

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ORGANIZATIONAL MAINTENANCE

CLEANING MACHINE
FUEL CAN AND DRUM
(BARNES MODELS 4310CA
AND 15801CA)

This reprint includes all changes in effect at the
time of publication; change 1

HEADQUARTERS, DEPARTMENT OF THE ARMY
JANUARY 1960

Organizational Maintenance Manual**CLEANING MACHINE
FUEL CAN AND DRUM
(BARNES MODELS 4310CA AND 15801CA)**

CHANGE

No. 1

TM 10-4940-201-20, 27 January 1960, is changed as follows:

3. Forms, Records, and Reports

(Superseded)

The forms, records, and reports to be used in the second-echelon maintenance of this cleaning machine are listed and described in TM 38-750.

7. Organization Mechanic Responsibilities (Second Echelon)

Rescinded

8.1. Preventive Maintenance Services

(Added)

Preventive maintenance services are the minimum inspections which are performed to insure that defects may be discovered and corrected before they result in serious damage to or failure of the equipment. When

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WASHINGTON, D. C., 6 February 1964

defects are discovered during operation of the equipment, they must be corrected as soon as operation has ceased. If continued operation would result in damage to the equipment, the defects must be corrected at once. All deficiencies and shortcomings that are discovered and all corrective action that is taken will be recorded on DA Form 2404 as soon as possible.

8.2. Second-Echelon Quarterly Services

(Added)

The preventive maintenance services listed on figure 3.1 are the minimum quarterly inspections to be performed by second-echelon maintenance personnel. The quarterly interval is equal to 3 calendar months or 250 hours of operation, whichever occurs first. The services will be performed in the sequence in which they are numbered.

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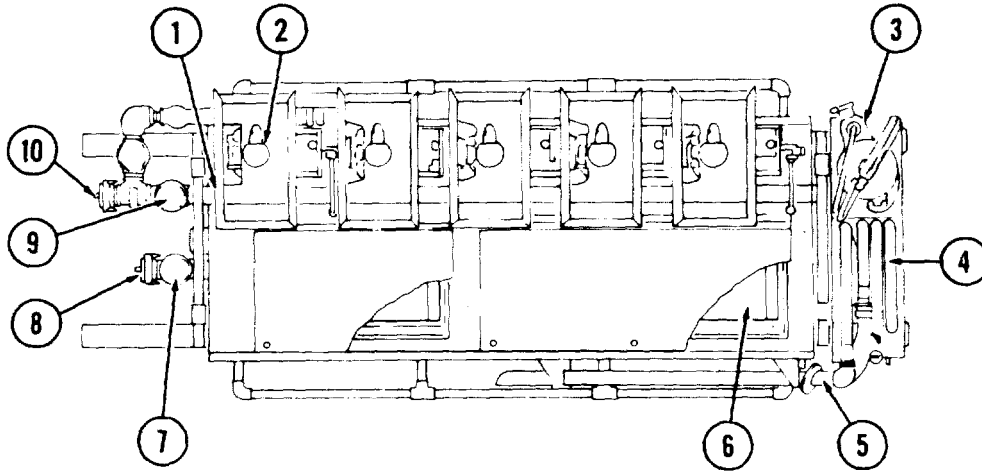
PREVENTIVE MAINTENANCE SERVICES

QUARTERLY

TM 10-4940-201-20

BARNES MODELS 4310CA
AND 15801CA

CLEANING MACHINE
FUEL CAN AND DRUM



LUBRICATE IN ACCORDANCE WITH CURRENT LUBRICATION ORDER

ITEM		PAR REF
1	<u>SUPPLY LINE MANIFOLDS.</u> Inspect supply line manifolds for leaks, loose connections, and loose mounting.	
2	<u>CRADLE-VALVE ASSEMBLIES.</u> Inspect cradle valves for loose mounting and leaks. Check for clogged venturii, broken or weak stop springs and clogged or loose nozzles. Be sure cradle springs have enough tension to hold 5-gallon cans in position.	
3	<u>FIRE EXTINGUISHER.</u> Weigh the fire extinguisher. Recharge if weight is 1-1/2 lbs or more below weight shown on extinguisher nameplate.	
4	<u>HOSES.</u> Inspect all hoses for cracks, cuts, leaks, deterioration, kinks, and clogging. Check gaskets for deterioration and be sure static wires in hoses make firm contact with metal couplers.	
5	<u>DRUM WASHER ASSEMBLIES.</u> Inspect nozzles for leaks and corrosion. Check suction and flushing tubes for dents and clogging.	
6	<u>SEDIMENTATION TANKS.</u> Check sedimentation tanks for leaks and for warped or loose hatches. Inspect strainers and filters for tears, clogging or loose mounting. Inspect float valves for leaks, loose mounting or holes in floats.	

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MSC 4940-201-20/3.1 (1)

Figure 3.1. (Added) Quarterly preventive maintenance services

ITEM		PAR REF
7	<u>PRESSURE GAGES.</u> Check pressure gages for leaks and for loose mounting. Operating pressure -28 psi	
8	<u>QUICK COUPLERS.</u> Check for leakage. Replace gasket if necessary.	
9	<u>GATE VALVES.</u> Inspect gate valves for leaks and loose mounting.	
10	<u>DUST PLUGS, DUST CAPS, AND CHAINS.</u> Check port openings and quick couplers for missing dust plugs and caps. Inspect chain links for weakness and breaks.	
	<u>NOTE 1. OPERATION.</u> During operation, observe for unusual noises or vibration and make necessary adjustments.	

MSC 4940-201-20/3.1 (2)

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Figure 3.1. - Continued.

APPENDIX I

REFERENCES

(Superseded)

AR 320-5	Dictionary of United States Army Terms
AR 320-50	Authorized Abbreviations and Brevity Codes
AR 700:58	Report of Damaged or Improper Shipment
AR 735-35	Supply Procedures for TOE Units, Organizations, and Non-TOE Activities
AR 750-5	Organization, Policies and Responsibilities for Maintenance Operations
DA Pam 108-1	index of Army Motion Pictures, Film Strips, Slides, and Phone-Recordings
DA Pam 310-2	Military Publications; Index of Blank Forms
DA Pam 310-3	Military Publications; Index of Doctrinal, Training, and Organizational Publications
DA Pam 310-4	Military Publications; Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 4, 6, 7, 8, and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.
FM 10-77	Quartermaster Petroleum Supply Company, Mobile
FM 21-5	Military Training
FM 21-6	Techniques of Military Instruction
FM 21-30	Military Symbols
TM 9-1799	Ordnance Maintenance: Fire extinguishers.
TM 10-4940-201-10	Operator's Manual: Cleaning Machine, Fuel Can and Drum (Barnes Models 4310CA and 15801CA)
TM 10-4940-201-20P	Second Echelon Repair Part Allowances: Cleaning Machine, Fuel Can and Drum, Portable, Barnes Mfg. Co. Model 4310CA, Army Model SPE 19 (F.S.N. 4940-268-9771); Barnes Mfg. Co. Model 1580-CA, Army Model SPE 19A (F.S.N. 4940-658-2889)
TM 38-230	Preservation, Packaging, and Packing of Military Supplies and Equipment
TM 38-750	The Army Equipment Record System and Procedures
LO 10-4940-201-20	Cleaning Machine, Fuel Can and Drum (Barnes Models 4310CA and 15801CA)
TAGO 7932A	

By Order of the Secretary of the Army:

EARLE G. WHEELER,
*General, United States Army,
Chief of Staff.*

Official:

J. C. LAMBERT,
*Major General, United States Army,
The Adjutant General.*

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USAECOM (5)	10-107
USATECOM (5)	10-377
USASMCOM (1)	10-445
QMRECEN (2)	

NG: State AG (3).

USAR: None:

For explanation of abbreviations used, see AR 320-50.

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TECHNICAL MANUAL

WASHINGTON 25, D. C., 27 January 1960
HEADQUARTERS,
DEPARTMENT OF THE ARMY

No. 10-4940-201-20

**CLEANING MACHINE, FUEL CAN AND DRUM
(BARNES MODELS 4310CA AND 15801CA)**

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*This manual supersedes section III of TM 10-4940-201-20P, 13 August 1959, and applicable portions of TM 10-1140, 24 June 1952.

TAGO 3791A-January

**CHAPTER 1
INTRODUCTION**

Section I. GENERAL

1. Scope

This manual is published for the use of personnel responsible for organization maintenance (second echelon) of the Cleaning Machine, Fuel Can and Drum (Barnes Models 4310CA and 15801CA). The repair parts and special tools list is published as TM 10-4940-201-20P.

2. Appendixes

Appendix I contains a list of current references. Appendix II, maintenance allocation chart, lists maintenance repair responsibilities by echelons.

3. Maintenance Forms and Records

Responsibility for proper execution of record and report forms rests with the commanding officer of the unit maintaining the cleaning machine. Blank forms that may be used in the preparation of records, reports, and requisitions pertaining to the cleaning machine are as follows:

- a. DA Form 10-103 (Worksheet for Special Purpose Vehicles and Equipment Preventive Maintenance Services and Inspections).
- b. DA Form 285 (Accident. (Report of Individual Accident)).
- c. DA Form 460 (Preventive Maintenance Roster).
- d. DA Form 468 (Unsatisfactory Equipment Report). (AR 700-38).
- e. DA Form 478 (Organizational Equipment File).
- f. DA Form 811 (Work Request an(d Job Order).
- g. DA Form 953 (Summary of Accident Experience). (AR 385-40).
- h. DA Form 1546 (Request for Issue or Turn-In). (AR 711-16).
- i. DD Form 6 (Report of Damaged or Improper Shipment). (AR 700-58).
- j. DD Form 1149 (Requisition and Invoice Shipping Document). (AR 725-5).

Section II. DESCRIPTION AND DATA

4. Description

Description of the cleaning machine appears in TM 10-4940-201-10.

5. Tabulated Data

a. *Cubage.*

b. *Dimensions.*

Basket-type strainer:

Cleaner assembly (2).....235 cubic feet

Large:

Height 4 1/2 inches

Length..... 34 inches

Width 11 inches

Small:

Height 4Y inches

Length..... 21 inches

Width 11 inches

Cradle spring:

Length..... 10 1/4 inches

Outside diameter..... 4 1/2 inches

Hose compartment:

Height 10 1/2 inches

Length..... 16 inches

Width 8 inches

Cleaner assembly:

Crated (2):

Height 7 feet 4 inches

Length..... 8 feet 8 inches

Width 3 feet 9 inches

Uncrated (1), without cradle:

Height 36 inches

Length..... 7 feet 10 inches

Width 37 inches

Stem packing, graphite 1 1/2 inches

Supply-line manifold, length..... 72 inches

Thrust bearing, inside diameter 3/4 inch

c. *Sizes of Pipe Plugs.*

Sedimentation tank:

Drain..... 1 1/2 inches

Eductor body..... 1 inch

Supply-line manifold 1 1/2 inches

Venturi cleanout..... 3/8 inch

CHAPTER 2 MAINTENANCE INSTRUCTIONS

6. General

Second echelon maintenance is that degree of maintenance performed by specially trained personnel provided for that purpose in the using organization. Necessary tools, spare parts, supplies, and test equipment are authorized for the performance of second echelon maintenance.

7. Organization Mechanic Responsibilities (Second Echelon)

Those preventive-maintenance services which are beyond the operator's responsibility will be performed by the organization mechanic. These services normally consist of periodical inspections, lubrication, adjustments, minor repairs, and minor component replacement as required, so far as they are authorized

and as capabilities and facilities permit. Detailed instructions for preventive-maintenance services and inspections to be performed by the organization mechanic are outlined in DA Form 10-103 and TM 10-1400. Appendix II, maintenance and allocation chart, outlines the responsibilities by echelons.

8. Lubrication Service

The cleaning machine will be lubricated in accordance with 10-4940-201-20 (fig. 1). Note that only the thrust bearing and the oil filler need be lubricated on each cradle-valve assembly. The oil filler is a ball-bearing type of fitting that is lubricated with the use of an oil can (fig. 2). The thrust bearing must be removed (par. 11) in order to be repacked with a lubricant (fig. 3).

LUBRICATION ORDER

LO 10-4940-201-20

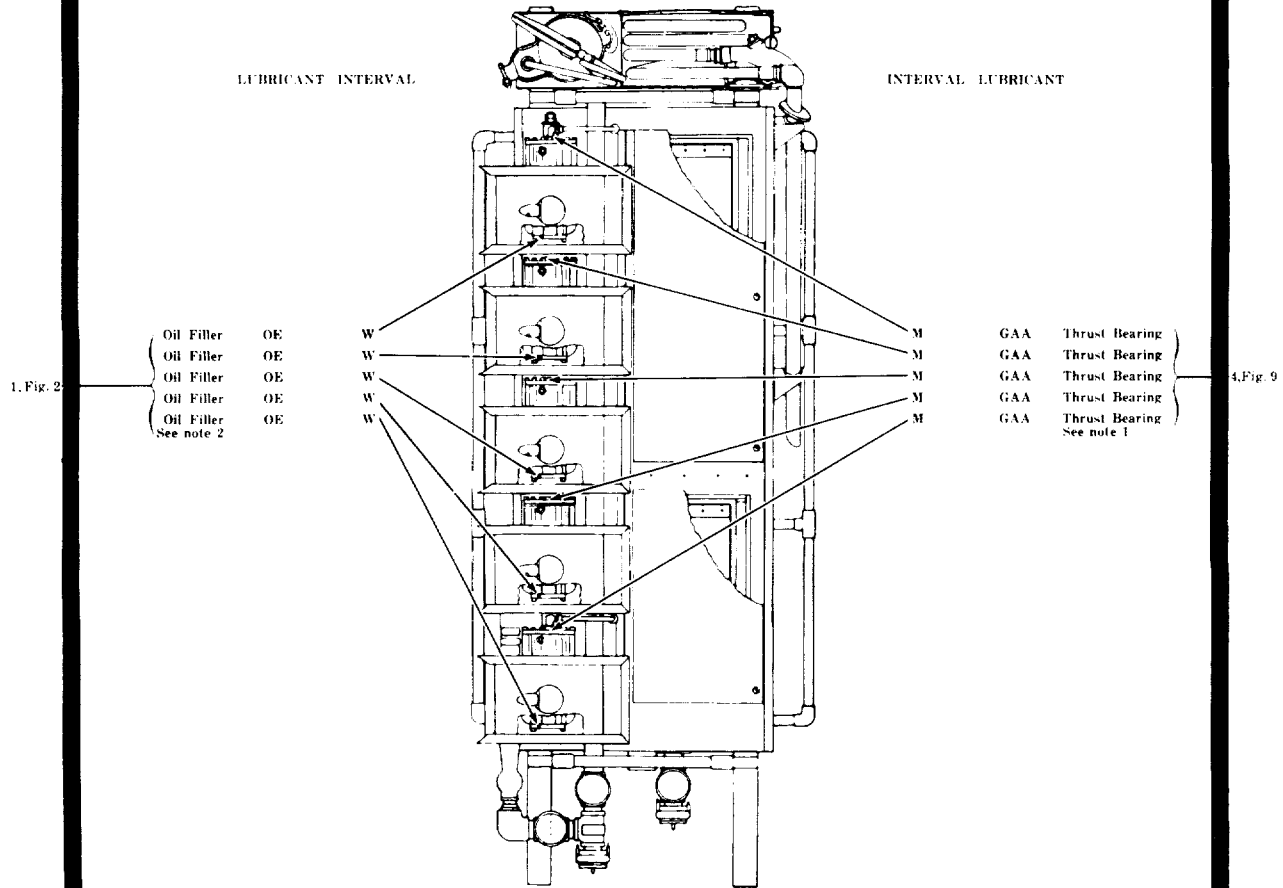
(Supersedes LO 10-1140, 21 November 1951)

CLEANING MACHINE, FUEL CAN AND DRUM
(BARNES)

Reference: TM 10-4940-201-20

Intervals given are maximum for normal operations. For abnormal conditions or activities, intervals should be shortened to compensate. During inactive periods, intervals may be extended commensurate with adequate preservation.

