TM 3-38

WAR DEPARTMENT TECHNICAL MANUAL

U. S. Dept. of Army

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CIR 373 1946

GENERATOR, SMOKE, MECHANICAL, M2

(50 Gallon)

40

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TM 3-381

TECHNICAL MANUAL

GENERATOR, SMOKE, MECHANICAL, M2 (50 GALLON)

CHANGES No. 1

WAR DEPARTMENT
Washington 25, D. C., 26 April 1945

TM 3-381, 15 June 1944, is changed as follows:

2. RECORDS (Superseded). **a.** Following instructions given in paragraphs 28, 29, 30, and 31, generator operators will utilize WD Form 48 (Driver's trip ticket and P.M. service record) to keep track of all first echelon maintenance services prescribed for the generator.

b. Following instructions given in paragraph 32, second echelon maintenance personnel will utilize WD AGO Form 461 (Work sheet for wheeled and half-track vehicles) to keep a record of services requiring the skill and tools of trained mechanics.

Figure 1 is rescinded.

3. GENERAL.

* * * * * * *

e. Liquids. Operation of generator * * * in figure 2. **The gasoline used in the generator should have an octane rating of 76 or above.** Specifications for water * * * 17 and 18.

4. FUNCTIONING.

* * * * * * *

c. Gasoline flow.

* * * * * * *

(2) *Discharge.* The pump discharges the gasoline **both to the engine carburetor and to the thermostatic fuel valve.** When the generator * * * in combusion chamber.

* * * * * * *

e. Fog oil flow. (1) *Control.* Flow of fog * * * the fog valve. The valve, diagrammed in figure 9, is an ordinary three-way plug cock which has been altered by cutting of a small groove in the body, so that when the lever of valve is in **ON** position, it is still possible for water to pass through valve itself to pump and inlet line.

* * * * * * *

7. TOOLS, ACCESSORIES, AND SPARE PARTS.

* * * * * * *

b. Accessories. (1) Normally one olive drab, water-resistant canvas cover for protecting generator (fig. 11), one funnel (fig 13), one spare spark plug, and one instruction manual are issued with each unit.

*These changes supersede TB 3-381-1, February 1945.

AGO 628C—Apr. 637403°—45——1

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(2) (Added.) For use in storing fog oil, each smoke generator company using M2 generators is issued four M1, 2-inch oil faucets. four M3 funnels, and four M1 10-foot barrel skids. In addition the Chief of the Chemical Warfare Service may authorize issuance of one or more M1 drum filling stations to each company for use in the continental United States.

* * * * * * *

9. NEW EQUIPMENT.

* * * * * * *

c. Preliminary inspection. Upon receipt of a new generator, check the following:

(1) *Fog oil suction hose.* Remove hose from * * * of furnace assembly. **Kinks in suction hose can often be avoided by loosening elbow by which hose attaches to the generator. This gives the hose more play and makes it easier to handle. Loosen elbow only enough to permit its being moved up or down.**

* * * * * * *

f. Preliminary operation.

* * * * * * *

(2) *Smoke* (Superseded). The smoke should not be "wet" or too "hot." "Wet" smoke is indicated when particles of fog oil can be seen emerging from the spray nozzles, by yellow smoke, by "drooling" at the nozzles, and by the lack of a clear jet at the nozzles. "Hot" smoke is indicated by a long clear jet at the nozzles, and when the temperature rises very high, a yellow color may appear in the smoke. The smoke issuing from each of the four nozzles of the smoke discharge manifold should resemble the smoke as diagrammed in figure 18 but it should be adjusted as near as possible to "wet" smoke. Smoke should be transparent for 3/8 to 1/2 inch from nozzle. For the next 1½ inches it should be clear in middle and fuzzy at edges. The rest of the smoke should be dense white fog. "Good smoke," as described here, indicates generator is functioning correctly. If "wet" smoke appears or smoke gets too "hot," adjust the thermostatic fuel valve (fig. 15) until the clear jet at each nozzle is 3/8 to 1/2 inch long. Directions for adjusting valve are given in paragraph 88.

* * * * * * *

(4) *Speed of engine* (Superseded). Production of the right amount of smoke and the continuing operation of the generator largely depend on maintenance of engine speed at approximately 3,600 revolutions per minute. (A speed between 3,500 and 3,700 revolutions per minute is satisfactory.) This is extremely important. Directions for determining engine speed and for adjusting governor to correct overspeeding or underspeeding are given in paragraph 64.

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5. TO START GENERATOR.

* * * * * * *

d. Crack burner valve slightly. After gasoline has ignited, as evidenced by roar of burning gasoline, open burner valve slowly to its wide open position. It takes approximately * * * use fog oil.

Caution (Added): If fire does not start within 30 seconds, close burner valve and check burner spark plug. With poor ignition, backfires occur.

* * * * * * *

f. Turn handle of fog oil strainer a few times. If oil does * * * a few seconds.

Caution (Added): If steam does not emerge from smoke discharge nozzles within 30 seconds after burner is ignited, turn off burner and engine and check water strainer, water line, and feedwater regulator for dirt and oil.

Note (Added). Abbreviated starting directions are given on instruction plate attached to each generator.

15.1. DURING OPERATION (Added). **a.** To insure proper operation of smoke generator, provision must be made for regular checking of engine speed and thermostatic fuel valve setting during a screening operation. Trained mechanics should be assigned to sectors of the generation line and one operator assigned to each generator. Each mechanic should be equipped with a tachometer (speed indicator) for determining engine speed, a 6-inch adjustable crescent wrench, and a 3/8-inch open end wrench to make necessary adjustments. (If tachometers are not available, mechanics should be trained to judge engine speed by sound.)

b. Operator keeps constant check on all parts of the generator affected by vibration.

c. Operator replaces fog oil drum when contents drop to 3-inch level, and sees to it that a full drum is in position and ready for use before pulling hose out of used drum. This reduces change-over time to a minimum.

d. Operator refills gasoline and water tanks every 45 minutes.

e. Operator checks packing box nut on thermostatic fuel valve assembly for tightness when fog oil vapors appear at this point.

f. Operator gives handle of fog oil strainer a few turns every 15 minutes.

16. TO STOP GENERATOR (Superseded).

a. Turn fog valve lever to OFF position.

b. After 45 to 60 seconds, or when smoke noticeably slackens, turn off burner.

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c. ALLOW ENGINE TO RUN AT LEAST 3 MINUTES AFTER TURNING OFF BURNER.

d. Stop engine by moving ignition switch to OFF position.

Note. Never stop engine without following b and c above, except in extreme emergency. This procedure prevents fog oil from backing up into feedwater regulator, water strainer, and water tank. Fog oil in these parts prevents water from being drawn by the fog oil-water pump.

17. IMPORTANT PRECAUTIONS.

a. Concerning fog oil and water. (1) *Operation* (Superseded). Do not run generator without water, as such operation will shorten the life of the coil assembly and may destroy the generator.

* * * * * * *

f. Concerning water flow (Added). Except when emergency conditions prohibit, make certain at all times that the proper amount of water is being introduced into the system with the fog oil. Failure of water to flow at a suction of about 1 pound per square inch produces inferior smoke, tends to cause fires, and greatly shortens the life of the coil assembly. Proper flow of water is achieved by keeping water strainer, water tank, water lines, and feed-water regulator clean and in good repair, and by maintaining proper engine speed.

g. Concerning coil assembly (Added). Never operate burner unless water or fog oil and water are flowing through the coil assembly. If the burner is operated without first introducing water or a mixture of fog oil and water into the coil, the coil burns out in 2 minutes.

18. FUEL CHANGES AND SPECIFICATIONS.

a. Water. (1) *Mixtures* (Superseded). When denatured alcohol is available, add the following percentages (by volume) to the water:

20 percent for temperatures between 32° and 15° F.
30 percent for temperatures between 15° and minus 5° F.
40 percent for temperatures below minus 5° F.

Note. Use only denatured alcohol as an antifreeze agent.

* * * * * * *

b. Adjustment without alcohol. When denatured alcohol is not available, the generator can be adapted to cold weather operation as follows:

(1) Run engine and burner until steam ceases to emerge in a steady stream from the smoke discharge nozzles (with fog valve lever in OFF position) to heat coil assembly. This operation should not consume more than 1 minute. Then shut off engine and burner at the same time.

Caution: **If burner is operated without water in the coil, coil burns out within 2 minutes.**

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(2) Remove water strainer and open drain cock on the feedwater regulator, allowing all water in system to drain. Replace strainer and close drain cock.

(3) Remove small plug on bottom of fog oil-water pump, place fog valve lever in ON position, and allow fog oil-water pump to drain. Replace plug.

(4) Drain water tank. Replace plug.

(5) Remove drain plug at bottom of fog oil strainer; give handle a few turns to drain strainer. Replace drain plug.

(6) Keep a 5-gallon can of water warm and ready to be used when operation is started. Once operation is well under way, the water to be used need not be heated.

c. **Fog oil.** (1) *Types.* Two types of fog oil are available for use in generator: "SGF1" and "SGF2." In temperatures above 40 degrees Fahrenheit, use SGF1. In temperatures between 40 degrees Fahrenheit and 0 degrees Fahrenheit, use SGF2. In temperatures below zero, blend SGF2 with wax-free kerosene as required.

* * * * * * *

25. LUBRICATION ORDER.

a. **General.** War Department Lubrication Order No. 3–381, reproduced in figure 25, shows all points to be lubricated, lubricants to be used, and intervals at which they must be applied. Detailed instructions are given in paragraph 27.

* * * * * * *

c. **Importance of order** (Superseded). Instructions on the lubrication order are binding on all echelons of maintenance.

* * * * * * *

e. **Lubricants** are prescribed in the "key" on the lubrication order in accordance with three temperature ranges: above 32° F., between 32° and 0° F., and below 0° F. When to change * * * change-over periods. Sluggish starting that cannot be accounted for by faulty ignition or faulty carburetion is an indication that lubricants are thickening and a signal to change to grades prescribed for the lower or higher temperature range. Ordinarily grade of * * * OR HIGHER RANGE.

26. EQUIPMENT (Superseded). The guns, oilcans, and other equipment necessary for lubricating parts are obtained from organizational motor pool or shop. Clean each piece of lubricating equipment thoroughly, both before and after use.

27. LUBRICATION PROCEDURES.

* * * * * * *

b. **Crankcase fill and level** (Superseded). Crankcase holds one quart and should not be overfilled. Drain while oil is hot to insure

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WAR DEPARTMENT LUBRICATION ORDER LO 3-381

(Supersedes WDLO 4002, 20 June 1944)

Reference: TM 3-381 GENERATOR, SMOKE, MECHANICAL, M2 (50-Gallon)

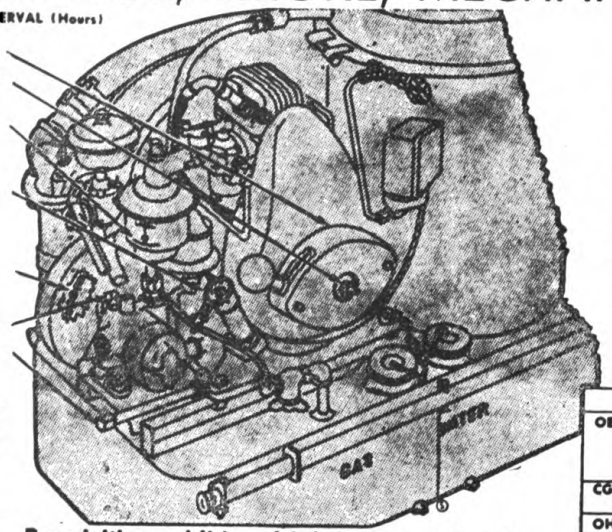
LUBRICANT • INTERVAL (Hours)		
Magneto (See note)	CG	
Starter Mechanism (Fitting on flywheel nut)	CG	192
Air Cleaner — Check level (See note) Every 48 hours, remove and wash all parts.	OE	8
Crankcase Fill and Level — Check level. Caution: Also check level before every operation and refill to Full mark on gage.	OE	8
Pump Drive Chain — Clean and oil (To reach, remove guard shield)	OE	48
Pump Shaft	CG	8
Crankcase Drain — Drain and refill. Cap. 1 qt. (Drain only when engine is hot)		48

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

[A. G. 300.8 ( )]

By order of the Secretary of War:
G. C. Marshall, Chief of Staff

Official:
J. A. Ulio, Major General, The Adjutant General



Requisition additional lubrication orders in conformance with instructions and lists in FM 21-6

NOTES

Clean fittings before lubricating.

To clean parts, use SOLVENT, dry cleaning or OIL, fuel, Diesel. Dry before lubricating.

Reduce intervals under severe operating conditions.

AIR CLEANER—Refill oil reservoir to indicated level with used crankcase oil or OE. From 0°F. to —40°F. use SA or OH. Below —40°F. remove oil and operate dry.

MAGNETO—When flywheel is removed for other purposes, wipe braker cam lightly with CG.

OIL CAN POINTS—Every 48 hours lubricate Choke, Throttle and Governor Connections with OE.

COLD WEATHER—For operation below 0°F., drain crankcase, refill crankcase with 75% OE, SAE 10 and 25% gasoline thoroughly mixed. Check level more often. Maintain at full mark on gauge by adding gasoline only. At end of each operating period check level; add gasoline to full mark if necessary. Start engine, run for five minutes before stopping. Reduce drain interval by one-half.

KEY

LUBRICANTS	LOWEST ANTICIPATED AIR TEMPERATURE		
OE—OIL, engine	above +32°F.	+32°F. to 0°F.	below 0°F.
Crankcase	SAE 30	SAE 10	See note
Other Points	SAE 30	SAE 10	PS
CG—GREASE, general purpose	No. 1	No. 0	No. 0
OH—OIL, hydraulic			
SA—FLUID, shock-absorber, light			
PS—OIL, lubricating, preservative, special			

Fig. 25. War Department Lubrication Order.

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removal of dirt and sediment. When generator is being operated in temperatures of less than 0° F., drain crankcase and fill with engine oil SAE 10 to the full "F" mark on measuring stick. Then add one-half pint of gasoline and operate engine for 5 minutes. Stop engine and mark on measuring stick the level of the oil-gasoline mixture. After that, before each operation, fill crankcase with engine oil to the "F" mark and add enough gasoline to bring oil-gasoline mixture up to the marked level.

c. Air cleaner (Superseded). Always clean parts before refilling. To disassemble, remove cleaner as shown in figure 29, unscrew top, and lift out screen. (See fig. 30.)

d. Alemite fitting on flywheel nut. Use lubricating gun to grease. (This fitting is * * * mechanism grease fitting.)

e. Pump drive chain. Wash this part when it is removed. To remove chain * * * lubricate this part.

* * * * * * *

28. FIRST ECHELON MAINTENANCE (Superseded).

a. *To insure mechanical efficiency*, it is necessary that the M2 smoke generator be systematically inspected by the operator at designated intervals to discover and correct defects before they result in serious damage. The scheduled first echelon preventive maintenance services prescribed are designed to insure maximum efficiency when accomplished at the intervals indicated.

b. *General inspection or servicing* of each item applies also to any supporting member or connection and generally includes a check to see that the item is in good condition, correctly assembled, secure, and not excessively worn.

c. *Inspection for good condition* is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. The term "good condition" means: not bent, twisted, chafed, burned, broken, cracked, bare, frayed, dented, collapsed, torn, or cut.

d. *Inspection to see that a part is correctly assembled* is usually an external visual inspection to see whether it is in its normal assembled position in the unit.

e. *Inspection of a part to determine if it is secure* is usually an external visual examination or a pry-bar check for looseness. Such an inspection should include any brackets, lock washers, lock nuts, locking wires, or cotter pins used in the assembly.

f. *Excessively worn* is understood to mean worn close to or beyond serviceable limits, and likely to result in a failure if not replaced before the next scheduled inspection.

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g. *Operator's preventive maintenance services* are listed on the back of WD Form 48 which is designed to cover equipment of all types. Items peculiar to the M2 smoke generator that are not listed on WD Form 48 are covered under items with which they are related. Those items listed on the form that do not pertain to this equipment are omitted from the procedures as described in this manual.

h. *Items listed on WD Form 48* that apply to the smoke generator are expanded in this manual to provide specific procedures for accomplishment of necessary inspections and services. These procedures are arranged to facilitate their execution and to conserve time of the operator, and are not necessarily in the same numerical order as given on WD Form 48. Item numbers, however, are identical with those shown on that form.

i. *Any defects* or unsatisfactory operating characteristics beyond the scope of first echelon maintenance personnel must be reported at earliest opportunity to the designated individual in authority.

j. *First echelon maintenance* on the smoke generator consists of before operation, during operation, and after operation services, as described in the following paragraphs. No at-halt services are prescribed.

29. BEFORE OPERATION SERVICES (Superseded).

a. This inspection schedule is designed primarily as a check to see that the equipment has not been tampered with or sabotaged since the after operation service was performed. Various circumstances may have rendered the equipment unsatisfactory for the performance of its intended purpose or unsafe for operation.

b. The before operation service consists of inspecting the items in the following schedule according to procedures prescribed, and correcting or reporting any deficiencies. Upon completion of the service, results should be reported promptly to the designated individual in authority.

Note. Always remove all dirt and oil from generator before starting engine.

(1) *ITEM 1, tampering or damage.* Look for any damage to equipment and for any signs of tampering or sabotage. Check fog oil suction hose carefully for breaks. To facilitate starting the engine, dry spark plugs and wiring if they appear wet. See that equipment is placed in a level position and on a firm foundation.

(2) *ITEM 3, fuel, oil, and water.* See that gasoline and water tanks are full, adding liquids as required. Before filling water tank, be sure filler cap is on gasoline tank to avoid getting water in gasoline. Be sure contents of fog oil barrel are sufficient to insure uninterrupted operation. (See par 30.) Check water strainer and clean with dry-cleaning solvent or gasoline, if necessary. If water strainer is oily,

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clean water line and feedwater regulator, washing all parts with dry-cleaning solvent or gasoline. Check gasoline strainer and clean with dry-cleaning solvent or gasoline. Give handle of fog oil strainer a few turns, as shown in figure 33. This revolves filter cartridge inside strainer past cleaner blades, combing out all collected solids and dropping them into sump below. Check crankcase. Oil level in crankcase should be at "F" mark on measuring stick. Add oil, if required, to bring it to that level. (See War Department Lubrication Order 3–381, latest issue.) Inspect for any foreign material in fog oil, lubricating oil, gasoline, or water that might damage generator and remedy before starting engine. Any appreciable loss in water, oil, or gasoline since the after operation services must be investigated, and the cause corrected or reported.

(3) *ITEM 6, leaks, general.* Look for water, gasoline, or oil leaks, and examine fittings of all piping for tightness. Trace leaks to source and correct or report.

(4) *ITEM 7, engine warm up.* Check speed of engine and adjust governor, if necessary, to between 3,500 and 3,700 revolutions per minute. (See par. 64.)

(5) *ITEM 8, choke.* When starting a cold engine, keep choke closed for first three or four pulls of ready-pull starter. If engine fails to start, open choke and give ready-pull starter several more pulls. Repeat this entire procedure until engine starts. This prevents over-choking. When engine starts, adjust choke so that engine runs without surging or missing. Gradually open choke as engine warms up until it operates smoothly with choke completely open. Never operate with partly closed choke.

(6) *ITEM 21, tools and equipment.* See that funnel and tools with which each generator is equipped are clean and readily available. Fold canvas cover and place in clean spot during operation.

(7) *ITEM 25, during operation check.* As soon as the operation to make smoke is initiated, begin during operation services as directed in paragraph 30.

30. DURING OPERATION SERVICES (Superseded).

a. *While the generator is operating*, listen for any sounds such as rattles, knocks, squeals, or hums indicative of trouble, particularly of improper engine speed. Observe smoke closely. If smoke becomes "wet" or too "hot," report this condition to designated authority, as necessity for adjustment of thermostatic fuel valve by second echelon personnel is indicated.

b. *During operation services* consist of observing the items in the following schedule, accomplishing the procedures described, and promptly investigating any indications of serious trouble. Note

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minor deficiencies to be corrected or reported; these deficiencies can usually be remedied during the next after operation period.

(1) *ITEM 31, engine and controls.* Be on the alert to detect any unusual operating characteristics, such as overspeeding or underspeeding engine. If engine speed is seriously incorrect, adjust governor. (See par 64.) Note any looseness or binding in engine control mechanism and linkage. Observe any looseness that may develop in any part of engine or its mounting.

(2) *ITEM 37.1, fuel oil, and water.* Replace fog oil barrel when contents drop to the 3-inch level. To insure uninterrupted operation, measure level of oil in barrel at least every 45 minutes. Refill gasoline and water tanks every 45 minutes. Check water strainer every 30 minutes. If strainer is oily, stop generator and clean strainer, water line, and feedwater regulator, washing all parts with dry-cleaning solvent or gasoline.

Note. Add this item to during operation service list on back of WD Form 48.

31. AFTER OPERATION SERVICES (Superseded).

a. After operation servicing is particularly important because at this time the operator inspects and services the generator to detect and correct any deficiencies first echelon personnel are authorized to handle, and to prepare it so it is ready for use at any time that it is needed. The before operation service, with a few exceptions, is necessary only to be certain that the equipment is in the same condition in which it was left upon completion of the after operation service.

b. When performing the after operation service, operator must remember and consider any irregularities noticed during the operation of the equipment.

c. The after operation services are to be performed after each day or 8 hours of operation. They consist of inspecting and servicing the following items according to the prescribed procedures. Those items marked with an asterisk (*) require additional services weekly or every 48 operating hours, whichever occurs first; the procedures for these services are given below in (*b*) of each applicable item.

(1) *ITEM 54, fuel, oil, and water.* Wipe gasoline tank filler cap clean and see that air vent hole is open. Fill tank with fuel and replace cap. Do the same with water tank. Check crankcase oil level and replenish with correct grade of engine oil (War Department Lubrication Order 3–381, latest issue) if needed to bring level to "F" mark on measuring stick. Check water strainer and clean if necessary. If strainer is oily, clean strainer. water line, and feed water regulator, washing all parts with dry-cleaning solvent or gasoline. Replace fog oil suction hose in metal loops on generator, taking care furnace assembly has cooled.

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(2) *ITEM 63, *accessories.* (*a*) Examine breather pipe, carburetor, exhaust pipe and preheater, spark plugs, flywheel housing, gasoline tank, water tank, gasoline pump, fog oil-water pump, blower fan and housing, burner, and thermostatic fuel valve to see that all are in good condition, clean, and secure.

(*b*) (Weekly.) Inspect engine spark plug and make necessary adjustments. To do this, detach cable (fig. 35) and remove spark plug, as shown in figure 36. If plug has become fouled, scrape off carbon with knife or sandpaper. Check gap with gauge issued to organizational motor mechanics. Gap should be .022 inch. Reset if necessary with motor mechanic's gauge. Do the same with burner spark plug, gap of which should be .060 to .065 inch.

(3) *ITEM 66, *fuel filters.*

Note. Under before operation services, these strainers are covered under item 3, fuel, oil, and water.

(*a*) Give handle of fog strainer a few turns, as shown in figure 33.

(*b*) (Weekly.) Drain fog oil strainer by removing drain plug on bottom. To force collected dirt and sludge out of sump of fog oil strainer, give handle a few turns while drain plug is removed. Remove gasoline and water strainers and wash screens with dry-cleaning solvent. (See fig. 19.)

(4) *ITEM 46, *electrical wiring.* (*a*) Examine all exposed wiring to see that it is in good condition, well supported, clean, and properly connected.

(*b*) (Weekly.) Clean all exposed wiring and shielding and see that all connections are secure.

(5) *ITEM 65, air cleaner.* Check air cleaner to see if it is excessively dirty; if it is, remove and clean with dry-cleaning solvent, dip in lubricating oil, and drain. Be sure cleaner is installed securely.

(6) *ITEM 73, leaks, general.* Examine entire equipment thoroughly for indications of fog oil, gasoline, lubricating oil, or water leaks.

(7) *ITEM 67, engine controls.* Examine engine, accessory controls, and linkage to see that they are in good condition, secure, and operating freely.

(8) *ITEM 82, *tighten.* (*a*) No daily tightening is required other than when inspection indicates looseness of accessories or mountings.

(*b*) (*Weekly.*) Check all engine mounting and base bolts; exhaust and intake manifold bolts; breather tube, carburetor, and gasoline pump bolts; burner mounting and thermostatic fuel valve bolts and tighten as required.

(9) *ITEM 55, engine operation.* Run engine and check speed. Adjust governor, if necessary, to give an engine speed between 3,500 and 3,700 revolutions per minute. (See par 64.)

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(10) *ITEM 85, tools and equipment.* See that funnel and tools are kept clean and readily available. Never put canvas cover back on generator until generator has cooled. Cover holds heat in and may cause gasoline fumes to ignite.

32. SECOND ECHELON PREVENTIVE MAINTENANCE (Superseded).

a. The numbers of the preventive maintenance procedures given in the chart which follows are identical with those outlined on WD AGO Form 461. Those items on the work sheet that do not apply to the M2 smoke generator are not included. In general, the numerical sequence of the items on the work sheet is followed in the chart, but in some instances there is deviation for conservation of the mechanic's time and effort.

b. Special services are directed by repeating the item numbers in the columns which indicate the interval at which the services are to be performed, and show the parts or assemblies which are to receive certain mandatory services. For example, an item number in one or both columns opposite a procedure marked "tighten" means that the actual tightening of the object must be performed. The special services are described as follows:

(1) *Adjust.* Make all necessary adjustments in accordance with the instructions available in publications pertinent to the equipment.

(2) *Clean.* Clean components and parts of the equipment indicated with dry-cleaning solvent, unless otherwise directed, to remove excess lubricant, dirt, and other foreign material. If parts have been removed from equipment, they should be rinsed in clean solvent or gasoline and dried thoroughly before installing. Be sure to keep parts clean until reassembled and installed. Clean the protective grease coating from new parts as this material is not a good lubricant.

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

(4) *Service.* This usually consists of performing certain operations such as draining and refilling units with oil and replenishing strainer material.

(5) *Tighten.* All tightening operations must be performed with sufficient force on the wrench handle (torque) to tighten the unit sufficiently to hold under jarring and vibration, but still not damaging threads or causing distortion. Tightening will always be understood to include the correct installation of lock washers, lock nuts, and cotter pins provided and necessary to secure the tightening.

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c. The procedures for performing operations for each item in the 96 operating hours or monthly schedule (whichever occurs first) and the 384 operating hours or 6 months schedule (whichever occurs first) are described in the following chart. Each page of the chart has two columns at the left; the first indicates 6-month maintenance, the second monthly maintenance. It will be found that a particular procedure may not be required at both intervals. To determine those procedures that are to be performed, follow the column corresponding to the maintenance interval that is due, and wherever an item number appears in that column, perform the operations indicated opposite that number.

d. The frequencies of preventive maintenance services outlined herein are considered a minimum requirement for normal operation of the equipment. Under *unusual* operating conditions, it may be necessary to perform the maintenance services more frequently.

384 Operating Hours or 6 Months	96 Operating Hours or 1 Month	
		RUNNING TEST
1	1	*BEFORE OPERATION SERVICE.* Perform before operation service as outlined in paragraph 29 to determine whether equipment is supplied with fuel, oil, and water, and to prepare it for running test.
9	9	*ENGINE.* Operate engine and listen for knocks, rattles, hums, and any other unusual noises that would indicate trouble. Notice any tendency to surge, stall, or miss. Be on the alert for any odors that might mean undesirable operation. Check the governed speed; it should be between 3,500 and 3,700 revolutions per minute; adjust governor if required. (See par. 64.)
10	10	*Unusual noises.* Be on the alert for any unusual noises that would indicate trouble in the engine; loose, damaged, or unsatisfactory operating accessories; or mounting bolts that need tightening.
14	14	*Leaks.* Examine the generator in general and all lines and connections to detect any signs of fuel, water, or oil leaks.
		MAINTENANCE OPERATIONS
18	18	*CYLINDER HEAD AND GASKET. Clean.* Remove cylinder head. Using a wire brush, remove deposits from cylinder head, valve faces, and valve seats. Inspect valve faces and seats and, if reconditioning or replacement is required, this operation should be performed at this time by authorized personnel. Examine head and block for cracks. If head gasket is not in good condition and usable, replace with a new one when reinstalling head.
18	18	*Tighten.* Tighten cylinder head nuts evenly and securely. Retighten cylinder head nuts after engine has been run.
19	19	*VALVE MECHANISM. Adjust.* Remove flywheel housing, cylinder head, and valve spring cover plate. This exposes valve spring chamber. Turn engine over until the piston is on top, or flush with top of cylinder, and both valves are closed. Try a thickness gauge between valve stem and valve lifter. Clear-

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ance should be .008 inch. To remove valve, pry up valve spring cap until the valve pin is exposed; remove pin with long-nosed (brake spring) pliers. In replacing valve, be sure that the pin does not tip the valve cap and spring. While checking valve clearance, it is advisable to grind in the valves to assure a perfect seating. (Never use a coarse grinding compound.) To check the valve timing, it is necessary to remove the magneto and the front bearing plate. This exposes crankshaft and cam gear. The indicator or punch marks on the gear must come together or mate when the piston is on top dead center or flush with top of cylinder.

63 | 63 *ENGINE* (mountings). Check all engine mounting and base bolts; exhaust and intake manifold bolts; breather tube, carburetor, and gasoline pump bolts and tighten as required.

20 | 20 *SPARK PLUGS. Clean.* Remove shields from spark plugs, disconnect cables, and remove spark plugs. Clean plugs by washing in gasoline, carefully removing any carbon or lead deposit with a knife. Replace plugs if insulators are cracked or damaged, or if electrodes are badly eroded. Send all used or replaced plugs to higher echelon of maintenance.

81 | 81 *WIRING AND CONDUITS.* Inspect all spark plug shields and all ignition connections, wire, and conduits for damage.

20 | 20 *Adjust.* Set electrode gaps of engine plug at .022 inch and those of burner plug at .060 to .065 inch. Install plugs (using new gaskets), wiring, and shields, making certain all connections are cleaned and secure.

31 | 31 *MAGNETO.* Adjust breaker points as directed in paragraph 46, clean points, lubricate cam, and test magneto as directed in paragraph 47.

33 | 33 *MANIFOLDS.* Observe the intake and exhaust manifolds and breather tube to see that they are in good condition, secure, and that manifold gaskets appear to be in good condition and not leaking.

33 | *Tighten.* Tighten all manifold and breather tube nuts.

84 | 84 *EXHAUST PIPE.* Examine exhaust pipe to see that it is in good condition and not clogged.

34 | 34 *AIR CLEANER. Clean and service.* Remove carburetor air cleaner and see that gasket and cleaner are in good condition. Wash air cleaner thoroughly in dry-cleaning solvent, dip in clean lubricating oil, and drain. Reinstall cleaner, using new gasket if used one is damaged.

34 | 34 *Tighten.* Tighten connecting bolts evenly and securely.

36 | 36 *CARBURETOR* (choke, linkage, and governor). See that these items are in good condition, correctly assembled, and securely installed. Examine particularly the governor to see that it operates freely and that none of the other connections of the governor to carburetor linkage are binding.

37 | 37 *GASOLINE STRAINER, WATER STRAINER, FOG OIL STRAINER, BURNER VALVE, AND LINES.* Inspect piping to see that it is in good condition and that connections are tight and not leaking.

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384 Operating Hours or 6 Months	96 Operating Hours or 1 Month	MAINTENANCE OPERATIONS—Continued
37	37	*Clean.* Remove gasoline and water strainers and wash parts with dry-cleaning solvent. If water strainer is oily, clean water lines, water tank, and feed water regulator, washing all parts with dry-cleaning solvent or clean gasoline. Clean fog oil filter by removing drain plug and turning handle. Remove burner valve and wash in dry-cleaning solvent or gasoline.
38	38	*PUMPS.* Inspect pumps for leaks. Be sure that they are in good condition and securely mounted.
82	82	*TANKS AND FITTINGS.* Inspect gasoline and water tanks to see that they are in good condition and securely mounted. Examine filler caps for plugged vents. Be certain tanks do not leak.
39	39	*READY-PULL STARTER.* Inspect to see that ready-pull starter is in good condition and serviceable. Start engine and observe ease of starting.
40	40	*LEAKS.* Examine the entire equipment for indications of leaks that might result from the servicing. Trace any leaks to source and correct or report them. Tighten cylinder head nuts after engine is warm.
42	42	*CARBURETOR.* If unsatisfactory operation is observed, adjust carburetor as directed in paragraph 54.
29	29	*DRIVE BELT* (pump drive chain). *Inspect.* Inspect thoroughly, and make necessary minor repairs in case of breakage or wear verging on breakage.
29	29	*Lubricate.* Lubricate chain as directed in War Department Lubrication Order 3–381, latest issue.
131	131	*TOOLS.* Inspect all tools for damage and request replacements as needed.
135	135	*PUBLICATIONS AND FORMS.* Make certain sufficient copies of this manual are on hand and that manual has been corrected in accordance with published changes received. Check available stock of WD Forms 48 and 461, ordering additional forms as needed.

Figure 37, page 34, is rescinded.

Figure 38, page 34, is rescinded.

33. GENERAL.

* * * * * * *

c. Precaution. Rescinded.

34. ENGINE TROUBLES.

a. Engine hard to start:

Possible cause	*Possible remedy*
* * *	* * *
(12) No gasoline at carburetor.	Check tank and gasoline pump delivery.

* * * * * * *

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d. Engine lacks power:

Possible cause	*Possible remedy*
* * *	* * *
(5) (Added.) Dirty burner.	Remove and wash with dry-cleaning solvent.

* * * * * * *

g. Backfire through carburetor or gasoline intake manifold:

Possible cause	*Possible remedy*
* * *	* * *

(5) Rescinded.

35. OTHER TROUBLES.

a. Wet smoke. (1) *Possible causes.* When insufficient gasoline reaches burner, inadequate fire results, and wet smoke **(indicated by emergence of particles of fog oil from discharge nozzles, yellow smoke, "drooling" at nozzles, and lack of clear jet at nozzles) emerges.** Possible causes of * * * their remedies are:

* * * * * * *

(2) *Check.* When wet smoke * * * position (fig. 15). If, while holding lever up, fire in combustion chamber comes on higher, causes (a) through (d) above are ruled out and it is likely that cause (e) __ too small a gap __ **or cause (*f*) __ loose box __** is responsible for trouble.

b. No smoke.

* * * * * * *

Possible cause	*Possible remedy*
* * *	* * *
(9) Engine speed incorrect.	**Adjust as directed in paragraph 64.**

* * * * * * *

* * * * * * *

47. MAINTENANCE OF MAGNETO ASSEMBLY. (Second echelon only.)

a. Cleaning. In addition to * * * which become dirty. To do this, disassemble flywheel housing and flywheel (par. 38), and scrape points with a **contact point dresser (41–D–1410).**

* * * * * * *

64. DETERMINATION AND ADJUSTMENT OF ENGINE SPEED (Superseded).

a. Check. For successful operation, the speed of the generator engine must be kept between 3,500 and 3,700 revolutions per minute. If a tachometer (revolution counter) is available, measure speed of

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engine with tachometer and adjust accordingly. If a tachometer is not available, speed of engine can be determined by either of the two following methods:

(1) *By sound.* An experienced man can judge whether an engine is revolving at approximately the correct speed by the sound of the engine. All generator operators should acquire this skill.

(2) *By rate of fog oil consumption.*

Note. Use this method only when absolutely necessary.

(*a*) When the generator is making smoke, it should consume 5 gallons of fog oil every 6 minutes. To obtain correct engine speed, adjust governor as directed below so that this rate of fog oil consumption is maintained.

