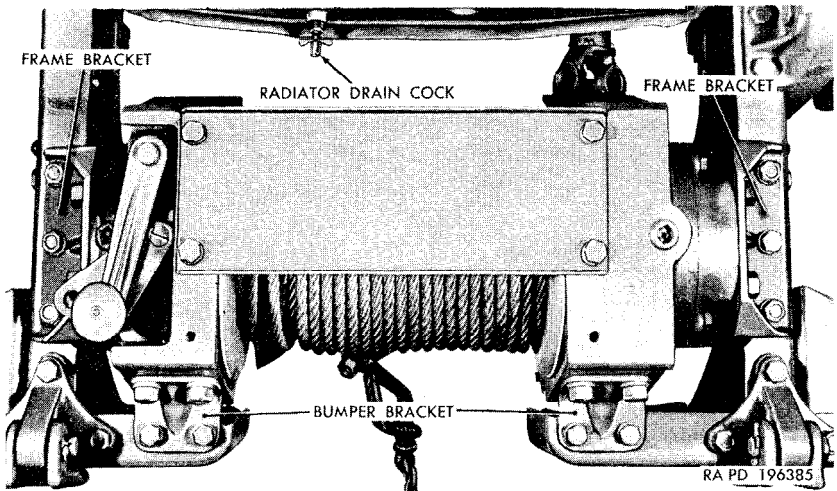


Figure 152. Winch—top view.

noticeable drag is felt when the wormshaft is rotated in one direction.

- (3) Hold the inner jamnut and install the  $\frac{1}{4}$ -20NF outer jamnut. Tighten the outer nut to hold the adjustment.

c. Connect Drive Shaft.

- (1) Remove the punch from the shearpin hole in the wormshaft and position the universal joint front yoke on the wormshaft, aligning the shearpin holes. Install the shearpin and secure with locking wire (fig. 153).
- (2) If the drive shaft is equipped with a collar, position the collar to provide  $\frac{5}{8}$ -inch clearance between the collar and the

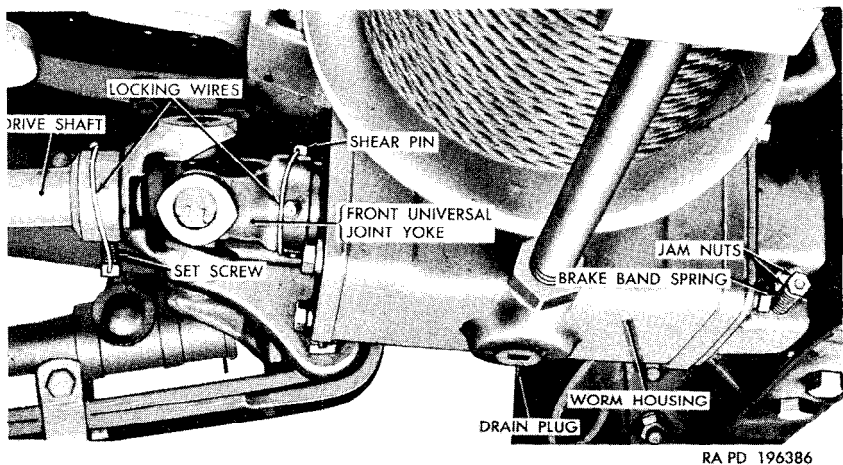


Figure 153. Winch—bottom view.

front end of the drive shaft rear universal joint yoke, tighten the collar setscrew, and secure with locking wire.

## 182. Drive Shaft Shearpin

*a. General.* Since breakage of the shearpin usually occurs as a result of overloading the winch, it is important that the winch load be lessened before attempting to move or support it after replacing the shearpin.

**Caution:** Support the load or make certain that the safety brake is properly adjusted (par. 181*b*) to hold the winch load while replacing the shearpin.

### *b. Replacement.*

- (1) If the pieces of the broken shearpin cannot be removed cleanly from the universal joint yoke and the wormshaft, disconnect the yoke (par. 181*a*) and remove the pieces.
- (2) Position the universal joint yoke on the winch wormshaft and connect the drive shaft (par. 181*c*).

## 183. Drive Shaft and Universal Joints

### *a. Removal.*

- (1) If the drive shaft (fig. 154) is equipped with a collar, remove the locking wire from the collar setscrew, loosen the setscrew, and slide the collar forward.
- (2) Remove the locking wire from the shearpin (fig. 153) and remove the shearpin. Push the shaft and assembled parts to the rear, and remove the front universal joint yoke (fig. 153) from the wormshaft.
- (3) Remove the 10 bolts and lockwashers that secure the winch brackets to the frame side rails and front bumpers, and raise the left side of the winch sufficiently to permit removal of the drive shaft.
- (4) Pull the shaft forward to disengage the splined end of the shaft from the front yoke of the rear universal joint, and remove the shaft. Remove the collar (if so equipped) as the shaft is removed.
- (5) Remove the locking wire from the setscrew in the rear universal joint yoke, loosen the setscrew, and remove the universal joint from the power-take-off. Remove the woodruff key from the power-take-off shaft. Remove the front universal joint from the drive shaft in the same manner.

### *b. Inspection.*

- (1) Clean all parts.
- (2) Inspect the drive shaft for distortion, cracks, and damaged splines.

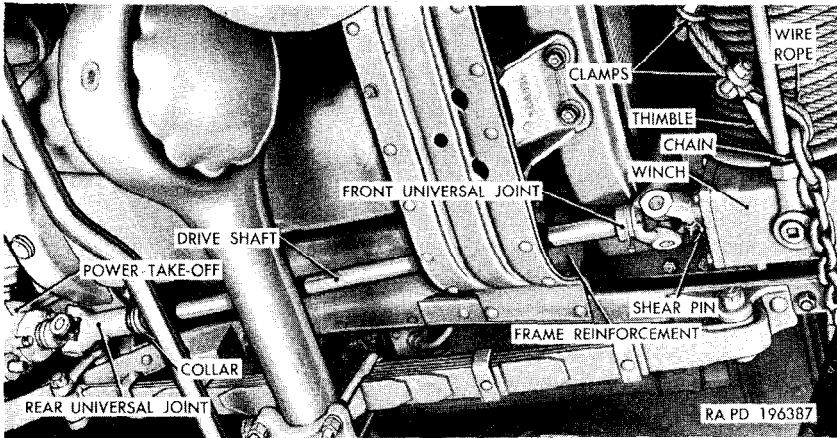


Figure 154. Winch drive shaft and universal joints.

- (3) Inspect both universal joints for wear, binding, and damaged splines (front yoke of rear joint).

*Note.* The front yoke should slide freely on the shaft to insure the safety feature of the shear pin.

- (4) Inspect the power-takeoff drive shaft and the switch wormshaft for corrosion damage and burs. Remove minor scratches or burs with crocus cloth.
- (5) Inspect the collar and all setscrews for cracks and damaged threads.
- (6) Replace parts that are unfit for further service.

*c. Installation.*

- (1) Install a No. 817 or 127 woodruff key in the keyway at the front end of the drive shaft. Install the rear yoke of the front universal joint on the shaft, aligning the keyway in the yoke with the key. Install the setscrew, tighten, and secure with locking wire (fig. 153).
- (2) Install the rear universal joint on the power-takeoff drive shaft in the manner described in *c*(1) above.
- (3) Apply a light coating of automotive and artillery grease to the splines of the drive shaft. With the winch raised as in *a*(3) above, insert the splined end of the shaft through the opening in the frame reinforcement from the front. Install the collar on the shaft (if so equipped), and insert the shaft in the front yoke of the rear universal joint, aligning the journals of both universal joints. Push the shaft and assembled parts toward the rear.
- (4) Lower the winch into position and align the front universal joint front yoke with the wormshaft. Install the yoke on the wormshaft, aligning the shearpin holes. Install the shearpin and secure with locking wire.

- (5) Install the six  $\frac{1}{2}$ -inch lockwashers and  $\frac{1}{2}$ -20NF x  $1\frac{3}{8}$  bolts for the winch frame brackets and four  $\frac{1}{2}$ -inch lockwashers and  $\frac{1}{2}$ -20NF x 1 bolts for the bumper brackets. Tighten the bolts evenly.
- (6) If the drive shaft is equipped with a collar, position the collar to provide  $\frac{5}{8}$ -inch clearance between the collar and the front end of the universal joint yoke, tighten the collar setscrew, and secure with locking wire.

## 184. Winch Cable

*a. Removal.* Place the winch clutch shifter handle in the DISENGAGED position (fig. 27) and unwind all the cable from the drum. Remove the setscrew that secures the cable to the drum and remove the cable.

*b. Inspection.* Inspect the wire rope for broken strands and rust or corrosion. Inspect the chain for damaged links or hook. Inspect the thimble and two clamps for wear or damage. Replace parts that are unfit for further service.

*c. Installation.*

- (1) Install the thimble on the chain, thread the wire rope through the chain link, and fit it on the thimble. Secure the rope with the two clamps and tighten the clamp nuts.
- (2) Clean the winch drum and apply a film of engine oil to the drum surface. Install the rope on the drum by passing it under the winch and around the drum at the rear, so the cable will wind correctly. Attach the end of the wire rope to the drum with the setscrew. Wind the rope under power (par. 55e), applying engine oil to the rope as it winds on the drum.

## 185. Winch

*a. Removal.*

- (1) Disconnect the winch drive shaft (par. 181a).
- (2) Remove the four bolts and lockwashers that secure the winch to bumper brackets (fig. 152) and to the front bumpers.
- (3) Remove the six bolts and lockwashers that secure the winch to frame brackets to the frame side rails, and remove the winch.
- (4) Remove the two bolts and lockwashers that secure each bumper bracket, and remove the brackets. Remove the four nuts and lockwashers that secure each frame bracket and remove the brackets.

*b. Installation.*

- (1) Install the two frame brackets on the studs in the winch. Install the four  $\frac{9}{16}$ -inch lockwashers and  $\frac{9}{16}$ -18NF nuts for each bracket. Tighten the nuts.

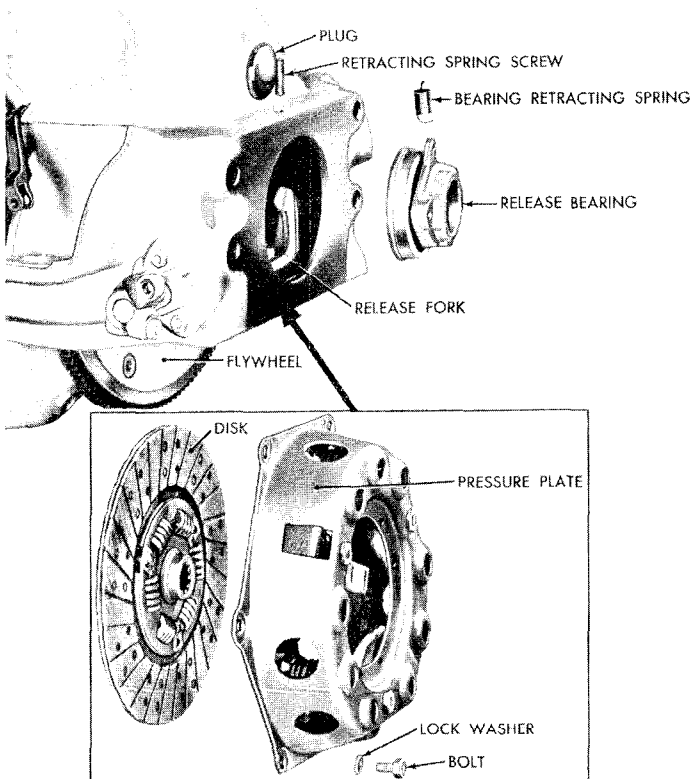
- (2) Install the two bumper brackets on the front of the winch and install two  $\frac{5}{8}$ -inch lockwashers and  $\frac{5}{8}$ -11NC x  $1\frac{1}{2}$  bolts for each bracket. Tighten the bolts.
- (3) Position the winch on the frame side rails with the bolt holes in the frame brackets alined with those in the frame. Install three  $\frac{1}{2}$ -inch lockwashers and  $\frac{1}{2}$  20NF x  $1\frac{3}{8}$  bolts for each bracket. Install two  $\frac{1}{2}$ -inch lockwashers and  $\frac{1}{2}$ -20NF x 1 bolts for each bumper bracket. Tighten all bolts evenly.
- (4) Connect the winch drive shaft front universal joint and install the shearpin (par. 181c).
- (5) Position the collar (if so equipped) (par. 183c(6)).
- (6) Adjust the winch safety brake (par. 181b).

## Section XV. CLUTCH

### 186. Description and Data

#### a. Description.

- (1) The clutch (fig. 155) consists of the disk and pressure plate, clutch release bearing, and release fork which is actuated by the clutch pedal. The disk is splined to the transmission



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*Figure 155. Clutch parts—exploded view.*

- shaft and the pressure plate is bolted to the engine flywheel.
- (2) Organizational maintenance of the clutch includes adjustment of the clutch pedal, replacement of the clutch pan and pan plate, and emergency replacement of the release bearing, disk, and pressure plate (par. 189).

*b. Data.*

Clutch pedal free travel..... 1 in  
Facing :  
    Dimensions..... 10 OD x 6 ID x 0.125 thick  
    Material..... molded woven asbestos  
    Total friction area..... 100.53 sq in  
Make..... Borg and Beck  
Model..... 11828  
Pilot bearing :  
    Size..... 0.941 OD x 0.752 ID x 7/8 long  
    Type..... Oillite  
Release bearing :  
    Make..... Aetna  
    Model..... A-893-4  
    Type..... ball thrust (prelubricated)  
    Size..... 10 in  
Total spring pressure..... 1,504 lb

**187. Clutch Pedal Adjustment**

*a. General.* Correct clutch pedal free travel is 1 inch. Adjustment is accomplished by changing the position of the clutch pedal in relation to the clutch pedal adjusting collar. Two adjusting bolts (fig. 156) are provided for this purpose.

*b. Adjustment.*

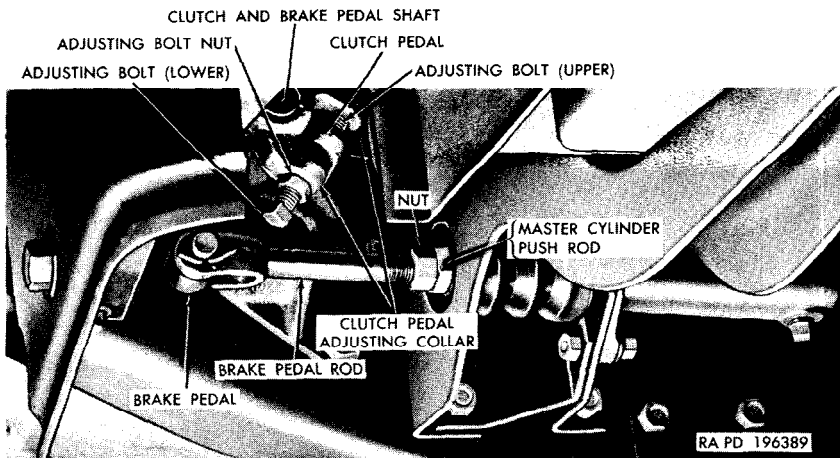


Figure 156. Clutch and brake pedals installed.

- (1) Loosen the adjusting bolt nuts on the upper and lower adjusting bolts (fig. 156).
- (2) Turn the bolts in or out of the collar to provide 1-inch free travel of the pedal. Loosen the upper bolt and tighten the lower bolt to increase free travel; loosen the lower bolt and tighten the upper bolt to decrease free travel.
- (3) Tighten the nuts on both adjusting bolts after making the adjustment.

## 188. Clutch Housing Pan and Pan Plate

(fig. 157)

*a. General.* Design changes in the clutch housing pan and pan plate provide a change in the pan drain plug and the pan plate seal (par. 6). The drain plug in the clutch pan on early vehicles is a pipe plug, while the drain plug (fig. 157) for pans on later vehicles is of a different type and is provided with a gasket. The clutch pan plate on early vehicles has two seals riveted to the plate, while the plate on later vehicles has a one-piece seal cemented to the plate. Removal and installation procedures are the same for both types of pan and plate.

*b. Removal.*

- (1) Remove the four bolts and lockwashers that secure the pan plate to the front side of the clutch housing and remove the plate with seal.

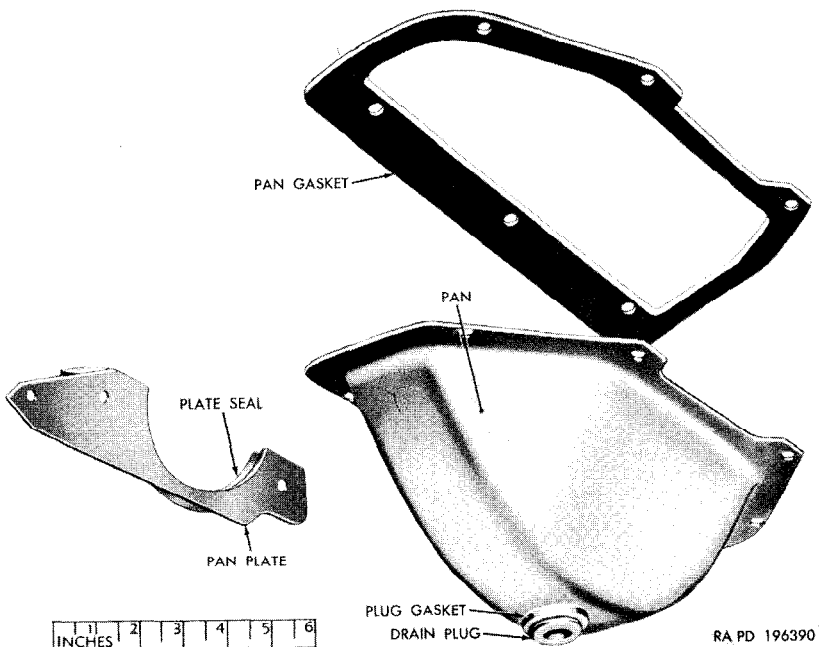


Figure 157. Clutch housing pan and pan plate (late-type).



- (2) Remove the six bolts and lockwashers that secure the pan to the clutch housing, and remove the pan and pan gasket.
- (3) Remove the drain plug from the pan. If a gasket is provided with the plug, remove the plug gasket.

*c. Inspection.*

- (1) Clean all parts, including the mating surfaces of the clutch housing and housing pan with dry-cleaning solvent or volatile mineral spirits.
- (2) Inspect the pan for cracks, damaged flange surfaces, distortion, or damaged threads.
- (3) Inspect the pan plate for cracks, distortion, or damaged, loose or deteriorated seals. Remove damaged seals.
- (4) Replace all parts that are unfit for further service.

*d. Installation.*

- (1) If the pan plate seal or seals were removed (*c*(3) above) install new seal or seals. For the late-type plate, cement the seal to the flange side of the plate with synthetic rubber cement. For the early-type plate, position the upper seal on the flange side of the plate and the lower seal on the opposite side. Install the ten  $\frac{1}{8} \times \frac{1}{16}$  split rivets with the rivet heads next to the seals.
- (2) Apply a coating of liquid-type gasket cement to both sides of the pan gasket and position the gasket on the pan, aligning the bolt holes. Position the pan and gasket on the clutch housing and install the six  $\frac{5}{16}$ -inch lockwashers and  $\frac{5}{16}$ -18NC  $\times \frac{5}{8}$  bolts. Tighten the bolts evenly. Install the pan drain plug gasket (if required) and the drain plug.
- (3) Position the pan plate at the front of the housing with the upper seal toward the front of the engine and the front portion of the pan gasket (late-type) down. Install a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -16NC  $\times \frac{5}{8}$  bolt in the upper bolt hole at each side of the plate and  $\frac{5}{16}$ -inch lockwasher and  $\frac{5}{16}$ -18NC bolt for each lower bolt hole. Tighten the four bolts.

## **189. Clutch Release Bearing, Pressure Plate, and Disk**

*a. Co-ordination with Ordnance Maintenance Unit.* Replacement of the clutch disk, pressure plate, and release bearing is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, provided authority is obtained from the responsible commander. Replacement parts, tools, and instructions may be obtained from the supporting ordnance maintenance unit.

*b. Remove Clutch Release Bearing* (fig. 155).

- (1) Remove the transmission (par. 194*b*).
- (2) Detach the retracting spring from the release bearing and

from the retracting spring screw, and remove the spring through the transmission shaft opening in the clutch housing.

- (3) Disengage the release bearing from the fork and remove the bearing through the transmission shaft opening.
- (4) Remove the retracting spring screw, if it must be replaced.

*c. Inspection.* Wipe the release bearing with a clean cloth and inspect for wear, roughness in the bearing, and damaged bearing sleeve.

**Caution:** Do not clean the bearing with dry-cleaning solvent or volatile mineral spirits.

Inspect the retracting spring for cracks and distortion. Inspect the retracting spring screw for damaged threads. Replace parts that are unfit for further service.

*d. Install Clutch Release Bearing (fig. 155).*

- (1) If the retracting spring screw was removed, install the screw in the clutch housing.
- (2) Install the release bearing in front of the bearing fork, with the larger diameter of the bearing sleeve toward the front and the retracting spring hole at the top.

*Note.* A new clutch release bearing is prelubricated.

- (3) Attach the retracting spring to the spring screw and to the release bearing sleeve.
- (4) Install the transmission (par. 194c).
- (5) Adjust the screw so there is slight tension on the spring when the fork is in the released position.

*e. Remove Clutch Pressure Plate and Disk.*

- (1) Remove the transmission (par. 194b).
- (2) Remove the clutch housing pan and pan plate (par. 188b).
- (3) Remove the clutch release bearing (*b* above).
- (4) Loosen the the six bolts that secure the pressure plate to the flywheel, rotating the flywheel to gain access to the bolts. Remove the six bolts and lockwashers, and remove the pressure plate and the clutch disk.

*f. Cleaning and Inspection.*

- (1) Clean the parts thoroughly with dry-cleaning solvent or volatile mineral spirits. Clean the pilot bearing (bushing-type) in the end of the crankshaft and inspect for wear or damage. Clean disk-contacting surfaces and flywheel. If the pilot bearing or flywheel is worn or scored, notify ordnance maintenance personnel.
- (2) Inspect the disk for worn, glazed, or loose facings, damaged hub splines, damaged springs, or distortion.
- (3) Inspect the pressure plate for scored disk-contacting surface, distortion, or damaged springs or fingers.

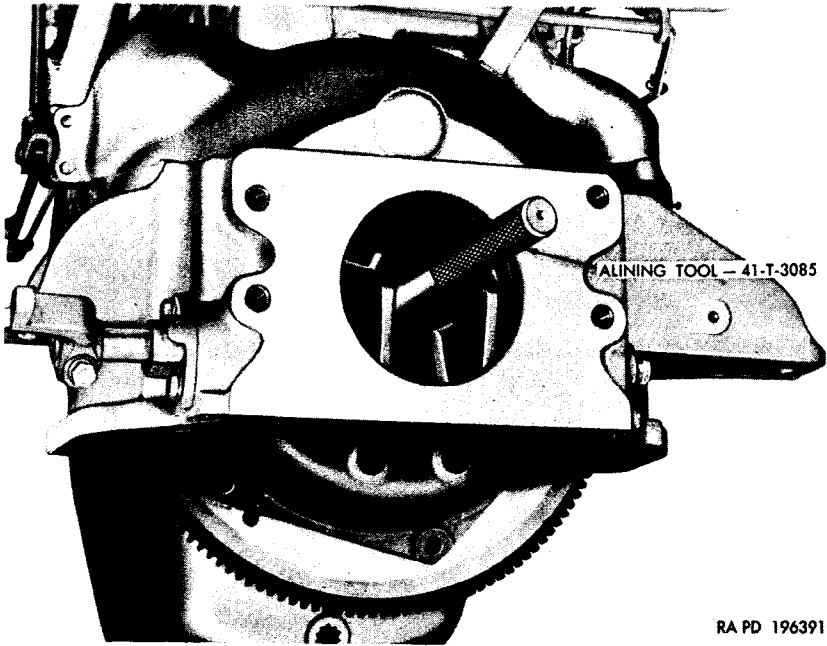


Figure 158. Alining clutch parts.

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- (4) Inspect the clutch release bearing (*c* above).
- (5) Replace all parts that are unfit for further service.

*g. Install Clutch Pressure Plate and Disk.*

- (1) Position the disk and the pressure plate (fig. 155) on the flywheel. Install the six special bolts and  $\frac{3}{8}$ -inch lockwashers. Do not tighten the bolts until all are installed and the clutch parts are alined ((2) below).
- (2) Insert the clutch alining tool 41-T-3085 through the pressure plate, disk, and into the pilot bearing to aline the parts (fig. 158). Tighten the six bolts evenly to 15 to 20 pound-feet torque, using a torque-indicating wrench. Remove alining tool.
- (3) Install the clutch release bearing (*d* above).
- (4) Install the clutch housing pan and pan plate (par. 188*d*).
- (5) Install the transmission (par. 194*c*).
- (6) Adjust clutch pedal (par. 187*b*), if necessary.

*h. Record Replacement.* Record the clutch replacement on DA Form 478.

## Section XVI. TRANSMISSION AND POWER-TAKE-OFF

### 190. Description and Data

- (1) The transmission is a helical gear, synchro-shift unit, with four forward speeds and one reverse. On vehicle equipped

with a winch, the power-take-off is mounted at the left side of the transmission.

- (2) Organizational maintenance operations include replacement of the transmission and gear shift lever, the power-take-off cover gasket or gaskets, and the filler and drain plugs; and emergency replacement of the transmission top cover and/or gasket and the transmission with or without power-take-off.

*b. Data.*

Transmission :

Capacity :

Through engine T245-3955

W/o power-take-off ----- 9 pt

W/power-take-off ----- 10½ pt

After engine TT245-3955

W/power-take-off ----- 7 pt

W/o power-take-off ----- 6 pt

Make ----- New Process

Model ----- 88950

Power-take-off :

Gear speed ----- 395 rpm at 1,000 rpm engine speed

Speeds :

Forward ----- 4

Reverse ----- 1

Ratios :

First ----- 6.40 : 1

Second ----- 3.09 : 1

Third ----- 1.69 : 1

Fourth ----- 1.00 : 1

Reverse ----- 7.61 : 1

Type ----- helical gear synchro-shift

## 191. Gear Shift Hand Lever

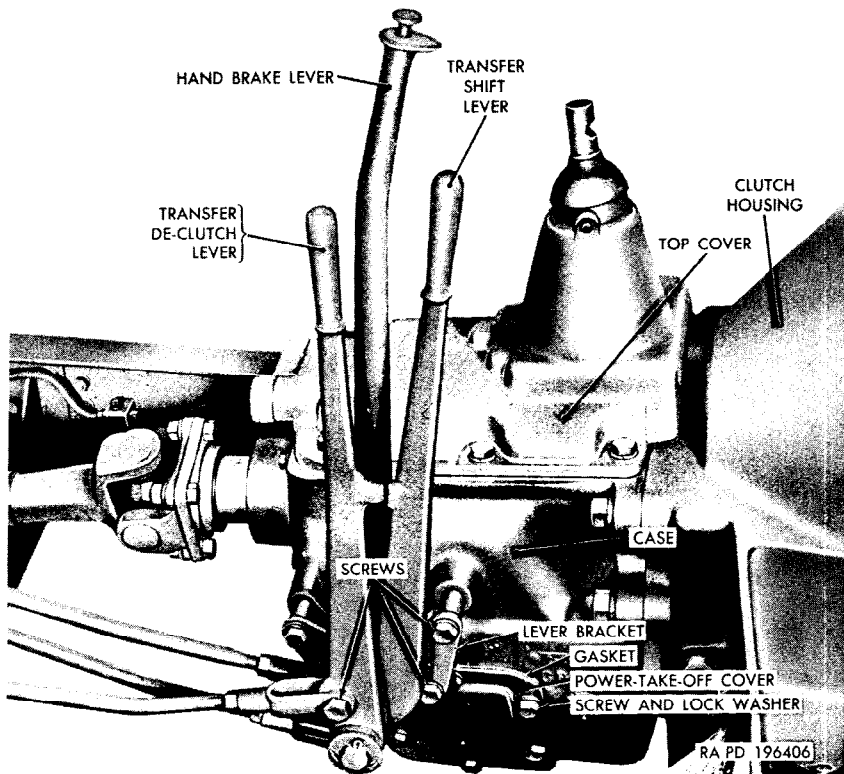
*a. Removal.* Remove the nut, lockwasher, and bolt that clamps the gear shift hand lever to the gear shift lower lever and remove the hand lever.

*b. Installation.* Position the hand lever on the lower lever and install the ¼-20NF x 2 bolt, ¼-inch lockwasher, and ¼-20NF nut. Tighten the nut.

## 192. Power-Take-Off Cover Gasket

*a. General.* The transmission is provided with one or two power-take-off covers, the number depending on whether a power-take-off is used. On transmissions with power-take-off, one cover is attached to the right side of the transmission and on a transmission without power-take-off, a second cover is used at the left side. If either cover gasket is damaged or deteriorated, causing leakage of transmission lubricant, replace the gasket (*b* below).

*b. Replacement.* Both cover gaskets are removed and installed in the same manner.



*Figure 159. Transmission—right side.*

- (1) Remove the drain plug (S, fig. 36) from the bottom of the transmission case and drain the lubricant into a clean container. Install the drain plug and tighten.
- (2) Remove the six cap screws and lockwashers that secure the cover to the transmission case (fig. 159) and remove the cover and cover gasket. Discard the gasket.
- (3) Clean the gasket surfaces of the case and the cover thoroughly.
- (4) Apply liquid-type gasket cement to both sides of a new gasket and position the gasket on the cover. Position the cover and gasket on the case, aligning the screw holes. Install the six  $\frac{3}{8}$ -inch lockwashers and  $\frac{5}{16}$ -16NC x  $\frac{3}{4}$  cap screws. Tighten the screws evenly.
- (5) Fill the transmission to the proper level with the correct grade of lubricant. Refer to lubrication order (figs. 33 and 34). Use the lubricant which was drained from the transmission, if it is clean and of correct grade.

## 193. Transmission Case Top Cover and/or Gasket

a. *Coordination with Ordnance Maintenance Unit.* Replacement of the transmission case top cover and/or cover gasket is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, provided authority for performing such replacement is obtained from the responsible commander. A replacement cover may be obtained from the supporting ordnance maintenance unit.

### b. *Removal.*

- (1) Remove the transmission access cover (par. 121g).
- (2) Disengage the battery-to-starter cable from the cable clip (fig. 160).
- (3) Clean the top cover and remove the six bolts and lockwashers that secure the cover to the transmission case. Remove the cable clip from the right front corner and remove the cover (fig. 161). Remove and discard the cover gasket.
- (4) Clean the gasket surfaces of the transmission case and cover thoroughly, exercising care to prevent any dirt or other foreign matter from entering the case.

### c. *Installation.*

- (1) Apply a coating of liquid-type gasket cement to both sides of a new cover gasket and position the gasket on the transmission case.
- (2) Install the cover carefully, engaging the rear shifter fork in

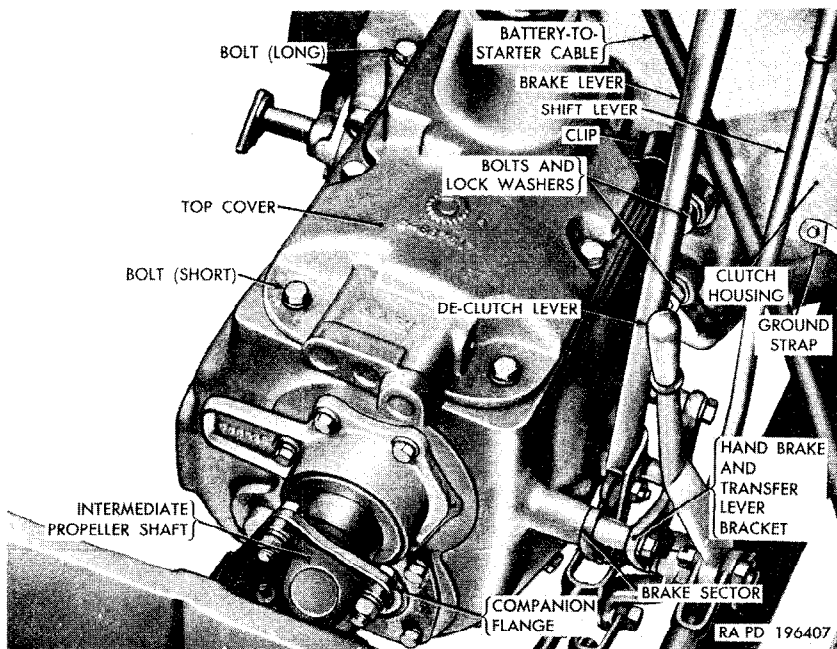


Figure 160. Transmission installed.

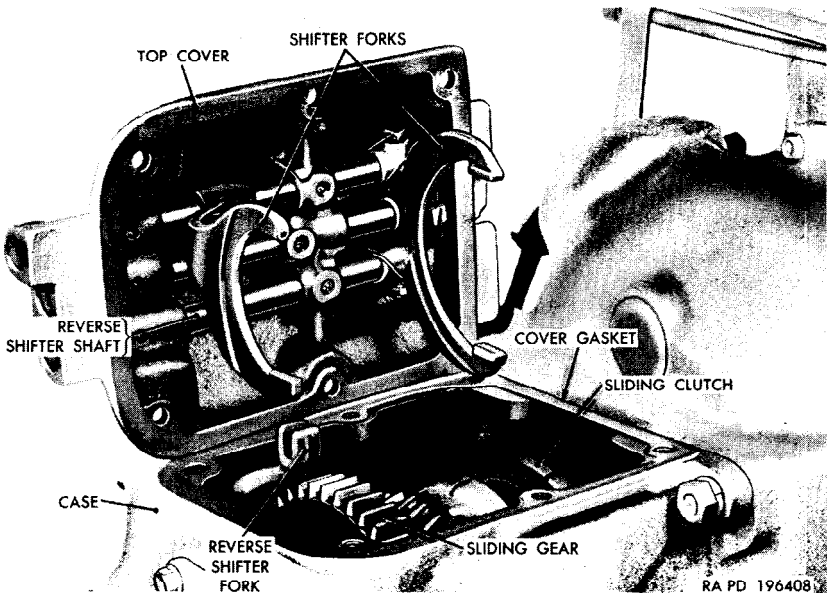


Figure 161. Transmission top cover removed.

the transmission sliding gear, the reverse shifter fork with reverse shifter shaft, and the front shifter fork in the sliding clutch (fig. 161).

- (3) Install a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -16NC x  $1\frac{1}{8}$  bolt for the left front bolt opening (fig. 160) and a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -16NC x  $\frac{7}{8}$  bolt for each of the other five openings, attaching the cable clip at the right front corner. Tighten the bolts evenly.
- (4) Engage the battery-to-starter cable in the cable clip.
- (5) Install the transmission access cover (par. 122f).

*d. Record Replacement.* Record the replacement on DA Form 478.

## 194. Transmission

(fig. 159)

*a. Coordination with Ordnance Maintenance Unit.* Replacement of the transmission is normally an ordnance maintenance operation, but may be performed by the using organization, provided authority for performing such replacement is obtained from the responsible commander. A replacement transmission may be obtained from the supporting ordnance maintenance unit.

*b. Removal.* Removal operations described below are for a transmission with power-takeoff. When replacing a transmission without power-takeoff, disregard steps pertaining to the power-takeoff and winch drive shaft.

- (1) Remove the transmission access cover (par. 121g).

- (2) Remove the three screws and lockwashers that secure the handbrake and transfer lever bracket to the right side of the transmission case.
- (3) Disengage the battery-to-starter cable from the clip on the transmission top cover (fig. 160).
- (4) Remove the four nuts, lockwashers, and bolts that secure the intermediate propeller shaft to the companion flange on the transmission (fig. 160). Secure the shaft to keep it off the floor.
- (5) Remove the four bolts and lockwashers that secure the transmission to the clutch housing. Using jacks or a dolly move the transmission straight back to disengage the main shaft from the clutch housing and the splined yoke of the winch drive shaft from the drive shaft. Lower the transmission and remove it.
- (6) If the transmission is to be replaced, remove the winch drive shaft rear universal joint from the power-takeoff drive shaft (par. 183a(4)).

*c. Installation.*

- (1) Clean the machined surfaces of the transmission and the clutch housing thoroughly.
- (2) Install the winch drive shaft rear universal joint on the power-takeoff drive shaft (par. 183c(1) and (2)).
- (3) Using jacks or a dolly, position the transmission and move it forward to engage the transmission shaft in the clutch; at the same time, guide the winch drive shaft into the front yoke of the rear universal joint on the power-takeoff drive shaft, aligning the universal joint journals. Do not attempt to force the transmission into the clutch by hammering or other extreme methods.
- (4) Install the four  $\frac{9}{16}$ -inch lockwashers and  $\frac{9}{16}$ -12NC x  $1\frac{3}{4}$  bolts. Tighten the bolts evenly. Remove the jacks or dolly.
- (5) Connect the intermediate propeller shaft to the transmission companion flange and install the four  $\frac{7}{16}$ -20NF x  $1\frac{1}{4}$  bolts,  $\frac{7}{16}$ -inch lockwashers, and  $\frac{7}{16}$ -20NF nuts. Tighten the nuts evenly.
- (6) Engage the battery-to-starter cable in the clip on the transmission cover (fig. 160).
- (7) Place the assembled handbrake lever and transfer shift levers and bracket in position at the side of the transmission and install the three  $\frac{3}{8}$ -inch lockwashers and  $\frac{3}{8}$ -16NC x  $2\frac{3}{4}$  screws (fig. 159). Tighten the screws evenly.
- (8) Install the transmission access cover (par. 122f).

*d. Record Replacement.* Record the transmission replacement on DA Form 478.



## Section XVII. TRANSFER

### 195. Description and Data

#### *a. Description.*

- (1) The transfer (fig. 162) is of the two-range type and provides a means of transferring engine power to the front and rear axles. The handbrake band and drum are mounted at the rear of the transfer. The speedometer drive pinion is actuated by the transfer driven shaft.
- (2) Organizational maintenance operations include adjustment of the transfer control linkage, replacement of the speedometer drive pinion, air vent, and emergency replacement of the transfer. The vent is serviced in the same manner as the vent for the front axle (par. 207a).

#### *b. Data.*

Capacity----- 5 pt  
Make----- New Process  
Model----- 88845  
Ratio:  
    High range----- 1.00:1  
    Low range----- 1.96:1

### 196. Transfer Control Linkage Adjustment

*Nota.* The key letters noted in parentheses are in figure 162 except where otherwise indicated.

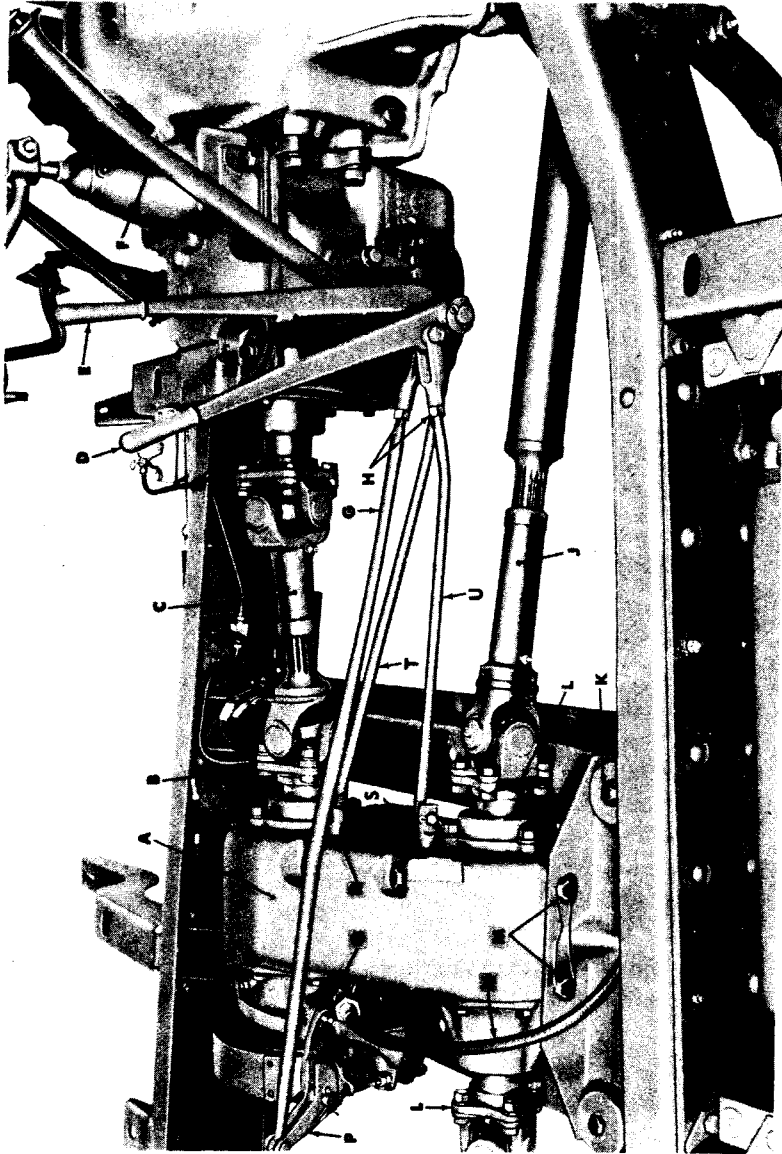
*a. General.* The transfer control shifter lever rod and declutch shifter lever rod must be properly adjusted to prevent disengagement of the clutch gears.

#### *b. Check Operation of Shifter Shafts.*

- (1) Remove the two cotter pins that secure the declutch shifter lever rod (U) and control shifter lever rod (T) to the shifter shafts (R) and (S) and disengage the rods from the shafts.
- (2) Jack up one rear wheel from the floor far enough to permit the wheel to be rotated. Block the other wheels and release the handbrake.
- (3) While an assistant rotates the rear wheel, move the shifter shafts "in" and "out" by hand. Make certain that the poppet ball for each shaft engages in the detent slots as the shifts are accomplished.

#### *c. Adjust Control Shifter Lever Rod.*

- (1) Push the shifter shaft (R) in until the poppet ball engages in the slot, indicating that the transfer is in high range.
- (2) Move the transfer shift control lever (Q, fig. 12) forward until approximately one-half inch exists between the lever and the front end of the lever slot in the transmission access



**KEY** **ITEM**

- A—TRANSFER
- B—INPUT SHAFT COMPANION FLANGE
- C—INTERMEDIATE PROPELLER SHAFT
- D—DE-CLUTCH LEVER
- E—SHIFT LEVER
- F—BRAKE LEVER
- G—BRAKE CONTROL ROD
- H—NUT
- J—FRONT PROPELLER SHAFT
- K—BOLT
- L—OUTPUT SHAFT COMPANION FLANGE
- M—MOUNTING BRACKET BOLTS
- N—SPEEDOMETER SHAFT
- P—CAM LEVER
- Q—PINION RETAINING NUT
- R—TWO SPEED CLUTCH GEAR SHIFTER SHAFT
- S—FRONT AXLE OUTPUT SHAFT CLUTCH GEAR SHIFTER SHAFT
- T—CONTROL SHIFTER LEVER ROD
- U—DECLUTCH SHIFTER LEVER ROD

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*Figure 162. Transfer and controls.*

cover. While an assistant holds the lever in this position, check the alinement of the control shifter lever rod (T) with the hole in the shifter shaft (R). If adjustment of the rod is necessary, loosen the nut (H) on the front end of the rod and turn rod in turns of 360-degrees IN or OUT until proper alinement is obtained. Insert end of rod through shifter shaft (offset of rod down) and install a  $\frac{3}{32} \times 1\frac{1}{8}$  cotter pin. Tighten nut (H) at the front end of rod.

- (3) Move the shifter lever to the rear until the poppet ball engages in the slot, indicating that the transfer is in low range.

*d. Adjust Declutch Lever Rod (fig. 162).*

- (1) Push the shifter shaft (S) in until the poppet ball engages in the slot, indicating that the front axle is engaged.
- (2) With the transfer shift control lever (Q, fig. 12) in the low range position as described in *c*(3) above, move the transfer declutch control lever (R, fig. 12) forward until approximately  $\frac{1}{2}$ -inch clearance exists between the bosses of both levers. While an assistant holds the lever in this position, check the alinement of the declutch shifter lever rod (U) with the hole in the shifter shaft (S). If adjustment of the rod is necessary, loosen the nut on the front end of the rod and turn rod in turns of 360° "in" or "out" until proper alinement is obtained. Insert end of rod through shifter shaft (offset of rod down) and install  $\frac{3}{32} \times 1\frac{1}{8}$  cotter pin. Tighten nut (H) at front end of rod.

*Note.* Do not change the position of the declutch shifter lever rod to establish the correct clearance, as this lever has been positioned properly if instructions in *c* above were followed.

- (3) Remove the jack and blocking.

## **197. Speedometer Drive Pinion and Oil Seal**

*a. Removal (fig. 162).*

- (1) Disconnect the speedometer shaft (N) from the pinion retaining nut (Q).
- (2) Unscrew the pinion retaining nut from the bearing retainer. Remove the nut and drive pinion.
- (3) Remove the pinion and the pinion oil seal from the retaining nut. Discard the oil seal.

*b. Installation (fig. 162).*

- (1) Position speedometer drive pinion in the bearing retainer, making certain that the pilot at the lower end of the pinion engages in the hole of the retainer boss.
- (2) Place speedometer drive pinion oil seal in the drive pinion retaining nut (Q) and install the nut in the bearing retainer. Tighten the nut.

- (3) Connect the speedometer shaft (N) engaging the shaft core with the drive pinion, and screw the shaft nut to the pinion retaining nut.

## 198. Transfer

*Note.* The key letters noted in parentheses are in figure 162, except where otherwise indicated.

*a. Coordination with Ordnance Maintenance Unit.* Replacement of the transfer is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, provided authority for such replacement is obtained from the responsible commander. A replacement transfer may be obtained from the supporting ordnance maintenance unit.

### *b. Remove Transfer.*

- (1) Working from underside of the vehicle, disconnect the propeller shafts from the two output shaft companion flanges (L) and the input shaft companion flange (B) by removing the four nuts, lockwashers, and bolts that secure each propeller shaft yoke. Secure the propeller shafts to the frame to keep them off the floor.
- (2) Disconnect the transfer control shifter lever rod (T) and declutch shifter lever rod (U) at the transfer by removing the cotter pin that secures each rod to shifter shafts (R and S) and disengage the rods.
- (3) Disconnect the speedometer shaft (N) from the pinion retaining nut (Q).
- (4) Remove the cotter pin and clevis pin that secures the hand-brake control rod to the cam levers (fig. 163).
- (5) Remove the nuts, lockwashers, and plain washers from the four transfer mounting bolts (fig. 164).
- (6) Support the transfer with jacks or a dolly and remove the eight nuts, lockwashers, and bolts that secure the rear cross member (fig. 164) to the gussets on the frame side rails. Remove the rear cross member.

**Caution:** Exercise extreme care when removing the transfer, to support it adequately and prevent it from dropping and causing damage to the transfer or serious injury to personnel.

- (7) Remove the four transfer mounting bolts (fig. 163). Move the transfer to the rear to clear the front cross member, lower the transfer, and remove it from underneath the vehicle. Remove the four spacers and eight insulators from the left and right mounting brackets (fig. 163).

### *c. Remove Mounting Brackets and Speedometer Drive Pinion.*

- (1) Remove the locking wire from the two mounting bracket bolts (M, fig. 162) for each mounting bracket.
- (2) Remove the two bolts and lockwashers from each bracket, and remove the two brackets.
- (3) Remove the speedometer drive pinion (par. 197a).

