

- (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.*

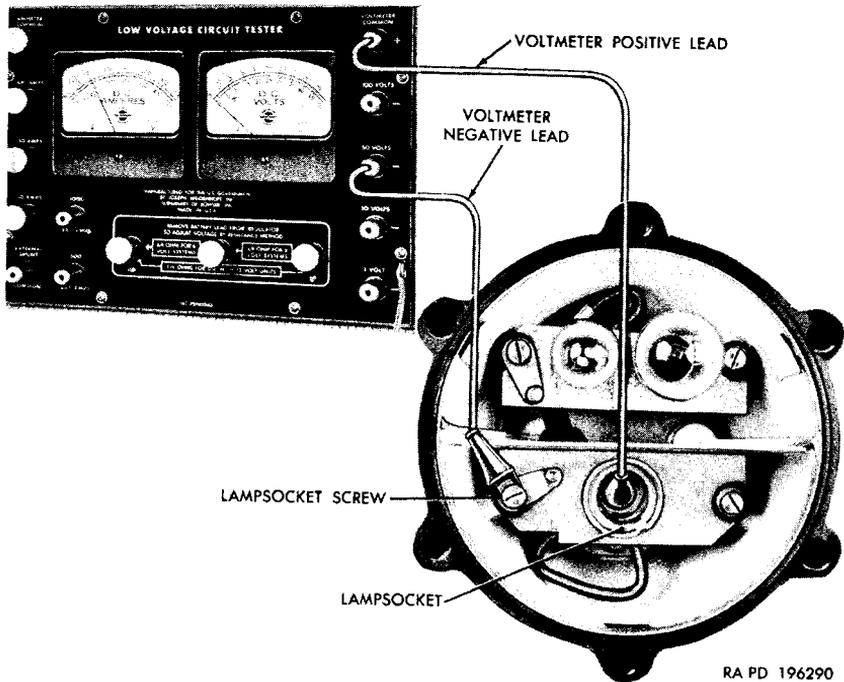
- (1) *Spark plugs faulty or incorrectly adjusted.* Refer to *d*(1) above.
- (2) *Ignition timing incorrect.* Check timing with timing light and adjust if necessary (par. 126).
- (3) *Fuel system faulty.* Refer to paragraph 86*e*.
- (4) *Valves faulty.* Refer to paragraph 85*b*(3).
- (5) *Other causes.* 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.



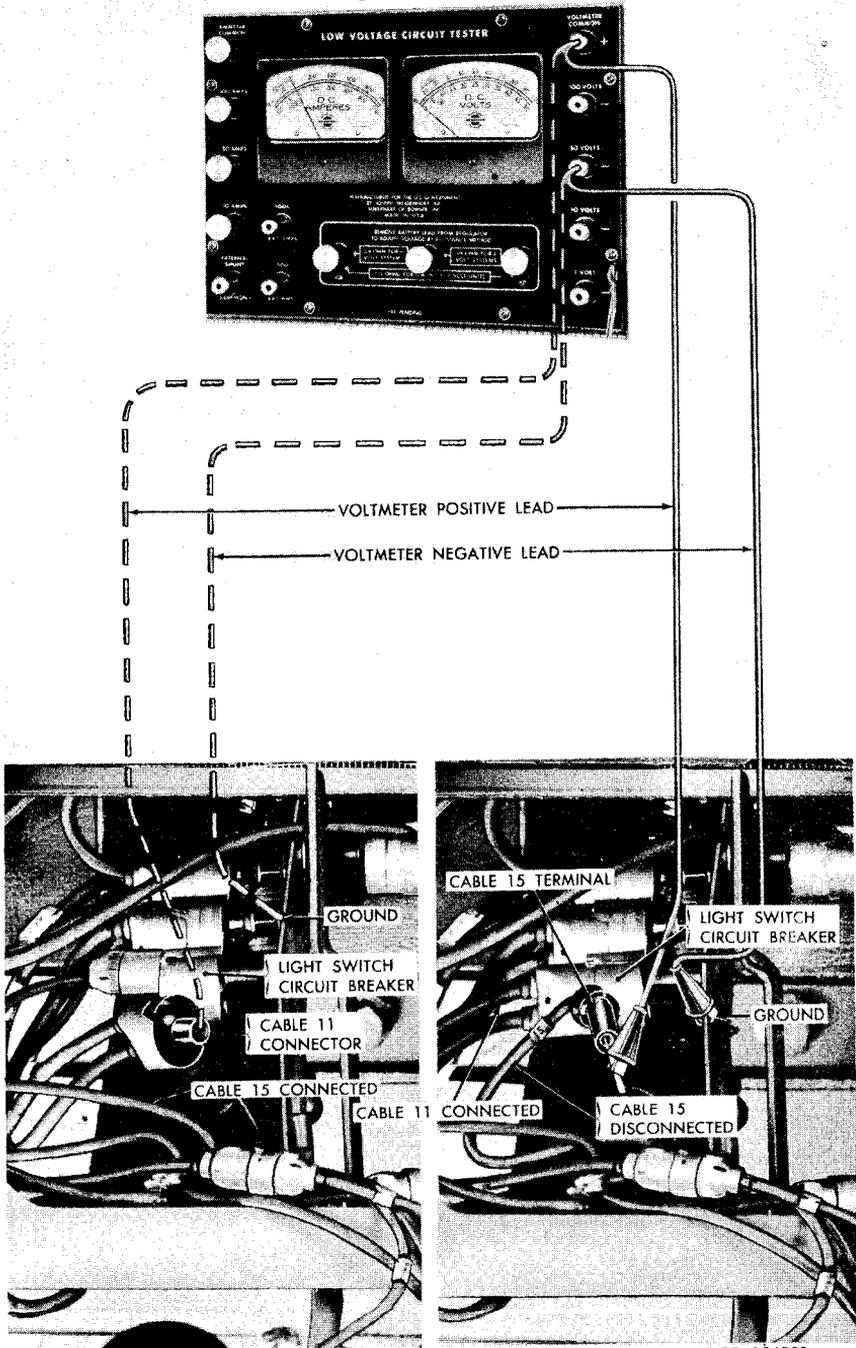
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Figure 57. Checking for current at blackout marker light.

- (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



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).

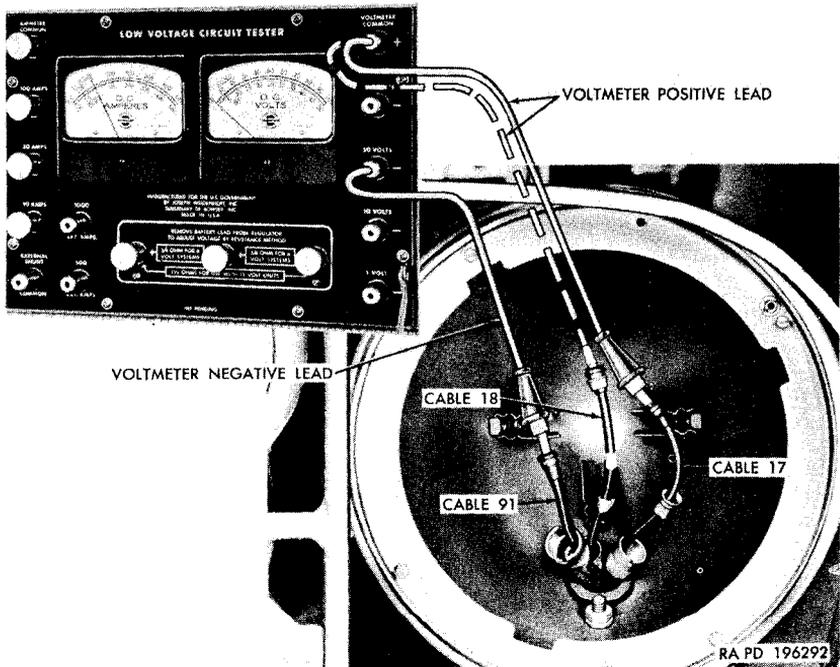


Figure 59. Checking for current to headlight.

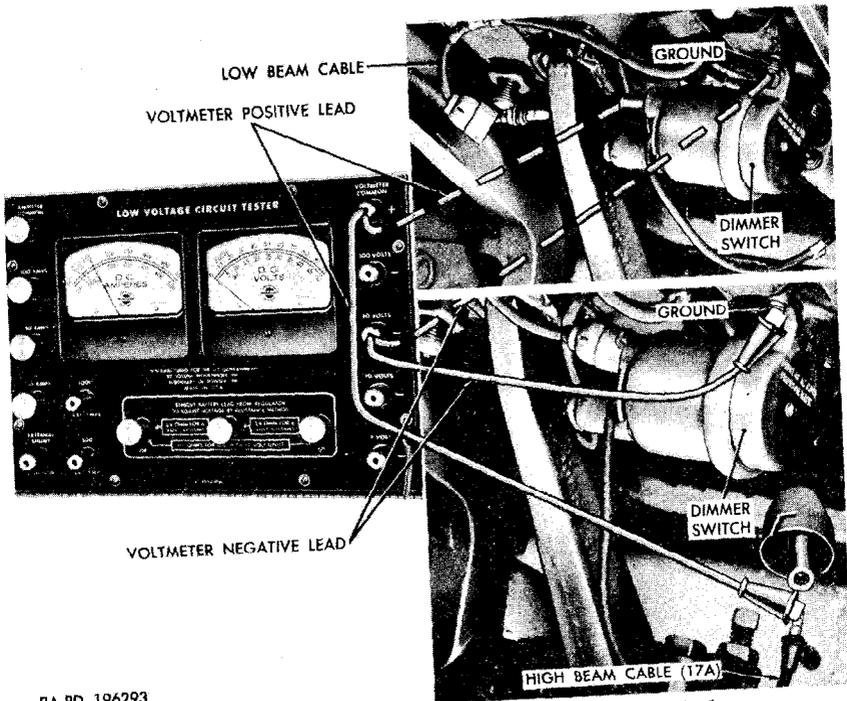
- (g) If the voltmeter readings indicate that current is flowing through the dimmer switch in one circuit, but not in the other, replace the dimmer switch (par. 173c and d). If both circuits show no voltage readings, determine whether current is reaching the dimmer switch ((i) below).
- (h) If voltmeter 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.

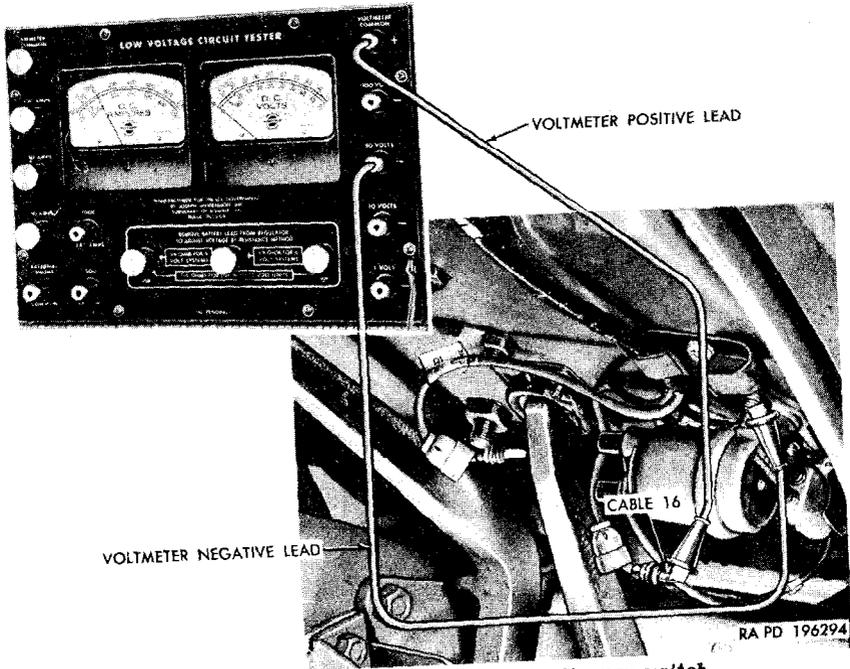


Figure 61. Checking for current to dimmer switch.

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.

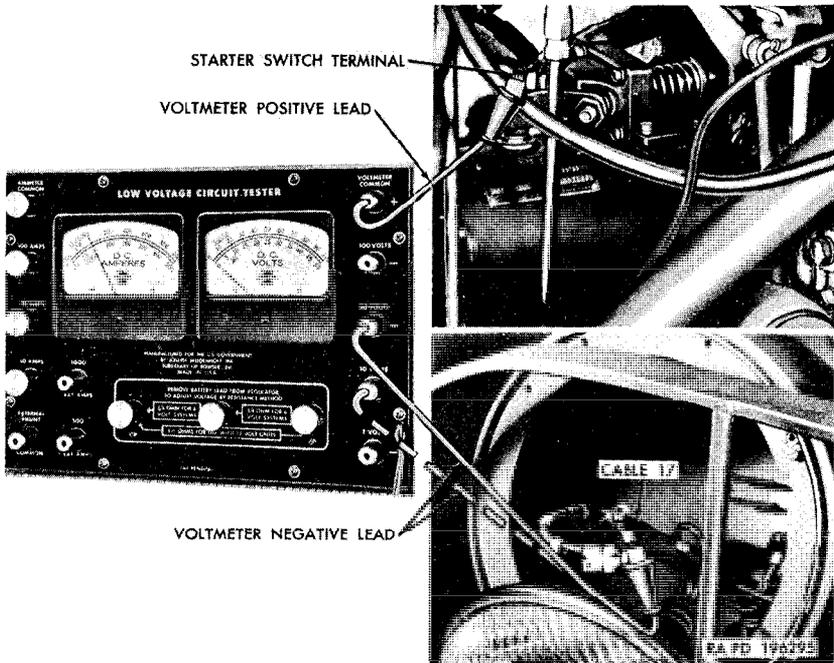


Figure 62. Checking headlight circuit resistance.

- (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).

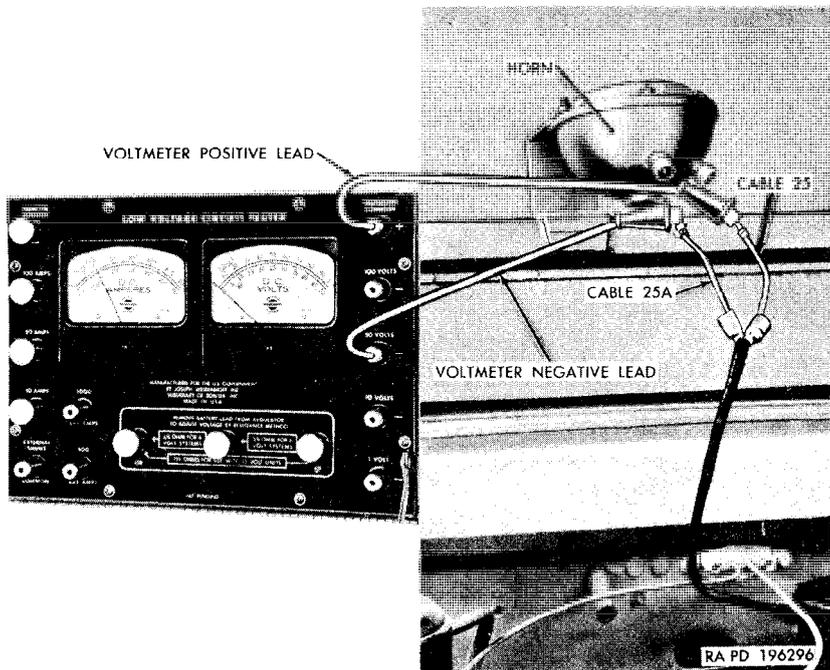


Figure 63. Checking for current at horn connections.