(*b*) When it is desirable to check engine speed without making smoke, break the inlet line (piping between fog oil-water pump and coil assembly) at the union nearest the coil assembly. Direct long end of broken piping into a 5-gallon can. Run engine without operating burner. If approximately 5 gallons of fog oil are pumped into can in 6 minutes (or 1 gallon in 70 to 75 seconds), engine speed is correct.

b. Adjustment (fig. 65). To adjust speed of engine, alter position of governor as follows:

(1) If engine is underspeeding, increase the spring tension on the governor throttle lever by moving the speed adjusting lever toward

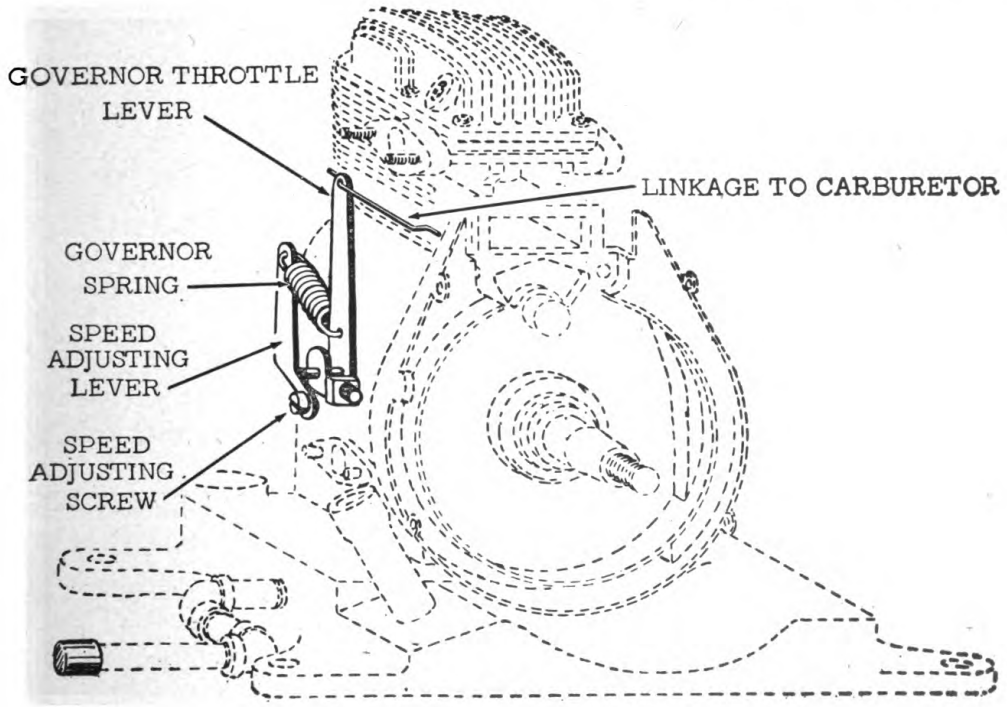


Fig. 65. Governor mechanism

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the blower. (Loosen speed adjusting screw to move lever; tighten when lever is in proper position.)

(2) If engine is overspeeding, decrease the spring tension of the governor throttle lever by moving the speed adjusting lever away from blower. (Loosen speed adjusting screw to move lever; tighten when lever is in proper position.)

75. GENERAL.

* * * * * * *

b. Description and functioning.

* * * * * * *

(2) (Superseded.) At the same time, the blower fan is circulating air in the air casing of the furnace assembly. Part of this air swirls from casing into combustion chamber through a series of ducts; part of it flows from casing into burner air duct and tube, where it mixes with incoming gasoline which has been partly vaporized by heat of the engine exhaust.

* * * * * * *

88. ADJUSTMENT OF THERMOSTATIC FUEL VALVE (Superseded). **(Second echelon only.)**

a. When to adjust. The appearance of "wet" smoke or smoke that is "too hot" can frequently be remedied by cleaning the water system thoroughly or by adjusting the engine speed. Should these remedies prove inadequate, adjust the thermostatic fuel valve.

b. Position of box. See that the thermostatic fuel valve box is firmly seated against the shoulder of the packing box and that the two set screws are tight. Looseness or incorrect position of the box may be the cause of the trouble. Care must be taken that the box is replaced properly following removal.

c. Looseness of stem. See that the valve stem is free and easily moved with the fingers.

d. Carbon. Check element button for carbon deposit, as this causes sticking. If necessary, remove button, eliminate carbon by scraping carefully with a knife, wash button in dry-cleaning solvent or gasoline, and replace.

e. Adjustment of gap. (1) A gap equal to the thickness of the thermostatic fuel valve gauge (about ⅛ inch) between the adjusting screw and the valve stem gives a safe operating temperature. To adjust screw, loosen lock nut and turn as required.

(2) To correct "wet" smoke, slowly increase the gap between adjusting screw and valve stem while the generator is making smoke.

(3) To correct "too hot" smoke, slowly reduce the gap between adjusting screw and valve stem while the generator is making smoke.

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f. Check. Check results by observing length of the clear jet (should be 3/8 inch to 1/2 inch) and by passing hand through smoke about 8 to 12 inches from nozzles of smoke discharge manifold. If smoke is at proper temperature, it will slightly moisten the hand.

APPENDIX

Section I. SHIPMENT AND STORAGE

1. PREPARATION FOR SHIPMENT BY USING PERSONNEL.

* * * * * * *

b. Rescinded.
c. Rescinded.
d. Rescinded.

* * * * * * *

Section II. LIST OF REFERENCES (Superseded)

Tactics of Chemical Warfare.	FM 3–5
Supply and Field Service.	FM 3–15
Large Area Smoke Screening.	FM 3–50
Electrical Fundamentals.	TM 1–455
Mechanical Smoke Generator M1 (100-gallon).	TM 3–380
Cleaning, Preserving, Sealing, Lubricating and Related Materials Issued for Ordnance Matériel.	TM 9–850
Motor Vehicle Inspections and Preventive Maintenance Services.	TM 37–2810
Fuels and Carburetion.	TM 10–550
Headquarters and Headquarters Detachment, Chemical Smoke Generator Battalion.	T/O & E 3–266S
Chemical Smoke Generator Company.	T/O & E 3–267

Army Service Forces, Chemical Warfare Supply Catalog CW 7–217122, Generator, Smoke, Mechanical, M2 (50 Gallon).

Note. For further references and for up to date information on status of above list, consult latest FM 21–6. For visual training aids consult latest FM 21–7.

Section III. ACTION IN EVENT GENERATOR CATCHES ON FIRE (Added)

1. GENERAL.

Dirt on the generator or in any of its systems is a definite fire hazard. To prevent fires, KEEP THE GENERATOR CLEAN.

2. FIRE AT NOZZLES.

When fire appears at nozzles of smoke discharge manifold, promptly put the fog valve lever in the OFF position, *but do not stop the engine*

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or the burner. The fire will shortly blow itself out; when it does, check and clean the water system thoroughly. When restarting, check thermostatic fuel valve to correct improper adjustment or the delivery of too much gasoline to the burner. Too much gasoline may cause flames to appear at top of flue pan.

3. BURNED OUT COIL.

Black smoke will be seen at the flue pan for some time before coil assembly completely burns out. When black smoke continues to emerge, failure of generator can be expected. When flame appears at the flue pan, promptly put fog valve lever in OFF position (or remove fog oil suction hose from drum) and turn off the burner. Do not stop the engine, as its continuing operation will help blow out the fire. Extinguish flames with any available means, such as fire extinguisher, dirt, or sand. If fog oil is shut off quickly, the fire usually burns out in 1 to 2 minutes with no damage to the generator.

4. OTHER TYPES OF FIRE.

If fires arise from sources other than those discussed above, extinguish them by the best means available.

[AG 300.7 (19 Feb 45)]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL
Chief of Staff

OFFICIAL:
J. A. ULIO
Major General
The Adjutant General

DISTRIBUTION:

AAF (5); AGF (Cml O) (10); ASF (5); T of Opns (Cml O) (10); Def Comd (Cml O) (4); Arm & Sv Bd (1); S Div ASF (1); Tech Sv (2); SvC (Cml O) (2); PE (Cml O) (2); Sub PE (Cml O) (1); HD (1); Ars 3 (1); ASF Dep (CW Sec) (1); Dep 3 (1); Pro Dist 3 (1); Tech SvC (1); Gen & Sp Sv Sch (CW Instr) (2); USMA (2); Tng C (1); A (Cml O) (4); CHQ (Cml O) (4); D (1); B (1); Bn 3 (1); AF (Cml O) (1); T/O & E 3-47 (4); 3-67 (1); 3-137S (2); 3-117 (1); 3-266S (4); 3-267 (10); 3-418 (2); 3-500 (Types AI, AJ, BA, BC, BD, CA, CB, CC) (1); 9-7 (1); 9-9 (1); 9-37 (1).

Refer to FM 21-6 for explanation of distribution formula.

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TM 3–381
C 2

TECHNICAL MANUAL

GENERATOR, SMOKE, MECHANICAL, M2 (50 GALLON)

CHANGES No. 2

WAR DEPARTMENT
WASHINGTON 25, D. C., 27 July 1945.

TM 3–381, 15 June 1944, is changed as follows:

PART FOUR (Added)

AUXILIARY EQUIPMENT

Section XIX. GENERAL

108. SCOPE.

Part Four contains information necessary for guidance of using personnel in identifying, connecting, and taking care of auxiliary equipment. The auxiliary equipment is issued for use by the operations section of each smoke generator company.

Section XX. SKID, BARREL, 10–FOOT, M1

109. DESCRIPTION AND FUNCTIONING.

The 10-foot barrel skid M1 (fig. 81) is used for moving 55-gallon drums up to or down from elevations. It consists of ~~two~~ 1¾ inch by 3¾-inch wooden side rails (width between side rails is 12½ inches) and

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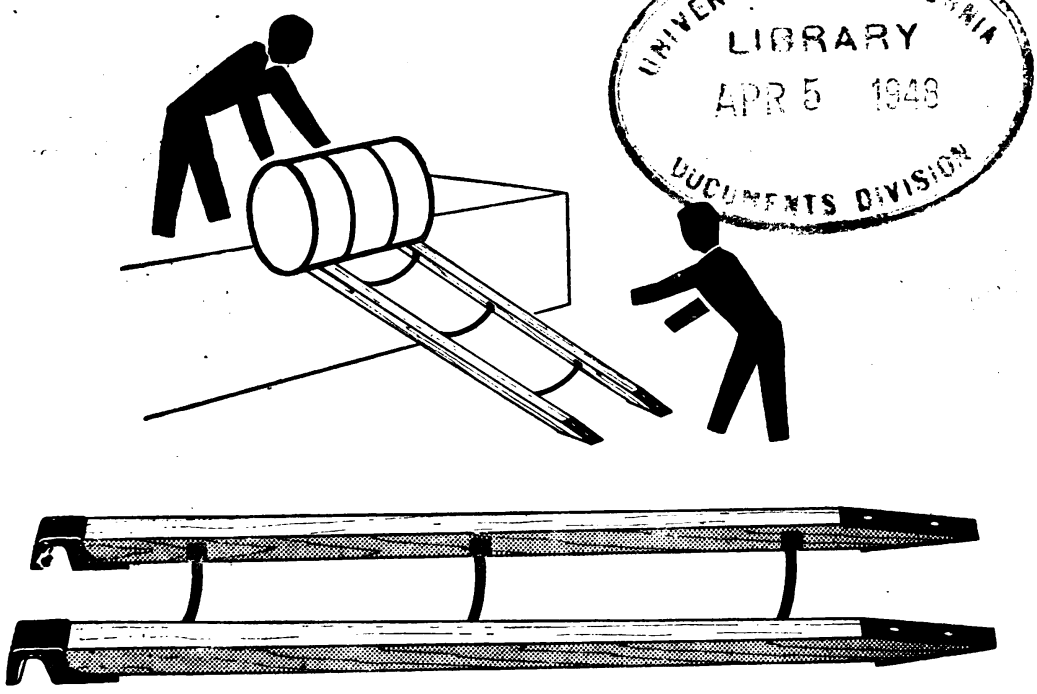


FIGURE 81.—Skid, barrel, 10-foot, M1.

AGO 1819C—July 657609°—45

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three steel cross bars. The 10-foot wooden side rails are provided with tapered steel shoes at the bottom end and steel hooks at the top end. Skid weighs 53 pounds and is shipped completely assembled.

Section XXI. STAND, BARREL, M7

110. DESCRIPTION AND FUNCTIONING.

The barrel stand M7 (made of pressed steel) is used to lift and drain 55-gallon drums of gasoline, water, and on occasion fog oil (fig. 82). Stand has two longitudinal side rails and two cross bars which are curved to accommodate the 55-gallon drum. The rear legs are curved to connect to the front legs and form the base of the stand. The curved base permits tilting the drum to a horizontal position and lifting it to a height of about 18 inches above the ground. The stand weighs 27½ pounds and is completely assembled when shipped. The standard 5-gallon can fits easily under the faucet. Stand can be tilted forward to drain the drum completely.

Section XXII. FUNNEL M3

111. DESCRIPTION AND FUNCTIONING.

The funnel (fig. 83) used to fill the 55-gallon drum is 13 inches high and about 14 inches in diameter at the mouth. Spout is 4 inches long and almost 2 inches in diameter. A steel sieve (4 x 4 mesh) is soldered about 3 inches deep in the mouth of the funnel.

Section XXIII. FAUCET, OIL, 2-INCH, M1

112. DESCRIPTION AND FUNCTIONING.

The oil faucet (fig. 84) completely drains the oil from the 55-gallon drum in approximately 3 minutes. Faucet consists of a faucet body and a spring-actuated valve mechanism. Oil flows from the faucet when the handle is lifted up. When handle is down, pressure is released and spring causes valve to seat automatically, thus shutting off the flow of oil. A pipe wrench or money wrench with a 2½-inch bite is required to fit the threaded end of the faucet into the large bung on the drum. A screw driver is the only tool required to assemble and disassemble the simply constructed faucet.

Section XXIV. CARE OF AUXILIARY EQUIPMENT

113. Clean auxiliary equipment before and after use; inspect it carefully every 2 weeks. Oil metal parts regularly to prevent corrosion.

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FIGURE 82.—Stand, barrel, M7.

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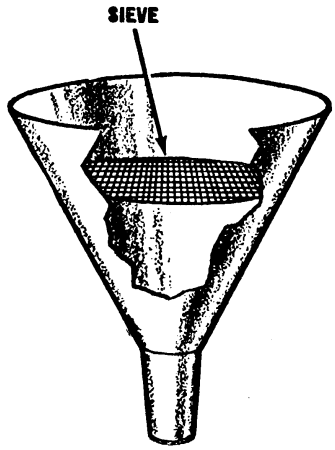
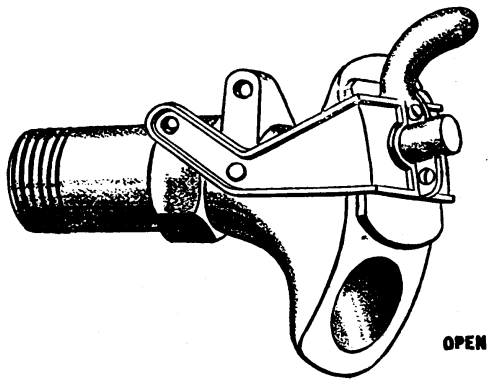


FIGURE 83.—Funnel M3.



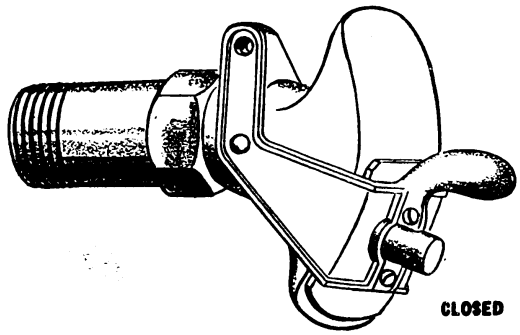


FIGURE 84.—Faucet, oil, 2-inch, M1.

[AG 300.7 (29 Jun 45)]

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Official:
EDWARD F. WITSELL
Major General
Acting The Adjutant General

G. C. MARSHALL
Chief of Staff

Distribution:

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Refer to FM 21-6 for explanation of distribution formula.

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War Department Technical Manual
TM 3-381

GENERATOR, SMOKE, MECHANICAL, M2

(50 Gallon)

RESTRICTED

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War Department - 15 June 1944
Washington, D. C.

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WAR DEPARTMENT,

Washington 25, D. C., 15 June 1944.

TM 3-381, Generator, Smoke, Mechanical, M2 (50 Gallon) is published for the information and guidance of all concerned.

[A. G. 300.7 (17 Dec 43)]

By order of the Secretary of War:

G. C. MARSHALL,
Chief of Staff.

Official:

J. A. ULIO,
Major General,
The Adjutant General.

Distribution:

Armies(10); Corps(10); Sv C(10); Depts(10); Def Comds(2); D(2); B(2); Bn 3(2); IC 3(10), (4), (2); IC 9(2); Tech Sv (2).

IC 3(10): T/O 3-267, Chem Smoke Gnr Co; IC 3(4): T/O 3-47, Chem Maint Co; 3-67, Chem Dep Co; 3-418, Chem Dep Co, Avn; IC 3(2): T/O 3-500, Chem Composite Co; IC 9(2): T/O 9-7, Ord M M Co; 9-9, Ord H M Co, FA; 9-37, H M Co, Tk.

(For explanation of symbols, see par. 26, FM 21-6.)

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999th CHEMICAL COMPANY (S.G.)

Daily Maintenance Record for Mechanical Smoke Generator No. 8

Operator Pfc C.D. Karlsruher (Hours on Duty 0700-1500)

Operator _____ (Hours on Duty _____)

Mechanic Sgt. R.H. Elder (Hours on Duty 1300-1600)

OPERATION					SERVICES PERFORMED			
Hour	Run	Fuels Consumed in Gallons: Fog oil	Gasoline	Water	Magneto	Crankcase	Engine Combustion Chamber	Other Parts
0100								
0200								
0300								
0400								
0500								
0600								
0700								
0800								
0900	✓	49	6	6				
1000	✓	50	5	6				
1100	✓	51	5	6				
1200								
1300					Breaker Cam Oiled		Carbon Removed Valves Oiled	Thermostatic Fuel Valve Cleaned
1400					Condenser and Coil Replaced	Drained and Refilled		Pump Drive Chain Oiled
1500					Breaker Pts Adjusted			Spark Plugs Checked Air Cleaner Drained and Refilled
1600								
1700								
1800								
1900								
2000								
2100								
2200								
2300								
2400								
Total Hrs of Operation	3							

Fig 1. Maintenance chart.

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PART ONE
INTRODUCTION

Section I GENERAL

1. SCOPE.

a. This manual is published for personnel to whom the generator, smoke, mechanical, M2 is assigned for use. It is arranged in three parts: Part One, "Introduction;" Part Two, "Operating Instructions;" and Part Three, "Maintenance Instructions." It contains instructions covering maintenance and operating procedures for which using personnel are responsible, together with brief descriptions of major parts of the generator, their functions, and their mechanical relationship.

b. Instructions for shipment and storage and a list of references are given in the appendix.

2. RECORDS.

Using personnel charged with day-by-day upkeep of generators are required to prepare and use a maintenance form on the order of the sample daily maintenance record shown in figure 1.

Section II DESCRIPTION AND DATA

3. GENERAL.

a. Major groups. The parts of the mechanical smoke generator M2 (shown in figures 3, 4, 5, 6, and 7) fall into three major groups: power group, heating group, and smoke-fuel group. Main components of the power group are engine and ignition system. Main components of the heating group are furnace assembly, burner, burner valve, thermostatic fuel valve, and blower. Main components of the smoke-fuel group are fog oil-water pump, fog valve, and feed water regulator. Detailed discussion of essential parts of these three major groups is contained in paragraphs 36 through 107.

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b. Use. M2 generators are used, alone or in conjunction with other smoke-making devices, to produce large area smoke screens, tactics and characteristics of which are covered in FM 3-50. The Table of Organization and Equipment for chemical smoke generator companies provides for mounting generators on 1/4-ton trucks and 1/4-ton trailers. The generator may also be mounted on the ground (fig 2), or in a boat. Movement of unit in operation does not impair its efficiency.

c. Performance. Forty-eight M2 generators, minimum complement used in majority of large area screening operations, can place an obscuring blanket of smoke over an area approximately 2-1/2 miles wide, the obscuring screen ranging from 8 to 15 miles or more, depending on terrain and weather conditions.

d. Characteristics. Specifications for generator and engine by which it is powered are given in figures 3 and 4.

e. Liquids. Operation of generator calls for four liquids: gasoline, water, engine oil, and fog oil. (Fog oil is also called special oil or SGF.) Gasoline is used to fuel both engine and burner. Engine oil is used to lubricate the engine. Water and fog oil are the ingredients from which the smoke is formed. Gasoline and water are carried in the two 6-gallon tanks comprising base of generator, the gasoline tank being located under engine, the water tank under furnace assembly. Fog oil is not carried on the generator but is drawn into the flow system from an outside source, normally a 55-gallon drum as shown in figure 2. The gasoline

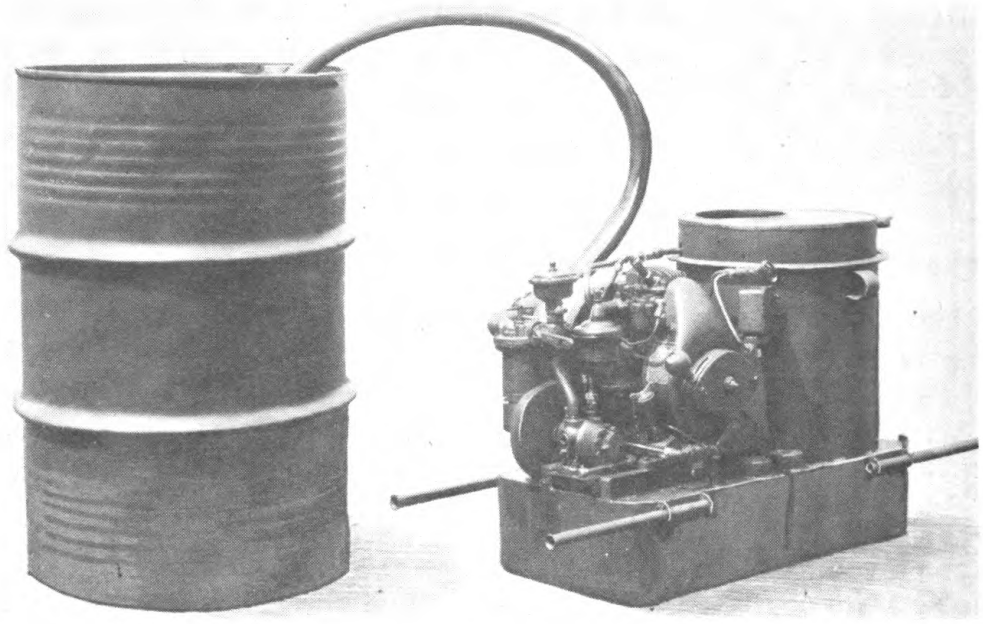


Fig 2. Mechanical smoke generator M2 set up for use with fog oil supply (55-gallon drum).

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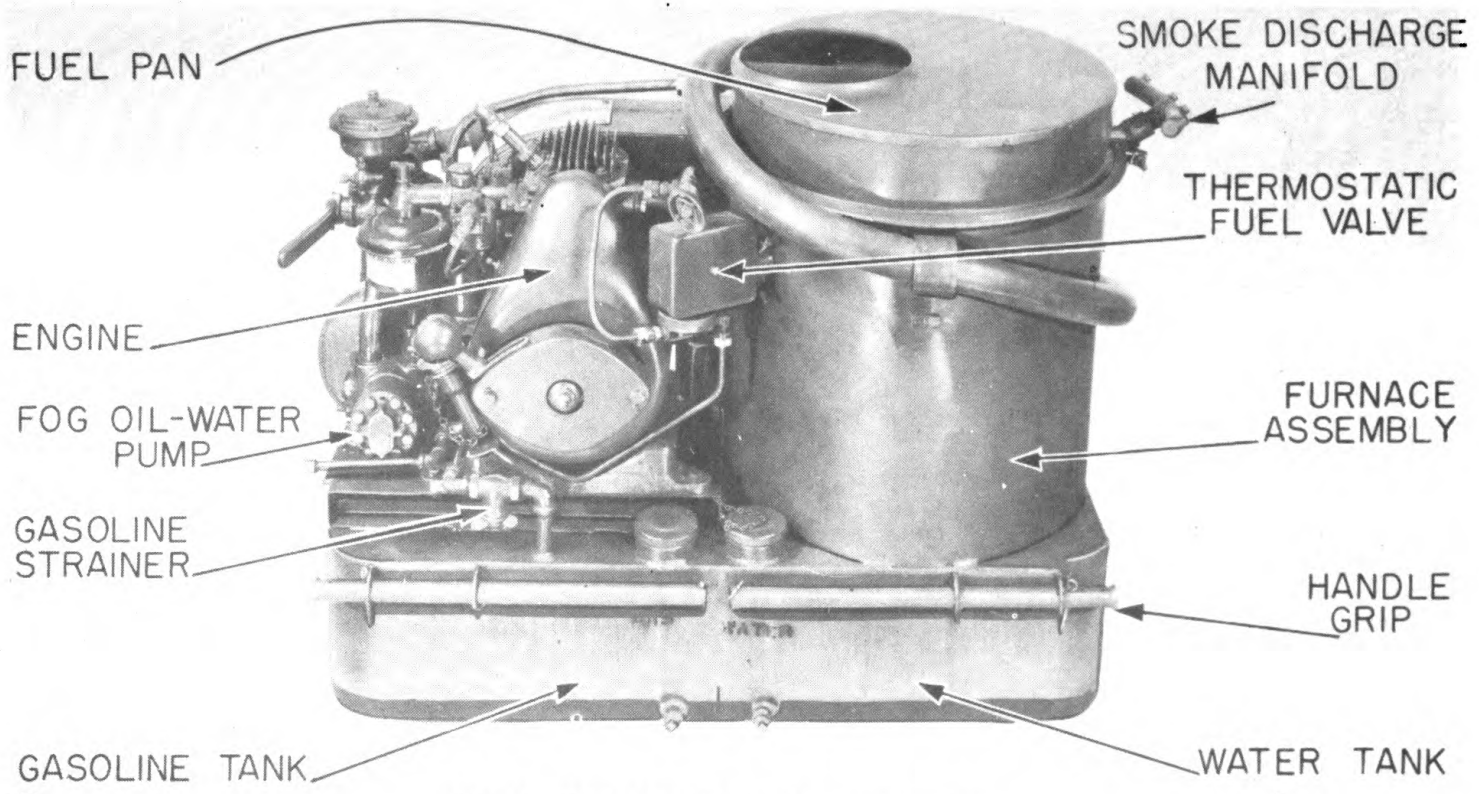


Fig 3. Specifications for generator.

	Net weight	180 lb	Length	33-1/2 in	Gasoline consumption	5 gal per hour
	Weight, all tanks filled	266 lb	Height	23-1/2 in	Water capacity	6 gal
	Width	19-1/2 in	Gasoline capacity	6 gal	Water consumption	5 gal per hour

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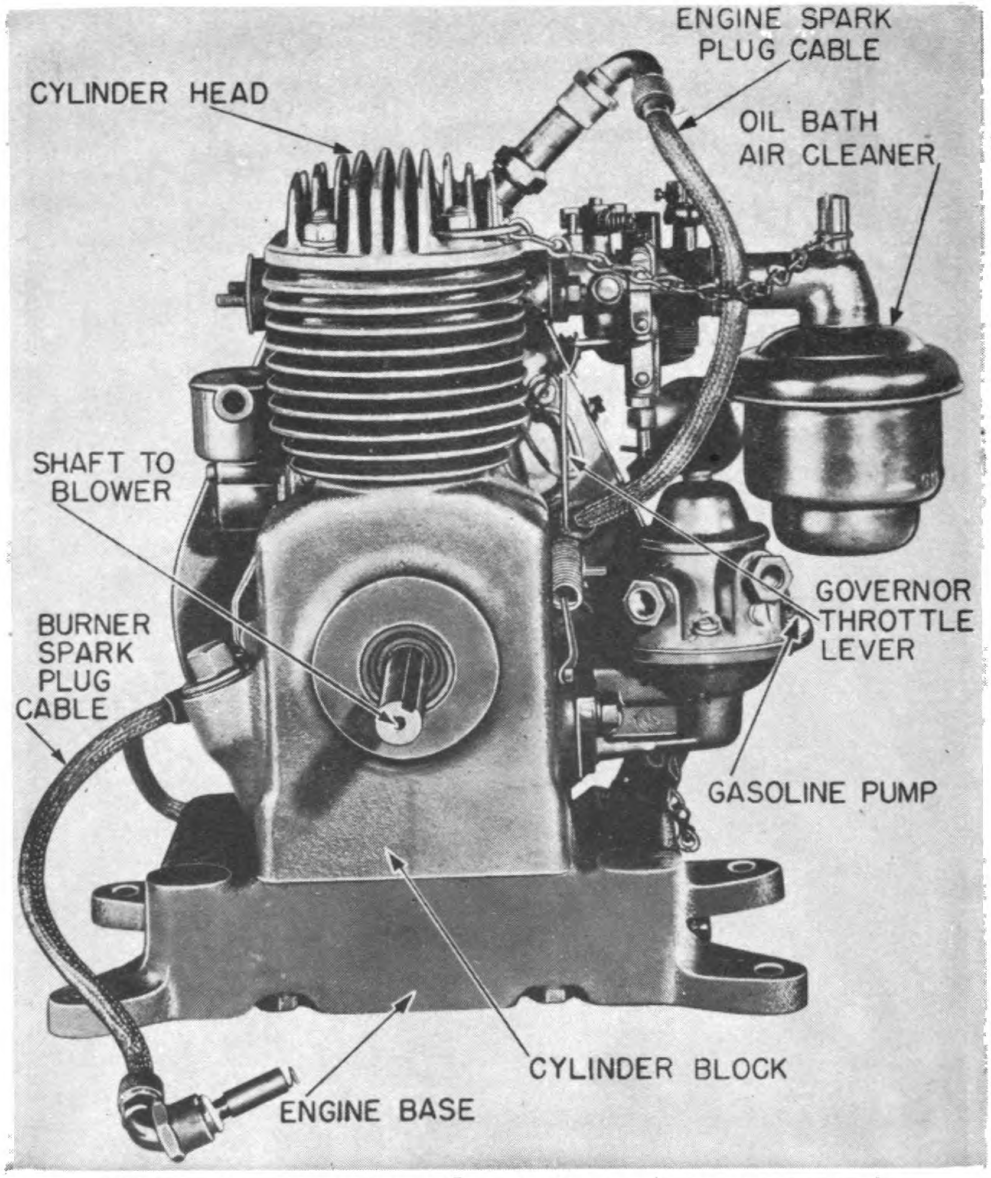


Fig 4. Specifications for engine used in generator.

Engine type	**1 cylinder, 4 cycle, upright, air-cooled, internal combustion,** with built-in magneto, cranked by hand with ratchet cable starter
Crankcase oil capacity	1 qt
Weight	34 lb
Ignition	WICO Magneto No. FW 1647
Spark plug	Champion C-10-S-Gap .020 in
Horsepower	1.5 at 3,600 revolutions per min
Compression ratio	5:1
Piston displacement	5.9 cu in

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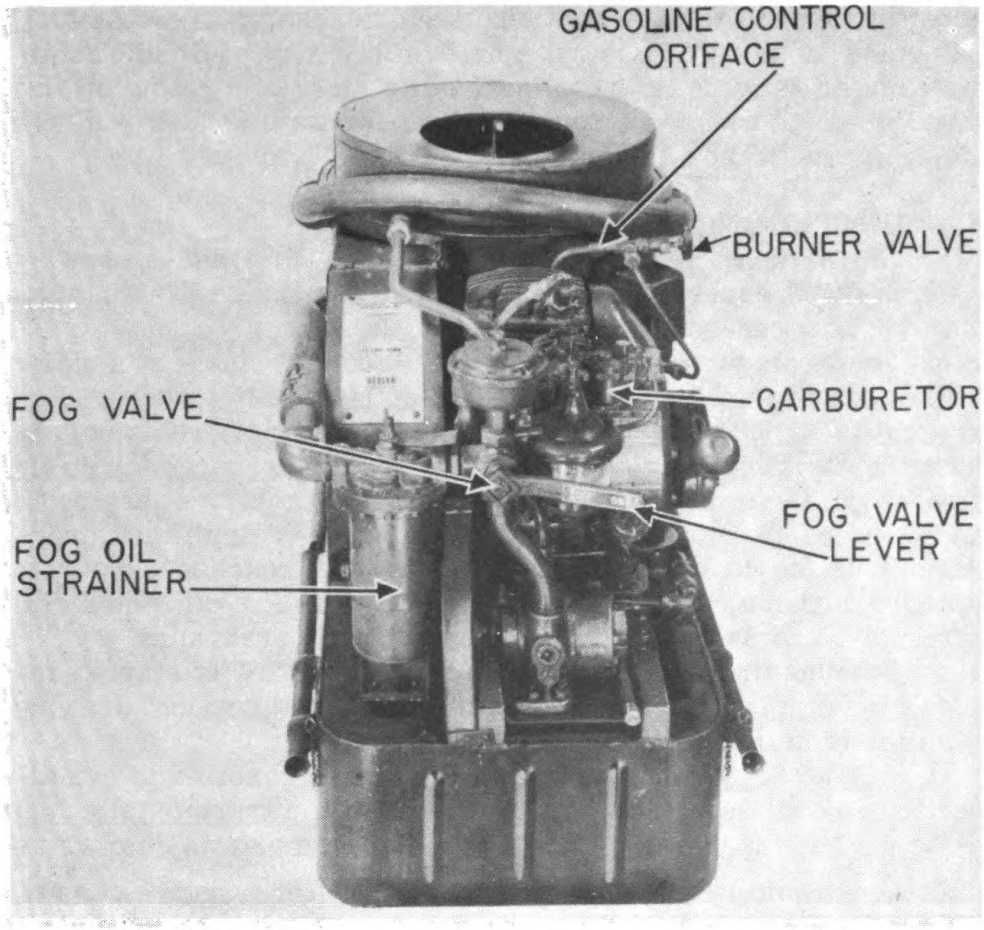


Fig 5. Smoke generator M2 (fog valve side).

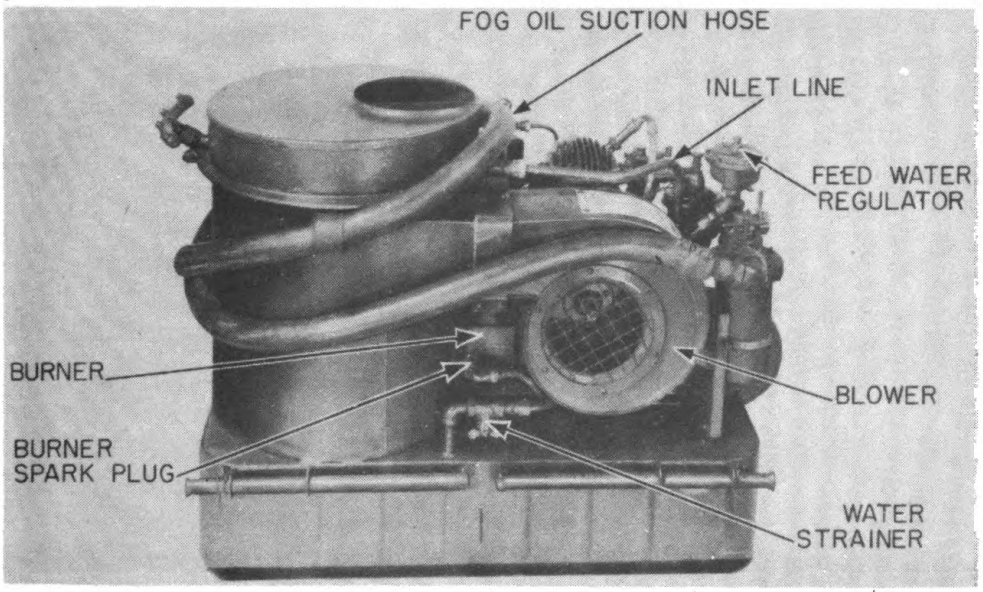


Fig 6. Smoke generator M2 (blower side).