*d. Inspection.* Inspect the mounting brackets and mounting parts for cracks and distortion. Inspect the mounting bolts for damaged threads. Check the insulator spacers for damage or distortion, and the insulators for damage or deterioration. Replace parts that are unfit for further service.

*e. Install Mounting Brackets and Speedometer Drive Pinion.*

- (1) Install the speedometer drive pinion (par. 197b).
- (2) Position the mounting brackets on the transfer.

*Note.* The left (large) bracket and right (small) bracket are installed in the same manner, but are not interchangeable.

Install a 1/2-inch lockwasher on each mounting bracket bolt (M, fig. 162) and install the two bolts for each bracket. Tighten the bolts and secure with locking wires.

*f. Install Transfer.*

- (1) Install the eight insulators in the mounting brackets with the larger diameters of the insulators toward the brackets, and install an insulator spacer from the upper side through each pair of insulators (fig. 163).

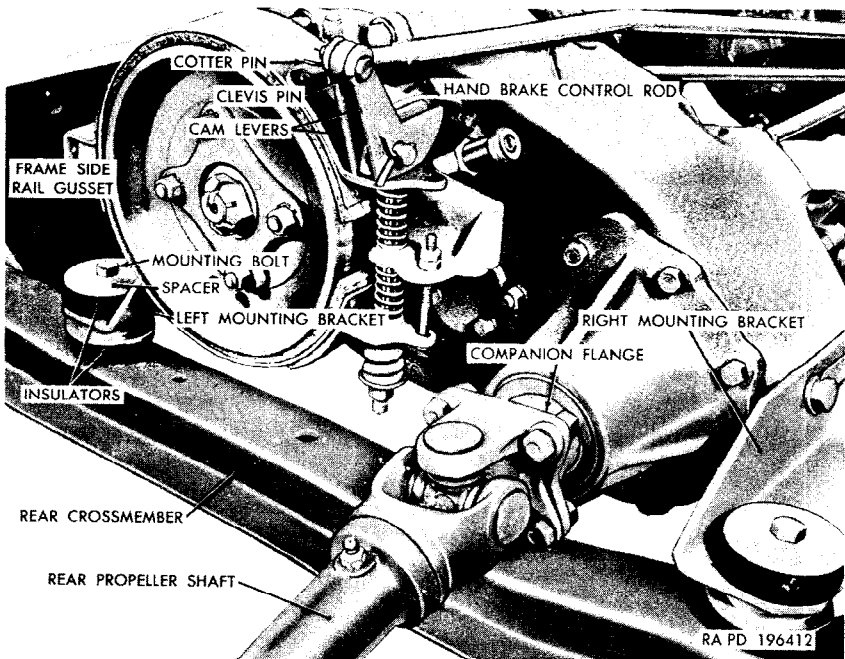
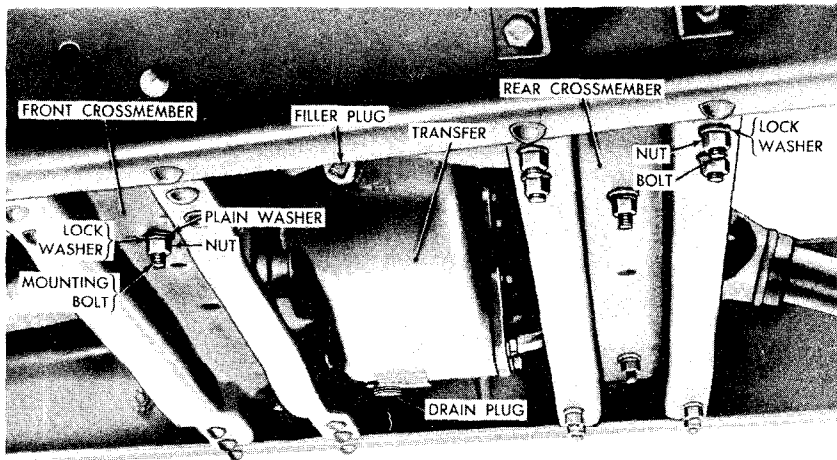


Figure 163. Transfer—rear view.



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*Figure 164. Transfer—bottom view.*

- (2) Position the transfer on the front cross member. Support the transfer in this position with jacks or blocking.
- (3) Position the rear cross member under the frame side rail gussets, aligning the bolt holes in the cross member with those in the gussets and mounting bolt spacers. Install the eight  $\frac{7}{16}$ -20NF x 1 bolts from the upper side,  $\frac{7}{16}$ -inch lockwashers, and  $\frac{7}{16}$ -20NF nuts to secure the cross member (figs. 163 and 164). Tighten the nuts.
- (4) Install a  $\frac{7}{16}$ -20NF x  $3\frac{1}{2}$  transfer mounting bolt through each of the four spacers (fig. 162). Install a  $1\frac{5}{32}$ -inch plain washer,  $\frac{7}{16}$ -inch lockwasher, and  $\frac{7}{16}$ -20NF nut on each bolt. Tighten the nuts evenly.
- (5) Remove the jacks or blocking that were used to support the transfer.
- (6) Attach the handbrake control rod to the two cam levers with the clevis pin and  $\frac{5}{32}$  x 1 cotter pin.
- (7) Connect the speedometer shaft (N) to the pinion retaining nut (Q).
- (8) Aline each propeller shaft with its respective companion flange and install the four  $\frac{7}{16}$ -20NF x  $1\frac{1}{8}$  bolts,  $\frac{7}{16}$ -inch lockwashers, and  $\frac{7}{16}$ -20NF nuts for each shaft. Tighten the nuts to 40-50 pound-feet torque.
- (9) Adjust the transfer control linkage (par. 196).
- (10) Adjust handbrake (par. 219).

*g. Record Replacement.* Record the transfer replacement on DA Form 478.

## Section XVIII. PROPELLER SHAFTS

### 199. Description and Data

#### *a. Description.*

- (1) The intermediate propeller shaft (C, fig. 162) transmits power from the transmission to the transfer. The front propeller shaft (J, fig. 162) and rear propeller shaft (fig. 163) divert power from the transfer to the front and rear axles, respectively.
- (2) Complete interchangeability is provided on the roller bearings, bearing oil seals, bearing oil seal retainers, and snap rings for all universal joints; however, the journals and yokes of the intermediate propeller shaft are of greater width than those provided for the other two propeller shafts.
- (3) Organizational maintenance operations include replacement of the propeller shafts and the universal joints or related parts. When replacing the rear propeller shaft, be sure to install the correct shaft for the vehicle involved, refer to *b* below for the correct length.

#### *b. Data.*

##### Length :

Front (all models)----- 35½ in.

Intermediate (all models)----- 10 in.

##### Rear :

Cargo truck M37 or command truck M42----- 31¼ in.

Ambulance truck M43 or telephone maintenance truck V-41--- 45¼ in.

Make-----Universal Products Company

##### Model :

Front (all models)----- 5160-56

Intermediate (all models)----- 5360-120

Rear (M37 and M42)----- 5160-57

Rear (M43 and M41)----- 5160-58

##### Universal joints :

Bearings----- cageless roller

Type----- journal and roller

### 200. Propeller Shaft

*a. Removal.* Procedure is the same for all propeller shafts. Remove the four nuts, lockwashers, and bolts that secure each universal joint flange yoke to the companion flanges on the transfer, transmission, or differential and remove the shaft.

#### *b. Installation.*

*Note.* When installing the propeller shafts, be sure to install the front and rear shafts with the splined yoke toward the transmission (fig. 162).

Place the shaft in position at the companion flanges, aligning the bolt holes. Install the four ¼<sub>16</sub>-20NF x 1½ bolts (front or rear shaft) or

$\frac{7}{16}$ -20NF x  $1\frac{1}{4}$  bolts (intermediate shaft),  $\frac{7}{16}$ -inch lockwashers, and  $\frac{7}{16}$ -20NF nuts for each flange yoke. Tighten the nuts to 40–50 pound-feet torque.

## 201. Propeller Shaft

(fig. 165)

*a. Disassemble Propeller Shafts.* Disassembly procedure is the same for all propeller shafts.

- (1) Remove the propeller shaft (par. 200a).
- (2) Unscrew the oil seal cap from the splined yoke and remove the oil seal and two oil seal washers from the cap.
- (3) Remove the splined yoke from the shaft.
- (4) Remove the lubrication fitting from the splined yoke.

*b. Disassemble Universal Joints.* All universal joints are disassembled in the same manner, with the exception of the lubrication fittings for the intermediate propeller shaft journals.

- (1) Place the universal joint in a vise and compress the two bearings sufficiently to remove the two snap rings (fig. 166). Change the position of the joint in the vise and remove the other two snap rings.
- (2) Press the four bearings from the universal joint in an arbor press, or remove them in the manner shown in figure 167. For this method, place the universal joint in a vise with a  $1\frac{1}{4}$ -inch heavy-duty socket over one bearing and a  $\frac{1}{2}$ -inch socket against the opposite bearing. Tighten the vise to force the bearing from the yoke, being careful not to damage either oil seal retainer as the bearing is removed. Remove the other three bearings in the same manner. Separate the two yokes and remove the journal.
- (3) Remove the four bearing oil seals from each journal.

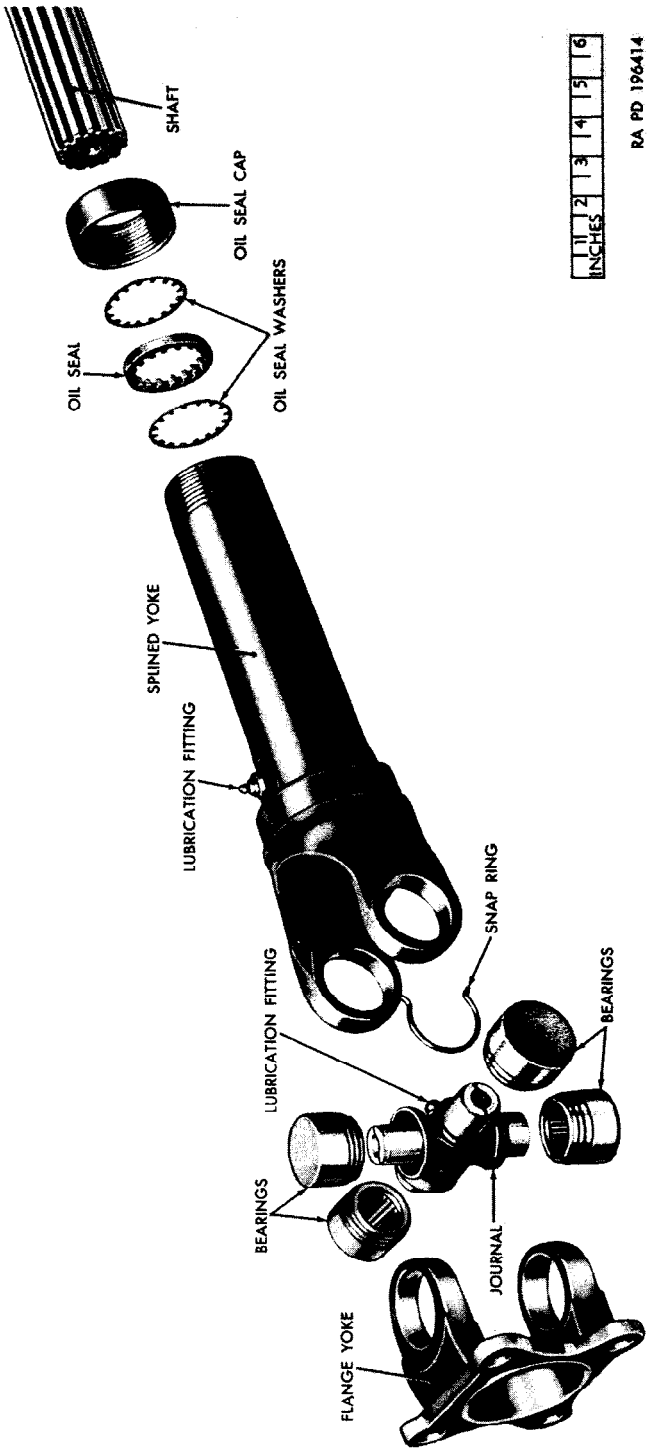
*Note.* Do not remove the oil seal retainers unless they are to be replaced, as the retainers must be a snug fit on the journal.

- (4) Remove the lubrication fitting from each journal.

*c. Inspection.*

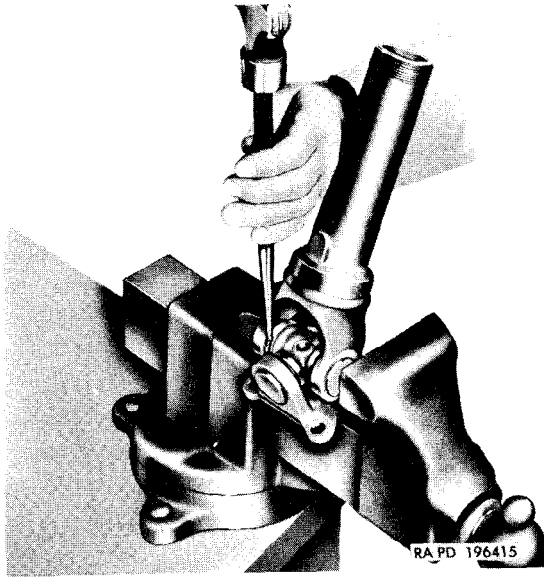
- (1) Clean the parts in dry-cleaning solvent or volatile mineral spirits and dry with compressed air.
- (2) Inspect the splined yoke and tube for distortion, cracks, and worn or damaged splines or bearing surfaces.
- (3) Inspect the flange yokes for distortion, cracks, and worn or damaged bearing surfaces.
- (4) Inspect the journals for damaged or worn bearing surfaces, damaged oil seal retainers, and distortion.
- (5) Replace parts that are unfit for further service. The universal joint repair kits provide journals with oil seals and retainers installed, journal bearings, and bearing snap rings.



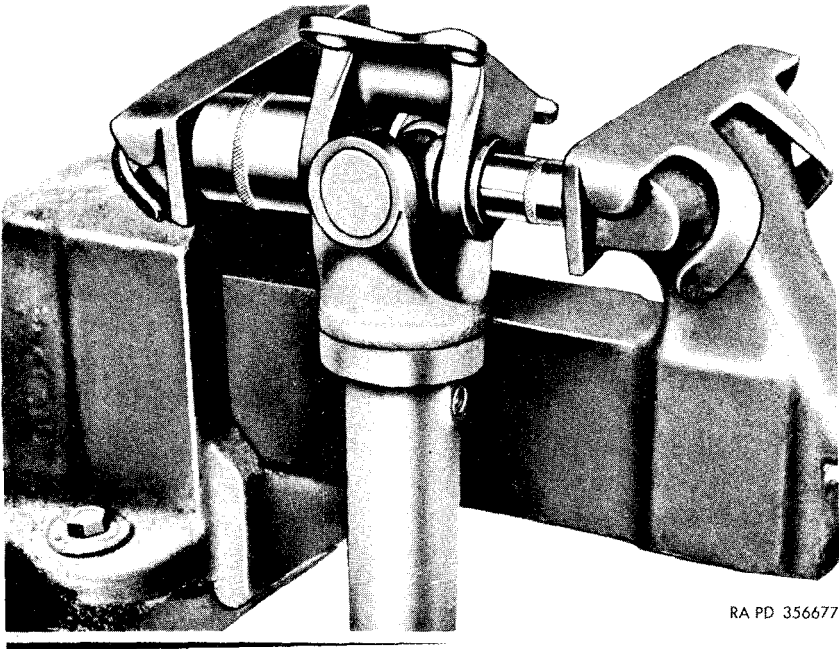


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Figure 165. Propeller shaft—exploded view.



*Figure 166. Removing bearing snap rings.*



*Figure 167. Removing bearings.*

*d. Assemble Universal Joints.*

- (1) For the front or rear propeller shaft, install a  $\frac{1}{8}$ NPT,  $67\frac{1}{2}^\circ$  lubrication fitting in each journal, tighten the fittings so they are properly positioned for grease gun connections. For the intermediate propeller shaft journals, install a  $\frac{1}{8}$ NPT lubrication fitting.
- (2) Prepare new bearing oil seals by soaking them in light engine oil for 10 minutes. If the four oil seal retainers were removed from the journal (*b* (3) above), install new retainers. Install a new oil seal in each retainer.

*Note.* Replace the oil seals whenever the universal joint is disassembled.

- (3) Position the journal in the splined yoke or tube, so the lubrication fitting is toward the splined yoke or tube (front or rear propeller shaft). Install a bearing at each side of the yoke, over the journal, pressing the bearings into position with an arbor press or between the jaws of a vice. Force the bearings in, until the bearing oil seals are compressed and install a new snap ring for each bearing, making certain that the rings are fully seated.

*e. Assemble Propeller Shaft.*

- (1) Install a  $\frac{1}{8}$ NPT lubrication fitting in the splined yoke.
- (2) Place an oil seal washer on each side of the oil seal and install the parts in the cap. Position the cap on the shaft.
- (3) Install the shaft in the yoke, matching the blind splines. Screw the cap to the splined yoke.
- (4) Lubricate all fittings with automotive and artillery lubricating grease. Make certain that grease is reaching all the journal bearings and the splines.
- (5) Install the propeller shaft (par. 200*b*).

## Section XIX. FRONT AXLE

### 202. Description and Data

*a. Description.*

- (1) The front axle is of the full-floating hypoid-type. The complete unit includes the housing, differential with carrier, steering knuckles, universal drives, tie rod, hubs, and service brakes.
- (2) Organizational maintenance operations include front wheel alignment toe-in, replacement of filler and drain plugs, air vent, steering knuckles, universal drives and tie rod; and emergency replacement of the front axle.

*b. Data.*

**Alinement :**

Camber angle (fixed).....	1¼° to 1¾°
Caster angle (fixed) :	
No-load.....	0° to 1°
Normal load.....	1° to 2°
Pivot angle (fixed).....	8°
Toe-in (adjustable).....	0 to ½ in.
Capacity.....	6 pt
Make.....	Dodge
Ratio.....	5.83:1
Tie rod.....	ball and socket
Type.....	full floating (hypoid)
Universal drive:	
Make.....	New Process
Model.....	Tracta
Turning angle (inside wheel).....	28° to 29°

**203. Front Wheel Alinement**

*a. General.* Front wheel alinement affects steering of the vehicle from a standpoint of control, ease of steering, and safety and is an important factor in the life of tires. The items affecting front wheel alinement are caster, camber, pivot angle, and toe-in. Caster, camber, and pivot angle are built into the front axle housing and cannot be adjusted. Toe-in adjustment is described in *d* below. Caster may be affected by shifting of the front springs on the axle, damaged springs, or distortion of the frame. Camber may be affected by loose hub bearings or steering knuckle flange bearings, bent steering knuckles, or a damaged axle housing.

*b. Check Camber, Caster, and Pivot Angle.*

- (1) Check both front springs for sagged or broken leaves and loose spring clip **U**-bolts. Make certain that the springs are positioned properly on the axle. Tighten spring clip **U**-bolt nuts or replace springs, as required.
- (2) Check hub bearings for looseness. Adjust or replace the bearings, if necessary (par. 226).
- (3) Check the flange bearings for looseness. If looseness is evident, notify ordnance maintenance personnel.
- (4) Check wheel and tire runout. If runout exceeds three-eighths of an inch replace the wheel (par. 227).
- (5) Inflate all tires to 40 psi. Tread on both front tires should be approximately the same. Replace badly worn tires (par. 229).
- (6) If correction of camber, caster, and pivot angle, requires alining equipment, notify ordnance maintenance personnel.

*c. Check Toe-In* (fig. 168). Since incorrect toe-in may be caused by worn, damaged, or incorrectly adjusted wheel bearings, damaged or loose steering knuckle parts, or a bent tie rod, make certain that

these items are in good condition and correctly installed before checking toe-in.

- (1) Inflate tires to 40 psi.
- (2) Check for correct wheel bearing adjustment (par. 226).
- (3) Position the vehicle on a smooth level floor with the wheels in a straightahead position.
- (4) Place the toe-in wheel alinement gage between the wheels at the rear of the axle and as near hug height as possible, with the ends of the gage bearing against the tire side walls and at equal distances from the floor.
- (5) Set the gage at zero.
- (6) Roll the vehicle straight back far enough to bring the gage toward the front the same distance from the floor as it was at the rear.
- (7) Observe the gage pointer. The reading should be 0 to  $-\frac{1}{8}$  inch.
- (8) If the gage indicates other than that specified in (7) above, adjust the toe-in (*d* below).

*d. Adjust Toe-In.* If toe-in is more than one-eighth of an inch or if the wheels toe out one-eighth of an inch or more, adjust both tie rod ends an equal amount. Otherwise, the adjustment may be made at the left tie rod end.

- (1) Detach the left tie rod end or both tie rod ends, if necessary, from the steering knuckle flange or flanges (par 204a).
- (2) Loosen the nut on the clamp bolt in the left tie rod end (fig. 170) or both ends, as required. Turn the end or ends counterclockwise to increase toe-in, or clockwise to decrease toe-in.

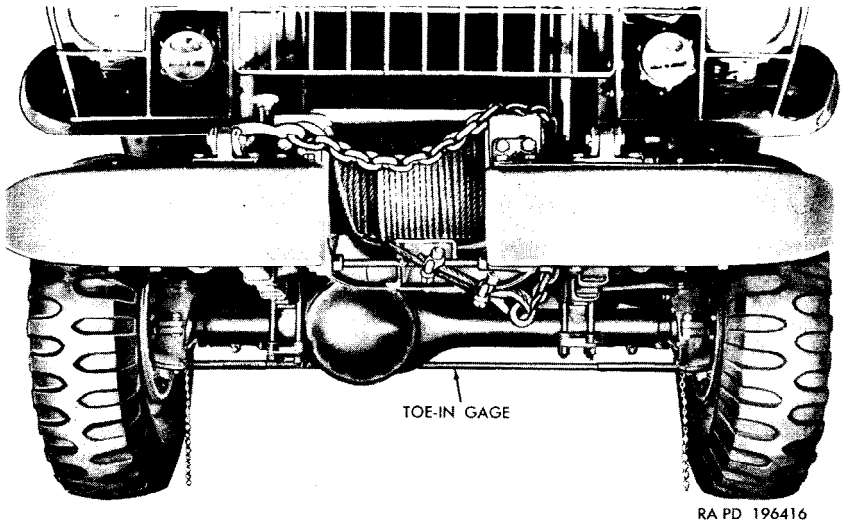


Figure 168. Measuring front wheel toe-in.

- (3) Attach the tie rod end or ends to the steering knuckle flange and again measure the toe-in (c(4) through (7) above).
- (4) Adjust the ends ((1) and (2) above) until toe-in is from 0– $\frac{1}{8}$  inch.
- (5) When the adjustment has been completed, tighten the nuts on the tie rod end clamp bolts, install the slotted stud nuts on the ball studs, tighten to 130 to 150 pound-feet torque, and install the  $\frac{1}{8}$  x  $1\frac{5}{8}$  cotter pins.

## 204. Tie Rod and Tie Rod Ends

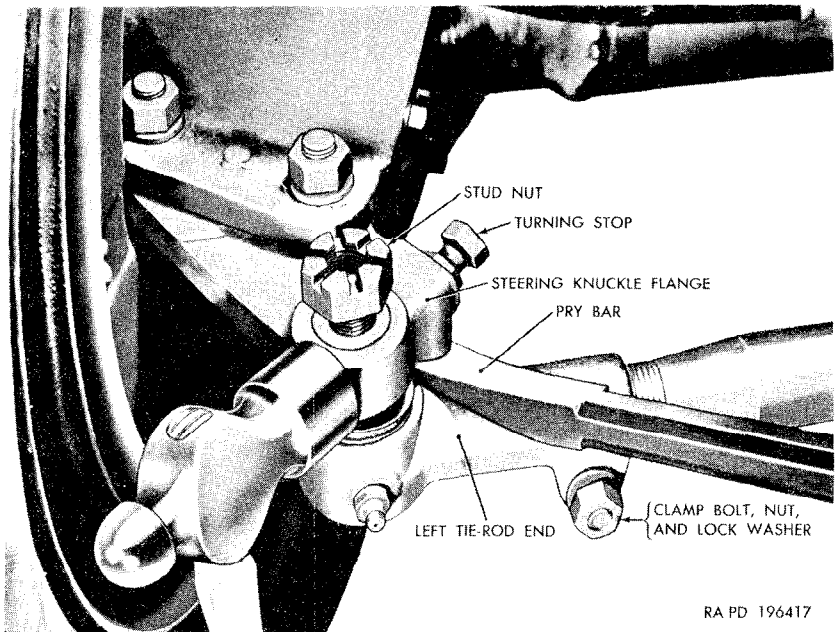
(figs. 169 and 170).

### a. Removal.

- (1) Remove the cotter pin from each tie rod end ball stud. Loosen but do not remove the stud nuts.
- (2) Insert a pry bar between the left tie rod end and the steering knuckle flange. Apply pressure on the pry bar and strike the flange with a medium hammer to free the ball stud from the flange. Loosen the right tie rod end in the same manner.
- (3) Remove the two stud nuts and remove the tie rod.

### b. Disassembly.

- (1) Remove the dust seal spring, the dust seal, and two seal retainers from each rod end ball stud (fig. 170). Discard the seals.



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Figure 169. Removing tie rod.

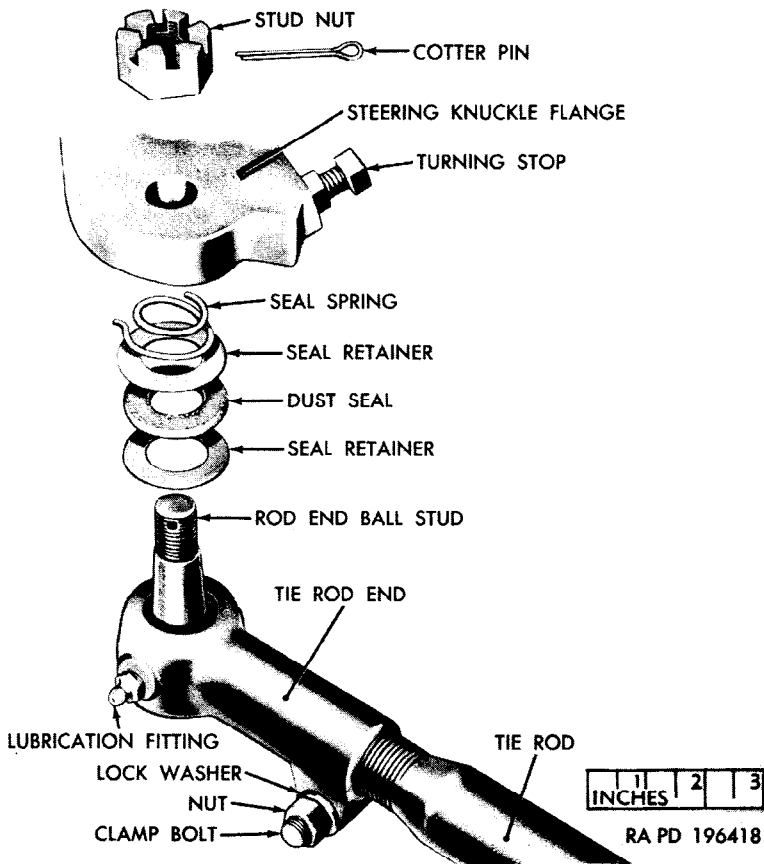


Figure 170. Tie rod—exploded view.

- (2) Remove the nut, lockwasher, and clamp bolt from each tie rod end and unscrew the ends from the tie rod.
- (3) Remove the lubrication fitting from each tie rod end.
- (4) Turning radius is governed by stop screws which are adjusted, then tack-welded to the steering knuckle arms. If inspection reveals the screws to be loose or missing, notify ordnance maintenance personnel.

*c. Inspection.*

- (1) Clean the tie rod and two tie rod ends in dry-cleaning solvent or volatile mineral spirits and dry with compressed air.
- (2) Inspect the tie rod for distortion or damaged threads.
- (3) Inspect both tie rod ends for cracks, damaged threads, distortion, or restricted lubricant opening. Rotate the end on the ball stud and check for freedom of operation or excessive looseness. Inspect the stud nuts for cracked or damaged threads.

- (4) Replace all parts that are unfit for further service. Dust seal parts and left and right tie rod ends are provided in kits.

*d. Assembly.*

- (1) Install a  $\frac{1}{8}$ NPT male lubrication fitting in each tie rod end (fig. 170).
- (2) Screw the tie rod ends on the tie rod, installing the right end at the offset end of the rod. Turn the two ends an equal amount on the rod until the distance from center to center of the ball studs is  $48\frac{1}{16}$  inches and the lubrication fittings in both ends are toward the rear.
- (3) Install the  $\frac{7}{16}$ -20NF x  $1\frac{7}{8}$  clamp bolt in each tie rod end from the front) and install a  $\frac{7}{16}$ -inch lockwasher and a  $\frac{7}{16}$ -20NF nut on each bolt. Do not tighten the nuts at this time.
- (4) Install the dust seal and related parts on each ball stud. Place a seal retainer on each side of the dust seal, install the parts on the ball stud, and install the dust seal spring with the larger diameter down.
- (5) Insert the ball studs up through the openings in the flanges. Install the two stud nuts but do not tighten.
- (6) Lubricate both tie rod ends with automotive and artillery lubricating grease.
- (7) Measure the toe-in (par. 203c) and adjust if necessary (par. 203d). Tighten the nuts on both tie rod end clamp bolts securely, and tighten the two stud nuts to 130–150 pound-foot torque. Install a  $\frac{1}{8}$  x  $1\frac{5}{8}$  cotter pin in each stud.

## 205. Steering Knuckle and Universal Drive Removal

*a. General.* Both steering knuckles and universal drives are removed in the same manner.

*b. Remove Wheel and Tire* (par. 227). Jack up the wheel and remove the five wheel stud nuts (the nuts for the left wheel have left hand threads). Remove the wheel and tire.

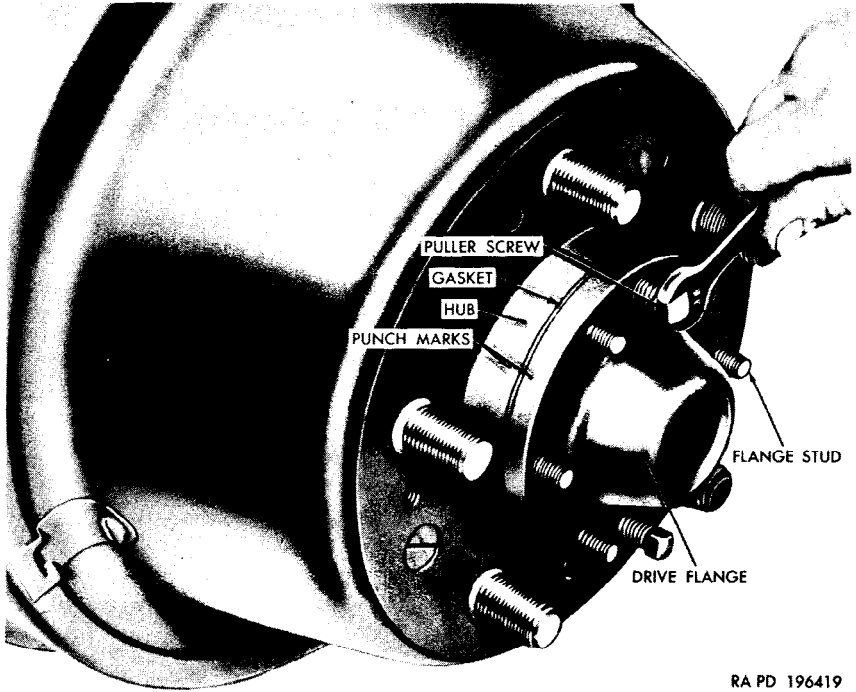
*c. Remove Drive Flange.*

- (1) Mark adjacent points of the drive flange and hub with a center punch.

*Note.* This is important, as the flange must be installed in the same position on the hub to prevent peeling of the studs.

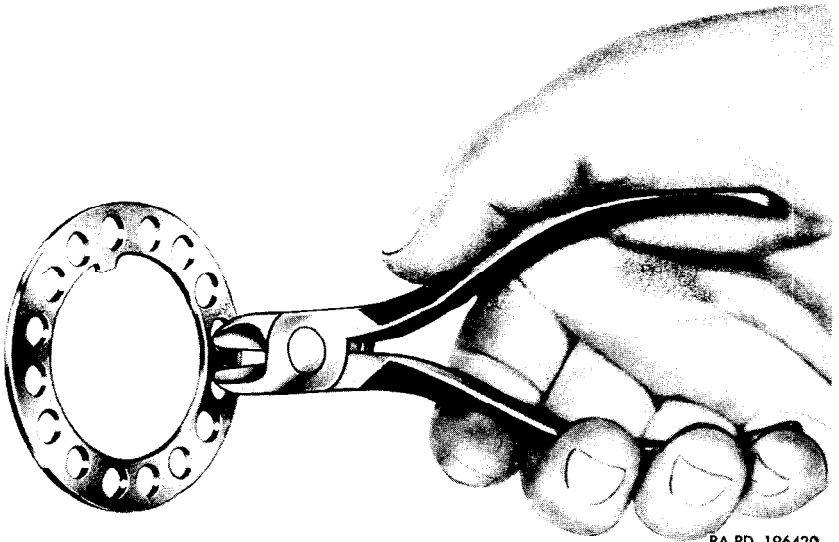
- (2) Remove the six nuts and lockwashers from the flange studs. Remove the two puller screws from the flange.
- (3) Remove the nuts from the two puller screws. Install the screws and tighten evenly to force the flange from the hub. Remove the flange and the flange gasket. Discard the gasket. Remove the two puller screws from the flange.





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*Figure 171. Removing drive flange.*



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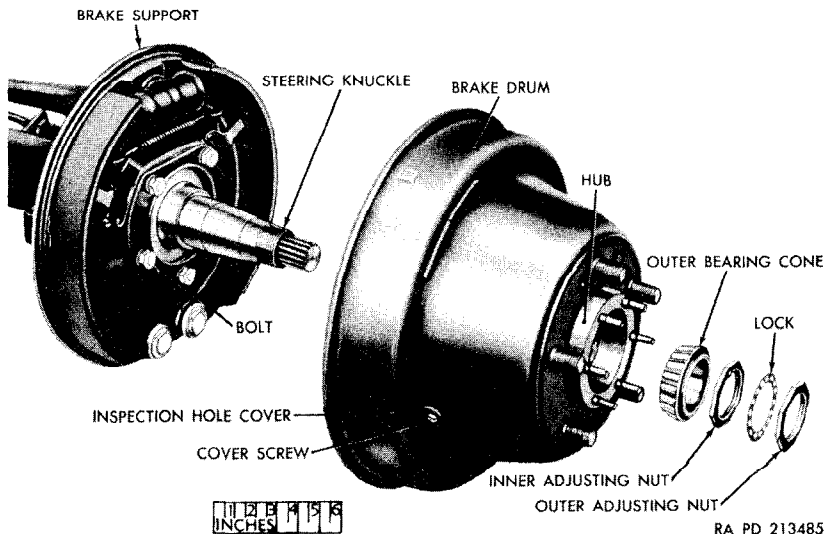
*Figure 172. Removing or installing adjusting nut lock.*

*d. Remove Hub and Drum.*

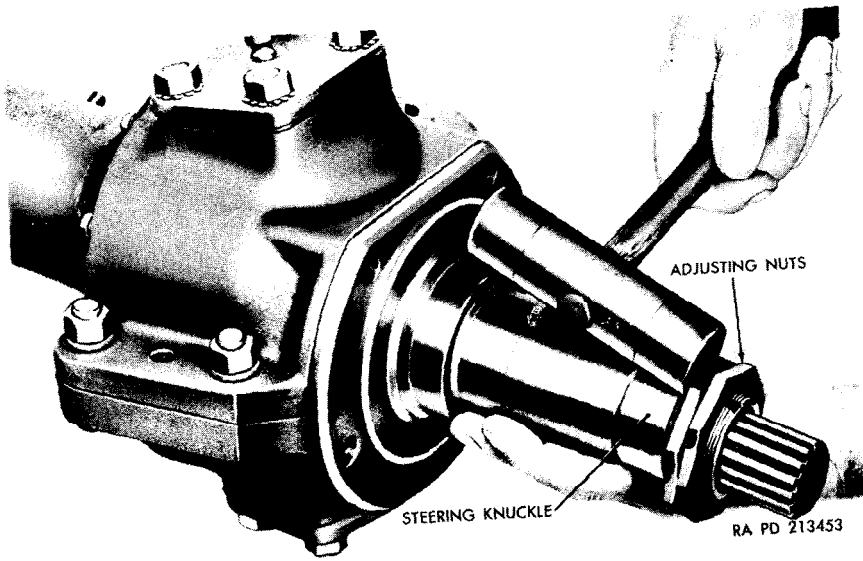
- (1) Remove the hub bearing outer adjusting nut, using the wrench 41-W-1991-17 (fig. 189).
- (2) Remove the adjusting nut lock, using diagonal-cutting pliers (fig. 172).
- (3) Remove the hub bearing inner adjusting nut, using the wrench 41-W-1991-17 (fig. 189).
- (4) Pull the hub and brake drum part way off the steering knuckle to free the outer bearing cone, remove the cone, the hub, and brake drum (fig. 173).

*e. Remove Brake Support, Steering Knuckle, and Universal Drive.*

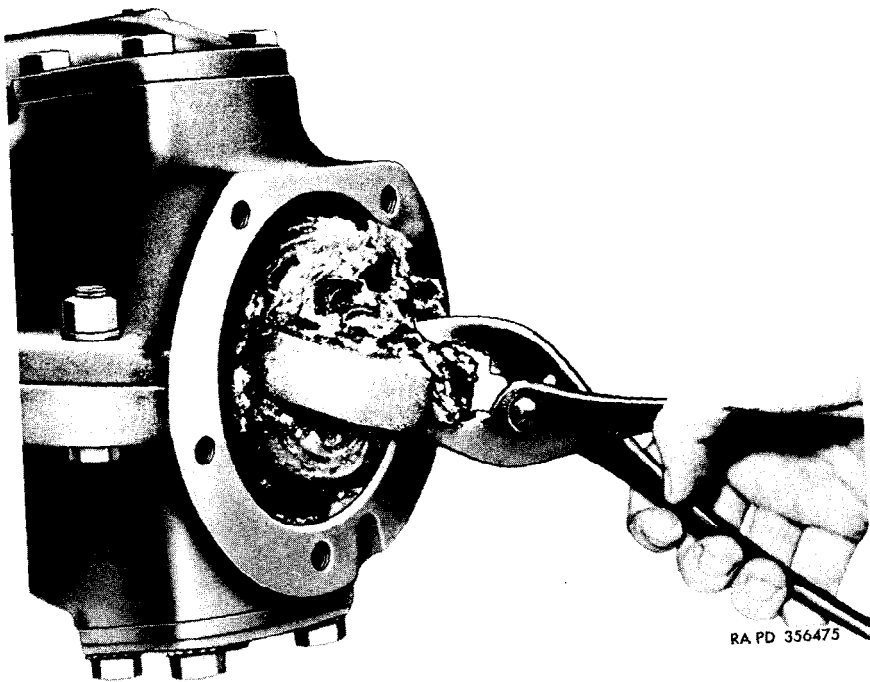
- (1) Remove the bolt and gasket that secure the brake cylinder inlet connection to the wheel cylinder, and remove the flexible line and attached connector from the wheel cylinder (fig. 181).
- (2) Remove the five bolts and lockwashers that secure the brake support and steering knuckle to the steering knuckle flange. Remove the brake support (fig. 173).
- (3) If the steering knuckle cannot be removed by pulling it from the flange, temporarily install the wheel bearing adjusting nuts on the knuckle and strike the nuts with a plastic hammer to free the steering knuckle (fig. 174). Remove the knuckle, outer shaft, and female portion of the universal joint. Separate the parts.



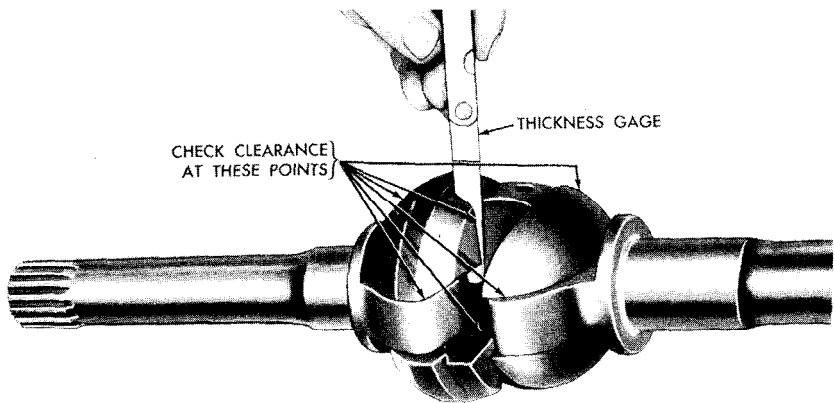
*Figure 173. Front wheel hub and drum and related parts—exploded view.*



*Figure 174. Removing steering knuckle.*



*Figure 175. Removing inner shaft.*



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*Figure 176. Checking universal drive parts for wear.*

- (4) Remove the male portion of the universal joint and the inner shaft (fig. 175). Separate the parts.

*f. Cleaning and Inspection.*

- (1) Inspect the lubricant in the steering knuckle flange for evidence of differential lubricant. Differential lubricant in the flange indicates leakage past the drive shaft oil seal. Notify ordnance maintenance personnel.
- (2) Clean the parts in dry-cleaning solvent or volatile mineral spirits and clean the inside of the bearing flange.
- (3) Inspect the splined surfaces of the inner and outer shafts for cracks, abrasions, or chipping. Check the shafts for distortion or damaged bearing surfaces.
- (4) Inspect the universal joint parts for cracks, chipping, or scoring.
- (5) Assemble the shafts and universal joint and check for clearance between parts as shown in figure 176. If clearance at any of the checking points exceeds 0.007 inch, replace the shaft assembly.
- (6) Inspect the steering knuckle for damaged threads, distortion, or scored or damaged bearing surfaces. Replace a damaged steering knuckle.
- (7) Inspect the brake support and brake line connection (par. 220).
- (8) Inspect the hub and bearings (par. 228*d*) and the brakedrum (par. 220*e*).

## **206. Steering Knuckle and Universal Drive Installation**

*a. Install Universal Drive, Steering Knuckle, and Brake Support (fig. 177).*

- (1) Apply a coating of automotive and artillery lubricating grease to the parts and inside the bearing flange.

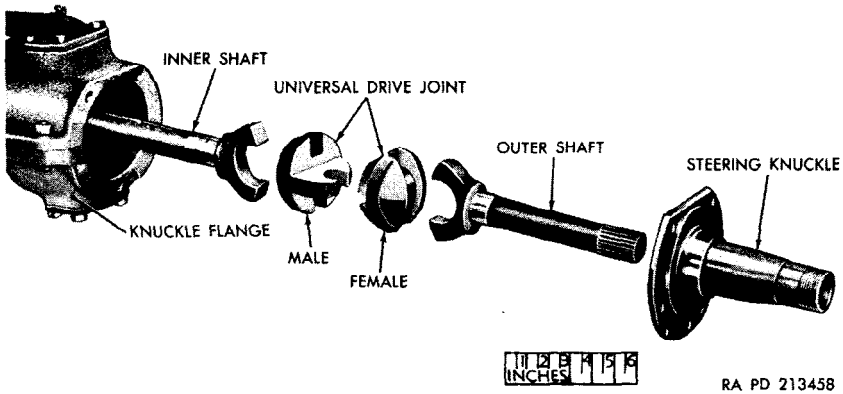


Figure 177. Steering knuckle and universal drive—exploded view.

- (2) Fit the male half of the universal drive joint on the inner shaft and insert the shaft into the axle housing, engaging the splined end of the shaft in the differential gear.
- (3) Fit the female half of the universal drive joint on the outer shaft and insert the shaft through the steering knuckle. Engage the female half of the universal drive joint with the male half and position the steering knuckle on the knuckle flange (flat side up), aligning the bolt holes. Tap the steering knuckle into place with a plastic hammer.
- (4) Position the brake support over the steering knuckle (fig. 173), aligning the bolt holes in the support with those in the knuckle and flange. Install the five  $\frac{1}{2}$ -inch lockwashers and  $\frac{1}{2}$ -13NC  $\times$   $1\frac{1}{2}$  bolts. Tighten the bolts to 80–85 pound-feet torque.
- (5) Clean the contacting surfaces of the brake line inlet connection and the wheel cylinder, and position the connection on the cylinder. Install the bolt gasket and the bolt. Tighten the bolt.

b. *Install Hub and Drum* (fig. 173).

- (1) Apply a light film of grease to the inside of the hub and the steering knuckle to prevent rust.
- (2) Install the assembled hub and brake drum on the steering knuckle.
- (3) Lubricate the outer bearing cone with automotive and artillery grease, using a roller bearing lubricator or kneading the grease into the bearing with the fingers. Do not over-lubricate. Install the cone on the steering knuckle, and install the inner bearing adjusting nut with the lock pin toward the outside. Screw the nut on the steering knuckle, using the

wrench — 41-W-1991-17 (fig. 189), but do not tighten.

(4) Install the wheel and tire (par. 227b).

(5) Adjust the hub bearings (par. 226).

c. *Install Drive Flange* (fig. 171).

(1) Coat both sides of a new drive flange gasket with liquid-type gasket cement and install the gasket over the drive flange studs.

(2) Position the drive flange on the hub, matching the punch marks on the flange and hub (par. 205c(1)). Install the six  $\frac{3}{8}$ -inch lockwashers and  $\frac{3}{8}$ -24NF nuts. Tighten the nuts to 30–35 pound-feet torque. Install the nut on each of the two puller screws, install the screws in the flange, and tighten the nuts.

d. *Lubricate.* Lubricate the universal drive and the steering knuckle flange bearings. Refer to lubrication order (figs. 33 and 34).

e. *Bleed the Brakes.* Refer to paragraph 216.

## 207. Air Vent, and Filler and Drain Plugs

a. *Air Vent.*

(1) The air vent (F, fig. 178) protects the axle against excessive pressure build-up and prevents water or dirt from entering the axle housing. The vent must operate properly to prevent failure of oil seals and contamination of the lubricant.

(2) At each inspection, or as often as necessary, remove the vent from the housing and clean in dry-cleaning solvent or volatile mineral spirits. Dry with compressed air and inspect for restriction of the air passage and faulty operation.

(3) Install the air vent, replacing it with a new one, if necessary. Screw the vent into the housing.

b. *Filler Plug.* The filler plug (EE, fig. 38) is a  $\frac{3}{4}$ -inch pipe plug. Check the filler plug each time the axle is serviced, and replace if necessary. No gasket is required.

c. *Drain Plug.* The drain plug (E, fig. 35) is a special plug. A  $\frac{7}{8}$ -inch annular gasket is used with the drain plug. Check the plug and gasket each time the axle is serviced, and replace if necessary.

