TM 11-948

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POWER UNIT

PE-210-(FR)

WORKING INSTRUCTIONS

Servalan

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POWER UNIT

PE-210 (FR)

CONTENTS

DESTRUCTION NOTICE

WHY - To prevent the enemy from using or salvaging this equipment.

WHEN - When ordered by your commander.

HOW - 1. Smash - Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.
2. Cut - Use axes, handaxes, machetes.
3. Burn - Use gasoline, kerosene, oil, flame throwers, incendiary grenades.
4. Explosives - Use firearms, grenades, TNT.
5. Disposal - Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT - 1. Smash - Cylinder head, cylinder, spark plug shield, spark plug, magneto, carburetor, generator, control box, gas tank, meter box.
2. Cut - All connecting wires and cables.
3. Burn - Packing cases, instruction books, canvas cover, fuel, oil.
4. Bury or scatter - Any or all of the above pieces after damaging.

DESTROY EVERYTHING

SAFETY NOTICE

1. Sufficient and proper ventilation must be provided if the power unit is operated in a confined space. Exhaust gases produced are poisonous, and excessive inhalations may result in sickness or death.

2. Do not service the unit with gasoline while the unit is running or if a radio transmitter is operating near the power unit. Avoid spilling fuel on a hot engine.

3. The operator should observe every standard safety regution while operating this power unit.

PART ONE

INTRODUCTION

Section I. DESCRIPTION

1. General

a. Power Unit PE-210 (figs. 1 and 2) is a compact, light-weight, electric generator set, consisting of a gasoline Engine GE-12-G and a d-c (direct-current) Generator GN-52-B. It has a nominal rating of 450 watts and is designed to deliver 30 amperes dc, with voltage variable from 6 to 22 volts. The unit may be started by hand or by connecting it to a 12-, or 18-volt storage battery. The unit is used principally for charging storage batteries. It may also be incorporated as an aid in starting larger power units at very low temperatures.

b. Engine GE-12-G is a single-cylinder, air-cooled, two-cycle gasoline engine which develops 1 hp (horsepower) at 3,000 rpm (revolutions per minute).

c. The GN-52-B is a d-c generator. It is coupled directly to the engine crankshaft by means of a female spline coupling which matches the splined extension on the crankshaft. Mounted on the tubular frame is a control box, which is used in controlling the generator output and is provided with a switch for starting the engine with a battery.

NOTE. The generator used in Power Unit PE-210-(FR) is coupled to the engine by a flexible coupling-fan assembly. The driving member of the coupling is provided with a female spline which matches the splined extension of the engine crankshaft.

d. The complete power unit is contained in an open frame of tubular construction. It is mounted on four rubber shock mounts which hold the unit securely in place during transportation and also serve to absorb vibration when the equipment is in operation. A metal box for spare parts is attached to the tubular frame assembly. Tools are contained in a canvas bag and are appropriately identified.

2. PERFORMANCE CHARACTERISTICS

Power Unit PE-210 (FR), when used to charge storage batteries, performs as follows :

a. When Charging 6-Volt Batteries

Ampères	Volts	Engine rpm
15	6,5	1,750
20	7.0	1,850
25	7.3	1,950
30	7,6	2,050

b. When Charging 12-Volt Batteries

Ampères	Volts	Engine rpm
8	13.0	2,160
10	13.5	2,230
15	13.8	2,300
20	13.85	2,400
25	14.0	2,500
30	14.2	2,630

3. Table of Condensed Specifications

Engine

Make	René BRIBAN & Co
Model	Sig.C.GE-12-G
Type	two-cycle
Number of cylinders	one
Bore	2-in. (inch)
Stroke	1 1/2-in.
Piston displacement	4.72 cu in.
Compression ratio	5.5 to 1
Engine speed (nominal)	3,000 rpm
Cooling	air-cooled
Horsepower	1 at 3,000 rpm
Piston	Vanasil
Piston rings	three (compression-type)
Piston pin	stationary in piston
Lubrication system	oil mixed with fuel
Air cleaner	dry type
Oil filter	none
Spark plug	HOT-Type 13/16"
Fuel tank capacity	1 gallon
Governor	electric solenoid type
Main bearings	ball bearing

Generator

Make	Moteurs LEROY
Type	d-c
Rating	450 watts, 30 amps at 15 volts
Brushes	four carbon brushes
Bearings	Two double-seal ball

4. Table of Major Components

Item	Height (in.)	Width (in.)	Length (in.)	Weight (lb.)
1 Bare unit consisting of:	13 3/4	16 1/4	17 3/4	65
1 Engine GE-12-G (complete)	13 1/4	13 1/2	17 3/4	37
1 Generator GN-52-B	5 5/8	5 5/8	9 3/8	20
1 Generator Control C-890-U	4 1/4	4 1/2	9 1/8	
2 Cords CD-1334, 6 ft lg			72	
1 Set tools				
1 Set running spare parts				

Power Unit PE-210, packed for export; weight 122 lb, volume 5 cu ft.

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisitioning of spare parts.

5. Description of Major Components

a. Engine. Engine GE-12-G is a single-cylinder, two-cycle, air-cooled unit, with a 2-inch bore, a 1 1/2-inch stroke, and a piston displacement of 4.72 cubic inches. It is designed to operate satisfactorily on 80-octane field gasoline, 100-octane aviation gasoline, or commercial gasoline with an octane rating as low as 62, and will run approximately 7 1/2 hours at full load on a single filling of the 1-gallon fuel tank.