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normally issued for all-weather use in generator is motor fuel, 80 octane, with a TEL (tetryl ethyl lead) content of 3 cubic centimeters per gallon. No gasoline having an octane rating of less than 76 should be used. Specifications for water and fog oil are given in paragraphs 17 and 18.

4. FUNCTIONING.

a. Illustrations. Reference to figures 3, 4, 5, 6, and 7, showing main parts of generator, and to flow chart in figure 8, aids in explaining how generator functions.

b. Smoke production. The generator produces smoke by forcing a mixture of fog oil and water into the coil assembly where a fire in combustion chamber, in which the coil assembly rests, vaporizes the two liquids. Through the smoke discharge manifold attached to the coil, the vapor escapes into the air, where rapid chilling condenses it into a white fog composed of tiny liquid droplets. This fog is the smoke. How gasoline reaches burner to produce necessary fire, and how water and fog oil reach coil assembly, are described in the following subparagraphs.

c. Gasoline flow. (1) Suction. When the engine is started, the gasoline pump, which is part of engine, produces suction, drawing gasoline from its tank to pump.

(2) Discharge. The pump discharges the gasoline in two directions -- to the engine carburetor and to the thermostatic fuel valve. When the generator is cold, the thermostatic fuel valve

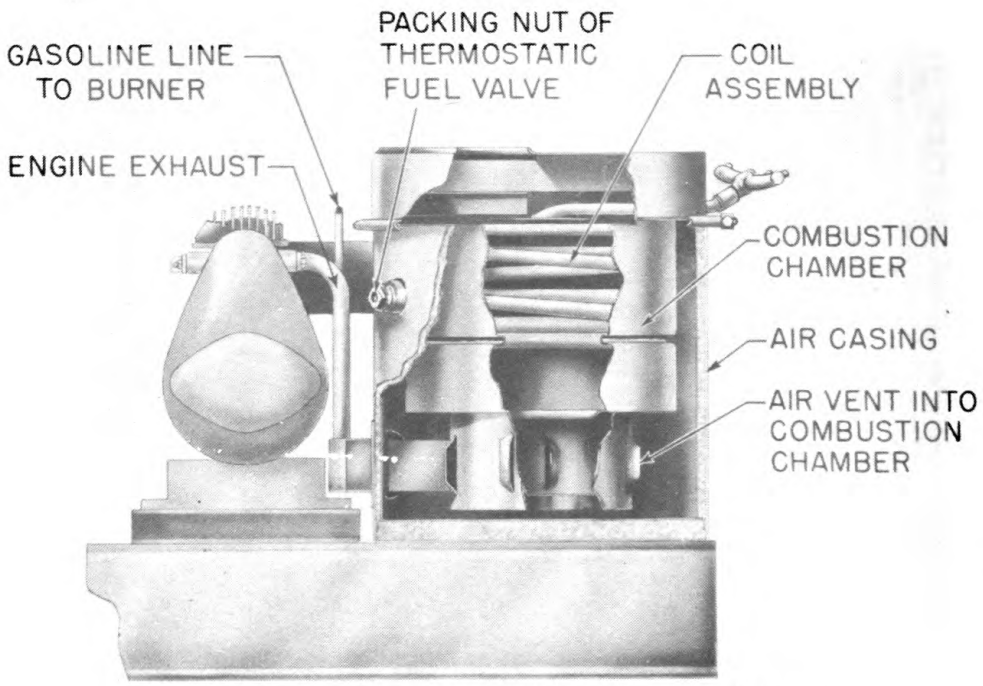


Fig 7. Sectionalized view of generator.

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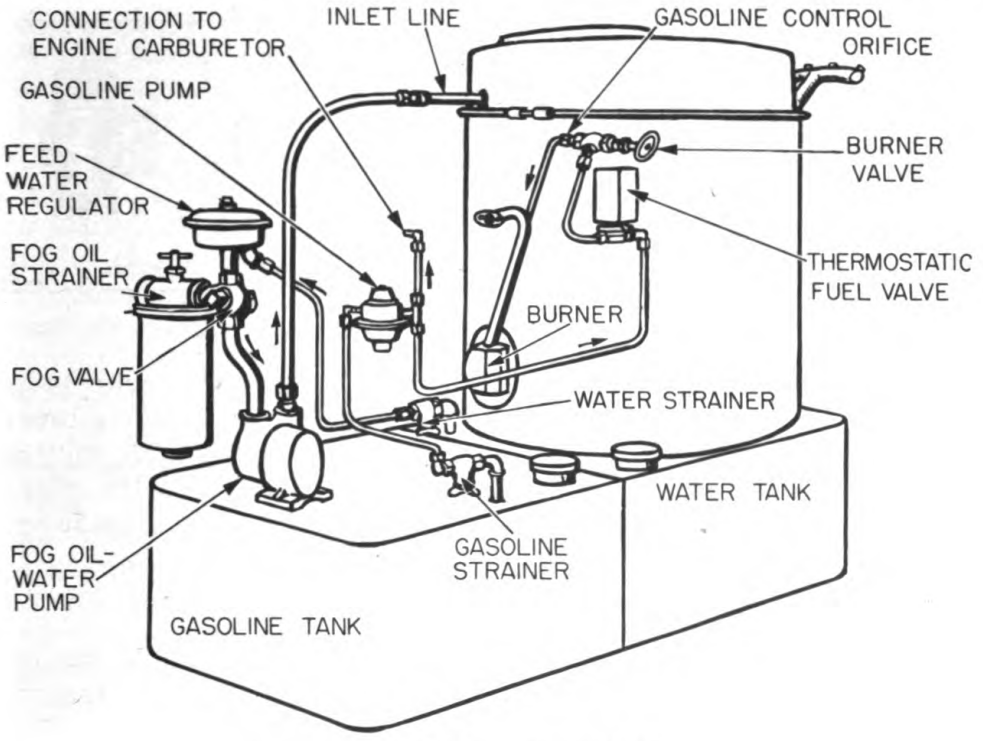


Fig 8. Flow chart.

is completely open and there is free passage to the burner valve. When the burner valve is opened, the gasoline flows through the gasoline control orifice (which limits the amount of gasoline for full fire), and then on to the burner, where it is mixed with air and ignited by the burner spark plug to produce fire in combustion chamber.

d. Water flow. (1) Suction. When the engine is started, the fog oil-water pump produces suction with the result that water is drawn from its tank through an orifice located in the elbow entering feed water regulator. The water leaves regulator through an outlet in the base of regulator and flows through fog valve to the pump. (The regulator is kept open by a spring, but when the suction increases to 1 pound per square inch, the regulator diaphragm is acted on by the suction and compresses the spring, partly closing the regulator. This action prevents an oversupply of water by maintaining a constant suction in the feed water regulator.)

(2) Discharge. From the pump, the water is discharged through the inlet line to coil assembly.

e. Fog oil flow. (1) Control. Flow of fog oil is controlled by the fog valve. The valve, diagrammed in figure 9, is an ordinary three-way plug cock which has been altered by cutting of a small groove in the body, so that when the lever of valve is in OFF position, it is still possible for water to pass through valve itself to pump and inlet line.

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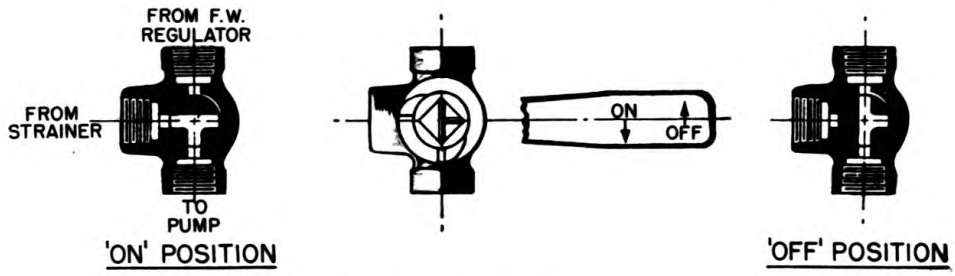


Fig 9. Fog valve.

(2) Suction and discharge. So long as fog valve lever is in OFF position, only water flows through fog oil valve. When lever is placed in ON position, fog oil, drawn through fog oil suction hose, is also admitted and flows through the valve to the pump together with the water. The pump then mixes the two liquids and forces them through inlet line to coil assembly.

5. IDENTIFICATION.

a. Types. The M2 generator is one of two mechanical smoke generators used by the U.S. Army, the other unit being designated as generator, smoke, mechanical, M1 (100 gallon) (fig 10). Operation and maintenance instructions for the M1 generator are given in TM 3-380.

b. Similarity. The smoke-making principle of the two units is identical, each producing a highly persistent white fog formed by vaporization of fog oil and water.

c. Differences. Differences in size and structural arrangement of the generators can be seen by comparing the picture of the M1

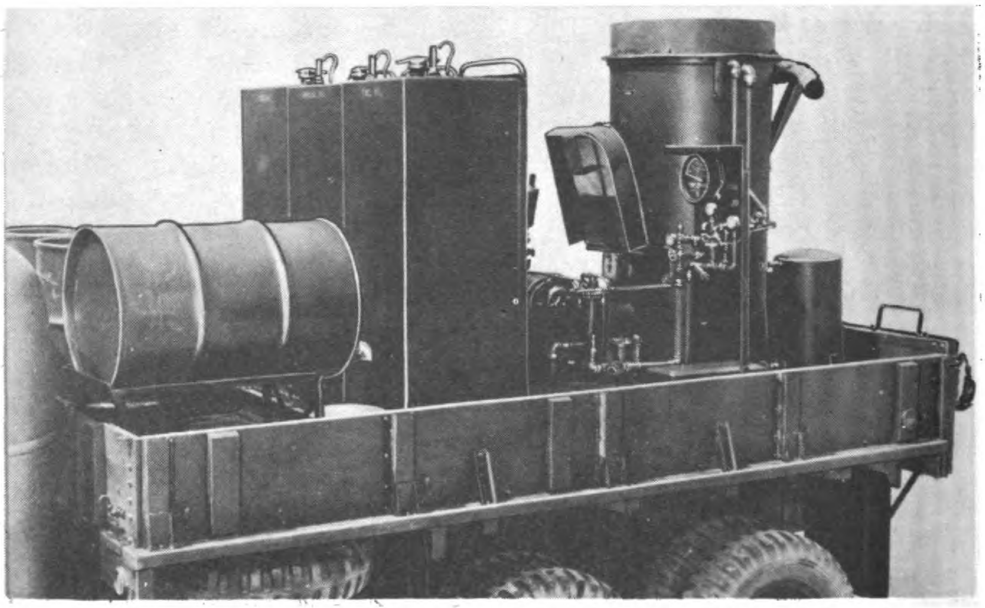


Fig 10. Mechanical smoke generator M1 (100 gallon).

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in figure 10 with pictures of the M2. Completely fueled, the M1 weighs 5,400 pounds. When the tanks of the M2 are filled, the M2 generator weighs only 266 pounds, but a 500-pound fog oil barrel must be carried with it to provide for 1 hour of operation. All fuels necessary for 1-hour operation of the M1 are carried in supply tanks mounted on the generator itself. Functionally, the most marked differences have to do with the amount of fog oil each unit consumes, relative effectiveness of smoke produced, type of liquid used in burner, and the number of gages and operating controls. These differences follow:

(1) Fog oil consumption. The M1 consumes approximately 100 gallons of fog oil per hour; the M2, approximately 50 gallons.

(2) Smoke streamers. Smoke produced by M2 generators has approximately the same obscuring effectiveness as that produced by the M1 when the M2 generators are spaced at 90 yards and the M1 generators at 150 yards. To put this another way, two M2 generators are more effective than one M1 generator.

(3) Burner fuel. Fuel oil is used in the burner of the M1 generator, with the result that operation of the M1 calls for four different liquids: fuel oil for burner, gasoline for engine, and fog oil and water for formation of smoke. This is in contrast to the three

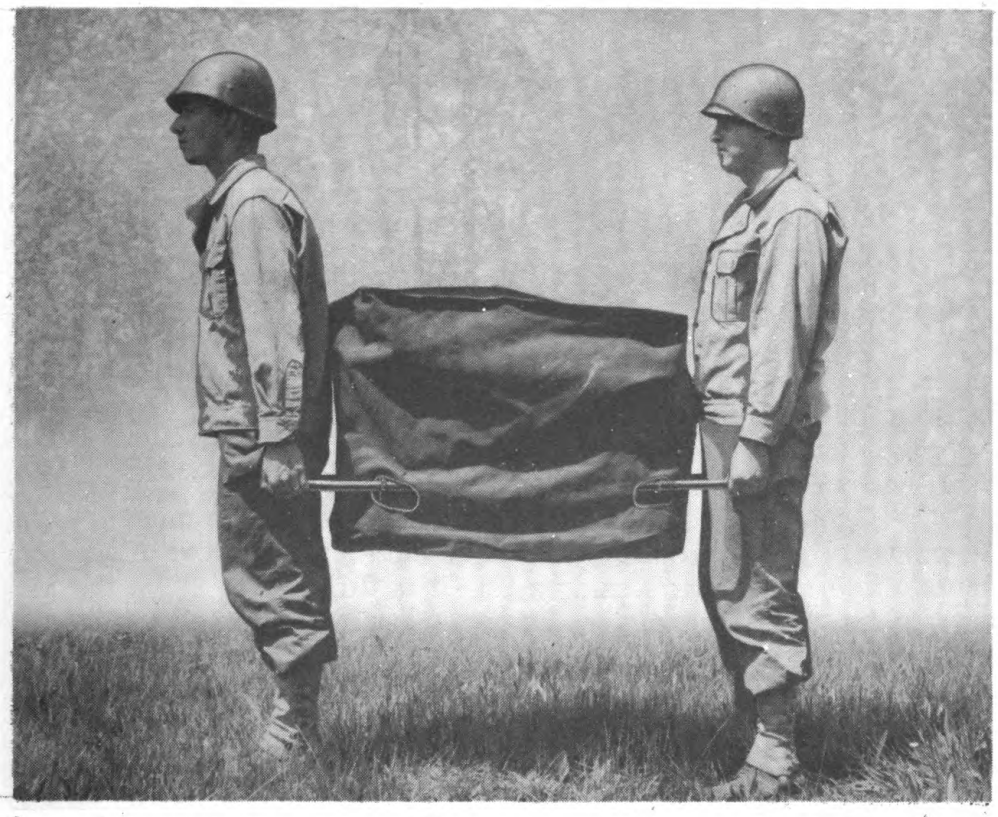


Fig 11. M2 generator with cover in place and handle grips extended.

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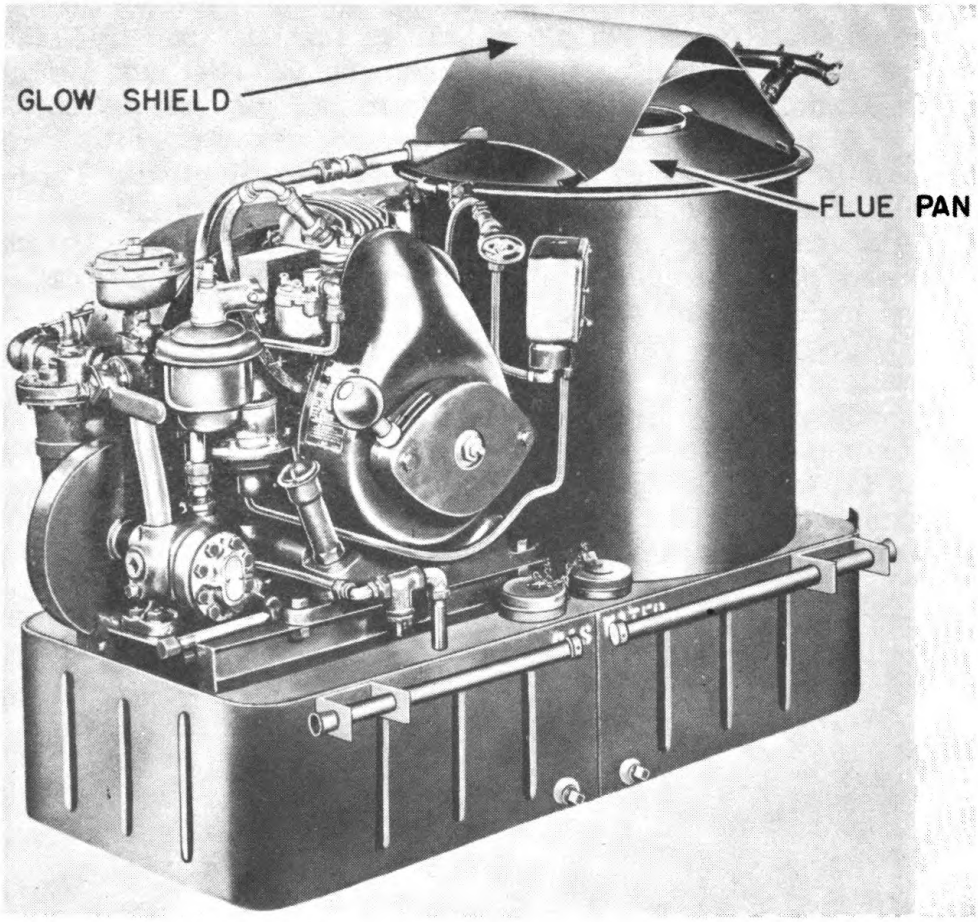


Fig 12. Earlier type M2 smoke generator.

liquids used by the M2 generator, both engine and burner of which operate on gasoline.

(4) Control instruments. The operator of the M1 generator must keep a number of gages under observation and must manipulate a relatively large number of operating controls. There are no gages and relatively few controls on the M2 generator.

d. Advantage of M2. Chief advantages of M2 generator are:

(1) Greater mobility. Whereas the M1 generator must always be moved on a vehicle, the M2 can be carried for short distances by two men as shown in figure 11. It is difficult to move the M1 on any but firm terrain, while the M2 can be adapted to practically any terrain.

(2) Greater speed. Owing to mechanical improvements, the M2 generator produces an effective streamer of smoke in from 30 seconds to 1 minute after engine is started in contrast to the 3 to 6 minutes or more required to warm up the M1 generator.

(3) Greater simplicity. The M2 generator is simpler to operate and maintain.

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6. DIFFERENCES IN GENERATORS.

Only one model of the M2 generator is currently issued. Some of the earlier generators, however, have a different type of flue pan, as can be seen by comparing figure 12, showing an earlier unit, with a later unit as shown in figure 3. On the earlier unit, the flue pan rests flat on top of furnace assembly with a glow shield above it. Purpose of the shield is to hide from aerial observation the reddening of the steel by fire in the combustion chamber. On the later unit there is no shield, the glow being hidden by two baffle plates integrated into the flue pan itself. Further improvements of the generator are likely. Examine newly received units carefully and adapt instructions contained in this manual to any changes which may have been made.

Section III TOOLS, ACCESSORIES, AND SPARE PARTS

7. TOOLS, ACCESSORIES, AND SPARE PARTS.

a. Tools. Tools normally issued with the M2 generator are shown in figure 23.

b. Accessories. Normally one olive drab, water-resistant canvas cover for protecting generator (fig 11), one funnel (fig 13), two spare spark plugs, and one instruction manual are issued with each unit.

c. Spare parts. The spare parts for the generator that are available to using personnel are discussed in paragraphs 36 through 107. Chemical Warfare Service nomenclature together with the numbers of paragraphs in this manual in which replacement of parts is described, follow:

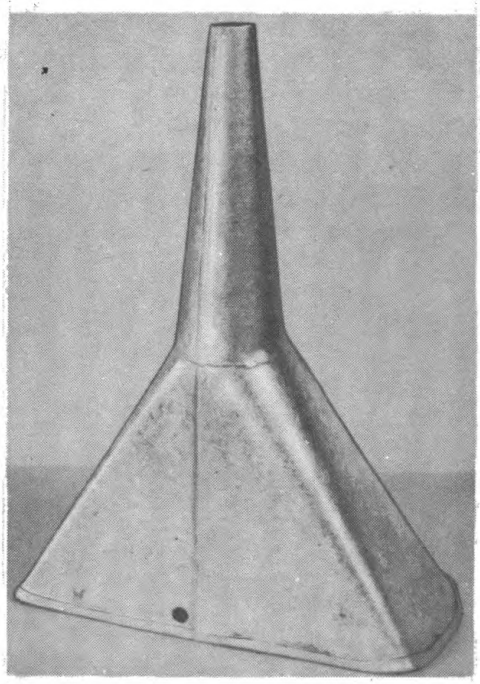


Fig 13. Flat-sided funnel provided with M2 smoke generator.

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(1) Generator parts exclusive of engine.

Nomenclature	Paragraphs
Line, gasoline (tank to pump)	73
Cap, filler	98
Strainer (water or gasoline)	74, 96
Screen (water or gasoline)	74, 96
Handle, grip	101
Pin, cotter, split	101
Manifold, smoke discharge	79
Line, gasoline (fuel valve, thermostatic, to manual burner valve)	89
Plug, spark	72
Valve, angle (burner valve)	85
Diaphragm, regulator valve	94, 95
Pan, flue	77, 78

(2) Engine parts.

Gasket, cylinder head	58
Head, cylinder	57
Pump, oil	70, 71
Gasket, inspection plate, valve spring	59
Lever, throttle stop	53
Carburetor	50, 51
Gasket, carburetor mounting	52
Cleaner, air, assembly	66, 67
Pump, fuel (gasoline)	62, 63
Points, breaker	44, 45
Coil, magneto	40, 41
Condenser	42, 43

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PART TWO
OPERATING INSTRUCTIONS

Section IV GENERAL

8. SCOPE.
Part Two contains information for personnel responsible for operating the mechanical smoke generator M2. Detailed operating instructions are given, together with descriptions of arrangement, location, and functions of operating controls, regulating, and carrying devices.

Section V SERVICE UPON RECEIPT OF EQUIPMENT

9. NEW EQUIPMENT.

a. Unloading and unpacking. Remove top and one side of crate and loosen four Z bars clamping generator to base of crate. Remove canvas roll containing tools and funnel from under canvas cover and put in safe place.

b. Cleaning gasoline tank. Wash out gasoline tank with clean gasoline to remove rust preventative. Tank is drained as shown in figure 17.

c. Preliminary inspection. Upon receipt of a new generator, check following:

(1) Fog oil suction hose. Remove hose from metal loops holding it to generator and examine for holes and breaks. To avoid kinking while replacing hose, insert it first through loop on engine side of furnace assembly, as shown in figure 14, then carry it around and through loop on blower side of furnace assembly.

(2) Spark plugs. Check gaps (par 32). Engine spark plug gap should be .020 inch. Burner spark plug gap should be .062 inch.

(3) Piping. Examine all fittings for tightness.

d. Preliminary fueling and lubrication. (1) Water and gasoline. Fill water and gasoline tanks with clean fuels.

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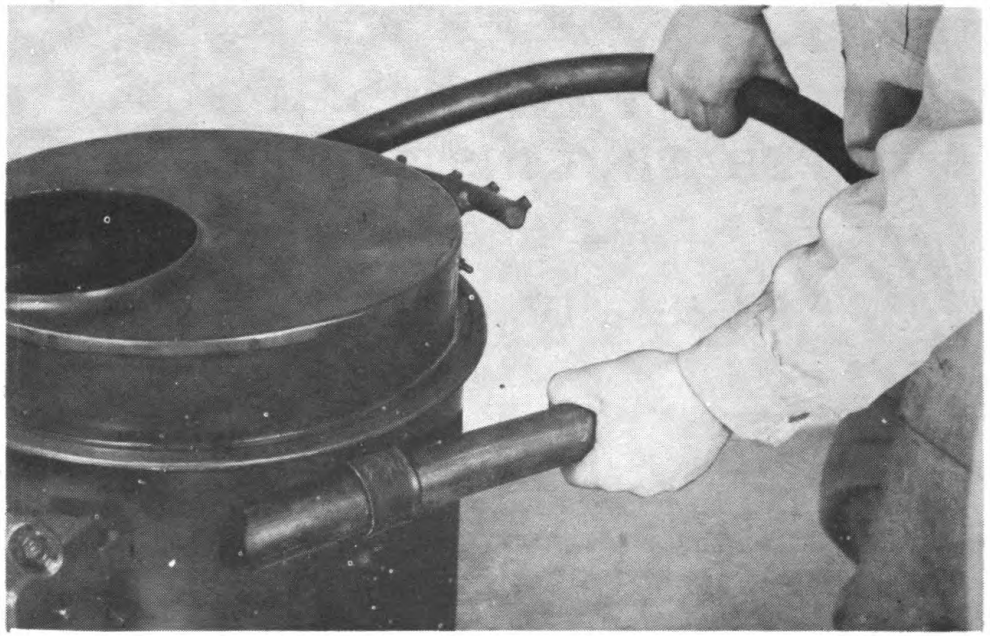


Fig 14. Replacing fog oil suction hose.

(2) Lubrication. Drain and refill both engine crankcase and oil bath air cleaner with clean oils, and lubricate entire unit. Full lubrication instructions are given in paragraph 27.

e. Flue pan. If early type generator is received, remove old-type flue pan and glow shield, requisition new-type flue pan, and attach new-type pan to generator. Directives for installing flue pan are given in paragraph 78 and requisition procedure is covered in paragraph 23.

f. Preliminary operation. (1) Check of smoke and carburetor. After taking steps described in subparagraphs a, b, and c above, operate generator 10 or 15 minutes to check quality of smoke and carburetor performance.

(2) Smoke. The jet of smoke issuing from each of the four orifices of smoke discharge manifold should resemble the jet of "good smoke" diagrammed in figure 18. Smoke for approximately 1/2 inch from orifice should be transparent. For next 1 or 1-1/2 inches, it should be clear in middle and fuzzy at edges. From there on, it should be dense white fog. "Good smoke" indicates generator is functioning correctly. If wet smoke (smoke having a yellowish tinge) or dry smoke appears, chances are the thermostatic fuel valve (fig 15) needs adjustment. Directions for adjusting valve are given in paragraph 88.

(3) Carburetor. Since factory tests of generator are usually made with gasoline having octane rating other than that issued in field, carburetor may require minor adjustments. Directives for making these are given in paragraph 54.

(4) Speed of engine. Check with a revolution-counter (tachometer). Production of the right amount of smoke depends on engine

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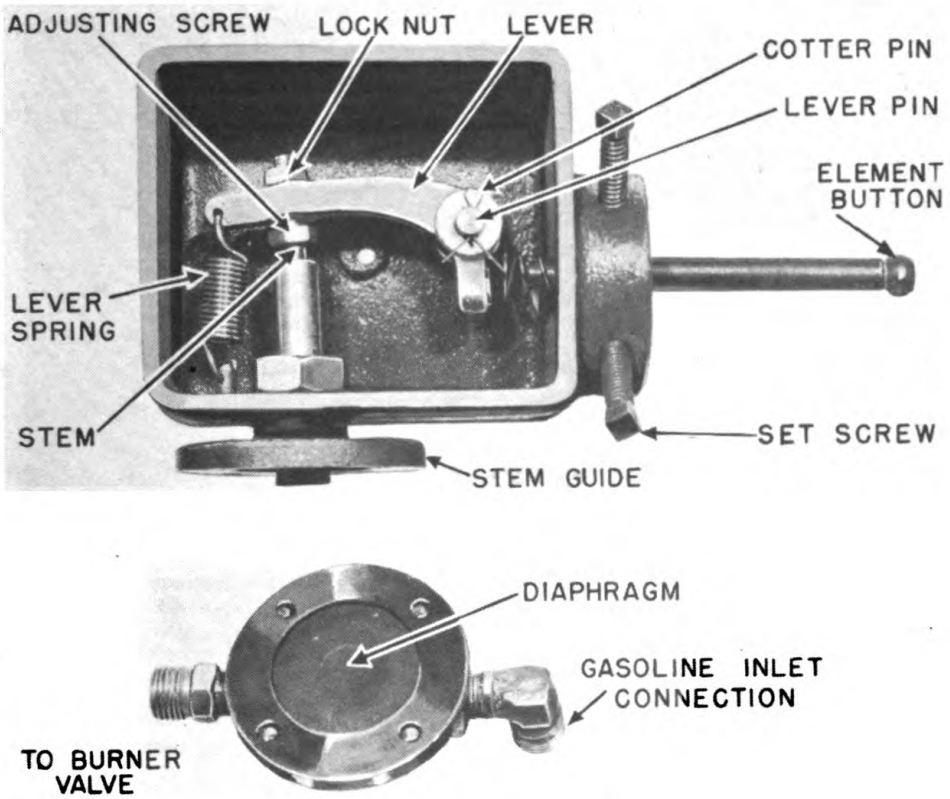


Fig 15. Thermostatic fuel valve.

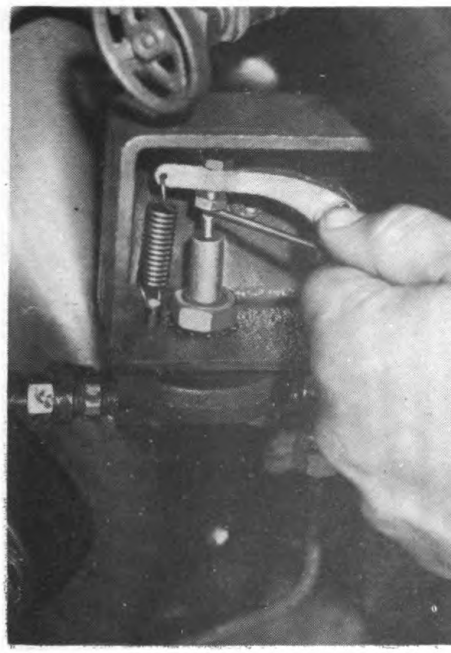


Fig 16. Checking thermostatic fuel valve gap.

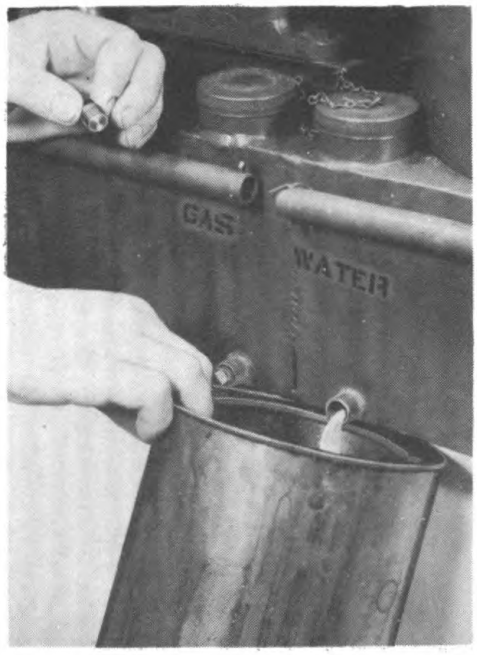


Fig 17. Draining water from supply tank.

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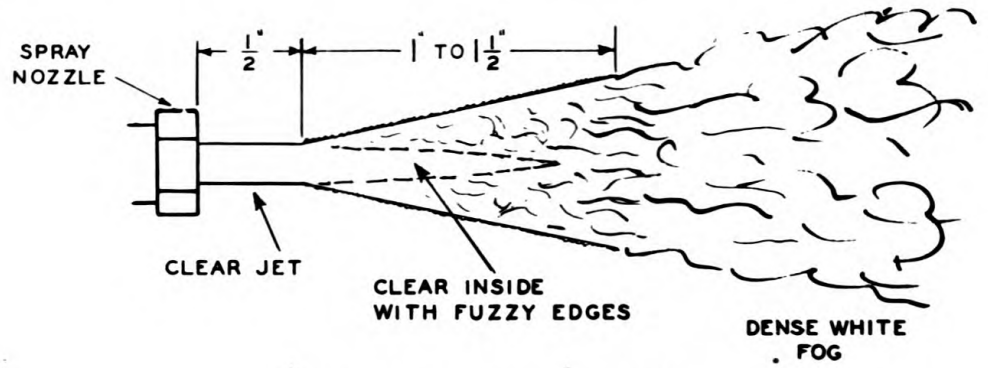


Fig 18. "Good smoke."

speed being maintained at 3,600 revolutions per minute. If engine is underspeeding or overspeeding, adjust as directed in paragraph 64.

10. USED EQUIPMENT.

Upon receipt of a used or reconditioned generator, take same action as with new generator, and, in addition, do the following:

a. Check gasoline and water strainers. Remove gasoline and water strainers and wash them with dry cleaning solvent. The gasoline strainer is located on gasoline line just above tank, and water strainer is similarly located on water line. Each is removed easily by turning the wing nut with the hand. One strainer, loosened and withdrawn from piping, is shown in figure 19.

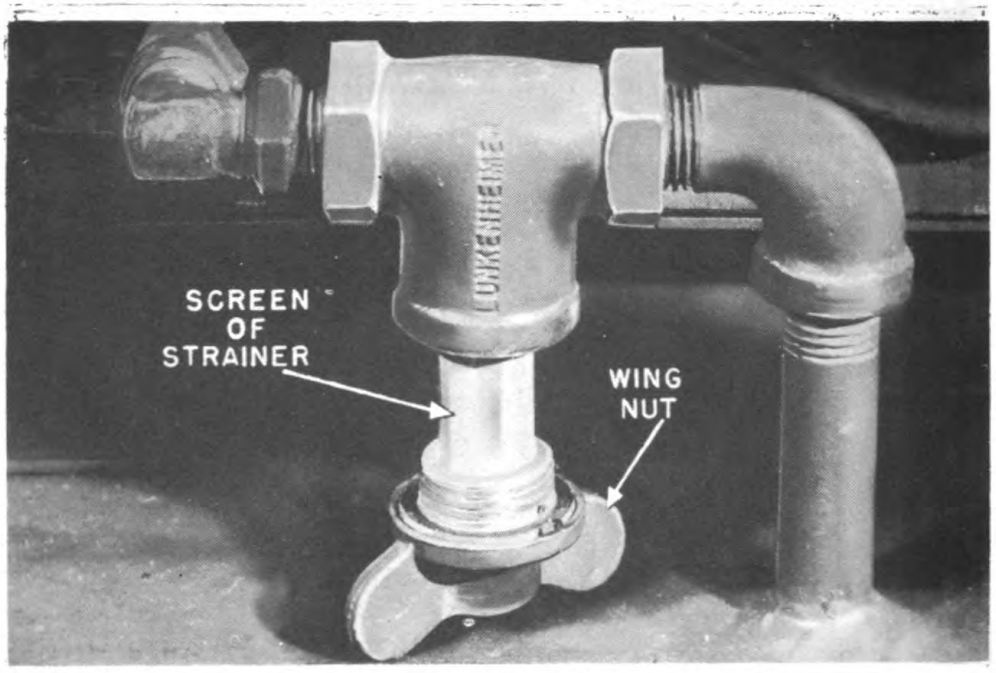


Fig 19. Wing nut unscrewed and gasoline strainer partly withdrawn from line.

