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DEPARTMENT OF THE ARMY TECHNICAL MANUAL

COMPRESSOR, AIR
SKID MOUNTED
GASOLINE DRIVEN
80 CFM, 3500 PSI
CLARK BROTHERS
MODEL HO6–4C
(LESS ENGINE)

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DEPARTMENT OF THE ARMY • *MAY 1956*

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TECHNICAL MANUAL
No. 5–5399–1

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *18 May 1956*

COMPRESSOR, AIR, SKID MOUNTED, GASOLINE DRIVEN, 80 CFM, 3500 PSI, CLARK BROTHERS MODEL HO6–4C (LESS ENGINE)

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CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual is published for the use of the personnel to whom this assembly area compressor is issued. It contains information on the operation and organizational maintenance of the compressor as well as a description of the major units and their functions in relation to other components of the material. It applies only to the compressor, air, skid-mounted, gasoline-driven, 80 cubic feet per minute, 3500 pounds per square inch, Clark Brothers, Model HO6–4C (less engine).

b. Any errors or suggestions for the improvement of this manual should be brought to the attention of the Commandant, The Engineer School, Fort Belvoir, Virginia, ATTN: TECES–TP.

2. Record and Report Forms

Maintenance record forms listed below will be used in the maintenance of this equipment.

a. DA Form 5–13 (Spot Check Inspection Report of Organizational Maintenance of Engineer Equipment).

b. DA Form 5–14 (Annual Technical Inspection Report of Engineer Equipment).

c. DA Form 9–71 (Locator and Inventory Control Card).

d. DA Form 9–77 (Job Order Register).

e. DA Form 9–79 (Parts Requisition).

f. DA Form 9–81 (Exchange Part or Unit Identification Tag).

g. DA Form 285 (Accident Report of Personnel or Property Damage).

h. DA Form 446 (Issue Slip).

i. DA Form 447 (Turn-in Slip).

j. DA Form 460 (Preventive Maintenance Roster).

k. DA Form 464, Work Sheet for Preventive Maintenance and Technical Inspection of Engineer Equipment).

l. DA Form 468 (Unsatisfactory Equipment Report).

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m. DA Form 478 (Organizational Equipment File).
n. DA Form 811 (Work Request and Job Order).
o. DA Form 867 (Status of Modification Work Order).
p. DD Form 6 (Report of Damaged or Improper Shipment).
q. DD Form 110 (Vehicle and Equipment Operational Record).
r. DD Form 518 (Accident-Identification Cards).

Section II. DESCRIPTION AND DATA

3. Description

a. General Information. The Clark Brothers compressor set Model HO6–4C (fig. 1) is a self-contained, skid-mounted unit, complete with all controls, switches, and indicators necessary for normal operation. Electric power necessary for the operation of the drier system is supplied from an outside source. All parts of the unit are readily accessible.

b. Engine. The compressor is driven by a Waukesha Motor Company model GKB water-cooled, six-cylinder, overhead valve, gasoline engine (2, fig. 2) with a displacement of 779 cubic inches. It is equipped with magneto ignition, oil and air filters, suppressor-type spark plugs, shielded wiring, spark-proof muffler, a governor, and a straight drive transmission and clutch assembly. The cylinder sleeves are of the wet type and removable. Shell type bearings are used throughout. Full pressure lubrication is furnished through a drilled crankshaft, camshaft, and tubes from a gear-type pump and relief valve.

c. Compressor. The six-cylinder, horizontally-opposed, single-acting, four-stage, air-cooled, Clark Brothers model HO6–4C compressor (2, fig. 3) is capable of attaining a pressure of 3500 psi (pounds per square inch) with a minimum dry air delivery of 80 cfm (cubic feet per minute) at 14.7 psia (pounds per square inch atmospheric) and 125° F. (fahrenheit). It is directly coupled to the engine through a flexible coupling and friction clutch (4). The crankcase is enclosed, dust-proof, and vented on each side through crank-end vent oil breathers. Oil is added to the crankcase through the oil filler and breather located on top of the compressor crankcase. A sight gage oil level indicator is attached to the crankcase alongside of the oil pump. The oil is drained by removing the oil temperature gage connection located under the oil pump. Main and connecting rod bearings are of the shell type, while roller bearings are used for the crosshead pins, thrust bearing, and accessory drive shaft. Main and connecting rod bearings are lubricated from

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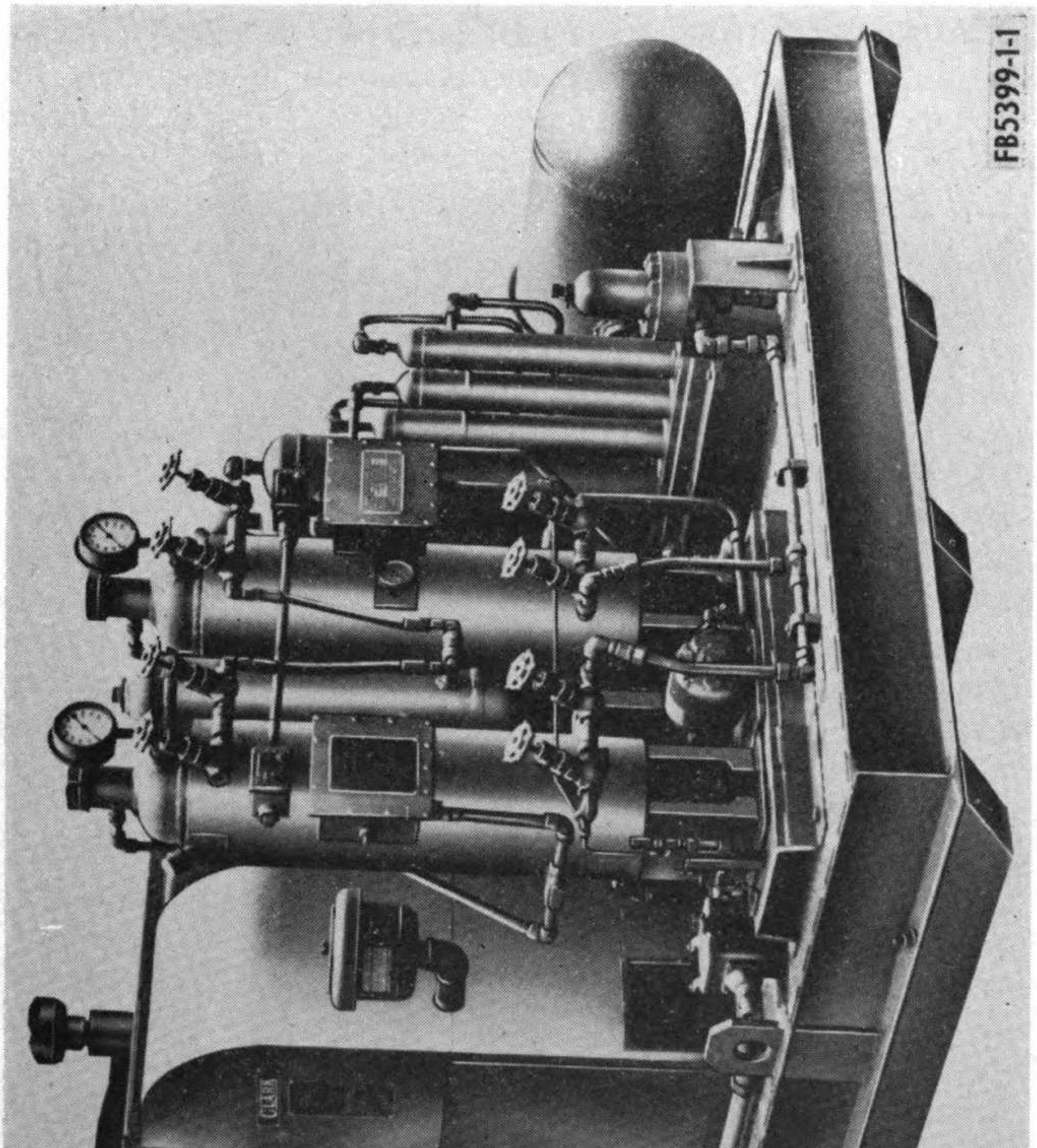

Figure 1. Left rear three-quarter view.

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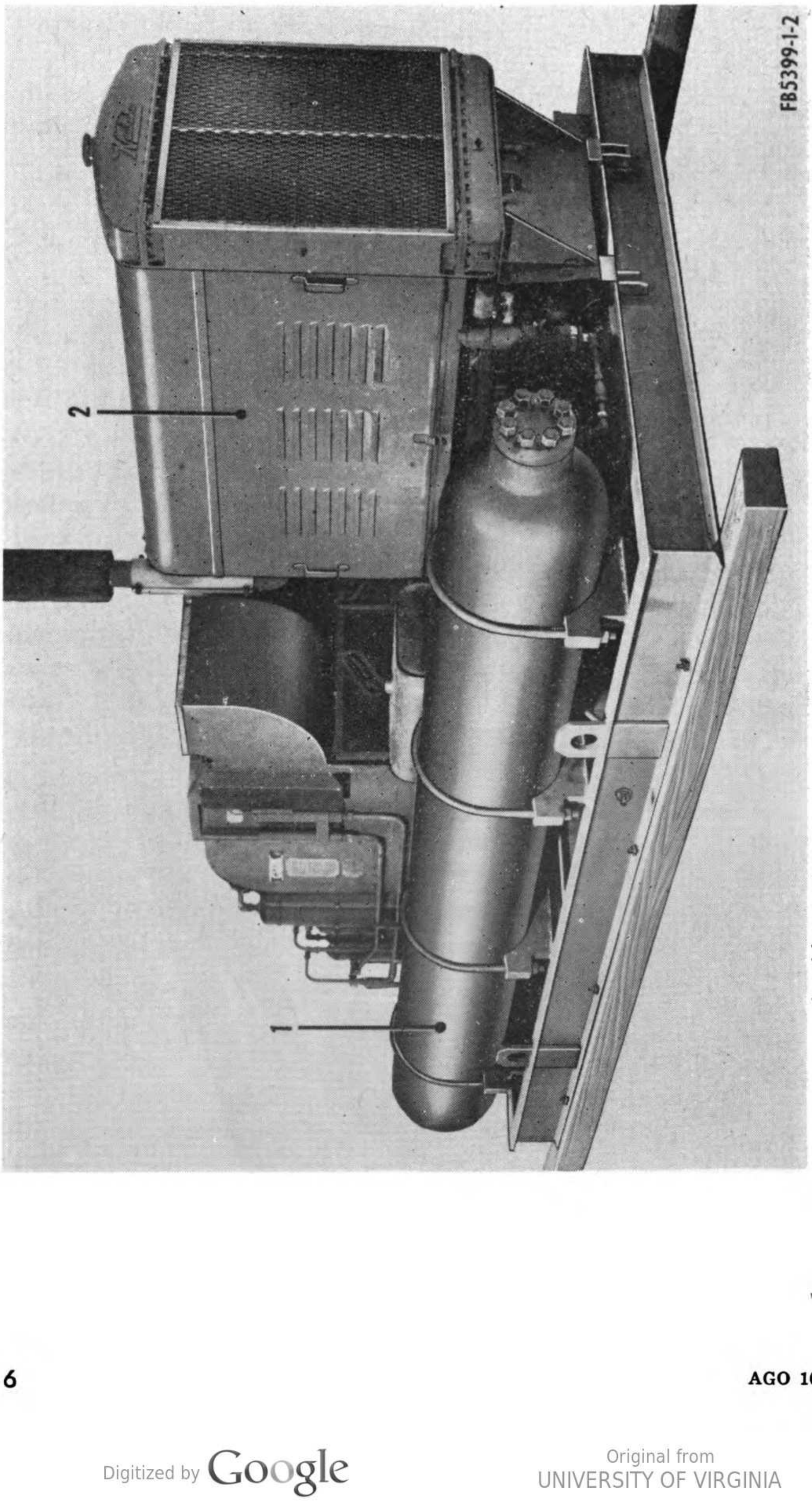

1 Air receiver
2 Engine

Figure 2. Right front three-quarter view.

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the oil header under pressure, and the crossheads, guides, and crosshead pins are splash lubricated. The cylinders and high-pressure packings are lubricated by means of a six-feed mechanical lubricator, gear driven from the crankshaft. The compressing unit and many of the accessories are enclosed by a Sheet-metal housing to protect operating personnel from injuries caused by contact with the moving parts and to protect the equipment against the settling of dust and moisture. At the base of the housing are two ventilating ports through which air currents are drawn by the cooler fans for cooling the heated cylinders and the cooler units during compressor operation.

d. Air Receiver. The A. O. Smith Corp., multi-layer, cylindrical receiver tank (1, fig. 2) is used to store compressed air at 3500 psi. The tank is mounted in a horizontal position parallel to the longest axis of the skid base, and adjacent to the gasoline driver (engine) and the compressing unit. The receiver has a storage capacity of 20 cubic feet and is 13 feet, 9 inches long and 18½ inches in diameter. The tank walls are constructed of 1 3/16 inch reinforced multi-layer steel plate. A 3-inch inspection port is located on the driver end of the receiver, through which the inside walls of the receiver may be examined for corrosion. At the lowest point of the under side of the tank, is a 1-inch drain coupling through which accumulated water is discharged. Compressed air is transferred from the air receiver tank to the missile through a coupling that is the only outside connection on the entire compressor assembly used for the purpose. The unloader pilot valve, a component of the automatic discharge and unloading system and connected directly to the air receiver, is thus actuated by the rise and fall of air pressure in the receiver.

e. Moisture Knock-Out Bottles. The Clark Brothers, model 101–342 moisture knock-out bottles (1, fig. 3) are mounted vertically on a platform next to the compressing unit, and remove much of the excess moisture resulting from the compressing and cooling processes. Each bottle is provided with an individual drain valve that is operated manually to discharge (blow off) the moisture condensate. The bottles drain into a common manifold located under the skid base so that operator is protected when a blow-off is necessary. After every compression stage, air is conducted to one of the bottles for removal of free water vapor. Bottle No. 5, which receives the air following the fourth compression stage, also acts as a surge drum by reducing the pulsations normally accompanying high compression.

f. Intercoolers and Aftercooler. The Clark Brothers part number 116–1240 low stage intercooler (1, fig. 4) and part number

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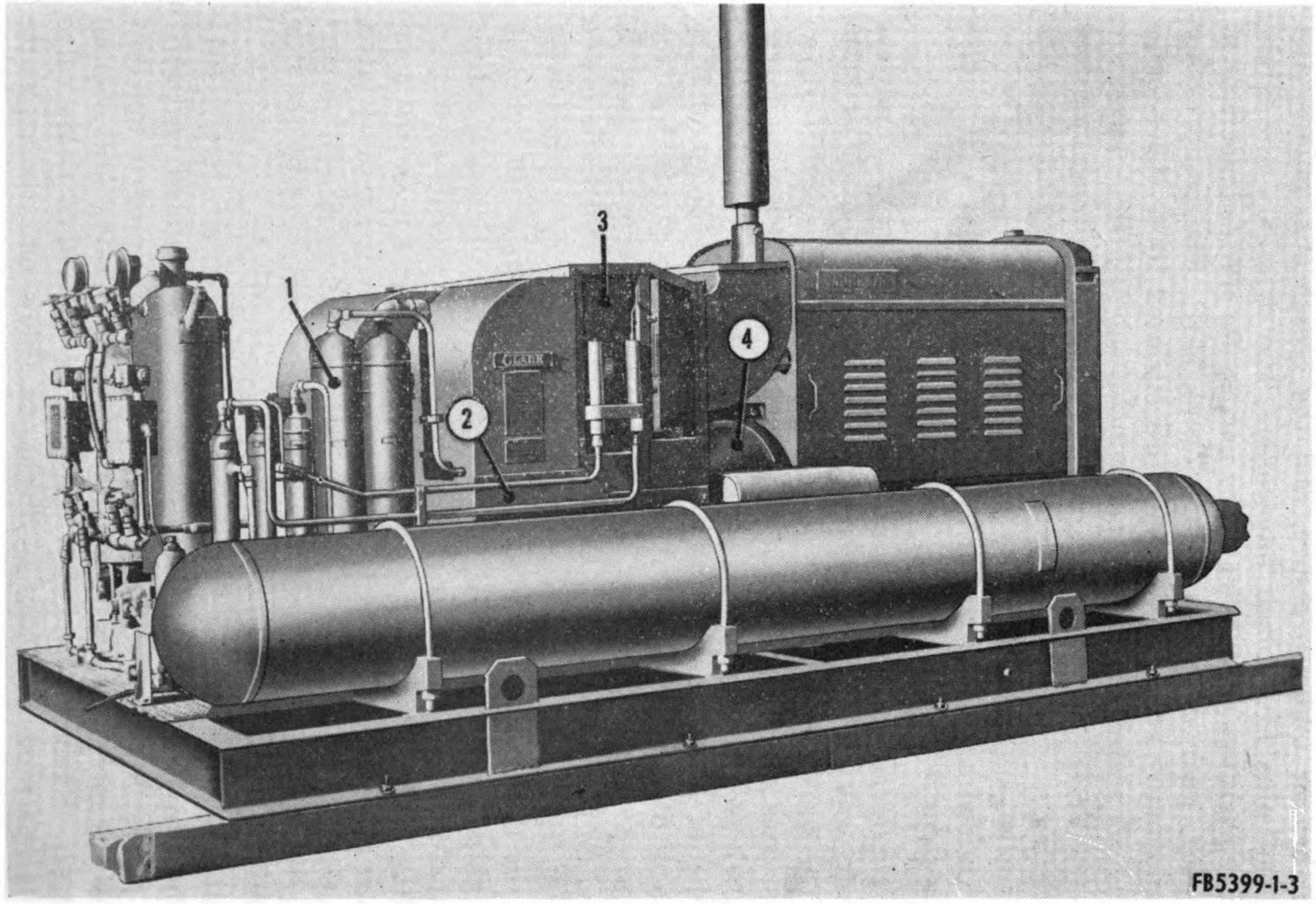

1 Moisture knock-out bottles
2 Compressor and aftercooler
3 High stage intercooler
4 Friction clutch

Figure 3. Right rear three-quarter view.

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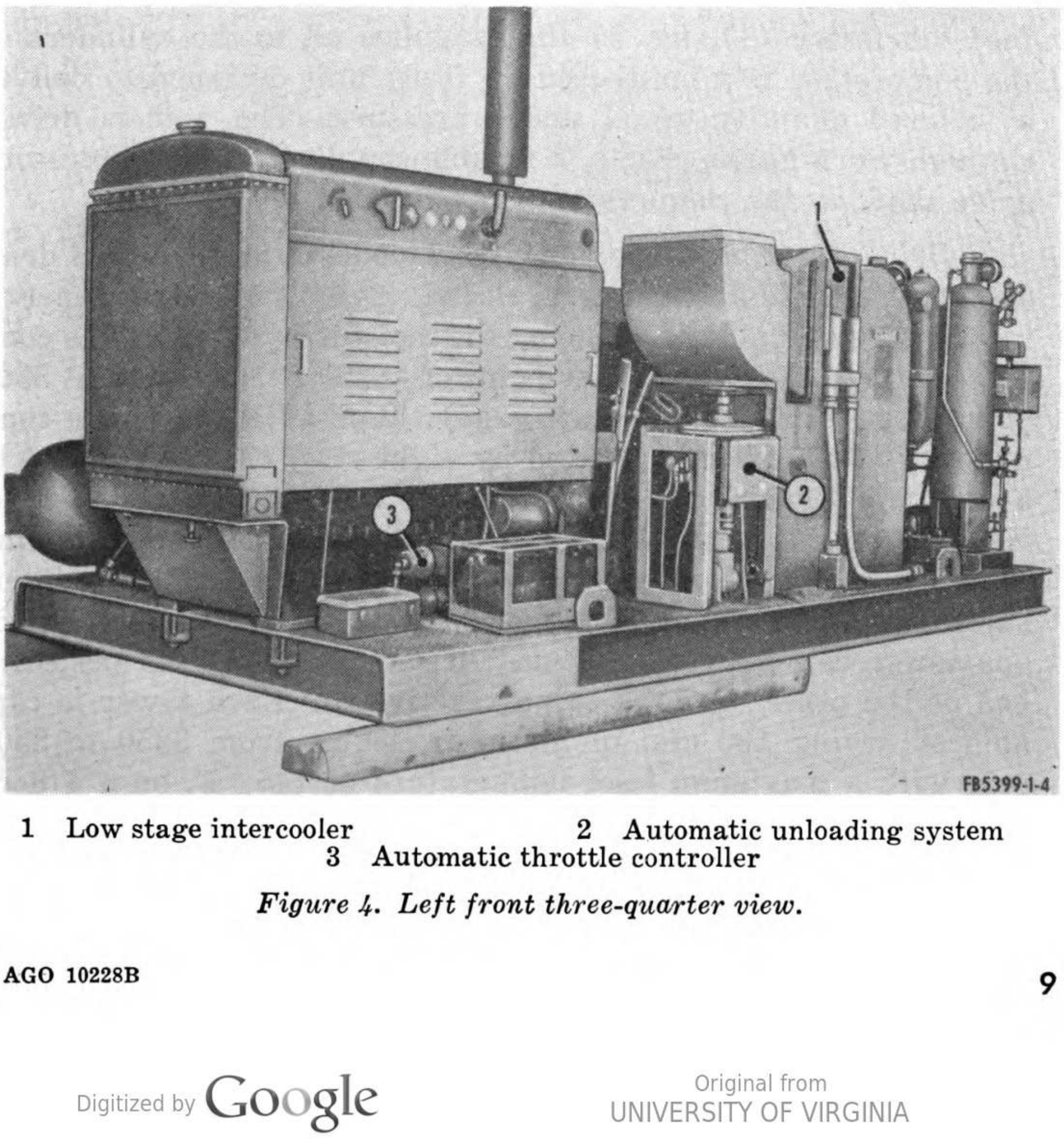
116–1241 high stage intercooler and aftercooler (3, fig. 3) are installed for the purpose of cooling compressed air and crankcase lubricating oil. Each cooler is individually equipped with a puller-type fan mounted on brackets directly behind the compressing unit. Each fan is driven by a fan-belt connected to the flywheel of the compressor and is capable of a minimum output of 2000 cfm (cubic feet per minute) at 2400 rpm. Both coolers have identical outside dimensions and serve similar purposes. Each contains two air cooling chambers, one having 112 square feet and the other 96 square feet of extended cooling surface. Each cooler also contains an oil-cooling chamber with 8 square feet of cooling surface. The left cooler receives air from the first and second compression stages; the right cooler serves as an intercooler following the third stage, and as an aftercooler following the fourth stage. The extended-fin cooling surface is constructed of $\frac{3}{8}$ inch OD red brass tubing. Soldered axially to each linear inch of the tubing are eight circular copper fins, each having a 1-inch diameter. These fins increase the cooling capacity of the cooler chambers. The compression heat built up in the cylinders is dissipated by the air currents introduced by the intercooler fans.



1 Low stage intercooler
2 Automatic unloading system
3 Automatic throttle controller

Figure 4. Left front three-quarter view.

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g. Automatic Unloader and Throttle Controller. The automatic unloader (2, fig. 4) is located on the left side of the unit. It consists of the Fisher Governor Company type 3500 positrol valve positioner, the type 67FR combination filter-regulator, the type 4104UR unloader pilot valve, the type 57TD unloader valve, and the regulator valve. High pressure air from the air receiver is piped to a Bourdon tube in the unloader pilot valve and low pressure air from the first stage of the compressor is piped through the filter-regulator valve to the positrol valve positioner and through the regulator valve to the unloader pilot valve. A hand wheel is provided to permit manual operation of the unloader valve and suitable gages, piping, and linkage are provided to permit observation and operation of the assembly under all conditions. A type 100-E A. W. Cash Company throttle controller (3) is used in conjunction with the automatic unloader to position the throttle during automatic operation of the compressor. It consists of a four-way valve, an automatic compensator, and a power cylinder. Suitable linkage is provided to transmit movement of the controller through the throttle lever to the engine carburetor. Provision is also made to render the automatic controller inoperative and manually control the speed of the engine.

h. Sight-Feed Lubricator. The McCord Corp., class SF forced-feed lubricator (17, fig. 5) that supplies oil to the cylinders of the compressor is a multi-feed (6 feed) unit designed to deliver a metered quantity of oil under pressure. The unit is driven through worn gears, shafts, a flexible coupling, and an accessory drive shaft by the compressor crankshaft.

i. Drier Assembly. The Kemp Co., model Oriad, BA 25E drier assembly (27) is a dual-tower, electrically-heated, self-regenerating air drier capable of reducing the moisture content of the compressed air to an effluent dew point of —30° F. measured at 3500 psig (pounds per square inch gage). It is adjacent to the compressing unit and is supported by eight steel channels bolted to a platform mounting bracket attached directly to the skid base. Each drying tower holds about 25 pounds of an activated alumina or silica gel disiccant capable of being reactivated. No interruption to the dehydration of the compressed air is required, since one tower can always be placed in service, when the desiccant bed of the other tower is being reactivated. Each tower is capable of drying 100 cfm of air at pressures from 3350 to 3500 psig with a maximum inlet temperature of 145° F. on a 4 hour operating cycle. The interior heating elements of each tower require a minimum of 925 watts at 110 to 115 volts which must be furnished from an outside power source. A set of insulated

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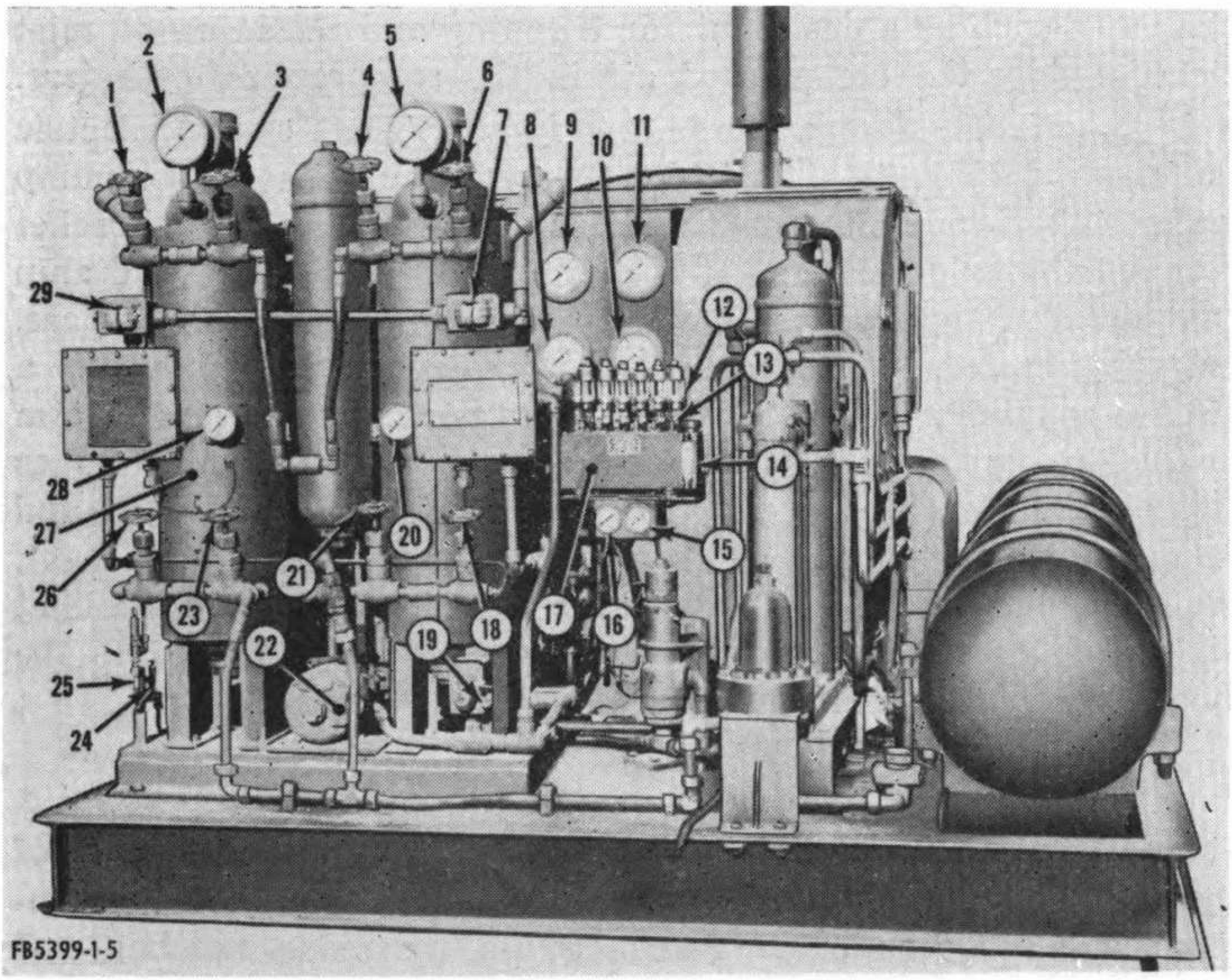

1 No. 1 drier tower reactivating air outlet valve
2 No. 1 drier tower pressure gage
3 No. 1 drier tower air inlet valve
4 No. 2 drier tower air inlet valve
5 No. 2 drier tower pressure gage
6 No. 2 drier tower reactivating air outlet valve
7 No. 2 drier tower heating element switch
8 Third stage compressor pressure gage
9 First stage compressor gage
10 Fourth stage compressor pressure gage
11 Second stage compressor pressure gage
12 Lubricator sight flow glass
13 Lubricator priming plunger
14 Lubricator sight level gage
15 Compressor oil temperature gage
16 Compressor oil pressure gage
17 Mechanical lubricator
18 No. 2 drier tower reactivator air inlet valve
19 Reactivator pump motor switch
20 No. 2 drier tower temperature gage
21 No. 2 drier tower air outlet valve
22 Reactivator pump motor
23 No. 1 drier tower air outlet valve
24 Reactivating air discharge valve
25 Reactivating air flowmeter
26 No. 1 drier tower reactivating air inlet valve
27 Drier assembly
28 No. 1 drier tower temperature gage
29 No. 1 drier tower heating element switch

Figure 5. Rear view of the compressor unit.

external strip heaters mounted on the outside of each drying tower requires a minimum of 1125 watts. For normal operation above 70° F. ambient temperature conditions, the internal heaters only are used. For lower temperature ranges, both sets of heaters are utilized. Mounted between the drying towers is the Kemp Co., model 31416 prefilter, which uses a replaceable filter media

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like vapoilsorb as a desiccant for trapping and retaining oil mist picked up by the compressed air in the compressing cylinders.

j. Reactivator Pump Motor and Pump. The General Electric Co., model 5HH47AB1442, ¼ hp (horsepower), reactivator pump motor (22) is mounted on the drier assembly mounting bracket between the drier towers. It is a single phase, 115 volt, 3.6 amp (amperes), 60 cycle a-c (alternating current), general purpose, induction motor, and is connected to the reactivator pump by a flexible coupling. The reactivator pump normally delivers 90 cfm to the drying tower that is being reactivated. Two fiber vanes at 180° from each other ride in slots machined in the rotor, and press against the pump housing tightly, thus producing a constant, even flow of air. A glass covered air filter is installed in the inlet piping of the pump. Since the pump is directly coupled to the motor, both units turn at 1725 rpm.

4. Identification

Identification plates are located on each major subassembly of the equipment requiring parts replacement during normal maintenance. They give official nomenclature, the model number, and the serial number of the unit. When requisitioning spare parts for this equipment, specify the Department of the Army registration and serial numbers, the engine serial number, and the compressor serial number.

a. The Corps of Engineers plate specifies the official nomenclature, the model number, and the serial number of the equipment.

b. The low-stage intercooler data plate (A, fig. 6), located on the left side of the intercooler, specifies the manufacturer, type, part number, working pressure, and serial number of this component.

c. The low-stage intercooler section assembly data plate (C), located on the left side of the intercooler below the intercooler data plate, specifies the part number, maximum working pressure, hydrostatic test pressure, and manufacturer of this component.

d. The high-stage intercooler and aftercooler data plate (B), located on the right side of the intercooler, specifies the manufacturer, type, part number, working pressure, and serial number of this component.

e. The high-stage intercooler and aftercooler section assembly data plate (D), located on the right side of the intercooler below the intercooler data plate, specifies the part number, maximum working pressure, hydrostatic test pressure, and manufacturer of this component.

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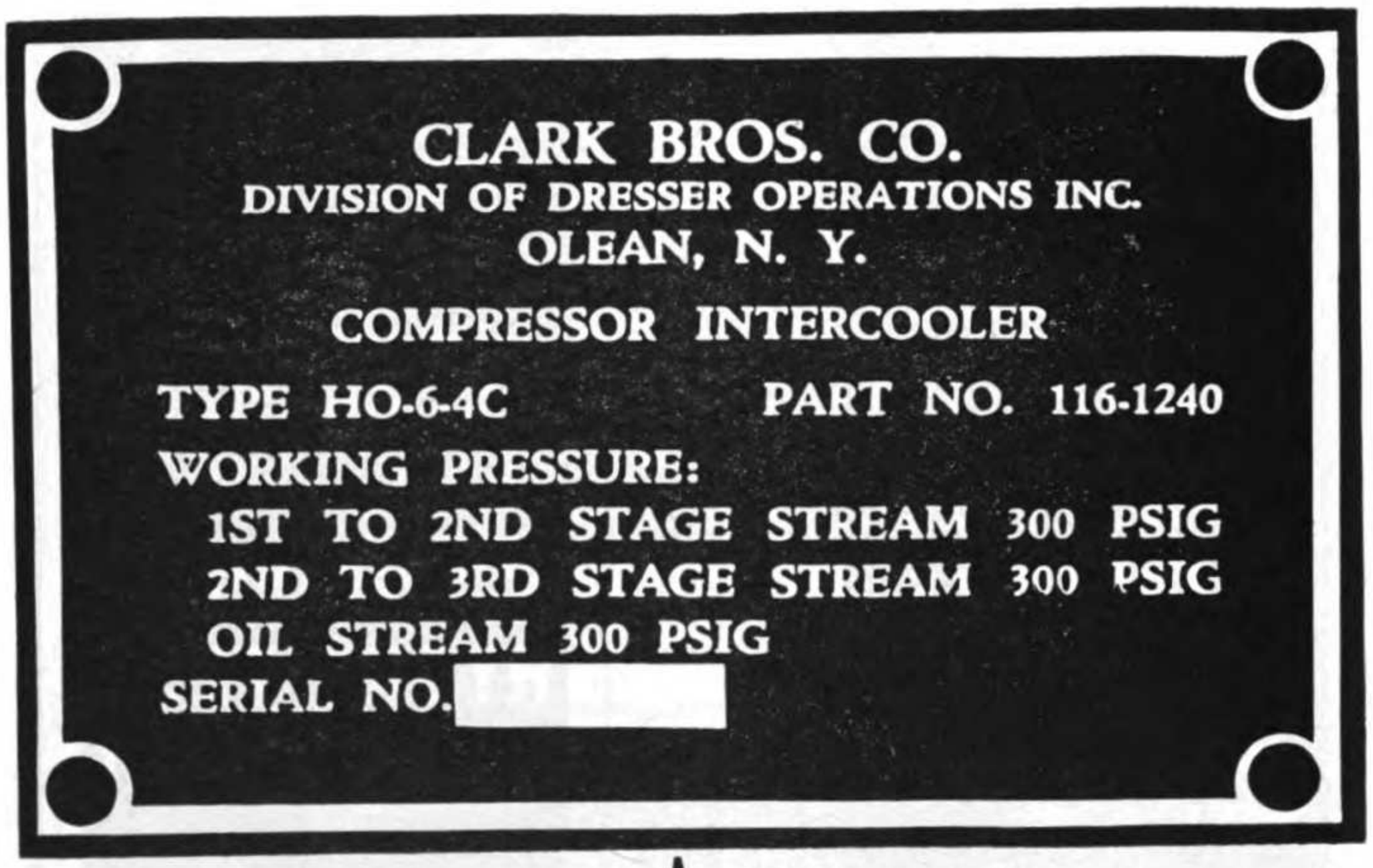

Figure 6. Identification plates.

f. The moisture separation bottle assembly data plate (E), located on the right side of the base of the assembly, specifies the type, part number, working pressure, and manufacturer of this component.

g. The air receiver data plate (F), located on the right side of the receiver in line with the engine firewall, specifies the manufacturer, serial number, patent number, maximum working

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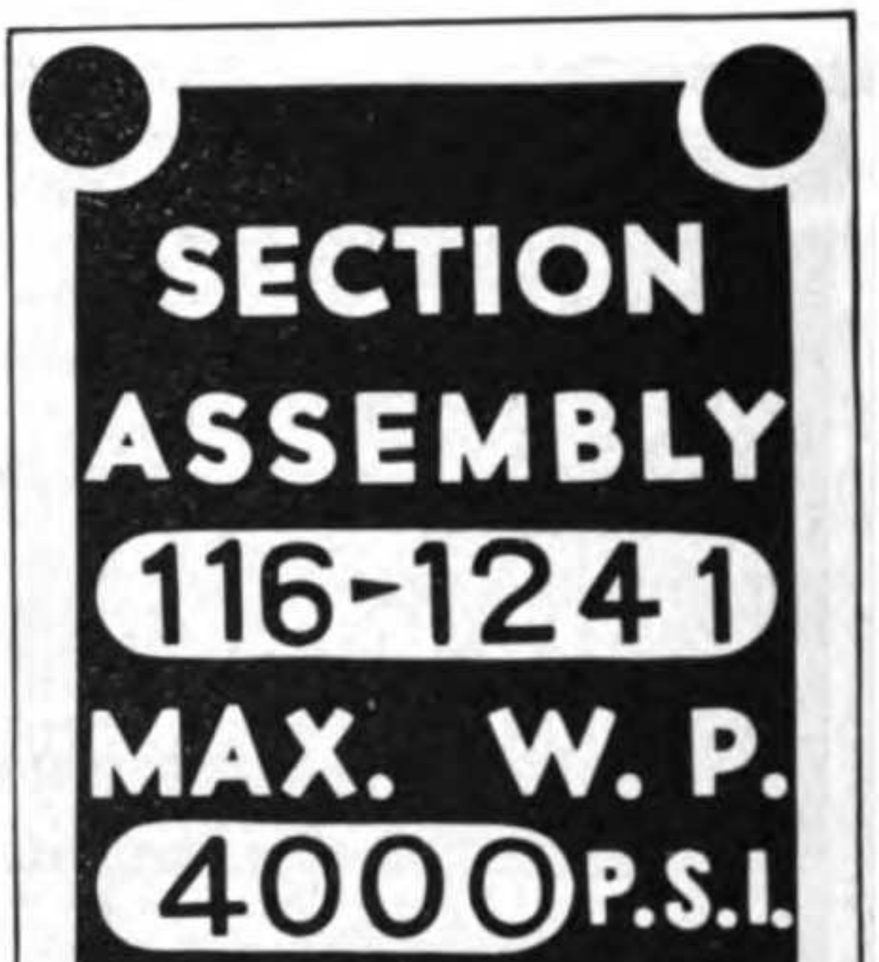
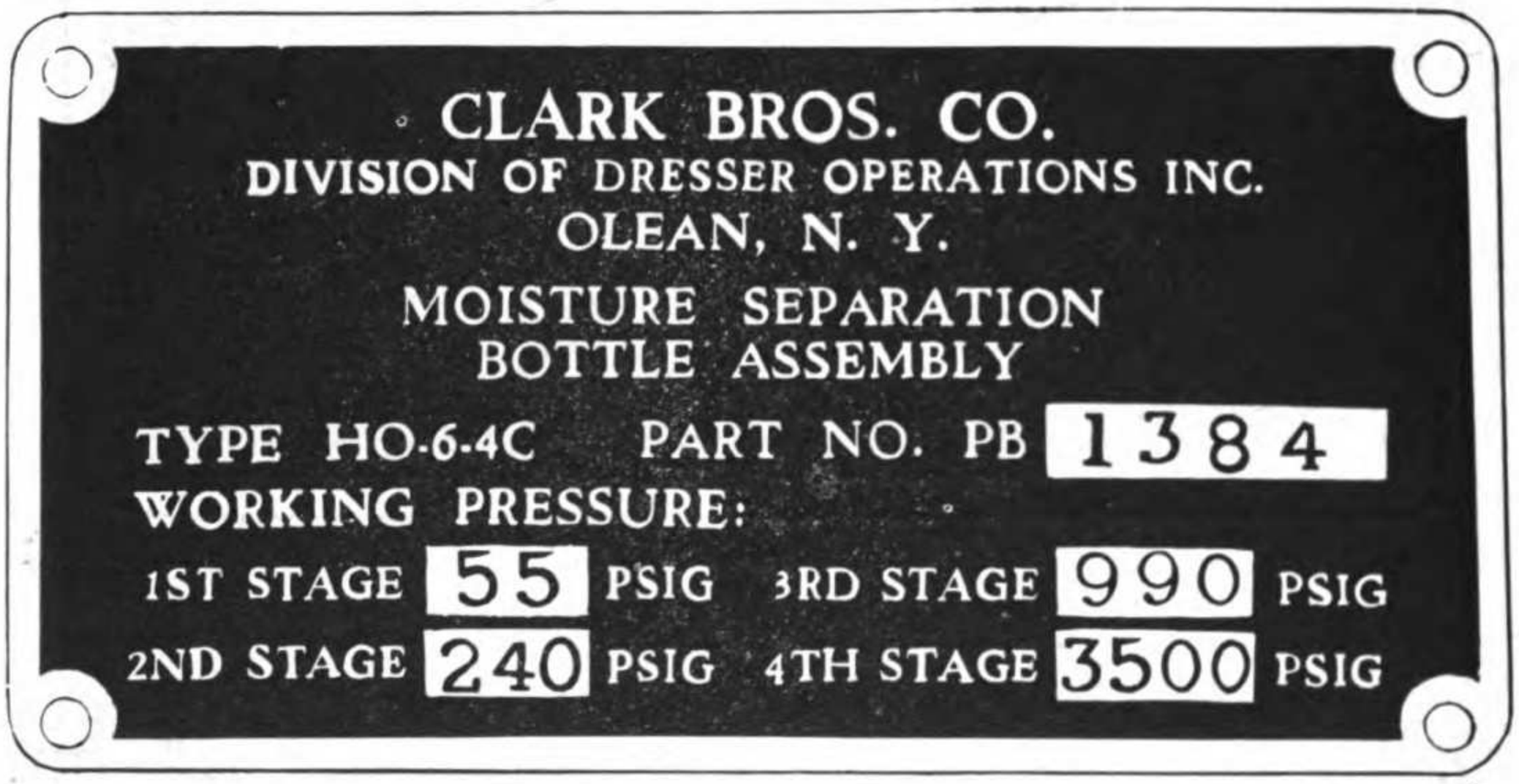
C



D



E

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Figure 6—Continued.

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Figure 6—Continued.

pressure, maximum working temperature, and test pressure of this component.

h. The clutch data plate (G), located on top of the clutch housing, specifies the manufacturer, assembly number, adjustment procedure, and lubrication of this component.

i. The engine identification plate (H), located on the right side of the engine block, specifies the manufacturer, model, serial number, lot number, and specification number of this component.

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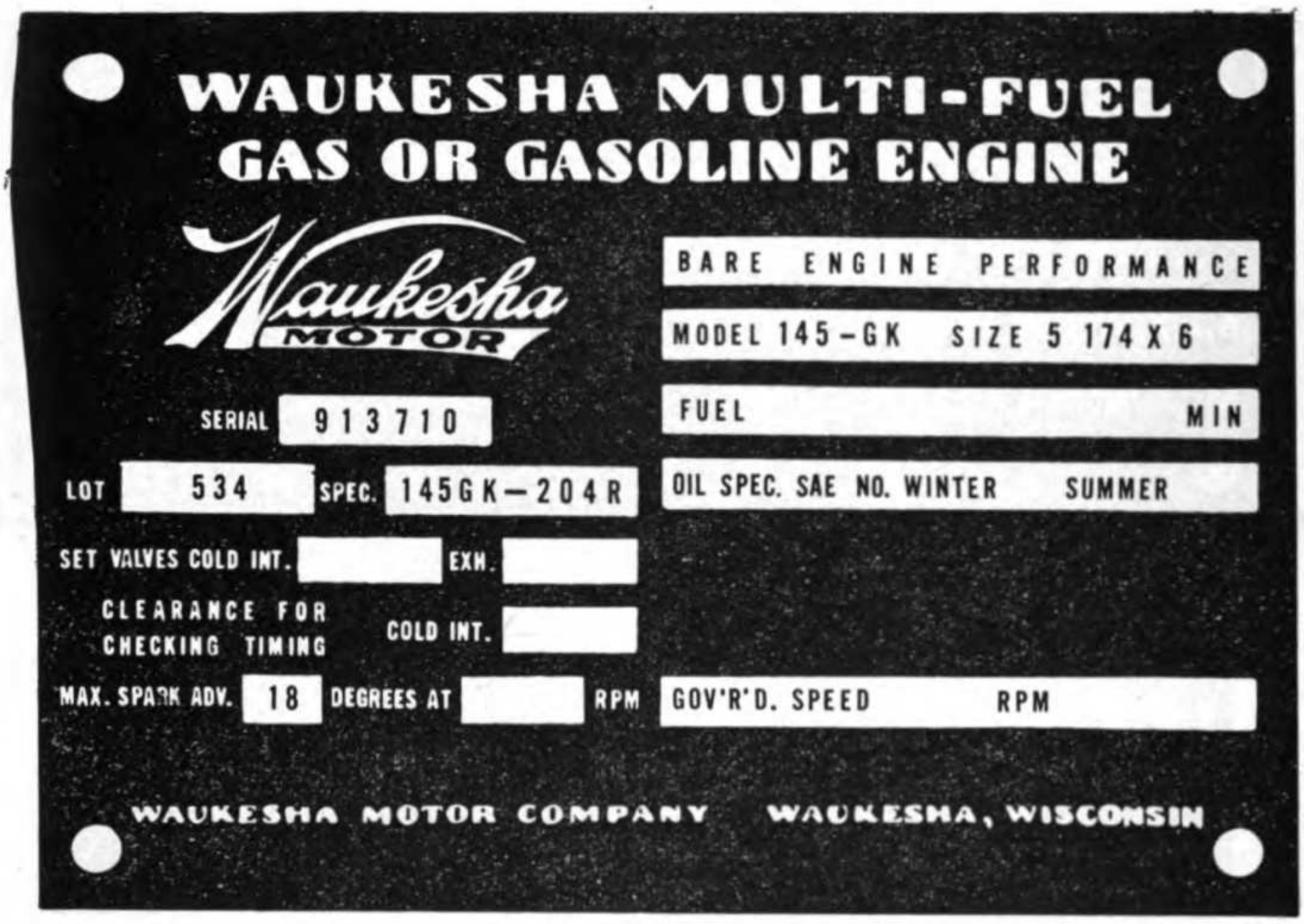

Figure 6—Continued.

j. The engine operating instructions data plate (K), located on the left side of the engine firewall, specifies the model number, unit number, valve tappet clearance, and operating instructions for this component.

k. The drier assembly plate (I), located on No. 2 drier tower thermostatic control box, specifies the serial number, flow rate, model number, pressure, service, temperature, current, drier cycle hours, and manufacturer of this component.

l. The lubricator data plate (J) is located on the front of the lubricator and specifies the class and number of this unit.

5. Differences in Models

This manual covers the compressor, air, skid-mounted, gasoline-driven, 80 cfm, 3500 psi, Clark Brothers model HO6–4C only.

6. Tabulated Data

a. Engine.

Manufacturer	Waukesha Motor Co.
Model	GKB 145
Number of cylinders	Six
Bore	5¼ inches
Stroke	6 inches
Piston displacement	779 cubic inches

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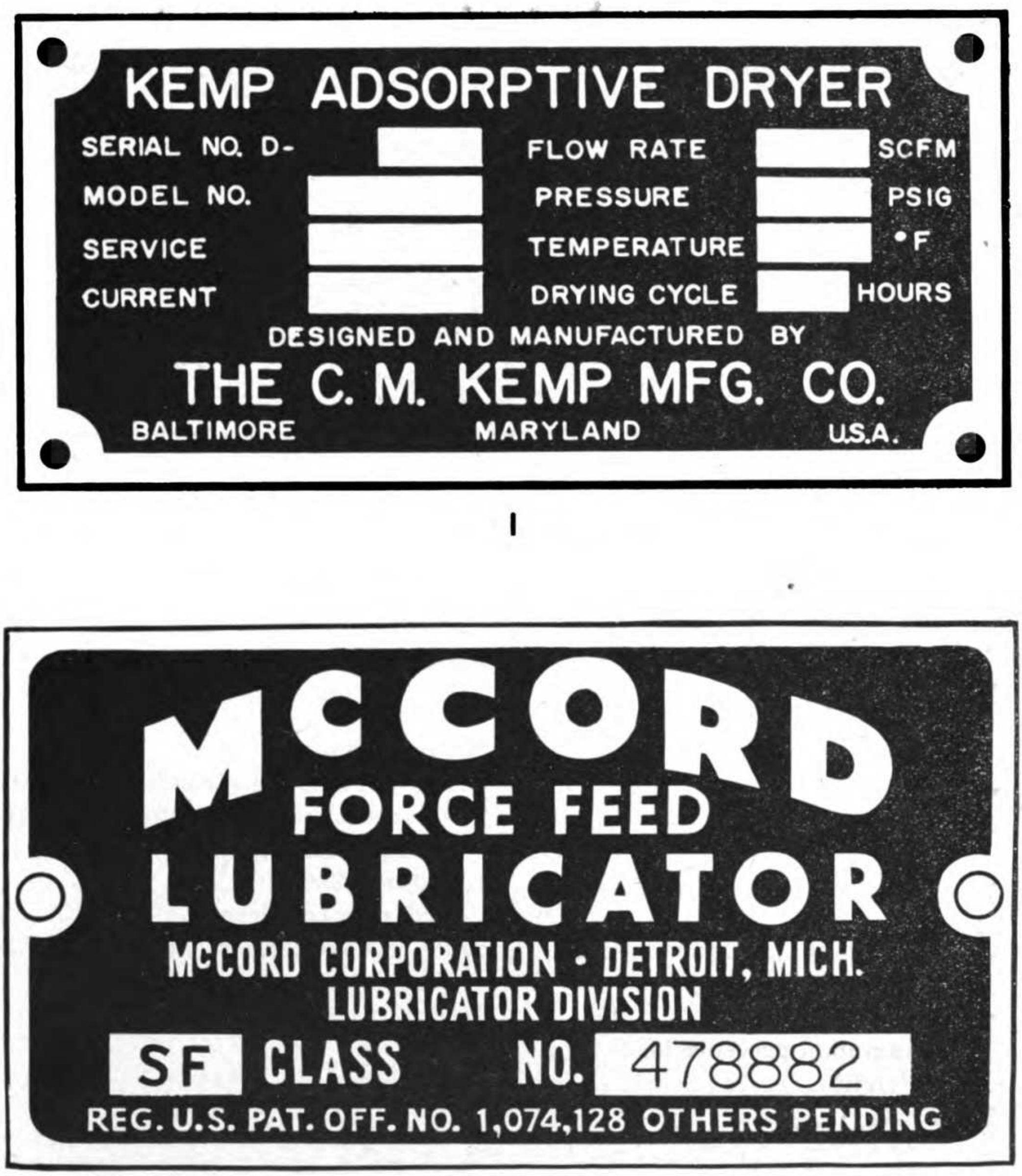

Figure 6—Continued.

Brake horsepower	145 at 1400 rpm
Permissible speeds	1200 rpm (continuous duty) or 1800 rpm (intermittent duty).
Type	Ordnance, internal combution, gasoline
Cooling system	Water-cooled, 18-gallon capacity

b. Compressor.

Manufacturer	Clark Brothers
Model	HO6-4C
Number of cylinders	Six
Number of stages	Four
Normal operating speed	1200 rpm
Discharge pressure	3500 psi

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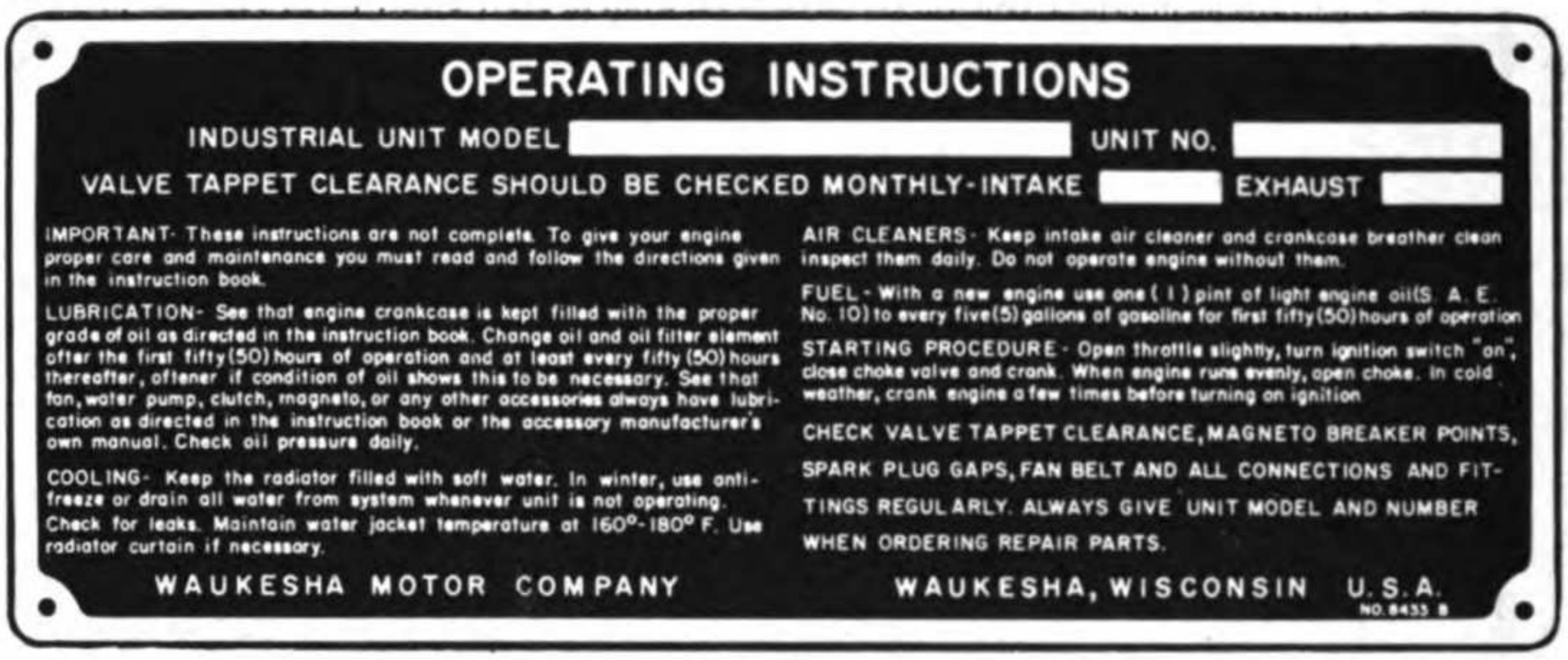

Figure 6—Continued.

Total dry air output	80 cfm at 14.7 psia and 125° F.
Type	Horizontal, balance opposed
Cylinder action	Horizontal, single-acting

c. Air Dryer.

Manufacturer	Kemp Company
Model	Oriad, BA 25E (electrically-operated)
Type	Self-regenerating, dual-tower (pounds per square inch gage).
Capacity	100 cfm at 3350 3500 psig (ea tower)
Desiccant	Silica gel or activated alumina 25 lbs. charge each tower.
Control system	Manually controlled (4 hour cycles)
Maximum pressure load	3600 psig
Weight	1375 pounds

d. Coolers.

Manufacturer	Clark Brothers
Model	116–1240, 116–1241
Type	Radiator, with extended cooling-fin surface.
Purpose	Cooling air and lubricating oil of compressor.

e. Clutch (Power Takeoff).

Manufacturer	Industrial Clutch Co.
Model	213.5
Type	Power takeoff
Maximum torque	1380 ft-lb
Assembly weight	236 lb
Maximum horsepower	180 at 1200 rpm

f. Flexible Coupling (Main Drive Shaft).

Manufacturer	Thomas Flexible Coupling Company
Model	312 CM
Type	Double-flexing with flywheel adapter

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Horsepower	11.4 per 100 rpm
Bore of hub	3⅛ inch
Maximum angular displacement	1°
Maximum parallel displacement	1/64 inch
Lubrication	None required

g. Air Receiver.

Manufacturer	A. O. Smith Corp.
Type	Multi-layer, cylindrical tank
Capacity	20 cubic feet
Working pressure	3750 psi
Material	ASTM-225GR "B" FBQ Mod.
Safety factor	Shell, 3 on ultimate tensile strength; heads, 3.6 on ultimate tensile strength.
Length	14 feet 11 inches
Diameter (outside)	19⅛ inches
Diameter (inside)	16⅜ inches
Wall thickness	1 3/16 inches
Tank head (dome) thickness	1 9/16 inches
Weight	3900 pounds

h. Compressor Lubricating Pumps.

(1) For cylinder lubrication:

Manufacturer	McCord Corp.
Model	Class SF forced-feed, multi-pump
Number of pumping unit (feeds).	Six
Oil resevoir capacity	8 pints
Type of feed sight	Tubular pyrex "clearsite"
Type of plungers	5/16 in differential, back outlet
Drive	Left hand, bottom rotary
Gear ratio	40 to 1
Valves	Stainless-steel ball check

(2) For crankshaft lubrication:

Manufacturer	Tuthill Pump Co.
Model	O L oil pump
Pumping capacity	68 gallons per hour at 1200 rpm
Maximum pressure	100 psi at 1200 rpm
Power source	Spur gear from auxiliary driveshaft
Flow control	Rotation (clockwise)
Type of mounting	Two-bolt flange bracket

i. Moisture Knock-Out Bottle.

Manufacturer	Clark Brothers Co.
Model	101–342
Type	Moisture separator
Mounting	Platform brackets attached to skid base
Number of bottles	5

j. Prefilter (Dryer).

Manufacturer	Kemp Manufacturing Co.
Model	31416

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Type	Pipeline
Filter media	Vapoilsorb, replaceable, desiccant
Quantity of desiccant	10-pound charge
Mounting	Bolted to brackets between towers of dryer assembly.

k. Pipeline Filter.

Manufacturer	Clark Brothers Co.
Model	101–340–A
Type	High-pressure pipe line
Number of compressor	Z
Filter element	American Air Filter Company Primary No. 25 FG (filterdown) Secondary No. 50 FG (filterdown)
Mounting	Bolted to pad on base structure

l. Generator.

Manufacturer	Delco-Demy Division, General Motors Corp.
Type	Direct current, 6 volts
Model	1100985

m. Battery.

Source	Ordnance Corps
Type	Wet cell
Voltage	6

n. Governor.

Manufacturer	Waukesha Motor Co.
Type	Flyball
Model	0140338M

o. Water Pump.

Manufacturer	Waukesha Motor Co.
Type	Impeller
Model	00145760

p. Voltage Regulator.

Manufacturer	Delco-Remy Division, General Motors Corp.
Rating	6 volts
Model	5919

q. Carburetor.

Manufacturer	Zenith Carburetor Division, Bendix Aviation Corp.
Type	Updraft
Model	63 AW 16

r. Fuel Pump.

Manufacturer	AC Spark Plug Division, General Motors Corp.
Type	Mechanical cam operated
Model	1537662

s. Magneto.

Manufacturer	American Bosch Corp.
Model	MRA 6A 307

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t. Starting Motor.

Manufacturer	Delco-Remy Division, General Motors Corp.
Voltage	6
Model	1109159

u. Base Plan. If the compressor is to be operated in a permanent location, other than in a mobile repair shop, a suitable and secure concrete base or foundation (fig. 7) must be constructed. The steel base of the unit has four holes drilled in each

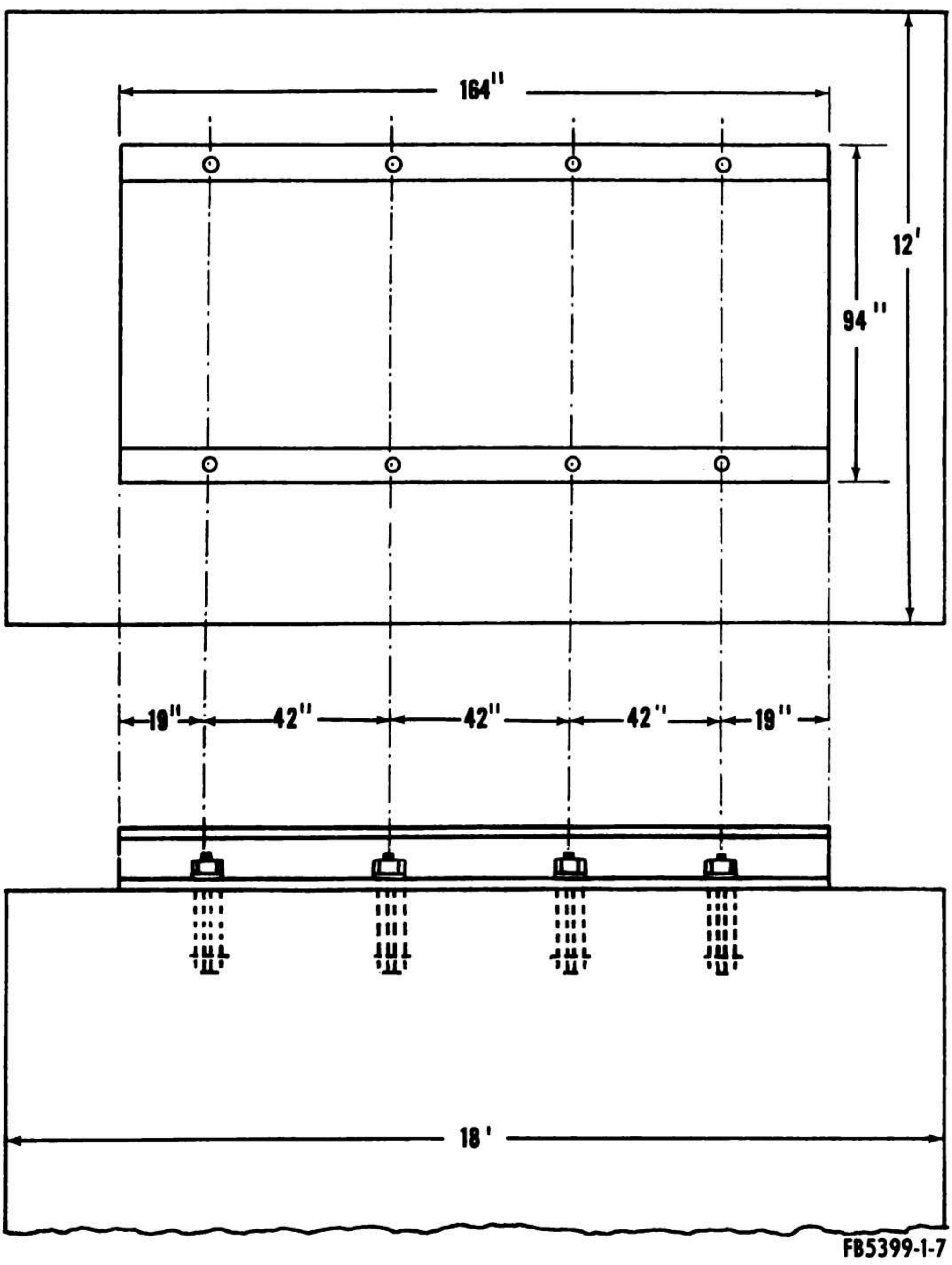

Figure 7. Base plan.

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side piece for holding bolts. The construction and particularly the depth of the foundation is regulated by the condition and type of soil where the unit is to be installed. A wooden template should be used to support and accurately locate the holding bolts while the foundation is being made. If a template is constructed, make sure that the holes drilled in the template correspond to the dimensions given in figure 7. Insert the bolts with one large iron washer in lengths of pipe with the inner diameter at least ½ inch larger than the diameter of the bolt, and install the bolts in the template. The bolts should be supported in the template so that the top edge of the pipes will be level with or slightly below the surface of the foundation. In this position the correct size of bolts will project above the finished foundation to take the frame, a washer, a locknut, and a standard nut. Dig a hole large enough to permit the erection of the concrete form having the following inside measurements:

LENGTH: 18 ft
WIDTH: 12 ft

Erect the form according to the above measurements and place the template with bolts and pipes on top of it. Each bolt should be approximately centered in its piece of pipe by blocking it in place with rags or similiar material that can be removed later. This will also prevent cement from entering the pipes.

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CHAPTER 2
OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

7. New Equipment

a. General. New air compressors are processed to meet military specifications. All openings in the compressor and engine are presealed. Certain procedures must be performed before the equipment can be put into operation. Move the unit as close as possible to the operating site, before unloading.

b. Unloading.

(1) Remove all side and end blocking which holds the compressor to the carrier bed.

(2) If a crane is available, attach cables (3, fig. 8) to the four lifting lugs (4). Install spreader bars (1) between the cables. Insert the crane hook (2) in the lifting ring, and lift the unit off the carrier.

Caution: Spreader bars should always be used to keep the slings from coming in contact with the compressor housing, as pressure from the slings will seriously damage the housing.

(3) If a crane is not available, construct a ramp of suitable timbers. Place rollers under each side of the skid and lower the compressor by means of a winch or chain fall connected to a chain or cable bridle fastened to the lifting lugs of the skid.

Caution: Due to the weight of the unit, care must be taken that the ramp is strong enough to support the unit.

c. Installation.

(1) Place the compressor as close as possible to the operating site and in as level a position as possible.

Caution: Never operate the compressor at more than 10° out of level, as this may cause undue wear on the bearings of the engine and compressor.

(2) Connect suitable piping from the compressing unit outlet connection to the unit which is to be charged.

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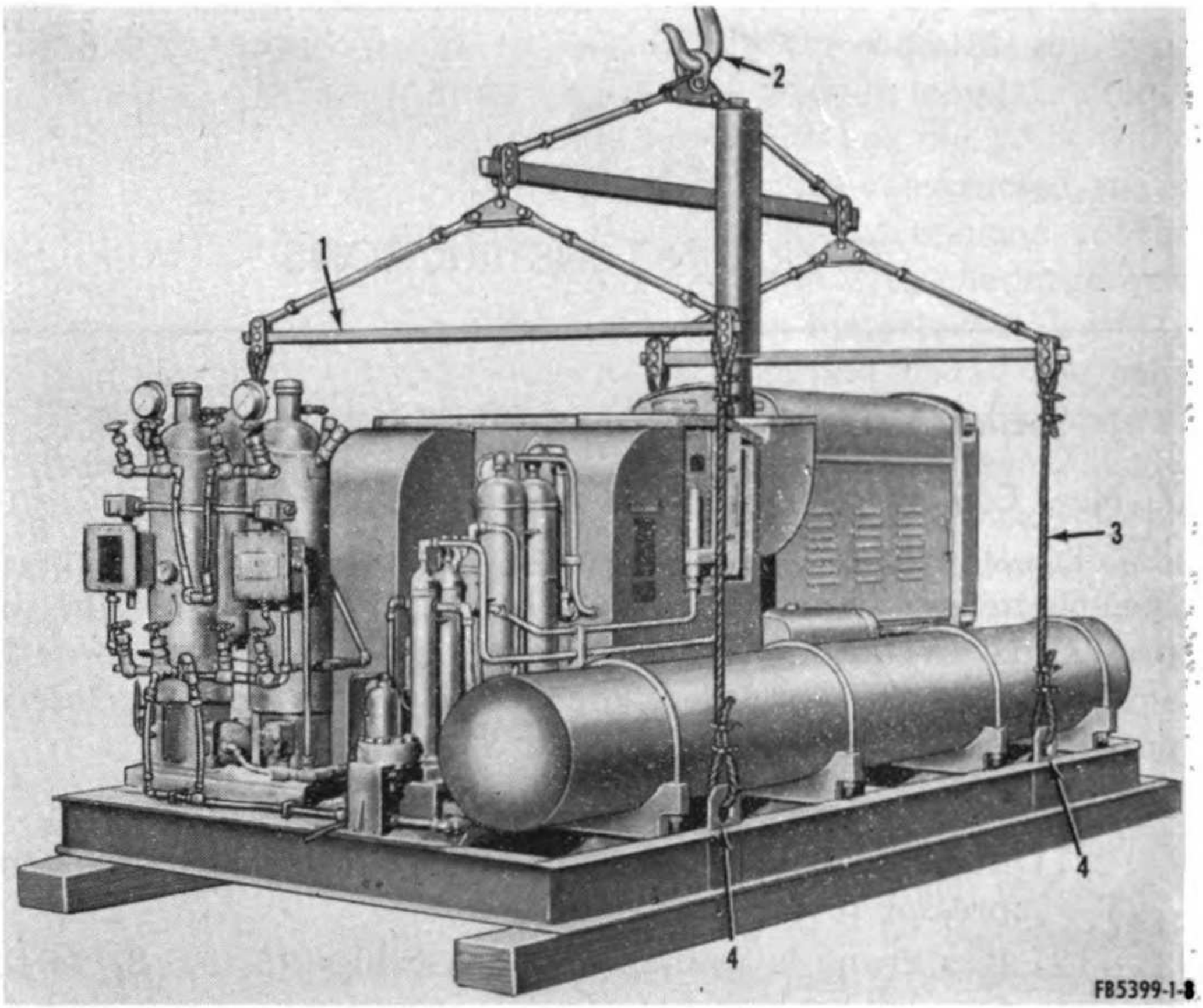

1 Spreader bars
2 Crane hook
3 Cables
4 Lifting lugs

Figure 8. Unloading compressor using crane and sling.

(3) Install the outside power supply source cable in the junction box mounted on the rear of the skid base, and connect the cable terminals to the terminal strip.

Note. Be sure that the outside power supply source is 110-volt, 60-cycle, single-phase, alternating current only.

d. Removal of Preservative Compounds, Lubricants, and Devices.

(1) Remove all tape from battery terminals, switches, circuit breakers, control boxes, and gage glass lenses.

(2) The radiator has been tagged to indicate whether the cooling system is empty or filled with antifreeze solution. Do not drain the radiator if the unit has been shipped with an antifreeze solution.

(3) Remove all waterproof coverings from the compressor, engine, compressor crankcase, and reactivator pump air inlets, and the engine exhaust pipe.

(4) Drain all preservative lubricants from the mechanical lubricator, and the engine and compressor crankcase.

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Refill as required with the correct type and grade of lubricant, as described in the current lubrication order.

e. Assembling. Fill the battery to the correct level with the electrolyte, shipped separately, and connect the terminals to the battery posts.

f. Inspection.

(1) Check the engine housing and compressor shrouding for evidence of damage during transit, for condition of paint, loose or broken handles, and visually inspect the muffler for general condition and security of attachment.

(2) Check the entire unit for loose connections, broken lines or fittings, tightness of attachments, security of mounting, and freedom of operation of all valves, controls, and switches.

(3) Be sure that all protective guards for belts, flywheel, and fans are securely attached and clear of the object they protect.

(4) Using the engine hand crank and with the ignition turned off, crank the engine to be sure that the pistons and bearings of the engine and compressor are free.

(5) Turn the fan blade assemblies by hand and see that there is sufficient clearance between the blades and cooling surfaces. See that the fan belts are in good condition.

(6) Inspect the gasoline tank for secure mounting and for the presence of water, rust, or any foreign matter.

(7) Inspect all wiring for loose terminal connections, frayed insulation, or broken wires.

g. Service.

(1) Lubricate the compressor as specified in LO 5–5399.

(2) Perform the preventive maintenance services as specified in paragraph 36*c*.

(3) After making sure that the fittings on the fuel line from fuel line to fuel pump are tight, remove the fuel tank cap and fill the tank with fuel. Be sure to provide a metallic contact between the container and tank when filling with fuel. Replace the cap upon completing the operation.

(4) Check the cleanness of the cooler assemblies. Remove any dirt or obstructions in the core air passages to insure against overheating of the compressor during operation.

(5) Be sure that the fire extinguisher is securely mounted and is not leaking.

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8. Used Equipment

Service used equipment in the same manner as outlined in paragraph 7. Perform each step carefully. Used equipment may require additional cleaning, checking, testing, and inspection. Careful performance of before-operation services (par. 36) will assure satisfactory operation of the compressor.

Section II. CONTROLS AND INSTRUMENTS

9. General

This section describes, locates, illustrates, and furnishes the operator sufficient information about the various controls and instruments for the proper operation of the unit.

10. Engine Controls

a. Fuel Line Shutoff Valve.

(1) *Locates.* The fuel line shutoff valve (3, fig. 9) is located near the gasoline tank (1) between the compressor unit and engine.

(2) *Purpose.* It controls the flow of fuel from the tank to the engine and heater units.

b. Fuel Pump Shutoff Valve.

(1) *Location.* The fuel pump shutoff valve (3, fig. 10) is located on the left side of the engine at the fuel filter.

(2) *Purpose.* It controls the flow of fuel from the fuel line to the fuel pump.

c. Compressor Low-Oil Pressure Switch Control Knob.

(1) *Location.* The compressor low-oil pressure switch control knob (1, fig. 11) is located on the rear of the engine cowling underneath the air cleaners.

(2) *Purpose.* It grounds the magneto to stop the engine if the compressor oil pressure falls below 20 psi.

d. Throttle Lever.

(1) *Location.* The throttle lever (1, fig. 12) is located at the left side of the engine between the rear engine cowling and the intercooler.

(2) *Purpose.* It permits either manual or automatic opening and closing of the carburetor throttle valve through suitable linkage, thus accelerating and decelerating the engine.

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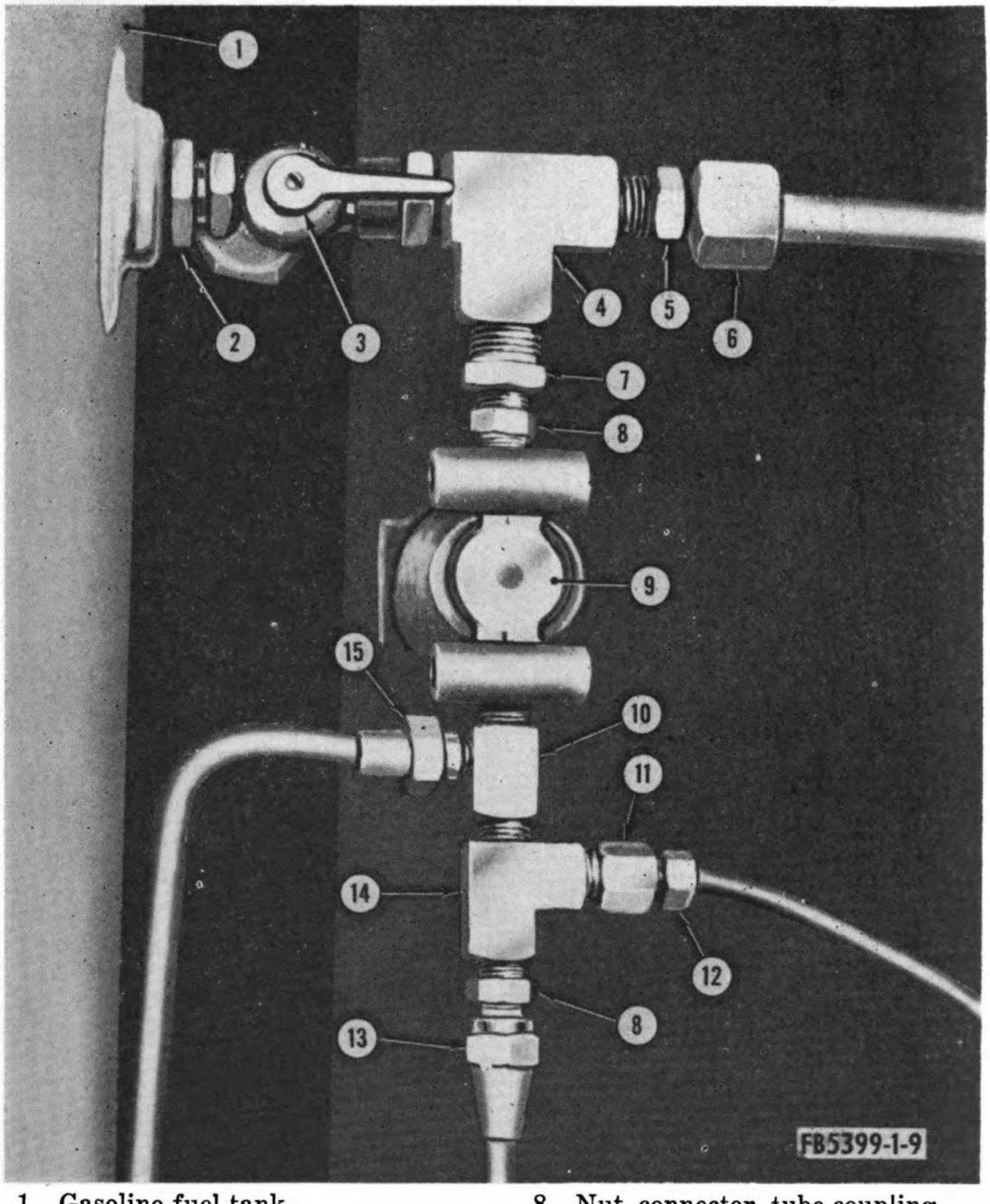

1 Gasoline fuel tank
2 Nut, reducing, tube coupling
3 Valve, fuel tank shutoff
4 Elbow, tube fitting
5 Nut, reducing, tube coupling
6 Nut, ferrule, tube coupling
7 Nut, reducing, tube coupling
8 Nut, connector, tube coupling
9 Fuel filter assembly
10 Tee fitting, tube connector
11 Nut, reducing, tube coupling
12 Nut, ferrule, tube coupling
13 Nut, flare, tube coupling
14 Elbow, tube fitting
15 Nut, flare, tube coupling

Figure 9. Fuel line shutoff valve and connections.

e. Clutch Lever.

(1) *Location.* The clutch lever (2) is located on the left side of the clutch housing.

(2) *Purpose.* It engages or disengages the clutch which transmits the power developed by the engine to the compressor.

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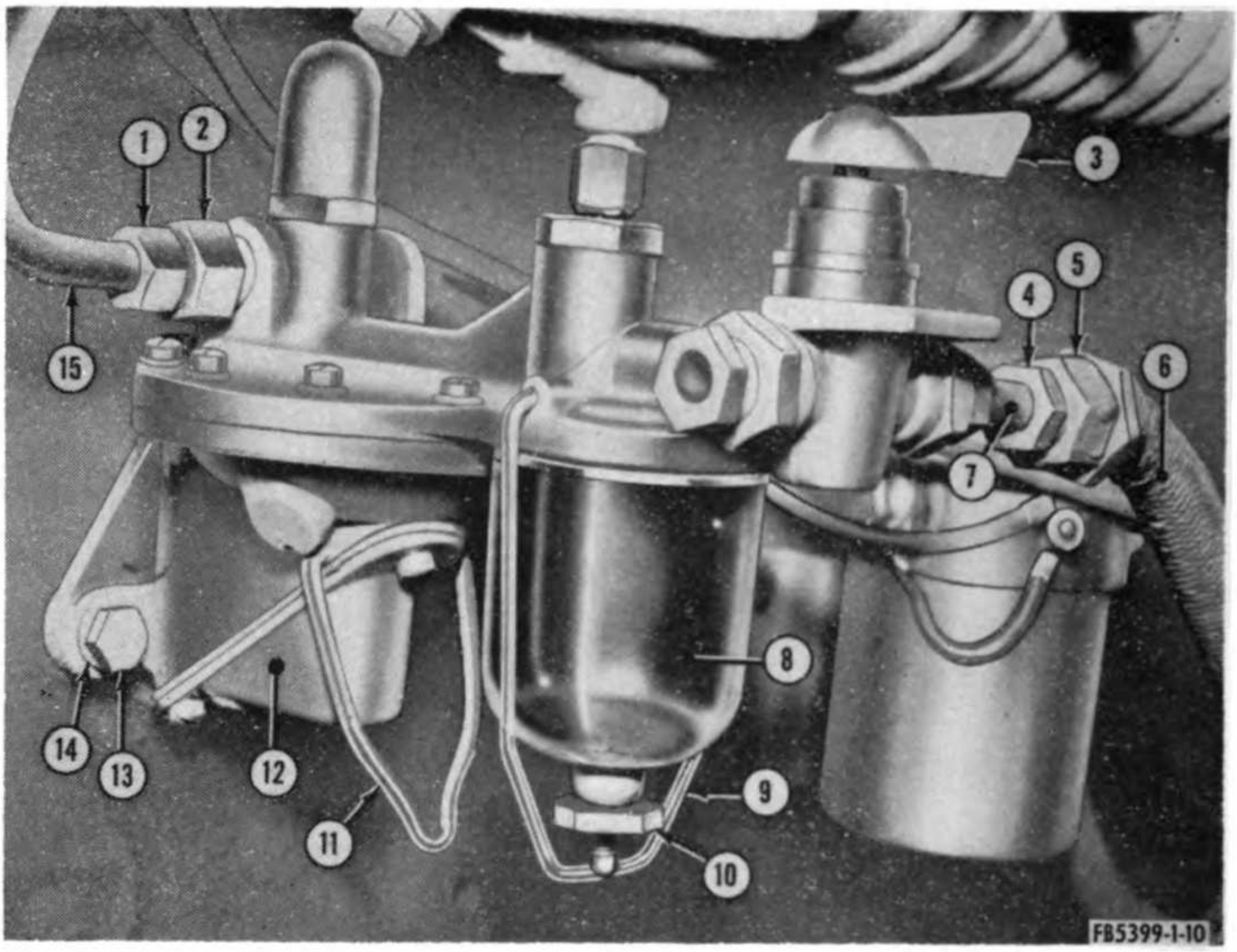

1	Outlet line ferrule nut	8	Sediment bowl
2	Outlet line ferrule adapter	9	Bail
3	Fuel pump shutoff valve	10	Knurled nut
4	Inlet line ferrule adapter	11	Priming lever
5	Inlet line ferrule nut	12	Fuel pump assembly
6	Inlet line	13	Cap screw
7	Pipe nipple	14	Lock washer
		15	Outlet line

Figure 10. Fuel pump mounting and connections.

f. Engine Crankcase Drain Valve.

(1) *Location.* The engine crankcase drain valve (6, fig. 13) is located on the lower right side of the engine at the bottom of the oil pan.

(2) *Purpose.* It is used to drain the oil from the engine crankcase.

g. Load-Unload Valve.

(1) *Location.* The load-unload valve (1, fig. 14) is mounted on the engine instrument panel.

(2) *Purpose.* It controls the flow of air to the throttle controller assembly.

h. Governor Control Lever.

(1) *Location.* The governor control lever (2) is mounted on the engine instrument panel next to the load-unload valve.

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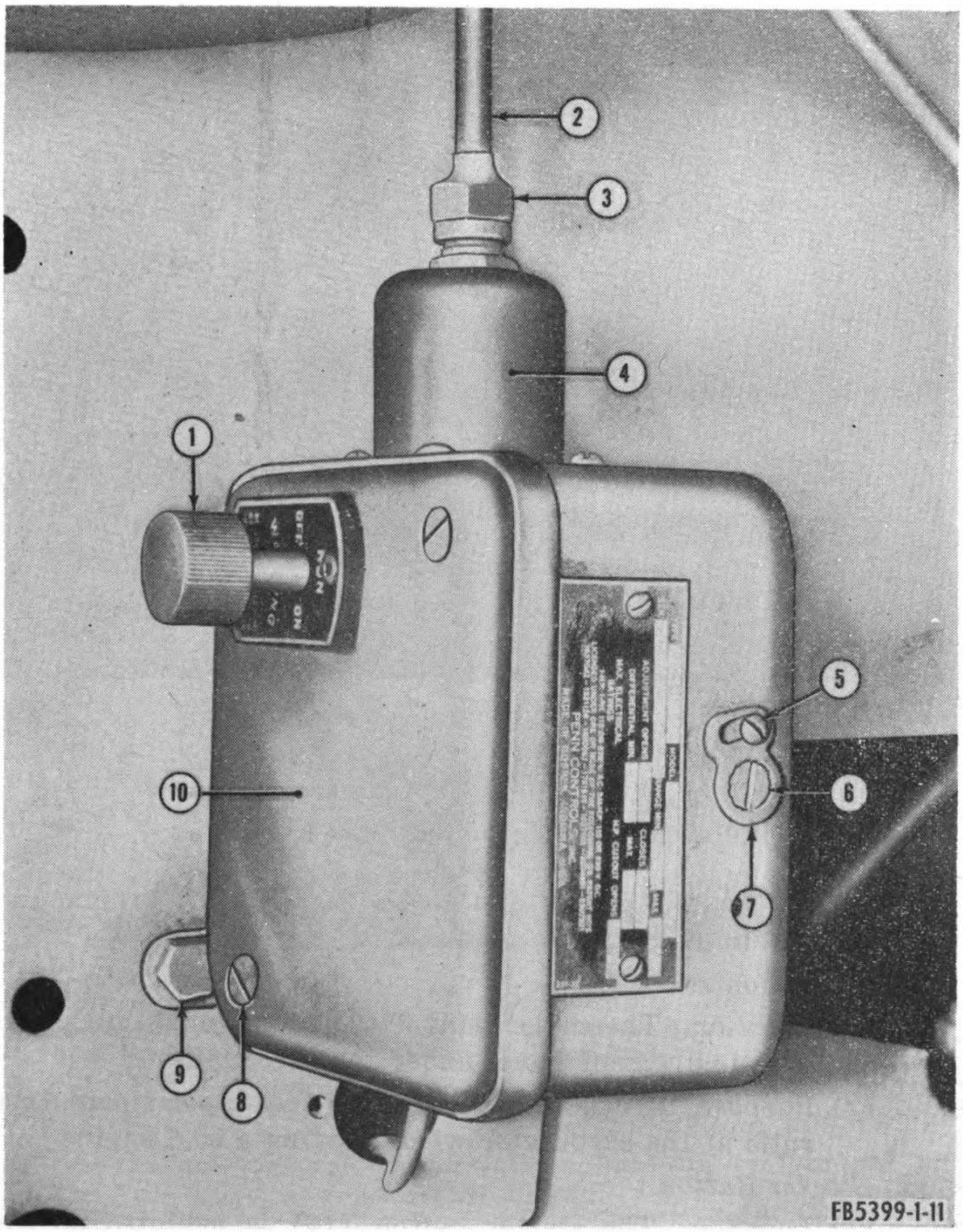

1 Compressor low-oil pressure switch control knob
2 Oil pressure line
3 Oil pressure line connection
4 Bellows assembly
5 Screw, locking
6 Adjusting screw
7 Adjusting screw lock
8 Cover screw
9 Cup screw
10 Compressor low-oil pressure switch

Figure 11. Compressor low-oil pressure switch mounting and connections.

(2) *Purpose.* It automatically controls the speed of the engine when the throttle is fully advanced.

i. Ignition Switch.

(1) *Location.* The ignition switch (7) is mounted on the engine instrument panel next to the throttle lever.

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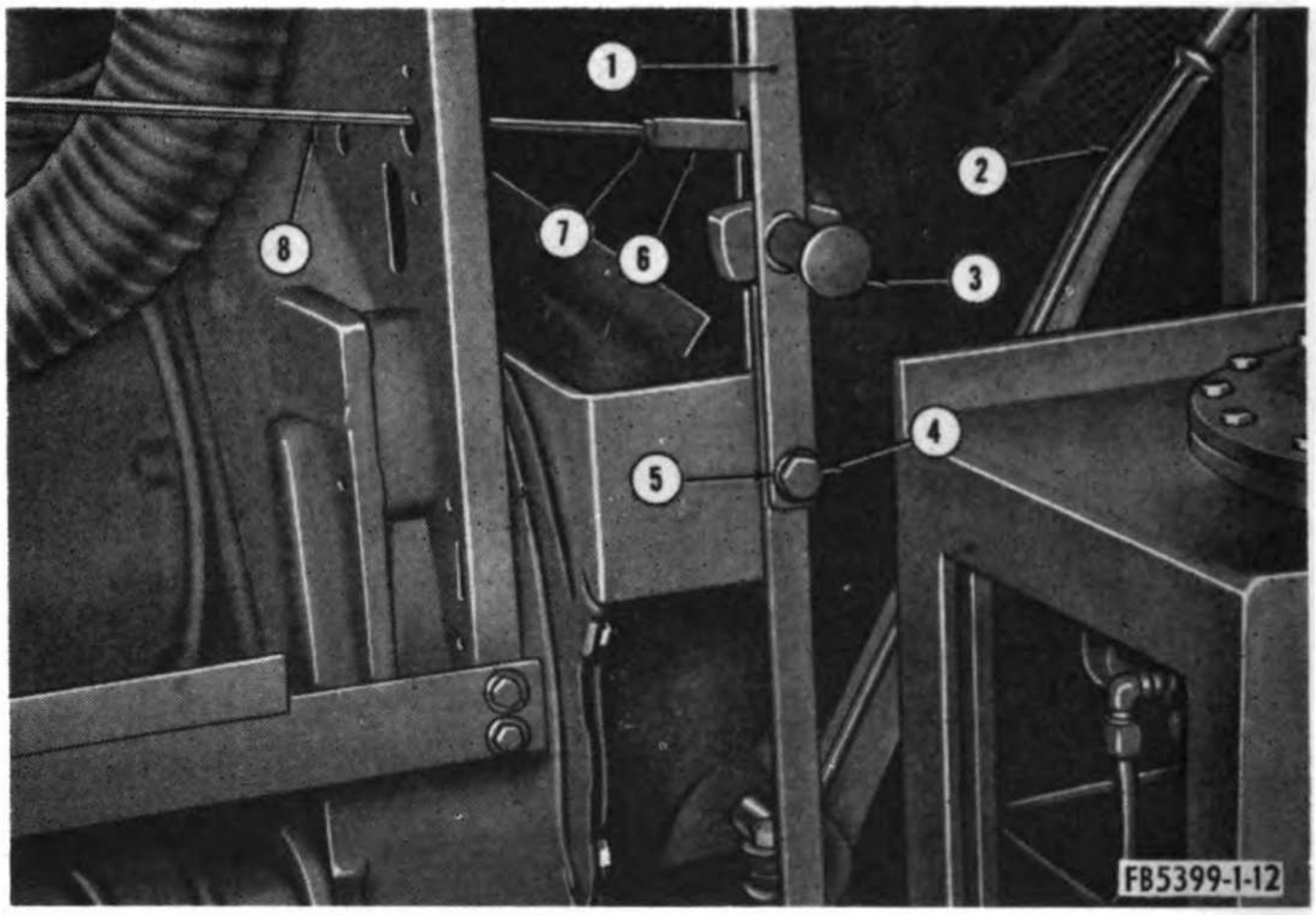

1	Throttle lever	5	Washer
2	Clutch lever	6	Clevis
3	Detent catch knob	7	Locknut
4	Cap screw	8	Throttle control rod

Figure 12. Throttle and clutch levers.

(2) *Purpose.* It opens and closes the primary ground circuit to the magneto.

j. Choke Control.

(1) *Location.* The choke control (9) is mounted on the engine instrument panel under the throttle lever.

(2) *Purpose.* It is used to change the fuel vapor-air mixture ratio at the carburetor when starting a cold engine.

k. Starter Button.

(1) *Location.* The starter button (10) is mounted on the engine instrument panel under the ignition switch.

(2) *Purpose.* It closes the circuit and energizes the starting motor for cranking the engine.

11. Engine Instruments

a. Tachometer.

(1) *Location.* The tachometer (3, fig. 14) is mounted on the engine instrument panel next to the governor control lever.

(2) *Purpose.* It registers the number of revolutions per minute attained by the engine.

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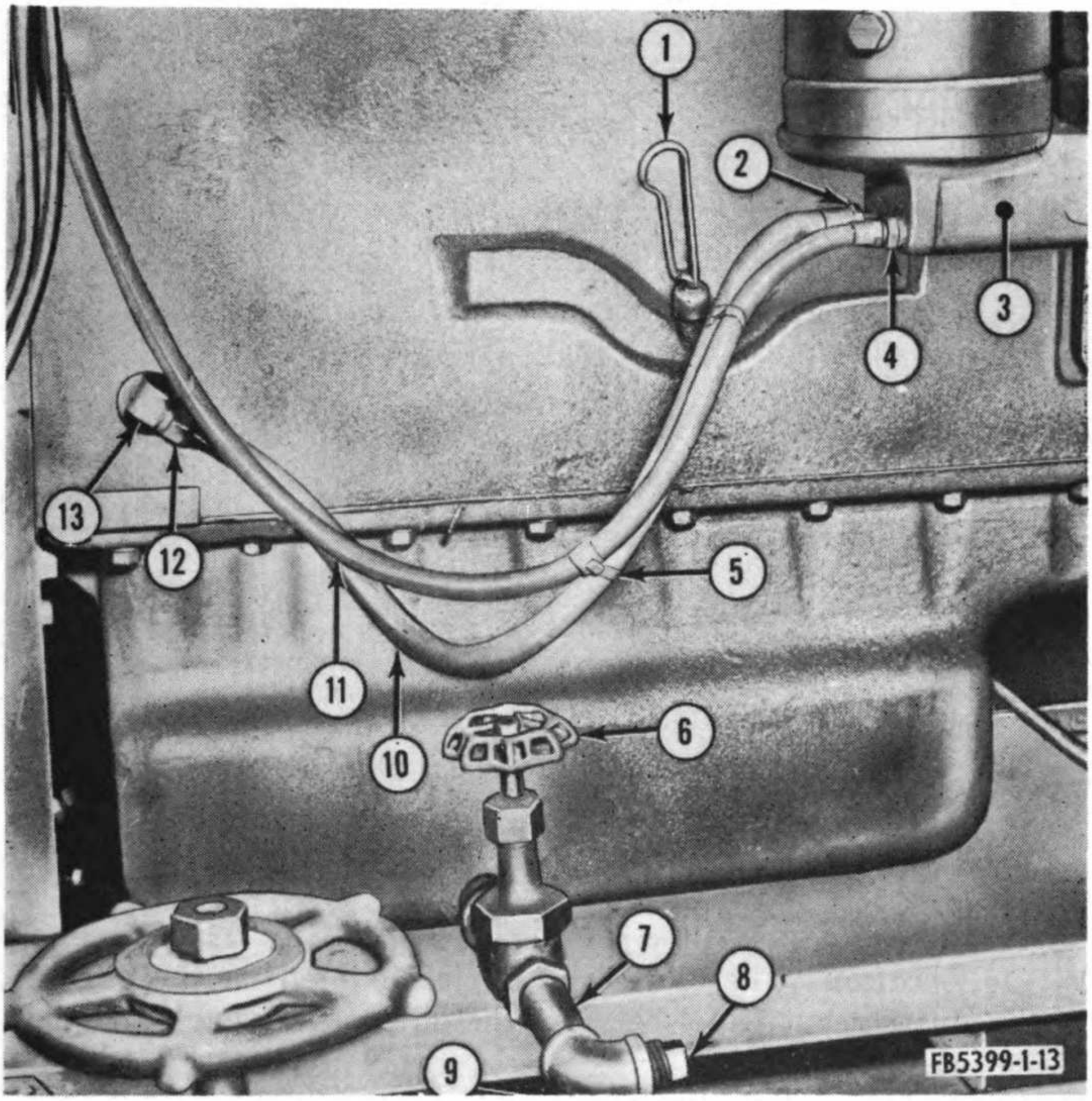

1	Oil level gage	8	Pipe plug
2	Filter outlet connection	9	Pipe elbow
3	Oil filter assembly	10	Outlet hose
4	Filter inlet connection	11	Inlet hose
5	Hose clamp	12	Outlet hose connection at engine
6	Engine crankcase drain valve	13	Outlet hose elbow
7	Pipe nipple		

Figure 13. Lower right side of engine, showing engine oil level gage and crankcase drain valve.

b. Hour-Meter.

(1) *Location.* The hour-meter (4) is mounted on the engine instrument panel between the tachometer and oil pressure gages.

(2) *Purpose.* It records the number of hours that the engine has been in operation.

c. Oil Pressure Gage.

(1) *Location.* The oil pressure gage (5) is mounted on the engine instrument panel between the hour-meter and ammeter gages.