Engine GE-12-G is a modification of Engine GE-12-B. Differences in models are explained in paragraph 6.

b. Generator. Generator GN-52-B is a 450-watt, 30-ampere, 15-volt, d-c shunt-wound, compensated, open, four-pole generator. The generator voltage can be regulated in the range of 6 to 22 volts full load by dual control of engine speed and shunt field through the rheostat adjusting knob on the control box. Rotation of the armature is counter-clockwise, viewed from the commutator end. Differences between the Generator used in power unit PE-210 and Generator used in power unit PE-210-(FR) are explained in paragraph 6.

c. Generator Control C-890-U-(FR). This control Box is attached to tubular frame of unit (fig.2). It contains a rheostat, starting switch, reverse-current relay, a 0 to 50 amp. scale ammeter, a 0 to 30 volt scale voltmeter, and three capacitors. A terminal Block is mounted on the inside of the bottom of the box.

(1) The rheostat, in conjunction with the electric governor, controls the engine speed and generator voltage to permit charging batteries 6 to 18 volts.

(2) When the unit is connected to a battery of 12 volts or higher, the starting switch, when held in the ON position, permits the battery current to flow through the generator and thus causes it to act as a motor for cranking the engine.

c. Place all tools in the tool kit and attach the kit to the tubular frame of the power unit.

d. Check the running spares with the spare parts list and replace any missing parts.

e. Bolt the unit to a wooden sub-base and place a block under the generator. Clamp the generator to the sub-base with wire or a steel strap to prevent any movement of the unit inside the frame during shipment.

f. If complete protection is necessary, wrap the unit in waterproof paper and seal all edges. Place the unit in the original box if available or build a new crate to inclose the unit.

Section IV. BEFORE-OPERATION PROCEDURES

15. Preparation for Use

Place 1 gallon of gasoline in a clean container and add 1/2 pint of engine oil (OE). An oilmeasuring cup is an integral part of the fuel tank cap. Use four measuring cupfuls of engine oil to each gallon of gasoline. Shake the container or stir the fuel and oil until thoroughly mixed. Then pour the mixture into the fuel tank. To avoid loss of oil from the measuring cup, hold a finger over the vent hole in the side of the tube. *Never plug this hole.*

Caution: Never run Power Unit PE-210 (FR) on gasoline to which oil has not been added. Never attempt to fill the fuel tank while the unit is operating.

a. Before pouring the fuel mixture into the tank, ground the fuel container momentarily to an unpainted surface on the unit that is away from the tank. Always keep the fuel container in contact with the tank during filling operations. This reduces the danger of fire from a static discharge (spark).

b. Replace the fuel tank cap securely.

c. Open the fuel shut-off valve and the air vent in the top of the fuel tank. Wipe off any fuel which may have been spilled while the tank was being filled.

16. Visual Inspection

a. Check the fuel shut-off valve, fuel tank drain valve, fuel line and connections, and carburetor float bowl for leaks (fig. 20).

b. Check the installation of the unit, including exhaust connections, foundation, and shelter. Make sure cooling-air intake is not obstructed.

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PART TWO

OPERATING INSTRUCTIONS

Note. For information on destroying the equipment to prevent enemy use, refer to the destruction notice at the front of the manual.

Section V. OPERATION

17. Starting

a. Rope Starting Power Unit PE-210 (FR). (1) The carburetor adjustments have been factory set and, unless changed, do not need readjustment each time the engine is started. See paragraph 67.1 for instructions for carburetor adjustments.

(2) Move the choke lever to the closed position (fig. 7-8). To close the choke, pull the choke lever toward the air cleaner.

(3) Slip the knotted end of the starter rope into the notch of the starter pulley and wind it clockwise around the pulley. Hold the unit frame with one hand and pull the starting rope up sharply with the other hand. If the engine does not start after four or five crankings, refer to paragraph 59 for the possible cause.

(4) When the engine starts, move the choke lever away from the air cleaner to its fully open position. If the engine will not run unless the choke is partially closed, readjust the carburetor in accordance with instructions in paragraph 67.1

Caution: Except in an extreme emergency, always operate the unit for at least 5 minutes before applying load. This is specially important when operating in low temperatures.

(5) Overchoking the engine when starting will flood it. This is particularly true when the engine is warm. If this occurs, proceed as follows:

(a) Close the main adjusting screw (fig. 8) by turning it clockwise as far as it will go. Note the number of turns so that the screw can be reset to its original position.

Caution: When closing the main adjustment screw, do not force it as this will damage the needle valve and seat.

(b) Open the crankcase drain cock and crank the engine a few times with this cock open. Be sure to close the cock securely after cranking.

(c) Remove the spark plug and clean and dry the spark plug adapter. Dry the spark plug and reinstall it in the engine.

(d) Make sure the choke is fully open and crank the engine.

(e) As soon as the engine starts, reset the main adjusting screw to its original position.

b. Precautions After Starting **(1) Insufficient fuel.** Failure to run more than a few seconds after starting or when load is applied usually indicates a lean carburetor adjustment. If this occurs immediately after starting and while the engine is still cold, partially close the choke. If it is necessary to keep the choke partially closed after the engine has reached operating temperature, readjust the carburetor in accordance with instructions in paragraph 67.