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Section VI OPERATING CONTROLS, REGULATING DEVICES, AND HANDLE ASSEMBLY

11. CONTROLS.

a. General. Operating controls are the devices which the operator manipulates to start or stop generator. There are five: the choke lever arm, ignition switch, ready pull-starter, burner valve, and the fog valve. Location of controls is shown in figure 20.

b. Choke lever arm. The choke lever arm is one of two small moving parts on top of carburetor, the other being the throttle stop lever. The choke arm is the part nearest the oil bath air cleaner. The choke, like that of an automobile, regulates the amount of air which reaches and mixes with engine gasoline supply. Push choke lever arm to right toward ready pull-starter to close choke valve, cutting off air intake and supplying engine with a richer gasoline mixture. Push arm to left toward blower to open choke valve, permitting air to reach and mix with gasoline supply. When arm is moved and released, it does not snap back into the open position but remains in the position to which it has been pulled. Generator engines must be run with choke valve wide open as a partly closed valve may build up a carbon deposit in the engine combustion chamber, causing loss of power. If engine will not run with choke wide open, gasoline-air mixture is wrong. To remedy this, adjust carburetor as directed in paragraph 54.

NOTE ON THROTTLE: The throttle stop lever, which regulates the flow of gasoline to engine combustion chamber, works automatically.

c. Ignition switch. The switch for turning the ignition on and off is located on engine flywheel housing next to carburetor. Turn ON switch by pushing it down; turn OFF switch by pushing it up. ON and OFF positions are labeled on flywheel housing.

d. Ready pull-starter. The ready pull-starter extends upward from starter spring housing, a roughly diamond-shaped extension on outer side of flywheel housing. Its function, as the name indicates, is to "turn over" engine and start it. To do so, grasp ball-shaped handle of pull-starter and pull it upwards a few times.

CAUTION: Take care that pull-starter does not slip from hand, as this may damage starter mechanism inside spring housing.

e. Burner valve. The burner valve is located on gasoline line

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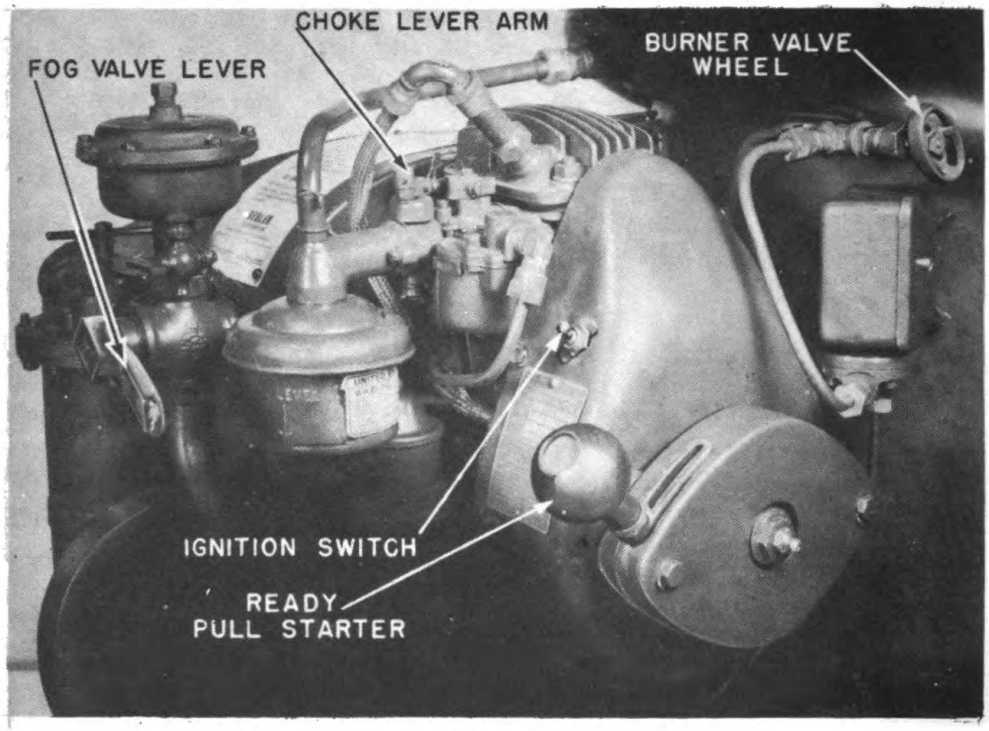


Fig 20. Operating controls.

next to furnace assembly, just above box which houses a portion of thermostatic fuel valve. It turns burner on or off. Turn wheel of valve counterclockwise (away from furnace assembly), to turn on burner; turn it clockwise (toward furnace assembly), to turn off burner.

f. Fog valve. The fog valve lever is located at juncture of fog oil and water lines. It opens and closes the fog valve, thus permitting or preventing flow of fog oil to pump. Push lever DOWN to vertical (ON) position to open valve, push UP to horizontal (OFF) position, in which it is shown in figure 20, to close valve. The words "ON" and "OFF" appear on lever, and a stamped arrow shows in which direction it should be moved.

12. REGULATING DEVICES.

a. General. By regulating devices are meant those parts which regulate the flow of liquids through the piping. There are two -- thermostatic fuel valve and feed water regulator. Locations of both are shown in figure 21.

b. Thermostatic fuel valve. Part of thermostatic fuel valve is housed in a box which is attached to gasoline piping at a point just below burner valve. Remainder of thermostatic valve extends through air casing of furnace assembly and attaches to tubing of coil assembly inside combustion chamber. When burner valve is open, the thermostatic valve regulates flow of gasoline to burner in such a way that the temperature of smoke, as it emerges at

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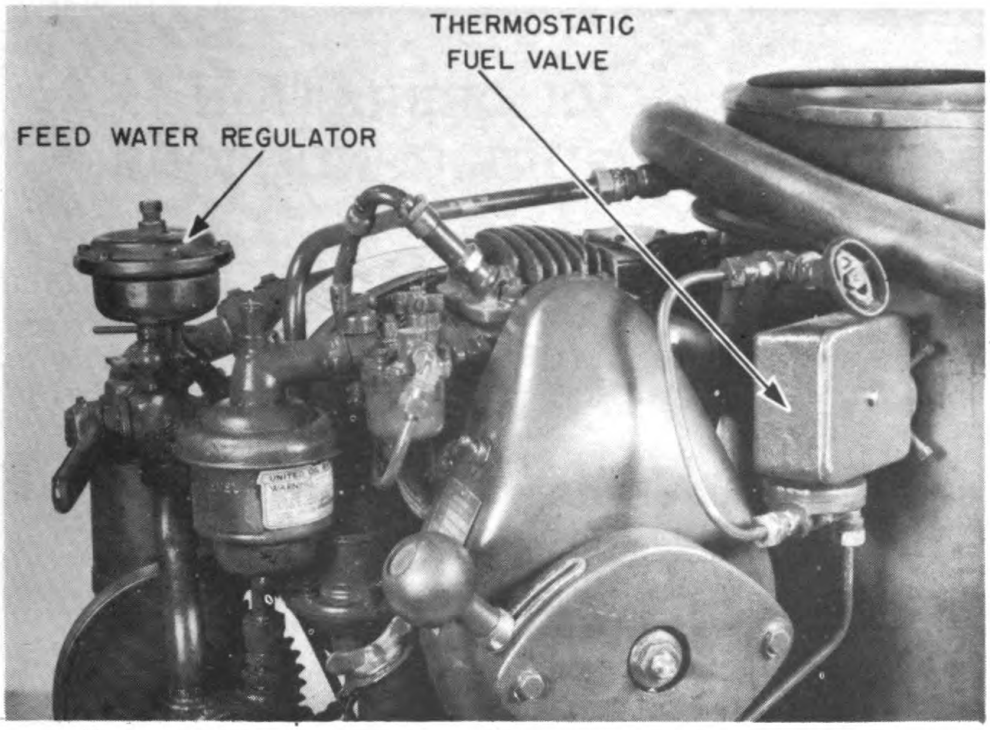


Fig 21. Regulating devices.

smoke discharge manifold, is always approximately 900 degrees Fahrenheit, which is correct temperature for "good smoke." To put this another way, when the vaporized fog oil-water mixture in the coil assembly becomes too hot, the thermostatic valve acts to reduce flow of gasoline to burner, lowering fire in combustion chamber. Conversely, when temperature of vapor in coil assembly falls too low, the valve acts to increase flow of gasoline to burner and builds up fire.

c. Feed water regulator. The feed water regulator is located on water piping above the fog valve lever. Proper functioning of generator requires that the same amount of water be fed to fog oil-water pump and inlet line at all times, and since the pump exerts greater suction on water tank when the fog valve is closed, the feed water regulator is provided to overcome this increased suction and to maintain a constant water flow.

13. HANDLE ASSEMBLY.

Four movable handle grips (fig 2) are attached to generator base by means of brackets. Each grip is held stationary by a stop pin attached by a jack chain to bracket nearest flanged end of grip. The stop pin fits into any of three pin holes in grip. When generator is to be carried, the pin is withdrawn and the grip pulled forward in order that the pin can be inserted in the hole which gives the desired extension. A cotter pin at rear of grip prevents its sliding out when extended.

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Section VII OPERATION UNDER USUAL CONDITIONS

14. BEFORE STARTING.

Insert fog oil suction hose in 55-gallon drum or other source from which oil is being drawn. Other steps to be taken prior to operation are essentially the maintenance services described in paragraph 29.

15. TO START GENERATOR.

a. Push ignition switch down. This closes circuit which supplies ignition to both engine and burner.

b. Give ready pull-starter a few pulls to start engine. Use choke as necessary. (Fig 22)

c. Permit engine to run about 10 seconds to pump some water through coil assembly befor taking next step

CAUTION: Always have engine running smoothly before taking next step.

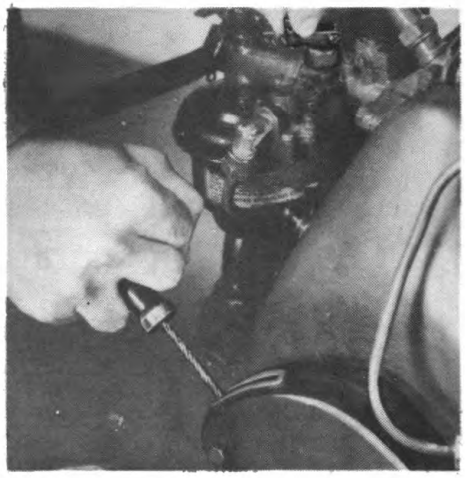


Fig 22. Manipulating ready pull-starter and choke to start engine.

d. Open burner valve to start fire in combustion chamber. It takes approximately from 10 to 20 seconds for fire to automatically diminish to low fire, after which generator is ready to use fog oil.

e. Push fog valve lever down to ON. This permits fog oil to enter system. Smoke begins to emerge within a few seconds.

f. Turn handle of fog oil strainer a few times. If oil does not flow in a few seconds, make sure suction line is not kinked or jammed against bottom of barrel. A little time is required for oil to be drawn through an empty hose. Smoke should emerge from generator in a few seconds.

16. TO STOP GENERATOR.

a. Push fog valve lever up to horizontal (OFF) position.
b. Allow unit to run until smoke output decreases noticeably.
c. Close burner valve.
d. Allow engine to run at least 30 seconds before turning off.

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This permits sufficient water to flow through system to sweep all fog oil from coil assembly.

e. Turn off ignition.

17. IMPORTANT PRECAUTIONS.

a. Concerning fog oil and water. Operation. Do not run generator for long periods without water as engine may overheat.

(2) Quality of water. Use only clean, fresh water of good drinking quality, preferably water of low mineral content. In emergencies, use any relatively clear water, avoiding salt water or brackish water whenever possible.

(3) Specifications. For fuel and fuel mixtures to be used under differing climatic conditions, see paragraph 18.

b. Concerning lubrication of engine. An engine run without oil is ruined within a few minutes. To avoid this, fill crankcase to full point (F) before each operation, and check oil level every 8 hours of operation. (See also lubrication instructions in paragraph 27.)

c. Concerning gasoline. Never mix oil with the gasoline as generator is equipped with a four-cycle engine to which such a mixture is harmful. Be sure funnel used to fill tank is absolutely clean.

d. Concerning suction hose. Before threading fog oil suction hose through the metal loops which hold it to generator between operations, take care that furnace assembly has cooled; otherwise the hose may be burned.

e. Concerning canvas cover. Never put canvas cover on generator until unit is relatively cool.

Section VIII OPERATION UNDER UNUSUAL CONDITIONS

18. FUEL CHANGES AND SPECIFICATIONS.

a. Water. (1) Mixtures. Do not use straight water in temperature of 32 degrees Fahrenheit or lower, as it freezes in pipes and seriously damages generator For all temperatures between 32 degrees Fahrenheit and zero, use a mixture of 30 percent denatured alcohol and 70 percent water For temperatures below zero, percentages of denatured alcohol should be approximately:

Minus 10 F.	40 percent
Minus 20 F.	44 percent
Minus 30 F.	55 percent
Minus 40 F.	60 percent

(2) Adjustment. When a temperature of less than 32 degrees Fahrenheit is expected, drain water tank and refill it with proper

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water-alcohol mixture. Then take the following steps to expel water remaining in coil assembly from previous operations:

(a) Turn on ignition and start engine. Let engine warm up before taking next step.

(b) Turn burner valve wide open and allow burner to run from 30 to 60 seconds. Superheated steam will emerge from smoke discharge manifold.

(c) Close burner valve and stop engine.

b. Fog oil. (1) Types. Two types of fog oil are available for use in generator: "SGF1" and "SGF2." In temperatures above 32 degrees Fahrenheit, use "SGF1." In temperatures between 32 degrees Fahrenheit and minus 15 degrees Fahrenheit, use "SGF2." In temperatures below minus 15 degrees Fahrenheit, use a 50-50 mixture of "SGF2" and wax-free kerosene.

(2) Specifications. Fog oil specifications follow:

Fog oil coded "SGF1"

Composition	All-distillate product from petroleum source; must contain no additives.
Viscosity SUS/210 F.	60 maximum. (65 viscosity at 210 F. maximum for oils having 50 viscosity index or higher.)
Conradson carbon	0.1 maximum.
Neut. no.	0.1 maximum.
Pour point	0 F. maximum.
Distillation	(See "Composition" above)
Vapor temp at 10 mm absolute pressure	10% 390 F. minimum. 50% 490 F. minimum. 90% 610 F. maximum.

Fog oil coded "SGF2"

Composition	Same as "SGF1"
Flash point	320 minimum.
Viscosity SUS/100 F.	100-110
Conradson carbon	0.1 maximum.
Neut. no.	0.1 maximum.
Pour point	Minus 40 F. maximum.

(3) Blending. Blend fog oil with kerosene by pumping it through a tank truck or by any other available pumping system. If pumping arrangement is not available, place kerosene and oil in a barrel in correct proportions, filling only three-fourths full. Up-end and roll barrel many times until uniform consistency is obtained.

19. OPERATING PROCEDURE CHANGE.

When starting generator in cold weather, do not open burner valve

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until engine exhaust (fig 7) is warm to naked hand. Reason for this is that pipe carrying gasoline to burner runs through center of exhaust, and since exhaust is outlet for hot vapors from engine, it not only assists in atomizing gasoline in burner but serves as heating jacket for gasoline piping; in cold weather it is important that this "heating jacket" be warm to insure proper ignition of gasoline at burner.

Section IX DEMOLITION

20. POLICY.

When circumstances force abandonment of smoke generators in the field, generators are destroyed or rendered useless to prevent their use or study by the enemy.

21. PROCEDURES.

a. Methods. The M2 generator is effectively destroyed by smashing or burning or both. Smash all parts with a heavy instrument, weapon, or vehicle. If M14 incendiary grenades are available, soak smashed parts with gasoline and set them afire, setting off one grenade in the midst of them.

b. Priority. Destroy generator parts in following order:

(1) Engine.
(2) Fog oil-water pump.
(3) Furnace assembly.
(4) Burner and blower.
(5) Supply tanks.
(6) Remaining parts.

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PART THREE
MAINTENANCE INSTRUCTIONS

Section X GENERAL

22. SCOPE.
Part Three contains information for personnel responsible for first and second echelon upkeep of mechanical smoke generator M2. The terms "first echelon maintenance" and "second echelon maintenance" are explained, and maintenance directives are given together with detailed descriptions of the parts to which these directives apply.

23. RESPONSIBILITY OF USING PERSONNEL AND REQUISITIONING OF PARTS. (IMPORTANT)

a. Definitions. All upkeep of generator which operator is authorized to do by himself is called first echelon or individual maintenance. Any other upkeep for which using personnel are responsible is called second echelon or organizational maintenance. As the term indicates, second echelon covers upkeep for which special skills are required together with tools over and above those issued with generator, such as those found in the company motor pool or in the battalion shop.

b. Responsibility. The maintenance procedures for which using personnel are responsible are described in paragraphs 25 through 107. Whenever a paragraph or subparagraph is preceded by the phrase "Second Echelon Only," the procedure described therein is one that must be performed in the second echelon. Operators should not attempt second echelon maintenance, and even trained mechanics should not attempt such maintenance unless all necessary tools are available. This division of responsibility must be observed as closely as circumstances permit. When -- in the theater of operation -- the generator requires maintenance that cannot be performed satisfactorily in the field or in the organizational motor pool or shop, send entire unit to nearest chemical maintenance company for third or fourth echelon repair or replacement. In the zone of interior, turn generator over to post chemical property officer for evacuation to next higher repair echelon.

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c. Requisitioning parts. Authority and all information for ordering spare parts are given in ARMY SERVICE FORCES CATALOG, GENERATOR, SMOKE, MECHANICAL, M2 (50 GALLON), CW7-217122. Always requisition from the supply catalog. Do not use this manual (TM 3-381) as a basis for ordering parts. Any stock numbers or Chemical Warfare Service nomenclature given in this manual are for information and guidance only.

Section XI SPECIAL EQUIPMENT

24. TOOLS.

Tools normally issued with the M2 generator are shown in figure 23. The thermostatic fuel valve gage is for checking gap in thermostatic fuel valve as explained in paragraph 88. The bung wrench is used to open oil drums as shown in figure 24.

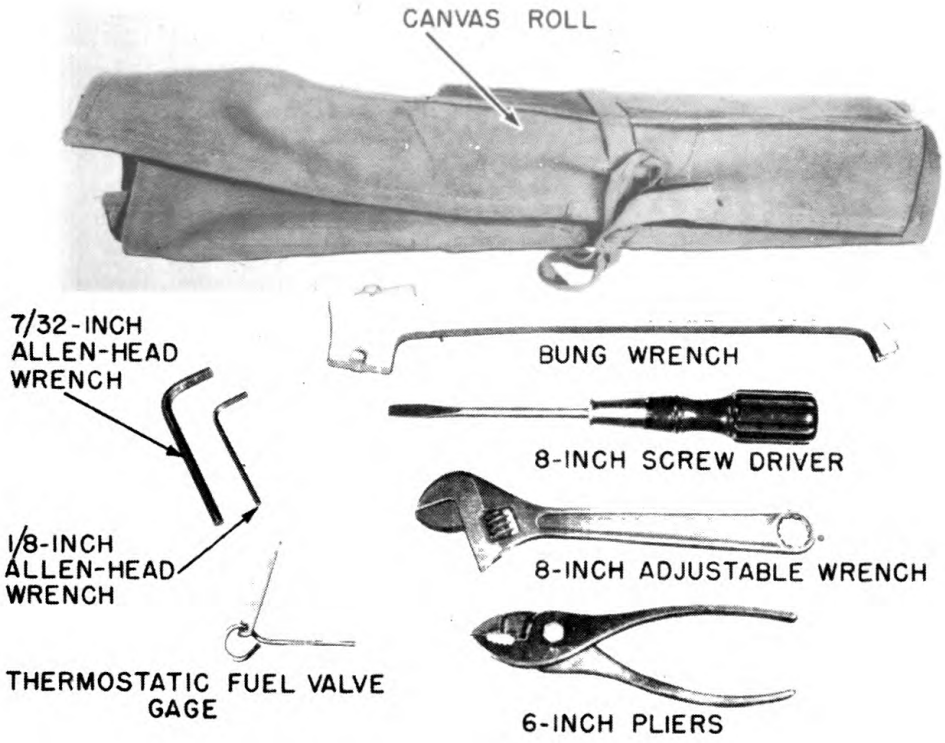


Fig 23. Tools provided with smoke generator M2.

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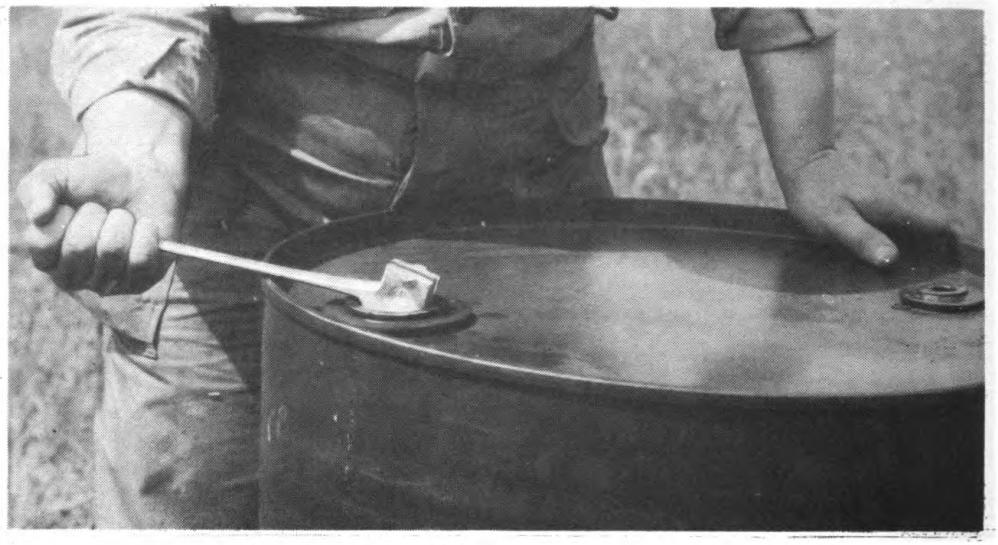


Fig 24. Opening 55-gallon drum of fog oil.

Section XII LUBRICATION

25. LUBRICATION ORDER.

a. General. War Department Lubrication Order No. 4002, reproduced in figure 25, shows all points to be lubricated, lubricants to be used, and intervals at which they must be applied. Detailed instructions are given in paragraph 27.

b. Distribution. One lubrication order is placed on or issued with each M2 generator.

c. Importance of order. Instructions on the lubrication order are binding on all echelons of maintenance. Should there be any discrepancies between any lubrication instructions given in this section of this manual and the lubrication order, follow the lubrication order.

d. Intervals. Service intervals specified on the lubrication order are for normal operating conditions in temperatures above 0 degrees Fahrenheit. Reduce these intervals under conditions of excessively high or excessively low temperatures, or when the generator is being operated for prolonged periods under excessively sandy, dusty, or other conditions likely to destroy the protective qualities of the lubricant quickly.

e. Lubricants are prescribed in the "key" on the lubrication order in accordance with two temperature ranges -- above 32° F. and below 32° F. When to change grades of lubricants is determined by maintaining a close check on operation of the generator during the approach to change-over periods. Sluggish starting is

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WAR DEPARTMENT LUBRICATION ORDER No. 4002

WAR DEPARTMENT, WASHINGTON 25, D. C., 15 JUNE 1944

SMOKE GENERATOR, M2

For detailed instructions, refer to TM 3-381

LUBRICANT • INTERVAL (Hours)

MAGNETO (See note) **CG**

Starter Mechanism **CG 192**
(Fitting on flywheel nut)

Air Cleaner **OE 8**
Check level (See note)
Every 48 hours, remove and wash all parts.

Crankcase Fill and Level **OE 8**
Check level
Caution: Also check level before every operation and refill to Full mark on gage.

Pump Drive Chain **OE 48**
Clean and oil
(To reach, remove guard shield)

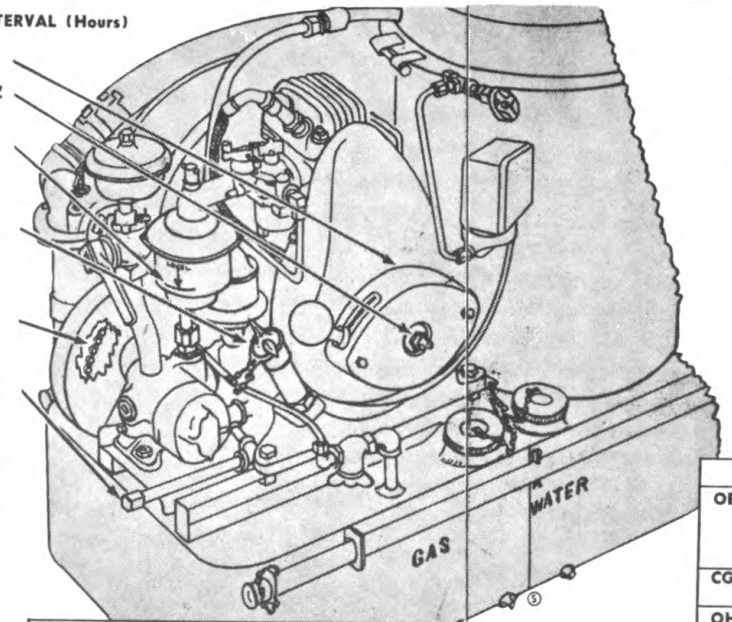
Crankcase Drain **48**
Drain and refill. Cap. 1 qt.
(Drain only when engine is hot)

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained therein are mandatory and supersede all conflicting lubrication instructions dated prior to 15 June 1944.

By order of the Secretary of War:
G. C. Marshall, Chief of Staff.

Official:
J. A. Ulio, Major General,
The Adjutant General.

No. 4002 [NOT TO BE REPRODUCED in whole or in part without permission of the Office of the Chief of Chemical Warfare Service.]



Requisition replacement Lubrication Order from the Chemical Warfare Supply Officer, A.S.F. Depot, Memphis, Tenn., or A.S.F. Depot, Ogden, Utah.

NOTES

Clean fittings before lubricating.

To clean parts, use SOLVENT, dry cleaning or OIL, fuel, Diesel. Dry before lubricating.

Reduce intervals under severe operating conditions.

AIR CLEANER—Refill oil reservoir to indicated level with used crankcase oil or OE. Below 0°F. use SA or OH.

MAGNETO—When flywheel is removed for other purposes, wipe braker cam lightly with CG.

OIL CAN POINTS—Every 48 hours lubricate Choke, Throttle and Governor Connections with OE.

DO NOT LUBRICATE—Pump Shaft (If provided with fitting, replace with plug).

KEY

LUBRICANTS	LOWEST ANTICIPATED AIR TEMPERATURE		
OE—OIL, engine	above +32°F.	+32°F. to 0°F.	below 0°F.
Crankcase	SAE 30	SAE 10	See TM
Other Points	SAE 30	SAE 10	**PS**
CG—GREASE, general purpose	No. 1	No. 0	No. 0
OH—OIL, hydraulic			
SA—FLUID, shock-absorber, light			
PS—OIL, lubricating, preservative, special			

Fig 25. War Department Lubrication Order.

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an indication that lubricants are thickening and a signal to change to grades prescribed for the lower or higher temperature range. Ordinarily grade of lubricants should be changed ONLY WHEN AIR TEMPERATURES ARE CONSISTENTLY IN THE NEXT LOWER OR HIGHER RANGE.

26. LUBRICANTS AND EQUIPMENT.

a. Lubricants. Engine oil SAE 30 for temperatures above 32 degrees Fahrenheit and engine oil SAE 10 for temperatures below 32 degrees Fahrenheit are issued to using organizations for use in crankcase and air cleaner of generator, and for oiling the pump drive chain. For other points on generator which must be kept oiled, grease, general purpose, No. 1, is issued for temperatures above 32 degrees Fahrenheit and grease, general purpose, No. 0, for temperatures below 32 degrees Fahrenheit.

b. Equipment. The guns, oilcans, and other equipment necessary for lubricating parts are obtained from organizational motor pool or shop. Clean each piece of lubricating equipment thoroughly both before and after use.

27. LUBRICATION PROCEDURES.

a. Precaution. Wipe lubrication fitting or part and all surrounding surfaces clean before applying oil or grease. Use dry cleaning solvent for parts which require cleaning.

b. Crankcase fill and level. Check oil level before every operation and fill crankcase every 8 hours of operation. Crankcase holds 1 quart. Fill to full mark (F) on measuring stick. Drain every 48 hours of operation (fig 26) and refill with clean oil (fig 27). Drain while oil is hot to insure removal of dirt and sediment. When generator is being operated in temperatures of less than 0 degrees Fahrenheit, drain crankcase and fill with engine oil SAE 10 to the full (F) mark on measuring stick. Then



Fig 26. Draining crankcase.



Fig 27. Refilling crankcase.

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add 1/2 pint of motor fuel (gasoline) and operate engine for 5 minutes. Stop engine and mark on the measuring stick the level of the oil-gasoline mixture. After that, before each operation, fill crankcase with engine oil to the "F" mark and add enough gasoline to bring oil-gasoline mixture up to the marked level.

c. Air cleaner. Fill with engine oil to point of arrow on outside of cleaner every 8 hours of operation (fig 28). Disassemble, clean parts with dry cleaning solvent, and refill with engine oil every 48 hours of operation. To do this, remove cleaner as shown in figure 29, unscrew top, and lift out screen (fig 30).



Fig 28. Correct oil level in oil bath air cleaner.

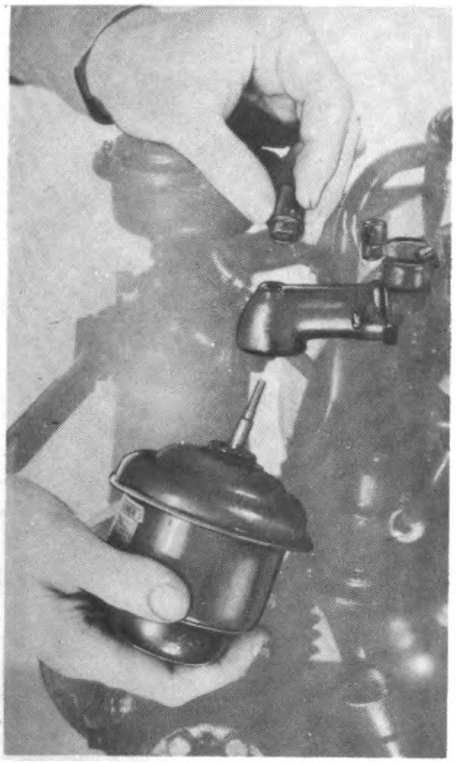


Fig 29. Removing oil bath air cleaner.

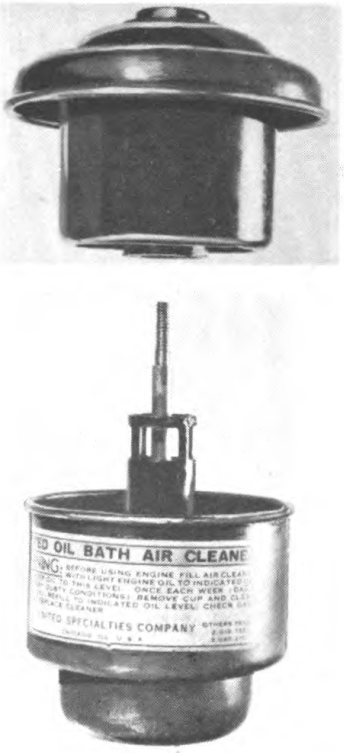


Fig 30. Oil bath air cleaner disassembled.

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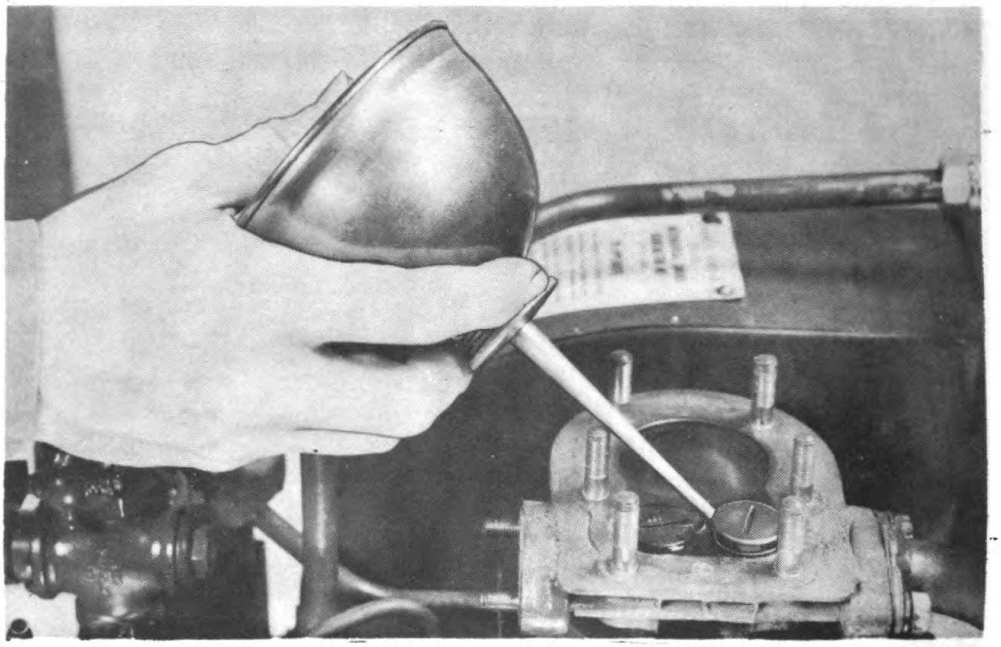


Fig 31. Lubricating engine exhaust valve.

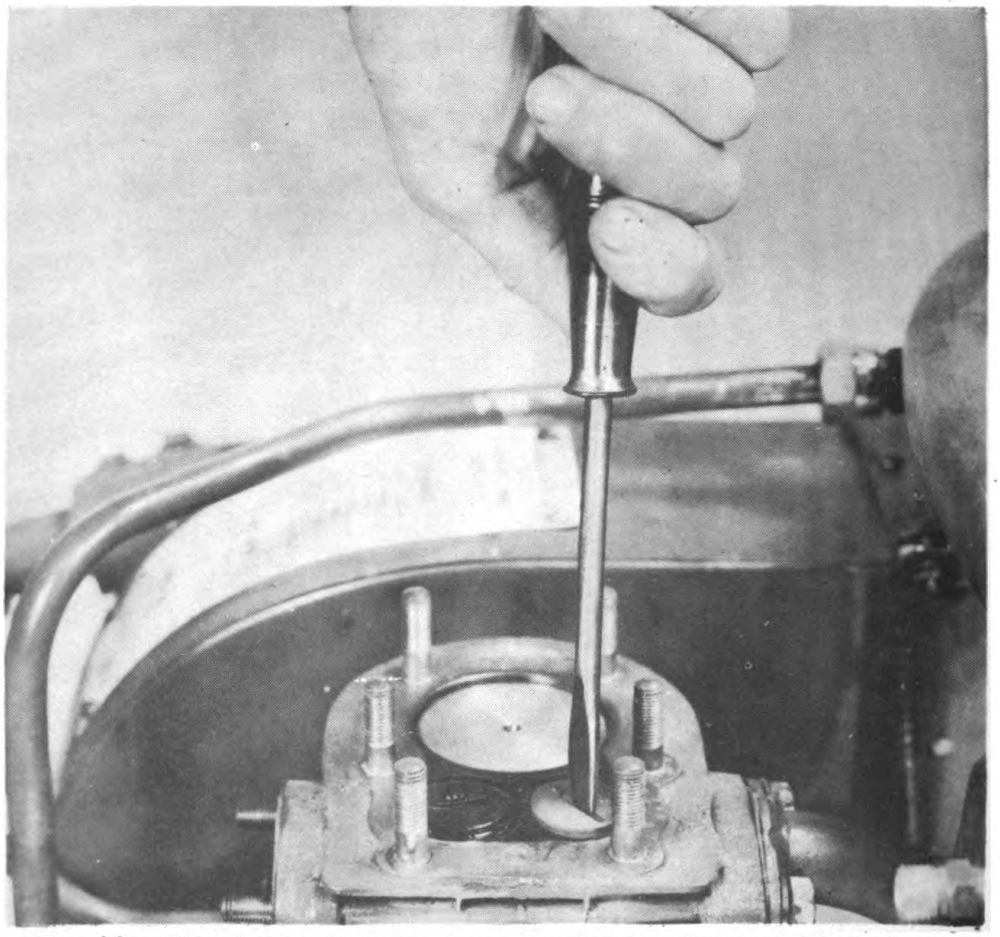


Fig 32. Turning exhaust valve on seat to clean and lubricate.