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).

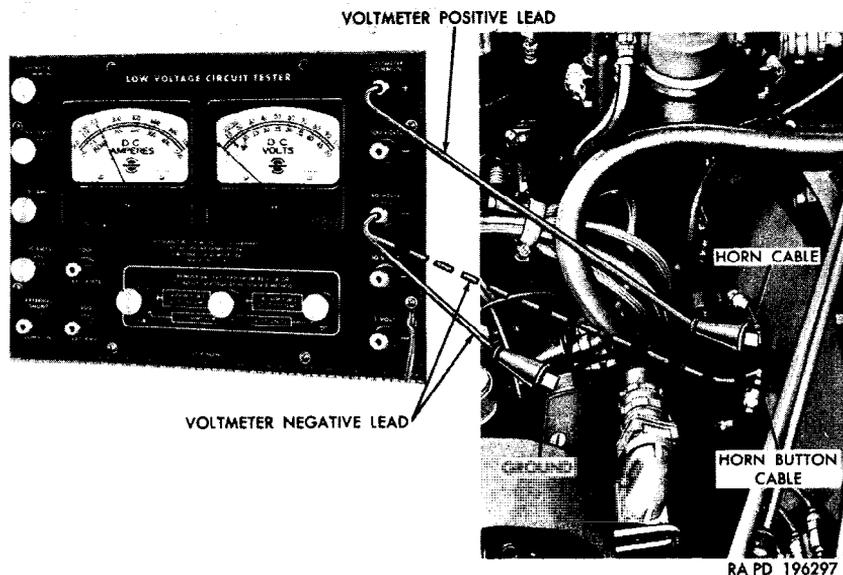


Figure 64. Checking for current through horn cables.

- (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.

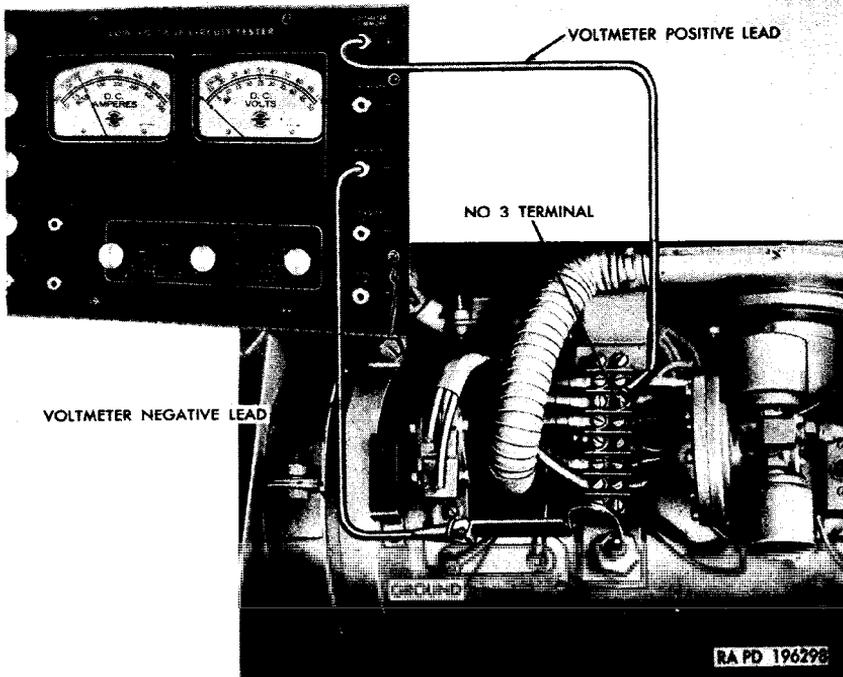
(c) Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to a suitable ground on the heater case.

(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

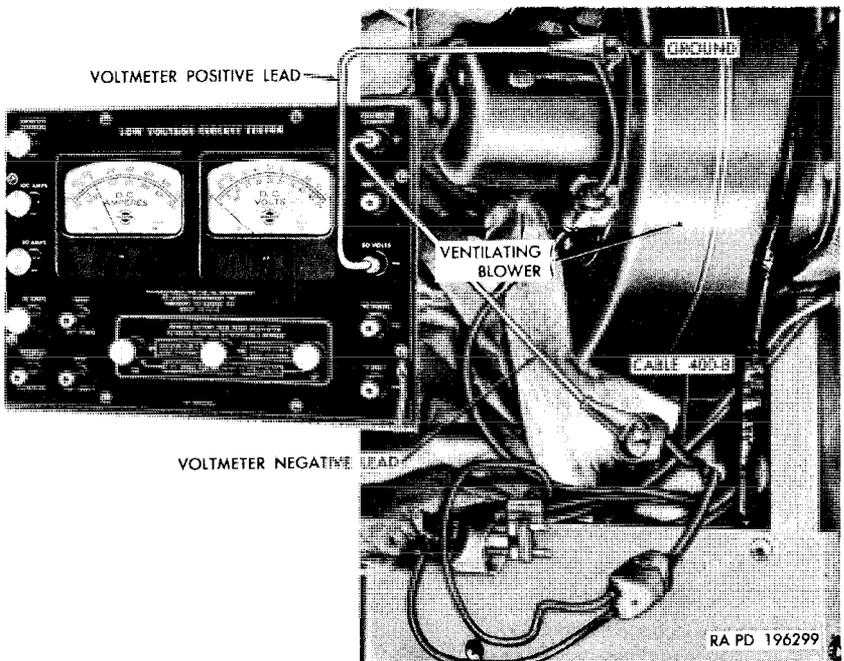


Figure 66. Checking for current at heater cable.

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.

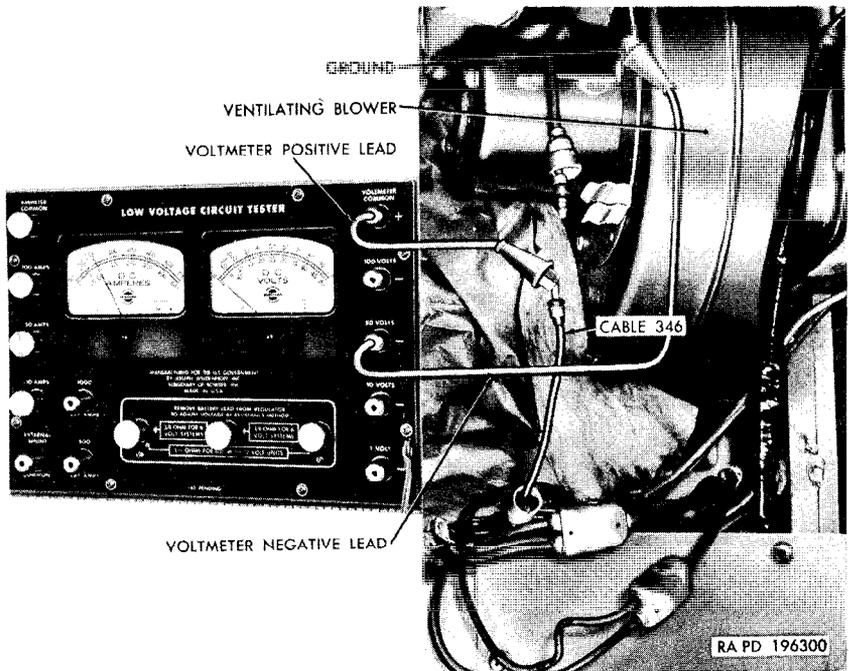


Figure 67. Checking for current to ventilating blower motor and switch.

- (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 :**

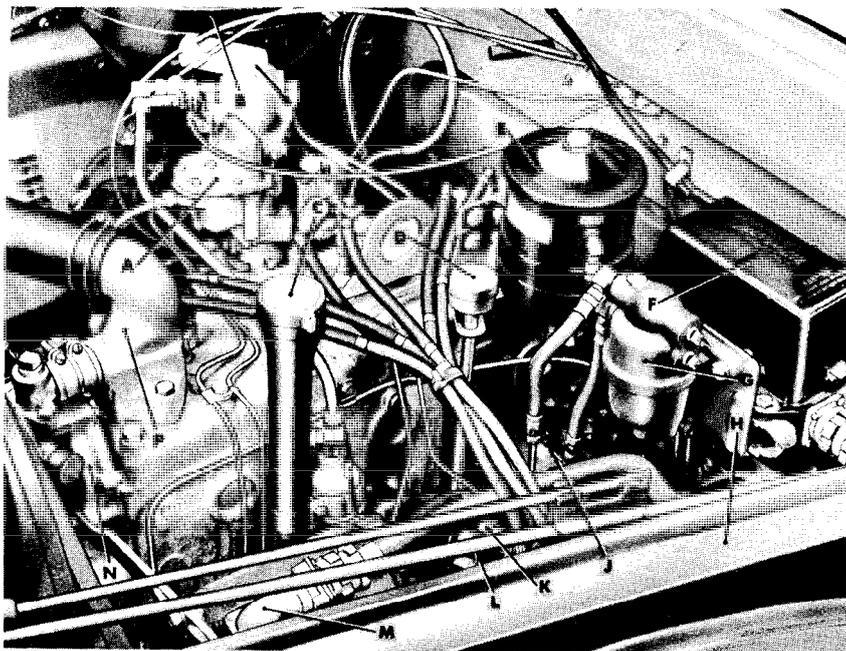
W/transmission and radiator (includes coolant and oil)----- 865 lb  
W/o transmission and radiator (shipping weight)----- 675 lb

## 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

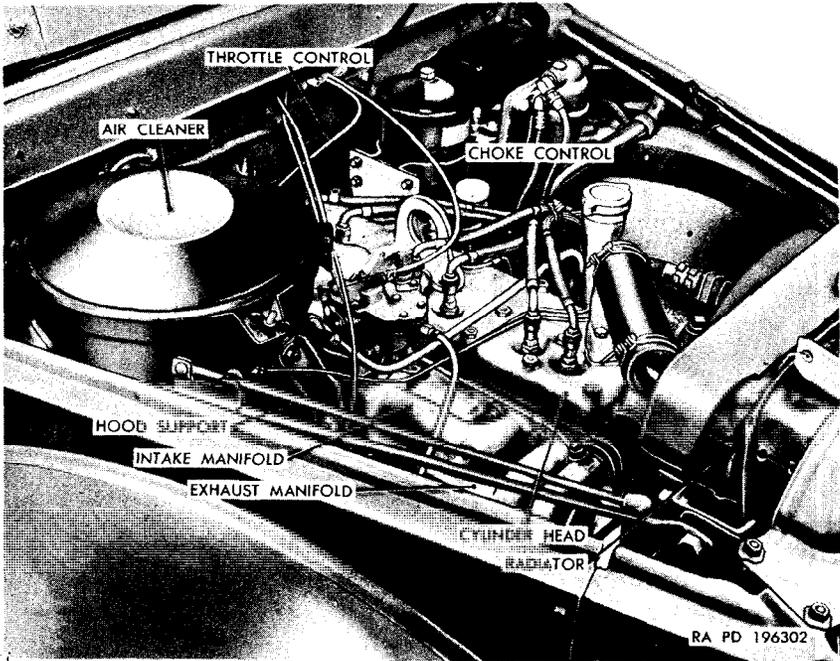
A—CARBURETOR  
B—AIR CLEANER  
C—OIL FILLER PIPE  
D—OIL LEVEL GAGE  
E—OIL FILTER  
F—GENERATOR REGULATOR  
G—FUEL FILTER

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.

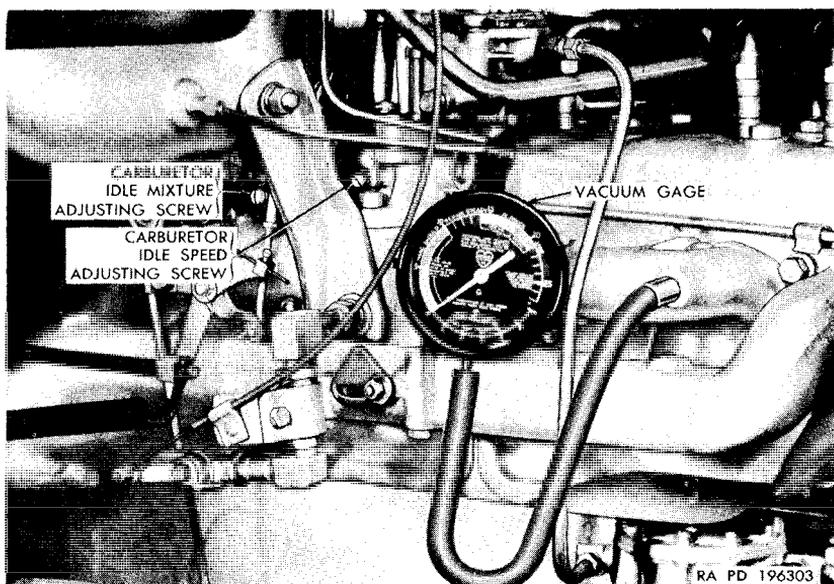


Figure 70. Manifold vacuum test

## 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.

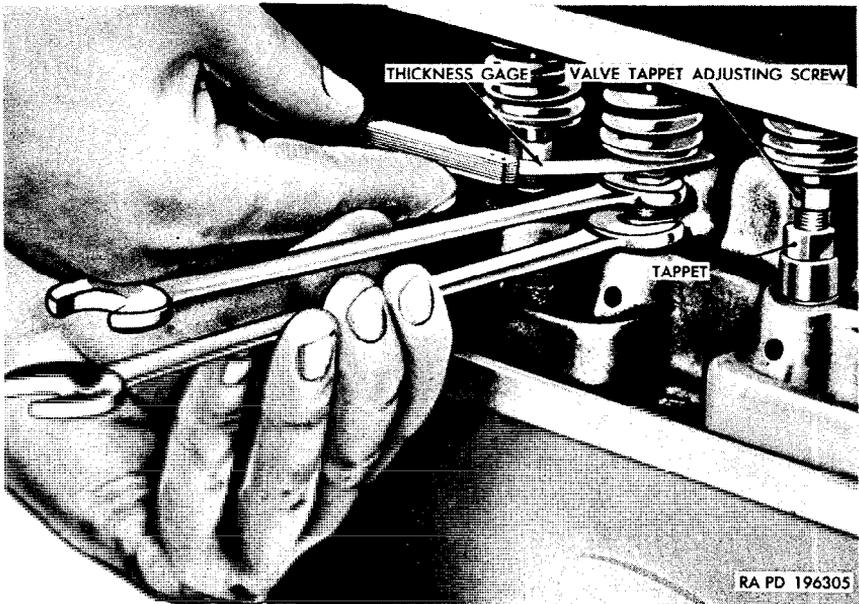


Figure 72. Adjusting valve tappets.

(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.