(2) Too much fuel. When the engine appears to misfire every alternate revolution and lacks power, it is usually an indication that the carburetor setting is too rich or that the choke is not fully open. Make sure that the choke is in a fully open position. If the choke is fully open and the difficulty persists, see paragraph 67. A slight amount of erratic missing may occur when the unit is operating without load. This is a characteristic of the engine and should disappear when load is applied. If erratic missing continues after load is applied, the difficulty may be due to a fouled spark plug or clogged spark plug adapter. Remove the spark plug. Clean the spark plug adapter, and clean or replace the spark plug to remedy this condition.

c. *Battery Starting*. Prepare the unit for battery starting as follows:

(1) Connect one Cord CD-1334 from the positive (+) terminal on the storage battery to the terminal on the control box marked +.

(2) Connect the other Cord CD-1334 from the negative (-) terminal on the storage battery to the terminal on the control box marked -

(3) Note the voltmeter reading. If the leads are connected properly, the voltmeter will indicate the battery voltage. If the leads are reversed, the voltmeter pointer will swing off scale to the left.

Note. Set the rheostat control knob at approximately one-third to onehalf travel from the extreme counterclockwise position. This, when using a 12 or 18-volt starting battery, prevents the carburetor throttle from closing when the starting switch is pushed up.

(4) The unit is now ready to start. Following the instructions given in subparagraph *a* above, push the starting switch on the control box and hold it up until the engine starts. Release the switch and make necessary running adjustments.

Caution: If the engine does not start within 20 to 30 seconds, release the starting switch and consult the trouble chart for the possible cause (part. 59). Always start the engine manually for charging operations.

(5) If the red and yellow leads connected to the terminals above

the starting switch are reversed when using 12- or 18-volt batteries, the generator will charge normally but no current will be supplied to the generator field when the starting switch is placed in starting position. Check the wiring diagram in the control box cover or figure 11 and correct this condition if it exists.

18. Operational Precautions

a. Overloading the generator causes overheating and may destroy the generator windings. However, an overload of 10 amperes beyond the rated output (30 amperes) for a period not exceeding 5 or 10 minutes is permissible but only on a 6- or 12-volt battery. A short-circuited generator will cause the throttle to open wide and the engine to overspeed.

b. When charging 18-volt batteries, limit the charging rate to 20 amperes to avoid overloading the unit.

c. Never accelerate the engine beyond its governed speed as this will raise the voltage output which may damage the insulation of the generator.

d. Do not charge batteries at more than a 10-ampere rate in temperatures close to -40° F, since the battery electrolyte will bubble excessively and the gas may damage nearby equipment. Keep open flames or sparks away from the immediate battery area during charging operations. The hydrogen gas generated is highly combustible.

19. Stopping Power Unit PE-210 (FR)

To stop Power Unit PE-210-(FR), turn the stop switch lever which extends from the magneto back plate and hold it in the OFF position until the engine comes to a complete stop. Close the fuel shut-off valve and fuel tank air vent when the unit is not in operation.

Section VI. EQUIPMENT PERFORMANCE CHECK LIST

20. Use of Check List

The equipment performance check list is a tabulation of information dealing with preparatory, starting, and stopping operations. The operator checks each item in the column headed *Item* in the order in which it appears. The column headed *Action or condition* lists operations to be performed. The column headed *Normal indication* lists the action that should result or the condition that should exist as a result of the action performed. The column headed *Corrective measure* lists action necessary to correct abnormal conditions.

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21. Equipment Performance Check List for Power Unit PE-210-(FR)

	Item No.	Item	Action or condition	Normal indication	Corrective measure
PREPARATORY	1	Connections	Connect positive (+) and negative (-) battery terminals to (+) and (-) control box terminals	Battery voltmeter will indicate battery voltage.	Reverse battery connection (par 17b).
	2	Fuel tank	Check fuel supply.	Tank full.	Add fuel (par 15).
	3	Fuel tank air vent	Open vent.	None apparent.	If clogged, engine may start and then stop. Make sure vent is open
	4	Fuel shut-off valve	Open valve.	None apparent. Valve should turn freely	If clogged, engine may start and then stop. Make sure valve is open.
	5	Carburetor needle valve	Set at position 7 or 8.	Indicator vane or needle valve pointing to 7 or 8.	Set valve in correct position (par 17a).
STARTING	6	Choke.	Close	Lever pulled toward air cleaner	Set lever in closed position.
	7	Starting rope.	Wind rope clockwise around pulley, and pull.	Engine should start.	If engine fails to start, see paragraph 59.
	8	Start switch	Push Button	Engine should start.	If engine fails to start, see paragraph 59.
OPERATING	9	Charging terminals	Should be connected to battery by cables	Voltmeter should indicate rate of charge	Adjust engine speed (par 54).
STOPPING	10	Stop lever	Press down.	Engine should stop.	If engine fails to stop, shut off fuel supply.

PART THREE

MAINTENANCE INSTRUCTIONS

Section VII. PREVENTIVE MAINTENANCE TECHNIQUES

22. Meaning

PM (preventive maintenance) is a systematic series of operations performed periodically in order to keep equipment operating at top efficiency. The primary purpose of PM is to *prevent* major break-downs and the consequent need for repair. The primary function of trouble shooting and repair is to locate and *correct existing* defects.

23. Importance

PM is of utmost importance since the failure or inefficient operation of one piece of equipment may cause the failure of an entire system. It is necessary to inspect the power unit systematically each day it is operated and at weekly intervals, so that defects may be discovered and corrected before they result in serious damage or failure (sec. IX).