Clean fittings before lubricating.
Clean parts with Solvent, dry cleaning (SD), or Thinner, paint (TPM). Dry before lubricating.



LUBRICANT INTERVAL

INTERVAL LUBRICANT

Oil Filler OE
Oil Filler OE
Oil Filler OE
Oil Filler OE
Oil Filler OE
See note 2

W
W
W
W
W

M
M
M
M
M

GAA Thrust Bearing
GAA Thrust Bearing
GAA Thrust Bearing
GAA Thrust Bearing
GAA Thrust Bearing
See note 1

—KEY AND NOTES—

LUBRICANTS	EXPECTED TEMPERATURES			INTERVALS
	above + 32° F.	+ 40° to - 10° F.	0° to - 65° F.	
GAA—GREASE, Automotive and Artillery	GAA	GAA	GAA	W— Weekly
OES—OIL, Engine, (Subzero)	OE-30	OE-10	OES	M— Monthly
OE—OIL, Engine, Heavy Duty	OE-30	OE-10	OES	

1. THRUST BEARING. Remove, wash, and pack.
2. OIL FILLER. Place a few drops of OE on oil filler cam.

BY ORDER OF WILBER M. BRUCKER,
SECRETARY OF THE ARMY:

L. L. LEMNITZER
General, United States Army,
Chief of Staff.

OFFICIAL:
R. V. LEE,
Major General, United States Army,
The Adjutant General.

A copy of this lubrication order will remain with the equipment at all time; instructions contained herein are mandatory and supersede all conflicting lubrication instructions dated prior to the date of this lubrication order.

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Figure 1. Lubrication Order 10-4940-201-20.

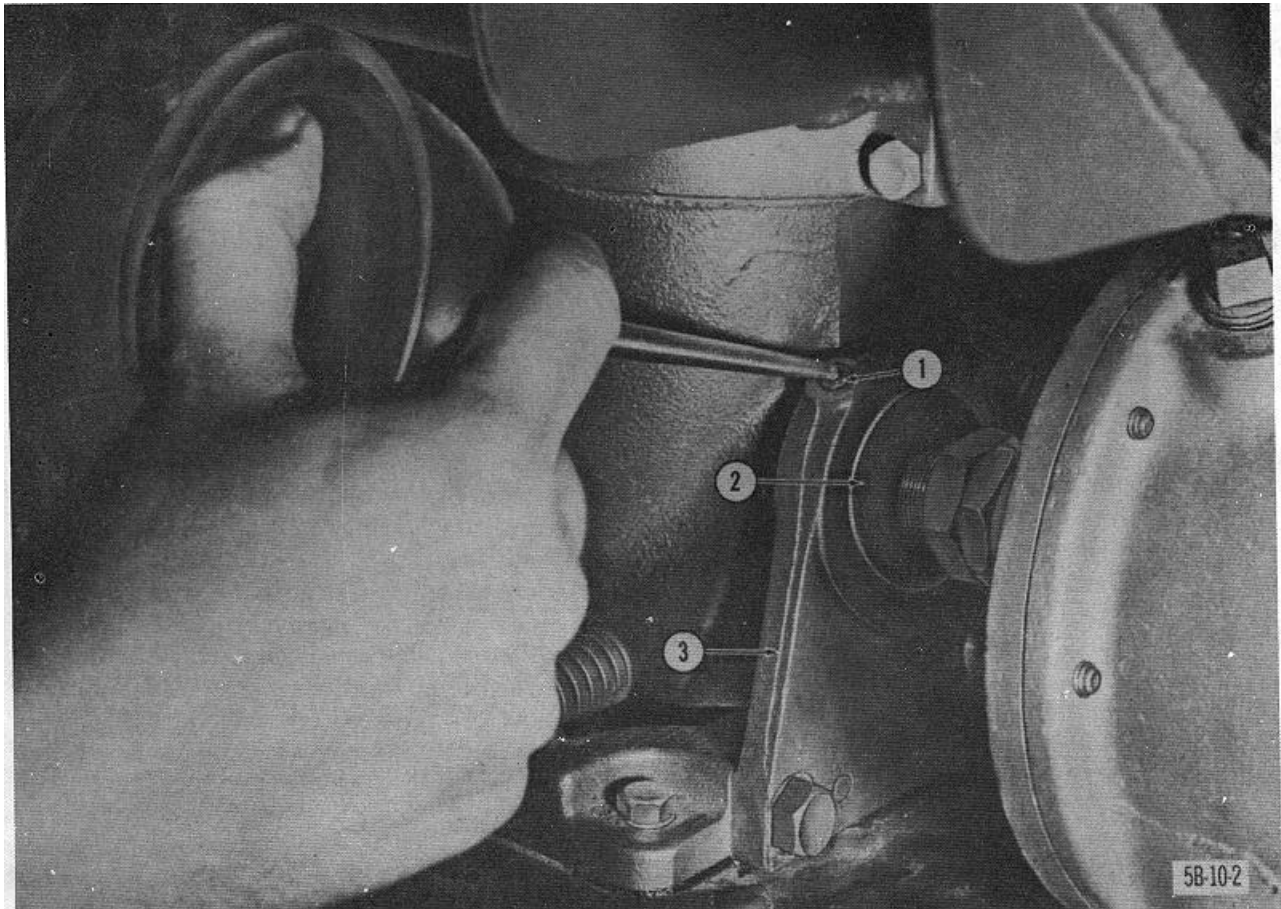


Figure 2. Lubricating working surfaces between support plates and trunnion through oil fitting.

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- 1 Oil filler
- 2 Trunnion
- 3 Support plate

Figure 3. Repacking thrust bearing with lubricant.

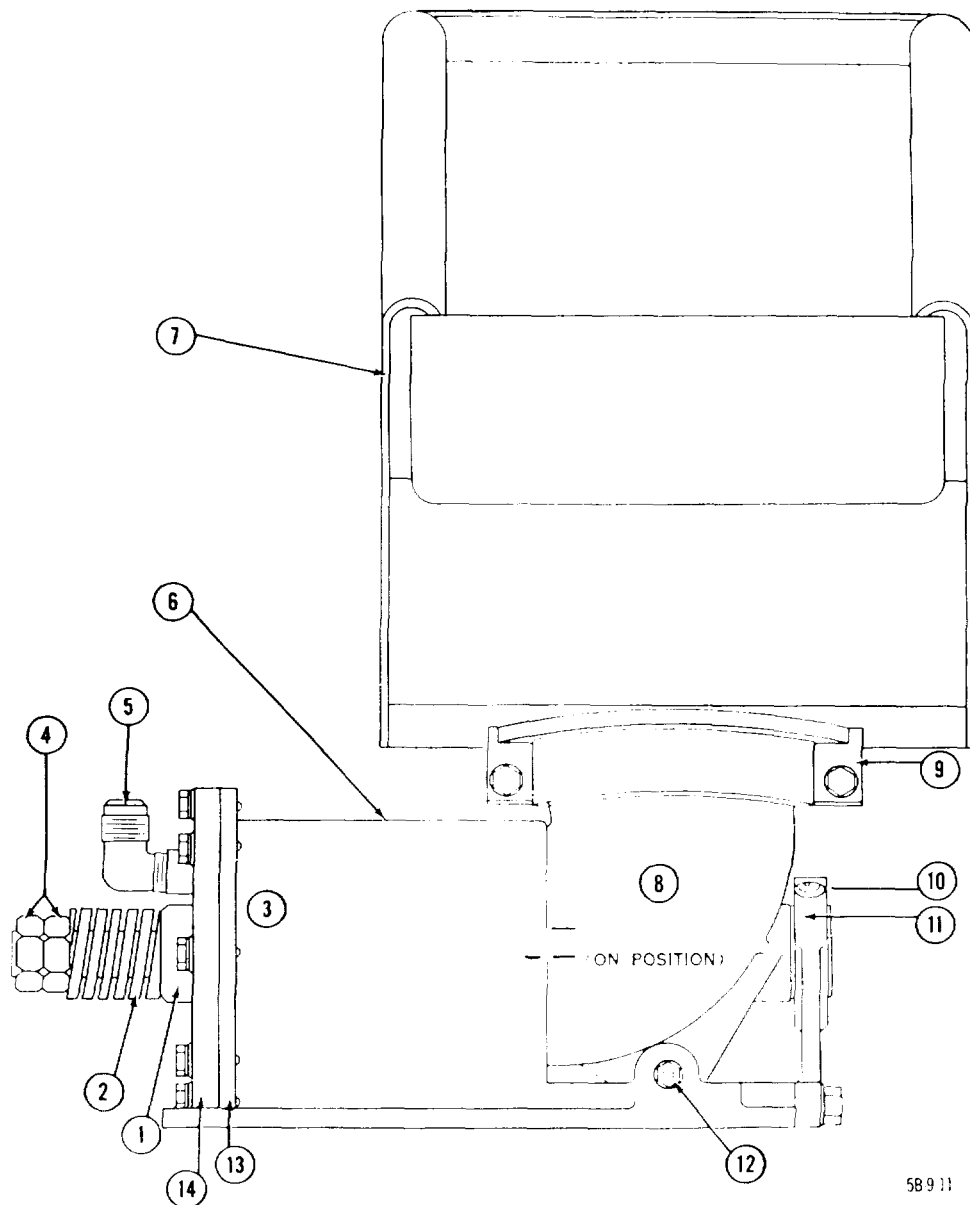
9. Servicing Rotation of Cradle

For a better understanding of the information contained in this paragraph, first study figures 4 and 5. In order to obtain proper cleaning results with the cleaning machine it is necessary that proper ducts and ports within the cradle-valve assembly be in alinement to produce

flushing or suction as needed. The alinement of the ducts changes when the cradle is rotated. Note that when the cradle is rotated, part of the cradle valve moves with it. The stop springs and adjusting nuts regulate the limits of movement of the cradle and the cradle-valve body and control the alinement of ducts. The adjusting nuts on the stop spring on the operating side of the cleaner assembly limit the cradle to the proper ON position; the adjusting nuts on the stop spring on the reverse side of the cradle limit the cradle to its proper OFF position. Thus, by tightening or loosening either pair of adjusting nuts, the markings on the cradle valve assembly can be brought into proper alinement. To adjust or readjust the limits or rotation, proceed as follows:

- a. Check the markings on the operating side of the cradle-valve assembly.
- b. To readjust to the proper limits of rotation, place the reference marks together with the cradle in the ON position. Then tighten the adjusting nuts of the stop spring nearest the operator until the carriage bolt (stop-spring guide) is firm against the valve body.
- c. Place the reference marks together with the cradle in the OFF position. Tighten the nuts on the stop spring on the reverse side of the cradle until its carriage bolt is firm against the valve body.
- d. After making these adjustments, check the reference marks to make sure that they are properly alined. If the carriage bolt is found to be too worn to make this type of adjustment, it will have to be replaced (par. 11).

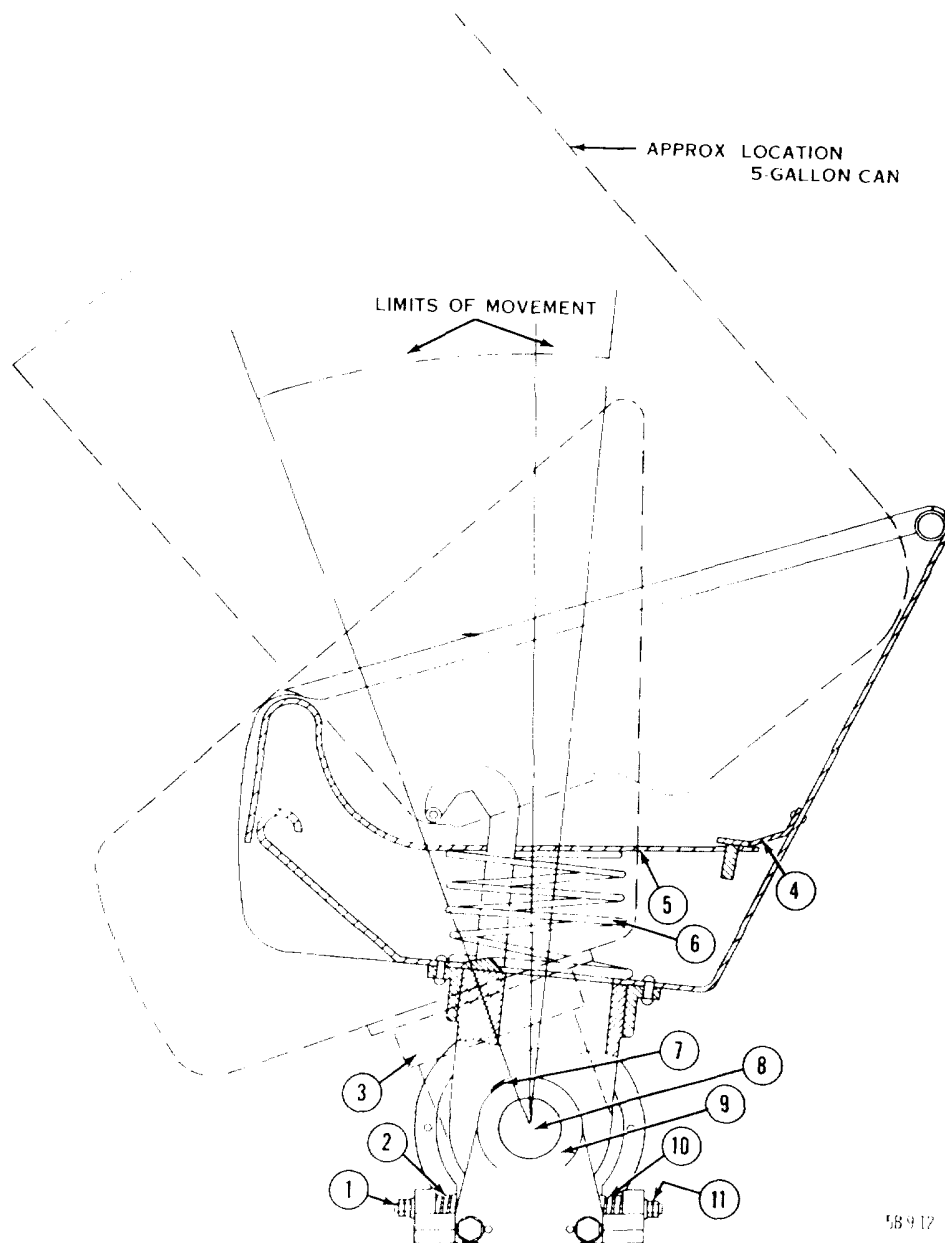
Note. The limits of rotation must be readjusted and checker each time the cradle-valve assembly is removed and dismantled for repair or replacement parts.