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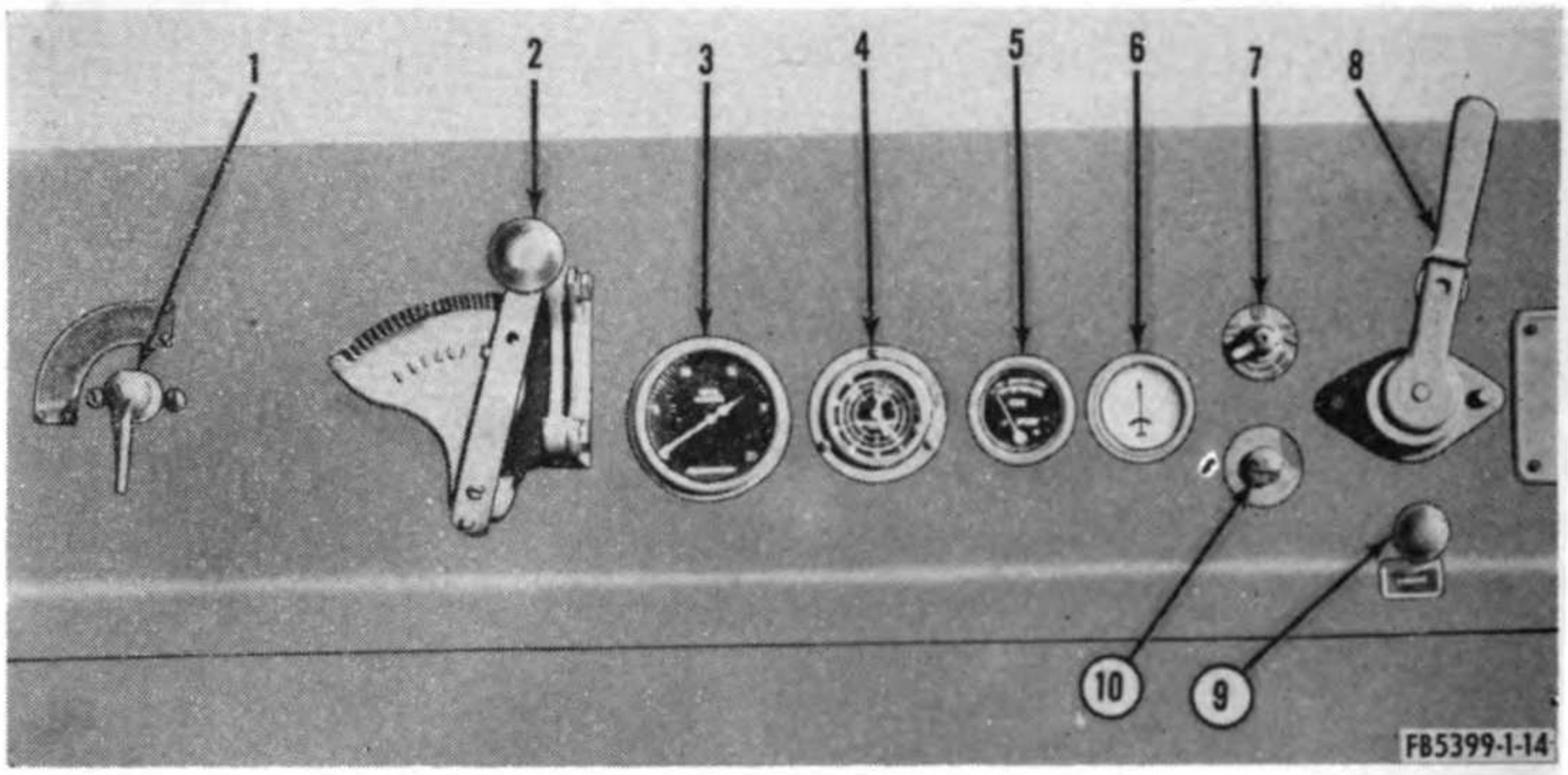

1 Load-unload valve
2 Governor control lever
3 Tachometer
4 Engine hour-meter
5 Oil pressure gage
6 Ammeter
7 Ignition switch
8 Throttle lever (not used with this equipment)
9 Choke control
10 Starter button

Figure 14. Engine instrument panel.

(2) *Purpose.* It indicates the operating pressure of the engine oil.

d. Ammeter.

(1) *Location.* The ammeter (6) is mounted on the engine instrument panel between the oil pressure gage and the ignition switch.

(2) *Purpose.* It indicates the rate of charge being put into the battery and the amount being discharged from the battery.

e. Oil Level Gage.

(1) *Location.* The oil level gage (1, fig. 13) is located on the right side of the engine slightly below and to the rear of the oil filters.

(2) *Purpose.* It indicates the amount of oil in the oil pan.

f. Water Temperature Gage.

(1) *Location.* The water temperature gage (4, fig. 15) is mounted on the rear engine cowling above the air cleaners.

(2) *Purpose.* It indicates the operating temperature of the engine cooling system.

12. Compressor Controls

a. Compressing Unit Blowdown Valve.

(1) *Location.* The compressing unit blowdown valve (38, fig. 16) is mounted on the skid base between the right

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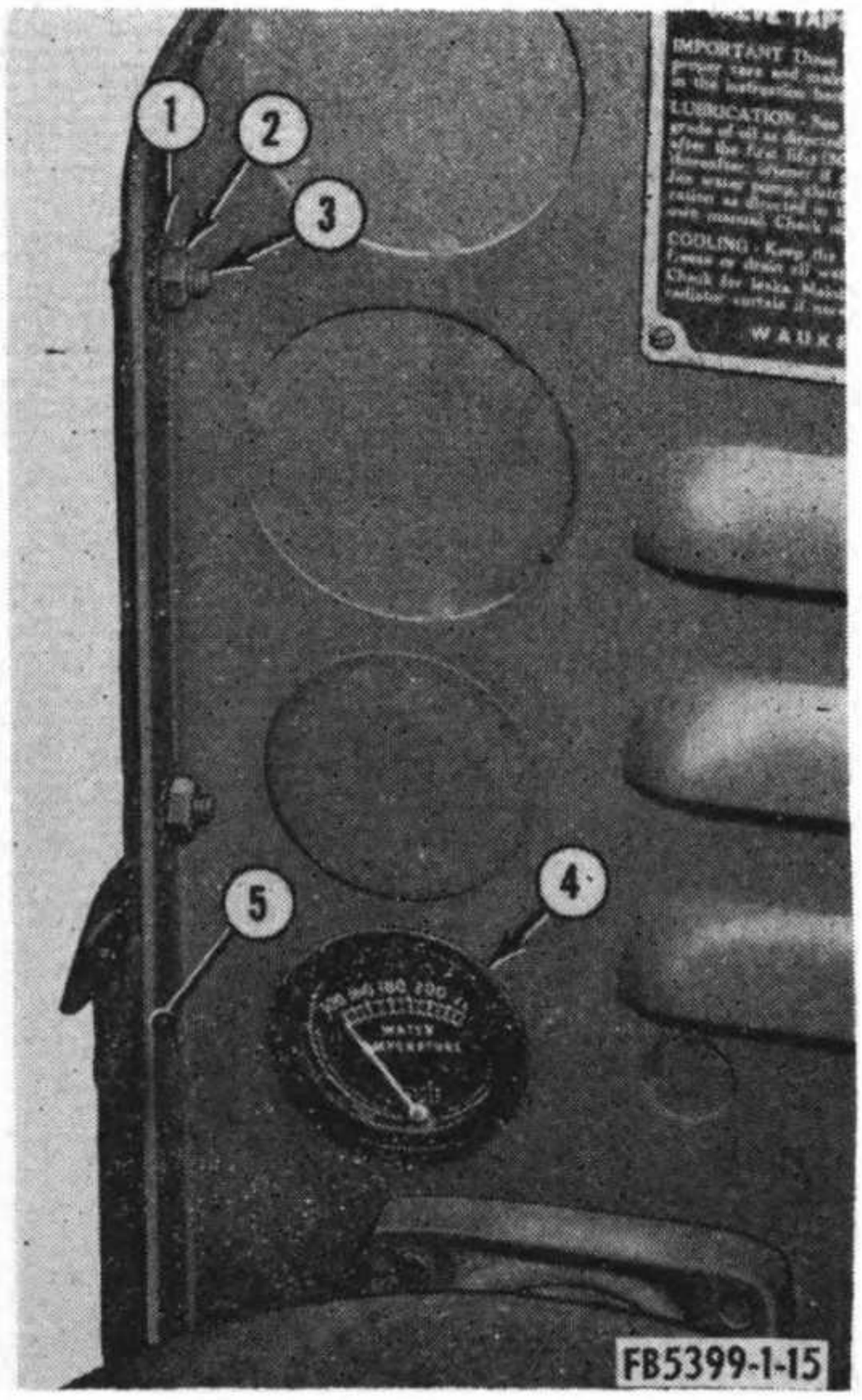

1 Internal-external tooth lock washer
2 Nut
3 Bolt, engine cowling
4 Water temperature gage
5 Firewall flange

Figure 15. Water temperature gage mounting.

side of the engine and the air receiver, forward of the pipe-line air filters.

(2) *Purpose.* It is used in pressure release to blow down the entire compressing unit.

b. Pipe-Line Air Filters Cut-Out Valve.

(1) *Location.* The pipe-line air filters cut-out valve (29) is mounted on the skid base slightly forward and to the left of the compressing unit blowdown valve.

(2) *Purpose.* It is used to cut out the air supply to the pipe-line air filters.

c. Compressing Unit Supply Valve.

(1) *Location.* This compressing unit supply valve (2, fig. 17) is mounted on the skid base between the right side of the engine and the air receiver, to the rear of the pipe-line air filters.

(2) *Purpose.* It is used to control the flow of air from the compressing unit to the unit which is to be charged.

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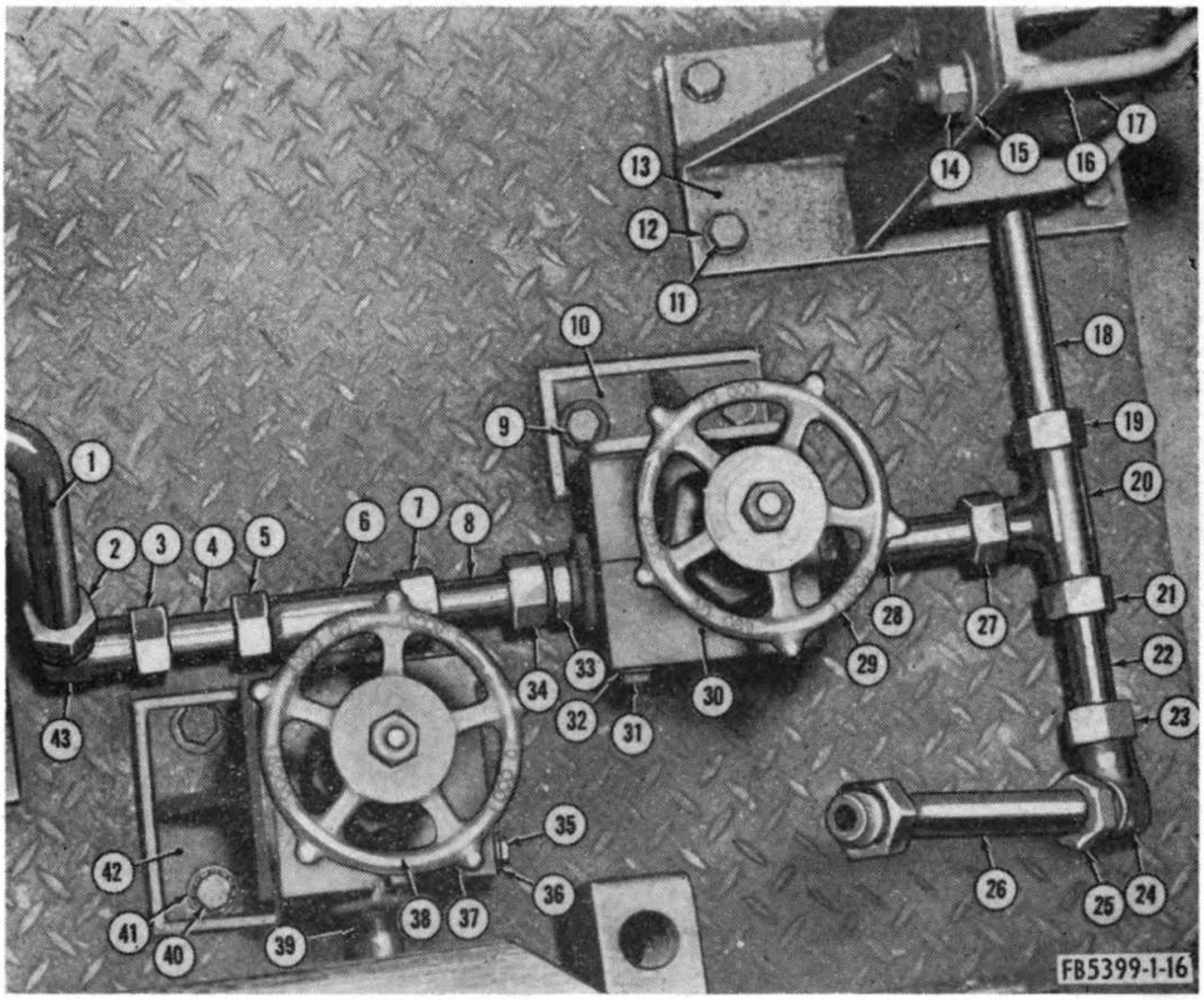

1 Filter inlet tubing
2 Tube coupling nut
3 Tube coupling nut
4 Nipple
5 Tube coupling nut
6 Tee
7 Tube coupling nut
8 Nipple
9 Cap screw
10 Mounting bracket
11 Cap screw
12 Lockwasher
13 Mounting bracket
14 Nut
15 Lockwasher
16 U-bolt
17 Safety-relief valve
18 Safety-relief valve inlet tubing
19 Tube coupling nut
20 Tee
21 Tube coupling nut
22 Nipple
23 Tube coupling nut
24 Elbow
25 Tube coupling nut
26 Receiver outlet tubing
27 Tube coupling nut
28 Nipple
29 Pipe-line air filters cut-out valve
30 Valve support collar
31 Cap screw
32 Lockwasher
33 Adapter
34 Tube coupling nut
35 Cap screw
36 Lockwasher
37 Valve support collar
38 Compressing unit blowdown valve
39 Nipple
40 Cap screw
41 Lockwasher
42 Mounting bracket
43 Elbow

Figure 16. Compressing unit blowdown valve, pipe-line filter cut-off valve, and their connections.

d. First Stage Knock-Out Bottle Drain Valve.

(1) *Location.* The first stage knock-out bottle drain valve (6, fig. 18) is located directly under the first stage knock-out bottle (5).

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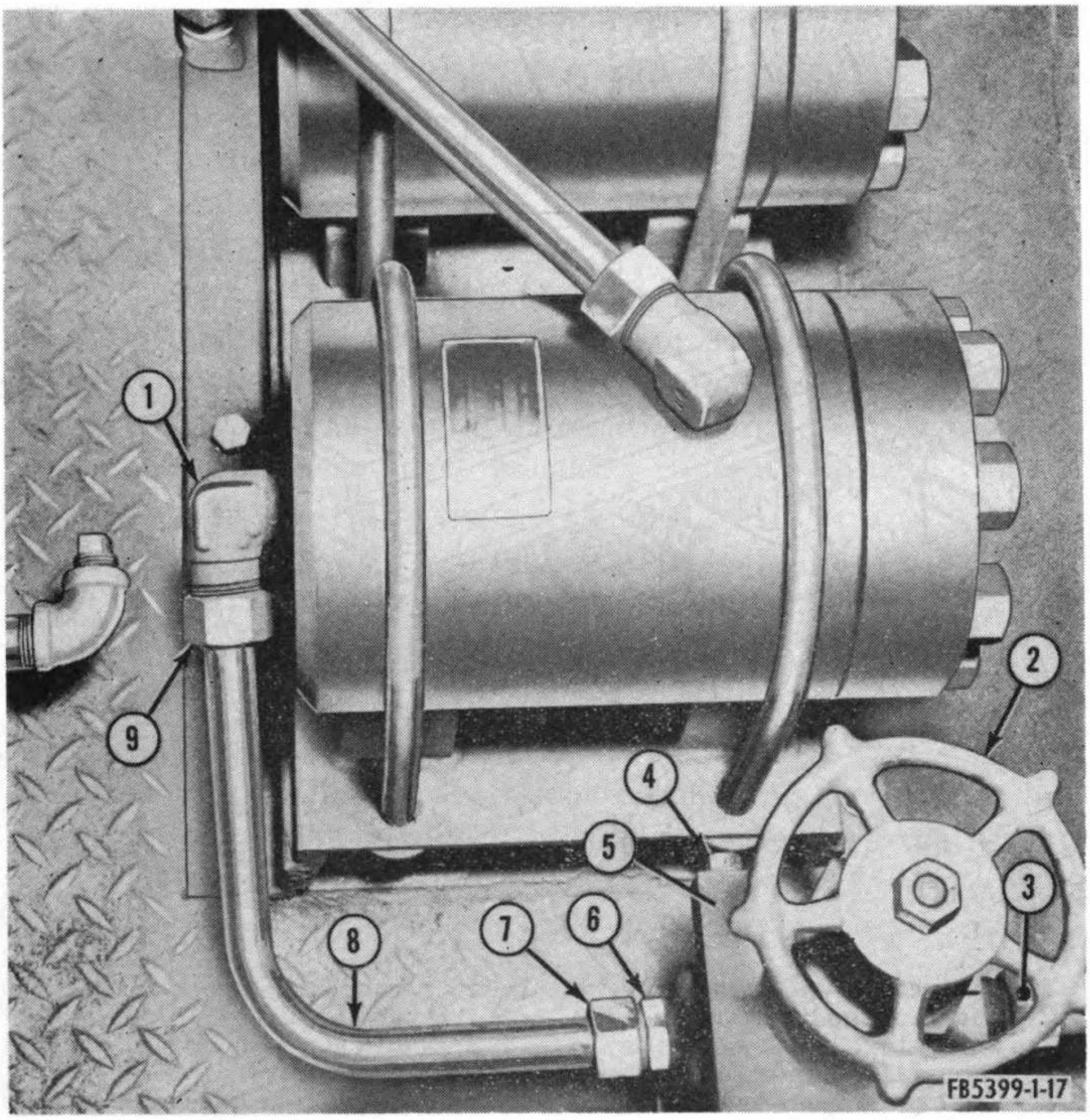

1 Elbow
2 Compressing unit supply valve
3 Tube coupling nut
4 Cap screw
5 Valve support collar
6 Adapter
7 Tube coupling nut
8 Filter outlet tubing
9 Tube coupling nut

Figure 17. Compressing unit supply valve mounting and piping connections.

(2) *Purpose.* It is used to drain the accumulated moisture from the knock-out bottle before, during, and after compressor operation.

e. Second Stage Knock-Out Bottle Drain Valve.

(1) *Location.* The second stage knock-out bottle drain valve (7) is located directly under the second stage knock-out bottle (4).

(2) *Purpose.* It is used to drain the accumulated moisture from the knock-out bottle before, during, and after compressor operation.

f. Third Stage Knock-Out Bottle Drain Valve.

(1) *Location.* The third stage knock-out bottle drain valve

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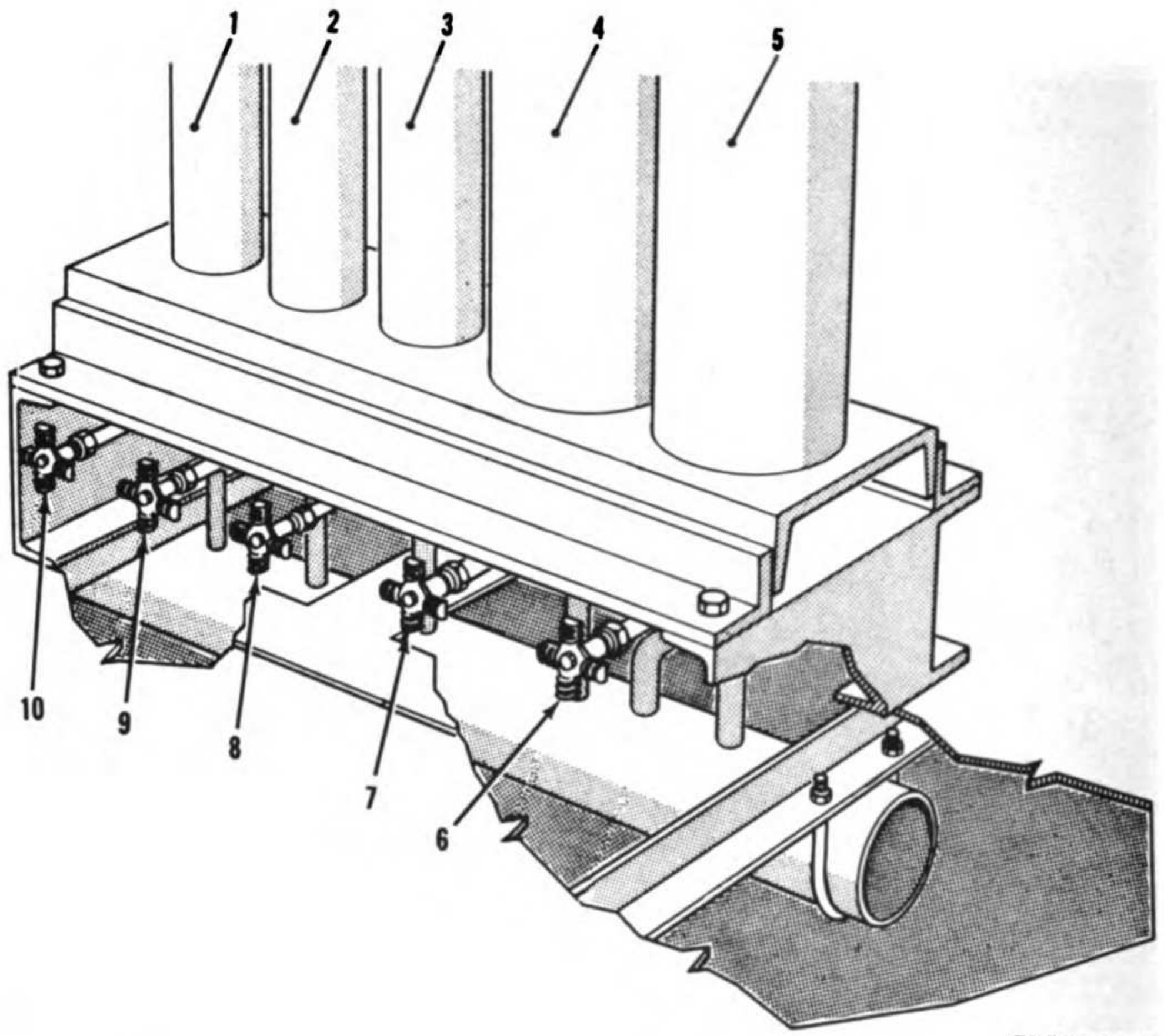

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1 After cooler knock-out bottle
2 Fourth stage knock-out bottle
3 Third stage knock-out bottle
4 Second stage knock-out bottle
5 First stage knock-out bottle
6 First stage knock-out bottle drain valve
7 Second stage knock-out bottle drain valve
8 Third stage knock-out bottle drain valve
9 Fourth stage knock-out bottle drain valve
10 Aftercooler knock-out bottle drain valve

Figure 18. Moisture knock-out bottle drain valves.

(8) is located directly under the third stage knock-out bottle (3).

(2) *Purpose.* It is used to drain the accumulated moisture from the knock-out bottle before, during, and after compressor operation.

g. Fourth Stage Knock-Out Bottle Drain Valve.

(1) *Location.* The fourth stage knock-out bottle drain valve (9) is located directly under the fourth stage knock-out bottle (2).

(2) *Purpose.* It is used to drain the accumulated moisture from the knock-out bottle before, during, and after compressor operation.

h. Aftercooler Knock-Out Bottle Drain Valve.

(1) *Location.* The aftercooler knock-out bottle drain valve

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(10) is located directly under the aftercooler knock-out bottle (1).

(2) *Purpose.* It is used to drain the accumulated moisture from the knock-out bottle before, during, and after compressor operation.

i. Unloader Valve Handwheel.

(1) *Location.* The unloader valve handwheel (1, fig. 19) is located on top of the automatic unloader assembly.

(2) *Purpose.* It is used to position and control the inner valve for manual and automatic operation of the automatic discharge and unloading control system.

j. Filter-Regulator Drain Valve.

(1) *Location.* The filter-regulator drain valve (15) is located on the bottom of the filter-regulator (19).

(2) *Purpose.* It is used to drain the accumulated moisture from the filter-regulator.

k. Blower Motor Circuit Breaker Switch.

(1) *Location.* The blower motor circuit breaker switch (1, fig. 20) is mounted on the skid base between the dryer assembly and the compressor.

(2) *Purpose.* It is used to close or open the blower motor circuit and to break the circuit if the current becomes excessive.

l. Heating Elements Circuit Breaker Switch.

(1) *Location.* The heating elements circuit breaker switch (3) is mounted on the skid base and has a common mounting with the blower motor circuit breaker switch.

(2) *Purpose.* It is used to close or open the heating elements circuit and to break the circuit if the current becomes excessive.

13. Compressor Instruments

a. Prefilter Air Temperature Gage.

(1) *Location.* The prefilter air temperature gage (2, fig. 20) is located in the air inlet piping at the top of the prefilter.

(2) *Purpose.* It indicates the temperature of the air entering the prefilter.

b. Unloader Valve Control Assembly Diaphragm Pressure Gage.

(1) *Location.* The unloader valve control assembly diaphragm pressure gage (5, fig. 19) is mounted on top of the by-pass valve of the unloader valve control assembly.

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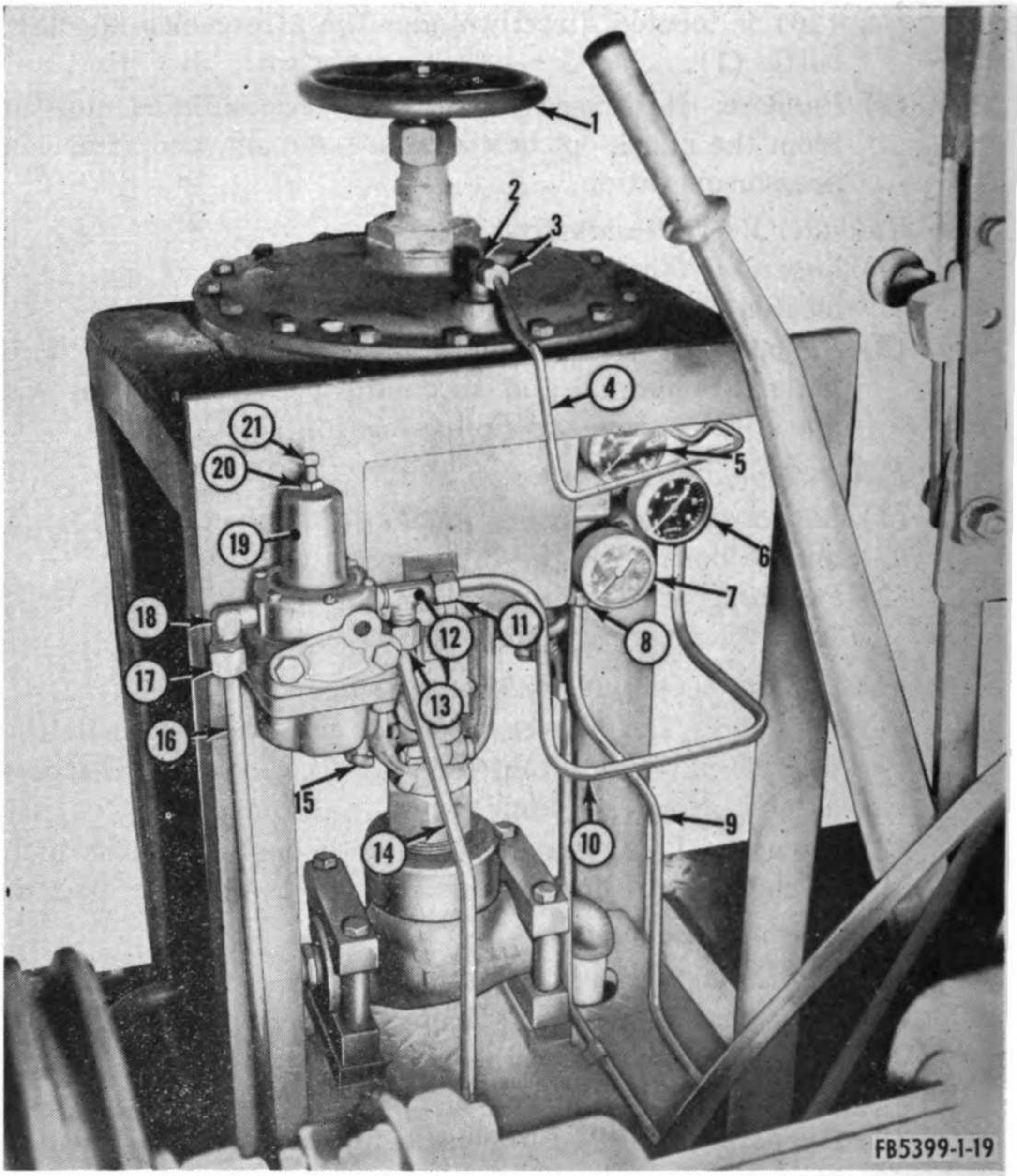

1	Unloader valve handwheel	10	Filter-regulator outlet line
2	Elbow	11	Tube coupling nut
3	Tube coupling nut	12	Tee
4	Diaphragm inlet line	13	Tube coupling nut
5	Unloader valve control assembly diaphragm pressure gage	14	Throttle controller supply line
6	Unloader valve control assembly supply pressure gage	15	Filter-regulator drain valve
7	Unloader valve control assembly instrument pressure gage	16	Filter-regulator inlet line
8	Tube coupling nut	17	Tube coupling nut
9	Load-unload valve supply line	18	Elbow
		19	Filter-regulator
		20	Locknut
		21	Adjusting screw

Figure 19. Rear view of the automatic unloader assembly.

(2) *Purpose.* It indicates the air pressure being supplied to the top of the unloader valve diaphragm.

c. Unloader Valve Control Assembly Supply Pressure Gage.

(1) *Location.* The unloader valve control assembly supply

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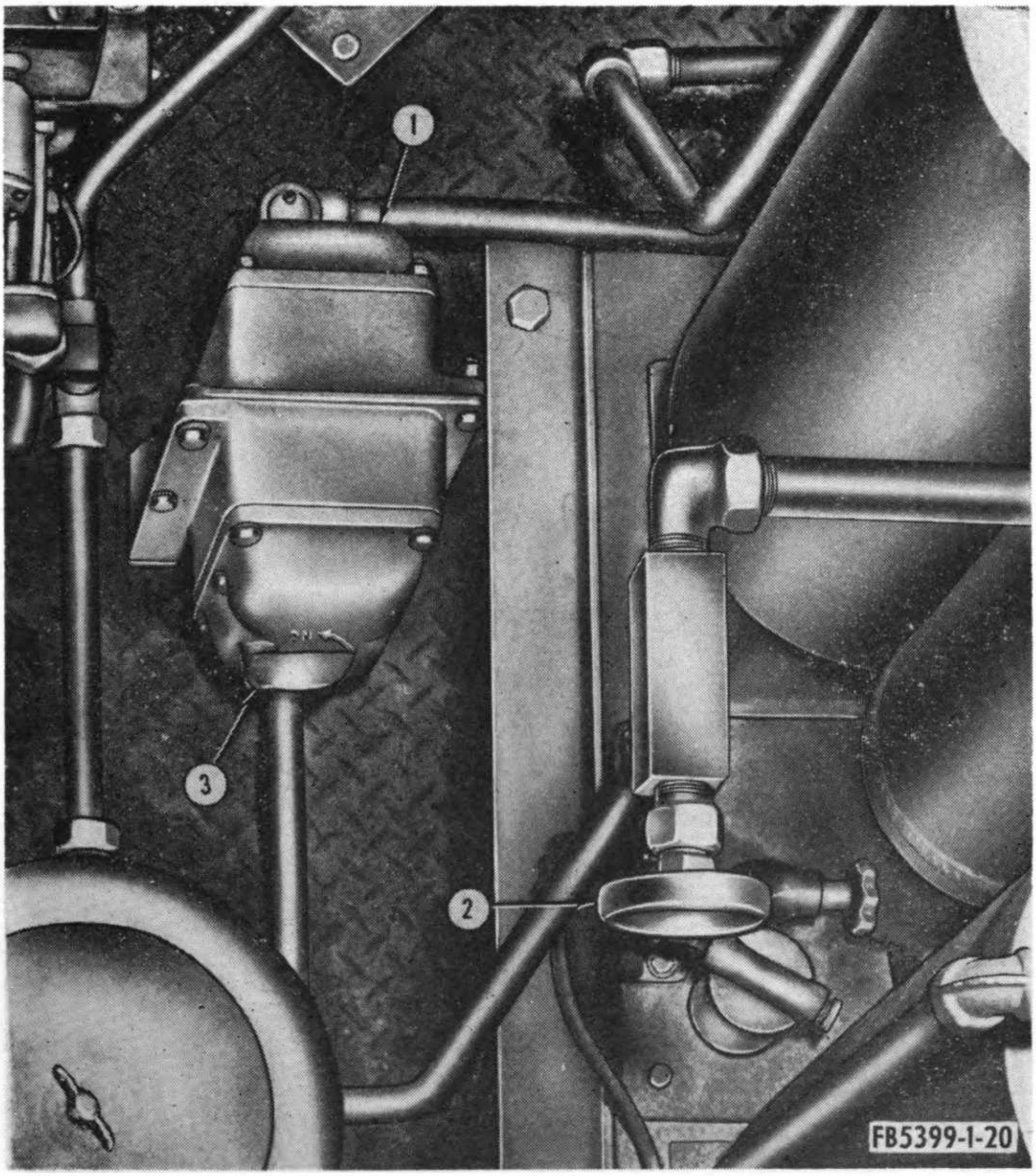

1 Blower motor circuit breaker switch
2 Prefilter air temperature gage
3 Heating elements circuit breaker switch

Figure 20. Top view of compressor assembly, showing circuit breaker switches and temperature gage.

pressure gage (6) is mounted under the diaphragm pressure gage on the bypass valve of the unloader valve control assembly.

(2) *Purpose.* It indicates the air pressure being supplied to the control assembly from the filter-regulator valve.

d. Unloader Valve Control Assembly Instrument Pressure Gage.

(1) *Location.* The unloader valve control assembly instrument pressure gage (7) is mounted under the supply

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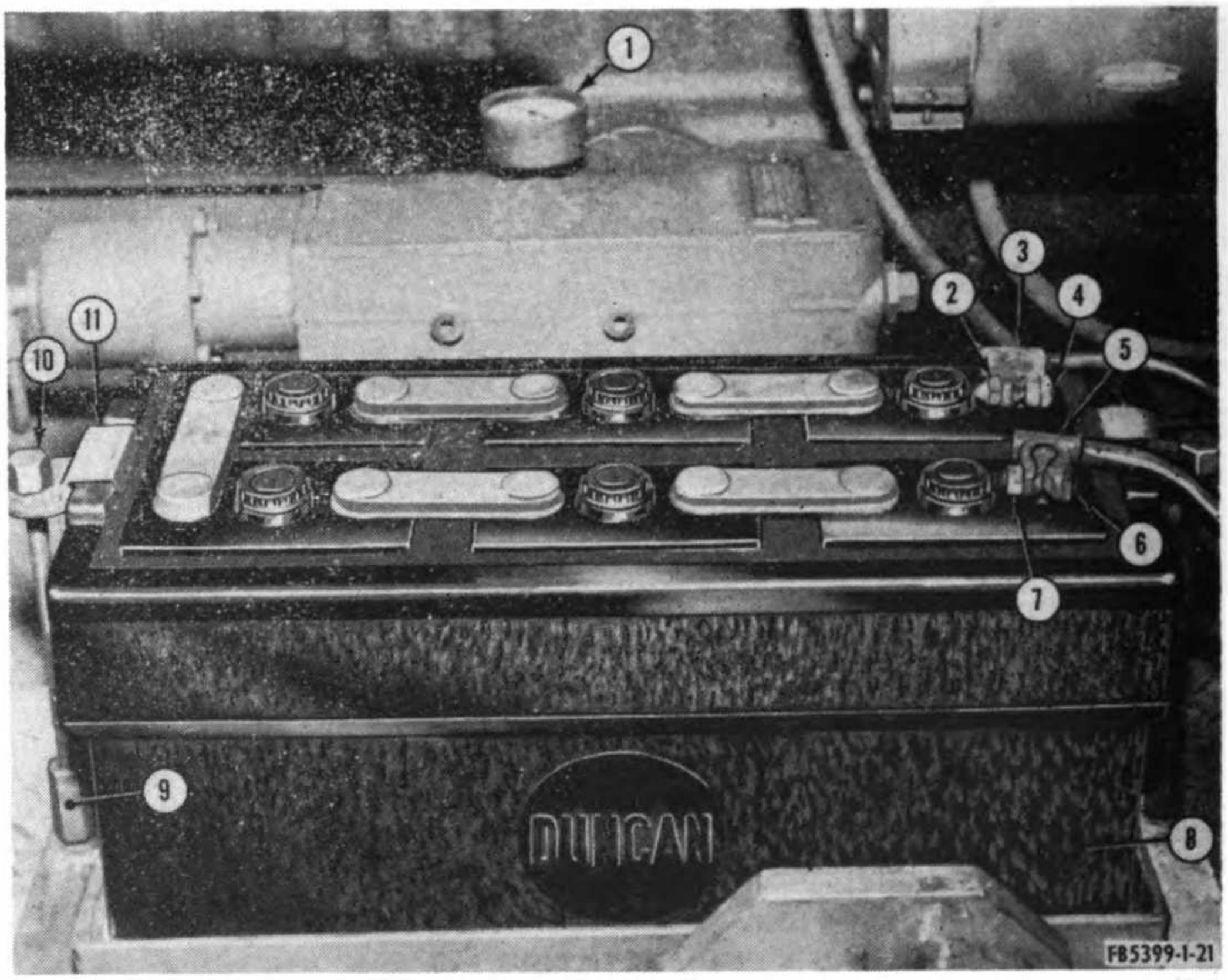
pressure gage on the bypass valve of the unloader valve control assembly.

(2) *Purpose.* It indicates the air pressure being supplied to the control assembly from the unloader pilot assembly.

e. Engine Speed Controller Pressure Gage.

(1) *Location.* The engine speed controller pressure gage (1, fig. 21) is located on top of the four-way valve at the center of the controller assembly.

(2) *Purpose.* It indicates the pressure of the instrument air supply required for operation of the engine speed controller assembly.



1	Engine speed controller pressure gage	6	Bolt, battery cable
2	Nut, battery cable	7	Nut, battery cable
3	Battery cable connector	8	Battery
4	Bolt, battery cable	9	Heavy nut
5	Battery cable connector	10	Clamp screw
		11	Bracket, battery

Figure 21. Battery connections, and engine speed controller pressure gage.

f. Unloader Pilot Assembly Supply Pressure Gage.

(1) *Location.* The unloader pilot assembly pressure gage (4, fig. 22) is located at the bottom left side of the unloader pilot assembly.

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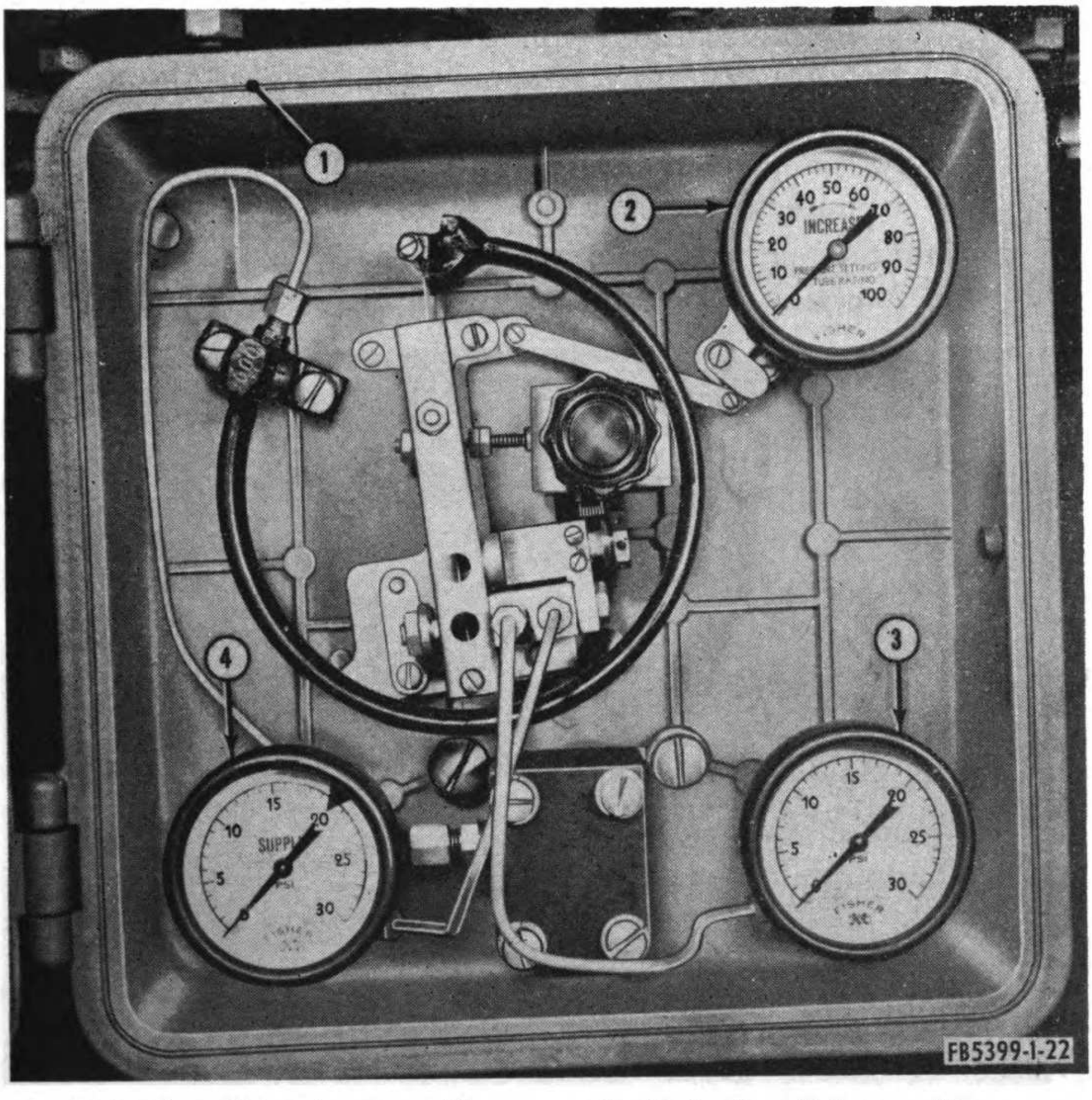
(2) *Purpose.* It indicates the reduced pressure of the instrument air supply utilized by the unloader pilot snap-acting pressure controls.



1 Unloader pilot valve assembly
2 Unloader pilot assembly controlled-pressure gage
3 Unloader pilot assembly diaphragm pressure gage
4 Unloader pilot assembly supply pressure gage

Figure 22. Unloader pilot assembly.

g. Unloader Pilot Assembly Diaphragm Pressure Gage.

(1) *Location.* The unloader pilot assembly diaphragm pressure gage (3) is located at the bottom right side of the unloader pilot assembly.

(2) *Purpose.* It indicates the amount of air pressure being exerted on the diaphragm of the unloader valve.

h. Unloader Pilot Assembly Controlled-Pressure Gage.

(1) *Location.* The unloader pilot assembly controlled-pressure gage (2) is located at the top right side of the unloader pilot assembly.

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(2) *Purpose.* It indicates the percentage for which the bourdon tube has been adjusted.

i. Crankcase Sight Level Gage.

(1) *Location.* The crankcase sight level gage (10, fig. 23) is connected to oil piping located next to the crankcase and adjacent to the lower right side of the accessory drive housing.

(2) *Purpose.* It indicates the level of the lubricant in the compressor crankcase.

j. First Stage Pressure Gage.

(1) *Location.* The first stage pressure gage (9, fig. 5) is

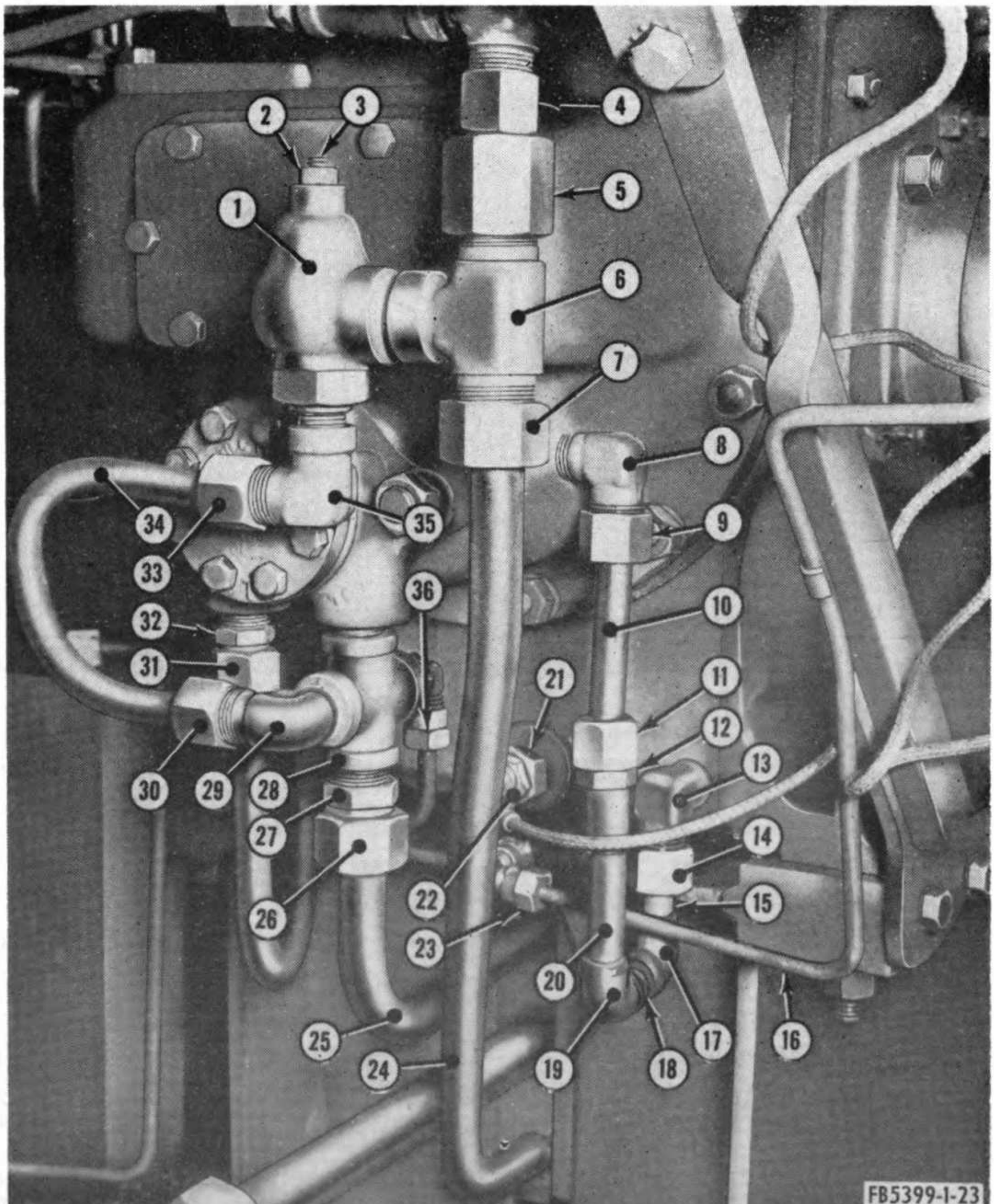

Figure 23. Accessory drive housing and oil piping.

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1 Relief valve
2 Locknut
3 Adjusting screw
4 Adapter
5 Inverted nut
6 Tee
7 Inverted nut
8 Elbow
9 Upper packing nut
10 Crankcase sight level gage
11 Lower packing nut
12 Adapter
13 Elbow
14 Inverted nut
15 Nipple
16 Oil pressure safety switch activating line
17 Elbow
18 Nipple
19 Elbow
20 Nipple
21 Thermo-couple connection
22 Thermo-couple
23 Inverted nut
24 Oil pump inlet line
25 Oil pump outlet line
26 Inverted nut
27 Adapter
28 Pipe cross
29 Elbow
30 Inverted nut
31 Inverted nut
32 Adapter
33 Inverted nut
34 By-pass line
35 Elbow
36 Inverted nut

Figure 23—Continued

mounted on the left upper corner of the compressor instrument panel which is supported by the cooler frame and positioned between the coolers just above the crankcase.

(2) *Purpose.* It indicates the air pressure reached in the first stage of the compressor.

k. Second Stage Pressure Gage.

(1) *Location.* The second stage pressure gage (11) is mounted on the right upper corner of the compressor instrument panel.

(2) *Purpose.* It indicates the air pressure reached in the second stage of the compressor.

l. Third Stage Pressure Gage.

(1) *Location.* The third stage pressure gage (8) is mounted on the lower left corner of the compressor instrument panel.

(2) *Purpose.* It indicates the air pressure reached in the third stage of the compressor.

m. Fourth Stage Pressure Gage.

(1) *Location.* The fourth stage pressure gage (10) is mounted on the lower right corner of the compressor instrument panel.

(2) *Purpose.* It indicates the air pressure reached in the fourth stage of the compressor.

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n. Oil Temperature Gage.

(1) *Location.* The oil temperature gage (15) is mounted in a panel bolted to the bracket supporting the mechanical lubricator (17).

(2) *Purpose.* It indicates the temperature of the compressor crankcase oil.

o. Oil Pressure Gage.

(1) *Location.* The oil pressure gage (16) is mounted in a panel bolted to the bracket supporting the mechanical lubricator.

(2) *Purpose.* It indicates the pressure of the compressor crankcase oil.

14. Drier and Mechanical Lubricator Controls

a. No. 1 Drier Tower Reactivating Air Outlet Valve.

(1) *Location.* The No. 1 drier tower reactivating air outlet valve (1, fig 5) is located in the piping near the top outer edge of the drier tower.

(2) *Purpose.* It controls the flow of reactivating air from the drier tower and provides a means of draining high-pressure air when necessary.

b. No. 1 Drier Tower Air Inlet Valve.

(1) *Location.* The No. 1 drier tower air inlet valve (3) is located in the piping near the top inner edge of the drier tower.

(2) *Purpose.* It controls the flow of high-pressure air from the compressor to the drier tower.

c. No. 2 Drier Tower Air Inlet Valve.

(1) *Location.* The No. 2 drier tower air inlet valve (4) is located in the piping near the top inner edge of the drier tower.

(2) *Purpose.* It controls the flow of high-pressure air from the compressor to the drier tower.

d. No. 2 Drier Tower Reactivating Air Outlet Valve.

(1) *Location.* The No. 2 drier tower reactivating air outlet valve (6) is located in the piping near the top outer edge of the drier tower.

(2) *Purpose.* It controls the flow of reactivating air from the drier tower and provides a means of draining high-pressure air when necessary.

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e. No. 2 Drier Tower Heating Element Switch.

(1) *Location.* The No. 2 drier tower heating element switch (7) is mounted on top of the electric control box on the front of the drier tower.

(2) *Purpose.* It opens and closes the circuit to the internal and external heating strips of the drier tower.

f. Lubricator Pump Priming Plungers.

(1) *Location.* The six lubricator pump priming plungers (13) are located along the top front of the mechanical lubricator (17).

(2) *Purpose.* They are used to supply each compressor cylinder with lubricating oil before the compressor is put into operation.

g. No. 2 Drier Tower Reactivating Air Inlet Valve.

(1) *Location.* The No. 2 drier tower reactivating valve (18) is located in the piping near the bottom outer edge of the drier tower.

(2) *Purpose.* It controls the flow of reactivating air from the reactivating pump to the drier tower.

h. Reactivating Pump Motor Switch.

(1) *Location.* The reactivating pump motor switch (19) is mounted on a supporting bracket of the number 2 drier tower.

(2) *Purpose.* It opens and closes the circuit from the circuit breaker to the reactivating pump motor.

i. No. 2 Drier Tower Air Outlet Valve.

(1) *Location.* The No. 2 drier tower air outlet valve (21) is located in the piping near the bottom inner edge of the drier tower.

(2) *Purpose.* It controls the flow of high-pressure air from the drier tower to the pressure-retaining valve.

j. No. 1 Drier Tower Air Outlet Valve.

(1) *Location.* The No. 1 drier tower air outlet valve (23) is located in the piping near the bottom inner edge of the drier tower.

(2) *Purpose.* It controls the flow of high-pressure air from the drier tower to the pressure-retaining valve.

k. Reactivating Air Discharge Valve.

(1) *Location.* The reactivating air discharge valve (24) is located in the piping near the bottom outer edge of the drier assembly (27).

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(2) *Purpose.* It controls the pressure of the reactivating air from the reactivating pump.

l. No. 1 Drier Tower Reactivating Air Inlet Valve.

(1) *Location.* The No. 1 drier tower reactivating air inlet valve (26) is located in the piping near the bottom outer edge of the drier tower.

(2) *Purpose.* It controls the flow of reactivating air from the reactivating pump to the drier tower.

m. No. 1 Drier Tower Heating Element Switch.

(1) *Location.* The No. 1 drier tower heating element switch (29) is mounted on top of the electric control box on the front of the drier tower.

(2) *Purpose.* It opens and closes the circuit to the internal and external heating strips of the drier tower.

15. Drier and Mechanical Lubricator Instruments

a. No. 1 Drier Tower Air Pressure Gage.

(1) *Location.* The No. 1 drier tower air pressure gage (2, fig. 5) is located near the top of the tower at the front of the drier assembly.

(2) *Purpose.* It indicates the pressure of the air when the tower is connected to the high-pressure air system.

b. No. 2 Drier Tower Air Pressure Gage.

(1) *Location.* The No. 2 drier tower air pressure gage (5) is located near the top of the tower at the front of the drier assembly.

(2) *Purpose.* It indicates the pressure of the air when the tower is connected to the high-pressure air system.

c. Lubricator Pump Sight Feed Glass.

(1) *Location.* The six lubricator pump sight feed glasses (12) are located on the top rear of the lubricator.

(2) *Purpose.* They permit visual inspection of the oil flow from the lubricator to the compressor cylinders.

d. Lubricator Oil Level Gage.

(1) *Location.* The lubricator oil level gage (14) is mounted on the front right side of the lubricator.

(2) *Purpose.* It indicates the oil level in the lubricator reservoir.

e. No. 2 Drier Tower Air Temperature Gage.

(1) *Location.* The No. 2 drier tower air temperature gage (20) is mounted on the front center of the drier tower.

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(2) *Purpose.* It indicates the temperature of the air within the tower during the reactivation cycle.

f. Flowmeter.

(1) *Location.* The flowmeter (25) is bracket-mounted on an angle-iron welded to the steel mounting platform that supports the drier and air blower assemblies.

(2) *Purpose.* It indicates the flow rate of the air stream supplied by the air blower assembly for reactivating the desiccant in the drier towers.

g. No. 1 Drier Tower Air Temperature Gage.

(1) *Location.* The No 1 drier tower air temperature gage (28) is mounted on the front center of the drier tower.

(2) *Purpose.* It indicates the temperature of the air within the tower during the reactivation cycle.

Section III. OPERATION UNDER USUAL CONDITIONS

16. General

a. The instructions in this section are published for information and guidance of the personnel responsible for the operation of this compressor.

b. It is essential that the operator know how to perform every operation of which the machine is capable. The section gives instructions on starting and stopping the machine, instructions on the basic motions of the machine, and instructions on how to coordinate the basic motions to perform the specific tasks for which the machine is designed. Since nearly every job presents a different problem, the operator may have to vary the given procedure to fit the individual job.

17. Starting

a. General. Before starting the air compressor, make certain that all items under paragraph 36*c*, before-operation services, have been performed.

b. Engine. Open the fuel line shutoff valve (5, fig. 9) and fuel pump shutoff valve (3, fig. 10). Make sure that the clutch lever (2, fig. 12) is in the disengaged position. Turn the compressor low-oil pressure switch (1, fig. 11) to the ON position, use the unloader valve handwheel (1, fig. 19) to position the inner valve for the discharge of air from the fourth stage of the compressor to the atmosphere, and release the detent catch of the throttle lever (1, fig. 12) to permit manual control of the throttle.

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Turn the load-unload valve (1, fig. 14) to the UNLOAD position and set the throttle about ¼ open. Turn the ignition switch (7) to the ON position. Push the starter button (9) to crank the engine. Regulate the choke (8) as necessary. If the engine is warm it may not be necessary to use the choke. If the engine is cold, keep the ignition switch in the OFF position, pull the choke all the way out, and crank the engine a few turns. Then turn the ignition switch to the ON position and start the engine. Allow the engine to warm up for 5 minutes at 750 rpm as indicated by the tachometer (3) before engaging the clutch.

Caution: Never operate the engine with the choke control pulled out, as this will cause an excess of raw fuel to be drawn into the cylinders, resulting in dilution of the crankcase oil or possibly stopping the engine due to overrich mixture.

c. Compressor. Open the five moisture knock-out bottle drain valve (6, 7, 8, 9, and 10, fig. 18) and be sure that the compressing unit blow-down valve (38, fig. 16) is closed. Make sure that the circuit breaker switches (1 and 3, fig. 20) are in the ON position and that the reactivating pump motor switch (19, fig. 5) and the drier tower heating element switches (7, fig. 29) are in the OFF position. Remove the intercooler baffle plates. Open or close the necessary valves to place one of the drier towers in service. After the engine has warmed up sufficiently and the gages are indicating properly, engage the clutch. Allow the compressor to run for 5 minutes with the drain valves open, then gradually increase the speed to about 1200 rpm and securely close the drain valves. Continue to operate the compressor under this fixed speed manual control until the air receiver pressure has built up to approximately 2500 psi, then turn the unloader valve handwheel (1, fig. 9) of the motor diaphragm valve counterclockwise to open it fully and turn the load-unload valve (1, fig. 14) to the LOAD position. The compressor will now operate automatically.

Note. If the ambient air temperature is below 40° F., the baffle plates should be left in place only long enough to raise the compressor oil temperature to approximately 70° F., after which they should be removed.

18. Stopping

a. Turn the load-unload valve (1, fig. 14) to the UNLOAD position to unload the diaphragm motor valve, the throttle controller, and to discharge air from the fourth stage cylinder.

b. Allow the compressor and engine to operate at idling speed for 5 minutes to cool the compressor gradually.

c. Disengage the clutch to stop the compressor, and place the

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engine throttle lever (1, fig. 12) at idling position, to gradually cool the engine.

d. After 5 minutes turn the ignition switch (7, fig. 14) off to stop the engine. If the engine continues to run because it is overheated, either continue idling to further cool the engine, or shut off the fuel supply at the fuel line shut-off valve (5, fig. 9).

e. Close the high-pressure control valves of the drier tower that has been in service. Crack the reactivating air outlet control valve of the tower to release the remaining air pressure to the atmosphere.

f. Turn the reactivating pump motor switch (19, fig. 5) to the OFF position and turn the drier tower heating element switch of the tower that was being reactivated to the OFF position.

g. Close both of the reactivating air control valves to prevent the entrance of moisture into the drier tower.

19. Operating Details

a. Engine. After the engine has warmed up sufficiently, advance the governor control lever (2, fig. 14) to its full-open position and open the throttle wide. The engine will then run at its maximum continuous duty governed speed of approximately 1200 rpm. Check the water temperature gage (4, fig. 15) before engaging the clutch to see that it registers its normal operating temperature of 140° F. to 180° F. In order to place the engine in automatic operation it is necessary to engage the throttle lever detent catch (3, fig. 12). This will permit the throttle controller linkage to actuate the carburetor linkage, thus increasing or decreasing the engine speed. Check the oil pressure gage, water temperature gage, tachometer, and ammeter frequently. If there is a sudden drop in oil pressure, a rise in water temperature, a rise in rpm's, or the ammeter registers "discharge," shut the engine down immediately.

Caution: The ammeter must at no time during operation register discharge, since this will indicate a defective electrical system.

b. Compressor. Air enters the compressing unit through an air intake filter (1, fig. 24) and passes into an air intake header (38) before beginning the first of four compression stages. Upon reaching the intake header, the air is drawn into three first stage cylinders (2) where it is compressed to approximately 45 psi. The air then passes to the outlet header (3). Since there is an increase of heat due to the compressing action, the air is

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piped to the first stage intercooler (23) for cooling and then to the first stage knock-out bottle (26) where a part of the moisture condensed by cooling at this pressure is removed. The air is then piped to the second stage cylinder (20) where it is compressed to approximately 195 psi. It is then routed to the second stage intercooler (22) and to the second stage knock-out bottle (25) for further cooling and removal of moisture. The air is then piped to the third stage cylinder (36) where compression is in-

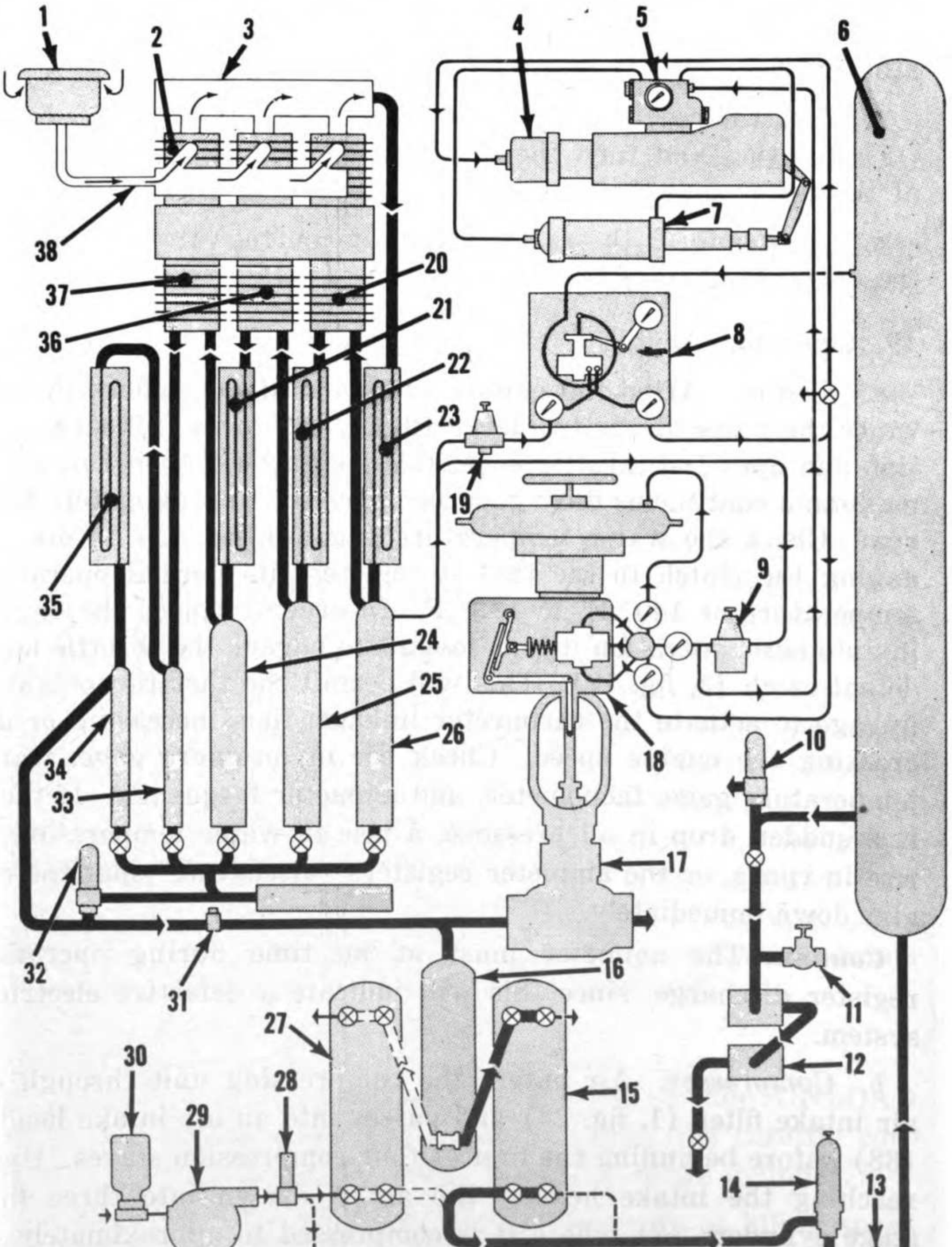

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Figure 24. Schematic air flow of the compressor.

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1 Air intake filter
2 First stage cylinder assembly
3 Outlet header
4 Throttle controller assembly
5 Pilot valve body
6 Air receiver assembly
7 Power cylinder assembly
8 Unloader pilot valve assembly
9 Filter regulator valve
10 Safety relief valve
11 Blow-down valve
12 Pipe-line air filter
13 Check valve
14 Pressure-rating valve
15 No. 2 drier tower
16 Prefilter
17 Unloader valve assembly
18 Positrol valve positioner assembly
19 Regulator valve
20 Second stage cylinder
21 Third stage intercooler
22 Second stage intercooler
23 First stage intercooler
24 Third stage knock-out bottle
25 Second stage knock-out bottle
26 First stage knock-out bottle
27 No. 1 drier tower
28 Safety relief valve
29 Reactivator pump
30 Reactivator pump air filter
31 Check valve
32 Safety relief valve
33 Fourth stage knock-out bottle
34 Aftercooler knock-out bottle
35 Aftercooler
36 Third stage cylinder
37 Fourth stage cylinder
38 Air intake header

Figure 24—Continued.

creased to approximately 875 psi. It is then piped to the third stage intercooler (21) and to the third stage knock-out bottle (24) where it is further cooled and moisture is removed. The fourth and final compression stage begins when air is forced into the fourth stage cylinder (37) where it is compressed to approximately 3500 psi. The air is then piped to the fourth stage knock-out bottle (33), which serves as both a surge drum and a dehydrating station, then to the aftercooler (35), and finally to the aftercooler knock-out bottle (34). Before entering the prefilter (16) of the drier assembly, the air passes through a check valve (31) set at 3000 psi. The check valve prevents high-pressure air from backing up into the compressor cylinders and a safety relief valve (32) set at 3850 psi bleeds the high-pressure air to the atmosphere should the pressure become excessive.

c. Drier Assembly. After passing through the check valve (31) the air enters the top of the prefilter which contains vapoilsorb desiccant for trapping and retaining oil mist picked up by the compressed air from the lubricating oil used in the compressing cylinders. When the No. 2 drier tower (15) is in service the air passes out of the bottom of the prefilter and into the top of the tower through the No. 2 drier tower air inlet valve (3, fig. 5). In passing through the activated alumina desiccant additional moisture is removed from the air. The air then passes out of the tower through the No. 2 drier tower air outlet valve (21) to the air receiver (6, fig. 24). Installed in the piping between

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the drier tower and receiver is a pressure-retaining valve (14) which increases the efficiency of the drier assembly by blocking the passage of air from the drier to the receiver until the pressure is built up to approximately 2500 psi. A check valve (13) is installed in the piping between the pressure-retaining valve and the receiver to prevent the air in the receiver from backing up into the drier assembly. While No. 2 drier tower is in service, the desiccant in No. 1 drier tower (27) is being reactivated.

Note. Check the prefilter air temperature gage (2, fig. 20) frequently to make certain that the temperature of air entering the amplifier enroute to the drier tower in service, is not more than 20° F. above the ambient air temperature.

d. Reactivation. While the No. 2 drier tower is in operation, be sure the No. 1 drier tower air inlet and outlet valves (3 and 23, fig. 5) are closed tightly. Open the No. 1 drier tower reactivator air inlet and outlet valves (26 and 1). Push the reactivator pump motor switch (19) to the ON position. If the ambient air temperature is above 70° F., turn the No. 1 drier tower heating element switch (29) to the LO position. It the ambient air temperature is below 70° F., turn the switch to the HI position. After the tower has been reactivated for 3½ hours under normal operating conditions, push the reactivator pump motor switch to the OFF position and turn the heating element switch to the OFF position, to allow the tower to cool for at least a half-hour before placing it in service.

Note. When drier tower temperature rises above 330° F. the automatically operated electric temperature control (thermoswitch) will cut off the electric current to the heating element switch.

e. Drier Tower Change-Over. After the drier tower has been in service for 4 hours, change over to the tower which has been reactivated. Close the No. 1 drier tower reactivator air inlet and outlet valves (26 and 1). Crack the No. 1 drier tower air inlet and outlet valves (3 and 23) and allow the pressure to build up slowly in the tower. After the pressure in both towers has equalized, as indicated by the No. 1 and 2 drier tower pressure gages (2 and 5), open valves fully. Close the No. 2 drier tower air inlet and outlet valves (4) and (21) tightly and crack the reactivator air outlet valve (6) to bleed all air from the tower. After all air has been bled from the tower, open the reactivator air inlet and outlet valves (18) and (6) fully. Start the reactivator pump motor, and depending upon the ambient air temperature, turn the No. 2 drier tower heating element switch (7) to either the HI or LO position. In order to place the No. 2 drier tower back in service after reactivation, stop the reactivator pump motor, close the reactivator air inlet and outlet valves, and turn the

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heating element switch to the OFF position. Crack the air inlet and outlet valves, allow the pressure to equalize in both towers, open the inlet and outlet valves fully, and close the No. 1 drier tower air inlet and outlet valves. Proceed to reactivator No. 1 drier tower as outlined in *e* above.

Warning: The above steps must always be performed in the exact sequence in which they are listed.

Caution: If the temperature gage of the reactivated drier tower reads over 150° F. after the normal cooling period, do not place the tower in service; the desiccant is incapable of removing moisture efficiently at this temperature. Do not take both towers out of service at the same time or the safety relief valve positioned between the compressor and the drier assembly will release the excess pressure. Make certain that all the air pressure has been released from the drier tower which is to be reactivated or the safety relief valve of the reactivator pump will be actuated.

f. Reactivator Pump Motor and Pump. The reactivator pump motor is protected from excessive voltage by the circuit breaker switch (1, fig. 20), which opens the circuit between the outside supply source and the motor. Air is drawn into the reactivator pump (29, fig. 24) through the air filter (30) and is discharged to the drier tower being reactivated at 6 psi. A reactivator air discharge valve (24, fig. 5) is installed in the discharge line just ahead of the flowmeter (25) to bleed off the air if the pressure exceeds 6 psi. A safety relief valve (28, fig. 24) is installed in the pipeline on top of the flowmeter to protect the pump if the pressure in the drier tower exceeds 6 psi.

g. Air Receiver and Pipeline Air Filters. After passing through the pressure-retaining valve (14) and the check valve (13), the air is piped to the air receiver (6). From the air receiver the air is piped to the two pipeline air filters (12) which remove any remaining dust and oil from the air. Installed in the piping between the receiver and filters is a safety relief valve (10) set at 3850 psi which releases the air to the atmosphere if the pressure in the receiver becomes excessive. A cut-out valve (29, fig. 16) which closes off the air supply to the filters is installed in the piping between the safety relief valve and filters. A blow-down valve (11, fig. 24) which releases the air in the receiver and filters to the atmosphere is installed in the piping between the cut-out valve and the filters. The compressing unit supply valve (2, fig. 17) is installed in the outlet piping of the filters and controls the supply of air to the item which is to be charged.

h. Automatic Unloader and Throttle Controller. The function of the automatic unloader and throttle controller is to maintain the

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air pressure in the air receiver at 3500 psi. When the air receiver is fully loaded with air at 3500 psi, the Bourdon tube in the unloader pilot valve (8, fig. 24) expands and forces the snap-acting flapper away from the nozzle of the orifice block, thus bleeding off the low-pressure or instrument air supply of 20 psi. Air from the first stage cylinders is supplied to the unloader pilot valve through the regulator valve (19) and to the positrol valve positioner (18) and four-way pilot valve body (5) through the filter regulator valve (9). Both regulator valves must be set at 20 psi for efficient operation of the control system. As the pressure is bled off by the unloader pilot valve, the pressure that has been acting against the diaphragm of the unloader valve (17) and the bellows of the throttle controller (4) is reduced. As the pressure gradually drops from 20 psi, the unloader valve (17) slowly opens and begins to discharge air from the fourth stage of the compressor. After the low-pressure air supply has fallen to about 10 psi, the unloader valve should be fully opened and all high-pressure air from the fourth stage is being unloaded to the atmosphere. Only after the instrument air pressure is reduced to10 psi does the throttle controller (4), acting through the four-way valve and power cylinder (7), begin to change the throttle setting. Then the controller slowly moves the engine throttle to idle position, reaching this position when the instrument air pressure has fallen to 0. Since the clutch is still engaged, a small amount of air from the fourth compression stage continues to be discharged to the atmosphere. When the pressure in the air receiver has dropped to 3350 psi, the bourdon tube in the unloader pilot valve will contract slightly, allowing the permanent magnet to snap the flapper against the nozzle of the orifice block, thus causing the instrument air supply to build up to 20 psi. As the pressure increases from 0 to 10 psi, the throttle controller assembly begins to slowly move the engine throttle from idle to the fully advanced position. At 10 psi, the engine is operating at maximum speed used for normal conditions. The unloader valve begins to close at 10 psi, eventually closing completely when the pressure reaches 20 psi. After the unloader valve is completely closed, all air from the fourth compression stage is routed to the air receiver until the receiver is again filled with air at 3500 psi. At 3500 psi, the automatic unloader and throttle control system is again actuated and the unloading phase is repeated.

i. Mechanical Lubricator. Since the mechanical lubricator (17, fig. 5) is driven by the compressor crankshaft through accessory gears and couplings, it is in operation at all times that the compressor is running. The six individual pumps deliver a metered

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quantity of oil to the bottom of each compressor cylinder through a piping assembly. The amount of oil delivered by each pump is adjustable and can be observed through the sight-feed glasses (12) mounted on top of the unit. Each pump is also equipped with a priming plunger (13) for manually operating the pumps when the compressor is not running.

20. Movement to a New Location

a. Disconnect the external electric power source from the terminal strip in the junction box, and tape or seal off all exposed wiring. Disconnect the piping between the air receiver and the unit drawing high-pressure air from the compressor. Close the fuel tank shut-off valve and secure the gas tank cap to prevent leakage while the unit is in transit. Install all the housing sections on the compressor and engine and secure them in position. Remove, disconnect, support, or protect with blocking, all overhanging or projecting ends of the compressor. Hookup a hoisting apparatus having suitable spreader bars (1, fig. 8), lift the compressor and place it on the transporting vehicle. Anchor it securely in position to prevent any shifting while it is in transit. Place a large tarpaulin over the entire unit and fasten it securely to prevent the entrance of dust or moisture.

Warning: Be sure that both the air receiver and the entire compressor have been blown down before attempting to dismantle the high-pressure air connections.

b. Move the compressor to the new location and install it in place according to the instructions given in paragraph 7.

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

21. Description of Fire Extinguisher

The fire extinguisher is mounted on a bracket near the compressor. It is of the 1-quart capacity, vaporizing liquid type.

22. Operation and Maintenance of Fire Extinguisher

a. Operation. Remove the extinguisher from the bracket, turn the handle to the left, and work like a pump. Direct stream at the base of flame; or for liquids burning in a container, direct stream against the side of the container.

b. Maintenance and Refilling. Refer to TM 5–687 and TM 9–1799 for maintenance and refilling instruction.

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Section V. OPERATION UNDER UNUSUAL CONDITIONS

23. Operation in Extreme Cold

a. General. When operating in temperatures below 0° F. special precautions must be taken to prevent damage to the fuel system, cooling system, electrical system and batteries.

b. Fuel System. The formation of ice crystals from small quantities of water in the fuel causes considerable trouble. To keep water out of the fuel tank, observe the following precautions:

(1) Strain the gasoline through a suitable strainer.

(2) Do not store fuel in old drums unless they have been thoroughly cleaned and dried.

(3) Never pump fuel drums dry when filling the gasoline tank. Allow about 4 inches of fuel to remain. The fuel residue can later be transferred to a settling tank. If time is not urgent, do not pump fuel from the drum to the unit until it has settled for 16 hours after the drum has been filled or moved. Keep portable hand pumps clean and protected from snow and frost.

(4) When a drum has been opened, be sure to cover the opening or replace the bung to keep out snow, frost, or other foreign matter. Store drums in a covered building or cover them with a tarpaulin or other suitable covering.

c. Fuel Tank.

(1) Remove snow and ice from the fuel tank filler cap. Keep the filler cap tight and secure to keep out snow and ice.

(2) If possible ,always keep the fuel tank full. This will reduce the condensation of water from the free space above the fuel.

(3) Add ⅛ pint of denatured alcohol to a tank of gasoline. The alcohol will absorb the water and prevent it from freezing.

Caution: Always provide a metallic contact between the fuel container and the gasoline tank when filling tank unless both the fuel tank and the gasoline container are independently grounded.

d. Cooling System. If temperatures below 32° F. are expected, protect the cooling system by adding antifreeze. The following procedure must be followed:

(1) Make sure that the cooling system is completely free from rust or other foreign substances. Drain and refill until the drained water is free from foreign matter.

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(2) Inspect the radiator hose and replace it if it shows signs of deterioration. Make sure that there are no leaks around the hose clamps, drain plug, or pet cocks. Check the radiator for leaks and repair when necessary.

(3) When the cooling system is found to be clean and free from leaks, fill the radiator with a pre-mixed solution of clean soft water and antifreeze. The following table gives the freezing points, composition and specific gravities of Military antifreeze materials.

Table I. Freezing Points, Composition and Specific Gravities of Military Antifreeze Materials

Lowest expected ambient temp. °F	Pints of inhibited glycol per gal of coolant[1]	Compound, Antifreeze, Arctic[2]	Ethylene glycol coolant solution specific gravity at 68° F.[3]
20	1½	Issued full-strength and ready mixed for 0° to —65° F. temperatures for both initial installation and replenishment of losses.	1.022
10	2		1.036
0	2¾		1.047
—10	3¼		1.055
—20	3½		1.062
—30	4		1.067
—40	4¼		1.073
—50	Arctic Antifreeze preferred.	*DO NOT DILUTE WITH WATER OR ANY OTHER SUBSTANCE.*	
—60			
—75			

[1] Maximum protection is obtained at 60 percent by volume, that is, 4.8 pints of ethylene glycol per gallon of solution.

[2] Military Specification MIL–C–11755 Arctic type, nonvolatile antifreeze compound is intended for use in the cooling system of liquid cooled internal combustion engines for protection against freezing primarily in Arctic regions where the ambient temperature remains for extended periods of time close to —40° F. or drops below, to as low as —90° F.

[3] Use an accurate hydrometer. To test hydrometer, use 1 part ethylene glycol type antifreeze to 2 parts water. This should produce a hydrometer reading of 0° F.

Note. Fasten a tag near the radiator filler cap indicating the type of antifreeze.

(4) Fill the cooling system to slightly below the filler neck of the radiator. Then operate the engine until it reaches normal operating temperature.

(5) Stop the engine and test the strength of the solution in the engine radiator with a hydrometer. Add antifreeze if necessary.

(6) Inspect the coolant weekly for strength and color. If it is rusty, drain and clean the cooling system. Add a new solution of antifreeze.

(7) Check the fan belt for adjustment and tightness. Do not use rubber fan belts at temperatures below —20° F. Use

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leather, fiber, or synthetic rubber fan belts at these low temperatures.

e. Battery. Make sure that the battery is fully charged, with a hydrometer reading between 1.275 and 1.300. A fully charged battery will withstand severe low temperatures, whereas a partially charged battery will freeze and rupture the cells. Table 2 shows how cold reduces the battery power. Maintain an electrolyte level 3/8 inch above the top of the plates in the battery.

Caution: Do not add water to a battery in sub-zero temperatures unless the battery is to be charged immediately. If water is added and the battery is not charged, the added water will stay at the top and freeze before it has had a chance to mix with the acid.

Table II. Freezing Temperatures of Batteries at Various Specific Gravities

State of charge	Specific gravity electrolyte (temperature corrected)	Freezing temperature (degrees Fahrenheit)
Fully charged	1.275 to 1.300	—85° to —95°
75%	1.250	—62°
50%	1.220	—31°
25%	1.120	1°
Discharged	1.130	10°
Fully discharged	1.000	32°

f. Electrical System Protection.

(1) Inspect the generator and starter brushes, commutators, and bearings. See that the commutators are clean. Large surges of current that occur when starting a cold engine require a good contact between brushes and commutators. Refer to table 3 for minimum and maximum voltage settings in extreme cold weather.

Table III. Minimum and Maximum Voltage Settings.

Type of system	Type of circuit	Air temperature	Generator regulator settings minimum	Volts maximum
24 volt	Open or closed	—40°	28.8	30.0
		Plus 150°	27.8	29.1
12 volt	Open or closed	—40°	14.3	15.3
		Plus 150°	14.0	15.0
	Open or closed	—40°	14.2	15.0
		Plus 150°	13.9	14.7
6 volt	Open or closed	—40°	7.3	7.8
		Plus 150°	7.0	7.5

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(2) Inspect and clean all connections, especially the battery terminals. Take care that no short circuits are present and that there is no ice on the spark plugs or other electrical equipment.

(3) Check the spark coil for proper functioning.

(4) Clean the magneto thoroughly, and clean or replace the ignition points. Check the points frequently. In cold weather when the current is heavier, the points may pit and burn more than usual.

(5) Clean, test, and/or replace the spark plugs if necessary. If it is difficult to make the engine fire, adjust the gap to 0.005 less than specified for normal operation. This will make sparking easier at reduced voltages likely to prevail.

(6) Check the engine timing carefully. Take care that the spark is not unduly advanced or retarted.

(7) The efficiency of the battery decreases with decreasing temperatures and becomes practically nothing at —40° F. Do not attempt to start the engine with the battery when it has been exposed to temperatures below —30° F. until the battery has been warmed.

(8) Due to the action of the generator regulator, the ammeter reading at constant engine speed will be low when the battery is fully charged and high when the battery is weak or discharged. To obtain an indication of battery condition, frequently check the ammeter readings at approximately equal engine speeds.

(9) Care must be exercised when handling any of the wiring or removing any component to which it is connected on both the engine and compressor, since the insulation will be very brittle and subject to cracking and splitting due to the low temperature.

(10) The electrical switches and controls must be covered with a tarpaulin or canvas shelter to prevent the accumulation of snow and ice. The alternate thawing and freezing of ice or snow would prevent the switches and other controls from operating freely, if at all.

(11) The junction box containing the connection to the outside power source must be kept tightly closed to prevent the introduction of moisture and the subsequent formation of ice.

(12) The reactivator pump motor must be covered at all times to prevent the accumulation of ice or snow that would

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later melt and seep into the internal components. Care must be taken to lubricate the motor with the proper lubricants for operation in extreme cold weather. Refer to the current lubrication order.

(13) Make certain that all components are sealed and protected with proper gaskets against the introduction of moisture and by covering them with ignition insulating compound.

g. Lubrication. Lubricate the compressor and engine as outlined in LO 5–5399.

h. Starting and Operating. It is possible to start the engine with the battery at temperatures as low as —30° F. if the engine and compressor are properly lubricated and in good mechanical condition.

(1) To insure that the engine will start on the first attempt, proper preparation of the engine is very important. Should the engine fire a few times and stop, water vapor which is a product of combustion may form frost in the combustion chamber and make it impossible to start without heating the engine to above 32° F. Prolonged starting efforts wear down the battery.

(2) Pull the choke all the way out and keep it partially out until the engine has warmed up. Since only the lightest components of gasoline vaporize in a cold engine, a very rich mixture is necessary.

(3) Make sure that there is no heavy grease or dirt on the starter throwout mechanism. Heavy grease or dirt may keep the gears from meshing or cause them to remain in mesh after the engine has started, thus ruining the starter.

(4) When attempting to start, turn the engine over as rapidly as possible. All engines have a critical cranking speed, that is, the engine must be turned over at a certain speed before any start at all is possible. For engines in good mechanical condition, this critical rate of speed may vary from 40 to 70 rpm.

(5) After the engine has started, idle it at 750 rpm until it has warmed up enough to run smoothly. Do not place the engine in operation until its operating temperature of 140° F. to 180° F. has been reached.

(6) At temperatures below 0° F., do not use oil in air cleaners. The oil will congeal and prevent the easy flow of air. At temperatures below —30° F., remove the air cleaners. Ice and frost formations on the air cleaner

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screens may cause an abnormally high intake vacuum and an over-rich mixture in the engine carburetor.

(7) Remove or bypass the oil filters at temperatures below —30° F. because the oil cannot flow freely through them. Remove and clean the gasoline sediment bowl and strainer at frequent intervals.

(8) Install the intercooler baffle plates before engaging the clutch and leave them in place until the compressor crankcase oil has reached a temperature of at least 70° F.

(9) After operating the compressor, be sure to drain all air from the unit to prevent any moisture present in the air from freezing. Since moisture expands when frozen, this condition could cause damage to the compressor control valve assembly. Close all valves tightly after draining the air from the unit.

i. Compressor Shrouding and Engine Hood.

(1) Keep the compressor shrouding and engine hood in place and free of snow and ice at all times.

(2) In temperatures below —30° F., keep the unit in sheltered areas shielded from the wind. Cold wind increases starting difficulties.

(3) Cover the unit with a tarpaulin, tent, or collapsible shed when it is not in operation.

24. Operation in Extreme Heat

a. General. When operating in extremely high temperatures, efficient cooling and adequate lubrication are very important. Check the engine cooling system frequently for leaks and make certain that the circulation of air through the radiator and intercooler assembly cores is not impaired. Pay special attention to all fan belts, making sure that they are in good condition and properly adjusted. Replace defective fan belts.

b. Cooling System Maintenance.

(1) During hot weather, the engine cooling system may be obstructed by scale and rust. To prevent this condition, add rust preventive compound to the coolant.

(2) Thoroughly clean and flush the cooling system at frequent intervals.

(3) Check the operation of the thermostat to see that it opens at the proper temperature.

(4) Check the intercooler assembly fan belts carefully. Make certain that the tension is adjusted correctly to provide maximum cooling.

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(5) Be sure that the intercooler baffle plates are removed before operating the compressor and inspect the air intake screens in the compressor shrouding frequently for obstructions.

c. Oil Filters. Check the engine and compressor oil filter elements at more frequent intervals when operating in hot weather and replace the elements as necessary.

d. Drier Assembly. Check the air temperature gages on the drier assembly frequently to make certain the heat control adjustments are correct, and that the coolers are operating efficiently.

e. Ventilation. Remove the engine side panels and locate the compressor to get the maximum amount of ventilation.

f. Batteries. Batteries operated in high temperatures may show a lower specific gravity. Therefore, a specific gravity reading of 1.220 may indicate a fully charged battery. Under this condition, the battery need not be recharged until the reading is approximately 1.170 to 1.180. Check the water level in the battery regularly, to be sure that the heat has not caused excessive evaporation. Add water as necessary.

g. Lubrication. Check LO 5–5399 order for the correct intervals and lubricants to be used.

25. Operation Under Dusty or Sand Conditions

a. Protection by Location. Whenever circumstances permit, locate the equipment where dust and sand are at a minimum. To guard the unit from dust and sand storms, construct protective breaks and coverings.

b. Internal Protection. All connections, threaded, loose-fitting, or press-fitted, should always be tightened securely or sealed to prevent the entrance of fine dust particles. If any of the gages or instruments have loose-fitting glass or plastic lenses, use a sealer or tape to prevent the entrance of dust or sand. Keep the engine side panels closed as much as possible, and at all times when the engine is shut down.

c. Additional Cleaning and Lubrication. In addition to the standard lubricating services listed in paragraph 33 and LO 5–5399, clean all operating parts frequently. Pay particular attention to the air filters. Blow all sand and dust out of the radiator and intercooler assembly cores and air intake screens as often as necessary to keep these passages clear. Clean the gasoline sediment bowl and strainer at least once a day, and more often if necessary. Remove and clean the crankcase breathers at least once

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a day. Frequently examine all painted surfaces and repaint as necessary.

26. Operation in Salt Water Areas

a. Lubrication. Refer to paragraph 33 and the current lubrication order for details of lubrication. Steam clean the entire unit frequently if equipment is available. After each cleaning, lubricate the entire compressor unit. Apply a surface film of light grease or rust-preventive compound on all unprotected metal surfaces. Clean the air filters daily.

b. Electrical System. Inspect the ignition and wiring system to be sure all components are adequately waterproofed. See that the gaskets of all electrical switches and controls are in good condition.

c. Painting. In addition to the standard painting instructions given in TM 9–2851 observe the following precautions: When it is observed that salt corrosion is beginning to take place on painted surfaces, indicated by cracking and blistering, scrape the corroded parts clean and repaint them with a rust-inhibiting paint. Check all hidden surfaces and also treat them in the same manner.

27. Operation in Humid Areas

a. Starting. Where high humidity exists, internal condensation of moisture is frequent. Before starting, turn the engine several turns with either the hand crank or the starter, with the ignition off and the clutch disengaged. This will remove any moisture present. Be sure to open the knock-out bottle drain valves fully before engaging the clutch and starting compressor operation.

b. Electrical System. Inspect the magneto, generator, starter, reactivator pump motor, all electric switches, and all wiring for adequate waterproofing.

28. Operation at High Altitudes

a. General. Operation at high altitudes presents special problems due to lower atmospheric pressure and wide differences between the temperatures during the day and night. Pay particular attention to the cooling system and carburetor.

b. Carburetor. Adjust the carburetor so that the engine will idle smoothly after the warm up. Avoid operating the engine with the choke pulled out. Keep all the air passages to the carburetor clean. Check the fuel system for evidence of water in the lines, as it will freeze at night due to lower air temperatures and cooling action of the gasoline which evaporates readily at reduced pressures. Check the fuel system frequently for leaks.

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c. Cooling System. Keep the cooling system clean and filled to the proper level. Check level frequently when operating at high altitudes as the coolant evaporates at a faster rate under these conditions. Keep air passages around radiator fins clean and free of obstructions. Use sufficient antifreeze for the lowest expected air temperatures. Operate compressor at temperatures not to exceed 25 percent below the boiling point of water at high altitudes. Following are the boiling points of water at various altitudes.

Height above sea level in feet	Boiling point of water (degrees Fahrenheit)
0	212
2500	207.5
5000	203.0
7500	198.5
10000	194.0

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CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

29. General

The tools and equipment required to perform organizational maintenance on the compressor are standard mechanic's hand tools which are not enumerated in this section.

30. Tool and Publications Set

The tool and publication set normally supplied with this equipment for the use of the operator are listed in appendix II.

31. Special Organizational Maintenance Tools and Equipment

No special organizational maintenance tools and equipment are required for the compressor.

Section II. LUBRICATION AND PAINTING

32. General Lubrication Information

a. LO 5–5399 prescribes first and second echelon lubrication maintenance for the compressor, air, skid-mounted, gasoline-driven, 80 cfm, 3500 psi, Clark Brothers model HO6–4C (Less engine). The instructions contained therein are mandatory.

b. A lubrication order is issued with each item of equipment and is to be carried with it at all times. The lubrication order shown in figure 25 is a reproduction of the approved lubrication order for this materiel. For the current lubrication order refer to DA Pam 310–4.

33. Detailed Lubrication Information

a. Care of Lubricants.

(1) *General.* The primary function of a lubricant is to decrease the wear and maintain the efficiency of a machine by reducing friction between the moving parts and by dissipating frictional heat. If a lubricant is contaminated with dust, dirt, diluents, or water, it cannot perform its

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LUBRICATION ORDER

LO 5-5399

13 January 1956

COMPRESSOR, AIR, SKID MOUNTED, GASOLINE DRIVEN, 80 CFM, 3500 PSI, CLARK BROTHERS MODEL H06-4C

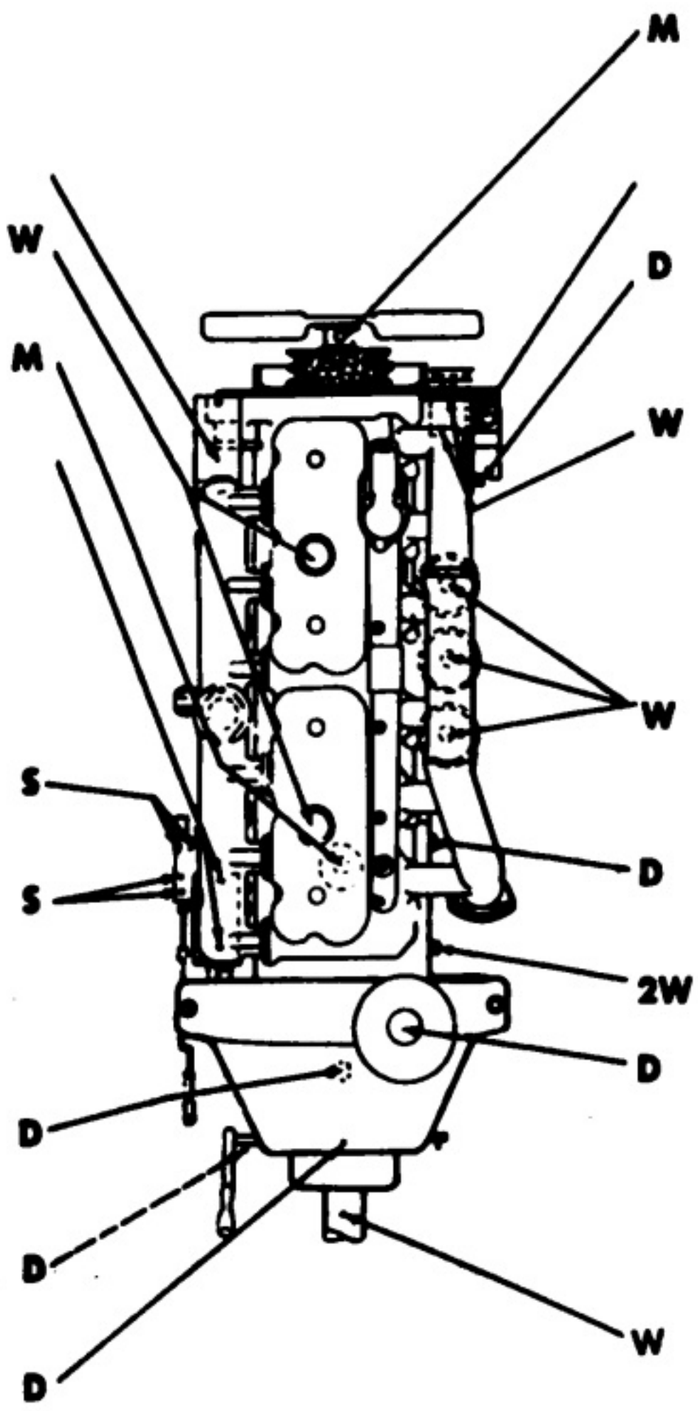
References: TB 5-5399-1

Intervals given are maximums for normal 8-hour day operation. For abnormal conditions or activities, intervals should be shortened to compensate.
Clean fittings before lubricating.
Relubricate after washing.

Clean parts with SOLVENT, Dry Cleaning, or OIL, fuel, Diesel. Dry before lubricating.
Lubricate points indicated by dotted arrow shafts on both sides of equipment.
Drain crank case only when hot after operation; replenish and check level when cool.

LUBRICANT • INTERVAL

INTERVAL • LUBRICANT



1 — Magneto (See note 4 & 5); Breather Cap OE (Remove, clean, re-oil and replace)
2 — Sump Screen (Remove, clean and replace); Starter (Equipped with Life Seal bearings, see notes 4 & 5)
3 — Automatic Throttle Control Sprocket Assembly GAA S; Automatic Throttle Control Bellow Shaft Bearing GAA S
4 — Clutch Throwout Collar (Sparingly) GAA D
5 — Clutch Lever Shaft Bearing (Sparingly) GAA D; Clutch Shaft Bearing (Sparingly) BR D
6 — BR Fan Bearing (Replace plug after lubricating)
7 — OE Crankcase Fill (See key); WP Water Pump (Turn cup down one full turn, refill as necessary); OE Generator (6 to 8 drops of oil) (When equipped with Life Seal bearings, see Note 4 & 5)
8 — Engine Oil Filters (Remove plug and drain, renew element)
9 — Crankcase Level Gage (Check level); Crankcase Drain Plug
10 — OE Air Cleaner (Clean and refill oil reservoir to level mark. Every week, disassemble entire unit. Clean and reassemble)
5 — BR Pilot Bearing (Sparingly)

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Figure 25. Lubrication order.