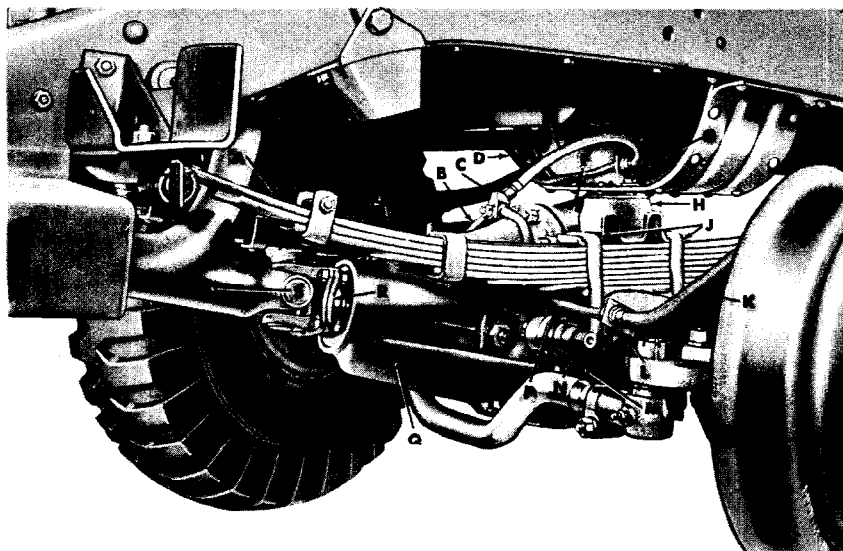
## 208. Front Axle

a. *Coordination with Ordnance Maintenance Unit.* Replacement of the front axle is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, provided authority for performing such replacement is obtained from the responsible commander. A replacement axle and necessary tools may be obtained from the supporting ordnance maintenance unit.

b. *Removal.*

*Note.* The key letters noted in parentheses are in figure 178.

- (1) Apply the handbrake and block the rear wheels.
- (2) Place a jack under each frame side rail to the rear of the front axle, and raise the frame sufficiently to relieve the load on the front springs.
- (3) Remove the cotter pin and slotted nut that secure the lower end of the right front shock absorber, and remove the bearing retainer and shock absorber with bearings from the shock absorber stud (N) in the right spring clip U-bolt plate (M).
- (4) Remove the four nuts, lockwashers, and bolts that secure the front propeller shaft (S) to the differential carrier companion flange (R). Secure the propeller shaft to keep it off the floor.
- (5) Disconnect the brake flexible line (E) at the brake line bracket (G) on the frame front crossmember.
- (6) Disconnect the drag link from the steering knuckle arm (par. 235).
- (7) Remove the nuts and lockwashers from the four spring clips (J). Remove the clips and axle bumpers (H) from above the axle, and swing the left spring clip plate with attached shock absorber toward the rear.



KEY	ITEM
A	FRONT SPRING
B	LEFT BRAKE LINE
C	BRAKE LINE TEE
D	BRAKE LINE (FRAME TEE-TO-FRONT FLEXIBLE LINE)
E	BRAKE FLEXIBLE LINE (FRONT)
F	AIR VENT
G	BRAKE LINE BRACKET (FRAME)
H	AXLE BUMPER
J	SPRING CLIPS

KEY	ITEM
K	BRAKE FLEXIBLE LINE (TO WHEEL)
L	BRAKE LINE BRACKET (AXLE)
M	SPRING CLIP PLATE
N	SHOCK ABSORBER STUD
P	RIGHT BRAKE LINE
Q	DIFFERENTIAL CARRIER
R	COMPANION FLANGE
S	FRONT PROPELLER SHAFT

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Figure 178. Removal or installation of front axle.

- (8) Remove the axle.
- (9) Support the axle and remove the two wheels and tires (par. 227a).
- (10) Remove the brake flexible line (E) from the brake line tee (C) on the differential carrier and discard if unfit for further service.

*c. Installation.*

- (1) Install the brake flexible line (E) in the brake line tee (C) on the differential carrier (Q) and tighten.
- (2) Install wheels (par. 227b).
- (3) Position a front axle bumper (H) over the center bolt of each front spring (A) (offset toward center of vehicle), and install the two spring clips U-bolts (J) for the right spring on the bumper, over the spring and axle and through the spring clip U-bolt plate (M). Position the left spring clip U-bolt plate under the axle and install the clips U-bolts.

*Note.* The spring clips U-bolts for the right front spring are longer than those for the left front spring. Be sure to install the correct clips U-bolts for each spring.

- (4) Install the two  $\frac{9}{16}$ -inch lockwashers and spring clip U-bolt nuts on each clip U-bolt. Tighten the eight nuts to 130–140 pound-feet torque.
- (5) Attach the drag link to the steering arm (par. 235).
- (6) Connect the brake flexible line (E) at the brake line bracket (G) on the frame front crossmember.
- (7) Aline the front propeller shaft flange yoke with the companion flange (R) on the differential carrier (Q) and install the four  $\frac{7}{16}$ -20NF x  $1\frac{1}{8}$  bolts,  $\frac{7}{16}$ -inch lockwashers, and  $\frac{7}{16}$ -20NF nuts. Tighten the nuts to 40–50 pound-feet torque.
- (8) Attach the right shock absorber with bearings to the shock absorber stud (N) in the spring clip U-bolt plate. Install the bearing retainer and  $\frac{3}{4}$ -16NF triple-slotted nut. Tighten the nut and install the  $\frac{5}{32}$  x  $1\frac{3}{4}$  cotter pin.
- (9) Lower the frame and remove the jacks and rear wheel blocking.
- (10) Bleed the brake system (par. 216).
- (11) Adjust the toe-in (par. 203).
- (12) Check the lubricant level of the front axle and replenish, if necessary. Refer to lubrication chart (figs. 33 and 34).

*d. Record Replacement.* Record the replacement of the front axle on DA Form 478.



## Section XX. REAR AXLE

### 209. Description and Data

#### a. Description.

- (1) The single speed rear axle is of the full floating hypoid-type. The complete axle consists of the axle housing, differential with carrier, axle drive shaft, hubs, and service brakes.
- (2) Organizational maintenance operations include replacement of the air vent, filler and drain plugs, and the axle shafts, and emergency replacement of the axle.

#### b. Data.

Capacity.....	6 pt
Make.....	Dodge
Ratio.....	5.83 : 1
Type.....	full floating (hypoid)

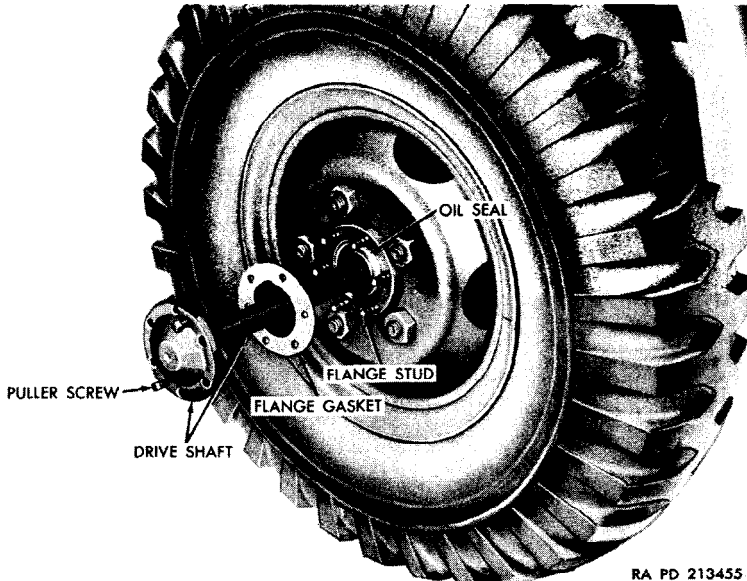
### 210. Drive Shaft

a. *Removal* (fig. 179). Both drive shafts are removed in the same manner. It is not necessary to raise the rear axle.

- (1) Mark adjacent spots on the shaft flange and the hub with a center punch.

*Note.* This is important, as the shaft flange must be installed in the same position on the hub to prevent peeling of the studs.

- (2) Remove the nuts and lockwashers from the six drive shaft flange studs. Remove the two puller screws from the flange



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Figure 179. Rear axle drive shaft removal.

and remove the nuts. Install the screws in the flange and tighten evenly to force the flange from the hub. Pull the drive shaft from the axle housing. Remove and discard the flange gasket and remove the two puller screws from the flange.

- (3) If the drive shaft is broken and a piece of the shaft remains in the axle housing, it may be removed by snaring it with a length of wire. If the broken portion cannot be removed, replace the axle (par. 212).

*b. Installation (fig. 179).*

- (1) If the original shaft is to be installed, clean and inspect it for damaged splines, distortion, or damaged flange surfaces. Clean the gasket surfaces of the flange and the hub.
- (2) Apply a coating of liquid-type gasket cement to both sides of a new flange gasket, and position the gasket over the flange studs.
- (3) Install the drive shaft in the axle housing, engaging the splines in the differential gear and alining the punch marks on the flange and hub (*a*(1) above). (Disregard the punch mark on the hub when installing a new shaft.)
- (4) Install the six  $\frac{3}{8}$ -inch lockwashers and  $\frac{3}{8}$ -24NF nuts on the flange studs. Tighten the nuts to 30–35 pound-feet torque. Install the nuts on the two puller screws, install the screws in the flange, and tighten the nuts.

## 211. Air Vent and Filler and Drain Plugs

*a. Replace Air Vent.* The air vent (fig. 180) for the rear axle serves the same purpose as the vent in the front axle (par. 207*a*). The rear axle vent secures the brake line tee on the axle housing and is removed by unscrewing the vent nut. At each inspection, service the vent as described in paragraph 207*a*(2). When installing the vent, position the tee on the axle housing and screw the vent through the tee into the housing. Tighten the vent nut.

*b. Filler and Drain Plugs.* The filler plug, drain plug and gasket for the rear axle are the same as corresponding plugs for the front axle, and are serviced in the same manner (par. 207*b* and *c*).

## 212. Rear Axle

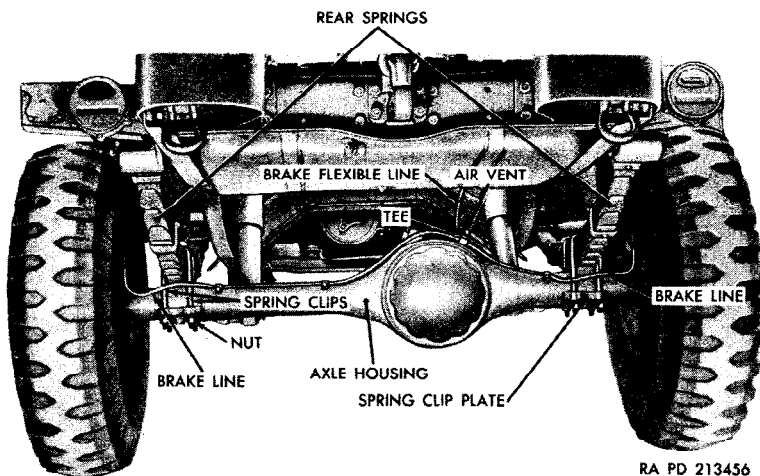
*a. Coordination with Ordnance Maintenance Unit.* Replacement of the rear axle is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, provided authority for performing such replacement is obtained from the responsible commander. A replacement axle may be obtained from the supporting ordnance maintenance unit.

*b. Removal.*

- (1) Apply the handbrake and block the front wheels of the vehicle.
- (2) Place a jack under each frame side rail ahead of the rear axle. Raise the frame sufficiently to relieve the load on the rear springs (fig. 80).
- (3) Disconnect the rear propeller shaft (R, fig. 187) at the differential carrier companion flange by removing the four nuts, lockwashers, and bolts.
- (4) Disconnect the brake flexible line at the bracket attached to the fuel tank support frame crossmember (H, fig. 187).
- (5) Remove the nuts and lockwashers from the four spring clips. Remove the clips, U-bolts, and the two clip U-bolt seats. Swing the two spring clip U-bolt plates, with attached shock absorbers, forward.
- (6) Remove the axle.
- (7) Support the axle on jacks or blocking.
- (8) Remove both wheels and tires (par. 227a).
- (9) Remove the brake flexible line (M, fig. 187) from the tee on the differential carrier and discard, if unfit for further service.

*c. Installation.*

- (1) Install the brake flexible line (fig. 180) in the tee on the differential carrier and tighten.
- (2) Install the two wheels and tires (par. 227).
- (3) With the frame raised (*b*(2) above), position the axle under the rear springs, with the spring center bolts in the recesses of the seats in the axle housing.



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*Figure 180. Removal or installation of rear axle.*

- (4) Position a spring clip U-bolt seat over each rear spring, fitting the opening over the spring center bolt.
- (5) Swing the spring clip U-bolt plates, with attached shock absorbers, toward the rear and fit each plate on the axle housing directly below the spring. Hold the parts in position and install the two spring clips U-bolt for each rear spring.
 

*Note.* Be careful not to damage the brake lines when installing the clips. Make certain that the lines are to the rear of the clips U-bolt.
- (6) Install the two  $\frac{9}{16}$ -inch lockwashers and nuts for each spring clip U-bolt. Tighten all spring clip U-bolt nuts to 130–140 pound-feet torque.
- (7) Connect the brake flexible line at the bracket attached to the fuel tank support cross member.
- (8) Aline the rear propeller shaft (R, fig. 187) flange yoke with the companion flange on the differential carrier and install the four  $\frac{7}{16}$ -20NF x  $1\frac{1}{8}$  bolts,  $\frac{7}{16}$ -inch lockwashers, and  $\frac{7}{16}$ -20NF nuts. Tighten the nuts to 40–50 pound-feet torque.
- (9) Lower the frame, and remove the jacks and front wheel blocking.
- (10) Bleed the brake system (par. 216).
- (11) Check lubricant level of rear axle and replenish if necessary. Refer to lubrication chart (figs. 33 and 34).

*d. Record Replacement.* Record the replacement of the rear axle on DA Form 478.

## Section XXI. BRAKES

### 213. Description and Data

#### *a. Description.*

- (1) Hydraulic service brakes with expanding brakeshoes are used at all four wheels. The brake pedal in the driver's compartment actuates the master cylinder, which operates the four wheel cylinders to apply the brakes.
- (2) Brake linings, when new, are tapered so they are thicker at the center than at the ends. This necessitates different major adjustment procedures for new and worn linings (par. 218).
- (3) Organizational maintenance operations for service brakes include replenishing brake fluid, adjustment of the brake pedal, bleeding brake systems, minor brake adjustment, major brake adjustment, replacement of the master cylinder, wheel cylinders, brakeshoes, lines, and fittings.
- (4) The handbrake lever (S, fig. 12) is connected to a control rod which operates a contracting brake band on the rear of the transfer.
- (5) Organizational maintenance operations for the handbrake

include adjustment of the brake hand and control rod and replacement of the brake lever, control rod, and brake band.

*b. Data.*

**Hand brake:**

Clearance adjustment..... 0.008 to 0.010 in.

Lever location..... right side of transmission

**Lining:**

Dimensions..... 2 x 24 x  $\frac{1}{4}$  in.

Material..... woven asbestos

Method of attaching..... rivets

**Service brakes:**

**Linings:**

Dimensions.....  $1\frac{3}{4}$  x 15 x  $\frac{1}{4}$  in.

Make..... Thermoid

Method of attaching..... bonded

Type..... tapered woven and molded

Make..... Dodge

Master cylinder bore.....  $1\frac{1}{4}$  in.

Pedal free travel.....  $\frac{3}{4}$  to 1 in.

Type..... single cylinder

**Wheel cylinder bore:**

Front shoe (all).....  $1\frac{1}{4}$  in.

Rear shoe (all).....  $1\frac{3}{8}$  in.

## 214. Service Brake Minor Adjustment

*a. General.* Minor adjustment of service brakes may be necessary to compensate for normal wear of brake linings. This adjustment is made by turning the two cam adjusters on each wheel (*b* below). Before adjusting the brakes, be sure that the pedal free travel is correct (par. 217) and that wheel bearings are in good condition and properly adjusted (par. 226). Brakedrums must be cool for proper adjustment.

*b. Procedure.*

- (1) Place the vehicle on a level floor and release the handbrake lever (S, fig. 12). Place transmission gearshift lever (W, fig. 12) in neutral position. Disengage the front axle (fig. 26).
- (2) Jack up the wheel of the brake to be adjusted until the tire is off the floor and block the other wheels.
- (3) Turn one brakeshoe cam adjuster in the direction shown in figure 181 to decrease the clearance between the lining and the drum. Rotate the wheel and turn the cam adjuster until a noticeable drag is felt. Repeat this operation on the other cam adjuster.
- (4) Repeat operation (3) above on both brakeshoe cam adjusters of the other three wheels.

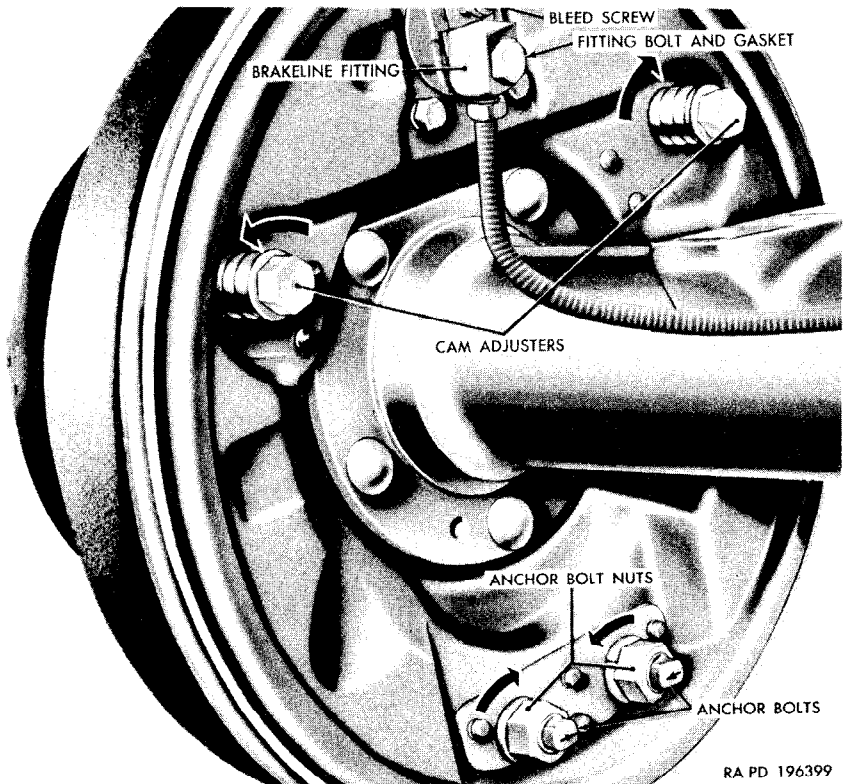


Figure 181. Brakeshoe cam adjusters and anchor bolts.

## 215. Replenishing Brake Fluid

*a. General.* If the brake fluid is low in the master cylinder, it may be an indication of an external leak in the brake system. Inspect the master cylinder, brake lines, fittings, and brake support plates (brakeshoe cam adjuster side) for evidence of brake fluid leakage. Replace parts, as required, to correct leakage.

### *b. Procedure.*

- (1) Turn the master cylinder access cover studs 90 degrees counterclockwise and remove the cover from the floor panel in the driver's compartment (fig. 182).
- (2) Clean the top of the master cylinder and remove the master cylinder filler plug.
- (3) Fill the master cylinder with brake fluid until the fluid level is three-fourths of an inch below the top of the filler plug opening.
- (4) Install the filler plug.
- (5) Install the master cylinder access cover and turn the cover studs 90° clockwise.

## 216. Bleeding Brake System

*a. General.* Bleeding of the hydraulic brake system is necessary when wheel cylinders or brake lines have been replaced or whenever any part of the system has been disconnected. A hydraulic brake pressure filler is available for this operation (*b* below). However, the system may be bled in an emergency without use of the pressure filler (*c* below).

*b. Bleed Brake System, Using Pressure Filler* (fig. 182).

- (1) Remove the master cylinder access cover (par. 215*b*(1)). Close the master cylinder vent line shutoff cock. Clean top of master cylinder and remove the filler plug.

*Note.* Make certain the pressure filler contains an adequate amount of brake fluid.

- (2) Connect the filler hose to the top of the tank. Close the filler hose shutoff cock.
- (3) Connect a compressed air hose to the air valve in the top of the tank and charge the tank to a minimum of 25 psi as indicated on the pressure gage.
- (4) Insert the end of the filler hose in the master cylinder filler opening, and open the filler hose shutoff cock just enough to fill the master cylinder to the top. Close the filler hose shutoff cock.
- (5) Remove the filler hose from the master cylinder and install the proper adapter in the filler opening. Connect the filler hose to the adapter in the master cylinder.
- (6) Before tightening the hose connection in the adapter, open the filler hose shutoff cock slightly. When the fluid flowing from the loose connection is free from air bubbles close the filler hose shutoff cock. Tighten the connection and open the filler hose shutoff cock fully. Note the reading on the pressure gage. The gage reading should be maintained at approximately 25 psi.
- (7) Attach bleeder hose to the bleeder screw (fig. 181) of the right rear wheel cylinder. Submerge the free end of the bleeder hose in a glass receptacle containing a small amount of brake fluid. Open the bleeder screw and allow fluid to flow into the receptacle until the fluid is entirely free from air bubbles. Close the bleeder screw and remove the bleeder hose.
- (8) Bleed the left rear, right front, and left front wheel cylinders in that order, following the procedure in (7) above. When the left front wheel cylinder has been bled and while the bleeder hose is still attached to the bleeder screw (screw open), close the filler hose shutoff cock and remove the hose from the adapter in the master cylinder. Depress the brake pedal and hold it down while closing the bleeder screw at the

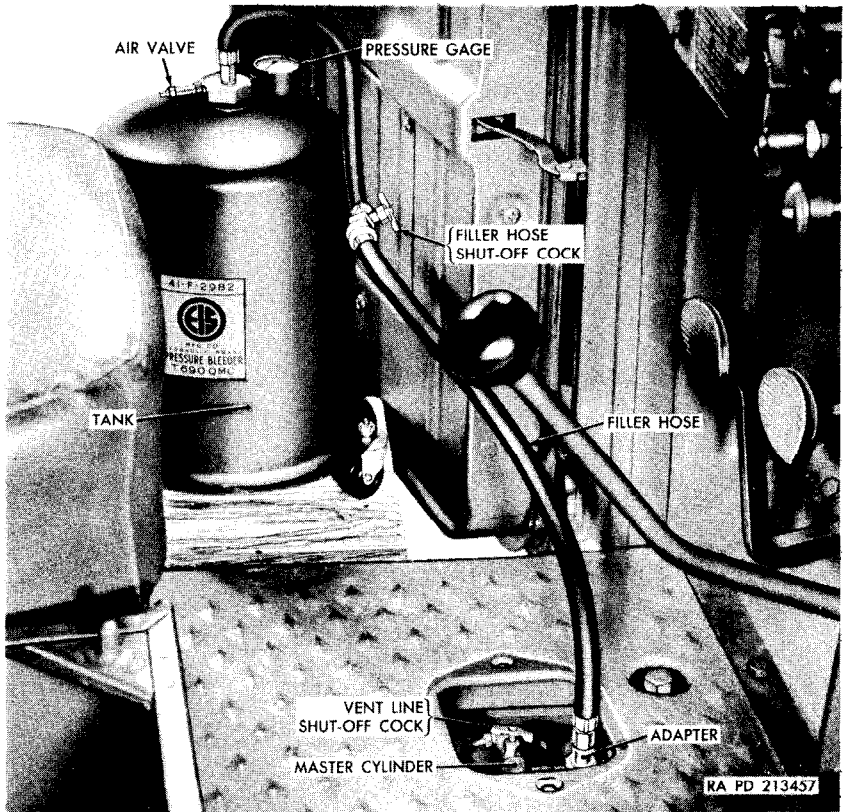


Figure 182. Pressure filler connected to master cylinder.

left front wheel cylinder. Release the brake pedal and remove the bleeder hose.

- (9) Remove the adapter from the master cylinder and install the filler plug. Open the vent line shutoff cock.
- (10) Install the master cylinder access cover and turn the two studs clockwise 90°.

*c. Bleed Brake System, Without Pressure Filler.*

- (1) Fill the master cylinder as in paragraph 215b(1), (2), and (3).
- (2) Connect the bleeder hose to the bleeder screw (fig. 181) at the right rear wheel cylinder. Submerge the free end of the bleeder hose in a glass receptacle containing a small amount of brake fluid. Open the bleeder screw.
- (3) Depress the brake pedal slowly about halfway and allow the pedal to return to the released position. Refill the master cylinder, as necessary, to maintain the fluid level. Repeat this procedure until the fluid flowing from the bleeder hose is clear and free from bubbles.



- (4) Close the bleeder screw and remove the bleeder hose.
- (5) Bleed the left rear, right front, and left front wheel cylinders in that order, following the procedure in (3) and (4) above for each wheel.
- (6) Fill the master cylinder, if necessary, to bring the fluid level to three-fourths of an inch below the top of the filler plug opening.
- (7) Install the filler plug.
- (8) Install the master cylinder access cover and turn the two studs 90° clockwise.

## 217. Brake Pedal Adjustment

*a. Measure Free Travel of Pedal.* Depress the brake pedal by hand until resistance is felt, release the pedal, and note the distance the pedal travels. Correct free travel is  $\frac{3}{4}$  to 1 inch. If the free travel is not within these limits, adjust the pedal rod (*b* below).

*b. Adjust Pedal Rod* (fig. 156). Loosen the locknut on the pedal rod, detach the pedal rod from the brake pedal by removing the cotter pin and clevis pin. Turn the pedal rod in or out of the push rod as required to establish correct pedal travel (*a* above). Turning the pedal rod in increases pedal travel, and turning it out decreases the pedal travel. Turn the locknut up tight against the push rod after completing the adjustment. Aline the pedal rod with the brake pedal and install the clevis pin and  $\frac{1}{8} \times \frac{7}{8}$  cotter pin.

## 218. Service Brake Major Adjustment

*a. General.*

- (1) A major brake adjustment is necessary when new brakeshoes are installed or when the linings have worn to the degree that they are no longer tapered.
- (2) For new shoes or linings, perform the major brake adjustment as in *b* below. For linings that are slightly worn, perform the major brake adjustment as in *c* below.

*b. Adjust Brakes With New Linings.*

*Note.* Check the wheel bearing adjustment for all wheels before adjusting the brakes. Adjust if necessary (par. 226).

- (1) Place the vehicle on a level floor, release the handbrake, place the transmission gearshift lever in neutral and disengage the front axle.
- (2) Jack up one of the wheels and block the other wheels to prevent the vehicle from rolling off the jack. Remove the wheel and tire.
- (3) Remove the screw that secures the drum inspection hole cover and remove the cover.

- (4) Loosen the anchor bolt nuts (fig. 181) and turn both anchor bolts to the fully released position (flats on the same horizontal plane and the arrows or punch marks toward each other).
  - (5) Rotate the drum until the inspection hole is opposite the top (toe) of the front shoe and note the clearance between the lining and the drum.
  - (6) Rotate the drum until the inspection hole is opposite the bottom (heel) of the front shoe and note the clearance at this point.
  - (7) Adjust the cam adjuster and the anchor bolt alternately in the directions indicated in figure 181 until clearance is equalized at toe and heel and the center of the lining is in contact with the drum, resulting in a decided drag at this point.
  - (8) Hold the anchor bolt and tighten the anchor bolt nuts to 90-110 pound-feet torque after completing the adjustment.
  - (9) Adjust the rear shoe in the same manner ((5) through (8) above). Position the inspection hole cover and install the  $\frac{1}{4}$ -20NC x  $\frac{3}{8}$  tapping screw. Install the wheel and tire (par. 227b), and remove the jack and blocking.
  - (10) Adjust the other three brakes in the same manner.
- c. *Adjust Brakes with Worn Linings (No Taper).*
- (1) Perform the preliminary operations as in b(1) through (4) above.
  - (2) Turn the cam adjusters so that a 0.006-inch feeler gage is a snug fit between the upper end (toe) of each brakeshoe lining and drum.
  - (3) Turn the anchor bolts in the direction indicated in figure 181 to decrease the clearance between the lower and (heel) of the brakeshoe lining and the drum to 0.006 inch. This will cause the brakeshoe to move down and out, increasing the clearance at the toe of the lining to approximately 0.012 inch, resulting in proper centralization of the brakeshoe.
  - (4) Hold the anchor bolts and tighten both anchor bolt nuts to 90-110 pound-feet torque after completing the adjustment.
  - (5) If pedal travel is too great after the adjustments have been completed, decrease the clearance between the toe of the lining and the drum (par. 214b(3)).
  - (6) Position the inspection hole cover and install the  $\frac{1}{4}$ -20NC x  $\frac{3}{8}$  tapping screw.
  - (7) Install the wheel and tire (par. 227b) and remove the jack and blocking.
  - (8) Adjust the other three brakes in the same manner.

## 219. Handbrake Adjustments

### a. Adjust Handbrake Band (fig. 183).

- (1) Place the vehicle on a level floor and place the handbrake in the fully released position.
- (2) Remove the cotter pin and clevis pin that attach the control rod to the cam levers.
- (3) Remove the locking wire from the anchor screw.
- (4) Loosen the two jamnuts on the adjusting J-bolt and the two jamnuts on the adjusting screw.
- (5) Insert a 0.015-inch thickness gage between the brake lining and the drum at the anchor clip (point A). Turn the anchor screw as required until slight friction is felt as the gage is withdrawn.
- (6) Insert the thickness gage at point B and turn the upper nut on the adjusting J-bolt as required to establish the same clearance as at point A.
- (7) Insert the thickness gage at point C, hold the adjusting screw, and turn the lower nut on the adjusting screw as required to establish the same clearance as at points A and B.
- (8) Check the clearance between the lining and the drum at several points. Clearance should be approximately 0.015 inch at all points.
- (9) When the adjustment has been completed, tighten the jamnuts on the adjusting J-bolt and the adjusting screw. Secure the anchor screw with locking wire, attaching the wire to the

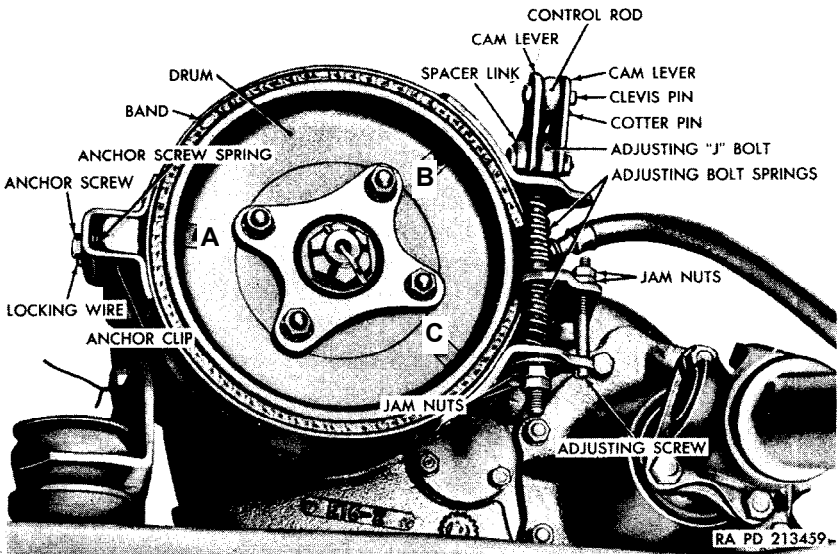


Figure 183. Handbrake band adjustment.

bracket in such a manner that it will not interfere with the anchor screw spring.

- (10) Adjust the handbrake control rod (*b* below) before connecting it to the cam levers.

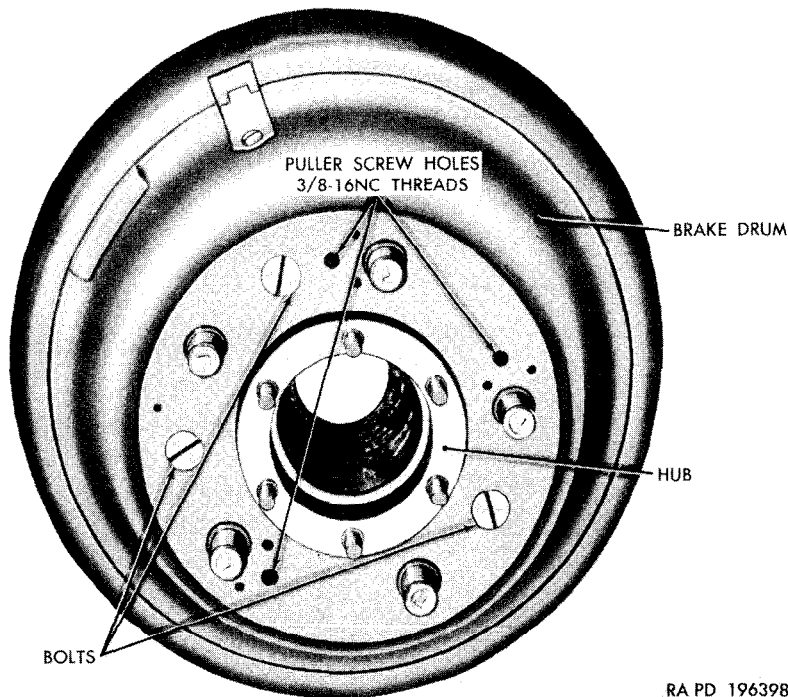
*b. Adjust Handbrake Control Rod.*

- (1) With the brake control rod detached from the cam levers (*a*(2) above), loosen the nut at the yoke end of the brake control rod (G, fig. 162) and turn the rod in the yoke until the eye of the rod is in alinement with the clevis pin holes in the two cam levers (fig. 183).
- (2) Attach the control rod to the cam levers with the clevis pin and  $\frac{5}{32} \times 1$  cotter pin.
- (3) Tighten the nut against the yoke.

*Note.* With the brake band and control rod properly adjusted, the pawl should be engaged in the third to fifth notch of the sector for full application of the brake.

## 220. Brakeshoe and Wheel Cylinder

*a. General.* Front and rear brakeshoes for all wheels are identical and hence interchangeable. Wheel cylinders are marked "L" or "R" for left or right wheels, respectively, and must be installed accordingly. When brakeshoes for one of the front or rear wheels require replacement, replace the brakeshoes for the other front or rear wheel



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Figure 184. Brakedrum and hub.

at the same time to insure proper equalization of the brakes. Procedure is the same for all wheels.

*b. Remove Brakedrum.*

- (1) Remove the wheel and tire (par. 227a).
- (2) Remove the three bolts that secure the brakedrum to the hub (fig. 184), using a broad-bladed screwdriver. If the bolts are corroded, strike the screwdriver with a hammer to shock each bolt, being careful not to damage the bolt slots.
- (3) Install a  $\frac{3}{8}$ -16NC x  $1\frac{1}{2}$  bolt in each of the three puller screw holes in the drum and turn the three bolts in evenly to force the drum from the hub. If the drum is corroded, strike the puller bolts with a hammer as they are tightened to free the drum from the hub. Remove the drum and remove the three puller bolts.

*c. Remove Brakeshoes.*

- (1) Remove the brakeshoe return spring, using brake spring pliers (fig. 185).

*Note.* Insert a tough rubber pad between the pliers and the brake lining to prevent damaging the lining.

- (2) Place a wheel cylinder clamp over the ends of the wheel cylinder to hold the parts in place when the shoe is removed.
- (3) Remove the nut and lockwasher that secures each anchor bolt (fig. 181) and remove the two anchor bolts, with assembled C-washers, oil washers, and oil washer retainers.

*Note.* While the brakeshoes can be removed from the anchor bolts by removing the C-washers, it is advisable to remove the anchor bolts as described above, as they must be cleaned and lubricated each time the brakeshoes are replaced.

Release the shoes from the guide springs and wheel cylinder (fig. 185) and remove the shoes.

*d. Remove Wheel Cylinder (fig. 185).*

- (1) Remove the wheel cylinder inlet fitting bolt and gasket (fig. 181).
- (2) Remove the two-wheel cylinder bolts and lockwashers (fig. 181), and remove the wheel cylinder.

*e. Inspection.*

- (1) Inspect the brakedrum for cracks, distortion, wear, or scoring. Replace the drum, if necessary.
- (2) Inspect the brakeshoe return spring for cracks, distortion, or weakness. Replace the spring, if necessary.
- (3) Inspect the anchor bolts for wear, corrosion, damaged threads, or distortion. Inspect the C-washers and the oil washers and retainers for damage. Remove minor corrosion

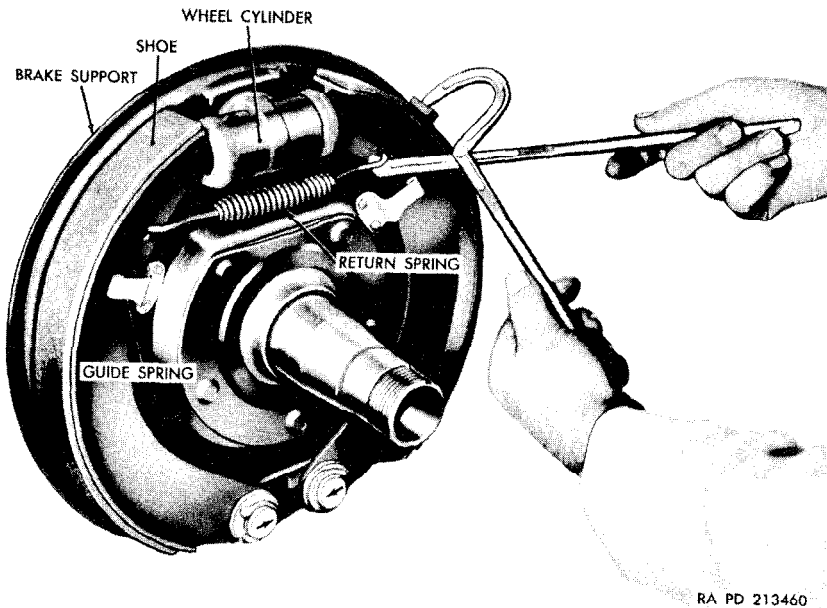


Figure 185. Removing brakeshoe return spring.

or abrasions from the anchor bolts with crocus cloth. Replace damaged anchor bolts or related parts.

- (4) Inspect the inlet fitting on the brake line. If the fitting is damaged, remove it.

*f. Install Wheel Cylinder.*

- (1) If the inlet fitting was removed (*e*(4) above), install a new fitting on the brake line.
- (2) Position the cylinder on the brake support (fig. 185), being sure to use the correct cylinder (*a* above). Install the two  $\frac{5}{16}$ -inch lockwashers and  $\frac{5}{16}$ -18NC x  $\frac{5}{8}$  bolts from the rear side of the brake support (fig. 185). Tighten the two bolts.
- (3) Position the inlet fitting on the wheel cylinder and install the gasket and bolt. Tighten the bolt.

*g. Install Brakeshoes.*

- (1) Apply a film of lubricant on the brakeshoe cams and inner sides of the guide springs. Position the two brakeshoes on the support plate with each shoe engaged in the guide spring (fig. 185) and the upper ends of the shoes in the boots at each end of the wheel cylinder.
- (2) If the C-washers and oil washers were removed from the anchor bolts (*e*(3) above), install a new C-washer on each bolt. Apply a film of lubricant to the anchor bolts and install an oil washer retainer and oil washer on each bolt.

- (3) Install the two anchor bolts from the brakeshoe side and install a  $\frac{5}{8}$ -inch lockwasher and  $\frac{5}{8}$ -18NF nut on each anchor bolt. Position the anchor bolts so the arrows or punch marks are toward each other (fig. 181) and tighten the nuts fingertight.
- (4) Engage one end of the brakeshoe return spring in the hole in one of the brakeshoes and engage the other end in the opposite hole, using brake spring pliers and a rubber pad (fig. 185).
- (5) Remove the wheel cylinder clamp.

*h. Install Brakedrum.*

- (1) Apply a coating of water pump grease to the contacting surfaces of the brakedrum and the hub to prevent corrosion and to facilitate future removal.
- (2) Position the drum on the hub, alining the bolt holes. Install the three  $\frac{3}{8}$ -16NC x  $\frac{7}{8}$  flathead bolts (fig. 184). Tighten the bolts evenly.

*i. Perform a Major Brake Adjustment.* Refer to paragraph 218b.

*j. Install the Wheel and Tire.* Refer to paragraph 227.

*k. Bleed the brake system.* Refer to paragraph 216.

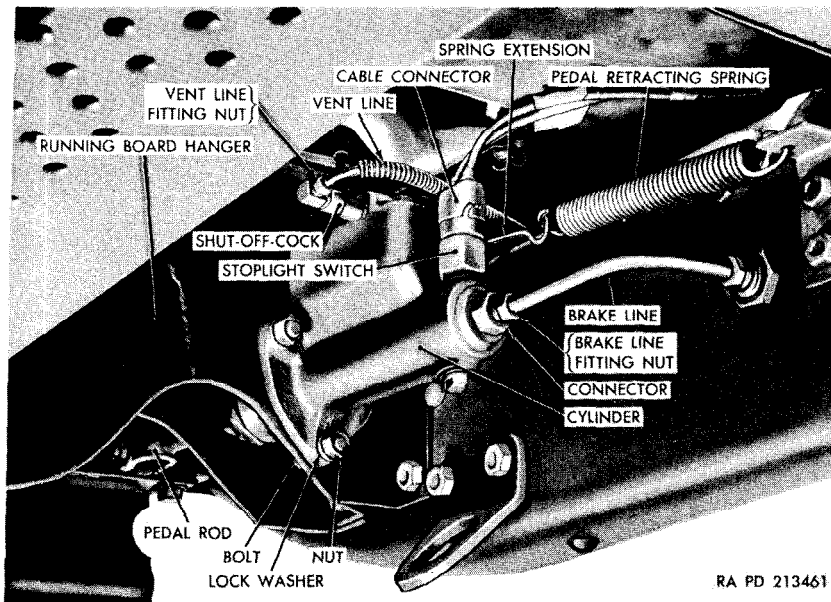
## 221. Brake Master Cylinder

*a. Removal.*

- (1) Disconnect the cable connector (fig. 186) from the stop light.
- (2) Unscrew the vent line fitting nut from the elbow in the shutoff cock.
- (3) Unscrew the brake line fitting nuts from the connector in the master cylinder and frame. Detach the brake line.
- (4) Remove the cotter pin and clevis pin that attach the pedal rod to the brake pedal (fig. 156).
- (5) Remove the three nuts, lockwashers, and bolts securing the master cylinder to the left running board hanger and pull the master cylinder out through the hanger.
- (6) Remove the stop light switch, the vent line shutoff cock and attached elbow, and the brake line connector. Unscrew the brake rod from the push rod. Remove the nut from the pedal rod if either part requires replacement.

*b. Installation.*

- (1) Install the inverted flared tube connector (fig. 186) in the rear of the master cylinder. Tighten the connector.
- (2) Install the vent line shutoff cock with attached elbow in the master cylinder cover. Tighten the shutoff cock.
- (3) Install the stop light switch.
- (4) Position the master cylinder on the left running board front hanger and install the three  $\frac{3}{8}$ -24NF x  $1\frac{1}{4}$  bolts,  $\frac{3}{8}$ -inch lockwashers, and  $\frac{3}{8}$ -24NF nuts. Tighten the nuts evenly.



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Figure 186. Brake master cylinder installed.

- (5) Install the  $\frac{1}{2}$ -20NF nut on the pedal rod and screw the pedal rod into the master cylinder push rod (fig. 156). Connect the pedal rod to the brake pedal with the clevis pin. Do not install the  $\frac{1}{8}$  x  $\frac{7}{8}$  cotter pin until the brake pedal free travel has been adjusted ((10) below).
- (6) Connect the brake line to the master cylinder and frame, screwing the fitting nuts into the connectors.
- (7) Connect the vent line to the elbow in the vent line shutoff cock, screwing the fitting nut to the elbow.
- (8) Connect the cable connector to the stop light switch.
- (9) Fill the master cylinder with hydraulic brake fluid and bleed the brake system (par. 216).
- (10) Adjust the brake pedal free travel (par. 217).

## 222. Brake Lines, Master Cylinder Vent Line, and Fittings

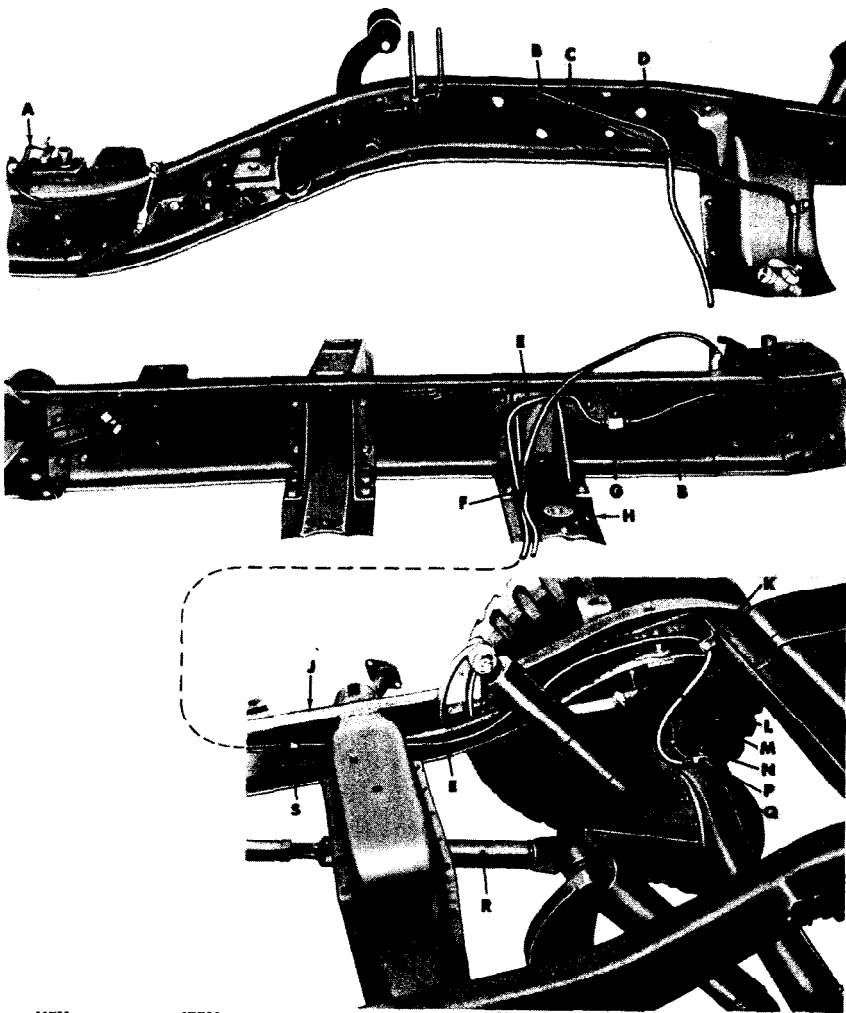
*Note.* The key letters noted in parentheses are figure 187, unless otherwise indicated.

*a. General.* If leaks develop in any of the brake lines or fittings or the master cylinder rear vent line (A), replace the affected parts as required.

*b. Remove Brake Lines or Fittings.*

- (1) Disconnect the affected line at both ends, disengage or remove brake line clips and remove the line. Flexible lines to the front wheel cylinders and flexible lines from the frame





KEY	ITEM
A	—MASTER CYLINDER REAR VENT LINE
B	—LINE (FRAME TEE-TO-UNION)
C	—UNION
D	—LINE (UNION-TO-FRAME BRACKET)
E	—LINE (FRAME TEE-TO-FRAME BRACKET)
F	—CLIP
G	—FRAME TEE
H	—FRAME CROSSMEMBER
J	—RIGHT FRAME SIDE RAIL
K	—FRAME BRACKET

KEY	ITEM
L	—LINE (AXLE TEE-TO-RIGHT REAR WHEEL CYLINDER)
M	—FLEXIBLE LINE
N	—CLIP
P	—LINE (AXLE TEE-TO-LEFT REAR WHEEL CYLINDER)
Q	—AXLE TEE
R	—REAR PROPELLER SHAFT
S	—CLIP

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Figure 187. Brake lines and fittings.