- | | |
|--------------------------------|-------------------------|
| 1 Thrust bearing | 8 Valve body |
| 2 Valve spring | 9 Cradle clamp |
| 3 Valve housing | 10 Oil filler |
| 4 Adjusting nuts, valve spring | 11 Support plate |
| 5 Male flare union | 12 Stop spring |
| 6 Valve assembly | 13 Valve-housing flange |
| 7 Cradle assembly | 14 Valve faceplate |

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Figure 4. Cradle and cradle-valve assemblies, showing indications of proper limits of movement of cradle, operator's view (Model 4310CA).



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- | | | | |
|---|-----------------------------|----|------------------------------|
| 1 | Adjusting nuts, ON position | 6 | Cradle spring |
| 2 | Stop spring | 7 | Oil filler |
| 3 | Cradle clamp | 8 | Trunnion |
| 4 | Can-positioning hinge | 9 | Support plate |
| 5 | Can-positioning plate | 10 | Stop spring |
| | | 11 | Adjusting nuts, OFF position |

Figure 5. Cradle and cradle-valve assemblies, showing approximate limits of movement of cradle, side view (Model 4310CA).

10. Servicing A Clogged Venturi

The venturi is located in the valve portion of each cradle valve. It is designed to create both the pressure and the suction action. The loss of proper suction or

pressure may be due to a clogged venturi. There are two ways to clear this condition.

a. *Wire Method.* It may be possible to clean out the venturi with a thin wire while the cradle valve is mounted on the sedimentation tank.

- (1) Rotate the cradle to the OFF position, and remove the cradle assembly from the cradle valve.
- (2) Remove the venturi cleanout plug. Now look into the hole left by the plug and see if the venturi is centered in the bottom of the hole. It must be centered perfectly in order to be removed.
- (3) Use the tip of a screwdriver to loosen the venturi cap; keep the screwdriver in the groove on the venturi cap. If the screwdriver is held on a slight angle it may be possible to lift out the cap.
- (4) Slip a thin wire down the venturi cavity, slowly working the wire up and down.
- (5) Remove the wire and replace the venturi cap and the venturi cleanout plug.
- (6) Take up the slack between the valve faceplate and the valve housing by tightening the valve-spring adjusting nuts.

b. *Cradle Valve.*

(1) Disassembly.

- (a) Remove the cradle from the cradle valve.
- (b) Remove the screws holding the nozzle assembly to the valve body. Remove the nozzle assembly. This will make accessible the nozzle gasket (or gaskets for the Model 15801CA), which can be pried off with the fingers.
- (c) Disengage the flare nut from the copper-tube connection near the valve faceplate. Disengage the flare nut on the male flare union and remove the feeder pipe from the assembly.
- (d) Loosen the valve-spring adjusting nuts (18, fig. 8). (The adjusting nut should be removed when the cradle valve is off the sedimentation tank.)
- (e) Remove the screws holding the valve housing to the top of the sedimentation tank. Lift up and remove the cradle-valve assembly. This will make accessible the cradle-valve mounting gasket (15, fig. 7), which can then be pried off with a screwdriver.
- (f) With the cradle valve dismantled, the first step is to remove the venturi cleanout plug (fig. 11). Then remove the valve-spring adjusting nuts, valve spring, and thrust bearing (1, 2, and 3, fig. 7).
- (g) Remove the two screws holding the support plate (13, fig. 7) to the base of the valve housing. To disengage the support plate and make it come clear of the trunnion (11, fig. 7), it is necessary to lightly tap both sides of the plate facing the valve body. The plate will then come clear of its dowel pins. Remove the eight screws which hold the valve faceplate (4, fig. 7) to the valve housing. Remove the faceplate from the dowel pin, which is used to align the valve faceplate on the assembly. Disengage the valve body from the valve housing, holding both sections and pulling

b. Disassembly Method. If the above procedure cannot be followed, or if it fails, then disassemble the valve and check the condition of the venturi assembly (par. 11).

11. Cradle and Cradle-Valve Assemblies

Before second echelon maintenance of the cradle and cradle-valve assemblies (figs. 6-10) is attempted personnel should study the construction of the cradle assembly (fig. 6) and the cradle-valve assembly (figs. 7 and 8). Maintenance personnel are reminded that the parts removed in disassembly should be placed side by side in an orderly manner since reassembly in reverse order will be required.

a. Cradle Disassembly and Reassembly. To disassemble the cradle, first loosen the cradle clamp by loosening the cradle-clamp bolts (fig. 9). Lift the cradle off the cradle valve (fig. 10); press down on the can-positioning plate and pull outward so that the plate comes free of the retaining lugs riveted to the underneath side of the can-positioning hinge. Remove the can-positioning plate and then the cradle spring. Note that the plate is unpainted. It should remain so to avoid contamination during can-wash operations. To reassemble the cradle, reverse the order given above.

Note. The cradle clamp is riveted to the cradle and seals in the cradle-clamp gasket. Normally, the cradle-clamp gasket will not need to be replaced within the operating lifetime of the cradle.

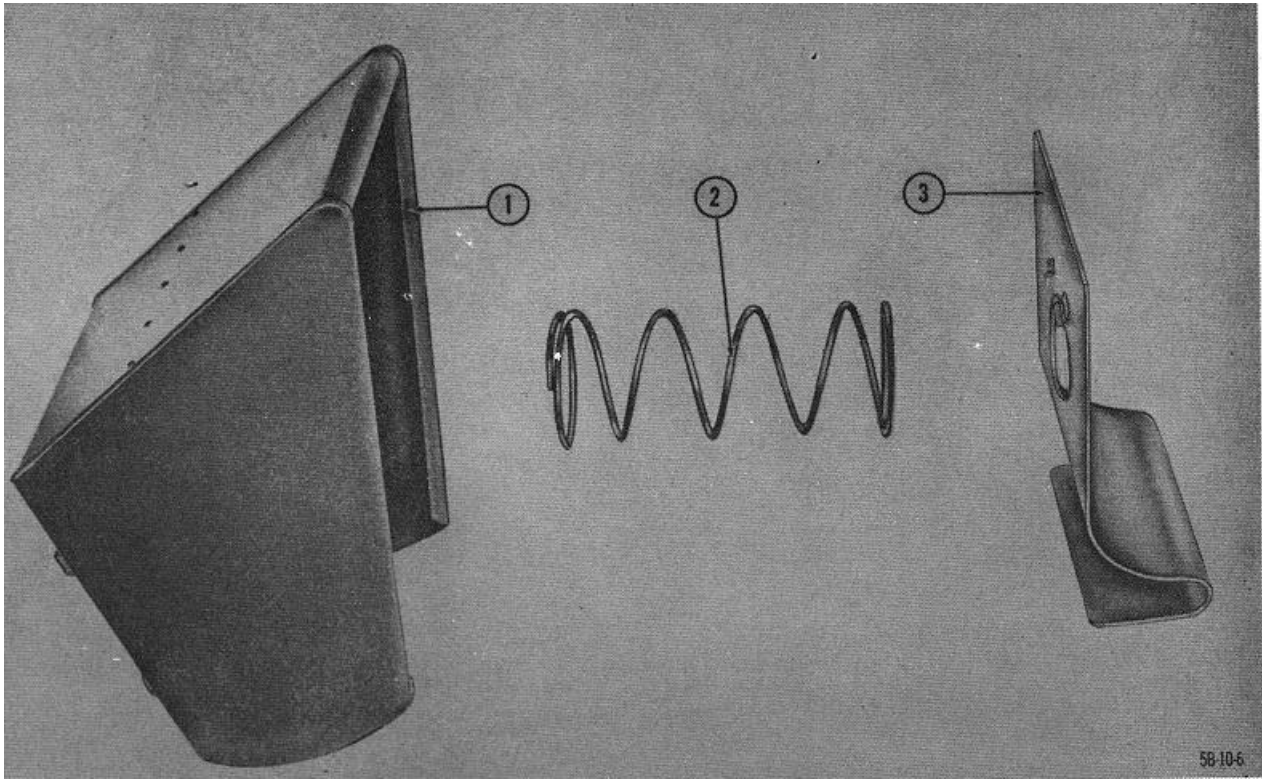
apart with gentle rocking motion. This will make the faceplate gasket (14, fig. 7) and the valve body seal (O-ring) accessible.

- (h) To disengage the venturi, turn the valve body so that the throat is in a vertical position. Remove the venturi cap (fig. 12). Then turn the valve body upside down and release the venturi setscrew at the base of venturi cavity (fig. 13). Turn the valve body to its side, and with a screwdriver gently push out the venturi assembly (fig. 14). Note the matching holes on the venturi assembly and valve body to engage these units. With the venturi assembly released, the following parts become quickly accessible: venturi spring (21, fig. 7), venturi washer (22), and the O-rings (top and bottom venturi seals (23 and 26).
- (i) Any O-ring can be quickly removed from its machined groove by gently slipping the tip of the screwdriver under the O-ring and slightly stretching the ring to come free of the groove.
- (j) To remove the carriage bolts, disengage the stop-spring adjusting nuts (19, fig. 7). The cradle valve is now completely disassembled.

(2) *Inspection and corrective action.* While disassembled, the general appearance and operating condition of the parts of the cradle

valve should be checked. Check all gaskets and O-rings to see if they have become worn or cracked. If so, they should be replaced. The pressure and suction orifices of the nozzle as well as the venturi openings should be examined and cleaned. All springs should be checked to determine whether they have become weak through usage, and should be replaced if necessary.

- (3) *Reassembly.* Reassemble the cradle valve in reverse order, with the following precautions noted:
 - (a) To reassemble the venturi, proceed as follows: Replace the venturi cap on the valve body. Turn the valve body upside down. Insert the venturi spring, followed by the venturi washer, into the venturi cavity. Carefully drop into the cavity the venturi seal (O-ring), then insert the venturi body, with the bottom seal already in its proper groove. Line up the matching holes (fig. 14) and secure the venturi setscrew. This replacement procedure will prevent the top venturi seal from shearing on the wall of the venturi cavity.
 - (b) To fit the valve faceplate back on the valve-housing flange, it will be necessary to properly engage the dowel pin on the valve housing with its hole (5, fig. 7) on the valve faceplate.



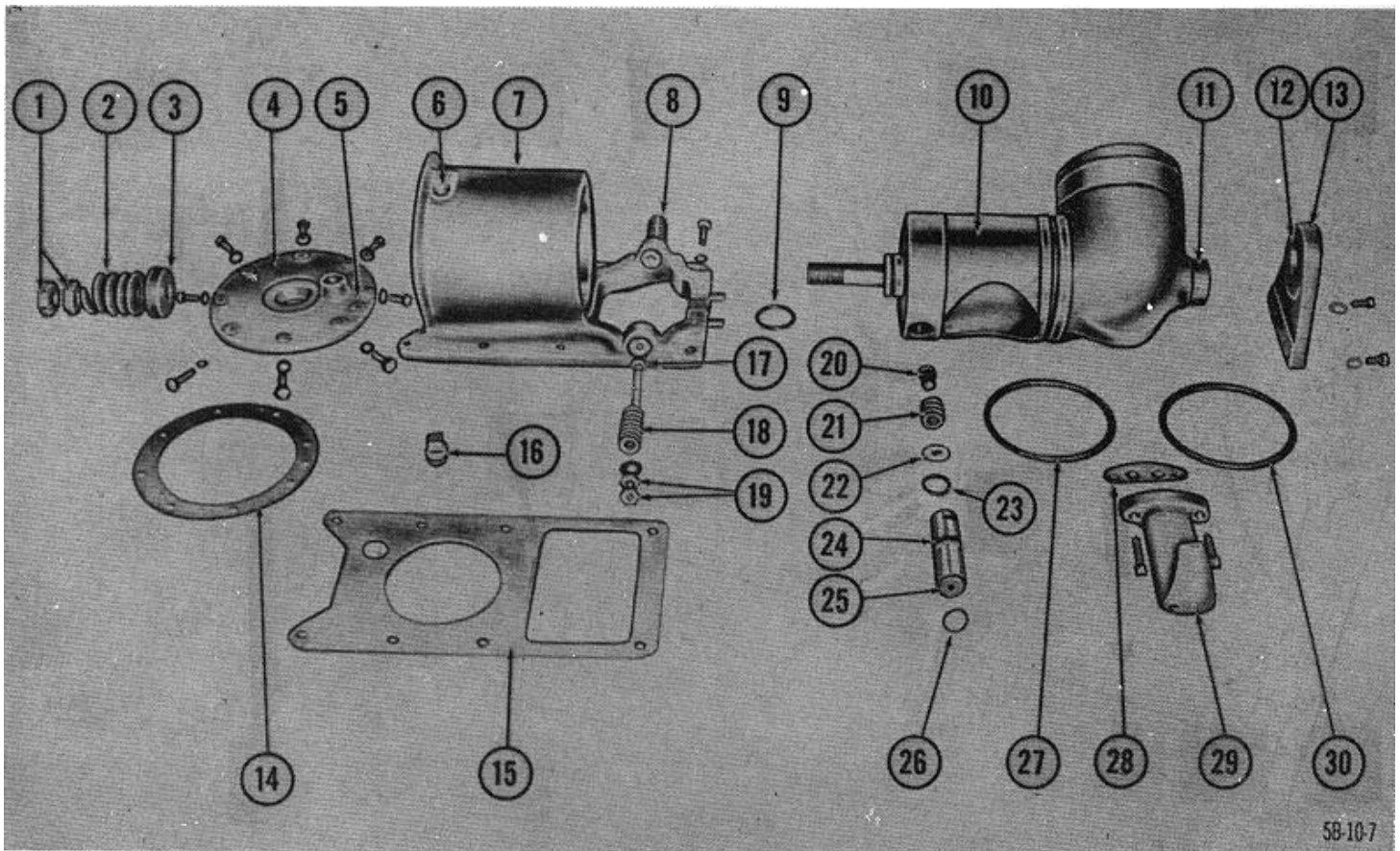
1 Cradle

2 Cradle spring, steel 3/16-inch

3 Can-positioning plate

Figure 6. Cradle assembly.