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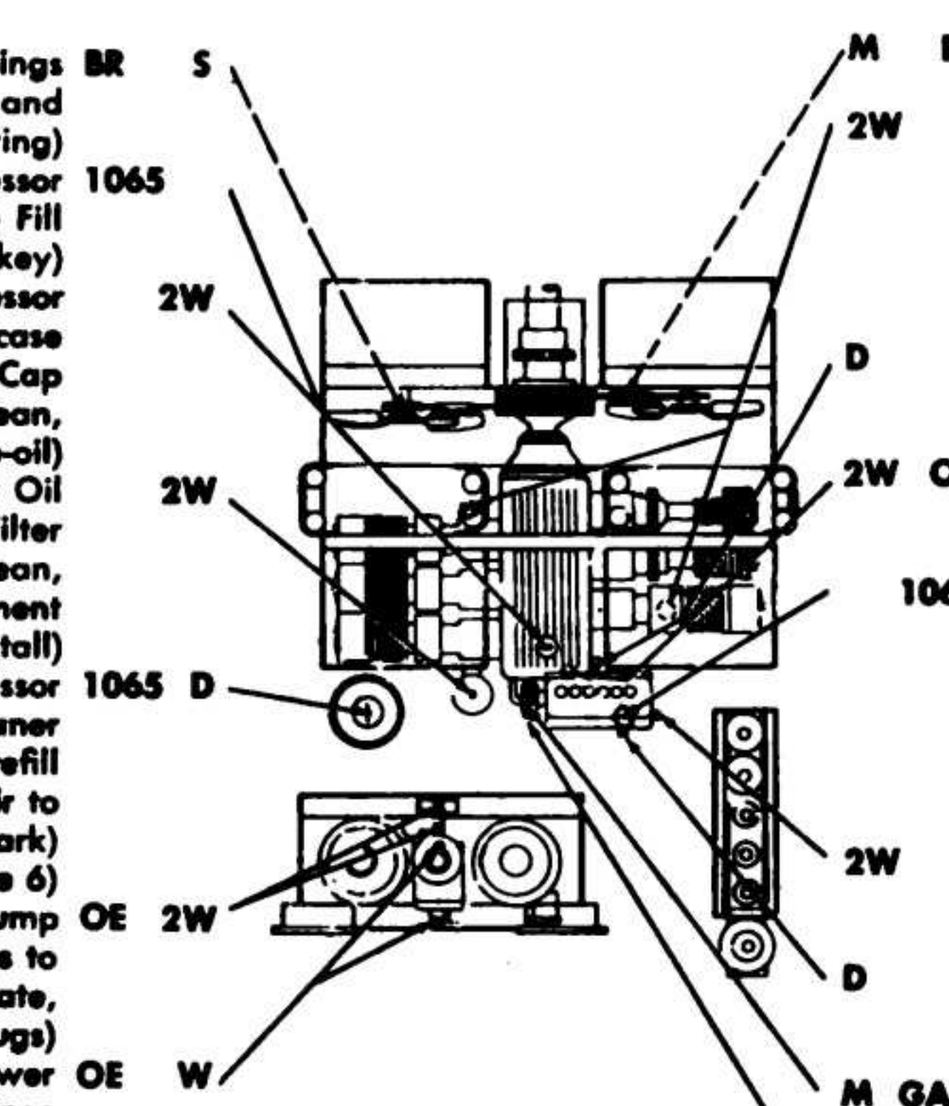

— KEY —

LUBRICANT	CAPACITY	EXPECTED TEMPERATURE			INTERVALS
		Above +32°F	+32°F to −10°F	Below −10°F	
OE—OIL, Engine Heavy Duty		OE 30 or 9250	OE 10 or 9110	See Note 1	D — Daily W — Weekly 2W — 2 Weeks M — Monthly Q — Quarterly S — Semi-annually
Engine Crankcase	18 qts				
Engine Air Cleaner		OE 30 or 9250	OE 10 or 9110	OHA	
Oil Can Points					
1065—OIL, Lubricating, Aircraft Engine		1065	1100	1100	
Compressor Crankcase	3½ qts				
Mechanical Lubricator					
Compressor Air Cleaner					

OHA — OIL, Hydraulic, Aircraft, Petroleum Base.
GAA — GREASE, Automotive and Artillery.
BR — LUBRICANT, Ball and Roller Bearing.
WP — GREASE, Lubricating, Automotive and Industrial.

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Figure 25—Continued.

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NOTES:

1. COLD WEATHER—WHEN WINTERIZATION KIT IS NOT AVAILABLE. ENGINE CRANKCASE. Every 3 days, drain crankcase; refill to FULL mark with OE 10. Add 4½ quarts of gasoline. Run engine 5 minutes to mix. Mark the new level on the gage for future reference. CAUTION: Every half day, check level and fill to FULL mark with OE 10. Then, if engine is to be shut down for a half day or more, add 4½ quarts of gasoline to reach new level mark. Operate engine for 5 minutes to mix. NOTE: Diesel fuel may be used as a temporary diluent, but ONLY when sufficient gasoline is not available. WARNING: Diluent used is inflammable. Do not service equipment near heater or open flame.

2. FOR OPERATION OF EQUIPMENT IN PROTRACTED COLD TEMPERATURES BELOW —10° F — Remove the lubricants prescribed in the key for above —10° F. Clean parts with SOLVENT, dry cleaning and drain all oil housings. Relubricate with lubricants indicated in the key for below —10° F temperatures.

3. OIL CAN POINTS — Weekly, lubricate throttle, carburetor, governor connections, automatic throttle and unloader valve linkages with OE.

4. DO NOT RELUBRICATE — Life-seal bearings or oil impregnated bushings. CAUTION: In servicing, do not use Solvent, dry-cleaning, wipe with oil damp cloth.

5. LUBRICATED BY TECHNICAL SERVICE PERSONNEL — Semi-annually, or at disassembly, lubricate generator bearings, starter bearings and Bendix, magneto bearings, magneto wick (Replace when hard) and coat cams sparingly with OE or GAA.

6. COMPRESSOR AIR CLEANER — Weekly disassemble entire unit and clean, paying special attention to the filter element. The filter element may be cleaned by using either a jet of hot water or steam or by washing in a strong solution of washing soda and water. Rinse in clear water and drain dry. When completely dry dip the filter element in oil the same grade of oil as used in the compressor crankcase, drain excess oil and reassemble the unit. CAUTION: Do not use any volatile cleaning solvents, gasoline, or kerosene in cleaning the filter element. The resulting fumes or vapors may collect and explode when drawn into the header or compressor cylinders and may cause the loss of life.

7. MECHANICAL LUBRICATOR — Daily before operation, manually operate each plunger 10 strokes to insure an adequate supply of oil to each cylinder. If unit has been inoperative for two weeks or more manually operate each plunger 50 strokes before starting.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory and supersede all conflicting lubrication instructions dated prior to the date of this Lubrication Order.

By Order of Wilber M. Brucker, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

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Figure 25—Continued.

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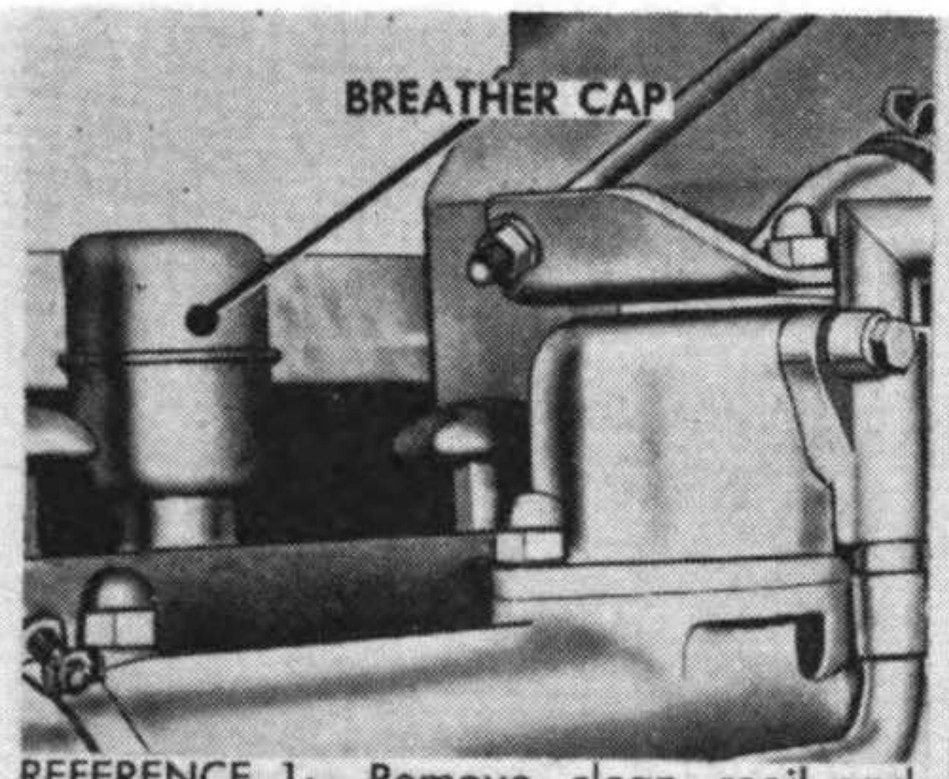
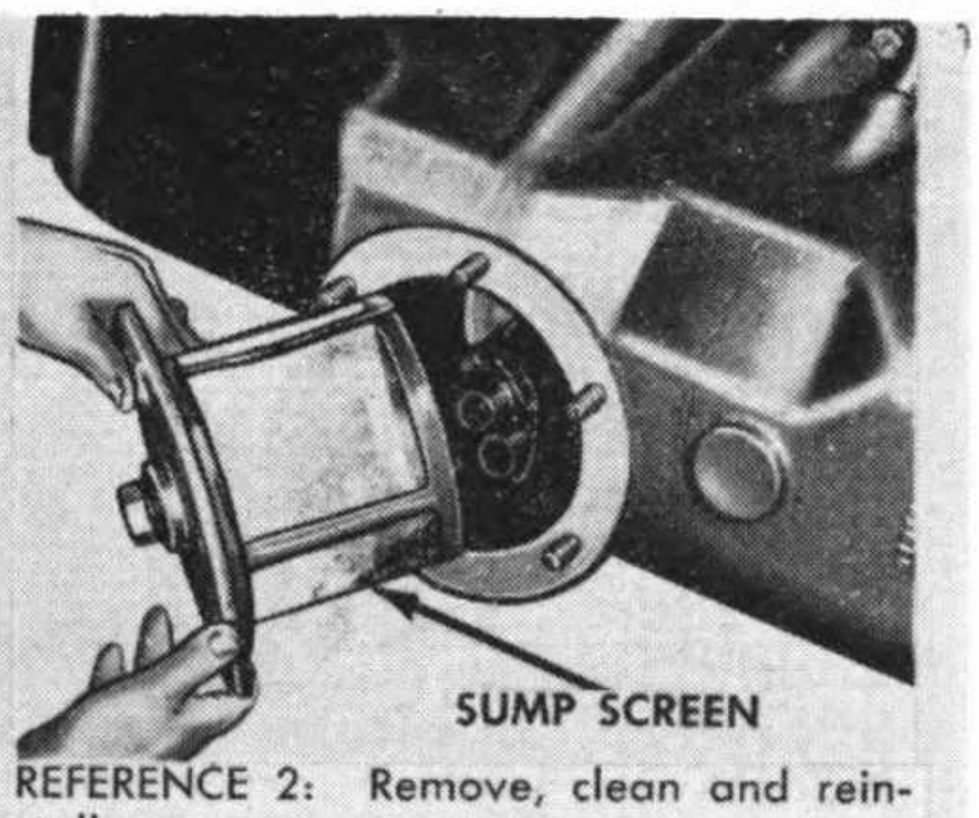
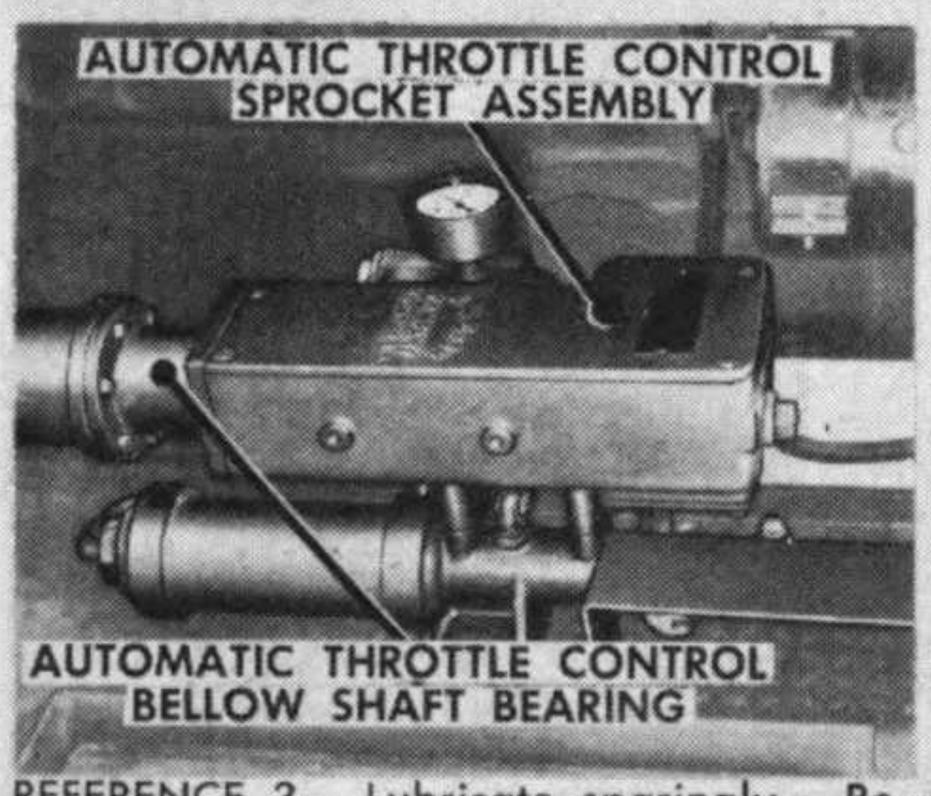


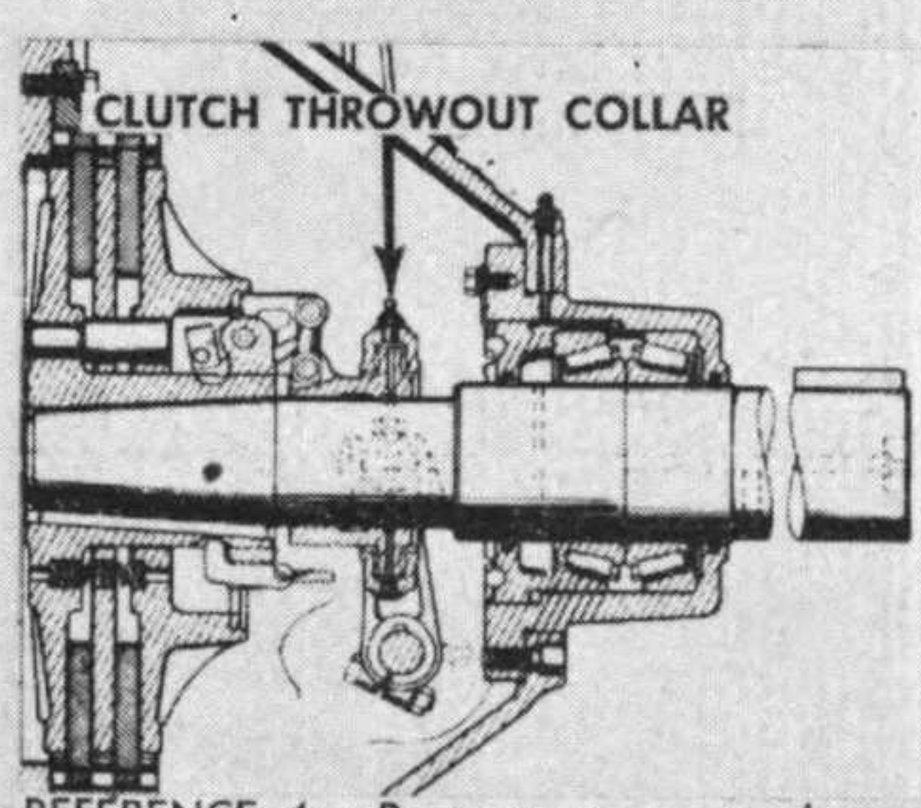
REFERENCE 1: Remove, clean, reoil and reinstall.



REFERENCE 2: Remove, clean and reinstall.

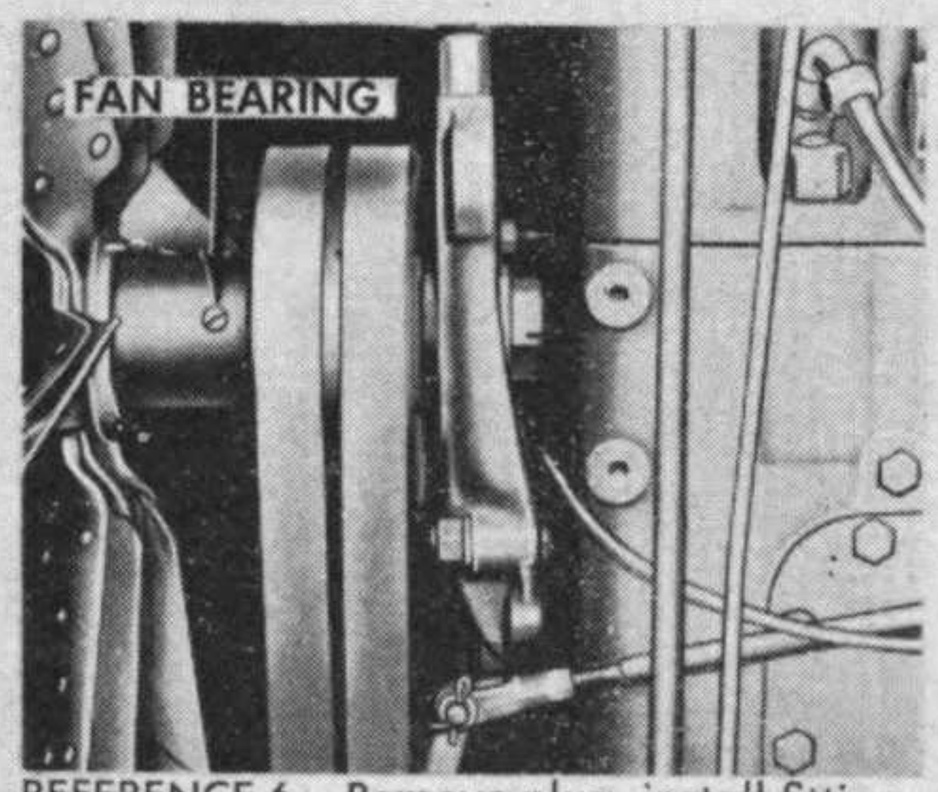


REFERENCE 3: Lubricate sparingly. Remove cover, apply grease and reinstall cover.



REFERENCE 4: Remove cover, apply grease gun and reinstall cover.

REFERENCE 5: Use grease gun sparingly.



REFERENCE 6: Remove plug, install fitting, lubricate and reinstall plug.

FB5399-1-25/4.

Figure 25—Continued.

function. Every precaution must be taken to protect lubricants from contamination.

(2) *Storage.* All lubricants and lubrication equipment should be kept in airtight containers. Lubrication equipment should be cleaned periodically while in storage to prevent

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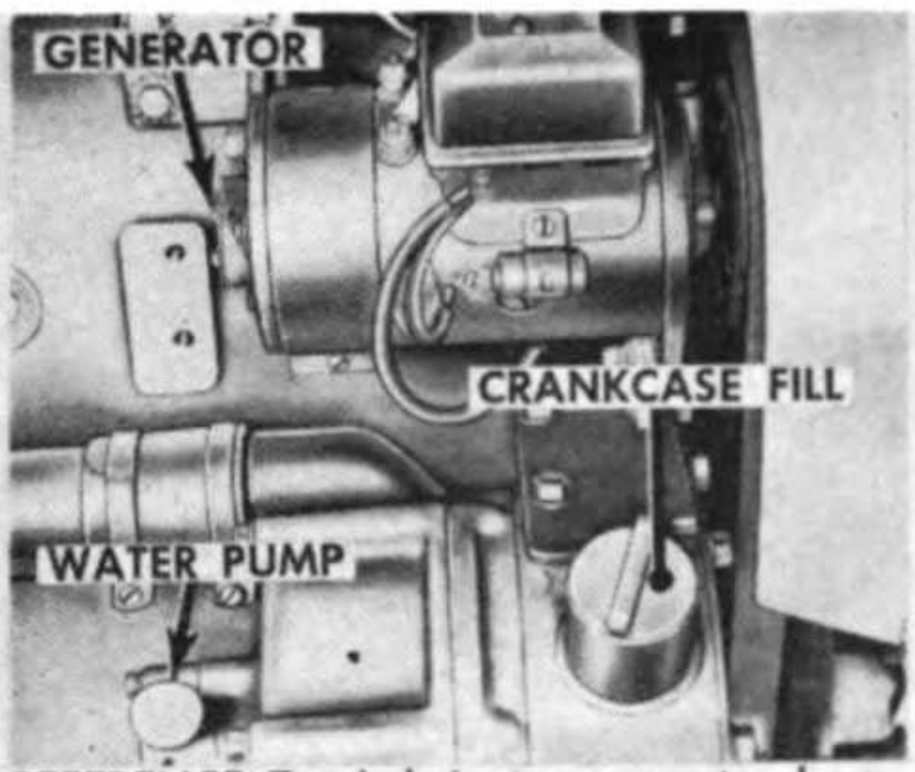
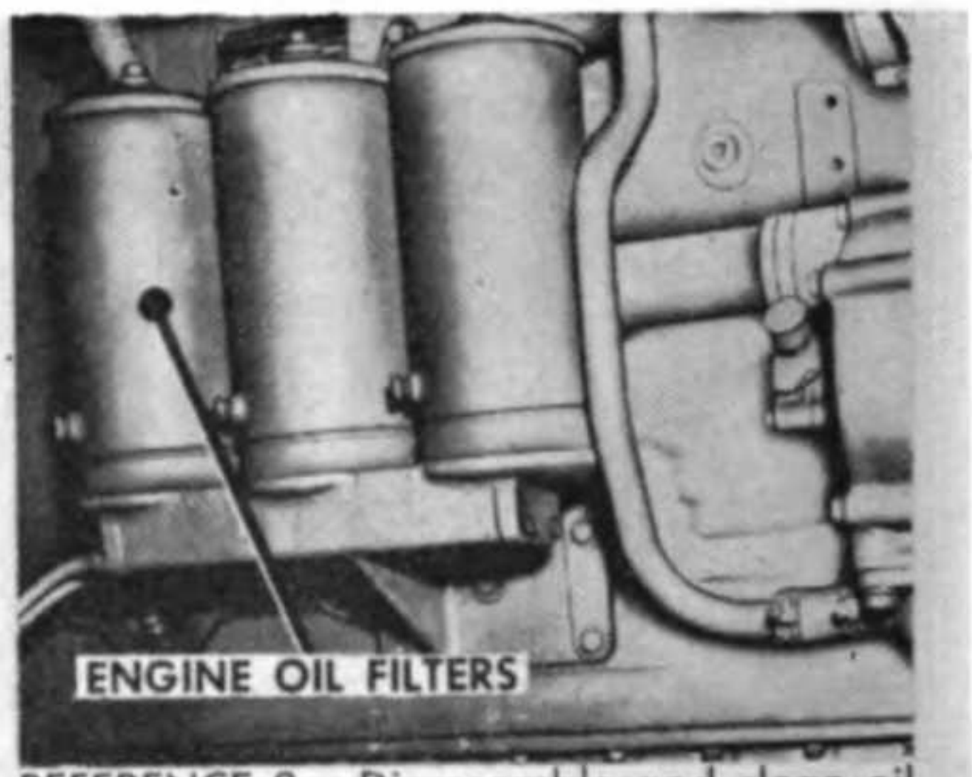
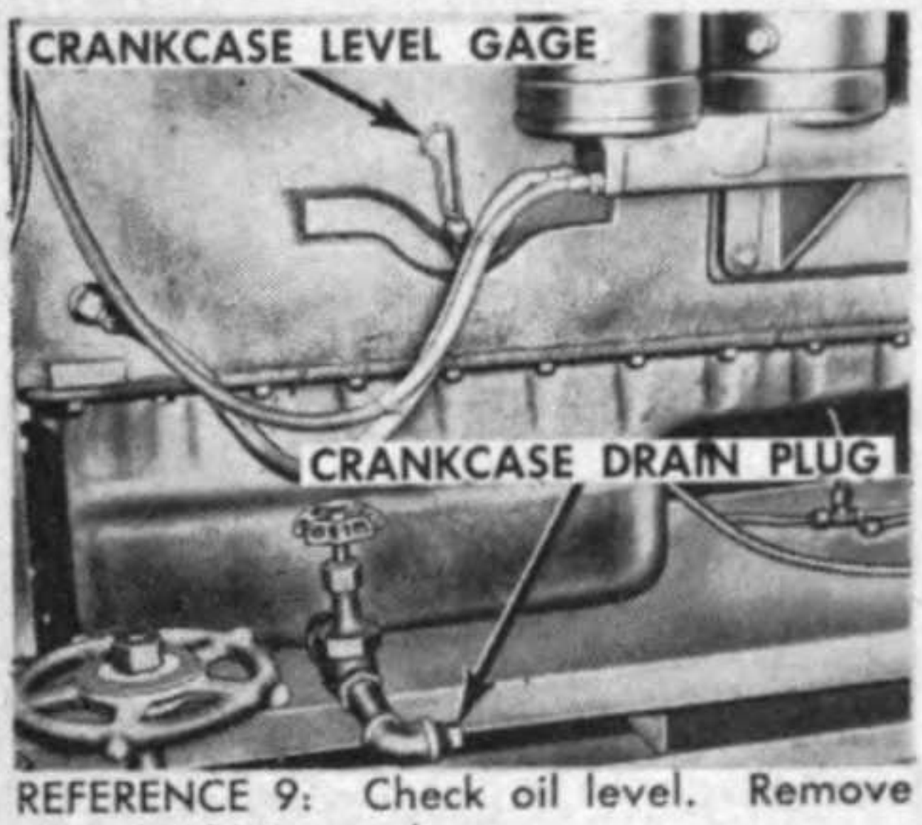


REFERENCE 7: Lubricate generator bearings sparingly with engine oil. Turn cup down one full turn, refill as necessary.

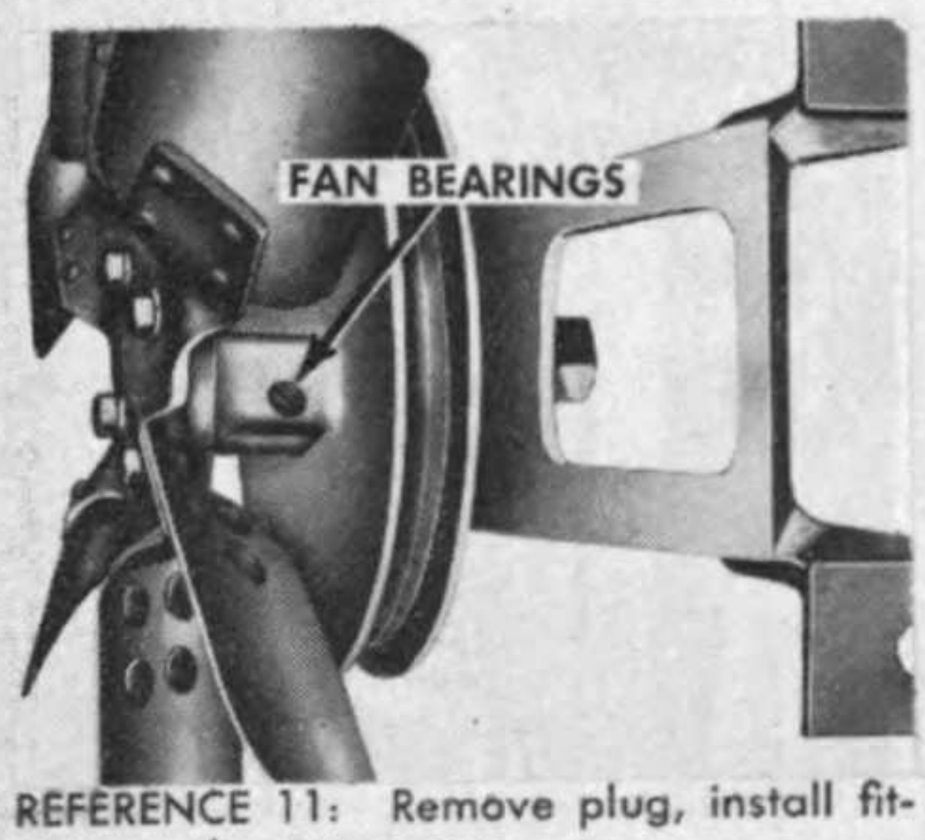


REFERENCE 8: Disassemble and clean oil filter, renew element with each crankcase oil change.

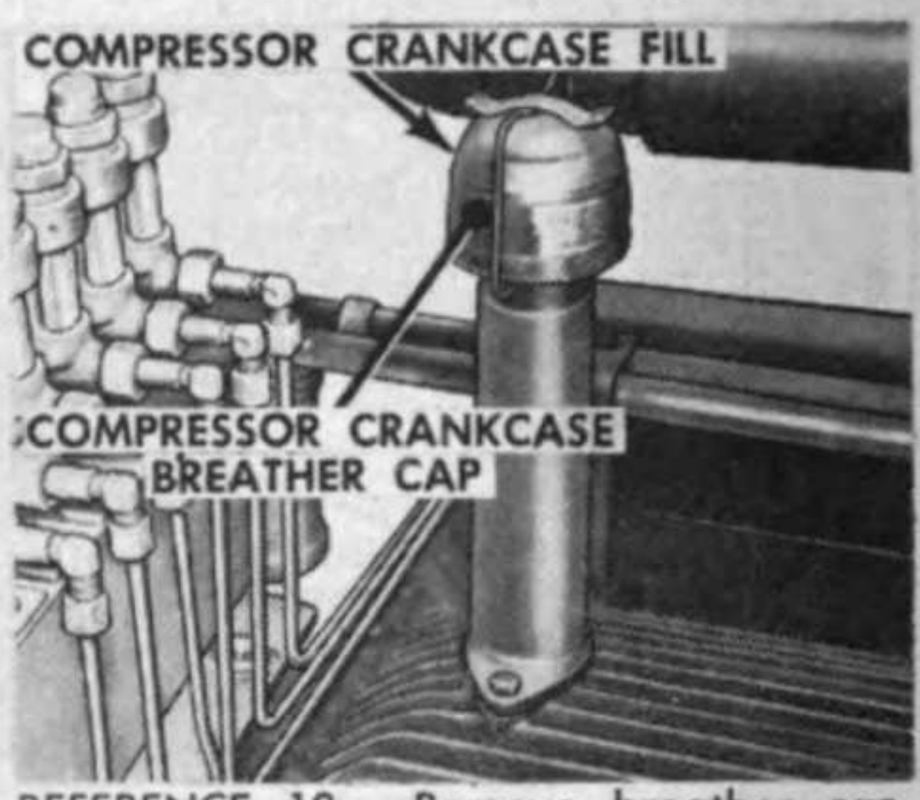


REFERENCE 9: Check oil level. Remove plug to drain crankcase.

REFERENCE 10: Remove, clean, refill oil reservoir to level mark.



REFERENCE 11: Remove plug, install fitting, apply grease gun.



REFERENCE 12: Remove breather cap, clean, reoil and reinstall.

FB5399-1-25/5

Figure 25—Continued.

the formation of a spongy film which dust tends to build up on greasy surfaces.

(3) *Handling.* Whenever possible, lubrication operations should be conducted in a protected place. Oil cans and grease containers should be wiped clean before they are opened, and should be protected from dust while their

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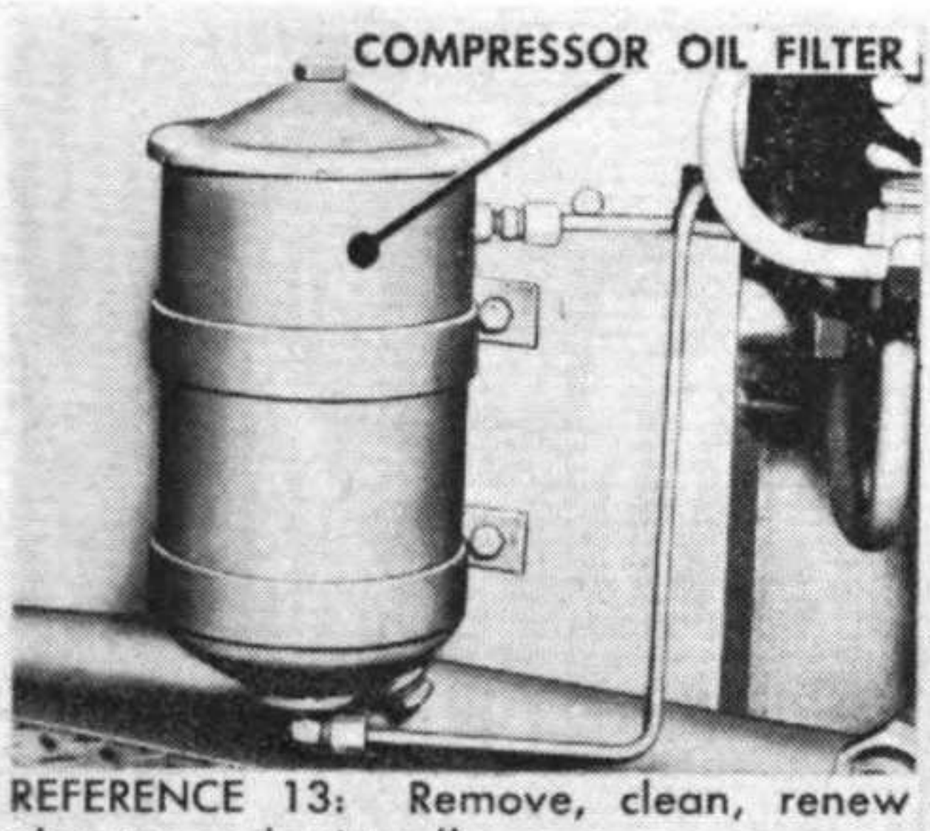
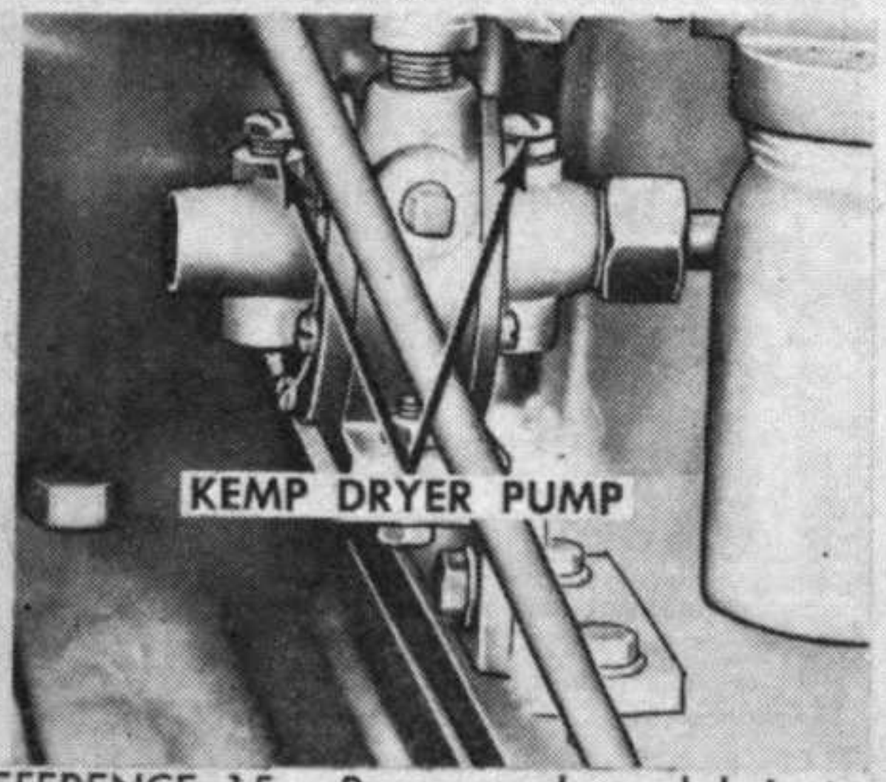
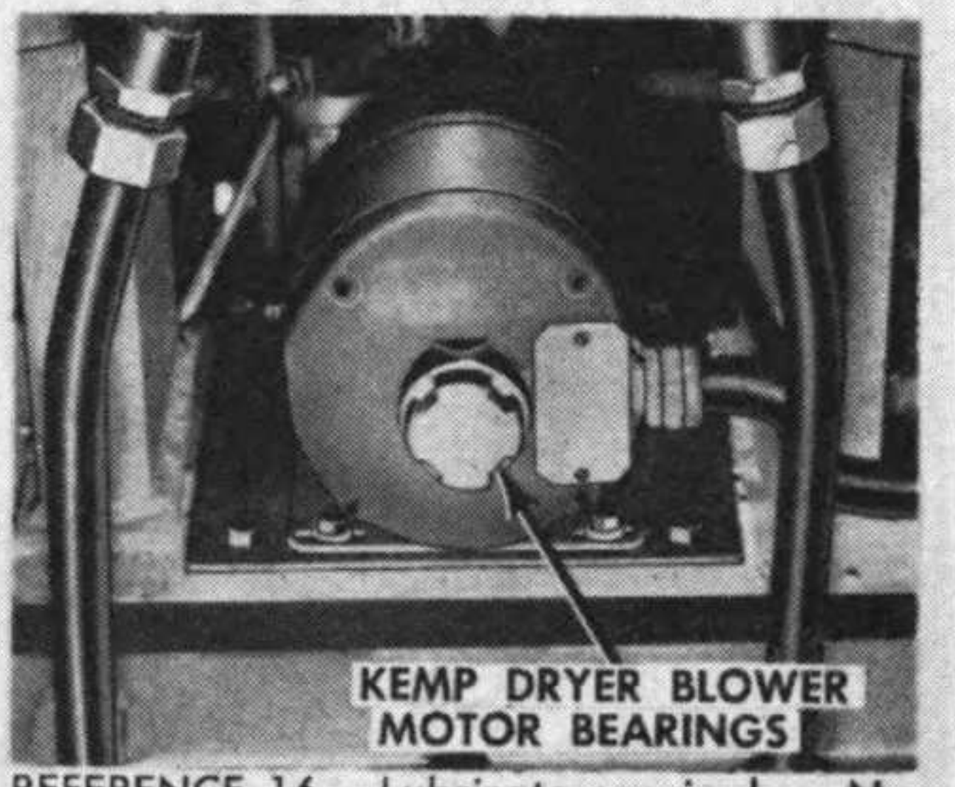


REFERENCE 13: Remove, clean, renew element and reinstall.

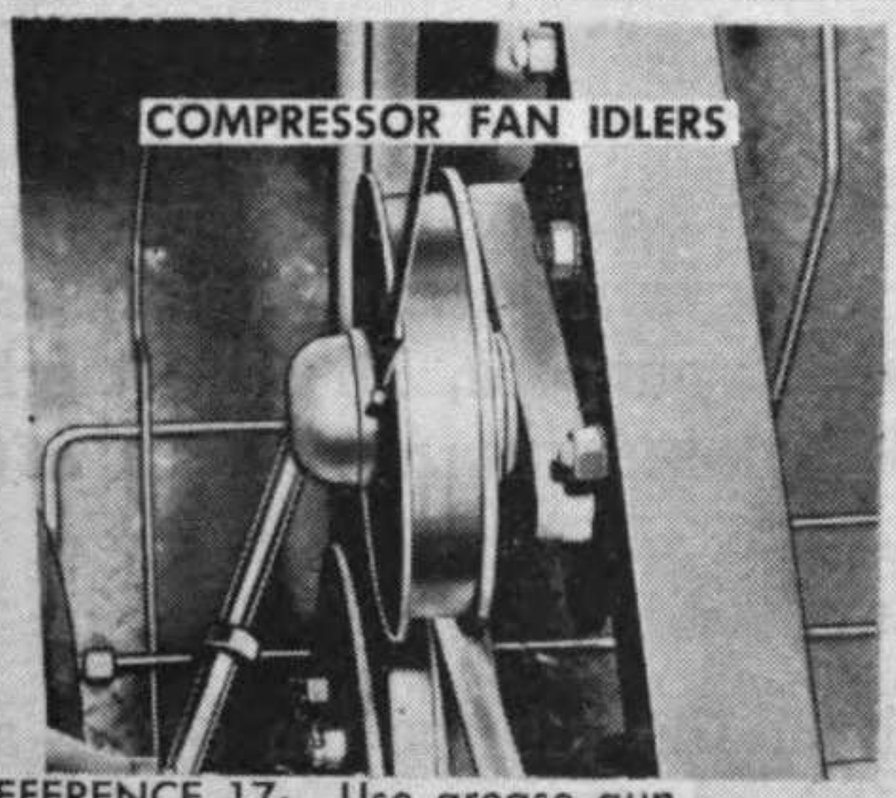
REFERENCE 14: Remove, clean and refill oil reservoir to level mark.



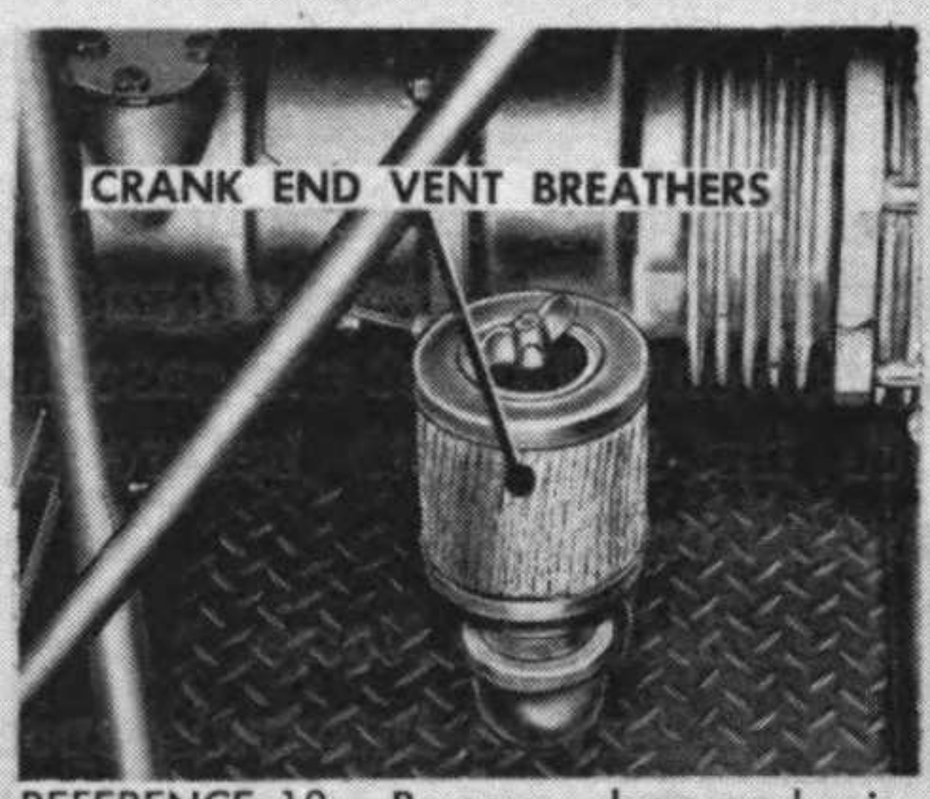
REFERENCE 15: Remove plugs, lubricate sparingly, reinstall plugs.



REFERENCE 16: Lubricate sparingly. No lubrication necessary when equipped with Life Seal bearings.



REFERENCE 17: Use grease gun.



REFERENCE 18: Remove, clean and reinstall.

FB5399-1-25/6

Figure 25—Continued.

covers are removed. Lubrication equipment should be cleaned with cleaning solvent and carefully dried before filling, and before and after use.

b. Points of Application. Follow the detailed lubrications given for each lubrication point illustrated on the lubrication order. Apply the proper lubricant as indicated in LO 5–5399.

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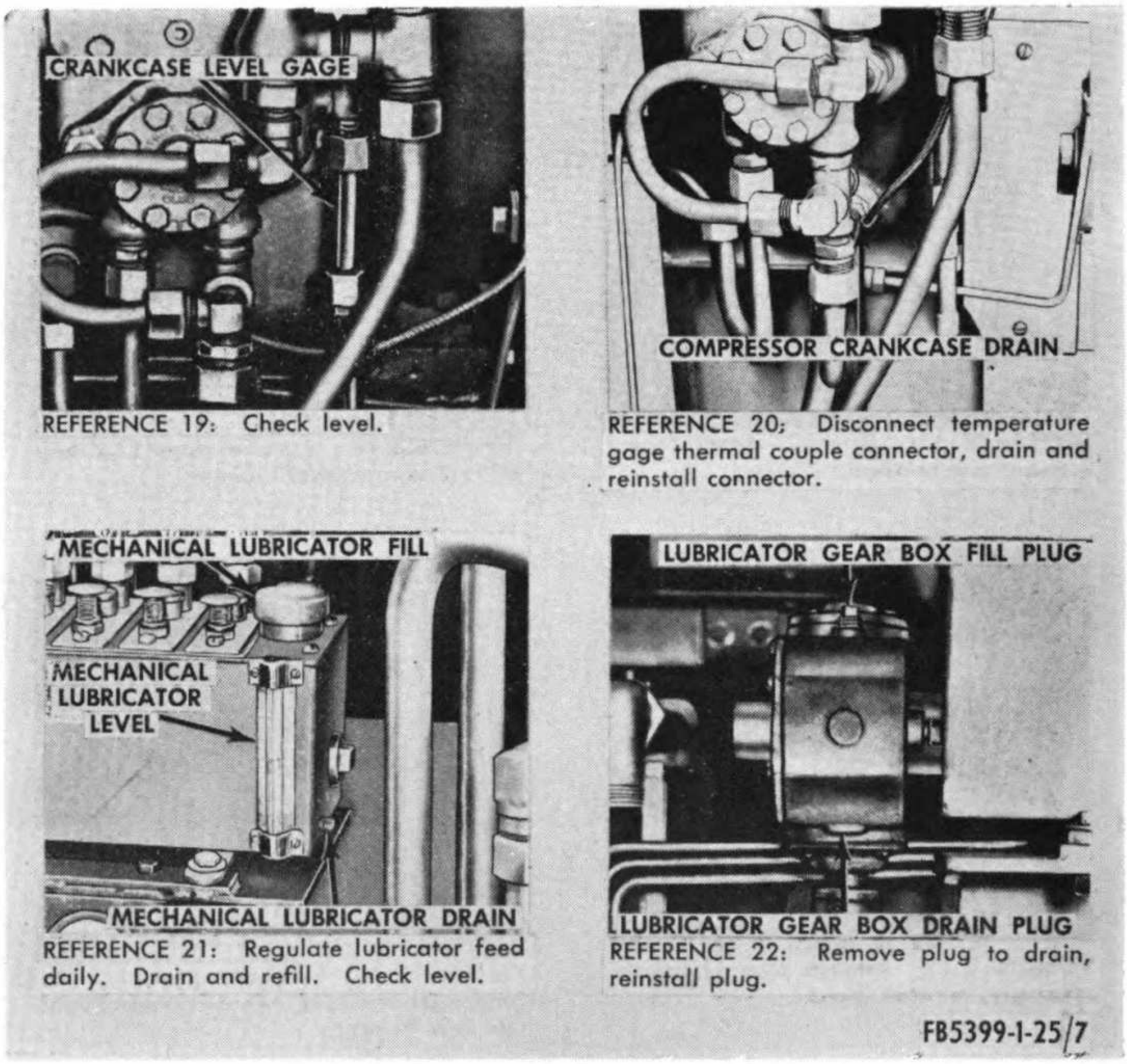

Figure 25—Continued.

c. Cleaning. Before lubricating, clean all lubricators, points of lubrication, and areas around these points with an approved cleaning solvent. Do not use gasoline for this purpose. Dry thoroughly with lint-free cloth before applying lubricants. Reclean after lubrication.

d. Lubrication Notes.

(1) Service intervals specified on the lubrication order are for normal operating conditions. Reduce these intervals when operating under adverse conditions such as sand, dust, or mud. When operating in torrid or frigid zones refer to the lubrication order.

(2) Lubricants are specified in the key in accordance with three temperature ranges; above +32° F., from +32° F. to —10° F., and below —10° F. The change in the grades of lubricant used are determined by maintaining a close check on the operation of the equipment during the change-over periods in accordance with the weather fore-

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cast data. Improper functioning of the equipment may be caused by the wrong type or grade of lubricant. Ordinarily it will be necessary to change grade of lubricant only when air temperatures are consistently in the next higher or lower range.

e. Intercooler Fans. In order to lubricate the intercooler fans it will be necessary to remove the air-outlet deflectors of the compressor shrouding. Then, using a screwdriver, remove the plug located between the pulley and fan blades, install a high-pressure grease fitting, and add the lubricant specified in the current lubrication order. Remove the grease fitting, install the plug, and replace the air-outlet deflectors of the compressor shrouding.

f. Fan Idler Assemblies. In order to lubricate the fan idler assemblies, using a grease gun with a flexible hose, install the hose on the alemite fitting located on the back of the idler pulley, and add lubricant as specified in the current lubrication order.

g. Compressor Oil Filter.

(1) *Removal.*

(*a*) Place a container under the filter drain plug (7, fig. 26), remove the plug, and allow all of the oil to drain.

(*b*) Unscrew inlet line ferrule nut (3) and outlet line ferrule nut (8) from the inlet line adapter (2) and outlet line elbow (9).

(*c*) Remove the four cap screws (6) and washers (5) holding the two mounting brackets (4) on the compressor shrouding.

(*d*) Lift the oil filter assembly (1) away from the compressor shrouding and place it on a workbench or some convenient working surface.

Note. It is not necessary to remove the filter assembly to renew the filter element. Exercise care to prevent any dirt or sludge from clogging the outlet line when cleaning the filter casing.

(2) *Disassembly.*

(*a*) Remove the cover retaining bolt (5, fig. 27) and lift the cover (6), cover spring (4), and gasket (7) off of the filter casing (1).

(*b*) Lift out the filter element (2) with the top tube gasket (3) attached and remove the bottom tube gasket (8). Discard the filter element.

(*c*) Slide the two mounting brackets (10) down off of the filter casing, and remove the inlet line adapter (2, fig. 26) and the outlet line elbow (9). Use care in remov-

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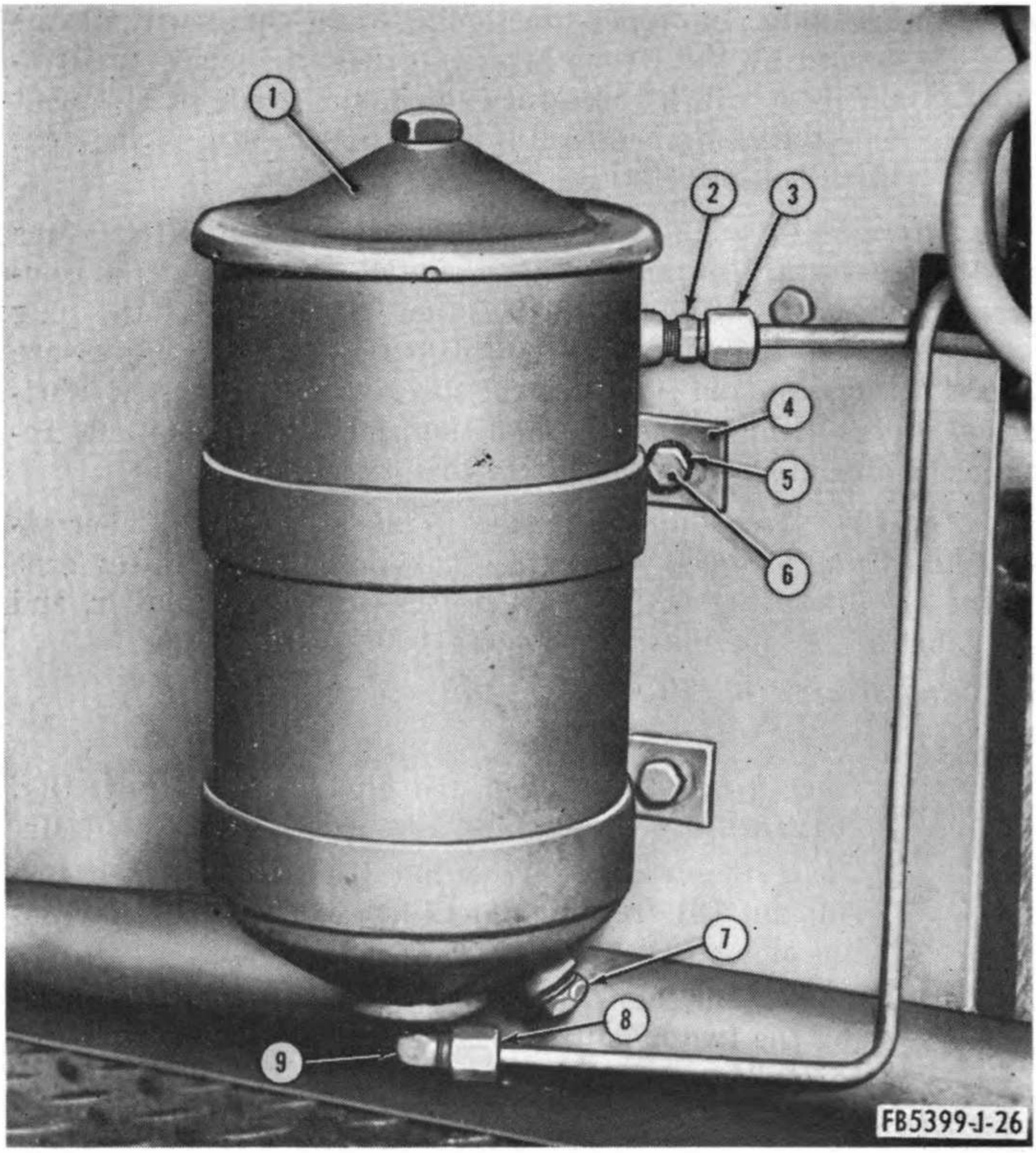

1 Compressor oil filter assembly
2 Inlet line adapter
3 Inlet line ferrule nut
4 Mounting bracket
5 Washer
6 Cap screw
7 Filter drain plug
8 Outlet line ferrule nut
9 Outlet line elbow

Figure 26. Compressor oil filter removal points.

ing these fittings as they are made of soft metal and are easily damaged.

(3) *Cleaning and inspection.*

(*a*) Clean all parts in an approved cleaning solvent.

(*b*) Inspect all fittings and threaded surfaces for stripped threads. Check oil line connections for splits, distortion or other damage.

(*c*) Check the gaskets for serviceable condition. Replace defective gaskets.

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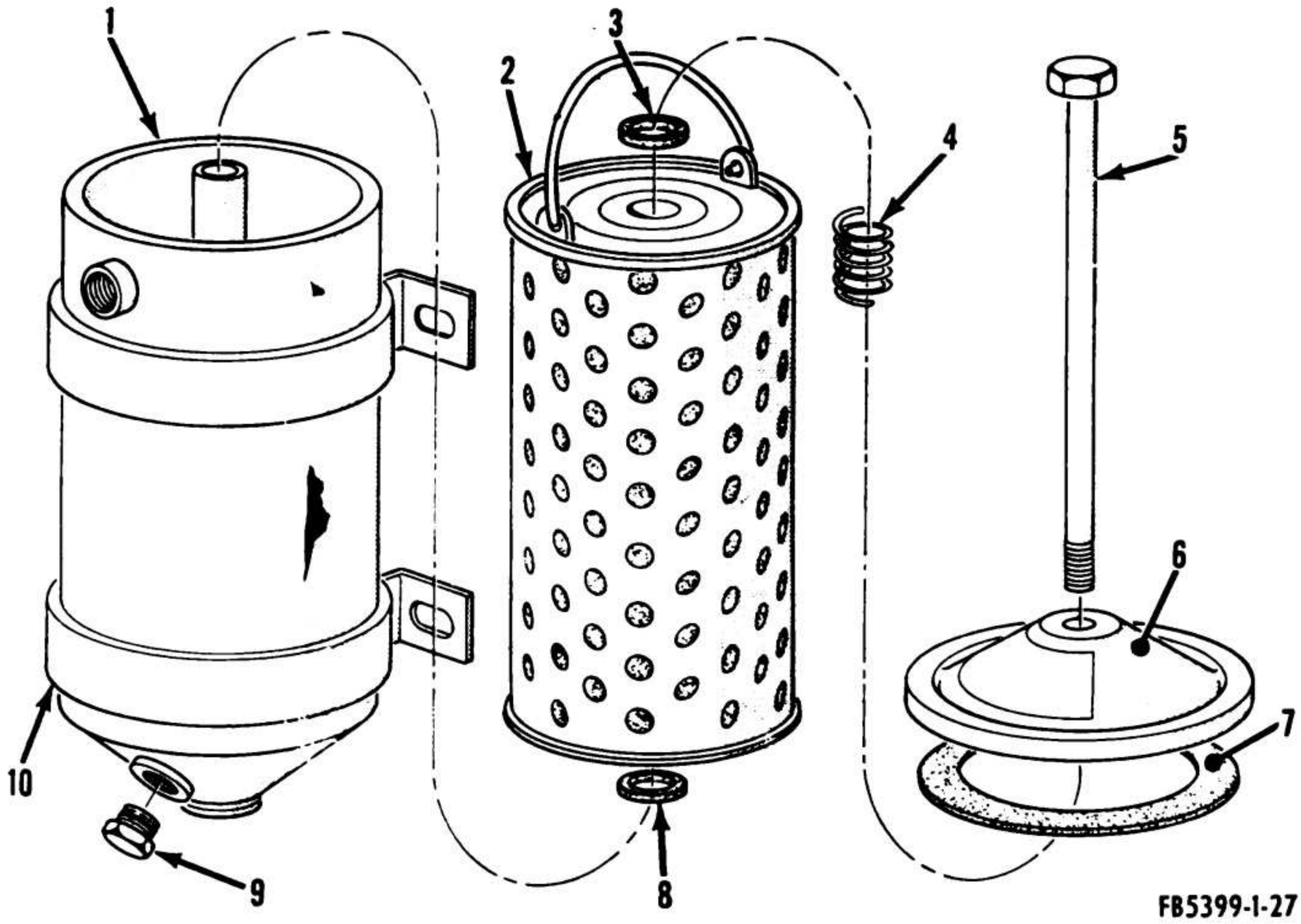

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1	Filter casing	6	Cover
2	Filter element	7	Gasket, cover
3	Top tube gasket	8	Bottom tube gasket
4	Cover spring	9	Drain plug
5	Bolt, cover retaining	10	Mounting bracket

Figure 27. Compressor oil filter, exploded view.

(*d*) Inspect the filter casing and cover for dents, cracks, distortion or other damage.

(*e*) Inspect the cover spring for breakage and proper tension.

(4) *Reassembly.*

(*a*) Install the inlet line adapter (2, fig. 26) and outlet line elbow (9) into the filter casing (1, fig. 27).

(*b*) Slide the mounting brackets (10) into position on the casing.

(*c*) Install the bottom tube gasket (8), a new filter element (2), and the top tube gasket (3).

(*d*) Place gasket (7) in cover (6); place the cover, and the cover spring (4) over the cover retaining bolt (5).

(*e*) Fit cover on the filter casing and tighten the retaining bolt.

(5) *Installation.*

(*a*) Place the compressor oil filter assembly (1, fig. 26) on the compressor shrouding with the holes in the mounting brackets (4) in line with the holes in the shrouding.

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(*b*) Install the washers (5) on the cap screws (6) and install and tighten the cap screws.

(*c*) Connect the inlet line ferrule nut (3) to the inlet line adapter (2), and the outlet line ferrule nut (8) to the outlet line elbow (9), and tighten.

(*d*) Install and tighten the drain plug (7).

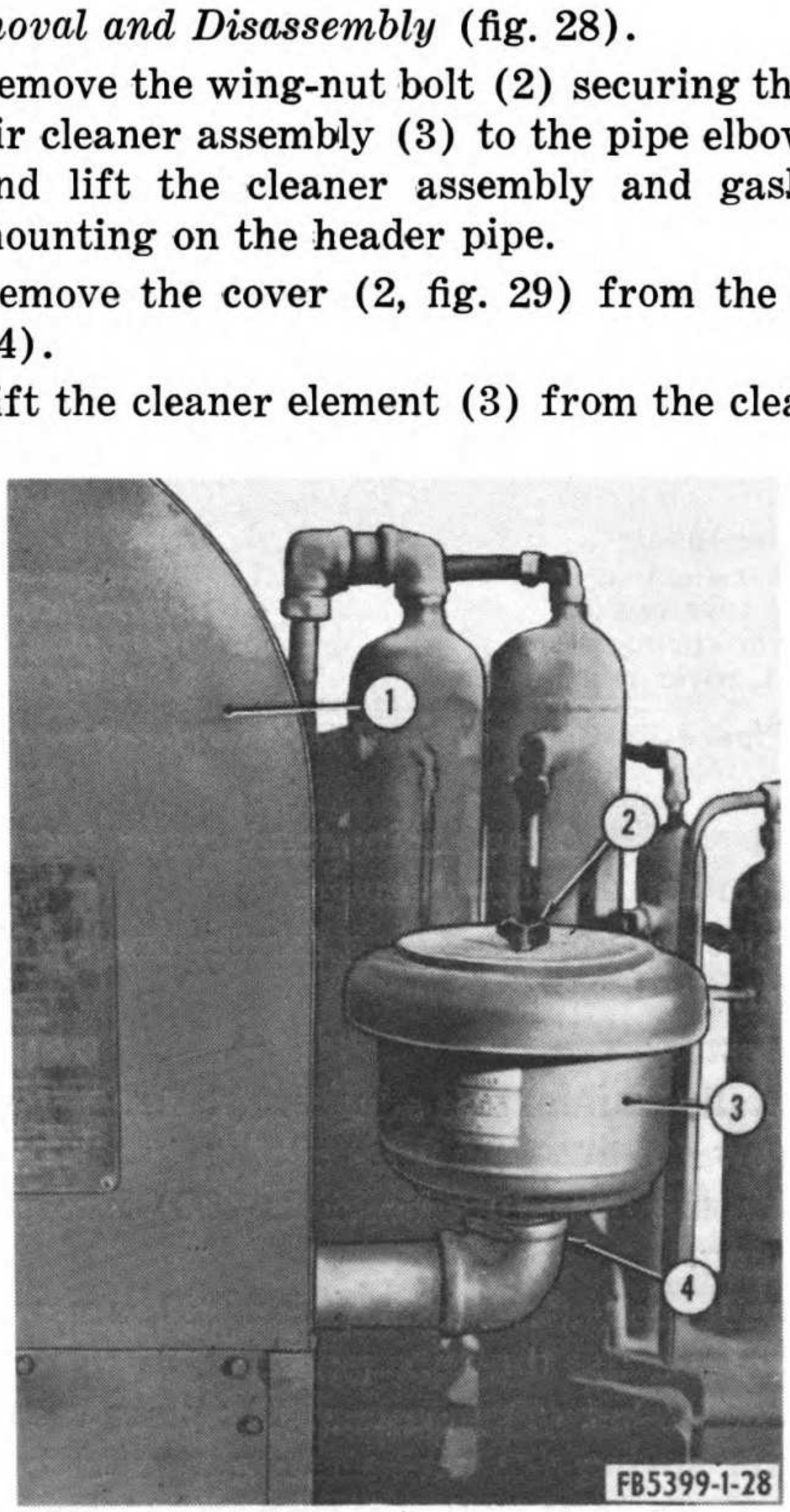
h. Compressor Air Cleaner.

(1) *Removal and Disassembly* (fig. 28).

(*a*) Remove the wing-nut bolt (2) securing the compressor air cleaner assembly (3) to the pipe elbow fitting (4), and lift the cleaner assembly and gasket from its mounting on the header pipe.

(*b*) Remove the cover (2, fig. 29) from the cleaner bowl (4).

(*c*) Lift the cleaner element (3) from the cleaner bowl.



1 Compressor
2 Wing-nut bolt
3 Compressor air cleaner assembly
4 Pipe coupling

Figure 28. Compressor air cleaner mounting and removal points.

(2) *Cleaning and inspection.*

(*a*) Remove the old oil from the cleaner bowl, and clean all metal parts with an approved cleaning solvent.

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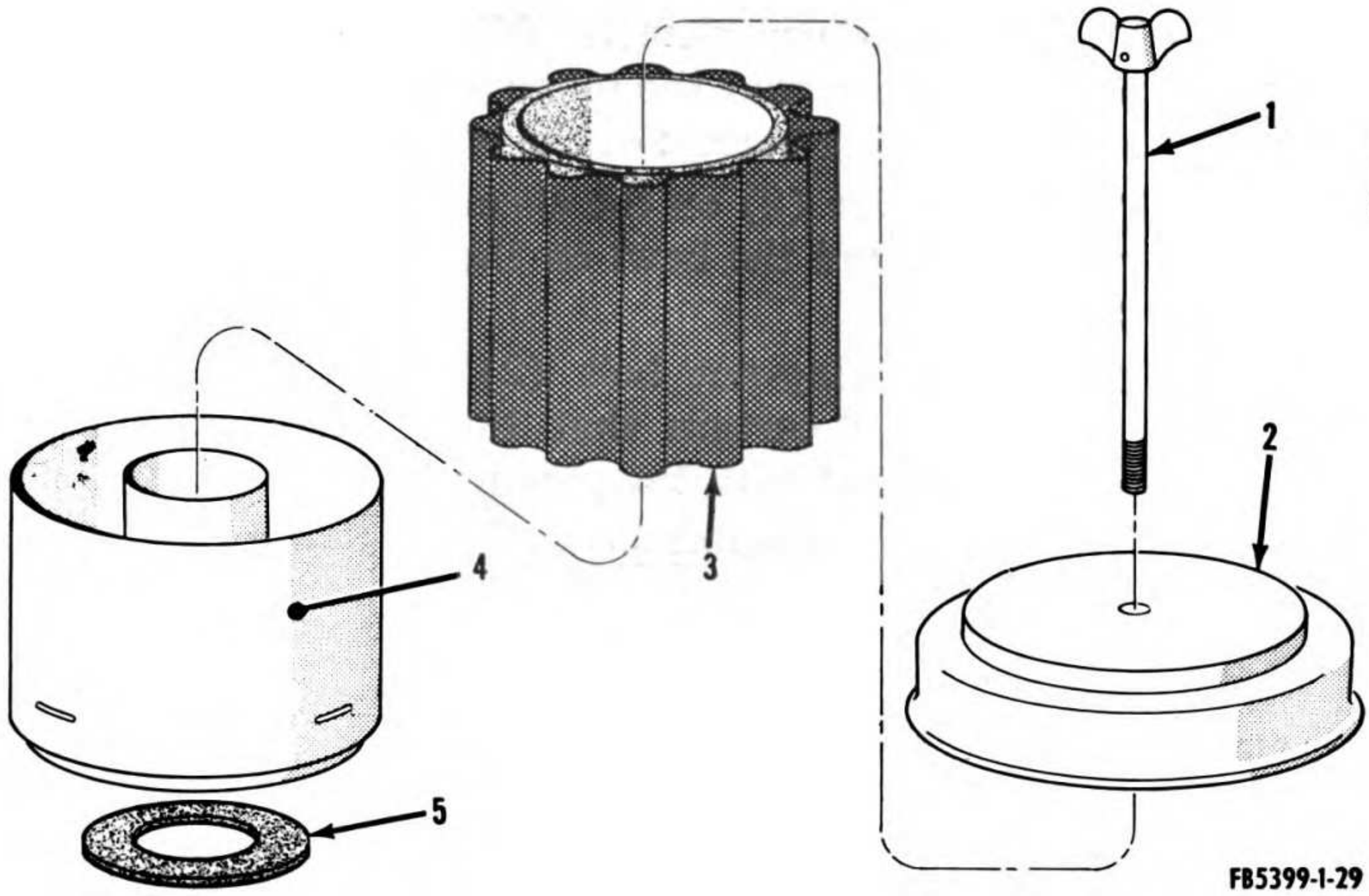

1 Wing-nut bolt
2 Cover
3 Cleaner element
4 Cleaner bowl
5 Gasket

Figure 29. Compressor air cleaner, exploded view.

(*b*) Clean the element using either a jet of hot water or steam, or a strong solution of washing soda and water. Allow the cleaner element to drain dry or use low-pressure air to blow away residual moisture.

Caution: Do not use kerosene or gasoline to clean the filter element. The resulting fumes may collect and explode when drawn into the header or compressor cylinders.

(*c*) After the cleaner element is completely dry, dip it in clean compressor crankcase oil and drain off all surplus oil before placing it in the filter bowl.

(*d*) Inspect parts for breakage, cracks, or distortion which may affect air flow through the cleaner; repair or replace defective parts.

(*e*) Inspect wing-nut bolt and pipe coupling for damaged or stripped threads. Repair or replace defective parts.

(*f*) Check gasket for breaks or deterioration and replace it if necessary.

(3) *Assembly and installation.*

(*a*) Add new oil to the cleaner bowl (4) to the oil level indicator bead as instructed in the current lubrication order.

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(*b*) Place the cleaner element (3) in the cleaner bowl, making certain that the felted end of the element rests squarely on the bottom of the bowl.

(*c*) Place the cover (2) on the cleaner bowl and mount the gasket (5) and the bowl on the pipe coupling (4, fig. 28).

(*d*) Install the wing-nut bolt (2) and tighten securely after making certain that the cleaner assembly is properly alined with the pipe mounting.

Note. Be sure that the skirt-end of the cleaner cover extends slightly below the surface of the oil, thus preventing air from passing into the header without first being washed through the oil.

i. Crank-End Vent Oil Breather Caps.

(1) *Removal.*

(*a*) Remove the two small plates located adjacent to the accessory drive housing on the front right panel of the compressor shrouding, and the front left side panel of the shrouding as outlined in paragraph 124*a*. This will give the operator access to the low-pressure crank-end vent oil breather cap (1, fig. 30) and the high-pressure breather cap located under the second-stage cylinder.

(*b*) Unscrew the breather cap base fitting (3) from the elbow (2) and lift the breather cap off of the elbow. Remove the high-pressure breather cap in the same manner.

(2) *Disassembly.*

(*a*) Remove the wing-nut bolt (1, fig. 31) and lift the top cover (2) off of the wire mesh screen (3).

(*b*) Lift the wire mesh screen out of the breather cap base fitting (4).

(3) *Cleaning and inspection.*

(*a*) Inspect the wing-nut bolt and base fitting for stripped or damaged threads.

(*b*) Check the top cover for dents or being out-of-round.

(*c*) Drop the wire mesh screen in an approved cleaning solvent to clean all oil and dust particles from the screen. Examine the screen for breaks, cracks, or distortion which may affect air flow through the breather caps; repair or replace a defective screen.

(*d*) Clean interior and exterior of the top cover and base fitting with an approved cleaning solvent.

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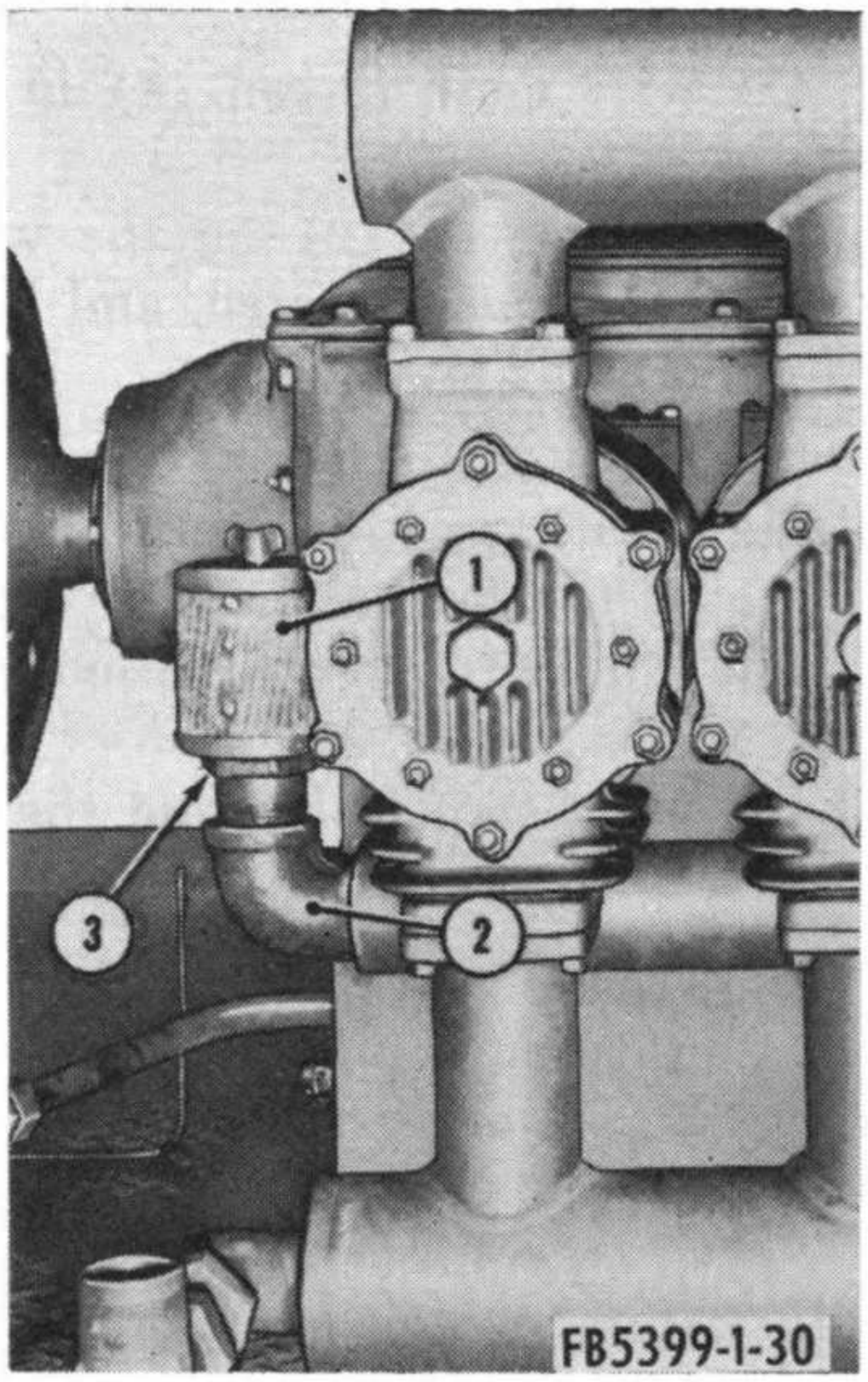
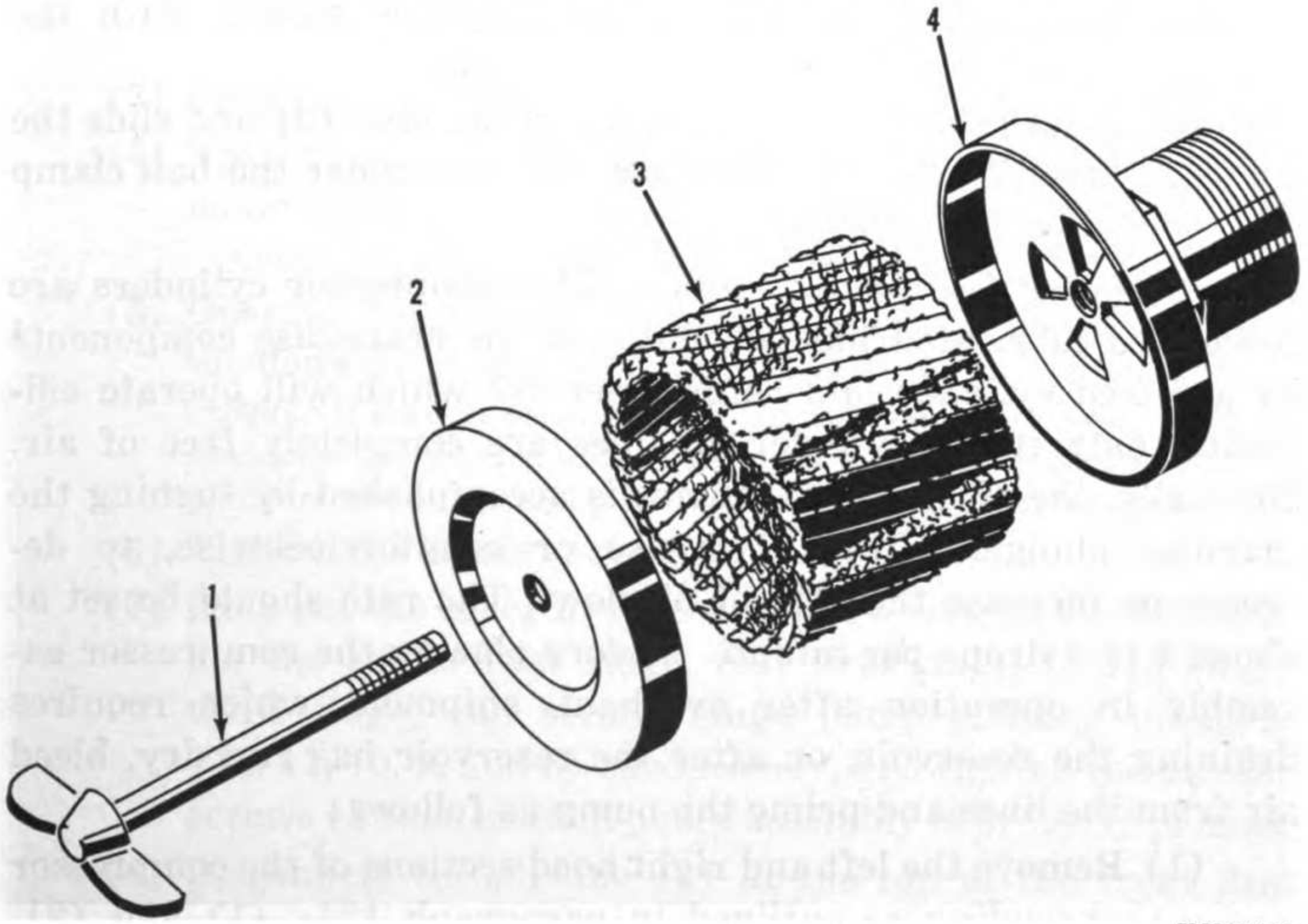


1 Low-pressure crank-end vent oil breather cap
2 Elbow
3 Breather cap base fitting

Figure 30. Compressor crank-end vent oil breather cap removal points.



1 Wing-nut bolt
2 Top cover
3 Wire mesh screen
4 Breather cap base fitting

Figure 31. Compressor crank-end vent oil breather cap exploded view.

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(4) *Reassembly.*

(*a*) Install the wire mesh screen (3) in the breather cap base fitting (4).

(*b*) Install the top cover (2) on the wire mesh screen, being sure that it is centered, and install and tighten the wing-nut bolt (1).

(5) *Installation.*

(*a*) Install the breather cap base fitting (3, fig. 30) in the elbow (2) of the low-pressure breather vent header. Install the high-pressure breather cap in the same manner.

(*b*) Install the two small plates and the side plate of the compressor shrouding as outlined in paragraph 124*c*.

j. Compressor Crankcase Breather (fig. 32).

(1) Remove the breather cap (3, fig. 32) by lifting up the bail clamp (1), sliding the bail (2) forward from under the clamp, and pulling the cap off the breather pipe (4).

(2) Drop the cap in an approved cleaning solvent to clean the filtering material.

(3) Examine breather cap for dents. Check the bail clamp for breaks and loss of tension. Examine the bail for cracks, breaks, and correct alinement. Check to see that the part of the cap which engages tightly with the breather pipe is not out-of-round.

(4) Install the breather cap (3) on the pipe (4) and slide the bail (2) over the breather cap and under the bail clamp (1).

k. Cylinder Lubricator Pumps. The compressor cylinders are force-feed lubricated independently of the crankcase components by a 6-feed cylinder lubricator assembly which will operate efficiently only if the cylinder oil lines are completely free of air. Normally, the oil-flow adjustment is accomplished by turning the priming plunger either clockwise or counterclockwise, to decrease or increase the rate of oil flow. The rate should be set at about 3 to 4 drops per minute. Before placing the compressor assembly in operation after overhaul, shipment which requires draining the reservoir, or after the reservoir has run dry, bleed air from the lines and prime the pump as follows:

(1) Remove the left and right hood sections of the compressor shrouding as outlined in paragraph 124*a* (1) and (2).

(2) Add the oil needed to bring the level up to the required mark in the reservoir.

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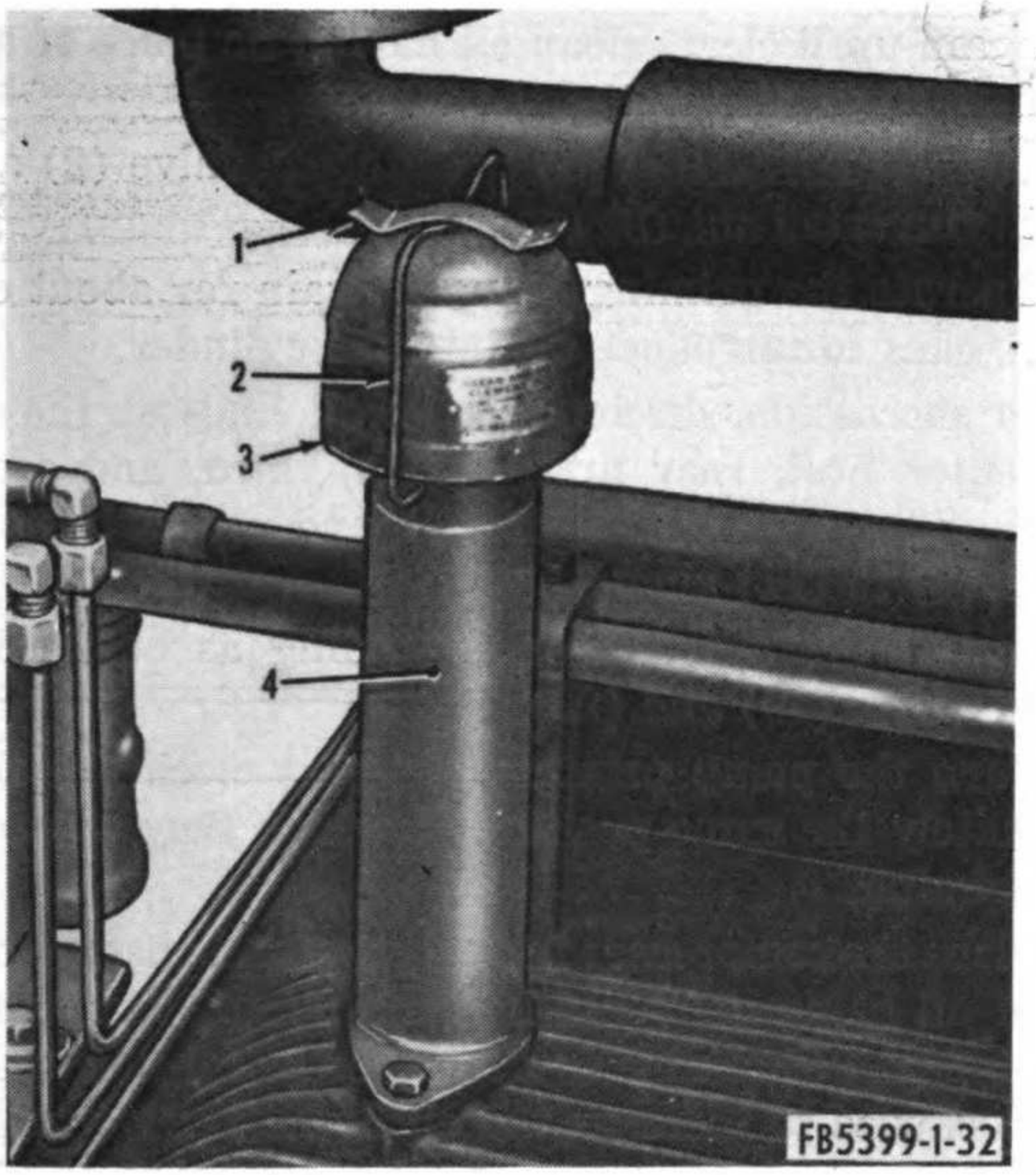

1 Bail clamp
2 Bail
3 Breather cap
4 Breather pipe

Figure 32. Compressor breather cap removal.

(3) Back out the bleeder screw (14, fig. 33) four or five turns.

(4) Turn the front first stage pump priming plunger (13) counterclockwise until the stop position is reached.

Note. This action will allow maximum pumping capacity.

(5) Operate the priming plunger manually until clear, clean oil flows from the bleeder screw hole.

Note. It may be necessary to turn the compressor over manually to change the position of the cam shaft in the reservoir so all of the plungers can be manually operated with a full pumping stroke.

(6) Tighten the bleeder screw securely.

(7) Back out the other five bleeder screws one at a time, operate the center first stage, rear first stage, fourth stage, third stage, and second stage pump priming plungers (12, 11, 10, 9, and 8) successively, and tighten the bleeder screws as soon as each pump assembly is properly primed.

(8) Disconnect the oil line (4) at the top of the front first stage cylinder (16) by unscrewing the inverted nut (3) from the check valve (2).

(9) Operate the front first stage pump priming plunger (13)

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again until clear, clean oil having no trace of air bubbles flows from the end of the oil line.

(10) Connect the oil line (4) to the check valve (2) and tighten the inverted nut (3) securely.

(11) Operate the priming plunger again for about eight more strokes to introduce oil into the cylinder.

(12) In succession, disconnect the oil lines at the top of the center first, rear first, fourth, third, and second stage cylinder (17, 1, 5, 6, and 7) and repeat the steps given in (8) to (11) above.

(13) Install the compressor shrouding as outlined in paragra 124*c* (19) and (20).

(14) Turn the pump priming plungers clockwise to approximately the same position at which they were set before priming.

(15) Place the compressor in operation and observe the amount of oil being delivered by each pump. Turn the priming plungers clockwise to decrease the oil flow and counterclockwise to increase the oil flow. The normal flow rate is three to four drops of oil per minute as observed in each sight flow glass (15).

l. Carburetor Air Cleaners.

(1) *Disassembly.* Twist the cup (fig. 34) and disengage the latches, which hold the cup to the outer chamber, and separate the vortex chamber and oil cup. Lift the disc from the oil cup. Both air cleaners are disassembled in this manner.

Note. It is not necessary to remove the air cleaners from their mounting to service them.

(2) *Inspection and repair.* Inspect parts for any mechanical damage. Renew any damaged parts. Wipe dust and grit from all parts. Flush and clean with an approved cleaning solvent and dry with compressed air. Service air cleaners in accordance with instructions contained in LO 5–5399.

(3) *Reassembly.* Refill cup to oil level mark. Attach to outer chamber by twisting until latches engage.

m. Cylinder Head Breathers. The cylinder head breather caps are fitted with small air cleaners to prevent the entrance of dust or other foreign matters. These units should be cleaned periodically by washing in cleaning solvent and draining, or blowing dry with compressed air. Before reinstalling the caps, saturate the elements with engine oil.

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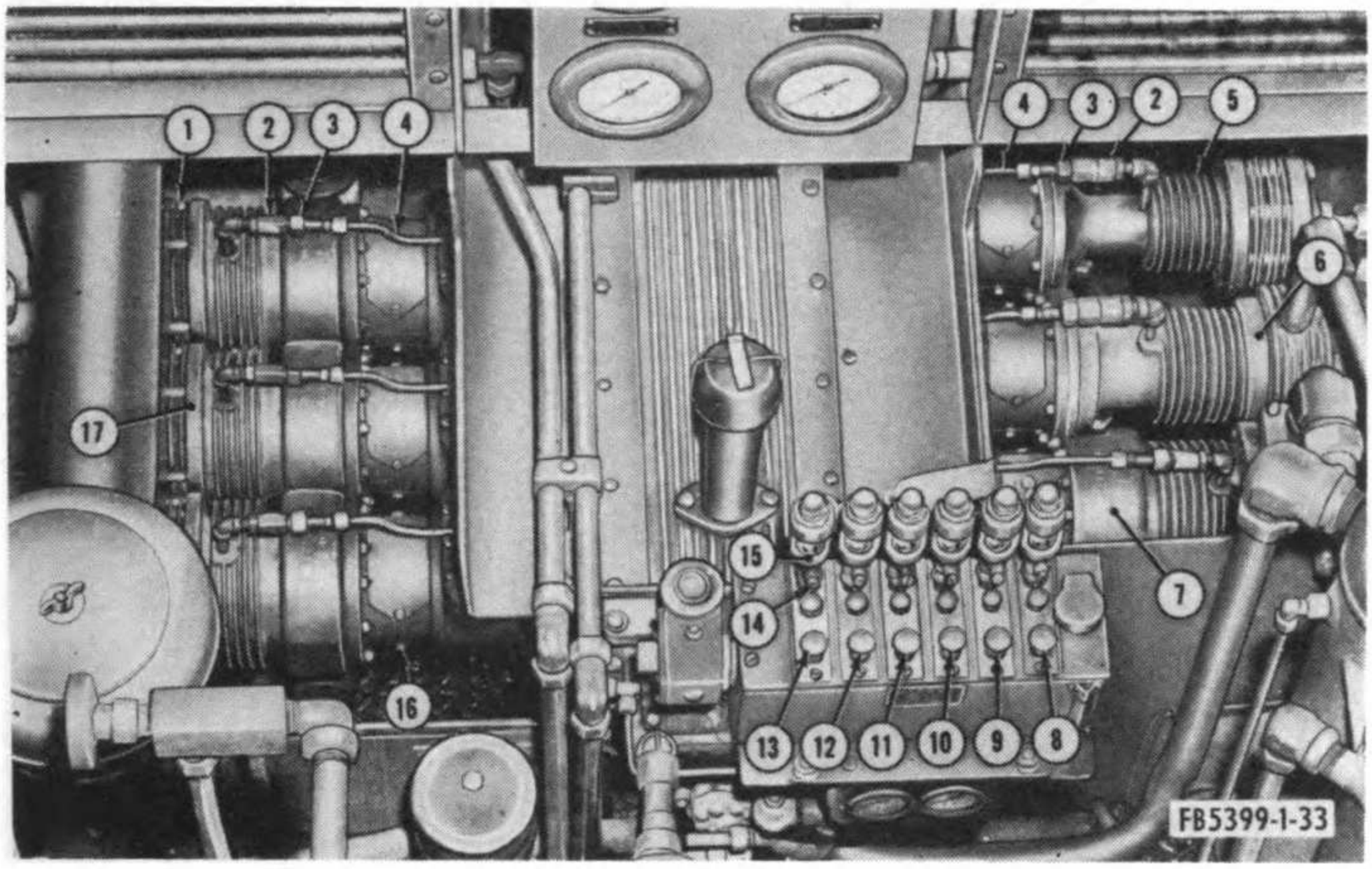

1 Rear first stage cylinder
2 Check valve
3 Inverted nut
4 Oil line
5 Fourth stage cylinder
6 Third stage cylinder
7 Second stage cylinder
8 Fourth stage cylinder pump priming plunger
9 Third stage cylinder pump priming plunger
10 Second stage cylinder pump priming plunger
11 Rear first stage cylinder pump priming plunger
12 Center first stage cylinder pump priming plunger
13 Front first stage cylinder pump priming plunger
14 Bleeder screw
15 Sight flow glass
16 Front first stage cylinder
17 Center first stage cylinder

Figure 33. Lubricator oil lines and connections.

n. Engine Oil Filter Assembly. Due to the position in which the filter assembly is mounted, it is necessary to remove the assembly to service it.

(1) *Removal.*

(*a*) Disconnect the outlet hose (10, fig. 13) by removing the ferrule nut (12) from the outlet hose elbow (13).

(*b*) Disconnect the oil inlet hose (4, fig. 35) by removing the ferrule nut (3) from the adapter (5) and pull the hose over to the right side of the engine.

(*c*) Remove the five cap screws (3, fig. 36) and lockwashers (2) being sure to support the oil filter assembly (1) adequately while the cap screws are being removed. Remove the oil filter assembly and move it to a work bench or other suitable place for disassembly.

Note. To prevent oil from dripping out of the hose ends, hold the hose above the filter assembly.

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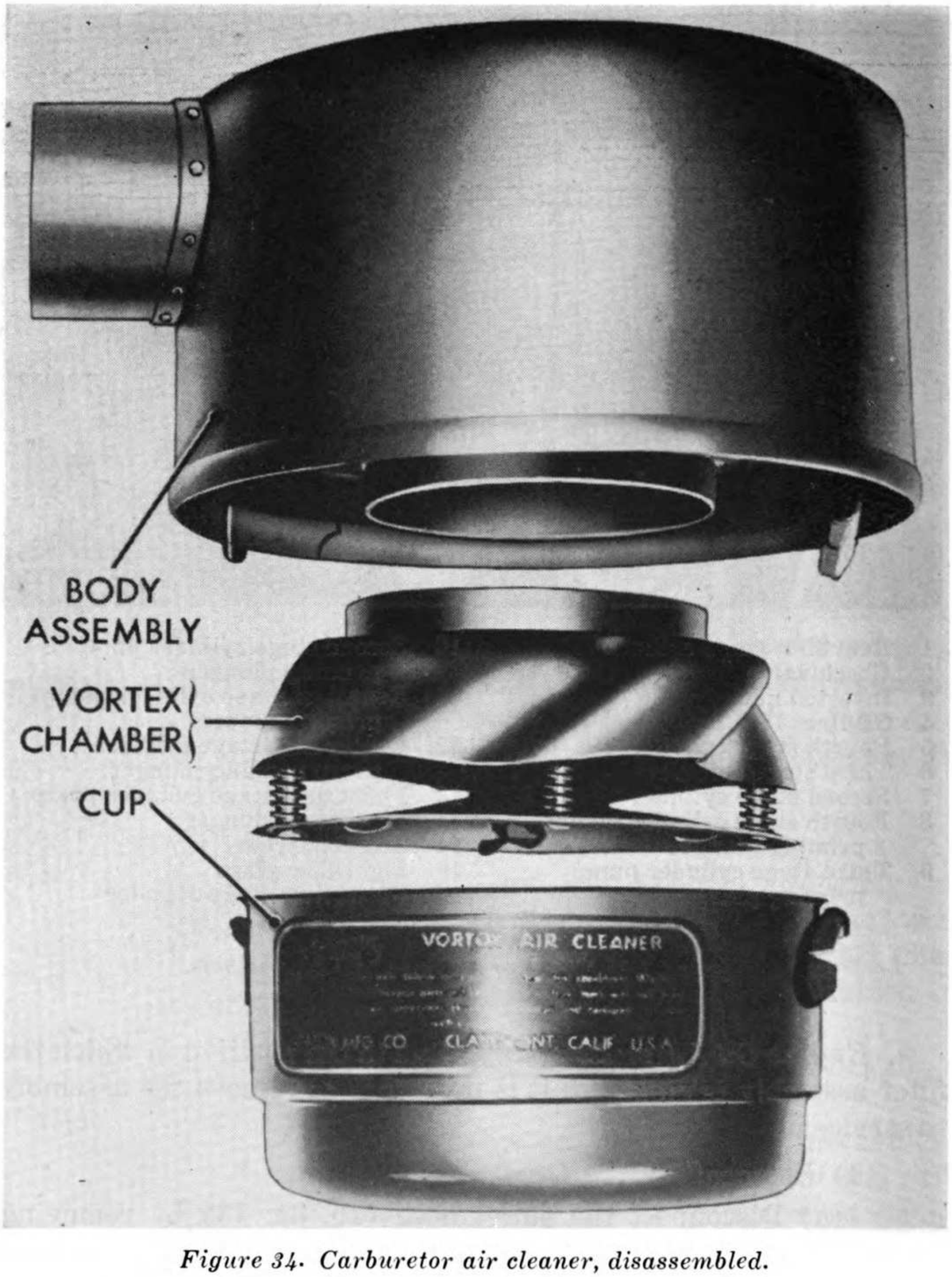

Figure 34. Carburetor air cleaner, disassembled.

(2) *Disassembly.*

(*a*) Remove the two hose clamps (17, fig. 37). Remove the outlet hose (16) and the inlet hose (18) and adapter (15).

(*b*) Remove the screw (1) and lift the cover assembly off of the housing assembly (9). Remove the spring (5) and lift the screw out of the cover (3). Remove the gasket (2) from the screw and the gasket (4) from the cover.

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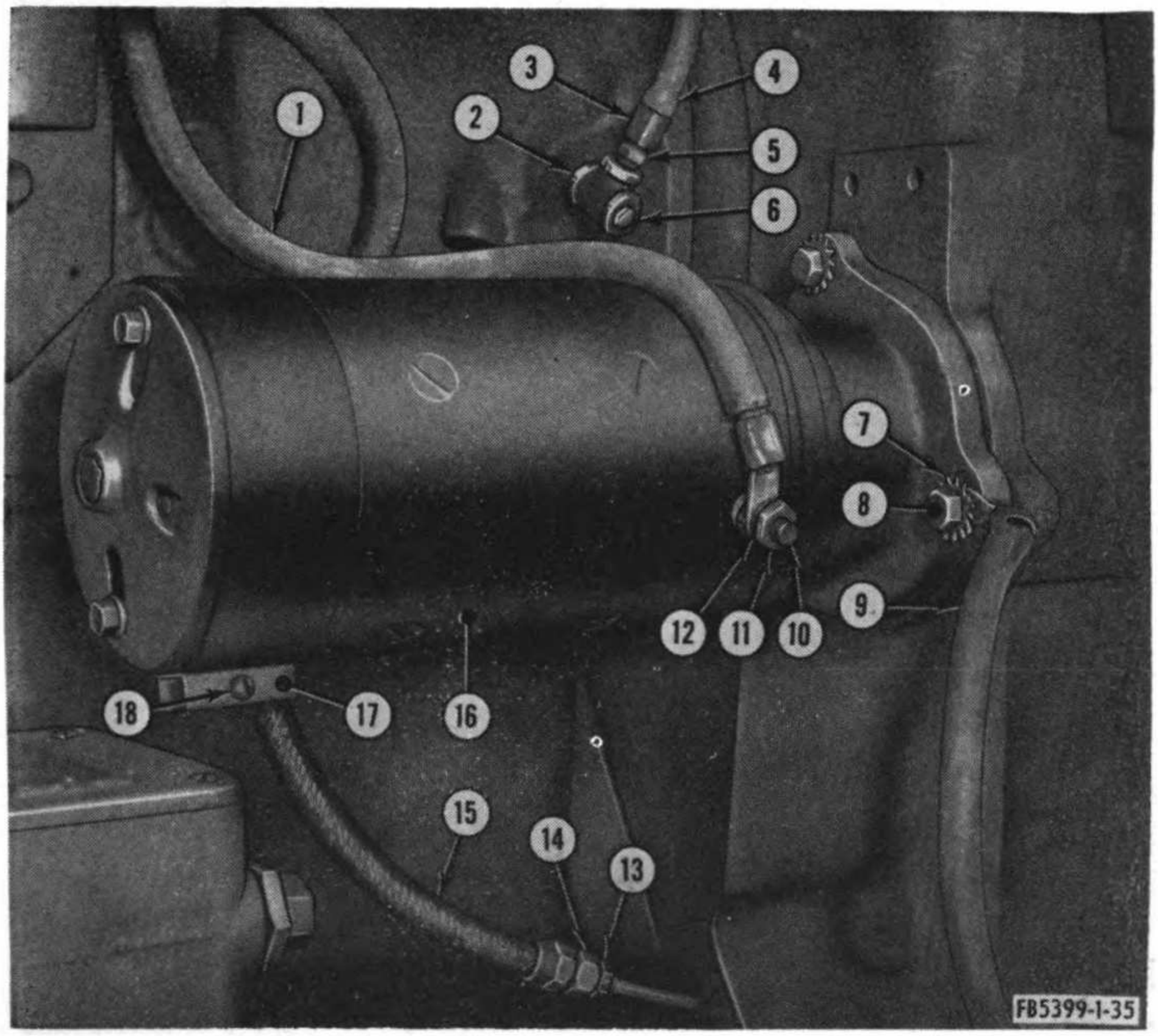

1	Starting motor lead	10	Stud terminal
2	By-pass valve	11	Nut, terminal stud
3	Ferrule nut	12	Washer
4	Oil inlet hose	13	Adapter
5	Adapter	14	Ferrule nut
6	Adjusting screw	15	Fuel inlet line hose
7	Lockwasher	16	Starting motor
8	Cap screw	17	Cover band
9	Battery ground lead	18	Cover band screw

Figure 35. Starting motor mounting and oil filter inlet line connection, showing removal points.