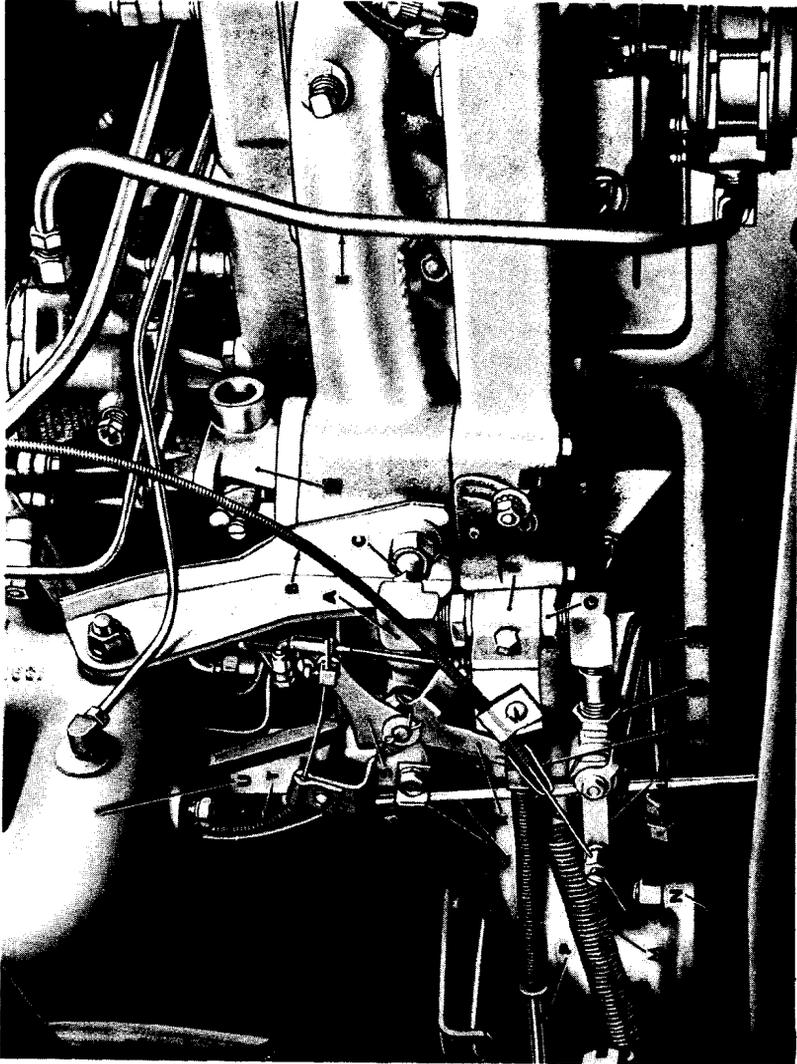
*o. Install Carburetor Air Cleaner.* Refer to paragraph 133e.

## 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.

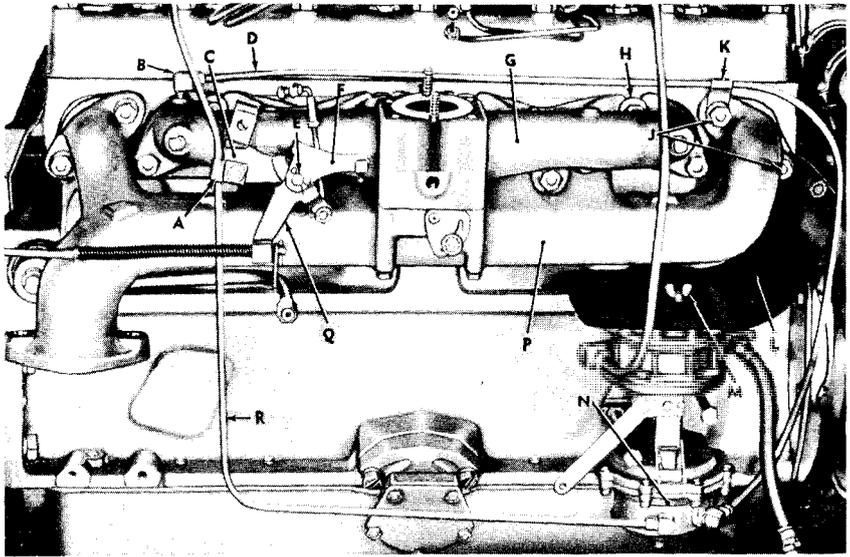
### *b. Removal.*

- (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
- ITEM
- 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

- A—WIPER HOSE LINE CLIP
- B—ELBOW
- C—THROTTLE CONTROL CLIP BRACKET
- D—FUEL PUMP TO INTAKE MANIFOLD LINE
- E—BELLCRANK STUD
- F—THROTTLE CONTROL LEVER
- G—INTAKE MANIFOLD
- H—WASHER

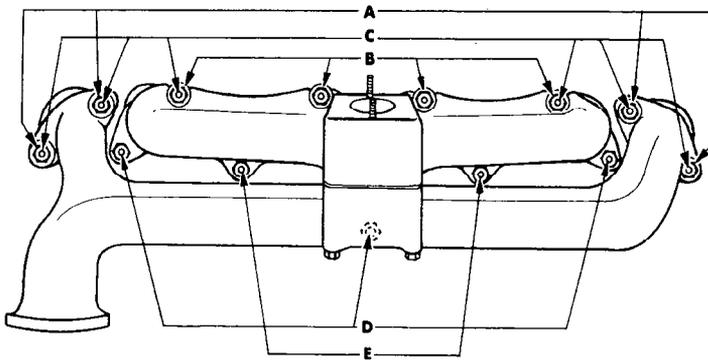
KEY ITEM

- J—MANIFOLD STUD NUTS
- K—VACUUM LINE CLIP
- L—FUEL PUMP HEAT SHIELD
- M—HEAT SHIELD WING NUT
- N—FUEL PUMP
- P—EXHAUST MANIFOLD
- Q—THROTTLE CONTROL BELLCRANK
- 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.

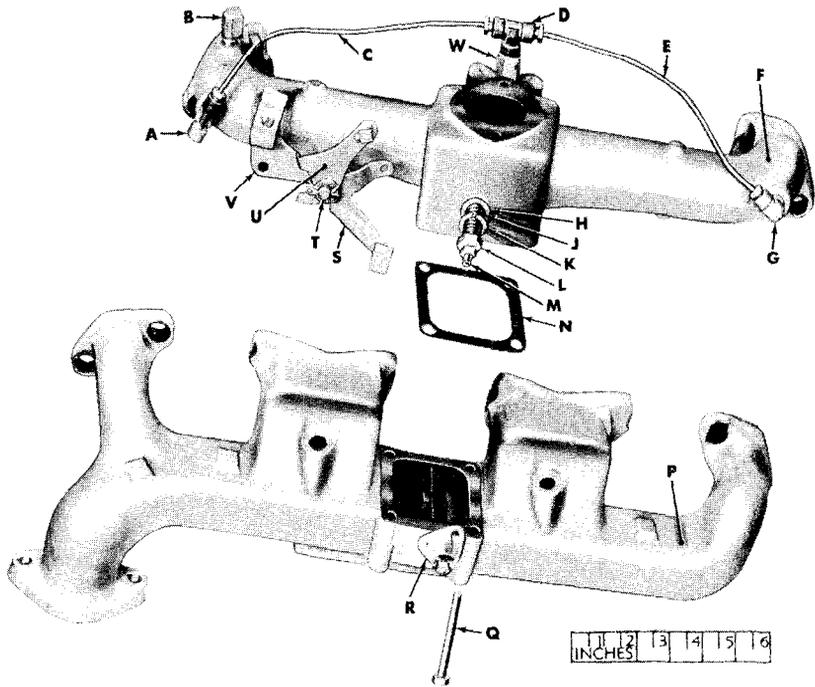
(A and D) and the elbow-type nozzle (G). Remove the three nozzles and the nozzle extension. On engines not so equipped, remove the three pipe plugs from the intake manifold.

- (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.

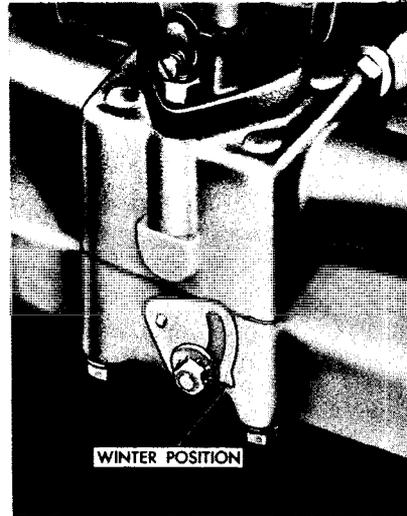
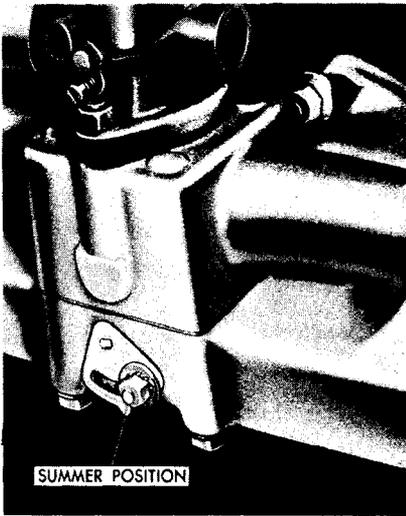
*g. Adjust Manifold Heat Control Valve.* Loosen the control valve adjusting plate stud nut and move the heat control valve plate (R, fig. 76) to the proper position for prevailing ambient temperature. Set the plate at SUMMER position for ambient temperatures consistently above 60° F. and at WINTER position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

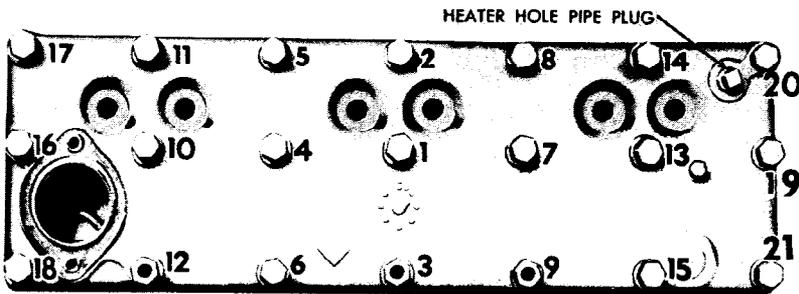
### *b. Tighten Cylinder Head.*

- (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.*

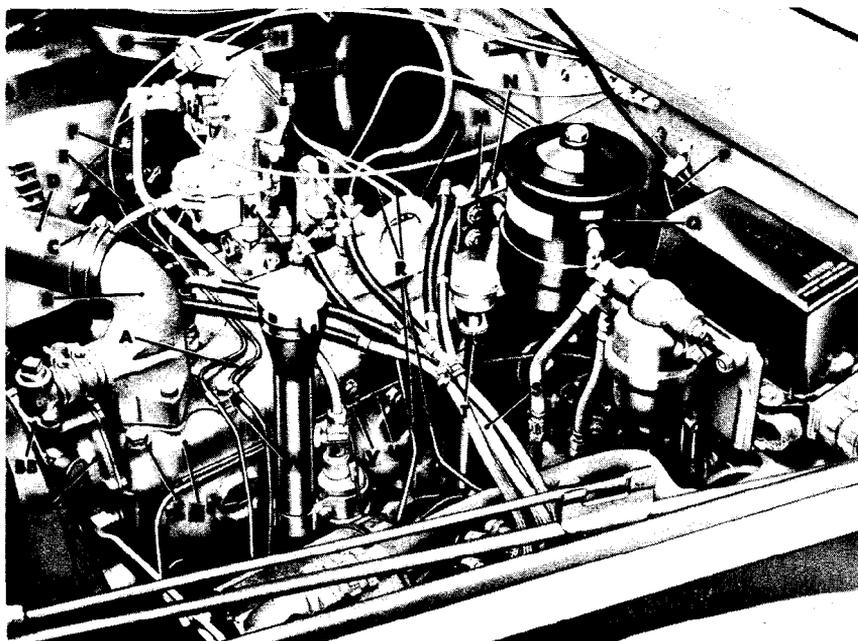
*Note.* The key letters noted in parentheses are in figure 79.

- (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.

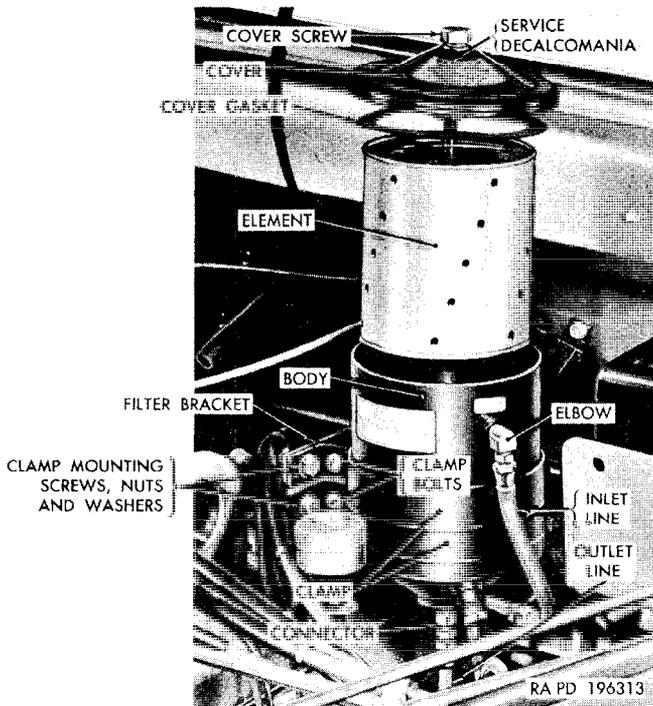


Figure 80. Replacing oil filter element.