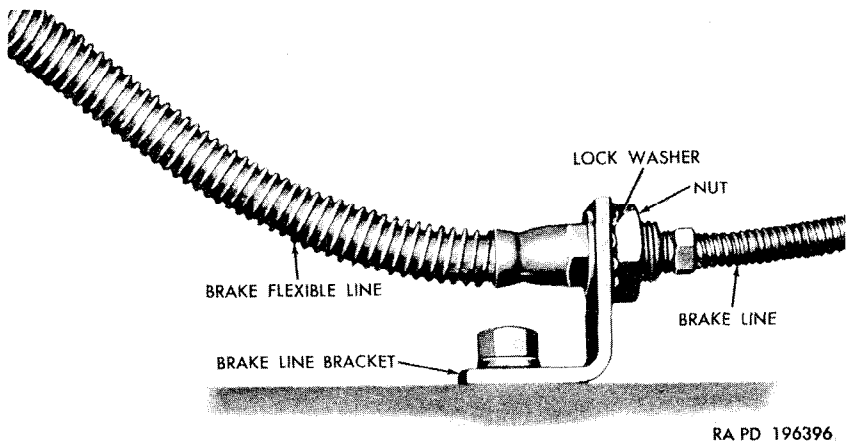
cross members to the tees on the axles are replaced as assemblies. Disconnect all flexible lines at the brake line bracket end first (fig. 188). For other lines provided with covers, remove the cover from the line before discarding the line.

- (2) Removal procedure of tees, unions, and connectors will be apparent upon examination.

*c. Install Brake Line from Master Cylinder to Frame Tee.* Use an  $8\frac{1}{4}$ -inch length of  $\frac{5}{16}$ -inch seamless tubing and two  $\frac{5}{16}$ -inch inverted flared tube fitting nuts. Install the nuts on the tubing and double flare the tubing at both ends, using a flaring tool. Shape the tube as required and screw the fitting nuts to the connector in the master cylinder (fig. 186) and the frame tee (G).

*d. Install Brake Lines from Frame Tee to Front and Rear Flexible Lines.*

- (1) Use  $\frac{1}{4}$ -inch seamless tubing, flexible conduit cover, and two  $\frac{1}{4}$ -inch inverted flared tube fitting nuts for each line. The line (B) from the frame tee (G) to the union (C) at the left frame side rail is  $40\frac{1}{4}$  inches long for all models. The line (E) from the tee to the frame bracket (K) is in two sections, joined by a union at the right frame side rail. The front section is  $43\frac{3}{4}$  inches long for all models. The rear section is  $68\frac{1}{2}$  inches long for the cargo truck M37 or command truck M42; the corresponding line for the ambulance truck M43 or telephone maintenance truck V-41 is  $82\frac{1}{2}$  inches long. The line (D) from this union to the front flexible line is  $34\frac{1}{4}$  inches long for all models.
- (2) Install the conduit cover and two fitting nuts on the tubing, double flare the tubing at both ends, using a flaring tool.



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Figure 188. Brake flexible line installation

Position the line and shape it as necessary. Screw the fitting nuts to the union and the frame tee or the front or rear flexible line. Install any clips that were removed and engage the line in the clip.

*e. Install Brake Flexible Lines.* All flexible lines (fig. 188) are installed in the same manner, but are not interchangeable.

- (1) Connect the flexible line to the tee on the axle or to the inlet fitting at the wheel cylinder.
- (2) Insert the threaded fitting of the brake flexible line through the brake line bracket on the frame crossmember or front axle. Install a  $\frac{5}{8}$ -inch external-teeth lockwasher and the  $\frac{5}{8}$ -inch nut and tighten the nut.
- (3) Screw the brake line fitting nut to the flexible line.

*f. Install Lines from Axle Tees to Wheel Cylinders.*

- (1) For the line (P), use a 41-inch length of  $\frac{1}{4}$ -inch seamless tubing, flexible conduit cover, and two  $\frac{1}{4}$ -inch inverted flared tube fitting nuts. Install the cover and two fitting nuts on the tubing and double flare both ends of the tubing, using a flaring tool. Form the tube as necessary and connect one end of the line to the tee on the rear axle, and the other end to the inlet fitting at the left rear wheel cylinder. Engage the line in the two clips on the axle.
- (2) Install the line (L) for the right rear wheel in the manner described in (1) above, using a  $23\frac{1}{4}$ -inch length of  $\frac{1}{4}$ -inch seamless tubing. Only one clip is used to secure this line to the axle.
- (3) For the line from the front axle tee to the bracket at the left side of the axle (fig. 178) use a  $25\frac{1}{2}$ -inch length of  $\frac{1}{4}$ -inch tubing, flexible conduit cover, and two  $\frac{1}{4}$ -inch inverted flared tube fitting nuts. Assemble the line as described in (1) above. Connect one end of the front line to the front axle tee and the other end to the flexible line for the left front wheel. Engage the line in the two clips on the axle.
- (4) Install the line for the right side (fig. 178) ((3) above), using a 14-inch length of  $\frac{1}{4}$ -inch seamless tubing. Engage the line in the clip on the axle.

*g. Bleed the Brake System* (par. 216).

*h. Replace Master Cylinder Rear Vent Line* (A, fig. 187).

- (1) Disconnect the vent line from the elbow at the shutoff cock (fig. 186) and from the flexible line below the generator and remove the vent line. Remove the conduit cover from the line.
- (2) Use a 50-inch length of  $\frac{3}{16}$ -inch seamless tubing, flexible conduit, and two  $\frac{3}{16}$ -inch inverted flared tube fitting nuts. Assemble the tubing, cover, and fitting nuts (in *f*(1) above).

Install the line, shaping it as required, and connect it to the flexible line below the generator and the elbow at the shut-off cock (fig. 186).

## **223. Handbrake Band, Cam Levers, and Spacer Link**

### *a. Removal.*

- (1) Remove the cotter pin and clevis pin which attach the handbrake control rod to the brake cam levers (fig. 183).
- (2) Remove the cotter pin which attaches the spacer link to the spacer link stud in the brake support on the transfer and remove the spacer link from the stud.
- (3) Remove the two jamnuts and lockwasher from the brake adjusting screw and remove the screw.
- (4) Remove the two jamnuts and plain washer from the adjusting J-bolt and remove the bolt, with attached cam levers and spacer link from the brake band and brake support, catching the two adjusting bolt springs as the bolt is withdrawn.
- (5) Remove the locking wire from the anchor screw and remove the anchor screw. Pull the band from the brake support, catching the anchor screw spring as the band is removed.
- (6) If the adjusting J-bolt, cam levers, or spacer link requires replacement, remove the cotter pin and clevis pin that attach the two levers and the spacer link to the J-bolt. If the spacer link stud in the brake support requires replacement, remove the nut, lockwasher, and stud.

### *b. Inspection.*

- (1) Clean the parts that were removed and the brakedrum.
- (2) Inspect the cam levers and link spacer for cracks, distortion, and elongated clevis pin holes.
- (3) Inspect the adjusting J-bolt, adjusting screw, anchor screw, and spacer link stud for cracks and damaged threads.
- (4) Inspect all springs for cracks, distortion and weakness.
- (5) Inspect the drum for scoring or cracks. Report a damaged drum to ordnance maintenance personnel.
- (6) Replace all parts that are unfit for further service.

### *c. Installation.*

- (1) If the spacer link stud was removed, install the stud in the brake support and install the  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -24NF nut. Tighten the nut.
- (2) Assemble the adjusting J-bolt and related parts with a cam lever at each side of the bolt and the spacer link next to the left lever, aligning the clevis pin holes in the link and two levers with the eye in the adjusting J-bolt. Install the cam lever clevis pin and  $\frac{5}{32}$  x 1 cotter pin.

- (3) Position the anchor screw spring in the anchor clip on the band and install the band on the brake support. Install the anchor screw but do not tighten at this time.
- (4) Position an adjusting bolt spring at each side of the brake support between the support and the band ends, and install the adjusting J-bolt and attached cam levers and spacer link, inserting the bolt through the band ends, two springs, and brake support. Install the  $\frac{7}{16}$ -inch plain washer and two  $\frac{7}{16}$ -20NC jamnuts on the lower end of the bolt, but do not tighten at this time.
- (5) Attach the front end of the spacer link to the spacer link stud and install the  $\frac{3}{32}$  x  $\frac{3}{4}$  cotter pin.
- (6) Install the  $\frac{1}{4}$ -20NC x  $2\frac{1}{2}$  adjusting screw up through the band lower end and the brake support and install the  $\frac{1}{4}$ -inch lockwasher and two  $\frac{1}{4}$ -20NC jamnuts. Do not tighten the nuts at this time.
- (7) Adjust the band and control rod (par. 219).

## 224. Handbrake Control Rod and Lever

### *a. Remove Handbrake Control Rod.*

- (1) Remove the cotter pins and clevis pins that attach the control rod to the cam levers (fig. 183) and the control rod yoke to the handbrake lever (F, fig. 162) and remove the control rod.
- (2) If the control rod yoke or yoke nut requires replacement, remove the yoke and nut from the rod.

### *b. Install Handbrake Control rod.*

- (1) Install the  $\frac{7}{16}$ -20NF nut and the yoke on the threaded end of the control rod.
- (2) Attach the yoke to the handbrake lever (F, fig. 162) with the clevis pin and  $\frac{3}{32}$  x  $\frac{3}{4}$  cotter pin.
- (3) Adjust the rod in the yoke (par. 219).

### *c. Remove Handbrake Lever and Sector.*

- (1) Remove the transmission access cover (par. 121g).
- (2) Detach the control rod yoke from the handbrake lever (a(1) above).
- (3) Remove the three screws and lockwashers that secure the transfer lever bracket (fig. 88) to the transmission and remove the handbrake lever and attached sector.
- (4) Remove the two nuts and the bolt that secure the handbrake lever to the sector and remove the sector.

### *d. Inspection.*

- (1) Inspect the sector for wear, cracks, and distortion.
- (2) Inspect the handbrake lever pawl for wear. Check the ac-

tion of the button, rod, and pawl for ease of operation and correct spring action.

(3) Replace the sector and lever, if necessary.

*e. Install Handbrake Lever and Sector.*

(1) Depress the hand lever button and position the sector in the lower end of the lever with the narrow end of the sector toward the rear. Aline the center bolt hole in the sector with the upper holes in the end of the lever; install the sector bolt from the left side of the lever and release the lever button.

(2) Install the  $\frac{3}{8}$ -24NF plain nut and the  $\frac{3}{8}$ -24NF jamnut on the sector bolt and tighten both nuts.

(3) Position the sector and the transfer lever bracket on the transmission (fig. 87), alining the screw holes in the bracket and sector with those in the transmission case. Install the three  $\frac{3}{8}$ -inch lockwashers and  $\frac{3}{8}$ -16NC x  $2\frac{3}{4}$  cap screws. Tighten the screws evenly.

(4) Install the transmission access cover (par. 122*d*).

## Section XXII. WHEELS, HUBS, AND TIRES

### 225. Description and Data

*a. Description.*

(1) The disk-type steel wheels are fitted with mud and snow tread pneumatic tires and tubes. Wheels and tires are interchangeable.

(2) The hubs are mounted on opposed tapered roller bearings. Oil seals are provided to retain lubricant.

(3) Organizational maintenance operations include wheel bearing adjustment and replacement of wheels, hubs, hub bearings, oil seals, tires, and tubes.

*b. Data.*

Hubs:

Bearings:

Number..... 2

Type..... tapered roller cup and cone

Method of adjustment..... locking nut

Tires:

Ply..... 8

Pressure:

Highway..... 40 lb

Cross-country, mud, snow, or sand..... 15 lb

Size..... 9.00 x 16

Type..... truck and bus, mud and snow tread

Wheels:

Bolt circle diameter.....  $6\frac{7}{8}$  in.

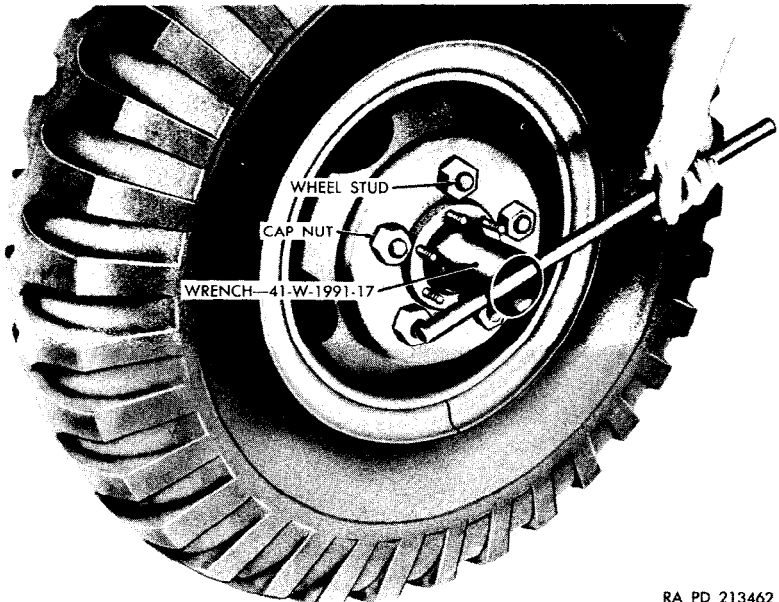
## Wheels—Continued

Dish.....	4 in.
Number of studs.....	5
Rim size.....	6.50 x 16
Tread (front and rear).....	62 in.
Type.....	Steel disk

## 226. Wheel Bearing Adjustment

*a. Front Wheel Bearings.* Procedure is the same for both front wheels.

- (1) Jack up the wheel and remove the drive flange and flange gasket (par. 205*c*).
- (2) Remove the outer bearing adjusting nut, using the wrench 41-W-1991-17 (fig. 189). Remove the adjusting nut lock (fig. 172).
- (3) Using the wrench 41-W-1991-17, turn the inner adjusting nut in until the bearings are tight. Then back the nut off one-sixth of a turn. Rotate the wheel to test the tightness of the bearings.
- (4) Install the adjusting nut lock, engaging the lock pin on the adjusting nut in one of the holes in the lock. If the lock does not engage the lock pin, reverse the position of the lock.
- (5) Install the outer bearing adjusting nut and tighten securely with the wrench 41-W-1991-17 (fig. 189).
- (6) Install the flange gasket and the flange (par. 206*c*).



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*Figure 189. Adjusting wheel bearings.*

*b. Rear Wheel Bearings.* Both rear wheel bearings are adjusted in the same manner.

- (1) Jack up the wheel and remove the axle drive shaft and the flange gasket (par. 210*a*).
- (2) Remove and discard outer oil seal and the other flange gasket.
- (3) Remove the outer bearing adjusting nut, using the wrench 41-W-1991-17 (fig. 189) and remove the adjusting nut lock (fig. 172).
- (4) Adjust the rear bearings in the manner described in *a*(3) above.
- (5) Install the adjusting nut lock (*a*(4) above).
- (6) Install the outer bearing adjusting nut and tighten securely with the wrench 41-W-1991-17.
- (7) Prepare a new oil seal by soaking it in neats-foot oil for approximately 30 minutes. Position a new flange gasket and the oil seal on the flange studs with the shoulder of the seal in the counterbore of the hub.
- (8) Install another new flange gasket and the axle drive shaft (par. 210*b*).

## **227. Wheels and Tires**

*a. Removal.* All wheels are removed in the same manner.

- (1) Apply the handbrake, jack up the wheel to be removed, and block the other wheels to hold the vehicle.
- (2) Remove the five cap nuts that secure the wheel to the wheel hub studs (fig. 189), and remove the wheel.

*Note.* Cap nuts for both left wheels have left-hand threads.

*b. Installation.*

- (1) Position the wheel on the wheel studs with the dished side next to the hub.
- (2) Install the five  $\frac{3}{4}$ -16NF cap nuts with the tapered side toward the wheel (note *a*(2) above).
- (3) Tighten the nuts to 200 to 225 pound-feet torque.

## **228. Hub, Hub Bearings, and Oil Seal**

*Note.* The key letters noted in parentheses are in figure 190, except where otherwise indicated.

*a. General.* Hubs for all wheels are identical and are serviced in the same manner. An outer bearing oil seal is provided for each rear hub. All hubs have an inner oil seal and inner and outer bearings. Wheel studs for the left wheels have left-hand threads.

*b. Remove Hub and Drum.*

- (1) Remove the wheel and tire (par. 227*a*).
- (2) Remove the front axle drive flange (par. 205*c*) or the rear



axle drive shaft (par. 210a) and the flange gasket. For the rear hub, remove the outer bearing oil seal and gasket.

(3) Remove the hub and drum (par. 205d).

*c. Disassemble Hub and Drum.*

(1) Remove the snapping (N) that secures the oil seal (M).

(2) Insert the drift 41-D-1535-25 with handle 41-H-1397 (fig. 191) in the hub from the outer end, so the drift bears against the inner bearing cone. Drive the inner bearing cone and inner oil seal from the hub in one operation. Remove the drift and handle.

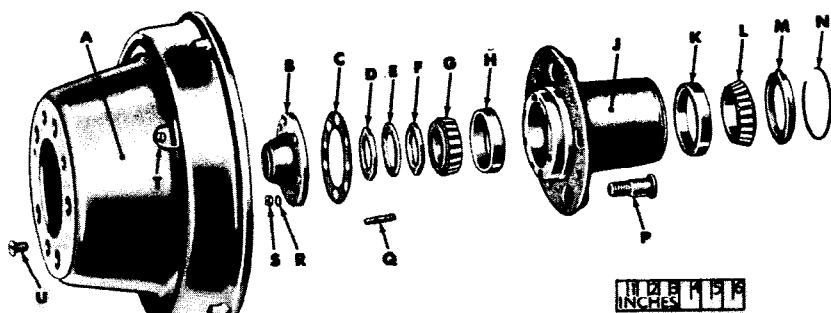
(3) If the drum (A) or hub (J) requires replacement, remove the drum (par. 219).

*d. Inspection.*

(1) Clean all parts in dry-cleaning solvent or volatile mineral spirits and dry.

(2) Inspect the hub (J) for cracks, loose or damaged wheel studs (P) or flange studs (Q), damaged flange surfaces, and loose or damaged bearing cups (H and K). Tighten loose wheel or flange studs. Remove damaged studs.

(3) Inspect the inner and outer bearing cones (G and L) for wear, chipping, or roughness. Inspect the inner and outer bearing cups (H and K) in the hub for scoring and pitting. If either of the bearing cups require replacement, remove the cups by driving them out with a brass drift and hammer. If either cup or cone requires replacement, replace both items.

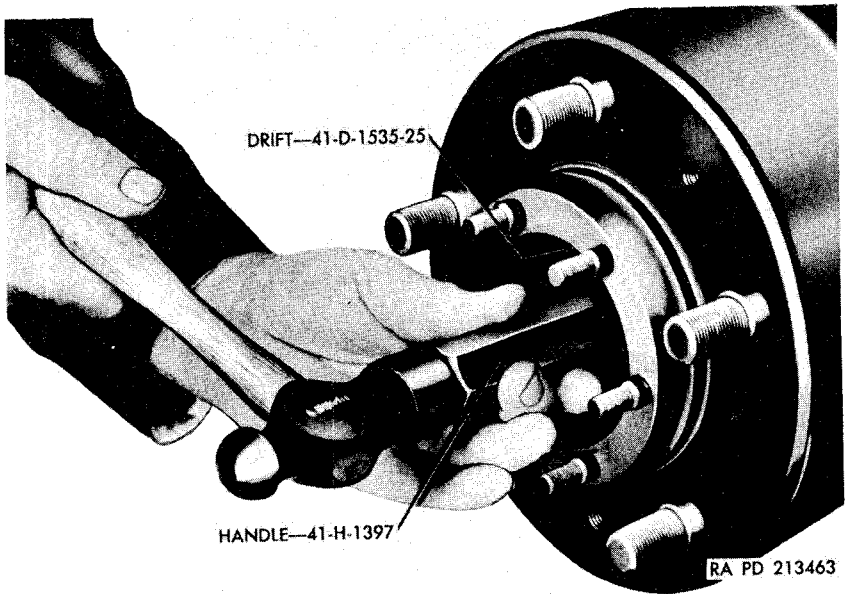


- KEY**                      **ITEM**
- A—DRUM
  - B—DRIVE FLANGE
  - C—GASKET
  - D—OUTER BEARING ADJUSTING NUT
  - E—ADJUSTING NUT LOCK
  - F—INNER BEARING ADJUSTING NUT
  - G—OUTER BEARING CONE
  - H—OUTER BEARING CUP
  - J—HUB
  - K—INNER BEARING CUP

- KEY**                      **ITEM**
- L—INNER BEARING CONE
  - M—OIL SEAL
  - N—SNAP RING
  - P—WHEEL STUD
  - Q—FLANGE STUD
  - R—LOCK WASHER
  - S—NUT
  - T—INSPECTION HOLE COVER
  - U—SCREW

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Figure 190. Hub, drum, and related parts—exploded view.



*Figure 191. Removing inner bearing cone and oil seal.*

- (4) Inspect the inner and outer bearing adjustment nuts (D and F) for cracks or damaged threads, or a damaged lock pin on the inner nut. Inspect the adjusting nut lock (E) for cracks or distortion.
- (5) Inspect the drum (A) (par. 220e).
- (6) Replace all parts that are unfit for further service.

*e. Assemble Hub and Drum.*

- (1) If the wheel studs (P) were removed (d(2) above), or if a new hub is to be installed, install new  $\frac{3}{4}$ -16NF x  $2\frac{1}{4}$  riveted-type studs, matching the flat surface of the stud head with the shoulder on the hub. Press the studs into place with an arbor press.

*Note.* Wheel studs for the left hubs have left-hand threads. Be sure to use correct studs.

- (2) If the flange studs (Q) were removed (d(2) above), install new flange studs in the hub and tighten.
- (3) If the bearing cups (H and K) were removed (d(3) above) install new cups in the hub, using an arbor press. Make certain that the cups are bottomed in the hub counterbores.

*Note.* Bearing cups are already installed in a new hub.

- (4) Install the brake drum (par. 220h).
- (5) Lubricate the inner bearing cone (L) with grease GAA using a roller bearing lubricator or kneading the grease into the bearing rollers with the fingers. Position the cone in the inner bearing cup.

- (6) Immerse a new inner bearing oil seal (M) in clean neats-foot oil for about 30 minutes to soften the leather. Remove the seal from the oil and roll with a smooth steel bar (fig. 192) to condition the seal.
- (7) Position the oil seal (M) in the hub with the lip of the seal next to the inner bearing cone (L). Fit the replacer 41-R-2392-405 (fig. 193) over the seal and drive the seal into position.

*Note.* Do not drive the seal into the hub beyond the snapping groove to prevent interference between the seal and the bearing cone.

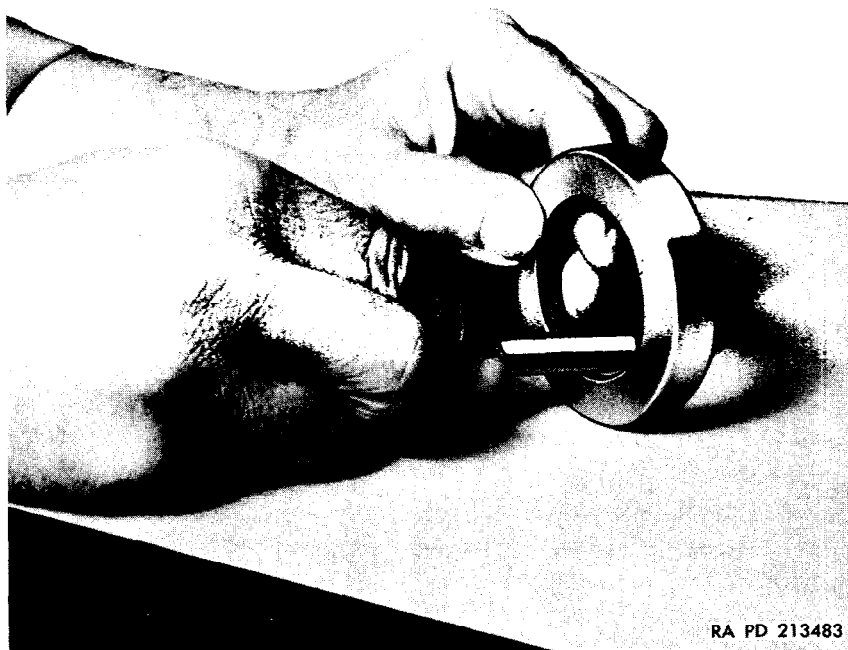
Remove the replacer and install the snapping (N), making certain that the ring seats properly.

*f. Install Hub and Drum.* Refer to paragraph 206*b*.

*g. Install the Wheel and Tire.* Refer to paragraph 227*b*.

*h. Adjust Wheel Bearings.* Refer to paragraph 225.

*i. Install Front Wheel Drive Flange or Rear Outer Bearing Oil Seal and Axle Drive Shaft.* Refer to paragraphs 206*a*, 225*b*, and 209*b*.



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*Figure 192. Conditioning oil seal.*



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Figure 193. Installing inner bearing oil seal.

## 229. Tire and Tube

### *a. Removal.*

- (1) Remove the wheel and tire (par. 227a).
- (2) Remove the valve cap, unscrew and remove the valve core from the valve stem, and deflate the tube.
- (3) Lay the wheel on the floor with the outer side up. Insert a pry bar between the tire and one of the bead clips, and press downward until tension on the clip is relieved. Tap the clip with a hammer to disengage it from the ring.
- (4) Repeat the operation in (3) above for each of the other five clips. Drive bar between clips and rim to break tire bead from rim.
- (5) Insert a pry bar between the ends of the ring and pry the end nearest the first cut-out in the ring (fig. 194) enough to permit a second pry bar to be inserted in the cut-out. Work the ring from the wheel flange, prying at the cut-outs in the ring, and remove the ring. Remove the six bead clips from the outer side of the tire.
- (6) Mark the location of the valve stem on the tire if the original mark has been obliterated and remove the tire, tube, and six inner bead clips. Remove the tube from the tire.

### *b. Inspection.*

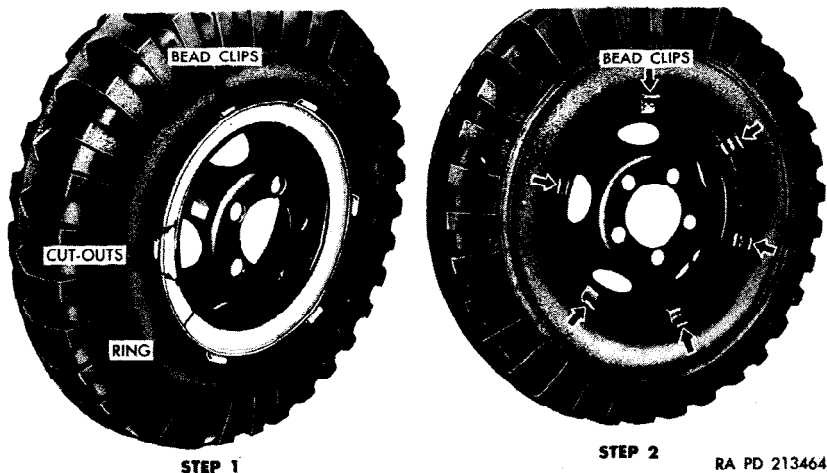


Figure 194. Removing tire.

- (1) Clean the wheel and inspect for distortion, damage, or corrosion. If the wheel is corroded, remove corrosion and paint the flange surface. Replace a damaged wheel.
- (2) Inspect the inside of the tire for penetrating objects and broken cords. Inspect the tread for cuts, abrasions, cupping, and wear. Remove nails or other sharp objects from the tire. Replace the tire if it is worn or damaged.
- (3) Inspect the tube for cuts or damaged valve stem. Repair the tube as instructed in TM 31-200 or replace with a new one, as required.
- (4) Inspect the bead clips for breaks or distortion. Replace damaged clips.
- (5) Inspect the side ring for cracks or distortion. Replace a damaged ring.

*c. Installation.*

- (1) Install a new valve core in the tube valve stem and inflate the tube slightly. Install the tube in the tire with the valve stem in alignment with the marking on the tire (a(6) above).
- (2) Place six bead clips on each bead of the tire, spacing them evenly and alternating the clips on one bead with those on the other.
- (3) Position the tire on the wheel with the valve stem extending through the hole in the wheel toward the outside of the wheel.
- (4) Install the ring on the wheel with the split between two of the clips. Force the ring under the wheel flange, working around the tire. The bead clips should snap into place over the outer edge of the ring as the ring is worked into place.
- (5) Inflate the tire slowly to 40 pounds pressure, and install the valve cap.
- (6) Install the wheel and tire (par. 227b).

## Section XXIII. STEERING GEAR AND CONTROLS

### 230. Description and Data

#### a. Description.

- (1) The steering gear (fig. 195) is of the worm- and sector-type. The worm operates in tapered roller bearings and the sector or pitman arm shaft is mounted in bronze bushing-type bearings. A vent in the steering gear housing prevents build-up of excess pressure in the housing.
- (2) The two drag links act in conjunction with the idler arm to provide correct steering geometry.
- (3) Organizational maintenance operations include alinement and adjustment of the steering gear and replacement of the drag links, idler arm, dust covers, steering gear, pitman arm, steering wheel, tie rod, and tie rod ends. Replacement of the tie rod and tie rod ends is described in paragraph 204.

#### b. Data.

##### Drag links:

Adjustment..... threaded plug  
Number..... 2  
Type..... tubular

##### Steering gear:

###### Bearings:

Worm..... tapered roller  
Pitman shaft..... bushing-type (bz)  
Capacity..... 12-oz  
Make..... Gemmer  
Model..... B-60  
Ratio..... 23.2:1

### 231. Steering Gear Alinement

a. *General.* Correct alinement of the steering gear must be established to prevent binding of the parts when the vehicle is turned to left or right.

#### b. Check and Correct Alinement.

- (1) Disconnect the upper drag link from the pitman arm (par. 235) (T, fig. 195).
- (2) Turn the steering wheel back and forth, and note whether it turns freely throughout the full range. If the wheel does not turn freely, check the position of the steering gear at the instrument panel ((3) and (4) below).
- (3) Remove the four lockwasher screws that secure the steering column cut-out access cover to the instrument panel, and remove the cover (fig. 146).
- (4) Loosen the nuts on the two bolts that secure the steering post clamp and bracket to the instrument panel (fig. 146) and

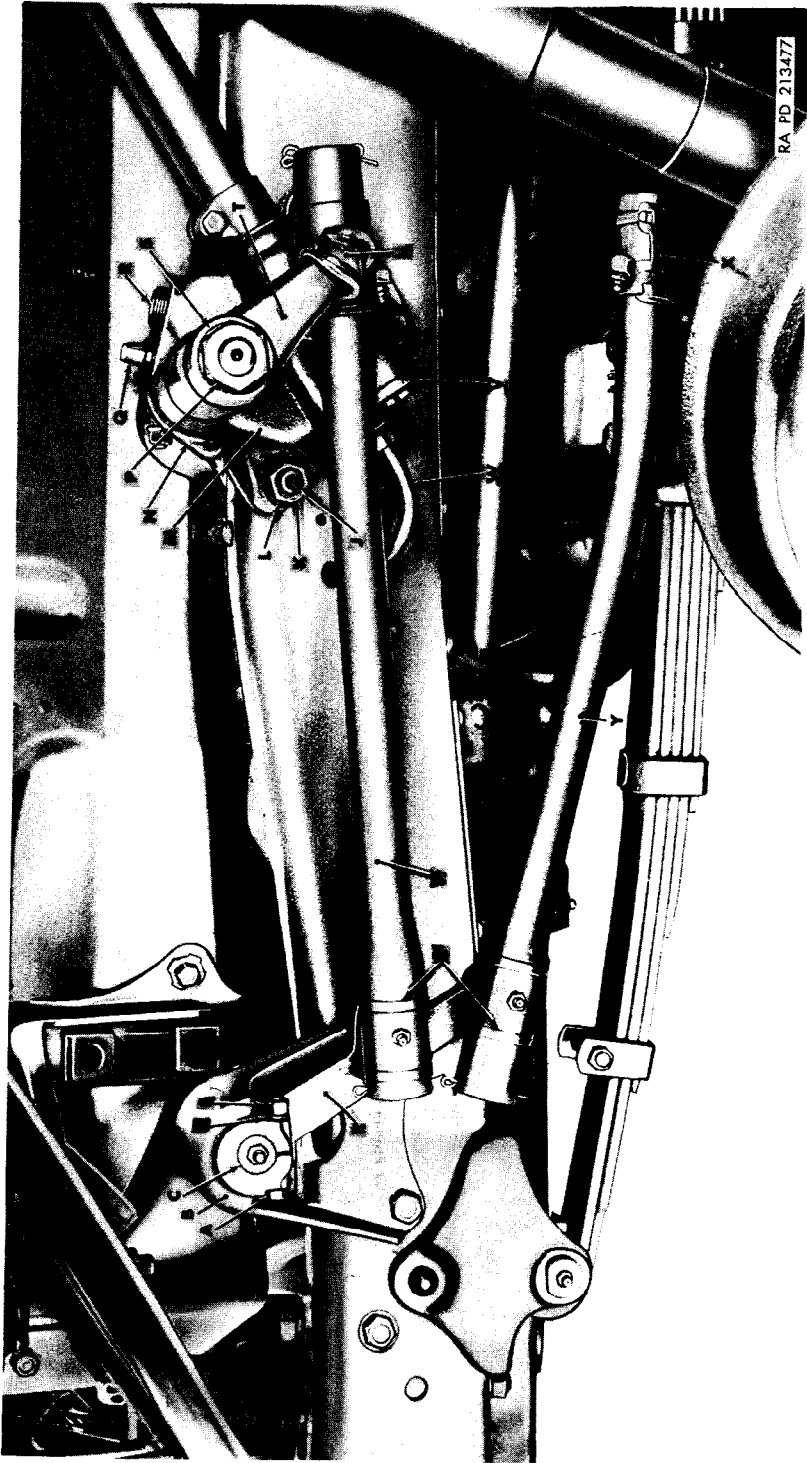


Figure 195. Steering gear and controls.

A	Clamp bolt	N	Pitman arm shaft adjusting screw
B	Idler arm bracket	P	Pitman arm nut
C	Idler arm shaft	Q	Vent
D	Lockwasher	R	Filler plug
E	Nut	S	Lockwasher
F	Idler arm	T	Pitman arm
G	Outer dust cover	U	Dust cover
H	Idler arm-to-steering gear drag link (upper)	V	Lower cover
J	Steering gear bolt	W	Horn button cable
K	Nut	X	Dust cover retainer
L	Lockwasher	Y	Idler arm-to-steering arm drag link (lower)
M	Steering gear housing		

*Figure 195*—Continued.



note whether the steering gear has a tendency to move to one side when the bolts are loosened. If it does, loosen the nuts on the three steering gear bolts (J, fig. 195) and allow the steering gear to assume correct alinement. Tighten the nuts on the steering gear bolts to 140–150 pound-feet torque.

- (5) Position the bracket and clamp on the instrument panel (fig. 146), making sure that the rubber collar is correctly positioned on the steering gear and tighten the nuts on the two bolts securely. The bolt holes in the instrument panel are elongated to provide for this adjustment. Install the access cover on the instrument panel with the four lockwasher screws.
- (6) When the adjustment has been completed, attach the upper drag link to the pitman arm (par. 235) (T, fig. 195).

## 232. Steering Gear Adjustment

*a. General.* Steering gear adjustments include adjustment of the worm bearings and the control of backlash.

### *b. Adjust Worm Bearings.*

- (1) Remove the upper idler arm-to-steering gear drag link (par. 235) (H, fig. 195).
- (2) Remove the four screws that secure the lower cover to the steering gear housing and pull the cover down to expose the shims.

*Note.* On vehicles of early production, two covers are used, with a gasket between. Be careful not to damage the gasket when making the adjustment.

- (3) Remove one thin shim from between the cover and the housing.
- (4) Install the cover (or covers) on the housing and install the four special cover screws. Tighten the screws.
- (5) Turn the steering wheel to check the adjustment. There should be a slight resistance as the wheel is turned in either direction.
- (6) Repeat (2) and (3) above, if necessary, until correct adjustment is obtained.
- (7) Install the upper idler arm-to-steering gear drag link (par. 235) (H, fig. 195).
- (8) Lubricate the steering gear. Refer to lubrication order (figs. 33 and 34).

### *c. Adjust Backlash.*

- (1) Remove the upper idler arm-to-steering gear drag link (par. 235) (H, fig. 195).
- (2) Turn the steering wheel to left or right as far as possible. Turn the wheel in the opposite direction as far as it will go,

and count the number of turns. Then turn the wheel back one-half the total turns.

*Note.* The steering wheel must be properly positioned before adjustment of backlash, as a high spot is provided on the worm for the midposition.

- (3) Working from the engine compartment, remove the nut and lock plate from the pitman arm shaft adjusting screw.
- (4) Using a screwdriver, turn the adjusting screw in to decrease backlash or out to increase backlash. Adjust the screw to provide a slight drag as the steering wheel is turned through the midposition.
- (5) Install the lock plate on the adjusting screw, making certain that the plate is engaged with the button on the housing cover. Install the nut and tighten. Check the backlash to make certain that the adjustment has not changed.
- (6) Install the upper idler arm-to-steering gear drag link (par. 235) (H, fig. 195).

### **233. Steering Wheel**

#### *a. Removal* (fig. 196).

- (1) Remove the horn button cable (par. 179*b*).
- (2) Remove the steering wheel nut and the horn button lower retaining plate.
- (3) Install the adapter 41-A-18-173, and puller 41-P-2954 on the steering wheel as shown in figure 196, with the three rubber pads on the ring bearing against the three wheel spokes and the three puller jaws spaced midway between spokes.
- (4) Tighten the puller screw in against the adapter. If the puller screw is difficult to turn, strike the end of the screw smartly with a medium hammer to dislodge the wheel from the steering shaft.

*Note.* The steering wheel is of molded rubber and may be distorted if excessive pressure is exerted on the puller before the wheel is dislodged.

- (5) Remove the wheel, the wheel puller, and adapter.

#### *b. Installation.*

- (1) With the front wheels pointing straightahead, position the steering wheel on the steering shaft so that the spoke adjacent to the two square indentations points down. Force the wheel into position and install the lower horn button retaining plate and the wheel nut. Tighten the nut to 60-70 pound-feet torque.
- (2) Install the horn button cable and horn button (par. 179*d*).

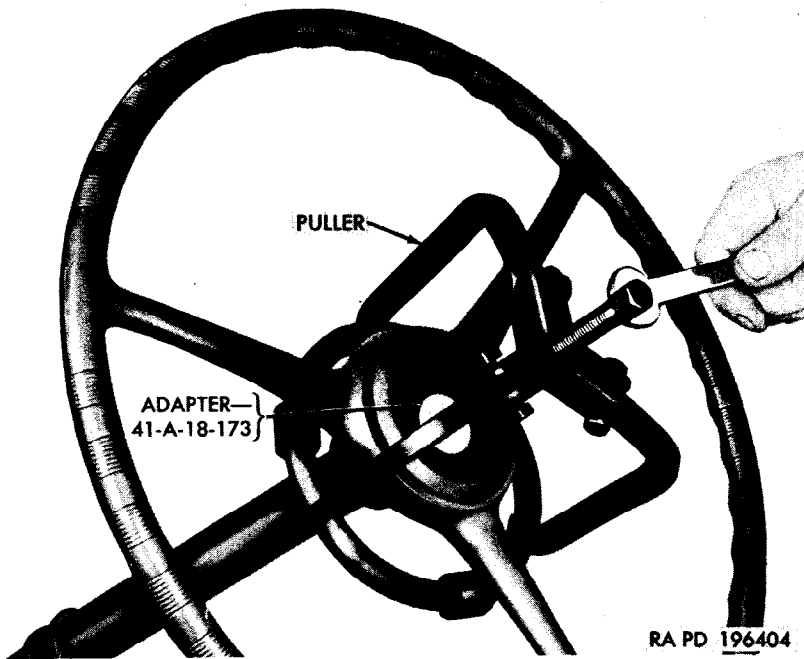


Figure 196. Removing steering wheel.

## 234. Steering Idler Arm

*Note.* The key letters noted in the parentheses are in figure 198, except where otherwise indicated.

### a. Removal.

- (1) Open the clips of the two outer dust covers (D) at the idler arm (F, fig. 195). Remove the cotter pin (H) that secures the plug at the front end of each drag link, and unscrew the plugs (A) enough to permit the links to be pulled from the arm. Remove the inner and outer dust covers (D and E) and dust cover seals (F) from the idler arm balls.
- (2) Remove the nut, lockwasher, and clamp bolt from the idler arm bracket (B, fig. 195).
- (3) Remove the lubrication fitting from the idler arm shaft and install the adapter 41-A-18-241 in the fitting opening. Install the puller on the adapter and remove the idler arm shaft (fig. 197). Remove the idler arm (F, fig. 195). Remove the puller and the adapter.
- (4) Inspect the parts removed for wear or other visual damage. Replace parts as necessary.

### b. Installation.

- (1) Position the idler arm in the idler arm bracket, aligning the shaft opening in the arm with those in the bracket. Apply a

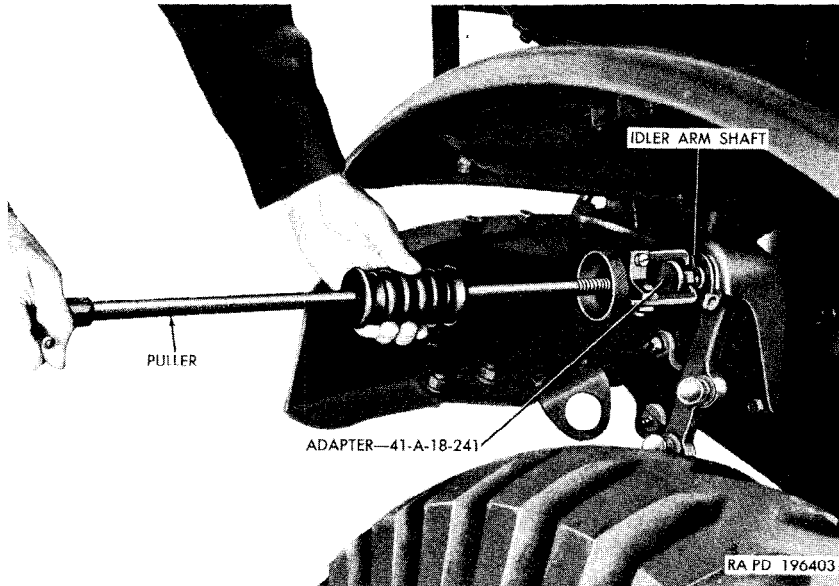


Figure 197. Removing idler arm shaft.

- film of lubricant to the shaft and install the shaft, aligning the clamp bolt groove with the bolt holes in the bracket.
- (2) Install the  $\frac{3}{8}$ -24NF x  $2\frac{1}{4}$  clamp bolt,  $\frac{3}{8}$ -inch lockwasher, and  $\frac{3}{8}$ -24NF nut. Tighten the nut.
  - (3) Install a  $\frac{1}{8}$ NPT male lubrication fitting in the idler arm shaft and lubricate the shaft.
  - (4) Install an outer dust cover (D), inner dust cover (E), and dust cover seal (F) over each idler arm ball. Position the upper drag link over the upper ball with the ball between the two ball seats in the drag link. Tighten the plug using a drag link bit-and-socket wrench. Back the plug out one-half turn from the nearest cotter pin hole and install a  $\frac{5}{32}$  x  $2\frac{3}{4}$  cotter pin. Attach the lower drag link to the lower ball in the same manner.

### 235. Drag Link

*Note.* The key letters noted in parentheses are in figure 198, except where otherwise indicated.

*a. Remove and Disassemble Drag Link from Pitman Arm to Idler Arm.*

- (1) Remove the two lubrication fittings (M) and the lubrication elbows (L) from the drag link and open the outer dust cover at each end of the steering gear to idler arm drag link (J).
- (2) Remove the cotter pin (H) that secures the plug (A) at each end of the steering gear to idler arm drag link (J) and loosen

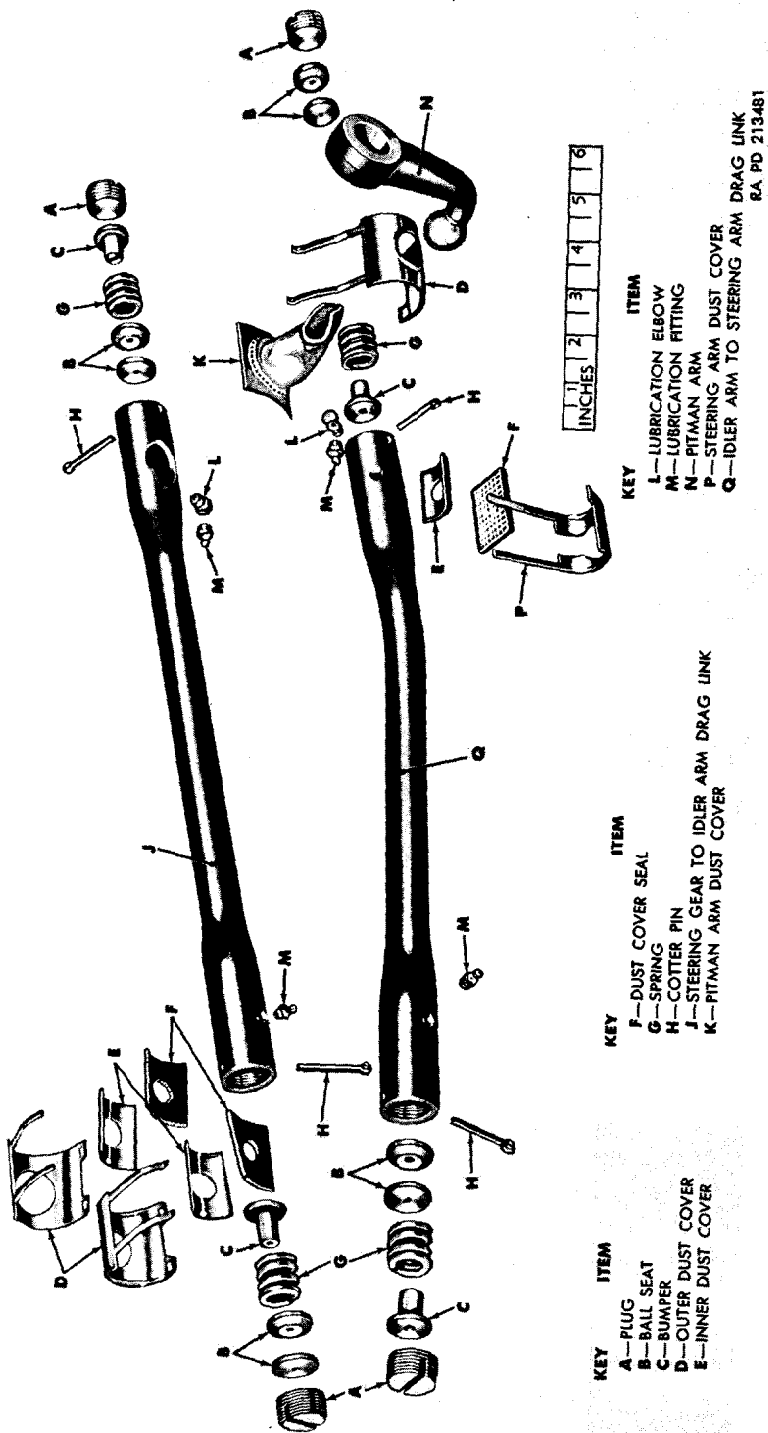


Figure 198. Drag links and related parts—exploded view.

the plugs, using a drag link bit-and-socket wrench. Pull the drag link from the pitman arm ball and the idler arm ball.

- (3) Remove the dust cover seals and related parts, if necessary.
- (4) Remove the plug (A) from each end of the steering gear to idler arm drag link (J) and remove the bumpers (C), springs (G), and ball seats (B).