(*c*) Remove the three drain plugs (10) and drain sludge out of the housing assembly.

(*d*) Lift the filter element (6) out of the housing assembly.

(*e*) Remove the center tube (7) and the retaining bolt (8) from the housing assembly.

(*f*) Lift the housing assembly (9) off of the base assembly (14) and remove the gasket (19).

(*g*) Remove the two pipe plugs (11) from the base assembly.

(*h*) Disassemble the other two housing assemblies as given in steps (*b*) through (*f*) above.

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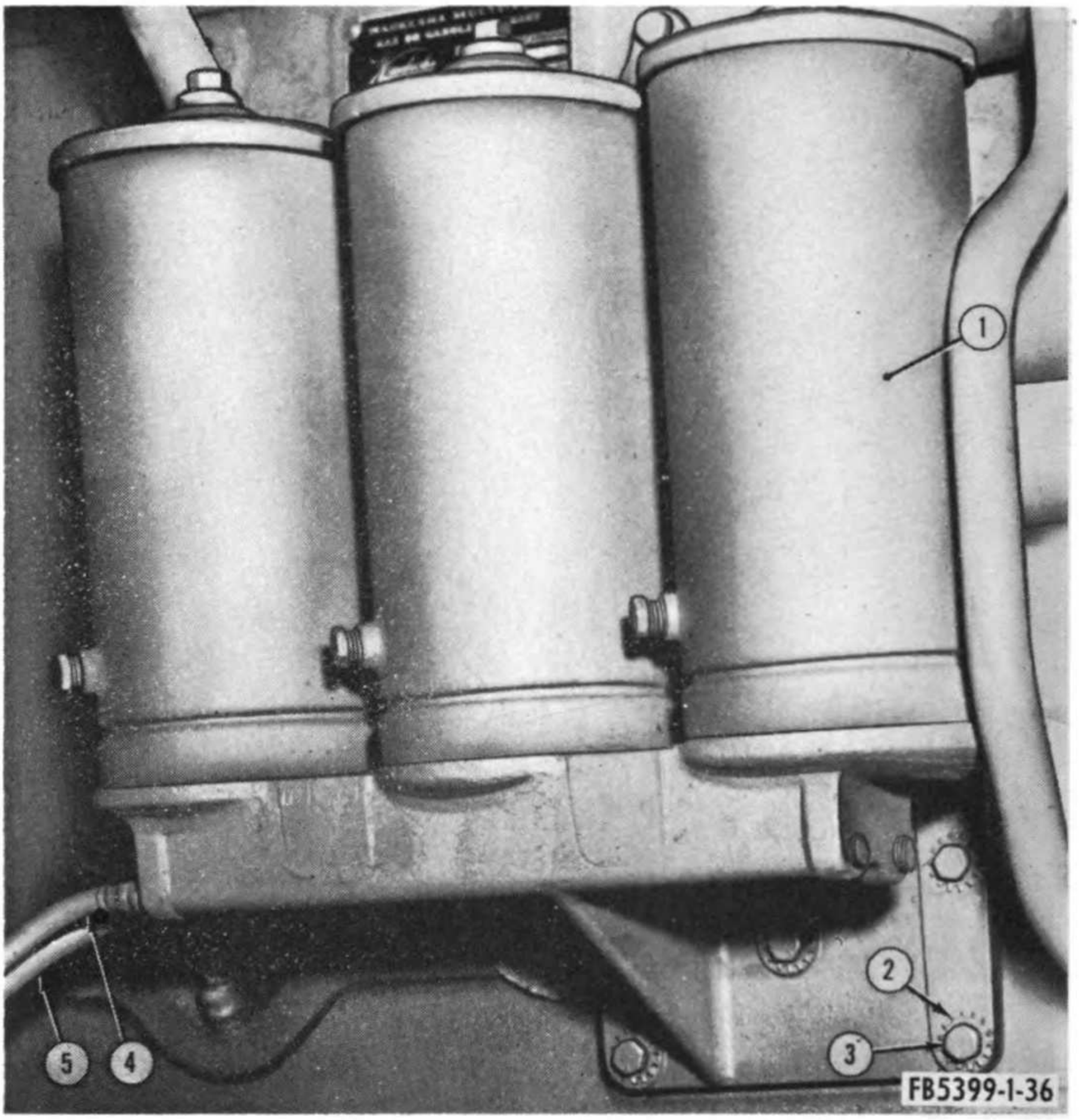

1 Oil filter assembly
2 Lockwasher
3 Cap screw
4 Oil outlet line
5 Oil inlet line

Figure 36. Oil filter mounting and removal points.

(3) *Cleaning and inspection.*

(*a*) Inspect the screws, center tubes, retaining bolts, drain plugs, pipe plugs, cap screws, base assembly fittings and oil line connections for stripped or damaged threads.

(*b*) Check to see that the gaskets have not deteriorated.

(*c*) Inspect the covers and housing assemblies for dents or out-of-round.

(*d*) Clean interior and exterior of housing assemblies, covers, and base assembly fittings and connectors with an approved cleaning solvent.

(*e*) Examine the cover springs and lockwashers for breakage.

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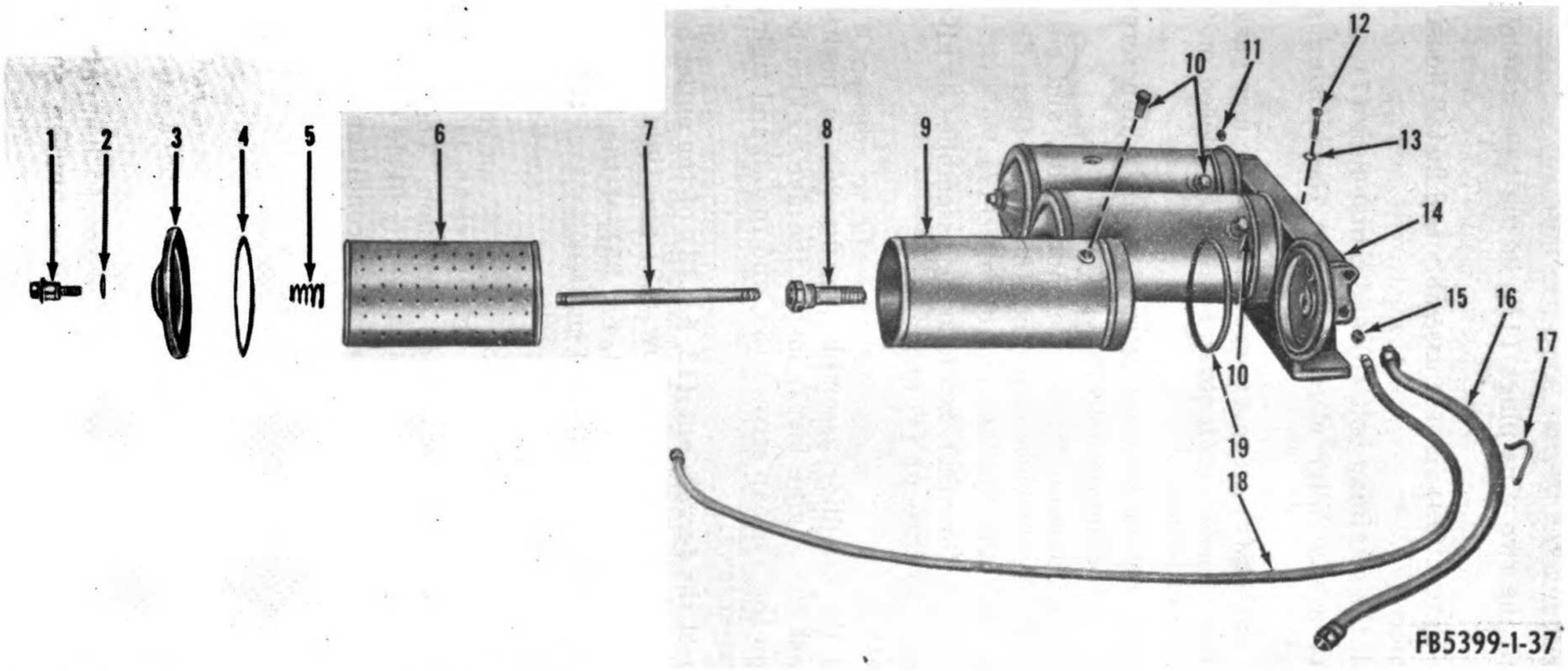

1	Screw, cover	6	Filter element	11	Pipe plug	15	Adapter
2	Gasket, cover screw	7	Center tube	12	Screw, cap, ⅜ x 1½ in NC (5 rqr)	16	Outlet hose
3	Cover	8	Retaining bolt			17	Hose clamp
4	Gasket, cover	9	Housing assembly	13	Lockwasher, ⅜ in (5 rqr)	18	Inlet hose
5	Spring, cover	10	Drain plug	14	Base assembly	19	Gasket, housing assembly

Figure 37. Engine oil filter assembly, exploded view.

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(4) *Reassembly.*

(*a*) Install the two pipe plugs (11) in the base assembly (14).

(*b*) Place gasket (19) in base assembly and install housing assembly (9).

(*c*) Install the retaining bolt (8) and center tube (7).

(*d*) Install a new filter element (6) in the housing assembly.

(*e*) Place gasket (2) on cover screw (1); place new gasket (4) in cover (3) with cover spring (5) placed on inside end of screw.

(*f*) Fit cover on the housing assembly and tighten screw, making sure the gasket is properly seated.

(*g*) Install the adapter (15), inlet hose (18), and outlet hose (17) in the base assembly. Install the three drain plugs (10) and the two hose clamps (17).

(*h*) Reassemble the other two housing assemblies as given in steps (*b*) through (*f*) above.

(5) *Installation.*

(*a*) Place the oil filter assembly (1, fig. 36) in position against the engine block, install the five lockwashers (2) on the five cap screws (3), and install and tighten the cap screws.

(*b*) Connect the ferrule nut (12, fig. 13) of the outlet hose (10) to the outlet hose elbow (13) and tighten.

(*c*) Connect the ferrule nut (3, fig. 35) of the inlet hose (4) to the adapter (5) and tighten.

34. Painting

a. General. The unit must not only be kept clean, but must be inspected for signs of chipped paint or corrosion. The housing and other exposed parts of the unit are especially likely to require touching up or repainting. Extreme weather conditions will accelerate the deterioration of the paint. Surface treatment and painting are to be performed in accordance with TM 9–2851.

b. Parts To Be Painted.

(1) When required, paint the housing, skid frame, radiator, engine, air receiver, knock-out bottles, drier assembly and accessories.

Caution: Use only a heat-resistent paint when painting the engine, exhaust manifold, pipes, muffler, and fittings.

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(2) Information and data plates may be coated with a clear lacquer.

c. Parts Not To Be Painted.

(1) Do not paint electrical contacts, terminal blocks, instruments, or threaded surfaces and sliding parts of control rods and linkages.

(2) Mark or mask all items to be protected.

Note. If accessory equipment has been removed from the unit, make sure that good ground contacts are established for radio suppression when the equipment is reinstalled. In some cases, it may be necessary to scrape off a small amount of paint.

Section III. PREVENTIVE MAINTENANCE SERVICES

35. General

The operator or crew of the compressor and the organizational maintenance personnel must perform their preventive maintenance services regularly, to make sure that the compressor operates well and to lessen the chances of mechanical failure.

36. Operator or Crew Maintenance

a. Inspections. Inspections must be made before operation, during operation, at halt, and after operation, as described in this section. All inspections of assemblies, subassemblies, or parts must include any supporting members or connections and must determine whether the unit is in good condition, correctly assembled, secure, or excessively worn. Any mechanical condition which may result in further damage to the unit must be corrected before the equipment is operated. (Refer to TM 5–505 for definition of inspection terms.)

b. Reporting Deficiencies. The operator will report all deficiencies on DD Form 110.

c. Before-Operation Services. The following services will be performed to determine if the condition of the equipment has changed since it was last operated, and to make sure the equipment is ready for operation. Any deficiencies must be corrected or reported to the proper authority before the unit is put into operation.

(1) *Location and installation.* Place the compressor as close as possible to the operating site, and in as level a position as possible. Connect the outside terminal strips in the junction box mounted on the compressor skid base.

(2) *Fuel.* Check the fuel supply in the gasoline tank. Add fuel if necessary. Check the reserve supply of fuel, and replenish, if necessary.

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(3) *Oil.* Check the oil level in the engine and compressor crankcase. Add oil if necessary. Check the oil level in the lubricator, and add oil if necessary. Disconnect the oil lines from the lubricator to the compressor cylinders, and operate each lubricator pump plunger by hand until all air is forced from the lines. Reconnect the lines and tighten them securely.

(4) *Coolant.* See that the coolant in the engine is up to the proper level. Add coolant if necessary. When filling a cooling system containing antifreeze, allow room for expansion.

(5) *Leaks, general.* Inspect the entire unit for leaks, paying particular attention to the engine cooling system, and to the fuel-line and lubricator connections. Look for signs of leaks under the compressor and engine. Repair all leaks, or report uncorrected leakage to the proper authority.

(6) *Visual inspection.* Make a visual inspection of the entire unit, checking for insecurely mounted, damaged, or missing parts. Make sure that all protective guards for belts, flywheel, exhaust pipe, and fans are in place. Inspect all wires and terminals for damage and loose connections. See that the battery is securely mounted. Correct all deficiencies, or report them to the proper authority.

(7) *Fire extinguisher.* Check the condition of the fire extinguisher, and check it for full charge and secure mountings.

(8) *Tools and equipment.* Check the condition of all tools and equipment and make sure they are cleaned and properly storaged. See that the toolbox is clean and securely mounted.

(9) *Starting precautions.* Start the engine, observing the procedures and cautions outlined in paragraph 17.

d. During-Operation Services. The operator is responsible for correcting or reporting unusual sounds or odors, deficiencies in performance, or other signs of abnormal operation. He will perform the following specific services.

(1) *Instruments and gages.* Check all instruments and gages frequently while the unit is in operation. At normal operating speed, after the warmup, the readings should be as follows:

Engine oil pressure	Approximately 35 psi
Battery-charging ammeter.	0, or slight charge

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Coolant temperature	140° F. to 180° F.
Engine tachometer	Approximately 1200 rpm
Operative drier pressure.	3500 psi, maximum
Inoperative drier pressure.	0
First-stage pressure	Approximately 50 psi
Second-stage pressure	Approximately 200 psi
Third-stage pressure	Approximately 880 psi
Fourth-stage pressure	Approximately 3500 psi
Compressor oil pressure.	Approximately 40 psi
Prefilter air temperature.	20° F. high than ambient air temperature, maximum.
Reactivator air temperature.	330° F., maximum
Instrument air supply pressure.	Approximately 20 psi

If any other readings are obtained, stop the engine and correct or report the condition responsible for the deficiency. Do not operate the unit until the failure or deficiency has been corrected.

(2) *Unusual operation and noises.* Check for any abnormal operation, such as the engine running at below-governed speed; the engine or compressor overheating; smoke coming from the engine or compressor; vibration in the compressor; failure of the compressor to deliver full volume; failure of the engine to respond to controls; or any unusual noise. Be sure that the mechanical lubricator is delivering the proper amount of oil. Check the operation of the reactivator pump, pump motor, and heating elements, making sure that the drain valves and the reactivator pump relief valve remain closed during operation. If any of the above deficiencies are noticed, stop the compressor immediately and correct the condition or report it to the proper authority.

(3) *Air leaks.* Check for leaks in the piping from or to the compressor stages, and in the driers, intercoolers, filters, air receiver, receiver connections, and automatic control system. If a leak is noticed, stop the compressor and correct the condition or report it to the proper authority.

(4) *Visual inspection.* Inspect all oil, water, and fuel lines and their connections for leaks during operation, but never attempt to clean, repair, or adjust parts while the

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engine is running. Correct all deficiencies or report them to the proper authority.

e. At-Halt Services. During halts, even for short periods, the operator should make a general check of the equipment and correct or report any deficiencies noted, in addition to performing the following specific duties.

(1) *Fuel.* Drain any water from the fuel system. Check the gasoline supply. Add fuel as required.

(2) *Oil.* Check the oil level in the engine and compressor crankcase and in the mechanical lubricator. Add oil if necessary.

(3) *Coolant.* Check the coolant level in the engine radiator. Add more coolant if necessary.

Caution: Never add cold water to the engine radiator when the unit has become overheated. Shut down operations and allow it to cool sufficiently to prevent serious damage to the water jackets and cylinders.

(4) *Leaks, general.* Check the entire system for leaks, especially in the fuel, oil, and coolant lines and connections. Look under the engine for signs of leakage.

(5) *Visual inspection.* Make a visual inspection of the entire unit, checking for badly worn, bent, cracked, or broken parts, and for loose or missing bolts, nuts, screws, pins, connections, and wires. Tighten or replace any parts found to be defective, or report them to the proper authority. If operating under extremely dusty conditions, inspect the air cleaners, and if necessary, service them according to LO 5–5399.

f. After-Operation Services. To insure that the equipment is ready to operate at any time, the following services must be performed by the operator or crew immediately after any operating period of eight hours or less. All deficiencies must be corrected or reported to the proper authority.

(1) *Shutdown precautions.* Turn the automatic throttle controller lever to the unload position, slow the engine to approximately 750 rpm, and allow the compressor to idle for about five minutes. Disengage the clutch, and idle the engine for a few minutes to cool it off before stopping it. Close the valves of the drier tower that has been on the line, and crack the reactivating air outlet valve to release the remaining air pressure to the atmosphere. Crank the blow-down valve located between the air lines filters and the receiver. After the pressure is

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released, close the blowdown valve and all drier control valves. Open the drain valves on the moisture knock-out bottles.

(2) *Fuel, oil, and coolant.* Fill the fuel tank with clean fuel. Check the oil level in the crankcases of the engine and compressor, and in the mechanical lubricator. Add oil if necessary. Check the level of the coolant in the engine radiator. Add coolant if necessary. Change the coolant if it is contaminated with rust or dirt. If antifreeze is added, run the engine for a short period to mix the antifreeze and coolant.

Caution: If no antifreeze is used, and freezing weather is expected, drain the engine coolant system radiator and engine block and leave the draincocks open.

(3) *Belts.* Check the engine and intercooler fan belts for proper tension. The belts should depress from one-half to three-fourths inch when light thumb pressure is applied midway between the pulleys.

(4) *Wiring.* Check all wiring for worn, cracked, or frayed insulation, broken wires, and loose or corroded connections.

(5) *Leaks, general.* Check the fuel, oil, and coolant lines and their connections for leaks. Repair or replace all defective parts, or report any uncorrected leakage to the proper authority.

(6) *Lubrication.* Lubricate the compressor in accordance with the instructions in the current LO 5–5399.

(7) *Clean equipment.* Wipe all accumulations of dust, sand, grease, and oil from the exterior of the unit. Inspect the engine radiator and its cooling fins and brush or blow out all accumulation of foreign matter.

(8) *Compressed air system.* Drain all water present in the compressed air system by opening the drain valves at the bottom of the moisture knock-out bottles. Clean the intercooler air intake screen.

(9) *Tools and equipment.* See that all tools and equipment assigned to the compressor are clean, in serviceable condition, and properly stowed or mounted. Report all unserviceable tools to the proper authority.

(10) *Air cleaners.* Check the air cleaners, paying particular attention to the amount and cleanness of the oil. If necessary, clean the air cleaners thoroughly and change the oil. Refer to the current lubrication order.

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(11) *Visual inspection.* Check for damage which may have occurred to the unit during operation. Correct all deficiencies noticed or report them to the proper authority.

(12) *Protection.* If the engine side panels have been removed, reinstall them. Cover the entire unit with a tarpaulin or other suitable covering making sure that it is tied down securely.

37. Maintenance Precautions

a. Correct or report all deficiencies that may result in damage to the compressor if it is permitted to continue in operation.

b. Be sure that the mechanical lubricator delivers the correct amount of oil to each cylinder during operation.

c. Great care must be given to the lubrication of the reactivator pump at all times.

d. Always build up or reduce air pressure in the compressor and drier slowly, to permit even expansion and contraction in the compressor, and to enable the activated alumina to adjusted to the changes in pressure.

e. Do not add water to a battery in subzero temperatures unless the battery is to be charged immediately.

f. If the engine overheats from lack of coolant, coolant should be added with engine running at slightly faster than idling speed.

g. Disconnect batteries before performing maintenance services on them, to avoid damage from accidently caused short circuits.

h. If a safety valve blows off, or if any automatic safety device stops the operation of the equipment, correct or report the condition causing the stoppage or blow-off before restarting.

i. Open each of the five moisture knock-out bottle drain valves at least once an hour or as often as necessary during compressor operation to release the moisture condensed after each compression stage.

j. Keep the reactivator pump and pump motor housings free of dust and dirt.

k. Make sure that general ventilation is adequate for proper operation of the compressor.

l. Never clean the pipeline air filters or other compressor parts with gasoline or any other flammable substance, as this may cause an explosion in the high-pressure air system.

m. Never operate the engine with the choke control out any longer than necessary.

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n. Never operate the compressor for extended periods of time without having all the shrouding in place.

o. Take extreme care when servicing the intercooler assemblies to avoid damaging or bending the fins and cooling coils.

p. Never operate the compressor when the crankcase oil temperature rises above 150° F.

q. Do not place a drier tower in service if, after reactivation and a normal cooling period, the temperature of the tower reads over 150° F.

r. Never operate the compressor at more than 10 degrees off true horizontal as this may cause undue wear on the bearings of the engine and compressor.

38. Organizational Maintenance

a. Organizational preventive maintenance is performed by organizational maintenance personnel, with the aid of the operator, at weekly and monthly intervals. The weekly interval will be equivalent to 60 hours of use. The monthly interval will be equivalent to 4 weeks, or 240 hours, of use, whichever occurs first.

b. The technical inspection column is provided for the use of personnel performing technical inspection, and constitutes the minimum inspection requirements for the equipment.

c. The preventive maintenance services to be performed at these regular intervals are listed and described below. The numbers appearing in the columns opposite each service refer to a corresponding number appearing on DA Form 464, and indicate that a report of the service should be made at that particular number on Form 464. These numbers appear in either second, third, or both columns, as an indication of the interval at which the service is to be performed.

Technical Technical	Services	
	Monthly	Weekly
1	1	1
2	2	2
3	3	----------

Before-operation services. Perform inspection and services listed in paragraph 36c.

Lubrication. Inspect the entire unit for missing or damaged lubrication fittings, and for indications of insufficient lubrication. Record the lubrication order number and its date of publication in the spaces provided.

Tools and equipment. Inspect the condition of all tools and equipment assigned to the compressor. Check the condition and mounting of toolboxes or compartments.

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Technical inspection	Services	
	Monthly	Weekly
		3
4	4	4
	4	4
5	5	5
6	6	6
	6	6
7	7	--------
11	11	11
	11	11
12	12	12

See that all tools and equipment assigned to the compressor are clean, serviceable and properly stowed or mounted.

Fire extinguisher. Check the carbon tetrachloride type for full charge and secure mounting. See that there are no signs of corrosion. Inspect the carbon-dioxide (CO_2) type for insecure mounting, kinked or damaged hose, and missing or broken seal. If the seal is missing or broken, the extinguisher should be weighed to determine the amount of charge. The empty and full weights are stamped on the body. Check the date of the last hydrostatic test stamped on the cylinder, just below the neck. The time elapsed should not exceed 5 years.

See that all extinguisher deficiencies are corrected or reported to the proper authority.

Publications. See that this technical manual TB 5–5399–1, the current lubrication order, and DA Form 285 are on or with the equipment and in serviceable condition.

Appearance. Inspect the general appearance of the equipment, paying particular attention to cleanness, legibility of identification markings, and condition of paint.

See that all deficiencies noticed are corrected or reported to the proper authority.

Modifications. See that all available modification work orders applying to this equipment have been completed and recorded on DA Form 478.

Cylinder head, manifold, and gaskets. Inspect the cylinder heads, manifolds, and exhaust pipes for cracks or indications of oil, water, or compression leaks around studs, cap screws, and gaskets.

Tighten all loose cylinder-head nuts, loose manifold assembly mountings, and exhaust-pipe connecting-flange nuts. If new gaskets are installed, tighten the nuts on the cylinder head three times as follows: First, upon installation; second, after the engine has warmed up; and third, after completing the first week of operation.

Valve mechanism. Check the valve-tappet adjustment if loss of power or excessive noise is noticed.

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Technical inspection	Services	
	Monthly	Weekly
	12	12	Adjust the valve-tappet clearance if necessary. Reinstall the valve cover, making sure that the valve-cover gasket makes an oiltight seal. Replace the gasket with a new one if necessary. Report uncorrected deficiencies to the proper authority.
14	14	14	*Crankcase and breather.* With the engine running at idling speed, inspect the crankcase for leaks. Check the condition, cleanness, and mounting of the crankcase breathers and their air-filtering caps.
	14	14	Correct or report all leaks noticed. If the breather caps are dirty, remove and clean them, then service them in accordance with the current lubrication order.
15	15	15	*Oil filters.* Check the oil filter assembly and its lines and connections for leaks while the engine is running.
	15	15	Service the oil filter as specified in the lubrication order. Always replace the gaskets when installing a new cartridges. After changing cartridges, check for leaks while the engine is running.
16	16	16	*Radiator.* Inspect the radiator for leaks, obstructions in core air passages, and loose mounting bolts. Check all cooling system hoses, lines, and connections for leaks, deterioration, and looseness. Inspect the cap and cap gasket. Check the operating temperature and condition of the coolant. If antifreeze is used, check the freezing point of the coolant, and record it on DA Form 464.
	16	16	Drain, flush, and refill the cooling system if the coolant is contaminated with rust or dirt, and also before and after using antifreeze. If the coolant is oily, report to the proper authority, and do not operate the engine until corrections have been made. Clean the core air passages. Tighten all loose mounting and pipe-connection bolts and nuts. Replace all damaged, defective, or missing cooling system parts, including hoses, and make sure that their clamps are tight. In cold weather, protect the coolant from freezing.
17	17	17	*Water pump, fan, and shroud.* Inspect the pump for leaks and see whether the fan blades are clean, in good condition, and properly secured to the hub. See that the

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Technical inspection	Services	
	Monthly	Weekly
	17	17
18	18	18
	18	18
19	19	19
	19	19
20	20	20
	20	20
38	38	38
	38	38

shroud is properly alined with the fan and that it is securely mounted.

If the pump leaks, replace it with a new or reconditioned one, (par. 87). Repair damaged fan blades and shroud. Tighten or replace loose or missing screws, nuts, and bolts.

Belts and pulleys. Inspect for badly worn, cracked, or frayed belts. Check the tension of the belts and the condition, mounting, and alinement of the pulleys. Make sure that the belts are not oil-soaked or slipping.

Realine the pulleys and secure their mounting if necessary. Replace the belts if they are frayed, oil-soaked, or badly worn (par. 91). If necessary, adjust the tension of the belts so that they can be deflected one-half to three-fourths inch from normal position by applying light thumb pressure midway between the pulleys.

Oil pump, pressure relief valve. Check the oil pump, the oil lines, and their connections for leaks. Take the oil-pressure reading and record it on DA Form 464.

Report all leaks and other deficiencies in connection with the oil pump, lines, and pressure to the proper authority.

Governor and linkage. Inspect the governor for undesirable looseness in mounting, absence of parts, and poor linkage action.

Replace missing parts. Tighten appropriately. If necessary, adjust the governor to meet varying load conditions and to eliminate surging or other improper operation (par. 80*d*). Report uncorrected deficiencies to the proper authority.

Fuel pump. Inspect the fuel pump and lines for leaks. Check for loose or missing mounting and assembly screws, bolts, and nuts. Check the sediment bowl for water, dirt, and tank residue.

Tighten or replace all loose or missing assembly and mounting screws, bolts, and nuts. Close the fuel shut off valve, and remove the bowl, gasket, and screen. Clean the sediment bowl and screen in an approved cleaning solvent (par. 75*b*). Dry the parts thoroughly and reinstall them, using a new gasket if necessary. Turn on the fuel shutoff valve,

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Technical inspection	Services	
	Monthly	Weekly
39	39	39
	39	39
41	41	41
	41	41
43	43	43
	43	43
44	44	44
	44	44
46	46	46
	46	--------

and recheck for leaks. If the pump is defective, replace it with a new or reconditioned one (par. 75*c* and *e*).

Carburetor and linkage. Inspect the carburetor for loose or missing mounting and assembly bolts, nuts, and screws. Check all connections for air or fuel leaks. Inspect the control linkages, including the choke and throttle shafts, for bent or badly worn parts. Check the flexibility and operation of the linkages. Tighten loose mounting and assembly bolts and screws. Repair or replace badly worn or damaged parts. Report uncorrected deficiencies to the proper authority.

Air cleaners. Remove the air cleaners. Inspect the condition of all gaskets, seals, clamps, and connecting hose or tubes, and of the cleaning elements, baffles, and bodies. Check the oil in the reservoir of the oil-bath cups for proper level and cleanness.

Service the air cleaner as specified in the current lubrication order.

Fuel tank. Inspect the fuel tank and its connections for leaks, insecure mounting, and bent, broken, loose, or missing parts. Examine the tank cap for defective seat or gasket, or a plugged vent hole. Check the fuel line and fittings for damaged, kinked, and leaky lines and connections and for loose supports.

Drain accumulated water and sediment from the fuel tank. Repair or replace leaky or damaged fuel lines, connections, fittings, and missing or damaged parts.

Fuel lines. Check the fuel lines for damage, leaks, loose connections, and insecure mounting.

Repair or replace damaged or collapsed fuel lines and parts. Tighten loose connections and mountings. Report all uncorrected deficiencies to the proper authority.

Spark plugs. Examine the spark plugs to see that their insulators are clean and in good condition, and there is no laekage around the insulators and gaskets. See that the wires from the magneto are properly connected to the plugs.

Remove the spark plugs and examine them for poor condition, broken insulators, carbon deposits, and electrodes which are burned thin.

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Technical inspection	Services		
	Monthly	Weekly	
			Replace unserviceable plugs. Report damaged insulators and burned electrodes and insulators, and check again, after cleaning, for cracks. If a plug cleaner is not available, install new or reconditioned plugs. Adjust gap as necessary by bending the side electrode. Install the plugs, using new gaskets. Avoid over-tightening which might damage or distort the plugs.
47	47	47	*Battery*. Inspect the battery case for cracks and leaks. Check the condition of all battery cables, terminals, bolts, posts, straps, and holddown clamps. Test the specific gravity and voltage, and record the readings on DA Form 464. Specific-gravity readings below needs recharging, or should be replaced. Check the level of the electrolyte. The correct level is three-eighths to one-half inch above the separators.
	47	47	Make a high-rate discharge test of the batteries to see that the cells are in satisfactory condition, taking care to make the test according to the instructions available with the condition test accompanying the test instrument. Normally a true test cannot be made if the gravity is below 1.225. If the difference in voltmeter readings obtained from the cells is more than 30 percent, replace the battery.
	47	47	Clean the battery and case. Repaint the case if it is corroded. Thoroughly clean the battery terminals, terminal bolts and nuts, and battery posts. Tighten all terminals and holddown clamps carefully to avoid damage to the battery. Grease the terminals lightly with chassis grease. If necessary, add distilled water to maintain the correct electrolyte level. See that the filler caps are tight, and that the vent holes are unobstructed.
48	48	48	*Generator, starter*. Check to see that the generator and starting motor are in good condition and securely mounted, and that their wiring and connections are clean, in good condition, and secure.
48	48	--------	Remove the generator and starting-motor inspection covers and see that the commutator brushes are in good condition, are free in their holders, and have sufficient spring tension to hold them in contact with the commutators, (pars. 96*f* and 98*c* (6)). See that the

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Technical inspection	Services	
	Monthly	Weekly
		48
49	49	----------
	49	----------
50	50	50
	50	50
51	51	51
		51
	51	----------

brush connections are secure and not frayed. Check the holders for cracks.

Clean the commutator ends of the generator and starting motor by blowing out any dirt or residue with compressed air, if available. If the commutator is dirty, clean with grade No. 00 sandpaper only, and blow out the dust with compressed air if available. Tighten the generator and starting-motor mounting bolts securely.

Magneto. Determine whether the magneto is in good condition and securely mounted. Check to see whether there is evidence of oil leaks at the mounting pad gaskets. Remove the breaker-point inspection cover and check to see that the points are well alined, and free of oil, lint, and dust; that the mating surfaces engage squarely; that point gaps are correctly adjusted; that the fulcrum-pin bearing hole is clear; and that the end of the fulcrum pin is polished.

Replace unserviceable breaker points and adjust the magneto breaker-point gaps (par. 99*e*). Free the contact points of oil, lint, or grease, and aline them, if necessary, so that the full surfaces of both contacts meet flush. Clean pitted contacts on a suitable stone.

Wiring and switches. Inspect the condition of all wiring, paying particular attention to oil-soaked, cracked, or frayed insulation, broken wires, and loose or corroded connections. Check the operation of all switches.

Replace defective wires and switches. See that all wiring is clean and that the connections are clean and tight.

Voltage regulator. Check the voltage regulator for proper operation, secure mounting, dirty or loose connections, and missing parts.

Replace the regulator if it works improperly (par. 97*c* and *d*). Tighten or replace all loose or missing mounting bolts. Clean and tighten all wire connections.

To test the voltage regulator, warm up the equipment to normal operating temperatures, connect the low-voltage circuit tester, and observe whether the voltage

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inspection inspection	Services	
	Monthly	Weekly
57	57	57
	57	57
58	58	58
	58	58
62	62	62
	62	62
71	71	71
	71	71
72	72	72

regulator and cutout control the generator output properly. Replace the regulator if the test shows faulty operation.

Gages. See that all gages operate properly and are securely mounted, and that all connections are tight. Check the readings to see that they are within the proper operating limits. Check for cracked or broken glass and loose or missing mounting screws.

Tighten or replace loose or missing mounting screws. Replace damaged or defective gages.

Meters. Inspect all meters for cracked or broken glass, loose mounting screws, and defective operation.

Tighten or replace loose or missing mounting screws. Replace damaged or defective meters.

Levers, rods and linkage. See that the engine speed-control lever, choke lever, clutch lever, the automatic throttle controller lever, and their linkages are in good condition. Check for proper adjustment; badly worn, cracked, or missing parts; and loose or missing screws, nuts, washers, and cotter pins.

Repair or replace badly worn, bent, or cracked parts. Tighten or replace washers, screws, nuts, and cotter pins. Adjust levers and linkages for proper operation.

Engine speed controller. Inspect the engine speed controller for loose or missing mounting and assembly bolts, nuts, and screws. Check all connections for air leaks. Inspect the control linkage for bent or badly worn parts. Check the flexibility and operation of the linkage.

Tighten loose mounting and assembly bolts and screws. Repair or replace badly worn or damaged parts. Report uncorrected deficiencies to the proper authority.

Oil-pressure safety switch. Inspect the oil-pressure safety switch for loose or missing mounting and assembly screws and nuts. Inspect the piping for leaks, loose connections, cracks, and breaks. Check for loose wiring connections, cracked or frayed wiring insulation, corroded terminals, and

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Technical inspection	Services	
	Monthly	Weekly
	72	72
80	80	80
	80	80
84	84	84
	84	84
95	95	95
	95	95
110	110	110

loose or missing nuts and screws. Check the switch for proper operation.

Tighten or replace all loose and missing mounting and assembly screws and nuts. Tighten all loose piping connections and repair or report to the proper authority all cracks, leaks, or breaks. Replace defective wiring and tighten all loose connections, nuts, and screws. Replace the switch if it is defective (par. 103).

Frame. Inspect the compressor skid base to see that it is in good condition. Check the I-beams and deck plates for cracks, breaks, and broken welds.

Repair or report to the proper authority all cracks, breaks, or broken welds in the skid base.

Hood and side panels. Inspect the hood, side panels, rear panel and tracks for secure mounting, and for cracks, breaks, and other damage. See that the side panels slide easily in their tracks, and that the handles are securely mounted.

Tighten or replace all loose or missing mounting bolts, nuts, and cap screws. Repair or report to the proper authority all cracks, breaks, or other damage in the hood, side panels, rear panel, and track. Tighten or replace loose side panel handles, and repair or report to the proper authority all other deficiencies (par. 119).

Clutch. Check the operation, adjustment, and condition of the clutch. See that it engages and disengages freely, holds securely when engaged, and does not drag when disengaged. Inspect the clutch housing for cracks and damage.

Adjust the clutch if necessary (par. 121). Be sure that the clutch lever is set within specified limits. If the clutch has reached the limit of its adjustment, or if it is cracked or damaged, report the condition to the proper authority.

Drive coupling. Inspect the drive coupling for loose bolts and nuts, worn or broken flexible disks, and cracked or damaged coupling hubs or the flexible float member. Check the cover guard for mounting, cracks, breaks, and other damage.

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Technical inspection	Services		
	Monthly	Weekly	
	110	110	Tighten or replace all loose coupling bolts and nuts. Repair or replace all worn or broken flexible disks. Repair or replace the flexible float member, if necessary. Tighten all cover-guard bolts, and repair any cover-guard damage or report it to the proper authority.
133	133	133	*Compressor shrouding.* Inspect the compressor shrouding for loose or missing mounting cap screws, misalinement of the plates, and bent, broken, or damaged plating. Check the air inlet screens for broken or bent wire mesh and for obstructions in the air passages.
	133	133	Tighten or replace all loose or missing cap screws. Repair or replace all bent, broken, or damaged plating (pars. 124 and 125). Aline the plating if necessary. Remove all obstructions in the air inlet passages and repair or replace all bent or broken wire mesh screens. Report all uncorrected deficiencies to the proper authority.
134	134	134	*Air intake filter.* Remove and disassemble the air intake filter. Inspect the element for cleanness and for proper operating conditions.
	134	134	Wash the element and other parts in hot soapy water. Rinse the parts in clean water. After the filter element is completely dry, dip it in compressor crankcase oil and allow it to drain before placing it in the filter bowl. Reassemble and reinstall the element, and tighten all connections.
135	135	135	*Pipe line, air filters.* Check the pine line air filters for insecure mounting, leaks, and loose or missing assembly nuts, bolts, and parts. Inspect the filter elements for accumulation of dust and oil. Check the piping for cracks, breaks, loose connections, and other damage.
	135	135	Clean the pipe line air filter elements if necessary (par. 137*d*). Tighten or replace all loose or missing mounting and assembly bolts and nuts. Repair or report all leaks to the proper authority. Tighten all loose connections in the piping, and report all cracks or breaks to the proper authority.
136	136	136	*Knock-out bottles, drain valves, and piping.* Inspect the knock-out bottles for secure

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Technical inspection	Services	
	Monthly	Weekly
	136	136
137	137	137
	137	137
138	138	138
	138	138
139	139	139
	139	139

mounting, leaks, and signs of corrosion. Check the drain valves for proper operation, and for leaks. Check the piping for cracks, breaks, loose connections, and damage.

Tighten or replace all loose or missing mounting bolts and nuts. Repair or report all leaks to the proper authority. Repair or replace all drain valves if they are defective (par. 147). Tighten all loose connections in the piping, and report all cracks and breaks to the proper authority.

Oil pump and accessory drive. Inspect the oil pump and accessory drive for loose and missing mounting bolts and cap screws, and for oil leaks. Check the flexible coupling for signs of wear and misalinement. See that the oil pump is delivering the proper pressure. Check the pipings for cracks, breaks, loose connections, and damage.

Tighten or replace all loose or missing mounting bolts and cap screws. Repair or report to the proper authority all oil leaks. If the coupling is worn or out of line, or if the oil pump is not delivering the proper pressure, repair or report the condition to the proper authority. Tighten all loose connections in the piping and report all cracks and breaks to the proper authority.

Oil filter. Check the oil filter and its lines and connections for leaks while the compressor is running.

Service the oil filter as specified in the lubricating order. Always replace the gasket when installing a new cartridge. After changing the cartridge, check for leaks while the compressor is running.

Air receiver and piping. Inspect the air receiver for loose and missing mounting U-bolts and nuts, and inspection plate studs and nuts. Check the receiver for cracks, breaks, and signs of corrosion. Inspect the piping for cracks, breaks, loose connections, and damage.

Tighten or replace all loose and missing mounting and inspection plates, U-bolts, studs, and nuts. Tighten all loose connections in the piping, and report all cracks, breaks, and signs of corrosion in the piping and receiver to the proper authority.

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Technical inspection	Services		
	Monthly	Weekly	
140	140	140	*Belts and pulleys.* Inspect for badly worn, cracked, or frayed belts. Check the condition, mounting, and alinement of the pulleys, and the tension of the belts. Make sure that the belts are not oil-soaked or slipping.
	140	140	Realine the pulleys and secure their mounting if necessary. Replace the belts if they are frayed, oil-soaked, or badly worn. If necessary, adjust the tension of the belts (par. 126*b*), so that they can be deflected one-half to three-fourth inch from normal position by applying light thumb pressure midway between the pulleys.
142	142	142	*Intercoolers, aftercoolers, oil coolers, fans, and shrouds.* Inspect the intercoolers, aftercoolers, oil coolers, fans and shrouds for loose or missing mounting and assembly bolts, nuts, and cap screws; and for leaks, cracks, breaks and other damage. Check all piping for breaks, cracks, loose connections, and damage. Inspect for leaks at the cooler headers. See whether the fan blades are clean, in good condition, and properly secured to the hub. See that the shrouds are properly alined with the fans, and that they are securely mounted. Inspect the coolers for obstructions in the core air passages. Inspect the baffle plates for cracks, breaks, and other damage. See that the entire assembly is securely mounted on the skid base.
	142	142	Tighten or replace all loose and missing mounting and assembly bolts, nuts, and cap screws. Repair or replace damaged fan blades, shrouds, and baffle plates. Clean the core air passages if necessary, by blowing through them with compressed air. Tighten or replace all loose or missing assembly mounting nuts. Tighten all loose piping connections, and report all cracks, breaks, and other damage to the proper authority. If leaks are noticed in the cooler assemblies, repair or report the condition to the proper authority.
143	143	143	*Mechanical lubricator.* Inspect the mounting bracket and housing for cracks, breaks, and other damage. Check for loose or missing mounting bolts and nuts, and assembly screws, and drain plug. Inspect the priming

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Technical inspection	Services	
	Monthly	Weekly
		plungers for secure mounting and proper operation. Inspect the sight-lever glass and the sight-flow glasses for leaks, cracks, and other damage. Inspect all piping for loose connections, leaks, kinks, cracks, and damage.
		Check the housing cover, pump-valve assemblies, drive gear housing covers, and cam shaft for leaks at the gaskets. Inspect the drive gear housing for loose or missing assembly screws, and for cracks, breaks, and other damage. Inspect the six pumps for proper operation by observing flow through the sight-flow glasses.
143	143	Tighten or replace all loose or missing mounting bolts, nuts, assembly screws, and drain plug. Repair all leaks in the sight-level and sight-flow glasses, and replace defective glasses. Tighten all loose piping connections. Replace all damaged piping. Replace the gaskets if there are leaks at the housing cover, pump assemblies, cam shaft, or gear housing cover gaskets. Adjust the pumps so that they deliver three or four drops of oil per minute. If they cannot be adjusted, report the condition to the proper authority. Repair all cracks, breaks, or other damage to the mounting bracket, housing, and driver gear housing, or report them to the proper authority.
144	144	*Discharge-inlet valves.* Inspect the discharge-inlet valves for proper operation. Deficiencies in compressor operation which may indicate defective valves include slowness in building up maximum air pressure; failure to deliver the rated volume of air; abnormal compression stage pressures; and a tendency for the air to blow back through the air cleaner.
	144	Correct any deficiencies noticed, or report them to the proper authority.
145	145	*Automatic discharge unloading system.* Inspect the automatic discharge unloading assembly for loose or missing mounting bolts and nuts, and for cracks, breaks and other damage. Inspect the unloader valve, unloader valve positioner, unloader pilot valve, regulator valve, and filter regulator valve for loose or missing mounting and assembly

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Technical inspection	Services		
	Monthly	Weekly	
			bolts, nuts, and cap screws, and for leaks, cracks, breaks, and other damage. Inspect the pressure gage for proper operation and secure mounting. Check all piping for loose connections, cracks, breaks, leaks, and kinks. See that the control system operates properly and unloads the compressor at 3500 psi.
	145	145	Tighten or replace all loose or missing mounting and assembly bolts, nuts, and cap screws. Repair or report to the proper authority all cracks, breaks, and leaks, in the unloading system. Tighten all loose piping connections (par. 148) and repair or report to the proper authority all defective piping. Adjust the system so that the compressor is unloaded at 3500 psi. If it cannot be adjusted, report condition to the proper authority.
146	146	146	*Cylinders, heads, gaskets, piping, and vent oil breathers.* Inspect the air cylinders, guide cylinders, and heads for loose or missing mounting studs and nuts; for cracks, breaks, and leaks; and for leaky gaskets. Inspect the condition, cleanness and mounting of the vent oil breathers. Check the dust covers for insecure mounting and for damage.
	146	146	Tighten or replace all loose or missing mounting studs and nuts. Replace all defective gaskets. Repair all cracks, breaks, and leaks in the heads, cylinders, and piping, or report them to the proper authority. Tighten or replace all loose or missing dust-cover mounting cap screws. Repair all damaged dust covers or report them to the proper authority. If the breathers are dirty, service them as outlined in the current lubrication order.
147	147	147	*Piston rods and packing glands.* Remove the dust covers, and inspect the piston rods for scoring and misalinement. Check the packing glands for leaks.
	147	147	Report all packing gland leaks and all scored or misalined piston rods to the proper authority.
148	148	148	*Crankcase, thrust bearing, and breather.* Inspect the compressor and thrust bearing mounting studs and nuts for looseness and damage. Check for leaks at the thrust bearing housing and accessory drive ends of the

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Technical inspection	Services	
	Monthly	Weekly
	148	148
211	211	211
	211	211
	212	212
		212
213	213	213

crankcase. Check the condition, cleanness, and mounting of the crankcase breather and its air-filtering cap.

Tighten or replace all loose or missing mounting studs and nuts, and report all cracks, breaks, and other damage to the proper authority. Correct or report all leaks noticed. If the breather cap is dirty, remove and clean it, then service it in accordance with the current lubrication order.

Drier, control valves, and piping. Check the drier for loose and missing mounting bolts and nuts; for bent, cracked, or broken frame members; and for breaks and cracks in welds. Inspect all piping for rust, and to see that it is properly supported and tightly connected. Check the control valves for proper operation, and for leaks at the packing glands and connections. Check the flexible air hoses for loose connections, cracks, and breaks.

Tighten or replace all loose or missing mounting bolts and nuts. Repair or report to the proper authority all cracked, bent or broken frame members, or breaks in welded joints. Remove all rust and replace badly pitted piping. Tighten or replace all loose or damaged piping connections and flexible air hoses, or report them to the proper authority. If the control-valve packing glands leak, tighten the glands and add to or replace the packing as necessary. Tighten all loose or damaged valve connections or report them to the proper authority.

Prefilter. Inspect the prefilter for loose or missing mounting bolts and nuts, and for leaks. Inspect the piping and drain and fill plugs for loose connections, cracks, and braeks. Inspect the assembly for cracks and breaks in welds.

Tighten or replace all loose or missing mounting bolts and nuts. Tighten all loose pipe connections and plugs, or report them to the proper authority. Repair or report to the proper authority all leaks, cracks, or breaks, or breaks in welded joints.

Gages and thermometers. See that all gages and thermometers operate properly and are

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Technical inspection	Services	
	Monthly	Weekly
			securely mounted, and that all connections are tight. Check the readings to see that they are within the proper operating limits. Check for cracked or broken glass and loose or missing mounting screws.
	213	213	Tighten or replace all loose or missing mounting screws, and tighten all loose piping connections. Replace broken or damaged glass, and damaged or defective gages.
214	214	214	*Safety, pressure-retaining, and check valves, and piping.* Inspect the safety, pressure-retaining, and check valves for proper operation, leaks, and secure mounting. Check the piping for loose connections, leaks, cracks, and breaks, and for loose mounting brackets.
214	214	214	Tighten all loose piping connections, mounting brackets, and valve mountings (par. 146). Repair or report to the proper authority all defective valves.
215	215	215	*Reactivator blower and relief valve.* Inspect the reactivator blower for loose or missing mounting and assembly cap screws. Check the packing gland for leaks. Inspect the flexible coupling for alinement, cracks, breaks, and looseness on the shaft. Inspect the piping for loose connections, leaks, cracks, and breaks. Check the relief valve for proper operation, leaks, and secure mounting. Check the flowmeter for secure mounting and proper operation. Inspect the discharge bleeder valve for proper operation and leaks.
	215	215	Tighten all loose or missing mounting and assembly cap screws. Tighten the blower and discharge bleeder valve packing glands, and add to or replace packing as necessary. Repair or report to the proper authority a defective flexible coupling. Tighten all loose piping connections and repair or report to the proper authority all cracks, leaks, or breaks in the piping, flowmeter, and relief valve. Repair or replace a defective discharge bleeder valve.
216	216	216	*Air filter.* Remove the air filter glass jar and inspect the cover and jar for cracks, breaks, and defective threads. Check the condition of the retaining ring, filter element, and wire mesh screen. Inspect the piping for loose connections, leaks, cracks and breaks.

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Technical inspection	Services	
	Monthly	Weekly
	216	216
		Wipe out the jar and cover with a line-free cloth. Replace the cloth filter element and repair or replace all defective parts (par. 129). Tighten all loose piping connections and repair or report to the proper authority all cracks, breaks, and leaks. Reinstall the filter glass jar.
217	217	217
		Reactivator blowing motor. Inspect the blower motor for secure mounting, loose wiring connections, cracked or frayed wiring insulation, corroded terminals, and loose or missing nuts and screws. Check for signs of inadequate lubrication.
	217	217
		Tighten or replace all loose or missing mounting bolts. Replace defective wiring, and tighten all loose connections, nuts, and screws. Add lubrication in accordance with the current lubrication order, if necessary. Report all uncorrected deficiencies to the proper authority.
218	218	218
		Heating elements. Inspect the external heating element covers for loose or missing screws, and for cracks, breaks, and bent or damaged parts. Inspect the internal heating element pipe cap covers for cracks, breaks, and damaged threads. Check for loose wiring connections, frayed or cracked insulation, and loose or missing screws and nuts. See that the elements, thermostats, and thermal controls operate properly and are securely mounted.
	218	218
		Tighten or replace all loose or missing cover screws. Repair or report to the proper authority all cracked, broken, bent, or damaged covers, and all damaged pipe cap cover threads. If the thermostats, heating elements, or thermal controls are not operating properly, correct the deficiency or report it to the proper authority. Replace defective wiring, and tighten all loose connections, nuts, and screws.
219	219	219
		Reactivator-blower switch, heating element switches, circuit breakers, and terminal control boxes. Inspect the switches, circuit breakers, and control boxes for loose or missing mounting and assembly bolts, nuts, and screws, and for cracks, breaks, and other damage, particularly in the covers.

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Technical inspection	Services	
	Monthly	Weekly
	219	219

Check the switches and circuit breakers for defective operation, and for loose wiring connections, cracked or frayed wiring insulation, corroded terminals, and loose or missing nuts and screws. Inspect all wiring conduit for loose connections, cracks, and breaks.

Tighten or replace all loose or missing mounting and assembly bolts, nuts, and screws. Repair all cracked, broken, or damaged covers. Replace defective wiring and tighten all loose connections, nuts, and screws. Repair or report to the proper authority all loose connections, cracks, and breaks in the wiring conduit. Replace the blower and heating element switches if they are defective. Report all uncorrected deficiencies to the proper authority.

Section IV. TROUBLESHOOTING

39. Use of Troubleshooting Section

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the compressor or any of its components. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause.

40. Engine Fails to Start

Probable cause	*Possible remedy*
No fuel in tank	Fill the tank.
Shut-off valve closed	Open shut-off valve.
Fuel tank cap vent hole plugged	Clean vent hole.
Spark plugs fouled	Remove and clean (par. 100).
Clutch engaged	Disengage clutch.
Oil pressure safety switch in OFF position.	Turn switch to ON position.

41. Engine Stops

Probable cause	*Possible remedy*
Out of fuel	Fill fuel tank.
Dirty gasoline	Clean tank and strainer.
Air vent hole in cap plugged	Open cap vent hole.
Oil pressure safety switch grounds magneto.	Repair or replace switch if defective (par. 103).

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42. Clutch Slips

Probable cause	*Possible remedy*
Worn clutch facings	(*)
Sticking clutch sleeve	(*)
Worn clutch springs	(*)
Clutch out of adjustment	Adjust clutch (par. 121).

43. Clutch Chatters

Probable cause	*Possible remedy*
Sticking clutch sleeve	(*)
Oily or burned clutch	(*)
Broken clutch spring	(*)

44. Clutch Grabs

Probable cause	*Possible remedy*
Oil or grease on clutch facings	(*)
Worn clutch driving plate	(*)

45. Compressor Loses Capacity

Probable cause	*Possible remedy*
Compressor not operating at normal speed.	Check engine rpm reading and adjust.
Air intake filter dirty or clogged	Clean filter (par. 33*h*).
Compressor cylinder valve leaking or broken.	(*)
Broken or excessively worn piston rings.	(*)
Cylinder or cylinder liner walls excessively worn.	(*)
Leaking coolers	(*)
Excessive clearances in cylinder assemblies, particularly in first stage.	(*)
Leakage from piping	Locate leak and replace piping.

46. Air Stream Drawn Back Into Intake Header

Probable cause	*Possible remedy*
Broken or defective first-stage intake valve springs.	(*)
Defective first-stage valve disk or seat.	(*)

47. Dirty Intake and Discharge Valves

Probable cause	*Possible remedy*
Dirty air intake filter	Clean filter (par. 33*h*).
Excessive cylinder oilflow rate	Adjust flow of mechanical lubricator par. 33*k*).

48. Above Normal Outlet Air Temperature

Probable cause	*Possible remedy*
Cooler fans operating too slowly	Check fan-belt tension and adjust if necessary (par. 126*b*).

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Probable cause	*Possible remedy*
Air flow past cooling coils obstructed	Remove cooler baffle plates or clean out foreign matter from around the coils.

49. Above Normal Crankcase Oil Temperatures

Probable cause	*Possible remedy*
Faulty oil cooling by oilcooler sections because of obstructions in oil lines.	(*)
Cooler fans operating too slowly	Check fan-belt tension and adjust (par. 126*b*).
Air flow past oil-cooling coils obstructed.	Remove cooler baffle plates or clean out foreign matter from the coils.
Defective oil temperature gage	Repair or replace gage (par. 132*b*).
Low oil pressure	Perform corrective action outlined in paragraph 50.

50. Low or Erratic Crankcase Oil Pressure

Probable cause	*Possible remedy*
Leakage in oil piping or connection	Tighten connections and repair or replace defective connections and piping.
Excessively worn crankcase oil pump	(*)
Ruptured oil lines	Replace oil line.
Crankcase oil level too low	Add oil to bring level up to safe operating minimum.
Dirty or faulty crankcase oil filter	Replace oil filter cartridge (par. 33*g*), and inspect inlet and outlet of filter casing.
Clogged oil lines	Detach and blow out oil lines.
Oil pressure relief valves faulty	Remove and clean or replace relief valves.
Defective oil-pressure gage	Check and repair or replace oil-pressure gage (par. 132).
Excessively worn bearings	(*)
Clogged or defective crankcase oil strainer.	(*)

51. Excessively High Crankcase Oil Pressure

Probable cause	*Possible remedy*
Faulty oil pump	(*)
Faulty oil pressure safety relief valves.	(*)

52. Excessively High Crankcase Oil Consumption

Probable cause	*Possible remedy*
Defective or rupture oil piping, or loose connections allowing oil to leak.	Replace piping, and replace or tighten loose connections.

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Probable cause	*Possible remedy*
Defective gaskets and seals on crankcase oil pump, accessory drive components, and other components mounted on compressor crankcase.	(*)
Improperly or loosely mounted components.	Tighten loose mounting bolts. Remove and remount component.
Improper grade of lubricating oil used in compressor crankcase.	Drain oil from crankcase, and fill with oil specified in the current LO 5–5399.

53. Groaning Noises During Normal Compressor Operation

Probable cause	*Possible remedy*
Cylinder or cylinders need lubrication	Adjust mechanical lubricator (par. 33*k*).
Main bearings and connecting rod bearing need lubrication.	See corrective action for low or insufficient oil flow (par. 50).
Cooler fan-belt driver or idler needs lubrication.	Check idler and fan drives and lubricate if necessary.

54. Pounding Action Noises During Normal Compressor Operation

Probable cause	*Possible remedy*
Excessively worn main or connecting rod bearings.	(*)
Loosely mounted components	Locate and tighten loose parts.
Improper piston-to-discharge valve seat clearance.	(*)
Defective crosshead or crosshead guide	(*)

55. Excessive Pressure in Drier Tower

Probable cause	*Possible remedy*
Drier tower air outlet valve closed	Open valve.
Pressure-retaining valve defective or out of adjustment.	(*)

56. High Air Pressure Safety-Relief Valves Blow Off

Probable cause	*Possible remedy*
Both drier towers taken out of service at the same time.	Open one or both drier tower air inlet valves.
Compressor supply valve closed	Open valve.

57. Reactivator Air Safety Relief Valve Blows Off

Probable cause	*Possible remedy*
Reactivating air inlet and/or outlet valve not open on drier tower being reactivated.	Open appropriate valve.
High pressure air leaking into tower which is to be reactivated.	Close the drier tower air inlet and outlet valves tightly.

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58. Reactivating Air Not Flowing From Outlet to Atmosphere

Probable cause	*Possible remedy*
Reactivator pump motor switch not turned on.	Turn on switch.
Dirty or clogged air cloth bag filter on pump.	Change air cloth bag filter.
Reactivating air discharge valve not open.	Open reactivating air discharge valve.

59. Drier Tower Does Not Heat During Reactivation Cycle

Probable cause	*Possible remedy*
Electric heating element switch not turned on.	Turn on electric switch.
Outside power source failure or disconnected.	Check power source, and have it turned on.
Circuit breaker not turned on	Turn on circuit breaker switch.
Defective heating elements	(*)
Loose or disconnected terminal connection.	Tighten or connect terminals.

60. Desiccant Sample From Prefilter Dark Brown or Air Discharge From Receiver Not Sufficiently Dried

Probable cause	*Possible remedy*
Prefilter or desiccant needs replacement.	Remove desiccant from prefilter and recharge with vapoilsorb (par. 135).
Drier tower desiccant needs reactivation or replacement.	Reactivate desiccant, or replace if necessary (par. 134).

61. Reactivator Pump Motor Overheats

Probable cause	*Possible remedy*
Defective motor	Check motor and replace (par 128). (*)
Dirty cloth filter obstructing air flow	Replace filter (par. 129).
Defective reactivator pump	(*)
Air flowmeter clogged with dirt	(*)

62. Inadequate Cylinder Lubrication

Probable cause	*Possible remedy*
Incorrect adjustment	Adjust cylinder lubricating pump for proper oil flow (par. 33*k*).
Low oil level in lubricator reservoir	Check level in reservoir and add necessary oil.
Air in cylinder oil lines	Disconnect lines and bleed off the air.
Pumping units not primed before compressor placed in operation.	Prime each pumping unit.
Clogged cylinder oil lines	Disconnect lines and blow out with low pressure air.

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Probable cause	*Possible remedy*
Sight-feed glass chamber is completely filled with water-glycerine solution, preventing formation of oil packet inside chamber.	Drain small amount of glycerine solution from sight-feed chamber; operate priming plunger manually to force oil into lines after oil has accumulated at top of chamber.

63. Cylinder Pumping Units Not Delivering Oil to Cylinders

Probable cause	*Possible remedy*
Dirt particles lodged on seat of stainless steel ball-check valve not allowing valve to check back oil pressure.	Drain reservoir and clean reservoir and oil lines. Refill reservoir with clean oil.
Ball-check valves installed in reverse position.	(*)

64. Unloader Valve Operating Improperly

Probable cause	*Possible remedy*
Diaphragm ruptured or no longer pliable.	(*)
Packing gland too tight	Loosen gland.
Inner valve not seating properly	(*)
Stuffing box leaking	(*)
Unloader valve control assembly set improperly.	(*)
Instrument air supply too high or too low.	(*)

65. Unloader Pilot Valve Assembly Operating Improperly

Probable cause	*Possible remedy*
Leaks in lines and fittings	(*)
Instrument air supply too high or too low.	(*)
Unloader pilot valve assembly set improperly.	(*)
Magnet covered with dirt or iron particles.	(*)
Snap-acting flapper not seating properly against orifice block.	(*)
Magnet holding flapper off the orifice when on maximum adjustment.	(*)
Orifice partially plugged	(*)

66. Throttle Controller Mechanism Operating Improperly

Probable cause	*Possible remedy*
Strainer in four-way pilot valve clogged.	(*)
Instrument air supply too high or too low.	(*)

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Probable cause		*Possible remedy*
Linkage improperly adjusted or loose, broken or missing parts.	(*)	
Lever bearing in pilot body defective	(*)	
Piston cup leather in power cylinder excessively worn.	(*)	
Broken or weak pressure, compensating, pusher post, or lever bearing springs.	(*)	
Defective bellows assembly	(*)	
Leaking or defective piping and connections.	(*)	

Section V. RADIO SUPPRESSION

67. Definition of Suppression

Radio noise suppression is the elimination or minimizing of compressor and engine electrical equipment disturbances within the equipment which interfere with radio reception and disclose the location of the compressor unit and its associated components to sensitive electrical detectors.

68. Source of Interference

Spark plugs, high-tension wires form the magneto to the spark plugs, magneto breaker points, ac and dc generators, switches, regulators, and poor electrical joints between adjacent parts on the engine-compressor frame are sources of electrical interference.

69. Methods Used to Suppress Interference

In this compressor set, capacitors, bonding, and shielding are used to suppress radio interference.

a. Capacitors. Metal-foil capacitors are attached to the point of a circuit at which a spark occurs, for the purpose of conducting the interfering voltage to ground.

b. Bonding. Bonding is accomplished by internal-external toothed lockwashers and bond straps, connected to the frame of the unit to provide an easy path for grounding static charges.

c. Shielding. All electrical wiring which carries interfering surges is shielded to prevent their radiation.

70. Effects of Suppression

There is no interference from equipment which is satisfactorily suppressed for radiated and conducted interference over the fre-

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quency range of 0.55 through 156.0 megacycles at a distance of 25 feet from the unit.

71. Testing the Suppression System

a. Install a battery-powered radio receiver in good operating conditions not more than 10 feet from the compressor set. A wide-band receiver covering the frequency range of 0.55 to 156.0 megacycles is preferred.

b. Start the equipment and tune the receiver. Turn the receiver volume control to the maximum, and select three widely separated frequencies for listening. Use frequencies that are from signals with strong carriers, so that the receiver will be in its most sensitive operating condition.

c. Operate the engine throttle, and listen to the receiver speaker or headset. If a regular, clicking sound is heard, varying with the engine speed and ceasing the instant the ignition is shut off, the interference is caused by the ignition circuit.

d. Sparking between the brushes and commutator segments of the battery-charging generator may cause interference in the receiver. This type of interference can be recognized by a roaring or whining noise, which varies in pitch with the speed of the engine.

e. A whining sound which varies with the engine speed and continues a few seconds after the ignition is shut off, indicates that the interference is caused by the battery-charging generator.

72. Replacement of Suppression Material

a. General. If capacitor test equipment is not available and interference is indicated, insolate the cause of interference by the trial-and-error method of replacing each capacitor in turn until the interference is eliminated. In installing a capacitor, always make sure that the washers are replaced, that the fastenings are tight, and that the capacitor is well grounded. Clean rust and dirt from the points at which the capacitor is attached to the frame. It is important that exact replacement of suppression components be accomplished when needed. For example, use capacitors with the same electrical value as the one being replaced.

b. Capacitor Replacement.

(1) *Battery-charging generator capacitors* (A, fig. 38). Remove the screw (5) and internal-external tooth lockwasher (4) from the capacitor terminal. Remove the screw (1) and internal-external tooth lockwasher (2)

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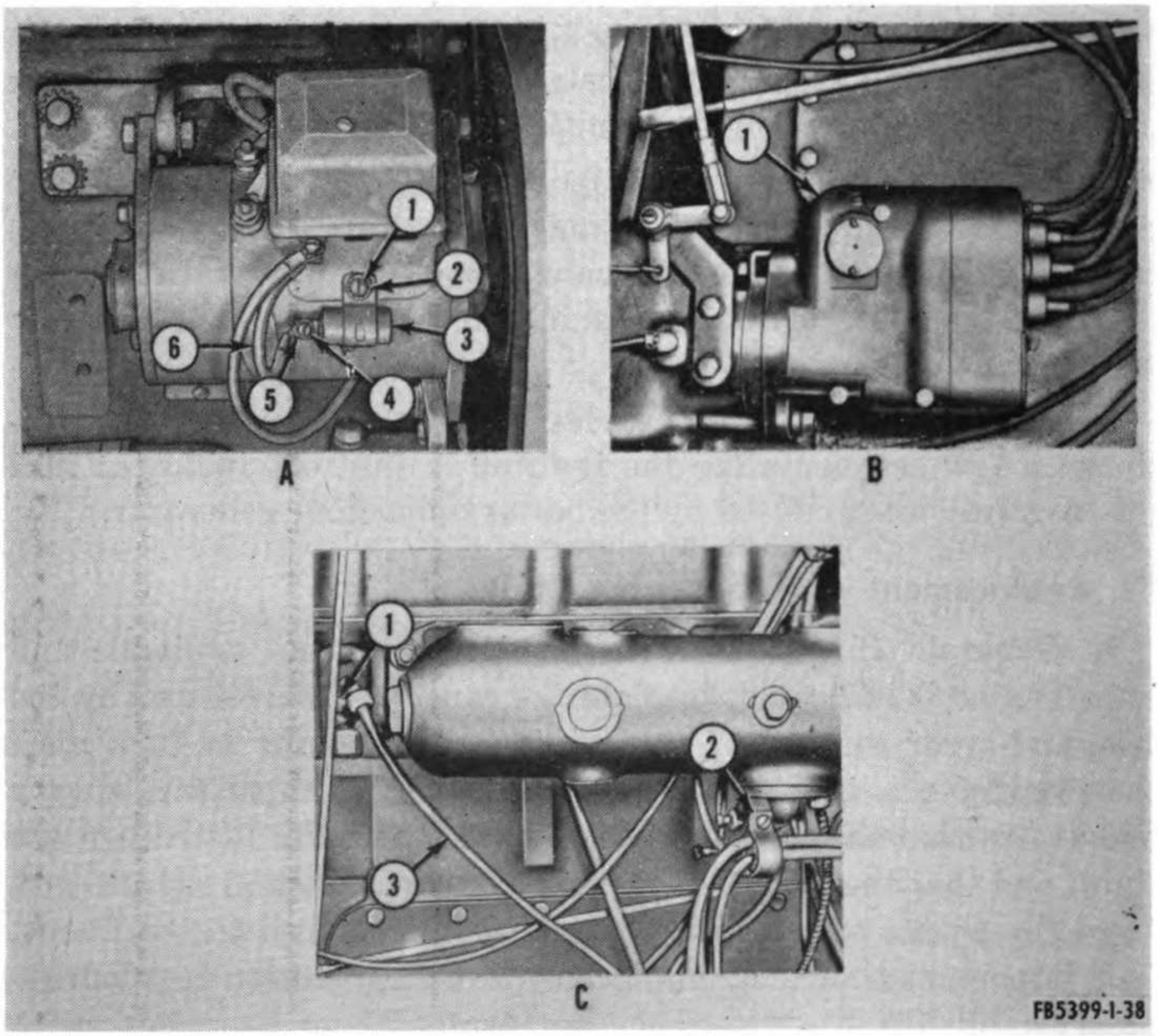
and lift the capacitor (3) off the generator. Install a new capacitor, install the internal-external tooth lockwasher (2) on the screw (1), and install and tighten the screw. Place the capacitor lead terminal (6) on the capacitor terminal, install the internal-external tooth lockwasher (4) on the screw (5), and install and tighten the screw. Remove and install the capacitor on the other side of the voltage regulator in the same manner.

(2) *Magneto capacitor* (B, fig. 38). The magneto (1) is completely metal enclosed. It is internally suppressed and has a capacitor-type ground connection built in.

c. Spark Plugs and Ignition Cables (C, fig. 38). The ignition cables (3) are completely covered with double-braided shielding,



1 Screw
2 Lockwasher
3 Capacitor
4 Lockwasher
5 Screw
6 Capacitor lead

A

1 Magneto

B

1 Spark plug
2 Metal clips
3 Ignition cables

C

Figure 38. Location of suppression components.

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a full cone coat ferrule at the magneto end, and a soldered-on type elbow at the spark plug end. The ignition wires are of the copper-conductor, neoprene-jacket-type, which is impervious to attack by fungi. The ignition wire shields are attached to the engine at convenient points by means of metal clips (2) which assist in grounding the shielding loom and providing mechanical rigidity. Replace the cables as given in paragraph 100. The spark plugs (1) are completely shielded and internally suppressed. Replace the spark plugs as given in paragraph 100.

d. Bonding Straps and Lockwashers. Bonding straps and internal-external tooth washers are used in numerous places throughout the unit such as the battery-charging generator and starting motor mounting, intake manifold, engine canopy mounting, oil filter mounting, mechanical lubricator mounting, and all other places where a static charge may be built up. When it is necessary to remove any component or sub-assembly so mounted, be sure to reinstall the bonding straps and washers.

Section VI. FUEL SYSTEM

73. Description

The engine fuel system consists of a skid-mounted fuel tank, pump, and hand primer, carburetor, air cleaners, and suitable lines and connections for the engine. Fuel under gravity pressure passes from the fuel pump where it is picked up and filtered. The fuel pump is driven by the camshaft of the engine and delivers the fuel to the carburetor under pressure. A hand primer lever on the fuel pump enables the operator to hand prime the carburetor for immediate starting, especially in cold weather or with a new or reconditioned engine. The air cleaners remove dust and grit from the air before it enters the carburetor. When properly adjusted to atmospheric conditions the carburetor mixes fuel and air in the proper proportions for efficient combustion.

74. Carburetor

a. Description. The carburetor is a Zenith updraft type with five circuits, and is mounted below the intake manifold.

(1) *Float circuit.* The float circuit maintains the correct level of fuel in the carburetor bowl at all times.

(2) *Low-speed circuit.* The low-speed, or idle, circuit delivers the proper mixture of air and fuel when the throttle is practically closed.

(3) *High-speed circuit.* The high-speed, or metering, circuit delivers the proper air-fuel mixture in the range above

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the low-speed circuit. This circuit delivers the fuel from the bowl to the venturi.

(4) *Accelerating-pump circuit.* The accelerating-pump circuit quickly provides a measured supply of fuel for sudden acceleration.

(5) *Choke circuit.* The choke circuit provides a method of enriching the fuel mixture for starting and warming up a cold engine.

b. Removal (fig. 39).

(1) Remove the cotter pin from the clevis pin (6), pull the pin out of the clevis (7), and tie the throttle rod up out of the way.

(2) Remove the tube clamp screw (13) and the lever clamp screw (14) and pull the choke cable (12) out of the choke lever and bracket.

(3) Remove the screw (10) from the hose clamp (9), and pull the hose (11) off the carburetor air intake.

(4) Disconnect the carburetor inlet line (18) by screwing the inverted nut (19) from the elbow (20).

Note. It may be necessary to loosen the inverted nut at the fuel pump connection and turn the fuel inlet line down in order to drop the carburetor away from the governor throttle valve housing.

(5) Remove the two cap screws (2) and lockwashers (1) and drop the carburetor assembly (16) away from the governor throttle valve housing.

(6) Remove the gasket.

c. Cleaning and Inspection.

(1) Clean the carburetor with an approved cleaning solvent and dry thoroughly with compressed air if available or a lint-free rag.

(2) Inspect for loose, missing or damaged parts; check gaskets and gasket surfaces for good condition.

(3) Tighten any loose plugs and body screws. Do not tamper with the carburetor adjusting screws. Replace damaged or missing parts or gaskets.

d. Installation.

(1) Place the gasket on the throttle body of the carburetor assembly (16), place the carburetor against the flange of the throttle valve housing, and install and tighten the two cap screws (2) with lockwashers (1).

(2) Connect the carburetor inlet line (18) by installing and tightening the inverted nut (19) on the elbow (20).

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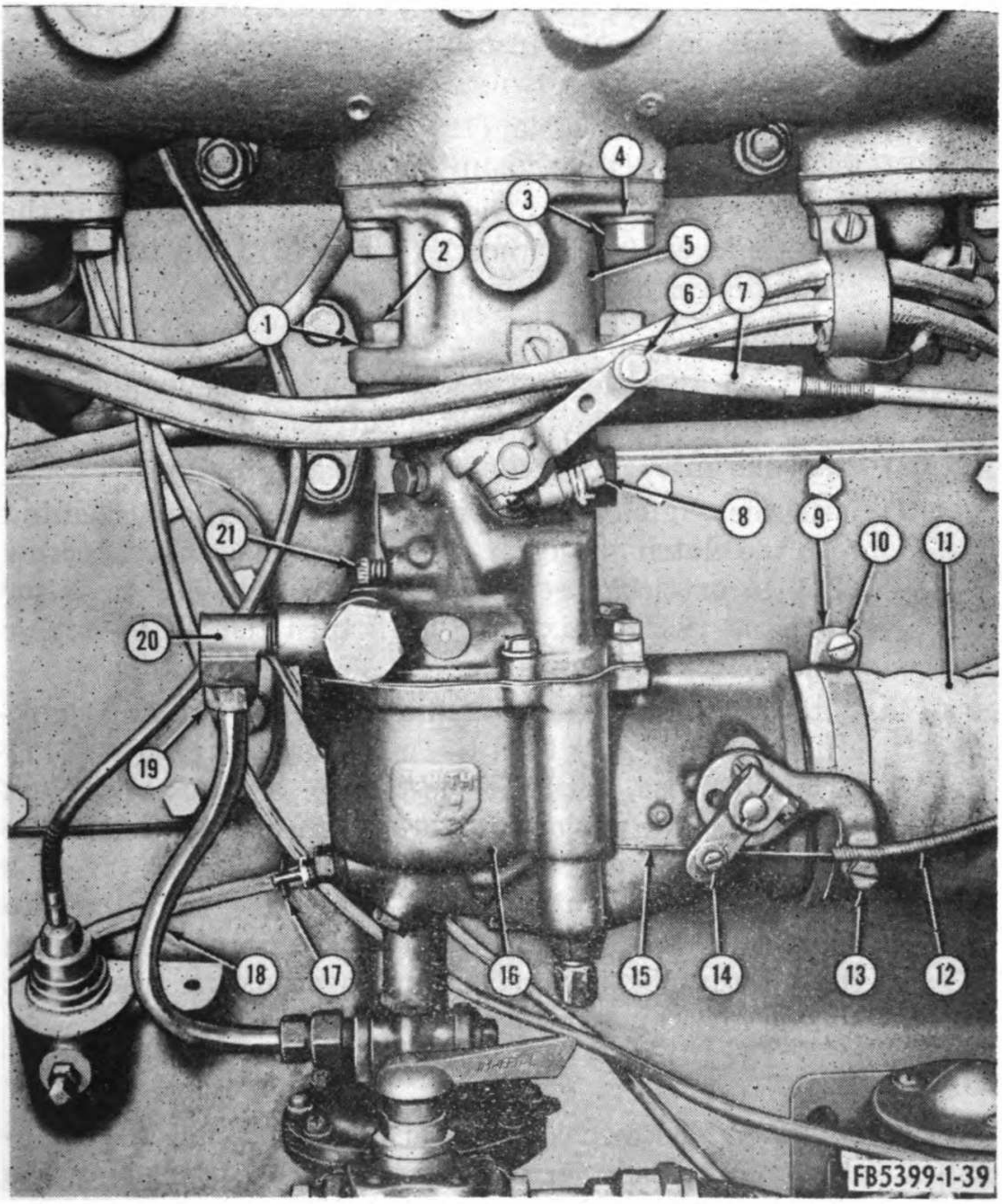

1 Lockwasher
2 Cap screw
3 Cap screw
4 Lockwasher
5 Governor throttle valve housing
6 Clevis pin
7 Clevis
8 Throttle stop screw
9 Hose clamp
10 Screw, hose clamp
11 Hose
12 Choke cable
13 Tube clamp screw
14 Lever clamp screw
15 Choke wire
16 Carburetor assembly
17 Main adjusting screw
18 Carburetor inlet line
19 Inverted nut
20 Elbow
21 Idle adjusting screw

Figure 39. Carburetor and throttle valve housing assembly removal points.

Tighten the inverted nut at the fuel pump connection if it has been loosened.

(3) Slide the hose (11) on the carburetor air intake, and install and tighten the screw (10) in the hose clamp (9).

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(4) Insert the choke wire (15) in the hole in the swivel of the choke lever, and install and tighten the lever clamp screw (14).

(5) Install the choke cable (12) in the bracket and install and tighten the tube clamp screw (13).

(6) Place the clevis (7) of the throttle rod in position at the throttle lever, install the clevis pin (6), and install the cotter pin in the clevis pin.

e. Adjustment.

(1) Screw the throttle stop screw (8) clockwise against the stop pin to hold the throttle slightly open.

(2) Start the engine as outlined in paragraph 17.

(3) With the engine at operating temperature and running with the clutch disengaged, turn the idle adjusting screw (21) in or clockwise, until the engine begins to falter from too rich a mixture. Then turn the screw out or counterclockwise, until the engine runs smoothly.

(4) With the clutch engaged and the engine running at governed speed, slowly turn the main adjusting screw (17) in or clockwise, until the speed drops appreciably. Next turn the screw out or counterclockwise, until the engine picks up and runs smoothly again. This will give the most economical mixture. If the engine is inclined to backfire or be sluggish with the clutch engaged, enrich the mixture by turning the main adjusting needle out sufficiently to overcome the condition.

75. Fuel Pump

a. Description. The mechanical fuel pump (12, fig. 10) is installed on the engine between the fuel tank and carburetor. The suction side of the pump is connected to the fuel tank and the discharge side to the carburetor by tubing designed to carry the fuel. The purpose of the pump is to deliver fuel from the supply tank to the carburetor float bowl at the required pressure. The sediment bowl (8) and strainer are an integral part of the fuel pump making it unnecessary to remove the pump in order to completely service the unit.

b. Cleaning Sediment Bowl and Strainer.

(1) Turn the knurled nut (10)counterclockwise until there is enough clearance to swing the bail (9) up and away from the bowl. Be sure to support the bowl while swinging the bail.

(2) Remove the bowl and drain the fuel residue.

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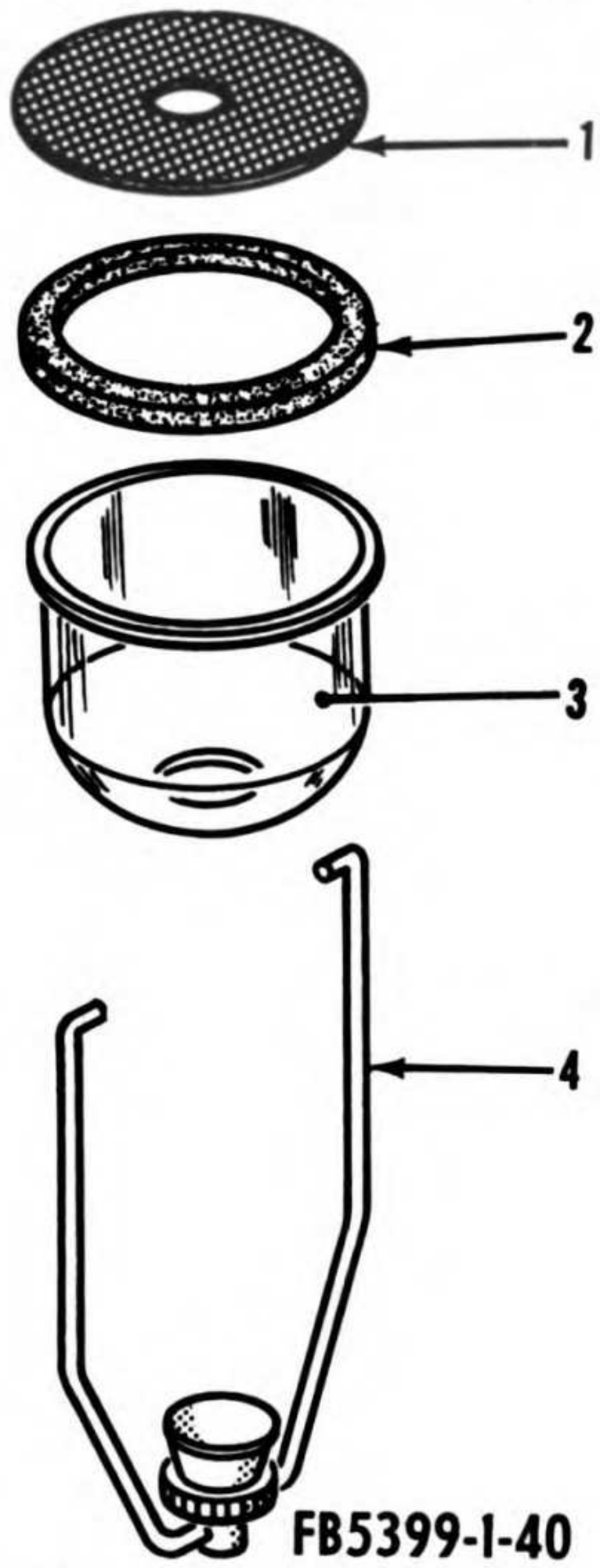
(3) Remove the gasket (2, fig. 40) and screen (1) from the fuel pump cover.
(4) Clean the bowl and strainer with approved cleaning solvent, and dry with low-pressure compressed air, if available, or wipe dry with a line-free cloth.
(5) Inspect the gasket for breaks or deterioration and check the bowl for cracks and breaks.
(6) Install the strainer (1) and gasket (2) in the fuel pump cover, using a new gasket if necessary.
(7) Place the bowl (3) in position in the cover, being sure that its outer lip is seated properly against the gasket.
(8) Swing the bail (9, fig. 10) down and under the bowl and tighten the knurled nut (10) securely.



1 Strainer
2 Gasket
3 Bowl
4 Bail

Figure 40. Sediment bowl and strainer, exploded view.

c. Fuel Pump Removal.
(1) Disconnect the outlet line by unscrewing the outlet line ferrule nut (1, fig. 10) from the outlet line ferrule adapter (2).

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(2) Disconnect the inlet line (6) by unscrewing the inlet line ferrule nut (5) from the inlet line ferrule adapter (4).

(3) Remove the two cap screws (13) and lockwashers (14) which mount the fuel pump on the engine block.

(4) Withdraw the fuel pump and gasket from the engine.

d. Cleaning and Inspection.

(1) Clean the sediment bowl and strainer as outlined in *b* above.

(2) Wash the fuel pump in an approved cleaning solvent and dry thoroughly, with compressed air, if available.

(3) Inspect for stripped or damaged threads, cracks, or breaks, repair or report faulty parts to the proper authority.

(4) Check to see that the priming lever operates properly. If defective, report the condition to the proper authority.

e. Installation.

(1) Position the fuel pump assembly (12) and gasket on the side of the engine block and install and tighten the two cap screws (13) with lockwashers (14).

(2) Connect the inlet line by screwing the inlet line ferrule nut (5) to the inlet line ferrule adapter (4).

(3) Connect the outlet line (15) by screwing the outlet line ferrule nut (1) to the outlet line ferrule adapter (2).

76. Air Cleaners and Hose

a. Description. The two air cleaners (6, fig. 41) are mounted outside the engine back panel and are connected to an adapter (1) which channels the air through the air intake hose (9) to the carburetor air intake.

b. Removal and Disassembly.

(1) Disassemble the two air cleaners as outlined in paragraph 33*l*.

(2) Remove the screw (8) from the hose clamp (7) and slide the hose (9) off of the adapter.

(3) Remove the screw (10, fig. 39) from the hose clamp (9) and slide the hose (11) off of the carburetor air intake.

(4) Support the air cleaner cover and remove the four cap screws (5, fig. 41) and lockwashers (4) from the outside flange of the adapter (1). Support the inside air cleaner cover and remove the four cap screws and lockwashers from the inside flange of the adapter.

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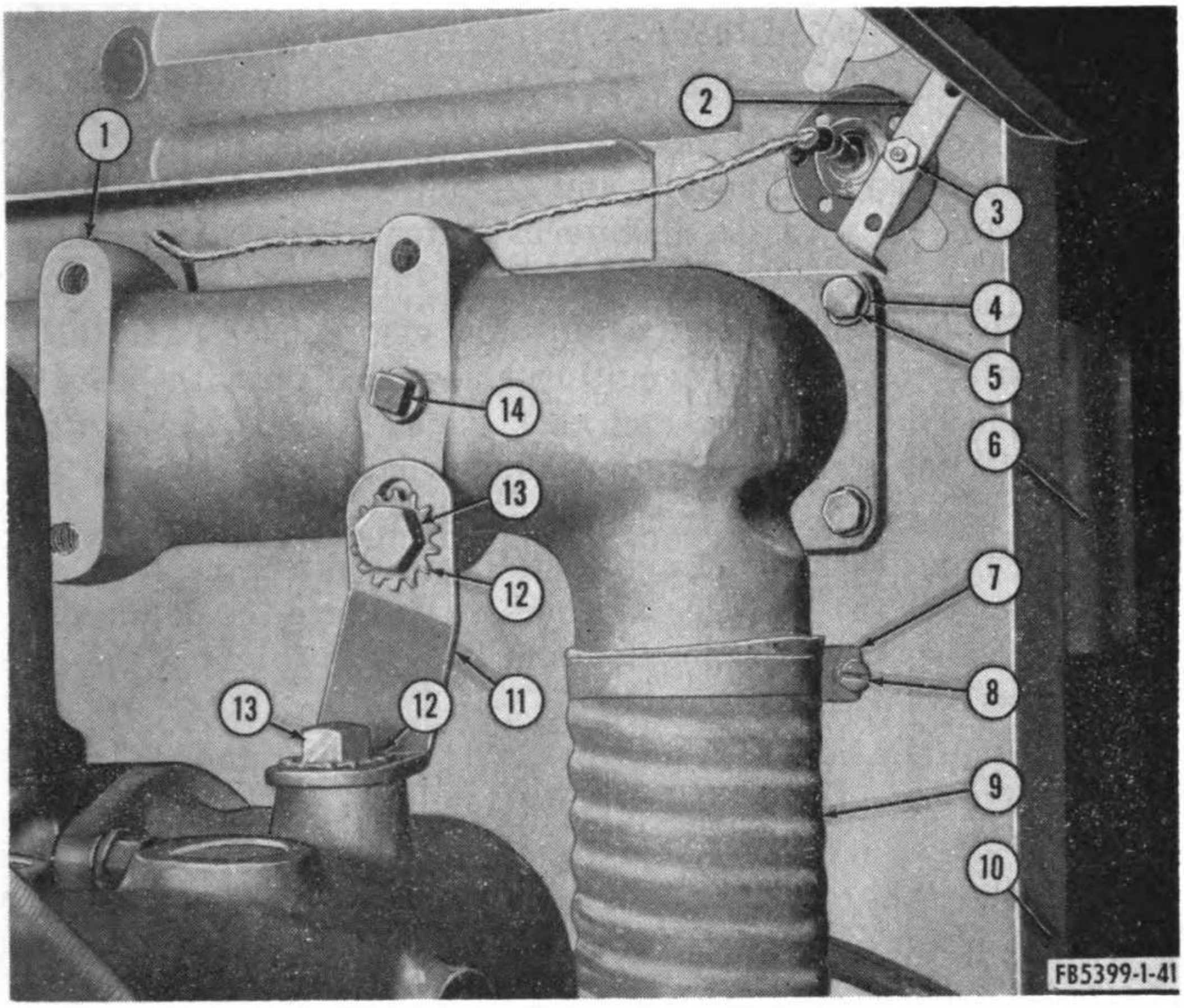

1 Adapter
2 Gage mounting bracket
3 Nut
4 Lockwasher
5 Cap screw
6 Air cleaner
7 Hose clamp
8 Screw
9 Hose
10 Engine back panel
11 Bonding strap
12 Internal-external tooth lockwasher
13 Cap screw
14 Pipe plug

Figure 41. Air cleaner adapter hose connections and removal points.

(5) Remove the cap screw (13) and washer (12) from the bonding strap (11) and remove the adapter. Remove the cap screw and washer which holds the bonding strap to the intake manifold, and remove the strap.
(6) Remove the pipe plug (14) from the adapter.

c. Cleaning and Inspection.
(1) Clean the air cleaners as outlined in paragraph 33*l*.
(2) Inspect the cap screws, hose clamp screws, and pipe plug for stripped or damaged threads; repair or replace all defective parts.
(3) Inspect the adapter and bonding strap for cracks, breaks, or damage. Repair or replace if defective.
(4) Inspect the hose for cracks, breaks, and signs of deterioration, specially in the interior of the hose and under the hose clamps. Replace if defective.

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d. Reassembly and Installation.

(1) Install the pipe plug (14) in the adapter (1).

(2) Place the bonding strap (11) in position on the intake manifold, and install and tighten the cap screw (13), being sure to use an internal-external tooth lockwasher (12).

(3) Position the adapter against the engine back panel (10) with the adapter mounting holes lined up with holes in the bonding strap and back panel. Install and tighten the cap screw with internal-external tooth washer.

(4) Place the inside air cleaner cover in position against the engine back panel and install and tighten the four cap screws (5) with lockwashers (4). Place the outside air cleaner cover in position and install and tighten the cap screws with lockwashers.

(5) Slide the hose (11, fig. 39) onto the carburetor air intake and install and tighten the screw (10) in the hose clamp (9).

(6) Slide the other end of the hose (9, fig. 41) onto the adapter and install and tighten the screw (8) in the hose clamp (7).

(7) Reassemble the air cleaners (6) as outlined in paragraph 33*l*.

77. Fuel Tank, Lines, and Fittings

a. General. The fuel tank is mounted on the skid base and it is necessary to remove the tank in order to drain it. The fuel system has two lines only. One line consisting of tubing and a flexible hose connects the fuel tank to the fuel pump assembly and another connects the fuel pump to the carburetor.

b. Removal.

(1) *Fuel tank-to-fuel pump line.*

(*a*) Close the fuel tank shutoff valve (3, fig. 9).

(*b*) Unscrew the ferrule nut (6) from the reducing nut (5), unscrew the ferrule nut (14, fig. 35) from the adapter (13), and remove the fuel line (15).

(*c*) Unscrew the inlet line ferrule nut (5, fig. 10) from the inlet line ferrule adapter (4) and remove the inlet line hose (6).

(*d*) Remove the nipple (7) from the fuel pump shutoff valve (3), and unscrew the valve from the fuel pump assembly (12).

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(2) *Fuel pump-to-carburetor line.* Unscrew the outlet line ferrule nut (1) from the outlet line ferrule adapter (2). Unscrew the inverted nut (19, fig. 39) from the elbow (2) and remove the carburetor inlet line (18).

(3) *Fuel tank.*

(*a*) Disconnect the ferrule nut (12, fig. 9), the flare nuts (13 and 15) and remove the fuel filter and fittings, as an assembly, from the reducing nut (7). Remove the elbow fitting (4).

(*b*) Remove the four cap screws (5) from the front and rear mounting flanges of the fuel tank assembly (1) and the six cap screws (7) from the sides of the tank mounting flanges.

(*c*) Place the tank on a workbench or other suitable surface, place a clean container under the fuel line shut-off valve, and open the valve to drain the tank. Remove the fuel tank cap (2, fig. 42), allowing fuel to drain faster.

Caution: Drain the fuel tank only where there is adequate ventilation. Keep flame or spark away from the fuel.

(*d*) After all fuel has drained, remove the fuel tank shut-off valve (3, fig. 9) and the tube coupling reducing nut (2) as an assembly from the fuel tank.

c. Cleaning, Inspection, and Repair.

(1) Blow out fuel lines and fittings with compressed air, if available. Block the line at one end and inspect for any air leaks at the bends in the tubing.

(2) Check the inlet line hose for cracks, breaks, and signs of deterioration. Check for stripped threads, damaged fittings, and severe kinks; replace fittings or lines if defective.

(3) Check the two-way and three-way valves for cracks and breaks, and proper operation; replace defective valves.

(4) Clean the outside of the tank and tank cap with an approved cleaning solvent. Dry thoroughly.

(5) Install the nipple and fuel line shut-off valve in the tank.

(6) Prepare a solution of one-half pound of trisodium phosphate to each six gallons of clean water. Fill the tank with this solution.

(7) Install the tank cap, and agitate the tank so that the solution will cut down all residue and gum in the tank.

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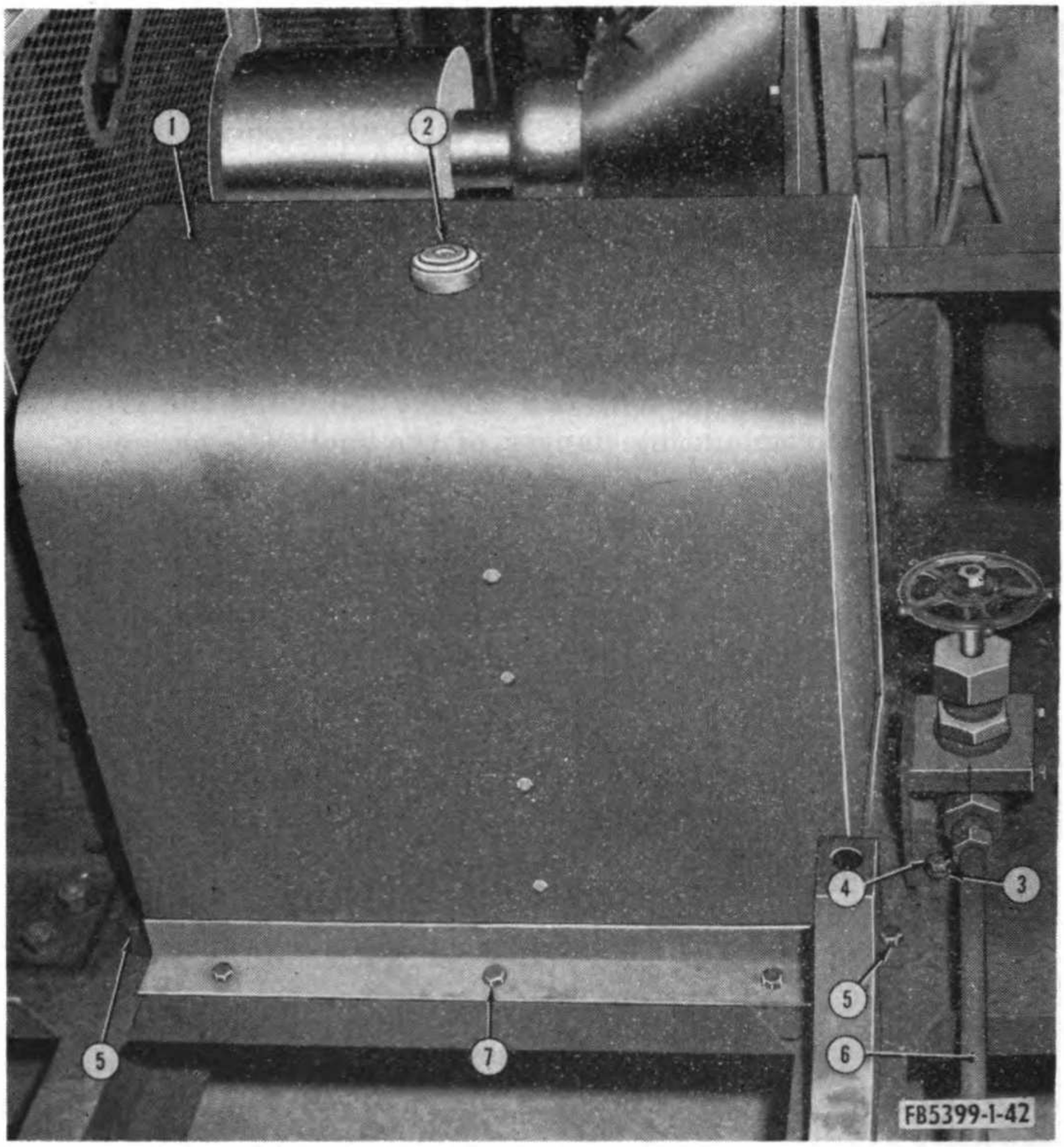

1 Fuel tank assembly
2 Fuel tank cap
3 Lockwasher
4 Cap screw
5 Cap screw
6 Compressor unit outlet line
7 Cap screw

Figure 42. Fuel tank mounting and removal points.