- (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  $\frac{1}{4}$ -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).*

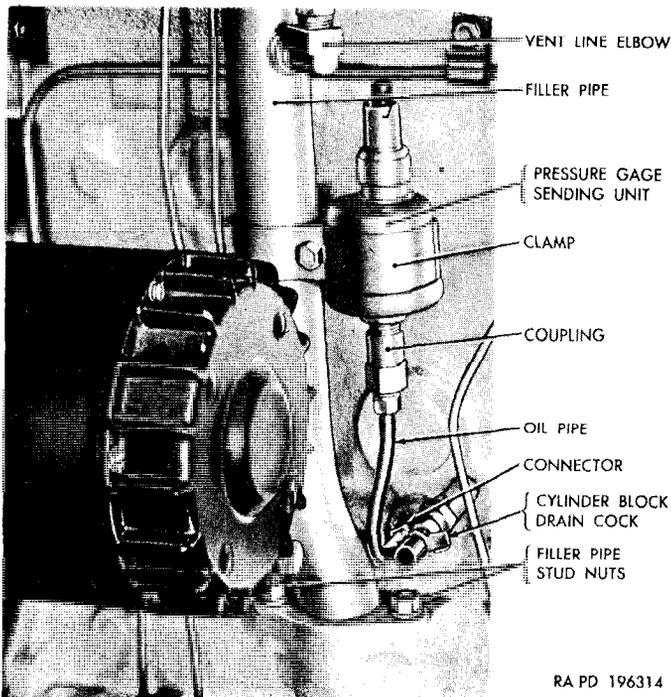
- (1) Disconnect the sending unit cable from the oil pressure gage sending unit.
- (2) Move the generator (*i*(1) above) to provide access to the parts.
- (3) Disconnect the sending unit oil line from the coupling on the oil pressure gage sending unit.
- (4) Remove the sending unit clamp nut, lockwasher, 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.*

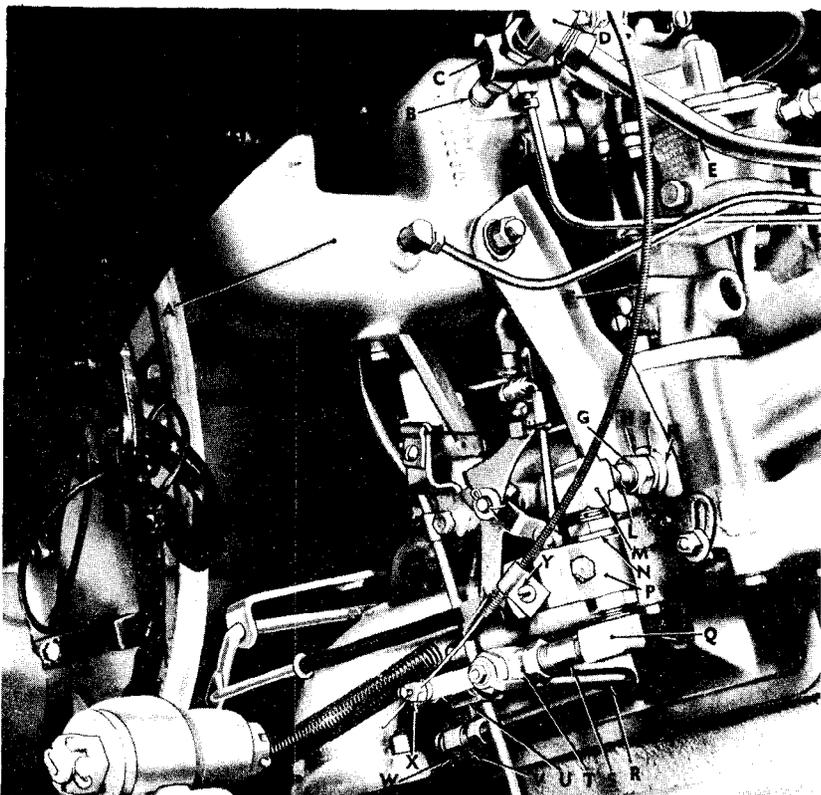
- (1) On vehicles equipped with ventilation shutoff valves, loosen the filler pipe shutoff valve lever swivel screw at the upper shutoff valve (C) and pull out the crankcase ventilation valve dual control (G, fig. 12) to disengage the control from the swivel.
- (2) Remove the oil filler pipe vent line (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).

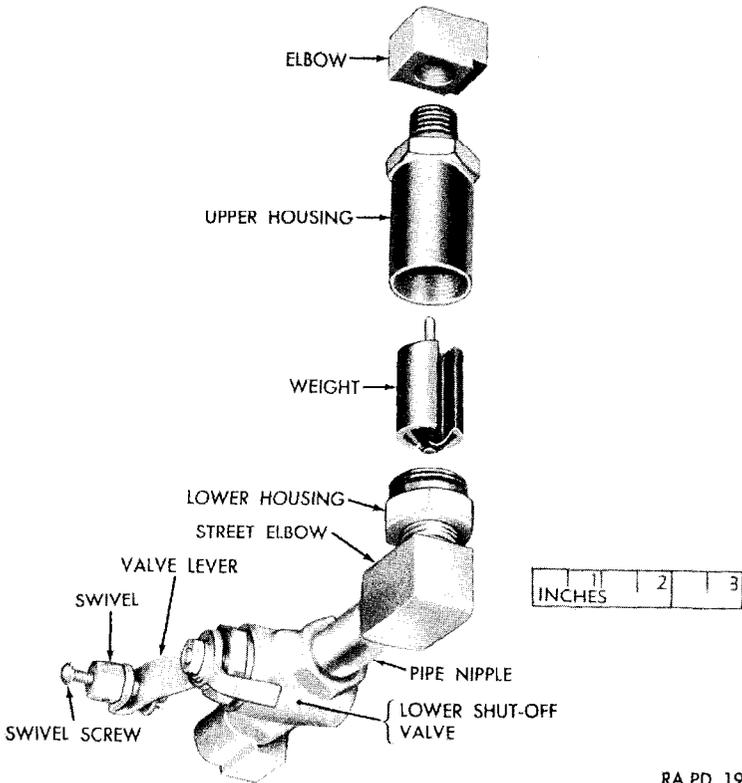
*g. Disassemble Crankcase Vent Line and Related Parts.* Remove the crankcase vent line (R) from the connector (W) and remove the connector from the fitting.

*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

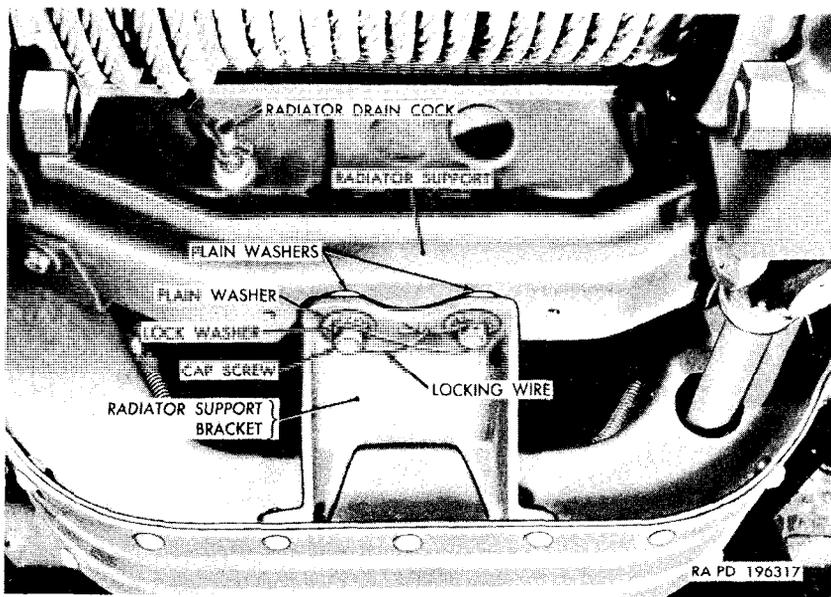
the generator, distributor, starter, and carburetor. It is not necessary to drain the engine oil, cooling system, or transmission.

*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.

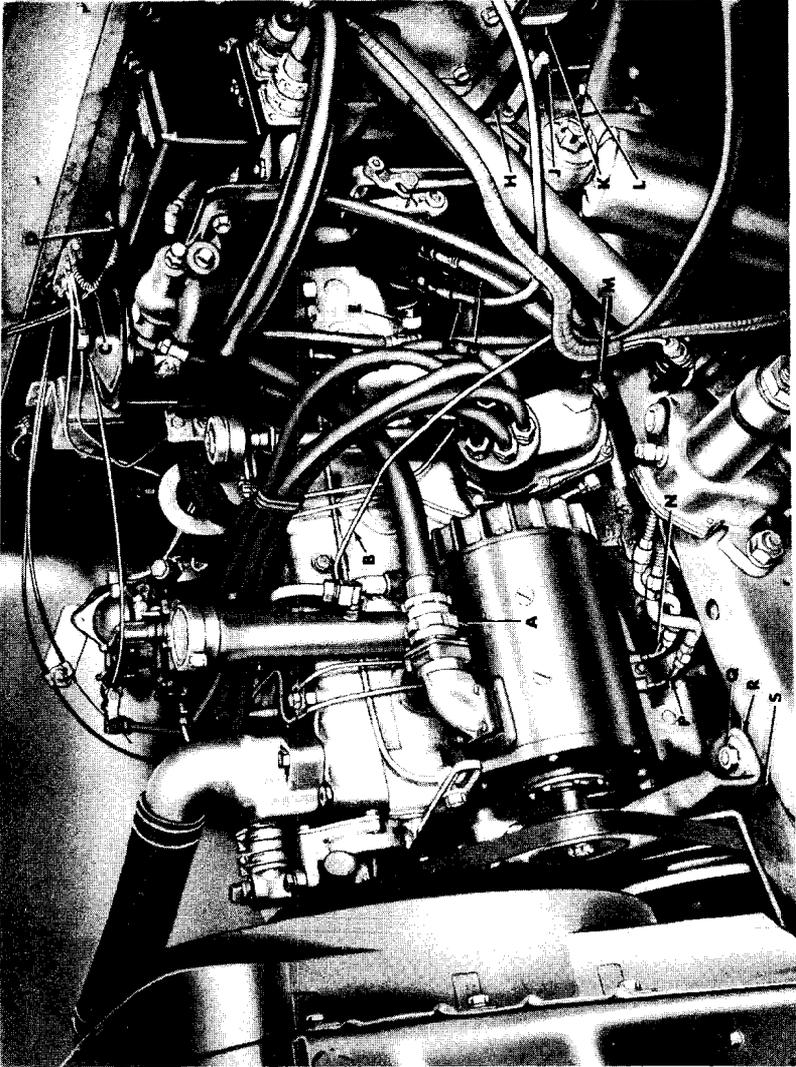
*Note.* On vehicles not equipped with a slave receptacle, only two cables are attached to the starter switch.

- (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.

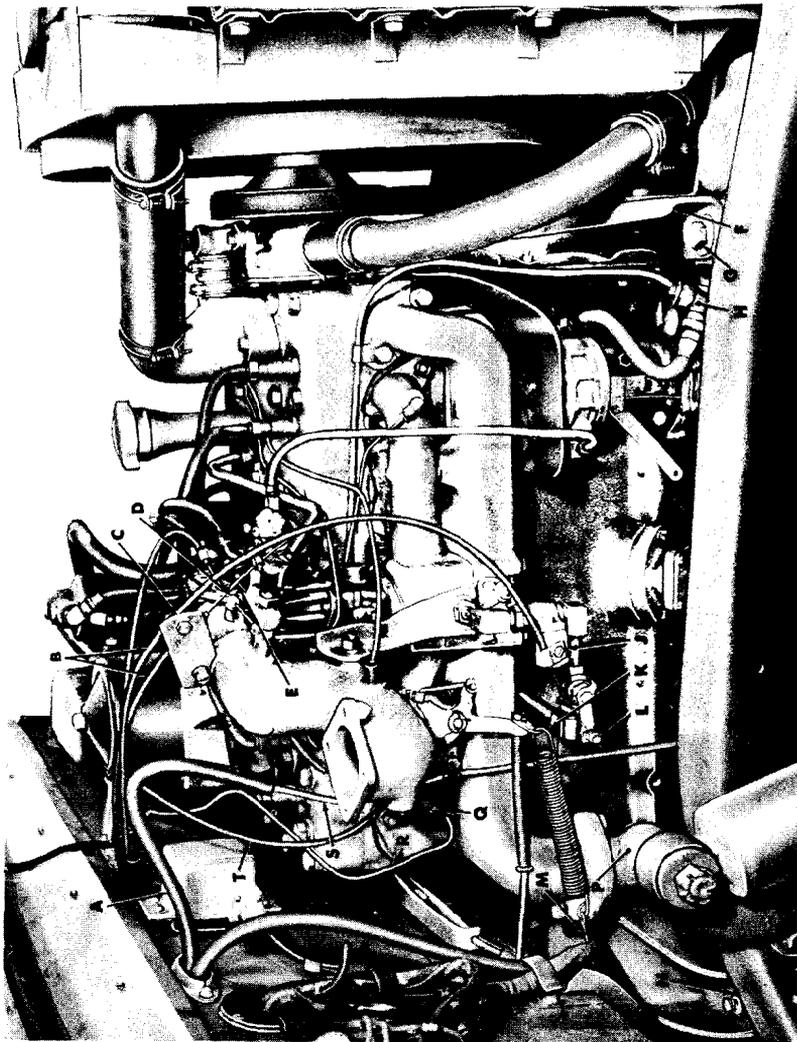


**KEY ITEM**

- 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.*



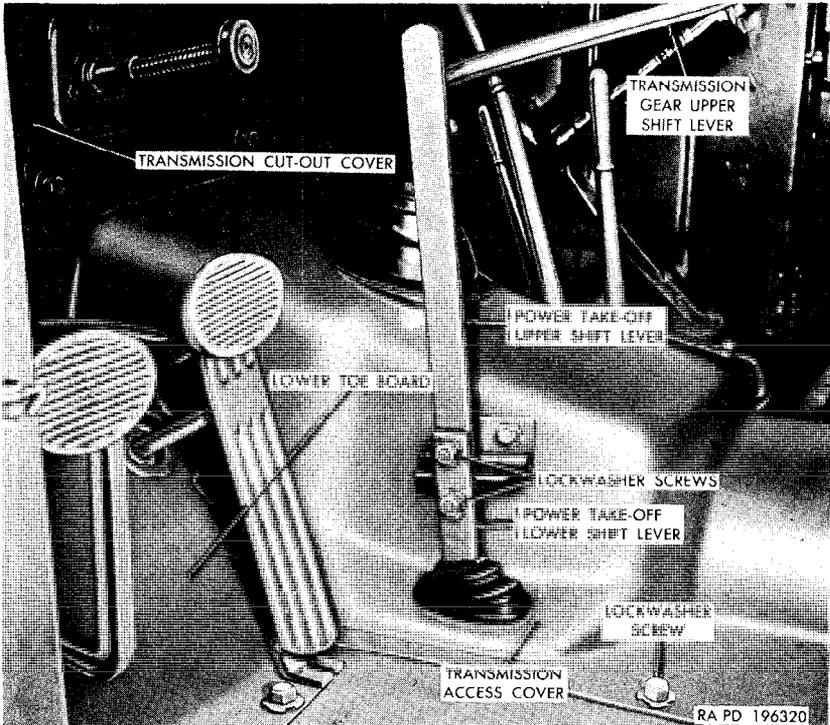
**KEY**

- 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.