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d. Alemite fitting on flywheel nut. Using a lubricating gun, apply grease to fitting every 192 hours of operation. (This fitting is also called starter mechanism grease fitting.)

e. Pump drive chain. Remove, wash with dry cleaning solvent, and coat lightly with engine oil every 48 hours of operation. To remove chain, proceed as directed in paragraph 105.

NOTE: An alemite fitting is found on the fog oil-water pumps of some generators. It is not necessary to lubricate this part.

f. Engine magneto and combustion chamber. It is advisable to lubricate parts of these units whenever they are disassembled for any reason. The job must be handled by second echelon personnel only. Instructions covering magneto will be found in paragraph 47; instructions concerning engine combustion chamber, paragraph 32c.

Section XIII PREVENTIVE MAINTENANCE

28. GENERAL.

Preventive maintenance services for which using personnel are responsible consist of:

a. Before, during, and after operation services performed by generator operator.

b. Scheduled services performed by operator or by trained mechanics assigned to using organization.

29. BEFORE OPERATION SERVICES.

All parts of generator to be serviced before every operation are listed below together with descriptions of services to be rendered:

a. Fuel tanks. Make certain gasoline and water tanks are filled. Before filling water tank, be sure filler cap is on gasoline tank to avoid getting water into gasoline.

b. Fog oil suction hose. Check hose carefully for breaks.

c. Fog oil strainer. Give handle of strainer a few turns, as shown in figure 33. This revolves filter cartridge inside strainer past cleaner blades, combing out all collected solids and dropping them into sump below.

d. All piping. Examine unions for tightness.

30. DURING OPERATION SERVICES.

Replace fog oil barrel whenever contents drop to the 3-inch level. To insure uninterrupted operation, measure level of oil in barrel every 45 minutes or oftener. Refill gasoline and water tanks every 45 minutes.

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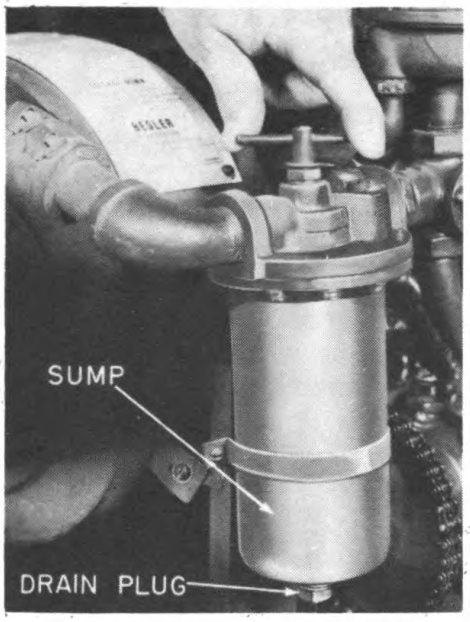


Fig 33. Turning handle of fog oil strainer.

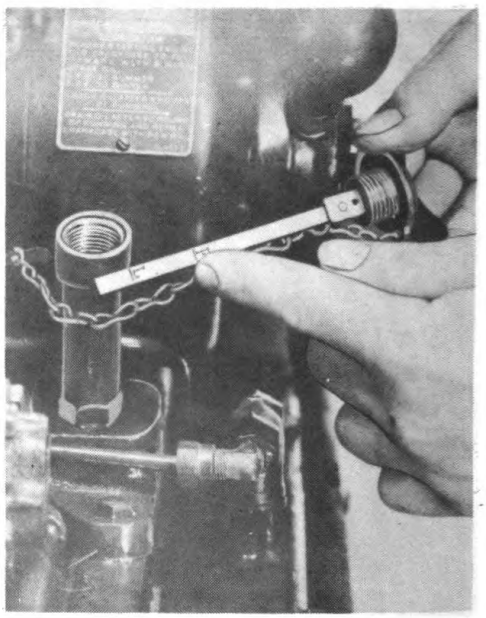


Fig 34. Checking crankcase oil level.

31. AFTER OPERATION SERVICES.

Parts to be serviced after every operation are listed below together with services to be rendered:

a. Fog oil strainer. Clean as described in subparagraph 29c, above.

b. Fog oil suction hose. Replace in metal loops on generator, taking care furnace assembly has cooled.

c. Generator as a whole. Shroud with canvas cover when generator has become cool.

32. SCHEDULED SERVICES.

Parts to be serviced at regular intervals, services to be rendered, and time intervals, follow:

a. Engine spark plug. Inspect and make necessary adjustments once a week. To do this, detach cable (fig 35), and remove spark plug as shown in figure 36. If plug has become fouled, scrape off carbon with knife or sandpaper. Check gap with gage issued to organizational motor mechanics. Gap should be .020 inch. Reset if necessary with motor mechanic's gage as shown in figure 37.

b. Burner spark plug. Inspect and make necessary adjustments once a week. Follow same procedure as with engine spark plug. Gap should be .062 inch.

c. Engine combustion chamber. Remove carbon deposits from underside of cylinder head, piston, and top faces of cylinder and valves every 500 hours of operation. To do this, remove cylinder head as described in paragraph 57, and use carbon scraper issued to organizational motor mechanics. Be sure valves are closed

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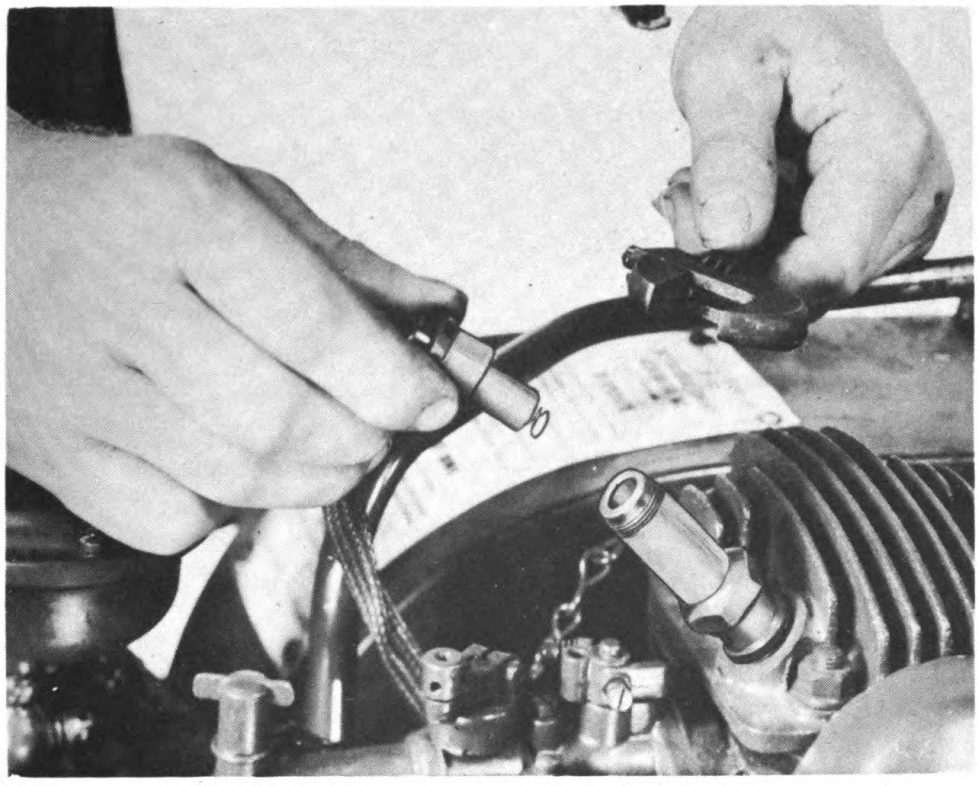


Fig 35. Detaching cable of engine spark plug.

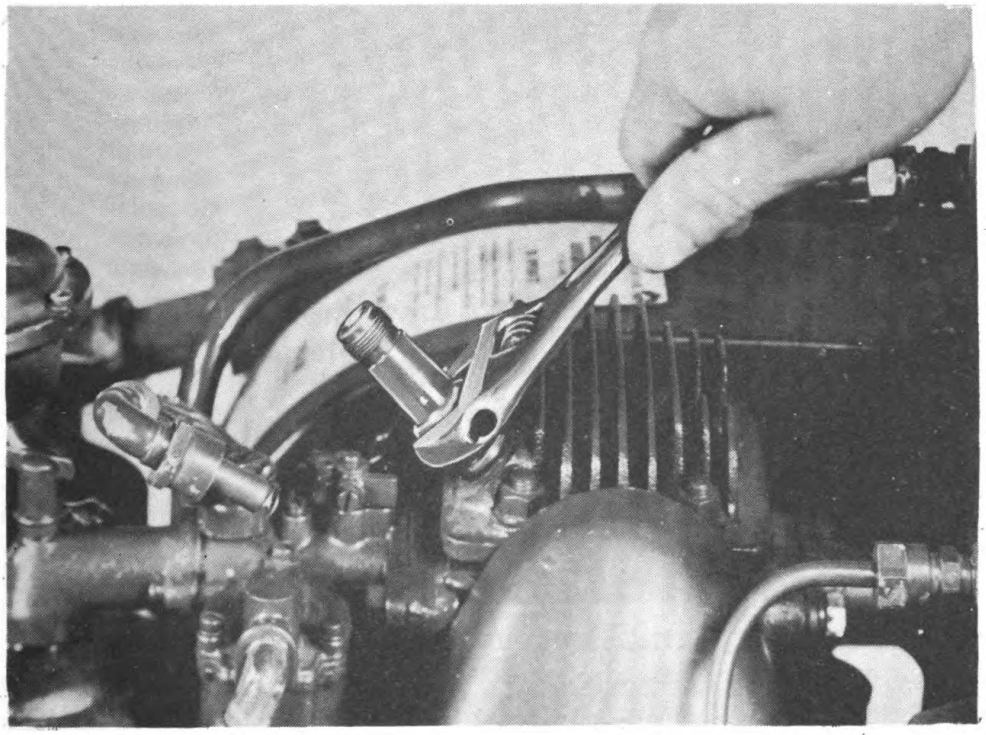


Fig 36. Removing engine spark plug.

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Fig 37. Regapping engine spark plug.

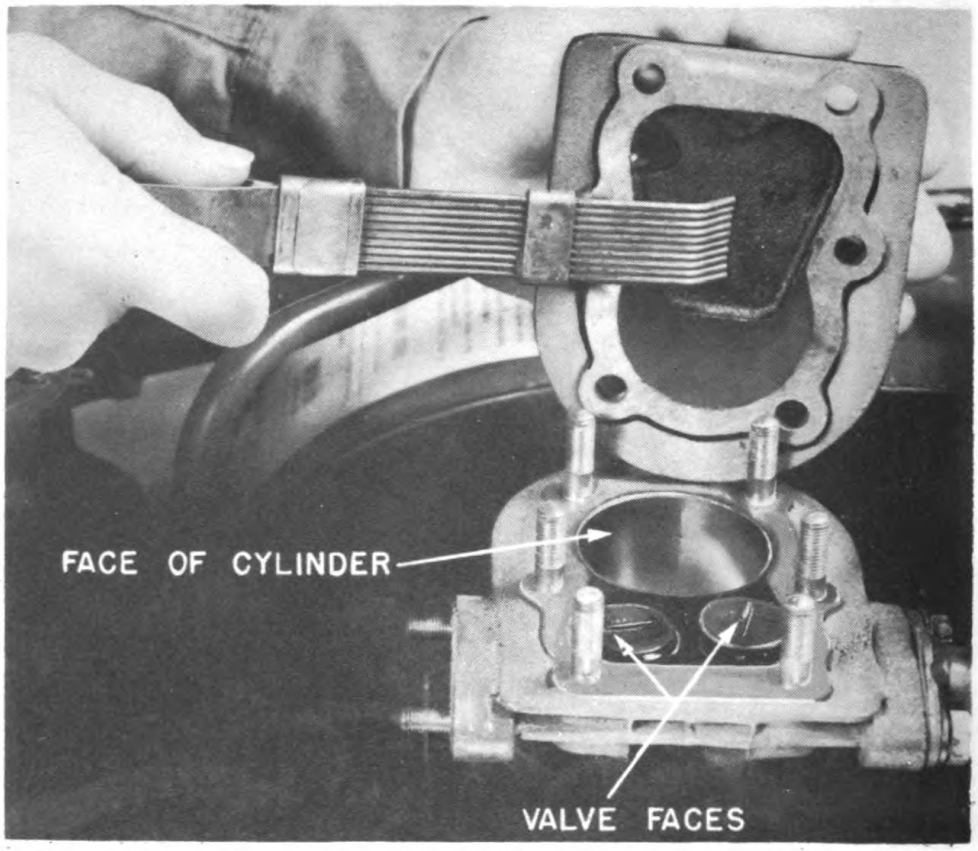


Fig 38. Scraping carbon from under side of cylinder head. (Do not hold cylinder head above valves, as shown here. Move cylinder head to one side to clean, to prevent carbon from falling on valves.)

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while removing carbon and move cylinder head to one side to scrape it (fig 38). Before replacing cylinder head, clean and lubricate valves with engine oil (SAE 30 in temperatures above 32 degrees Fahrenheit, and SAE 10 for temperatures below 32 degrees Fahrenheit). To do this, open one valve by turning engine over with ready pull-starter, squirt a little oil under valve as shown in figure 31, close valve by turning over engine with starter, and turn valve on seat with screw driver as shown in figure 32, to clean particles from valve seat and face and to lubricate valve stem. Repeat with other valve. Always replace cylinder head gasket before reassembling cylinder head (par 58).

d. Blower fan. Once each week, whether engine has been operated or not, check and, if necessary, tighten the two Allen-head set screws holding fan to engine shaft. Location of set screws is shown in figures 68 and 69. Directions for removing blower screen to reach screws are given in paragraph 70.

e. Fog oil strainer. Drain once a week by removing drain plug on bottom. To force collected dirt and sludge out of sump, give handle a few turns while drain plug is removed.

f. Gasoline and water strainers. Remove once a week and wash screen with dry cleaning solvent (fig 19).

Section XIV TROUBLE SHOOTING

33. GENERAL.

a. Scope. This section describes troubles likely to arise during operation of M2 generator, possible causes, and remedies. In the case of troubles calling for remedies over and above those mentioned here, send generator to nearest chemical maintenance company for third and fourth echelon repair or replacement in theater of operations. In zone of interior turn generator over to post chemical property officer for evacuation to next higher repair echelon. Except in emergencies, only highly trained mechanics should attempt repairs other than those discussed in this manual.

b. References. Paragraph numbers cited throughout this section refer to those paragraphs in this book which contain detailed instructions for performing repair, replacement, or adjustment suggested.

c. Precaution. Before replacing any iron pipe fitting which has been removed from generator, lute threads with "pipe dope." Acceptable pipe dopes are paint, whitelead, key paste, oil dope, gas dope, and shellac. Apply to threads with brush or fingers (male threads whenever possible).

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34. ENGINE TROUBLES.

a. Engine hard to start:

Possible cause	Possible remedy
(1) Gasoline tank empty.	Fill it.
(2) Gasoline flow obstructed.	Wash gasoline filter. If trouble persists, drain tank and clean tank and gasoline suction line. (Pars 99 and 103)
(3) Water in gasoline supply.	Drain gasoline tank and carburetor and blow out all lines, carburetor jets, and gasoline pump with compressed air. Then refill tank.
(4) Loose or defective wiring.	Tighten loose connections. There are wires in the magneto and paragraph 38 tells how to expose this part. Check gaps of engine and burner spark plugs. (Par 32)
(5) Spark plug cracked.	Replace with new plug. (Par 32)
(6) Spark plug fouled.	Clean. (Par 32)
(7) Throttle shutter stuck.	Loosen throttle shutter screw and tap shutter with screw driver. (Par 55)
(8) Defective magneto.	Check magneto for loose wire connections or improper breaker point gap and remedy if found. (Par 38)
(9) Gasoline intake manifold leaking.	Tighten bolts holding carburetor to cylinder block and replace carburetor mounting gasket if necessary. (Pars 50 and 51)
(10) Engine valve sticks.	Lubricate. (Par 32c)
(11) Improper gas mixture.	Adjust carburetor. (Par 54)
(12) No gasoline at carburetor.	Check tank.
(13) No spark at spark plug.	Check cable for short.

b. Engine misses:

Possible cause	Possible remedy
(1) Spark plug fouled.	Clean. (Par 32)
(2) Spark plug cracked.	Replace. (Par 32)
(3) Spark plug gap wrong.	Correct to approximately .020 inch. (Par 32)
(4) Defective wiring.	Tighten loose connections including wiring in magneto

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	(pars 38, 40, 41, 42, and 43). Check engine and burner spark plug gaps. (Par 32)
(5) Ignition breaker points sticking.	Lubricate breaker cam, loosen hex nut and lock holding breaker arm assembly to stator plate. (Pars 44, 45, and 46)
(6) Cylinder head gasket leaking.	Replace. (Par 58)
(7) Improper gas mixture.	Adjust carburetor. (Par 54)

c. Engine overheats:

Possible cause	Possible remedy
(1) Outside of cylinder block dirty.	Clean.
(2) Choke valve partly closed.	Push choke lever arm to wide open position. (Par 11)
(3) Lack of oil.	Fill crankcase.

d. Engine lacks power:

Possible cause	Possible remedy
(1) Improper gas mixture.	Adjust carburetor. (Par 54)
(2) Oil bath air cleaner dirty.	Remove oil bath air cleaner, empty, clean, and refill. (Par 27)
(3) Governor throttle lever loose.	Tighten governor throttle lever. (Par 64)
(4) Throttle stop lever loose.	Tighten throttle lever retaining screw. (Par 53)

e. Engine knocks:

Possible cause	Possible remedy
(1) Carbon in engine combustion chamber.	Remove carbon. (Par 32)
(2) Engine overheated.	(See subparagraph 34c above.)
(3) Loose flywheel.	Tighten flywheel nut, Allen-head set screw, and alemite fitting. (Pars 38 and 39)
(4) Lack of oil.	Fill crankcase.

f. Faulty carburetor:

Possible cause	Possible remedy
(1) Carburetor improperly adjusted.	Adjust. (Par 54)

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(2) Gasoline intake manifold leaking.	Tighten bolts holding carburetor to cylinder block and replace carburetor mounting gasket if necessary. (Pars 50 and 51)
(3) Carburetor mounting gasket leaking.	Replace. (Par 52)
(4) Water in gasoline.	Drain gasoline tank and refill.
(5) Sediment in gasoline tank.	Drain gasoline tank and clean. (Par 99)

g. Backfire through carburetor or gasoline intake manifold:

Possible cause	Possible remedy
(1) Gas mixture too lean.	Adjust carburetor. (Par 54)
(2) Throttle shutter stuck.	Loosen throttle shutter screw and tap shutter with screw driver. (Par 55)
(3) Cylinder head gasket leaking.	Replace. (Par 58)
(4) Gasoline intake manifold leaking.	Tighten bolts holding carburetor to cylinder block and replace carburetor mounting gasket if necessary. (Pars 50 and 51)
(5) Engine "jumping" time.	Adjust governor throttle lever. (Par 64)

35. OTHER TROUBLES.

a. Wet smoke. (1) Possible causes. When insufficient gasoline reaches burner, inadequate fire results, and wet smoke (smoke having a yellowish tinge) emerges from smoke discharge manifold. Possible causes of insufficient gasoline flow and their remedies are:

Possible cause	Possible remedy
(a) Leaky gasoline suction line piping.	Tighten unions.
(b) Leaking gasoline pump.	Replace. (Pars 62 and 63)
(c) Dirt in gasoline control orifice.	Remove burner valve and blow into control orifice. (Par 85)
(d) Thermostatic fuel valve lever or stem sticking.	Remove lever and loosen stem by hand while lever is off. Clean and replace lever. (Par 88)
(e) Thermostatic fuel valve gap too small.	Adjust. (Par 88)
(f) Thermostatic fuel valve box loose.	Tighten set screws. (Par 87)

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(2) Check. When wet smoke appears check for cause by removing cover of thermostatic fuel valve box and raising lever against pull of lever spring to put valve in its wide open position (fig 15). If, while holding lever up, fire in combustion chamber comes on higher, causes (a) through (d) above are ruled out and it is likely that cause (e) -- too small a gap -- is responsible for trouble.

b. No smoke. Defects which may prevent generator from making smoke, possible causes, and remedies are:

Possible cause	Possible remedy
(1) Suction hose not inserted below oil level in fog oil drum.	Push it down.
(2) Loose pipe connection at fog oil strainer or at fog oil-water pump.	Tighten.
(3) Water tank empty.	Fill it.
(4) Draincock under feed water regulator open.	Close it.
(5) Water strainer loose.	Tighten. (Par 9)
(6) Water strainer gasket broken.	Replace entire strainer. (Par 9)
(7) Broken diaphragm in feed water regulator.	Replace. (Pars 94 and 95)
(8) Fog oil drum empty.	Replace.
(9) Engine speed incorrect.	Check with tachometer and adjust governor lever. (Par 64)
(10) Water in fog oil drum.	Remove hose and use new drum of oil.
(11) Water in fog oil strainer.	Drain and flush out. (Par 32)

c. Failure of burner ignition. (1) Spark plug. If burner does not ignite within 6 seconds after opening burner valve, close valve as cause of failure may be no spark and gasoline will collect in combustion chamber. To check spark, remove burner spark plug and place it in open where it can be seen clearly. (You need not place spark plug on metal as body is already grounded by radio shielding harness around spark plug cable.) Pull ready pull-starter with ignition switch ON and burner valve closed, and if spark plug fails to spark at points, clean it and check gap which should be .062 inch (par 32). If a spark still fails to appear, try a spare spark plug.

(2) Cable. If new spark plug fails to spark, the trouble is probably in the ignition cable running from magneto to burner spark plug. This may have been grounded by accident.

(3) Gasoline control orifice. If spark plug is sparking, it is probable that gasoline is not reaching burner. To check this, remove gasoline piping between thermostatic fuel valve and burner

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valve. Then pull ready pull-starter slowly with ignition switch OFF. If gasoline issues from open piping at thermostatic fuel valve (indicating that there are no obstructions in line prior to this point), trouble probably is obstruction in gasoline control orifice. To remedy this, remove burner valve and blow into control orifice. (Par 85)

Section XV POWER GROUP

36. GENERAL.

a. Main parts. Main parts of power group are engine and ignition system.

b. Engine. The engine, specifications for which are given in figure 4, is bracketed to generator gasoline tank by means of four cap screws, and base is held to cylinder block above by four more cap screws extending upward from base. Engine runs fog oil-water pump and blower, discharges gasoline to burner, and assists in atomizing burner fuel mixture. Fog oil-water pump is attached to extension of engine crankshaft by a drive chain and two sprockets so that when crankshaft revolves, pump goes into operation. Similarly fan of blower is attached directly to crankshaft extension and revolves with it. Engine gasoline pump furnishes fuel to the burner by discharging a part of the gasoline through the thermostatic fuel valve and burner valve. The hot vapors of engine exhaust assist in atomizing burner fuel mixture as explained in paragraph 19.

c. Ignition system. The magneto assembly, the engine flywheel and breaker cam, two spark plugs, two spark plug cables, and a series of leads and grounds in the magneto, comprise the ignition system of generator. One ignition cable leading from magneto to engine spark plug carries spark for combustion of engine fuel mixture. The other, from magneto to burner spark plug, carries spark necessary for igniting burner fuel mixture to provide fire in combustion chamber of furnace assembly. Each spark plug cable is covered with a radio shielding harness which grounds the spark plug. Ignition switch on engine flywheel housing opens and closes the circuit, a lead wire from switch attaching to condenser inside magneto.

37. MAGNETO ASSEMBLY.

a. General. The magneto assembly consists essentially of condenser, breaker points, and magneto coil mounted on a stator plate which serves as the stationary member of the electricity-

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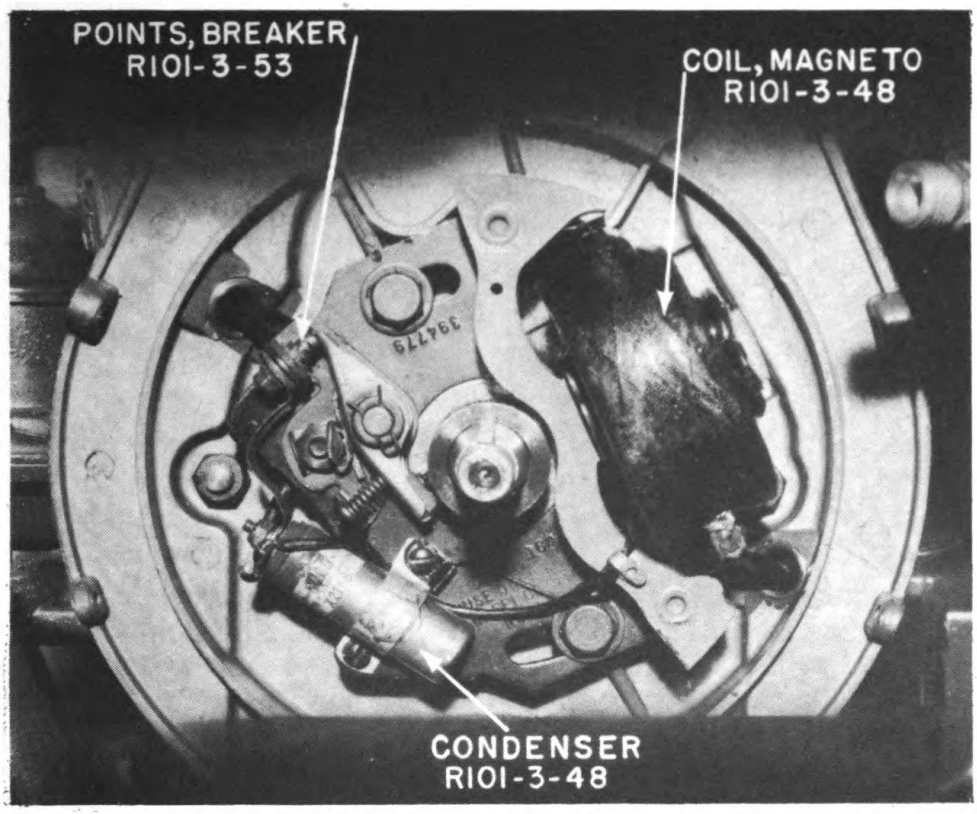


Fig 39. Magneto assembly, showing Chemical Warfare Service nomenclature of parts.

producing group, the engine flywheel and breaker cam serving as the revolving members.

b. Responsibility. (Second echelon only) Using personnel are responsible for adjustment and cleaning of breaker points, and for replacement of breaker points, condenser, and magneto coil. Location of these components is shown in figure 39, with Chemical Warfare Service nomenclature.

38. REMOVAL OF MAGNETO ASSEMBLY. (Second echelon only.)

Proceed as follows:

a. Remove alemite fitting from flywheel nut by holding nut with 25/32-inch open-end wrench and loosening fitting with 7/16-inch open-end or socket wrench.

b. Loosen Allen-head set screw in flywheel nut, as shown in figure 40. To do this, insert larger of two Allen-head wrenches issued with M2 generator, hold nut with open-end wrench, and turn Allen-head wrench counterclockwise with aid of pliers. On a new generator, this screw usually turns hard and best results are obtained by applying considerable force slowly and steadily.

c. Remove small hex nut and lock washer holding ignition switch to flywheel housing as shown in figures 41 and 42.

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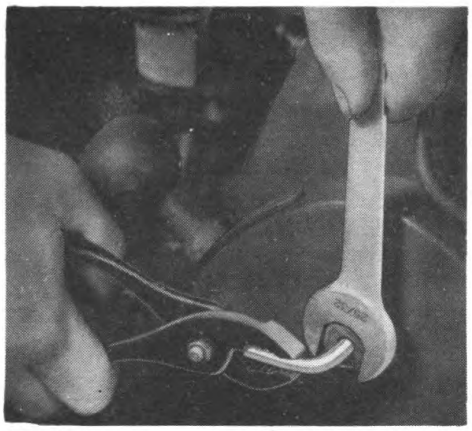


Fig 40. Loosening Allen-head set screw in flywheel nut to uncover magneto.

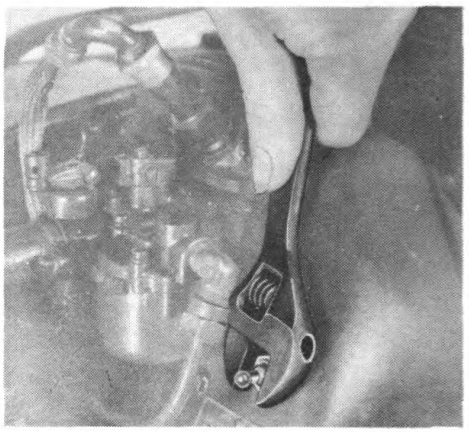


Fig 41. Removing small hex nut holding ignition switch to flywheel housing.

d. Loosen four cap screws holding flywheel housing to engine. On some generators, cap screws have slotted heads and can be loosened with screw driver. If heads are not slotted, loosen the three cap screws which can be reached easily with adjustable wrench as shown in figure 43, and then loosen cap screw nearest neck of crankcase filler cap with 5/16-inch socket wrench. Measuring stick of crankcase filler cap must be removed to loosen screw to which its jack chain is attached. (Fig 44)

e. Remove flywheel housing and spring housing which come off as a unit. Do not disassemble spring housing except in case of emergency, as described in paragraph 48.

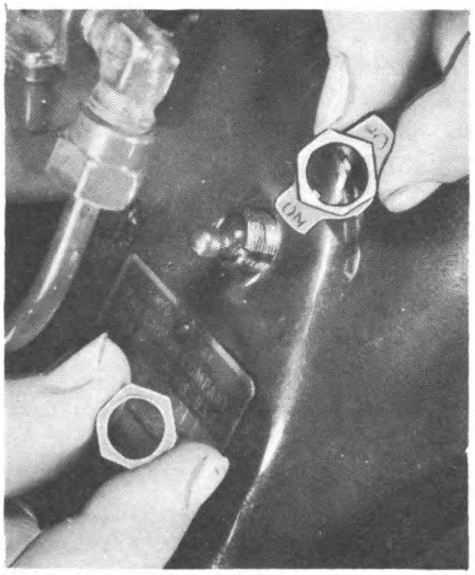


Fig 42. Ignition switch hex nut and lock washer detached from flywheel housing.

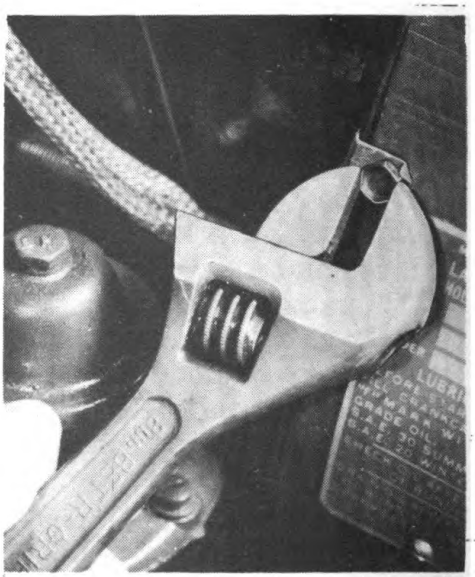


Fig 43. Loosening cap screws which hold flywheel housing to engine.

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Fig 44. Removing crankcase filler cap to permit loosening of one flywheel housing cap screw.

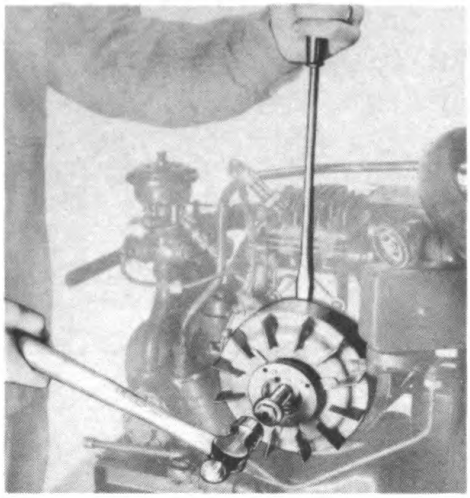


Fig 45. Jarring flywheel loose from engine shaft to uncover magneto assembly.

f. Remove flywheel. To do this, place heavy duty screw driver between flywheel and engine bearing plate as a pry, pull flywheel nut out 1/4 inch, and then strike end of nut with hammer as shown in figure 45. This jars flywheel loose, and permits flywheel, starter pawl assembly, and flywheel nut to be removed from shaft. (Fig 46)

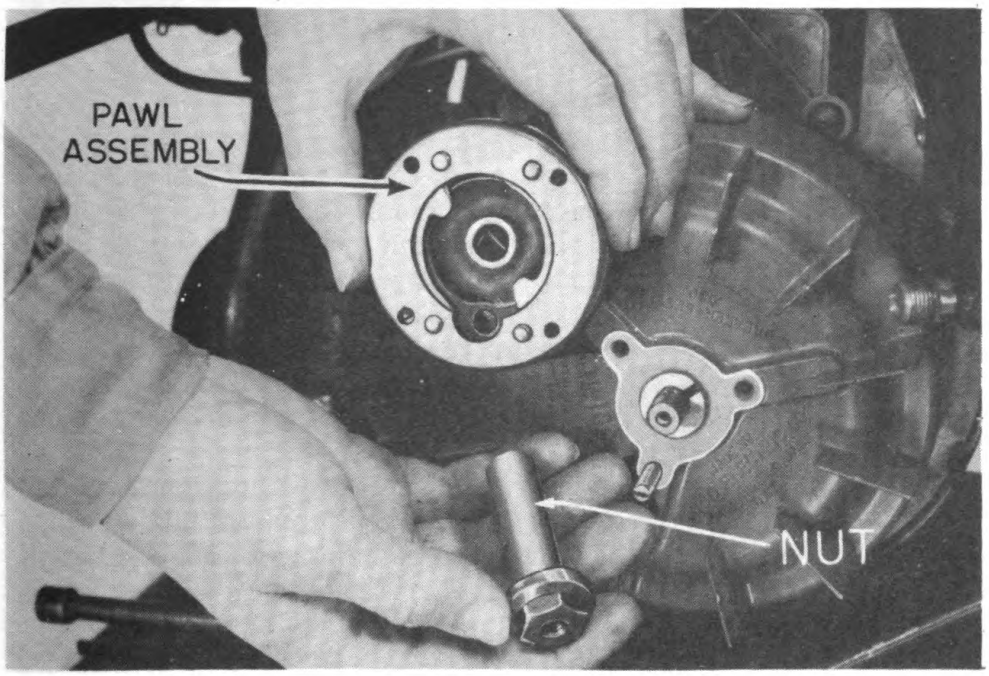


Fig 46. Removing starter pawl assembly and flywheel nut from engine shaft.