(8) Remove the cap, and drain the solution from the tank.

(9) Remove the fuel line shut-off valve and nipple, and flush the tank with clean water.

(10) Inspect the interior of the tank for rust. If a heavy rust deposit is found, or if the tank is badly dented, replace it with a new tank.

(11) Inspect the cap screws for stripped or damaged threads.

(12) See that the cap is in good condition, and that it fits closely over the neck. Make sure that the vent-hole in the cap is open and that the gasket is in good condition.

(13) Replace all damaged or unserviceable parts.

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d. Installation.

(1) Place the fuel tank assembly (1, fig. 42) in position on the skid base and install and tighten the four front and rear cap screws (5) and the six side cap screws (7).

(2) Reinstall the fuel shutoff valve (3, fig. 9) and tube coupling reducing nut (2), as an assembly, in the fuel tank (1).

(3) Reinstall the fuel filter assembly and fitting subassemblies, removed in paragraph *b* above, and reconnect the ferrule nuts (6 and 12) and flare nuts (13 and 15).

(4) Connect the inlet line hose (15, fig. 35) by installing and tightening the ferrule nut (14) on the ferrule adapter (13).

(5) Install the fuel pump shut-off valve (3, fig. 10) on the fuel pump assembly (12) and install the nipple (7) in the valve.

(6) Connect the inlet line hose (6) to the nipple by installing and tightening the inlet line ferrule nut (5) on the adapter (4).

(7) Connect the carburetor inlet line (18, fig. 39) by installing and tightening the outlet line ferrule (1, fig. 10) on the outlet line ferrule adapter (2), and by installing and tightening the inverted nut (19, fig. 39) on the elbow (20).

(8) Fill the tank, install the fuel tank cap (2, fig. 42), prime the fuel pump, and check the tank and connections for leaks.

Section VII. ENGINE SPEED GOVERNOR

78. Description

The centrifugal type governor employs two weights, driven directly from the engine gear train, which respond to variations in engine speed by moving inward or outward from the governor shaft. This movement is transmitted to the governor weight shifter lever through a pilot bearing sliding on the governor shaft. From the shifter lever the movement is carried to the governor throttle valve between the intake manifold and the carburetor by a series of linkages.

79. Governor Removal, Cleaning and Inspection, and Installation

a. Removal.

(1) Remove the magneto as outlined in paragraph 99*b*.

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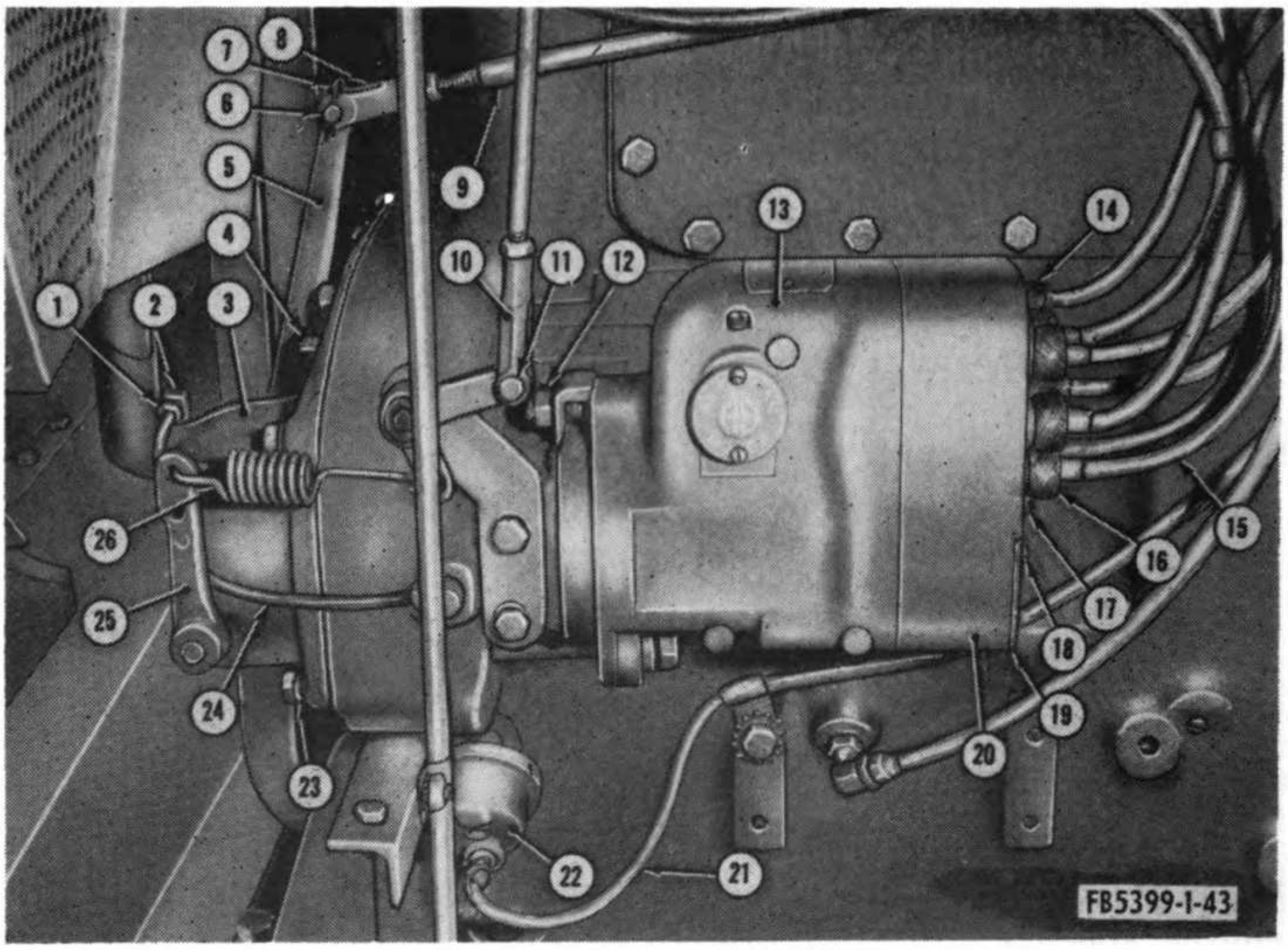
(2) Remove the cotter pin (7, fig. 43) from the clevis pin (6) and pull the clevis pin out of the clevis (8).
(3) Lift the governor control rod assembly (9) off the governor lever (5).
(4) Remove the spring (26) from the governor spring lever (25).
(5) Disconnect the oil line (24) by unscrewing the ferrule nuts (1) from the elbows (2) at both ends of the line, and remove the oil line.
(6) Remove the four cap screws (4) and lockwashers (23) which mount the governor assembly (3) on the engine, and remove the governor assembly and governor cover gasket.

b. Cleaning and Inspection.

(1) Clean the mounting flanges of the governor housing and



1 Ferrule nut
2 Elbow
3 Governor assembly
4 Cap screw
5 Governor lever
6 Clevis pin
7 Cotter pin
8 Clevis
9 Governor control rod assembly
10 Clevis
11 Clevis pin
12 Nut
13 Magneto
14 Knurled nut
15 Ignition cable
16 Coupling nut
17 Screw
18 Screw
19 Shield, end cap
20 Shield cover
21 Oil pressure switch lead
22 Engine oil pressure switch
23 Lockwasher
24 Oil line
25 Governor spring lever
26 Spring

Figure 43. Magneto and engine speed governor removal points.

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the gear cover of the engine of grease, dirt, and parts of the old gasket.

(2) Inspect the spring for proper tension and check the clevis pin for signs of wear. Replace all unserviceable parts.

(3) Inspect the oil line for cracks and breaks, and the ferrule nuts, elbows, and cap screws for stripped or damaged threads. Replace all defective parts.

c. Installation.

(1) Using a new gasket, place the governor assembly (3) in position on the gear cover of the engine.

(2) Install and tighten the four cap screws (4) with lockwashers (23).

(3) Connect the oil line (24) by tightening the ferrule nuts (1) in the elbows (2) at both ends of the oil line.

(4) Install the spring (26) in the top hole of the governor spring lever (25).

(5) Place the clevis (8) of the governor control rod assembly (9) in position on the governor lever (5), install the clevis pin (6) through the clevis and governor arm, and install a new cotter pin (7) in the clevis pin.

(6) Install the magneto as outlined in paragraph 99*d*.

80. Governor Throttle Valve Assembly Removal, Cleaning and Inspection, Installation, and Adjustment

a. Removal.

(1) Remove the carburetor as outlined in paragraph 74*b*.

(2) Remove the cotter pin (7, fig. 43) from the clevis pin (6) and pull the clevis pin out of the clevis (8). Lift the governor control rod assembly (9) off the governor lever (5).

(3) Remove the two cap screws (3, fig. 39) and lockwashers (4) from the upper flange of the governor valve throttle assembly (5).

(4) Lower the throttle assembly from the intake manifold flange and pull the governor control rod assembly (9, fig. 43) out from under the spark plug cables and other control wires. Remove the throttle housing gasket.

b. Cleaning and Inspection.

(1) Clean the flanges of the housing assembly intake manifold, and carburetor of dirt, grease and parts of old gaskets.

(2) Inspect the linkage for worn, bent, broken, or unserviceable parts. Replace all unserviceable parts.

(3) Inspect the housing assembly for cracks, breaks, or other

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damage, and check the cap screws for stripped or damaged threads. Replace all defective parts.

c. Installation.

(1) Using a new gasket, place the governor throttle valve housing assembly (5, fig. 39) in position against the intake manifold flange, inserting the governor control rod assembly (9, fig. 43) behind the spark plug cables and other control wires.

(2) Install the two cap screws (3, fig. 39) with lockwashers (4) through the housing assembly flange into the intake manifold flange.

(3) Place the clevis (8, fig. 43) of the governor control rod assembly (9) in position on the governor lever (5), install the clevis pin (6) and the cotter pin (7).

(4) Install the carburetor as outlined in paragraph 74*d*.

(5) Start the engine, let warm up to normal operating temperature, check the operation of the governor, and if necessary adjust as outlined in *d* below.

d. Adjustment. If the engine surges when running at top speed without load, it is an indication the governor is out of adjustment. Assuming that the governor spring lever has the right spring tension, the correct adjustment can be obtained by changing the length of the control linkage between the governor and the governor throttle valve assembly as follows:

(1) Disconnect the governor control rod assembly (9, fig. 43) as outlined in *a*(2) above.

(2) Open the throttle valve wide by pushing the control rod toward the carburetor as far as it will go. With the control rod in this position, the holes in the clevis should line up with the top hole in the governor lever.

(3) If it does not, loosen the clevis locknut and turn the clevis clockwise or counterclockwise until the correct position is obtained. Tighten the clevis locknut.

(4) Connect the governor control rod assembly as outlined in paragraph *c*(3) above.

Section VIII. INTAKE AND EXHAUST MANIFOLDS

81. Description

The intake manifold, which is water heated to give a quick warm up, is double-walked to permit the passage of water from the

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cylinder heads at the intake manifold attachment pads through two external lines to a fitting on the side of the crankcase. The exhaust manifold, which is water cooled to prevent the heat normally radiated by the exposed exhaust pipe from overheating those parts of the engine in the vicinity of the exhaust manifold, receives water from the main circulating stream at the elbow where the water enters the cylinder block after leaving the water pump. An external line conveys the water into the bottom rear of the exhaust manifold. At the exit point on the forward end of the manifold, a thermostat acts to direct the water to the by-pass line until it has warmed up to approximately 165° F.

82. Intake Manifold

a. Removal (fig. 44).

(1) Remove the carburetor as outlined in paragraph 74*b*, and the governor throttle valve housing assembly as outlined in paragraph 80*a*. Drain the engine cooling system.

(2) Remove the cap screw (18, fig. 44) which holds the choke cable clamp (19) on the side of the intake manifold (31).

(3) Remove the nut (24) and lockwasher (23) of both water pipe elbows (25) which holds the spark plug cable clamps (26) on the pipe elbow studs and slide the clamps off the studs.

(4) Remove the two cap screws (28) and lockwashers from the water inlet flange.

(5) Remove the cap screw (21) and lockwasher (20) from the bonding strap (22).

(6) Remove the 18 nuts (30) and washers (29), which hold the six flanges of the intake manifold to the cylinder heads, from the flange studs, and slide the manifold off the studs, being careful not to damage the stud threads.

b. Disassembly (fig. 45).

(1) Remove the gaskets (1, fig. 45) from the faces of the intake manifold flanges and the gasket (25) from the face of the water inlet elbow.

(2) Remove the two nuts (18) and lockwashers (17) which were not removed previously in *a*(3) above from the studs (16) attaching intake manifold water pipe assembly to manifold (10), and remove the water pipe. Remove the gaskets (14).

(3) Loosen screws on four hose clamps (19), and remove two hoses (13) from the ends of the intake manifold water pipe (20) and from the water pipe elbows (15).

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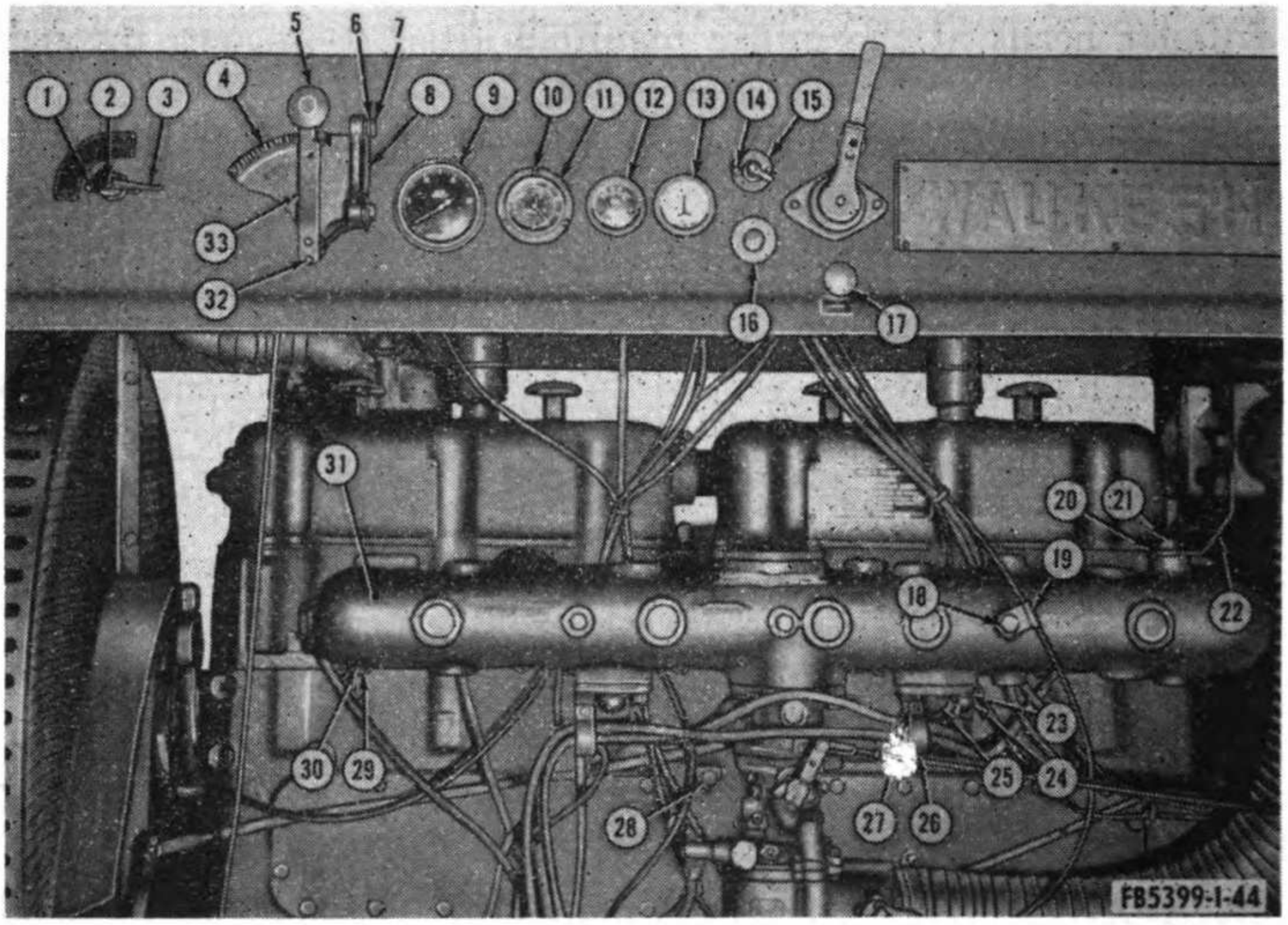

1	Screw	17	Choke control button
2	Valve handle screw	18	Cap screw, cable clamp
3	Valve handle	19	Choke cable clamp
4	Governor control bracket with lever	20	Lockwasher
5	Governor control lever knob	21	Cap screw, bonding strap
6	Lockwasher	22	Bonding strap
7	Cap screw	23	Lockwasher
8	Governor control bracket	24	Nut
9	Tachometer	25	Water pipe elbow
10	Screw, mounting	26	Spark plug cable clamp
11	Engine hour-meter	27	Clamp screw
12	Oil pressure gage	28	Cap screw
13	Ammeter	29	Washer
14	Screw, mounting	30	Nut
15	Ignition switch	31	Intake manifold assembly
16	Starter button	32	Rivet
		33	Governor lever

Figure 44. Intake manifold and engine controls and instruments removal points.

(4) Remove the four studs (16) from the bottom of the manifold, using a stud puller to prevent damaging the threads.

(5) Remove the two cap screws (12) and copper washers (11).

(6) Remove the two plugs (28) and gaskets (27) from the ends of the manifold.

(7) Remove the two cap screws (6) and lockwashers (5) from the carburetor flange cover (7) and lift the cover and gasket (4) off the manifold.

(8) Remove three pipe plugs (3, 8, and 9).

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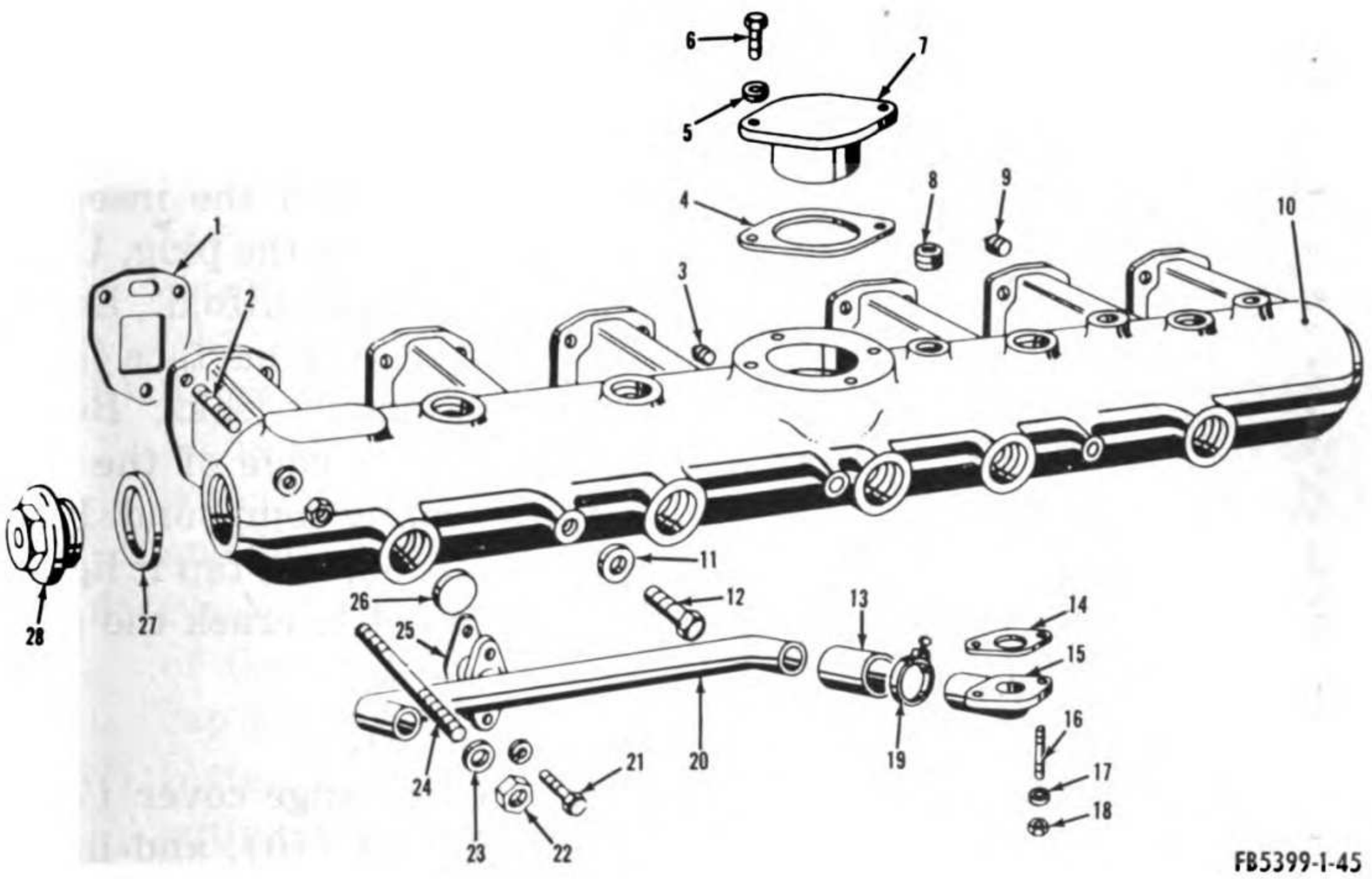

1 Gasket
2 Cylinder head short stud (12 rqr)
3 Plug pipe ⅛ in (1 rqr)
4 Gasket
5 Washer, lock $\frac{7}{16}$ in (2 rqr)
6 Screw cap, $\frac{7}{16}$ x 1 in NC (2 rqr)
7 Carburetor flange cover
8 Plug pipe, ½ in (1 rqr)
9 Plug pipe, square hd, ½ in (1 rqr)
10 Intake manifold
11 Washer copper $\frac{7}{16}$ in (3 rqr)
12 Screw cap $\frac{7}{16}$ x ¾ in NC (3 rqr)
13 Hose, water
14 Gasket
15 Water pipe elbow
16 Stud, ⅜ x 2 in NC (4 rqr)
17 Washer, lock ⅜ in (6 rqr)
18 Nut, hex, ⅜ in NC (4 rqr)
19 Hose clamp
20 Intake manifold water pipe
21 Screw, cap ⅜ x 1 in NC (2 rqr)
22 Nut, hex, $\frac{7}{16}$ in NC (18 rqr)
23 Washer, $\frac{7}{16}$ in (18 rqr)
24 Cylinder head long stud (6 rqr)
25 Gasket
26 Expansion plug
27 Gasket
28 Plug

Figure 45. Intake manifold, exploded view.

c. Cleaning, Inspection, and Repair.

(1) Thoroughly clean all parts in an approved cleaning solvent.

(2) Scrape or brush all carbon, corrosion, or rust from parts and scrape off all particles of gaskets, gasket cement, or like material. Remove all burs or nicks that might prevent a tight seal between surfaces on reassembly.

(3) Inspect manifold for cracks or damage, replace manifold if defective.

(4) Inspect the water pipe hoses and water pipe elbows for cracks, breaks, or damage. Replace defective parts.

(5) Inspect all screws, nuts, studs, and bolts for signs of thread damaged, and replace any that show damage. Renew all gaskets.

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(6) Inspect the thirteen expansion plugs (26) for cracks, breaks, and signs of leaks. Replace any defective expansion plugs. To remove the plug, tap the center of the plug until it loosens sufficiently to permit the insertion of a screw driver behind the outer edge of the plug. Using light pressure, pry the plug out of the manifold. Before installing the new plug, clean the seating surface inside the manifold thoroughly to insure against leaks. Before installing the new plug, coat the outer edge of the plug with white lead or other suitable sealing compound. Place the new plug in position in the manifold and tap it lightly until it seats tightly, being careful not to crack the plug.

d. Reassembly.

(1) Install the three pipe plugs (3, 8, and 9).

(2) Place the gasket (4) and carburetor flange cover (7) in position on top of the intake manifold (10), and install and tighten the two cap screws (6) with lockwashers (5).

(3) Place a gasket (27) on each plug (28) and install and tighten the plugs in each end of the manifold.

(4) Install and tighten the three copper washers (11) and cap screws (12).

(5) Using a stud driver install and tighten the four studs (16) in the bottom of the manifold.

(6) Install a hose (13) with hose clamps (19) attached on each end of the intake manifold water pipe (20) and install the water pipe elbows (15) in the hose. Tighten the clamp screws.

(7) Place a gasket (14) on each water pipe elbow (15), place the intake manifold water pipe assembly in position against the manifold, and install, but do not tighten the four nuts (18) with lockwashers (17).

e. Installation.

(1) Install a new gasket (1) on each set of flange studs at the cylinder heads. Install the intake manifold assembly (31, fig. 44) on the studs, being careful not to damage the stud threads.

(2) Install the 18 nuts (30) with washers (29) on the studs, and tighten the nuts evenly all the way around to prevent setting up any undue stress which might crack or break the manifold.

(3) Place the bonding strap (22) in position on the manifold, and install and tighten the cap screw (21) with lockwasher (20).

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(4) Place the gasket (25, fig. 45) in position against the inlet flange on the side of the engine, place the water inlet flange against the gasket, and install and tighten the two cap screws (21) with lockwashers (17).

Note. It may be necessary to loosen the hose clamps at the ends of the water inlet line and slide the line into the hoses in order to obtain enough clearance to install the gasket between the water inlet flange at the side of the engine.

(5) Remove the nut (24, fig. 44) and lockwasher (23) which holds the spark plug cable clamps (26) in place on the water inlet elbow studs, slip the clamps onto the studs, and install lockwashers and tighten the nuts.

(6) Place the choke cable clamp (19) in position on the side of the manifold and install the washer and tighten the cap screw (18).

(7) Install the governor throttle valve housing assembly as outlined in paragraph 80*c*, and the carburetor as outlined in paragraph 74*d*. Fill the engine cooling system.

83. Exhaust Manifold

a. Removal.

(1) Remove the exhaust manifold thermostat as outlined in paragraph 88*b*. Drain the engine cooling system.

(2) Remove the exhaust pipe as outlined in paragraph 118*b*.

(3) Remove the nuts (33, fig. 46) and lockwashers from the inlet line flange (34).

(4) Remove the eighteen nuts (7, fig. 47) and washers (6) from the studs (16) of the six exhaust manifold flanges at the cylinder heads.

(5) Lift the exhaust manifold assembly (3, fig. 46) off the studs, being careful not to damage the threads, and remove the gaskets (15, fig. 47).

b. Disassembly.

(1) Remove the eight bolts (1) and lockwashers (2) from each end of the exhaust manifold (5), and remove the exhaust manifold flange (3), the exhaust manifold end cover (13), and the gaskets (4 and 14).

(2) Using a stud puller, remove the studs (12) from the manifold.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts thoroughly with an approved cleaning solvent.

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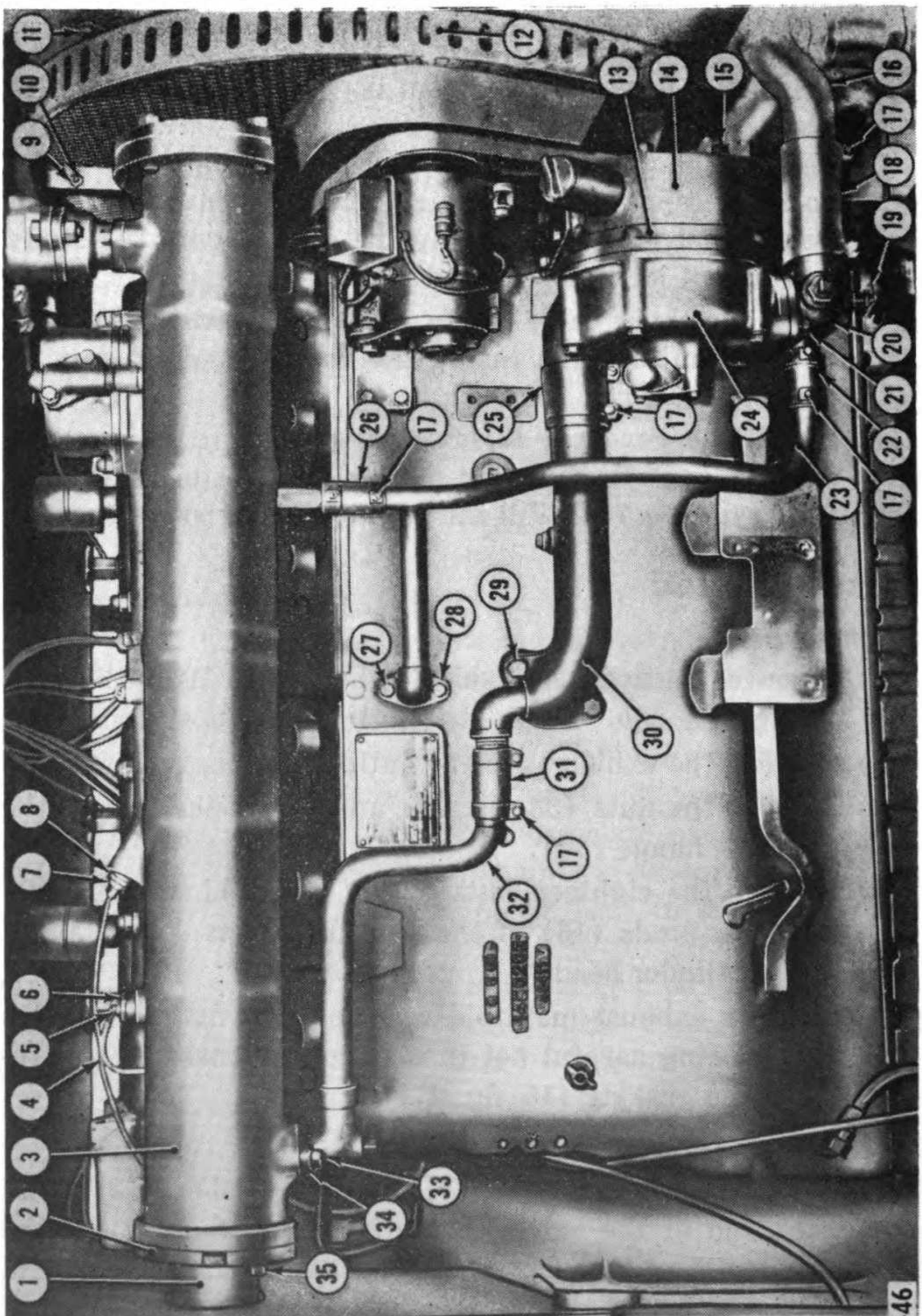

Figure 46. Exhaust manifold, water pump, water piping and hose removal points.

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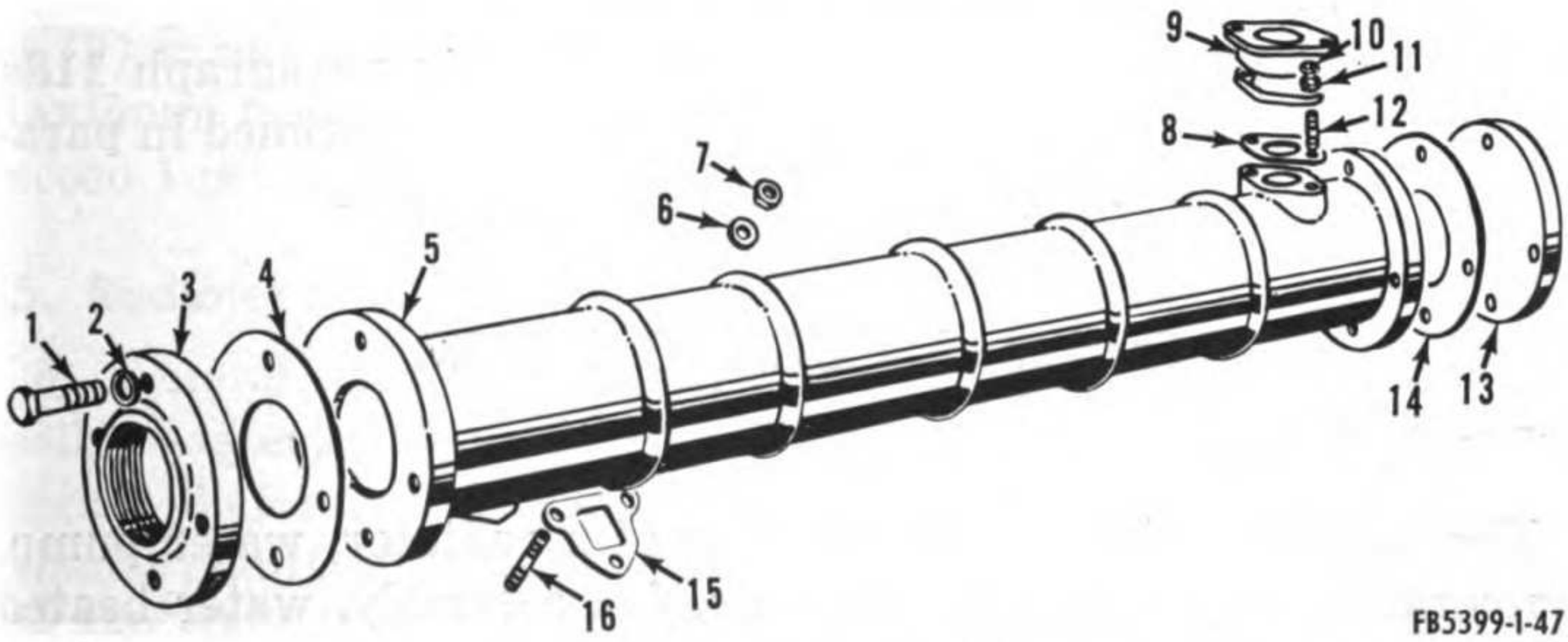
1 Nipple
2 Flange
3 Exhaust manifold assembly
4 High temperature cutout switch lead
5 Screw
6 High temperature cutout switch
7 Temperature gage thermocouple
8 Temperature gage thermocouple socket
9 Nut, fan guard bolt
10 Bolt, fan guard
11 Cap screw
12 Fan guard assembly
13 Pump cover
14 Timing gear housing
15 Cap screw
16 Lower radiator adapter
17 Hose clamp
18 Water inlet hose
19 Drain cock
20 Water inlet elbow connection
21 Cap screw
22 Lower by-pass pipe hose
23 Lower by-pass pipe
24 Water pump assembly
25 Water pump discharge hose
26 Lower-to-upper by-pass pipe hose
27 Cap screw
28 Flange
29 Cap screw
30 Crankcase-to-water pump elbow
31 Exhaust manifold coolant inlet hose
32 Exhaust manifold coolant inlet pipe
33 Nut, inlet flange
34 Flange, inlet line
35 Screw, cap, manifold flange

Figure 46—Continued.



1 Bolt, machine, ⅜ x 1½ in NC (8 rqr)
2 Washer, lock ⅜ in (8 rqr)
3 Exhaust manifold flange
4 Gasket manifold flange
5 Exhaust manifold
6 Washer
7 Nut
8 Gasket, thermostat
9 Thermostat housing adapter
10 Nut ⅜–24
11 Lockwasher $\frac{7}{16}$
12 Stud ⅜–24
13 Exhaust manifold end cover
14 Gasket, end cover
15 Gasket, cylinder head flange
16 Stud

Figure 47. Exhaust manifold, exploded view.

(2) Scrape or brush all carbon, corrosion, or rust from all parts thus affected and scrape off all particles of gaskets, gasket cement or line material.

(3) Inspect the manifold, flanges, and adapter for cracks, breaks, or damage. Check for stripped or damaged threads inside the flange. Renew any defective parts.

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(4) Inspect the stud bolts, studs, and nuts for stripped or damaged threads. Renew all defective parts and renew all gaskets.

d. Reassembly.

(1) Using a stud driver, install and tighten the studs (12).

(2) Place the gasket (14) and exhaust manifold end cover (13) in position at one end of the manifold and the gasket (4) and threaded exhaust manifold flange (3) in position at the other end of the manifold. Install four bolts (1) with lockwashers (2) in each flange.

e. Installation.

(1) Install the gaskets (15) on the studs (16) of the six manifold flanges at the cylinder heads.

(2) Install the exhaust manifold (3, fig. 46) on the studs being careful not to damage the studs. Install and tighten the eighteen nuts (7, fig. 7) with lockwashers (6).

(3) Place the inlet line flange (34, fig. 46) in position against the exhaust manifold and install and tighten the nuts (33) with lockwashers.

(4) Install the exhaust pipe as outlined in paragraph 118*d* and the exhaust manifold thermostat as outlined in paragraph 88*g*. Fill the engine cooling system.

Section IX. COOLING SYSTEM

84. Description

The engine cooling system consists of a radiator, water pump, temperature controlling thermostats, fan assembly, water heated intake manifold, water cooled exhaust manifold, water manifold, and suitable piping and fittings for the passage of the water. The coolant enters the water pump (8, fig. 48) at the pump inlet (7) on the lower right side of the engine. The centrifugal pump causes the supply of cool water to pass into a fitting (9) that leads directly into the engine cylinder jacket. The water enters the engine in the area of the cylinder sleeve lower ends. From here the water flow is directed about the cylinder sleeves in an even manner until it passes upward from the crankcase and into the cored passages in the cylinder heads. These passages are carefully designed to allow cooling water access to all areas around the valves. Some of the water then is led through passages into the intake manifold (6) for heating purposes and then passes through a line across the crankcase, emerges

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on the opposite side and is carried by a short line (11) to join the by-pass line (10) that runs vertically from the thermostat housing to the water pump inlet. A water manifold (5) collects the water from the cylinder heads at several points on the right side of the engine and directs it to the radiator. Thermostats at the forward end of the water manifold control the exit temperature of the water. A by-pass line from the thermostats leads vertically down the right side of the engine and returns the water to the pump inlet for recirculation under cold water conditions. When the engine is warmed up and operating normally, the extire flow passes out of the engine at the water outlet (4) unless temperatures are marginal, in which case occasional by-passing will occur. The exhaust manifold (12) is supplied water through a line which is connected to the elbow where the water enters the cylinders after leaving the pump. At the exit point, a thermostat (1) acts to direct the water to the by-pass line until it has warmed to approximately 165° F. A short line (3) leads directly to the junction of the by-pass line and the main engine thermostat housing. On reaching normal operating temperatures, the water in the exhaust jacket opens the outlet thermostat and passes through the thermostat housing outlet (2) to an elbow connection in the main water outlet hose fitting. Maximum back pressures, feeding into cooling devices, should not exceed 1 psi at 900 rpm, and 2 psi at higher speeds.

85. Radiator

a. General. The radiator assembly (1, fig. 49) is the part of the cooling system which assures that the engine is kept within cooling limits. Water enters the top header from the engine block and exhaust manifold and flows through the core of the radiator where the fan cools it as it passes. Cool water is then directed out the bottom header to the water pump and up through the engine.

b. Removal and Disassembly.

(1) Remove the engine upper hood panel as outlined in paragraph 119*b*.

(2) Remove the filler cap (2) and open the drain cock (5), to drain the radiator and engine block.

(3) Remove the drain cock and pipe coupling (4). Remove the fan guard as outlined in paragraph 91*b*(1) and (2).

(4) Remove the two cap screws (9, fig. 50) and lockwashers (4, fig. 51) that secure the upper radiator adapter flange (8, fig. 50) and gasket (6, fig. 51) to the radiator. Remove the gasket.

(5) Remove the two cap screws (3) and lockwashers (4) that

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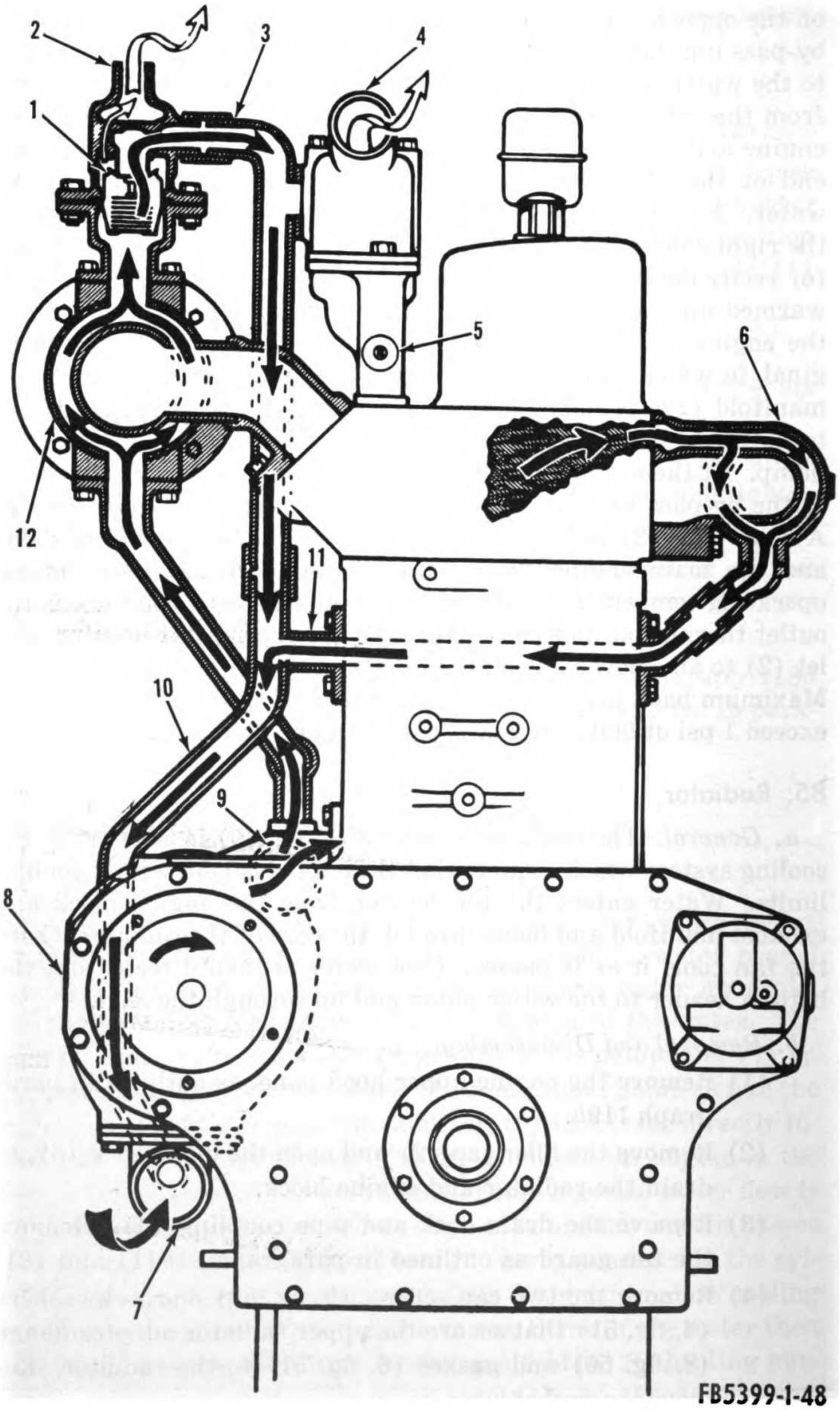

Figure 48. Cooling system flow diagram.

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1	Thermostat	7	Pump inlet
2	Thermostat housing outlet	8	Water pump
3	Short line	9	Fitting
4	Water outlet	10	By-pass line
5	Water manifold	11	Short line
6	Intake manifold	12	Exhaust manifold

Figure 48—Continued.

hold the lower radiator adapter flange (21) and gasket to the radiator. Remove the gasket.

(6) Remove the two front cap screws (3, fig. 49) and lockwashers, and remove the two nuts (20, fig. 51) and lockwashers (19) from the two rear bolts (16) that hold the radiator to the front support (11). Remove the rear bolts and lockwashers (17).

(7) Use a hoist, if possible, to remove the radiator, pulling up and out to prevent damage to the fins against the fan.

(8) Remove the two radiator shims (15) and the four front support shims (18) from the top of the front support.

(9) Remove the four cap screws (10) and lockwashers (9) which hold the radiator guard (8) in place, and remove the guard.

(10) Remove the nipple (12) from the bottom header.

c. Cleaning, Inspection, and Repair.

(1) Clean the core air passages, and radiator guard of all dirt, dust, and foreign matter, using compressed air, if available.

(2) Clean the surfaces of the upper and lower adapter flanges and their connecting points on the radiator of all rust, scale, and remnants of gaskets. Reinstall new gaskets.

(3) Inspect for bent, missing, broken, and cracked fins. Straighten all bent fins, and if an excessive amount of fins are missing, cracked, or broken, replace the radiator.

(4) Inspect the entire assembly for leaks, paying particular attention to the top and bottom header joints and the vertical tubes of the core. If any leaks are noticed, replace the radiator.

(5) Inspect the shims for cracks or breaks. Replace defective shims, using shims of the same thickness.

(6) Inspect the radiator guard for bent, cracked, or broken frame members, and for torn or bent wire. Straighten all bent frame members and wire, and repair or replace the guard if it is cracked or broken.

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(7) Inspect for loose or missing mounting and assembly cap screws and nuts, and for stripped or damaged threads. Repair or replace all defective parts.

(8) Inspect the drain cock for proper operation, and check the threads of the nipple, pipe coupling, and drain cock for damage. Repair or replace all defective parts.

d. Reassembly and Installation.

(1) Install the nipple (12) in the bottom header.

(2) Place the radiator guard (8) in position against the radiator (7), and install and tighten the four cap screws (10) with lockwashers (9).

(3) Place the two radiator shims (15) and the four front support shims (18) in position on the front support (11) and using a hoist if available, lower the radiator onto the front support. When lowering the radiator, be sure not to hit the fan blades.

(4) Insert the two rear bolts (16) with lockwashers (17) up through the front support, shims, and bottom header, and install and tighten the two nuts (20) with lockwashers (19).

(5) Install and tighten the two front cap screws (3, fig. 49) with lockwashers.

(6) Install a new gasket (6, fig. 51) between the lower radiator adapter flange (21), and install and tighten the two cap screws with lockwashers.

(7) Install a new gasket (6) between the upper radiator adapter flange (8, fig. 50), and install and tighten the two cap screws (9) with lockwashers (4, fig. 51).

(8) Install the pipe coupling (4, fig. 49) on the nipple (12, fig. 51) and the drain cock (5, fig. 49) in the coupling. Close the drain cock.

(9) Install the fan guard as outlined in paragraph 91*c* (4), and (5) and install the engine upper hood panel as outlined in paragraph 119*d*.

(10) Fill the system, install the filler cap (2) and test for leaks.

86. Cooling System Cleaning and Flushing

a. General. The cooling system should be cleaned and flushed regularly as follows:

(1) On any occasion when the cooling is restricted, due to accumulations of rust and scale.

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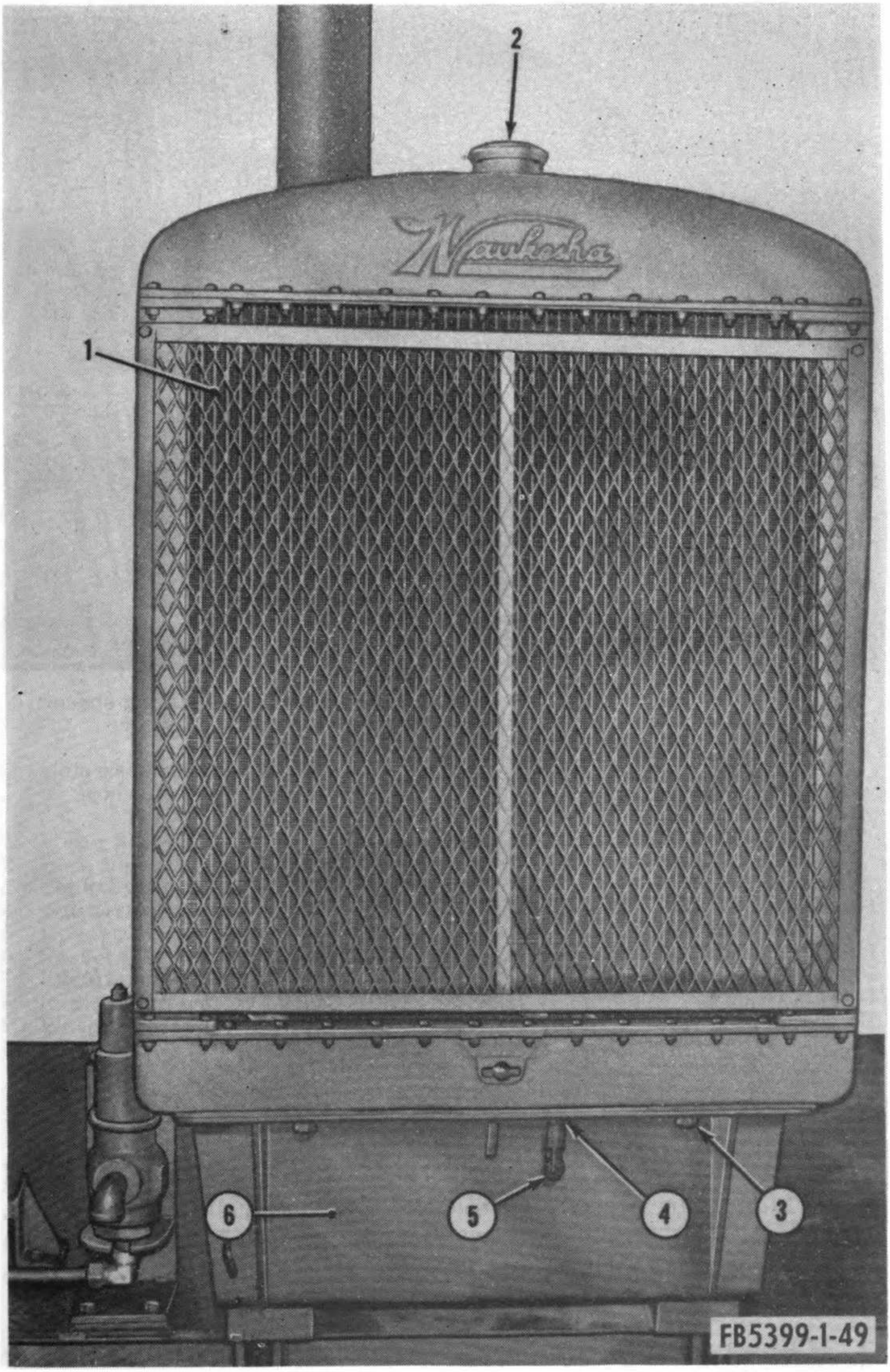

1 Radiator
2 Filler cap
3 Cap screw
4 Pipe coupling
5 Drain cock
6 Front support

Figure 49. Radiator removal and installation points.

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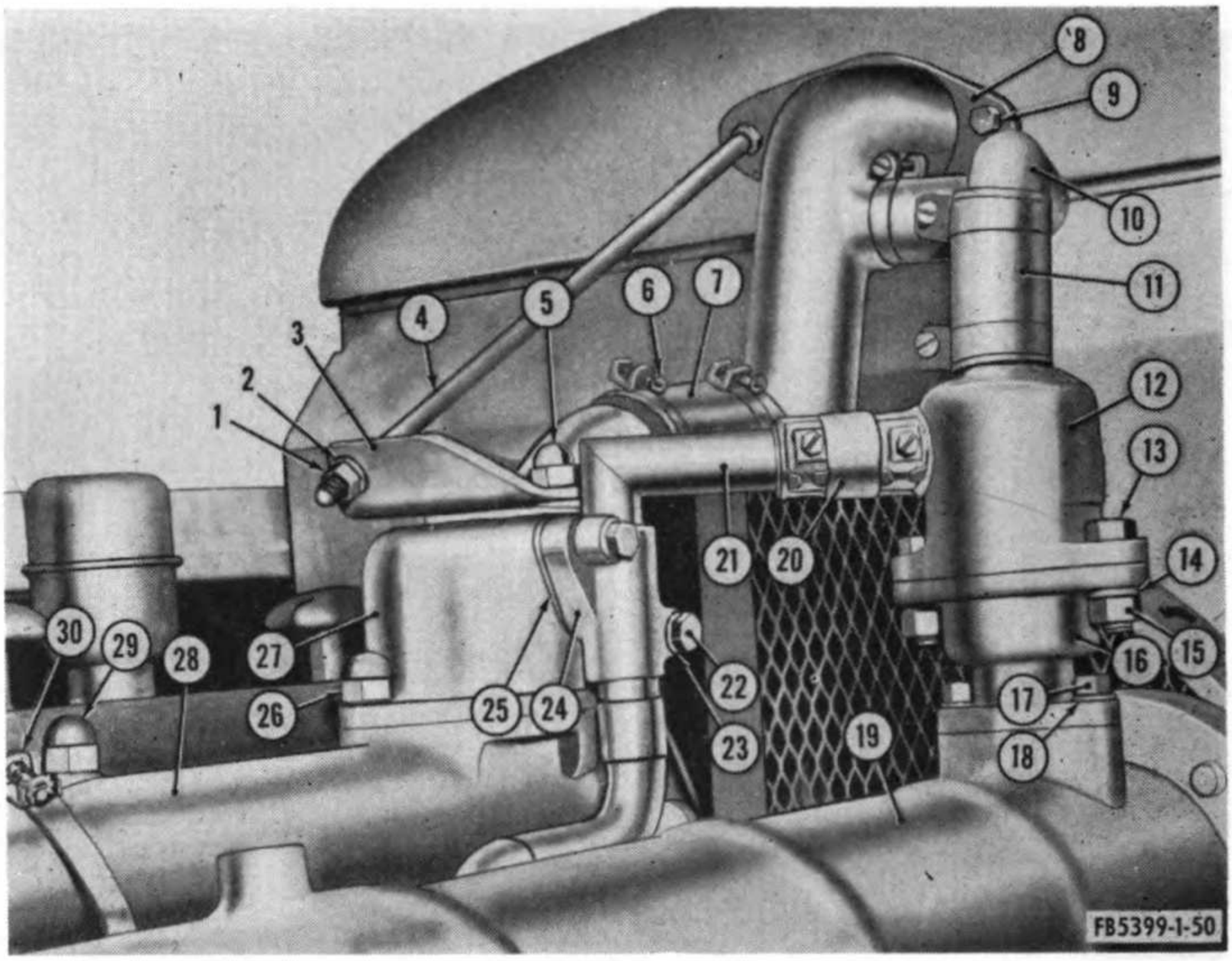

1	Nut	16	Thermostat housing spacer
2	Lockwasher	17	Nut, housing spacer
3	Bracket, radiator brace	18	Lockwasher
4	Brace rod	19	Exhaust manifold assembly
5	Acorn nut	20	Upper by-pass pipe hose
6	Hose clamp	21	Upper by-pass pipe
7	Water outlet hose	22	Cap screw
8	Upper radiator connector flange	23	Lockwasher
9	Cap screw	24	Upper by-pass pipe flange
10	Elbow assembly	25	Gasket, by-pass pipe flange
11	Elbow assembly hose	26	Acorn nut
12	Thermostat housing	27	Thermostat housing
13	Bolt, thermostat housing	28	Front top water manifold
14	Lockwasher	29	Acorn nut
15	Nut	30	Hose clamp

Figure 50. Top water manifold, thermostats, hoses, and piping removal and installation points.

(2) When the engine is operated in alternate hot and cold climate the engine should then be flushed in the fall, before the cooling system is serviced and antifreeze added; and in the spring to remove the rust and scale accumulated during the winter.

(3) When the engine is operated in a continuously warm or cold climate, the cooling system should be drained and flushed once a year.

(4) When the engine is operated continuously in areas, where the water used for cooling has a high mineral salt con-

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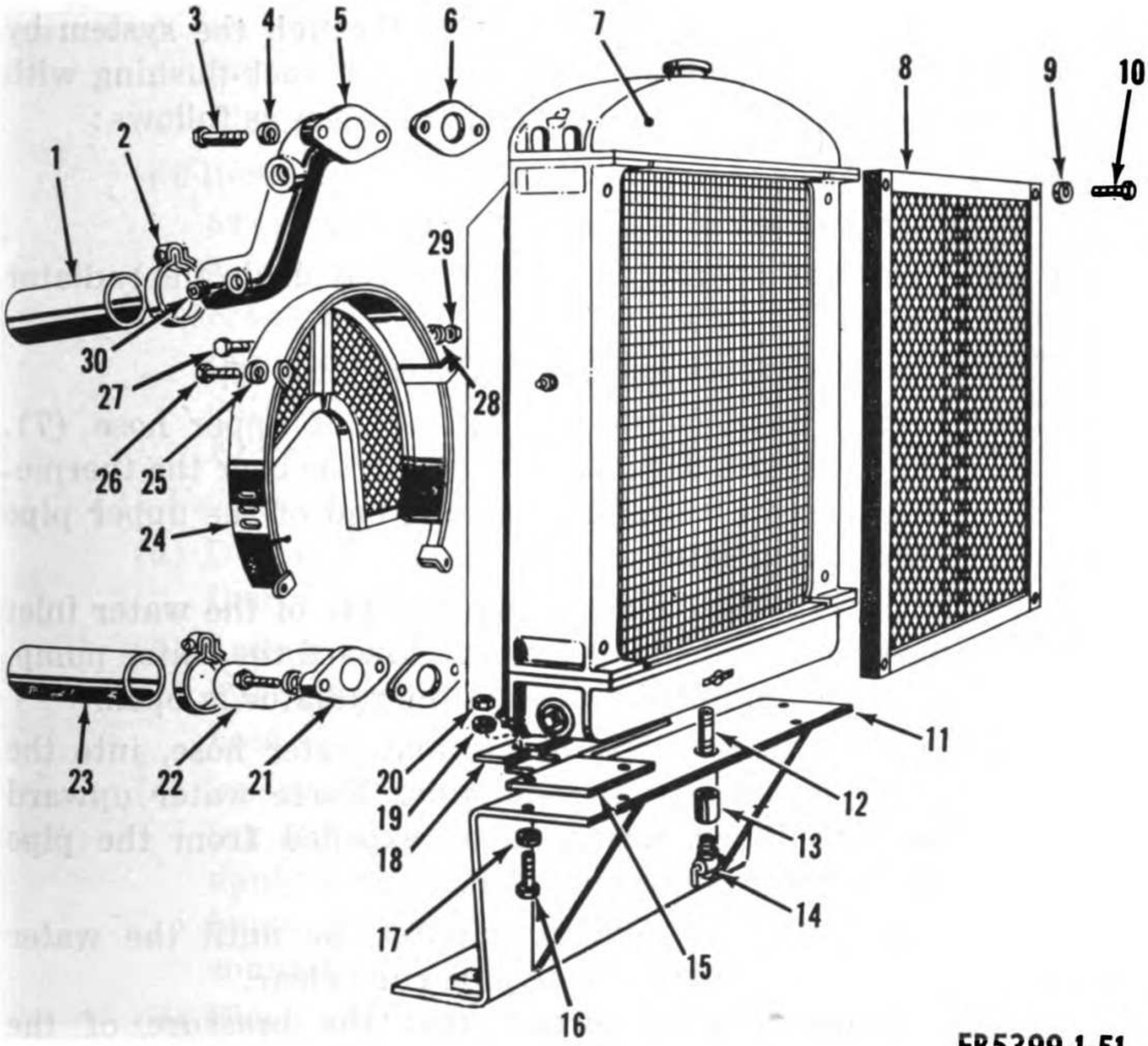

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1 Water outlet hose
2 Hose clamp
3 Screw, cap ⅜ x 1 in NC (4 rqr)
4 Washer, lock ⅜ in (4 rqr)
5 Upper radiator adapter
6 Gasket, radiator adapter
7 Radiator assembly
8 Radiator guard
9 Washer, lock ⅜ in (4 rqr)
10 Screw, cap ⅜ x 1½ in NC (4 rqr)
11 Front support
12 Nipple
13 Pipe coupling
14 Drain cock
15 Radiator shim
16 Bolts, machine ⅝ x 1½ in NC (2 rqr)
17 Washer, lock ⅝ in (2 rqr)
18 Front support shim
19 Washer, lock ⅝ in (2 rqr)
20 Nut, hex, ⅝ in NC (2 rqr)
21 Lower radiator adapter flange
22 Lower radiator adapter
23 Water inlet hose
24 Fan guard assembly
25 Washer, lock ⅜ in (4 rqr)
26 Screw, cap ⅜ x ¾ in NC (4 rqr)
27 Bolts ⅜ x ⅝ in NC (2 rqr)
28 Washer, lock ⅜ in (2 rqr)
29 Nut, hex ⅜ in NC (2 rqr)
30 Pipe plug

Figure 51. Radiator and connections, exploded view.

tent, the cooling system should be drained and flushed every three months.

b. Flushing. Before flushing the cooling system, rust and scale should be loosened by an approved cleaning solution. Pour the solution into the radiator and allow it to circulate in the system for a sufficient period, while the engine is in operation. Use a

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flushing gun which forces air and water through the system by compressed air or the more common method of back-flushing with a water hose. Proceed to flush the cooling system as follows:

(1) *Radiator.*

(*a*) Remove the radiator cap (2, fig. 49).

(*b*) Open drain cock (4) and completely drain the radiator (1).

(*c*) Close drain cock and install the radiator cap.

(*d*) Loosen hose clamps (6, fig. 50) of upper hose (7), slide the hose back toward the engine over the thermostat housing outlet, so that the end of the upper pipe from the radiator is open.

(*e*) Loosen the hose clamps (17, fig. 46) of the water inlet hose (18) and slide hose back toward the water pump, until the end of the pipe to the radiator is open.

(*f*) Insert a water hose, or air and water hose, into the lower opening of the radiator. Force water upward through the radiator, to be expelled from the pipe at the upper hose connection.

(*g*) Back flush for several minutes, or until the water expelled from the upper pipe runs clear.

Caution: Make certain that the pressure of the water, or the air and water, does not exceed 90 psi.

(*h*) Wipe ends of upper and lower pipes with a clean cloth.

(*i*) Apply a thin coat of gasket shellac to the pipe ends, slide hoses into place, and tighten the hose clamps.

(*j*) Fill the radiator with clean water or antifreeze solution allowing room for expansion when liquid is hot. Use an approved rust inhibitor to retard rust and scale accumulations in the cooling system.

Note. If the engine or exhaust manifold are to be back-flushed, do not fill the radiator until the completion of these operations.

(2) *Engine.*

(*a*) With all water drained from the radiator, remove the engine thermostats as outlined in paragraph 89*b*.

(*b*) Loosen the hose clamps (17, fig. 46) on the water pump discharge hose (25) and slide the hose back on the crankcase-to-water-pump elbow (30) so that the end of the elbow is clear. Back flushing will now by-pass both the thermostat and water pump.

(*c*) Insert a water hose, or air and water hose, in the opening through the top water manifold and apply

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stream. Water will be forced down through the water jacket passages and intake manifold, and expelled from the water inlet connection at the water pump.

(*d*) Flush for several minutes or until the water runs clear.

(*e*) Remove water hose and install the engine thermostats as outlined in paragraph 89*d*.

(*f*) Apply a thin coat of gasket shellac to ends of the crankcase-to-water-pump elbow (30) and the water pump outlet connection. Slip the hose (25) onto the outlet connection, and tighten the hose clamps (17). Fill system and test for leaks.

(3) *Exhaust manifold.*

(*a*) Drain the radiator and remove the exhaust manifold thermostat as outlined in paragraph 88*b*.

(*b*) Loosen the hose clamps (17) at the exhaust manifold inlet pipe (32) and remove the exhaust manifold inlet hose (31).

(*c*) Insert a water hose, or air and water hose in the opening at the thermostat housing spacer (16, fig. 50) and apply stream. Water will be forced through the exhaust manifold, and expelled from the water inlet connection.

(*d*) Flush for several minutes or until water runs clear.

(*e*) Remove the water hose and install the thermostat as outlined in paragraph 88*g*.

(*f*) Apply a thin coat of gasket shellac to ends of the exhaust manifold inlet pipe (32, fig. 46) and the elbow-to-manifold water line. Slip hose (31) over pipe ends and tighten hose clamps (17). Fill system.

Note. Flush radiator, engine block, and exhaust manifold in separate operations in order to bypass thermostats and water pump.

87. Water Pump

a. General. The water pump (24, fig. 46) forces circulation of coolant through the engine, radiator, and exhaust and intake manifolds. The water pump consists of a housing with a water inlet, water outlet, and an impeller. The impeller is mounted and driven by the pump shaft. When rotated, it forces coolant from the radiator into the engine block. The water pump is mounted on the lower right-front side of the engine and is driven off the timing gear. It is blind-end, ball bearing, packless or auto-seal type and all leaks or repairs are referred to third, or

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higher echelons. Water pump trouble in the field is handled by replacing the unit as a whole.

b. Removal.

(1) Drain the radiator and engine block, and open the drain cock (19) in the water inlet elbow (20).

(2) Loosen the hose clamps (17) and remove the water inlet hose (18).

(3) Loosen the hose clamps (17) and slide the water pump discharge hose (25) back onto the crankcase-to-water-pump elbow (30).

(4) Loosen the hose clamps (17) on the lower by-pass line hose (22) and remove the hose.

(5) Remove the four cap screws (15) and lockwasher extending through the timing gear housing (14) to the pump cover (13) and the two cap screws which are located between the pump body and engine block and extend through the pump body into the gear housing.

(6) Lift the pump assembly away from the gear housing, being careful not to damage the drive gear teeth.

Note. It may be necessary to turn the pump assembly slightly in order to clear the pump-to-crankcase elbow and the lower by-pass line.

c. Cleaning and Inspection.

(1) Clean the exterior of the pump body, cover, and drive gear with an approved cleaning solvent.

(2) Inspect the pump body and cover for cracks, breaks, and other damage.

(3) Inspect for chipped, broken, or excessively worn drive gear teeth. If any defects are noticed, the entire pump assembly must be replaced with a new or reconditioned one.

d. Installation.

(1) Position the pump drive gear in the timing gear housing (14) using a new gasket between the pump cover (13) and the gear housing.

(2) Install the two cap screws with lockwashers which are located between the pump body and engine block.

(3) Install the four cap screws (15) with lockwashers through the gear housing to the cover and tighten the six cap screws evenly to prevent undue stress on the drive gear and idler gear.

(4) Apply a thin coat of gasket shellac to the ends of the

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lower by-pass line (23) and water inlet elbow (20), install the lower by-pass pipe hose (22) and tighten the hose clamps (17).

(5) Apply a thin coat of gasket shellac to the ends of the crankcase-to-water-pump elbow (30) and the pump outlet connection, slide the water pump discharge hose (25) onto the outlet connection, and tighten the hose clamps (17).

(6) Apply a thin coat of gasket shellac to the ends of the lower radiator adapter (16) and the water inlet elbow (20), install the water inlet hose (18), and tighten the hose clamps (17).

(7) Close the drain cock (19) in the water inlet elbow, fill the system, and test for leaks.

88. Exhaust Manifold Thermostat

a. General. The exhaust manifold thermostat, located at the forward end of the exhaust manifold (19, fig. 50) in conjunction with the engine thermostats, enables a cold engine to warm up to operating temperatures faster by automatically stopping the flow of water from the manifold to the radiator. The hot exhaust gases passing through the manifold transfer heat to the water circulating through the manifold. Located at the side, near the top, of the exhaust manifold thermostat housing (12) is a hose (20) which connects the thermostat housing to the upper by-pass pipe (21). The upper by-pass pipe is mounted on the side of the engine thermostat housing (27) and is connected by suitable hoses and piping to the water inlet elbow. The thermostat remains closed until the water reaches 165° F. temperature thus recirculating the water through the by-pass line back to the pump and preventing cold water from the radiator circulating through the system. When the water temperature has reached 165° F., the thermostat starts to open and allows the water to pass out through the top of the housing. Two short lengths of hose (11) and an elbow assembly (10) connect the housing to the upper radiator adapter (5, fig. 51) directing the heated water into the radiator to be cooled. The thermostat will open and close as needed to keep the water within the normal heat range. The normal heat range for this engine is from 165° F. to 185° F. Do not attempt to repair a broken, or inoperative thermostat. The entire unit must be replaced when defective.

b. Removal.

(1) Drain the system, loosen the two hose clamps (6, fig. 50)

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and slide the hose (20) back onto the upper by-pass line (21).

(2) Loosen the two hose clamps (6) on the hose (11) at the upper radiator adapter and remove the hose.

(3) Remove the nuts (17) and lockwashers (18) and lift the thermostat assembly off the exhaust manifold (19). Remove the gasket (28, fig. 52).

c. Disassembly.

(1) Loosen the two hose clamps (7) on the elbow assembly hose (21) at the top of the thermostat housing (24) and remove the elbow assembly (22) and the hose.

(2) Remove the two nuts (29) and lockwashers (30) from the bolts (23) and remove the bolts.

(3) Lift the thermostat housing of the thermostat housing spacer (27) and remove the gasket (26).

(4) Lift the thermostat (25) out of the housing spacer.

d. Cleaning and Inspection.

(1) Clean all parts of the assembly in an approved cleaning solvent.

(2) Remove all remnants of gaskets from the flanges of the housing and housing spacer, and remove all rust and scale from all metal surfaces.

(3) Inspect the housing, housing spacer, thermostat, and elbow assembly for cracks, breaks, and damage. Replace all defective parts.

(4) Inspect the hoses and hose clamps for cracks, breaks, and signs of deterioration. Replace defective hoses and hose clamps if necessary.

(5) Inspect for loose or missing cap screws and nuts, and for stripped or damaged threads. Repair or replace all damaged cap screws and nuts.

e. Testing Thermostat (fig. 53).

(1) Fill a bucket with sufficient water to cover the thermostat and suspend an accurate thermometer in the water so that the sensitive bulb portion does not rest directly on the bucket bottom or side as shown in figure 53.

(2) Using either a stove or torch, bring the water to a heat range of 160° F., stirring the water while it is being heated for even heating.

(3) As the temperature passes the 160° F., to 165° F., range the thermostat should start to open and should be com-

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pletely open when the temperature has risen to 185° F. to 190° F.

(4) Lift the thermostat into the colder temperature of the surrounding air. This should cause a pronounced closing action and the unit should close entirely within a short time.

f. Reassembly.

(1) Place the thermostat (25, fig. 52) in the thermostat housing spacer (27), seating the thermostat squarely and in the center.

(2) Install the gasket (26) on the spacer and position the thermostat housing (24) on the spacer.

(3) Install the two bolts (23) through the housing and spacer flanges, and install and tighten the two nuts (29) with lockwashers (30).

(4) Apply a thin coat of gasket shellac to the ends of the hose connection at the top of the housing and the elbow assembly. Install the elbow assembly hose (21) on top of the housing, install the elbow assembly (22) in the hose, and tighten the hose clamps (7).

g. Installation.

(1) Install a new gasket (28) on the studs at the exhaust manifold (19, fig. 50) and install the thermostat assembly on the studs.

(2) Install and tighten the nuts (17) with lockwashers (18).

(3) Apply a thin coat of gasket shellac to the ends of the hose connection at the upper radiator adapter and the elbow assembly (10), install the hose (11) and tighten the hose clamps (6).

(4) Apply a thin coat of gasket shellac to the ends of the upper by-pass line assembly (21) and the thermostat housing connection, slide the hose (20) onto the housing connection, and tighten the hose clamps. Fill the system and test for leaks.

89. Engine Thermostats

a. General. At the exit point of the front top water manifold (28, fig. 50) a dual thermostat acts to direct the water circulation through the engine block and intake manifold to the upper by-pass pipe (21), until it has warmed up to approximately 165° F. The thermostat housing (27) is mounted directly on the top water manifold and is connected to the upper radiator adapter by the water outlet hose (7). The two thermostats control the circulation of water from the engine block and intake manifold

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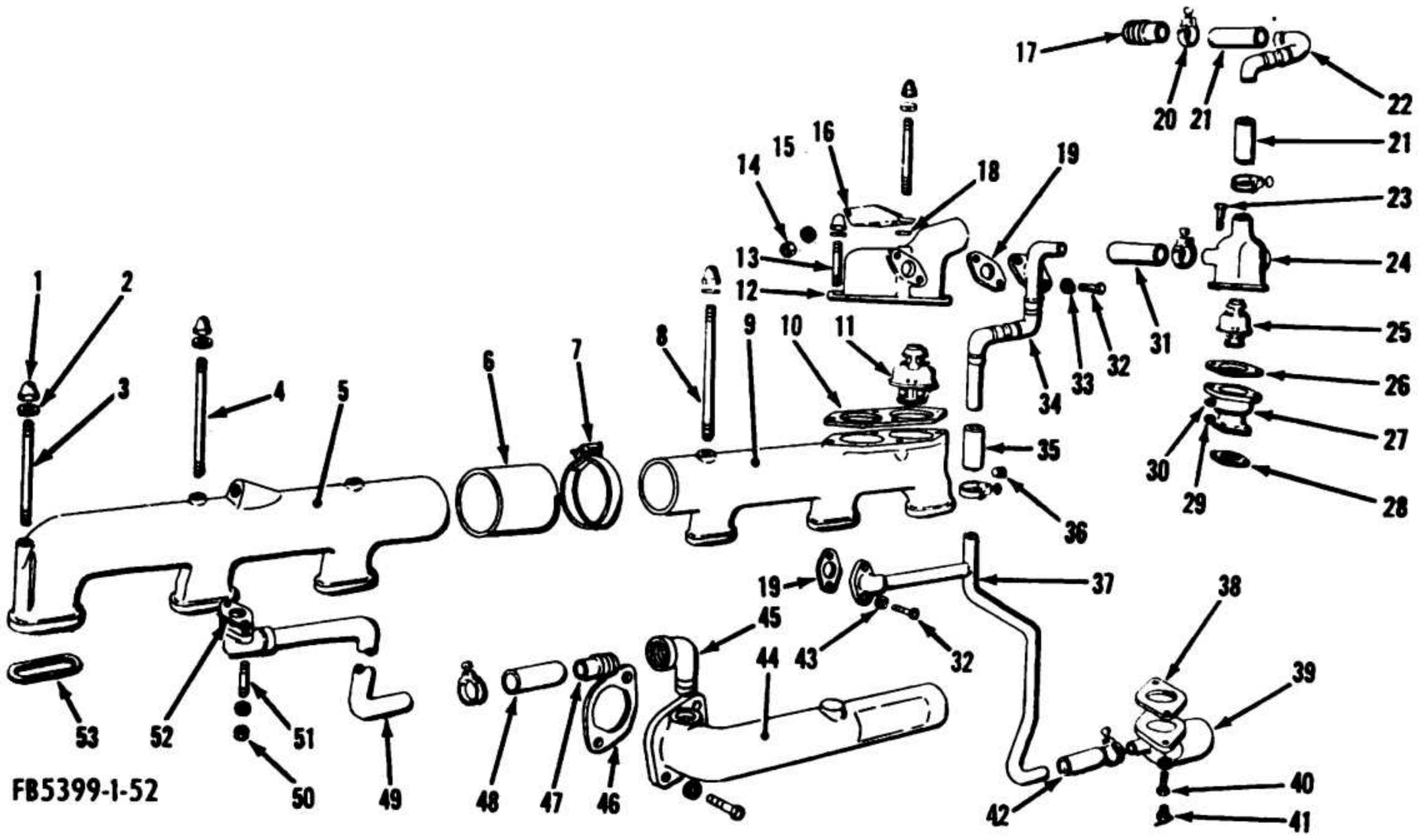

1 Acorn nut
2 Washer, copper
3 Stud, short
4 Stud, medium
5 Manifold, rear top water
6 Hose, water, tap manifold
7 Clamp, hose, manifold
8 Stud, long
9 Manifold, front top water
10 Gasket, thermostat housing
11 Engine thermostat
12 Thermostat housing
13 Thermostat housing stud
14 Nut, hex, ⅜ in NC (3 rqr)
15 Washer, lock ⅜ in (3 rqr)
16 Bracket, brace
17 Hose adapter
18 Washer, plain
19 Gasket, by-pass pipe
20 Clamp, hose, by-pass
21 Hose, by-pass
22 Elbow assembly, upper by-pass
23 Bolt ½–13 x 1¼ in (4 rqr)
24 Thermostat housing
25 Thermostat, exhaust manifold
26 Gasket, thermostat housing
27 Thermostat housing spacer
28 Gasket, manifold thermostat housing
29 Nut, hex, ½–13 in (2 rqr)
30 Washer, lock ½ in (6 rqr)
31 Upper by-pass pipe hose
32 Screw, cap ⅜–16 x 1 in (4 rqr)
33 Washer, copper
34 Upper by-pass pipe assembly
35 Upper-to-lower by-pass pipe hose
36 Pipe plug
37 Lower by-pass pipe assembly
38 Gasket, inlet elbow
39 Water inlet elbow
40 Screw, cap ½–13 x 1 inch (2 rqr)
41 Cock, drain
42 Hose, lower by-pass pipe
43 Washer, lock ⅜ in (4 rqr)
44 Crankcase-to-water pump elbow
45 Elbow, street
46 Gasket, inlet elbow
47 Hose adapter
48 Hose, exhaust manifold inlet pipe
49 Exhaust manifold inlet pipe assembly
50 Nut, hex, ⅜–24 in (2 rqr)
51 Stud, ⅜–24 in (2 rqr)
52 Gasket, manifold inlet flange
53 Gasket, water manifold

Figure 52. Top water manifold, and water pipe assembly, exploded view.

in the same manner as the exhaust manifold thermostat. Two thermostats are used in order to insure adequate reserve circulation for heavy operation and passing large volumes of cooling water.

b. Removal.

(1) Drain the system, loosen the hose clamps (6) on the water outlet hose (7), located between the thermostat

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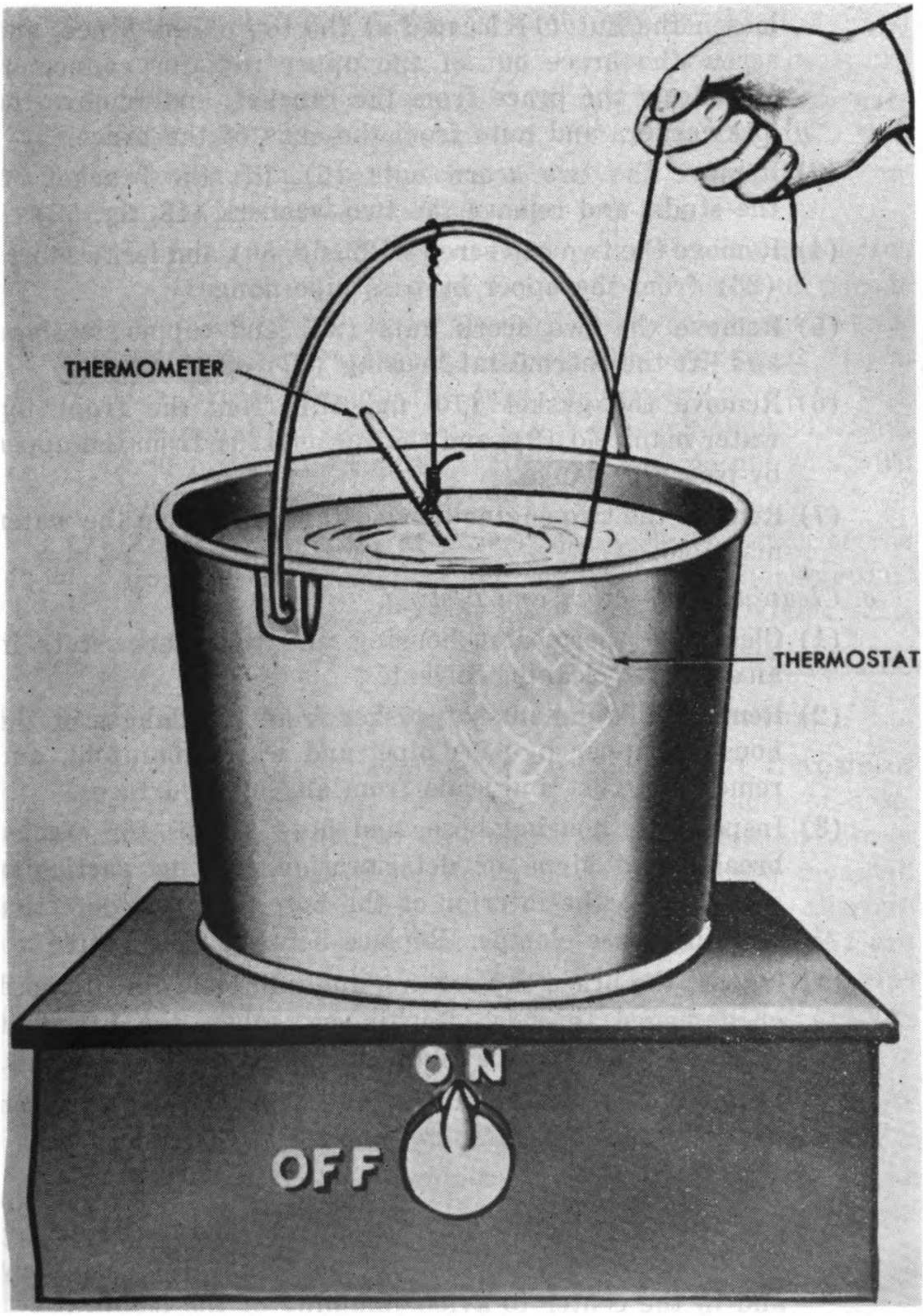

Figure 53. Thermostat testing.

housing outlet and upper radiator adapter, and remove the hose.

(2) Remove the nut (1) and lockwasher (2) from the end of the brace (4). Screw the nut located on the brace inside the bracket (3) at least half-inch up on the brace,

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loosen the nut (1) located at the top of the brace, and screw the brace out of the upper radiator connector. Withdraw the brace from the bracket, and remove the lockwashers and nuts from the ends of the brace.

(3) Remove the two acorn nuts (5), lift the bracket off the studs, and remove the two washers (18, fig. 52).

(4) Remove the two cap screws (22, fig. 50) and lockwashers (23) from the upper by-pass pipe flange.

(5) Remove the two acorn nuts (26) and copper washers and lift the thermostat housing (27) off the studs.

(6) Remove the gasket (10, fig. 52) from the front top water manifold (9), and the gasket (19) from the upper by-pass pipe flange.

(7) Remove the two engine thermostats (11) from the water manifold.

c. Cleaning, Inspection, and Testing.

(1) Clean the thermostat housing and the thermostats in an approved cleaning solvent.

(2) Remove all remnants of gasket from the flanges of the housing, upper by-pass pipe, and water manifold, and remove all rust and scale from all metal surfaces.

(3) Inspect the housing hose, and hose clamps for cracks, breaks, and signs of deterioration, paying particular attention to the interior of the hose. Replace defective hose and hose clamps. Replace housing if defective.

(4) Inspect the brace cap screws, and nuts, and for stripped or damaged threads. Repair or replace the brace, if necessary, and replace all defective cap screws, and nuts.

(5) Test the two thermostats in the same manner as given in paragraph 88*e*.

d. Installation.

(1) Place the two engine thermostats (11) in the front top water manifold (9), seating the thermostats squarely and in the center to aviod jamming of the bellows.

(2) Install a new gasket (10) on the studs of the water manifold, and place the thermostat housing (27, fig. 50) on the studs.

(3) Install a new gasket (19, fig. 52) between the upper by-pass pipe flange and the thermostat housing. Install and tighten the two cap screws (22, fig. 50) with lockwashers (23).

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(4) Install the two washers (18, fig. 52) on the studs, and place the bracket (3, fig. 50) in position on the studs.

(5) Install the two acorn nuts (5), and the two acorn nuts (26) with copper washers (2, fig. 52) on the studs, and tighten them evenly to prevent setting up undue stress on the thermostats and housing.

(6) Install a nut and lockwasher on each end of the brace (4, fig. 50) far enough up on the threads to permit insertion of the brace through the bracket and installation of the brace in the upper radiator adapter. Insert the brace through the bracket, screw the brace into the adapter, tighten the top nut (1) and the inside nut, and install and tighten the bottom outside nut (1) with lockwasher (2).

(7) Apply a thin coat of gasket shellac to the ends of the upper radiator adapter and the thermostat housing outlet, and install the water outlet hose (7). Tighten the hose clamps (6), fill system and test for leaks.

90. Top Water Manifold, Hoses, Piping, and Pipe Fittings

a. General. The top water manifold (28, fig. 50) consists of two castings, connected in the center by a short length of hose, which collect the water from the engine cylinder heads and direct it to the engine thermostats. The two castings are mounted directly on the cylinder heads and the temperature gage thermo-couple (7, fig. 46) and high temperature cut-out switch (6) are mounted on top of the manifold. Suitable hoses, piping, and pipe fittings are provided to circulate the water throughout the system.

b. Removal and Disassembly.

(1) Drain the system and remove the engine thermostats as outlined in paragraph 89*b*.

(2) Remove the high temperature cut-out switch (6) as outlined in paragraph 105*b*, and the temperature gage thermo-couple (7) and socket (8) as outlined in paragraph 115*b*.

(3) Remove the four acorn nuts (29, fig. 50) and lift the front top water manifold (9, fig. 52) and the rear top water manifold (5), with hose (6) attached, off the cylinder heads.

(4) Loosen the two hose clamps (7) and remove the hose (6). Remove the six gaskets (53) from the cylinder heads. Remove the pipe plug (36) from the front manifold.

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(5) Using a stud puller, remove the three short studs (3), the two medium studs (4), and the one long stud (8) from the cylinder heads.

(6) Remove and disassemble the exhaust manifold thermostat, hoses, and piping as outlined in paragraph 88*b* and 88*c*.

(7) Loosen the hose clamps (20) on the lower-to-upper by-pass line hose (35). Remove the capscrews (32) copper washer (33) and remove the upper by-pass pipe (34) and hose.

(8) Loosen the hose clamps (20) on the lower by-pass pipe hose (42) and slide the hose back onto the lower by-pass pipe (37).

(9) Remove the two cap screws (32) and lockwashers (43) from the flange and remove the lower by-pass pipe assembly (37).

(10) Remove the lower by-pass pipe hose (42) and the gasket (19).

(11) Remove the two cap screws (40) and lockwashers holding the water inlet elbow (39) on the water pump (24, fig. 46) and remove the elbow.

(12) Remove the gasket (38, fig. 52) and drain cock (41) from the elbow.

(13) Loosen the hose clamps (20) on the exhaust manifold inlet hose (48) and remove the hose. Remove the two nuts (50) and lockwashers from the studs (51) at the manifold inlet elbow and remove the exhaust manifold inlet pipe (49).

(14) Using a stud puller, remove the two studs (51) from the exhaust manifold.

(15) Loosen the hose clamps (17, fig. 46) on the water pump discharge hose (25) and slide the hose back onto the crankcase-to-water pump elbow (30). Remove the two cap screws (29) and lockwashers from the elbow flange. Remove the elbow and gasket (46, fig. 52).

(16) Remove the water pump discharge hose from the end of the elbow, remove the hose adapter (47) from the street elbow (45), and remove the street elbow.

(17) Remove all hose clamps from all hoses.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts and fittings in an approved cleaning solvent. Make sure there are no obstructions in water passages.

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(2) Scrape or brush all carbon, corrosion, or rust from parts affected, and scrape off all particles of gaskets, gasket cement or like material.

(3) Inspect the manifolds, piping, and pipe fittings for cracks, breaks, and damage. Repair or replace all defective parts.

(4) Inspect all hoses for cracks, breaks, and signs of deterioration, paying particular attention to the interior of the hose. Check all hose clamps for cracks, breaks, and damage. Replace all defective hoses and hose clamps.

(5) Check all studs, nuts, and cap screws for stripped or damaged threads. Repair or replace all defective parts. Renew all gaskets.

d. Reassembly and Installation.

(1) Install the street elbow (45, fig. 52) in the crankcase-to-water pump elbow (44), and the hose adapter (47) in the street elbow.

(2) Slide the water pump discharge hose (25, fig. 46) with hose clamps (17) onto the elbow, place the gasket (46, fig. 52) and elbow in position against the engine block, install the lockwashers (30), and tighten the cap screws (29, fig. 46).

(3) Slide the discharge hose onto the water pump outlet connection and tighten the hose clamps.

Note. When installing cooling system hoses, always apply a thin coat of gasket shellac to ends of the pipe on which it is being installed.

(4) Using a stud driver, install the two studs (51, fig. 52) in the exhaust manifold. Place the gasket (52) and exhaust manifold inlet pipe assembly (49) in position on the studs, install the lockwashers and tighten the two nuts (50).

(5) Install the drain cock (41) in the water inlet elbow (39). Position the gasket (38) and install the elbow, (20, fig. 46) on the water pump assembly (24) and install and tighten the cap screws (21) with lockwashers.

(6) Install the water inlet hose (18) and tighten the hose clamps (17).

(7) Slide the lower by-pass pipe hose (42, fig. 52) with hose clamps (7) onto the lower by-pass pipe (37). Position the gasket (19) and install the lower by-pass pipe flange (28, fig. 46) on the engine block, with lockwashers and the two cap screws (27). Slide the lower by-pass pipe

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hose (22) onto the water inlet elbow connection and tighten the hose clamps (17).

(8) Install the upper-to-lower by-pass pipe hose (26) with hose clamps (17) on the lower by-pass pipe. Install the upper by-pass pipe (34, fig. 52), and tighten the hose clamps.

(9) Using a stud driver, install the three short studs (3), two medium studs (4), and one long stud (8) in the cylinder heads. Install the pipe plug (36) in the front top water manifold (9).

(10) Place the six gaskets (53), front and rear top water manifolds in position on the cylinder heads, and install and tighten the four acorn nuts (1) with copper washers (2).

(11) Install the hose (6) and hose clamps (7) between the manifolds, making sure that it is centered, and tighten the hose clamps.

(12) Reassemble and install the exhaust manifold thermostat hoses, and piping as outlined in paragraph 88*f* and 88*g* and install the engine thermostats as outlined in paragraph 89*d*.

(13) Install the temperature gage thermo-couple (7) and socket (8, fig. 46) as outlined in paragraph 115*d* and the high temperature cutout switch as outlined in paragraph 105*b*. Fill the system and test for leaks.

91. Fan Belts and Fan Guard

a. General. The fan assembly (1 and 13, fig. 54) is driven by two V-belts (10 and 11) from a pulley mounted on the front end of the crankshaft. The inner belt also turns the battery-charging generator pulley and drives the generator. Belt wear and stretch will gradually develop and adjustment will be necessary. Inspect the fan and belts at regular intervals to insure proper engine cooling. The fan guard assembly (12, fig. 46) consists of two semi-circular frames to which wire mesh screening is mounted for protection of the fan blades and the radiator core. The two frames are joined at the top, over the fan pulley, and are mounted on the radiator frame. The right frame member also has a metal strip which extends over the generator pulley, for protection of personnel and to prevent foreign objects from coming into contact with the belts, fan blades, and pulleys.

b. Removal.

(1) Remove the two nuts (9, fig. 46) and lockwashers from the fan guard bolts (10).

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(2) Remove the four cap screws (11) holding the two frame members to the radiator, and remove the frames.

(3) Loosen the clamp nut (8, fig. 54) located behind the fan support bracket, and the fan adjusting nut (2) on top of the fan support bracket.

(4) Lower the fan hub and pulley to relieve the belt tension. Remove the outer belt (11) from the crankshaft pulley and lift it over the fan blade assembly (1). Remove the inner belt (10) from the crankshaft pulley and the generator pulley, and lift it over the fan assembly.

c. Installation.

(1) Install the inner belt (10) over the fan and into the inner groove of the fan and crankshaft pulleys, and the generator pulley.

(2) Install the outer belt (11) over the fan and into the outer groove of the fan pulley (12).

Note. When it is necessary to install new belts, both belts must be renewed at the same time.

(3) Adjust belt tension as instructed in *d* below. Tighten the clamp nut (8).

(4) Place the two sections of the fan guard assembly (24, fig. 51) in position on the radiator, and install and tighten the four cap screws (26) with lockwashers.

(5) Install the two bolts (27) through the frames of the fan guard, and install the lockwashers (28) and tighten the two nuts (29).

d. Checking and Adjusting Fan Belt Tension (fig. 55).

(1) Remove the fan guard (*b*) above.

(2) Grasp each belt one at a time, midway between the crankshaft and fan pulleys with the thumb and forefinger and apply enough pressure to take up all slack in the belt. The belt is properly adjusted when the deflection from the perpendicular is about one inch on either side. More or less than a one inch deflection requires adjustment.

(3) If the deflection is less than one inch, loosen the clamp nut (8, fig. 54), and turn the adjusting nut (2) counterclockwise until the proper tension is reached. If the deflection is more than one inch, turn the adjusting nut clockwise until the proper tension is reached. Tighten the clamp nut after the belts are properly adjusted, and install the fan guard.

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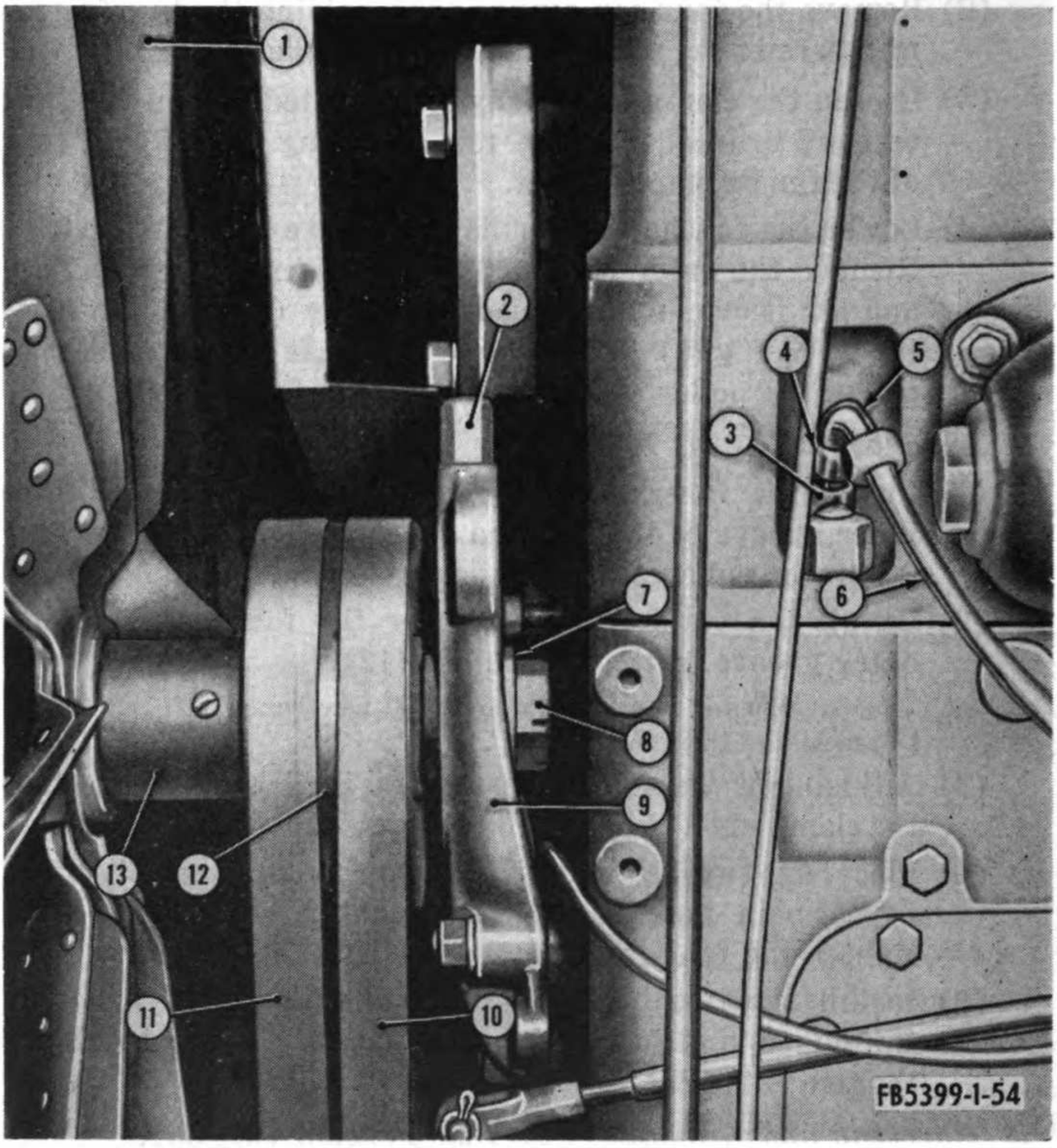

1	Fan blade assembly	7	Clamp, washer
2	Adjusting nut	8	Clamp nut
3	Spark plug	9	Fan bracket
4	Ferrule nut	10	Inner belt
5	Conduit	11	Outer belt
6	Spark plug cable	12	Fan pulley
		13	Fan hub assembly

Figure 54. Fan belt adjustment and fan assembly removal points.