24. Services

a. General. These services are the responsibility of the commanders of operating organizations. They comprise the scheduled maintenance services performed by power unit operators and maintenance personnel respectively.

b. Operator. Ordinarily, the power unit operator will replenish fuel, lubricant, and battery liquid. He will perform necessary cleaning operations; tighten loose nuts, bolts, screws, and other fastenings; care for tools and accessories; and make such emergency repairs as are within the scope of his ability, tool equipment, and parts available. He will perform all daily lubrication operations, before operation, at halt (during shut-down periods), and after operation (par. 39). He will assist the unit mechanic in performing the weekly maintenance on the unit.

c. Maintenance Personnel. Maintenance personnel will perform the weekly and monthly maintenance operations (sec. IX) assisted by the operator. The unit mechanic will also see that daily lubrication operations have been properly performed by the operator. Any maintenance or repair operations beyond the scope of maintenance personnel will be reported to the officer in charge.

bolts are secure. See that the rubber mountings are in good condition and free from oil or grease.

g. Lubrication as Needed. Refer to section VIII and perform the lubrication operations scheduled for daily lubrication. Perform any other lubrication operations scheduled for this particular period.

Section VIII. LUBRICATION

35. Lubrication Orders

a. Lubrication orders are illustrated, numbered, and dated cards or decalcomania labels which prescribe approved lubrication instructions for mechanical equipment which requires lubrication by using organizations. Current lubrication orders should be requisitioned in conformance with instructions and lists in SR 310-20-3.

36. LO 11-947

a. If not already installed, LO 11-947 (fig.58) will be obtained and mounted on Power Unit PE-210. Instructions therein will be fully complied with.

b. LO 11-947 is mounted on the fuel tank.

37. Approved Lubricants and Cleaner

Symbols	Standard nomenclature
OE-10	To be used at all temperatures.
OE-A	Oil Engine, Arctic, for use in Sub zero Temperatures, When available.
GL	Grease, Lubricating, Special or Navy Spec. OS1350.
SD	Solvent, Dry Cleaning, Federal P-3-661a.
DA	Oil, Fuel, Diesel, U.S.Army Spec. 2-102C.

38. Lubrication Instructions

a. Organization Personnel. Lubrication to be performed by organization personnel will be in accordance with LO 11-947 (fig. 58).

b. Lubrication by Field or Base Personnel (after Disassembly).

(1) The magneto cam lubricating wick (cam wiper) is saturated with grease at the factory and should not require any lubrication for long periods. However, if it becomes necessary to remove the flywheel, clean off all the old lubricant and dirt from the cam surface and apply 1 or 2 drops

of engine oil (OE-10) to the felt wick. Avoid excessive lubrication of the wick.

(2) The magneto breaker-arm pivot bearing is lubricated at the time of assembly and should not require additional lubrication. When replacing breaker points (par 71c), clean off all the old lubricant with solvent (SD) and allow to dry thoroughly. Apply a thin coat of grease (GL) to the magneto breaker-arm pivot-bearing surface.

Caution: Avoid placing lubricant on the breaker points. Wipe off excess lubricant.

c. Parts Not To Be Lubricated.

The generator used on Power Unit PE-210 (FR) has two, prelubricated, sealed ball bearings. These bearings cannot be relubricated.

39. Forms and Records *

a. The following standard forms will be used for reporting unsatisfactory conditions of equipment, or improper preservation, packaging, packing, marking, loading, stowage, or handling thereof :

(1) DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army), NAV DEPT SERIAL 85P00 (Navy), and AFR 71-4 (Air Force).

(2) DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700-45-5.

(3) AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700-45-5 and AFR 65-26.

(4) Use other forms and records as authorized.

b. The following forms are necessary in connection with the operation and maintenance of Signal Corps internal-combustion-engine-driven equipment:

(1) NME Form 110 (Vehicle and Equipment Operational Record) is explained in TM 37-2810, Changes No. 1.

(2) WD AGO Form 460 (Preventive Maintenance Roster) is explained in TM 37-2810, paragraph 4c.

(3) DA AGO Form 464 (Work Sheet for Preventive Maintenance and Technical Inspection of Engineer Equipment) is explained in TM 37-2810, paragraph 18.

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* *See Note page 88*

Section IX. PREVENTIVE MAINTENANCE

40. Meaning of Scheduled Preventive Maintenance

PM consists of many simple operations which are performed regularly to keep equipment in condition. When PM is intelligently planned and conscientiously performed, equipment rarely fails.

41. Preventive Maintenance Service *

a. Routine PM of Power Unit PE-210 (FR) is performed as part of normal operation, and is reported on NME Form 110 (pars. 25 and 26).

b. In addition, however, Power Unit PE-210 normally operated 8 hours daily must have special scheduled services performed weekly and monthly by trained personnel. For *longer* operating hours, the intervals *must be shortened*. For example, a power unit operating 16 hours daily requires a *weekly* service twice a week and *monthly* service twice a month.

c. Under extreme conditions of heat, cold, dust, or moisture, certain items may require special attention. (sec. X).