*b. Remove and Disassemble Drag Link from Idler Arm to Steering Arm.* Procedure for removal and disassembly of the idler arm to steering arm drag link is the same as *a* above.

*c. Inspection.*

- (1) Clean the parts in volatile mineral spirits or dry-cleaning solvent and dry with compressed air.
- (2) Inspect the drag links (J and Q) for wear, cracks, distortion, or damaged threads.
- (3) Inspect the ball seats (B) and bumpers (C) for abrasions, corrosion, wear, or cracks.
- (4) Inspect the plugs (A) for damaged threads.
- (5) Inspect the balls on the idler arm, pitman arm, and steering arm for abrasions, wear, or cracks.
- (6) Remove minor abrasions or corrosion with crocus cloth. Replace either drag link, the pitman arm, or idler arm if the parts are damaged. Report a damaged steering arm to ordnance maintenance personnel.

*d. Assemble and Install Drag Link from Idler Arm to Steering Arm.*

- (1) Apply a film of lubricant to the ball seats.
- (2) Install an outer dust cover (D), inner dust cover (E), and dust cover seal (F), on the lower ball of the idler arm and the steering arm dust cover (P), dust cover seal (F), and inner dust cover (E) on the ball of the steering arm.
- (3) Place a spring (G) over the smaller diameter of one of the bumpers (C) and install the parts in the steering arm end of the drag link (Q), with the spring toward the outside. Install a ball seat (B) with the cupped side out.
- (4) Install a ball seat (B) in the idler arm end of the drag link (Q), with the cupped side out.
- (5) Position the drag link on the idler arm ball and the steering arm ball, making certain that the cupped surfaces of the ball seats contact the balls.
- (6) Install a ball seat (B) in the steering arm end of the drag link (Q) with the cupped side in and install the plug (A) in the end of the tube.
- (7) Install a ball seat (B) in the idler arm end of the drag link (Q) with the cupped side in. Place a spring (G) over the smaller diameter of the bumper (C) and install the parts in

the idler arm end of the drag link (Q) with the spring toward the ball seat. Install a plug (A) in the end of the tube.

- (8) Tighten the plugs and install the two cotter pins (H) (par. 234b(4)).
- (9) Close the dust idler and steering arm covers (D and P).
- (10) Install a  $\frac{1}{8}$ NPT, 90° lubrication elbow (L) in the steering arm end of the drag link (Q) and  $\frac{1}{8}$ -NPT lubrication fitting (M) in each end of the drag link and lubricate the drag link (fig. 33).

*e. Assemble and Install Drag Link from Pitman Arm to Steering Idler Arm.*

- (1) Insert the pitman arm dust cover (K) through the opening in the outer dust cover (D) from the concave side and install the covers on the pitman arm ball.
- (2) Place the outer dust cover (D), inner dust cover (E) and dust cover seal (F), over the upper ball of the idler arm.
- (3) Install a bumper (C), spring (G), and ball seat (B) in the idler arm end of the drag link (J) (d(3) above).
- (4) Install a ball seat (B) in the pitman arm end of the drag link (J), with the cupped side out.
- (5) Position the drag link on the pitman arm ball and the idler arm ball.
- (6) Install a ball seat (B), spring (G), and bumper (C) in the pitman arm end of the drag link (J) and install a plug (A) in the end of the tube (d(7) above).
- (7) Install a ball seat (B) in the idler arm end of the drag link (J) with the cupped side in and install a plug (A) in the end of the tube.
- (8) Install the plugs "A" and cotter pins (H) (par. 234b(4)).
- (9) Close the outer dust covers (D) at the idler arm end of the drag link and the pitman arm. Secure the pitman arm dust cover (K) with locking wire.
- (10) Install the lubrication elbow (L) and fittings (M) (d(10) above), and lubricate the drag link (fig. 33).

### **236. Pitman Arm**

*Note.* The key letters noted in parentheses are in figure 198, except where otherwise indicated.

*a. Removal.*

- (1) Remove the nut and lockwasher that secure the pitman arm to the steering gear (fig. 195).
- (2) Remove the pitman arm from the shaft, using a suitable puller.
- (3) Open the outer dust cover (D) at the pitman arm, remove the cotter pin (H), loosen the plug (A), and remove the

pitman arm. Remove the outer dust cover and pitman arm dust cover (K) from the arm.

*b. Installation.*

- (1) Position the dust covers on the pitman arm (par. 235e(1)). Insert the pitman arm ball in the drag link between the two ball seats. Tighten the plug just enough to hold the pitman arm.
- (2) Install the pitman arm on the pitman arm shaft, aligning the locating marks on the arm and shaft. Turn the steering wheel, if necessary, to align the marks.
- (3) Install a  $\frac{7}{8}$ -inch lockwasher and  $\frac{7}{8}$ -14NF nut on the shaft. Tighten the nut to 140–150 pound-feet torque.
- (4) Tighten the plug (A) at the pitman arm end of the drag link (par. 234b(4)). Secure the dust cover (par. 234e(9)).
- (5) Lubricate the drag link (fig. 33).

## 237. Steering Gear

(fig. 195)

*a. Removal.*

- (1) Remove the steering wheel (par. 233a).
- (2) Remove the four lockwasher screws that secure the steering column cutout access cover to the instrument panel and remove the cover (fig. 146).
- (3) Remove the nuts and lockwashers from the two bolts that secure the steering post clamp and bracket to the instrument panel (fig. 146) and remove the clamp, bracket, and the rubber insulator. Apply a light coating of grease to the jacket and remove the jacket collar (at toe-board).
- (4) Remove the pitman arm (par. 236a).
- (5) Remove the nuts and lockwashers from the three steering gear bolts. Remove the bolts and plain washers from the inner side of the frame and remove the steering gear from the under side of the fender.

*b. Installation.*

- (1) Insert the steering gear up through the opening in the cowl panel from underneath the left front fender. Position the steering gear housing on the frame left side rail, aligning the bolt holes in the housing with those on the frame. Install a  $1\frac{1}{16}$ -inch plain washer on each of the three  $\frac{5}{8}$ -18NF x  $1\frac{7}{8}$  steering gear bolts and install the bolts from the frame side. Install a  $\frac{5}{8}$ -inch lockwasher and  $\frac{5}{8}$ -18NF nut on each steering gear bolt (J, fig. 195), but do not tighten.
- (2) Install the jacket collar over the steering column jacket and position the collar at the toe-board. Install the rubber insulator over the jacket. Position the clamp and clamp



bracket on the instrument panel so there is no binding of the steering gear at the clamp (fig. 146). Install a  $\frac{3}{8}$ -inch lockwasher (fig. 146) and  $\frac{3}{8}$ -24NF nut on each clamp bracket bolt, but do not tighten the nuts.

- (3) Tighten the nuts on the three steering gear bolts to 140-150 pound-feet torque. Tighten nuts on the clamp bracket bolts.
- (4) Position the access cover on the instrument panel and install the four lockwasher screws (fig. 146).
- (5) Install the steering wheel (par. 233b).
- (6) Install the pitman arm (par. 236b).
- (7) Check the lubricant level in the steering gear housing and replenish if necessary (figs. 33 and 34).

## **Section XXIV. PINTLE, LIFTING SHACKLES, AND SPARE WHEEL CARRIER**

### **238. Description**

a. A pintle (fig. 199) is mounted on the frame rear cross member of all models except the ambulance truck M43.

b. All vehicles are equipped with four lifting shackles, two at the front and two at the rear.

c. The hinged-type spare wheel carrier (fig. 200) is mounted at the left side of the ambulance truck M43. The spare wheel for the cargo truck M37 or command truck M42 is carried on a bracket at the front body panel (fig. 5), and that for the telephone maintenance truck V-41 is stowed in a compartment in the body (fig. 7).

d. Organizational maintenance operations include replacement of the pintle, lifting shackles, and the spare wheel carrier (ambulance truck M43 only).

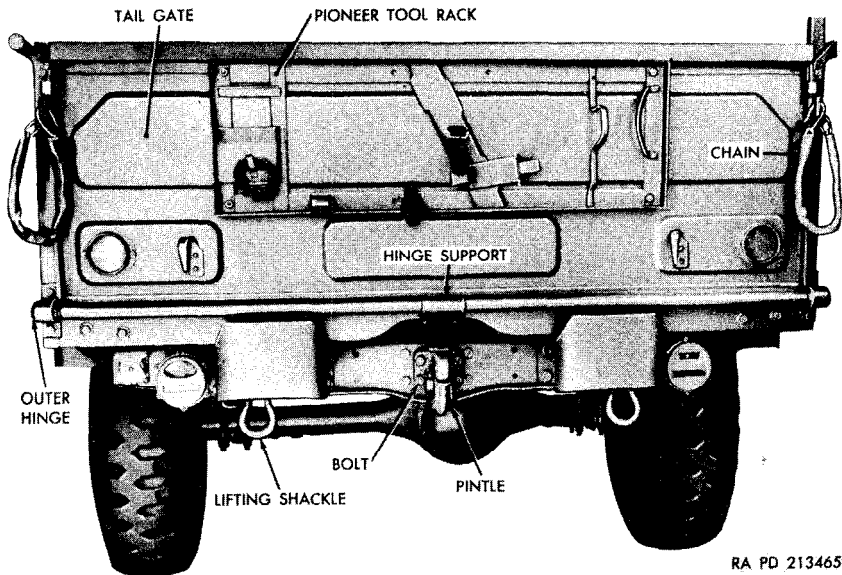
### **239. Pintle**

#### *a. Removal.*

- (1) Remove the cotter pin, slotted nut, and plain washer from the front end of the pintle adapter and remove the pintle and adapter.
- (2) Remove the four nuts, lockwashers, and bolts (fig. 199) that secure the pintle to the adapter and remove the adapter.
- (3) Inspect the lubrication fitting in the adapter flange. If the fitting is damaged, remove it.

#### *b. Installation.*

- (1) If the lubrication fitting was removed from the adapter flange (a(3) above), install a  $\frac{1}{8}$ NPT male lubrication fitting.
- (2) Position the pintle adapter on the pintle, aligning the four bolt holes. Install the four  $\frac{1}{2}$ -20NF x  $1\frac{5}{8}$  adapter bolts (from the pintle side) and install a  $\frac{1}{2}$ -inch lockwasher and



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Figure 199. Tailgate, pintle, and lifting shackles.

- $\frac{1}{2}$ -20NF nut on each bolt. Tighten the nuts evenly.
- (3) Install the adapter through the frame cross member and the adapter flange. Install the adapter washer and the  $1\frac{1}{4}$ -12NF slotted nut on the pintle. Tighten the nut to permit free rotation of the adapter in the flange without end play and install the  $\frac{7}{32}$  x  $2\frac{1}{2}$  cotter pin.
  - (4) Lubricate the pintle (fig. 33).

## 240. Lifting Shackle

*a. Removal.* All lifting shackles are removed and installed in the same manner. Remove the cotter pin and shackle pin that attach the shackle to the shackle bracket and remove the shackle.

*b. Installation.* Position the shackle on the shackle bracket. Install the shackle pin and the  $\frac{5}{32}$  x  $1\frac{1}{4}$  cotter pin.

## 241. Spare Wheel Carrier (Ambulance Truck M43)

*a. Remove Spare Wheel Carrier.*

- (1) Remove the spare wheel locking nut and remove the spare wheel.
- (2) Remove the four nuts and lockwashers (fig. 200) that secure the carrier hinge bracket on the bolts through the cowl left pillar.
- (3) Disengage the lock from the lock bolt and remove the spare wheel carrier.

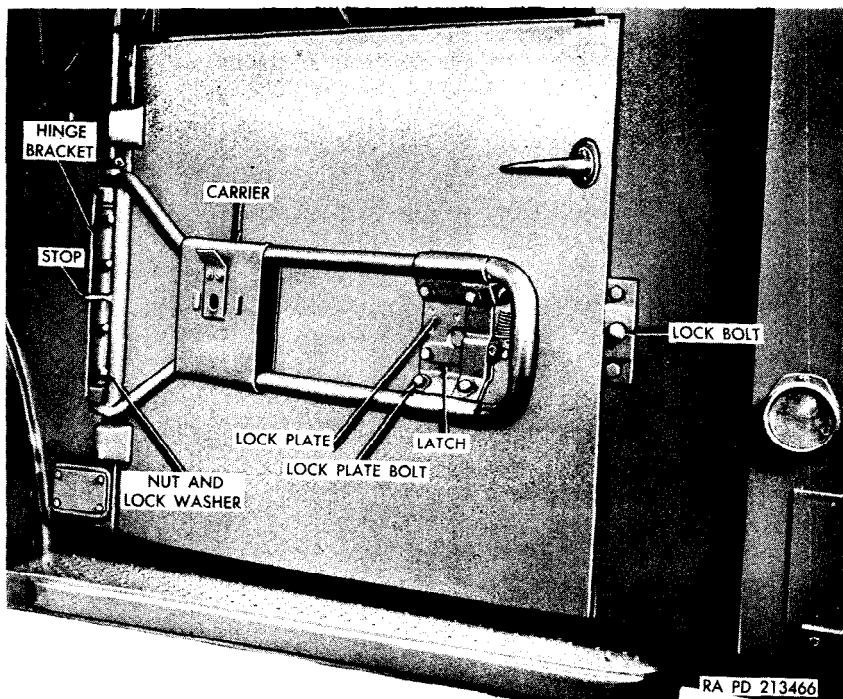


Figure 200. Spare wheel carrier (ambulance truck M43).

*b. Remove Lock Bolt and Related Parts.*

- (1) Remove the nut from the inner end of the lock bolt, disengage the lock bolt spring from the handle and the bracket, and remove the handle and spring (fig. 21).
- (2) Remove the other nut and plain washer from the lock bolt and remove the lock bolt from outside the driver's compartment. Remove the spacer washer from the bolt.

*c. Install Lock Bolt and Related Parts.*

- (1) Install the spacer washer on the lock bolt and install the lock bolt from the outside with the slot down.
- (2) Install a lock bolt nut on the bolt to provide slight end play for the bolt (fig. 21).
- (3) Position the spring over the lock bolt and engage the short end of the spring in the front of the inner bracket. Install the handle on the bolt (pointing toward the rear) wind the spring sufficiently to engage the long end of the spring over the handle (fig. 21).
- (4) Install the other lock bolt nut on the end of the lock bolt and tighten against the handle (fig. 21).

*d. Install Spare Wheel Carrier.*

- (1) Position the spare wheel carrier hinge bracket on the four

bolts in the cowl left pillar and engage the carrier lock with the lock bolt.

- (2) Install a 1/2-inch lockwasher and 1/2-20NF nut on each of the four bolts. Tighten the nuts.
- (3) Operate the spare wheel carrier to check the alinement of the lock plate and lock bolt. If the hole in the lock plate does not aline with the lock bolt, loosen the four lock plate bolts (fig. 200), move the plate forward or back as required and tighten bolts. (The bolt holes are elongated to provide for this adjustment.)
- (4) Mount the spare wheel on the carrier and install the locking nut (fig. 6).

## Section XXV. SPRINGS AND SHOCK ABSORBERS

### 242. Description and Data

#### *a. Description.*

- (1) Semielliptical springs are provided at front and rear of all models. All springs are mounted in shackles at the rear end and in brackets at the front end.
- (2) Front and rear shock absorbers are of the telescoping hydraulic-type.
- (3) Proper maintenance of the springs is very important, since the springs affect the steering geometry of the vehicle. Constant flexing of the springs and repeated shock under severe operating conditions may cause loosening of spring clips (U-bolts) or breakage of center bolts or leaves, resulting in hard steering and excessive tire wear.
- (4) Organizational maintenance operations include tightening spring clip nuts U-bolt, replacement of springs, spring clips, U-bolt shackles, spring bolts, shock absorbers, shock absorber bearing, and bearing retainers. A visual inspection will indicate whether replacement of parts is necessary.

#### *b. Data.*

##### Front springs:

Bearings..... bronze, bushing-type

##### Dimensions:

Front eye to center bolt..... 24 in.

Rear eye to center bolt..... 22 in.

Width..... 2 in.

##### Number of leaves:

All models except telephone maintenance truck V-41..... 7

Telephone maintenance truck V-41..... 8

##### Rear springs:

Bearings..... bronze, bushing-type

##### Dimensions:

Eye to center bolt..... 28 in.

Width..... 2 in.

## Rear Springs—Continued

### Number of leaves:

Cargo truck M37, command truck M42.....	11
Ambulance truck M43, telephone maintenance truck V-41.....	13

### Shock absorbers:

Make.....	Delco, Gabriel, or Monroe
Size.....	2 in.
Type.....	hydraulic, three-stage control

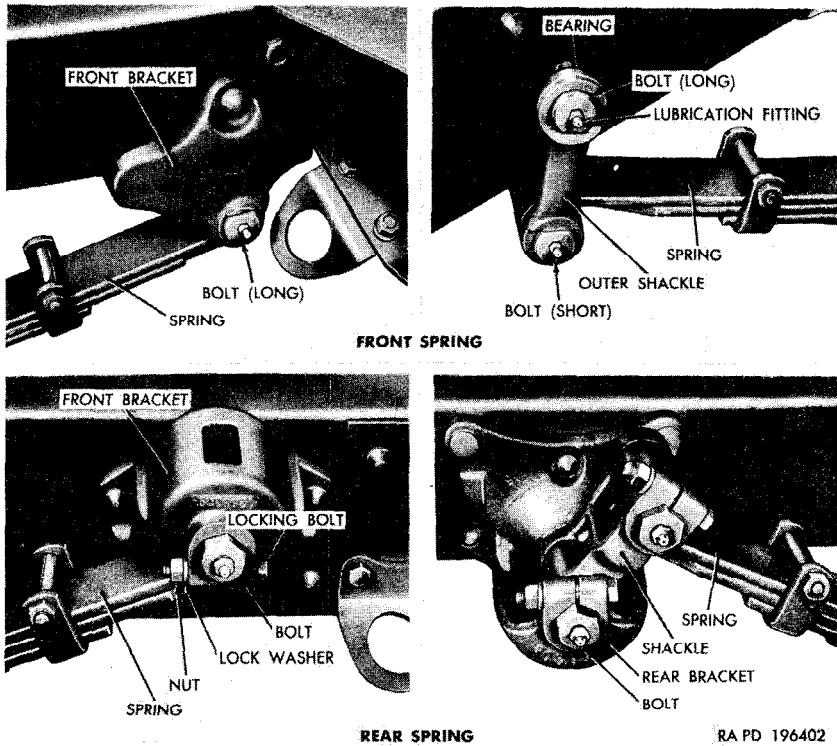
## 243. Front Springs and Related Parts

*a. Removal.* Both front springs are removed and installed in the same manner.

- (1) Place the vehicle on a level floor, apply the hand brake, and block the rear wheels.
- (2) Remove the two nuts and lockwashers from each spring clip (J, fig. 178) (U-bolt).
- (3) Place a jack under the frame side rail just back of the front spring shackle and raise the frame enough to relieve the load on the spring.
- (4) Remove the cotter pin and slotted nut from the spring bolt at the front bracket.
- (5) Remove the lubrication fitting from the front spring bolt (fig. 201). Remove bolt with drift and hammer.
- (6) Remove the bolt that secures the rear end of the spring to the shackles (fig. 201) ((4) and (5) above).
- (7) Support the spring clip (U-bolt) plate with blocking from the under side (left side only) and remove the two spring clips (U-bolts) and the axle bumper. Remove the spring.
- (8) If the spring shackles or the shackle bolt require replacement, remove the shackle bolt ((4) and (5) above) and remove the shackles.

### *b. Inspection.*

- (1) Clean the parts in dry-cleaning solvent or volatile mineral spirits and dry with compressed air.
- (2) Inspect the spring for worn or damaged bearings, weak or broken spring leaves, and loose or broken center bolt. Replace the spring, if necessary.
- (3) Inspect the spring bolt and shackle bolts for wear, damaged threads, or corrosion.
- (4) Inspect the inner and outer shackles for wear, cracks, or distortion.
- (5) Inspect the rear bracket bearing in the frame for wear or damage. Report an excessively worn or damaged bearing to ordnance maintenance personnel.
- (6) Inspect the spring clips (U-bolts) for cracks, distortion, or damaged threads.



**Figure 201. Spring bolts and shackles.**

- (7) Inspect the front axle bumper for cracks or deterioration.
- (8) Replace all parts that are unfit for further service.

*c. Installation.*

*Note.* When installing front springs, be sure to install the correct spring for the vehicle. Refer to data (par. 242b).

- (1) Apply a film of lubricant to all spring bolts to facilitate installation.
- (2) If the shackles were removed (a(8) above), position the outer shackle (fig. 201) over the bearing in the frame side rail with the offset down and toward the frame. Install a long shackle bolt through the shackle and the frame, with the flat side of the bolt head aligned with the locking boss on the shackle. Install the inner shackle on the shackle bolt with the offset down and facing the outer shackle. Install a  $\frac{3}{4}$ -16NC triple slotted nut on the bolt and tighten fingertight.
- (3) Position the spring on the axle with the center bolt head in the recess in the axle housing and the front end in the front bracket (fig. 201). Aline the bolt opening in the spring and bracket and install a long spring bolt, with the flat side of the bolt head aligned with the locking boss on the bracket.

Install a  $\frac{3}{4}$ -16N triple slotted nut on the bolt and tighten fingertight.

- (4) Align the rear end of the spring between the inner and outer shackles and install a short bolt with the flat side of the bolt head aligned with the locking boss on the outer shackle. Install a  $\frac{3}{4}$ -16NC triple-slotted nut on the bolt.
- (5) Tighten the nuts on the spring bolt in the front bracket to 40-50 pound-feet torque. Install a  $\frac{1}{8}$  x  $1\frac{5}{8}$  cotter pin.
- (6) Tighten the nuts on the shackle bolts sufficiently to overcome end play when the spring is checked with a pry bar.

*Note.* Do not tighten the shackle bolt nuts excessively, as it will cause spring breakage.

- (7) Position the front axle bumper on the spring over the center bolt nut with the offset side of the bumper toward the inside and install the two spring clips (J, fig. 178) (U-bolts).

*Note.* Clips for the right front spring are longer than those for the left front spring.

- (8) Lower the frame and remove the jack.
- (9) Install the two  $\frac{9}{16}$ -inch lockwashers and two clip nuts on each clip. Remove the blocking from the clip plate (left spring only). Tighten each spring clip nut to 130-140 pound-feet torque.
- (10) Install a  $\frac{1}{8}$ NPT lubrication fitting in each bolt and lubricate the bolts (fig. 33).
- (11) Remove the blocking from the rear wheels.

## 244. Rear Springs and Related Parts

*a. General.* Two types of rear spring bolts have been used. On early production vehicles, the spring bolts are plain, whereas a groove is provided for the locking bolt on late production vehicles.

*b. Removal.* Both rear springs are removed and installed in the same manner.

- (1) Place the vehicle on a level floor, apply the hand brake, and block the front wheels.
- (2) Remove the two nuts and lockwashers from each of the two spring clips (J, fig. 178) (U-bolts).
- (3) Place a jack under the frame side rail just ahead of the front bracket of the spring to be removed and raise the frame enough to relieve the load on the spring.
- (4) Remove the nuts, lockwashers, and locking bolts that secure the spring bolts in the front bracket and the shackle (fig. 201).
- (5) Remove the lubrication fittings from the two spring bolts. Unscrew and remove the two bolts.
- (6) Support the spring clip plate (fig. 202) from the under

side and remove the two spring clips and the spring clip seat. Remove the spring.

- (7) If the shackle (fig. 201) requires replacement, remove the bolt ((4) and (5) above) and remove the shackle.

*c. Inspection.*

- (1) Inspect the spring for worn or damaged bearings, weak or broken spring leaves, or loose or broken center bolt. Replace the spring, if necessary.
- (2) Inspect all bolts for wear, damaged threads, or corrosion.
- (3) Inspect the shackle for worn or damaged bearings, damaged threads, cracks, or distortion.
- (4) Inspect the spring clips (U-bolts) for cracks, distortion, or damaged threads.
- (5) Replace all parts that are unfit for further service.

*d. Installation.*

*Note.* When installing rear springs, be sure to install the correct spring for the vehicle. Refer to data (par. 242b).

- (1) If the shackle was removed (a(7) above), position the shackle in the rear bracket (fig. 201). Install the spring bolt through the bracket and shackle, and tighten the bolt sufficiently to permit installation of the locking bolt. Install a  $\frac{3}{8}$ -24NF x  $2\frac{1}{2}$  locking bolt in the bracket and a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -24NF nut on the bolt.

*Note.* On early production vehicles, tighten the spring bolts in the frame bracket to 140–160 pound-feet torque.

- (2) Position the spring on the axle with the center bolt head in the recess in the axle housing. Install the clip seat (fig. 202) over the spring and install the two spring clips (U-bolt) over the spring clip (U-bolt) seat and through the holes in the clip plate, being careful not to damage the brake line.
- (3) Aline the front end of the spring with the front bracket (fig. 201) and install the bolt. Tighten the bolt and install the locking bolt ((1) above).
- (4) Aline the rear end of the spring with the spring shackle and install the bolt and locking bolt ((1) above).

*Note.* On early production vehicles, check action of the shackle with a pry bar to make certain that the spring does not bind. Loosen the bolt slightly, if adjustment is too tight.

- (5) Tighten the nuts on the three locking bolts.
- (6) Lower the frame and remove the jack.
- (7) Install two  $\frac{9}{16}$ -inch lockwashers and two spring clip (U-bolt) nuts on each spring clip (U-bolt) (J, fig. 180). Remove the blocking from the spring clip (U-bolt) plate. Tighten each spring clip (U-bolt) nut to 130–140 pound-feet torque.



- (8) Install a  $\frac{1}{8}$ NPT lubrication fitting in each of the three spring bolts and lubricate the bolts (fig. 33).
- (9) Remove the blocking from the front wheels.

## 245. Shock Absorber

*a. General.* All shock absorbers are serviced in the same manner. They are stamped FRONT or REAR to identify their positions.

### *b. Removal.*

- (1) Remove the cotter pin, slotted nut, and bearing retainer that attach each end of the shock absorber to the anchor stud (fig. 202).
- (2) Remove the shock absorber and the four rubber bearings from the anchor studs.

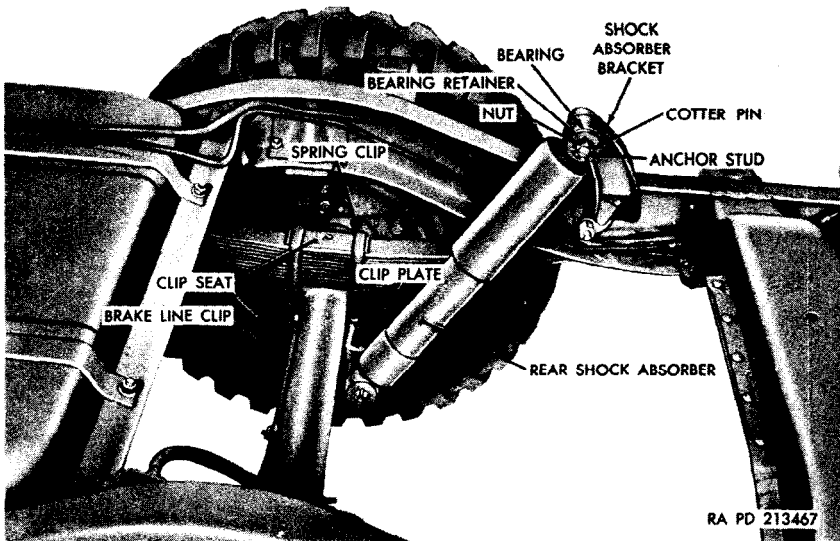


Figure 202. Rear spring and shock absorber.

- (3) If either anchor stud requires replacement, remove the cotter pin and slotted nut that secure the stud to the shock absorber bracket or the spring clip plate, and remove the stud and inner bearing retainer.

### *c. Inspection.*

- (1) Inspect the shock absorber for evidence of leaks, broken or damaged welds at the eyes, or distortion.
- (2) To check the operation of the shock absorber, clamp the lower end in a vise with the absorber in an upright position, operate the shock absorber several full strokes to expel air from the pressure cylinder, and observe the amount of resistance offered when the shock absorber is moved in either

direction. If the shock absorber is operating properly, there will be noticeable resistance to any movement, without lost motion. Rotate the dust shield and observe whether it rotates freely without binding. Binding indicates distortion or damage of internal parts.

- (3) Inspect the rubber bearings for wear, cracks, or deterioration. Inspect the bearing retainers for cracks or distortion.
- (4) Inspect the anchor studs for wear, distortion, or damaged threads. Inspect the nuts for cracks or damaged threads.
- (5) Replace all parts that are unfit for further service.

*d. Installation.* Be sure to install the correct shock absorber (*a* above).

- (1) If the anchor studs and inner retainers were removed (*b* (3) above), install retainers and new studs in the shock absorber bracket and the spring clip plate. Install a  $\frac{3}{4}$ -16NC triple slotted nut on the stud, tighten, and install a  $\frac{5}{32} \times 1\frac{3}{4}$  cotter pin for each stud.
- (2) Place a bearing in each side of each eye of the shock absorber with the small diameter of each bearing toward the eye. Install the shock absorber (large end up) with the bearings on the anchor studs (fig. 202).
- (3) Install a bearing retainer and a  $\frac{3}{4}$ -16NC triple slotted nut on each stud. Tighten the nuts and install a  $\frac{5}{32} \times 1\frac{3}{4}$  cotter pin for each stud.

## **Section XXVI. HOOD, FENDERS, PANELS, SPLASH SHIELDS, AND RUNNING BOARDS**

### **246. Description**

*a.* The welded steel hood is hinged to the cowl. The horn is mounted on a bracket on the under side.

*b.* Two front fenders are provided on all models. Two rear fenders are provided on all models except the ambulance truck M43. Headlights and marker lights are mounted on the front fenders; the liquid container bracket is supported on the right front fender. On the telephone maintenance truck V-41, the spotlight is supported on the left front fender. Two running boards are supported on hangers. A side panel is provided between each front fender and the hood.

*c.* Organizational maintenance operations include replacement of the hood, front fenders, splash shields, hood to fender panels, rear fenders, and running boards, and alinement of the hood and front fenders.

### **247. Hood**

*a. Replace Hood Bumpers* (fig. 17). If the two rubber bumpers in the hood front reinforcement are damaged or deteriorated, remove and

discard the bumpers. Dip the new bumpers in liquid soap and force them into the openings in the reinforcement, using a short piece of  $\frac{1}{8}$ -inch rod inserted in the opening in the bumper. Remove the rod after installing the bumper.

*b. Replace Hood Safety Catch (Vehicles so Equipped) (fig. 17).*

- (1) Open the hood and remove the two lockwasher screws that secure the safety catch to the hood front reinforcement and remove the catch.
- (2) Position a new catch on the reinforcement with the hooked portion toward the front and in alignment with the opening in the radiator upper baffle. Install the two lockwasher screws and tighten.

*c. Replace Hood Windshield Holddown Catches (Except Ambulance Truck M43).* Both windshield holddown catches (fig. 17) are removed in the same manner. Open the hood and remove the two nuts, lockwashers, and screws that secure the catch to the hood and remove the catch. Position the new catch on the hood with the cutout side of the catch toward the front. Install the two  $\frac{1}{4}$ -28NF cross-recess pan head screws,  $\frac{1}{4}$ -inch lockwashers, and  $\frac{1}{4}$ -28NF nuts. Tighten the nuts and close the hood.

*d. Replace Hood Support Bumpers.* The rubber bumper on each hood support (fig. 203) may be replaced without removing the support. Open the hood and remove the bumper from the support. Dip a new bumper in liquid soap and force it onto the support.

*e. Replace Hood Supports.* Both hood supports (fig. 203) are replaced in the same manner.

- (1) Open the hood and remove the nut, lockwasher, and bolt that attach the hood support retainer to the radiator tie rod and remove the support and retainer.
- (2) Position the hood support retainer on the tie rod with the hinge toward the rear, approximately  $11\frac{1}{2}$  inches forward of the tierod bracket on the cowl. Install a  $\frac{1}{4}$ -28NF x  $\frac{7}{8}$  bolt,  $\frac{1}{4}$ -inch lockwasher, and  $\frac{1}{4}$ -28NF nut. Tighten the nut and close the hood.

*f. Remove Hood and Hood Hinges.*

- (1) Open the hood and remove the two bolts and lockwashers that secure the horn to the horn bracket. Place the horn on the engine.
- (2) Close the hood, drive out the two hood hinge pins, and remove the hood.
- (3) Remove the three nuts, lockwashers, plain washers, and bolts that secure each female half hinge on the hood and remove the hinges.
- (4) Remove the three lockwasher screws that secure each male half hinge on the cowl and remove the hinges.

*g. Install Hood and Hood Hinges.*

- (1) Position the female half hinges on the hood, aligning the bolt holes. Install a  $\frac{3}{8}$ -inch flat washer on each of the three  $\frac{3}{8}$ -24NF x  $\frac{3}{4}$  bolts for each half hinge and install the bolts. Install a  $\frac{3}{8}$ -inch internal-external-teeth lockwasher and  $\frac{3}{8}$ -24NF nut on each bolt. Tighten the nuts only fingertight.
- (2) Attach the male half hinges to the female half hinges with the hinge pins, inserting each pin from the inner side of the hinge.
- (3) Position the hood on the vehicle, aligning the screw holes in the male half hinges with those in the cowl. Install the three lockwasher screws for each hinge.
- (4) With the hood in the closed position, check the clearance between the rear edge of the hood and the recess of the cowl. Adjust the position of the hood, as required, to provide a uniform clearance of approximately one-fourth inch at this point and tighten all the hinge screws.
- (5) Position the horn on the horn bracket and install the two  $\frac{1}{4}$ -inch external-teeth lockwashers and  $\frac{1}{4}$ -24NF x 1 bolts. Tighten the bolts.

## **248. Front Fenders and Guards**

*a. Removal.*

- (1) Remove the liquid container and disengage the liquid container strap from the bracket at the right side of the cowl (fig. 203).
- (2) For the telephone maintenance truck V-41, remove the four nuts, lockwashers, and bolts that secure the spot light support to the left front fender (fig. 23).
- (3) Open the hood and secure it in the open position.
- (4) Remove the four lockwasher screws that secure each fender-to-hood panel (fig. 203) and remove the two panels.
- (5) Disengage the cables from the cable clips (fig. 204) on the left front fender, three cables from the clips on the left splash shield, and three cables from the clips on the right splash shield.
- (6) Remove the cable connectors from the connector clips (fig. 204) near the front of each splash shield and separate the four cables at each side. Remove the cable connectors from the connector clips near the rear of the right splash shield but do not separate the cables.
- (7) Remove the horn button cable connector (fig. 204) from the clip on the left splash shield.

- (8) Remove the lockwasher screw (fig. 203) that secures each radiator tie rod to the radiator support.
- (9) Remove the two lockwasher screws (fig. 203) that secure each fender front support to the radiator support.
- (10) Remove the three lockwasher screws (fig. 203) that secure each fender and rear splash shield to the rear support.
- (11) Remove the assembled front fenders and guards, as a unit.

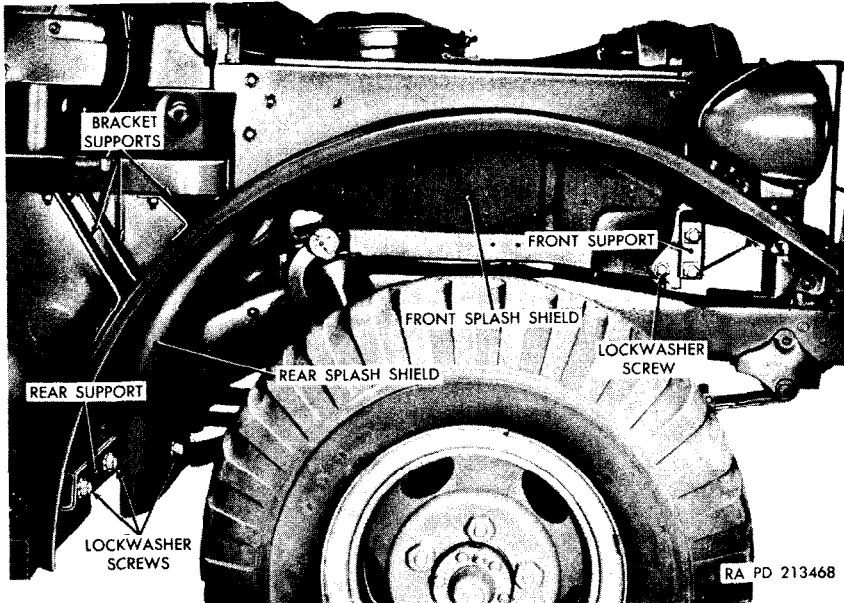
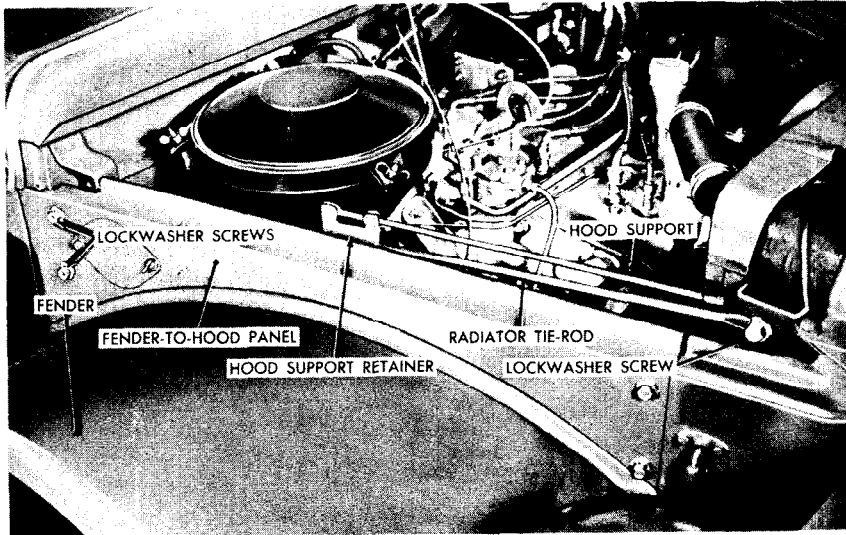
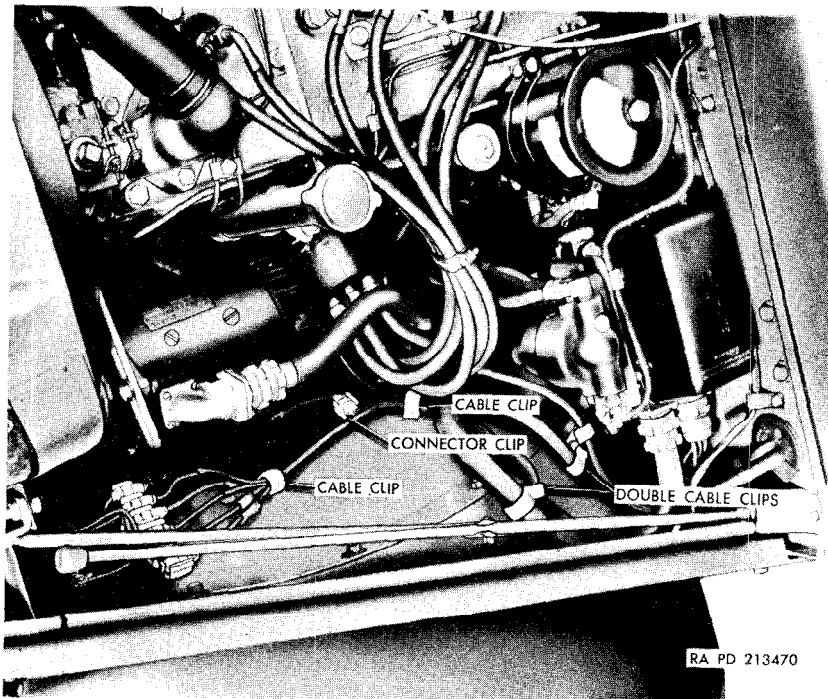
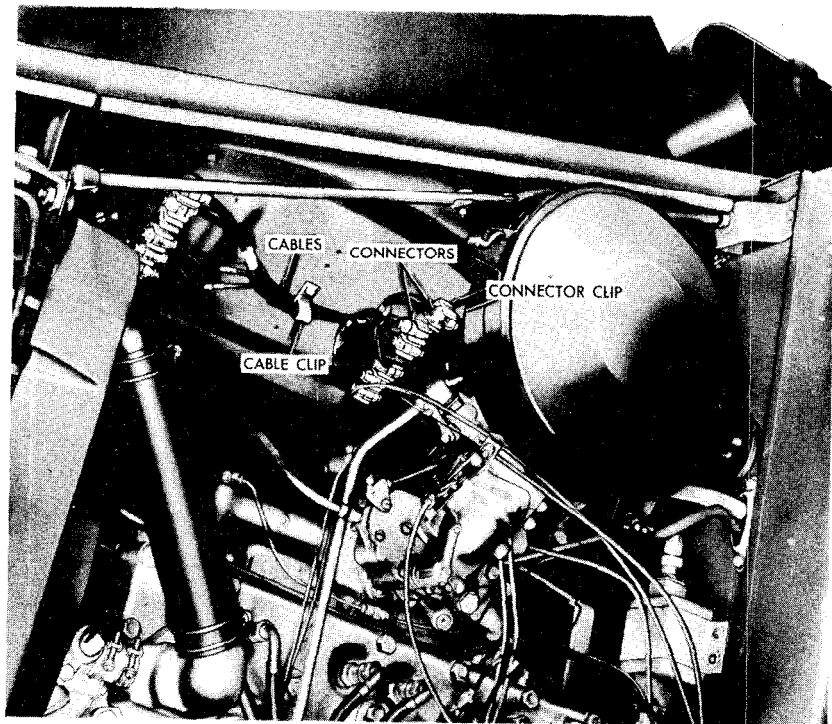


Figure 203. Front fender and panel disconnect points.



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Figure 204. Cable connectors and clips.

### *b. Installation.*

*Note.* Install all attaching parts only fingertight until the fenders are properly aligned.

- (1) Position the assembled front fenders and guards on the vehicle, aligning screw holes in the fender front supports with their respective holes on the radiator support and the fender and rear splash shields with the rear supports.
- (2) Install the three lockwasher screws at each rear support and the two lockwasher screws for each front support (fig. 203).
- (3) Install the lockwasher screw for each radiator tie rod (fig. 203).
- (4) Engage the horn cable connector (fig. 204) in the clip on the left splash shield.
- (5) Engage the cable connectors in the connector clips at the rear of the right splash shield.
- (6) Connect the cables (fig. 204), near the front of each splash shield, matching the numbers on the cables. Engage the cable connectors in the clips.
- (7) Engage the cables in the three cable clips (fig. 204) on the right splash shield, three clips on the left splash shield, and on the left fender.
- (8) Position the two fender-to-hood panels, and install the four lockwasher screws (fig. 203) for each panel.
- (9) Lower the hood and check the alignment of the fenders, panels, and radiator guard side supports with the hood (*c* below).
- (10) For the telephone maintenance truck V-41, position the spot light support (fig. 23) on the left fender and install the four  $\frac{1}{4}$ -20NC x  $\frac{5}{8}$  bolts,  $\frac{1}{4}$ -inch lockwashers, and  $\frac{1}{4}$ -20NC nuts. Tighten the nuts.
- (11) Engage the liquid container strap in the bracket at the cowl, install the liquid container, and secure it with the strap.

*c. Alinement.* Before aligning the fenders, make certain that the hood is correctly positioned on the cowl (par. 247g(3)).

- (1) With the fender attaching parts loosely installed (*b* above), close the hood and observe the position of the hood in relation to the two panels and the radiator guard. There should be a uniform clearance of one-fourth inch between the outer edges of the hood and each fender-to-hood panel, and the front edge of the hood should be flush with the outer edge of the radiator guard.
- (2) To establish correct clearance at the hood and hood-to-fender panels, raise or lower the fenders at the front or rear supports, as necessary. Tighten the lockwasher screws at each fender support and the radiator tie rods.

- (3) If the radiator guard is not flush with the front edge of the hood at all points, loosen both nuts on each radiator tie rod at the brackets on the cowl. Turn the front or rear nuts as required to align the guard. Tighten both nuts after completing the adjustment.
- (4) Check the headlight aiming and adjust, if necessary (par. 170).

## **249. Front Fenders, Panels, and Splash Shields**

*a. General.* Service operations for both front fenders, and splash shields on all models are essentially the same. Unless otherwise noted, instructions in this paragraph apply to both front fenders and related parts for all models.

### *b. Remove Front Fender Panel, and Splash Shields.*

- (1) Remove the four lockwasher screws that secure the fender-to-hood panel (fig. 203) and remove the panel.
- (2) Remove the service headlight and mounting bracket (par. 172b).
- (3) Remove the blackout marker light and bracket (par. 172g).
- (4) For the left front fender, remove the blackout driving light cable from the opening in the fender (par. 172e (4), (5), and (6)). Disengage the cables (fig. 204) from the clips on the fender.
- (5) For the left front fender on the telephone maintenance truck V-41, remove the four nuts, lockwashers, and bolts that secure the spotlight support to the fender (fig. 23).
- (6) For the right front fender (fig. 203), remove the liquid container from the container bracket and disengage the container strap from the bracket at the cowl.
- (7) Remove the two nuts, lockwashers, and lockwasher screws that secure the headlight guard (fig. 139) to the fender.
- (8) Remove the six lockwasher screws that attach the front splash shield (fig. 203) to the fender.
- (9) Remove the two screws and lockwashers that secure the fender to the radiator guard side support (under side of fender).
- (10) Remove the two lockwasher screws (fig. 203) that attach the front support to the radiator support.
- (11) Remove the three lockwasher screws that secure the fender and rear splash shield to the rear support (fig. 203).
- (12) Remove the fender with attached rear splash shield.
- (13) If the front splash shield is to be replaced, disengage the cables from the clips (fig. 205) and the connector clips on the splash shield (par. 248a (5), (6), and (7)). Remove the lockwasher screw that attaches the radiator guard side sup-



port to the splash shield (fig. 203), and remove the front splash shield.

*c. Strip Front Fender and Front Splash Shield.*

- (1) Remove the three nuts, lockwashers, screws, and plain washers that secure the fender to the front support (fig. 203), and remove the support.
- (2) Remove the three lockwasher screws that secure the rear splash shield (fig. 203) to the fender, and remove the splash shield.
- (3) For the left front fender, remove the screws that secure the two double cable clips (fig. 204), and remove the clips.
- (4) For the right front fender, remove the six nuts, lockwashers, and bolts that secure the liquid container bracket supports (fig. 203) to the fender, and remove the bracket and supports.
- (5) Remove the cable clips and cable connector clip plates from the front splash shield (par. 250*d*).

*d. Inspection.*

- (1) Inspect the fender-to-hood panel for cracks, distortion, or damaged or deteriorated filler. If only the filler requires replacement, cut or remove the seven rivets that secure the filler to the panel, and remove and discard the filler.
- (2) Inspect the fender for cracks, distortion, loose or damaged weld nuts, or corrosion. Inspect the filler for damage or deterioration. If only the filler requires replacement, cut or remove the five rivets that secure the filler, and remove and discard the filler.
- (3) Inspect the front and rear splash shields for distortion, cracks, or corrosion.
- (4) Inspect the fender front support for distortion, broken welds, or cracks.
- (5) For the right front fender, inspect the liquid container bracket, strap, and bracket supports for damage or wear.
- (6) Replace all parts that are unfit for further service.