92. Fan Assembly

a. General. The fan assembly consists of a six blade assembly (1, fig. 54) mounted on a fan hub assembly (13) and pulley (12). It is driven by two belts (10 and 11) from a pulley mounted on the engine crankshaft. It is mounted on the fan bracket (9) above the timing gear housing.

b. Removal.

(1) Remove the fan guard and fan belts as outlined in par-

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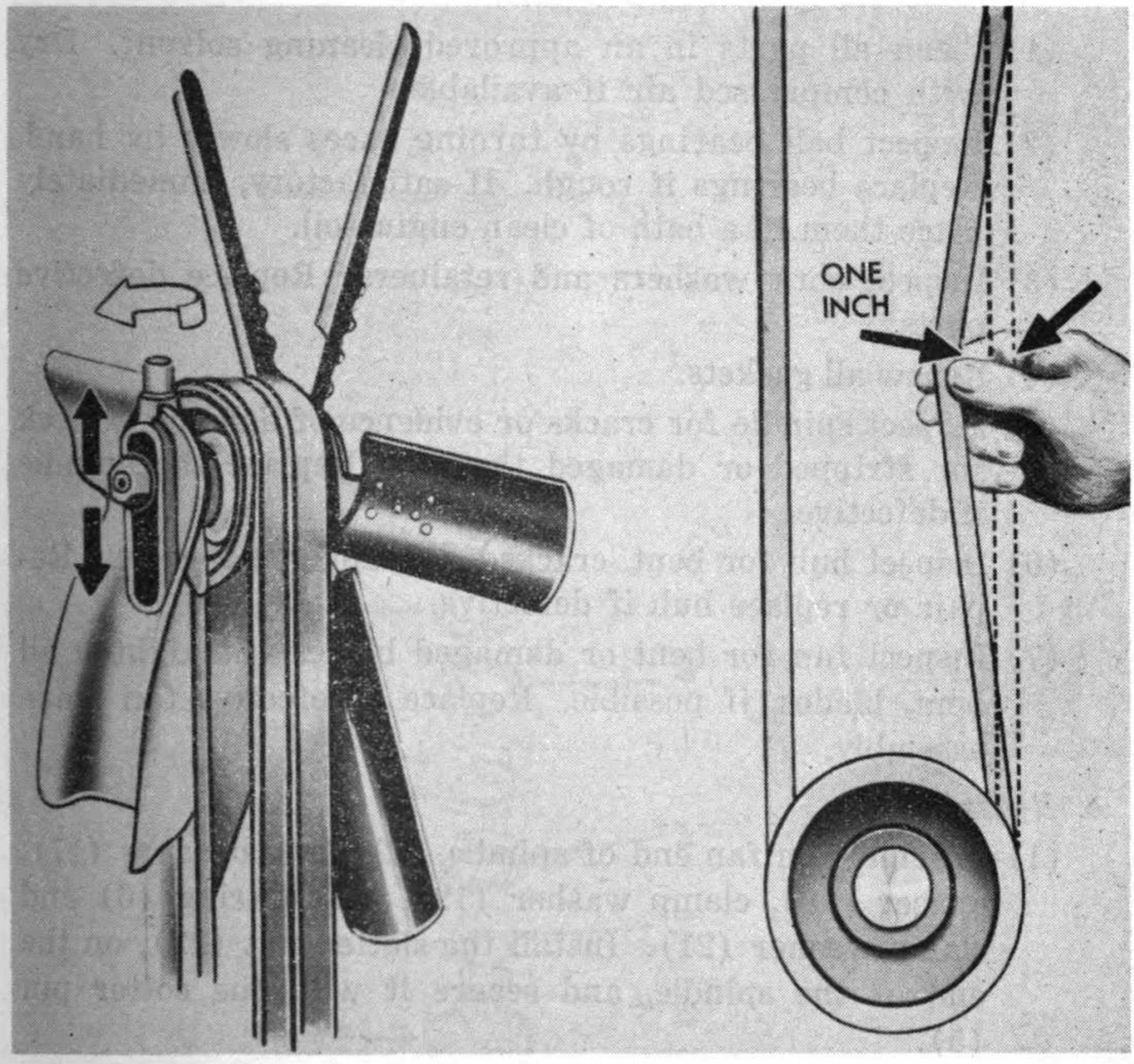

Figure 55. Checking and adjusting fan belt tension.

agraph 91*b*. Remove the clamp nut (8) and clamp washer (7).

(2) Remove the adjusting nut (2) and lift the fan assembly out of the fan bracket (9).

c. Disasembly.

(1) Remove oil plug (7, fig. 56) and drain oil from hub assembly (20).

(2) Remove four cap screws (1) and lockwashers (2) attaching fan blade assembly (3) to hub (20). Remove fan blade assembly and gasket (4).

(3) Remove lock wire (8) on bracket end of spindle (12) and remove cork retainer (11), cork washer (16), cork washer retainer (10), and gasket (9) from spindle (12). Withdraw spindle.

(4) On fan end of spindle withdraw cotter pin (5) and remove slotted nut (22). Remove clamp washer (21), ball bearing (6), clamp washer (19), spacer (18), and ball bearing (17) from spindle (12).

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d. Cleaning, Inspection, and Repair.

(1) Clean all parts in an approved cleaning solvent. Dry with compressed air if available.

(2) Inspect ball bearings by turning races slowly by hand. Replace bearings if rough. If satisfactory, immediately place them in a bath of clean engine oil.

(3) Inspect cork washers and retainers. Replace defective parts.

(4) Renew all gaskets.

(5) Inspect spindle for cracks or evidence of damage. Check for stripped or damaged threads. Replace the spindle if defective.

(6) Inspect hub for bent, cracked, or damaged sheaves. Repair or replace hub if defective.

(7) Inspect fan for bent or damaged blades. Straighten all bent, blades, if possible. Replace a defective fan blade assembly.

e. Reassembly.

(1) Assemble on fan end of spindle (12), ball bearing (17), spacer (18), clamp washer (19), ball bearing (6) and clamp washer (21). Install the slotted nut (22), on the end of the spindle, and secure it with the cotter pin (5).

(2) Insert spindle in hub assembly and assemble the gasket (9), cork washer retainer (10), cork washer (16), and cork retainer (11) on the hub end of spindle. Secure by installing lock wire (8).

(3) Place gasket (4) and fan blade assembly (3) in position against the hub and install and tighten the four cap screws (1) with lockwashers (2).

f. Installation and Adjustment.

(1) Insert the fan assembly through the fan bracket (9, fig. 54) and install the adjusting nut (2).

(2) Install the clamp washer (7) and clamp nut (8) on the spindle, but do not tighten until step (3) below has been completed.

(3) Install the fan belts as outlined in paragraph 91*c*, adjust the belts as outlined in paragraph 91*d*, and install the fan guard as outlined in paragraph 91*c*. Lubricate the fan assembly as outlined in the current lubrication order and install the oil plug (7, fig. 56).

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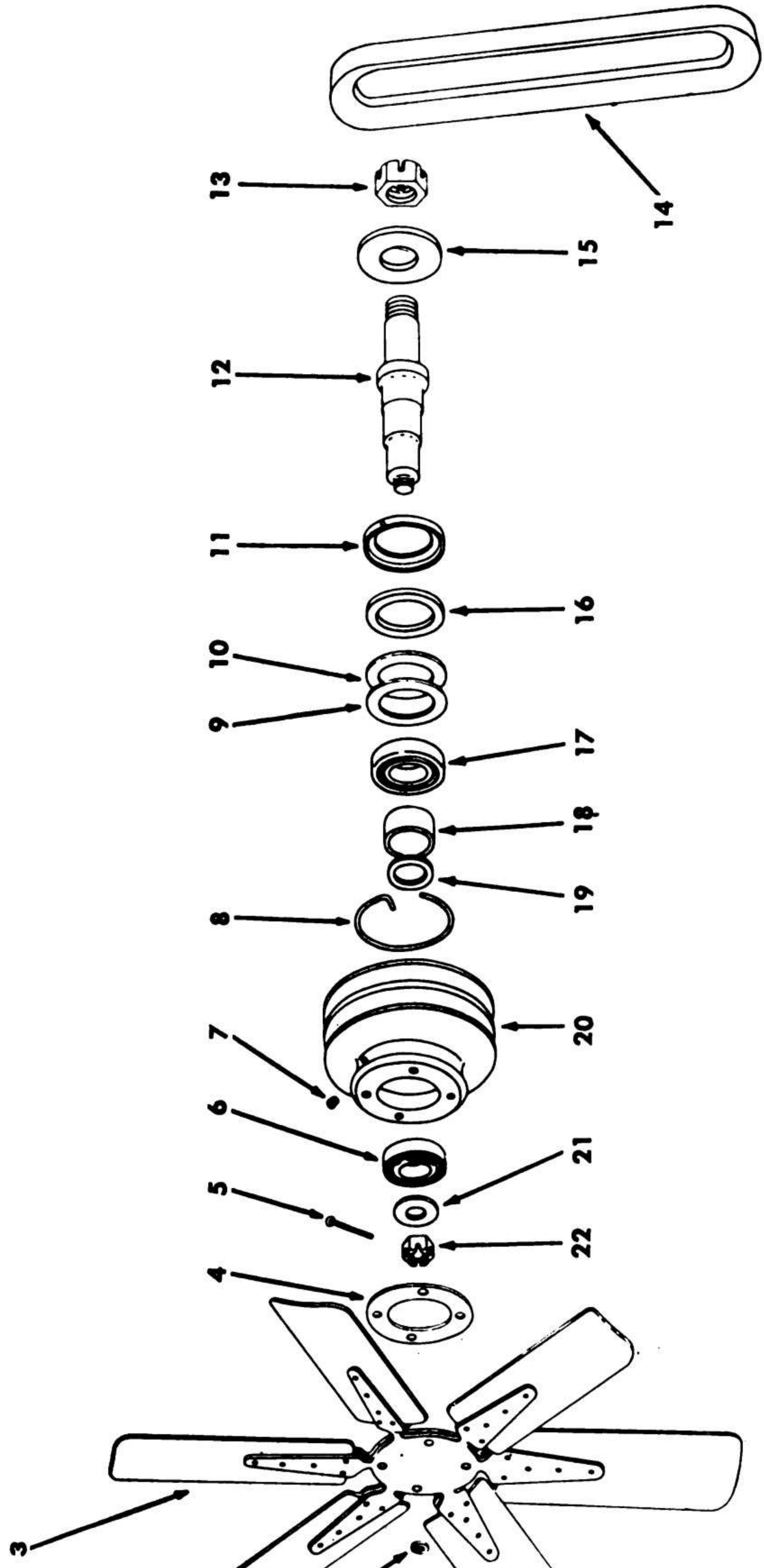

Figure 56. Fan and hub assembly, exploded view.

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Section X. ENGINE ELECTRICAL SYSTEM

93. Description

The engine electrical system is a 12-volt, one-wire system. Included in the system are the battery, battery-charging generator, starting motor, magnetic switch, voltage regulator, magneto, ignition switch, starter switch, engine low oil pressure switch, high temperature cut-out switch, clutch mercury switch, compressor low oil pressure switch, and spark plugs. Also included in the system are the ammeter, engine hour meter, ignition cables and wiring.

94. Storage Battery and Battery Leads

a. General. The battery (8, fig. 21) is a 12-volt lead-acid storage battery containing six cells. It is mounted in the battery box (9) which is located on the skid base at the left side of the engine. The battery ground lead (9, fig. 35) is grounded at the starting motor and is connected to the positive terminal post of the battery. The battery starter lead (6, fig. 57) is connected to the negative terminal post of the battery and the battery terminal of the magnetic switch (5).

b. Removal.

(1) Remove the protective cover (not illustrated) the nut (2, fig. 21) from the battery bolt (4), and lift the battery cable connection (3) off the positive terminal post. Remove the battery bolt.

(2) Remove the nut (7) from the battery bolt (6) and lift the battery cable connection (5) off the negative terminal post. Remove the battery bolt.

Note. It may be necessary to spread the cable connections to remove them from the posts.

(3) Remove the two clamp screws (10) from the battery brackets (11), and lift the screws with brackets from the battery.

(4) Remove the heavy nuts from the battery box.

(5) Lift the battery out of the battery box, and remove the plywood cushion.

(6) Remove the cap screw (8, fig. 35) and internal-external tooth washer (7) holding the battery ground lead (9) and remove the lead.

(7) Remove the cap screw (9, fig. 57) and lockwasher holding the battery starter lead (6) to the magnetic switch (5) and remove the lead.

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c. Cleaning, Inspection, and Repair:

(1) Clean the top of the battery with a rag or stiff brush. Ammonia and water or soda-ash and water are best for this purpose, although plain water may be used. Do not let any water get inside the cells.

(2) Clean the battery terminal posts and coat the terminals with an approved grease.

(3) Inspect the battery cables for loose connections, corrosion and tightness of fit on the battery terminal posts. Check the leads for cracked, frayed, or broken insulation and wire. Replace defective leads.

(4) Open the holes in cell cover caps. Inspect caps for condition and proper fit.

(5) Inspect the battery case for cracks and breaks, paying particular attention to cracks in the sealing compound between the cells on top of the battery. Replace the battery if defective.

(6) Inspect the clamps, bracket, and plywood cushion for cracks, breaks, and damage. Repair or replace all defective parts.

(7) Inspect the clamp screws, cap screws, and nuts for stripped or damaged threads. Repair or replace all defective parts.

d. Installation.

(1) Position the battery starter lead (6) over the terminal of the magnetic switch (5) and install and tighten the cap screw (9) with lockwasher.

(2) Position the battery ground lead (9, fig. 35) on the starting motor flange and install and tighten the cap screw (8) with internal-external tooth washer (7).

(3) Install the plywood cushion in the battery box and place the box in position on the skid base.

(4) Install the battery (8, fig. 21) in the box clamps and install the heavy nuts (9). Place the brackets (11) in position on the battery, and install and tighten the clamp screws (10). Tighten the heavy nuts against the battery box.

Note. When tightening clamp screw, be careful not to exert enough pressure to crack the case. Tighten sufficiently to maintain the battery assembly snugly in place.

(5) Place the battery cable connection (5) in position on the negative terminal post, install the battery bolt (6), and install and tighten the nut (7).

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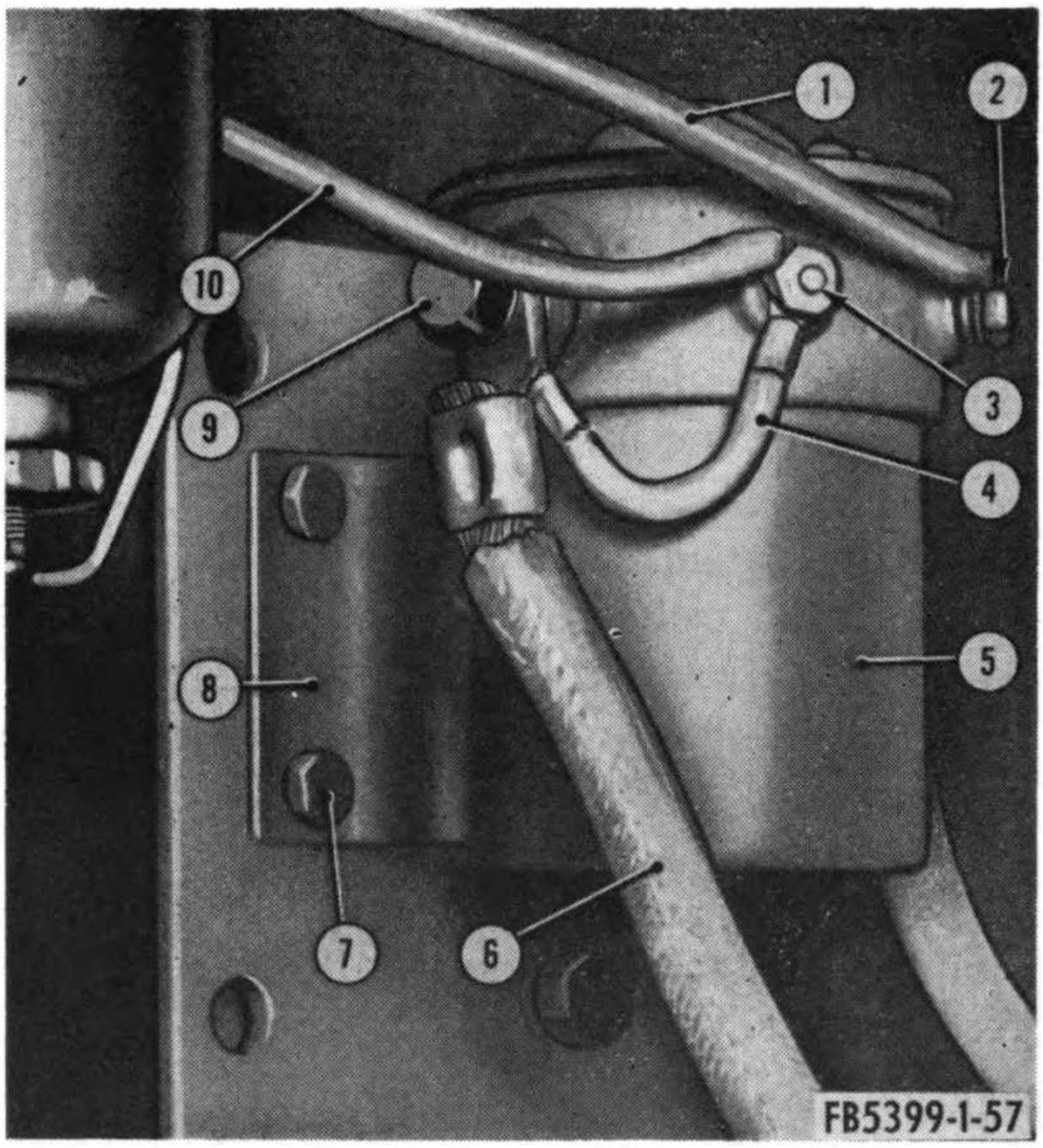
(6) Place the battery cable connection (3) in position on the positive terminal post, install the battery bolt (4), and install and tighten the nut (2). Install the protective cover.



1 Starter button switch lead
2 Nut, starter switch lead
3 Switch control terminal
4 Jumper lead
5 Magnetic switch assembly
6 Battery starter lead
7 Cap screw, mounting bracket
8 Mounting bracket
9 Cap screw, terminal connector
10 Ammeter lead

Figure 57. Magnetic switch mounting connections and removal points.

95. Magnetic Switch

a. General. The magnetic switch (5, fig. 57) is mounted on the left side of the engine above the starting motor. The switch winding is energized by action of the ignition and starter button switch and the battery. This pulls a plunger into the winding to close the circuit between the battery and the starting motor field winding, and energizes the starter motor to start the engine.

b. Removal.

(1) Disconnect the battery ground lead as outlined in paragraph 94*b* (1).

(2) Remove the cap screw (9) and lockwasher to disconnect the battery starter lead (6) and jumper lead (4).

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(3) Remove the cap screw and lockwasher on the opposite side of the switch to release the starting motor lead.

(4) Remove the nuts (2) from the two switch control terminals (3) to release the jumper lead, ammeter lead (10), and starter button switch lead (1) from the terminals (3).

(5) Remove the four cap screws (7) holding the mounting bracket (8) and withdraw the switch assembly.

c. Cleaning and Inspection.

(1) Clean all metal parts with a clean cloth dampened with an approved cleaning solvent.

(2) Inspect cover, housing, and mounting bracket for cracks, breaks, or damage. Replace defective parts.

(3) Inspect the leads for breaks and improperly soldered or corroded terminals, and for cracks or breaks in the insulation. Repair or replace any that are defective.

(4) Inspect the switch control terminals and switch terminal cap screws for stripped threads or corrosion. Replace defective terminal cap screws. Repair defective control terminals. Replace a defective switch.

d. Installation.

(1) Position the magnetic switch (5) and install and tighten the cap screws (7) through the mounting bracket (8).

(2) Place the jumper lead (4) and ammeter lead (10) on the left hand switch control terminal (3), place the starter button switch lead (1) on the other switch control terminal, and install and tighten the two nuts (2).

(3) Place the jumper lead and battery starter lead (6) in position against the switch, and install and tighten the cap screw (9). Place the starting motor lead in position against the opposite side of the switch and install and tighten the cap screw.

(4) Connect the battery ground lead as outlined in paragraph 94*d*(6).

e. Testing.

(1) *Closing voltage.* Connect a 12-volt battery and a variable resistor in series with the switch control terminals. Connect a test voltmeter across the control circuit. Increase the voltage on the switch slowly and note the voltage required to close the contacts. The contacts should close at a maximum reading on the voltmeter of 7.0 volts. Closing of the contacts is indicated by a click which can

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normally be heard. A more exact measurement of closing voltage is to connect test lamp probes between the two main switch terminals. The light will be lighted as the contacts close.

(2) *Current draw.* Use the same test set-up as in (1) above except connect an ammeter in series with the magnetic switch winding. Increase the voltage to 12 volts and read ammeter. The ammeter should read between 12.0 and 13.0 amps.

96. Starting Motor

a. Description. The function of the starting motor is to crank the engine. When the starting switch closes the circuit connecting it to the storage batteries, magnetic fields are produced in the starter. These fields produce a torque effect on the armature causing it to revolve. As the armature rotates, the bendix drive pinion moves down the loosely threaded drive shaft and engages the gear teeth of the flywheel. When the engine starts and its speed exceeds that of the starting motor, the drive pinion is driven back up the threads to disengage the flywheel. The shock of engaging and disengaging is taken up by the drive spring on the shaft.

b. Removal.

(1) Disconnect the battery ground lead as outlined in paragraph 94*b*(1).

(2) Disconnect the starting motor lead (1, fig. 35) by removing the nut (11) and washer (12) from the stud terminal (10) and lifting the lead off the terminal.

(3) Remove the three cap screws (8) and internal-external tooth washers (7) and carefully slip the starting motor from its mounting on the engine flywheel housing.

c. Cleaning and Inspection.

(1) Clean the exterior of the starting motor with a cloth moistened in an approved cleaning solvent. Be careful not to allow any of the cleaning solvent to enter the inside of the starting motor.

(2) Check the starting motor stud terminal for secure mounting on the frame. If it is loose, tighten the hex nut at the base of the terminal. If it will not tighten up, replace the starting motor.

(3) Remove the inspection cover band (17) by removing the screw (18). Check the condition of the commutator. If it needs cleaning, follow the directions given in *e* below. If high mica exists, replace the starting motor. Check

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the condition of the brushes. If they are worn beyond one-half of their original length, replace them. Follow the directions given in *f* below. Reinstall the inspection cover band after inspection and repair.

d. Installation.

(1) Position the starting motor pinion drive housing into the opening in the flywheel housing with the stud terminal (10, fig. 35) pointing outward.

(2) Install the cap screws (8) with internal-external tooth lockwashers (7), and tighten the screws.

(3) Place the starting motor lead (1) on the stud terminal (10), install the lockwasher (12) and tighten the nut (11).

(4) Connect the battery ground lead as outlined in paragraph 94*d*(6).

e. Cleaning Commutator. Remove the inspection cover band (17). Place a ¾-inch strip of No. 00 sandpaper over a piece of wood. With the ignition switch in the OFF position, press the starter button. With the starting motor turning, move the sandpaper back and forth across the commutator until it is brightly polished. Blow out the resulting sand and carbon deposits. Reinstall the inspection cover band. Do not operate starting motor more than 30 seconds at a time.

f. Replacing Brushes.

(1) Remove the inspection cover band. Remove the screws holding the brush lead. Using a wire hook, lift the brush spring and remove the brush from the holder.

(2) Lift the brush spring and insert the new brush, making sure to install it so that it can move freely in its holder. Fasten the brush lead with the screws.

(3) Place a piece of No. 00 sandpaper between the brush and the commutator, with the abrasive side of the sandpaper toward the brush. Move the sandpaper back and forth until the brush conforms to the curve of the commutator. Blow out the accumulated carbon and sand. Replace the inspection cover band.

97. Voltage Regulator

a. Description (fig. 58). The voltage regulator is a 12-volt unit consisting of a cutout relay and a step-voltage control unit. The cutout relay prevents the battery from discharging back through the generator whenever the engine is stopped or is not running

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fast enough for the generator to charge. The step-voltage control, mounted on the same base and enclosed by the same cover, is a magnetic switch which automatically permits full generator output when the battery is low and requires a high charging rate. When the battery comes up to charge, the step-voltage control reduces the generator output to a low value to avoid battery overcharge.

Caution: Before working on any part of the electrical system, disconnect the battery ground cable. Do not reconnect this cable until all the connections have been made. This will avoid short circuiting and possible damage to any of the electrical units.

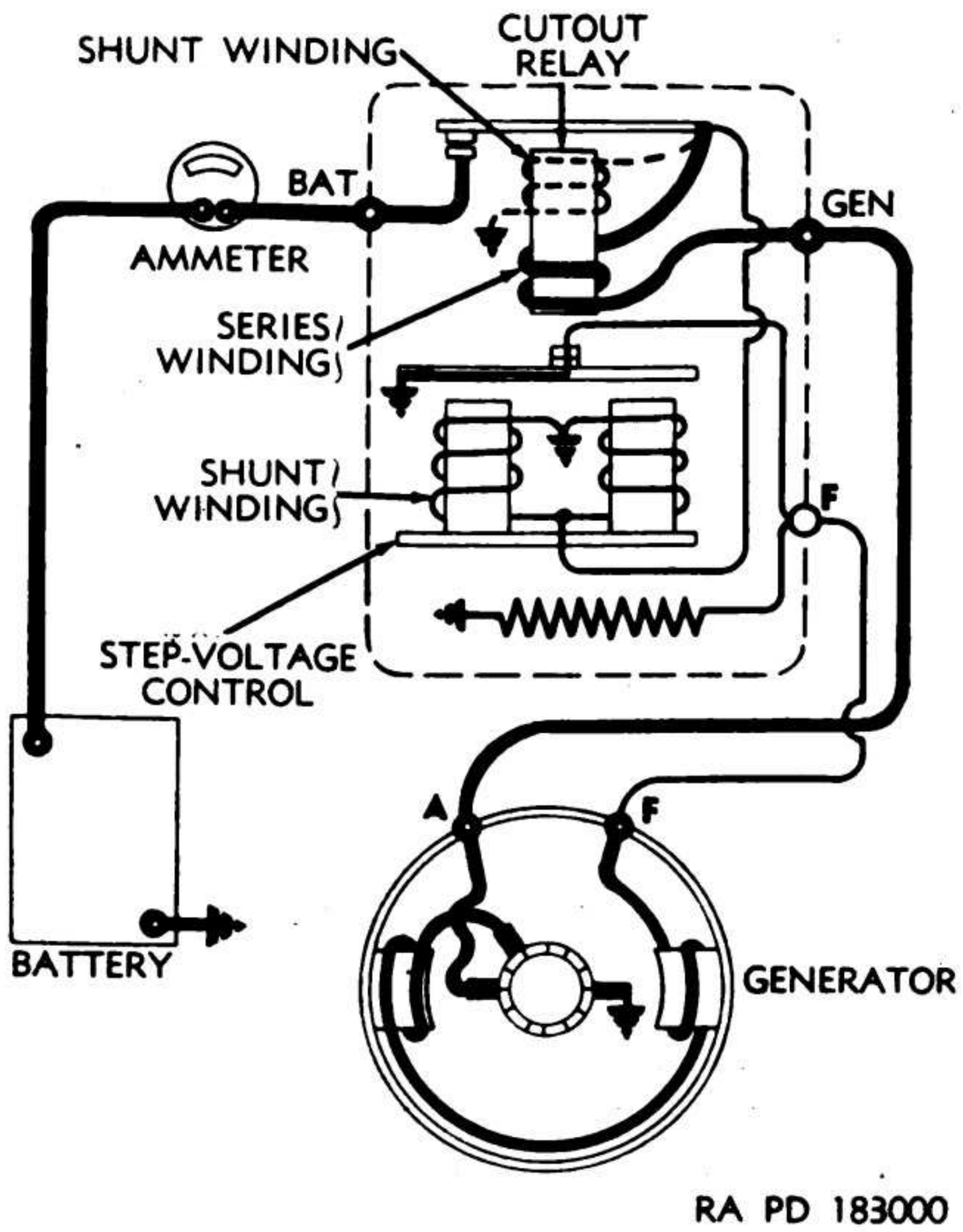

Figure 58. Schematic wiring diagram of the voltage regulator.

b. Inspection. Inspect the battery (par. 94*c* and *d*) and generator (par. 98*c*) for signs of undercharging or overcharging. Rapid and continued fluctuation of the ammeter indicator may indicate that the voltage regulator is defective and should be replaced.

c. Removal (fig. 59).

(1) Disconnect the battery ground lead as outlined in paragraph 94*b* (1).

(2) Remove the nut (19) and lockwasher from the field terminal stud (20) and the armature terminal (22). Lift

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the field terminal lead (21) and armature terminal lead off the terminals.

(3) Remove the capacitor (11) from each side of the voltage regulator (8) as outlined in paragraph 72*b*. Remove the regulator to ammeter lead (14) and remove the regulator.

Note. The capacitor mounting screws (10) and lockwashers (9) also serve as voltage regulator mounting screws.

d. Installation.

(1) Position the voltage regulator assembly (8) on the generator assembly and install the capacitors as outlined in paragraph 72*b*, being sure to position the regulator to ammeter lead (14) on the regulator terminal.

(2) Place the field terminal lead (21) and armature terminal lead on the field terminal (20) and the armature terminal (22). Install and tighten the nut (10) with lockwashers.

(3) Connect the battery ground lead as outlined in paragraph 94*d*(6).

98. Battery-Charging Generator

a. Description.

(1) The generator used on the compressor engine is a twelve-volt, two pole, third brush output-control type. The armature is supported by ball bearings in the drive end and a bronze bushing in the commutator end of the generator. Mounted on the crankcase, the generator is belt-driven from a pulley on the engine crankshaft. A step-voltage control is used in the charging circuit.

(2) A small amount of mechanical energy from the engine is converted into electrical energy by the generator. The converted energy is then carried through the wiring to the battery where it is stored for future use. By altering the position of the third brush with respect to the main brushes, the charging rate of the generator can be changed. The charging rate of the generator is increased by moving the third brush in the direction of rotation and decreased by moving it opposite to rotation.

b. Removal (fig. 59).

(1) Disconnect the battery ground lead as outlined in paragraph 94*b*(1) and remove the voltage regulator (8) as outlined in paragraph 97*c*.

Note. While it is not necessary to remove the voltage regulator to remove the generator, it is best to do so, to avoid damage to the regulator.

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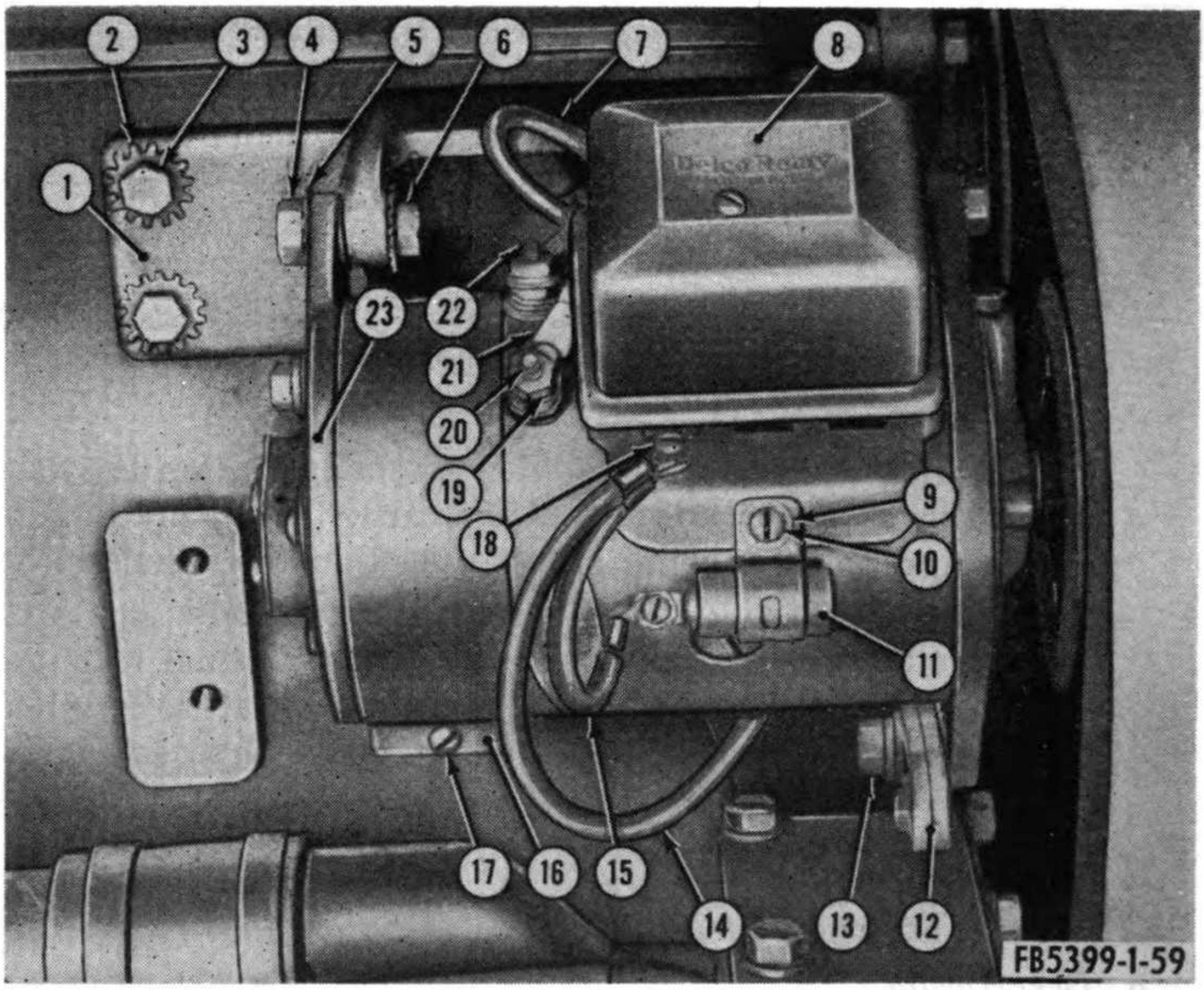

1 Bracket, generator mounting
2 Internal-external tooth washer
3 Cap screw
4 Nut, mounting bolt
5 Internal-external tooth washer
6 Bolt, generator mounting
7 Capacitor lead
8 Voltage regulator assembly
9 Internal-external tooth washer
10 Screw, capacitor mounting
11 Capacitor
12 Adjusting support
13 Cap screw, belt adjusting
14 Regulator to ammeter lead
15 Capacitor lead
16 Inspection cover band
17 Screw, inspection cover
18 Screw, regulator terminal
19 Nut, field terminal
20 Field terminal stud
21 Field terminal lead
22 Armature terminal
23 Generator assembly

Figure 59. Voltage regulator and battery-charging generator removal points.

(2) Remove the cap screw (13) and lockwasher from the adjusting support (12), push the generator back toward the engine crankcase to relieve the belt tension, and remove the generator drive belt from the pulley.

(3) Remove the two nuts (4) and internal-external tooth washers (5) from the mounting bolts (6). Support the generator and remove the bolts and washers. Remove the generator from the mounting bracket (1).

(4) Remove the four cap screws (3) and internal-external tooth washers (2) and remove the bracket. Remove the cap screw and lockwasher holding the adjusting support (12) to the bracket and remove the support.

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c. Cleaning, Inspection, and Repair.

(1) Clean the outside of the generator with a cloth dampened in an approved cleaning solvent.

(2) Inspect insulation, terminals, external connections, and wiring. Replace removable defective parts.

(3) Loosen the screw (17), remove the inspection cover band (16) for inspection of the commutator and brush assembly.

(4) Check for missing lockwashers, missing or loose screws, and check all parts for security of attachment. Replace missing hardware and tighten loose parts.

(5) Inspect commutator for dirt, roughness, out-of-round, high mica, or burning. If necessary clean the commutator as instructed in paragraph 96*e*.

(6) Inspect the brushes for misalinement, sticking, or excessive wear. If edges of brushes do not aline perfectly with the commutator segments, check for incorrect brush assembly or for bent or distorted brush holders. Replace the brushes if they are worn to less than one-half of their original length.

(7) Inspect brush springs for signs of burning or overheating. An overheated spring becomes blued.

(8) Check inside of cover band for signs of melted solder. Melted solder indicates that the generator has been overloaded. Replace the generator if defective.

(9) Inspect the bracket and adjusting support for cracks, breaks, and damage. Inspect all nuts and cap screws for stripped or damaged threads. Repair or replace all defective parts.

d. Installation.

(1) Position the bracket (1) on the crankcase and install and tighten four cap screws (3) with internal-external tooth washers. Place the adjusting support (12) in position against the bracket and install and tighten the cap screw with lockwasher.

(2) Position the generator (23) in the mounting bracket and install the mounting bolts (6). Install the two nuts (4) with internal-external tooth washers (5) on the bolts and tighten.

(3) Start the belt-adjusting cap screw (13), push the generator towards the engine crankcase and install the generator drive belt on the pulley.

(4) Pull the generator out from the engine until the belt has

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the proper tension and tighten the adjusting cap screw (13). Make sure the lockwasher is installed.

(5) Install the voltage regulator as outlined in paragraph 97*d* and connect the battery ground lead as outlined in paragraph 94*d*(6).

99. Magneto

a. Description. The two-pole inductor type magneto (13, fig. 43), together with the spark plugs and spark plug cables, comprise the ignition system of the compressor. The condenser, breaker, and coil assembly are stationary and the magneto rotor rotates between laminated pole shoes. Mounted horizontally to the governor housing, and coupled to the governor drive shaft, the magneto incorporates a built-in impulse coupling to produce a spark at cranking speed for easier starting of the engine. When the magneto rotor shaft attains a speed of approximately 180 rpm, the impulse coupling will automatically disengage and act as a positive drive, timing the ignition to the normal spark advance.

b. Removal.

(1) Unscrew the coupling nuts (16, fig. 43) to disconnect the six spark plug cables (15). Unscrew the knurled nut (14) to disconnect the magneto stop switch wire assembly.

(2) Remove the nuts (12) from the top and bottom studs. Remove the magneto.

c. Cleaning and Inspection.

(1) Clean the exterior of the magneto with a lint free cloth moistened in an approved cleaning solvent. Do not permit any of the solvent to drain into the magneto.

(2) Examine the spark plug cable terminals for loose or missing parts, corrosion or signs of burning. Remove corrosion with a stiff brush. Burning or discoloration is an indication that the breaker contact points are improperly adjusted or that the cables have been improperly installed. Replace missing parts.

(3) Examine the magneto switch terminal for loose, defective, or missing parts. Tighten or replace loose, defective, or missing parts.

(4) Inspect the nuts and mounting studs for stripped or damaged threads. Repair or replace defective parts.

d. Installation.

(1) Remove the three screws (18, fig. 43) from the end shield

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cover (19) and remove the cover. Remove the inspection plug in the center of the magneto shield cover (20).

(2) Rotate the impulse coupling until the arrow on the distributor rotor (1, fig. 60) points to the center of cable outlet number one in the upper right hand corner of the distributor plate. This operation is best performed by turning the impulse coupling clockwise, thus eliminating the engagement of the impulse coupling weights.

(3) Rotate the engine until the timing marks on the flywheel line up at the top dead center for the number one cylinder. This may be established by removing the number one spark plug and holding the thumb over the spark plug hole. Rotate the engine until the point of greatest compression is felt and the timing mark on the flywheel is alined with the mark on the engine block simultaneously.

(4) With the engine and magneto in the positions outlined above, the impulse coupling drive tongues will engage the slot in the magneto drive disc when the magneto is positioned against the mounting flange. Approximate timing to the engine is now obtained.

(5) Tighten the two nuts (12, fig. 43) on the top and bottom studs by hand but not to the extent that the magneto cannot be moved toward or away from the cylinder block.

(6) With the magneto assembled and installed on the engine as in *d*(1) through (5) above, the breaker points should just begin to open. To obtain the exact setting and timing, turn the magneto either in direction of distributor rotation, or opposite to distributor rotation, until the breaker points begin to open at the desired instant. The exact timing (instant of contact point opening) can be checked in either of the two following ways.

(*a*) *With timing light.*

1. Install the end shield cover and connect the ignition wires. Start the engine.

2. Connect a timing light lead to the No. 1 spark plug and check the running spark advance angle indicated on the engine flywheel under the timing pointer.

3. Adjust the position of the magneto as directed in *d*(6) above until the light flashes at the same instant the running spark advance mark inscribed on the flywheel lines up with the timing pointer. The light flashes as the contact points open. Secure the magneto in this position.

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(*b*) *Without timing light.*

1. Crank the engine until the distributor rotor arm approaches the firing position for No. 1 spark plug.

2. Place a thin strip of paper between the breaker points.

3. Adjust the position of the magneto as directed in *d*(6) above until the points open, releasing the paper strip at the exact instant the running spark advance inscribed on the flywheel lines up with the timing pointer. When the exact setting is obtained, secure the magneto in this position. Be sure to remove the paper strip.

(7) When exact timing has been obtained, securely tighten the two nuts (12, fig. 43) on the studs. Place the shield end cap (19) in position and install and tighten the three screws (18). Install the inspection plug in the center of the shield cover (20).

(8) Install the six spark plug cables (15) and tighten the coupling nuts (16). Install the magneto stop switch wire assembly and tighten the knurled nut (14).

e. Replacing Contact Breaker Points.

(1) Remove the four screws (17) from the shield cover (20) and remove the cover.

(2) Remove the cotter pin (5, fig. 60) from the breaker lever pin (4).

(3) Loosen the terminal screw (7) sufficiently to free the breaker lever spring (6) and lift the breaker lever (3) with spring off the pin.

(4) Remove the lock screw (10) and adjusting screw (9) and lift the adjustable contact bracket (8) off the contact breaker plate assembly (2).

(5) Install a new adjustable contact bracket (8) on the contact breaker plate assembly (2) and install the adjusting screw (9).

(6) Install, but do not tighten the lock screw (10).

(7) Install the new breaker lever (3) on the breaker lever pin (4) and the breaker lever spring (6) on the terminal screw (7). Tighten the screw.

(8) Install the cotter pin (5) in the breaker lever pin.

Note. When installing the breaker lever spring be sure that the spring is placed behind the metal washer on the screw.

f. Setting Contact Breaker Points. Crank engine until the breaker lever is resting on the high point of the cam. Insert a

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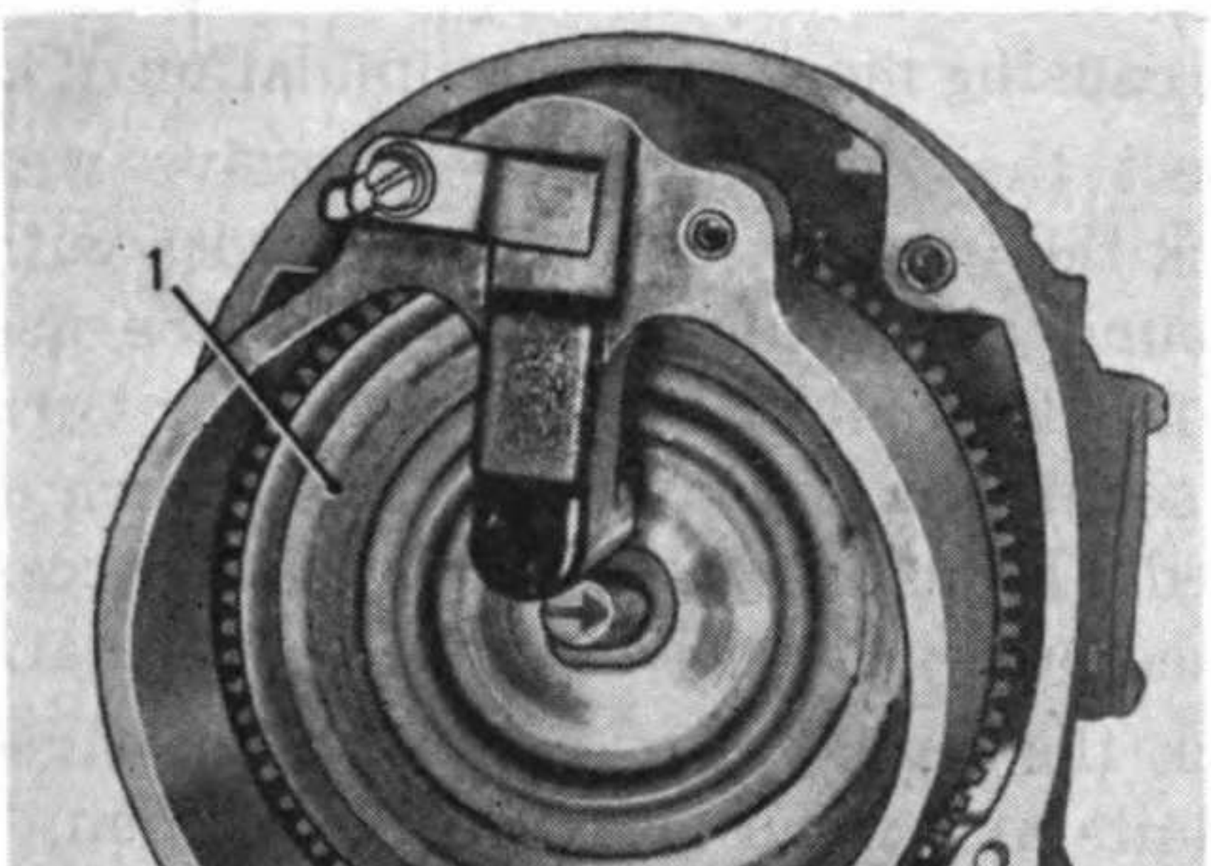
feeler gage between the breaker points (11) and check the gap. Correct setting is 0.016 inch. Turn the adjusting screw (9) until this setting is obtained. Tighten the lock screw (10) after the correct gap is obtained. Turning the adjusting screw clockwise will decrease the gap, and turning it counterclockwise will increase the gap.



1 Distributor rotor
2 Contact breaker plate assembly
3 Breaker lever
4 Breaker lever pin
5 Cotter pin
6 Breaker lever spring
7 Screw, terminal
8 Adjustable contact bracket
9 Adjusting screw
10 Lock screw
11 Breaker points

Figure 60. Replacing and setting contact breaker points.

100. Spark Plugs and Cables

a. Removal.

(1) Remove the spark plug cables at the magneto as outlined in paragraph 99*b*.

(2) Unscrew the ferrule nut (4, fig. 54) on the conduit (5) and pull the electrode out of the spark plug (3).

(3) Using an air hose, blow out all dirt in the cylinder head well.

(4) Use a spark plug box wrench and remove the plug and gasket from the cylinder head.

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b. Cleaning and Inspection.

(1) Clean and inspect the condition of spark plugs. The recommended method of cleaning spark plugs is sand-blasting. A stiff brush may be used if sand-blasting equipment is not available. Never scrape or clean the insulators with anything which will damage the insulators, causing more rapid accumulation of carbon deposits.

(2) Inspect the electrodes for excessive wear or burning. Check the gap between the electrodes with a feeler gage. A round wire feeler gage should be used because the ground electrode will usually wear or burn in a curve. A gap setting of approximately 0.025 inch should be maintained. Replace spark plugs with excessively worn or burned out electrodes or damaged insulation.

(3) Check the spark plug cables for damaged ferrule nuts, conduits and worn or frayed insulation. Replace all defective cables.

c. Spark Plug Setting. Check the gap between the electrodes. A round wire, gage is preferable, but a flat gage may be used when adjusting new plugs, or properly reconditioned ones. Set the gap at 0.025 inch by bending the ground electrode. A spark plug gap setting tool is preferable to avoid damage to the electrode.

d. Installation.

(1) Make sure the spark plug well is clean.

(2) Fit a new gasket over the base of the plugs and start them in the cylinder head well. Screw the plug down finger tight.

(3) If a torque wrench is available, plugs should be seated between 26 and 32 foot pounds. If not, draw them up snugly, but do not exert enough force on the plugs to damage the gaskets on insulator.

(4) Insert the electrode into the spark plug, seat the conduit (5) on the plug, and tighten the ferrule nut (4).

(5) Install the spark plug cables at the magneto as instructed paragraph 99*d*(8).

101. Engine Oil Pressure Switch

a. Description. The engine oil pressure switch (22, fig. 43) works only on oil pressure from the engine. When the engine is running, oil under pressure of 3.5 to 4.5 psi to the switch expands the bellows and opens the switch. If, for any reason, the oil pressure should fail, the bellows will contract and close the switch.

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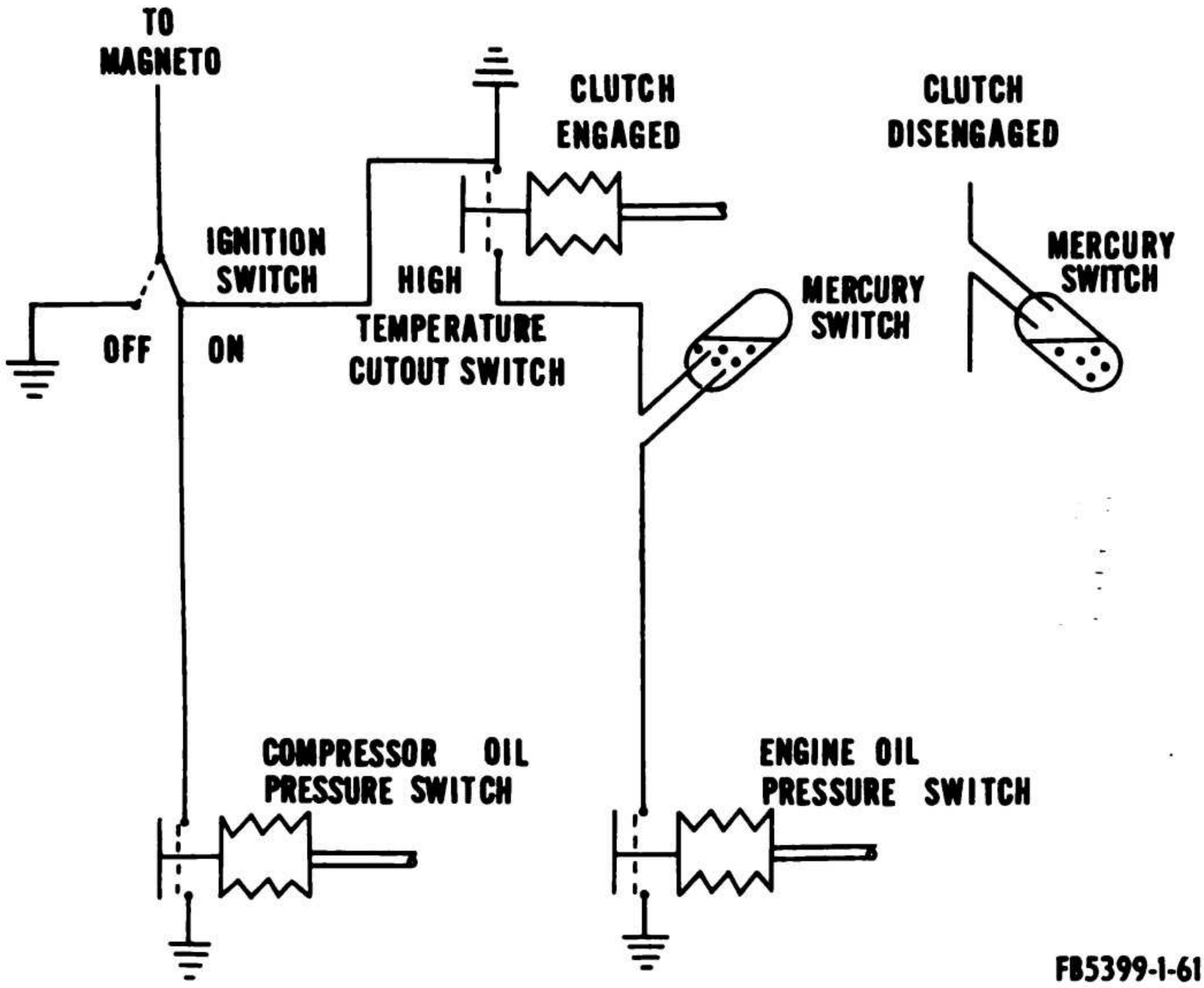

Figure 61. Schematic wiring diagram of ignition and safety switches.

The schematic wiring diagram (fig. 61) shows this switch open as in normal engine operation with normal engine oil pressure.

Caution: Before attempting to remove any of the switches or electrical instruments, be sure to disconnect the battery ground lead as outlined in paragraph 94*b*(1).

b. Removal.

(1) Remove the protective tape from the terminal screw on top of the switch (22, fig. 43), remove the terminal screw nut, and lift the oil pressure switch lead (21) off the terminal screw.

(2) Using a wrench on the hexagonal stem of the switch, remove the switch.

Caution: Do not use a wrench on the body of the switch since this will collapse the bellows inside the body, and render the switch inoperative.

c. Cleaning and Inspection.

(1) Clean the terminal screws and the terminal lug of the switch lead of all dirt, oil, and corrosion. Be sure that

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the terminal connections make a positive contact, otherwise the switch will be inoperative. Replace a defective switch assembly.

(2) Inspect the lead for broken, damaged, or frayed insulation. Repair or replace the lead, if necessary.

d. Installation.

(1) Install the engine oil pressure switch (22) in the engine block and tighten, using a wrench on the hexagonal stem.

(2) Install the oil pressure switch lead (21) on the terminal screw and install and tighten the terminal screw nut. Install the protective tape on the terminal screw.

102. Clutch Mercury Switch

a. Description. The clutch mercury switch (2, fig. 62) is secured to the clutch shaft splines on the end of the clutch shaft (7) with a screw (9) and locknut (8). When the clutch is disengaged the mercury must not be touching the two contacts inside switch tube which are visible through the switch inspection glass (3). This provides an open magneto ground circuit, thus eliminating the engine oil pressure switch from the ground circuit. When the clutch is engaged, as shown in figure 61, the mercury switch is tilted and the mercury closes the circuit between the two contacts. The engine oil pressure switch is then placed in the circuit, and should the engine oil pressure drop below normal, the oil pressure switch grounds the magneto through the clutch switch.

b. Removal.

(1) Remove the two screws (4) from the switch terminals, and remove the ignition switch lead (5) and oil pressure switch lead (6).

(2) Loosen the locknut (8) and remove the screw (9).

(3) Remove the clutch mercury switch (2) from the clutch shaft (7).

Caution: In order to install the switch in the same position on the clutch shaft, be sure to scribe a mark across the end of the shaft and the base of the switch.

c. Cleaning and Inspection.

(1) Using a stiff wire brush or emery paper, clean the switch terminals and the terminal lugs of the switch leads. Be sure that the terminal connections make appositive contact, otherwise the switch will be inoperative.

(2) Inspect the leads for broken, damaged, or frayed insulation. Repair or replace defective leads.

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(3) Check the switch through the inspection glass for loss of its mercury charge. If there is no mercury present, replace the switch.

(4) Inspect the terminal screws, locknut, and mounting screw for stripped or damaged threads. Repair or replace all defective parts.

d. Installation.

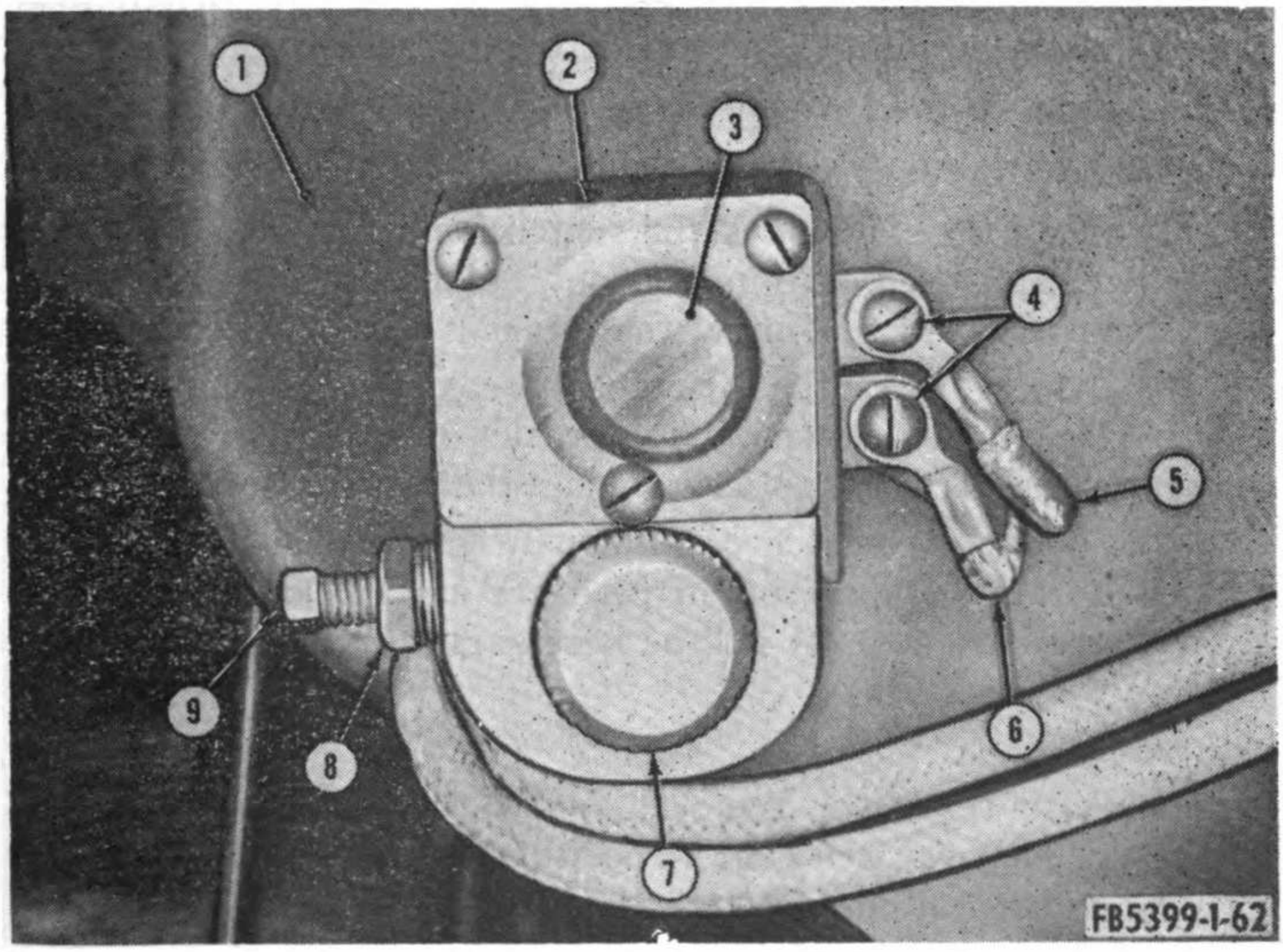
(1) Line up the clutch mercury switch (2) with the clutch shaft (7) at the marks scribed across the switch and shaft, install the switch on the shaft.

(2) Install the screw (9) with locknut (8) in the switch, tighten the screw until it engages the clutch shaft, and tighten the locknut.

(3) Place the ignition switch lead (5) and oil pressure switch lead (6) in position at the switch terminals and install and tighten the two terminal screws (4).

103. Compressor Low Oil-Pressure Switch

a. Description. The compressor low-oil pressure switch (10,



1	Flexible coupling guard	6	Oil pressure switch lead
2	Clutch mercury switch	7	Clutch shaft
3	Inspection glass	8	Locknut
4	Terminal screw	9	Screw
5	Ignition switch lead	10	Cap screw

Figure 62. Clutch mercury switch and flexible coupling guard removal points.

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fig. 11) is connected to the compressor oil system through the oil pressure line (2) which runs along the center of the skid base from the rear of the compressor. The compressor low-oil pressure switch control knob (1) can be set in the ON, RUN, and OFF position. It must be set in the ON position to start the engine. As soon as the clutch is engaged and the compressor is running, oil pressure from the compressor, acting through the bellows assembly (4) causes the switch to move automatically to the RUN position. Should the oil pressure drop, the bellows assembly actuates the switch and moves it to the OFF position. This grounds the magneto and stops the engine. The switch is in the RUN position as shown in figure 61.

b. Removal.

(1) Unscrew the oil pressure line connection (3, fig. 11) from the bellows assembly (4) and lift the oil pressure line (2) clear of the assembly.

(2) Remove the set screw from the compressor low-oil pressure switch control knob (1) and remove the knob.

(3) Remove the two cover screws (8) and remove the cover. Disconnect the compressor low-oil pressure switch lead at the terminal block inside the switch cover.

(4) Remove the two cap screws (9) and remove the switch.

c. Cleaning and Inspection.

(1) Clean the exterior of the switch including the cover with an approved cleaning solvent, being careful not to allow any solvent to contact the interior of the switch.

(2) Inspect the switch for cracks, breaks, and damage. Check the bellows assembly for cracks, breaks, and dents. If any defects are noticed, replace the switch.

(3) Should the switch continuously ground the magneto at normal compressor oil pressure as indicated by the oil pressure gage, it will be necessary to replace the switch with a new one.

d. Installation.

(1) With the cover removed, place the compressor low-oil pressure switch (10) in position against the engine panel and install and tighten the two cap screws (9).

(2) Connect the compressor low-oil pressure switch lead to the terminal block inside the switch.

(3) Place the cover on the switch and install and tighten the two cover screws (8).

(4) Install the compressor low-oil pressure switch control

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knob (1) on the knob shaft and install and tighten the set screw in the knob.

(5) Place the oil pressure line (2) in position and install and tighten the oil pressure line connection (3).

104. Ignition Switch

a. Description. The ignition switch (15, fig. 44) is a two position switch mounted on the engine hood which also serves as the engine instrument panel. It must be in the ON position to start the engine regardless of the position of the other switches. When the switch is in the OFF position the engine cannot be started. The switch is in the ON position as shown in figure 61.

b. Removal.

(1) Remove the nut (6, fig. 63) from the terminal screw at the back of the engine instrument panel and lift the compressor low-oil switch lead (30), clutch mercury switch lead (4), high temperature cutout switch lead (3), and magneto ground lead (2) off the terminal. Tag the leads as they are removed to prevent errors in installation.

(2) Remove the protective tape from the starter button ground lead terminal and remove the terminal nut. Lift the starter button ground lead (5) off the terminal screw.

Note. The starter button ground lead terminal screw and nut also serves as one of the mounting screws and nuts for the ignition switch.

(3) Remove the other two screws (14, fig. 44) from the switch being sure to catch the nuts on the inside of the panel. Remove the switch from the outside of the panel.

c. Cleaning and Inspection.

(1) Using a wire brush or sandpaper, clean the terminal screw and terminal lugs on all leads until a bright, clean surface is obtained.

(2) Inspect the switch for proper operation. If it sticks or fails to open and close the circuit, it must be replaced.

(3) Inspect all leads for loose or broken wiring, and for frayed insulation. Repair or replace defective wiring.

d. Installation.

(1) Insert the ignition switch (15) through the front of the engine hood and install the three mounting screws (14).

(2) Place the starter button ground lead (5, fig. 63) on its terminal screw and install and tighten the nut. Replace the protective tape.

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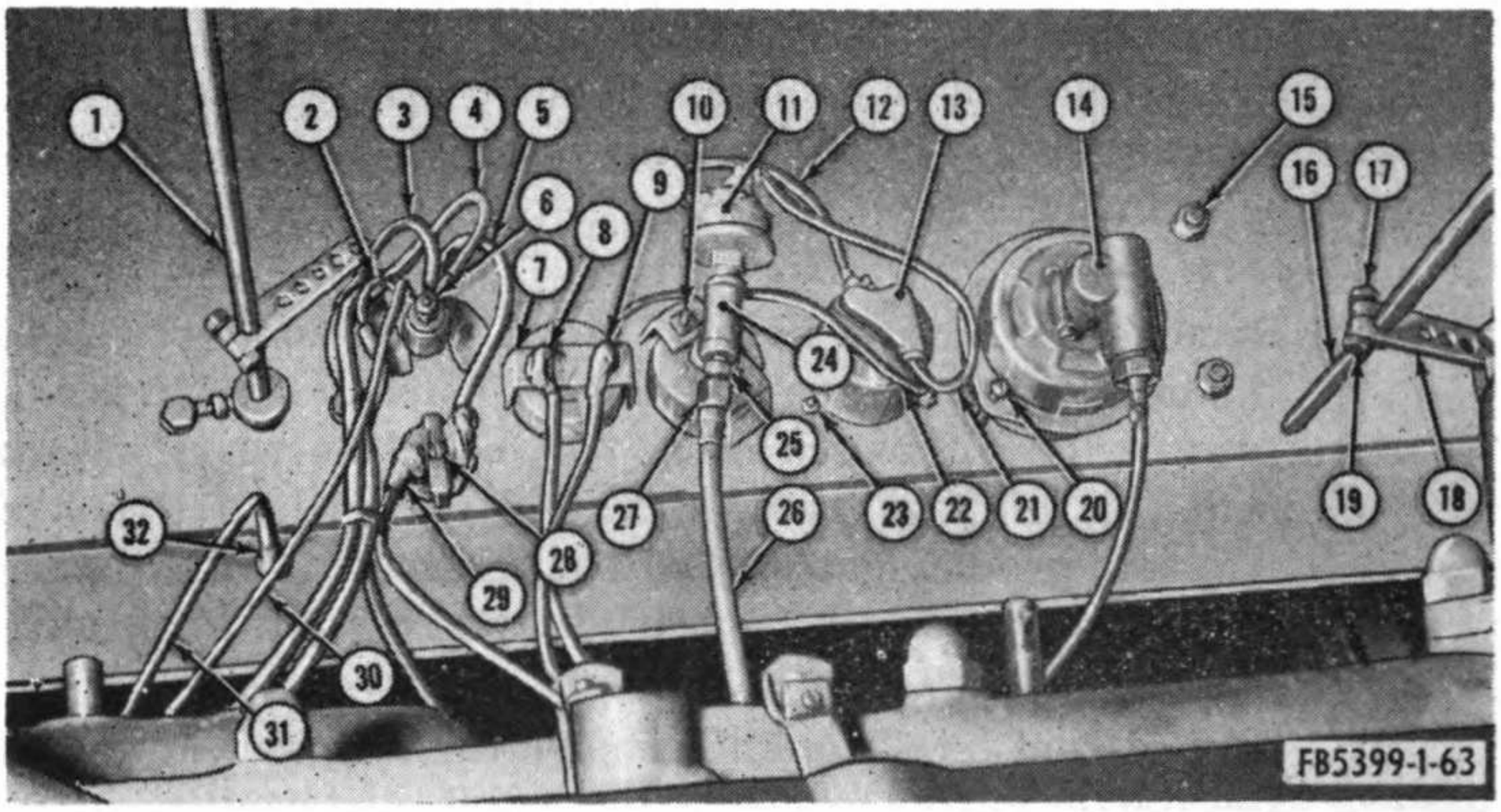
(3) Install and tighten the other two nuts on the mounting screws.

(4) Place the magneto ground lead (2), high temperature cutout switch lead (3), clutch mercury switch lead (4) and the compressor low-oil pressure switch lead (30) on the switch terminal screw and install and tighten the nut (6).



1 Throttle control rod (Not connected)
2 Magneto ground lead
3 High temperature cutout lead
4 Clutch mercury switch lead
5 Starter button ground lead
6 Nut, ignition switch
7 Ammeter mounting bracket
8 Ammeter to magnetic switch lead
9 Regulator to ammeter lead
10 Nut, mounting
11 Hourmeter switch
12 Hourmeter switch ground lead
13 Hourmeter
14 Tachometer
15 Nut, mounting
16 Governor control rod
17 Nut, governor control arm
18 Governor control rod arm
19 Bolt, governor control arm
20 Screw, tachometer mounting
21 Hourmeter to hourmeter switch lead
22 Ammeter to hourmeter lead
23 Nut, hourmeter mounting
24 Tee
25 Adapter
26 Oil line
27 Ferrule nut
28 Screw, starter button
29 Starter button to magnetic switch lead
30 Compressor low-oil pressure switch lead
31 Choke cable assembly
32 Nut

Figure 63. Engine controls and instruments removal and installing points.

105. High Temperature Cutout Switch

a. Description. The high temperature cutout switch (6, fig. 46) is located on top of the engine water manifold. It is normally open as shown in figure 61, but closes when the engine cooling water rises above 200° F., thus grounding the magneto and stopping the engine.

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b. Removal.

(1) Remove the terminal screw (5, fig. 46) and remove the high temperature cutout switch lead (4).

(2) Unscrew the high temperature cutout switch (6), being sure to place the wrench on the hex head of the switch.

c. Cleaning and Inspection.

(1) Clean the terminal screw, terminal lug, and surface of the switch thoroughly of all dirt, rust, or corrosion.

(2) Check the threads for damage and inspect the body of the switch for cracks, breaks, or damage. Replace the switch if defective.

(3) If the water temperature gage indicates normal operating temperatures, and the switch continuously grounds the magneto, the switch must be replaced.

d. Installation.

(1) Install the high temperature cutout switch (6) in the engine water manifold and tighten, being sure to place the wrench on the hex head of the switch.

(2) Place the high temperature cutout switch lead (4) in position on the switch and install and tighten the screw (5).

106. Starter Button

a. Description. The starter button (16, fig. 44) is mounted in the engine hood which also serves as the engine instrument panel. It is a push type switch. It closes the circuit between the magnetic switch and the battery to energize the starting motor.

b. Removal.

(1) Remove the protective tape from the terminal screws and remove the nuts which hold the starter button ground lead (5, fig. 63) and the starter button to magnetic switch lead (29). Remove the leads.

(2) Remove the screw (28) from the mounting bracket, and remove the button at the outside of the instrument panel.

c. Cleaning and Inspection.

(1) Clean the terminal screws and terminal lugs of all dirt, scale or corrosion. Inspect the leads for loose or broken wire and for frayed insulation. Replace defective leads.

(2) Check the button for proper operation. Replace defective starter button.

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d. Installation.

(1) Insert the starter button (16, fig. 44) through the instrument panel and install and tighten the screw (28, fig. 63) in the mounting bracket from the inside of the panel.

(2) Install the starter button ground lead (5) and the starter button to magnetic switch lead (29) on the terminal screws and install and tighten the nuts on the screws. Replace the protective tape.

107. Ammeter

a. Description. The ammeter (13, fig. 44)is mounted in the instrument panel and indicates the rate of charge supplied to the battery or the rate of discharge from the battery. It is graduated from 0 to 30 amperes positive and from 0 to 30 amperes negative. The terminal screws are insulated from the mounting bracket and also serve as mounting screws for the ammeter.

b. Removal.

(1) Remove the protective tape from the terminal screws and remove the nuts holding the ammeter to magnetic switch lead (8, fig. 63), regulator to ammeter lead (9), and ammeter to hourmeter lead (22).

(2) Remove the ammeter from the outside of the instrument panel, being careful not to damage the terminal screws as they pass through the ammeter mounting bracket (7).

c. Cleaning and Inspection.

(1) Clean and inspect the terminal screws and terminal lugs, and leads as instructed in paragraph 106*c*(1).

(2) If the ammeter appears to be defective, it should be replaced, since serious damage to the engine electrical system can result from false ammeter readings.

d. Installation.

(1) Insert the ammeter (13, fig. 44) through the instrument panel, being careful not to damage the terminal screws as they pass through the ammeter mounting bracket (7, fig. 63) from the inside of the panel.

(2) Install the ammeter to hourmeter lead (22), regulator to ammeter lead (9), and ammeter to magnetic switch lead (8) on the terminal screws. Install and tighten the terminal screw nuts, and replace the protective tape.

108. Hourmeter Switch and Hourmeter

a. Description. The hourmeter switch (11, fig. 63), actuated by the engine oil pressure, closes the circuit to the hourmeter (11, fig. 44) which records the number of hours that the engine has

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been in operation. Thus the hourmeter records the hours that the engine is operating under all conditions.

b. Removal.

(1) Remove the protective tape from the terminal screws on top of the hourmeter switch (11, fig. 63), remove the nuts from the terminal screws, and remove the hourmeter switch ground lead (12) and the hourmeter to hourmeter switch lead (21).

(2) Remove the ammeter to hourmeter lead (22) as given in paragraph 107*b* (1).

(3) Remove the switch from the tee (24), being sure to place the wrench on the hex neck of the switch.

(4) Remove the three nuts (23) from the screws (10, fig. 44) and remove the hourmeter from the outside of the instrument panel.

c. Cleaning and Inspection.

(1) Clean and inspect the terminals and leads as instructed in paragraph 106*c* (1).

(2) Check the switch and hourmeter for proper operation. If it appears, the hourmeter is not recording the engine hours correctly, the switch and hourmeter should be replaced.

d. Installation.

(1) Insert the hourmeter (11, fig. 44) through the instrument panel, install the three screws (10), and install and tighten the three nuts (23, fig. 63) from the inside of the panel.

(2) Install and tighten the hourmeter switch (11) in the tee (23), being sure to place the wrench on the hex neck of the switch.

(3) Install the ammeter to hourmeter lead (22) as instructed in paragraph 107*d* (2).

(4) Install the hourmeter to hourmeter switch lead (21) and the hourmeter switch ground lead (12) on the terminal screws on top of the switch. Install and tighten the terminal screw nuts and replace the protective tape.

Section XI. ENGINE MECHANICAL CONTROLS AND INSTRUMENTS

109. General

In addition to the engine electrical controls and instruments described in paragraphs 101 to 108, the engine is equipped with

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the following mechanical controls and instruments; the governor control lever, choke, load-unload valve, manual throttle control lever, tachometer, oil pressure gage, and water temperature gage.

110. Tachometer

a. Description. The tachometer (9, fig. 44) continuously indicates the rpm of the engine while it is in operation. While the removal, repair, and installation is normally the responsibility of third echelon or higher, to remove the engine hood, it is necessary to remove the tachometer. Extreme care must be taken when removal is necessary.

b. Removal.

(1) Remove the three screws (20, fig. 63) from the tachometer (14), being sure to support the glass and cover on the outside of the engine instrument panel.

(2) Withdraw the tachometer from the inside of the panel, place the glass and cover over the face, and install and tighten the screws.

(3) Place the tachometer on top of the engine valve cover being careful not to kink or damage the drive cable. Place a protective cover over the instrument to prevent objects from falling on it.

c. Installation.

(1) Remove the protective cover and remove the three screws holding the glass and cover.

(2) Insert the tachometer through the engine instrument panel from the inside. Support both the glass and cover on the outside and the tachometer on the inside, and install and tighten the three screws (20, fig. 63).

111. Oil Pressure Gage

a. Description. The oil pressure gage (12, fig. 44) is mounted in the engine instrument panel and indicates the engine oil pressure. It is calibrated in increment of pressure from 0 to 75 psi, and graduated in 5 psi intervals. It receives its impulses through the oil line (26, fig. 63) which is connected to the main oil manifold in the crankcase.

b. Removal.

(1) Remove the hourmeter switch as intructed in paragraph 108*b* (1) and (3).

(2) Unscrew the ferrule nut (27, fig. 63) from the adapter (25) to disconnect the oil line (26).

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(3) Remove the tee (24) from the back of the gage and remove the adapter from the tee.

(4) Remove the two nuts (10) from the mounting screws attached to the back of the gage, and remove the gage from the outside of the instrument panel.

c. Cleaning and Inspection.

(1) Clean the exterior of the gage, the tee, adapter, ferrule nut, and oil line with an approved cleaning solvent.

(2) Inspect the gage connection, mounting screws, tee, adapter, and nuts for stripped or damaged threads. Repair or replace all defective fittings and connectors.

(3) Check the glass, dial and dial indicator for satisfactory condition. Replace the gage if defective.

d. Installation.

(1) Insert the oil pressure gage through the engine instrument panel from the outside.

(2) Install and tighten the two nuts (10) on the mounting screws.

(3) Install and tighten the adapter (25) in the tee (24) and install the tee on the gage.

(4) Place the oil line (26) in position at the adapter and install and tighten the ferrule nut (27).

(5) Install the hourmeter switch as instructed in paragraph 108*d* (2) and (4).

112. Choke

a. Description. The choke control button (17, fig. 44) is mounted on the engine hood and is held in place by the nut (32, fig. 63) which is screwed onto the threaded bushing portion of the choke cable assembly (31). The choke wire is imbedded into the choke button and slides back and forth through the cable.

b. Removal.

(1) Disconnect the choke wire and choke cable at the carburetor as instructed in paragraph 74*b* (2).

(2) Remove the choke cable clamp (19, fig. 44) by removing the cap screw (18). Slide the clamp off the cable.

(3) Remove the nut (32, fig. 63) from the threaded bushing, and pull the cable and wire from the front of the engine instrument panel.

(4) Pull the choke wire out of the cable by pulling the choke control button.

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c. Cleaning and Inspection. Clean all parts in an approved cleaning solvent, paying particular attention to the interior of the cable. Inspect the cap screw, nut, and threaded bushing for stripped or damaged threads. Replace all defective parts.

d. Installation.

(1) Apply a film of approved grease and insert the choke wire into the choke cable, being careful not to kink the wire. Insert the choke cable through the panel, being careful not to damage the threads on the bushing.

(3) Install the nut (12) over the cable and install and tighten on the threaded bushing portion of the cable assembly.

(4) Slide the choke cable clamp (19, fig. 44) over the cable and install and tighten the cap screw (18). Connect the choke wire and cable at the carburetor as instructed in paragraph 74*d* (4) and (5).

113. Governor Control Bracket With Lever

a. Description. The governor control bracket with lever (4, fig. 44) is mounted on the engine hood and is used to change the governed speed of the engine. It consists principally of the lever, bracket, knob, and control rod. The control rod is supported on each side of the engine hood, and suitable linkage is provided to increase or decrease the tension of the governor spring, thus changing the governor setting.

b. Removal and Disassembly.

(1) Remove the nut on the opposite side of the hood from the governor control rod supporting bushing.

(2) Remove the cotter pin from the clevis pin at the end of the governor control rod arm (18, fig. 63) and remove the clevis pin.

(3) Remove the nut (17) from the bolt (19).

(4) Remove the two cap screws (7, fig. 44) with lockwashers (6) and withdraw the governor control bracket with lever assembly. As the governor control rod (16, fig. 63) clears the panel on the far side remove the supporting bushing. When the rod clears the rod arm (18), remove the arm.

(5) Remove the nuts (15) from the bolts and remove the governor control bracket (8, fig. 44) from the instrument panel.

(6) Using a grinder, cut, grind off the head of the rivet (32) and also the end of the control rod just above the rivet.

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Remove the lever (33) from the rod. Slide the bracket off the end of the rod.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent.

(2) Inspect the control rod, control bracket with lever, control bracket, and rod arm for cracks, breaks, and damage. Repair or replace all defective parts.

(3) Inspect the teeth in the bracket for chips and breaks. Replace the bracket if the teeth are chipped, broken, or worn to the point that the tongue of the lever cannot be held in place.

(4) Inspect the cap screws and nuts for stripped or damaged threads. Repair or replace all defective parts.

d. Reassembly and Installation.

(1) Slide the governor control bracket onto the governor control rod and place the lever (33, fig. 44) in position on the end of the rod. Support the bracket and rod so that they will not be damaged, and peen the end of the rod over until the lever is tight on the rod.

(2) Install the rivet (32) and peen it over.

(3) Place the governor control bracket (8) in position against the panel, install the two cap screws, and install and tighten the nuts (15, fig. 63).

(4) Insert the governor control rod (16) through the panel and install the governor control rod arm (18) and the supporting bushing as the rod passes through the panel.

(5) When the rod has passed through the panel on the far side, place the governor control bracket with lever (4, fig. 44) in position against the control bracket and install and tighten the two cap screws (7) with lockwashers (6).

(6) With the supporting bushing in position on the inside of the panel, install and tighten the nut on the outside of the panel.

(7) Place the rod arm in approximately the same position that it was in before removal. Install, but do not tighten the bolt (19, fig. 63) and nut (17). Raise the connecting rod and move the arm until the clevis of the connecting rod is alined with the last hole in the arm. Tighten the nut (17).

(8) Install the clevis pin through the clevis and arm, and install the cotter pin.

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114. Load-Unload Valve

a. Description. The load-unload valve is mounted inside the engine instrument panel and its valve handle (3, fig. 44) extends through the panel to the outside of the instrument panel. It controls the admission of air to the throttle controller assembly and in conjunction with the throttle control lever, permits manual or automatic control of the engine speed. It is a two position valve and is connected to the throttle controller assembly by suitable piping.

b. Removal.

(1) Remove the valve handle screw (2) and remove the valve handle (3).

(2) Unscrew the tube coupling nut at the valve inlet on the inside of the panel.

(3) Remove the two mounting screws (1) and withdraw the valve from the inside of the instrument panel.

c. Cleaning and Inspection. Clean all parts in an approved cleaning solvent. Check the valve for proper operation. If valve leaks or is defective, replace with a new one.

d. Installation.

(1) Insert the valve through the engine instrument panel from the inside and install and tighten the two screws (1).

(2) Place the valve inlet line in position at the valve inlet and install and tighten the tube coupling nut.

(3) Install the valve handle (3) on the valve stem and install and tighten the valve handle screw (2).

115. Water Temperature Gage

a. Description. The water temperature gage (4, fig. 15) is mounted on the rear engine panel. A capillary tube is connected to the back of the gage and extends across the engine to the water manifold. The temperature gage thermo-couple (7, fig. 46) on the other end of the tube is mounted in the temperature gage thermo-couple socket (8). The gage indicates the temperature of the engine cooling system and its scale reads from 100° F. to 220° F. in increments of 10° F.

b. Removal.

(1) Unscrew the temperature gage thermo-couple (7) from the temperature gage thermo-couple socket (8). Remove the socket from the water manifold.

Note. To prevent damage to the thermo-couple, after removal, it should be screwed back into the socket.

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(2) Remove the nut (3, fig. 41) from the mounting screw which is attached to the back of the gage.

(3) Remove the gage from the outside of the rear engine panel, being careful not to damage the mounting screw threads as it is withdrawn from the mounting bracket (2), or to kink or bend the capillary tube.

c. Cleaning and Inspection. Clean the socket and thermo-couple of all rust, dirt, and corrosion with an approved cleaning solvent. Inspect the capillary tube and thermo-couple for cracks, breaks, or damage. Check the thermo-couple and socket for stripped or damaged threads. If any defects are noticed, replace the gage assembly.

d. Installation.

(1) Insert the thermo-couple with socket, capillary tube, and water temperature gage (4, fig. 15) through the rear engine panel, being careful not to damage the mounting screw threads, or kink the capillary tube.

(2) With the mounting screw in position in the mounting bracket (2, fig. 41), install and tighten the nut (3).

(3) Install the temperature gage thermo-couple socket (8, fig. 46) in the water manifold. Screw the temperature gage thermo-couple (7) into the socket.

116. Manual Throttle Control Lever

a. Description. The top section of the throttle control lever (1, fig. 12) is connected to and used to manually control the speed of the engine. It consists principally of the throttle control rod (8), detent catch knob (3), and upper lever. The lower section of the lever is the responsibility of third echelon or higher and cannot be repaired by the using unit.

b. Removal.

(1) Disconnect the throttle control rod (8) at the carburetor as instructed in paragraph 74*b*(1). Remove the cotter pin from the clevis pin inside the fork of the upper section of the lever. Remove the clevis pin from the clevis (6).

(2) Remove the control through the hole provided in the rear engine panel. Pull the detent catch knob (3) back and turn it until it locks in position.

(3) Remove the nut and lockwasher from the bolt (4). Remove the bolt and lockwasher (5). Lift the upper section of the lever off the lower section.

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(4) Measure the distance from the top of the locknut (7) to the top of the threads on the control rod. Record the measurement for use in reassembly. Loosen the locknut, remove the clevis, and remove the locknut. Perform the same operation on the carburetor end of the control rod.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent.

(2) Inspect for bent, cracked, or broken clevises, control rod, and lever. Straighten all bent parts, if possible, or replace defective parts.

(3) Check the control rod, nuts, and bolts for stripped or damaged threads. Replace defective parts.

(4) Check the tension of the detent catch spring. Replace the spring if defective. To replace the spring, drive the lock pin out of the detent catch knob with a drift pin, remove the knob, and remove the spring. Install a new spring, install the knob, and reinstall the lock pin.

d. Installation.

(1) Install a locknut (7) on each end of the throttle control rod (8) up to the point measured on the threads as instructed in *b* (4) above. Install the clevis on each end of the rod and tighten the locknuts.

(2) Place the upper section of the lever (1) in position on the bracket, being sure that the detent catch is locked in the disengaged position.

(3) Install the cap screw (4) with lockwasher (5) and install and tighten the nut with lockwasher on the cap screw.

(4) Insert the throttle control rod (8) through the rear engine panel, place it in position in the fork of the lever, insert the clevis pin through the lever and clevis (6), and install the cotter pin in the end of the clevis pin.

(5) Connect the throttle control rod at the carburetor as given in paragraph 74*d*(6).

Section XII. EXHAUST PIPE, MUFFLER, AND ENGINE HOOD

117. General

The exhaust pipe is connected to the exhaust manifold inside the engine hood and extends through the rear engine panel to a point above the engine hood. The muffler is attached to the pipe at this point and extends upwards still higher above the engine hood, thus minimizing, as much as possible, the danger of carbon monoxide

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accumulation. It is imperative that the pipe and muffler be kept in good condition and airtight to prevent the escape of carbon monoxide at a lower level. The engine hood is provided to protect the engine under adverse operating conditions and to prevent, as much as possible, the danger of foreign objects coming into contact with the vital parts of the engine.

Note. The effects of carbon monixide are cumulative. Continued short exposure will produce the same effect eventually that one long exposure will have.

118. Exhaust Pipe and Muffler

a. Description. The exhaust pipe and muffler consists of a threaded flange bolted to the exhaust manifold, a nipple, elbow, pipe, support bracket and muffler. The pipe extending upwards from the engine has a protective fireproof covering to prevent personnel from coming into direct contact with the hot pipe. The muffler contains a series of baffles which diminish the exhaust noise. Due to its construction, the muffler cannot be repaired and must be replaced when defective.

b. Removal.

(1) To remove the muffler (1, fig. 64) from the exhaust pipe, place the wrench as close as possible to the connecting end of the muffler and turn in a counterclockwise direction.

(2) Remove the two nuts and internal-external tooth washers from the bolts (3) and remove the bolts.

(3) Remove the four nuts (5) and lockwashers from the bolts (15) and remove the front half cover (14) and rear half cover (6).

(4) Remove the exhaust pipe from the elbow (13). Remove the elbow from the nipple (12).

(5) Remove the nipple (1, fig. 46) from the flange (2).

c. Cleaning, Inspection, and Repair.

(1) Clean the interior of the nipple, elbow, exhaust pipe, and muffler with an approved cleaning solvent and allow them to dry thoroughly.

(2) Inspect the muffler for cracks and breaks especially in the seams. A sooty deposit on the outside of the muffler is a positive indication of a crack. If any cracks or breaks are noticed, replace the muffler.

(3) Inspect the exhaust pipe, elbow and nipple for cracks and breaks. Check the muffler, exhaust pipe, elbow, and nipple for stripped or damaged threads. Replace all defective parts.

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(4) Inspect the cover halves and support bracket for cracks, breaks, and misalinement. Replace defective cover halves. Check the bolts and nuts for stripped and damaged threads. Replace all defective parts.

d. Installation.

(1) Install the nipple (1, fig. 46) in the flange (2).

(2) Install the elbow (13, fig. 64) on the nipple (12). Install the exhaust pipe in the elbow.

(3) Place the front half cover (14) and rear half cover (6) in position around the exhaust pipe, install the four bolts (15) with lockwashers and install and tighten the four nuts (5).

(4) Install the two bolts (3) with internal-external tooth washers through the supporting bracket (4) and upper hood panel (2) and install and tighten the two nuts with internal-external tooth washers.

(5) Screw the muffler (1) into the exhaust pipe.

119. Engine Hood

a. Description. The engine hood serves to shield and protect the engine from the top, sides, and rear, and to facilitate temperature control. It consists of the upper hood panel (2, fig. 64), the side hood sliding panels (7), the sliding door tracks (8), and the rear hood panel (11). Internal-external tooth washers are used throughout to aid in radio suppression of the unit.

b. Removal.

(1) Using the handles provided, lift the side hood sliding panel (7) up until it clears the sliding door track (8), then pull it out slightly at the bottom and lower it until it is clear of the upper hood panel. Both side panels are removed in this manner.

(2) Remove the two cap screws (9) with internal-external tooth washers from each end of the sliding door track and remove the track. Both tracks are removed in this manner.

(3) In order to remove the upper hood panel (2), it will be necessary to remove the following controls and instruments; ignition switch (par. 104*b*), starter button (par. 106*b*), ammeter (par. 107*b*), hourmeter switch and hourmeter (par. 108*b*), tachometer (par. 110*b*), oil pressure gage (par. 111*b*), and choke (par. 112*b*). It will also be necessary to disconnect the connecting rod of the gov-

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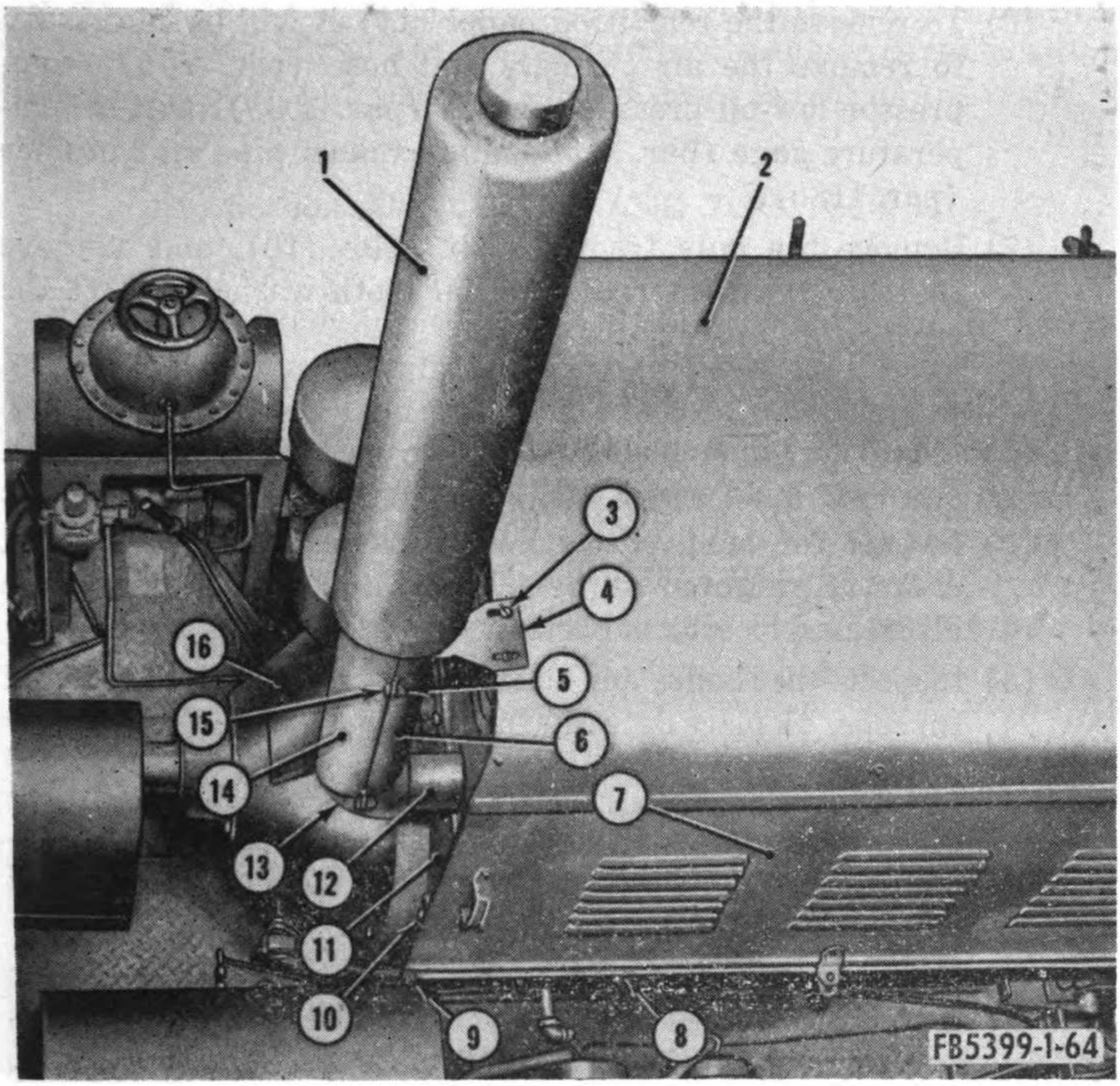

1	Muffler	9	Cap screw
2	Upper hood panel	10	Bolt, rear panel
3	Bolt, muffler support	11	Rear hood panel
4	Supporting bracket	12	Nipple, exhaust pipe
5	Nut, cover bolt	13	Elbow, exhaust pipe
6	Rear half cover	14	Front half cover
7	Side hood sliding panel	15	Bolt, protective covering
8	Sliding door track	16	Clutch assembly

Figure 64. Exhaust pipe, muffler, and engine hood removal and installation points.

ernor linkage (par. 113*b* (2)) and the load-unload valve inlet line (par. 114*b* (2)).

(4) Remove the seven nuts (2, fig. 15) and internal-external tooth washers (1) from the bolts (3) and remove the bolts. Remove the two nuts from the bolts (3, fig. 64) and remove the cap screws from the supporting bracket (4). It will not be necessary to remove the supporting bracket.

(5) Remove the seven nuts and internal-external tooth washers from the bolts on the front of the panel. Raise the panel at the front end, slide it out from under the supporting bracket, and lift if off the engine.

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(6) To remove the rear hood panel (11) it will be necessary to remove the air cleaners and hose (par. 76*b*), compressor low-oil pressure switch (par. 103*b*), water temperature gage (par. 115*b*), and exhaust pipe and muffler (par. 118*b*).

(7) Remove the nuts from the six bolts (10), and remove the bolts with internal-external tooth washers. Lift the rear hood panel off the engine.

c. Cleaning, Inspection, and Repair.

(1) Clean the upper hood panel, side door panels, side rails, and rear hood panel with an approved cleaning solvent.

(2) Inspect for bent, cracked, or broken panels, rails, and doors. Straighten all bent parts, and repair or replace all cracked or broken parts.

(3) Inspect the bolts and nuts for stripped or damaged threads. Replace defective parts.

d. Installation.

(1) Place the rear hood panel in position on the engine, install the six bolts (10, fig. 64) with washers, and install and tighten the nuts.

(2) Install the exhaust pipe and muffler (par. 118*d*), water temperature gage (par. 115*d*), compressor low-oil pressure switch (par. 103*d*), air cleaners and hose (par. 76*d*).

(3) Slide the upper hood panel (2) under the supporting bracket (4), install the two bolts (3) with washers and install and tighten the two nuts.

(4) Install the seven bolts with washers at the front of the upper panel and install and tighten the nuts.

(5) Install the seven bolts (3, fig. 15) and install and tighten the seven nuts (2) with washers (1).

(6) Connect the load-unload valve inlet line (par. 114*d*(2)) and the connecting rod of the governor linkage (par. 113*d*(8)).

(7) Install the choke (par. 112*d*), oil pressure gage (par. 111*d*), tachometer (par. 110*c*), hourmeter switch and hourmeter (par. 108*d*), ammeter (par. 107*d*), starter button (par. 106*d*), and ignition switch (par. 104*d*).

(8) Place the sliding door track (8, fig. 64) in position against the engine block and install and tighten the two cap screws (9) with lockwashers at each end of the track. Install the other track in the same manner.

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(9) Lift the side hood sliding panel (7) with the handles provided, slide its upper edge under the upper panel, position it over the track, and slide it down to seat on the track.

Section XIII. CLUTCH AND TOOL BOX

120. Description

The clutch assembly (16, fig. 64), is an integral part of the engine. It employs a positive action for clamping the two driving (friction) plates between the two driven plates. This positive action is accomplished through the snap-over-center throwout collar which is manually controlled by the clutch lever. Pushing the lever towards the engine causes the throwout collar to snap forward and press the driven plates against the driving plates. The friction disk drive allows for slight misalinements and consists of two flexible disk assemblies bolted to the flywheel of the engine. The clutch is readily adjusted by means of a thumb operated adjustment lock on the toggle assembly. The tool box is mounted on the skid base just forward of the throttle controller assembly.