42. Scheduling Services *

Schedule services for a month in advance, using WD AGO Form 460 (Preventive Maintenance Roster).

a. On the left-hand page write the names of the responsible mechanics, the power units in their care, and the normal operating hours of each unit. Under UNIT SERIAL NO. give the number assigned to each power unit by your organization. If no such number is assigned, put the manufacturer's serial number in the EQUIPMENT REG. NO. column.

b. On the right-hand page, show in pencil the service which will come due during the month. Weekly services are numbered to show when the monthly service is due. When services are actually performed, write over the entries in ink. If a unit is deadlined by accident or for repair by field or base maintenance, show this fact on the roster but do not reschedule.

43. Technical Inspections

These inspections, which are similar to PM services, are made by technically qualified personnel. They are made for any of the following purposes:

a. To determine whether a power unit should be continued in service, overhauled, or salvaged.

b. To determine extent of damage and estimated cost of repair in Reports of Survey and the like.

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* *See Note page 88*

c. To discover the cause of difficulties encountered in service.

d. To insure that all defects have been corrected in a field or base shop before the unit is returned to the using organization.

e. To determine the condition of a unit at the time accountability for it is transferred.

44. General Procedures *

PM services and technical inspections are recorded in detail on DA AGO Form 464 (Work Sheet for Preventive Maintenance and Technical Inspection of Engineer Equipment). The use of this form is explained in TM 37-2810, Motor Vehicle Inspections and Preventive Maintenance Services.

a. Fill in the appropriate spaces at the top of work sheet.

b. The three double columns of blocks, or groups, are used for recording the completion of items.

(1) For a technical inspection (TI) use the left-hand blocks in each column. Rule out 256 HR. MAINT. and the right-hand blocks.

(2) For the weekly inspection, use the right-hand blocks. Rule out 64 HR. MAINTENANCE and the left-hand blocks. Write WEEKLY above the right-hand columns.

(3) For a monthly inspection, use the left-hand blocks. Rule out 256 HR. MAINT. OR TECHNICAL INSPECTION and the right-hand blocks. Write MONTHLY over the left-hand columns.

c. An open block opposite an item means the items is to be inspected and corrected. In each inspection, make sure that the items and its supporting member or connection are *in good condition, correctly assembled, secure, and not excessively worn.* If an item is found to be satisfactory, put a check mark (√) in the box. If an adjustment is needed put an X in the box. If a repair is required, use XX. If a replacement is needed, use XXX. When the repair, adjustment, or replacement is made, circle the mark.

d. Some of the boxes have letters in them. These letters mean that, *besides the usual inspection and correction,* perform one or more of the following special services: When the special services have been performed, circle the letter or letters.

(1) *C-Clean.* Using solvent (SD), remove oil, grease, or dirt; rinse and dry. *Gasoline will not be used as a cleaning fluid for any purpose.*

(2) *T-Tighten.* Use the correct wrench and do not overtighten.

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* *See Note page 88*

Make sure that locknuts, lockwashers, cotter keys, and locking wires are in place.

(3) *A-Adjust.* Make adjustments as directed in paragraph 45.

(4) *L-Lubricate.* Perform special lubrication as directed in paragraph 38.

(5) *Serve.* Perform special operations as directed in paragraph 45.

e. During a technical inspection, make only such adjustments, repairs, or replacements, and perform only those inspecial services which are necessary to restore the unit to a safe operating condition. Replace damaged parts after the inspection.

45. Specific Procedures *

Following are detailed instructions for the items in the work sheet (DA AGO Form 464) which apply to Power Unit PE-210 (FR).

a. Locating Inspection or Service To Be Performed. Look down the column marked for the inspection or service which is to be performed. At each place where an item number appears in the column, follow the instructions to the right of the number. On each item make a general inspection, whether or not it is mentioned.

b. Marking Work Sheet When Items Are Completed. As the items are completed, mark the work sheet accordingly and rule out all items not mentioned here, as they do not apply.

c. Items To Be Written in on Work Sheet. Numbered blank spaces have been provided in all blocks, or groups, on DA AGO Form 464 to cover any items not listed. In the following table of detailed instructions there are three items which do not appear among the various headings which are printed on this work sheet. These three items are shown below and must be written in, opposite the appropriate printed item number shown, at the time this work sheet is prepared:

Item No.	*Heading to be written in*	*Where heading is to be written in*
21	Noise and vibration	Opposite blank space No. 21 in engine and accessories group.
175	Temperatures	Opposite blank space No. 175 in generators group.
211	Final running test	Opposite blank space No. 211, below graders group.

Note. If the tactical situation does not permit a full engine test, be sure to perform item 204.