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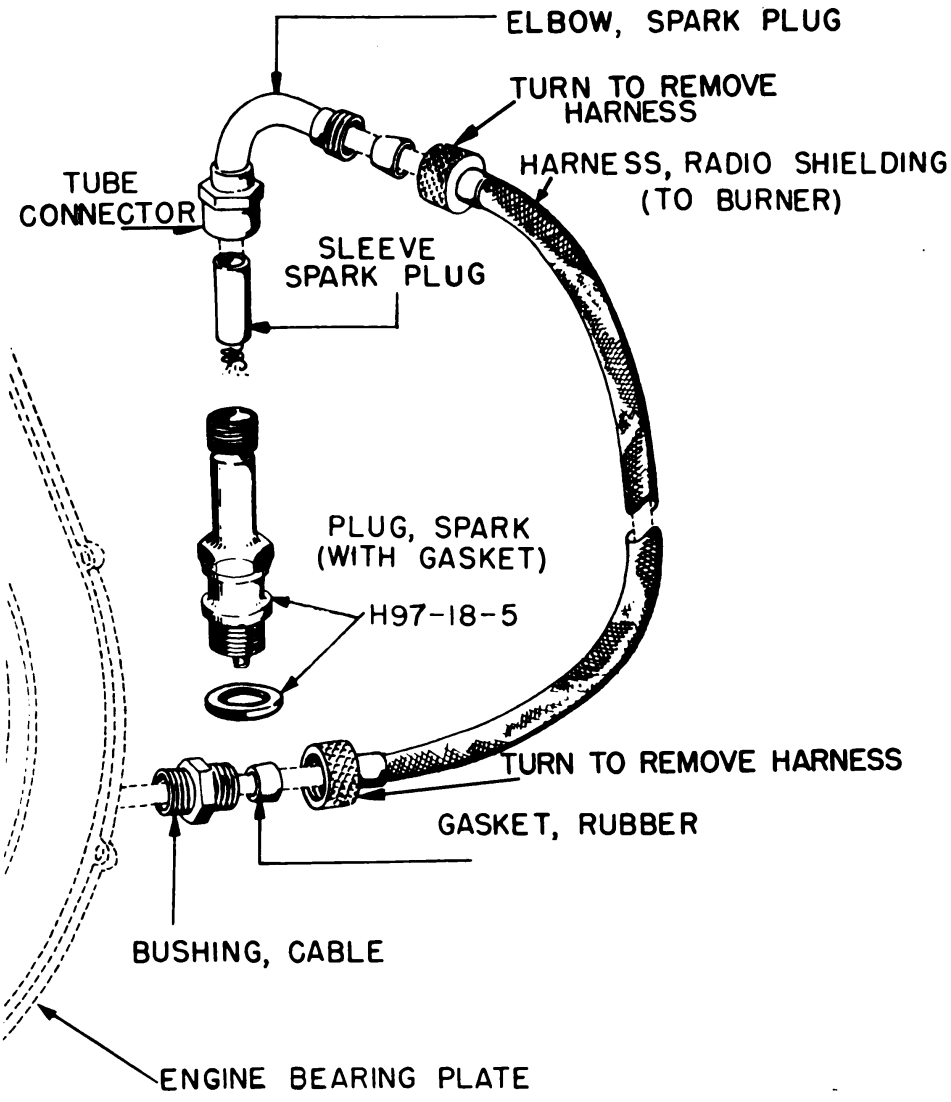


Fig 47. Radio shielding cable harness and related parts.

g. Loosen tube connectors at engine and burner spark plug elbows and withdraw spark plug sleeves. (Fig 47)

h. Remove both spark plug sleeves by pulling them off spark plug cables. (Fig 47)

i. Loosen radio shielding harness unions at spark plug elbows with pliers, and pull spark plug cables back through elbows, dislodging rubber gaskets in order to free cables of elbow fittings. (Fig 47)

j. Loosen harness unions at cable bushings near rear side of engine bearing plate, dislodge rubber gaskets nearest bearing plate, and strip radio shielding harnesses from both spark plug cables. (Fig 47)

k. Detach ignition switch lead by loosening machine screws

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and washers holding it to engine bearing plate above magneto.

l. Remove stator plate by loosening two cap screws holding it to engine bearing plate, pulling spark plug cables through openings by which they enter magneto. Ignition switch lead also comes off with stator plate, so that entire magneto assembly can now be removed from generator.

39. INSTALLATION OF MAGNETO ASSEMBLY. (Second echelon only.)

Proceed as follows:

a. Thread spark plug cables back through holes in engine bearing plate.

b. Replace stator plate on engine bearing plate and attach ignition lead to bearing plate.

c. Fit cables and lead snugly against parts, as they were before removal; otherwise flywheel will catch on them, causing a "knock" in mechanism.

d. Replace radio shielding harnesses on spark plug cables.

e. Replace spark plug sleeves and assemble them to spark plugs by inserting sleeves in plugs and tightening tube connectors.

f. Replace flywheel, starter pawl assembly, and flywheel nut, in that order.

g. Replace flywheel housing and spring housing by rebolting flywheel housing to engine.

h. Tighten Allen-head set screw in flywheel nut by turning Allen-head wrench clockwise, and replace alemite fitting.

40. REMOVAL OF MAGNETO COIL. (Second echelon only.)

Remove magneto assembly from engine bearing plate (par 38) and proceed as follows:

a. Detach coil lead wire and coil ground wire from condenser. Loosen ground (the uninsulated wire) by removing condenser support by which it is attached to condenser. Loosen lead by removing small hex nut and lock washer by which it is held to pole of condenser. (Figs 50 and 51)

b. Push coil up on pole of stator plate for a short distance by pressing hard as shown in figure 48. Do not use screw driver or other instrument as insulating of coil must not be broken.

c. Having pushed coil up some distance, push it down again to its original position. This will cause insulating wedges to "pop up" so that they may be pulled out with pliers as shown in figure 49. Coil and attached wires and cables can now be lifted off stator plate. (Fig 50)

41. INSTALLATION OF MAGNETO COIL. (Second echelon only.)

Remove magneto assembly from engine bearing plate (par 38), remove old coil and attached wires (par 40), and proceed as follows:

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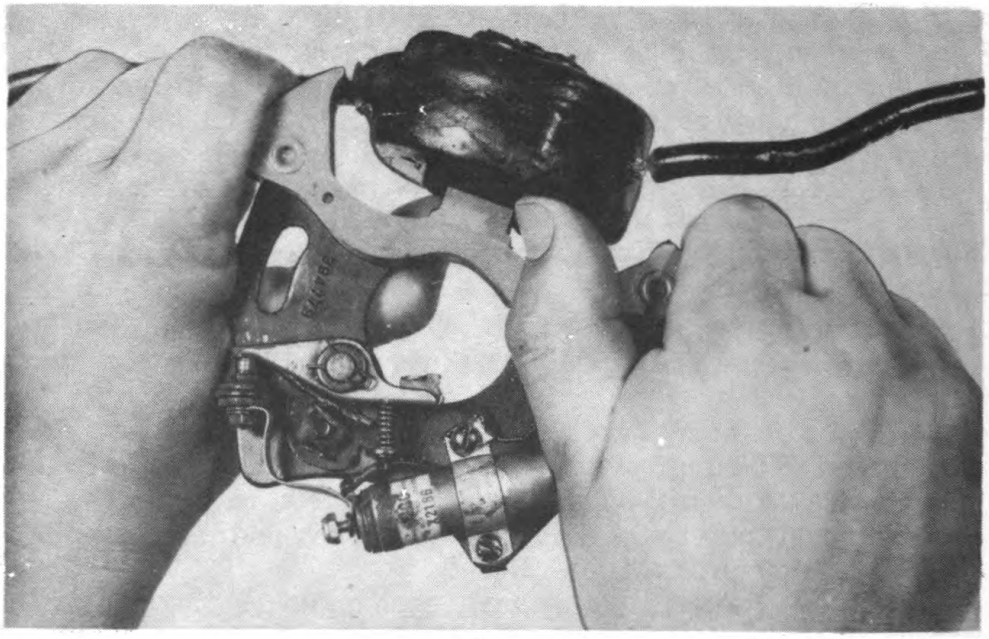


Fig 48. Forcing magneto coil off stator plate.

a. Push new coil down over pole of stator plate.

b. Insert insulating wedge between coil and pole, and pound wedge in with light taps of hammer, taking care not to break insulation of coil.

c. Attach spark plug cables to spark plugs (par 39).

d. Attach coil lead wire to condenser pole. To do this, loosen both machine screw at pole and the hex nut at condenser support, thread wire through support, and attach to pole. (Figs 50 and 51)

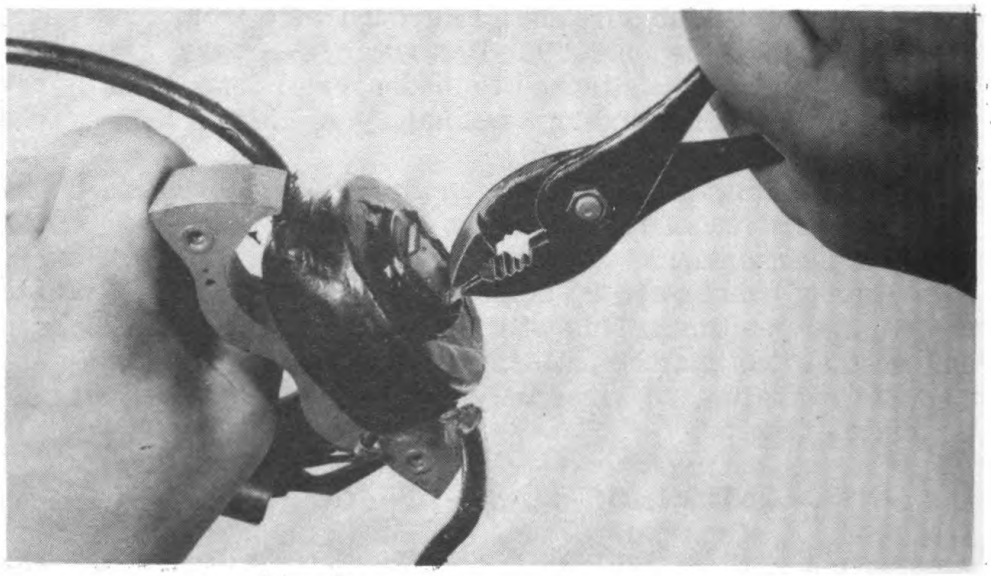


Fig 49. Removing insulation wedges from magneto coil.

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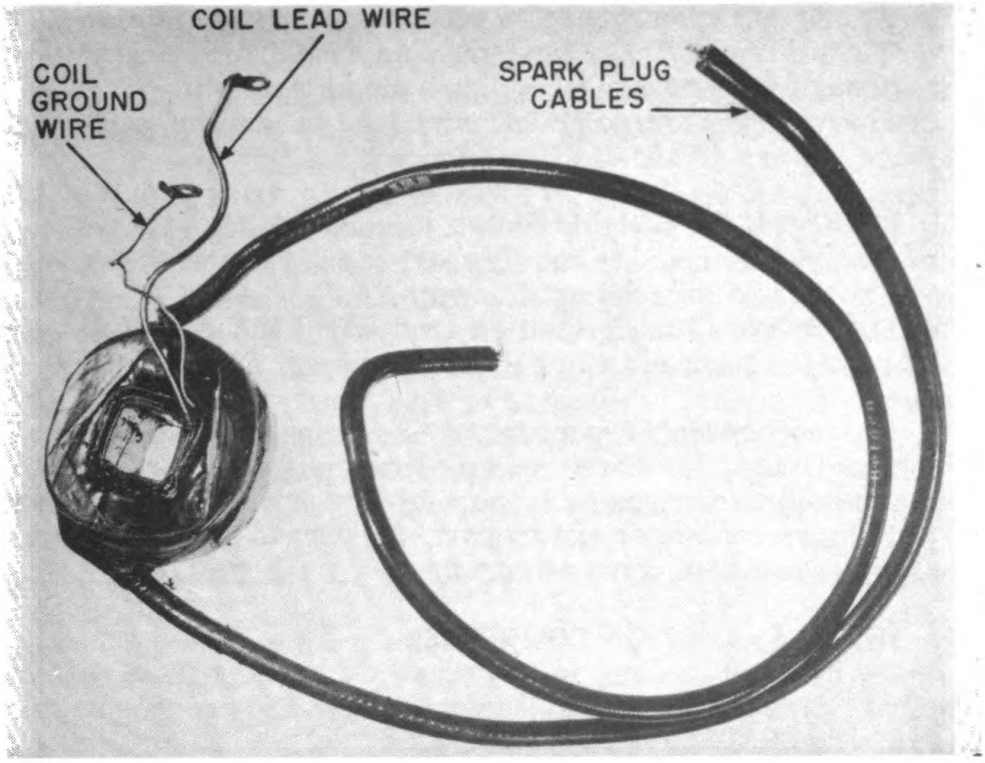


Fig 50. Magneto coil and attached wiring.

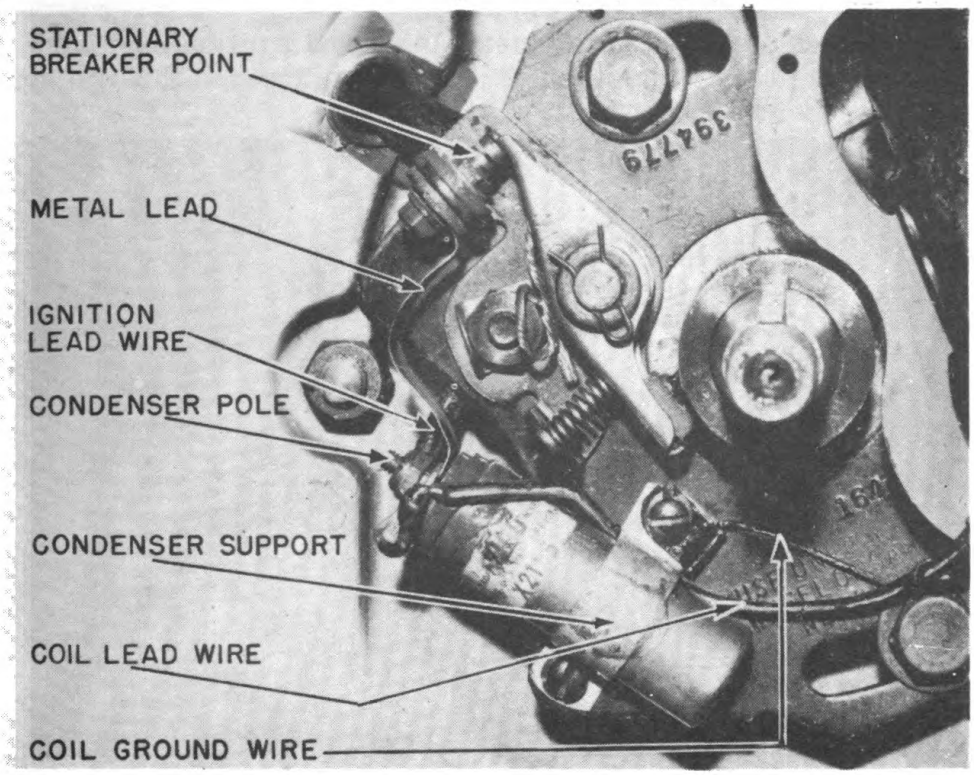


Fig 51. Condenser and related parts.

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e. Attach coil ground wire to condenser support.

f. Tighten support hex nut and pole machine screw to hold wires snugly to condenser. Be sure metal lead from condenser to stationary breaker point and wire lead to ignition switch are in place. (Pars 43 and 45)

42. REMOVAL OF CONDENSER. (Second echelon only.)

Remove flywheel housing and flywheel to expose magneto assembly (par 38), and proceed as follows:

a. Detach metal lead, ignition lead wire, and coil lead wire from pole of condenser (fig 51), by loosening hex nut and lock washer.

b. Loosen condenser support by loosening machine screws which hold it to stator plate. At same time, detach coil ground wire which is held to condenser support by screw and lock washer.

c. Remove condenser and support. Support is soldered to condenser, so that both come off together.

43. INSTALLATION OF CONDENSER.

Remove flywheel housing and flywheel to expose magneto assembly (par 38), remove old condenser (par 42), and proceed as follows:

a. Attach new condenser (fig 51), to stator plate by tightening support screws. Be sure condenser is faced upward toward stationary breaker point as shown in figure 52.

b. Attach coil lead wire, metal lead, and ignition lead wire to condenser pole. Be sure coil lead wire is threaded through con-

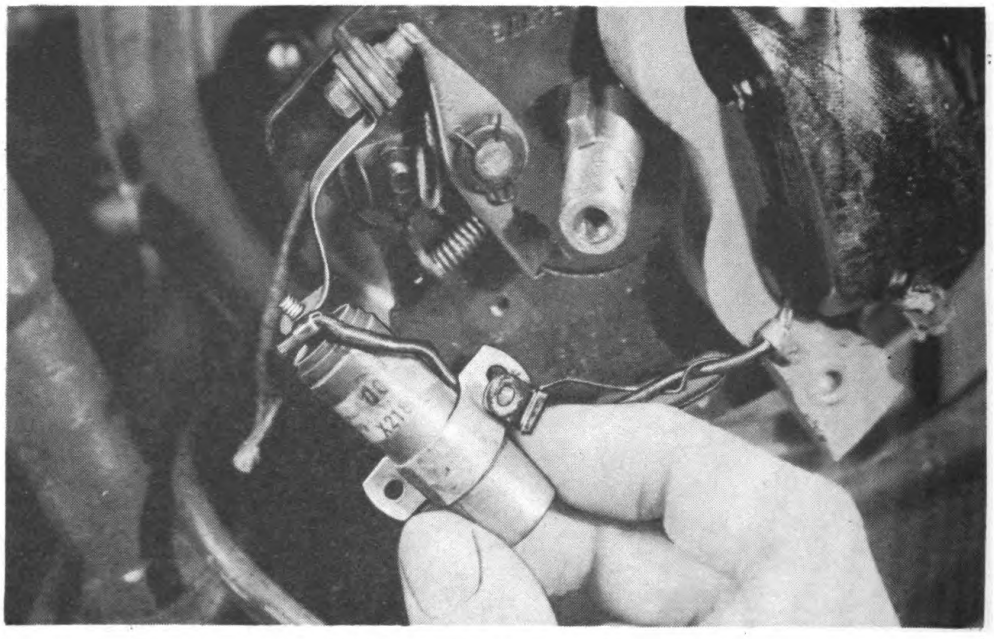


Fig 52. Installing condenser.

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denser support or caught under it before support is tightened down.

c. Attach coil ground wire to condenser support.

d. Tighten all machine screws and hex nuts to hold condenser and attached wiring in place.

44. REMOVAL OF BREAKER POINTS. (Second echelon only.) Remove flywheel housing and flywheel to expose magneto assembly (par 38) and proceed as follows:

a. Remove breaker arm lock with pliers, take off top breaker arm washer, and lift breaker arm assembly off breaker arm post on which it turns. This removes moving breaker point (fig 53).

b. Detach metal lead from condenser by loosening machine screw and lock washer which hold it to condenser pole.

c. Loosen breaker plate screw and lift breaker plate assembly off breaker arm post. This removes stationary breaker point.

45. INSTALLATION OF BREAKER POINTS. (Second echelon only.) Remove flywheel housing and flywheel to expose magneto assembly (par 38), remove old breaker arm assembly and old breaker plate assembly (par 44), and proceed as follows:

a. Place new breaker plate assembly on stator plate by dropping it over breaker arm post (fig 53).

b. Tighten breaker plate screw, and attach metal lead of stationary breaker point to condenser. (Par 43)

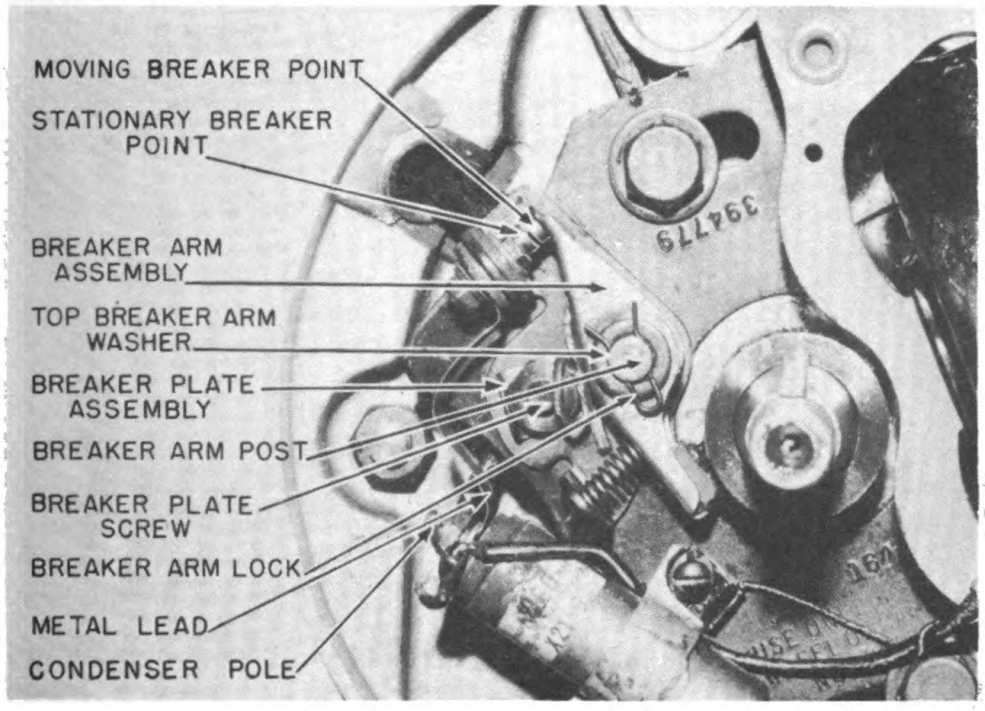


Fig 53. Breaker points and related parts.

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c. Place bottom breaker arm washer on post and place new breaker arm assembly in position, fitting top breaker arm washer and breaker arm lock in place to hold assembly.

d. Adjust breaker points, if necessary, as directed in paragraph 46, following.

46. ADJUSTMENT OF BREAKER POINTS. (Second echelon only.)

Remove flywheel housing and flywheel to expose magneto assembly (par 38), and proceed as follows:

a. Check breaker points for gap (fig 53). To do this, turn crankshaft until breaker arm rests on highest point of breaker cam. With cam in this position, gap between stationary breaker point and moving breaker point should be .020 inch. Measure by inserting .020-inch gage between points. (An easy way to turn crankshaft is to replace flywheel loosely on shaft and turn as needed.)

b. If gap is incorrect, loosen breaker plate screw and move breaker plate assembly to left or right until correct gap is reached. Be sure breaker plate screw is securely tightened before reassembling flywheel.

47. MAINTENANCE OF MAGNETO ASSEMBLY. (Second echelon only.)

a. Cleaning. In addition to adjustment directed in paragraph 46, using personnel are required to clean breaker points which become dirty. To do this, disassemble flywheel housing and flywheel (par 38), and scrape points with a breaker point file or manicure file.

b. Breaker cam. Whenever the magneto has been exposed for any reason, lubricate cam before replacing flywheel. Coat cam lightly with general purpose grease

c. Testing magneto. To test magneto, loosen pipe union on engine spark plug elbow and withdraw spark plug sleeve from spark plug (fig 47). Hold coil spring on end of sleeve about 1/8 inch from steel body of plug and give ready pull-starter a few pulls as in starting generator. If spark occurs, magneto is functioning correctly.

48. EMERGENCY ADJUSTMENT OF READY PULL-STARTER. (Second echelon only.)

If, in course of disassembly of flywheel housing, starter return spring jams or starter cable becomes twisted, remedy as follows:

a. Remove spring housing cover by loosening two screw caps holding it to spring housing.

b. Press starter return spring into place as shown in figure 54. Hold it so that it rests loose as shown, and be sure loop of spring is over post.

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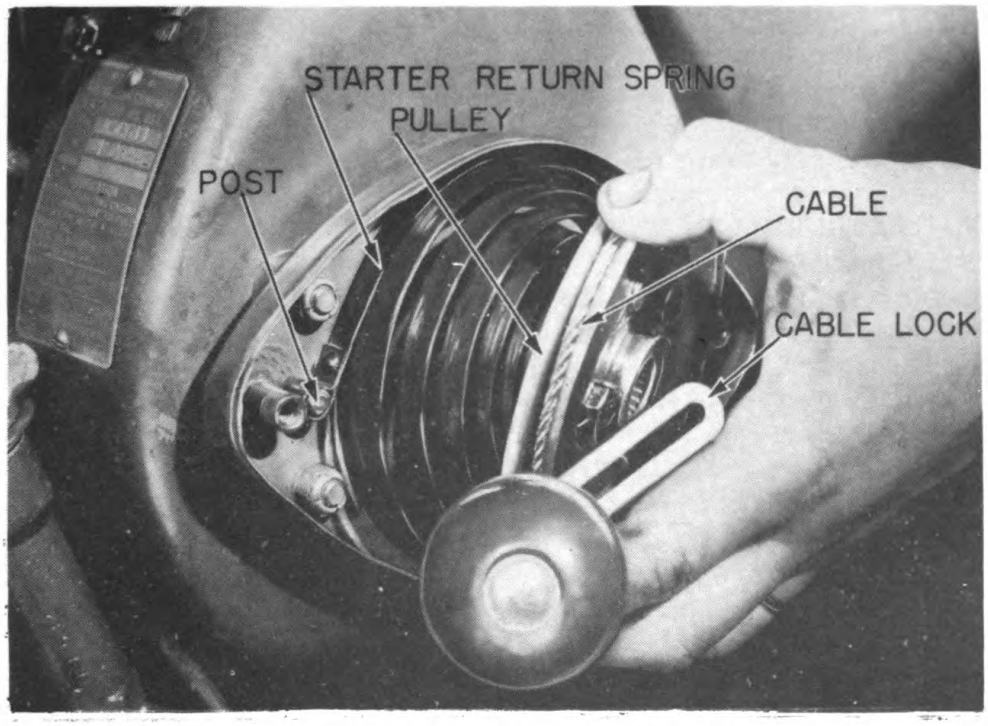


Fig 54. Adjusting ready pull-starter.

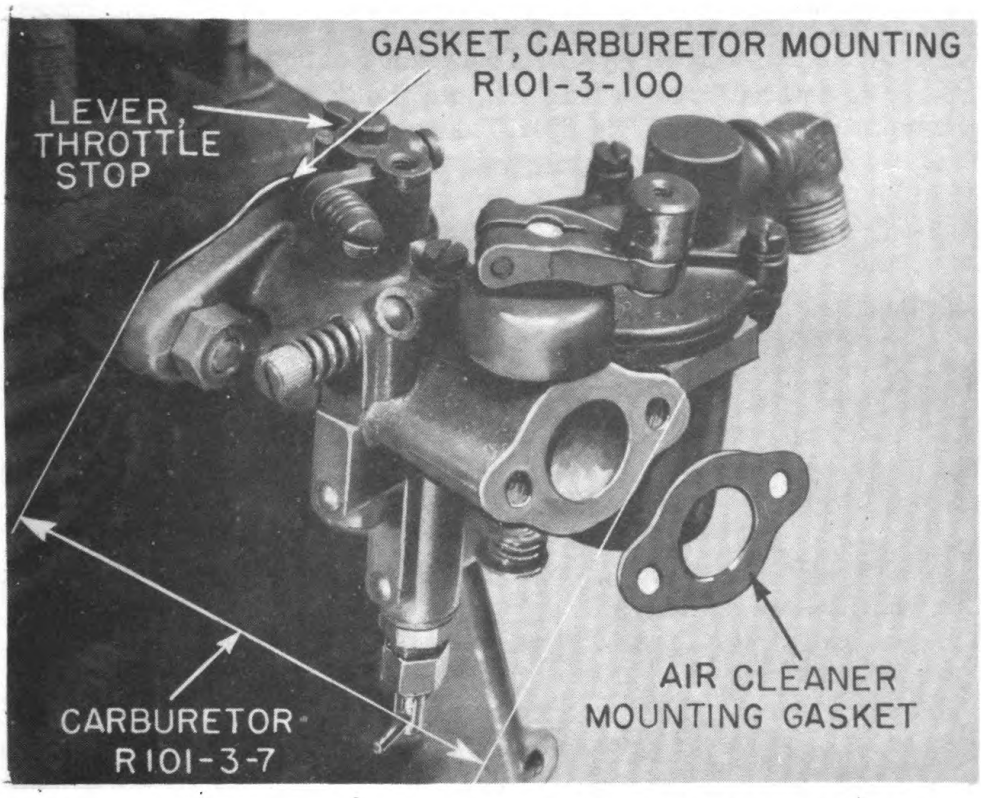


Fig 55. Carburetor, showing Chemical Warfare Service nomenclature of parts.

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c. If cable is twisted, unwind it from pulley and rewrap it clockwise so that it rests smoothly on pulley as shown in figure 54.

d. Place cable lock smoothly along pulley over cable. (Fig 54)

e. Push pulley back against spring, holding pulley lock in place, and replace spring housing cover.

49. CARBURETOR.

Using personnel are responsible for replacement of entire carburetor, replacement of carburetor mounting gasket, replacement of throttle stop lever, and for minor carburetor adjustments. Location of parts mentioned is shown in figure 55, together with Chemical Warfare Service nomenclature.

50. REMOVAL OF CARBURETOR.

Proceed as follows:

a. Break gasoline suction line at carburetor by loosening union as shown in figure 56.

b. Remove bowl and stem of oil bath air cleaner as shown in figure 29.

c. Detach air cleaner elbow and air cleaner mounting gasket from carburetor by loosening two machine screws holding elbow to carburetor. (Fig 57)

d. Remove carburetor by loosening two hex nuts by which it is held to carburetor mount of engine cylinder block (fig 57). (Use 7/16-inch open-end wrench.) To remove carburetor, it is necessary to detach throttle link between flange of throttle shaft and governor throttle lever (fig 65). Take care not to lose throttle link.

e. Peel carburetor mounting gasket off carburetor mount to

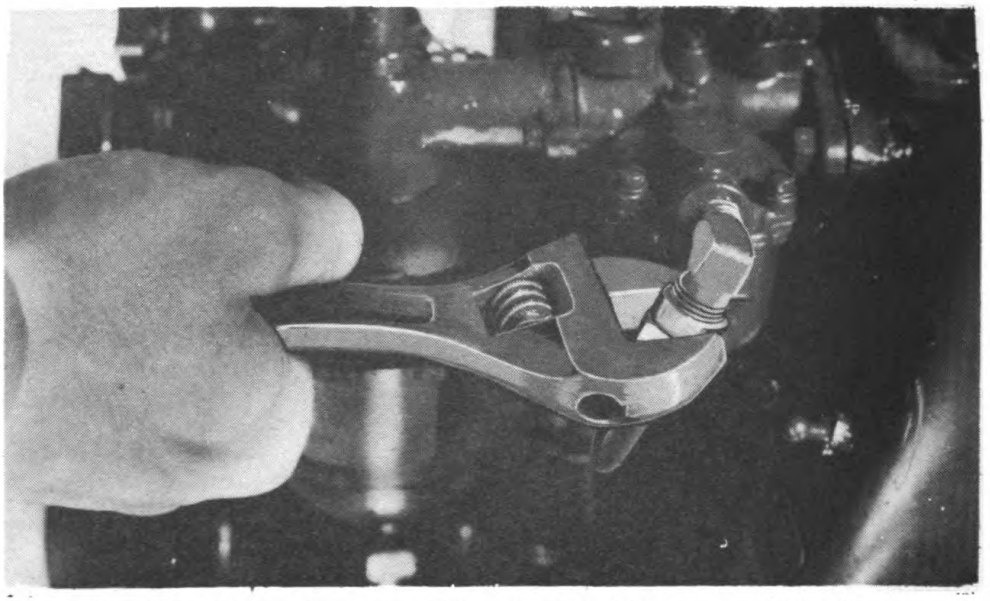


Fig 56. Breaking gasoline suction line at carburetor.

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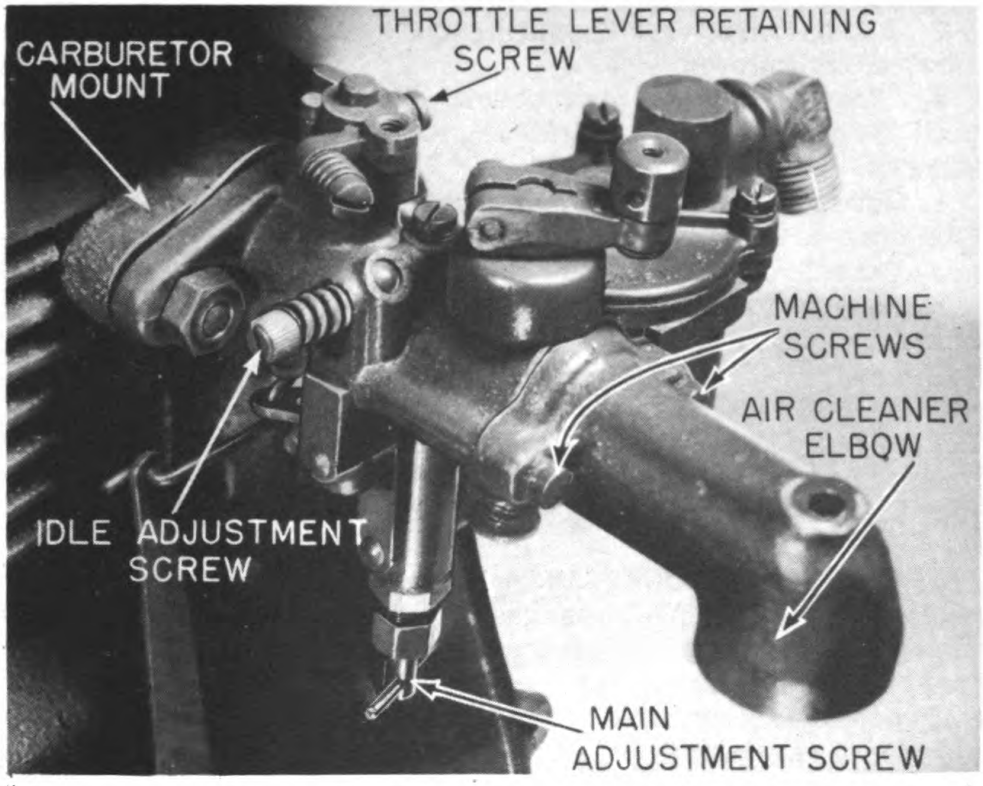


Fig 57. Carburetor and related parts.

which it usually is sealed with grease.

51. INSTALLATION OF CARBURETOR.

(Fig 57) Proceed as follows:

a. Seal carburetor mounting gasket to carburetor mount with grease.

b. Replace throttle link (fig 65). Be sure link is inserted in outer hole of throttle shaft flange.

c. Attach carburetor to carburetor mount of engine cylinder block by tightening hex nuts with 7/16-inch open-end wrench.

d. Replace air cleaner elbow and body and stem of oil bath air cleaner, and connect gasoline suction line to carburetor.