*e. Install Parts on Front Fender, Panel, and Front Splash Shield.*

- (1) If the fender-to-cowl panel filler was removed from the fender (*c*(2) above), install a new filler, securing it with five  $\frac{5}{64} \times \frac{7}{16}$  oval-head brass split rivets.
- (2) If the fender-to-hood panel filler was removed from the panel (*c*(1) above), install a new filler, securing it with seven rivets of the size and type described in (1) above.
- (3) Assemble the front splash shield (par. 250*e*).
- (4) For the right front fender, position the liquid container bracket supports on the fender (fig. 203) and install the six

- $\frac{3}{8}$ -24NF x 1 bolts,  $\frac{3}{8}$ -inch internal-external-teeth lockwashers, and  $\frac{3}{8}$ -24NF nuts. Tighten the nuts.
- (5) For the left fender, position the two open type double cable clips (fig. 204) on the fender and install a  $\frac{1}{4}$ -20NC x  $\frac{5}{8}$  tapping screw for each clip.
  - (6) Position the rear splash shield on the fender (fig. 203) and install the three lockwasher screws. Tighten the screws.
  - (7) Position the front support on the fender, aligning the screw holes. Install a  $\frac{7}{16}$ -inch plain washer on each of the three  $\frac{7}{16}$ -20NF x 1 cap screws and install the screws from the fender side. Install a  $\frac{7}{16}$ -inch lock washer and  $\frac{7}{16}$ -20NF nut on each screw and tighten.

*f. Install Front Fender, Panel, and Front Splash Shield.*

*Note.* Do not tighten any fender attaching parts until all have been installed and the fender properly aligned.

- (1) If the front splash shield was removed (*b*(13) above), position the splash shield at the inner side of the radiator guard side support, aligning the screw holes and install the lockwasher screw (fig. 203). Engage the cables in the cable clips and the cable connectors in the connector clips (par. 248*b*(8)).
- (2) Position the fender on the vehicle, aligning the screw holes in the front support with those in the radiator support, and install the two lockwasher screws. Aline the screw holes in the rear of the fender and the rear splash shield with those in the rear support, and install the three lockwasher screws (fig. 203).
- (3) Install the two  $\frac{3}{8}$ -inch internal-external-teeth lockwashers and  $\frac{3}{8}$ -24NF x  $\frac{3}{4}$  screws to secure the fender to the radiator guard side support (under side of fender).
- (4) Install the six lockwasher screws to secure the front splash shield (fig. 203) to the fender.
- (5) Aline the screw holes in the headlight guard with those in the fender and install the two  $\frac{3}{8}$ -24NF x  $\frac{7}{8}$  lockwasher screws,  $\frac{3}{8}$ -inch lockwashers, and  $\frac{3}{8}$ -24NF nuts (fig. 139).
- (6) Position the hood-to-fender panel and install the four lockwasher screws (fig. 203).
- (7) Check the alinement of the fender with the hood and adjust, if necessary (par. 248*c*). Tighten all screws.
- (8) For the right front fender, install the liquid container in the container bracket and secure it with the container strap.
- (9) For the left front fender of the telephone maintenance Truck V-41, position the spotlight support on the fender (fig. 23) and install the four  $\frac{1}{4}$ -20NC x  $\frac{5}{8}$  bolts,  $\frac{1}{4}$ -inch lockwashers, and  $\frac{1}{4}$ -20NC nuts. Tighten the nuts.

- (10) For the left front fender, engage the cables in the cable clips (fig. 204) and install the blackout driving light cable (par. 172f(3) through (6)).
- (11) Install the blackout marker light and bracket (par. 172h).
- (12) Install the service headlight and mounting bracket (par. 172d).

## 250. Front Fender Front and Rear Splash Shields

*a. General.* The front fender front splash shields (fig. 203) may be removed and installed without removing the front fenders. Removal and installation procedures for left and right shields are similar but not identical, because of the difference in the two shields. The left and right rear splash shields are serviced in the same manner.

### *b. Remove Right Fender Front Splash Shield.*

- (1) Remove the carburetor air cleaner (par. 133c).
- (2) Disengage the cable connectors from the connector clips and the cables from the three cable clips (fig. 204).
- (3) Remove the screw that secures the headlight ground cable to the splash shield.
- (4) Remove the six lockwasher screws that secure the splash shield to the fender (fig. 203).
- (5) Remove the lockwasher screw that secures the radiator guard side support to the splash shield (fig. 203) and work the splash shield up through the engine compartment.

*c. Remove Left Fender Front Splash Shield.* Removal of the left fender front splash shield is accomplished as described in *b* above, with the exceptions listed in (1) through (4) below.

- (1) Omit *b*(1) above.
- (2) In performing *b*(3) above detach the two ground cables secured by the screw.
- (3) Remove the horn cable connector (fig. 204) from the connector clip.
- (4) In performing *b*(5), above, after removing the lockwasher screw, raise the splash shield at the steering gear cutout and work it out toward the front and down to clear the drag links.

### *d. Disassemble Front Splash Shield (fig. 205).*

- (1) Remove the screws that secure the cable connector clips and clip plates, and remove the clips and plates.
- (2) Remove the screws that secure the three cable clips, and remove the clips.

### *e. Assemble Front Splash Shield (fig. 205).*

- (1) Position the three cable clips on the splash shield and install the  $\frac{1}{4}$ -20NC x  $\frac{5}{8}$  tapping screw for each clip.

- (2) Position the cable connector clip plates on the splash shield and install the two No. 8 x  $\frac{3}{8}$  pan-head tapping screws for each plate.

*Note.* The right splash shield for the ambulance truck M43 has a clip plate near the center (fig. 205). This plate is not required on other models.

- (3) For the left splash shield, position the horn cable connector clip on the splash shield and install the No. 8 x  $\frac{3}{8}$  pan-head tapping screw. For the right splash shield, position the single connector clip and install the  $\frac{1}{4}$ -20NC x  $\frac{5}{8}$  tapping screw.
- (4) Tighten all screws.

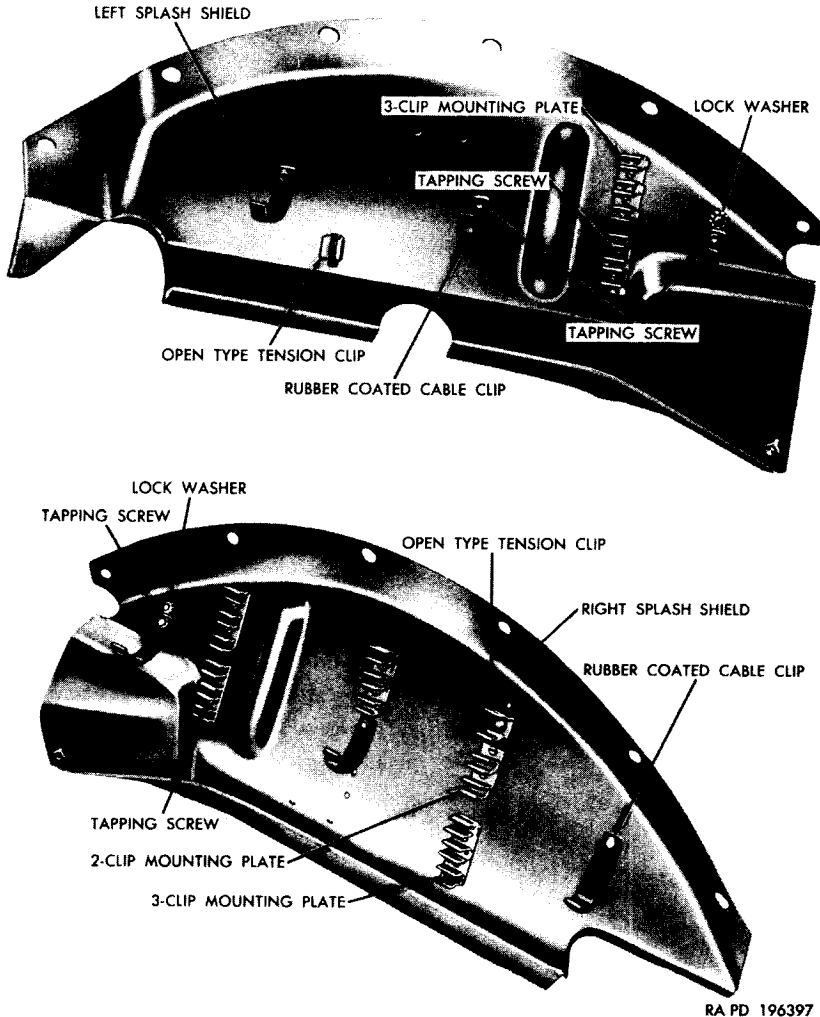


Figure 205. Left and right front splash shields.

*f. Install Right Front Fender Splash Shield.*

- (1) Position the right front fender splash shield (fig. 203) with the front end at the inner side of the radiator guard side support and install the lockwasher screw finger tight.
- (2) Aline the splash shield with the fender (fig. 203), and install the six lockwasher screws. Tighten all screws.
- (3) Aline the ground cable terminal with the screw hole in the splash shield and install a  $\frac{1}{4}$ -inch internal-external-teeth lockwasher and  $\frac{1}{4}$ -20NC x  $\frac{5}{8}$  tapping screw.
- (4) Engage the cable connectors in the connector clips and the cables in the cable clips (fig. 204).
- (5) Install the carburetor air cleaner (par. 133e).

*g. Install Left Front Fender Splash Shield.* Procedure for installing the left front fender splash shield is the same as *f* above, with the exceptions in (1), (2), and (3) below.

- (1) Engage the horn cable connector in the connector clip (fig. 204).
- (2) When performing *f* (3) above, attach both ground cable terminals.
- (3) Omit *f* (5) above.

*h. Remove Front Fender Rear Splash Shield* (fig. 203). Both front fender rear splash shields are removed in the same manner. Remove the four lockwasher screws that secure the splash shield to the fender and rear support and remove the splash shield.

*i. Install Front Fender Rear Splash Shield* (fig. 203). Position the splash shield on the fender and rear support, alining the screw holes, and install the four lockwasher screws. Tighten the screws.

## **251. Rear Fenders**

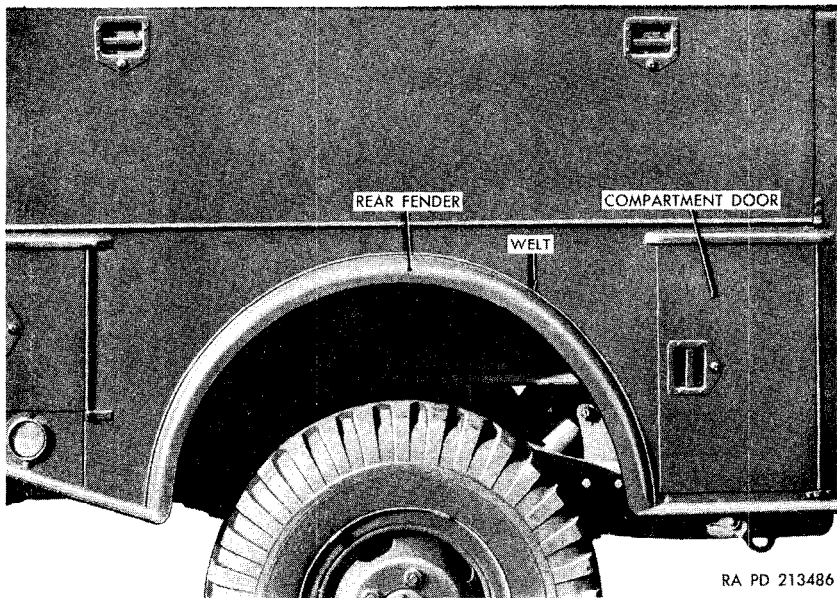
*a. General.* Rear fenders for the cargo truck M37 or command truck M42 are similar to those for the telephone maintenance truck V-41, but are not interchangeable. The body of the ambulance truck M43 fits over the rear wheels and no rear fenders are required.

*b. Replacement (Cargo Truck M37 or Command Truck M42* (fig. 112). Both rear fenders are serviced in the same manner.

- (1) Remove the eight lockwasher screws that secure the fender to the wheel housing, and remove the fender and the welt.
- (2) Place the welt on the fender with the cutouts alined with the screw holes, and position the fender and welt in the wheel housing, alining the screw holes in the fender with those in the housing. Install the eight lockwasher screws fingertight.
- (3) Aline the welt so that it is flush with each end of the fender and the bead fits snugly against the body. Tighten the eight lockwasher screws.

*c. Replacement (Telephone Maintenance Truck V-41) (fig. 206).*

- (1) Remove the four nuts, lockwashers, and bolts that secure the rear end of the fender and two nuts, lockwashers, and bolts that secure the front end. The two nuts and lockwashers at the front end are accessible from the compartment just forward of the rear fender.
- (2) Remove the 20 screws and lockwashers that secure the fender to the wheel housing and remove the fender and the welt.
- (3) Place a new welt on the fender and position the fender in the wheel housing, aligning the screw holes in the fender with those in the housing. Install twenty  $\frac{1}{4}$ -inch external-teeth lockwashers and No. 14 x  $\frac{1}{2}$  pan-head gimlet point sheet metal tapping screws.



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*Figure 206. Rear fender (telephone maintenance truck V-41).*

- (4) Install four No. 10-24NC x 1 roundhead bolts through the openings at the rear end of the fender, and two of the same type bolts through the openings at the front end. Install a No. 10 lockwasher and No. 10-24NC nut on each of the six bolts, installing the lockwashers and nuts for the front bolts from inside the compartment just forward of the fender.
- (5) Position the welt so it is flush with each end of the fender and the bead fits snugly against the body. Tighten the 20 screws and the nuts on the six bolts.

## 252. Running Board

*a. Removal.* Both running boards are serviced in the same manner, but are not interchangeable. Remove the two nuts, lockwashers, and step bolts that secure the running board to each running board hanger (fig. 116), and remove the running board.

*b. Installation.*

- (1) Install a  $\frac{5}{16}$ -18NC x  $\frac{3}{4}$  step bolt in each of the four step bolt holes in the running board.

*Note.* The right running board has four bolt holes at the front and four at the rear. Use the rear pair of each group.

- (2) Position the running board on the two hangers with the four step bolts extending through the hangers. Install a  $\frac{5}{16}$ -inch internal-external-teeth lockwasher and a  $\frac{5}{16}$ -18NC nut on each step bolt.
- (3) Aline the running board so the outer edge is in line with the outer edge of the front fender, and tighten the four nuts.

## Section XXVII. BUMPERS AND GUARDS

### 253. Description

*a.* Vehicles equipped with a winch are provided with left and right front bumpers, while those without a winch have one full-length front bumper. All vehicles are provided with left and right rear bumpers. Radiator and headlight guards are provided on all models. Vehicles without a winch are provided with a radiator guard extension.

*b.* Organizational maintenance operations include replacement of bumpers and related parts, guards, and radiator guard side supports.

### 254. Front Bumpers

*a. Removal (Vehicle with Winch)* (fig. 207). Both front bumpers and related parts are serviced in the same manner, but are not interchangeable.

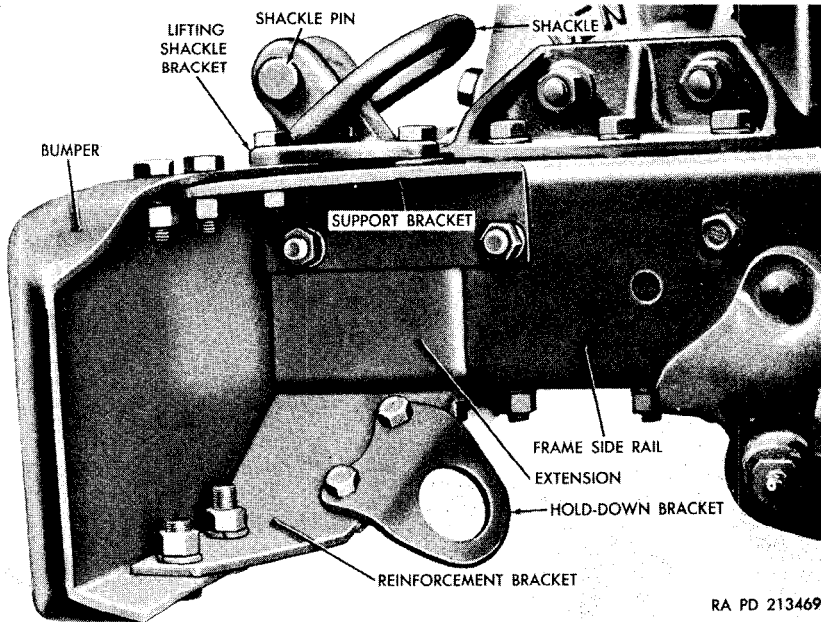
- (1) Remove the two bolts and lockwashers that secure the winch-to-bumper bracket (fig. 152).
- (2) Remove the two nuts, lockwashers, and bolts that secure the front of the lifting shackle bracket to the bumper.
- (3) Remove the two nuts, lockwashers, and bolts that secure the bumper to the support bracket.
- (4) Remove the four nuts, lockwashers, and bolts that secure the bumper to the reinforcement bracket and remove the bumper.
- (5) Remove the two nuts, lockwashers, and bolts that secure the support bracket to the frame side rail and extension, and remove the support bracket.
- (6) Remove the two nuts, lockwashers, and bolts that secure the reinforcement bracket to the extension and remove the bracket

and attached holddown bracket. Remove the two nuts, lockwashers, and bolts that secure the holddown bracket to the reinforcement bracket and remove the holddown bracket.

*b. Installation (Vehicle with Winch) (fig. 207).*

- (1) Position the holddown bracket on the reinforcement bracket and install the two  $\frac{7}{16}$ -20NF x  $1\frac{1}{8}$  bolts,  $\frac{7}{16}$ -inch lockwashers, and  $\frac{7}{16}$ -20NF nuts. Tighten the nuts.

*Note.* When installing the bumper brackets and bumper, do not tighten any of the attaching parts until all have been installed and the parts properly aligned.



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*Figure 207. Front bumper and related parts.*

- (2) Position the reinforcement bracket on the extension and install two  $\frac{1}{2}$ -20NF x  $1\frac{1}{4}$  bolts from the upper side of the extension. Install a  $\frac{1}{2}$ -inch lockwasher and  $\frac{1}{2}$ -20 NF nut on each bolt.
- (3) Position the support bracket on the frame side rail and extension and install two  $\frac{1}{2}$ -20NF x  $1\frac{1}{4}$  bolts from the inner side of the rail. Install a  $\frac{1}{2}$ -inch lockwasher and  $\frac{1}{2}$ -20NF nut on each bolt.
- (4) Position the bumper over the support and reinforcement brackets and under the shackle bracket, aligning the bolt holes in the bumper with those in the brackets. Install four  $\frac{1}{2}$ -20NF x  $1\frac{1}{4}$  bolts up through the bumper and the reinforcement bracket and two identical bolts down through the



bumper and the support bracket. Install a  $\frac{1}{2}$ -inch lockwasher and  $\frac{1}{2}$ -20NF nut on each bolt.

- (5) Install two  $\frac{1}{2}$ -20NF x  $1\frac{1}{2}$  bolts through the front holes in the lifting shackle bracket, and install a  $\frac{1}{2}$ -inch lockwasher and  $\frac{1}{2}$ -20NF nut on each bolt.
- (6) Install a  $\frac{1}{2}$ -inch lockwasher on each of two  $\frac{1}{2}$ -20NF x 1 bolts and install the bolts through the winch-to-bumper bracket (fig. 152).
- (7) Tighten all nuts and bolts evenly.

*c. Replacement (Vehicle without Winch).* Procedure for replacement of the front bumper on vehicles without a winch is similar to *a* and *b* above. Perform the operations at both sides of the vehicle, disregarding references to the winch-to-bumper bracket and frame side rail extensions.

## 255. Rear Bumpers

*a. Removal.* Both rear bumpers are serviced in the same manner, but are not interchangeable.

- (1) Remove the two nuts, lockwashers, and bolts that secure the rear lifting shackle bracket and the bumper to the frame side rail. Remove the lifting shackle bracket and shackle.
- (2) Remove the harness guard from the taillight bracket (par. 172i(2)) and remove the two nuts, lockwashers, and bolts that secure the taillight bracket and the bumper to the frame side rail (fig. 145).
- (3) Remove the two nuts, lockwashers, and bolts that secure the bumper to the frame rear cross member (fig. 145) and remove the bumper.

### *b. Installation.*

*Note.* When installing the rear bumper, do not tighten any of the attaching parts until all have been installed.

- (1) Position the bumper on the frame rear cross member, aligning the bolt holes in the bumper with those in the cross member and frame side rail (fig. 145). Install two  $\frac{5}{8}$ -18NF x 2 bolts through the bumper and rear cross member. Install a  $\frac{5}{8}$ -inch lockwasher and  $\frac{5}{8}$ -18NF nut on each bolt.
- (2) Position the taillight mounting bracket on the bumper at the frame side rail, aligning the bolt holes, and install two  $\frac{5}{8}$ -18NF x 2 bolts through the bracket, bumper and side rail (fig. 145) from the bracket side. Install a  $\frac{5}{8}$ -inch lockwasher and  $\frac{5}{8}$ -18NF nut on each bolt.
- (3) Install two  $\frac{1}{2}$ -20NF x  $1\frac{3}{4}$  bolts through the rear bolt holes at the side of the bumper and the side rail. Position the

lifting shackle bracket (fig. 145) on the two bolts and install a  $\frac{1}{2}$ -inch lockwasher and  $\frac{1}{2}$ -20NF nut on each bolt.

- (4) Tighten all nuts.
- (5) Install the harness guard on the taillight bracket (par. 172j(5)).

## 256. Headlight and Radiator Guards

*a. Replace Headlight Guard* (fig. 139). Both headlight guards are serviced in the same manner.

- (1) Remove the two nuts, lockwashers, bolts, and other lockwashers that secure the guard to the fender.
- (2) Remove the three nuts, lockwashers, and bolts that secure the guard to the radiator guard and guard side support, and remove the headlight guard.
- (3) Position the new guard on the fender, alining the bolt holes in the guard with those in the fender, radiator guard, and side support. Install a  $\frac{3}{8}$ -24NF x  $1\frac{1}{8}$  bolt through each of the three bolt holes in the headlight guard, side support, radiator guard, and guard extension (vehicles without a winch) from the outer side. For vehicles with a winch, install a  $\frac{3}{8}$ -24NF x 1 bolt in the lower bolt hole. Install a  $\frac{3}{8}$ -inch, internal-external-teeth, dished lockwasher and  $\frac{3}{8}$ -24NF nut on each bolt.

*Note.* Do not tighten the nuts on any of the bolts until all have been installed.

- (4) Install a  $\frac{3}{8}$ -inch, internal-external-teeth lockwasher on each of two  $\frac{3}{8}$ -24NF x  $1\frac{1}{4}$  bolts and install the two bolts through the guard and fender. Install a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -24NF nut on each bolt.
- (5) Tighten all nuts.

*b. Replace Radiator Guard and Guard Extension.*

*Note.* Instructions cover removal and installation of the radiator guard and guard extension. For vehicles with a winch, disregard the operations pertaining to the extension.

- (1) Remove the three nuts, lockwashers, and bolts that secure each headlight guard (fig. 139) to the radiator guard and guard extension.
- (2) Remove the four nuts, lockwashers, and bolts that secure the radiator guard to the radiator upper baffle (fig. 208), and remove the guard and attached extension.
- (3) Remove the two nuts, lockwashers, and bolts that secure the extension to the guard, and remove the extension.
- (4) Position the guard extension on the guard and install the two  $\frac{3}{8}$ -24NF x 1 bolts,  $\frac{3}{8}$ -inch, internal-external-teeth dished lockwashers and  $\frac{3}{8}$ -24NF nuts. Tighten the nuts.

- (5) Position the guard on the radiator upper baffle (fig. 208), aligning the bolt holes in the guard with those in the radiator baffle and the guard side supports. Install four  $\frac{3}{8}$ -24NF x  $\frac{7}{8}$  bolts from the upper side of the guard and install a  $\frac{3}{8}$ -inch internal-external-teeth, dished lockwasher and  $\frac{3}{8}$ -24NF nut on each bolt.

*Note.* Do not tighten any of the nuts on the attaching bolts until all have been installed.

- (6) Install the bolts, nuts, and lockwashers to secure each headlight guard to the radiator guard (fig. 139) and extension (a(3) above).
- (7) Tighten all nuts.

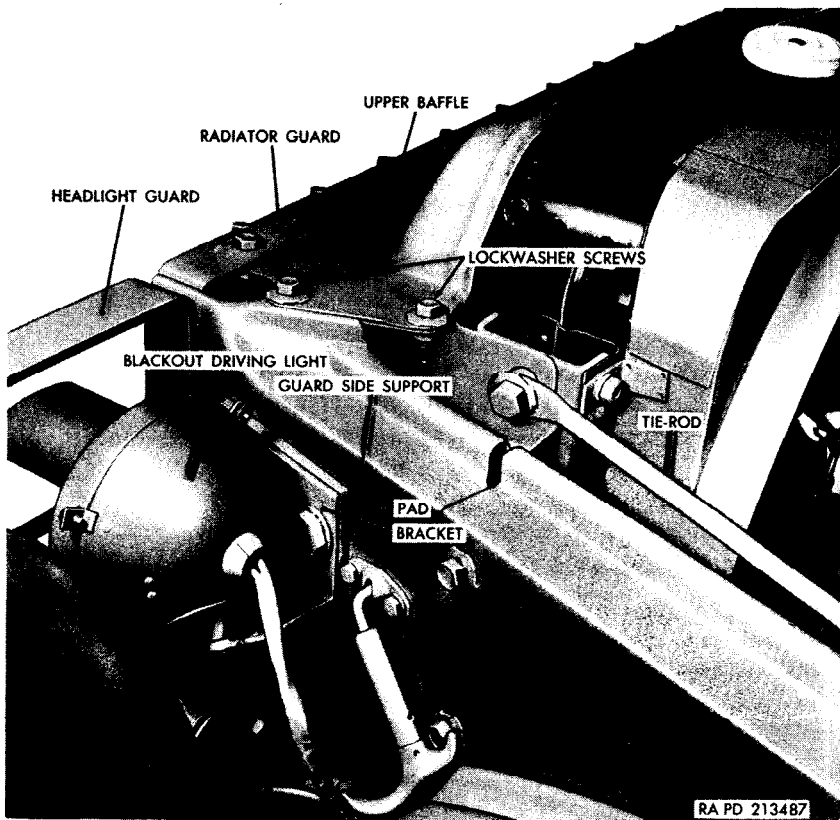


Figure 208. Radiator guard, guard side support, and upper baffle.

## 257. Radiator Guard Side Supports

*a. General.* Replacement procedure is the same for both left and right radiator guard side supports, with one exception. The blackout driving light is attached to the left side support and must be removed

before removing the support. Instructions described in *b* through *e* below cover the removal and installation of the left side support. When servicing the right side support, disregard operations pertaining to the blackout driving light.

*b. Remove Radiator Guard Left Side Support.*

- (1) Secure the hood in the fully open position.
- (2) Remove the four lockwasher screws that secure the fender-to-hood panel and remove the panel (fig. 203).
- (3) Remove the lockwasher screw that secures the radiator left tie rod to the radiator support (fig. 208).
- (4) Remove the four nuts, lockwashers, and bolts that secure the radiator guard to the radiator upper baffle and the two lockwasher screws that secure each end of the baffle to the side support and remove the baffle (fig. 208).
- (5) Remove the headlight guard (par. 256c(1) and (2)).
- (6) Remove the two bracket screws and lockwashers that secure the blackout headlight mounting bracket and pad to the side support. Place the light on the fender and remove the pad.
- (7) Disengage the headlight wiring harness from the cable clip at the inner side of the support.
- (8) Remove the two lockwasher screws that secure the fender front support and radiator guard side support to the radiator support (fig. 203).
- (9) Remove the lockwasher screw that secures the side support to the fender front splash shield (fig. 203).
- (10) Remove the two lockwasher screws that secure the front fender to the side support at the underside of the fender, and remove the guard.

*c. Strip Radiator Guard Side Support (fig. 209).*

- (1) Remove the two screws and lockwashers that secure the hood panel lock, and remove the lock.
- (2) Remove the screw that secures the cable clip, and remove the clip.

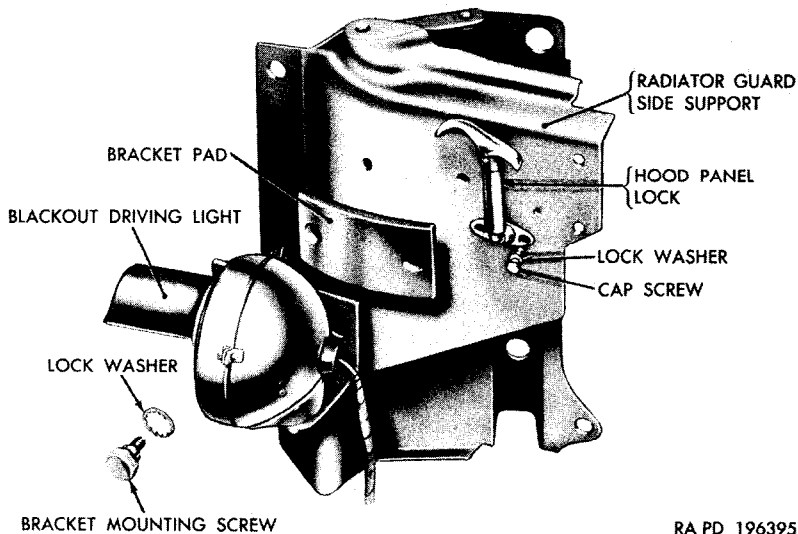
*d. Install Parts on Radiator Guard Side Support (fig. 209).*

- (1) Position the rubber coated open-type cable clip on the support and install the  $\frac{1}{4}$ -20NC x  $\frac{5}{8}$  tapered point tapping screw. Tighten the screw.
- (2) Position the hood panel lock on the support and install the two  $\frac{1}{4}$ -inch lockwashers and  $\frac{1}{4}$ -28NF x 1 cap screws. Tighten the two screws.

*e. Install Radiator Guard Left Side Support.*

*Note.* When installing the radiator guard side support, do not tighten any of the attaching parts until all have been installed.

- (1) Position the side support on the vehicle, aligning the screw holes in the support with corresponding holes in the fender,



*Figure 209. Radiator guard left side support removed.*

fender support, and radiator support. Install the lockwasher screw that secures the support to the fender front splash shield (fig. 203).

- (2) Install the two lockwasher screws that attach the fender to the support from the underside of the fender.
- (3) Install the two lockwasher screws that secure the fender front support and the radiator guard side support to the radiator support (fig. 203).
- (4) Engage the headlight wiring harness in the cable clip on the support.
- (5) For the left side support, position the bracket pad and blackout headlight bracket with light on the support, and install the two  $\frac{3}{8}$ -inch, internal-teeth lockwashers and two screws. Tighten the screws.
- (6) Install the headlight guard (par. 256a(3) and (4)).
- (7) Position the radiator upper baffle with the front edge under the radiator guard and the ends over the two side supports. Install the two lockwasher screws that secure each end of the baffle to the side support. Install the four  $\frac{3}{8}$ -24NF x  $\frac{7}{8}$  bolts,  $\frac{3}{8}$ -inch internal-external-teeth, dished lockwashers, and  $\frac{3}{8}$ -24NF nuts to secure the baffle to the guard (fig. 208).
- (8) Position the radiator tie-rod on the radiator support and install the lockwasher screw (fig. 208).
- (9) Position the fender-to-hood panel and install the four lockwasher screws (fig. 203).

- (10) Check the alinement of the fender, hood, panel, and side support (par. 247c) and tighten all attaching parts evenly.

## Section XXVIII. CAB AND BODIES

### 258. Description

*a. Cab.* A steel cab with removable top cover is used for the cargo truck M37, command truck M42, and telephone maintenance truck V-41. Organizational maintenance operations include adjustment of the doors and door glass and replacement of doors, door glass, windshield, toe-boards, seat cushions and seat back cushions, top cover, rear view mirror, liquid container strap and chape, various weather seals, and cab holddown bolts and springs.

*b. Body (Cargo Truck M37, Command Truck M42, and Telephone Maintenance Truck V-41).* Organizational maintenance operations include replacement of body holddown bolts, reflectors, and canvas items for all three models and replacement of roof bows, ridge pole, safety strap, pioneer tool rack, tailgate, and tool compartment door handles for the cargo truck M37 or command truck M42.

*c. Body (ambulance truck M43).* Organizational maintenance operations for the ambulance truck M43 include adjustment of the driver's compartment door and door glass, and the patient's compartment rear door; and replacement of body holddown bolts, litter stowage, holddown, and safety straps, blackout curtains, ventilator blower motors and switches, rear door hinges, the personnel heater and related parts, various weatherseals in the driver's compartment, toe-boards, and cushions for the driver's and attendant's seats and seat backs. Items in the driver's compartment which are identical to corresponding parts in the cab (*a* above) are serviced in the same manner.

### 259. Cab and Body Holddown Bolts and Related Parts

*a. General.* If any of the cab or body holddown bolts or related parts are lost or damaged, they must be replaced.

*b. Replacement.* Remove broken or damaged parts and install new parts as required. Figure 210 shows holddown bolts and related parts for the cab. Figure 211 shows body holddown bolts and related parts for the cargo truck M37 or command truck M42. Figure 212 shows body holddown bolts and related parts for the ambulance truck M43 and figure 213 shows body holddown bolts and related parts for the telephone maintenance truck V-41. Refer to the correct illustration for the parts to be replaced and the sequence of removal and installation. Tighten all parts.

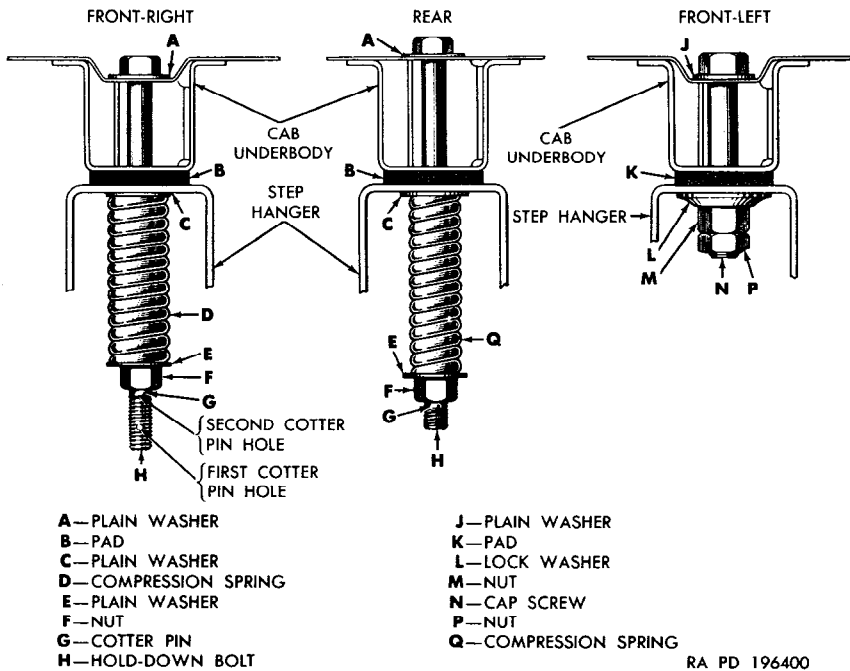


Figure 210. Cab holddown bolts and related parts.

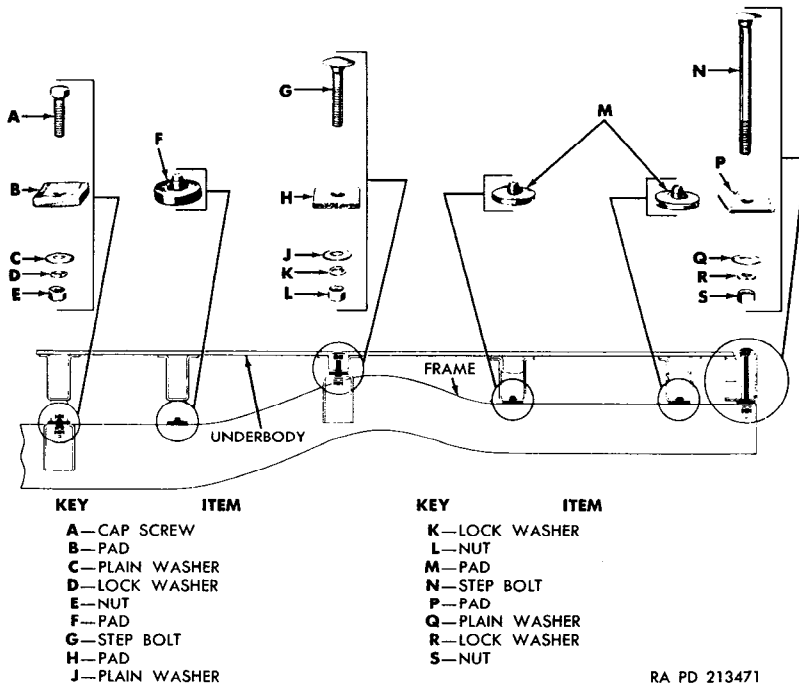
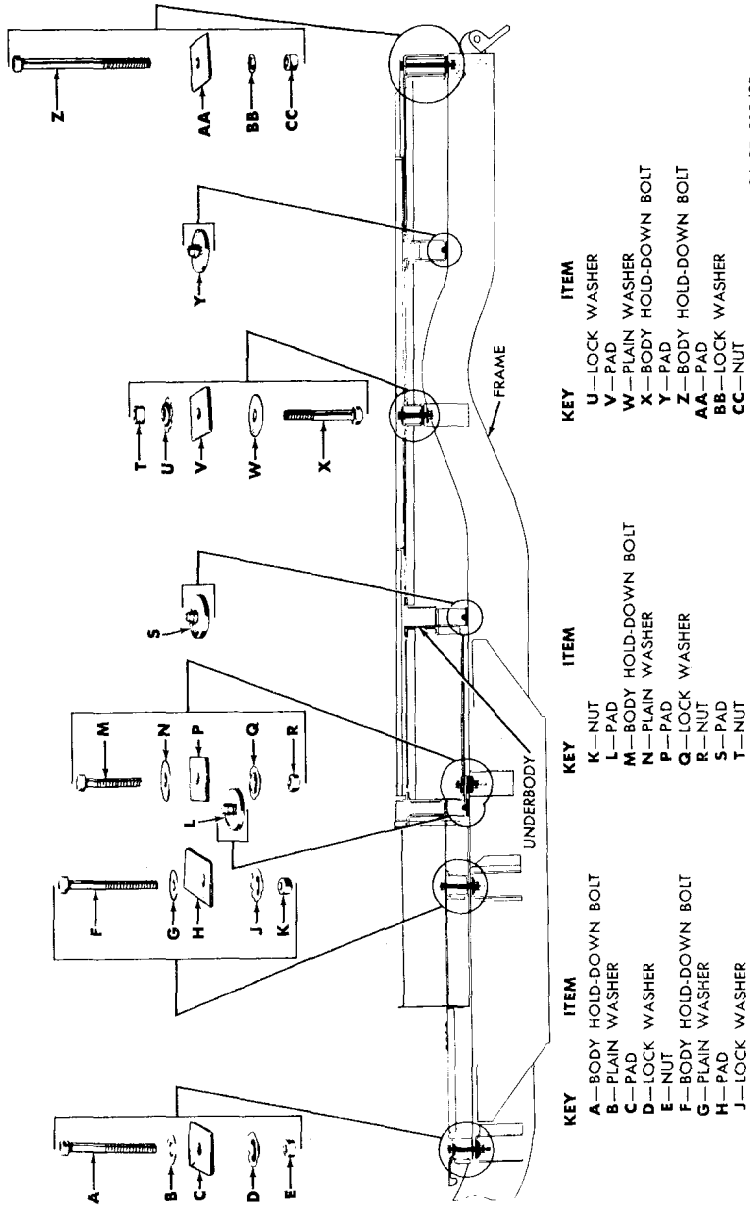


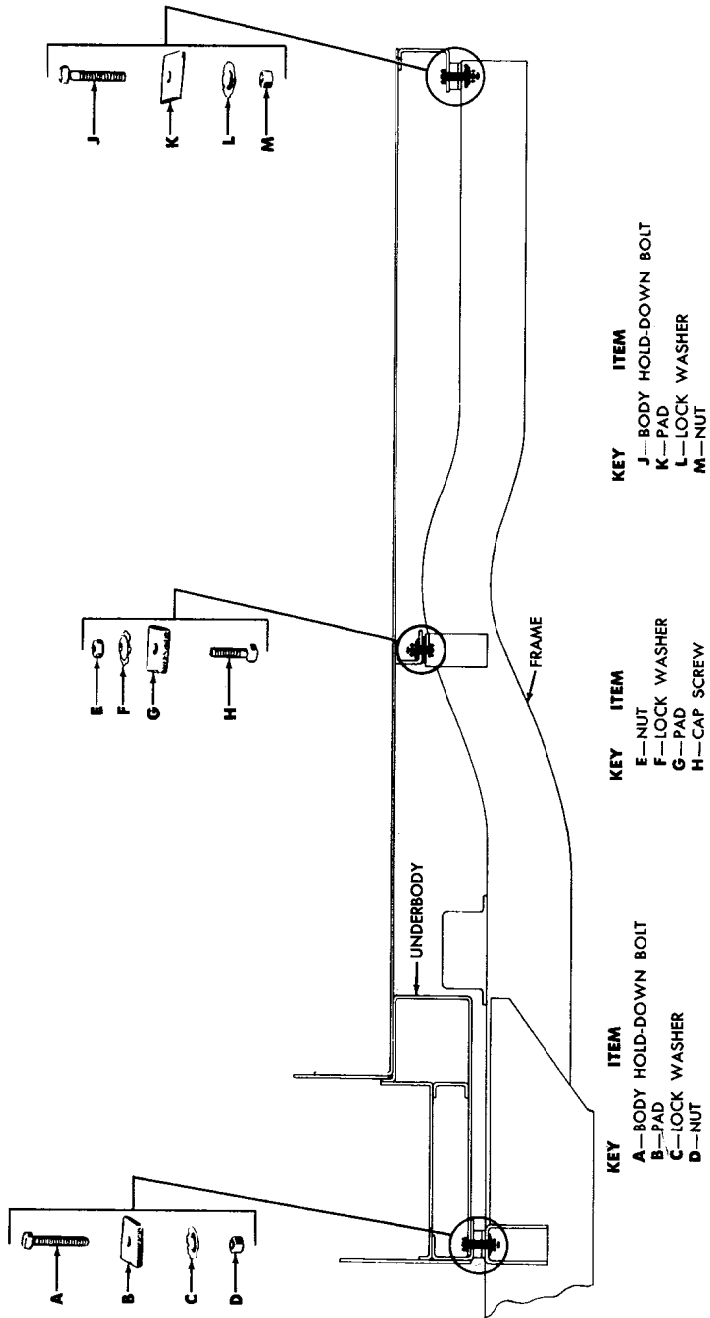
Figure 211. Body holddown bolts and related parts (cargo truck M37, command truck M42).



RA PD 213482

Figure 212. Body hold-down bolts and related parts (ambulance track M43).





- | KEY | ITEM                |
|-----|---------------------|
| A   | BODY HOLD-DOWN BOLT |
| B   | PAD                 |
| C   | LOCK WASHER         |
| D   | NUT                 |

- | KEY | ITEM        |
|-----|-------------|
| E   | NUT         |
| F   | LOCK WASHER |
| G   | PAD         |
| H   | CAP SCREW   |

- | KEY | ITEM                |
|-----|---------------------|
| J   | BODY HOLD-DOWN BOLT |
| K   | PAD                 |
| L   | LOCK WASHER         |
| M   | NUT                 |

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Figure 213. Body hold-down bolts and related parts (telephone maintenance truck V-41).

## 260. Driver's Compartment Door, Door Glass, Frame, and Weatherseals

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### *a. General.*

- (1) The door lock strikers, dovetails, hinges, and the door glass and weatherseals must be correctly adjusted to insure proper closing of the doors and effectiveness of the weatherseals. Elongated screw holes in the door lock strikers, dovetails, door hinges, weatherseal retainers, door glass frame lower channel and the regulator support provide for such adjustment for all models. In addition, all models except the ambulance truck M43 provide for adjustment at the top side rail rear supports and brackets, and the windshield pivot brackets, clamp brackets, and stops.
- (2) It is seldom necessary to perform all of the adjustments described in this paragraph. However, when a new door, door glass, or windshield is installed, check all points of alignment and adjust as necessary.

*Note.* Doors must be properly fitted before attempting any adjustment of the door glass, as a change in the position of the door affects the contact of the glass frame with the weatherseals.

### *b. Check Alinement of Door and Door Glass (fig. 214).*

- (1) Observe the fit of the door in the door opening. The door lock should engage the lock striker on the lock pillar so the door weatherstrips contact the door opening at all points. The female dovetail in the door must engage with the male dovetail on the lock pillar. The vertical edges of the door should be a uniform distance from the door pillars. If adjustments are required, refer to *c* and *d* below.
- (2) Close the door and roll the door glass up to within approximately one-fourth inch of the upper weatherseal. Check the fit of the door glass frame in the weatherseals at the top and each side. The sides and top of the frame should be a uniform distance from the weatherseal retainers and should contact the weatherseals at all points. If adjustments are required, refer to *e* through *j* below.

*c. Adjust Door Lock Striker and Dovetail (fig. 215).* The door lock striker and dovetail adjustments are made to provide proper engagement of the door lock and the dovetails to insure correct closing and correct seal at the door weatherstrips. To adjust the striker, loosen the two lockwasher screws that secure the striker to the lock pillar and move the striker in or out, as required. To adjust the dovetail, loosen the two lockwasher screws that secure the male dovetail to the lock pillar and move the dovetail up or down, as required. Tighten the screws after making the adjustments.

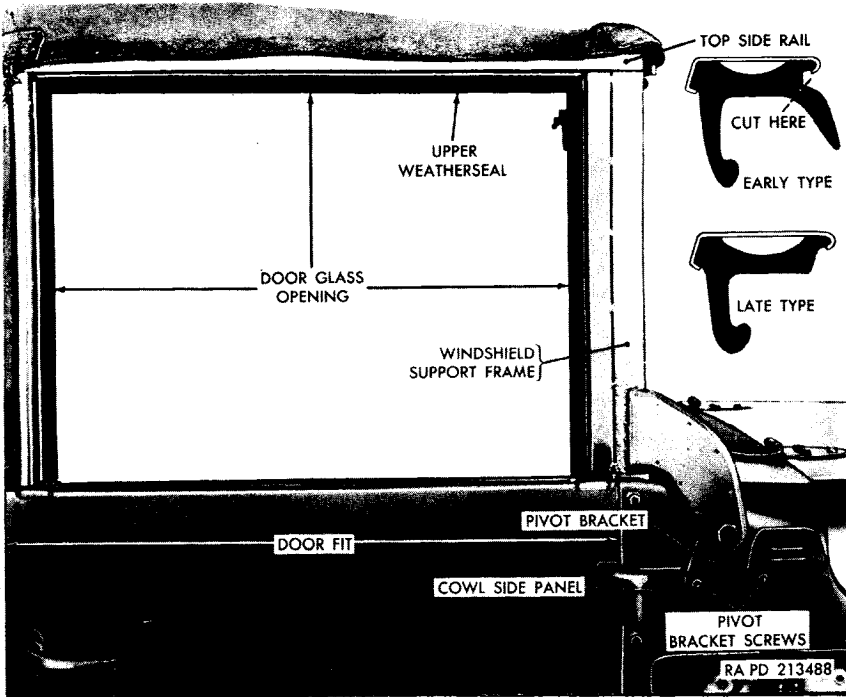


Figure 214. Alinement of drivers' compartment door and door glass.