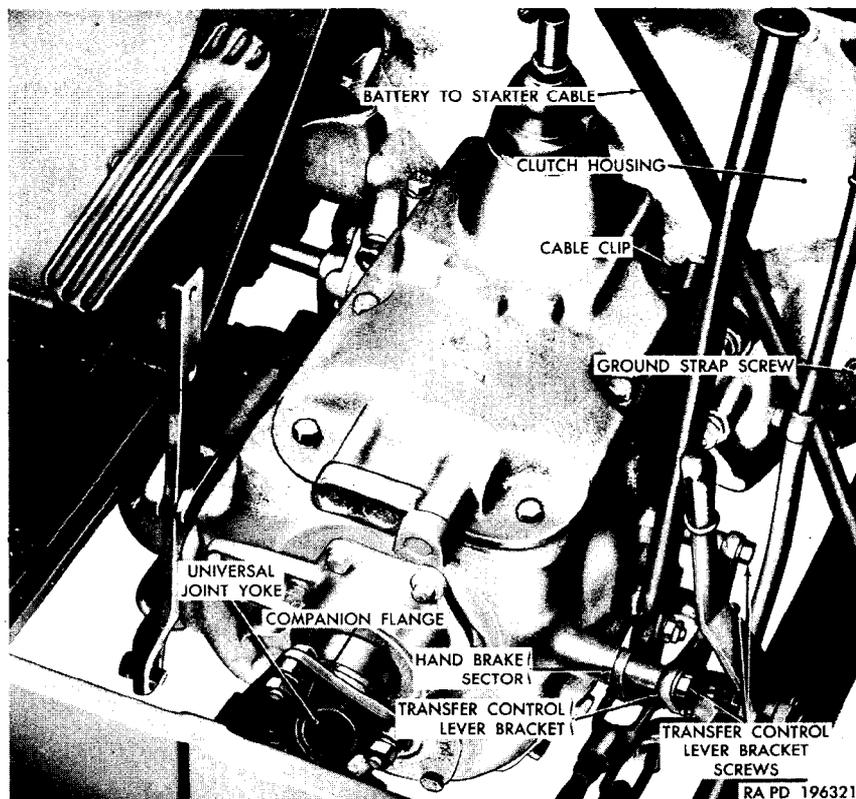
*Figure 87. Items removed in driver's compartment.*

*h. Disconnect Points in Driver's Compartment (fig 88).*

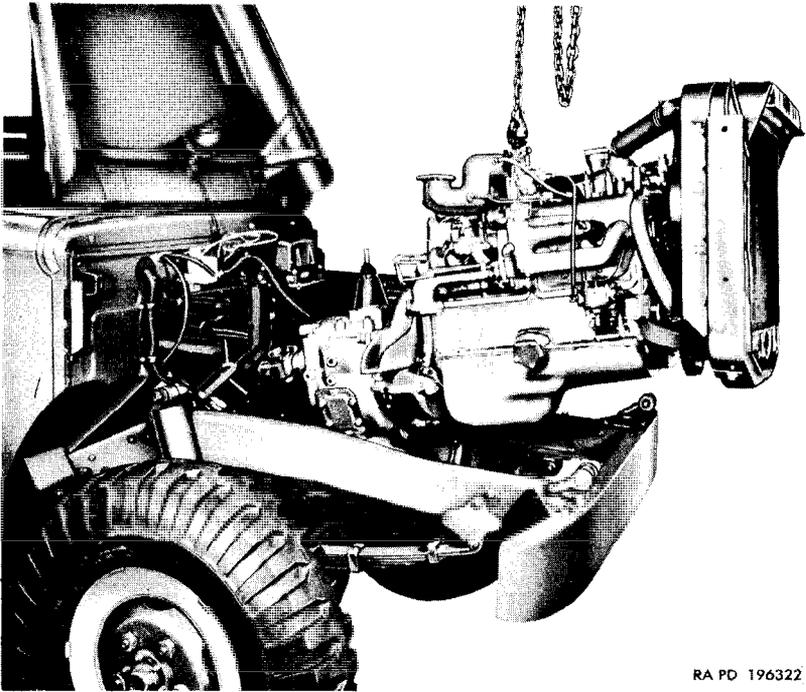
- (1) Disengage the battery-to-starter cable from the cable clip on the transmission case cover and pull the cable back from the engine compartment.
- (2) Remove the three screws and lockwashers that secure the transfer control lever bracket to the transmission.
- (3) Remove the four nuts, lockwashers, 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.

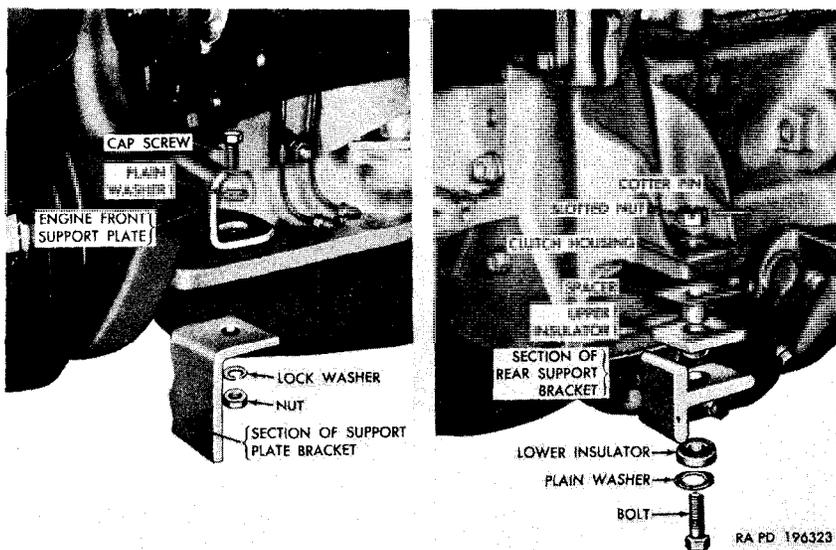


Figure 90. Engine mounting parts—exploded view.

*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) Aline 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  $\frac{5}{16} \times 1\frac{3}{16}$  clevis pin (J) and  $\frac{3}{32} \times \frac{3}{4}$  cotter pin.
- (4) Aline the clutch operating rod with the clutch release fork lever (K) and install the clevis pin and  $\frac{3}{32} \times \frac{3}{4}$  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  $\frac{3}{32} \times 1\frac{1}{8}$  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).

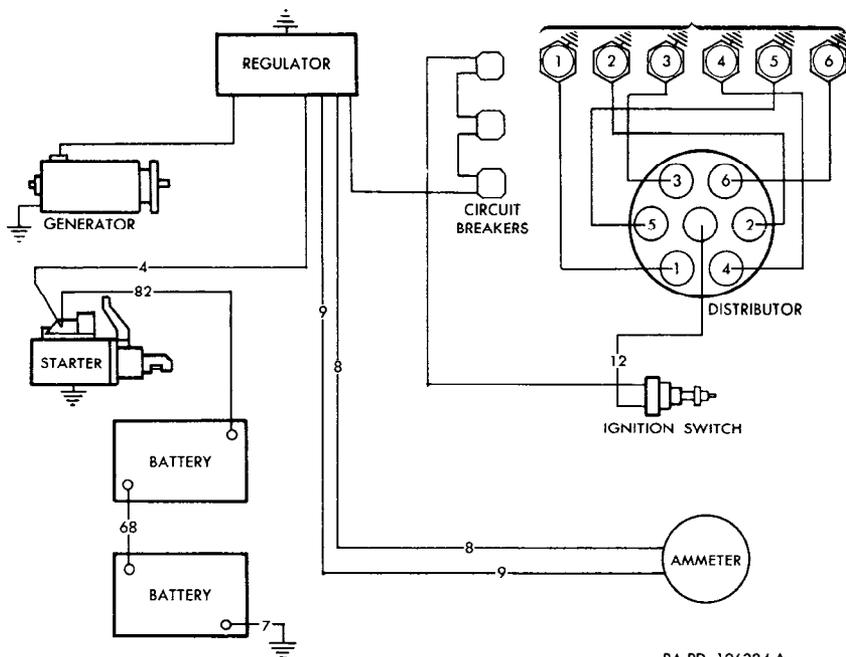
*m. Fill the Cooling System.* Refer to paragraph 148b.

*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. Align 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.

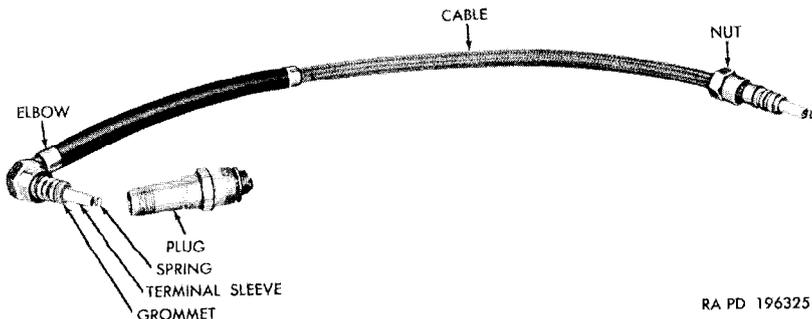


Figure 92. Spark plug and cable.

- (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).

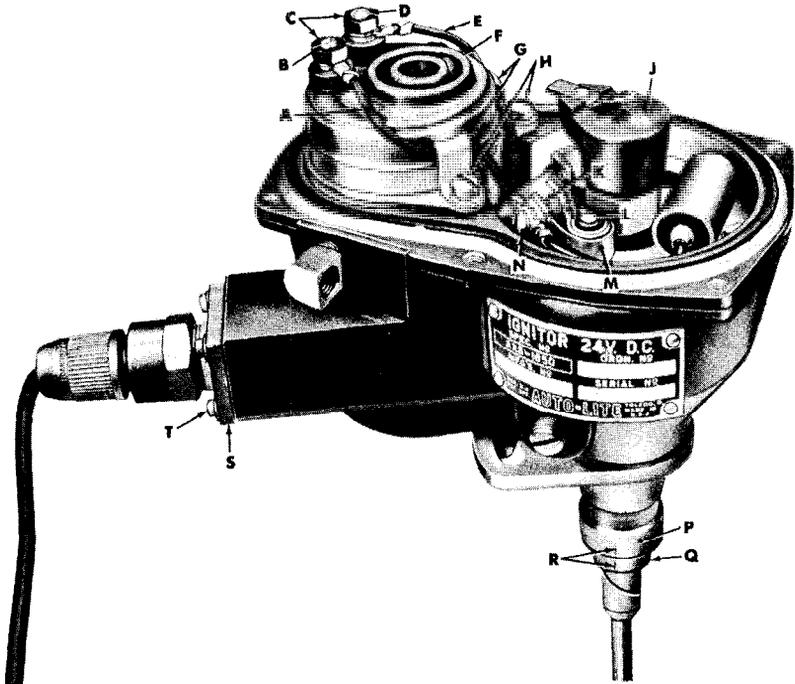
## **125. Distributor and Vent Lines**

*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

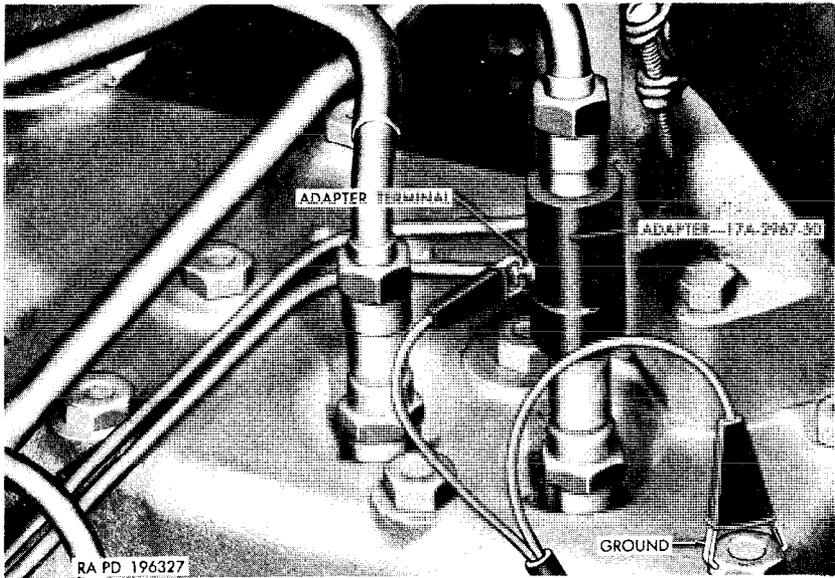


Figure 94. Timing light adapter 17-A-2967-50 installed.

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.

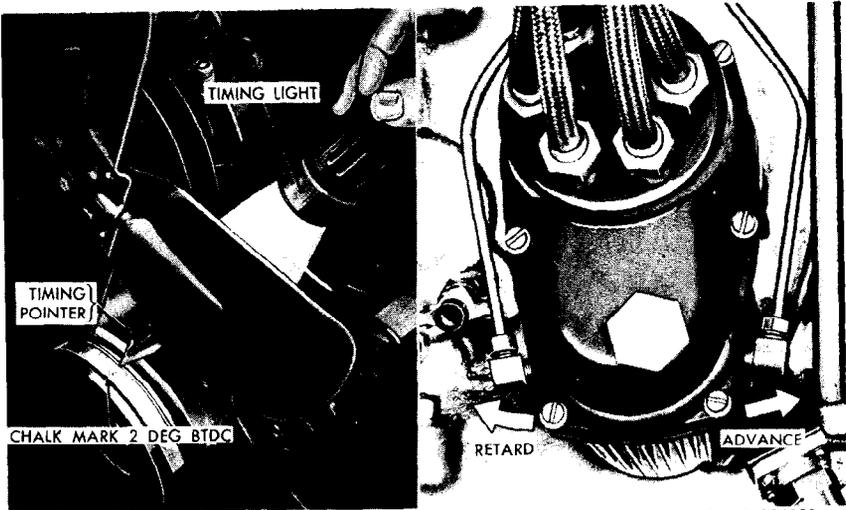
*d. Check Automatic Spark Advance.* Accelerate the engine and observe the chalk mark on the fan drive pulley. As the engine speed increases, the timing light flash should occur before the chalk mark is opposite the pointer, indicating that the automatic spark advance is satisfactory. If the spark advance is not satisfactory, replace the distributor (par. 125).

## 127. Distributor Cover and Cap

*Note.* The key letters noted in parentheses are in figure 96.

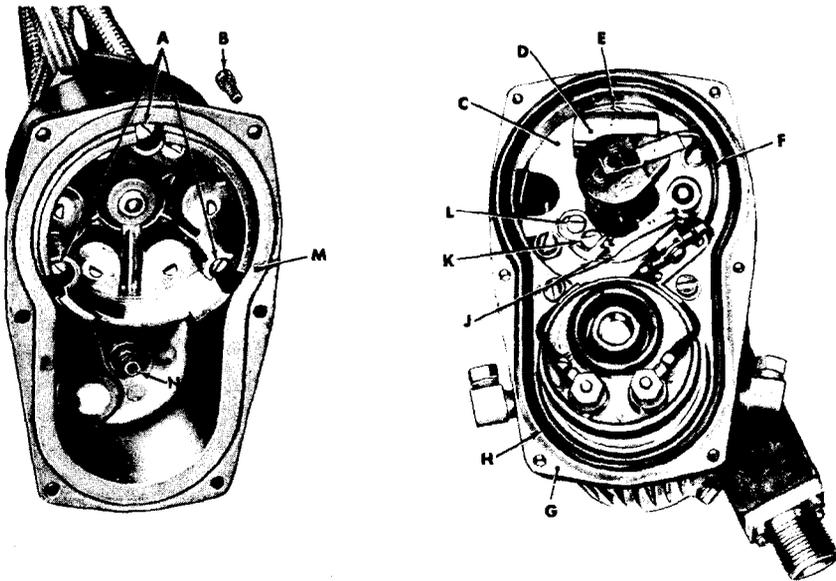
### *a. Removal.*

- (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.