52. REMOVAL AND INSTALLATION OF CARBURETOR MOUNTING GASKET.

(Covered in paragraphs 50 and 51.)

53. REMOVAL AND INSTALLATION OF THROTTLE STOP LEVER.

a. To remove, loosen throttle lever retaining screw and lift lever off throttle shaft. (Fig 57)

b. To install, place new lever on shaft and tighten retaining screw. (Fig 57)

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54. ADJUSTMENT OF CARBURETOR.
Proceed as follows:

a. Close main adjustment screw (fig 57) by turning clockwise until it seats lightly (do not force), and then open same screw one full turn counterclockwise.

b. Screw in idle adjustment screw (fig 57) until it seats and then open 3/4 of a turn.

c. Open throttle approximately 1/3 and run engine at that speed.

d. Slowly close main adjustment screw until the engine runs smoothly without missing.

55. MAINTENANCE OF CARBURETOR.
Occasionally throttle shutter sticks, obstructing flow of gasoline to engine combustion chamber. To remedy, remove carburetor (par 50) and loosen throttle shutter screw (fig 58).

56. CYLINDER BLOCK. Using personnel are responsible for replacement of cylinder head gasket, replacement of valve spring inspection plate gasket, and for cleaning engine valves, cylinder face, and underside of engine cylinder head. They are also permitted to replace cylinder head in emergencies. Location of parts mentioned is shown in figure 59, together with Chemical Warfare Service nomenclature.

57. REMOVAL OF CYLINDER HEAD.
Remove engine spark plug and loosen six hex nuts holding head to cylinder block. Use 1/2-inch socket wrench.

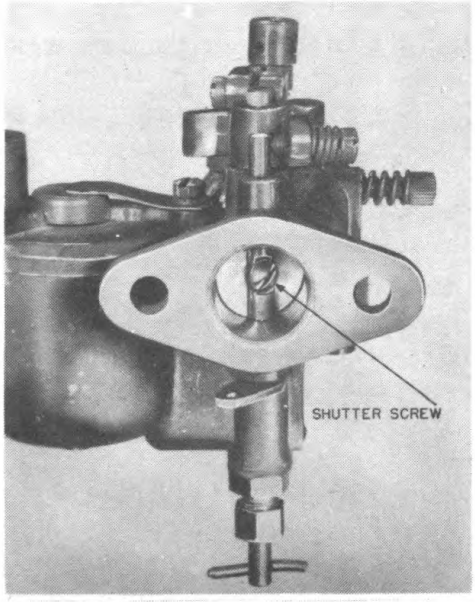


Fig 58. Throttle shutter screw.

58. REMOVAL AND INSTALLATION OF CYLINDER HEAD GASKET.
(Second echelon only.)
Be sure gasket is on straight and firm. Use a little grease on underside of gasket.

59. REMOVAL AND INSTALLATION OF VALVE SPRING INSPECTION PLATE GASKET.
(Second echelon only.)
Remove flywheel housing (par 38), loosen two cap screws holding plate to cylinder block, and peel off gasket. Use a little grease or luting material on underside when replacing.

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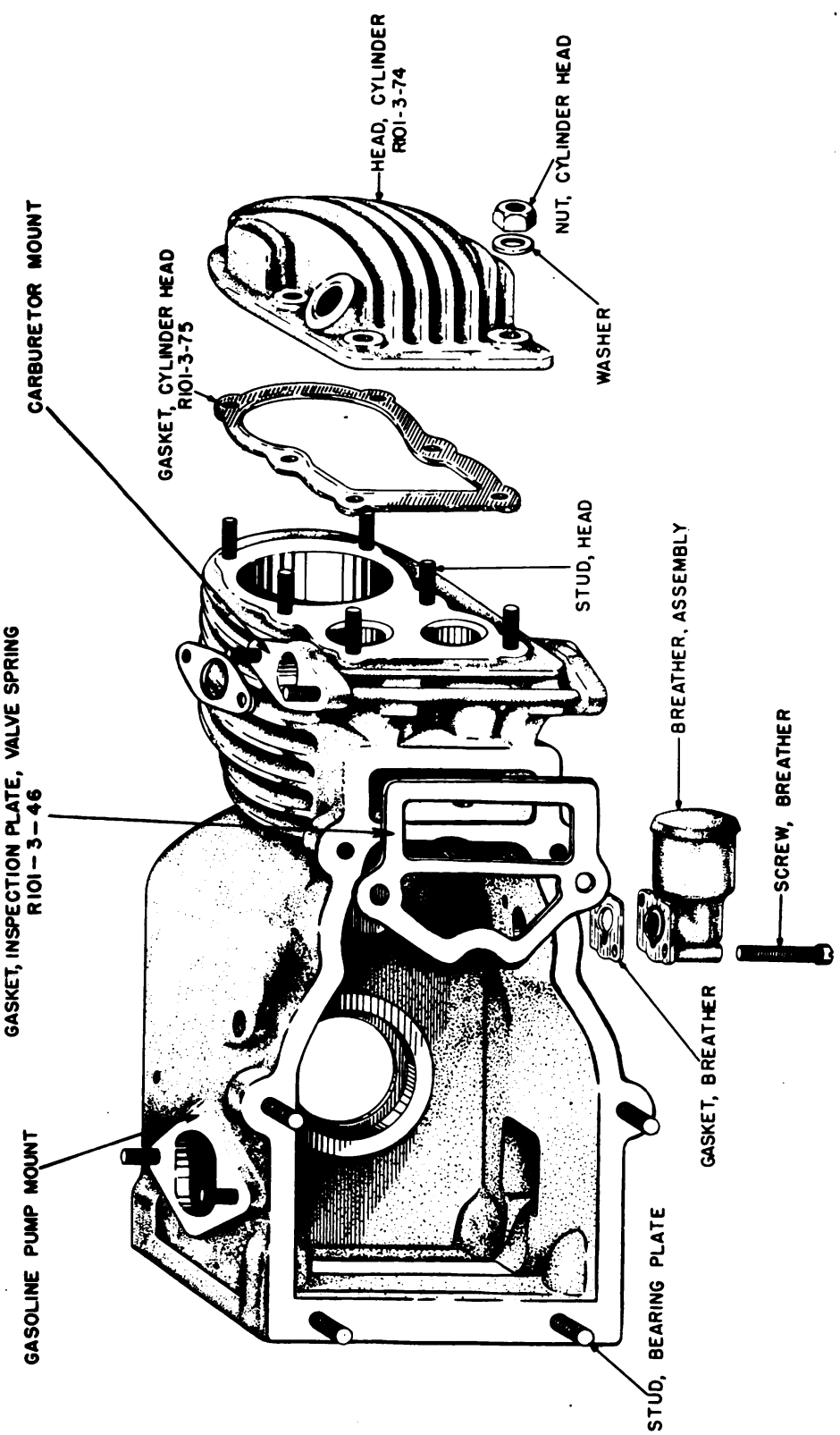


Fig 59. Upper portion of cylinder block showing Chemical Warfare Service nomenclature of parts.

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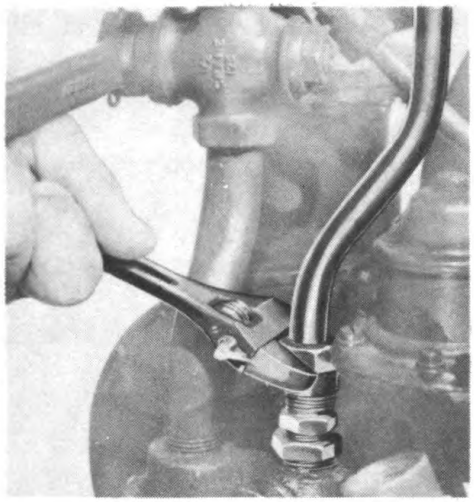


Fig 60. Breaking inlet line at fog oil-water pump.

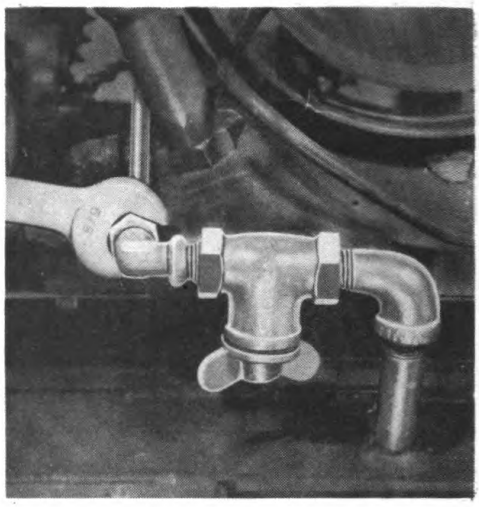


Fig 61. Breaking gasoline suction line at gasoline strainer.

60. MAINTENANCE OF CYLINDER BLOCK.
Clean underside of cylinder head and faces of valves and cylinder as directed in paragraph 32.

61. GASOLINE PUMP.
Using personnel are responsible for replacement of gasoline pump.

62. REMOVAL OF GASOLINE PUMP.
This pump is hard to reach. Simplest method of removal is to proceed as follows:

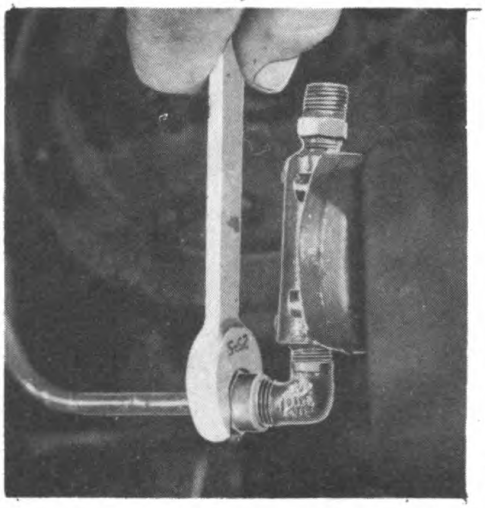


Fig 62. Breaking gasoline discharge line at thermostatic fuel valve inlet.

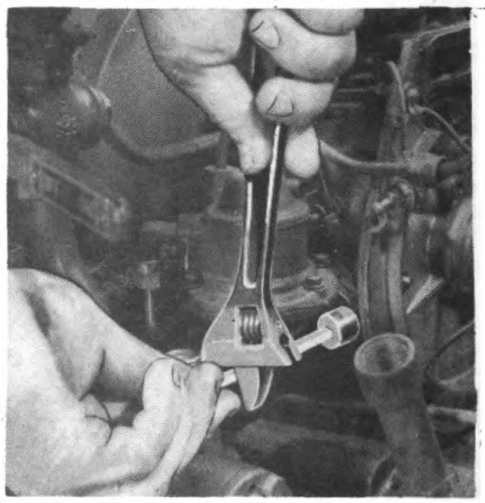


Fig 63. Loosening the two hex nuts which hold gasoline pump to cylinder block.

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a. Remove oil bath air cleaner as shown in figure 29.

b. Remove carburetor (par 50).

c. Break inlet line at fog oil-water pump as shown in figure 60. This line can now be moved aside to permit freeing of gasoline pump.

d. Break gasoline suction line at gasoline strainer as shown in figure 61.

e. Break gasoline discharge line at thermostatic fuel valve inlet as shown in figure 62.

f. Remove gasoline pump from cylinder block by loosening the two hex mounting nuts with 1/2-inch socket wrench as shown in figure 63. If hex nuts turn hard, apply pressure to handle of socket wrench with adjustable wrench.

g. It is now possible to withdraw pump and those fittings still attached to it from cylinder block (fig 64). In withdrawing pump, pull it up and out to free rocker arm. (Fig 64)

h. Detach from pump the discharge line to burner, the discharge line to carburetor, and the suction line (fig 64). Do not remove rocker arm as it is part of pump.

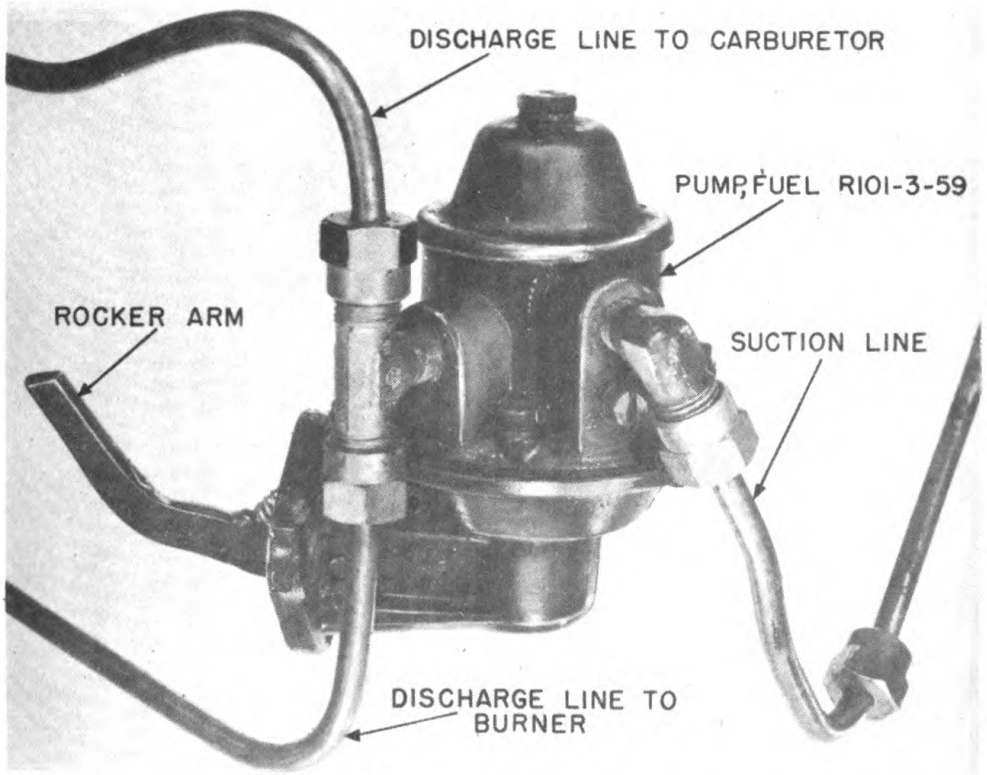


Fig 64. Gasoline pump freed from cylinder block with some fittings still attached. ("Pump, fuel" is Chemical Warfare Service nomenclature for this pump.)

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63. INSTALLATION OF GASOLINE PUMP. (Second echelon only.)
Remove old pump as directed in paragraph 62. Attach new pump by inserting rocker arm (fig 64) into opening in cylinder head and by tightening two hex nuts which hold pump to gasoline pump mount (fig 59) on lower part of cylinder head.

64. ADJUSTMENT OF GOVERNOR.
If engine underspeeds, tighten governor throttle lever by pushing lever toward blower as far as it will go, as shown in figure 65. (Figure 65 shows governor more exposed than is the case on a fully assembled engine; same adjustment can be made, however, with engine fully assembled.) If engine overspeeds, loosen lever by pushing it toward ready pull-starter.

65. OIL BATH AIR CLEANER.
Using personnel must maintain and replace this unit.

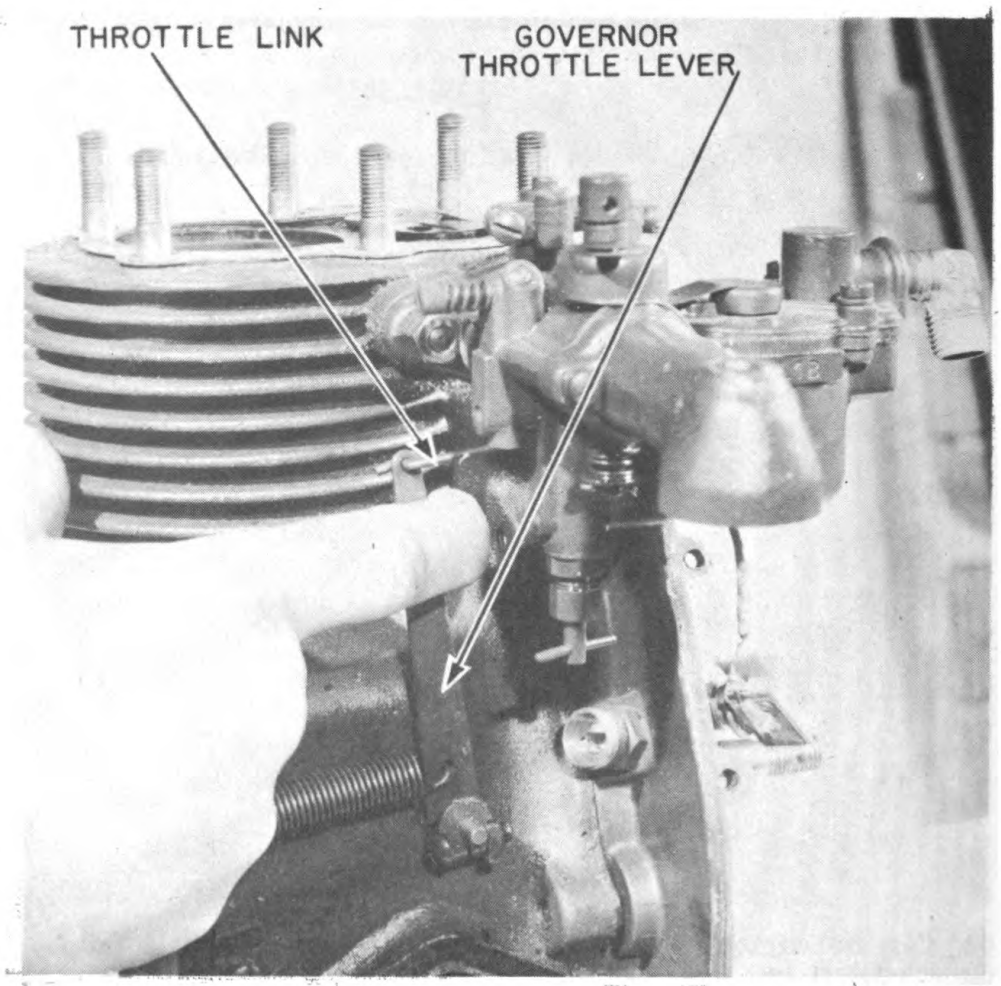


Fig 65. Adjusting governor throttle lever.

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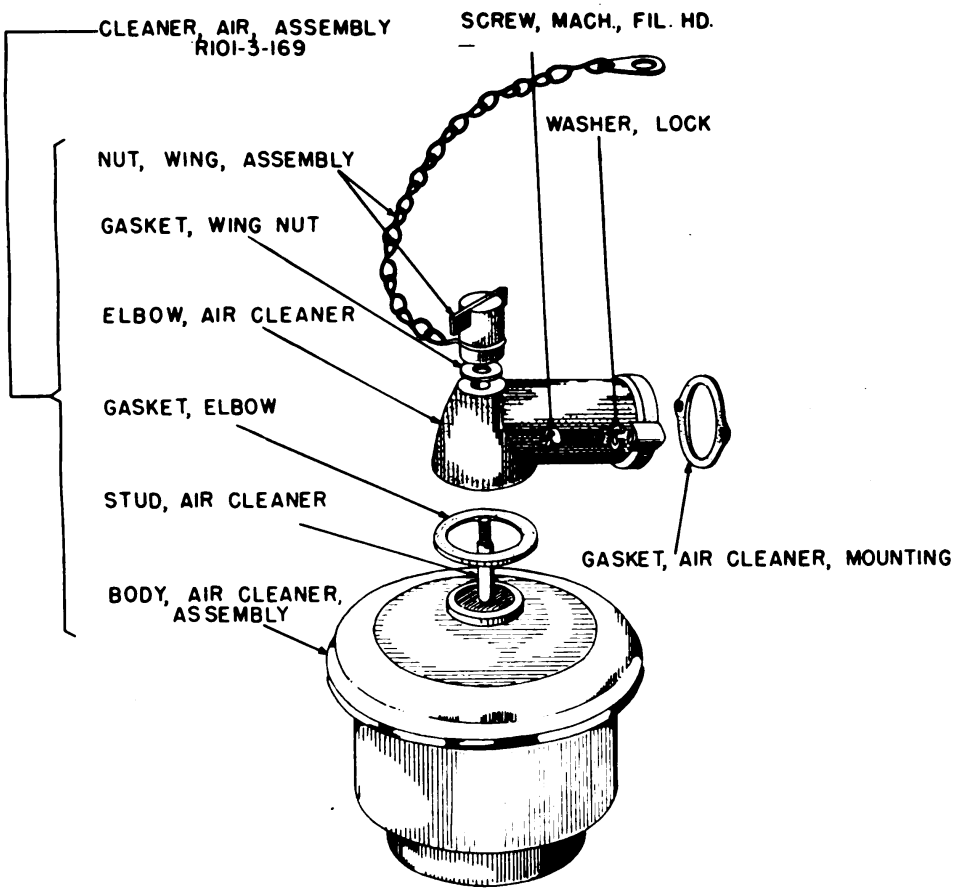


Fig 66. Oil bath air cleaner disassembled showing Chemical Warfare Service nomenclature of parts.

66. REMOVAL OF AIR CLEANER.

Proceed as follows:

a. Detach jack chain of wing nut assembly by loosening hex nut holding it to cylinder head. (Fig 66)

b. Remove entire air cleaner and air cleaner mounting gasket by loosening machine screws by which elbow of unit is attached to carburetor.

67. INSTALLATION OF AIR CLEANER.

Proceed as follows:

a. Seal air cleaner mounting gasket to carburetor with luting material (par 33) or grease

b. Attach elbow of air cleaner to carburetor by tightening two machine screws provided to hold it there.

c. Attach jack chain of wing nut assembly to cylinder head by tightening cylinder head hex nut to which this chain attaches.

68. MAINTENANCE OF AIR CLEANER.

(Covered in paragraph 27)

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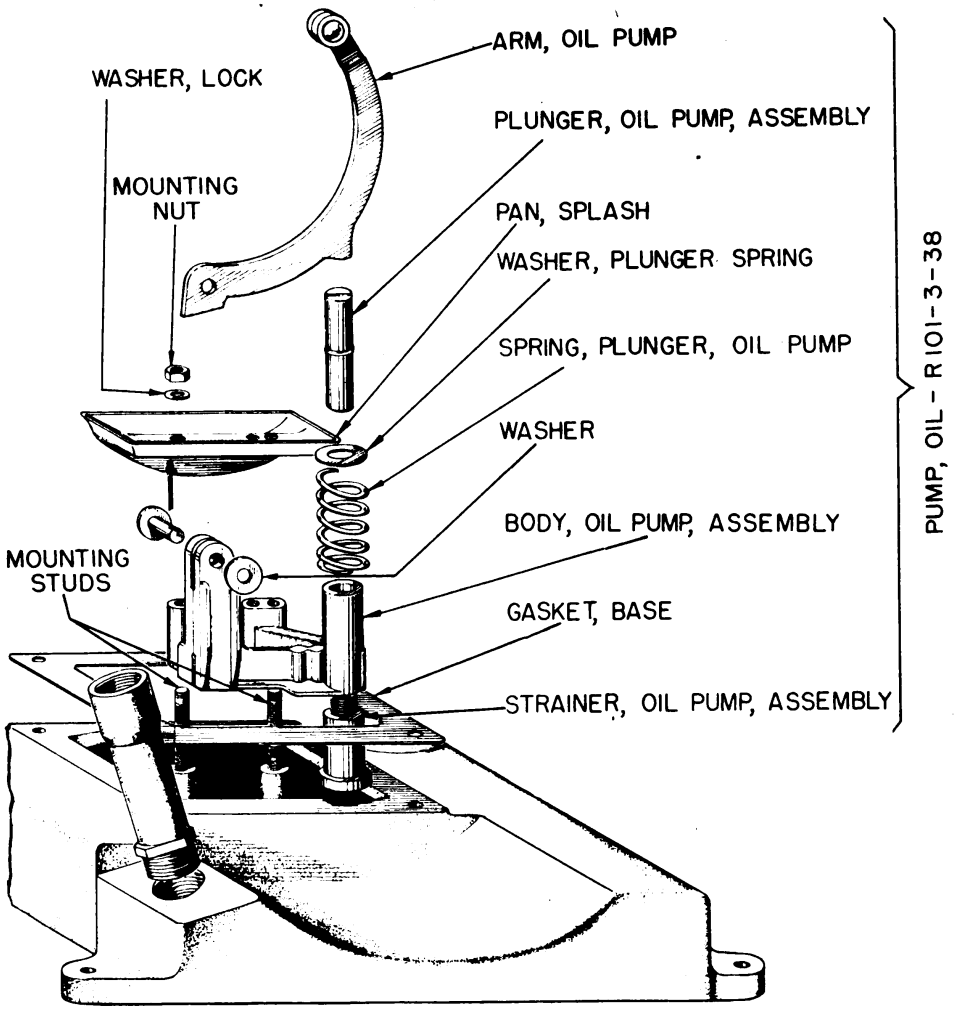


Fig 67. Engine oil pump disassembled, showing Chemical Warfare Service nomenclature of parts.

69. ENGINE OIL PUMP. (Second echelon only.)
In emergencies, using personnel may replace this unit. (Fig 67)

70. REMOVAL OF OIL PUMP. (Second echelon only.)
Proceed as follows:

a. Drain engine crankcase.

b. Detach spark plug cables from spark plugs. (Par 32)

c. Remove engine exhaust by loosening two hex nuts holding it to cylinder block. Use 1/2-inch open-end wrench.

d. Remove burner by loosening two hex nuts holding it to furnace assembly. Use 7/16-inch open-end wrench.

e. Remove screen of blower by loosening six machine screws holding it to blower.

f. Remove fan from engine take-off shaft. First, loosen two Allen-head set screws in shaft with smaller of two Allen-head wrenches issued with generator, and remove shaft key with pliers

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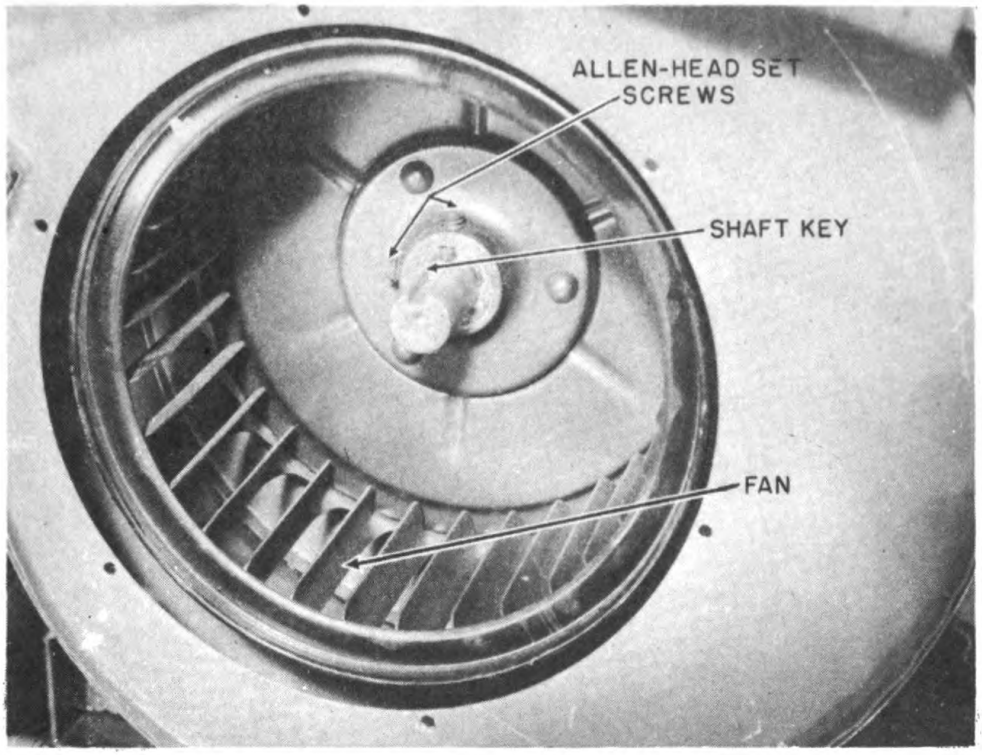


Fig 68. Interior of blower showing set screws, shaft key, and fan.

(figs 68 and 69). To withdraw fan, hold engine shaft in place by means of flywheel and turn fan on shaft, slowly working it free. (Fig 70)

g. Loosen Allen-head set screw in shaft near smaller of the two drive-chain sprockets.

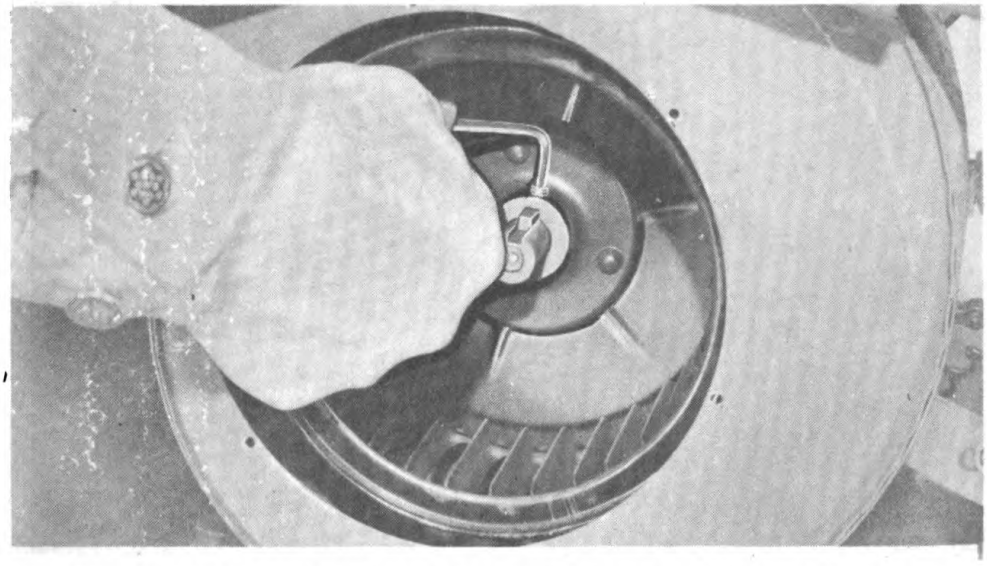


Fig 69. Loosening Allen-head set screws inside blower.

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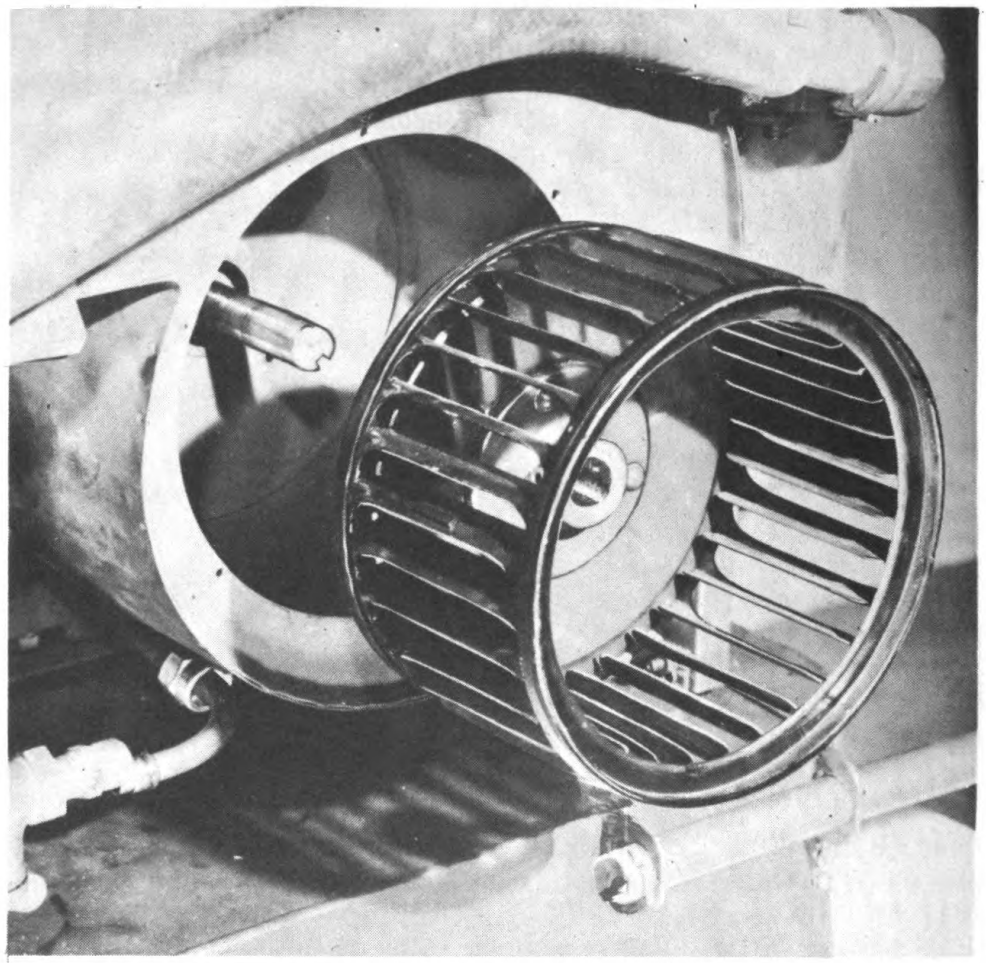


Fig 70. Fan disassembled from engine shaft and blower.

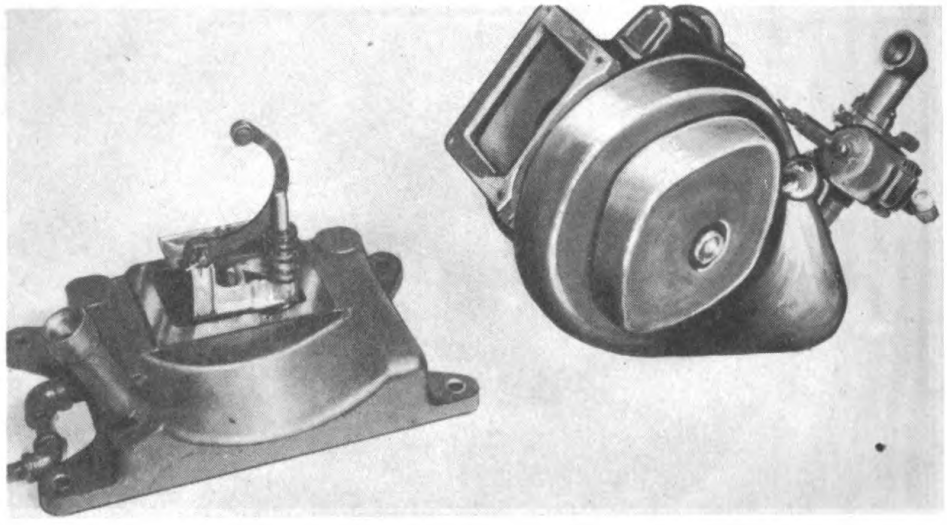


Fig 71. Engine base and cylinder block disassembled to expose oil pump.