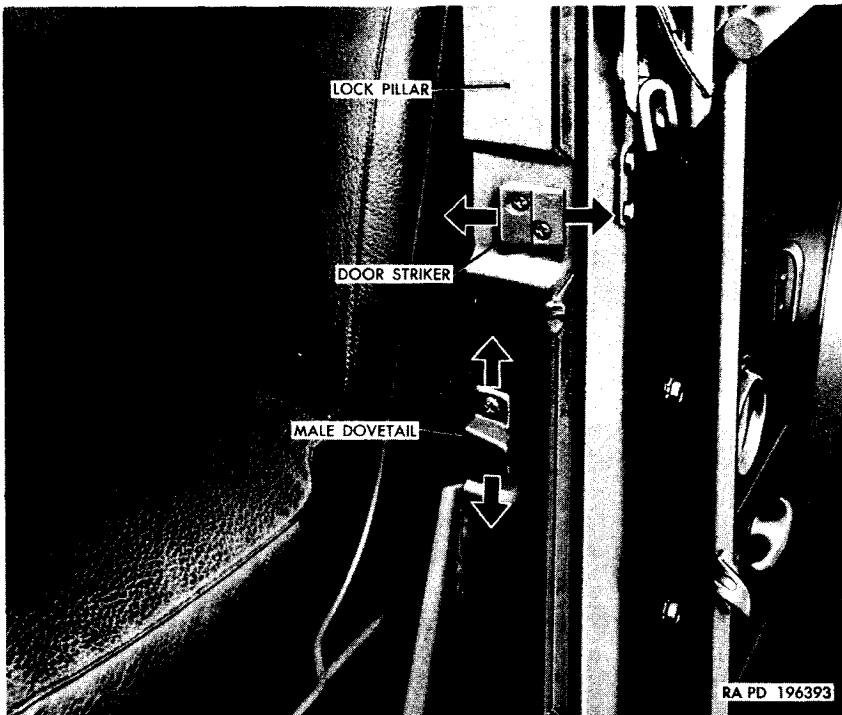


Figure 215. Door striker and dovetail adjustments.

d. *Align Door in Door Opening.* If the spaces between the vertical edges of the door and the door opening (fig. 214) vary considerably, bend the two hinges on the hinge pillar (fig. 216), using a bending tool.

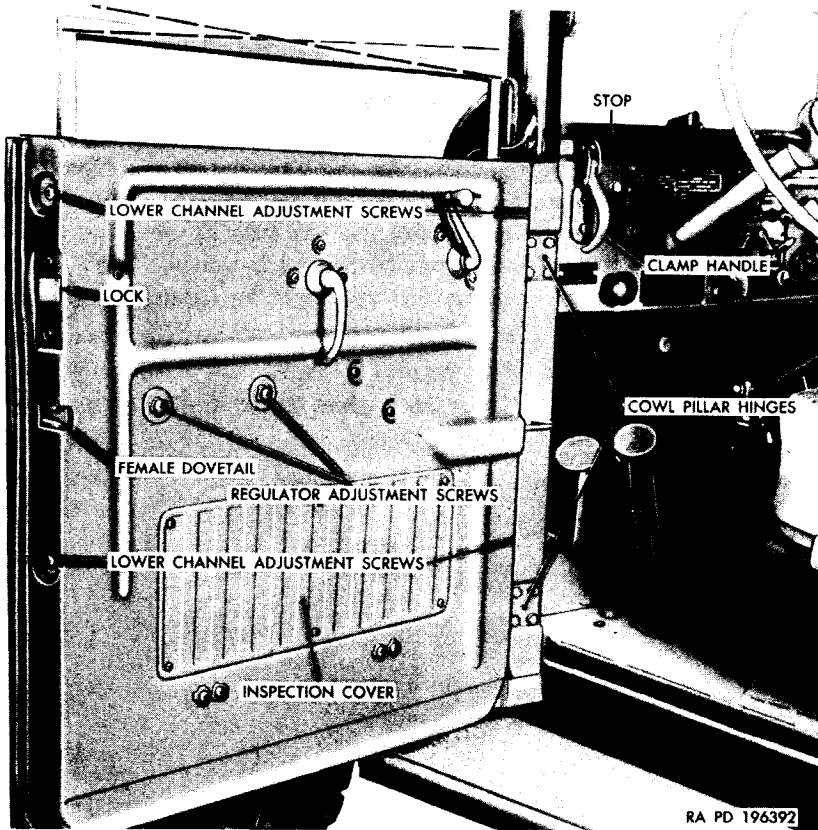


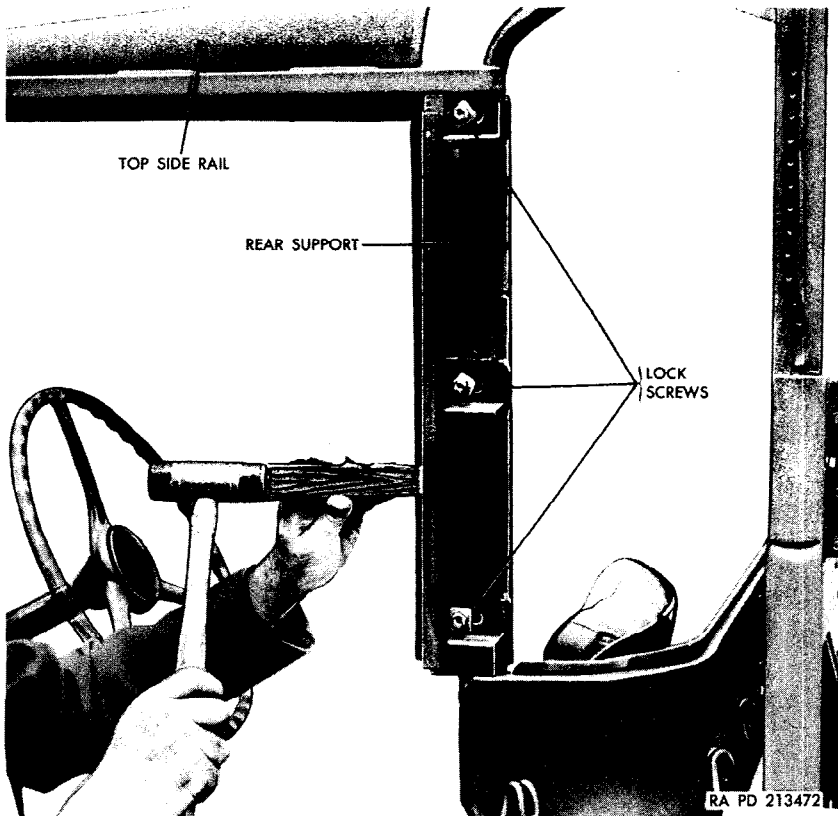
Figure 216. Door and glass adjustments.

e. *Align Windshield Support Frame (Except Ambulance Truck M43).* The windshield support frame can be adjusted to obtain proper contact between the front edge of the door glass frame and the weatherseal.

- (1) Loosen slightly the two pivot bracket screws that secure the pivot bracket to the cowl side panel (fig. 214) and the two screws that secure the top side rail to the rear support (fig. 217).
- (2) Place a hardwood block against the pivot bracket (fig. 214) and strike the block with a hammer to move the bracket the required distance and direction to align the windshield support frame.
- (3) Tighten the pivot bracket screws.

- (4) If the angle of the windshield support frame requires adjustment to provide uniform vertical alinement, release the two clamp handles (fig. 216) and loosen the two screws that secure each windshield stop. Move the top of the windshield support frame in or out, as required, to provide the correct angle of the windshield support frame. Correctly position the stops and tighten the two screws that secure each stop and the two screws that secure each top side rail. Lock the windshield clamp handles.
- (5) If the two clamp handles (fig. 216) are too tight or too loose, loosen the two screws that secure each clamp bracket to the instrument panel and move the brackets up or down, as required, using a hardwood block and hammer. Tighten the two screws for each bracket and lock the windshield clamps.

*f. Aline Door Glass.* If the space at the top of the door glass frame is not uniform, loosen the two regulator adjustment screws (fig. 216) and move either corner of the door glass up or down, as required. Tighten the two screws.

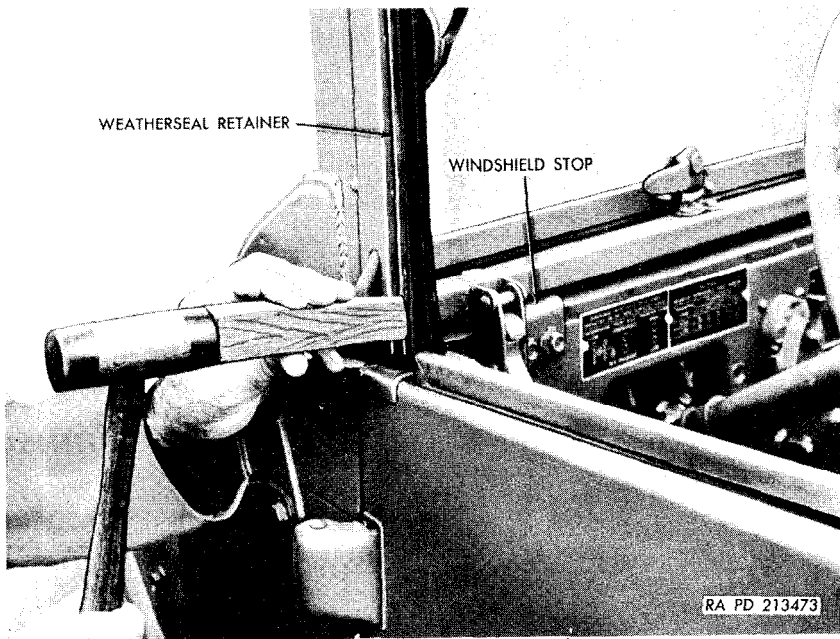


*Figure 217. Top side rail rear support adjustment.*

*g. Adjust Top Side Rail Rear Support (fig. 217) (Except Ambulance Truck M43).* The top side rail rear support may be adjusted to provide proper clearance between the door glass frame and the support weatherseal.

- (1) Loosen the three adjustment lock screws that secure the rear support.
- (2) Move the support forward or back, as required, using a hardwood block and hammer. Tighten the three lock screws.

*h. Adjust Weatherseal Retainers (fig. 218).* If the inner sides of the door glass frame do not make complete contact with the weatherseals, move the weatherseal retainers in or out, as required, using a hardwood block and hammer.



*Figure 218. Weatherseal retainer adjustment.*

*i. Adjust Door Glass Angle.* If the adjustment of the weatherseals fails to provide correct contact of the door glass frame and the weatherseals, adjust the angle of the door glass.

- (1) Loosen the four lower channel adjustment screws (fig. 216) that secure the door glass channels.
- (2) Move the top or bottom of either channel in or out, as required, to provide correct angle of the glass.
- (3) Tighten the four adjustment screws.

*j. Adjust Door Hinges (fig. 216).* If the door glass frame does not contact the upper weatherseal after the adjustments described in

*h* and *i* above have been performed, adjust the position of the cowl pillar hinges. If the top of the door must be tilted in, loosen the four screws in the lower hinge, force the lower hinge out, and tighten the screws. Then loosen the screws in the upper hinge, correct any distortion caused by adjustment of the lower hinge, and tighten the screws in the upper hinge.

*Note.* The upper weatherseal (fig. 214) on some early production vehicles is a U-shaped seal, necessitating slight lowering of the glass to open or close the door. The outer edge of this type of weatherseal may be removed with a sharp knife or razor blade. Seal the cut edge of the weatherseal with rubber cement or paint to prevent fraying of the fabric.

## **261. Patient Compartment Rear Doors (Ambulance Truck M43)**

*a. General.* The rear door strikers and the door and body pillar hinges must be correctly adjusted to insure proper closing of the doors and effectiveness of the door weatherseals. Elongated screw holes in the hinges and the strikers provide for such adjustment.

*b. Check Alinement of Doors.* Raise the rear folding step, close both doors and observe whether the door weatherseals contact the door openings at all points, and whether the spaces between the outer vertical edge of each door and the door pillar are equal and uniform from top to bottom. Observe the space at the top and bottom of each door for uniformity. If the doors are not properly alined, perform the necessary adjustments (*c*, *d*, and *e* below).

*c. Adjust Vertical Position of Door* (fig. 219). Both doors are adjusted in the same manner.

- (1) Open the door and remove the two rubber plugs at each pillar hinge.
- (2) Loosen the four lockwasher screws that secure each hinge to the hinge pillar.
- (3) Raise or lower the door, as required, to provide equal and uniform space at top and bottom.
- (4) Tighten the four lockwasher screws at each pillar hinge.
- (5) Install the two rubber plugs for each pillar hinge.

*d. Adjust Horizontal Position of Doors* (fig. 219). Both doors are adjusted in the same manner.

- (1) Loosen the four lockwasher screws that secure each door hinge to the door.
- (2) Move the door to left or right, as required, to provide uniform contact at the weatherseals and equal and uniform space at the outer edges of both doors. If the horizontal adjustment required is excessive, adjust both doors.
- (3) Tighten the four lockwasher screws for each door hinge.

*e. Adjust Rear Door Strikers* (fig. 219). If the rear doors close hard, or if the contact at the weatherseals is unsatisfactory, adjust the

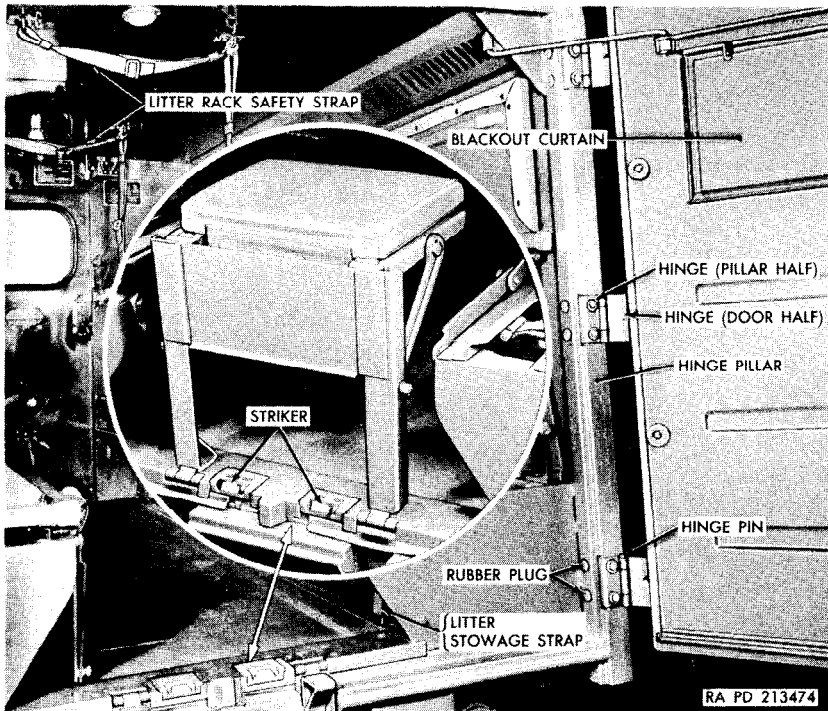


Figure 219. Patient compartment rear door adjustments.

rear door strikers located at the top and bottom of each door opening. All strikers are adjusted in the same manner.

- (1) Loosen the two screws that secure the striker to the striker plate.
- (2) Move the striker forward or back on the serrated striker plate, as required, until proper closing of the door is obtained. Tighten the screws.

## 262. Driver's Compartment Door Glass

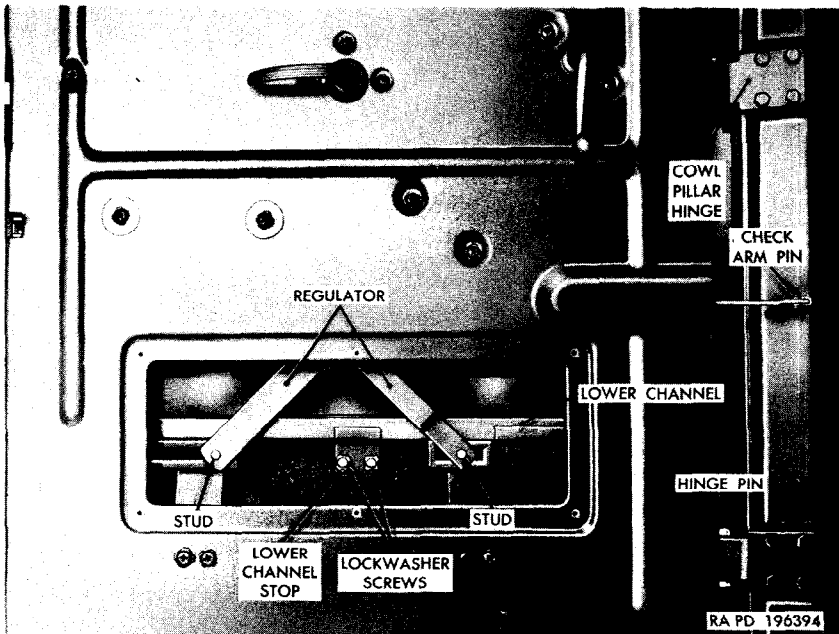
*a. Removal (fig. 220).* The glass for both doors is serviced in the same manner.

- (1) Remove the six lockwasher screws that secure the inspection cover (fig. 216) on the inside panel of the door and remove the cover.
- (2) Lower the glass. Remove the two lockwasher screws that secure the door glass lower channel stop, and remove the stop.
- (3) Remove the two retainers that secure the lower channel to the regulator arms.
- (4) Disengage the regulator from the door glass lower channel and remove the door glass from the top of the door. Refer door glass and frame to ordnance maintenance personnel for replacement of glass.



*b. Installation (fig. 220).*

- (1) Insert a new door glass with frame down through the door opening with the large gusset or lower channel toward the hinge, lowering the glass until it contacts the two lower stops.
- (2) Engage the studs in the two regulator arms in the openings in the glass lower channel and install the two retainers.
- (3) Position the lower channel stop on the lower channel with the offset at the top and the weldnuts toward the door outer panel. Install the two lockwasher screws and tighten finger-tight.



*Figure 220. Replacing glass in driver's compartment door.*

- (4) Close the door and raise the door glass. Adjust the lower channel stop on the bracket so the door glass, when fully raised, contacts the top of the upper weatherseal. Lower the glass and tighten the two screws after making the adjustment.
- (5) Position the inspection cover (fig. 216) on the door inside panel and install the six lockwasher screws. Tighten the screws.
- (6) Check the alignment of the door glass and the weatherseals and adjust, if necessary (par. 260).

## **263. Driver's Compartment Door**

*a. Removal.* Both doors are serviced in the same manner.

- (1) File or grind the lower end of the door check arm pin (fig. 220) and remove the pin.
- (2) Drive out the two hinge pins and remove the door.
- (3) If the cowl pillar hinges (fig. 220) are damaged, remove the four lockwasher screws that secure each hinge and remove the hinges.

*b. Installation.*

- (1) If the cowl pillar hinges (fig. 220) were removed (a(3) above), position the hinges on the pillar (pin offset forward) and install the four lockwasher screws for each hinge. Do not tighten the screws at this time.
- (2) Position the door, alining the hinges, and install the two hinge pins (fig. 220).
- (3) Aline the hole in the door check arm with the bracket and install the check arm pin and rivet the lower end.
- (4) Check the alinement of the door and adjust, if necessary (par. 260j). Tighten the hinge screws.

## **264. Patient's Compartment Rear Door Hinges (Ambulance Truck M43)**

*a. General.* Hinges for both rear doors are serviced in the same manner. It is seldom necessary to replace all hinges for either door. The door hinge halves (fig. 219) may be removed or installed with the doors closed. If any of the body pillar hinge halves (fig. 219) must be replaced, the door must be open and must be supported from below before removing the hinge pins.

*b. Replace Door Hinge Half.*

- (1) Close the door and remove the hinge pin.
- (2) Remove the four lockwasher screws that secure the hinge half to the door and remove the hinge.
- (3) Position the new hinge on the door and install the hinge pin.
- (4) Install the four lockwasher screws in the hinge. Adjust the alinement of the door if necessary (par. 261b), and tighten the four screws.

*c. Replace Body Pillar Hinge Half (fig. 219).*

- (1) Open the door and support it from below with a jack or blocking.
- (2) Remove the hinge pin.
- (3) Remove the rubber plugs from the two access holes for the hinge inner screws.
- (4) Remove the four lockwasher screws that secure the hinge and remove the body pillar hinge half.
- (5) Position the new hinge, alining it with the door hinge, and install the hinge pin.

- (6) Install the four lockwasher screws to secure the hinge. Remove the support from under the door, adjust the door alignment if necessary (par. 261b), and tighten the screws.
- (7) Install the rubber plugs in the two access holes.

## 265. Cab Top Cover and Related Parts (Except Ambulance Truck M43)

### a. Removal.

- (1) Unhook the cab top cover holddown rope from the hooks on the cab rear panel.
- (2) Remove the two cab top cover bow-to-windshield straps (fig. 221).
- (3) Pull the cover out from the left and right top side rails to disengage the retainers from the side rails (fig. 221).
- (4) Pull the cover up to remove it from the retainers on the left and right side rail rear supports (fig. 222).
- (5) Fold the cover toward the windshield and pull the cover from the left side of the windshield support frame retainer (fig. 223).
- (6) Loosen the upper rear support adjustment lock screws (fig. 217) at the right and left sides, and remove the top bow from the side rail rear supports.
- (7) Loosen the nuts on the J-bolt and U-bolt in each cab lock pillar. Remove the two lockwasher screws that secure each top side rail to the windshield frame and remove the two side rails and side rail rear supports as units. Remove the nuts and lockwashers from the J-bolts and U-bolts. Remove the bolts.

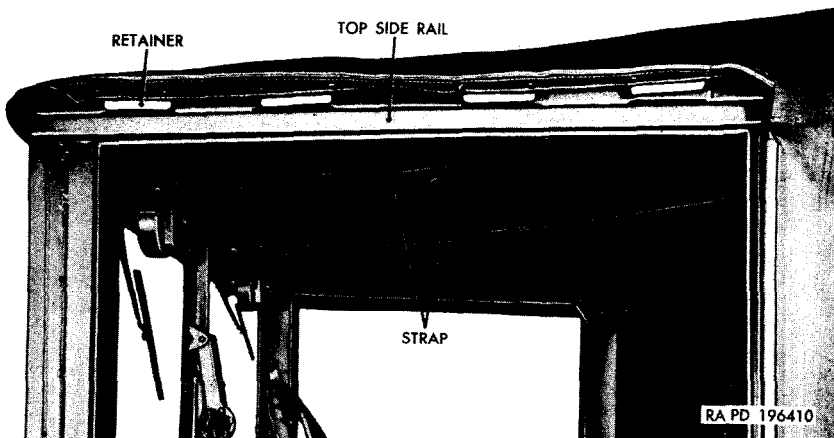


Figure 221. Top cover removed from top side rail.



*Figure 222. Removing top cover from side rail support.*

- (8) Remove the two lockwasher screws which secure each top side rail to the rear support, and separate the two.

*b. Inspection.*

- (1) Inspect the cab cover for wear and damage. Inspect the straps and the holddown rope for breaks, wear, or damage.

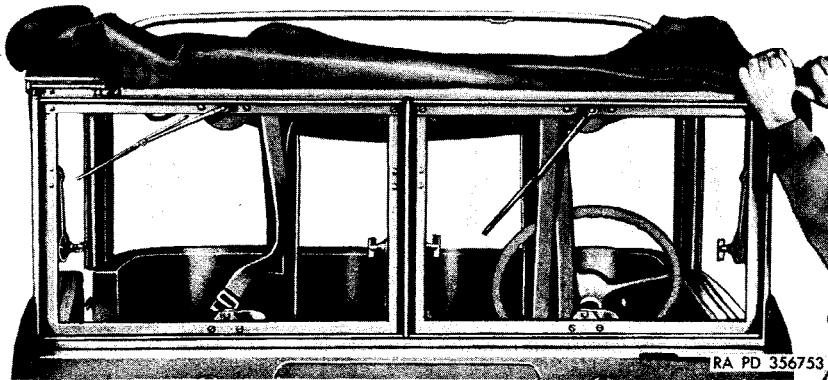


Figure 223. Removing top cover.

- (2) Inspect the J-bolts and U-bolts for wear, distortion, or damaged threads.
- (3) Inspect the top bow for cracks or distortion.
- (4) Replace parts that are unfit for further service.

*c. Installation.*

- (1) Install the left and right top side rails on the left and right rear supports respectively, and install the two lockwasher screws in each side.
- (2) Place the J-bolt and U-bolt in each cab lock pillar and aline them for installation of the top side rail with rear supports. Install the left and right rear supports. Install but do not tighten the two lockwasher screws to secure each support to the windshield frame. Install the two  $\frac{7}{16}$ -inch lockwashers and  $\frac{7}{16}$ -20NF nuts on each J-bolt and each U-bolt. Tighten the nuts.
- (3) Install the top bow in the left and right side rail rear supports, and tighten the two adjustment lock screws (fig. 217).
- (4) Check the door glass alinement and adjust as necessary (par. 260).
- (5) Insert the front of the top cover in the left end of the retainer on the windshield frame (fig. 223) and pull the cover into the retainer from left to right.
- (6) Insert the sides of the cover in the upper ends of the retainers on the left and right rear supports (fig. 222) and pull the cover down.
- (7) Insert the metal retainers at each side of the cover in the slots in the top rail (fig. 221).
- (8) Install the two cab top cover bows to windshield straps (fig. 221).
- (9) Attach the cab cover holddown rope to the hooks on the cab rear panel and buckle the two cover straps.

## 266. Body Cover and Related Parts (Cargo Truck M37 or Command Truck M42)

### a. Removal (fig. 224).

- (1) Detach the body cover ropes from the three hooks on each side panel, and remove the body cover.
- (2) To remove the side curtains (command truck M42), detach the strap that secures the inside lower edge of each side curtain to the center roof side bow, remove the lashing ropes and holddown ropes, and remove the curtains.
- (3) Detach the end curtain holddown ropes from the two hooks on the tailgate or the hooks on the front of each side panel. Remove the lashing rope that secures each curtain to the roof bow and remove the end curtains.
- (4) Remove the nut, lockwasher, and bolt that secure each roof side bow to the seat back supports and remove the bows and ridge pole as a unit.

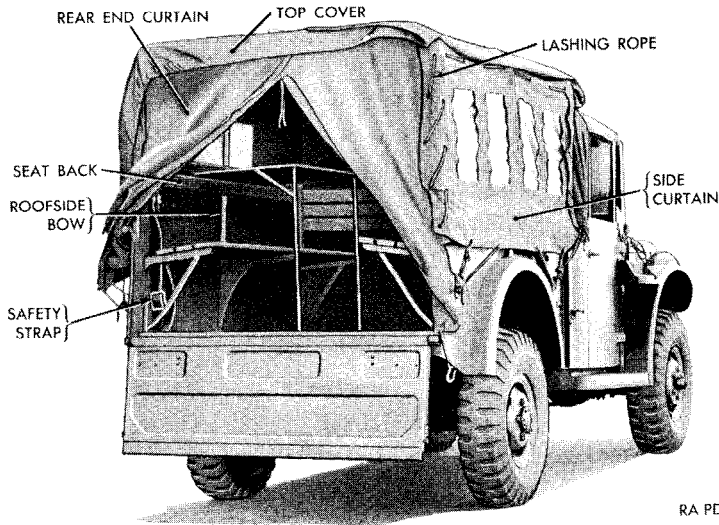


Figure 224. Top cover and curtains (command truck M42).

### b. Inspection.

- (1) Inspect the body cover, side curtains, and end curtains for wear, damage, or deterioration. Inspect all ropes for wear and damage.
- (2) Inspect the top bows, side bows, and ridge pole for breaks, and the bow corners and ridge pole brackets for damage and missing or damaged retaining parts.
- (3) Replace parts that are unfit for further service.

*c. Installation.*

- (1) If any of the bow corners require replacement, install a new corner and attach it to the top bow and side bow with two  $\frac{5}{16}$ -18NC x  $2\frac{1}{4}$  carriage bolts,  $\frac{5}{16}$ -inch lockwashers, and  $\frac{5}{16}$ -18NC nuts for each bow. Attach the cover roll-up strap with the top bolt for the side bow.
- (2) Install the assembled bows and ridge pole on the body, inserting the side bows in the seat back supports. Align the bolt holes in the side bows with those in the supports, and install the  $\frac{5}{16}$ -18NC x  $2\frac{1}{2}$  carriage bolt,  $\frac{5}{16}$ -inch lockwasher, and  $\frac{5}{16}$ -18NC nut for each side bow. Tighten the nuts.
- (3) Secure the end curtains to the front and rear top bows with lashing ropes, using  $\frac{1}{4}$ -inch rope. Install the side curtains for the command truck M42 ((4) below). Attach the front curtain holddown ropes to the hooks on the front of side panel. Attach the rear curtain holddown ropes to the two hooks on the tailgate.
- (4) For the command truck M42, insert the lashing rope for each side curtain through the opening in the corner of the center roof bow, plate the side curtain in position at the roof bows, and pass the ends of the rope through the grommets in the upper edge of the curtain at the front and rear of the center bow, pulling the rope through so that approximately equal lengths extend front and rear. Continue lacing the rope through the grommets in the curtain and around the front and rear bows, securing the sides of the front end curtain over the side curtains and the sides of the rear end curtain under the side curtains. Secure the lashing ropes to the side panel hooks, and secure the lower edge of each side curtain with a rope attached to the side panel hooks. Fasten the strap which secures the inside of each side curtain to the roof side bow.
- (5) Install the body cover and secure the cover ropes to the hooks on the side panels.

## **267. Safety, Stowage, and Holddown Straps, and Blackout Curtains**

*a. Replace Safety Strap and Eye Bolts (Cargo Truck M37 or Command Truck M42).*

- (1) Detach the safety strap (fig. 224) from the two eyebolts in the seat back lower boards and remove the strap.
- (2) Remove the nut and lockwasher from each eyebolt, and remove the two bolts and flat washers.
- (3) Place a  $1\frac{3}{32}$ -inch inside diameter flat washer on each eyebolt. Install the eyebolt through the upper hole at the rear of the

seat back lower board. Install a  $\frac{3}{8}$ -inch lockwasher and  $\frac{3}{8}$ -16NC nut on each eyebolt. Tighten the nuts.

(4) Attach the safety strap snaps to the eyebolts.

*b. Replace Litter Stowage and Holddown Straps (fig. 219) (Ambulance Truck M43).*

(1) Remove the two nuts, lockwashers, and screws that secure the bracket for each lower stowage strap to the side compartment and remove the strap and bracket. Remove the bracket from the strap. The buckle strap is removed in the same manner.

(2) Engage the strap in the strap bracket, position the bracket on the side compartment, and install the two No. 10-32NF x  $\frac{1}{2}$  cross-recess flathead screws, No. 10 lockwashers, and No. 10-32NF nuts for each bracket.

*c. Replace Litter Holddown Straps (P, fig. 22) (Ambulance Truck M43).* All litter holddown straps are replaced in the same manner. Remove the pin that secures the strap and remove the strap. Position the new strap and install the strap retaining pin.

*d. Replace Litter Rack Safety Straps (fig. 219) (Ambulance Truck M43).* The four-litter rack safety straps are all replaced in the same manner. Detach the strap from the litter rack and remove the strap from the bracket in the roof panel. Install the new strap in the bracket in the roof panel and attach the hook to the litter rack or the opposite bracket in the roof.

*e. Replace Blackout Curtains (fig. 219) (Ambulance Truck M43).* The blackout curtains on the rear door and on the partition door are all replaced in the same manner.

(1) Detach the curtain from the two fasteners at the lower edge. Remove the three screws and plain washers that secure the curtain to the door panel and remove the curtain.

(2) Position the new curtain on the door with the unfinished side toward the glass. Install the three No. 8 plain washers and No. 8 x  $\frac{1}{2}$  tapping screws. Tighten the screws. Secure the lower edge of the curtain with the two fasteners or roll it and secure it with the two roll-up straps.

## **268. Tailgate and Pioneer Tool Rack**

(fig. 199)

*a. Replace Pioneer Tool Rack.*

(1) Remove the tools from the rack.

(2) Remove the four nuts, lockwashers, and bolts that secure the rack to the tailgate and remove the rack.

(3) Position the new rack on the tailgate with the axe blade pocket at the left. Aline the bolt holes and install the four



$\frac{3}{8}$ -24NF x  $1\frac{1}{4}$  bolts,  $\frac{3}{8}$ -inch lockwashers, and  $\frac{3}{8}$ -24NF nuts. Tighten the nuts evenly.

- (4) Install the tools in the tool rack.

*b. Remove Tailgate.*

- (1) Remove the pioneer tool rack (a(1) and (2) above).
- (2) Remove the two lockwasher screws that secure the tailgate hinge support to the floor rear cross sill.
- (3) Remove the two lockwasher screws that secure each tailgate outer hinge to the body side panel.
- (4) Unhook the two tailgate chains and remove the tailgate.
- (5) If the tailgate chains or chain covers require replacement, open the link that secures each chain to the body side panel and remove the chains. Remove the chain covers.

*c. Install Tailgate.*

- (1) If the tailgate chains and chain covers were removed (b(5) above), install a new cover on each chain. Attach a chain to each body side panel and close the link.
- (2) Position one of the tailgate outer hinges on the body left side panel and install the two lockwasher screws. Tighten the screws.
- (3) Apply a coating of lubricant to the tailgate hinge bearings. Insert the left end of the tailgate tube in the left outer hinge on the body. Place the other outer hinge on the tube and position the parts on the body, alining the screw holes in the outer hinge with those in the side panel. Install the two lockwasher screws and tighten.
- (4) Close the tailgate and position the hinge support on the floor rear cross sill. Install the two lockwasher screws to secure the support and tighten.
- (5) Install the pioneer tool rack (a(3) and (4) above).

## **269. Windshield Wipers, Rear View Mirror, and Reflectors**

*a. General.* Maintenance of the windshield wipers includes replacement of the wiper blades, arms, wiper hose, and wiper motors. Both wiper motors are serviced in the same manner.

*b. Replace Windshield Wiper Blade and Arm.*

- (1) To replace the windshield wiper blade, unhook the blade from the arm and install a new blade, engaging the blade in the arm.
- (2) To replace the arm, remove the nut that secures the arm to the motor shaft and remove the arm and blade. Install a new arm on the motor shaft, alining the arm with the windshield wiper handle (D, fig. 12). Install the wiper arm nut and tighten. Install a new blade in the arm.

*c. Replace Wiper Hose.*

- (1) Remove the wiper hose from the manifold to wiper line in the engine compartment and from the wiper line hinge tube at the left pillar. Pull the hose out through the grommet in the cowl panel.
- (2) Cut a 24-inch length of  $\frac{3}{32}$ -inch ID rubber tubing. Insert one end of the tubing through the grommet in the cowl panel and attach it to the line at the left pillar. Attach the other end of the hose to the manifold-to-wiper line.

*d. Replace Wiper Motor.*

- (1) Remove the wiper arm and blade (*b*(2) above).
- (2) Remove the nut and lockwasher that secure each of the two motor studs at the front of the windshield frame.
- (3) Detach the wiper line from the wiper motor and remove the motor.
- (4) Position the new motor on the inner side of the windshield frame, inserting the two studs and the shaft through the holes in the frame. Attach the wiper line to the wiper motor.
- (5) Install a No. 10 lockwasher and No. 10-32NF nut on each of the two motor studs.
- (6) Install the wiper arm and blade (*b*(2) above).

*e. Replace Rear View Mirror* (fig. 23). Remove the blind nut and lockwasher that secure the mirror to the mirror arm and remove the mirror. Position the new mirror on the arm and install the  $\frac{1}{4}$ -inch lockwasher and  $\frac{1}{4}$ -28NF low crown blind nut. Tighten the nut.

*f. Replace Reflectors.* An amber reflector is mounted at each side of the body (fig. 6), just back of the driver's compartment door. A ruby reflector is mounted at each side of the body near the rear and at each side of the tailgate (fig. 13) or each rear door. Reflectors for all models except the ambulance truck M43 are serviced in the same manner.

- (1) To replace any of the reflectors (all models except ambulance truck M43), remove the two nuts, lockwashers, and bolts that secure the reflector and remove the reflector. Install two No. 12-24NC x  $\frac{1}{2}$  roundhead bolts from the inner side of the body or tailgate. Position the reflector on the two bolts and install a No. 12 lockwasher and No. 12-24NC nut on each bolt. Tighten the nuts.
- (2) To replace any of the reflectors on the ambulance truck M43, remove the two screws and lockwashers that secure the reflector and remove the reflector. Position a new reflector and install the two No. 12 lockwashers and No. 12-24NC x  $\frac{1}{2}$  over-head tapping screws.

## 270. Windshields and Windshield Adjusting Arms

*a. Replace Windshield.* Both windshields are replaced in the same manner.

- (1) Remove the windshield wiper motor (par. 269*d*).
- (2) Open the windshield and remove the lockwasher bolt that secures each adjusting arm to the bracket on the windshield frame (fig. 12). Disengage the arms from the brackets and remove the spring washer from each bracket.
- (3) Spread the outer end of the windshield upper hinge (fig. 16) with a screwdriver and slide the windshield out of the hinge.
- (4) Insert the inner end of the lower hinge of the new windshield in the upper hinge (fig. 16) and slide the windshield into position. Bend the outer end of the upper hinge to close it.
- (5) Install a spring washer on each windshield frame bracket, position arms on brackets and install a  $\frac{1}{4}$ -28NF x  $\frac{1}{2}$  lockwasher bolt for each bracket. Tighten the bolts.
- (6) Install the windshield wiper motor (par. 269*d*).

*b. Replace Windshield Adjusting Arm.* All adjusting arms are replaced in the same manner.

- (1) Open the windshield and support it in the open position.
- (2) Remove the two lockwasher bolts that secure the adjusting arm (fig. 12) to the brackets on the windshield frame and on the windshield support frame. Disengage the arm from the brackets and remove the arm. Do not lose the spring washer at each bracket.
- (3) Position the spring washer on each bracket and install a new adjusting arm on the two brackets with the longer arm at the windshield frame (fig. 12). Install a  $\frac{1}{4}$ -28NF x  $\frac{1}{2}$  lockwasher bolt for each bracket and tighten.
- (4) Close the windshield.

## 271. Weatherseals, Toe Boards, and Seat Cushions

*a. Replace Cowl Ventilator Door Weatherseal.*

- (1) Open the cowl ventilator door.
- (2) Remove the door weatherseal from the cowl and clean the trough.
- (3) Apply a coat of synthetic rubber cement to the trough and to the lower (flat) edge of a new weatherseal. Allow the cement to dry for 10 minutes.
- (4) Install the weatherseal in the trough in the cowl with the lip at the inner edge up. Press the seal firmly into the trough.
- (5) Close the ventilator door.

*b. Replace Gear Shift Lever Weatherseal.*

- (1) Remove the nut, lockwasher, and bolt that secure the transmission gear shift upper lever to the lower lever and remove the upper lever (fig. 12).
- (2) Remove the weatherseal from the transmission access cover (fig. 87).
- (3) Install a new weatherseal over the transmission gear shift lower lever and fit it into the opening in the transmission access cover (fig. 87).
- (4) Position the gear shift upper lever (fig. 12) on the lower lever and install the  $\frac{7}{16}$ -20NF x 2 bolt,  $\frac{7}{16}$ -inch lockwasher, and  $\frac{7}{16}$ -20NF nut. Tighten the nut.

*c. Replace Brake and Transfer Lever Weatherseal.*

- (1) Remove the four lockwasher screws that secure the weatherseal retainer and weatherseal to the transmission access cover (fig. 87). Remove the retainer and weatherseal.
- (2) Place a new weatherseal and weatherseal retainer over the hand brake lever and transfer levers (fig. 12) and position them on the transmission access cover, alining the screw holes. Install the four lockwasher screws and tighten.

*d. Replace Winch Lever Weatherseal (on Vehicles So Equipped).*  
Disengage the weatherseal from the opening in the transmission access cover (fig. 28) and remove it. Place a new weatherseal over the winch lever and fit it into the opening in the access cover.

*e. Replace Toe Boards.*

- (1) Remove the eight lockwasher screws that secure the lower toe board (fig. 87) and remove the toe board.
- (2) Remove the three lockwasher screws that secure the upper toe board and remove the toe board.
- (3) Remove the two lockwasher screws that secure the clutch pedal stop to the upper toe board and remove the stop.
- (4) Position the clutch pedal stop on the new upper toe board and install the two lockwasher screws. Tighten the screws.
- (5) Position the upper toe board, alining the screw holes, and install the three lockwasher screws in the three upper screw holes. Tighten the screws fingertight.
- (6) Position the lower toe board (fig. 87) on the floor panel and upper toe board, alining the screw holes. Install the eight lockwasher screws and tighten all screws evenly.

*f. Replace Driver's Seat Cushion and Seat Back Cushion.*

*Note.* The passenger's seat cushions for the ambulance truck M43 are serviced in the same manner as the driver's seat cushions.

- (1) Tilt the seat forward and remove the two bolts and lockwashers from the seat cushion board. Remove the cushion.

- (2) Remove the two bolts and lockwashers that secure the seat back cushion to the seat back panel. Lift the cushion up and out of the panel.
- (3) Position the seat back cushion in the seat back panel, engaging the upper portion of the cushion in the anchor clips on the panel. Aline the bolt holes in the cushion clips with those in the seat back panel and install the two lockwashers and two  $\frac{5}{16}$ -24NF x  $\frac{5}{8}$  bolts. Tighten the bolts.
- (4) Position the seat cushion on the seat board, alining the bolt holes in the seat board with the weld nuts in the cushion. Install the two lockwashers and  $\frac{5}{16}$ -24NF x  $1\frac{1}{4}$  bolts. Tighten the bolts and tilt the seat back.

*g. Replace Passenger's Seat Cushion and Seat Back Cushion (Except Ambulance Truck M43).*

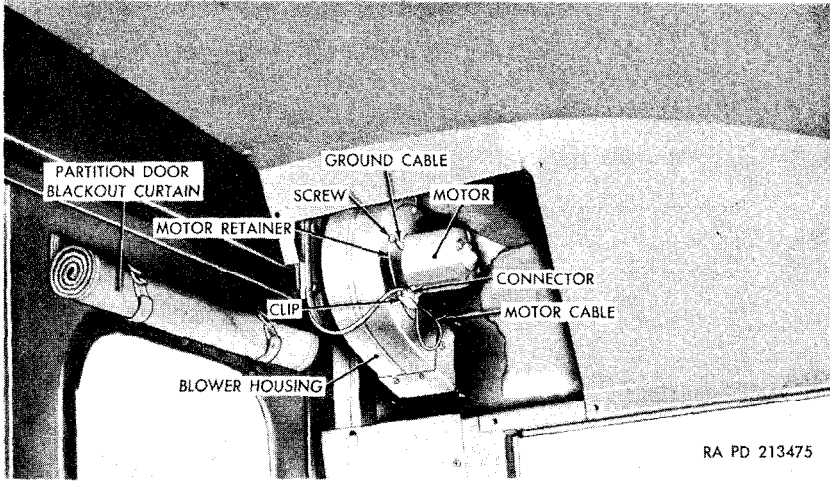
- (1) Unhook the toggle lock which secures the seat cushion to the seat riser, raise the front side of the cushion to disengage it from the dowel at each front corner, and remove the seat cushion.
- (2) Remove the two lockwasher screws that secure the seat back cushion to the cab rear panel, lift the cushion to disengage it from the two anchor clips, and remove the cushion.
- (3) Position the seat back cushion on the cab rear panel with the two clip brackets engaged in the anchor clips on the panel. Aline the screw holes in the two retaining brackets with those in the cab rear panel and install the two lockwasher screws. Tighten the screws.
- (4) Position the seat cushion on the seat riser with the dowels engaged in the dowel holes at the front corners of the cushion. Engage the toggle lock in the catch on the cushion.

## **272. Ventilator Blower Motors and Switches (Ambulance Truck M43)**

*a. General.* The left and right ventilator blower motors and switches are serviced in the same manner. The blower motors are not interchangeable, as they rotate in opposite directions, the left motor rotating clockwise and the right motor counterclockwise as viewed from the rear end of the motor shaft.

*b. Remove Blower Motor (figs. 225 and 226).*

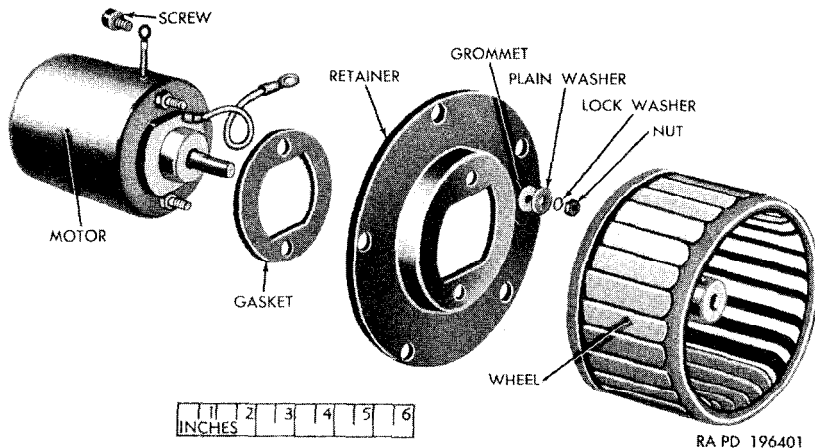
- (1) Remove the five lockwasher screws that secure the blower inspection cover in the driver's compartment, and remove the cover.
- (2) Disengage the motor cable connector from the connector clip and disconnect the cable at the connector.



RA PD 213475

Figure 225. Removal or installation of ventilator blower motor.

- (3) Remove the five screws that attach the motor retainer to the blower housing (one of the screws attaches the motor ground cable and another the cable connector clip). Pull the motor and retainer from the blower housing.
- (4) Loosen the set screw that secures the blower wheel on the motor shaft and remove the wheel.
- (5) Remove the nut, lockwasher, plain washer, and grommet from each of the two studs in the motor and remove the motor retainer and motor gasket.



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Figure 226. Blower motor, wheel, and related parts—exploded view.

c. *Install Blower Motor* (figs. 225 and 226). Be sure to install the correct motor for the blower being serviced (*a* above).

- (1) Position the motor gasket and the motor retainer over the shaft end of the motor. Install a motor grommet, No. 10 plain washer, No. 10 lockwasher, and No. 10-32NF nut, on each motor stud and tighten the two nuts.
- (2) Place the blower wheel on the motor shaft with open end of the wheel away from the motor.

*Note.* Left and right blower wheels are not interchangeable. The blower wheel blades must slant in the direction of motor rotation.

Align the set screw opening with the flat on the shaft, and position the wheel so that the hub of the wheel is flush with the chamfer on the end of the motor shaft. Tighten the set-screw.

- (3) Position the motor retainer and motor in the blower housing with the motor cable at the top for the right blower or bottom for the left blower. Install the five No. 8 x  $\frac{3}{8}$  pan-head tapping screws, attaching the motor ground cable and connector clip. Tighten the screws evenly. Connect the blower motor cable and insert the connector in the clip.
- (4) Position the blower inspection cover at the corner of the driver's compartment. Install a  $\frac{1}{4}$ -28NF x 1 pan-head lockwasher screw for each of the other four holes. Tighten the screws.

d. *Replace Ventilator Blower Switch.* Both ventilator blower switches are serviced in the same manner and are identical.

- (1) Remove the two screws that secure the heater control panel inspection cover to the front side of the partition. Remove the three cable connectors from the connector clips on the inner side of the cover and remove the cover.
- (2) Separate the switch cables at the cable connectors (one cable to the blower motor and one to the double connector). Remove the grommet and bushing from each cable and remove the cables from the connector shells.
- (3) Remove the four screws that secure the switch plate to the rear side of the partition (fig. 10) and remove the switch plate with attached switch and cables. Remove the two screws that secure the switch to the plate and remove the switch.
- (4) Position the new switch on the switch plate and install the two No. 8-32NC x  $\frac{5}{16}$  roundhead screws. Tighten the screws.
- (5) Insert the two cables through the opening in the partition, position the switch plate and install the four screws (fig. 10).