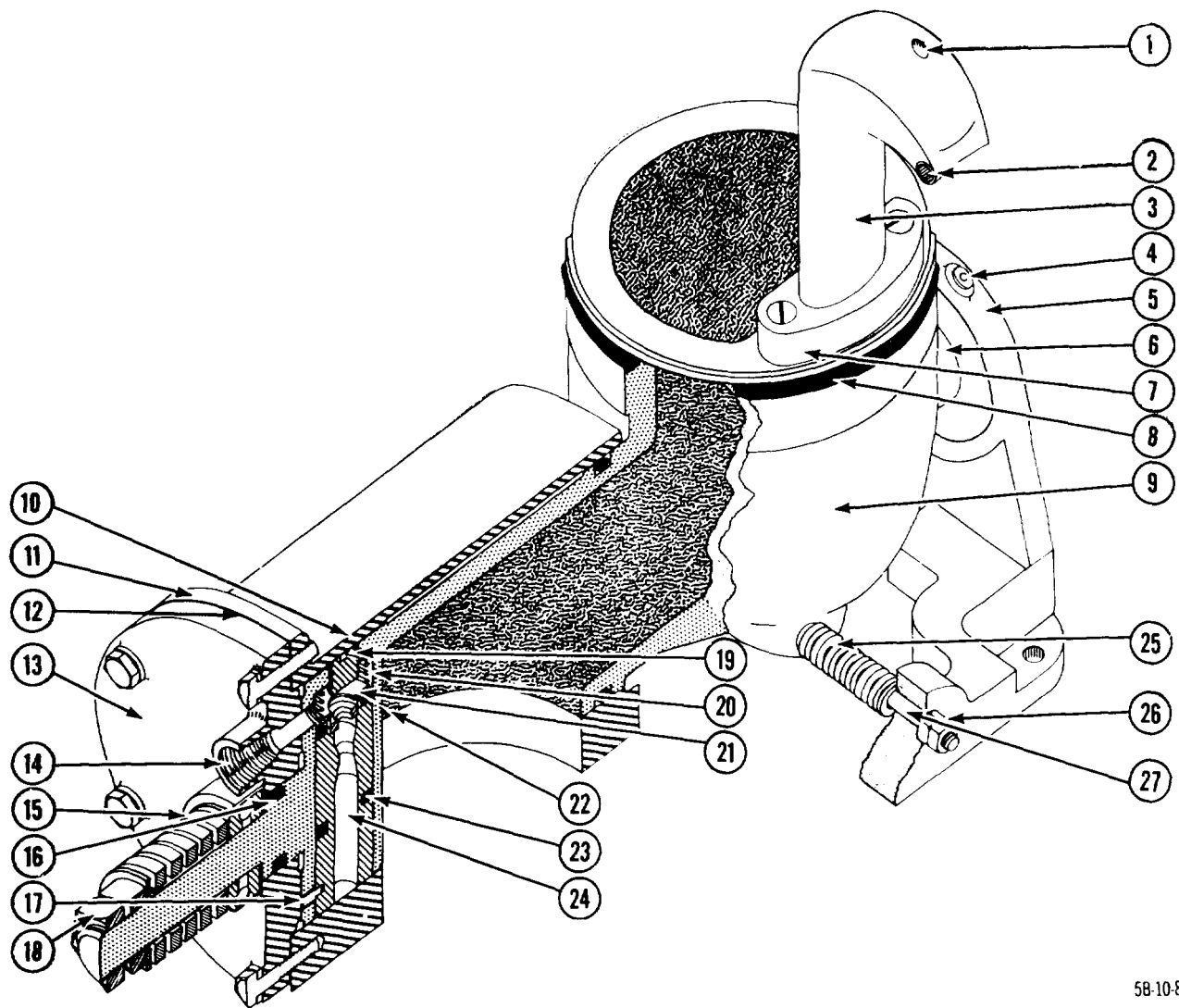
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- | | | | |
|----|--|----|--|
| 1 | Nuts, hex, steel, 3/4-16 NF, cadmium-plated | 16 | Venturi cleanout plug |
| 2 | Valve spring, steel, 1 3/4 inches long, cadmium-plated | 17 | Carriage bolt |
| 3 | Thrust bearing, steel, 3/4-inch i. d. | 18 | Stop spring (front) |
| 4 | Valve faceplate | 19 | Nuts, hex, steel, 1/4-20 NC, cadmium-plated w/steel washer |
| 5 | Dowel-pin hole | 20 | Venturi cap, (pipe plug) |
| 6 | Venturi-cleanout-plug opening | 21 | Venturi spring, steel, copper-plated |
| 7 | Valve housing | 22 | Venturi washer, brass |
| 8 | Stop spring (rear) | 23 | O-ring, venturi seal, top |
| 9 | O-ring, packing, 138- by 1/8-inch | 24 | Venturi O-ring groove |
| 10 | Valve body | 25 | Venturi (cradle-valve eductor) |
| 11 | Trunnion | 26 | O-ring venturi seal, bottom |
| 12 | Trunnion socket | 27 | O-ring packing |
| 13 | Support plate | 28 | Nozzle gasket, 1/32-inch |
| 14 | Valve-faceplate gasket | 29 | Nozzle |
| 15 | Cradle-valve mounting gasket | 30 | O-ring packing |

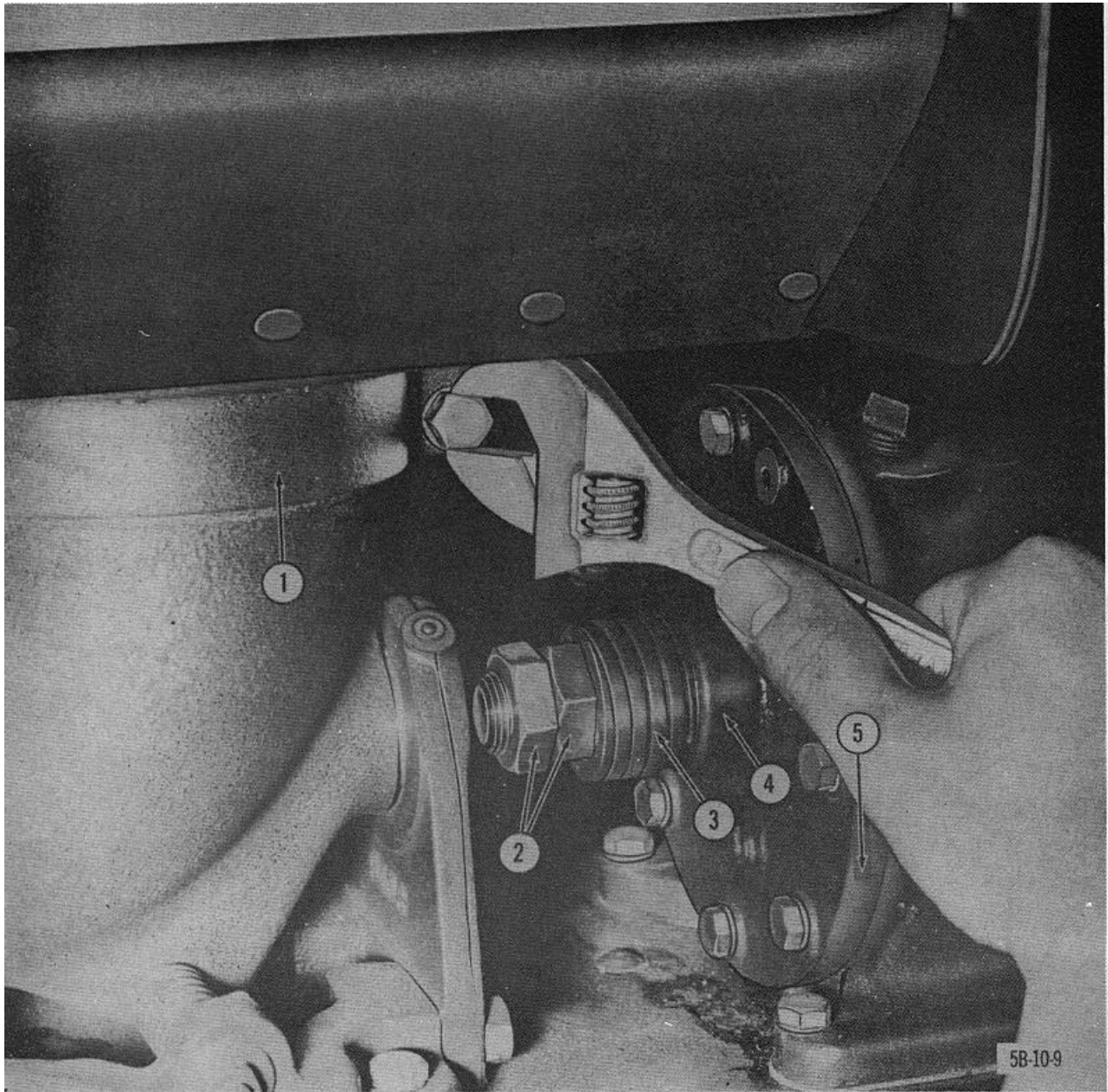
Figure 7. Cradle-valve assembly, exploded view (Model 4310CA).



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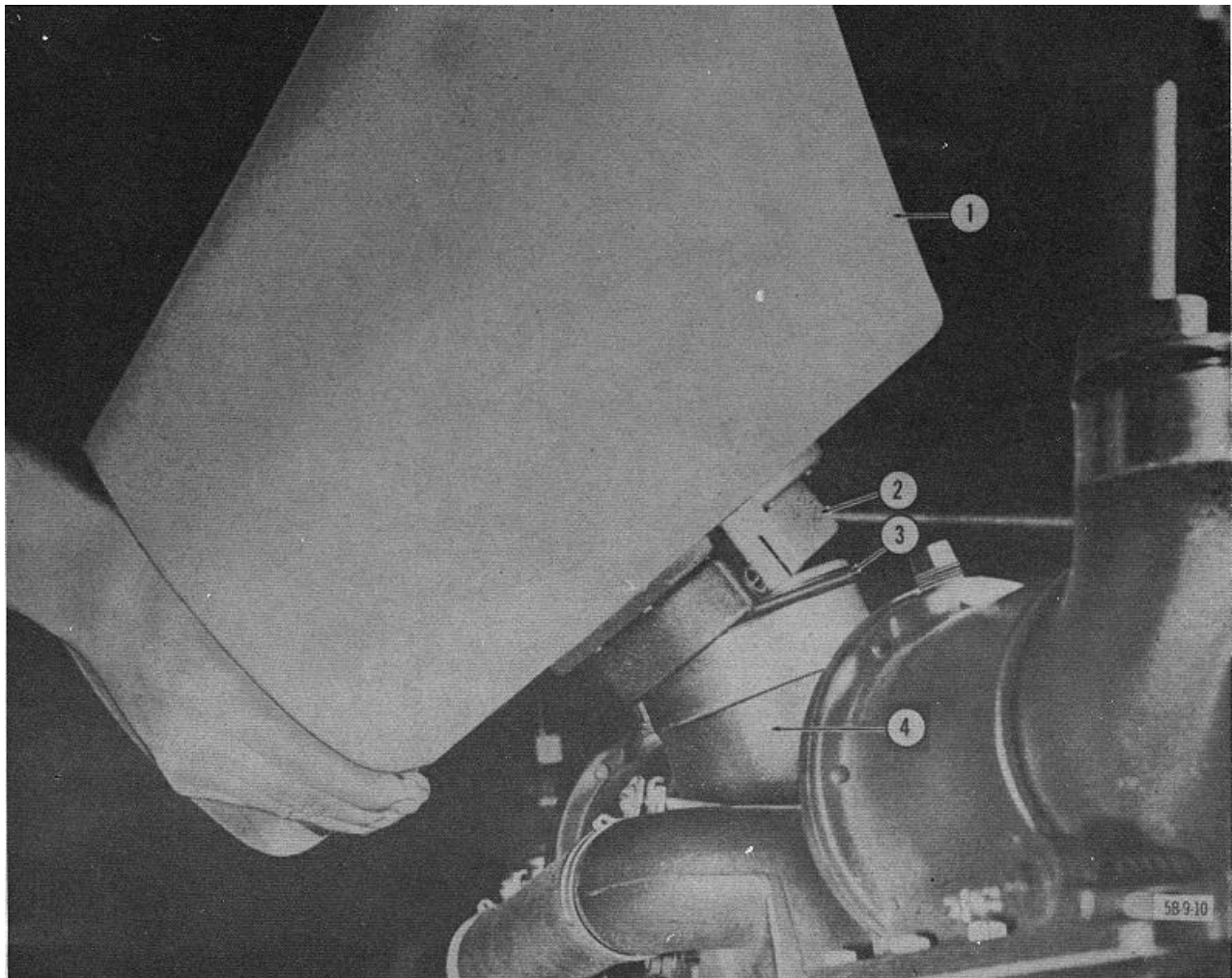
- | | |
|---------------------------|--------------------------------------|
| 1 Pressure orifice | 14 Copper-tube connection |
| 2 Suction orifice | 15 Valve spring |
| 3 Nozzle assembly | 16 O-ring, valve-faceplate seal |
| 4 Oil filler | 17 Venturi setscrew |
| 5 Support plate | 18 Valve-spring adjusting nut |
| 6 Trunnion | 19 Venturi cap |
| 7 Nozzle base | 20 Venturi spring |
| 8 O-ring cradle seal | 21 Venturi washer |
| 9 Valve body | 22 O-ring, venturi seal (top) |
| 10 Valve housing | 23 O-ring, venturi seal (bottom) |
| 11 Valve-housing flange | 24 Venturi (cradle-valve eductor) |
| 12 Valve-faceplate gasket | 25 Stop spring |
| 13 Valve faceplate | 26 Stop-spring adjusting nut |
| | 27 Carriage bolt (stop-spring guide) |

Figure 8. Cradle-valve assembly, assembly, cutaway view (Model 4310CA).



- | | | | |
|---|-----------------------------|-----------------|----------------|
| 1 | Cradle clamp | 3 | Valve spring |
| 2 | Valve-spring adjusting nuts | 4 | Thrust bearing |
| | 5 | Valve faceplate | |

Figure 9. Loosening bolts on cradle clamp.



- | | | | |
|---|--------------|---|----------------------|
| 1 | Cradle | 3 | O-ring (cradle seal) |
| 2 | Cradle clamp | 4 | Cradle-valve body |

Figure 10. Removing cradle from cradle valve (Model 4310CA).