121. Clutch Assembly

Due to the position of the clutch assembly in the compressor assembly, repairs normally the responsibility of the using unit must be made by third echelon, or higher, maintenance personnel. However, the using unit can adjust the clutch. To adjust the clutch, proceed as follows:

a. Remove the four screws (1, fig. 65) which attach the inspection cover (2) and remove the cover.

b. Press the adjustment collar lock (4) with the thumb and rotate the throwout collar (3) clockwise until the hand lever requires a distinct pressure and over-center snap to engage.

Note. New clutch facings may need several adjustments until they are properly worn in.

c. Place the inspection cover in position and install and tighten the four screws.

122. Tool Box

Normally the tool box will require no maintenance. Should it become necessary to replace the box, proceed as follows:

a. Lift the lid and remove all the tools. Remove the four cap screws in the bottom of the box, and remove the box.

b. Place the box in position on the skid base, install and tighten the four cap screws, replace the tools, and close the lid.

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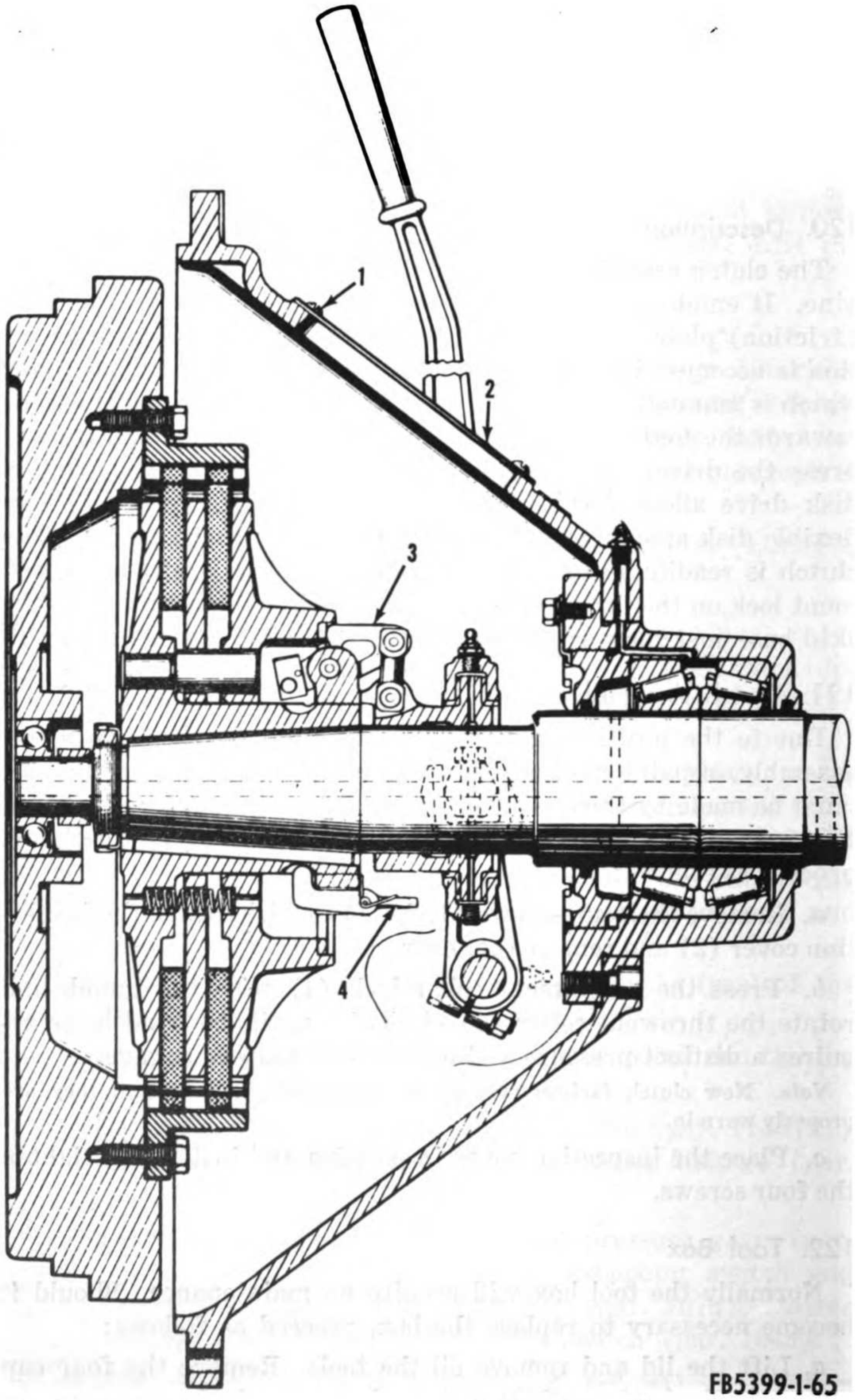

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1 Screw, cover
2 Inspection cover
3 Throwout collar
4 Adjustment collar lock

Figure 65. Clutch adjustment.

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Section XIV. COMPRESSOR SHROUDING, GUARDS, AND COOLER ASSEMBLY FAN BELTS

123. General

The compressor shrouding consists of approximately 25 sections of preformed pieces of sheet metal fitted on each compressor to form a protective shroud against adverse weather conditions and to prevent accidental damage to the equipment or injury to operating personnel. The intercooler fan-belt guard and flexible coupling guard prevent personnel from accidentally coming into contact with these moving parts. The shrouding directs a stream of cooling air over the compressor and through the coolers to help dissipate the heat resulting from the compression of air. Damaged sections of shrouding should be replaced soon as possible to insure the maximum benefit from the intake of cooling air. The cooler assembly fans are belt driven from the compressor flywheel located just to the rear of the flexible coupling. One belt drives the fan on the left or intercooler side of the compressor and the second belt drives the fan on the right or aftercooler side of the compressor.

124. Compressor Shrouding

a. Removal (fig. 66).

(1) Remove the sixteen cap screws (2) from the left hood section (1) and remove the hood section.

(2) Remove the sixteen cap screws (2) from the right hood section (3) and remove the hood section.

(3) Remove the eight cap screws from the left intake vent screen (18) and remove the screen.

(4) Remove the oil filter (par. 33*g*(1)) and remove the seven cap screws from the left front lower section (17). Remove the section.

(5) Remove the four remaining cap screws from the left front upper section (19) and remove the section.

(6) Remove the two screws (16) from the left front access section (15) and remove the section.

(7) Remove the four screws from the right front access section (14) and remove the section.

(8) Remove the eight cap screws (2) from the right intake vent screen (13) and remove the screen.

(9) Remove the seven remaining cap screws from the right front section (12) and remove the section.

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(10) Remove the twelve cap screws from the right side upper section (11) and remove the section.

(11) Remove the remaining five cap screws from the right side lower section (10) and remove the section.

(12) Remove the nine cap screws from the aftercooler lower section (9) and remove the section.

(13) Remove the five cap screws from the aftercooler upper section (8) and remove the section.

(14) Remove the intercooler baffle plate (23) and aftercooler baffle plate (7) by loosening their thumbscrews and sliding them out of the shrouding.

(15) Remove the ten cap screws from the right deflector section (5) and remove the section.

(16) Remove the ten cap screws from the left deflector section (4) and remove the section.

(17) Remove the nine remaining cap screws from the left side upper section (21) and remove the section.

(18) Remove the five cap screws from the left side lower section (20) and remove the section.

(19) Remove the four cap screws from the pipe cover which is located at the bottom center of the intercooler lower section (24) and remove the pipe cover. Remove the remaining three cap screws and remove the section.

(20) Remove the five cap screws from the intercooler upper section (22) and remove the section.

(21) Remove the ten cap screws from the intercooler and aftercooler housing cover (25) and remove the cover.

Note. The removal sequence of the sections will vary, depending upon circumstances. To service the crank-end vent oil breather caps or to free the lubricator discharge lines of air for instance, remove only the sections necessary to give access to these points.

Caution: When removing the shrouding, use extreme care in handling to prevent bending or damaging sections. Always store the sections in a safe place to insure against accidental damage.

b. Cleaning, Inspection, and Repair.

(1) Clean all surfaces of all shrouding sections with an approved cleaning solvent.

(2) Inspect for cracked, bent, or torn sections. Straighten all bent sections and repair or replace all cracked or torn sections.

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(3) Inspect all screws for stripped or damaged threads. Replace all defective screws.

c. Installation.

(1) Place the intercooler and aftercooler housing cover (25) in position and install and tighten the ten cap screws (2).

(2) Place the intercooler upper section (22) in position and install and tighten the five cap screws.

(3) Place the intercooler lower section (24) in position and install and tighten the three rear cap screws. Place the pipe cover in position and install and tighten the four cap screws.

(4) Place the left side lower section (20) in position and install and tighten the five cap screws.

(5) Place the left side upper section (21) in position and install and tighten the four top, two rear, and three bottom cap screws.

(6) Place the left deflector section (4) in position and install and tighten the ten cap screws.

(7) Place the right deflector section (5) in position and install and tighten the ten cap screws.

(8) Place the aftercooler upper section (8) in position and install and tighten the five cap screws.

(9) Place the aftercooler lower section (9) in position and install and tighten the nine cap screws.

(10) Place the right side lower section (10) in position and install and tighten the two rear and three bottom cap screws.

(11) Place the right side upper section (11) in position and install and tighten the twelve cap screws in the side of the section.

(12) Place the right front section (12) in position and install and tighten the two top, two bottom and top four side cap screws.

(13) Place the right intake vent screen (13) in position and install and tighten the eight cap screws.

(14) Place the right front access section (14) in position and install and tighten the four screws (16).

(15) Place the left front access section (15) in position and install and tighten the two screws.

(16) Place the left front upper section (19) in position and tighten the two top and two side cap screws (2).

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(17) Place the left front lower section (17) in position and install and tighten the four top and three bottom cap screws. Install the oil filter (par. 33*g* (5)).

(18) Place the left intake vent screen (18) in position and install and tighten the eight cap screws.

(19) Place the right hood section (2) in position and install and tighten the sixteen cap screws.

(20) Place the left hood section (1) in position and install and tighten the sixteen cap screws.

(21) Slide the intercooler baffle plate (23) and aftercooler baffle plate (7) into the back of the cooler section and tighten the thumbscrews to hold them in place.

125. Guards

a. Removal.

(1) Remove the nuts from the two bolts which join the two sections of the fan belt guard assembly (6, fig. 66) at the center.

(2) Remove the three cap screws attaching each section of the guard and remove the sections.

(3) Remove the four cap screws (10, fig. 62) from the flexible coupling guard (1) and remove the guard.

b. Cleaning, Inspection, and Repair.

(1) Clean all obstructions from the screening of the fan-belt guard and clean the surfaces of the flexible coupling guard and belt guard with an approved cleaning solvent.

(2) Inspect the belt guard and coupling guard for bent, cracked, torn or broken parts. Straighten all bent parts, and repair or replace all cracked, torn, or broken parts or sections.

(3) Check the nuts and bolts for stripped or damaged threads. Replace defective nuts or bolts.

c. Installation.

(1) Place the flexible coupling guard (1) in position over the flexible coupling and install and tighten the four cap screws (10).

(2) Place each section of the fan belt guard (6, fig. 66) in position and install and tighten the three cap screws in each section.

(3) Insert the two bolts through the center flanges of each section and install and tighten the nuts.

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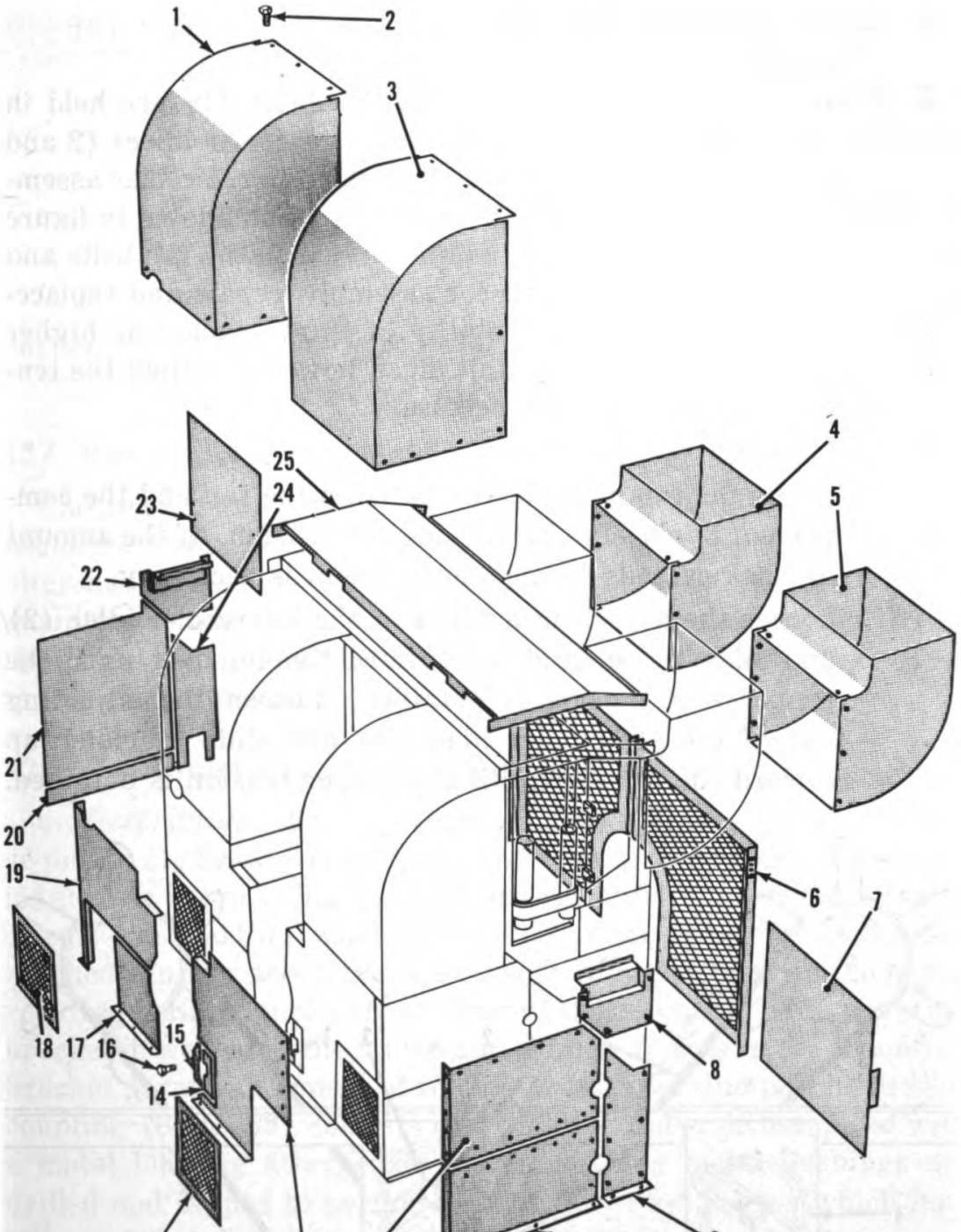

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1	Left hood section	14	Right front access section
2	Cap screw	15	Left front access section
3	Right hood section	16	Screw
4	Left deflector section	17	Left front lower section
5	Right deflector section	18	Left intake vent screen
6	Fan belt guard assembly	19	Left front upper section
7	Aftercooler baffle plate	20	Left side lower section
8	Aftercooler upper section	21	Left side upper section
9	Aftercooler lower section	22	Intercooler upper section
10	Right side lower section	23	Intercooler baffle plate
11	Right side upper section	24	Intercooler lower plate
12	Right front section	25	Intercooler and aftercooler housing cover
13	Right intake vent screen		

Figure 66. Exploded view of compressor shrouding showing removal and installation points.

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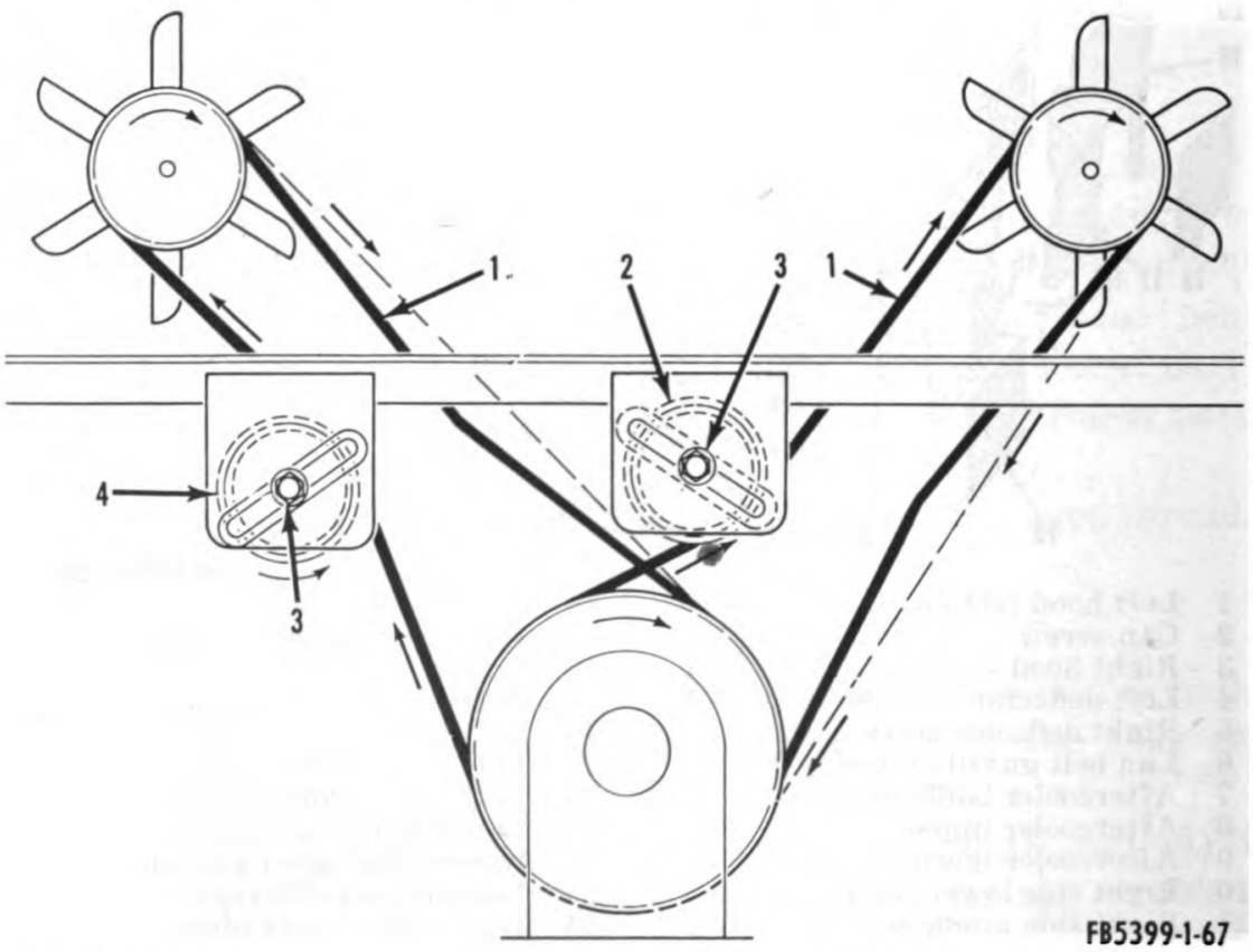
126. Cooler Assembly Fan Belts
(fig. 67)

a. Description. The cooler assembly fan belts (1) are held in place and adjusted by the intercooler and aftercooler idlers (2 and 4). The idlers are mounted in brackets welded to the cooler assembly frame and their pulleys rotate in the direction shown in figure 67. Due to the complexity of the manner in which the fan belts and fans are mounted in the compressor assembly, repair and replacement of the belts is the responsibility of third echelon or higher maintenance personnel. Using unit must, however, adjust the tension of the fan belts whenever necessary.

b. Adjustment.

(1) Grasp the fan belt midway between the fan and the compressor flywheel to inspect the belt tension. If the amount of slack exceeds ¾ inch, adjustment is necessary.

(2) Loosen the adjusting nut (3) of the intercooler idler (2) and slide the idler down toward the fan belt until the proper belt tension is obtained. Loosen the adjusting nut of the aftercooler idler (4) and slide the idler up toward the fan belt until the proper tension is obtained.



1 Fan belt
2 Intercooler idler
3 Nut, idler pulley adjusting
4 Aftercooler idler

Figure 67. Cooler assembly fan belt adjustment points.

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(3) Tighten the nuts after the idlers are correctly positioned.

Note. Do not attempt to adjust an excessively worn, damaged, or stretched fan belt. Report the condition to the proper authority. Always adjust and/or replace both fan belts, although only one may appear to need it.

Caution: Never attempt to adjust the fan belts with the compressor in operation.

Section XV. REACTIVATOR PUMP MOTOR, FLEXIBLE COUPLING, AND PUMP AIR INTAKE FILTER

127. Reactivator Pump Motor

The reactivator pump motor, the flexible coupling which connects the motor shaft to the pump shaft, and the pump air intake filter are located directly under the prefilter on the drier tower mounting bracket. The motor, through the flexible coupling, drives the pump which supplies clean air through the air intake filter to the drier towers as needed.

128. Reactivator Pump Motor and Flexible Coupling

a. Description. The reactivator pump ¼ horsepower, 110-volt ac motor (1, fig. 68) is a repulsion-induction type continuous service electric motor using a spring-loaded centrifugal switch to short circuit the starting windings of the stator once the motor has reached running speed. Equipped with life-seal bearings the motor requires maintenance only at time of disassembly. The mounting bracket is welded to the frame and elongated slots in the mounting bracket permit alinement of the motor with the pump. The flexible coupling (8, fig. 69) consists of a molded rubber center piece with a metal bushing attached to each end. The metal bushings are drilled and tapped to permit installation of set screws which hold the coupling on the pump and motor shaft.

b. Removal.

(1) Remove the two screws which hold the terminal strip cover on the front of the reactivator pump motor and remove the cover.

(2) Remove the two terminal stud nuts (2, fig. 68) from the terminal studs (3) and remove the two leads (4). Tag the leads to facilitate reassembly.

(3) Unscrew the conduit union nut (6) from the adapter (5).

(4) Remove the set screw (7, fig. 69) from the flexible coupling (8) at the pump end of the coupling.

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(5) Remove the four cap screws (8, fig. 68) and four lockwashers (7).

(6) Slide the motor away from the union nut slightly, and pull the motor, with flexible coupling attached, away from the pump.

(7) Remove the set screw at the motor end of the flexible coupling and remove the coupling.

c. Cleaning, Inspection, and Repair.

(1) Clean the exterior of the motor with a cloth moistened in an approved cleaning solvent, being careful not to allow any solvent to enter the interior of the motor. Clean the terminals and terminal screws of all rust, dirt, and corrosion with a wire brush or sandpaper. Blow out all dirt with an air hose.

(2) Inspect the mounting bracket for cracks, breaks, or damage. Check the cap screws and set screws for stripped or damaged threads. Repair or replace defective parts.

(3) Inspect the flexible coupling for cracks, breaks, or damage. Check the metal bushings for looseness, wear, or damage. Replace the coupling if defective.

(4) Inspect the motor for signs of running hot. Test the motor speed with a tachometer. Replace the motor if defective.

d. Installation.

(1) Install the flexible coupling (8, fig. 69) on the motor shaft and install and tighten the set screw (7).

(2) Place the pump end of the coupling in position and slide the reactivator pump motor (1, fig. 68), with coupling attached onto the pump shaft.

(3) With the motor slightly away from the conduit union nut (6) insert the two leads (4) through the adapter (5).

(4) Aline the motor with the pump and install and tighten the four cap screws (8) with lockwashers (7).

Note. After tightening the four cap screws check the alinement by turning the flexible coupling. If any binding is noticed, loosen the cap screws and realine the motor.

(5) Connect the conduit union nut to the adapter.

(6) Place the two leads (4) on the terminal studs (3) and install and tighten the two nuts (2).

(7) Place the terminal strip cover in position on the motor and install and tighten the two screws.

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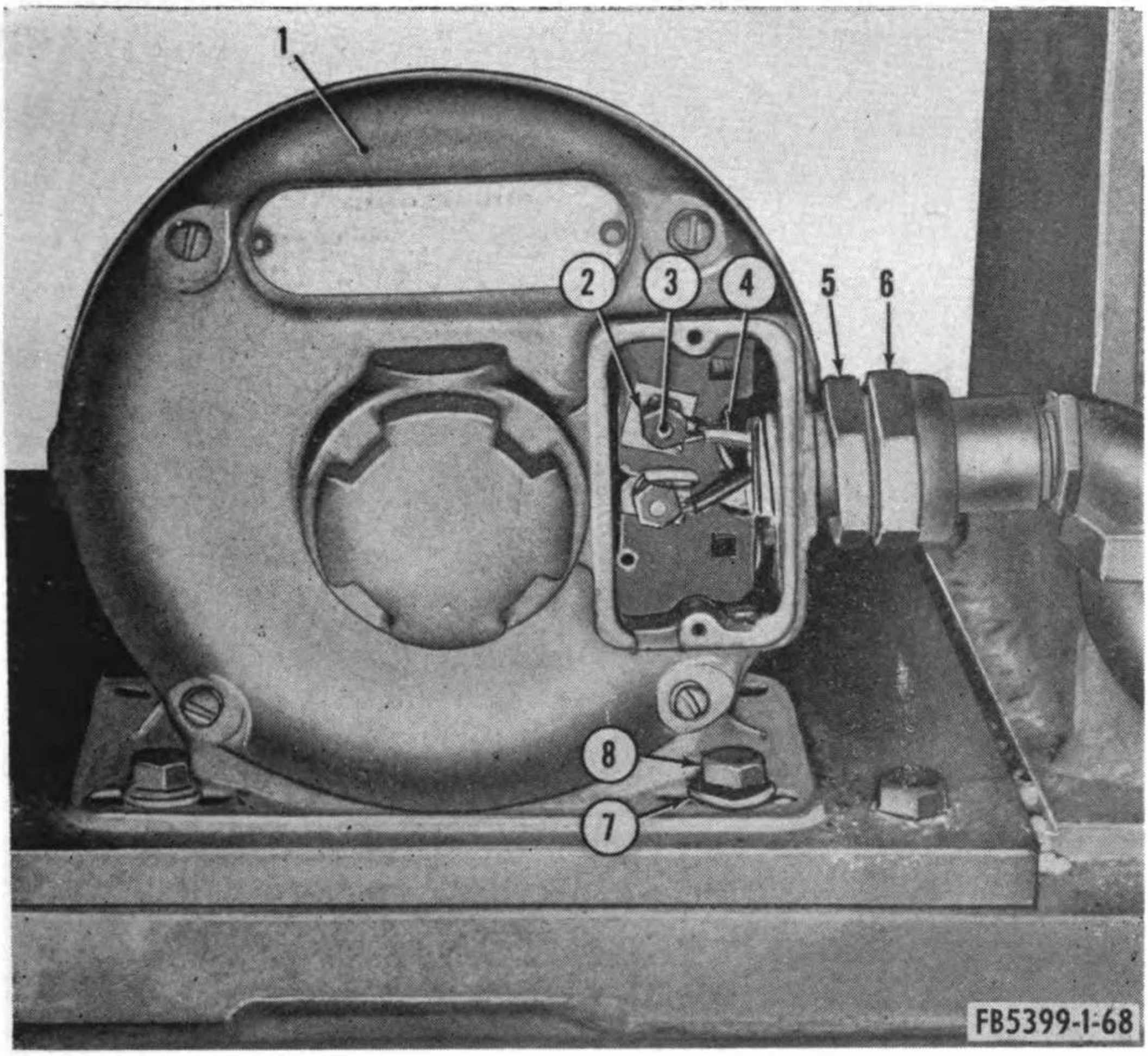

1 Reactivator pump motor
2 Nut, terminal stud
3 Terminal stud
4 Lead
5 Adapter
6 Conduit union nut
7 Lockwasher
8 Cap screw

Figure 68. Reactivator pump motor removal and installation points.

129. Pump Air Intake Filter

a. Description. The pump air intake filter assembly (1, fig. 69) consists of a glass jar, filter bag, filter screen attached to the filter cover, retaining ring to hold the bag in place on the screen, filter cover with air inlet and outlet ports, and suitable piping connections. Air is drawn in through the cover, passes through the screen and filter bag and passes out through the cover into the reactivator pump.

b. Removal.

(1) Unscrew the union nut (2) from the union elbow (3) and lift the pump air intake filter assembly (1) away from the pump.

(2) Remove the coupling elbow from the pump inlet.

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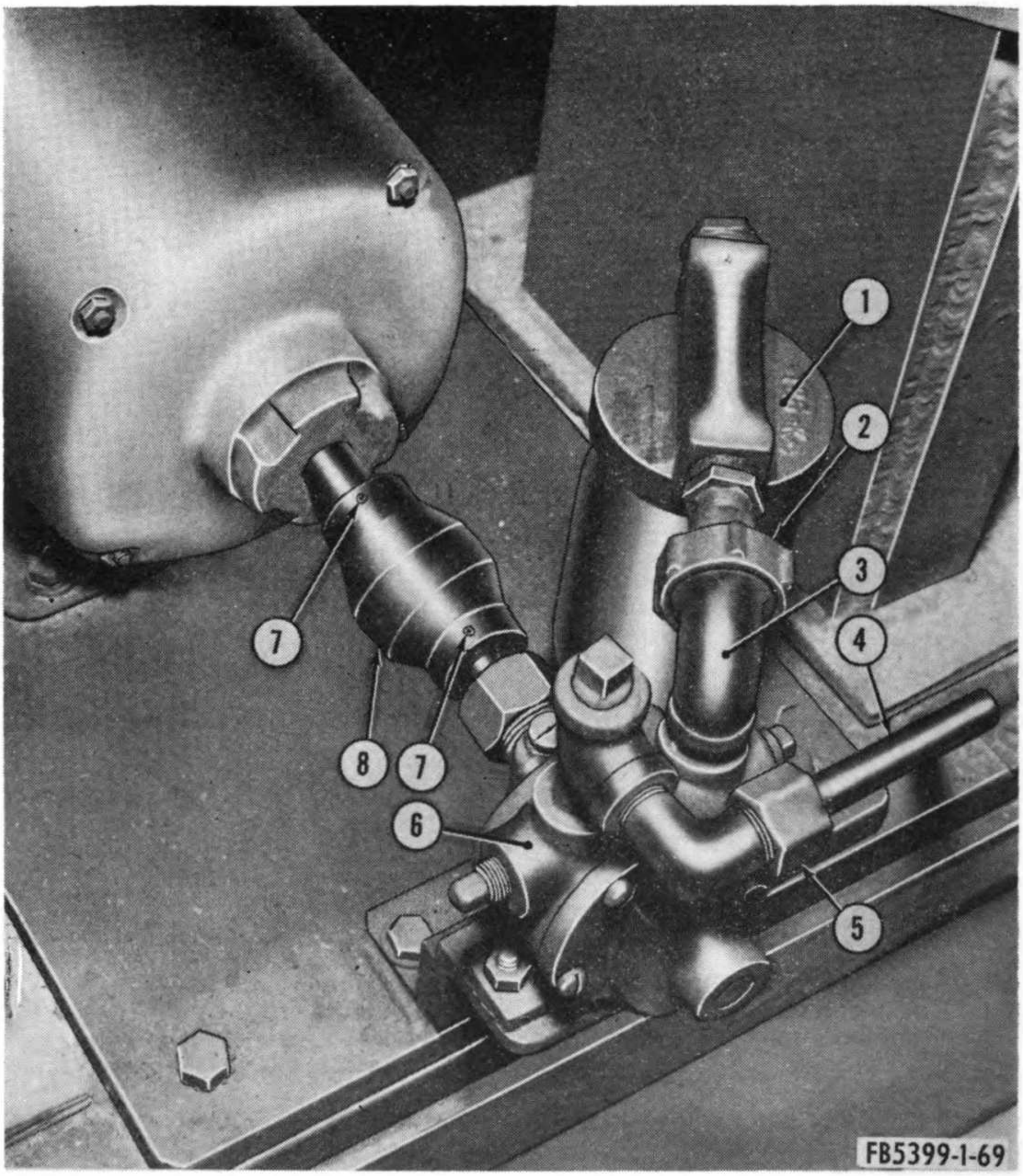

1 Pump air intake filter assembly
2 Union coupling nut
3 Coupling elbow
4 Reactivator pump discharge line
5 Ferrule nut
6 Reactivator pump
7 Set screw
8 Flexible coupling

Figure 69. Flexible coupling and pump air intake filter removal and installation points.

c. Disassembly (fig. 70).

(1) Remove the union half (2) from the adapter (4) and remove the union nut (3).

(2) Remove the adapter from the cover assembly (5).

(3) Unscrew the glass jar (9) from the cover. Remove the gasket (6) from the cover.

(4) Remove the retaining ring (7) from the filter bag (8) and slide the bag off the filter screen.

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d. Cleaning, Inspection, and Repair.

(1) Clean the glass jar with soap and water and wipe dry with a lint-free cloth. Clean all metal parts with an approved cleaning solvent. Blow out the filter screen, cover, and piping connections with an air hose.

(2) Wash the filter bag in soap and water, rinse and dry thoroughly. Replace it if defective.

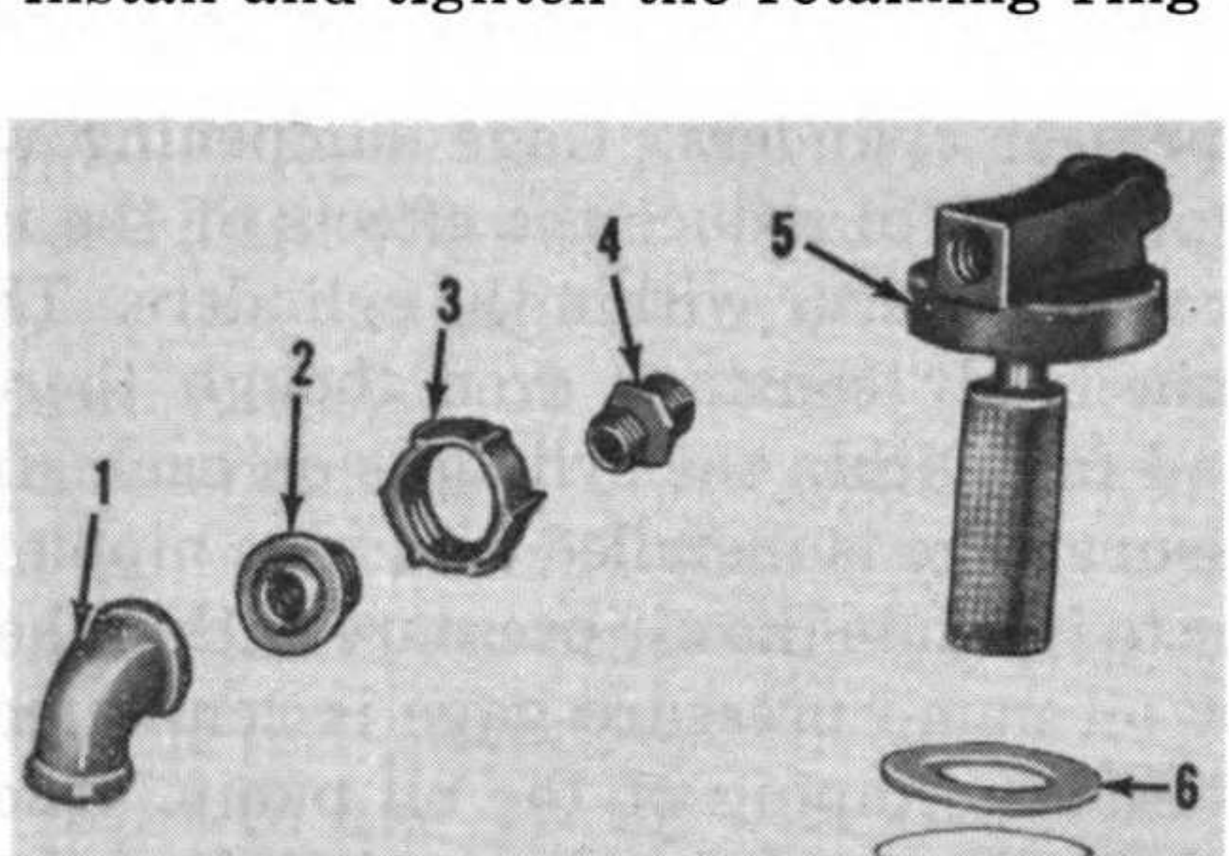
(3) Inspect the jar for cracks and for damaged threads. Replace the jar if defective.

(4) Inspect the cover and all piping connections for cracks, breaks, and stripped or damaged threads. Replace all defective parts.

Note. The pump air intake filter should be serviced at least once a week under ordinary circumstances and more often if necessary.

e. Reassembly.

(1) Slide the filter bag (8) into position over the filter screen and install and tighten the retaining ring (7).



1 Union elbow
2 Union half
3 Union nut
4 Adapter
5 Cover and screen assembly
6 Gasket
7 Retaining wire
8 Filter bag
9 Glass jar

Figure 70. Pump air intake filter, exploded view.

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(2) Install the gasket (6) in the cover assembly (5) and screw the glass jar (9) into the cover.

(3) Install and tighten the adapter (4) in the cover.

(4) Place the union nut (3) on the union half (2) and install and tighten the union half in the adapter.

f. Installation.

(1) Install and tighten the union elbow (3, fig. 69) in the reactivator pump inlet.

(2) Place the pump air intake filter (1) in position at the elbow and install and tighten the union nut (2).

Section XVI. COMPRESSOR AIR AND OIL PRESSURE GAGES AND OIL TEMPERATURE GAGE

130. General

The four compressor air pressure gages which indicate the pressure of the air in the four stages of compression are connected by suitable piping to the inlet headers of the intercoolers for their respective compressor cylinders. Gage dampening valves are installed in each pipe line to reduce the effects of the rapid fluctuations in pressure which occur within the cylinders. The gage readings that remain fairly constant even though there is a rapid pressure rise and fall within the cylinders on each stroke of their pistons. A pressure gage is installed on a pipe nipple at the top of each drier tower to indicate the air pressure within the drier tower. The compressor oil pump pressure gage is connected by suitable piping to the discharge piping of the oil pump. The compressor oil temperature gage is a sealed unit consisting of the gage, capillary tube, and thermo-couple. The thermo-couple to crankcase connection also serves as the compressor crankcase drain.

131. Compressor Air Pressure Gages

a. Description. The first stage pressure gage (9, fig. 5) is graduated from 0 to 100 in increments of one pound. The second stage pressure gage (11) is graduated from 0 to 400 in increments of two pounds. The third stage pressure gage (8) is graduated from 0 to 1500 in increments of ten pounds. The fourth stage pressure gage (11) and drier tower pressure gages (5 and 11, fig. 72) are graduated from 0 to 5000 in increments of fifty pounds.

b. Removal.

(1) Unscrew the cover of the second stage pressure gage (1, fig. 71) on the front of the gage panel and remove the glass.

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(2) Unscrew the tube coupling nut (5) holding the second stage gage pipe (11), remove the three nuts (2) from the three screws (3), and remove the gage from the panel.

Caution: Make sure that the pressure is removed from the system before removing the pressure gages.

(3) Remove the cover and glass of the first stage pressure gage (4) as instructed in (1) above. Unscrew the tube coupling nut holding the first stage gage pipe (6), remove the three nuts and screws and remove the gage from the panel.

(4) Remove the cover and glass of the third stage pressure gage (7) as instructed in (1) above. Unscrew the tube coupling nut holding the third stage gage pipe (8), remove the three nuts and screws, and remove the gage from the panel.

(5) Remove the cover and glass of the fourth stage pressure gage (10) as instructed in (1) above. Remove the tube coupling, nut holding the fourth stage gage pipe (9), remove the three nuts and screws, and remove the gage from the panel.

Caution: Be extremely careful, when removing the gages, or the dial indicators on the front of the gages. Improper handling of the gages will result in bent or misplaced indicators. The gage glasses and covers should be replaced immediately after gage removal to prevent injury to the gage mechanism.

(6) Remove the left drier tower and right drier tower pressure gages (5 and 11, fig. 72) from their nipples (6), being sure to place the wrench on the flatted surfaces of the gage connections.

c. Cleaning and Inspection.

(1) Clean the exterior of all gages with an approved cleaning solvent, being careful not to allow any solvent to enter the openings at the pipe connections.

(2) Inspect the gages for cracked or broken glass, damaged dial and dented or damaged cases. Inspect for signs of faulty operation. Replace any defective gages.

(3) Inspect the nuts and screws and other fittings for stripped or damaged threads. Replace all defective parts.

d. Installation.

(1) Install and tighten the left drier tower and right drier tower pressure gages (5 and 11, fig. 72) in their nipples

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(6), being sure to place the wrench on the flatted surfaces of the gage connection.

(2) Place the fourth stage pressure gage (10, fig. 71) in position in the panel, install the three screws (3), and install and tighten the three nuts (2).

(3) Place the fourth stage gage pipe (9) in position and install and tighten the tube coupling nut (5).

(4) Place the gage glass in position and install and tighten the cover on the front of the panel.

(5) Place the third stage pressure gage (7) in position, install the three screws, and install and tighten the three nuts. Place the third stage gage pipe (8) in position and install and tighten the tube coupling nut. Install the gage glass and cover as given in (4) above.

(6) Place the first stage pressure gage (4) in position, install the three screws, and install and tighten the three nuts. Place the first stage gage pipe (6) in position and install and tighten the tube coupling nut. Install the gage glass and cover as given in (4) above.

(7) Place the second stage pressure gage (1) in position, install the three screws, and install and tighten the three nuts. Place the second stage gage pipe (8) in position and install and tighten the tube coupling nut. Install the gage glass and cover as given in (4) above.

132. Compressor Oil Pressure and Temperature Gages

a. Description. The compressor oil pressure gage (16, fig. 5) is graduated from 0 to 100 in increments of two pounds. The oil temperature gage (15) is graduated from 40° F. to 240° F. in increments of 20 pounds.

b. Removal.

(1) Remove the thermocouple (22, fig. 23) from the thermocouple connection (21) and withdraw the thermocouple bulb from the connection.

(2) Unscrew the mounting nut (13, fig. 73) from the threaded portion of the capillary tube (12). Remove the oil temperature gage (16) from the front of the gage panel (15), being careful not to damage the capillary tube or thermocouple as they pass through the mounting bracket (14).

(3) Unscrew the ferrule nut (5) from the adapter (4). Remove the two nuts (8) from the screws (7), and with-

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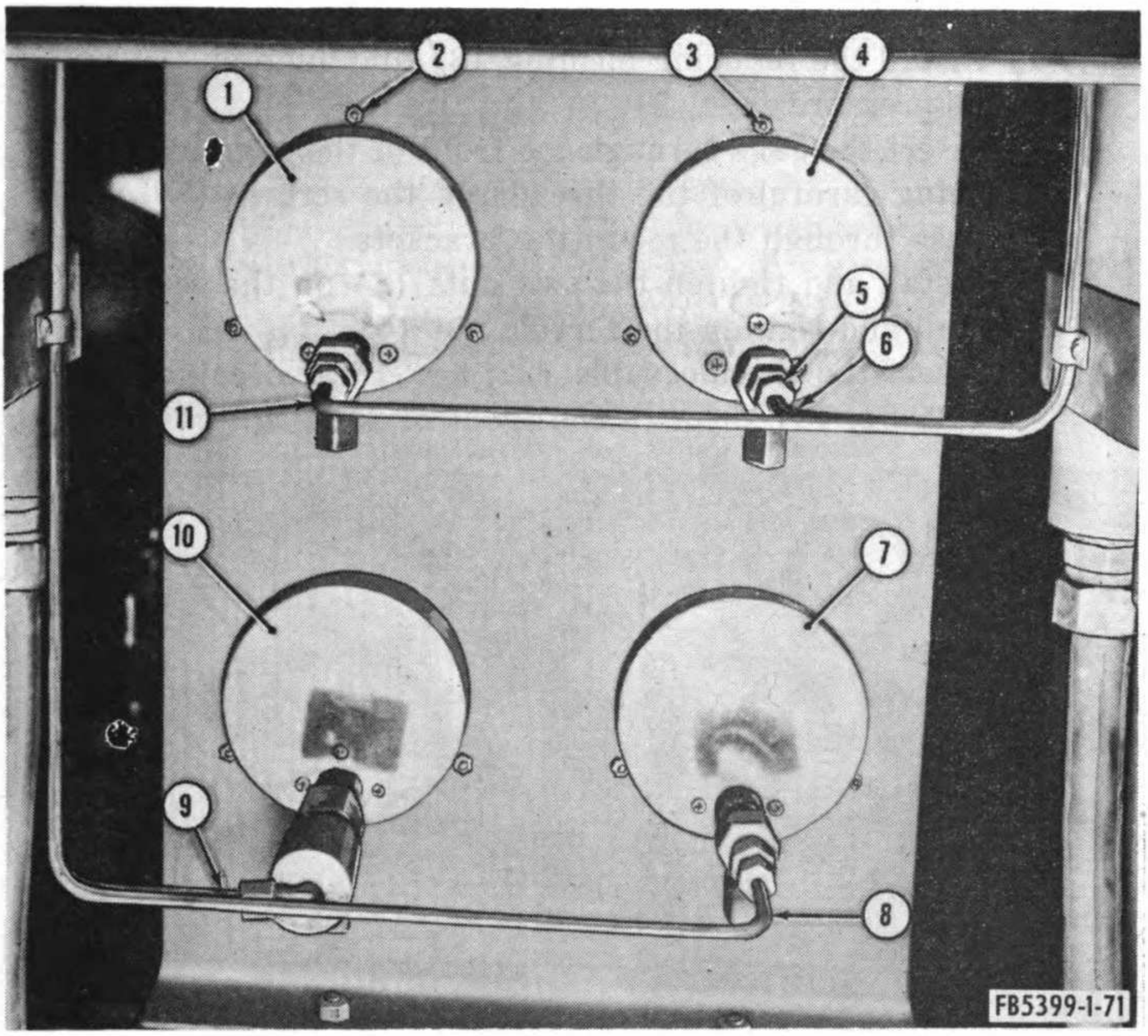

1 Second stage pressure gage
2 Nut, mounting
3 Screw, mounting
4 First stage pressure gage
5 Tube coupling nut
6 First stage gage pipe
7 Third stage pressure gage
8 Third stage gage pipe
9 Fourth stage gage pipe
10 Fourth stage pressure gage
11 Second stage gage pipe

Figure 71. Compressor air pressure gage, removal and installation points.

draw the oil pressure gage (2) from the front of the gage panel.

(4) Remove the adapter (4) and reducing bushing (3) from the gage.

c. Cleaning and Inspection.

(1) Clean the exterior of the gages with an approved cleaning solvent.

(2) Inspect the gages for broken glass and damaged cases or dials. Check for signs of faulty operation. Inspect the capillary tube and thermocouple for cracks, breaks, and damage. Replace defective gages.

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d. Installation.

(1) Install the reducing bushing (3) and adapter (4) on the oil pressure gage (2).

(2) Insert the gage through the front of the gage panel (15), being careful of the threads on the screws (7) as they pass through the mounting brackets.

(3) Install and tighten the two nuts (8) on the screws. Install and tighten the ferrule nut (5).

(4) Insert the thermocouple (22, fig. 23) and capillary tube (12, fig. 73) through the front of the gage panel, being

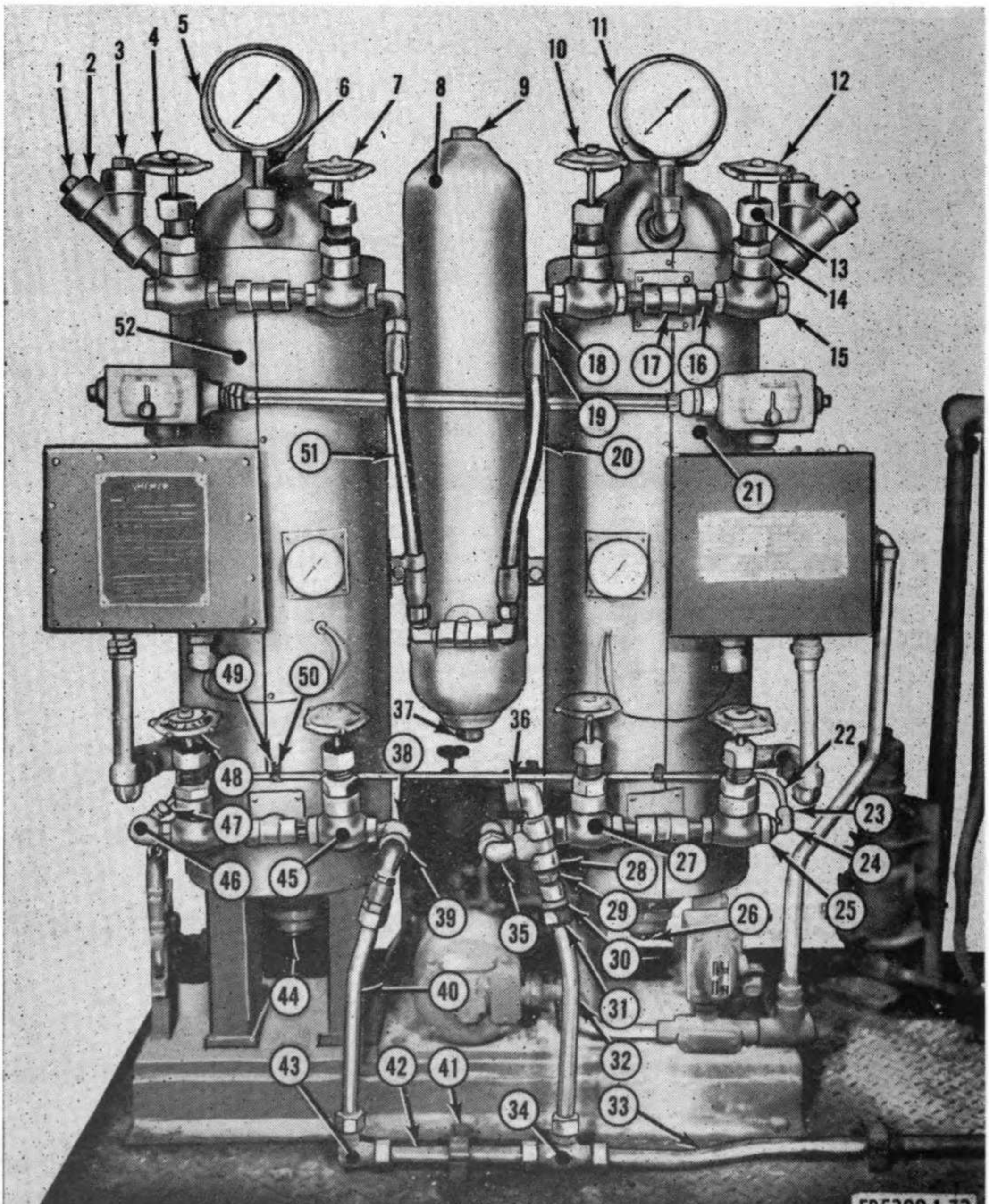

Figure 72. Drier assembly dessicant and piping removal and installation points.

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1 Pipe plug
2 Y-connection
3 Filter plug
4 Left drier tower reactivating air outlet valve
5 Left drier tower pressure gage
6 Nipple
7 Left drier tower air intake valve
8 Prefilter
9 Prefilter fill plug
10 Right drier tower air inlet valve
11 Right drier tower pressure gage
12 Right drier tower reactivating air oulet valve
13 Packing nut
14 Valve bonnet
15 Valve body
16 Nipple
17 Tee
18 Elbow
19 Ferrule nut
20 Right drier tower flexible hose
21 Right drier tower
22 Right drier tower reactivating air inlet tube
23 Tube coupling nut
24 Elbow
25 Right drier tower reactivating air inlet valve
26 Right drier tower drain plug
27 Right drier tower air outlet valve
28 Tee
29 Adapter
30 Bushing
31 Tube coupling nut
32 Right drier tower air outlet tube
33 Drier to pressure retaining valve tube
34 Tee
35 Street elbow
36 Plugged elbow
37 Prefilter drain plug
38 Street elbow
39 Nipple
40 Left drier tower air outlet tube
41 Tube clamp
42 Connecting tube
43 Elbow
44 Left drier tower drain plug
45 Left drier tower air outlet valve
46 Street elbow
47 Tube coupling nut
48 Left drier tower reactivating air inlet valve
49 Tube clamp
50 Tube clamp screw
51 Left drier tower flexible hose
52 Left drier tower

Figure 72—Continued.

careful not to damage them as they pass through the mounting bracket (14). Position the oil temperature gage (16) in the gage bracket and install and tighten the mounting nut (13).

(5) Install and tighten the thermocouple in the thermocouple connection (21, fig. 23).

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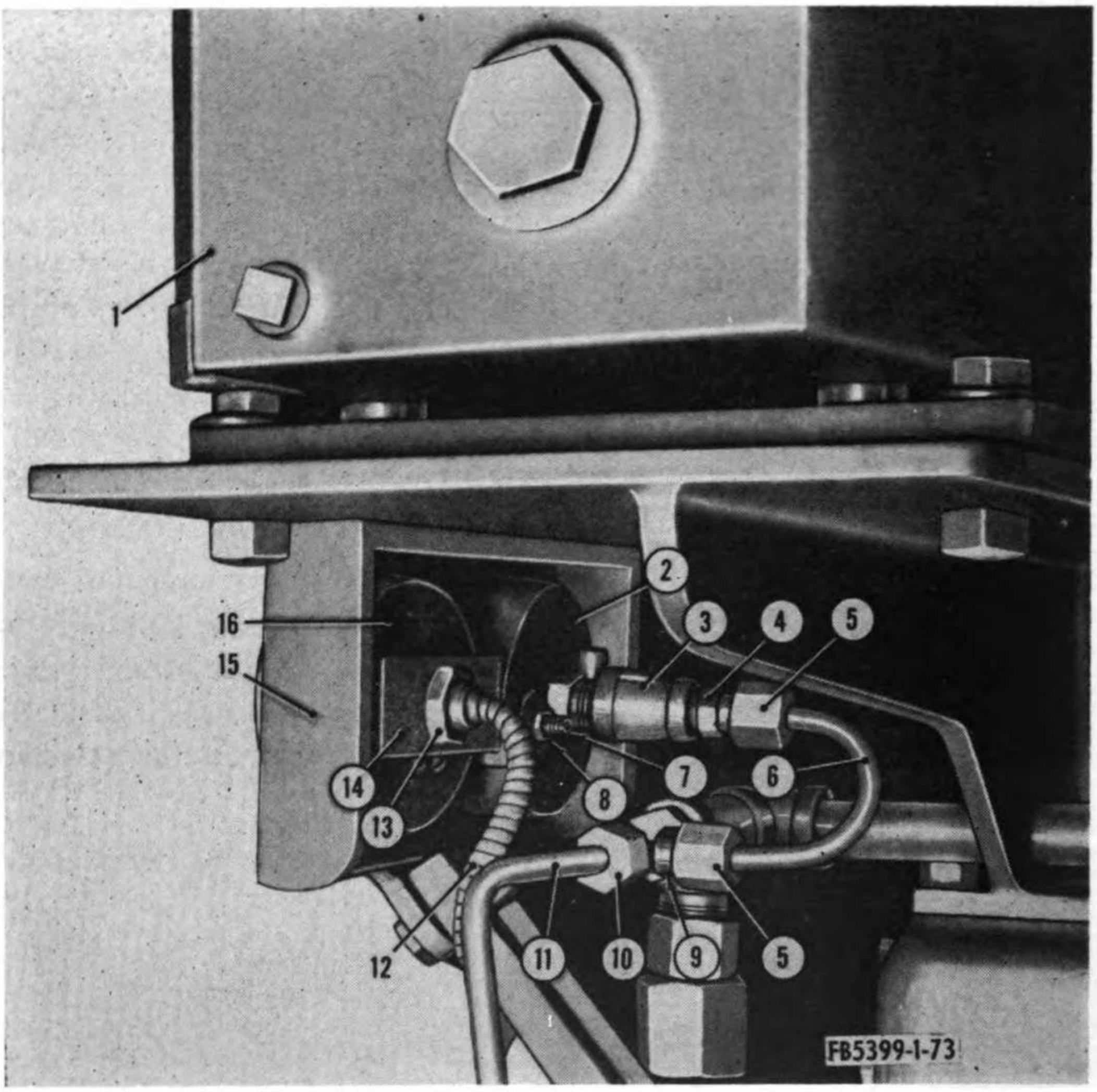

1	Mechanical lubricator	9	Tee
2	Oil pressure gage	10	Ferrule nut
3	Reducing coupling	11	Oil pressure safety switch activating line
4	Adapter	12	Capillary tube
5	Ferrule nut	13	Mounting nut
6	Oil pressure gage line	14	Mounting bracket
7	Screw	15	Gage panel
8	Nut	16	Oil temperature gage

Figure 73. Compressor oil pressure and temperature gage removal and installation points.

Section XVII. DRIER ASSEMBLY

133. General

The drier assembly consists of the left and right drier towers, prefilter, reactivating air motor and pump, and necessary valves and piping. The drier towers and prefilter are made up of welded steel sections capable of withstanding the high air pressure discharged by the compressor. Because of their construction they are the responsibility of third echelon or higher maintenance per-

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sonnel. The using unit, however, is responsible for changing the dessicant in the towers and for replacing the piping.

134. Drier Towers Dessicant

a. Description. The left drier tower (52, fig. 72) and right drier tower (21) contain a charge of activated alumina which removes the moisture from the high pressure air. The dessicant (actiuate alumina) in the dryer towers will become ineffective due to deterioration resulting from continuous use and must be replaced. The moisture content of the air discharged from the dryer towers should be noted each inspection period. The towers are drained and filled through openings at the bottom and top of the tower.

Caution: Make sure that all air is discharged from the system before servicing the drier assembly.

b. Dessicant Removal and Charging.

(1) Remove the left and right drier tower drain plugs (26 and 44), being sure to place a suitable container under the plugs to catch the dessicant. After all the dessicant has been drained, remove the filler plugs (3) in the top of the Y-connection (2).

(2) Install the drain plugs, place a funnel in the opening in the Y-connection, and charge each tower with 25 lbs. of activated alumina.

(3) Install and tighten the filler plugs in the Y-connection.

Note. Inspect the filler plugs and drain plugs for stripped or damaged threads after removal and replace plugs if necessary.

135. Prefilter Dessicant

a. Description. The prefilter (8, fig. 72) contains a charge of vapoilsorb which removes some of the moisture and most of the oil carried over by the compressor from the high pressure air. Periodic checks by taking small samples of the vapoilsorb will indicate the necessity of changing the vapoilsorb. If it is dark and oily, the dessicant should be changed.

b. Dessicant Removal and Charging.

(1) Remove the prefilter drain plug (37, fig. 72), being sure to place a suitable container under the plug to catch the dessicant.

Note. It may be necessary to remove the prefilter fill plug (9) and insert a wooden stick to dislodge any of the dessicant sticking to the sides of the prefilter.

(2) Install and tighten the drain plug, and with the fill plug removed, charge the prefilter with approximately 10 lbs of vapoilsorb for maximum efficiency.

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Note. Inspect the threads of the prefilter fill and drain plugs for stripped or damaged threads. Replace the plugs if defective.

Section XVIII. PIPE-LINE AIR FILTERS, VALVES, AND PIPING

136. General

The pipe-line air filters are installed in the system to filter out all dirt, oil, and moisture remaining in the air before it is discharged. They are installed in the downstream or outlet side of the air receiver. Air from the receiver passes through the pipe-line air filters cutout valve into the upstream filter housing through suitable piping. It enters the filter housing at the top towards the front and leaves through the rear center of the housing. It then passes through a connecting tube to the downstream filter housing, enters through the top front, and leaves through the rear at the center. From the downstream filter, the air passes to the compressing unit supply valve through suitable piping and is discharged through the outlet tube which passes under the air receiver and through a hole drilled in the side of the skid base. The compressing unit blowdown valve is installed in the piping between the cutout valve and upstream filter, and the safety-relief valve is installed in the piping between the air receiver and cutout valve.

137. Pipe-Line Air Filters

a. Description. The pipe-line air filter assembly consists of the upstream filter housing (11, fig. 74) and the downstream filter housing (6) mounted on the filter base (15). The base is mounted on the skid base and cradle supports (12) are welded to the filter base. The filter housing are held in place in the cradle supports by U-bolts and nuts. Each filter housing contains a deflecting cylinder which prevents the high pressure air from coming into direct contact with the filter element and screens from the inlet tubing. This action assures an even distribution of air over the entire surface of the filter element and screen. In addition to providing even distribution of air, the deflecting cylinder prevents the air from blowing continuously on one small area of the filter element and screen. The filter housings also contain the outer screen, filter retainer and tube, filter element, inner screen, filter retainer, and gaskets which are held in place in the housing by the housing cover (2) and cover nuts.

b. Removal.

(1) Unscrew the tube coupling nut (9) from the pipe-to-tube elbow (8), unscrew the tube coupling nut (13) from the elbow (14), and remove the filter inlet tubing (10).

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Caution: Make sure that all air is discharged from the system and the compressing unit outlet tubing is disconnected at the outlet end before servicing the pipe-line air filters.

(2) Unscrew the tube coupling nut (7, fig. 17) from the adapter (6), unscrew the tube coupling nut (9) from the elbow (1), and remove the filter outlet tubing (8).

(3) Remove the six cap screws (16, fig. 74) holding the filter base (15) on the skid base and remove the filter assembly.

Note. It is not necessary to remove the filter assembly or to disconnect the piping in order to service the filters, but, for proper cleaning and ease of operation, it is best to do so.

(4) Remove the pipe-to-tube elbow (8). Unscrew the tube coupling nut (5) from the pipe-to-tube elbow (4), unscrew the tube coupling nut from the pipe-to-tube elbow at the rear of the upstream filter housing (11), and remove the connecting tube (7). Remove the pipe-to-tube elbows from the top and rear of the downstream filter housing and the rear of the upstream filter housing.

(5) Remove the four nuts from the U-bolts (3) holding the upstream filter housing in the cradle supports (12). Lift the housing out of the supports.

(6) Remove the four nuts from the U-bolts holding the downstream filter housing (6) in the cradle supports. Lift the housing out of the supports.

c. Disassembly.

(1) Remove the eight nuts (1, fig. 75) from the filter housing cover (2) of the upstream filter housing (8) and remove the cover and gasket (3).

(2) Using a wrench on the hex head of the filter retainer and tube assembly (12), remove the filter element assembly as a unit. Remove the filter gasket (9) and filter retainer (10).

(3) Remove the two screws (4) and lockwashers (5) holding the deflecting cylinder (6) on the filter retainer and tube and remove the cylinder.

(4) Remove the outer screen (14). Cut the string securing the filter element (13) around the inner screen (11) and remove the string and filter element. Remove the inner screen. Use the old filter element as a pattern to cut a new one and discard the old one.

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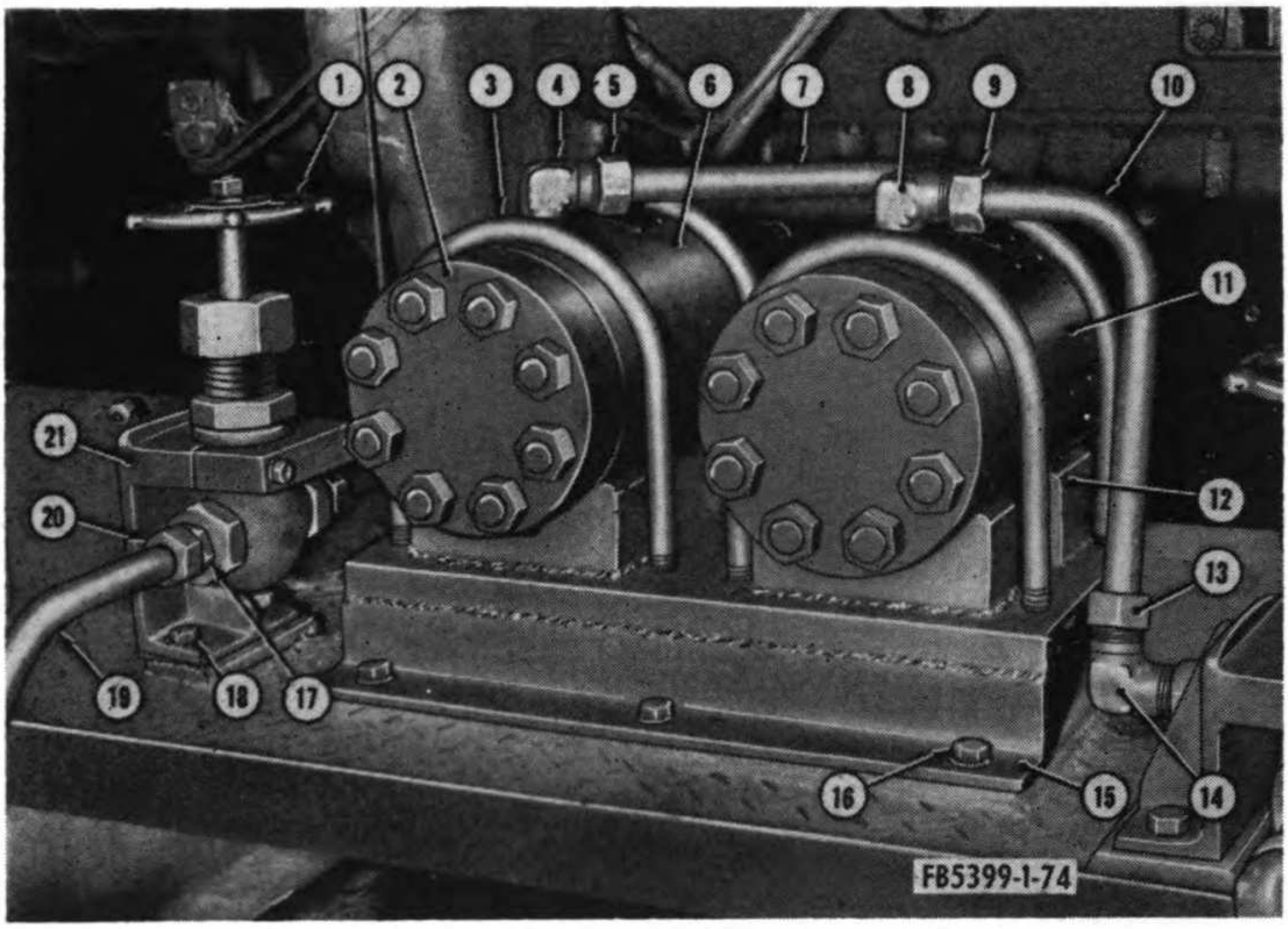

1	Compressing unit supply valve	11	Upstream filter housing
2	Filter housing cover	12	Cradle support
3	U-bolt	13	Tube coupling nut
4	Pipe-to-tube elbow	14	Elbow
5	Tube coupling nut	15	Filter base
6	Downstream filter housing	16	Cap screw
7	Connecting tube	17	Adapter
8	Pipe-to-tube elbow	18	Cap screw
9	Tube coupling nut	19	Compressing unit outlet tubing
10	Filter inlet tubing	20	Tube coupling nut
		21	Mounting bracket

Figure 74. Pipe-line air filters removal and installation points.

Note. The downstream filter is disassembled in the same manner. Disassemble one filter at a time to avoid mixing the parts, since the filter elements differ in composition and are not interchangeable.

d. Cleaning, Inspection and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Allow the parts to dry thoroughly or blow them dry with an air hose.

(2) Inspect the inner and outer screens, deflecting cylinder, filter retainer and tube, filter retainer, housing cover, and filter housing for cracks, breaks or damage.

(3) Inspect the filter base and cradle supports for cracks, breaks, or damage.

(4) Check the nuts, studs, screws, and cap screws for stripped or damaged threads. Replace all defective parts.

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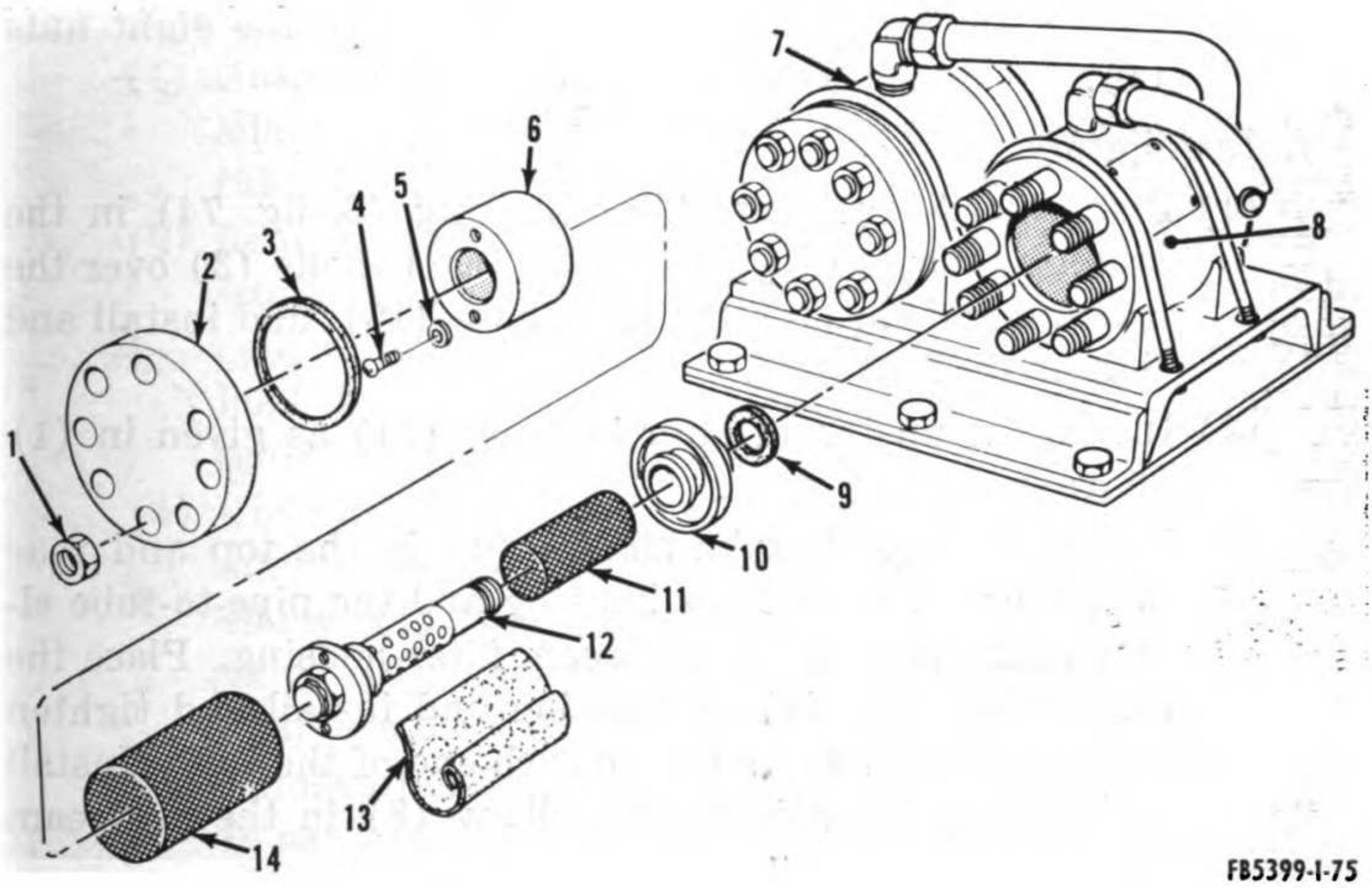

1	Nut hex, ⅝-11 in. (16 rqr)	9	Filter gasket
2	Filter housing cover	10	Filter retainer
3	Gasket, housing cover	11	Inner screen
4	Screw ¼-20x¾ in. (4 rqr)	12	Filter retainer and tube assembly
5	Lockwasher ¼ in. (4 rqr)	13	Filter element
6	Defecting cylinder	14	Outer screen
7	Downstream filter housing		
8	Upstream filter housing		

Figure 75. Pipe-line air filters, partially exploded view showing disassembly removal points.

Note. If a stud is defective, remove the stud, using a stud puller. Install the new stud using a stud driver.

e. Reassembly.

(1) Install the inner screen (11) on the filter retainer and tube (12). Place a new filter element (13) in position around the inner screen and secure with several turns of string tied in a knot.

(2) Install the outer screen (14) over the filter element.

(3) Slide the deflecting cylinder (6) over the outer screen, aline the holes in the cylinder and the retainer and tube, and install and tighten the two screws (4) with lockwashers (5).

(4) Place the filter gasket (9) and filter retainer (10) in position in the upstream filter housing (8). Insert the filter retainer and tube assembly through the retainer and gasket, and tighten the filter element assembly by using a wrench on the hex head of the filter and retainer tube.

(5) Place the gasket (3) in position, install the housing cover

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(2) on the studs, and install and tighten the eight nuts (1).

f. Installation.

(1) Place the downstream filter housing (6, fig. 74) in the cradle supports (12), install the two U-bolts (3) over the housing and through the filter base (15), and install and tighten the four nuts.

(2) Install the upstream filter housing (11) as given in (1) above.

(3) Install the pipe-to-tube elbows (4) in the top and rear of the downstream filter housing and the pipe-to-tube elbow in the rear of the upstream filter housing. Place the connecting tube (7) in position and install and tighten the tube coupling nut (5) on each end of the tube. Install and tighten the pipe-to-tube elbow (8) in the upstream housing.

Note. When installing the pipe-to-tube elbows, be sure to position them so that no stress is placed upon the tubing, otherwise the tubing connections will leak.

(4) Place the filter base (15) in position on the skid base and install and tighten the six cap screws (16).

(5) Place the filter inlet tubing (10) in position, install and tighten the tube coupling nut (9), and install and tighten the tube coupling nut (13).

(6) Place the filter outlet tubing (8, fig. 17) in position, install and tighten the tube coupling nut (7), and install and tighten the tube coupling nut (9).

138. Valves and Piping

a. Description. The compressor unit supply valve (2, fig. 17), pipe-line air filters cutout valve (29, fig. 16), compressing unit blowdown valves (38), and safety relief valve (17) are on the outlet side of the air receiver. For maintenance purposes they will be considered as a unit since they are interconnected to each other by piping. The cutout valves are 6000 psi test, high pressure globe valves, and the safety relief valve is a 6000 psi test, spring-loaded valve, preset at 3850 psi to relieve the air pressure should it rise above the pressure setting. Seamless steel piping and flareless-tube or compression-type fittings are utilized in the air and oil piping system. These fittings provide a seal for pressures up to the bursting strength of the piping itself. Regulating, draining and safety control apparatus is installed in the assembly to insure safe operation of the compressor unit.

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b. Removal.

(1) Unscrew the tube coupling nut (20, fig. 74) from the adapter (17) and remove the compressing unit outlet tubing (19).

(2) Remove the two cap screws (4, fig. 17) and lockwashers which hold the valve support collar (5) and remove the collar. Remove the two cap screws (18, fig. 74) which hold the mounting bracket (21) on the skid base and remove the bracket.

(3) Unscrew the tube coupling nut (7, fig. 17) from the adapter (6), unscrew the tube coupling nut (9) from the elbow (1), and remove the compressing unit supply valve (2) and filter outlet tubing (8). Remove the adapters from the valve.

(4) Remove the filter inlet tubing (10, fig. 74) as instructed in paragraph 137*b* (1).

(5) Unscrew the tube coupling nut (3, fig. 16) from the elbow (43) and remove the elbow. Unscrew the tube coupling nut (5) from the tee (6) and remove the nipple (4).

(6) Remove the nipple (39) from the compressing unit blowdown valve (38). Remove the two cap screws (35) holding the valve support collar (37) and remove the collar.

(7) Unscrew the tube coupling nut (7) from the tee, remove the two cap screws (40) and lockwashers which hold the mounting bracket (42) on the skid base, and remove the bracket.

(8) Remove the valve and remove the tee adapter, and nipple from the valve.

(9) Unscrew the tube coupling nut (34) from the adapter (33) and remove the nipple (8).

(10) Remove the two cap screws (31) and lockwashers holding the valve support collar (30) and remove the collar. Remove the two cap screws (9) and lockwashers holding the mounting bracket (10) on the skid base and remove the bracket.

(11) Unscrew the tube coupling nut from the adapter on the inlet side of the pipe-line air filters cutout valve (29) and remove the valve. Remove the adapters from the valve.

(12) Unscrew the tube coupling nut (27) from the tee (20) and remove the nipple (28).

(13) Unscrew the tube coupling nut (19) from the tee (20). Unscrew the tube coupling nut from the elbow at the air

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receiver and remove the piping section consisting of the tee (20), nipple (22), elbow (24), receiver outlet tubing (26), and tube coupling nuts.

(14) Unscrew the tube coupling nut (21) from the tee and remove the tee. Unscrew the tube coupling nut (23) from the elbow and remove the nipple. Unscrew the tube coupling nut (25) from the elbow and remove the receiver outlet tubing.

(15) Unscrew the tube coupling nut from the elbow at the safety-relief valve inlet and remove the safety-relief valve inlet tubing (18). Remove the elbow from the safety-relief valve (17).

(16) Remove the four cap screws (11) and lockwashers (12) from the mounting bracket (13) and remove the bracket and valve.

(17) Remove the two nuts (14) and lockwashers (15) from the U-bolt (16) and remove the U-bolt. Lift the valve off of the mounting bracket.

Note. The above removal procedure is not mandatory but is a recommended manner of removal. If it is necessary to replace a valve or small section of piping, remove only the necessary parts.

c. Cleaning, Inspection, and Repair.

(1) Clean all tubing and fittings with an approved cleaning solvent and allow to dry thoroughly or blow dry with an air hose. Wipe the exterior surfaces of the valves with a cloth moistened in an approved cleaning solvent and blow through the valve openings with an air hose.

(2) Inspect the valves for proper operation and signs of leaks. Replace defective valves.

(3) Inspect all tubing and fittings for cracks, breaks, and signs of leaks. Replace all defective parts. To replace the tubing, the following procedure must be used.

(*a*) Using the defective piece of tubing as a pattern, cut the new section of tubing to the required length, being careful to cut the ends square.

(*b*) Using a file, remove the burs from the inside and outside edges of the tube ends.

Note. Exercise care to avoid excessive chamfering of the outside edge; this will prevent the correct bearing of the tube end on the fitting seat.

(*c*) After the tubing is properly formed, slide the tube coupling nut (2, fig. 76) and sleeve (3) onto the tube

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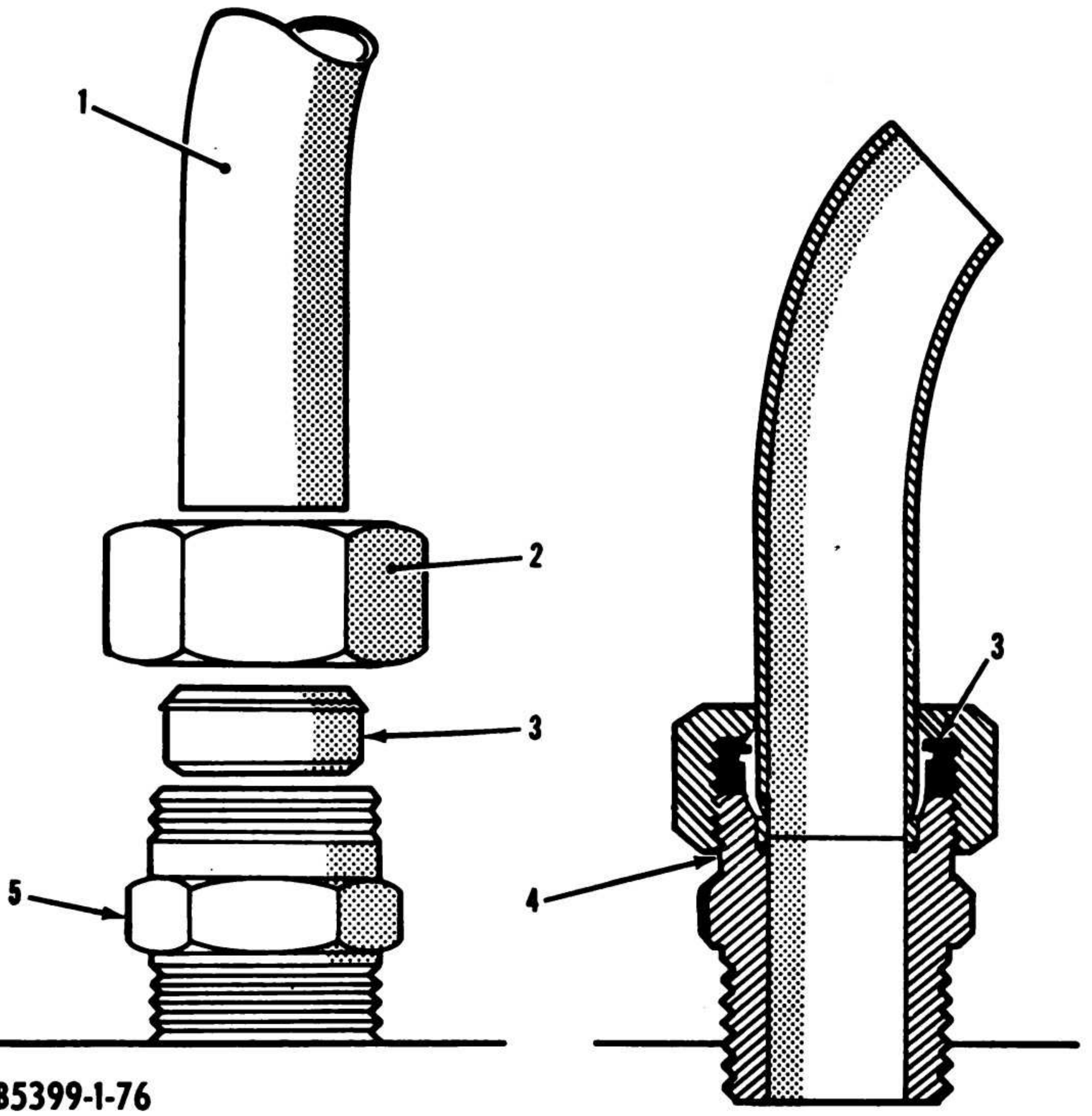
(1). Make certain that the head of the sleeve is facing the tube coupling nut.

Caution: If it is necessary to bend the tubing, extreme care must be used. It must always be correctly formed, alined, and fitted by proper bending only. Dangerously weak or unreliable connections may result from the excessive stress caused by tube ends that are alined by being force-fitted into position.

(4) Inspect the mounting brackets and valve support collars for cracks, breaks, and damage. Inspect the cap screws, nuts, and U-bolt for stripped or damaged threads. Replace all defective parts.



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1 Tubing
2 Tube coupling nut
3 Sleeve
4 Fitting shoulder
5 Body

Figure 76. Flareless-tube fittings partially exploded view, showing assembly and installation detail.

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d. Installation.

(1) Place the safety-relief valve (17, fig. 16) in position in the mounting bracket (13), install the U-bolt (16), and install and tighten the two nuts (14) with lockwashers (15).

(2) Place the mounting bracket in position on the skid base and install and tighten the four cap screws (11) with lockwashers (12).

(3) Install and tighten the elbow in the safety-relief valve inlet opening. Place the safety-relief valve inlet tubing (18) in position and tighten the tube coupling nut in the following manner:

(*a*) Insert the tube end into the body (5, fig. 76) of the fitting, making certain that the tube (1) is seated squarely against the body shoulder (4). Apply a thin film of oil to the fitting components before installing.

(*b*) Turn the tube coupling nut (2) with a wrench until it "feels tight". A "feel tight" connection is made by turning the nut with a wrench while slowly revolving the tube with the other hand. When the tube can no longer be turned by hand, stop tightening the nut, and after noting the position of the wrench, make one and one-half more turns. This will result in a "feel tight" assembly which must be used for all tubing installations.

Note. When assembling or installing tubing, always insert each tube end into the fitting connection before tightening the tube coupling nuts. This allows free movement of the tubing at both ends and insures correct seating at each connection.

(4) Place the receiver outlet tubing (26, fig. 16) and nipple (22) in position at the elbow (24). Install but do not tighten the tube coupling nuts (25) and (23). Place the tee (20) in position at the nipple and place the piping section in position at the air receiver. Tighten the tube coupling nuts (19, 21, 23, and 25) and the nut at the receiver.

(5) Install and tighten the adapter (33) and the adapter at the inlet side of the pipe-line air filters cutoff valve (29). Place the nipple (28) and valve in position and install and tighten the tube coupling nut (2[redacted]) and the tube coupling nut at the adapter.

(6) Place the mounting bracket (10) in position at the valve and install and tighten the two cap screws (9) with lock-

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washers. Place the valve support collar (30) in position and install and tighten the two cap screws (31) with lockwashers (32).

(7) Place the nipple (8) and tee (6) in position and install and tighten the tube coupling nuts (34) and (7). Install and tighten the adapter in the inlet side of the compressing unit blowdown valve (38), place the nipple and valve in position, and install and tighten the tube coupling nuts on the tee and adapter. Install and tighten the nipple (39).

(8) Place the mounting bracket (42) in position at the valve and install and tighten the two cap screws (40) with lockwashers (41). Place the valve support collar (37) in position and install and tighten the two cap screws (35) with lockwashers (36).

(9) Place the nipple (4) and elbow (43) in position and install and tighten the tube coupling nuts (3) and (5).

(10) Install the filter inlet tubing (10, fig. 74) as given in paragraph 137*c*(5).

(11) Install and tighten the adapter (6, fig. 17) and the adapter at the outlet side of the compressing unit supply valve (2).

(12) Place the supply valve and filter outlet tubing (8) in position and install and tighten the tube coupling nuts (7 and 9).

(13) Place the mounting bracket (21, fig. 74) in position at the valve and install and tighten the two cap screws (18) with lockwashers. Place the valve support collar (5, fig. 17) in position and install and tighten the two cap screws (4) with lockwashers.

(14) Place the compressing unit outlet tubing (19, fig. 74) in position at the supply valve and install and tighten the tube coupling nut (20).

Section XIX. COMPRESSOR OIL PIPING AND MECHANICAL LUBRICATOR OIL PIPING AND SIGHT FEED GLASSES

139. General

The compressor oil piping consists of the piping which delivers the oil from the compressor oil pump to the accessory drive housing and cooler assembly and the mechanical lubricator piping which delivers the oil to the compressor cylinders. The piping

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connections and tubing are the flareless-tube or compression-type and are made up of the same components as described in paragraph 138*a*, differing only in size. The mechanical lubricator supplies oil to the compressor cylinders through the six pumping units, sight-feed glasses, and suitable piping. The sight-feed glasses will become dirty during normal operation and must be cleaned whenever the oil-flow rate cannot be seen by the compressor operator. It is not necessary to remove the cylinder lubricating pumps to clean the sight-feed glasses.

140. Compressor Oil Piping

a. Description. The compressor oil piping circulates oil to the compressor bearings as shown in figure 77. All exterior piping is the responsibility of the using unit, but the piping inside the compressor crankcase and the cooler assembly is the responsibility of third echelon or higher maintenance personnel and will not be covered in this paragraph.

b. Removal.

(1) Disconnect the oil filter piping as instructed in paragraph 33*g*(1). Unscrew the ferrule nut (15, fig. 78) from the elbow (16) and remove the oil filter outlet tube (14). Unscrew the ferrule nut (36, fig. 23) from the elbow and remove the oil filter inlet tubing (13, fig. 78). Remove the elbows.

(2) Unscrew the inverted nuts (30, fig. 23) and (33) from the elbows (29 and 35). Remove the bypass line (34) and elbows.

(3) Unscrew the inverted nut (26) from the adapter (27). Unscrew the inverted nut (24, fig. 79) from the elbow (21) and unscrew the inverted nut (22) and remove the elbow. Remove the oil pump outlet line (25, fig. 23) through the front of the compressor mounting base.

(4) Remove the adapter from the pipe cross (28) and remove the pipe cross.

(5) Unscrew the inverted nut (7) from the tee (6) and unscrew the inverted nuts (18 and 20, fig. 79) from the elbow (19). Remove the elbow. Remove the cooler assembly outlet line (10, fig. 78).

(6) Unscrew the inverted nut (11) from the elbow (12) and the inverted nut (31, fig. 23) from the adapter (32) and remove the oil pump inlet line. Remove the adapter and elbow.

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(7) Remove the relief valve (1) from the tee (6). Unscrew the inverted nut (5) from the tee and remove the tee. Remove the adapter (4).

(8) Unscrew the upper and lower packing nuts (9, fig. 11) and remove the crankcase sight lever gage (10). Remove the elbow (8) and adapter (12).

(9) Unscrew the inverted nut (14) from the elbow (13) and remove the piping assembly consisting of the nipple (15), elbow (17), nipple (18), elbow (19), and nipple (20) No further disassembly of this section should be necessary since the components are soldered together. Remove the elbow (13).

(10) Unscrew the inverted nut (23) from the elbow. Unscrew the inverted nut (10, fig. 73), remove the clamps holding the oil pressure safety switch actuating line (16, fig. 23) and remove the line. Remove the elbow.

(11) Unscrew the ferrule nuts (5, fig. 73) from the adapter (4) and tee (9). Remove the oil pressure gage line (6). Remove the tee, adapter, and reducing bushing (3).

(12) Unscrew the ferrule nuts (3, fig. 78) and (6) from the tee (4) and adapter (7) and remove the accessory drive housing upper inlet line (5). Remove the adapter.

(13) Remove the tee (9) from the reducing tee (8) and remove the reducing tee.

(14) Unscrew the ferrule nut (2) from the tee (4), unscrew the ferrule nut (17), and remove the accessory drive housing lower inlet line (1). Remove the tee.

(15) Unscrew the ferrule nut (2, fig. 79) from the adapter (3), remove the pipe clamps, and remove the section of oil pressure safety switch actuating line (1) out through the front of the compressor. Remove the adapter from the ferrule nut (4).

(16) Unscrew the ferrule nut (17) from the adapter (16), remove the pipe clamp, and slide this section of oil pressure safety switch actuating line (1) out from under the automatic unloading system actuating line (15).

(17) Disconnect the remaining section of oil pressure safety switch actuating line as given in paragraph 103*b* (1). Remove the pipe clamps and remove the line.

c. Cleaning, Inspection, and Repair. Clean, inspect, and repair the oil lines and fittings as described in paragraph 138*c* (1) and (3). The oil piping is repaired in the same manner as the air piping.

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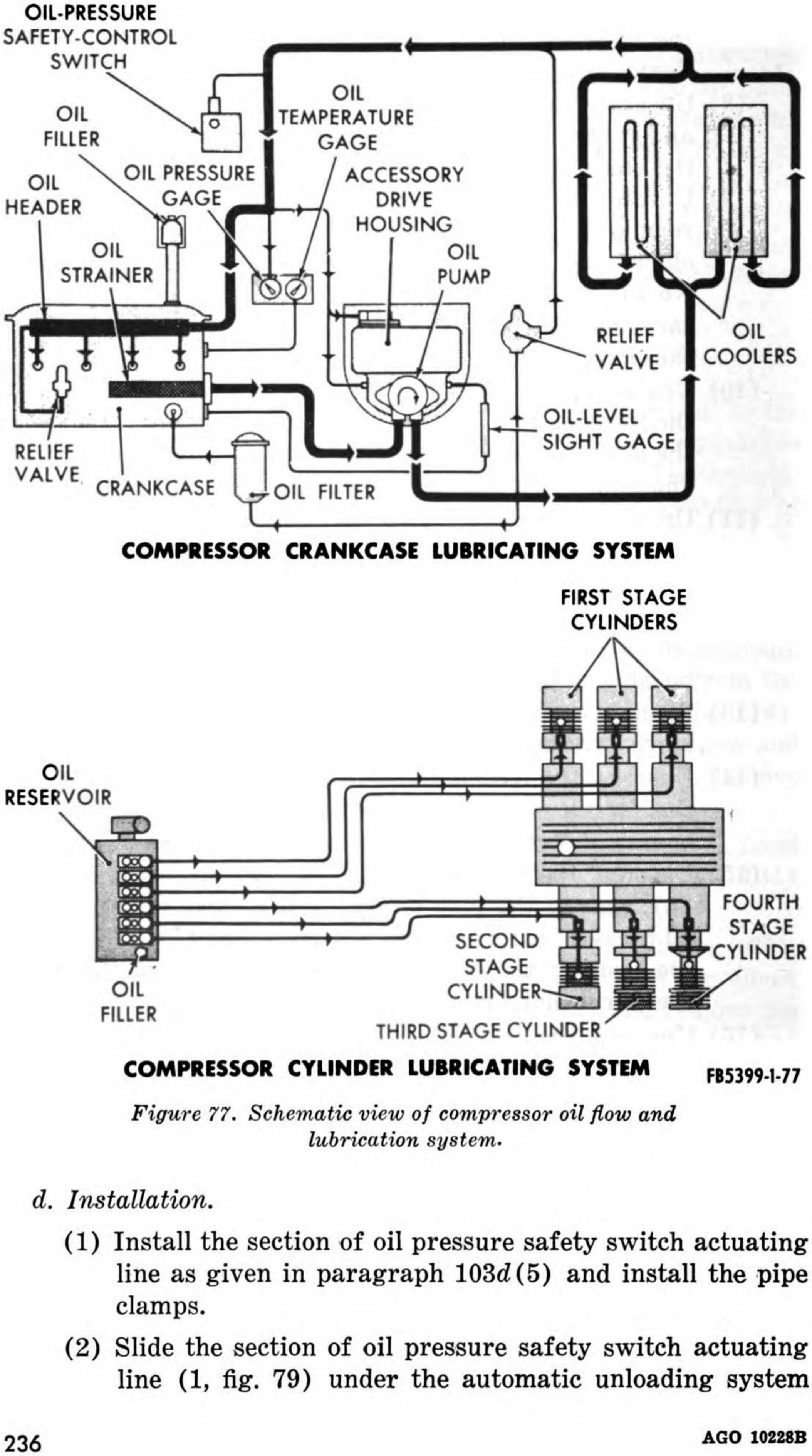

Figure 77. Schematic view of compressor oil flow and lubrication system.

d. Installation.

(1) Install the section of oil pressure safety switch actuating line as given in paragraph 103*d*(5) and install the pipe clamps.

(2) Slide the section of oil pressure safety switch actuating line (1, fig. 79) under the automatic unloading system

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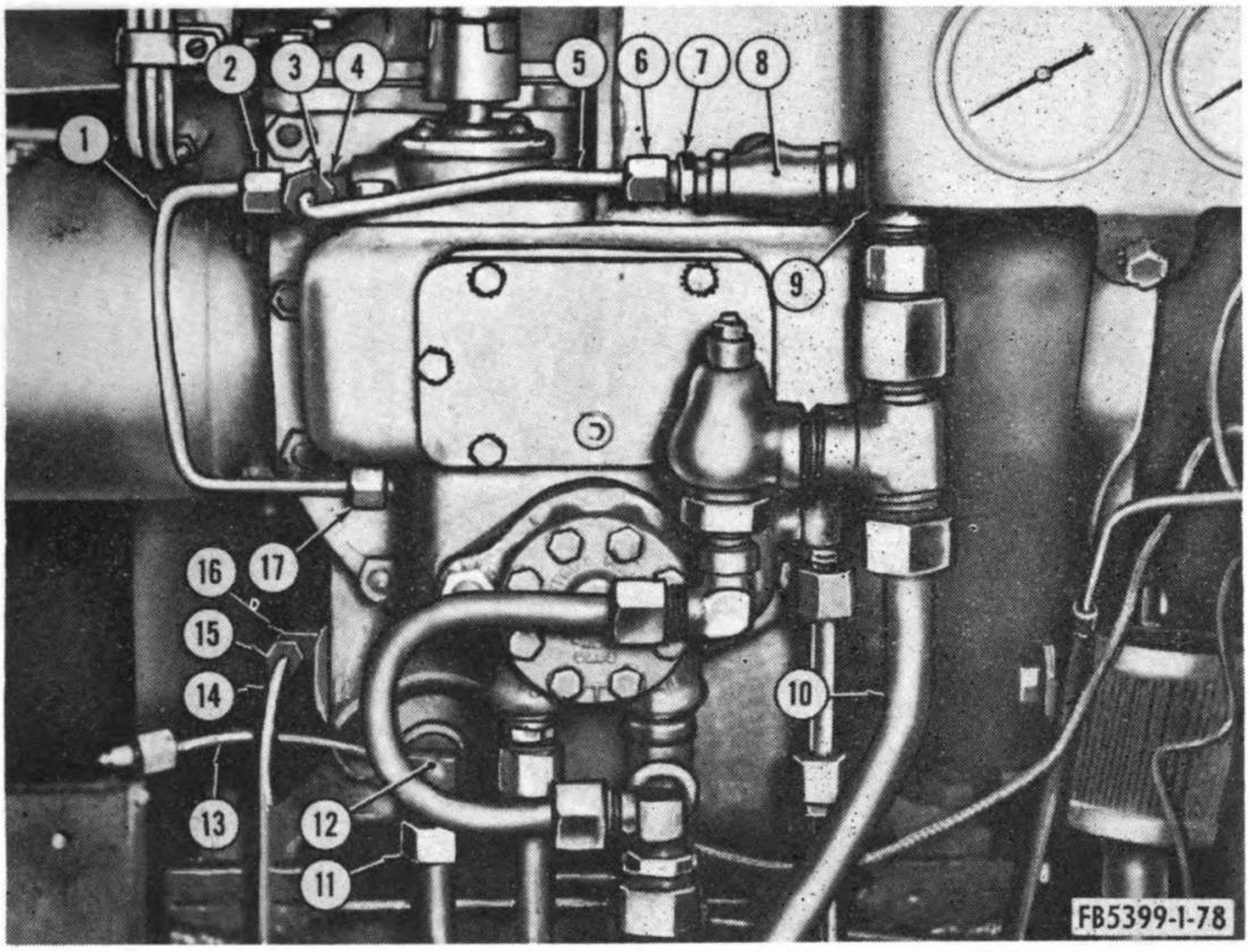

1	Accessory drive housing lower inlet line	8	Reducing tee
2	Ferrule nut	9	Tee
3	Ferrule nut	10	Cooler assembly outlet line
4	Tee	11	Ferrule nut
5	Accessory drive housing upper inlet line	12	Elbow
6	Ferrule nut	13	Oil-filter inlet line
7	Adapter	14	Oil-filter outlet line
		15	Ferrule nut
		16	Elbow
		17	Ferrule nut

Figure 78. Compressor oil piping removal and installation points.

actuating line (15) and install and tighten the ferrule nut (17) on the adapter (16). Install the pipe clamp.