* *See Note page 88*

d. Table of Detailed Instructions for Work Sheet Items

Tech insp	Monthly insp	Weekly insp	Action
1	1	1	*Before-operation Services.* Follow the before-operation procedure given in section IV.
2	2	2	*Lubrication.* Refer to LO 11-947 (fig. 58).
3	3	3	*Tools and Equipment.* All standard tools should be present (see tool list, par. 5), in good condition, and properly stowed. See that tools with cutting edges are sharp. Sharpen if necessary.
5	5	5	*Publications.* Two copies of TM 11-947 and a supply of NME Form 110, WD AGO Form 460, and DA AGO Form 464 should be present and in legible condition.
7	7	7	*Modifications (Mwo's completed).* Check to see that all modification work orders and other directives have been complied with.
			ENGINE AND ACCESSORIES
11	11	11	*Cylinder Head, Manifold,, and Gaskets.* Remove muffler and inspect for carbon deposits in exhaust ports and muffler (par. 74). Remove carbon if necessary and inspect for leaks and cracks. Tighten all mounting bolts and connections. *Note.* This operation should be performed half-way between weekly services, because an excessive amount of carbon may accumulate in a week.
	11		Remove the carburetor, muffler, and cylinder head and inspect for carbon deposits in the cylinder head, exhaust, and intake ports, and on the top of the piston. Remove carbon if necessary. Whenever the cylinder head is removed, clean both the spark plug and spark plug adapter.
20	20	20	*Governor and Linkage.* Inspect the governor and all connecting linkage, and see that they are secure and in good operating condition. Check linkage connections to see that they are not excessively worn. Check the plunger linkage and the attached throttle shaft to see that the parts are working freely and do not bind. *Note.* The following item is to be written in opposite blank space No. 21 in engine and accessories group.
21	21	21	*Noise and Vibrations (Engine Mountings and Exhaust).* While operating the engine, listen for any unusual noises in the engine. Notice any any excessive vibration that might indicate loose engine mountings, or noise that might indicate damaged, loose, or inadequately lubricated parts. *Serve.* Tighten mountings securely.
			FUEL SYSTEM
39	39	39	*Carburetor and Linkage.* Check for good condition, correct assembly, and secure installation. Be sure the carburetor does not leak. Inspect choke, throttle, linkage, and governor.

(3) Unprotected and exposed equipment will be affected by the high ambient temperatures existing during the day and by condensation at night. Midday temperatures in desert areas become abnormally high and unshaded equipment quickly absorbs the heat generated by the rays of the sun. Operation of the equipment under such conditions quickly raises its temperature to unsafe heights.

b. Power Unit PE-210 (FR)

(1) *Lubrication.* Clean all exposed or affected parts before applying the lubricant. Daily inspection of lubrication points is a must. Never add fresh lubricant to old dirt-bearing grease or oil.

(2) *Air Cleaner.* Remove and clean daily or oftener. Replace clogged or damaged element. Under any circumstances, do not operate the power unit without an air cleaner.

(3) *Shelter.* Power Unit PE-210 (FR) must be protected against windblown dust and sand. A roof must be placed over the equipment shelter that will effectively keep out the rays of the sun as well as sand. The unit is air-cooled and depends upon air circulation around the generator-armature and field coils and around the cylinder-cooling fins for cooling heated parts to safe operating temperature. Provide the shelter with adequate ventilation louvers and an outlet for the exhaust. Also place the door away from the prevailing wind. Place the canvas cover over the power unit during idle periods. (Wait until the unit cools sufficiently). Store fuels, lubricants, and other supplies in a suitable shelter to avoid the entrance of sand into the containers. Always strain fuel and oil of which the sand and dirt content is doubtful.

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PART FOUR

REPAIR INSTRUCTIONS

Section XI. THEORY OF EQUIPMENT

50. Principle of Two-cycle Engine (fig. 9).

a. When the piston travels away from the crankshaft, a charge of fuel vapor in the cylinder is compressed. At the same time, a partial vacuum, created in the crankease, causes the reed valve, attached to the carburetor, to open. A fuel-air mixture is then admitted into the crankcase (fig.9 (1)). At the end of the compression stroke of the piston (fig.9 (2)), the spark plug ignites the compressed fuel vapor in the combustion chamber, and the explosion, which follows, forces the piston toward the crankshaft on its power stroke (fig.9 (3)).

b. As the piston moves towards the crankshaft on its power stroke, it compresses the fuel vapors which have been admitted into the crankcase through the reed valve. When the piston passes the exhaust port openings, the ports are uncovered and most of the burned gases pass out of the cylinder and into the exhaust.

c. Just after the exhaust ports open, the piston uncovers the intake port openings and compressed fuel vapors from the crankcase pass through the bypass and intake port holes and into the cylinder. Fuel vapors are directed upward by a deflector located on the piston head (fig.9 (1)). The momentum of the flywheel carries the piston through the compression stroke. The continuous succession of these cycles produces a constant, smooth flow of power.

d. In engines of this type, lubrication of internal parts is accomplished with oil that is mixed with gasoline (fuel) that is drawn into the base of the engine in the form of vapor.

51. Engine Ignition System

The magneto has a rotating, permanent magnet in the flywheel (rotor) and a stationary coil (stator). The primary winding of the coil is in series with the breaker points. The secondary winding is connected to the spark plug. As the permanent magnet (flywheel) rotates, the magnetic flux through the coil is repeatedly reversed, and an induced current flows in the primary circuit when the contact points are closed. When the contact points open, the primary current stops flowing and the magnetic

field immediately collapses, thus inducing a very high voltage in the secondary winding of the coil. This potential is fed through the magneto cable to the spark plug where it jumps the spark-plug gap. (See TM 10-580, Automotive Electricity, for a more complete discussion of magnetos).

52. Theory of Generator Operation (fig. 10)

If a wire is moved through (cuts) a magnetic field, a voltage is induced in that wire. If the ends of that wire are connected to a load, current will flow in that wire or circuit. The induced voltage will be greater if the wire is longer, if the wire moves faster, or if the magnetic field is strengthened.

a. Generator GN-52-B is a d-c generator whose armature consists of coils of insulated wire wound through slots running axially on the armature surface. As the armature revolves, these coils are carried past the magnetic fields which are generated in the electromagnetic coils of the field windings. Voltages thus induced in the armature windings are picked up by the carbon brushes (fig.48) which are in contact with the ends (commutator segments) of the armature coils.

b. Once the field poles are magnetized, they usually retain some of the magnetism (called residual magnetism) even though there is no current in the field winding when the generator is not running. When the armature starts to rotate, the armature windings pass through, or cut, the field flux of this residual magnetism. This generates a small amount of voltage in the armature, which causes current to build up and flow in the field, thus strengthening it. This action increases until the full output voltage of the generator is reached.