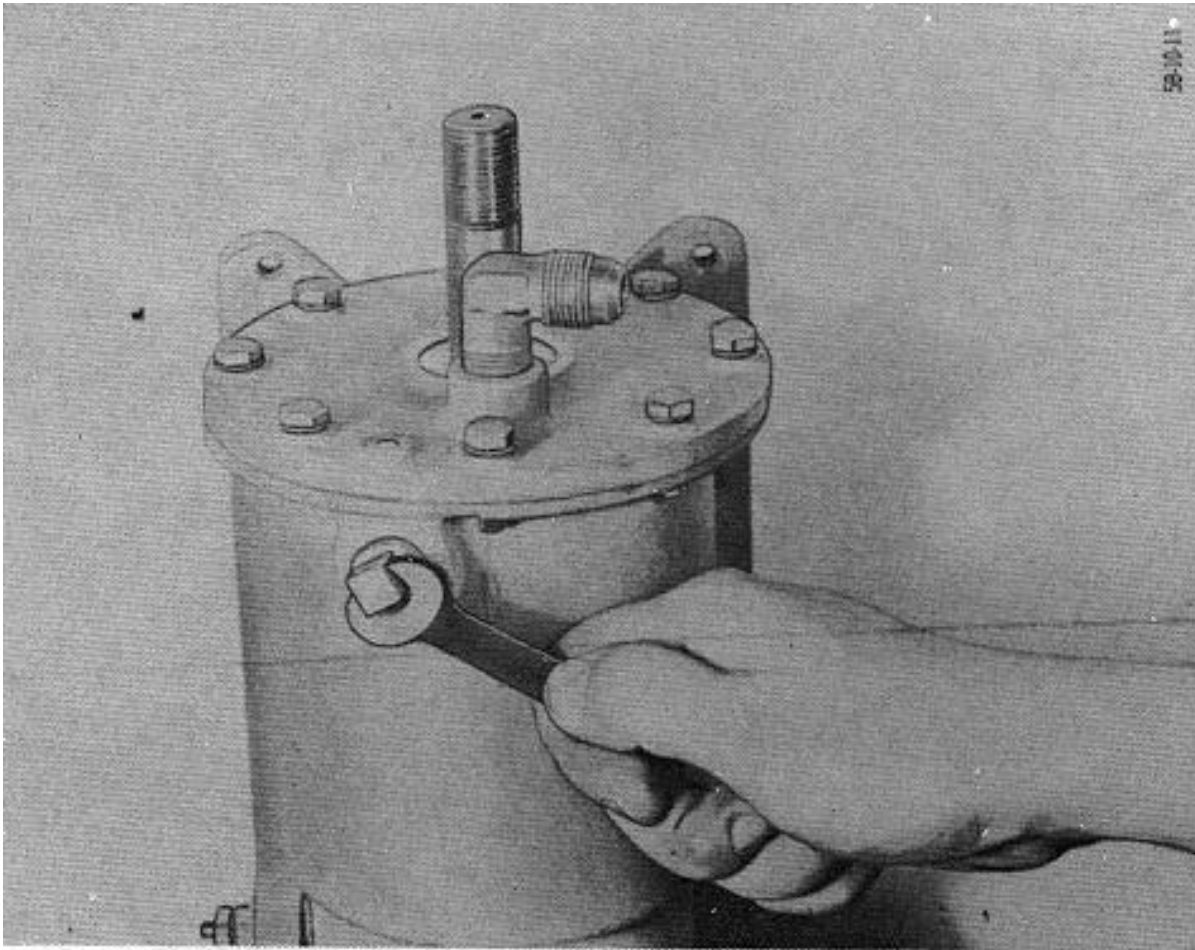
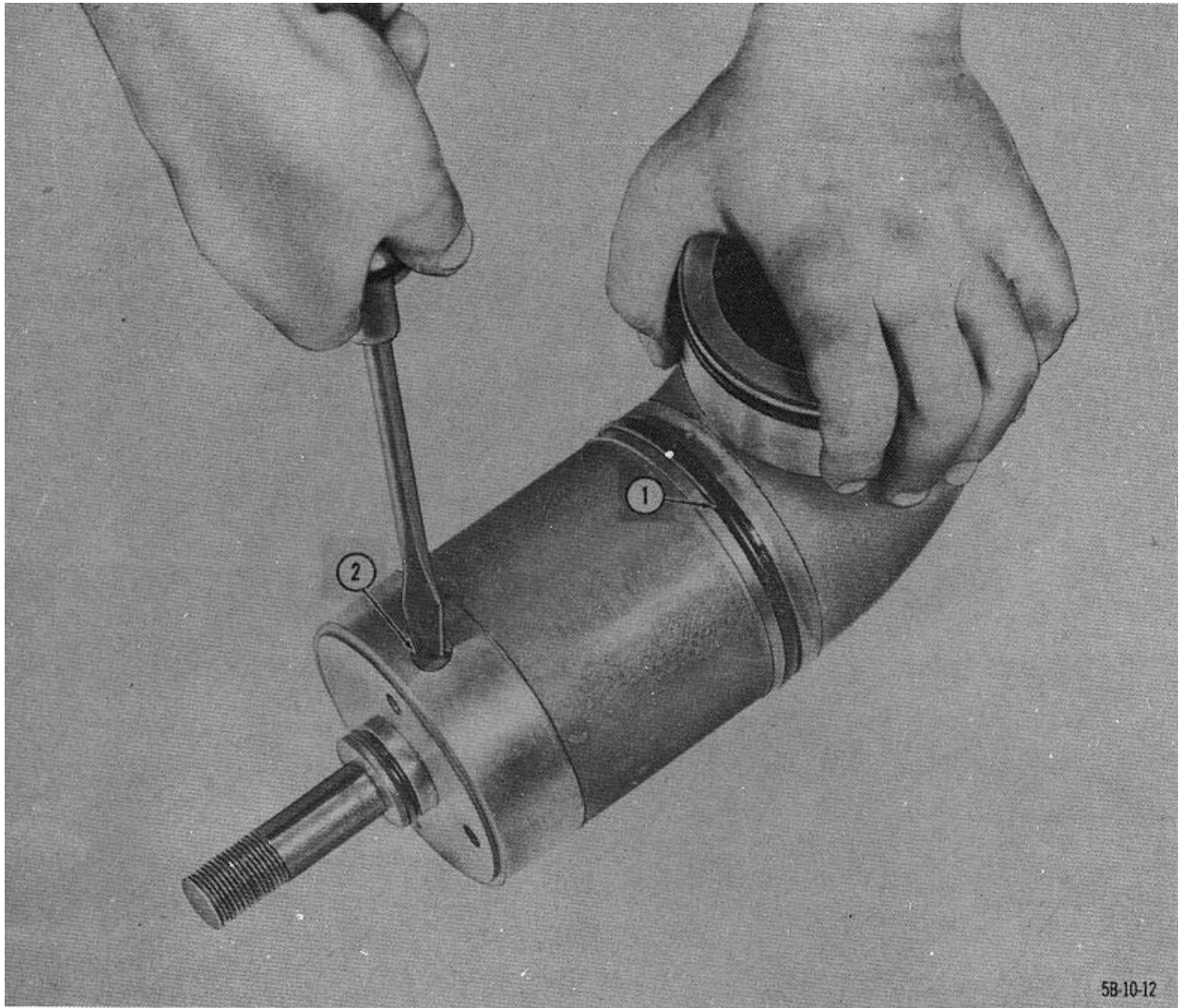


Figure 11. Removing venturi cleanout plug.

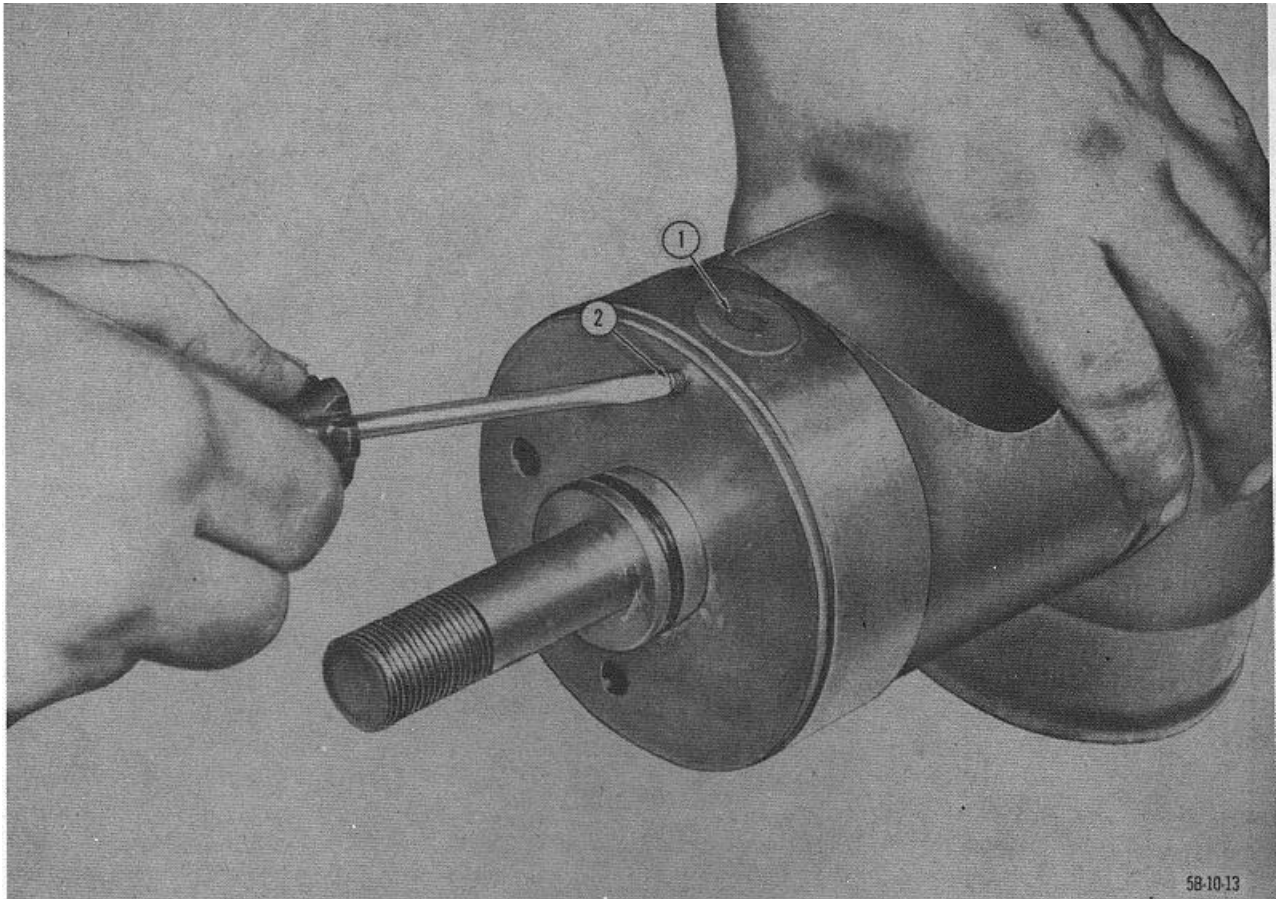
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1 Valve-body seal (O-ring)

2 Venturi cap

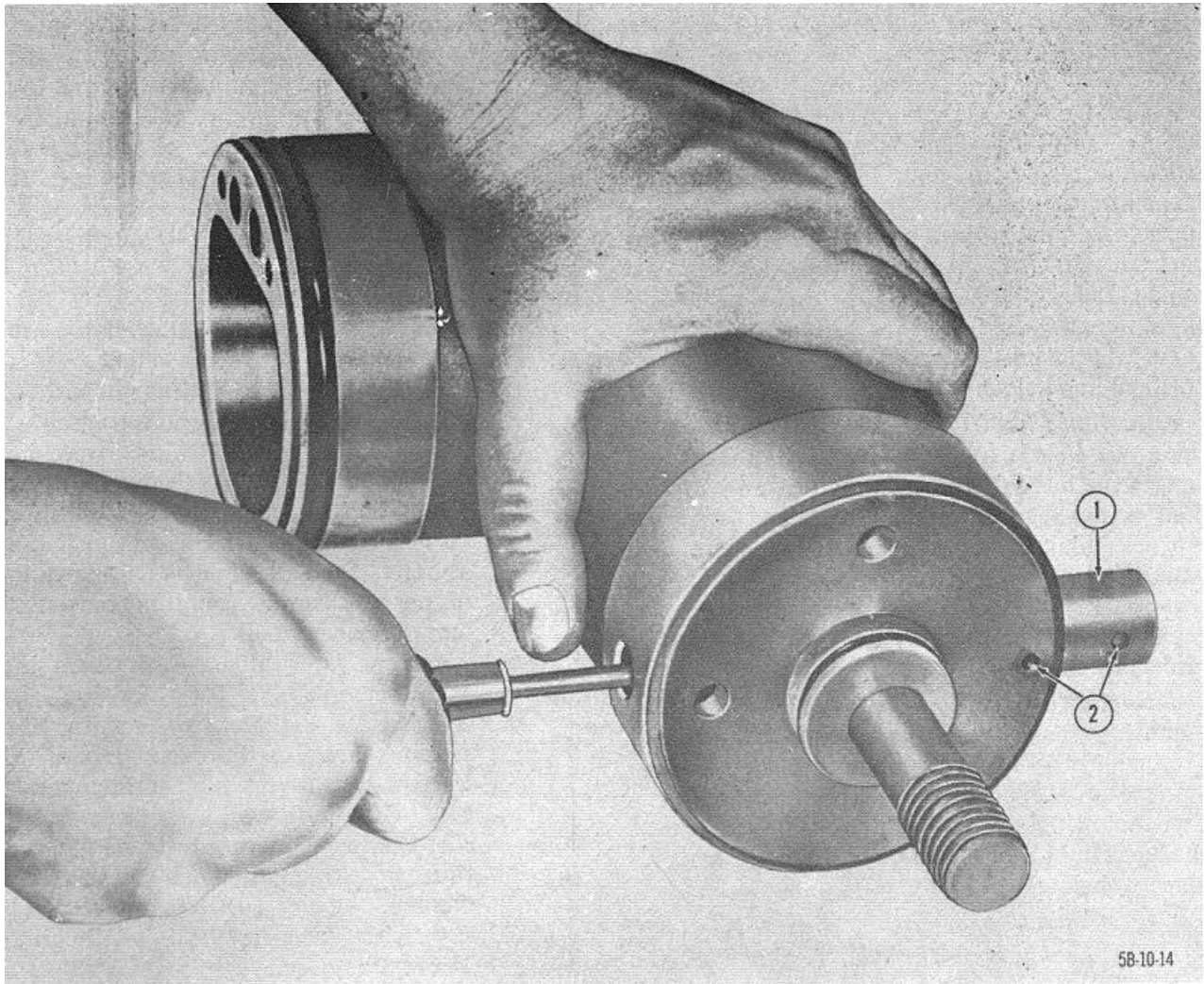
Figure 12. Removing venturi cap.



1 Venturi assembly

2 Venturi setscrew

Figure 13. Releasing venturi assembly by removing set-screw.



1 Venturi assembly

2 Matching holes for venturi setscrew

Figure 14. Pushing out venturi assembly from its cavity (Model 4310CA).