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h. Loosen four cap screws holding engine to bracket on top of gasoline tank and withdraw entire engine from generator, loosening pump drive chain at smaller socket to do so. (Loosen screws with 1/2-inch open-end or socket wrench.)

i. Turn engine upside down and loosen four cap screws holding base to cylinder block.

j. Lift cylinder block off base. This exposes oil pump as shown in figure 71.

k. Remove oil pump by loosening mounting nuts and lock washers holding it to mounting studs. (Fig 67)

71. INSTALLATION OF OIL PUMP. (Second echelon only.)
Proceed as follows:

a. Disassemble engine base from cylinder block as directed in paragraph 70.

b. Drop new pump onto mounting studs and tighten mounting nuts and lock washers to hold it firmly in place. (Fig 67)

c. In reassembling engine, be sure that pump arm roller (fig 67) rides on engine valve cam. This can be adjusted by turning flywheel as needed. Burner is difficult to replace due to tight fit. With a little juggling -- and patience -- however, this part will slip back in place.

72. SPARK PLUGS.

a. Responsibility. Using personnel are responsible for replacement and adjustment of both engine and burner spark plugs.

b. Installation of spark plug. Before installing a new spark plug on engine or burner, adjust gap as directed in paragraph 32.

73. GASOLINE SUCTION LINE.
Replacement of this line may be the responsibility of using personnel. To remove, break line at gasoline strainer and at gasoline pump.

74. GASOLINE STRAINER.
Replacement of strainer is a responsibility of using personnel.

Section XVI HEATING GROUP

75. GENERAL.

a. Main parts. Main parts of heating group are furnace assembly, burner, blower, burner valve, and thermostatic fuel valve.

b. Description and functioning. Reference to figure 72, show-

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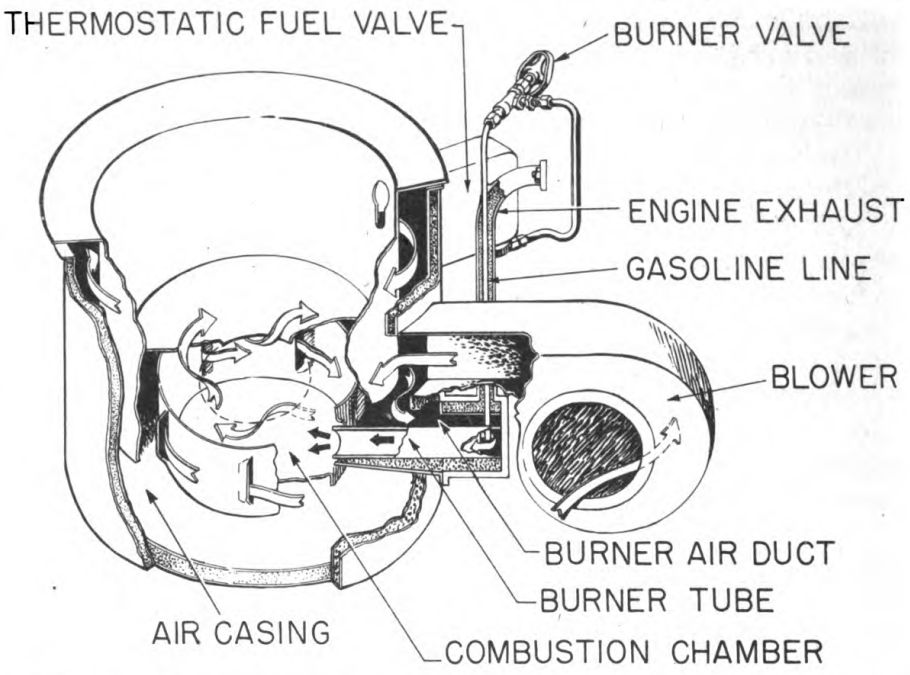


Fig 72. Heating group parts, showing flow of engine vapors and air.

ing heating group parts in relationship to one another, aids in understanding how these parts produce and control fire in combustion chamber of furnace assembly.

(1) The process by which fire is built up takes place in burner (fig 72). The piping by which gasoline reaches burner passes through engine exhaust. When the burner valve is opened, to permit the discharge of gasoline through the piping, the engine exhaust vapors heat the gasoline. The engine vapors escape into combustion chamber of furnace assembly, while the gasoline is carried on into burner tube.

(2) At the same time, the blower fan is circulating air in the air casing of the furnace assembly. This air swirls into the combustion chamber through a series of vents and from there into burner air duct and tube where it mixes with incoming gasoline which has been partly vaporized by heat of the engine exhaust.

(3) The burner spark plug ignites the air gasoline mixture as it passes into combustion chamber. When burner valve is first opened, the gasoline flow is regulated by gasoline control orifice. Full fire results, gasoline being consumed at the rate of approximately 6 gallons an hour. As soon, however, as the fire becomes hot enough to produce the correct operating temperature of 900 degrees Fahrenheit at the smoke discharge manifold, the thermostatic fuel valve acts to reduce flow of gasoline to burner and lowers fire (pars 12 and 86).

(4) When the fog valve is opened, the fire comes up, and while the generator is making smoke, the gasoline consumption approx-

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imates 4-1/2 to 5 gallons an hour, the thermostatic fuel valve passing just enough gasoline to maintain proper operating temperature at discharge manifold. (Formation of smoke is described in paragraph 4.)

76. FURNACE ASSEMBLY.

a. General. Figure 73 shows furnace assembly parts disassembled. Coil assembly rests inside combustion chamber and is attached to inlet line as shown, and to outer parts of thermostatic fuel valve by the thermostatic fuel valve packing box. Flue pan is held to air casing by clamp band.

b. Responsibility. Using personnel are responsible for replacing flue pan and may replace smoke discharge manifold. Using personnel may also remove a damaged coil assembly from an otherwise good generator and install the good coil of an otherwise damaged generator.

77. REMOVAL OF FLUE PAN.

Release clamp band by loosening hex nut of clamp bolt (figs 73 and 74) Pry clamp band loose with heavy duty screw driver, if necessary.

78. INSTALLATION OF FLUE PAN.

As a rule this job calls for two men. After flue pan is placed on air casing and alined with inlet piping, one man should stand on top of flue pan while the other hammers clamp band into place and bolts it together.

79. REMOVAL AND INSTALLATION OF SMOKE DISCHARGE MANIFOLD.

Unscrew manifold to remove, and reverse procedure to install. If force is necessary, use pipe wrenches. (Fig 73)

80. REMOVAL OF COIL ASSEMBLY.

Proceed as follows:

a. Break inlet line at connection to coil assembly by loosening union with adjustable wrench

b. Remove thermostatic fuel valve as directed in paragraph 87.

c. Remove thermostatic fuel valve packing nut (fig 73) with adjustable wrench.

d. Remove flue pan (par 77).

e. Remove engine exhaust by loosening two hex nuts holding it to cylinder block.

f. Remove spark plug cable to burner plug, and remove plug.

g. Remove burner by loosening two hex nuts holding it to furnace assembly. (Coil assembly can be removed without taking off burner. To insure obtaining good alinement when new coil is installed, it is advisable to remove exhaust and burner.)

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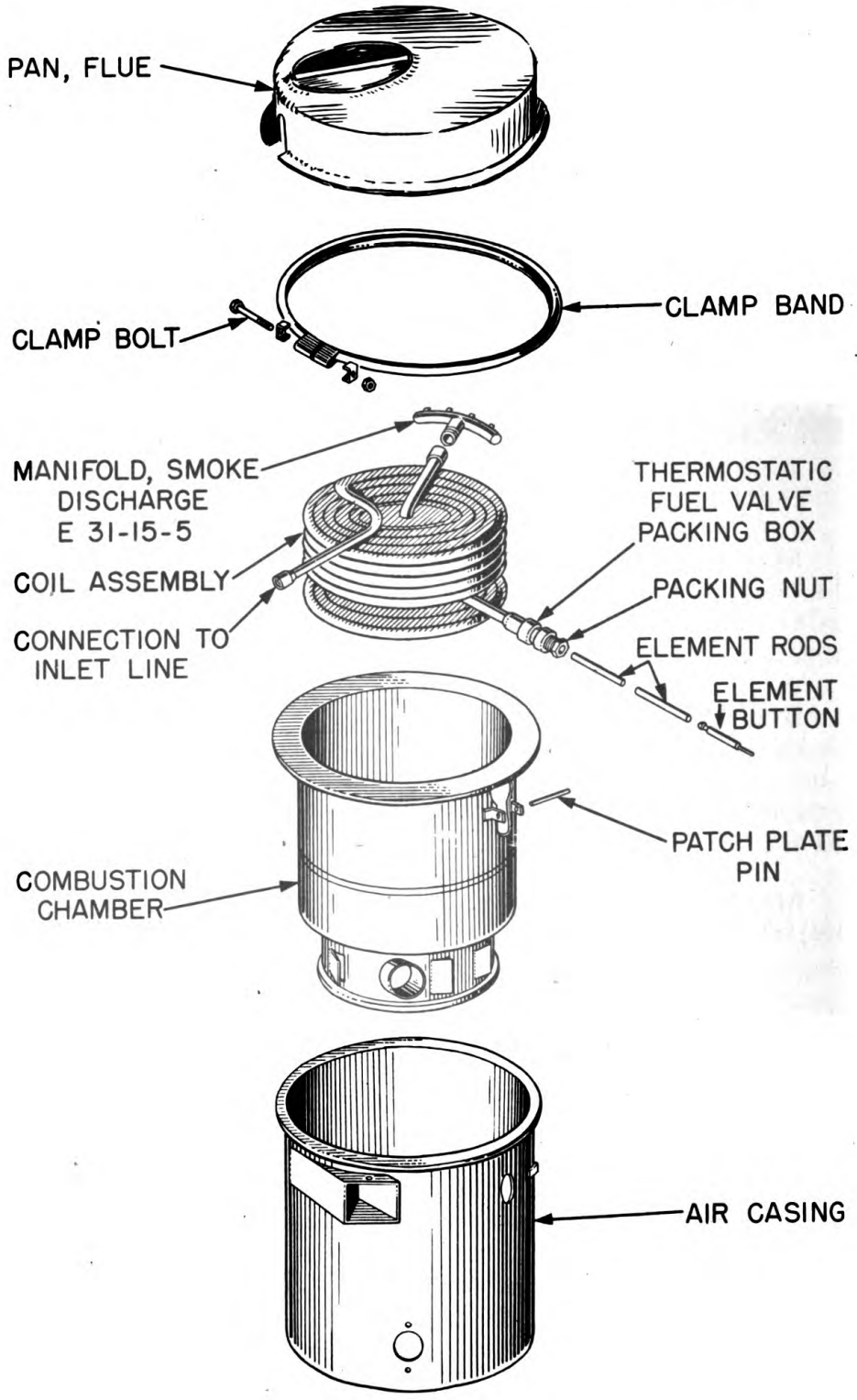


Fig 73. Furnace assembly disassembled, showing Chemical Warfare Service nomenclature of parts.

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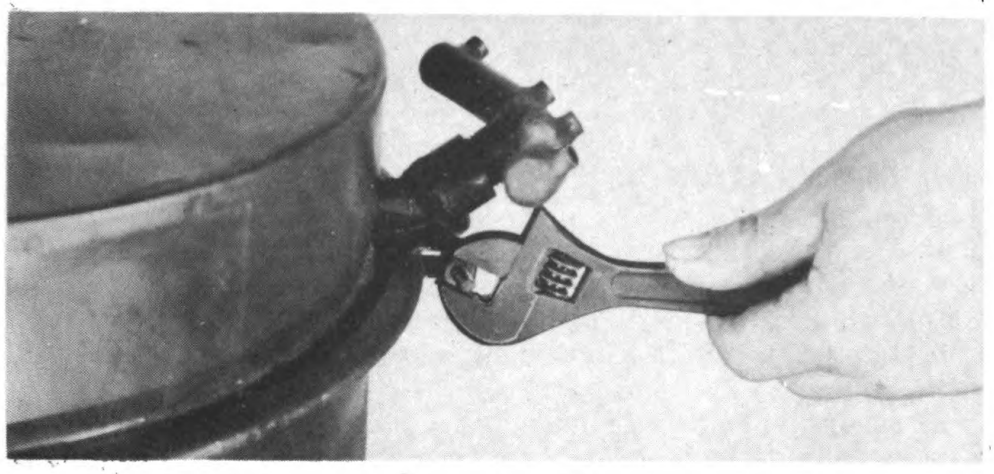


Fig 74. Releasing clamp band to remove flue pan.

h. Lift out coil assembly and combustion chamber as one unit (fig 75). To do this, grasp smoke discharge manifold with one hand, inlet pipe with the other, and move unit up and away from generator in order to disengage thermostatic fuel valve tubing from hole in air casing through which it normally projects.

i. Twist and pull out patch plate pin (fig 75) by applying constant pressure. Avoid straightening it.

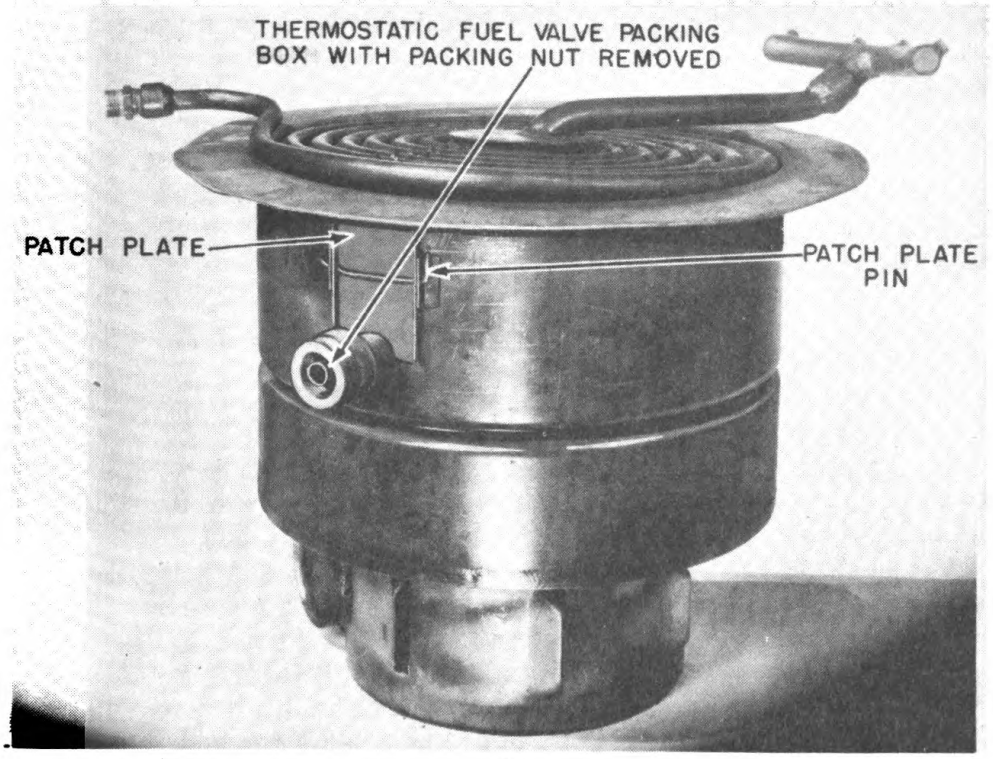


Fig 75. Combustion chamber and coil assembly.

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j. Remove patch plate. Coil assembly can now be lifted out of combustion chamber, the removal of patch plate having provided a slot large enough for thermostatic fuel valve packing box to slip through.

81. INSTALLATION OF COIL ASSEMBLY.

Proceed as follows:

a. Place coil in combustion chamber by inserting thermostatic fuel valve packing box through larger part of slot and pushing coil down until it seats snugly inside chamber. (Fig 73)

b. Replace patch plate by inserting and bending patch plate pin. (Fig 75)

c. Insert thermostatic fuel valve packing box through hole in air casing, and place coil assembly and combustion chamber in casing.

d. Connect coil assembly to inlet line by tightening union.

e. Place packing nut on thermostatic fuel valve packing box and tighten with adjustable wrench.

f. Replace burner, burner spark plug, spark plug cable, and engine exhaust. (Par 71)

g. Replace flue pan. (Par 78)

h. Replace thermostatic fuel valve. (Par 87)

82. BURNER.

Remove burner only in the event of emergency replacement of engine oil pump as directed in paragraphs 70 and 71, or when replacing coil assembly as directed in paragraphs 80 and 81.

83. BLOWER.

Fan of blower is turned by engine crankshaft and is located inside large air duct leading to air casing of furnace assembly, the fan being held to crankshaft by two Allen-head set screws and the crankshaft key as shown in figure 68. Set screws must be kept tight to prevent fan from becoming loose and rubbing on the case, or wobbling and destroying the fan bushing. (See figs 68 and 69.) Remove fan only in event of emergency replacement of engine oil pump as directed in paragraph 70.

84. BURNER VALVE.

a. General. Burner valve is an ordinary angle valve, opening and closing of which permits or prevents gasoline from flowing into tube of burner.

b. Responsibility. Using personnel may replace burner valve and must keep it clean.

85. REMOVAL AND INSTALLATION OF BURNER VALVE.

a. To remove, disconnect gasoline line at inlet to valve, hold gasoline control orifice with adjustable wrench, and turn valve loose with pipe wrench.

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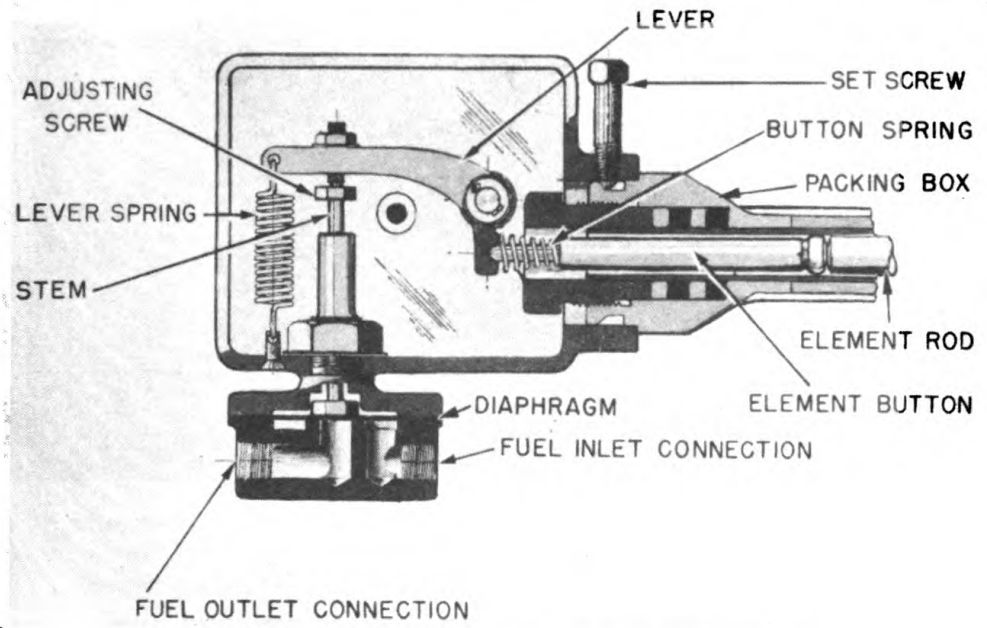


Fig 76. Diagram of thermostatic fuel valve.

b. To install, screw valve in as far as possible by hand. Complete installation with wrench and connect gasoline line at inlet to valve.

86. THERMOSTATIC FUEL VALVE.

(See also paragraph 12.)

a. Illustration. Reference to figure 73 and to diagrammatic drawing of thermostatic fuel valve in figure 76 will aid in understanding how valve works.

b. Inside furnace assembly. Packing box of valve is a tubing, inside which are two quartz element rods and a device known as the element button (fig 73). Packing box is located inside furnace assembly and is an extension of tubing of coil assembly.

c. Outside parts. Remaining mechanism of valve is housed in thermostatic fuel valve box on outside of furnace assembly and is an integral part of the piping through which gasoline is pumped to burner.

d. Movement of parts. Expansion of packing box inside furnace assembly is a measure of the temperature of the vapor in coil assembly. The element rods inside packing box have a very low expansion rate, and the difference between their expansion rate and the relatively higher expansion rate of packing box causes element button to move in when temperature of vapor inside coil assembly increases. This movement of element button causes valve lever to move down so that valve adjusting screw contacts valve stem. The stem then pushes diaphragm against seat in body, reducing flow of gasoline to burner.

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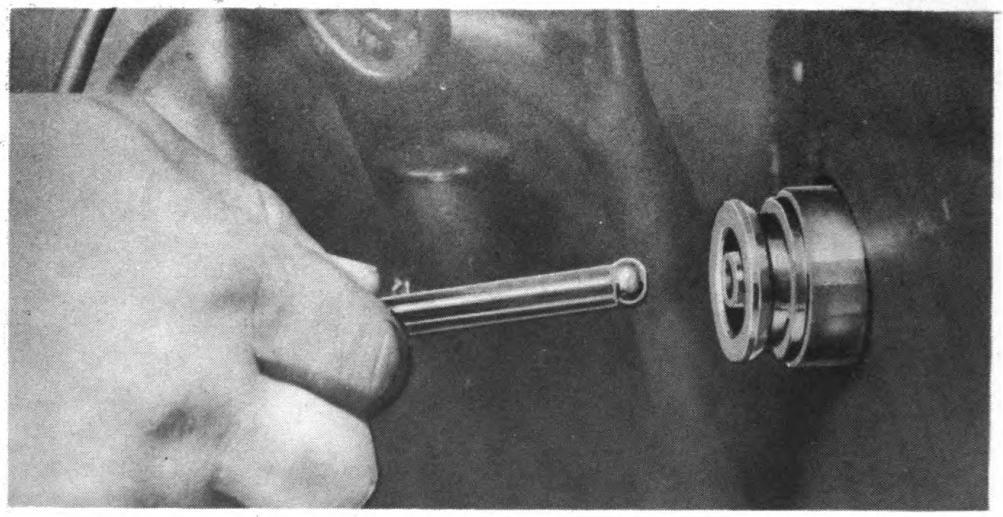


Fig 77. Inserting element button in packing box of thermostatic fuel valve.

e. Springs. Function of lever spring is to make lever follow motion of element button, and the spring is strong enough to overcome gasoline pressure on diaphragm and button spring. Purpose of button spring is to prevent element rods from becoming loose when valve is closed and the lever cannot follow up, thus preventing damage by vibration to element rods.

87. REMOVAL AND INSTALLATION OF THERMOSTATIC FUEL VALVE.

To remove outside parts of valve and element button, disconnect gasoline line, remove box by loosening two set screws holding it to thermostatic fuel valve packing box, and pull element button out of packing box. In replacing, insert ball-shaped end of element button first as shown in figure 77.

88. ADJUSTMENT OF THERMOSTATIC FUEL VALVE.

Remove cover of valve by loosening the screw which holds cover to box. (See figs 15 and 76.) If generator is not operating, check gap between upper end of valve stem and adjustment screw. As shown in figure 16, this is done by inserting thermostatic fuel valve gage (fig 23) between adjustment screw and stem with just enough pressure to force stem down to diaphragm. If gap proves smaller or larger than gage, loosen lock nut and turn adjustment screw up or down, retightening nut when proper gap is reached. Ordinarily adjustments are made while generator is operating. In such cases, do not use gage. Simply turn lock nut up or down until whatever trouble is being checked (normally, wet smoke) corrects itself. Stem of valve should be free in its guide, and this should be checked from time to time by moving stem up or down; it should be slightly loose. Lever also should be free on

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its pin. This can be tested by lifting lever against pull of lever spring. If lever has become tight, remove it by taking off lever spring and then removing cotter pin and washer. Wash pin and lever with dry cleaning solvent and replace.

89. GASOLINE LINE.
Using personnel may be held responsible for replacing the small gasoline tubing between burner valve and thermostatic fuel valve.

Section XVII
SMOKE-FUEL GROUP

90. GENERAL.
a. Main parts. Main parts of smoke-fuel group are fog oil-water pump, fog valve, and feed water regulator
b. Description and functioning. .(Covered in paragraph 4.)

91. FOG OIL-WATER PUMP.
Do not tamper with this pump under any circumstances.

92. FOG VALVE.
This item is also treated in paragraph 4. If this valve becomes loose through wear, tighten nut at rear of valve until valve has proper frictional pull.

93. FEED WATER REGULATOR.
Using personnel are responsible for replacing the diaphragm of this part.

94. REMOVAL OF DIAPHRAGM.
Proceed as follows:
a. Remove cover of feed water regulator with screw driver as shown in figure 78.
b. Disengage diaphragm from underside of cover by grasping stem and pulling, as shown in figure 79.
c. Remove stem by loosening hex nut which holds it to diaphragm. (Fig 79)

95. INSTALLATION OF DIAPHRAGM.
Insert stem in hole of diaphragm, tighten hex nut, and fit diaphragm and stem snugly into underside of feed water regulator cover.

96. WATER STRAINER.
Using personnel are responsible for replacing water strainer.

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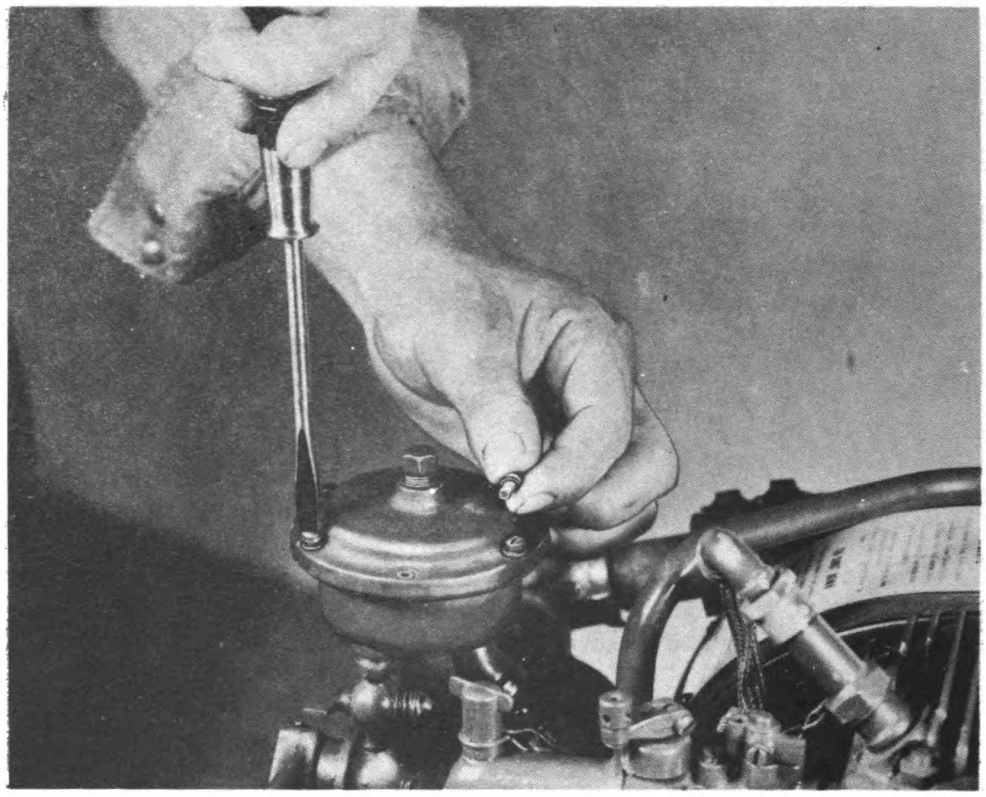


Fig 78. Removing cover of feed water regulator.

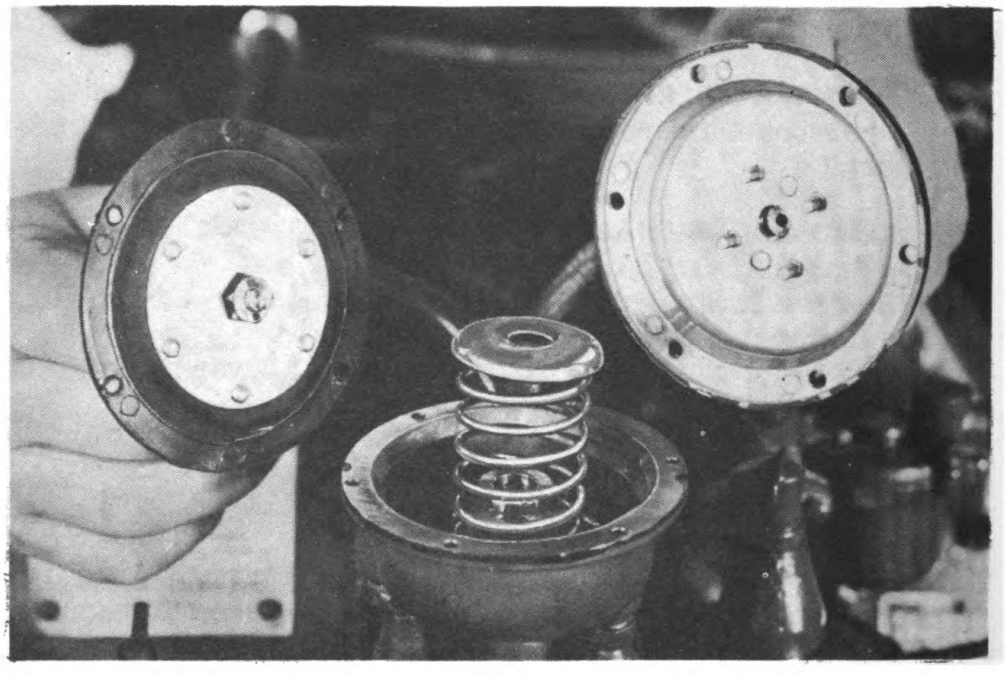


Fig 79. Disengaging diaphragm from underside of feed water regulator cover.

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Section XVIII
MISCELLANEOUS PARTS

97. GASOLINE AND WATER TANKS.
Using personnel are responsible for replacement of tank filler caps and for cleaning tanks.

98. REMOVAL AND INSTALLATION OF FILLER CAPS.
To remove either filler cap, uncrimp end of its jack chain from engine base bracket to which it is attached. To install, crimp end of new jack chain to bracket. Use pliers.

99. CLEANING TANKS.
To clean tanks, drain them and flush with dry cleaning solvent.
CAUTION: Never use water or oil to clean gasoline tank. If dry cleaning solvent is not available, use clean gasoline.

100. HANDLE GRIP.
Replacement of handle grips is a responsibility of using personnel. (Par 13)

101. REMOVAL AND INSTALLATION.
To remove, straighten and withdraw cotter pin at rear of handle with pliers. To install, insert cotter pin and bend ends to hold handle in place.

102. PIPING.
Using personnel are responsible for cleaning all piping which is readily removable from generator.

103. CLEANING PIPES.
Detach piping to be cleaned and run dry cleaning solvent through it. Do not use water or oil.

104. PUMP DRIVE CHAIN.
Using personnel are responsible for keeping drive chain in oily condition as directed in paragraph 27 and, in emergencies, may make minor repairs.

105. REMOVAL OF CHAIN.
Take off chain shield by loosening screws holding it to generator, and disengage chain by loosening connecting link (fig 80).

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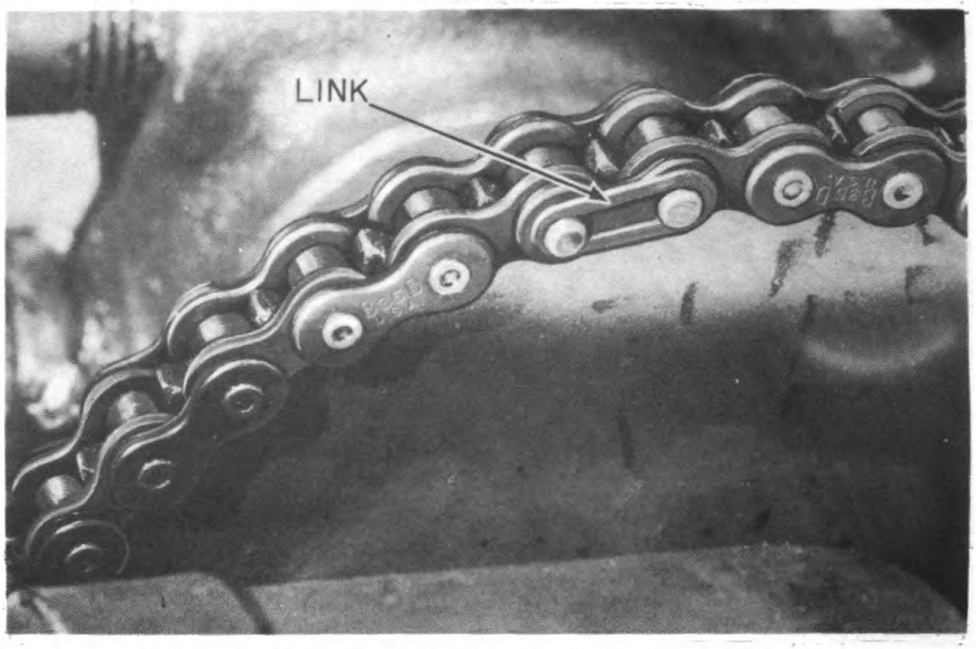


Fig 80. Connecting link of pump drive chain.

106. INSTALLATION OF CHAIN.
Place chain on sprockets and crimp connecting link in place.

107. MAINTENANCE.
Permissible repairs of chain are:

a. Replacement of chain when it falls off sprockets.

b. Replacement of broken links with links taken from another damaged chain.

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APPENDIX

Section I SHIPMENT AND STORAGE

1. PREPARATION FOR SHIPMENT BY USING PERSONNEL.

a. Completely drain all piping, strainers, and tanks. Blow dry, with compressed air, all assemblies containing water, such as coil assembly and water piping.

b. Flush internal surfaces of tanks, piping, and coil assembly with polar type, thin film, rust preventative compound (Navy Department Specification 52 C18). Drain excess rust preventative compound before replacing plugs and caps.

c. Spray same rust preventative compound over external surface of all unpainted metal assemblies, such as blower fan, blower housing, coil assembly, burner air duct and tube, pump drive chain, and sprockets.

d. Clean thoroughly and repaint all previously painted metal surfaces to protect them from corrosion or deterioration. Use lusterless, olive drab paint of the type specified in the Tank and Automotive Center Tentative Specification #ES-680.

e. Process engine as directed in Ordnance Department Specification AXS-836.

f. Process and wrap all tools, spare parts, and miscellaneous unpainted equipment as instructed in Chemical Warfare Service Specification 197-54-315.

g. After generator is processed as described above, fasten it securely to bottom of crate with Z bars.

h. Mark shipping crate clearly and legibly as prescribed in Chemical Warfare Service Specification 197-54-329 and War Department marking directive, "Requisitioning and Marking of Supplies for Overseas Shipment," File Reference: AG 400.161 (5-19-43), OB-S-SPMOT-M, dated 1 June 1943.

2. STORAGE BY USING PERSONNEL.

If storage is to be of long duration, prepare generator as for shipment (par 1, appendix). If storage is to be limited, simply cover generator with canvas cover and store it off ground to prevent corrosion of gasoline and water tanks.

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Section II LIST OF REFERENCES

FM 3-5 Tactics of Chemical Warfare
FM 3-15 Supply and Field Service
FM 3-50 Large Area Smoke Screening
TM 1-455 Electrical Fundamentals
TM 3-380 Mechanical Smoke Generator M1 (100-Gallon)
TM 10-550 Fuels and Carburetion
TM 10-570 The Internal Combustion Engine
T/O & E 3-266S Headquarters and Headquarters Detachment, Chemical Smoke Generator Battalion (2 July 1943)
T/O & E 3-267 Chemical Smoke Generator Company (4 May 1944)
Army Service Forces Catalog, Generator, Smoke, Mechanical, M2 (50 Gallon), CW7-217122
Manual of Operation and Maintenance, Chemical Warfare Service, Generator, Smoke, Mechanical, M2 (50 Gallon), published by Besler Corporation, March 1944

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