53. Control Box

Operation of the control box is explained in connection with the governor (par. 54).

54. Electric-governor Operating Principle (fig. 13)

a. Mounted above the carburetor is a small, solenoid-type, electric governor. Its function is to control the engine speed and, in so doing, control the generator output voltage. A small rheostat in the control box provides the means of adjusting generator voltage by changing both the engine speed and the generator-field resistance.

b. The solenoid is made up of copper wire wound around a hollow tube, a plunger or armature inside the tube, a link and lever connecting the plunger to the carburetor shaft, and a

spring to position the plunger in response to the magnetic pull of the solenoid.

c. A portion of the electric current from the generator is supplied to the solenoid. This current produces a downward pull on the plunger, which tends to position it in the center of the tube. The downward movement of the plunger closes the carburetor throttle by means of the connecting link and lever. The small tension spring, attached to the top of the plunger, balances the solenoid pull and tends to position the engine throttle so that the correct engine speed to produce the proper voltage is obtained.

d. One lead of both the governor and voltage coil of the reverse-current relay is connected to one side (upper) of the generator (fig.12). The other leads of both are connected to the right end of the 12-ohm rheostat. The arm of the rheostat is connected to the other side (lower) of the generator. Thus, both the governor and reverse-current relay are subjected to a definite fraction of the generator voltage, depending on the position of the arm of the rheostat. For example, with the arm in the extreme position to the right *on the diagram* (full counterclockwise position of the control knob on the control box), full generator voltage is supplied to the governor and relay and both will close at approximately 6 volts. When the control knob is moved in the clockwise direction, less generated voltage is supplied to the governor and relay. However, since approximately 6 volts are required by the governor for any control knob position, engine speed and generator voltage must increase with the clockwise movement of the control knob in order to supply this required governor voltage.

54.1. Theory of Carburetor Function (fig.22)

a. A constant fuel level must be maintained in the carburetor float bowl and all channels of the carburetor at all times. This is controlled by the inlet needle and seat assembly (C) and the float (F).

b. At low or idle speed, the throttle shutter (G) closes the venturi (R) and causes fuel to enter the engine through the idle discharge ports (H). Fuel flows by the main adjustment screw (T), through channel (W), and into the idle tube (L). High vacuum ahead of the throttle shutter (G) draws this fuel upward and out of the orifice (M). The fuel from the idle tube orifice mixes with air from channel (J) and the resulting air-fuel mixture is drawn into the engine through the idle fuel discharge ports (H). Additional air, passing the slightly open throttle shutter, is mixed with the fuel as it passes toward the engine.

c. When the engine is operating at other than idle speed or

pulling a load, the throttle shutter (G) is no longer closed. This reduces suction in the carburetor and minimizes the fuel discharge at (H). The opening of the throttle shutter increases, to a high velocity, the flow of air through the venturi (R). This rapidly flowing air draws fuel from the main nozzle (Y). As the engine speed or load is increased, air is bled automatically into the main nozzle through tube (U). This causes a proper proportion of fuel in relation to the main nozzle adjustment.

Section XII. TEST EQUIPMENT USED IN TROUBLE SHOOTING

55. Test Unit I-176

Test Unit I-176 is a multimeter using a high-resistance voltmeter, an ammeter, a milliammeter, and an ohmmeter. All ranges may be read on one instrument and are generally adequate for trouble shooting the electrical parts of Power Unit PE-210.

56. Application of Test Unit I-176

Use the ohmmeter range to determine the presence of shorts between any individual commutator segment and shaft of the armature. Disconnect alternate paths in the circuit under test. Consult the schematic and wiring diagrams (figs. 11 and 12) for wire colors and their terminals, to avoid the necessity for disassembling the generator or control box. The very low values of resistance of armature and field coils as well as the voltage and current coils in the control box will cause very slight readings on the instrument. Consideration must also be given to the higher resistance values of heated wire. Capacitors used on the control box and generator must be disconnected for high-resistance continuity tests.

57. Repairs

Generator GN-52-B must be turned in for repair if it is defective. The same procedure must be followed for defective control boxes.

Section XIII. TROUBLE-SHOOTING PROCEDURES

58. General

No matter how well equipment is designed and manufactured, faults will develop during service. When faults occur, the repairman must locate and correct them as rapidly as possible. The

information in this manual will aid in the rapid location of such faults. Consult the following trouble-shooting data when necessary:

a. Engine and generator trouble charts (pars. 59 and 60).

b. Diagrams (Fig. 11 and 12).

c. Illustrations of components. Front, top, and bottom views aid in locating and identifying parts. Cross-sectional views of components are also valuable. Exploded views show all parts in relative positions to each other.

59. Engine Trouble Chart

a. Engine Fails To Stard or Is Hard To Start.