12. Quick Couplers and Chains

Quick couplers are equipped with a hard rubber gasket lodged in the base of the socket. Leakage at the quick-coupling joint on the hose normally indicates a defective gasket. The gasket is removed by prying it out with the tip of a screwdriver. The gasket should be inspected and replaced when required. Quick couplers have dust plugs and adapters have dust caps. Plugs and caps are chained to the outlets they protect to prevent loss. The links of the chain should be inspected for weakness or breaks and repaired or replaced when necessary.

13. Suction System

a. Suction Filter.

- (1) *Cleaning by reverse flush method.* The suction filter should be examined externally whenever the cleaning solvent is drained from the tank. This examination will depend on how often the solvent has to be removed due to accumulated sediment. While the tank is empty, a rapid method for cleaning the suction filter is by reversing the flow of fluid through it. Disconnect the suction hose. Connect the discharge hose to the suction side. Draw fluid from the other sedimentation tank and run the pump for a few minutes until the suction filter is thoroughly flushed. Drain the tank and reassemble the hose for normal operation.

- (2) *Cleaning by disassembly.* If the above procedure fails, the suction filter should be removed from the float-valve housing (g below) and cleaned with a cleaning solvent.

b. *Butterfly Disk.* The butterfly disk is attached to the interior of the suction pipe within the sedimentation tank by a brass pin that may be removed with the use of a hammer and a punch. It may be necessary to remove the suction-pipe assembly in order to remove the pin; if such is the case, proceed with disassembly as outlined in g below.

c. *Suction Float.* The suction float moves with the liquid height in the sedimentation tank and causes the butterfly disk to open and close. The float is made of brass and is attached to the butterfly disk by a brass connecting rod which runs through the suction housing. The float is screwed into the rod and may be removed for replacement. The rod may be removed from the tank and repaired by welding if necessary.

d. *Suction-Mounting Gasket.* The suction-mounting gasket seals the suction mounting to the inside wall of the sedimentation tank. Any evidence of seepage or moisture around the suction mounting or suction flange indicates that the gasket has broken down. Remove and replace (g below).

e. *Gate Valve No. 3.*

- (1) *Leakage at threads.* Leakage at the threaded joints where gate valve No. 3 connects to the quick coupling and suction mounting indicates that these connections must be resealed with suitable compound. Remove the parts, reseal the threads, and replace.
- (2) *Leakage at valve stem.* A moist condition on the valve stem indicates a defective graphite packing. Repacking and cleaning of the valve will require disassembly (fig. 15). Valve parts should be cleaned with solvent. Be absolutely

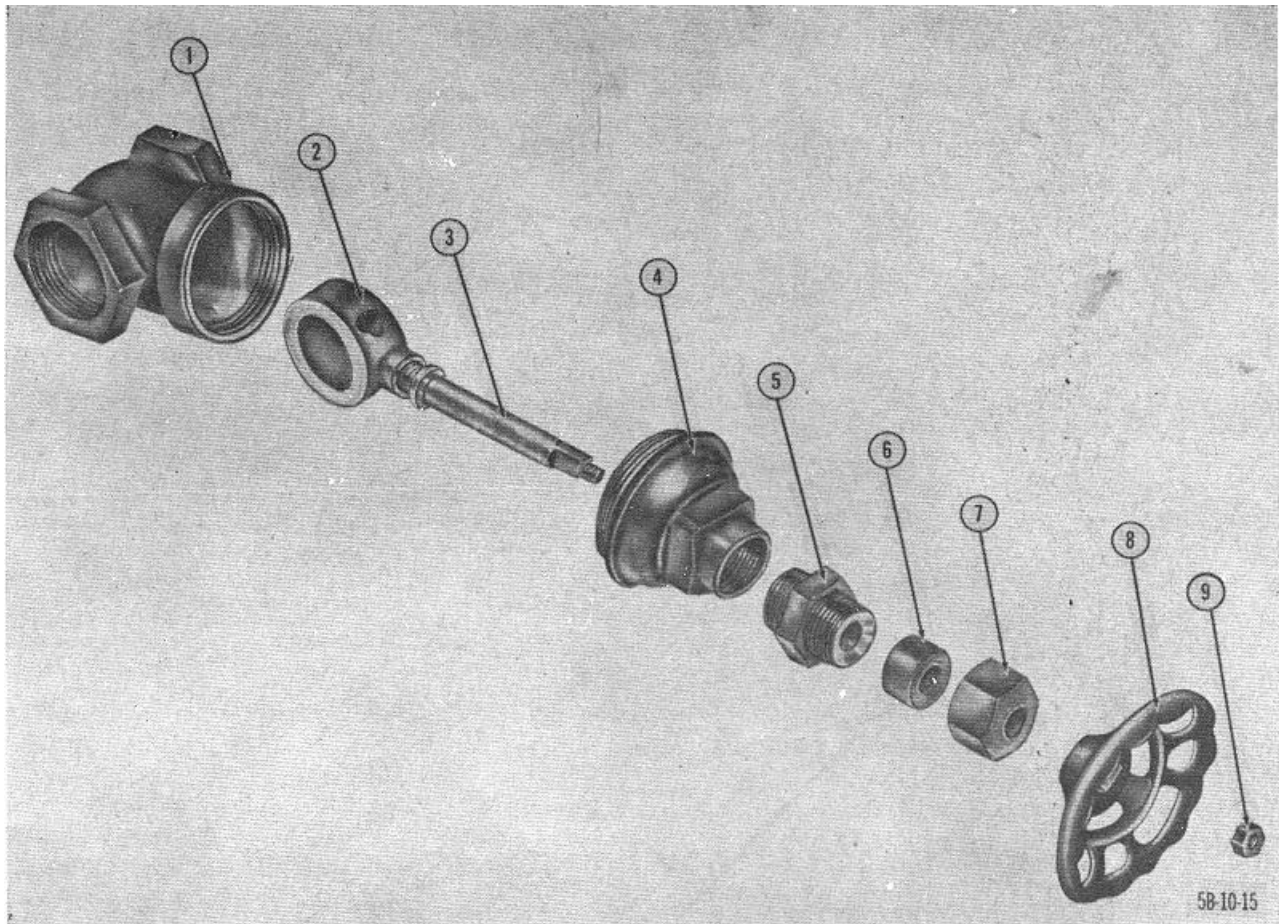
sure that valve joints are thoroughly airtight upon reassembly.

f. *Suction Hose.* Suction hose should be tested weekly for any signs of leakage due to breaks or cracks. A quick way to check this condition is to reverse the flow of liquid through the hose.

g. *Disassembly of Suction Pipe.*

- (1) Remove the toolbox (right-hand cleaner assembly only). This is done by disengaging the bolts holding the base of the toolbox to the skid mounting.
- (2) Disengage the suction filter from the float-valve housing. There is just enough clearance for the suction filter to be lowered on its threads and disengaged from the float-valve housing.
- (3) Unscrew the quick coupling connected to gate valve No. 3.
- (4) Unscrew gate valve No. 3 from the suction mounting.
- (5) Remove the eight screws holding the suction flange to the exterior wall of the sedimentation tank. On the reverse side of the tank wall these screws are also holding the flanged top of the suction mounting. Remove the suction flange.
- (6) Loosen and remove the U-bolt holding the suction pipe.
- (7) Lift the suction pipe out of the tank and remove the suction-mounting gasket from its flange.

h. *Reassembly.* Reassemble the suction system in reverse order. If removal of any fitting on the suction system is required, be absolutely sure that upon reassembly, the fitting is white-leaded and screwed in airtight. Suction system connections must be positively airtight or the pump will fail to prime.



- 1 Body
- 2 Disk
- 3 Stem
- 4 Bonnet

5 Stem-retaining nut

- 6 Stem packing
- 7 Packing nut
- 8 Handwheel
- 9 Handwheel nut

Figure 15. Gate valve No. 3.

14. Pressure System

a. Discharge Hose and Manifold Assembly. Discharge hoses should be examined daily for leaks and proper tightness. They must be disassembled and cleaned periodically, since foreign matter is likely to collect in them. Quick-coupling gaskets should be checked and replaced when there are signs of wear. The manifold assembly of the pressure system should also be checked for leaks or breaks. Check the pipe plug, pipe supports, and copper-tube connections of the manifold for tightness and absence of moisture at connecting points. Broken parts of the pressure piping should be repaired by welding, or should be replaced.

b. Gate Valve No. 1. Maintenance and repair instructions are the same as those given in paragraph 13e.

c. Disassembly of Pressure Piping.

- (1) Remove the toolbox.
- (2) Disengage the clamps holding the eductor body and T-mounting to connecting hose.
- (3) Press down firmly on the connecting hose to disengage from the T-mounting and eductor body (fig. 16).
- (4) It will be necessary to remove the cradle valves which flank the T-mounting in order to make the T-mounting screws accessible. Remove the T-mounting (fig. 17). The T-mounting gasket can be pried off with the tip of a screwdriver.

- (5) Use a pipe wrench to swing the eductor body so that it points to the ground. Then remove gate valve No. 3 on the suction line.
- (6) Use a pipe wrench to uncouple as a unit the following parts from the supply-line manifold: eductor body; gate valve No. 2; quick coupling; pressure-gage tee; and gate valve No. 1 (fig. 18).
- (7) The supply-line manifold then becomes accessible for inspection and cleaning.
- (8) Pressure piping and valves are assembled in reverse order.

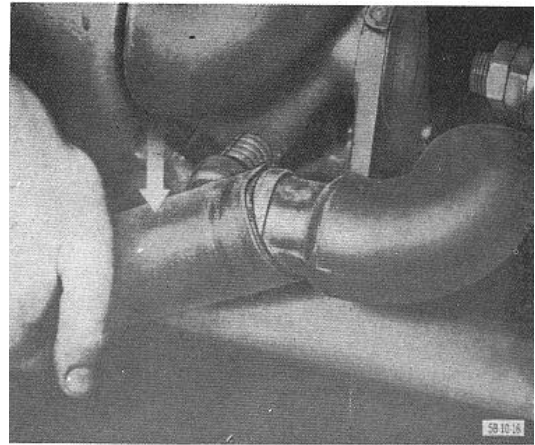


Figure 16. Uncoupling hose from T-mounting.

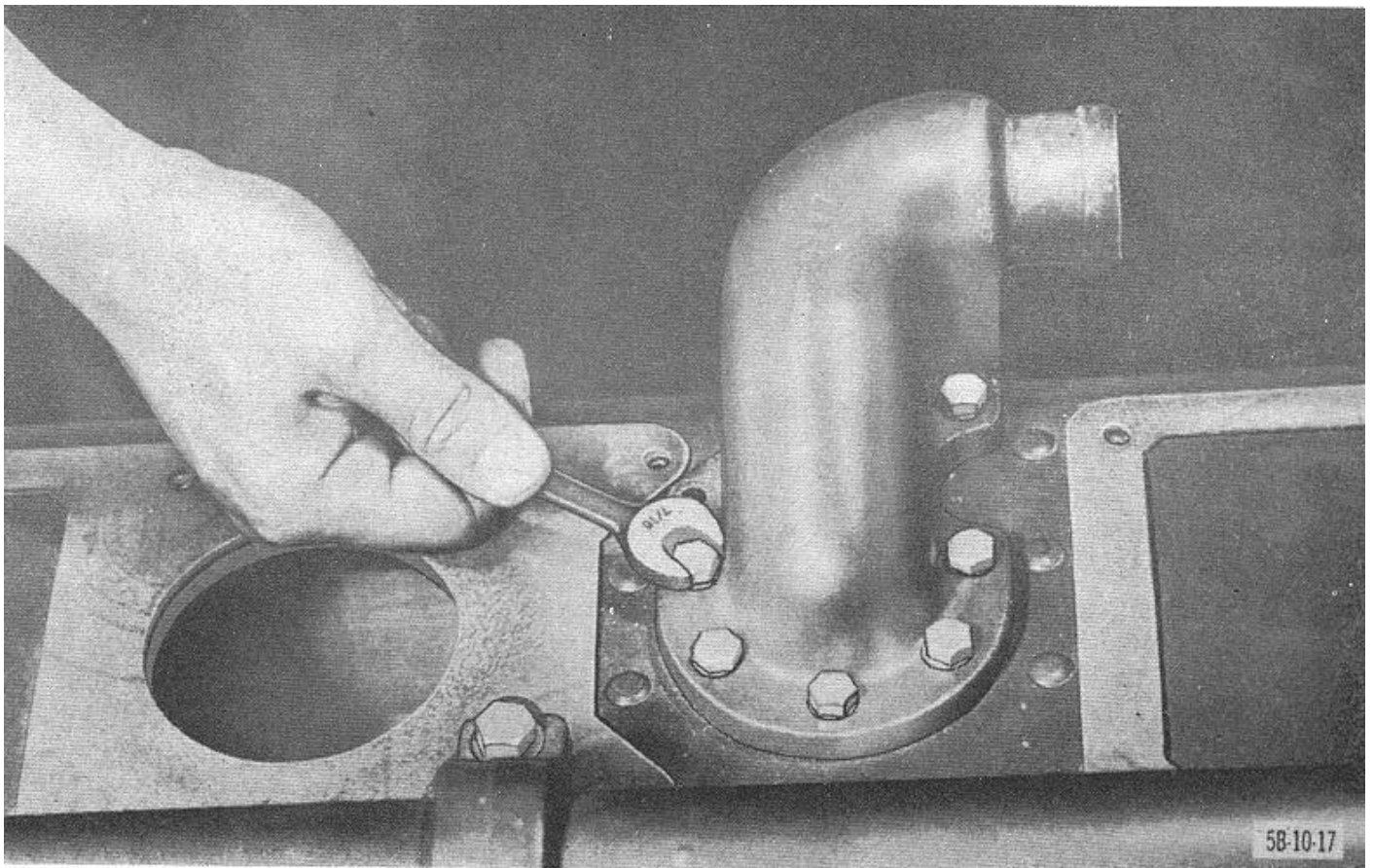
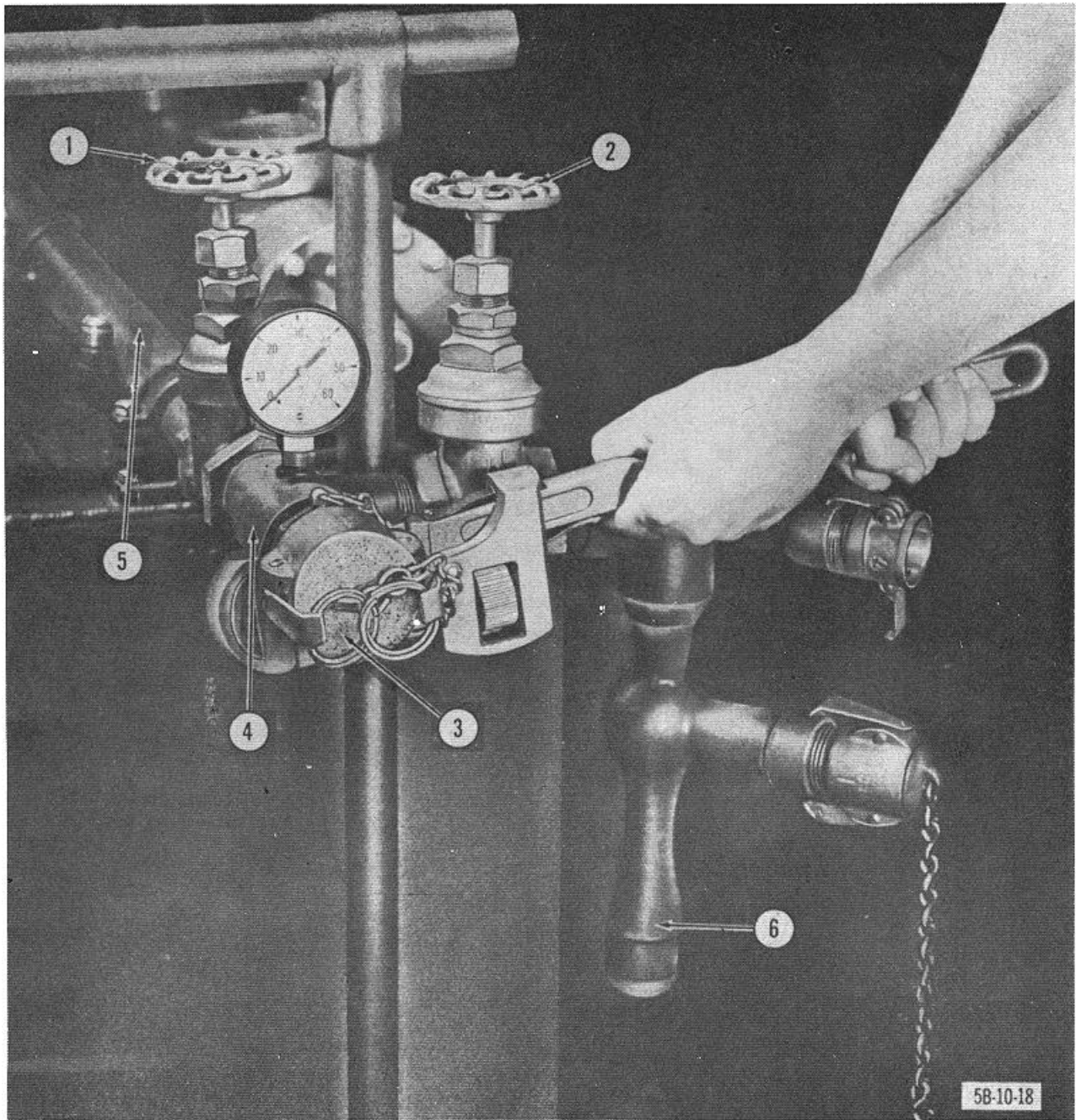