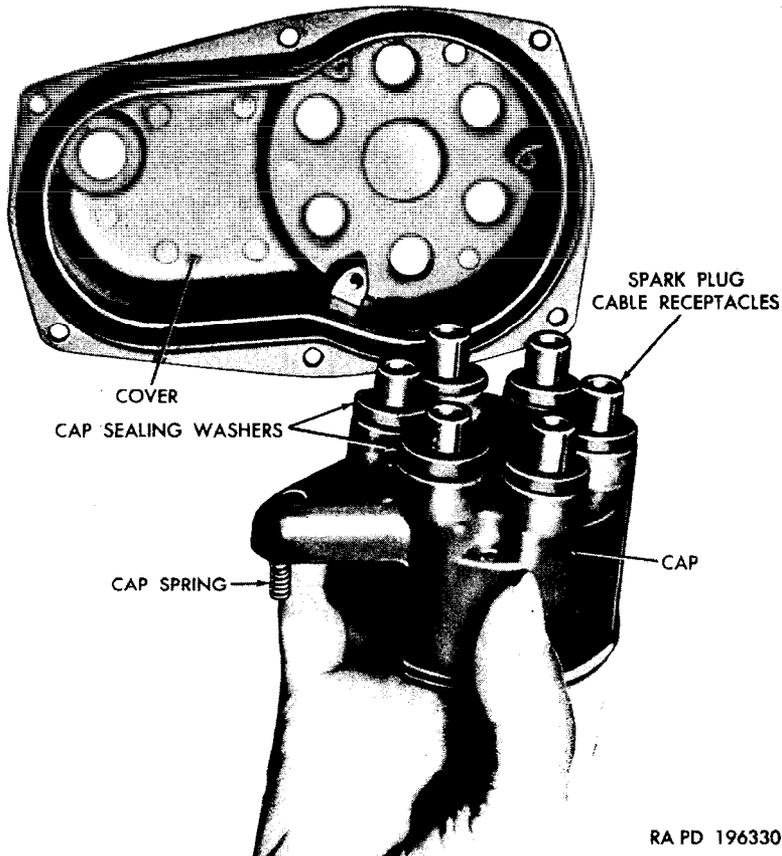


Figure 97. Installing distributor cap in cover.

- (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.

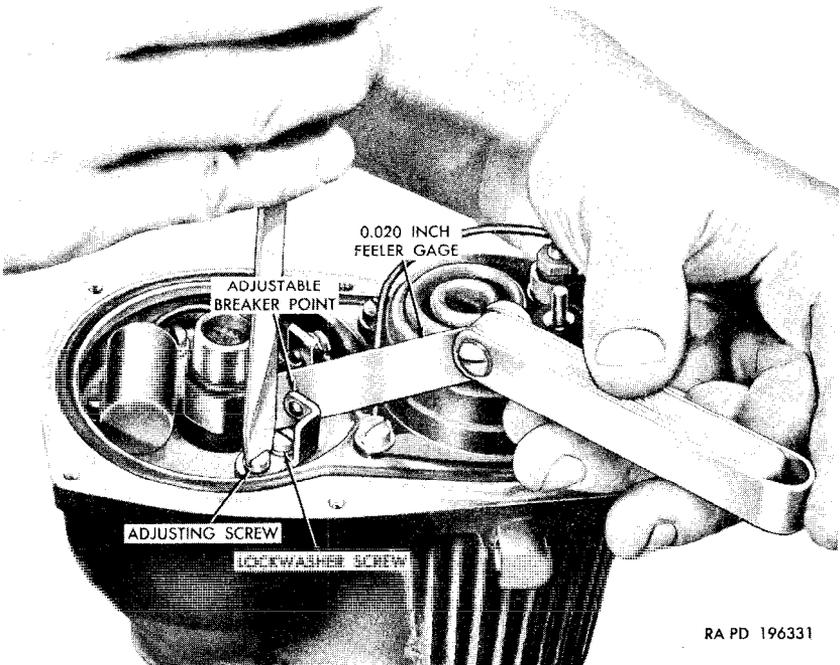
- (4) Position the breaker spring clip (K, fig. 93) over the breaker point spring (M, fig. 93), alining the holes in the clip, the spring, and the clip post. Aline the capacitor cable terminal and the breaker point cable terminal with the clip post hole. Install a No. 6 lockwasher on a No. 6-32NC x  $\frac{5}{16}$  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.

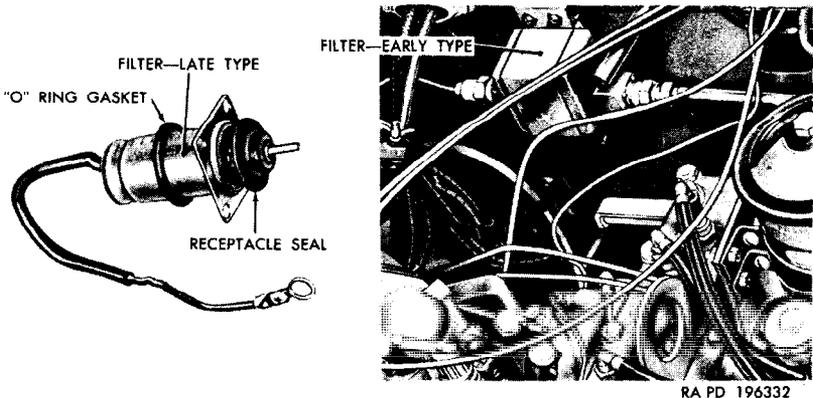


Figure 99. Ignition filters.

- (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.

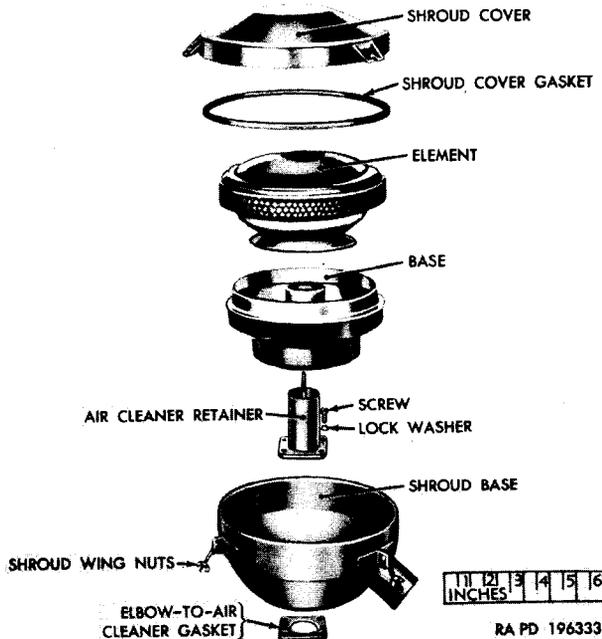


Figure 100. Carburetor air cleaner with shroud—exploded view.

- (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).

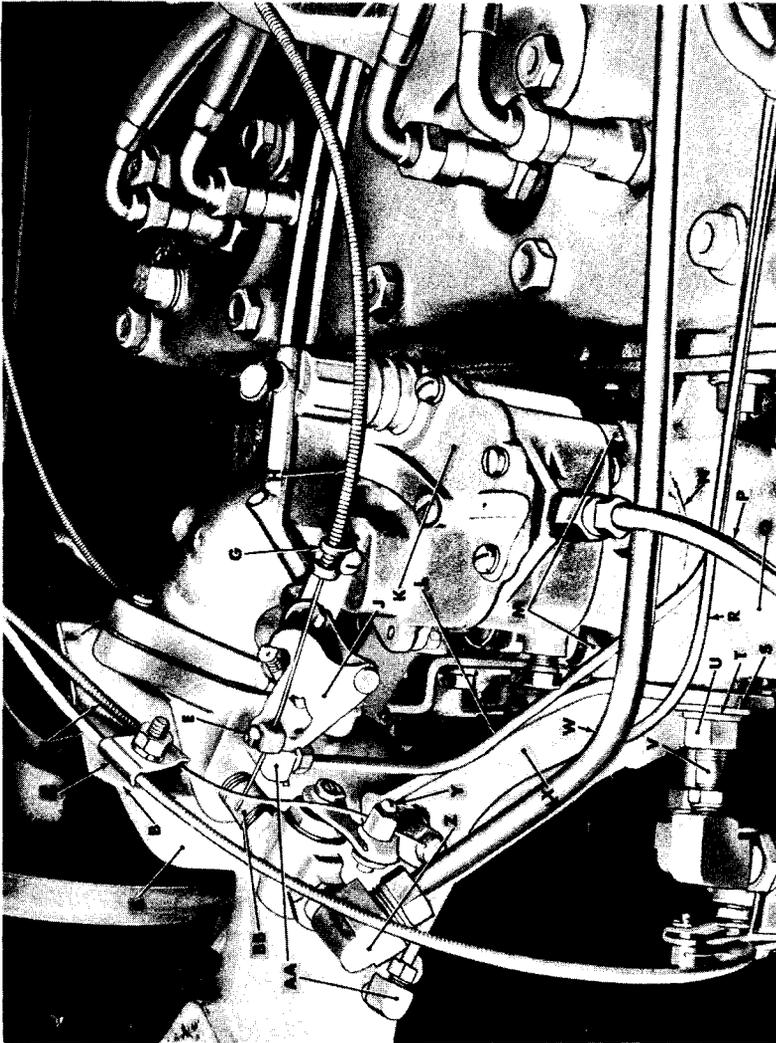


Figure 101. Carburetor (late type) and air cleaner elbow.

**KEY**

- ITEM**
- A—AIR CLEANER ELBOW
  - B—CONTROL SUPPORT PLATE
  - C—TENSION CLIP
  - D—CRANKCASE VENTILATION SHUT-OFF VALVE CONTROLS
  - F—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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- (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).

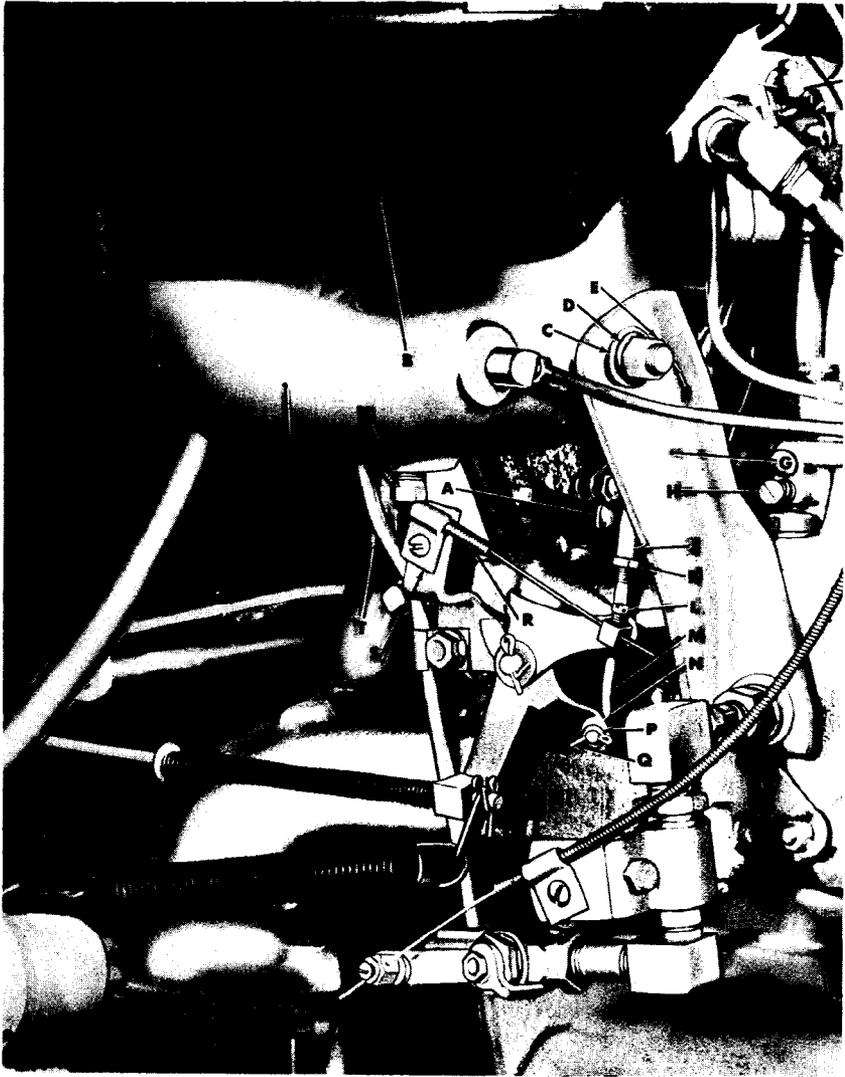
### 135. Air Cleaner Elbow

*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

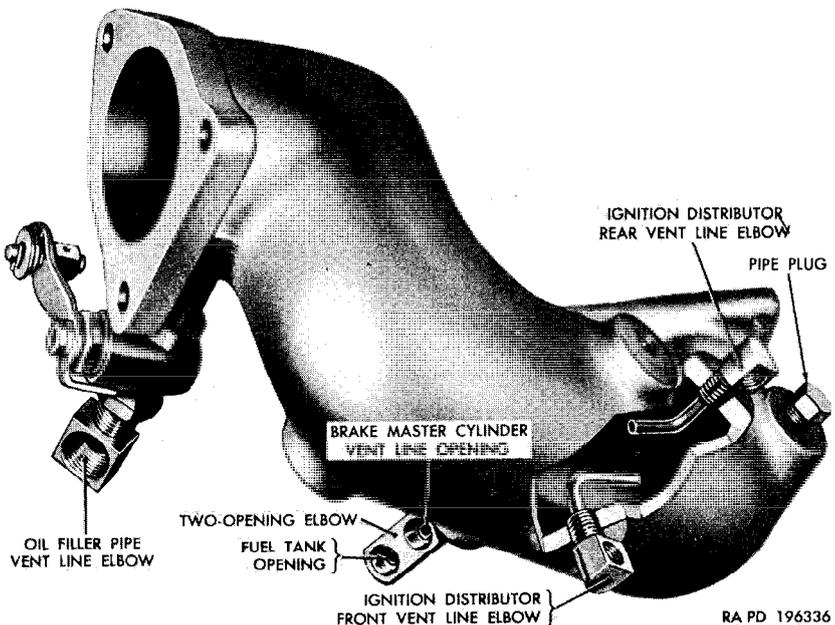
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*Figure 102. Throttle controls.*

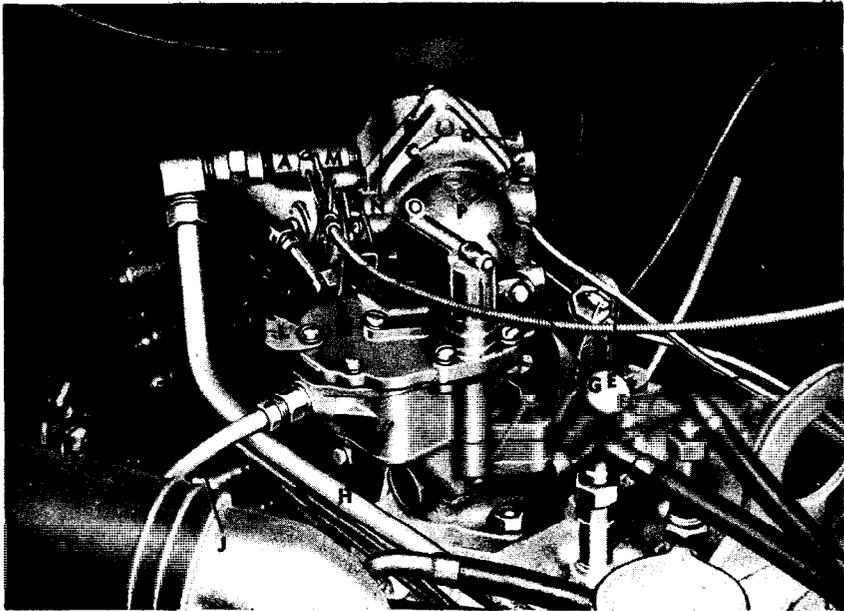
- (5) Disconnect the distributor front and rear vent lines (E and F, fig. 104) at the inverted flared tube elbows (D and P, fig. 104, and fig. 103).
- (6) Remove the screw, lockwasher, and plain washer attaching the elbow support bracket (T, fig. 102) to the intake manifold.
- (7) Remove the three nuts 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

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*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.