(3) Place the adapter (3) in position and install and tighten the ferrule nut (4). Slide the section of oil pressure safety switch actuating line (1) under the compressor from the front and install and tighten the ferrule nut (2). Install the pipe clamps.

(4) Install the tee (4, fig. 78), place the accessory drive housing lower inlet line (1) in position, and install and tighten the ferrule nuts (2 and 17).

(5) Install the reducing tee (8), install the adapter (7) in the tee, place the accessory drive housing upper inlet line (5) in position, and install and tighten the ferrule nuts (3 and 6). Install and tighten the tee (9) in the reducing tee.

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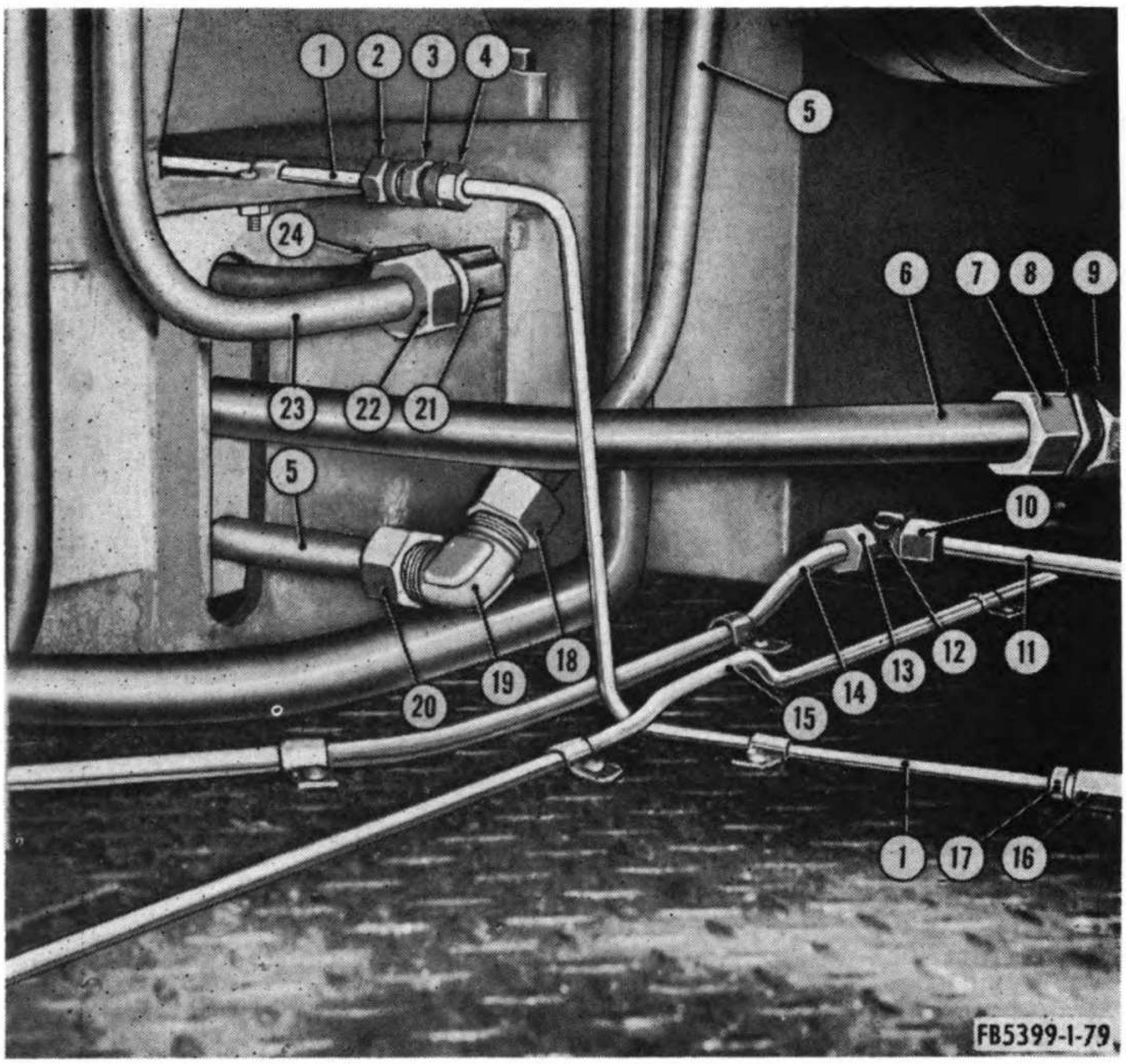

1 Oil pressure safety switch actuating line
2 Ferrule nut
3 Adapter
4 Ferrule nut
5 Cooler assembly outlet line
6 Compressor-to-unloader valve line
7 Tube coupling nut
8 Adapter
9 Tube coupling nut
10 Tube coupling nut
11 Unloader pilot valve supply line
12 Tee
13 Tube coupling nut
14 Automatic unloading system supply line
15 Automatic unloading system actuating line
16 Adapter
17 Ferrule nut
18 Inverted nut
19 Elbow
20 Inverted nut
21 Elbow
22 Inverted nut
23 Oil pump outlet line
24 Inverted nut

Figure 79. Compressor oil and air piping removal and installation points.

(6) Install and tighten the tee (9, fig. 73), install and tighten the reducing bushing (3) and adapter (4), place the oil pressure gage line (6) in position, and install and tighten the ferrule nuts (5).

(7) Place the oil pressure safety switch actuating line (16, fig. 23) in position, install and tighten the elbow in the

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crankcase just below the thermocouple (22), and install and tighten the inverted nut (23) at the elbow and the inverted nut (10, fig. 73). Install the pipe clamps.

(8) Install and tighten the elbow (13, fig. 23), place the piping assembly consisting of the nipple (15), elbow (17), nipple (18), elbow (19), and nipple (20) in position and install and tighten the inverted nut (14). Install and tighten the adapter (12).

(9) Install and tighten the elbow (8) place the crankcase sight level gage (10) in position and install and tighten the upper and lower packing nuts (9) and (11).

(10) Install and tighten the adapter (4), place the tee (6) in position, and install and tighten the inverted nut (5). Install and tighten the relief valve (1) in the tee.

(11) Install and tighten the elbow (12, fig. 78) and the adapter (32, fig. 23), place the oil pump inlet line in position, and install and tighten the inverted nut (31) and the inverted nut (11, fig. 78).

(12) Slide the cooler assembly outlet line (10) under the compressor from the front, install and tighten the inverted nut (18, fig. 79) on the elbow (19), and install and tighten the inverted nut (20) and the inverted nut (7, fig. 23).

(13) Install and tighten the pipe cross (28) in the oil pump housing, install and tighten the adapter (27), and slide the oil pump outlet line (25) under the compressor from the front. Place the elbow (21, fig. 79) in position, install and tighten the inverted nut (22), and install and tighten the inverted nut (24) and inverted nut (26, fig. 23).

(14) Install and tighten the elbows (29 and 35), place the by-pass line (34) in position, and install and tighten the inverted nuts (30 and 33).

(15) Install and tighten the elbow at the back of the pipe cross, place the oil filter inlet tubing (13, fig. 78) in position, and install and tighten the ferrule nut (36, fig. 23).

(16) Install and tighten the elbow (16, fig. 78), place the oil filter outlet tube (14) in position, and install and tighten the ferrule nut (15). Connect the oil filter piping as given in paragraph 33*g* (5) (*c*).

141. Mechanical Lubricator Oil Piping and Sight Feed Glasses

The mechanical lubricator, which is driven by a chain of shafts and gears from the compressor crankshaft, supplies the oil neces-

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sary to lubricate the compressor cylinders. Figure 77 shows the oil flow from the lubricator to the cylinders. The using unit is responsible for servicing the lubricator. Service the lubricator pump sight feed glasses and oil piping as instructed in paragraph 33*k*. All other repairs are the responsibility of third echelon or higher maintenance personnel.

142. Lubricator Pump Sight Feed Glasses

a. Description. The lubricator pump sight feed glasses (12, fig. 80) are mounted on top of each lubricator pump and consists of the cap nut (1), retainer, guide wire, connector, sight feed glass, top and bottom rubber washers, and body. It is not necessary to remove the body in order to remove the glass.

b. Removal and Disassembly.

(1) Remove the cap nut (1) from the retainer (3, fig. 81). Remove the retainer.

(2) Remove the connector (4) and guide wire (2). Remove the top washer (5) from the top of the sight feed glass (6).

(3) Place a clean cloth around the bottom of the glass and remove the glass.

(4) Remove the bottom washer (7) from the body (8). Remove and disassemble the other five sight glasses in the same manner.

c. Cleaning and Inspection.

(1) Clean all parts in an approved cleaning solvent paying particular attention to the sight feed glass.

(2) Inspect the glass for chips, cracks, and breaks.

(3) Inspect the top and bottom washers for cracks, breaks, and signs of deterioration.

(4) Inspect the cap nut, retainer, guide wire, and connector for cracks, breaks, or damaged stripped threads. Replace all defective parts.

d. Reassembly and Installation.

(1) Install the bottom washer (7) in the body (8).

Caution: Be sure to install the correct washer in the body. The thicker washer is installed in the bottom and the thin washer on top of the sight feed glass.

(2) Install the sight feed glass (6) in the body and install the top washer (5).

(3) Install the connector (4) over the top washer. Insert the guide wire (2) through the connector and into the nozzle.

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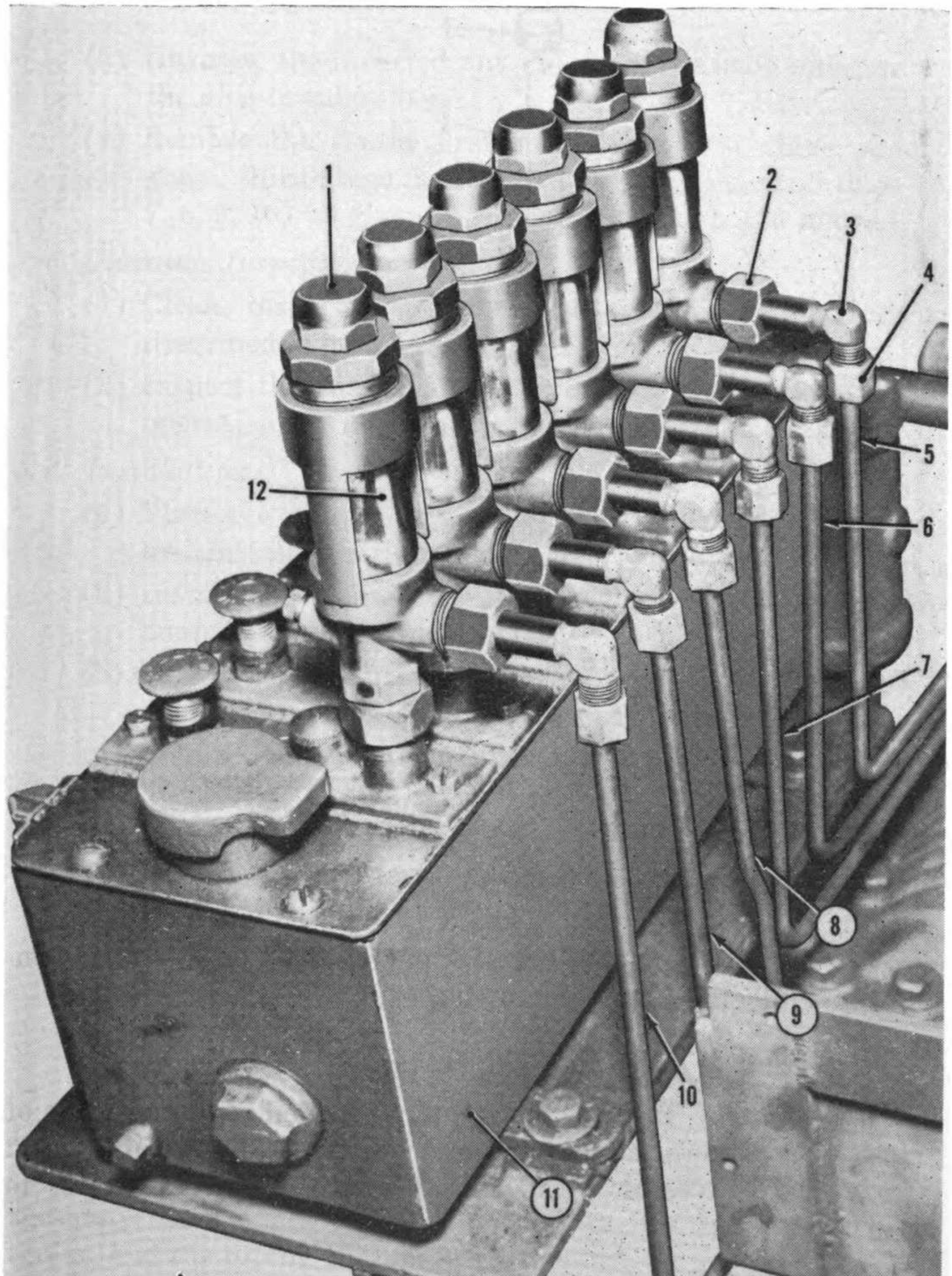

1 Cap nut
2 Inverted nut
3 Pipe-to-tube elbow
4 Inverted nut
5 Front first stage cylinder oil line
6 Center first stage cylinder oil line
7 Rear first stage cylinder oil line
8 Second stage cylinder oil line
9 Third stage cylinder oil line
10 Fourth stage cylinder oil line
11 Mechanical lubricator
12 Lubricator pump sight feed glass

Figure 80. Mechanical lubricator oil piping and pump sight feed glass removal and installation points.

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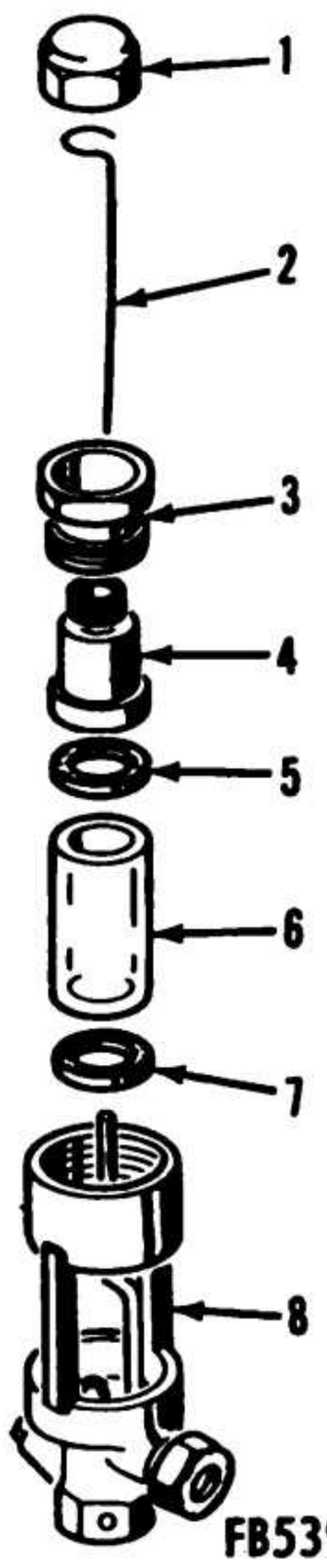

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1 Cap nut
2 Guide wire
3 Retainer
4 Connector
5 Top washer
6 Sight feed glass
7 Bottom washer
8 Body

Figure 81. Lubricator pump sight feed glass, exploded view.

(4) Install and tighten the retainer (3) in the body, and install and tighten the cap nut (1, fig. 80).

143. Mechanical Lubricator Oil Piping

a. Description. The mechanical lubricator oil piping consists of pipe-to-tube elbows, adapters, check valves, and the tubing and inverted nuts necessary to deliver the oil from the lubricator to the cylinders.

b. Removal.

(1) Disconnect the oil line at the cylinder as described in paragraph 33*k*(1) and (8). Disconnect the other oil lines in the same manner. Remove the chock valves (2, fig. 33).

(2) Unscrew the inverted nut (4, fig. 80) from the pipe-to-tube elbow (3) and remove the front first stage cylinder oil line (5).

Note. Before removing the oil line, it will be necessary to remove the oil line clamp at the front of the compressor crankcase.

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(3) Unscrew the inverted nut (2) from the body and remove the pipe-to-tube elbow.

(4) Remove the center first stage, rear first stage, second stage, third stage, and fourth stage cylinder oil lines (6, 7, 8, 9, 10) as given in steps (1) through (3) above.

c. Cleaning, Inspection, and Repair.

(1) Clean, inspect, and repair the oil lines and fittings as described in paragraph 140*c*(1).

(2) Inspect the check valves for cracks, breaks, and proper operation. If any defects are noticed, replace the valves.

d. Installation.

(1) Place the pipe-to-tube elbow (3) in position at the body and install and tighten the inverted nut (2).

(2) Install and tighten the check valves (2, fig. 33) in the adapters at the cylinders.

(3) Place the front first stage cylinder oil line (5, fig. 80) in position and install and tighten the inverted nut (4).

(4) Connect the oil line at the cylinder as given in paragraph 33*k*(10).

(5) Install the center first stage, rear first stage, second stage, third stage, and fourth stage cylinder oil lines as given in steps (1) through (4) above.

(6) Install the compressor shrouding as given in paragraph 124*c*(19) and (20).

Section XX. COMPRESSOR AIR PIPING

144. General

The compressor air piping consists of the piping from and to the compressor cylinders, knock-out bottles, intercoolers and after-cooler, and the piping to the drier assembly, air receiver, pipe-line air filters, and final discharge line. Necessary valves are installed in the piping to control the flow of air to the point of final discharge. It also consists of the piping used to deliver air to the automatic unloader system.

145. Drier Assembly Air Piping

a. Description. The drier assembly air piping consists of the air inlet piping to the prefilter and the two drier towers, and the air outlet piping from the prefilter and two drier towers. It also consists of the reactivating air inlet and outlet piping and the necessary control valves.

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b. Removal.

(1) Remove the pipe plug (1, fig. 72) and filler plug (3) from the Y-connection (2) located on the side of the left and right drier towers (52 and 21). Remove the Y-connections.

(2) Unscrew the ferrule nuts (19) from the elbows (18) at the top and bottom of the right drier tower flexible hose (20) and remove the hose. Remove the elbows. Remove the left drier tower flexible hose (51) and elbows in the same manner.

(3) Unscrew the tube coupling nut (23) from the elbow (24) and the tube coupling nut (47) from the tee. Remove the two tube clamp screws (50) from the tube clamps (49) and remove the right drier tower reactivating air inlet tube (22).

(4) Unscrew the tube coupling nuts (31) from the bushing (30) and the tee (34) located at the top and bottom of the right drier tower air outlet tube (32). Remove the tube. Remove the left drier tower air outlet tube in the same manner.

Note. It may be necessary to turn the two street elbows (35) and (38) at the top of the outlet tubes to remove the outlet tubes.

(5) Remove the bushings (30) and adapters (29). Remove the plugged elbow (36) from the tee and remove the tee. Remove the street elbow (35), nipple, elbow, and nipple from the right drier tower air outlet valve (27). Remove the street elbow (38), and nipple (39), from the left drier tower air outlet valve (45).

(6) Unscrew the tube coupling nut (31) from the elbow (43) and remove the elbow. Unscrew the tube coupling nut from the tee, remove the tube clamp (41) by removing the cap screw, and remove the connecting tube (42). Unscrew the tube coupling nut and remove the tee (34).

(7) To remove the right drier tower reactivating air outlet valve (12), it will be necessary to remove the valve bonnet (14) from the valve body (15). Remove the valve body from the nipple (16). Remove the right drier tower air inlet valve (10), air outlet valve (27), and reactivating air inlet valve (25), and the left drier tower air inlet valve (7), air outlet valve (45), reactivating air inlet valve (48), and reactivating air outlet valve (4) in the same manner.

(8) Remove the nipple (16) from each side of the tee (17)

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and remove the tee. Remove the other nipples and tees in the same manner.

Note. Unless the valves, nipples, or tees are defective, it is not advisable to remove them, since leaks may develop at the valve bonnets.

(9) Unscrew the tube coupling nut (5, fig. 82) from each end of the left drier tower reactivating air inlet tube (6) and remove the tube. Remove the tee (4) and adapter (3) from the elbow (2) and remove the elbow.

Note. It will be necessary to remove this section of piping before removing the left drier tower reactivating air inlet valve (46, fig. 72).

(10) Remove the relief valve (7, fig. 82) and elbow (18) from the tee (8) and remove the tee. Remove the adapter (9) from the flowmeter (10).

(11) Unscrew the tube coupling nut (15) from each end of the reactivating pump outlet tube (14), remove the two tube clamps (19), and remove the tube.

(12) Remove the elbow (16) and reactivating air discharge valve (17) from the tee (13) and remove the tee. Remove the adapter (12) from the flowmeter nipple (11).

c. Cleaning, Inspection, and Repair. Clean, inspect, and repair the drier assembly air piping as described in paragraph 138*c*.

d. Installation.

(1) Install and tighten the adapter (12) and tee (13) at the flowmeter nipple (11). Install and tighten the elbow (16) and reactivator air discharge valve (17) in the tee.

(2) Place the reactivator pump outlet tube (14) in position, install and tighten the tube coupling nut (15) at each end of the tube, and install the two tube clamps (19).

(3) Install and tighten the adapter (9) and tee (8) at the top of the flowmeter (10). Install and tighten the relief valve (7) and elbow (18).

(4) Install and tighten the tee (17, fig. 72) at the left drier tower lower connection, install and tighten the two nipples (16) in the tee, and install and tighten the valve body (15) of the left drier tower reactivating air inlet valve (48). Install and tighten the valve bonnet (14) in the valve body.

(5) Install and tighten the elbow (2, fig. 82) in the valve and install and tighten the adapter (3) and tee (4) at the elbow. Place the left drier tower reactivating air inlet tube (6) in position and install and tighten the tube coupling nut (5) at each end of the tube.

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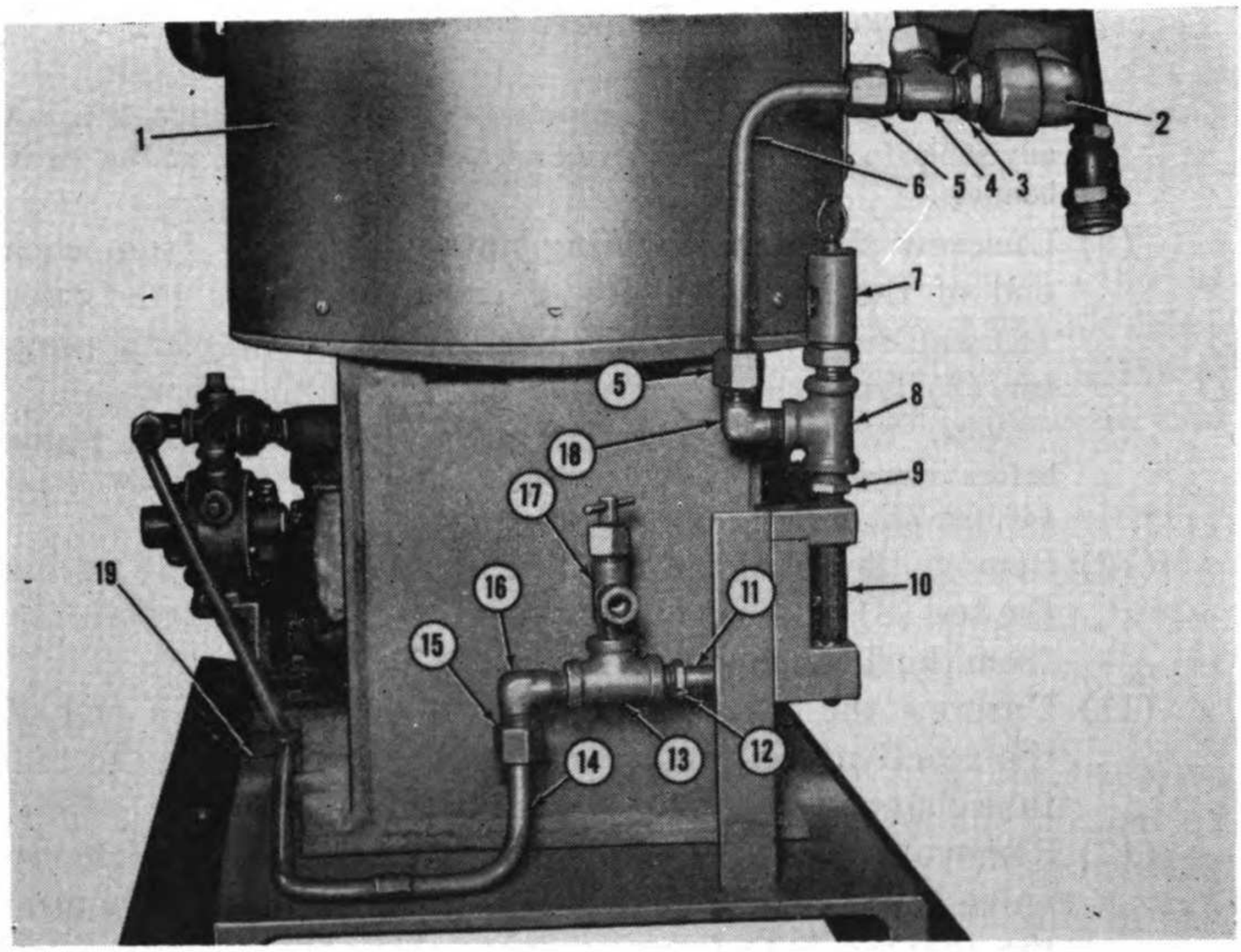

1	Left drier tower	10	Flowmeter
2	Elbow	11	Flowmeter nipple
3	Adapter	12	Adapter
4	Tee	13	Tee
5	Tube coupling nut	14	Reactivator pump outlet tube
6	Left drier tower reactivating air inlet tube	15	Tube coupling nut
7	Relief valve	16	Elbow
8	Tee	17	Reactivator air discharge valve
9	Adapter	18	Elbow
		19	Tube clamp

Figure 82. Drier tower piping removal and installation points.

(6) Install and tighten the nipples (16, fig. 72), tees (17), and drier tower assembly control valves (4, 45, 7, 25, 27, 10, and 12) in the same manner as given in (4) above.

(7) Install and tighten the street elbow (38), nipple (39), and street elbow (35) at the left drier tower air outlet valve (45).

(8) Install and tighten the nipple, elbow, nipple, and street elbow at the right drier tower air outlet valve (27). Install and tighten the tee (28) and plugged elbow (36).

(9) Install and tighten the adapter (29) and bushing (30) at the tee (28) and street elbow (35).

(10) Place the tee (34) in position at the drier assembly to pressure-retaining valve tube (33) and install and tighten the tube coupling nut (31).

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(11) Place the connecting tube (42) and elbow (43) in position and install and tighten the tube coupling nut (31) at each end of the tube. Install the tube clamp (41) and tighten the cap screw.

(12) Place the right drier tower air outlet tube (32) in position and install and tighten the tube coupling nuts at each end of the tube. Install the left drier tower air outlet tube in the same manner.

Note. It may be necessary to turn the elbows at the top of the tubes to install the outer tubes.

(13) Install and tighten the elbow (24) at the right drier tower reactivating air inlet valve (25). Place the right drier tower reactivating air inlet tube (22) in position and install and tighten the tube coupling nuts (23) and (47).

(14) Install and tighten the Y-connection (2) on the side of each drier tower. Install and tighten the pipe plug (1) and filler plug (3).

(15) Install and tighten the elbow (18) at the prefilter outlet tee and the right drier tower air inlet valve (10), place the right drier tower flexible hose (20) in position, and install and tighten the ferrule nut (19) at each end of the hose. Install the left drier tower flexible hose (51) in the same manner.

146. Pressure-Retaining, Safety-Relief, and Receiver Check Valves and Piping

a. Description. The pressure-retaining valve (40, fig. 83) is a spring-loaded valve which is preset to open at 2500 psi. It is placed in the piping just before the air enters the air receiver and maintains 2500 psi in the entire compressor assembly except the air receiver until the pressure in the receiver has reached 2500 psi. The valve is sealed at the adjusting screw and no attempt should be made by the operating unit to change the valve setting. Air from the drier tower in service enters the valve at the lower side and leaves through the bottom. A check valve (32) is installed in the line between the air receiver and the pressure-retaining valve to prevent higher receiver pressure from backing up into the compressor assembly should the compressor stop operating. A check valve (10, fig. 84) is installed in the piping between the safety-relief valve and the prefilter to prevent high pressure air in the drier assembly from backing up into the knock-out bottles, coolers, and compressor cylinders. The safety-relief valve (19, fig. 85) is installed in the piping between the number five knock-out

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bottle and the check valve (10, fig. 84) to relieve excessive pressure in the knock-out bottles, coolers, and compressor cylinders. The valve is a spring-loaded valve, preset at 3850 psi.

b. Removal.

(1) Unscrew the tube coupling nut (14) from the elbow (15) and from the tee (23). Remove the No. 4 moisture knock-out bottle outlet tube. Remove the elbow by unscrewing the tube coupling nut on top of the bottle.

(2) Unscrew the tube coupling nut (24) from the tee (23) and from the tee (28). Remove the connecting tube (27).

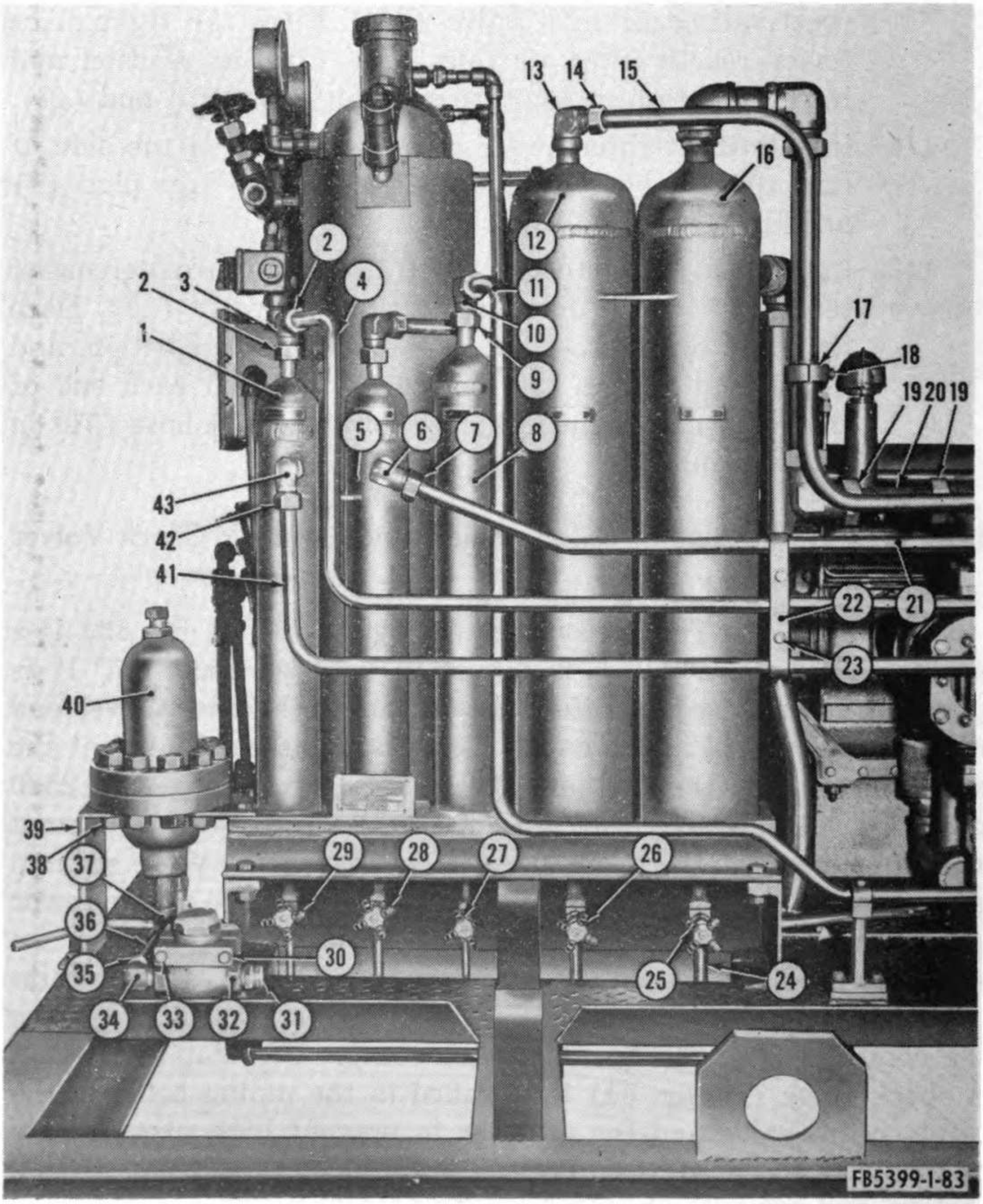

Figure 83. Pressure-retaining valve check valve, and compressor piping removal and installation points.

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1 No. 5 moisture knock-out bottle
2 Tube coupling nut
3 Elbow
4 Aftercooler inlet tube
5 No. 4 moisture knock-out bottle
6 Elbow
7 Tube coupling nut
8 No. 3 moisture knock-out bottle
9 Tube coupling nut
10 Elbow
11 Fourth stage inlet tube
12 No. 2 moisture knock-out bottle
13 Elbow
14 Tube coupling nut
15 Third stage inlet tube
16 No. 1 moisture knock-out bottle
17 Tube clamp
18 Cap screw
19 Tube coupling nut
20 Connecting tube
21 Aftercooler outlet tube
22 Tube clamp
23 Cap screw
24 Nipple
25 No. 1 moisture knock-out bottle drain valve
26 No. 2 moisture knock-out bottle drain valve
27 No. 3 moisture knock-out bottle drain valve
28 No. 4 moisture knock-out bottle drain valve
29 No. 5 moisture knock-out bottle drain valve
30 Valve support collar
31 Adapter
32 Check valve
33 Cap screw
34 Elbow
35 Tube coupling nut
36 Pressure-retaining valve outlet tube
37 Elbow
38 Nut
39 Mounting bracket
40 Pressure-retaining valve
41 Fourth stage outlet tube
42 Tube coupling nut
43 Elbow

Figure 83—Continued.

(3) Remove the single nipple (21) and tee. Remove the two nuts from the U-bolt (20) and slide the safety-relief valve (19) out of the mounting bracket (22).

(4) Unscrew the tube coupling nut (7, fig. 84) from the adapter (6) and the elbow (11) and remove the prefilter inlet tube (8). Remove the elbow.

(5) Unscrew the tube coupling nut at the tee (28, fig. 85) and at the check valve (10, fig. 84) and remove the connecting tube (9).

(6) Remove the two cap screws (13) from the valve support collar (12), remove the collar, and remove the check valve.

(7) Unscrew the tube coupling nut (31, fig. 72) from the tee (34) and unscrew the tube coupling nut (8, fig. 86) from the elbow (7).

(8) Remove the cap screw (11) from the tube clamp (10), remove the tube clamp, and remove the drier to pressure retaining valve tube (9).

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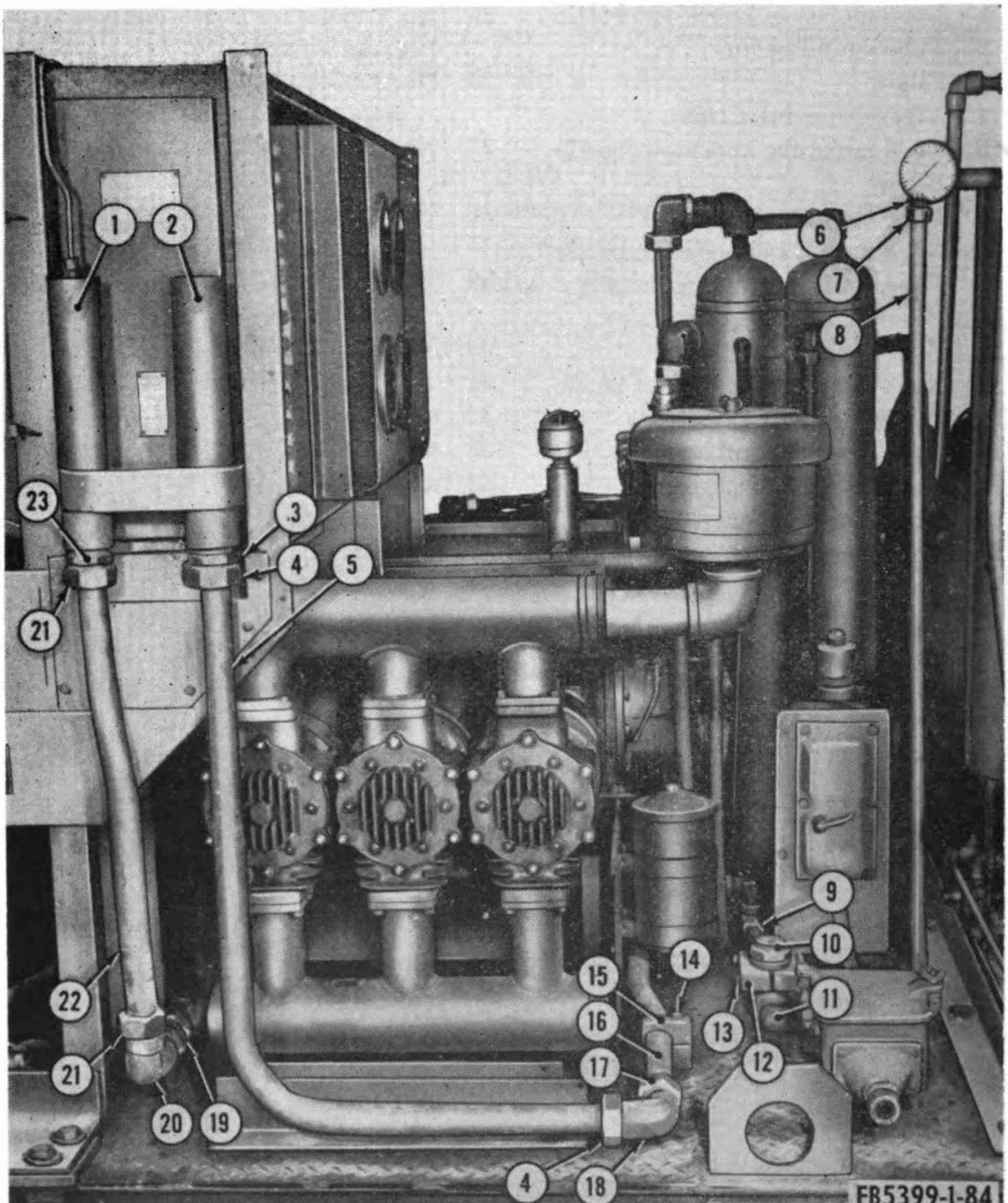

1 First stage intercooler inlet header
2 First stage intercooler outlet header
3 Adapter
4 Tube coupling nut
5 First stage intercooler upper outlet tube
6 Adapter
7 Tube coupling nut
8 Prefilter inlet tube
9 Connecting tube
10 Check valve
11 Elbow
12 Valve support collar
13 Cap screw
14 Cap screw
15 Tube clamp
16 First stage intercooler lower outlet tube
17 Tube coupling nut
18 Elbow
19 Tube coupling nut
20 Elbow
21 Tube coupling nut
22 First stage intercooler inlet tube
23 Adapter

Figure 84. Check valve and compressor piping removal and installation points.

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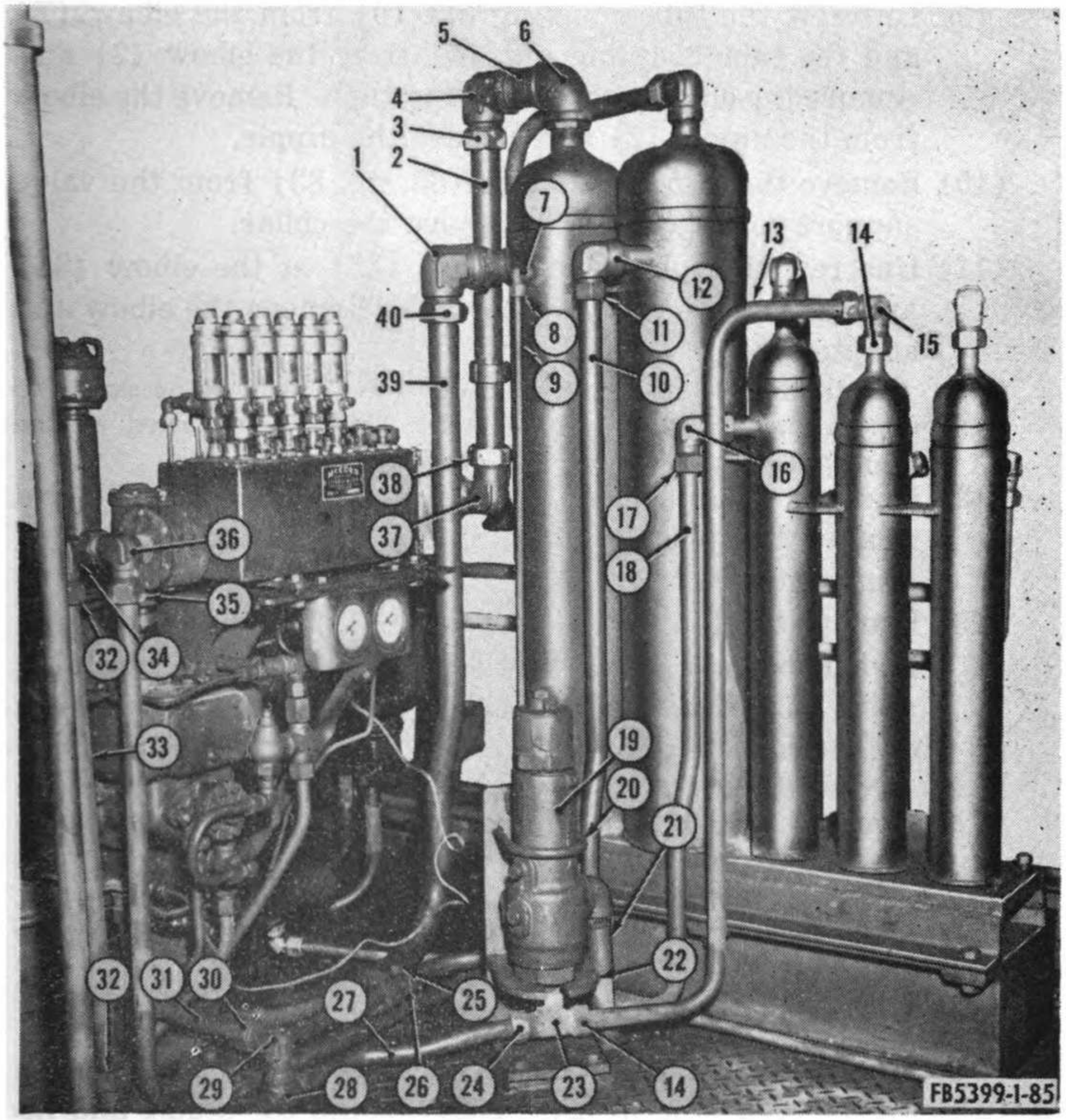

1 Elbow
2 Second stage inlet tube
3 Tube coupling nut
4 Elbow
5 Nipple
6 Elbow
7 Elbow
8 Tube coupling nut
9 Automatic unloading system supply tube
10 Second stage intercooler outlet line
11 Tube coupling nut
12 Elbow
13 No. 4 moisture knock-out bottle outlet tube
14 Tube coupling nut
15 Elbow
16 Elbow
17 Tube coupling nut
18 Third stage intercooler outlet tube
19 Safety-relief valve
20 U-bolt
21 Nipple
22 Mounting bracket
23 Tee
24 Tube coupling nut
25 Cap screw
26 Tube clamp
27 Connecting tube
28 Tee
29 Elbow
30 Tube coupling nut
31 Compressor-to-unloader valve tube
32 Tube coupling nut
33 Connecting tube
34 Elbow
35 Tube coupling nut
36 Elbow
37 Elbow
38 Tube coupling nut
39 First stage intercooler lower outlet tube
40 Tube coupling nut

Figure 85. Safety-relief valve and compressor piping removal and installation points.

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(9) Unscrew the tube coupling nut (6) from the elbow (7) and the tube coupling nut (4) from the elbow (3) and remove the elbow and connecting tube. Remove the elbow from the nipple (2) and remove the nipple.

(10) Remove the two cap screws (33, fig. 83) from the valve support collar (30) and remove the collar.

(11) Unscrew the tube coupling nut (35) at the elbow (34) and remove the check valve (32). Remove the elbow and adapter (31).

Note. Before removing the check valve it will be necessary to remove the air receiver inlet tube which is connected at the adapter (31) and the side of the air receiver.

(12) Unscrew the tube coupling nut from the elbow (37) and remove the pressure retaining valve outlet tube (36). Remove the elbow.

(13) Remove the top and bottom nuts (38) at the three front and three rear studs which hold the pressure retaining valve on the mounting bracket (39). Lift the valve out of the bracket.

Note. Do not remove the pressure retaining valve from the mounting bracket unless it is defective. Remove the four cap screws (12, fig. 86) and lift the mounting bracket and valve off the skid base as an assembly.

c. Cleaning, Inspection, and Repair. Clean, inspect, and repair the valves and piping as described in paragraph 138*c*.

d. Installation.

(1) Place the pressure retaining valve (40, fig. 83) in position on the mounting bracket (39), install the studs, and install and tighten the top and bottom nuts (38) on the three front and three rear studs.

Note. If a new valve is being installed, it will be necessary to remove the nuts and studs before mounting the valve on the bracket. If the bracket and valve have been removed as an assembly, place the mounting bracket in position at the skid base and install and tighten the four cap screws (12, fig. 86).

(2) Install and tighten the elbow (37, fig. 83), place the connecting tube (36) in position, and install and tighten the tube coupling nut at the elbow.

(3) Install and tighten the elbow (34) and adapter (31) in the check valve (32). Place the check valve and air receiver inlet tube in position, install and tighten the tube coupling nut (35), and install and tighten the tube coupling nut at each end of the receiver inlet tube. Place the valve support collar (30) in position and install and tighten the two cap screws (33).

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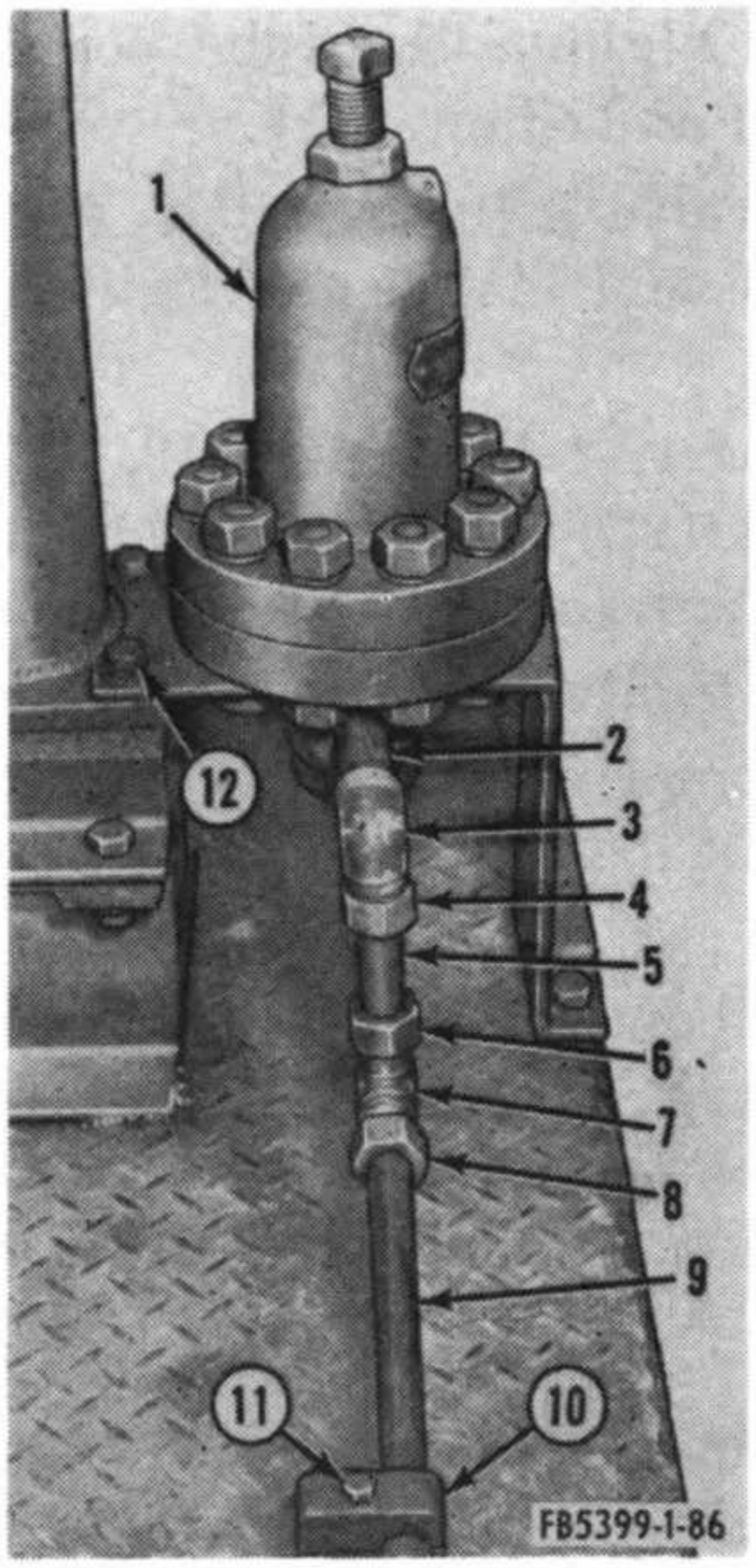

1	Pressure retaining valve	7	Elbow
2	Nipple	8	Tube coupling nut
3	Elbow	9	Drier to pressure retaining valve tube
4	Tube coupling nut	10	Tube clamp
5	Connecting tube	11	Cap screw
6	Tube coupling nut	12	Cap screw

Figure 86. Pressure retaining valve removal and installation points.

(4) Install the nipple (2, fig. 86). Install and tighten the elbow (3) place the connecting tube (5) and elbow (7) in position, and install and tighten the tube coupling nuts (4 and 6) at each elbow.

(5) Place the drier to pressure retaining valve tube (9) in position and install and tighten the tube coupling nut (8) at the elbow and the tube coupling nut (31, fig. 72) at the tee (34).

(6) Place the tube clamp (10, fig. 86) in position and install and tighten the cap screw (11).

(7) Place the connecting tube (9, fig. 84), and check valve (10) in position and install and tighten the tube coupling nut at the tee (28, fig. 85) and at the check valve.

(8) Install and tighten the elbow (11, fig. 84) in the check valve. Place the prefilter inlet tube (8) in position and

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install and tighten the tube coupling nut (7) at the adapter (6) and elbow (11).

(9) Place the valve support collar (12) in position at the check valve and install and tighten the two cap screws (13).

(10) Slide the safety-relief valve (19, fig. 85) onto the mounting bracket (22), place the U-bolt (20) in position, and install and tighten the two nuts on the U-bolt.

(11) Install and tighten the tee (23) and nipple (21).

(12) Place the connecting tube (27) in position and install and tighten the tube coupling nuts (24) at the tees (23 and 28).

(13) Place the elbow (15) in position, install and tighten the tube coupling nut (14), place the number 4 moisture knock-out bottle outlet tube (13) in position, and install and tighten the tube coupling nut (14) at each end of the tube.

147. Compressor Moisture Knock-Out Bottles, Cylinders, and Cooler Assembly Piping

a. Description. The compressor moisture knock-out bottles, cylinders, and cooler assembly piping consists of the piping to and from these components. The second and third stage intercooler inlet and outlet tubes cannot be removed without first removing the cooler assembly. Since the cooler assembly is the responsibility of third echelon or higher maintenance personnel, any defects noticed in this these tubes must be referred to higher authority.

b. Removal.

(1) Remove the compressor shrouding and guards as outlined in paragraph 124*a* and 125*a*.

(2) Unscrew the tube coupling nut (30, fig. 85) from the elbow (29) and the tube coupling nut (7, fig. 79) from the adapter (8) and remove the compressor-to-unloader valve tube (31, fig. 85). Remove the elbow.

(3) Unscrew the tube coupling nuts (21, fig. 84) from the adapter (23) and elbow (20). Remove the first stage intercooler inlet tube (22). Unscrew the tube coupling nut (19) and remove the elbow. Remove the adapter from the first stage intercooler inlet header (1).

(4) Unscrew the tube coupling nuts (4) from the adapter (3) and the elbow (18) and remove the first stage intercooler upper outlet tube (5). Remove the adapter from the first stage intercooler header (2).

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(5) Unscrew the tube coupling nut (17) from the elbow and remove the elbow. Remove the cap screw (14) from the tube clamp (15) and remove the clamp.

(6) Unscrew the tube coupling nut (35, fig. 85) from the elbow (36) and the tube coupling nut (17) from the elbow (16).

(7) Remove the cap screw (25) from each tube clamp (26) and remove the two clamps. Remove the third stage intercooler outlet tube (18). Remove the elbows.

(8) Unscrew the tube coupling nut (11) from the elbow (12) and from the elbow at the other end of the second stage intercooler outlet tube (10) and remove the tube.

(9) Unscrew the tube coupling nuts (32) from the elbow (34) and the elbow at the bottom of the connecting tube (33) and remove the tube. Remove the elbows.

Note. The second and third stage intercooler outlet tube sections from the elbows (34 and 36) and to the intercooler headers cannot be removed without removing the cooler assembly.

(10) Unscrew the tube coupling nut (40) from the elbow (1) and remove the first stage intercooler lower outlet tube (39), being careful not to damage any oil piping when removing it. Remove the elbow.

(11) Unscrew the tube coupling nut (8) from the elbow (7) and the tube coupling nut (13, fig. 79) from the tee (12), remove the four tube clamps, and remove the automatic unloading system supply line (14). Remove the elbow.

(12) Remove the cap screw (18, fig. 83) from the tube clamp (17) and remove the clamp. Unscrew the tube coupling nut (3, fig. 85) from the elbow (4) and the tube coupling nut (38) from the elbow (37) and remove the second stage inlet tube (2). Remove the elbow, nipple (5), and elbow (6).

(13) Unscrew the tube coupling nut (19, fig. 83) from each end of the connecting tube (20) and remove the elbow and connecting tube.

(14) Remove the nipples (24) from the No. 1, No. 2, No. 3, No. 4, and No. 5 moisture knock-out bottle drain valves (25, 26, 27, 28 and 29). Remove the drain valves by removing the valve bonnet from the valve body and removing the valve body.

(15) Remove the two cap screws (23) from the tube clamp (22) and remove the clamp.

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(16) Unscrew the tube coupling nut (7) from the elbow (6), unscrew the tube coupling nut from the adapter at the aftercooler outlet header, and remove the aftercooler outlet tube (21), elbow, and adapter.

(17) Unscrew the tube coupling nut (2) from the elbow (3), unscrew the tube coupling nut from the adapter at the aftercooler inlet header, and remove the aftercooler inlet tube (4) and adapter. Unscrew the tube coupling nut (2) from the elbow and remove the elbow.

(18) Unscrew the tube coupling nut (42) from the elbow (43), unscrew the tube coupling nut (4, fig. 87) from the elbow (5), and remove the fourth stage outlet tube (41, fig. 83). Unscrew the tube coupling nuts at the elbows and remove the elbows.

(19) Unscrew the tube coupling nut (9) from the elbow (10), unscrew the tube coupling nut (20, fig. 87) from the elbow (21), remove the cap screw (35) from the tube clamp (34) and remove the clamp, and remove the fourth stage inlet tube (11, fig. 83). Unscrew the tube coupling nuts at the elbows and remove the elbows.

(20) Unscrew the tube coupling nut (14) from the elbow (13), unscrew the tube coupling nut from the elbow at the other end of the third stage inlet tube (15), and remove the tube and elbows.

(21) Unscrew the tube coupling nut (18, fig. 87) from the elbow (13) and remove the connecting tube (19). Unscrew the tube coupling nut (12) from the elbow (13) and remove the elbow.

(22) Unscrew the tube coupling nut (10) from the adapter (9) and remove the connecting tube (11). Remove the adapter.

(23) Unscrew the tube coupling nut (32) from the adapter (33), unscrew the tube coupling nut from the adapter at the other end of the second stage intercooler outer inlet tube (30), and remove the tube. Remove the adapter.

(24) Unscrew the tube coupling nut (31) from the elbow (2), unscrew the tube coupling nut (17) from the adapter (16), and remove the third stage intercooler outer inlet tube (29). Remove the elbow.

Note. The second stage intercooler inner inlet tube (14) and the third stage intercooler inner inlet tube (15) cannot be removed without removing the cooler assembly.

(25) Unscrew the tube coupling nut (7) from the elbow, unscrew the tube coupling nut (25) from the crank end

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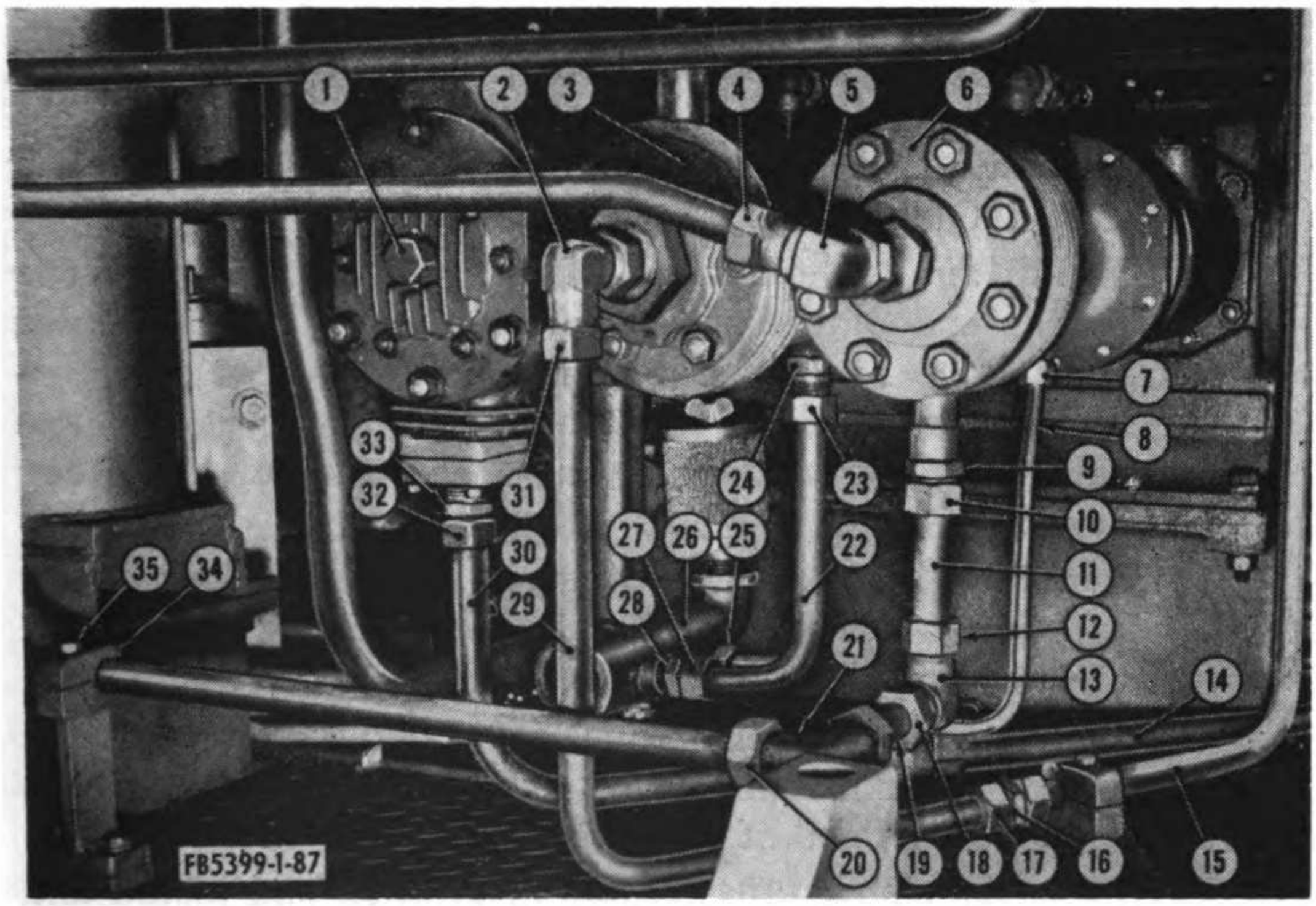
vent breather manifold (26), and remove the fourth stage end vent breather tube (8). Remove the elbow.

(26) Unscrew the tube coupling nut (23) from the elbow (24), unscrew the tube coupling nut (27) from the adapter (28), and remove the third stage end vent breather tube (22). Remove the elbow and adapter.

c. Cleaning, Inspection, and Repair. Clean, inspect, and repair the valves and piping as described in paragraph 138*c*.



1 Second stage cylinder
2 Elbow
3 Third stage cylinder
4 Tube coupling nut
5 Elbow
6 Fourth stage cylinder
7 Tube coupling nut
8 Fourth stage end vent breather tube
9 Adapter
10 Tube coupling nut
11 Connecting tube
12 Tube coupling nut
13 Elbow
14 Second stage intercooler inner inlet tube
15 Third stage intercooler inner inlet tube
16 Adapter
17 Tube coupling nut
18 Tube coupling nut
19 Connecting tube
20 Tube coupling nut
21 Elbow
22 Third stage and vent breather tube
23 Tube coupling nut
24 Elbow
25 Tube coupling nut
26 Crank end vent breather manifold
27 Tube coupling nut
28 Adapter
29 Third stage intercooler outer inlet tube
30 Second stage intercooler outer inlet tube
31 Tube coupling nut
32 Tube coupling nut
33 Adapter
34 Tube clamp
35 Cap screw

Figure 87. Compressor air piping removal and installation points.

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d. Installation.

(1) Install and tighten the adapter (28) and elbow (24). Place the third stage end vent breather tube (22) in position and install and tighten the tube coupling nuts (23) and (27).

(2) Install and tighten the elbow at the fourth stage cylinder (6), place the fourth stage end vent breather (8) in position at the elbow and crank end vent breather manifold (26), and install and tighten the tube coupling nuts (7 and 25).

(3) Install and tighten the elbow (2) and adapter (16), place the third stage intercooler outer inlet tube (29) in position, and install and tighten the tube coupling nuts (31) and (17).

(4) Install and tighten the adapter (33) and the adapter at the end of the second stage intercooler inner inlet tube (14). Place the second stage intercooler outer inlet tube (30) in position, and install and tighten the tube coupling nuts (32) and the nut at the other adapter.

(5) Install and tighten the adapter (9), place the connecting tube (11) and elbow (13) in position, and install and tighten the tube coupling nuts (10) and (12).

(6) Place the connecting tube (19) and elbow (21) in position and install and tighten the tube coupling nuts (18) at each end of the tube.

(7) Place the elbow (10, fig. 83) in position and install and tighten the tube coupling nut (9) at the knock-out bottle. Place the fourth stage inlet tube (11) in position and install and tighten the tube coupling nut (9) and the tube coupling nut (20, fig. 87). Place the tube clamp (34) in position and install and tighten the cap screw (35).

(8) Place the elbow (5) in position and install and tighten the tube coupling nut. Place the elbow (43, fig. 83) in position and install and tighten the tube coupling nut.

(9) Place the fourth stage outlet line (41) in position and install and tighten the tube coupling nut (42) and the tube coupling nut (4, fig. 87).

(10) Place the elbow (3, fig. 83) in position and install and tighten the tube coupling nut (2) at the knock-out bottle. Install and tighten the adapter in the aftercooler inlet header. Place the aftercooler inlet tube (4) in position

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at the elbow and aftercooler inlet header adapter and install and tighten the tube coupling nut (2) and the tube coupling nut at the adapter.

(11) Place the elbow (6) in position at the knock-out bottle and install and tighten the tube coupling nut. Install and tighten the adapter at the aftercooler outlet header. Place the aftercooler outlet tube (21) in position and install and tighten the tube coupling nut (7) and the tube coupling nut at the adapter.

(12) Place the tube clamp (22) in position and install and tighten the two cap screws (23).

(13) Install and tighten the elbow (13) and the elbow at the third stage cylinder, place the third stage inlet tube (15) in position, and install and tighten the tube coupling nut (14) and the tube coupling nut at the other elbow.

(14) Install and tighten the valve body of the No. 1 moisture knock-out bottle drain valve (25), install and tighten the valve bonnet, and install and tighten the nipple (24). Install the No. 2, No. 3, No. 4, and No. 5 moisture knock-out bottle drain valve (26, 27, 28, and 29) and their nipples in the same manner.

Note. If new valves are to be installed, it will be necessary to remove the valve bonnets from the valve bodies.

(15) Place the connecting tube (20) and elbow (37, fig. 85) in position and install and tighten the tube coupling nuts (19, fig. 83).

(16) Install and tighten the elbow (6, fig. 85), nipple (5), and elbow (4). Place the second stage inlet tube (2) in position and install and tighten the tube coupling nuts (3 and 38).

(17) Place the tube clamp (17, fig. 83) in position and install and tighten the cap screw (18).

(18) Install and tighten the elbow (7, fig. 85) in the knock-out bottle. Place the automatic unloading system supply tube (9) in position, install and tighten the tube coupling nut (8), and install and tighten the tube cupling nut (13, fig. 79) at the tee (12). Install and tighten the four tube clamps.

(19) Install and tighten the elbow (1, fig. 85). Place the first stage intercooler lower outlet tube (39) and the elbow (18, fig. 84) in position and install and tighten the tube coupling nuts (17 and 40, fig. 85).

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(20) Place the elbow (34) in position and install and tighten the tube coupling nut. Place the connecting tube (33) and the lower elbow in position and install and tighten the tube coupling nuts (32).

(21) Install and tighten the elbow (12). Place the second stage intercooler outlet tube (10) in position and install and tighten the tube coupling nuts (11).

(22) Place the elbow (36) in position and install and tighten the tube coupling nut (35) at the top of the elbow. Place the elbow (16) in position and install and tighten the tube coupling nut at the knock-out bottle. Place the third stage intercooler outlet tube (18) in position and install and tighten the tube coupling nuts (17 and 35).

(23) Place the two tube clamps (26) in position and install and tighten a cap screw (25) in each clamp. Install and tighten the elbow (29) in the tee (28).

(24) Place the compressor-to-unloader valve tube (31) in position, install and tighten the tube coupling nut (30), and install and tighten the tube coupling nut (7, fig. 79) at the adapter (8).

(25) Install and tighten the adapter (3, fig. 84). Place the first stage intercooler upper outlet tube (5) in position and install and tighten the tube coupling nuts (4).

(26) Place the elbow (20) in position and install and tighten the tube coupling nut (19). Install and tighten the adapter (23). Place the first stage intercooler inlet tube (22) in position and install and tighten the tube coupling nuts (21).

(27) Install the compressor shrouding (par. 124*c*) and guards (par. 125*c*).

148. Automatic Unloading System Air Piping

a. Description. The automatic unloading system air piping consists of the piping to and from the unloader pilot valve, regulator valves, and unloader valve control assembly and the piping to the unloader valve and throttle controller.

b. Removal.

(1) Unscrew the tube coupling nut (10, fig. 79) from the tee (12), unscrew the tube coupling nut (2, fig. 88) from the elbow, and remove the unloader pilot valve supply line (1).

(2) Unscrew the tube coupling nut (10, fig. 79) at the far side of the tee, unscrew the tube coupling nut (17, fig. 19)

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from the elbow (18), and remove the filter-regulator inlet line (16). Remove the elbow.

(3) Unscrew the tube coupling nut (9, fig. 79) from the adapter (8), unscrew the tube coupling nut (6, fig. 88) from the adapter (5) and remove the unloader valve inlet line (7).

(4) Unscrew the tube coupling nut (11, fig. 19) from the tee (12), unscrew the tube coupling nut from the elbow at the side of the unloader valve controller assembly, and remove the filter-regulator outlet line (10). Remove the elbow.

(5) Unscrew the tube coupling nut (3) from the elbow (2), unscrew the tube coupling nut from the elbow at the side of the unloader valve controller assembly, and remove the diaphragm inlet line (4). Remove the elbows.

(6) Unscrew the tube coupling nut (8) from the adapter, unscrew the tube coupling nut from the adapter located under the starting motor, and remove the load-unload valve supply line (9).

(7) Unscrew the tube coupling nut (3, fig. 88), unscrew the tube coupling nut from the adapter at the air receiver, remove the screws (9) from the four tube clamps (8) and remove the unloader valve assembly actuating line (4).

(8) Unscrew the tube coupling nut (13, fig. 19) from the tee (12), unscrew the tube coupling nut (5, fig. 89) from the adapter (4), and remove the throttle controller supply line (14, fig. 19). Remove the tee.

(9) Unscrew the tube coupling nut from the throttle controller valve assembly inlet connection and remove the inlet section and the throttle controller assembly supply line (6, fig. 89). Remove the adapter (4).

(10) Unscrew the tube coupling nut (13) from the elbow (1), unscrew the tube coupling nut (11) from the tee, and remove the throttle controller bellows actuating line (12).

(11) Unscrew the tube coupling nut at the load-unload valve, unscrew the tube connection at the tee located at the tube coupling nut (11), and remove the load-unload supply line. Remove the tee and the middle section of the supply line.

(12) Unscrew the tube coupling nut (9) from the elbow (8), unscrew the tube coupling nut from the adapter at the four-way valve, and remove the power cylinder actuating

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line (10). Unscrew the tube coupling nuts from the elbow (7) and the four-way valve, and remove the other power cylinder actuating line. Remove the elbows.

c. Cleaning, Inspection, and Repair. Clean, inspect, and repair the piping as described in paragraph 138*c*.

d. Installation.

(1) Install and tighten the elbows (7) and (8) in the power cylinder of the throttle controller assembly (2). Place the power cylinder actuating line (10) in position and install and tighten the tube coupling nut (9) and the tube coupling nut at the four way valve. Place the other power cylinder actuating line in position and install and tighten the tube coupling nuts.

(2) Place the load-unload valve supply line in position at the load-unload valve, place the tee in position at the other end of the line, and install and tighten the tube coupling nuts. Place the middle section of the load-unload supply line in position at the other side of the tee and install and tighten the tube coupling nut.

(3) Install and tighten the elbow (1), place the throttle controller bellows actuating line (12) in position, and install and tighten the tube coupling nuts (11 and 13).

(4) Place the inlet section of the throttle controller assembly supply line (6) in position at the inlet connection of the controller assembly and install and tighten the tube coupling nut (3).

(5) Install and tighten the tube (12, fig. 19), place the throttle controller supply line (14) in position, and install and tighten the tube coupling nut (13) and the tube coupling nut (5, fig. 89).

(6) Place the unloader valve assembly actuating line (4, fig. 88) in position, install and tighten the tube coupling nut (3) and install and tighten the tube coupling nut on the adapter at the air receiver. Place the four tube clamps (8) in position and install and tighten the four screws (9).

(7) Place the unloader pilot valve supply line (1) in position, install and tighten the tube coupling nut (2), and install and tighten the tube coupling nut (10, fig. 79) on the tee (12).

(8) Place the unloader valve inlet line (7, fig. 88) in position, install and tighten the tube coupling nut (6) on the

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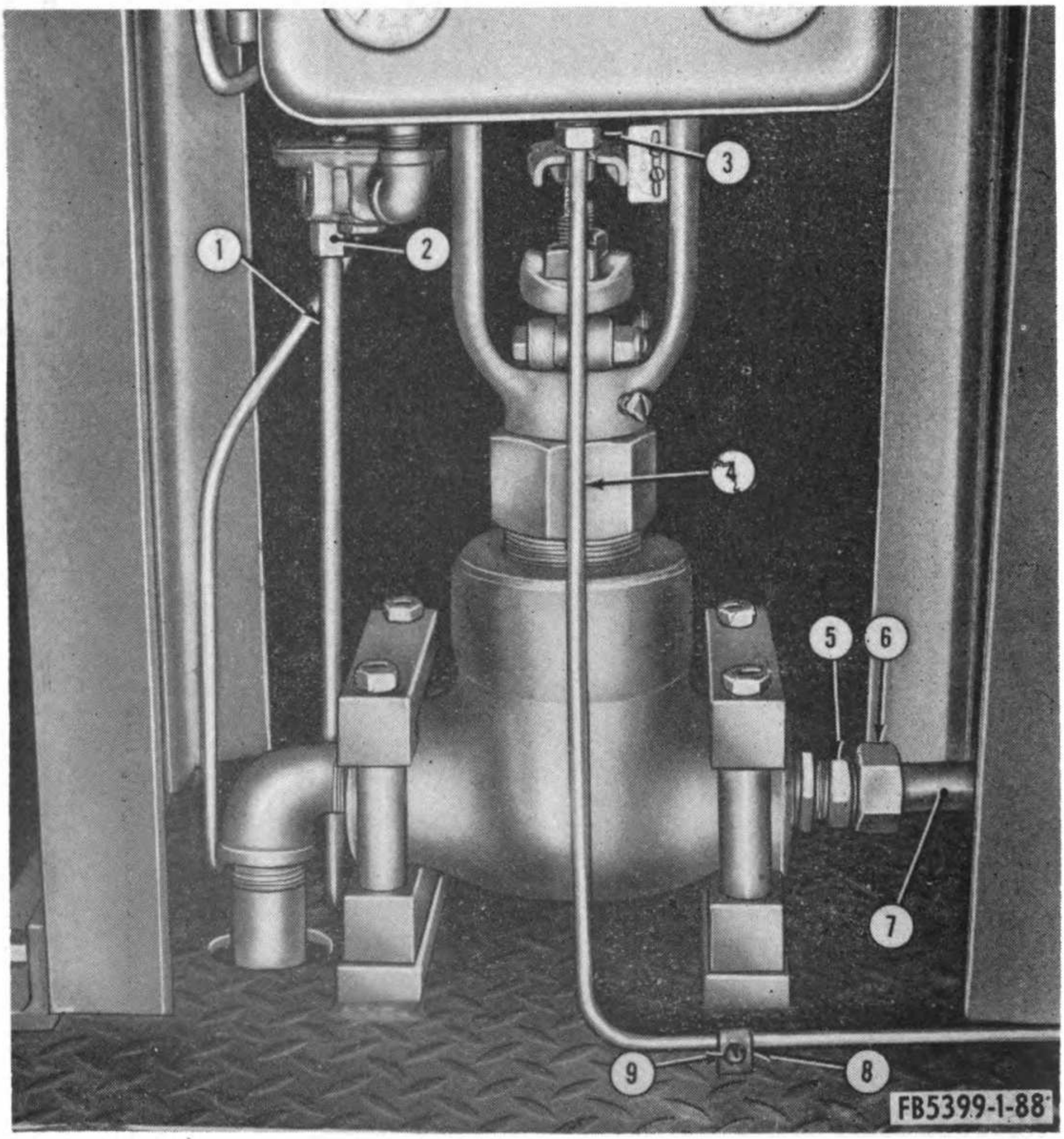
adapter (5), and install and tighten the tube coupling nut (9, fig. 79) on the adapter (8).

(9) Place the load-unload valve supply line (9, fig. 19) in position, install and tighten the tube coupling nut (8), and install and tighten the tube coupling nut at the adapter located under the starting motor.

(10) Install and tighten the elbow (2) and the elbow located at the side for the unloader valve controller assembly, place the diaphragm inlet line (4) in position, and install



1 Unloader pilot valve supply line
2 Tube coupling nut
3 Tube coupling nut
4 Unloader valve assembly actuating line
5 Adapter
6 Tube coupling nut
7 Unloader valve inlet line
8 Tube clamp
9 Screw

Figure 88. Automatic unloading system air piping removal and installation points, showing the diaphragm motor valve assembly.

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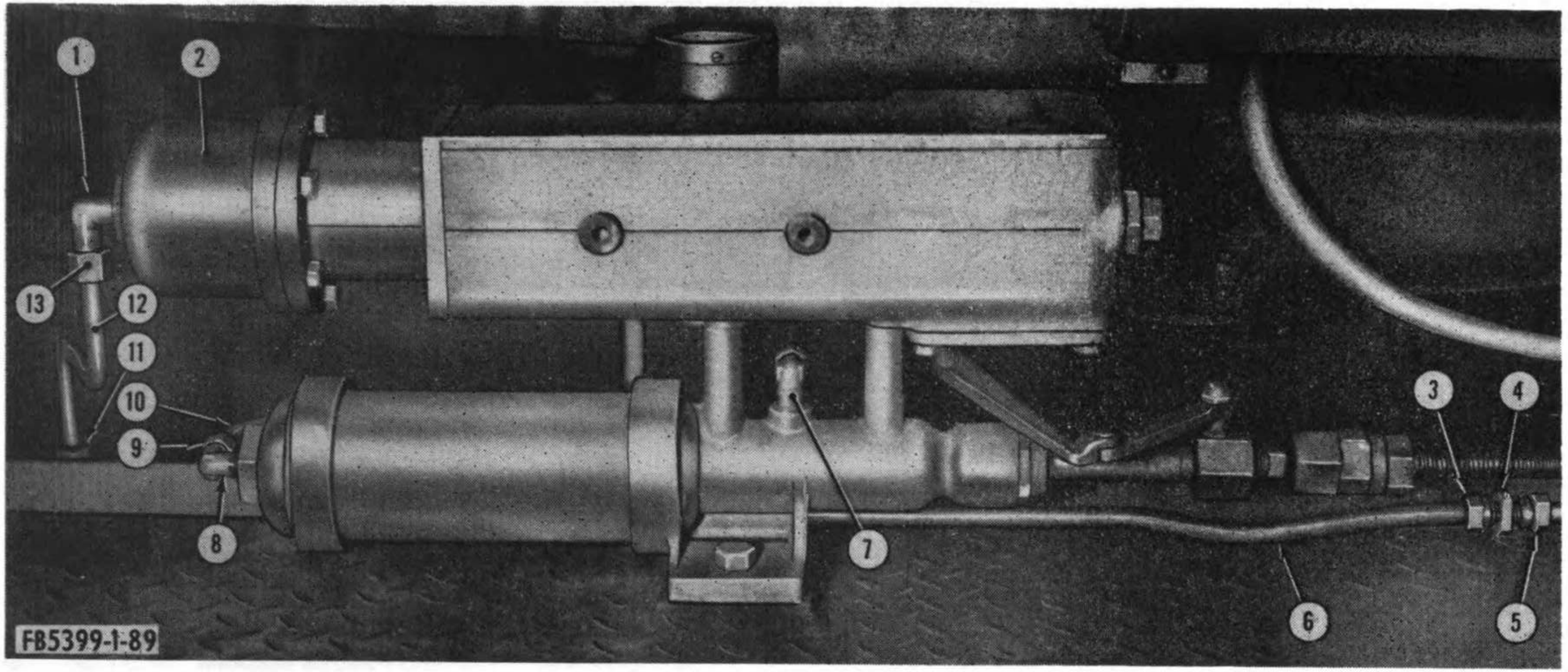

1 Elbow
2 Throttle controller assembly
3 Tube coupling nut
4 Adapter
5 Tube coupling nut
6 Throttle controller supply line
7 Elbow
8 Elbow
9 Tube coupling nut
10 Power cylinder actuating line
11 Tube coupling nut
12 Throttle controller bellows actuating line
13 Tube coupling nut

Figure 89. Automatic unloading system air piping removal and installation points, showing the power cylinder and throttle controller assemblies.

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and tighten the tube coupling nut (3) and the tube coupling nut at the elbow.

(11) Install and tighten the elbow in the side of the unloader valve controller assembly, place the filter-regulator outlet line (10) in position, and install and tighten the tube coupling nut (11) and the tube coupling nut at the elbow.

(12) Install and tighten the elbow (18), place the filter-regulator inlet line (16) in position, and install and tighten the tube coupling nut (17) and the tube coupling nut (10, fig. 79).

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CHAPTER 4

SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

149. Limited Storage

a. Inspection. Perform all the steps listed in the organizational maintenance services, paragraph 38.

b. Cleaning and Painting.

(1) Remove any water, oil, grease, or fuel that has accumulated on the skid base of the compressor assembly.

(2) Wash the entire compressor assembly thoroughly and below dry carefully with air pressure not exceeding 50 psi, using care to prevent damage to the electrical circuits.

(3) Thoroughly clean off any rust or corrosion and paint all parts on which the paint film has been damaged or removed. Refer to paragraph 34.

c. Complete Lubrication. Lubricate the compressor as instructed in LO 5–5399.

d. Protection in Storage. The compressor assembly, before being placed in limited storage should be serviced in such a manner that it can be easily withdrawn and put in operation in the shortest possible time. Under normal conditions the assembly, while in limited storage, should be operated every ten days long enough to bring it up to normal operating temperature to assure complete lubrication of all moving parts. During this exercise period, inspection must be made for any unusual conditions such as damage to parts, leaks, and rust. If the assembly remains in storage for 30 days or more, a complete inspection must be made. Prepare the compressor assembly for limited storage as follows:

(1) *Under usual conditions.*

(*a*) Locate the assembly on firm footing so as to prevent straining the skid base and flexible coupling.

(*b*) Drain and flush the cooling system. Protect with anti-

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freeze according to table 1 (par. 23*d*). Protect to 15° F. below the lowest expected temperature.

(*c*) Coat the battery terminals with a light coat of grease.

(*d*) Coat any unpainted surfaces with a light coat of oil.

(*e*) Cover the compressor assembly with a waterproof tarpaulin if available.

(2) *Under unusual conditions.*

(*a*) Complete the steps in (1) above.

(*b*) If extreme cold is expected disconnect and remove the battery. Clean the battery terminals and cable lugs and apply a coating of vaseline to terminals and lugs. Pack or store the battery separately in a warm, dry place. Keep the battery ready for immediate service by giving it a periodic booster charge.

(*c*) Keep the assembly well covered for protection against the elements.

150. Domestic Shipment

a. General.

(1) For short distance shipping and immediate reuse, refer to paragraph 20. In addition, cover the compressor assembly with a waterproof covering.

(2) To prepare the compressor assembly for shipment which will involve an idle time of not more than 30 days, refer to paragraph 149 above.

b. Hoisting and Handling.

(1) Hoist the compressor assembly with the use of slings and a suitable lifting device. Use caution in handling the assembly and do not drop or tip it. Do not allow it to swing and strike against a solid object.

(2) Block and secure the compressor assembly on its carrier.

Section II. DEMOLITION OF COMPRESSOR TO PREVENT ENEMY USE

151. General

When capture or abandonment of the air compressor to an enemy is imminent, the responsible unit commander makes the decision either to destroy the unit or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction. Whatever method of demolition is employed, it is

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essential to destroy the same vital parts of all air compressors and all corresponding repair parts.

152. Preferred Demolition Methods

Explosives and mechanical means, either alone or in combination, are the most effective methods to employ. Listed below are the vital parts in order of priority of demolition for each preferred method. Completion of the additional steps listed will further destroy the unit.

a. Demolition by Explosives (fig. 90). Place as many of the following charges as the situation permits and detonate them simultaneously with detonating cord and suitable detonator:

(1) A 2-pound charge between cylinders of the compressor.

(2) A 5-pound charge under engine crankcase.

Note. The above charges are the minimum requirement for this method.

(3) A 5-pound charge between the compressor flywheel and crankcase.

(4) A 10-pound charge between the drier towers and prefilter of the drier.

(5) A 3-pound charge between each of the moisture knock-out bottles.

(6) Four 10-pound charges equally spaced around the air receiver.

b. Demolition by Mechanical Means. Use sledge hammers, crowbars, picks, axes, or any other heavy tools which may be available, together with the tools normally included with the compressor, to destroy the following:

(1) The engine carburetor, magneto, spark plugs, clutch housing, starter, generator, manifolds, fan and water pump, cylinder castings, throttle controller, and cylinder heads.

(2) The compressor cylinder, crankcase, accessory drive housing, and mechanical lubricator.

Note. The above steps are the minimum requirement for this method.

(3) The cooler assembly, flexible coupling, automatic unloading system, compressor flywheel, and compressor thrust bearing.

(4) The drier towers, prefilter, pressure gages, electric switches, control valves, control boxes, reactivator pump motor and pump, and all piping.

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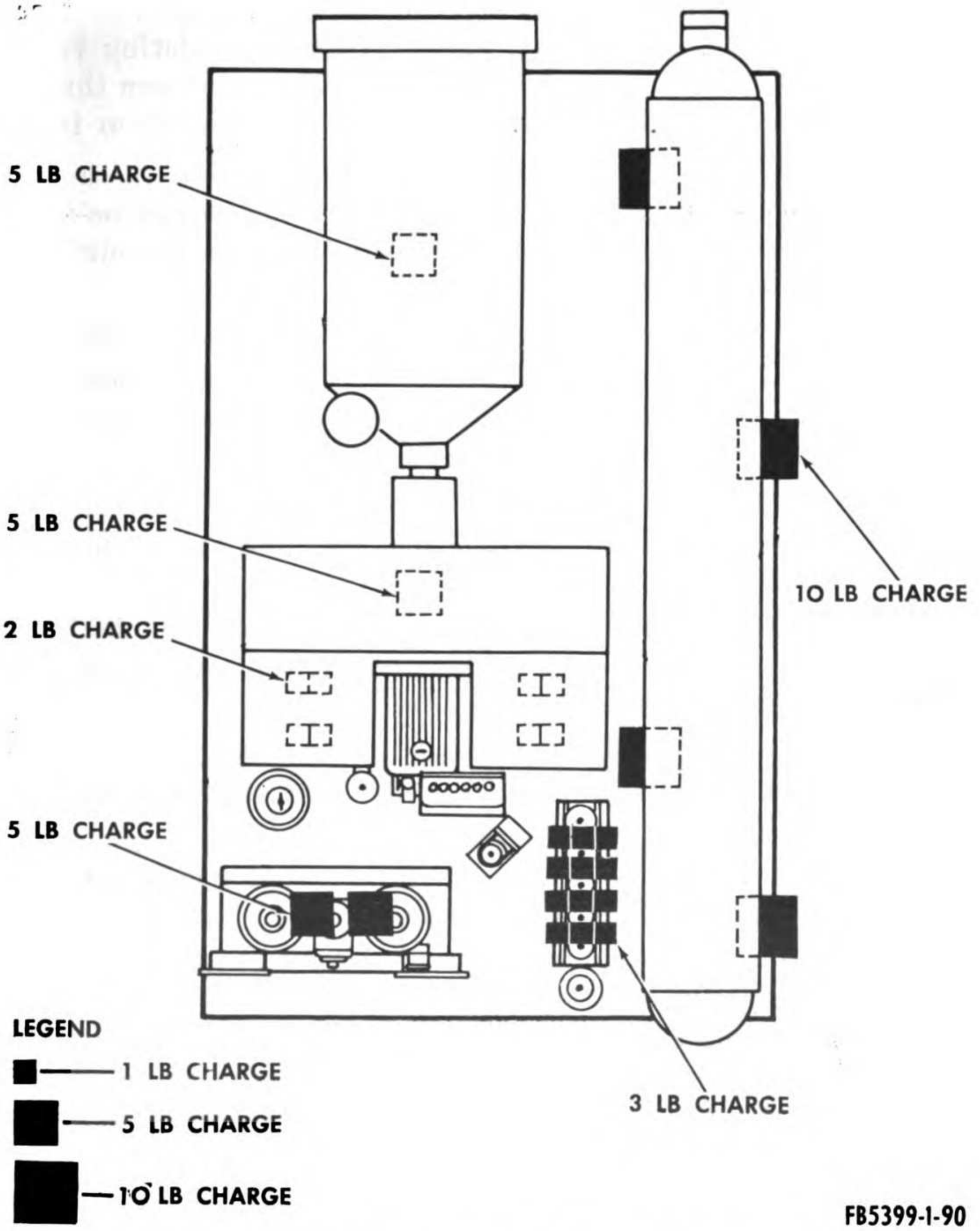

Figure 90. Placement of demolition charges.

(5) The moisture knock-out bottles, pressure-retaining valve, and safety relief valve.

(6) The pipe-line air filters and the air receiver.

153. Other Demolition Methods

If the situation prohibits employing either of the preferred methods, use the following, either singly or in combination.

a. Demolition by Weapons Fire. Fire on the compressor assembly with the heaviest weapons available.

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b. Demolition by Scattering and Concealment. Remove the carburetor, magneto, spark plugs, gages, pressure-regulating valves, lubricating pumps, and flexible coupling and scatter them through dense foliage, bury them in dirt or sand, or throw them into a lake, stream, well, or other body of water.

c. Demolition by Burning. Place rags, clothing, or canvas inside and around the compressor unit. Saturate them with gasoline, oil, or diesel fuel and ignite.

d. Demolition by Submersion. Totally submerge the unit in a body of water to afford some water damage to the engine and compressor and concealment for the unit. Salt water will do the greatest damage to metal parts.

e. Demolition by Misuse.

(1) Disengage the automatic discharge unloading system and control the compressor operation manually.

(2) Drain the oil from the crankcase, disconnect both the cylinder lubricating pumps and the compressor oil pressure safety switch.

(3) Shut all safety and pressure regulating valves.

(4) Close all manual pressure control valves on the drier assembly.

(5) Remove the compressor air intake filter and throw sand or emery dust in the intake header.

(6) Remove the compressor crankcase oil breather and pour sand or dirt into the crankcase.

(7) Start the engine, engage the clutch and set the manual control throttle to operate the compressor at full speed.

Warning: Immediately after placing the unit in full operation evacuate all personnel from the immediate vicinity.

154. Training

All operators should receive thorough training in the destruction of the compressor assembly. Simulated destruction, using all the methods listed above, should be included in the operator training program. It must be emphasized in training that demolition operations are usually necessitated by critical situations, when the time available for destruction is limited. For this reason, it is necessary that operators be thoroughly familiar with all methods of destruction and be able to carry out demolition instructions without references to this or any other manual.

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APPENDIX I

REFERENCES

1. Accessory Equipment

TM 5–5165 Engine, Gasoline, Waukesha Model 145–GKB.

2. Dictionaries of Terms and Abbreviations

SR 320–5–1 Dictionary of United States Army Terms.
SR 320–50–1 Authorized Abbreviations.

3. Lubrication and Painting

LO 5–5399 Compressor, Air, Skid Mounted, Gasoline Driven, 80 CFM, 3500 PSI, Clark Brothers Model HO6–4C (Less Engine).
TM 9–2851 Painting Instructions for Field Use.

4. Preparation for Export Shipment

TB 5–9711–1 Preparation of Corps of Engineers Equipment for Overseas Shipment.
TB 5–9713–1 Preparation for Export, Spare Parts for Corps of Engineers Equipment.

5. Preventive Maintenance

TB 5–5399–1 Preventive Maintenance Services: Compressor, Air, Skid Mounted, Gasoline Driven, 80 CFM, 3500 PSI, Clark Brothers Model HO6–4C (Less Engine).

6. Demolition to Prevent Enemy Use

FM 5–25 Explosives and Demolitions.

7. Publication Indexes

DA Pam 108–1 Index of Army Motion Pictures, Television, Recordings, and Film Strips.
DA Pam 310–1 Index of Administrative Publications.
DA Pam 310–2 Index of Blank Forms.
DA Pam 310–3 Index of Training Publications.

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DA Pam 310–4 Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.

DA Pam 310–25 Index of Supply Manuals, Corps of Engineers.

8. Supply Publications

ENG 1 Introduction.

ENG 7, 8, & 9–5399 Organizational Allowances, Field and Depot Maintenance Initial Stock Guide, Depot Compressor, Air, Skid Mounted, Gasoline Driven, 80 CFM, 3500 PSI, Clark Brothers Model HO6–4C.

9. Training Aids

FM 21–8 Military Training Aids.

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APPENDIX II

TOOL AND PUBLICATION SET

The tools listed herein are those required to perform the operator maintenance services of the compressor assembly. To insure that a surplus of tools is not supplied and that proper accounting is maintained, the tool and publications set will be requisitioned as a separate item as indicated in ENG 7, 8, & 9–5399.

Quantity	Nomenclature	Engineer stock No.
1	ENG 7, 8, & 9–5399.	
1	GUN, lubricating: pressure type; hand operated; Alemite; 9 oz; No. 7584.	41–4141.009.760
1	MODIFICATION KIT, (MWO ENG 1999–1), for Lubrication Guides, Check Cards, and Manuals; MIL P–11743.	99–1999.000.010
1	OILER; Steel; rd; ½ pt cap.; 5 in. spout; Eagle Mfg Co No. 145 PS or equal.	13–5496.050.500
1	PLIERS, combination: slip joint; 8 in.; FS GGG–P–471; Type F.	41–5976.300.080
1	SCREWDRIVER, common: plastic handle; heavy-duty; 8 in. blade; $\frac{7}{16}$ in. tip; MIL–S–15713; Type 11; class 2.	41–7165.040.045
1	SCREWDRIVER, common: plastic handle; 4 in. long x ¼ in. wide blade; MIL–S–15713; Type 11; class 1.	41–7165.040.030
1	WRENCH, adjustable: crescent-type; single hd; open end; heavy duty; FS FFF–W–631; Type 1; $\frac{15}{16}$ opening and 8 in. long.	41–9587.500.200
1	WRENCH, adjustable: crescent-type; single hd; open end; heavy-duty; FS GGG–W–631; Type 1; $1\frac{5}{16}$ in. opening x 12 in. long.	41–9587.500.400
1	WRENCH, box and open end: 12 point box, 15-deg angle both ends; FS GGG–W–636; Type 111; in set of 14 items; ⅜ to 1½ in.; in leatherette roll as follows;	41–9601.200.920
1	ROLL, leatherette; wrench set; box and open end; for 13 items; ⅜ to 1½ in.; Armstrong or equal.	41–6795.500.500
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends FS GGG–W–636; Type 111; single; ⅜ x ⅜ in. nominal opening; 5 in. approx length.	41–9601.300.120
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type	41–9601.300.140

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Quantity	Nomenclature	Engineer stock No.
	111; single; 7/16 x 7/16 in. normal opening; 7 in. approx length.	
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type 111; single; ½ x ½ in. nominal opening; 8¼ in. approx length.	41–9601.300.160
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type 111; single; 9/16 x 9/16 in. normal opening; 8¼ in. approx length.	41–9601.300.180
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type 111; single; 5/8 x 5/8 in. nominal opening; 8½ in. approx length.	41–9601.300.200
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type 111; single; 11/16 x 11/16 in. normal opening; 8½ in. approx length.	41–9601.300.220
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type 111; single; ¾ x 3.4 in. nominal opening; 10⅜ in. approx length.	41–9601.300.240
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type 111; single; 13/16 x 13/16 in. nominal opening; 10½ in. approx length.	41–9601.300.250
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type 111; single; ⅞ x ⅞ in. nominal opening; 10½ in. approx length.	41–9601.300.260
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type 111; single; 15/16 x 15/16 in. nominal opening; 12 in. approx length.	41–9601–300.270
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type 111; single; 1 x 1 in. nominal opening; 13 in. approx length.	41–9601–300.280
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type 111; single; 1¼ x 1¼ in. nominal opening; 17 in. approx length.	41–9601.300.290
1	WRENCH, box and open end; 12 point box; 15-deg angle both ends; FS GGG–W–636; Type 111; single; 1½ x 1½ in. nominal opening; 20 in. approx length.	41–9601.300.300

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[AG 412.3 (23 Mar 56)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

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CIA (1)
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AMS (3)
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Fld Maint Shops (2)
Div Engr (1)
Engr Dist (1)
Mil Dist (1)
Engr Maint Cen (12)
Units organized under
  following TOE:
    5–48R (2)
    5–157R (2)
    5–262R (2)
    5–267R (2)
    5–278R (2)
    5–279R (2)
    44–145R (2)
    44–147R (2)
    44–445R (2)
    44–446R (2)
    44–447R (2)
    44–448C (2)

NG: State AG (6).

USAR: None.

For explanation of abbreviations used, see SR 320–50–1.

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TM 5-5399-1 COMPRESSOR, AIR, SKID MOUNTED, GASOLINE DRIVEN, 60 CFM, 5500 PSI, CLARK BROTHERS MODEL H06-4C (LESS ENGINE)—1956

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