Figure 17. Removing T-mounting.



- | | | | |
|---|------------------|---|----------------------|
| 1 | Gate valve No. 1 | 4 | Pressure-gage tee |
| 2 | Gate valve No. 2 | 5 | Supply-line manifold |
| 3 | Quick coupling | 6 | Eductor body |

Figure 18. Removing gate valve and eductor body as a unit from supply-line manifold.

15. Tank Housing

a. Hatches. The hatches on the sedimentation tank should be checked frequently to make sure they are firmly seated and that they effectively seal the cleaning solvent from any outside contamination. Remove and replace if they are too warped to seat

properly.

b. Basket-Type Strainers. Where basket-type strainers show evidence of breaks or tears in the mesh, they should be repaired or replaced. Minor holes in the mesh can be repaired by the use of solder.

Caution

Under no circumstances will can- or drum-washing operations be attempted with the strainers removed from the tanks.

16. 55-Gallon Drum-Washer Assembly

a. *T-Mounting Gasket.* A moist condition around the base of the T-mounting indicates a faulty gasket. Remove and replace.

b. Gate Valve No. 2. Maintenance and repair directions given in paragraph 13e are also applicable to gate valve No. 2.

c. *Combination Suction and Flushing Tube.*

- (1) *Cleansing suction tip.* When the combination suction and flushing tube becomes clogged, decided variation in pressure will be observed on the pressure gage. Remove the suction tip, which is secured to the end of the tube by three flathead screws, and disassemble. Clean the tip thoroughly with cleaning solvent and reassemble.
- (2) *Clearing orifices.* If the above method fails to restore normal pressure, clean the orifices as follows:

- (a) Work a wire in and out of each orifice.
- (b) Remove the suction tip, depress the nozzle trigger, and flush out contamination.
- (c) Reassemble the suction tip to the combination suction and flushing tube.

17. Fire Extinguisher

The fire extinguisher should be recharged after each use. It should be weighed every 4 months (TM 9-1799) and the weight recorded on a card found inside the cylinder-record envelope. The envelope is attached to the cylinder by a chain. The full weight of the extinguisher, less hose and horn, is stamped on the valve. If the weight is 1 1/2 pounds less than the full weight, the fire extinguisher should be recharged. Report to proper authorities.

18. Troubleshooting

The following table can be of use in determining causes of trouble that may develop in the cleaning machine under average climatic conditions and normal usage.

TROUBLE	CAUSE	REMEDY
a. <i>Cradle.</i> (1) 5-gallon can loose in cradle. (2) Overextended limits of rotation.	Defective cradle spring. Improper adjustment to carriage bolt.	Replace cradle spring. Adjust limits of cradle rotation.
b. <i>Cradle Valve.</i> (1) Leakage at throat of valve body. (2) Leakage at thrust bearing. (3) Leakage at valve housing. (4) Leakage at venturi. (5) Loss of suction or flushing pressure at nozzle.	Defective cradle seal (O-ring) or nozzle gasket. Defective valve faceplate seal (O-ring). Defective valve-body seal (O-ring). Defective venturi seal (O-ring, top or bottom or both). Clogged venturi.	Replace defective part. Replace defective seal. Replace defective seal. Replace defective seal. Clean venturi by wire method, or disassemble.
c. <i>Sedimentation Tank.</i> (1) Tank overflows easily. (2) Seepage from bottom of tank. (3) Coarse particles on bottom of tank.	Clogged suction filter. A drain port is open or defective. Ruptured basket-type strainers.	Clean filter by reverse flush method, or disassemble. Close, or remove, reseal, and replace drain plug. Remove and resolder tears or holes in strainers.
d. <i>Suction Mounting.</i> Seepage at suction flange.	Defective suction-mounting gasket.	Replace gasket.
e. <i>Gate Valve.</i> (1) Leakage at threads. (2) Leakage at valve stem.	Defective sealing compound. Defective graphite packing.	Remove valve and reseal with compound. Replace packing and clean valve.
f. <i>Quick Coupling.</i> Leakage at the coupled joint.	Defective quick-coupling gasket.	Replace gasket.

TROUBLE	CAUSE	REMEDY
<p><i>g. Hose.</i> (1) Clogged pressure hose. (2) Clogged suction hose.</p> <p><i>h. Fire Extinguisher.</i> Weak or insufficient charge.</p> <p><i>i. 55-Gallon Drum-Washer Assembly.</i> (1) Sudden variation on pressure. gage (2) Weak flushing inside 55-gallon drum.</p> <p>(3) Insufficient suction inside 55-gallon drum.</p>	<p>Debris and grit in hose. Debris and grit in hose. Internal collapse.</p> <p>Cylinder undercharged.</p> <p>Clogged combination suction and flushing tube. Clogged orifices on casing of tube.</p> <p>Insufficient nozzle pressure.</p> <p>Clogged suction tip.</p> <p>Not enough time given for suction action. Clogged eductor body.</p>	<p>Clean hose by flushing. Clean hose by flushing. Replace hose.</p> <p>Report to proper authorities.</p> <p>Clean tube and flush.</p> <p>Clean orifices with wire.</p> <p>Increase nozzle pressure to maximum. Remove, clean, and replace suction tip. Keep tube in drum at least 20 seconds. Clean eductor body.</p>

CHAPTER 3

SHIPMENT, LIMITED STORAGE, AND DEMOLITION

19. Preparation for Limited Storage

a. *Cradles.* Remove the five cradles from each cleaner assembly. These cradles are stored inside the sedimentation tank. Place the first cradle against the suction pipe as shown in figure 19. Three additional cradles may be stored in tiers in the large-hatch area. Figure 20 shows the proper position of the cradles when the large-hatch area is full. Place the fifth cradle in the small-hatch area. Close the hatches and secure.

b. *Suction and Pressure Hose.* Suction and pressure hose will fit in the hose compartment of the 50-gpm dispenser if the sections are properly stowed. Coil the first length of discharge hose into the hose compartment as shown in figure 21. Coil in the

remaining lengths, starting on opposite sides of the compartment each time. The start and finish of each coil should be on the opposite side from the start and finish of the layer beneath.

c. *Dust Caps and Plugs.* Secure all dust caps and plugs.

d. *Threads.* Coat threads of all screws, bolts, and other screw fittings with a thin film of medium preservative lubricating oil (PL-medium) or engine oil (OE-30).

Note. Make sure that the sedimentation tanks are thoroughly drained.

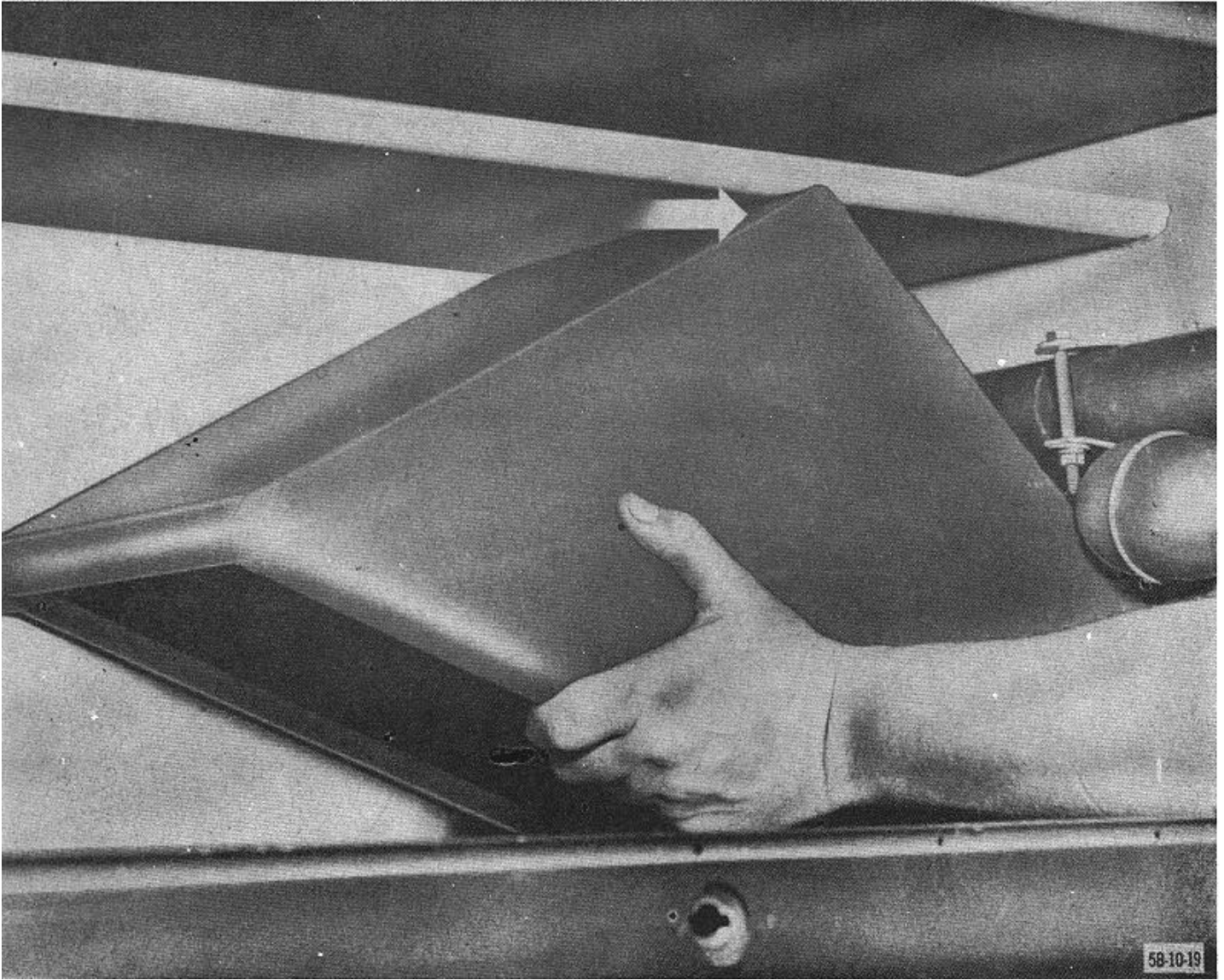


Figure 19. Storing first cradle in sedimentation tank (Model 4310CA).

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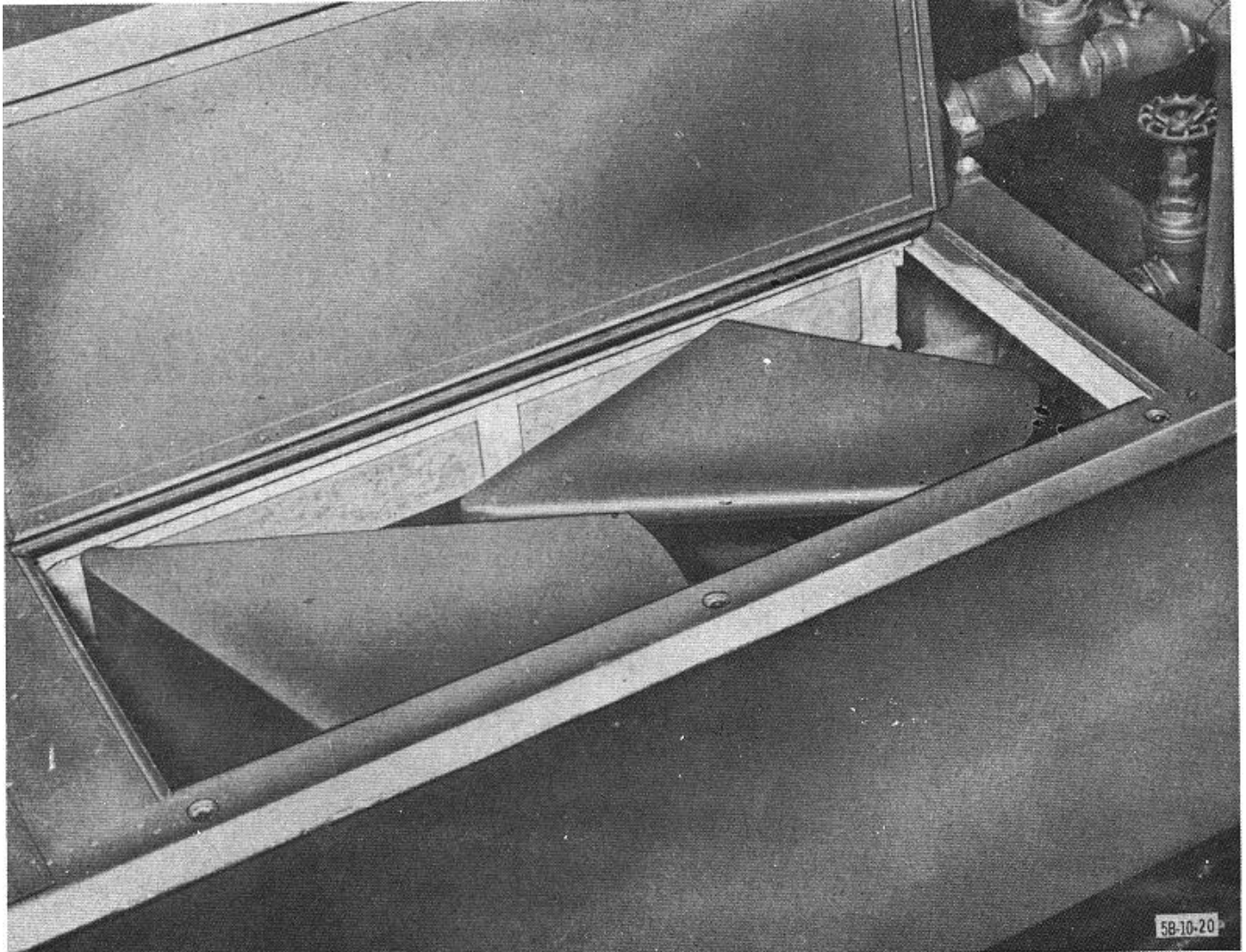


Figure 20. Proper position of cradles in large-hatch area (Model 4310CA).