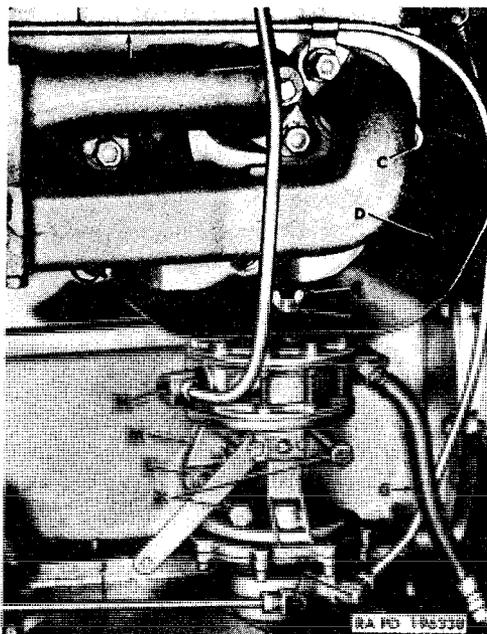
*b. Removal.*

- (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.

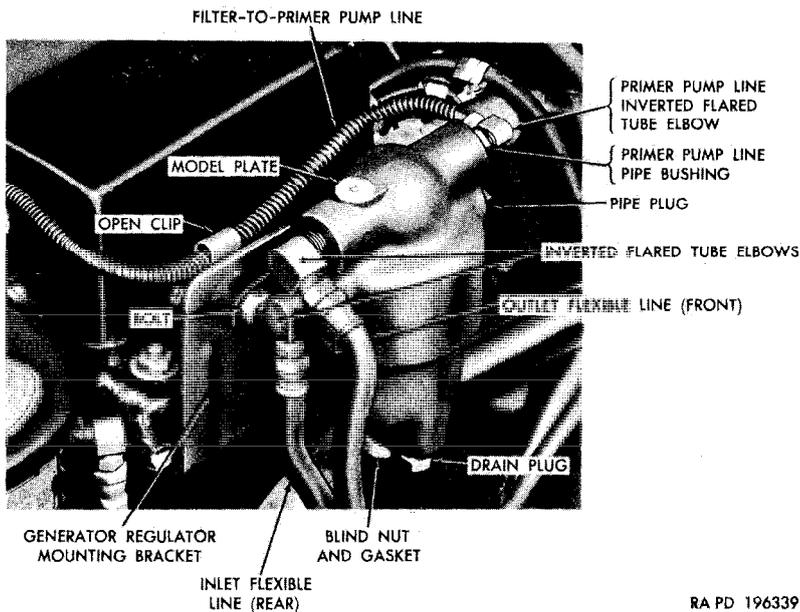
*d. Installation.*

- (1) Install the two 90°, 1/4-inch, 1/8-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 5/16-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).*



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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.

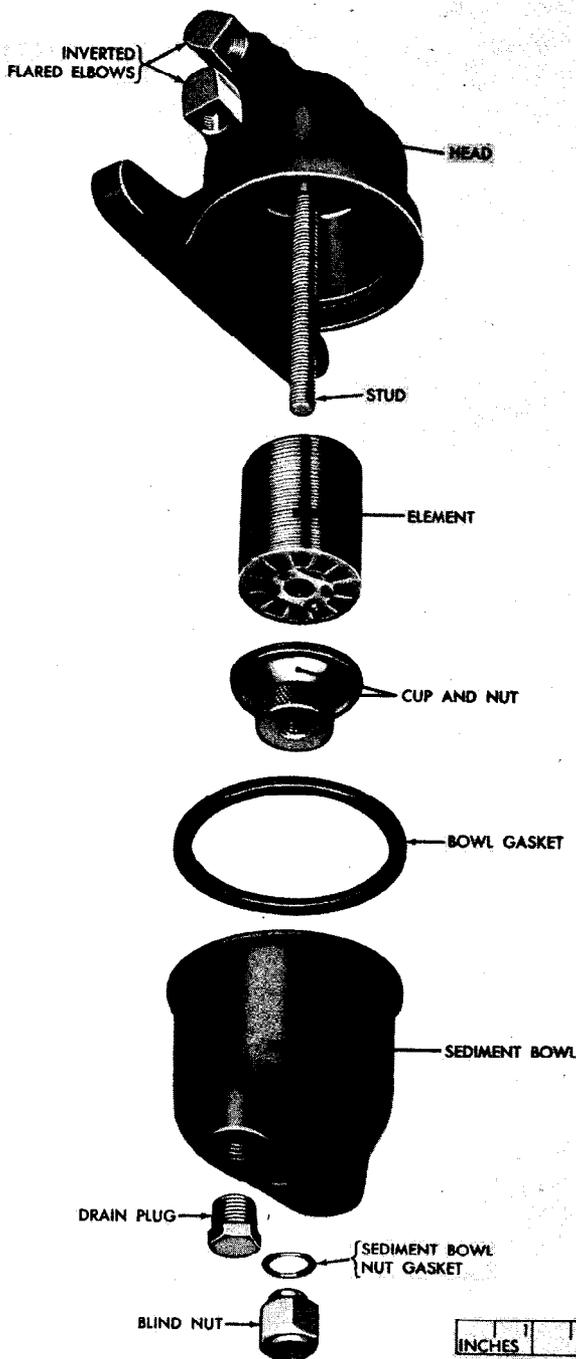
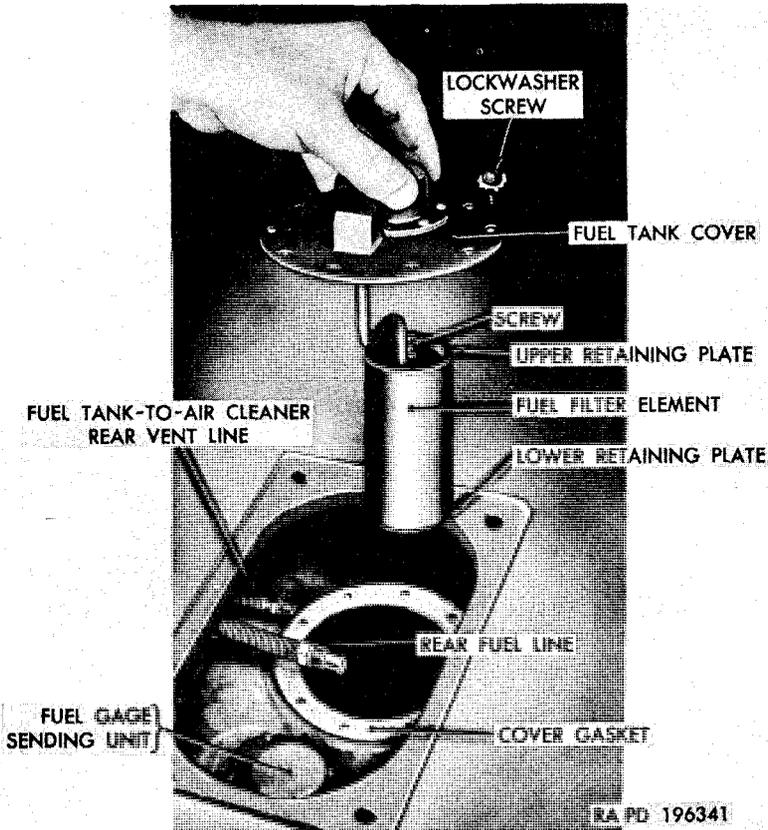


Figure 107. Fuel filter (early-type)—exploded view.



**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.*

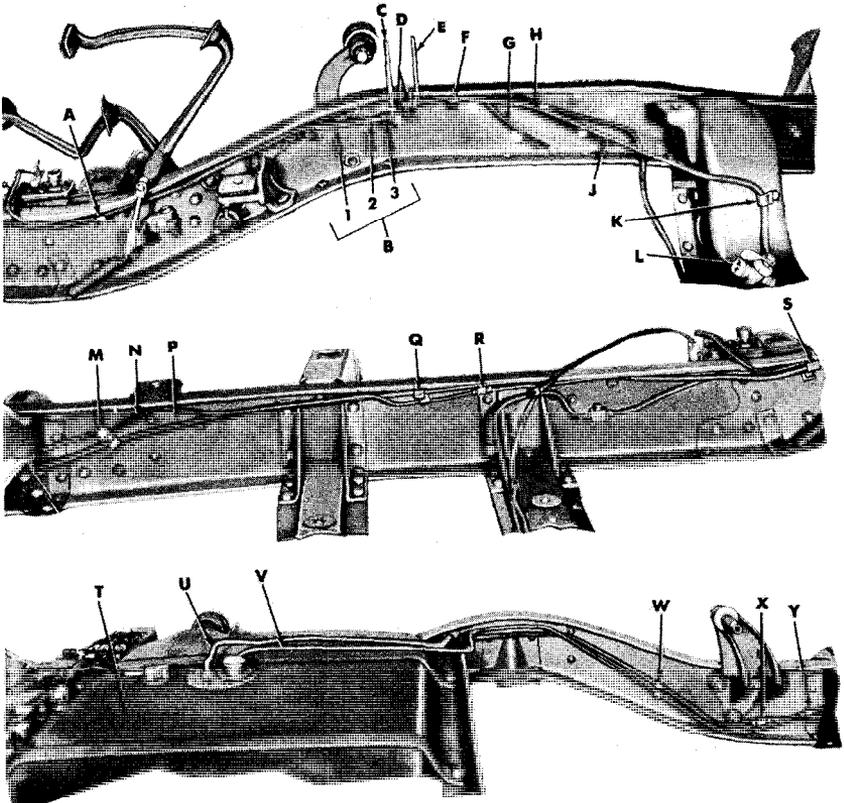
- (1) Disconnect the outlet flexible line, the inlet flexible line, and the priming system line (if connected) at the fuel filter (fig. 106).
- (2) Remove the two nuts, lockwashers, and bolts attaching the fuel filter to the generator regulator mounting bracket and remove the fuel filter.
- (3) If the 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
A	CLIP
B	INTERMEDIATE FUEL LINE
	1—FLEXIBLE CONDUIT
	2—TUBING
	3—FITTING NUT
C	TANK-TO-FILTER LINE
D	INVERTED FLARED TUBE ELBOWS
E	FILTER-TO-PUMP LINE
F	CLIP
G	MASTER CYLINDER REAR VENT LINE
H	TANK FRONT VENT LINE
J	FRONT FUEL LINE
K	CLIP

KEY	ITEM
L	SHUT-OFF COCK
M	DOUBLE CLIP
N	TANK INTERMEDIATE VENT LINE
P	INTERMEDIATE FUEL LINE
Q	DOUBLE CLIP
R	UNION (VENT LINE)
S	CLIP
T	FUEL TANK
U	REAR FUEL LINE
V	TANK REAR VENT LINE
W	DOUBLE CLIP
X	UNION (FUEL LINE)
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.

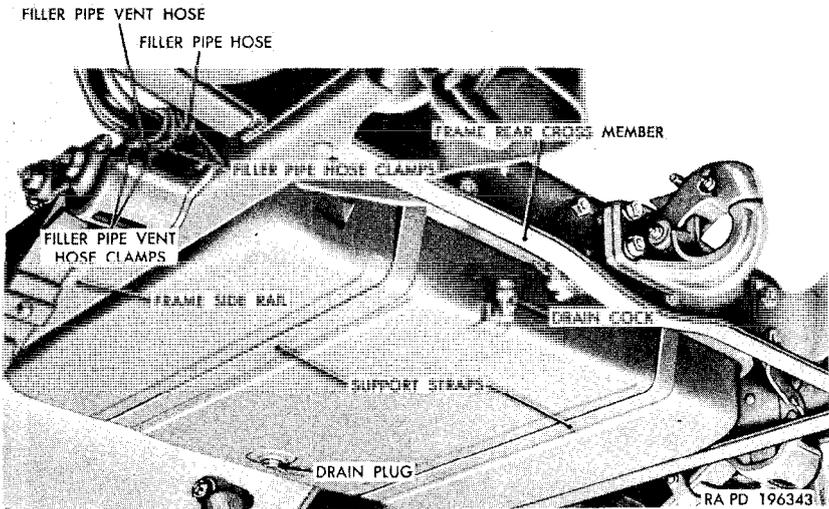


Figure 110. Fuel tank—bottom view.

- 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

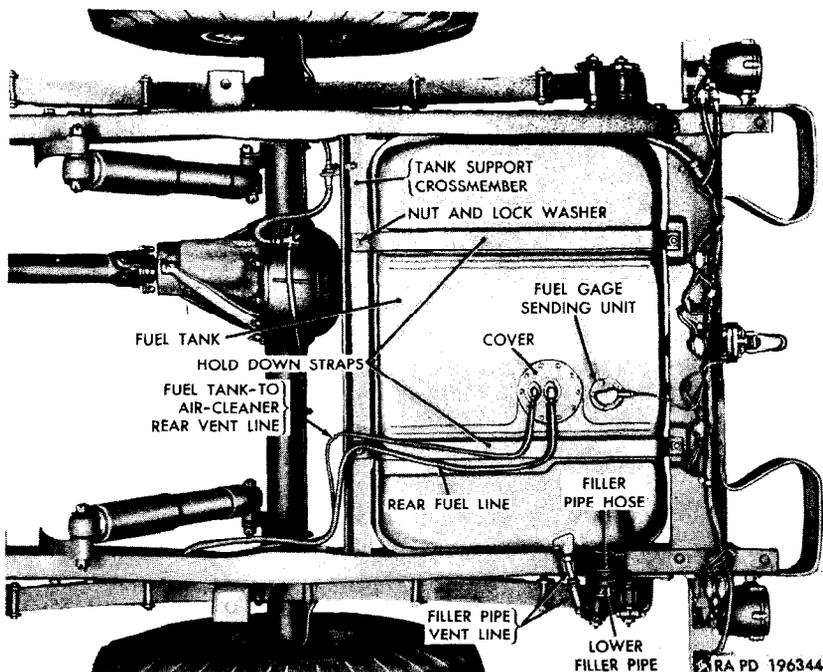


Figure 111. Fuel tank—top view (vehicle body removed).