Tighten the screws. Be sure the switch is in the OFF position.

- (6) Insert one cable terminal through the double connector shell, install the bushing and grommet and connect the cable terminal. Engage the double connector shell. Install the connector shell, bushing, and grommet on the other cable and connect the cable to the motor cable.
- (7) Install the three cable connectors in the connector clips on the inspection cover. Position the inspection cover on the partition and install the two  $\frac{5}{16}$ -20NC x  $\frac{5}{8}$  cap screws. Tighten the screws.

### **273. Personnel Heater and Related Parts**

#### *a. Remove Heater (fig. 227).*

- (1) Raise the right litter rack (par. 44c).
- (2) Turn the two guard fastener studs counterclockwise and remove the guard.
- (3) Disconnect the cable connector at the receptacle.
- (4) Disconnect the fuel line at the standpipe elbow.
- (5) Remove the two screws that secure the rear holddown clamp and remove the clamp.
- (6) Loosen the nut on the bolt in the clamp and the screw in the front holddown clamp. Pull the heater toward the rear to disengage it from the duct and remove the heater. Remove the O-ring gasket and heater spacer plate from the exhaust outlet extension at the under-side of the heater.

#### *b. Install Heater (fig. 227).*

- (1) Install the heater spacer plate and a new O-ring gasket on the exhaust outlet extension at the under side of the heater.
- (2) Position the asbestos-lined clamp on the heater duct. Install the heater, making certain that the exhaust outlet extension is properly aligned with the exhaust outlet pipe.
- (3) With the heater properly positioned, position the holddown clamps and install the rear clamp screws. Tighten all clamp screws and the clamp nut.
- (4) Connect the fuel line to the standpipe elbow.
- (5) Connect the cable connector to the receptacle.
- (6) Install the guard and turn the guard fastener studs clockwise.

#### *c. Remove Igniter.*

- (1) Remove the heater (*a* above).
- (2) Disconnect the blower motor cable from the No. 2 terminal on the terminal strip (fig. 227).
- (3) Detach the ground strap at the heater case (fig. 227).



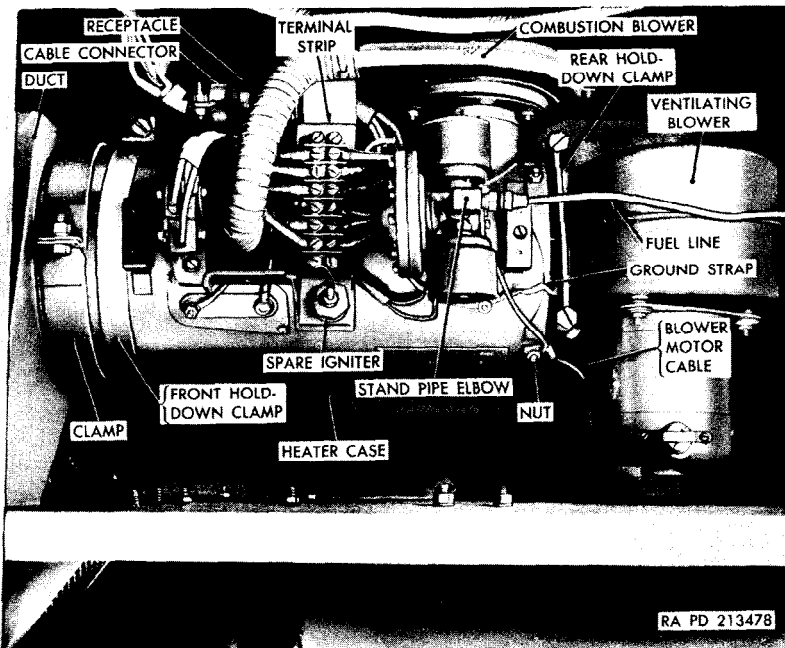


Figure 227. Personnel heater—installed.

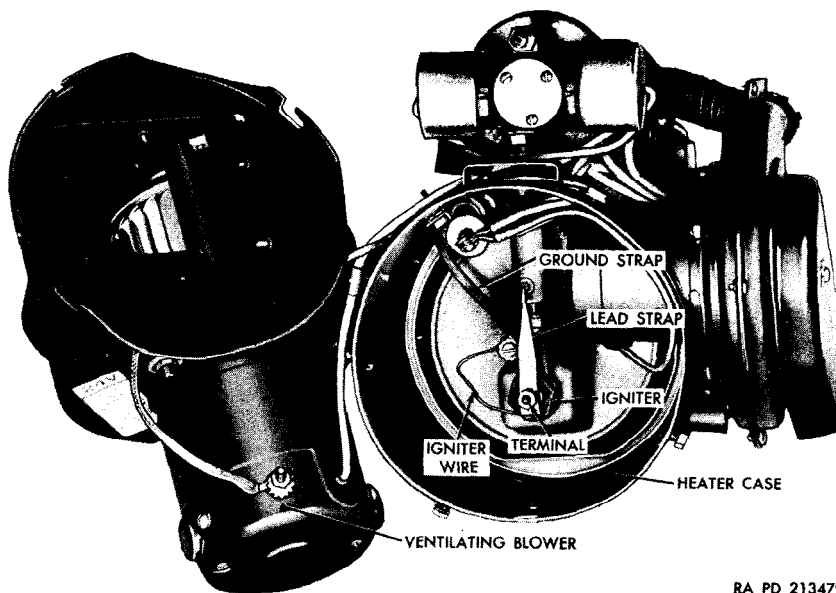


Figure 228. Personnel heater igniter.

- (4) Scribe alining marks (fig. 227) on adjacent parts of the heater case and the ventilator blower motor housing. Loosen the four nuts that secure the ventilating blower to the heater case. Turn the blower counterclockwise to disengage it from the studs in the heater case and remove the ventilating blower from the case.
- (5) Remove the screw and lockwasher that secure the igniter wire and ground strap (fig. 228).
- (6) Remove the two nuts from the igniter terminal, remove the igniter lead strap from the terminal and carefully move the strap to one side.
- (7) Wrap the igniter wire around the terminal and remove the igniter, using a suitable deep socket wrench.

*d. Install Igniter.*

- (1) Wrap the wire of the new igniter around the igniter terminal and install the igniter (fig. 228), using a suitable deep socket wrench. Tighten. Unwrap the igniter wire from the terminal.
- (2) Attach the lead strap (fig. 228) to the igniter terminal and install the two terminal lock nuts. Tighten the nuts.
- (3) Secure the igniter wire and the ground strap with the lockwasher and screw (fig. 228). Tighten the screw.
- (4) Install the ventilating blower on the heater case. Turn the blower clockwise to engage the studs in the heater case, matching the alining marks (c(4) above).
- (5) Attach the ground strap to the heater case (fig. 227).
- (6) Attach the blower motor cable to the No. 2 terminal on the terminal strip (fig. 227).
- (7) Install the heater (b above).

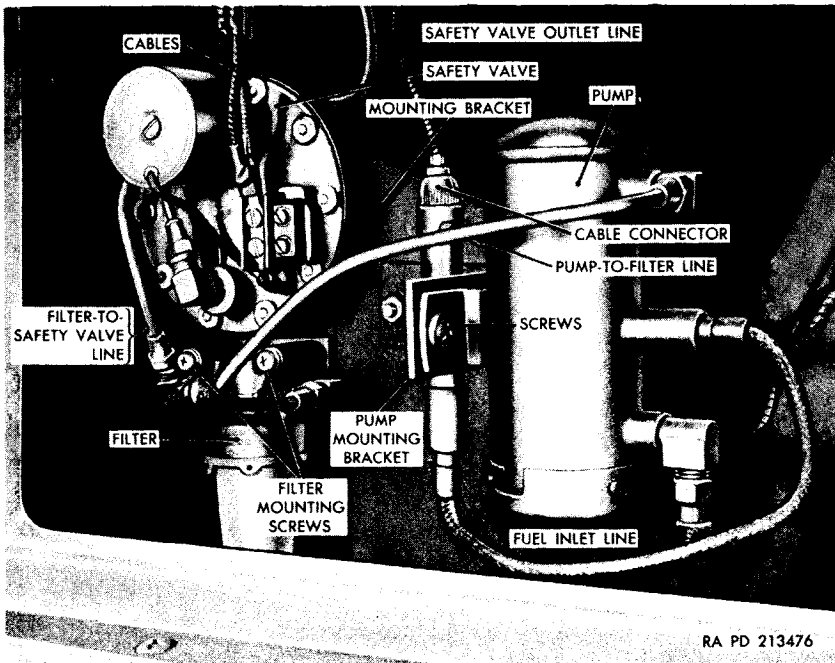
*e. Replace Fuel Pump Safety Valve.*

- (1) Remove the two screws and lockwashers that secure the grill to the right litter compartment and remove the grill.
- (2) Remove the screw that attaches the two cable terminals to the safety valve (fig. 229).
- (3) Remove the filter-to-safety valve line and disconnect the safety valve-to-heater line (fig. 229).
- (4) Remove the three screws and lockwashers (from the bracket side) that secure the valve to the mounting bracket and remove the valve.
- (5) Position the valve on the mounting bracket and install the three No. 10 internal-teeth lockwashers and No. 10-32NF x  $\frac{7}{16}$  cross-recess-roundhead screws (from the bracket side). Tighten the screws.
- (6) Install the filter-to-safety valve line and connect the safety valve-to-heater line, tightening the fitting nuts.

- (7) Position the two cables on the valve and install the terminal screw, tightening the screw.
- (8) Position the grill and install the two  $\frac{5}{16}$ -inch lockwashers and  $\frac{5}{16}$ -24NF x  $\frac{5}{8}$  screws. Tighten screws.

*f. Replace Fuel Filter (fig. 229).*

- (1) Remove the grill (*e*(1) above).
- (2) Disconnect the filter to fuel pump line and the safety valve-to-filter line at the fuel filter.



*Figure 229. Personnel heater fuel pump, filter, and safety valve.*

- (3) Remove the two filter mounting screws and lockwashers and remove the filter.
- (4) Position the filter on the filter bracket and install the two No. 10 internal-teeth lockwashers and No. 10-32NF x  $1\frac{1}{8}$  cross-recess-roundhead filter mounting screws. Tighten the screws.
- (5) Connect the filter-to-pump line and the safety valve-to-filter line, tightening the fitting nuts.
- (6) Install the grill (*e*(8) above).

*g. Replace Fuel Pump (fig. 229).*

- (1) Remove the grill (*e*(1) above).
- (2) Disconnect the cable connector.

- (3) Disconnect the pump-to-filter line and the fuel inlet line at the pump.
  - (4) Remove the two nuts, lockwashers, and screws that secure the pump and cable clip to the mounting bracket and remove the pump and attached cable.
  - (5) Position the pump and cable clip on the mounting bracket and install two  $\frac{1}{4}$ -20NC x  $\frac{5}{8}$  cross-recess pan-head screws,  $\frac{1}{4}$ -inch lockwashers, and  $\frac{1}{4}$ -20NC nuts. Tighten the nuts.
  - (6) Connect the fuel inlet line and the pump-to-filter line, tightening the fitting nuts.
  - (7) Install the grill (e(8) above).
- h. Replace Heater Control Thermostat (fig. 10).*
- (1) Remove the nuts and lockwashers that secure the two thermostat cables on the terminal posts and detach the cables.
  - (2) Remove the two screws that secure the thermostat to the partition and remove the thermostat.
  - (3) Position the new thermostat on the partition and install the two No. 10-32NF x  $\frac{3}{8}$  tapping screws.
  - (4) Attach cable No. 403A to the left terminal post and cable No. 403 to the right terminal post. Install a No. 8 lockwasher and a terminal nut on each post. Tighten the nuts.

## **Section XXIX. RADIO INTERFERENCE SUPPRESSION**

### **274. Purpose**

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 surrounding vehicles, or disclosing locations.

### **275. Description**

*a.* Suppression in these vehicles is accomplished primarily by metallic shielding of the more offending components such as high tension ignition cables, spark plug cables, generator, and generator regulator. An ignition filter serves to eliminate radiation from nonshielded wiring. In addition, metal parts of the vehicle engine are formed into a shield by the use of ground straps at the generator regulator brackets, the clutch housing and frame side rail, and the personnel heater and ventilating blower motors of the ambulance truck M43. Lockwasher screws attaching sheet metal parts assist in confining electrical disturbances to prevent or reduce interference with receiving equipment.

b. Organizational maintenance operations include replacement of the ignition filter, ground straps, defective electrical equipment, and servicing of lockwasher screws.

## **276. Ground Straps**

a. *Generator Regulator Brackets.* Replacement of the ground straps at the generator regulator brackets is described in paragraph 165.

b. *Chassis Ground Strap.* Replacement of the chassis ground strap (clutch housing-to-frame side rail) is described in paragraphs 121*h* and 122*c*.

c. *Personnel Heater (Ambulance Truck M43).* If radio interference is caused by the personnel heater, check ground strap screws for looseness. Tighten screws or replace heater, as required (par. 273).

d. *Ventilating Blower Motors (Ambulance Truck M43).* Replacement of the ventilating blower motors is described in paragraph 272.

## **277. Ignition Filter, Filter Bracket, and Cable (Early Type)**

a. *General.* Replacement of the ignition filter in the distributor is described in paragraph 130*c* and *e*. For replacement of the early type filter and cable, proceed as described below.

b. *Removal* (fig. 99). Be sure that the ignition switch is in the "OFF" position.

- (1) Disconnect the distributor-to-filter cable at the distributor receptacle and the receptacle at the left side of the ignition filter. Disengage the cable from the cable clip on the dash panel and remove the cable.
- (2) Disconnect the ignition switch cable from the receptacle at the right side of the filter.
- (3) Remove the four bolts and lockwashers that secure the filter to the filter bracket and remove the filter.
- (4) If the bracket must be replaced, remove the two bolts and lockwashers that secure the filter bracket to the dash panel and remove the bracket.

c. *Installation.*

- (1) If the filter bracket was removed (b(4) above), position the bracket on the dash panel and install two  $\frac{5}{16}$ -inch, internal-external-teeth lockwashers and  $\frac{5}{16}$ -24NF x  $\frac{3}{16}$  bolts. Tighten the bolts.
- (2) Position the filter on the bracket (fig. 99) and install the four No. 12 lockwashers and No. 12-24NC x  $\frac{3}{8}$  roundhead bolts. Tighten the bolts.
- (3) Connect the ignition switch cable to the receptacle at the right side of the filter.

- (4) Position the distributor-to-filter cable with the straight connector at the filter and the elbow connector at the distributor. Connect the cable connectors to the receptacles on the filter and distributor. Engage the cable in the cable clip on the dash panel, together with the temperature gage sending unit cable and horn cable.

## **Section XXX. MAINTENANCE UNDER UNUSUAL CONDITIONS**

### **278. 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  $-40^{\circ}$  F., Ordinary greases become as solid as cold butter.

*b.* These difficulties increase the time required to perform maintenance. At temperatures below  $-40^{\circ}$  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  $-50^{\circ}$  F. may approach 2 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.

**Caution:** It is important that the approved maintenance procedures be followed. TM 9-2855 contains general information which is specifically applicable to these vehicles as well as other vehicles. It must be considered an essential part of this manual, not merely an explanatory supplement to it.

*d.* Refer to TB 9-2855-5 for information on the personnel heater kit for the driver's compartment (all models), TB 9-2855-6 for information on the arctic winterization kit, and TB 9-2855-7 for information on the hard top closing kit (except ambulance truck M43).

### **279. Extreme-Cold Weather Maintenance**

Refer to TM 9-2855 for instructions on the application of antifreeze compounds, arctic-type lubrication, handling of storage batteries in extreme cold, and dewinterization procedure.

## 280. Extreme-Hot Weather Maintenance

*a. Cooling System.* Thoroughly clean and flush cooling system (par. 149) at frequent intervals and keep system filled to within 2¼ inches of the top of the filler neck with clean water when operating in extremely high temperatures. Formation of scale and rust in the cooling system occurs more rapidly 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 the correct reading for fully charged batteries. This procedure will prolong the life of the negative plates and separators. Batteries should be recharged at about 1.160 specific gravity.
- (3) *Self-discharge.* A battery will self-discharge at a greater rate if left standing for long periods at high temperatures. This must be considered when operating in torrid zones. If necessary to park for several days, remove the battery 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. Evidences will appear in the form of rust and paint blisters on metal surfaces and mildew, mold, or fungus growth on wood, fabrics, leather, and glass.
- (3) Protect all exposed exterior painted surfaces from corrosion by touch-up painting and keep a film of preservative lubricating oil (medium) 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.

## 281. 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 and dry all tools and equipment; clean all exposed painted 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 (figs. 33 and 34). 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 Case, and Axles.* Check the lubricant in the engine, transmission, transfer case, and axles. Should there be evidence that water has entered, drain, flush, and refill with the correct lubricant. Remove the vents from the transfer and front and rear axle housing. Clean and check the operation of the vent valves. Replace damaged vents. Remove and clean engine oil filter.

*d. Wheels and Brakes.* Remove the front wheels and flush out the steering knuckle flanges with a half-and-half mixture of engine oil (OE-10) and dry-cleaning solvent or volatile mineral spirits. Refill with the correct lubricant. Remove rear wheels. Wash all wheel bearings thoroughly with dry-cleaning solvent or volatile mineral spirits, 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 the steering gear. If the lubricant is contaminated, clean the housing thoroughly with a half-and-half mixture of engine oil (OE-10) and dry-cleaning solvent



or volatile mineral spirits. Assemble, refill with correct grade of lubricant, and adjust (par. 232).

*g. Electrical Connections.* Check all electrical connections for corrosion, particularly the bayonet-type connectors.

*h. Fuel System.* Drain fuel tank of any accumulated water, clean fuel filter and lines as necessary. If water is found in the air cleaner, clean and refill with oil.

*i. 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.

*j. 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.

*k. Deep-Water Fording.* Refer to TM 9-2853 for deepwater fording information.

## **282. 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 tire 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, and fuel and oil filters must be cleaned at least daily. Radiator fins must be cleaned daily with compressed air when operating in dusty terrain. Engine grills and other exposed vents should be covered with cloth at all times. When halted, the engine grills should be covered to protect the engine against entrance of sand or dust.

## CHAPTER 4

# SHIPMENT AND LIMITED STORAGE AND DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

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### Section I. SHIPMENT AND LIMITED STORAGE

#### 283. Domestic Shipping Instructions

*a. Preparation for Shipment in Continental United States.* When shipping the  $\frac{3}{4}$ -ton cargo truck M37 interstate or within the continental United States, except directly to ports of embarkation, the officer in charge of preparing shipments *will be responsible* for furnishing vehicles to the carriers for transport in a *serviceable* condition, properly cleaned, preserved, painted, and lubricated as prescribed in SB 9-4.

*Note.* For instructions on loading and blocking these vehicles on flatcars, see paragraphs 285 and 286. On vehicle materiel (OVM) will be prepared, packed, and stowed as prescribed in paragraph 385b.

*b. Removal of Preservatives Before Shipment.* Removal of preservatives is the responsibility of depots, ports, or field installations (posts, camps, and stations) receiving shipments. Personnel withdrawing vehicles from limited storage for domestic shipment *must not remove preservatives*, other than to insure that the vehicles are 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.

*c. Preparation for Shipment to Ports (see AR 747-30).*

- (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 perform any necessary supplementary or previously omitted processing upon receipt of vehicles, in accordance with AR 747-30.

- (3) *Marking of arctic-lubricated materiel.* It will be the responsibility of the officer in charge of the organization performing arctic lubrication to insure that the equipment is marked as prescribed in SR 746-30-10. It will be the responsibility of

the officer in charge of the organization shipping arctic-lubricated equipment to insure that each item is so marked. Unit commanders of using organizations will insure that such markings are not obliterated while the equipment is arctic-lubricated. When the equipment is deprocessed of the special lubrication, such marking will be immediately and thoroughly obliterated.

*d. Army Shipping Documents.* Prepare all Army shipping documents accompanying freight in accordance with TM 38-705.

*e. Deepwater Forging.* If deepwater forging is anticipated during shipment, prepare vehicles in accordance with TM 9-2853.

## **284. Limited-Storage Instructions**

### *a. General.*

- (1) Vehicles received for storage and already processed for domestic shipment, as indicated on the Processing Record for Shipment and Storage of Vehicles and Boxed Engines (DA Form 9-3), must not be reprocessed, unless inspection, performed on receipt of vehicles, reveals corrosion, deterioration, etc.
- (2) Process vehicles upon receipt directly from manufacturing facilities, or if processing data recorded on tag indicates that the preservatives have been rendered ineffective by operation or freight shipping damage.
- (3) Vehicles to be prepared for limited storage must be given a limited technical inspection and processed as prescribed in SB 9-4. Results and classification will be entered on DA Form 461-5, Limited Technical Inspection.

### *b. Receiving Inspections.*

- (1) Report of vehicles received for storage in a damaged condition or improperly prepared for shipment will be made on DD Form 6, in accordance with SR 745-45-5. Report of vehicles received in an unsatisfactory condition (chronic failure or malfunction) will be reported on the DA Form 468, Unsatisfactory Equipment Report, in accordance with SR 700-45-5.
- (2) When vehicles are inactivated, they will be processed in accordance with type I as prescribed in SB 9-4. Standby storage 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 paragraphs 9 through 12. Perform a systematic inspection and replace or repair all missing or broken parts. If repairs are beyond scope of unit and vehicles will be inactivated for an appreciable length

of time, store them in a limited-storage status and attach tags specifying repairs needed. Report 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 it and clean, paint, and treat with the prescribed preservatives.

*Note.* Touchup painting will be in accordance with TM 9-2851.

*d. Removal from Limited Storage.*

- (1) If vehicles are not shipped or issued upon expiration of the limited storage period, they will be further treated for standby storage by ordnance maintenance personnel.
- (2) If vehicles to be shipped will reach their destination within 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 vehicles 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. Lubricate as prescribed in paragraphs 73 through 78. Inspect and service vehicles as prescribed in paragraphs 80 and 83.
- (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 shed 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 vehicles protected against the elements as prescribed in TB ORD 379.

## **285. Loading the ¾-Ton 4 x 4 Cargo Truck M37 on Railroad Flatcars**

*a. Preparation.*

- (1) When vehicles are to be shipped by rail, every precaution must be taken to see that they are properly loaded and securely fastened and blocked to floor of flatcar as prescribed in paragraph 286.
- (2) Prepare vehicle for rail shipment as prescribed in SB 9-4. On vehicle materiel (OVM) will be thoroughly cleaned, preserved, packed (boxed or crated) and securely stowed in or on the vehicle as prescribed in *b* below.

- (3) If vehicle is equipped with steel tool boxes, remove all padlocks and keys from vehicle in order to prevent pilferage while in transit. Secure lids of steel tool boxes by wiring hasp to prevent damage during shipment. Preserve padlocks and keys with preservative engine oil (grade 1) and wrap in greaseproof barrier-material for domestic shipment or seal in a waterproof-greaseproof wrapping or bag for overseas shipment. Locate all wrapped padlocks and keys in shipping container with OVM.
- (4) Load vehicle in such a manner that it will not form an unbalanced load on flatcar. Apply parking brakes and place transmission in neutral position, after vehicle has been finally spotted on flatcar.
- (5) Increase tire pressure slightly higher than normal, except where shipment is to be exposed to extremely hot weather conditions.

*b. On Vehicle Materiel (OVM).*

- (1) *General.* Preserve and package all OVM materiel individually, except items used as sets or in quantities greater than one.
- (2) *Battery and electrolyte.*
  - (a) If vehicle is to be shipped within the continental United States, *except* direct to ports of embarkation, disconnect the battery cables from batteries. Clean ((*b*) below) and coat cable terminals with automotive and artillery grease (GAA). Tape ends of cable terminals with nonhygroscopic adhesive tape and secure away from batteries.
  - (b) If vehicles are to be shipped direct to ports of embarkation, *except* when vehicles are to be combat-loaded, remove batteries, plug vents, and clean outside of battery with a solution containing one-half pound of commercial grade baking soda (sodium bicarbonate) to one gallon of water. Rinse with *cool* water and remove plugs. Scrape or wire-brush cable terminals and battery box (holder) and clean with the above cleaning solution. Rinse with *cool* water. Coat cable terminals with automotive and artillery grease (GAA). Paint battery boxes, if required, with black acid-resisting paint. Batteries and electrolyte will be packed in accordance with TM 9-2857 and TM 9-2854 and shipped in vehicle separate from other OVM.
- (3) *Publications.* Package technical manuals in accordance with Method IC-3, "Waterproof bag, sealed", using heavy duty, type I, heat sealable, grade A, waterproof, class *b* bags. Pack in the OVM container. Where publications are provided by

separate technical services, such material will be packed in the same exterior OVM container with the items to which they are applicable.

- (4) *Unit Packages.* Unit packages that are impracticable to intermediate package, and are not water-resistant in construction will be overwrapped in flexible waterproof barrier material and sealed with waterproof water-resistant adhesive.
- (5) *Intermediate packages.* Unit packages of related items will be grouped together wherever possible and intermediate packaged in fiberboard cartons. Container closure will be made by sealing all seams with water-resistant gummed paper tape. When the gross weight exceeds 20 pounds, in addition to sealing with tape, the containers will be sealed with water-resistant adhesive (for sealing fiberboard boxes).
- (6) *Exterior containers.*
  - (a) Keep the number of exterior containers to a minimum. The size will be governed by the cubic displacement of the packaged OVM. Dimensions will be such, that when assembled in sets as required, and stowed on vehicles, the overall cubage of the vehicle will not be increased.
  - (b) Place heavy equipment in the bottom of exterior containers, and block and brace as necessary so that they will not damage other contents. Pack fragile materiel and canvas items above other OVM items at the top of the container. Pack canvas covers for OVM items in the same exterior container with the item for which it is intended.
  - (c) Pack unit and intermediate packages in a style 2, unlined, snug fitting, nailed wood box, for a type III load, modified as prescribed in 1 through 5 below.
    1. Exterior containers over 200-pounds gross weight will have nominal 2 x 4 end cleats. Also beveled end skids of nominal 2 x 4 lumber, placed flat, parallel to the ends of the containers, and spaced approximately 6 inches from each end, with span between skids not to exceed 36 inches.
    2. The fastening of the skids to the bottom will be accomplished by the use of nails driven through the floor into the skid member. Nails will be of sufficient length and size to achieve maximum holding power.
    3. Additional battens, when required will be fastened to the inside faces of the top and side panels, and to the inside face of the bottom panel when skids are not required.
    4. Construct the container top of matched lumber and nail to the side and end panels. The container will be

weatherproofed, strapped and marked in accordance with TM 9-2854.

*Note.* Weatherproofing top of containers will not be necessary if containers are to be stowed within closed vehicles.

5. Paint exterior surfaces of all OVM exterior containers (except tops) with one coat of olive drab enamel.

*Note.* OVM containers stowed within closed vehicles will not require painting.

(7) *Stowage.*

- (a) Stow all OVM containers inside the body, cab, or other suitable location, as applicable, without increasing the cubic displacement of the vehicle. Strap, block or brace all OVM containers to prevent free movement.

*Note.* OVM containers must receive maximum protection against corrosion, deterioration and mechanical damage during shipment and prolonged periods of storage.

- (b) OVM containers constructed without skids that are to be stowed in exposed locations in contact with platforms, floors or other boxes will be placed on nominal 1 x 4 wood cleats to minimize surface contact. Secure cleats in a manner that will prevent shifting or damage to contacted surfaces.

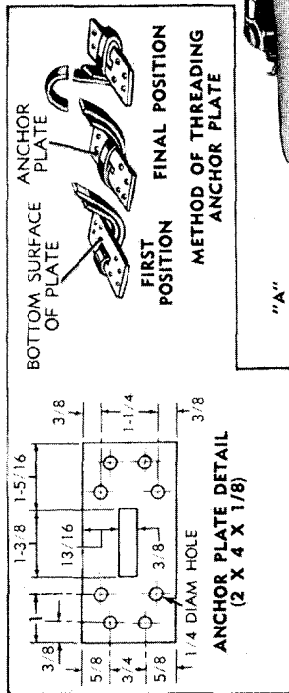
*c. Method of Loading the 3/4-ton 4 x 4 Cargo Truck M37 on flatcars.* For method of loading and general loading rules pertaining to rail shipment of ordnance vehicle, see TB 9-OSSC-G.

**Warning:** The height and width of vehicles, when prepared for rail transportation, must not exceed the limitations indicated by the loading table 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 in the order to avoid delays, dangerous conditions, or damage to equipment.

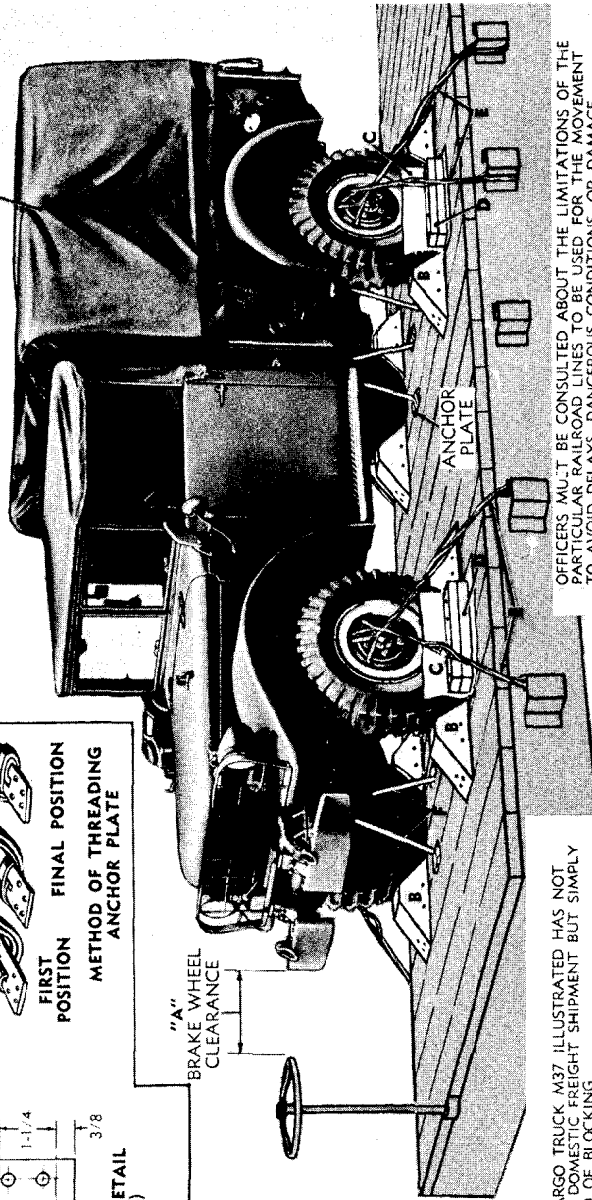
## **286. Blocking the 3/4-Ton 4 x 4 Cargo Truck M37 on Flatcars**

*a. General.* All blocking instructions specified herein are minimum and are in accordance with Association of American Railroads Pamphlet No. MD-7, "Rules Governing the Loading of Department of Defense Materiel 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 in *b* through *g* below refer to the details and locations shown in figure 230.

*Note.* Any loading instructions, regardless of source, which appear to be in conflict with this publication or existing loading rules of the carriers must be submitted for approval to the Chief of Ordnance, Washington 25, D. C.



SEE NOTES 1 AND 2



**NOTES:**

- 1—THE 3 1/4-TON, 4X4 CARGO TRUCK M37 ILLUSTRATED HAS NOT BEEN PROCESSED FOR DOMESTIC FREIGHT SHIPMENT BUT SIMPLY ILLUSTRATES METHOD OF BLOCKING.
- 2—THE HEIGHT AND WIDTH OF MATERIEL WHEN PREPARED FOR RAIL TRANSPORTATION MUST NOT EXCEED THE LIMITATIONS INDICATED BY THE LOADING TABLE AS DESCRIBED IN AR 700-105 (SECTION 11), 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, DANGEROUS CONDITIONS, OR DAMAGE TO EQUIPMENT.

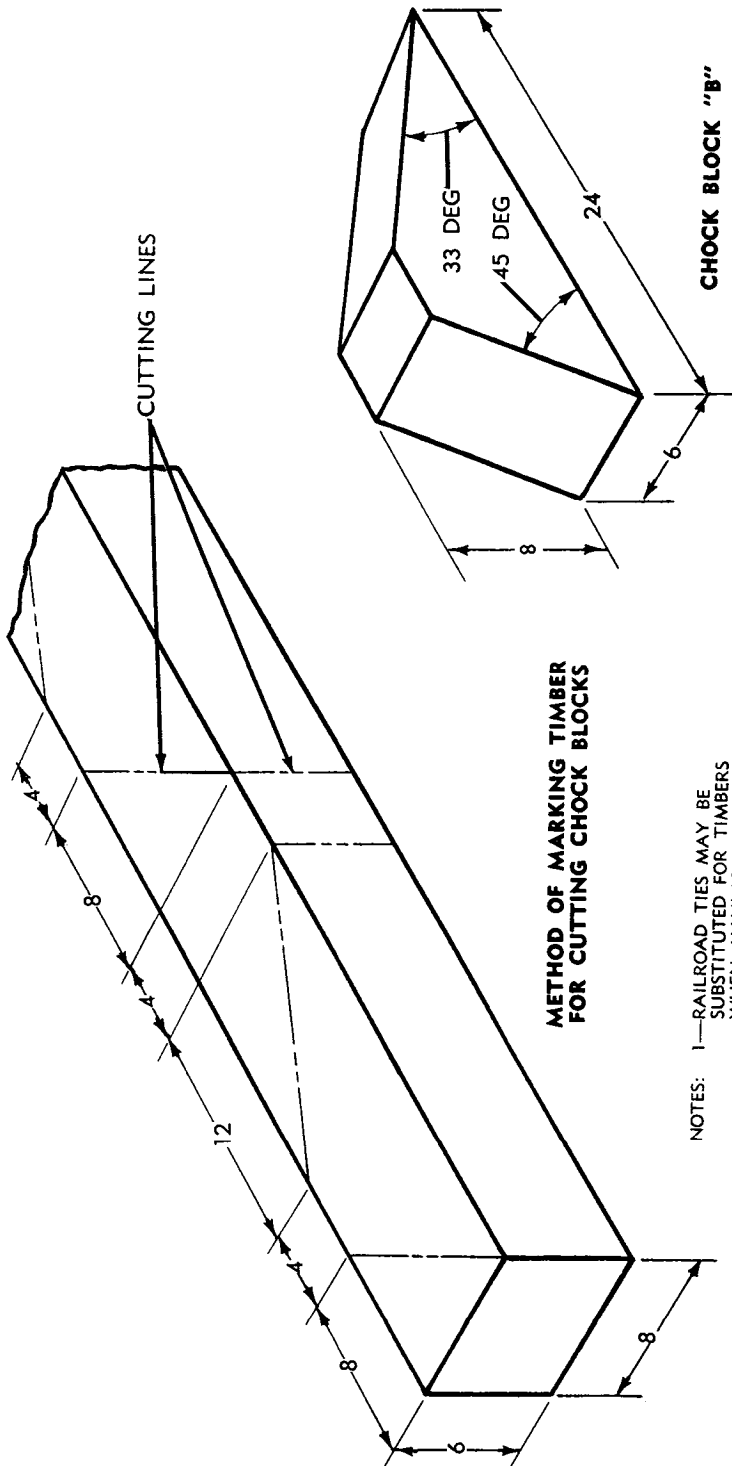
3—ITEM REFERENCE LETTERS REFER TO DESCRIPTIONS IN TEXT.

4—ALL DIMENSIONS SHOWN ARE IN INCHES.

RA PD 211876

**Figure 230. Method of blocking the 3 1/4-ton 4 x 4 cargo truck M37 on flatcar.**





NOTES: 1—RAILROAD TIES MAY BE  
SUBSTITUTED FOR TIMBERS  
WHEN AVAILABLE  
2—ALL DIMENSIONS SHOWN  
ARE IN INCHES

Figure 231. Cutting chock blocks from timbers.

RA PD 115824C

b. *Brake Wheel Clearance "A"* (fig. 230). Load vehicles 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. Brake wheel clearance should be increased as much as is consistent with proper location of load.

*Note.* Vehicle should be spotted on flatcar so that wheels are centrally positioned between stake pockets in order that wheel strapping "E" (f below) provides uniform crosswiring.

c. *Chock Blocks "B"* (6 x 8 x 24 in., *Eight Required*). Locate the 45° surface of blocks "B" against the front and rear of each wheel. Nail heel of blocks to car floor with forty-penny nails and toenail both sides of blocks to car floor with forty-penny nails.

*Note.* Chock blocks may be cut from timber (or railroad ties, when available), as shown in figure 231.

d. *Cushioning Material "C"* (fig. 230). Locate suitable cushioning material, such as waterproof paper or burlap, between tires and cleats "D". The cushioning material should protrude beyond cleats "D" at floor and above cleats "D" at the side of the tire.

e. *Wheel Side Cleats "D"* (2 ft. x 4 ft., *length to Suit, Eight Required*). Locate side cleats on top of cushioning material "C" and nail through cleats and cushioning material to floor of car with thirty-penny nails. Secure upper cleat to lower cleat with thirty-penny nails.

f. *Wheel Strapping "E"* (*Four Strands, No. 8 Gage, Black Annealed Wire, Length to Suit*). Twist-tie wire to form single cables "E". Pass cable through two adjacent ventilating holes at upper part of each wheel, slightly *forward* of center. Pass the other end of cable through a stake pocket, *rearward* of wheel and twist-tie cable just taut enough to remove all slack. Similarly, secure another cable through the two ventilating holes at upper part of each wheel, slightly *rearward* of center, and through a stake pocket *forward* of wheel.

g. *Axle Strapping "F"* (1¼ x 0.035 *Hot-Rolled Steel Strap, Length to Suit*). Pass two pieces of strapping "F" over each axle, one at each end, close to brake drum and through steel anchor plates, as shown in figure 230. Secure by nailing *anchor* plates to car floor with not less than six twenty-penny nails (double-headed nails preferred). As an alternate method, pass two cables (consisting of four strands of No. 8 gage, black annealed wire) over each axle and each end around 2 x 4 x 18-inch wooden cleat, locate cleats lengthwise of car, and nail to car floor with thirty-penny nails.

## Section II. DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

### 287. General

*a.* Destruction of the  $\frac{3}{4}$ -ton 4 x 4 truck, 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 flammables.

Demolition — Requires suitable explosives or ammunition.

Gunfire —Includes artillery, machineguns, 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  $\frac{3}{4}$ -ton 4 x 4 truck 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 enemy 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 materiel, 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 materiel 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) and (2) below.

- (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.

## 288. Method No. 1—Destruction by Burning

a. Remove and empty portable fire extinguishers.

b. 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.

c. Puncture fuel tanks as near the bottom as possible, collecting gasoline for use as outlined in *f* below.

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, if present, may be caused by the fire. Due consideration should be given to the highly flammable nature of gasoline and its vapor. Carelessness in its use may result in painful burns.

Elapsed time: about 6 minutes.

## 289. Method No. 2—Destruction by Demolition

a. Remove and empty portable fire extinguishers.

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 to make up each charge). Set the charges as in (1), (2), and (3) below.

- (1) *One* on top of the clutch 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. 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 ft in 30 to 45 sec; 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 tanks, 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.

### **290. Method No. 3—Destruction by Gunfire**

a. Remove and empty portable fire extinguishers.

b. Puncture fuel tanks.

c. Destroy the tires as in paragraphs 288 or 289.

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, body, axles, and wheels. Although one well-placed direct hit may render the vehicle temporarily useless, 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 artillery at ranges of 500 yards or less should be from cover. Firing rifle grenades or antitank rockets should be from cover.

Elapsed time: about 6 minutes.

# APPENDIX

## REFERENCES

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### 1. Publication Indexes

Special regulations in the 310-20-series; DA pamphlets of the 310-series, DA\* Pam 108-1, and FM 21-8 should be consulted frequently for latest changes or revisions of references in this appendix and for new publications relating to materiel covered in this manual.

### 2. Supply Manuals

#### *a. Destruction To Prevent Enemy Use.*

Land Mines and Components; Demolition ORD 3 SNL R-7  
Explosives and Related Items; and Ammunition for Simulated Artillery, Booby Trap, Hand Grenade, and Land Mines Fire.

#### *b. Maintenance and Repair.*

Cleaners, Preservatives, Lubricants, Recoil ORD 3 SNL K-1  
Fluids, Special Oils, and Related Maintenance Materials.  
Items of Soldering, Metallizing, Brazing and ORD 3 SNL K-2  
Welding Materials: Gases and Related Items.  
Lubricating Equipment, Accessories, and ORD (\*) SNL K-3  
Related Dispensers.  
Lubricating Fittings, Oil Filters, and Oil ORD 5 SNL H-16  
Filter Elements.  
Tool Set (Organizational Maintenance)---- ORD 6 SNL J-7, Sec. 1,  
2 and 3  
Tool Set (General Mechanic's)----- ORD 6 SNL J-10, Sec. 4  
*c. Vehicle.*  
Truck,  $\frac{3}{4}$ -Ton, 4 x 4, Cargo M37, Command ORD 7 SNL G-741  
M42, Ambulance M43, and Telephone  
Maintenance V-41 (Dodge).  
Winterization Equipment----- ORD 9, SNL G-249,  
Sec. 10

### 3. Forms

Standard Form 91, Operator's Report of Motor Vehicle Accident.  
Standard Form 94, Statement of Witness.

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\*See DA Pam 310-29, Index of Supply Manuals, Ordnance Corps, for published types of manuals of the Ordnance section of the Department of the Army Supply Manual.

- DA Form 9-3, Processing Record for Shipment and Storage of Vehicles and Boxed Engines.
- DA Form 9-4, Vehicular Storage and Servicing Record.
- DA Form 9-68, Spot Check Inspection Report for Wheeled and Half-Track Vehicles.
- DA Form 9-75, Daily Dispatching Record of Motor Vehicles.
- DA Form 348, Driver Qualification Record.
- DA Form 452-1, Placard-Documents Covering Shipment Are on Other Side of Car.
- DA Form 452-2, Placard-Documents Covering Shipment Are on This Side of Car.
- DA Form 460, Preventive Maintenance Roster.
- DA Form 461, Preventive Maintenance Service and Inspection for Wheel and Half-Track Vehicles.
- DA Form 461-5, Limited Technical Inspection.
- DA Form 468, Unsatisfactory Equipment Report.
- DA Form 478, Organizational Equipment File.
- DA Form 1089, Claim for Personal Property.
- DA Form 811 and 811-1, Work Request and Job Order Receipt.
- DA Form 1208, Report of Claims Officer.
- DD Form 6, Report of Damaged or Improper Shipment.
- DD Form 110, Vehicle and Equipment Operational Record.
- DD Form 313, U. S. Government Operator's Permit.
- DD Form 317, Preventive Maintenance Service.

#### 4. Other Publications

The following explanatory publications contain information pertinent to this materiel and associated equipment:

<i>a. Camouflage.</i>	
Camouflage, Basic Principles.....	FM 5-20
Camouflage of Vehicles.....	FM 5-20B
<i>b. Decontamination.</i>	
Decontamination .....	TM 3-220
Defense Against CBR Attack.....	FM 21-40
<i>c. Destruction to Prevent Enemy Use.</i>	
Explosives and Demolitions.....	FM 5-25
Safety: Regulations for Firing Ammunition for Training, Target Practice, and Combat.	SR-385-310-1 AFR-50-13
<i>d. General.</i>	
Artillery Materiel and Associated Equipment..	TM 9-2300
Association of American Railroad Rules Govern- ing the Loading of Department of De- fense Materiel on Open Top Cars.*	Pamphlet No. MD-7
Basic Arctic Manual.....	FM 31-70

\*Copies may be obtained from Aberdeen Proving Ground, Aberdeen, Md.

Chassis Coating Compound (Under Body Compound), Description, Method of Application, and Equipment Used.	TB ORD 401
Cooling Systems: Vehicles and Powered Ground Equipment.	TM 9-2858
Driver's Manual.....	TM 21-305
Driver Selection, Training and Supervision, Wheeled Vehicles.	TM 21-300
Fuel-Burning Heaters for Winterization Equipment.	TM 9-8662
Inspection of Ordnance Materiel in the Hands of Troops.	TM 9-1100
Instruction Guide: Operation and Maintenance of Ordnance Materiel in Extreme Cold (0° to -65° F.).	TM 9-2855
Military Vehicles.....	TM 9-2800
Motor Transportation, Operation.....	FM 25-10
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Operations in the Arctic.....	FM 31-71
Precautions in Handling Gasoline.....	AR 850-20
Preparation of Ordnance Materiel for Deep Water Forging.	TM 9-2853
Principles of Automotive Vehicles.....	TM 9-2700
Prevention of Motor Vehicles Accidents.....	AR 385-55
Reports of Accident Experience.....	SR-385-10-40
Spark Plugs.....	TB ORD 313
Storage Batteries, Lead-Acid Type.....	TM 9-2857
Motor Vehicles.....	AR 700-105
Supplies and Equipment: Unsatisfactory Equipment Report.	SR 700-45-5.
<i>e. Kits.</i>	
Arctic Winterization Kit.....	TB 9-2855-6
Hard-Top Closing Kit (except M43).....	TB 9-2855-7
Personnel Heater Kit (cab only, all models)---	TB 9-2855-5
<i>Note.</i> For a complete listing of cleaning, preservation, packaging, and packing specifications, consult the Operational List of Packaging Specifications and Instructions (General Supply). Copies may be obtained from Commanding Officer, Rossford Ordnance Depot, Toledo 1, Ohio, Attention: ORDWD-P.	
<i>f. Maintenance and Repair.</i>	
Abrasive, Cleaning, Preserving, Sealing, Adhesive and Related Materials Issued for Ordnance Materiel.	TM 9-850
Instruction Guide: Care and Maintenance of Ball and Roller Bearings.	TM 37-265
Lubrication .....	TM 9-2835



Lubrication Order.....	LO 9-8030
Maintenance and Care of Hand Tools.....	TM 9-867
Maintenance and Care of Pneumatic Tires and Rubber Treads.	TM 31-200
Maintenance Responsibilities and Shop Operation.	AR 750-5
Marking of Arctic-Lubricated Materiel and Equipment.	SR 746-30-10
Shipment and Digit Marking.....	SR 746-30-6
Painting Instruction for Field Use.....	TM 9-2851
Tactical Motor Vehicle Inspection and Preventive Maintenance Services.	TM 9-2810
<i>g. Shipment and Limited Storage.</i>	
Army Shipping Document.....	TM 38-705
Instruction Guide: Ordnance Packaging and Shipping (Posts, Camps, and Stations).	TM 9-2854
Marking and Packing of Supplies and Equipment: Marking of Oversea Supply.	SR 746-30-5
Military Standard, Marking of Shipments.....	MIL STD 129 *
Ordnance Storage and Shipment Chart-Group G.	TB 9-OSSC-G
Processing of Unboxed and Uncrated Equipment for Oversea Shipment.	AR 747-30
Preservation, Packaging, and Packing of Military Supplies and Equipment.	TM 38-230
Processing of Motor Vehicles and Related Unboxed Materiel for Shipment and Storage.	SB 9-4
Protection of Ordnance General Supplies in Open Storage.	TB ORD 379
Reusable Shipping Containers for Tank and Automotive Assemblies: Proper Use and Care.	SB 9-69
Shed and Open Storage of Supplies.....	SR 743-5-10
Report of Damaged or Improper Shipment....	SR 745-45-5
Standards for Oversea Shipment and Domestic Issue of Ordnance Materiel Other than Ammunition and Army Aircraft.	TB ORD 385
Station Supply Procedure.....	TM 38-403
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For explanation of abbreviations used, see SR 320-50-1.