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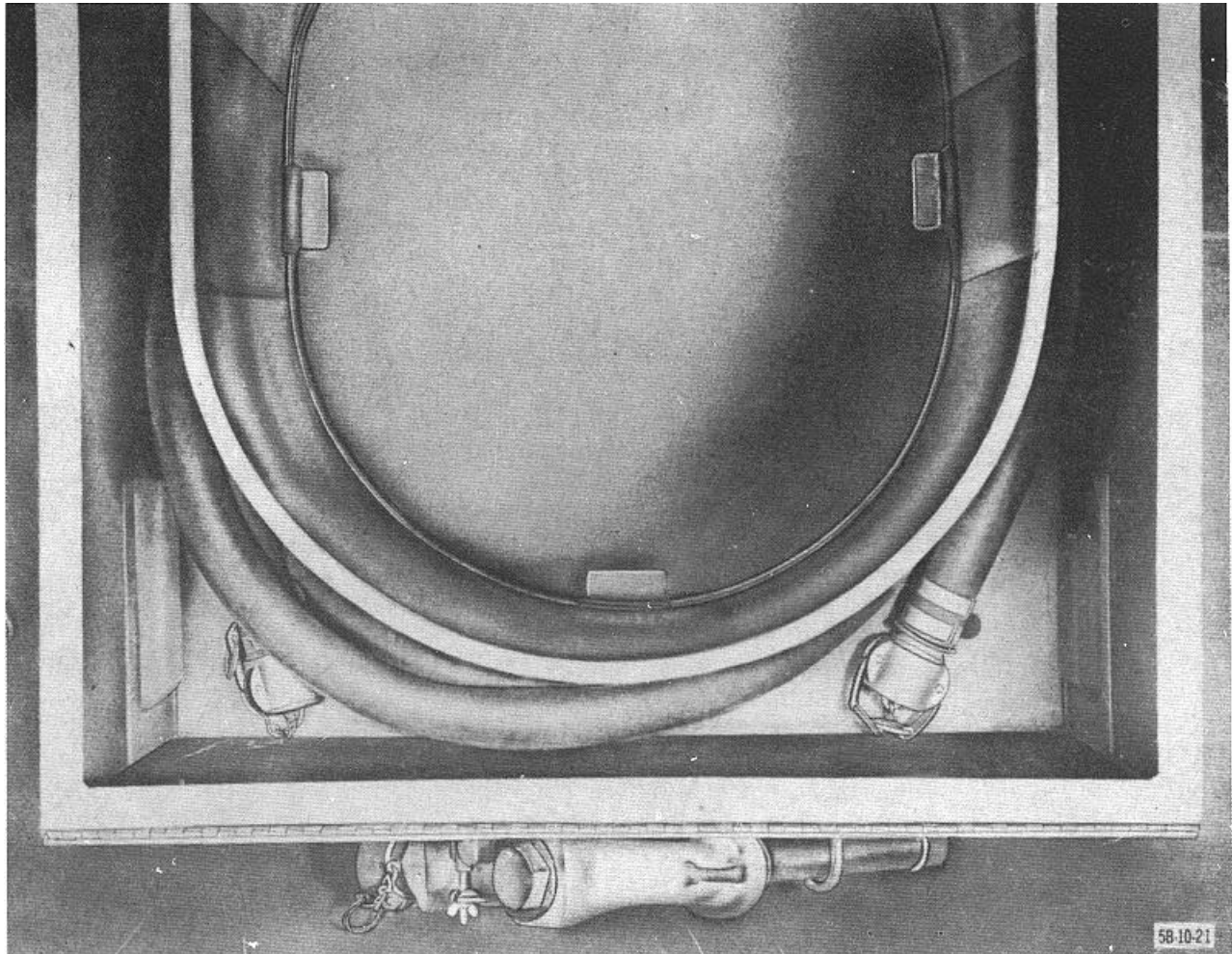


Figure 21. Coil of first hose section in proper position.

20. Preparation for Shipment

The cleaning machine is prepared for shipment in two crates. The first crate houses the 50-gpm dispenser; the second contains the cleaner assembly, one tank on top of the other.

21. Demolition

Demolition should be carried out only upon the orders of the commanding officer. The methods and thoroughness of destruction will depend on the time, personnel, and equipment available for demolition purposes. Always remove and destroy the same parts on each unit so that the enemy cannot salvage parts from one unit to use on another.

a. *By Gunfire or Grenade.*

- (1) Puncture sedimentation tank.

- (2) Fire upon the equipment with a machine-gun, rifle, or grenade. Direct the fire upon such vulnerable spots as the cradle valve, cradle, fire extinguisher, and 55-gallon drum-washer assembly. Remove and fire upon the basket-type strainers.
- (3) Fire upon suction and pressure hose; douse with gasoline and ignite.

b. *By Sledge Hammer and Ax.*

- (1) Smash feeder pipes (copper tubing).
- (2) Smash gate valves, cradles, and basket-type strainers.
- (3) Cut all suction and discharge hose; douse with gasoline and ignite.

APPENDIX I

REFERENCES

AR 320-5	Dictionary of United States Army Terms
AR 320-50	Authorized Abbreviations and Brevity Codes
AR 700-38	Unsatisfactory Equipment Report
AR 700-58	Report of Damaged or Improper Shipment
AR 711-16	Installation Stock Control and Supply Procedures
AR 725-5	Preparation, Processing, and Documentation for Requisitioning, Shipping, and Receiving.
AR 735-35	Supply Procedures for TOE Units, Organizations and Non-TOE Activities
AR 750-5	Maintenance Supplies and Equipment
AR 750-418	Inspection and Servicing of QM Mechanical Type Equipment Upon Receipt by Requisitioners.
AR 750-425	Spot Check; Technical Inspections, Adjectival Ratings and Reports, Quartermaster Corps Materiel.
DA Pam 108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings
DA Pam 310-1	Index of Administrative Publications
DA Pam 310-2	Index of Blank Forms
DA Pam 310-3	Index of Training Publications
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
FM 10-37	Quartermaster Petroleum Depot Company
FM 10-77	Quartermaster Petroleum Supply Company, Mobile
FM 21-5	Military Training
FM 21-6	Techniques of Military Instruction
FM 21-30	Military Symbols
TM 9-1799	Ordnance Maintenance: Fire Extinguishers
TM 10-1400	Special Purpose Vehicles and Equipment; Inspection and Organizational Preventive Maintenance Service.
TM 10-4940-201-10	Cleaning Machine, Fuel Can and Drum (Barnes Models 4310CA and 15801CA).
TM 10-4940-201-20P	Second Echelon Repair Part Allowances: Cleaning Machine, Fuel Can and Drum, Portable, Barnes MFG Co. Model 4310CA, Army Model SPE 19 (Federal Stock Number 4940-268-9771); Barnes MFG Co. Model 15801CA, Army Model SPE 19A (Federal Stock No. 4940-658-2889).
TM 10-4940-201-35P	Third, Fourth and Fifth Echelon Repair Part Allowances: Cleaning Machine, Fuel Can and Drum, Portable, Barnes Mfg. Co. Model 4310CA, Army Model SPE 19, (Federal Stock No. 4940-268-9771); Barnes Mfg. Co. Model 15801CA, Army Model SPE 19A (Federal Stock No. 4940-658-2889).
TM 38-230	Preservation, Packaging, and Packing of Military Supplies and Equipment
TOE 10-77D	Quartermaster Petroleum Supply Company
TOE 10-377D	Quartermaster Petroleum Depot Company
TOE 10-500R	Quartermaster Service Organization

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APPENDIX II

MAINTENANCE ALLOCATION CHART

**CLEANING MACHINE, FUEL CAN AND DRUM, PORTABLE
(BARNES MODEL 4310CA)
(FSN 4940-268-9771)
AND
(BARNES MODEL 15801CA)
(FSN 4940-658-2889)
SPE 19**

1. This maintenance allocation chart was prepared 20 April 1959 and lists all maintenance operations to be performed by the applicable echelons. These allocations are based on skills, tools, test equipment, and time required and/or available in the average TOE organization.

2. The sequence of entries coincides with the sequence followed in TM 10-4940-201-20P, Repair Parts and Special Tools List.

3. This maintenance allocation chart is a guide in performing maintenance operations; for authorization for specific repair parts refer to TM 10-4940-201-20P.

4. The explanations listed below define the terms used in the maintenance allocation chart.

a. Clean. To clean internally or with disassembly.

b. Adjust. To regulate periodically to prevent malfunction.

c. Inspect. To verify serviceability and to detect electrical or mechanical failure by scrutiny.

d. Test. To verify serviceability and to detect electrical or mechanical failure by the use of special equipment such as gages, meters, etc.

e. Replace. To remove and install or substitute serviceable assemblies, subassemblies, and parts for unserviceable like items.

f. Repair. To restore to a serviceable condition by replacing unserviceable parts or by any other action required utilizing tools, equipment, and skills available and authorized, to include welding, grinding, riveting, straightening, adjusting, etc.

g. Align. To adjust two or more parts and/or assemblies of an electrical, precision, mechanical, or steering system so that their functions are properly synchronized.

h. Overhaul. To restore an item to a completely serviceable condition by disassembling its assemblies and subassemblies, by inspecting and replacing parts, and by necessary boring, grinding, or machining operations, followed by reassembly and final inspection.

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	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
GROUP 91-CLEANER ASSEMBLIES					
FRAME, TANK FITTINGS, FLOAT VALVE					
QUICK COUPLERS AND CHAINS					
Inspect, Clean, Repair, Replace .....	.....	X			
DISK, LEFT AND RIGHT TANK FLOAT VALVE					
Inspect, Clean, Repair, Replace .....	.....	X			
HARDWARE AND PIPE FITTINGS, LEFT AND RIGHT SEDIMENTATION TANKS					
Inspect, Clean, Repair, Replace.....	.....	X			
STRAINERS, SEDIMENTATION TANKS					
Inspect, Clean.....	X				
Repair, Replace .....	.....	X			
VALVE ASSEMBLY, FLOAT, SEDIMENTATION TANKS					
Inspect, Clean, Repair, Overhaul, Replace .....	.....	X			
CRADLES, EJECTORS, NOZZLES, AND VALVES					
CRADLE ASSEMBLY					
Inspect, Repair, Replace.....	.....	X			
CRADLE VALVE					
Inspect, Clean.....	.....	X			
Repair, Overhaul, Replace.....	.....	.....	X		
NOZZLE ASSEMBLY, CRADLE VALVE					
Inspect, Clean Replace .....	.....	X			
TUBE ASSEMBLY, VALVE SUPPLY					
Inspect, Clean Replace.....	.....	X			
SUPPLY LINES, FITTINGS AND HOSES					
HOSE AND FITTINGS					
Inspect, Replace.....	.....	X			
MANIFOLD ASSEMBLIES					
Inspect, Clean .....	.....	X			
Repair, Replace.....	.....	.....	X		
GAGE, PRESSURE, AND PIPE FITTINGS					
Inspect, Clean, Replace.....	.....	X			
VALVE ASSEMBLY, GATE 1 1/2"					
Inspect, Clean, Repair, Replace.....	.....	X			
DRUM WASHERS, HOSE, AND FITTINGS					
HOSE AND HOSE CLAMPS					
Inspect, Replace .....	.....	X			
QUICK COUPLINGS AND FITTINGS					
Inspect, Replace.....	.....	X			
TIP, DRUM WASHER					
Inspect, Clean, Replace.....	.....	X			
NOZZLES AND TUBES, DRUM WASHER					
Inspect, Clean.....	.....	X			
Repair, Overhaul, Replace.....	X		

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

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The Adjutant General.

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CUSARROTC	(1) Arsenals (2)
Tech Stf, DA	(1) except QM Fld Maint Shops (2)
TQMG (15)	USA Corps (Res) (1)
Tech Stf Bd (2)	JBUSMC (1)
USCONARC (2)	Units org under fol TOE:
US Army Maint Bd (2)	10-17 (2)
US ARADCOM (2)	10-45 (2)
US ARADCOM Rgn (2)	10-47 (2)
OS Maj Comd (6)	10-61 (2)
Log Comd (2)	10-77 (2)
MDW (1)	10-127 (2)
Armies (6) except	10-237 (2)
First US Army (8)	10-277 (2)
Corps (2)	10-367 (2)
Div (2)	10-377 (2)
QMRECOMD (2)	10-427 (2)
Fld Comd, Def Atomic Spt Agcy (2)	10-500 (2)
Svc Colleges (2)	20-300 (2)
Br Svc Sch (2)	20-511 (2)
GENDEP (6) except	29-51 (2)
Atlanta GENDEP (None)	29-57 (2)
QM Sec, GENDEP (6)	39-51 (2)
Dep (6)	39 61 (2)
Oakland MSMC (1)	39 71 (2)
Ports of Emb (OS) (2)	55-515 (2)
Trans Terminal Comd (2)	55-517 (2)

NG: State AG (3); units org under fol TOE: 10-22 (5); 10 77 (4); 10 377 (4).

USAR: Units-same as Active Army except allowance is one copy for each unit.

For explanation of abbreviations used, see AR 320-50.

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigrams = .035 ounce
 1 decagram = 10 grams = .35 ounce
 1 hectogram = 10 decagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds
 1 quintal = 100 kilograms = 220.46 pounds
 1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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