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.*

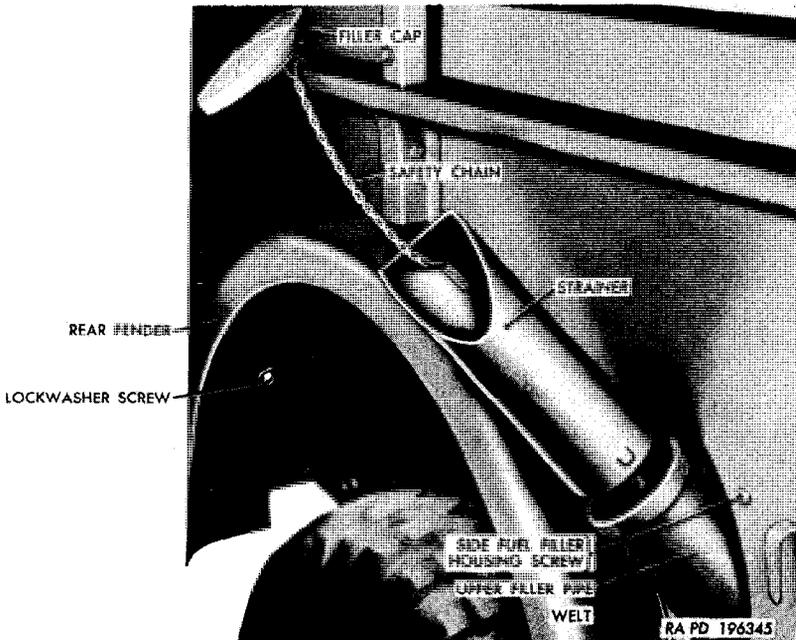


Figure 112. Fuel filler cap, strainer, and upper filler pipe.

- (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

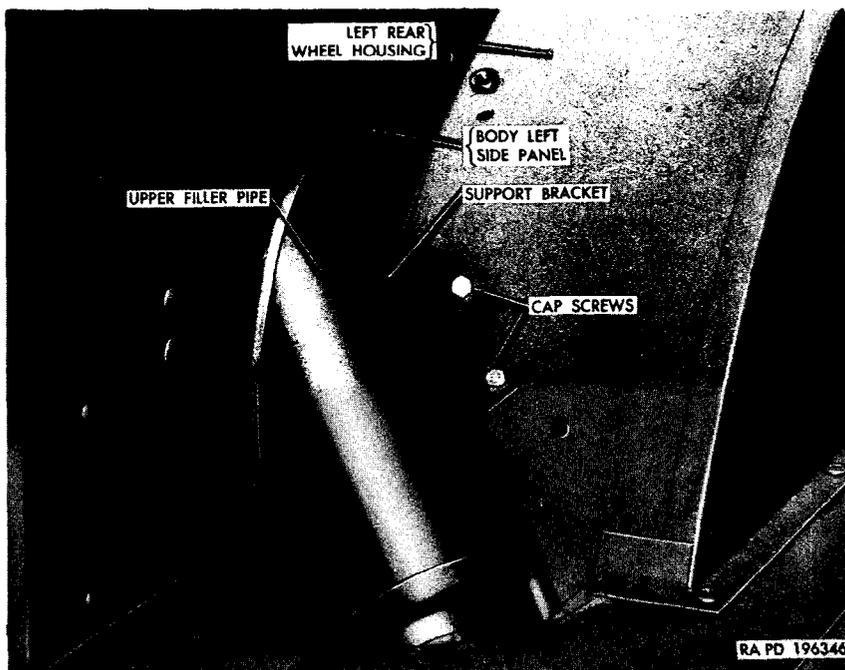


Figure 113. Upper fuel filler pipe (cargo truck M37 or command truck M42).

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.

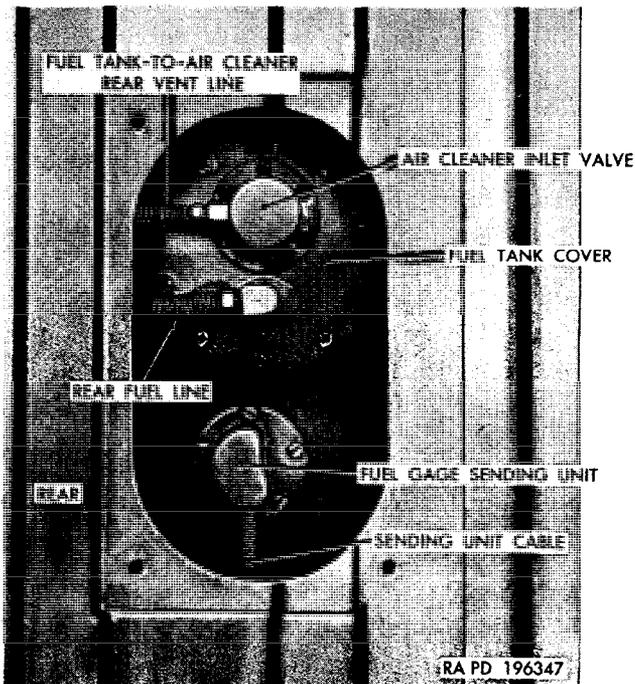


Figure 114. Fuel tank cover, air cleaner inlet valve, and fuel gage sending unit.

- (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).*

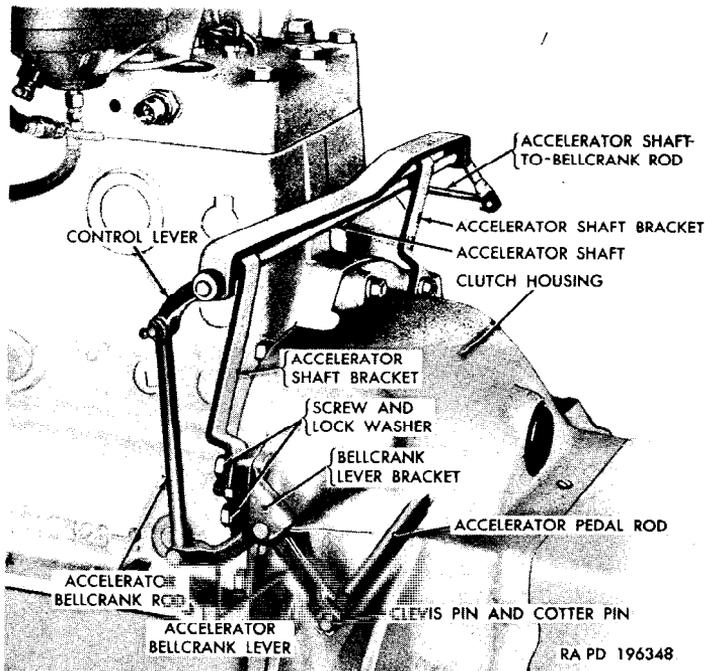
- (1) Loosen the choke control swivel screw (E, fig. 101) and the screw in the choke control clip (G, fig. 101) and withdraw the control from the clip and swivel.
- (2) Loosen the two screws that secure the control clamp to the bracket on the dash.
- (3) Unscrew the nut that secures the choke control 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.

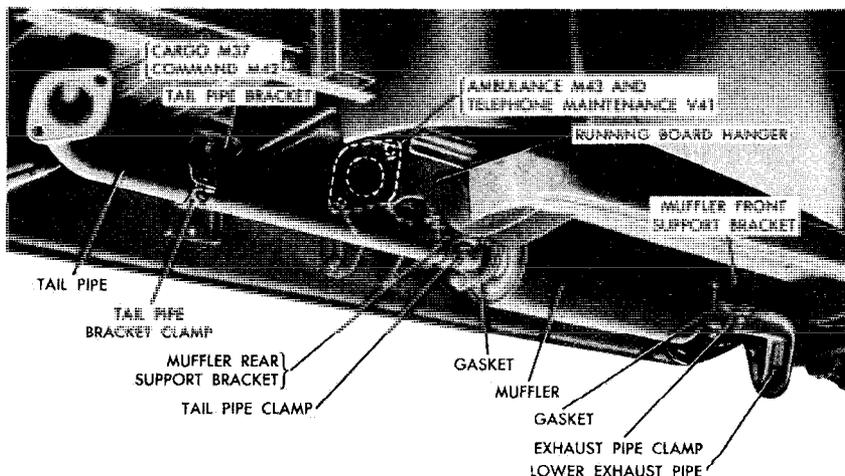
## 146. Exhaust Pipes, Muffler, and Tailpipe

### 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, alining 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, alining 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

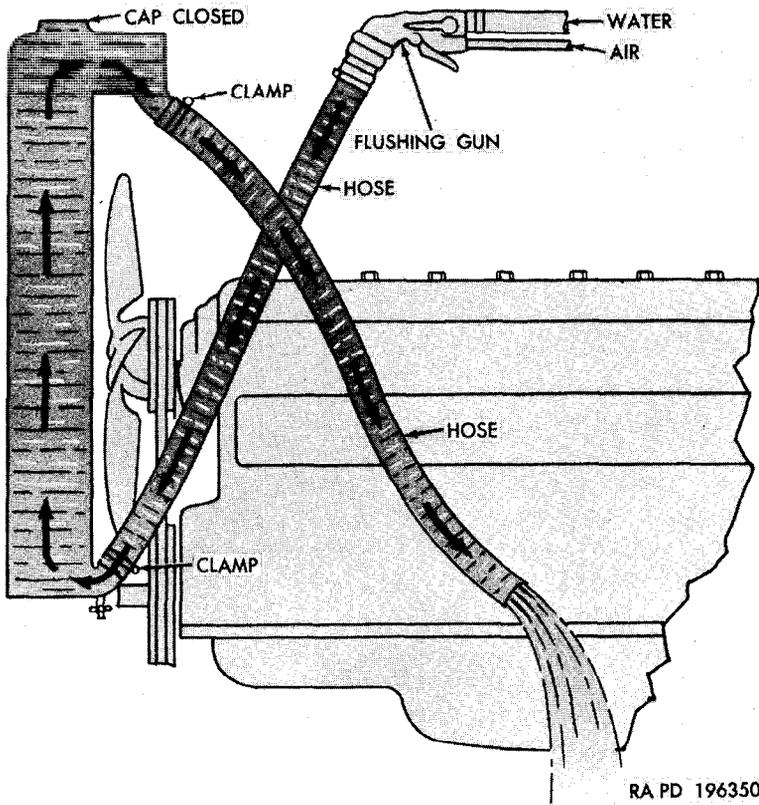


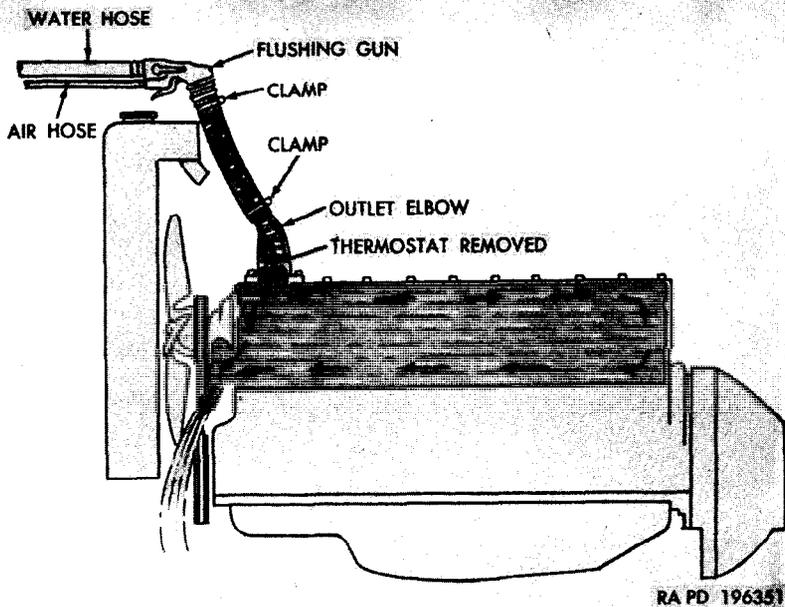
Figure 117. Pressure flushing radiator.

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.

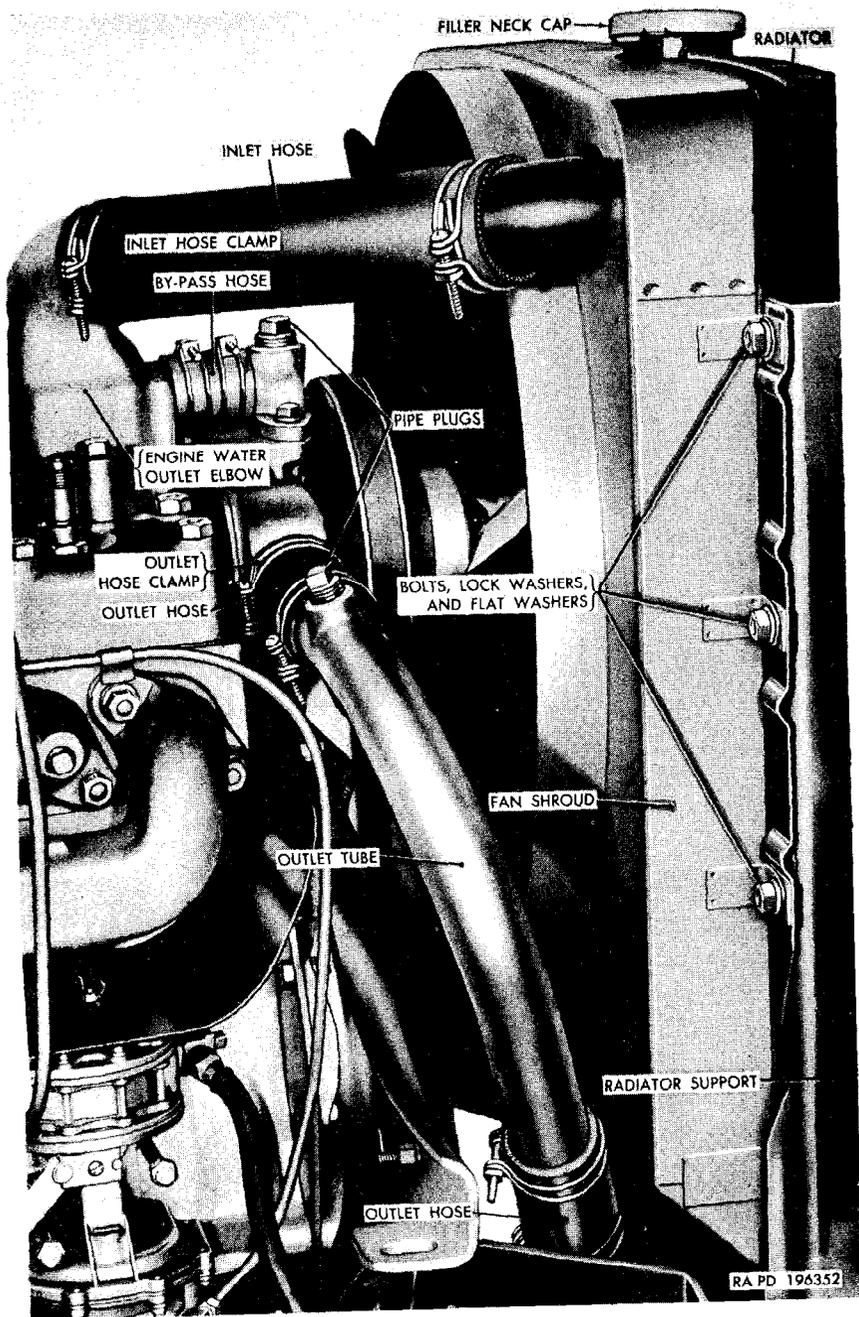
**Caution:** Turn on compressed air in short blasts to prevent core damage.

- (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.*