Possible cause	Check	Remedy	See par.
1. No fuel in tank.	Fuel tank.	Fill.	15
2. Fuel line shut-off not open.	Shut-off valve.	Open.	17
3. Air vent not open.	Air vent.	Open.	17
4. Defective spark plug.	Spark plug.	Replace.	70
5. Excessive carbon in spark plug.	Spark plug.	Clean.	70
6. Spark plug gap too wide	Spark plug.	Adjust to 0.035 in.	70
7. Wet spark plug.	Spark plug.	Dry or replace.	70
7.1. Spark Plug adapter clogged.	Inspect adapter.	Clean adapter.	
8. Water or dirt in fuel.	Fuel tank.	Drain, clean, and refill	45*d*, item 43
9. Carburetor nozzle clogged.	Carburetor nozzle.	Clean out.	67*c* (5)
10. Cylinder port holes plugged.	Cylinder port holes.	Clean out.	74
11. Muffler plugged.	Muffler.	Clean out or replace.	66*b*
12. Magneto points out of adjustment.	Magneto points.	Adjust gap to 0,020 in.	71*b*
13. Broken (open) magneto cable.	Magneto cable.	Replace.	71*f*
14. Defective capacitor.	Magneto.	Replace.	71*g*
15. Engine flooded.	Crankcase.	Open and drain.	17*a*(5)
16. Stop Switch short-circuited	Stop switch	Remove short circuit.	

b. Engine Overheats and Lacks Power.

Possible cause	Check	Remedy	See par.
1. Incorrect fuel mixture.	Fuel tank.	Drain and refill.	15
2. Cylinder port holes partially plugged.	Cylinder port holes.	Clean out.	74
3. Improper ignition timing.	Ignition timing.	Retime.	71*e*
4. Carburetor needle valve not properly adjusted.	Needle valve adjusting knob.	Reset.	17
4.1. Faulty carburetor adjustment	Setting of main and iddle adjusting screws.	Readjust	67.1
5. Carbon on top of piston and inside of cylinder head.	Cylinder and piston head.	Clean.	74
6. Wrong type spark plug.	Spark plug		70
7. Low compression.	Compression.	Replace or clean piston rings.	72

c. Engine Misfires.

Possible cause	Check	Remedy	See par.
1. Carburetor choke lever not in running position.	Choke lever.	Open Choke fully.	17
2. Chafed or broken magneto high-tension cable.	Magneto cable.	Replace.	71*f*
3. Carburetor needle valve not properly adjusted.	Needle valve adjusting knob.	Reset.	17

d. Excessive Smoke from Exhaust.

Possible cause	Check	Remedy	See par.
1. Incorrect ratio of oil to gas.	Fuel.	Replace with correct mixture.	15
2. Too rich a mixture in carburetor.	Carburetor adjusting knob.	Reset.	17

e. Poor Cylinder Compression.

Possible cause	Check	Remedy	See par.
1. Loose cylinder head.	Cylinder head nuts and gasket.	Replace gasket or tighten cylinder head nuts.	74c
2. Worn or stuck piston rings.	Piston rings.	Replace of free rings.	72
3. Loose spark plug.	Spark plug.	Tighten.	
4. Loose spark plug adapter.	Spark-plug adapter.	Tighten. Spark-plug adapter.	

f. Poor Crankcase Compression.

Possible cause	Check	Remedy	See par.
1. Faulty gasket on crankcase magneto back plate.	Magneto plate gasket.	Replace.	71d
2. Faulty carburetor gasket.	Gasket.	Replace.	67

60. Generator Trouble Chart.

a. Arcing at Carbon Brushes.

Possible cause	Check	Remedy	See par.
1. Dirty commutator.	Commutator.	Clean.	62 and 76
2. Worn out brushes.	Brushes.	Replace.	77
3. Brushes stuck in holders.	Brushes	Remove and clean.	77
4. Brushes not seated properly.	Brushes	Reseat.	77

b. Fails To Generate Voltage.

Possible cause	Check	Remedy	See par.
1. Brushes stuck in holders.	Brushes.	Remove and clean.	77
2. Brushes not seated properly.	Brushes.	Reseat.	77
3. Dirty commutator.	Commutator.	Clean.	76
4. Defective armature.	Armature.	Replace generator.	78
5. Shorted capacitor.	Capacitor.	Replace.	78

c. Fails To Deliver Rated Voltage.

Possible cause	Check	Remedy	See par.
1. Engine not up to speed.	Engine speed	Adjust governor.	17
2. Engine lacks power.	Engine.	See engine trouble chart.	59*b*
3. Worn out brushes.	Brushes.	Replace.	77
4. Brushes not seated properly.	Brushes.	Reseat.	77
5. Defective capacitors.	Capacitors.	Replace.	78

d. Governor Fails To Operate (Engine Overspeeds).

Possible cause	Check	Remedy	See par.
1. Open circuit in governor coil.	Solenoid coil.	Replace governor.	69
2. Broken wire from generator to coil.	Connecting wire.	Repair or replace.	
3. Generator fails to develop voltage.	Generator.	See *b* and *c* above.	

e. Interference with Near-by Radio.

Possible cause	Check	Remedy	See par.
1. Defective generator and control box capacitors.	Capacitors.	Replace.	78*a* and *c*
2. Loose spark plug shield.	Spark plug shield.	Tighten.	
3. Defective magneto-cable shielding.	Magneto-cable shielding.	Replace.	71*f*
4. Magneto-cam ground brush not seating.	Magneto-cam ground brush.	Loosen or replace.	71*d*

f. Batteries Do Not Take Charge.

Possible cause	Check	Remedy	See par.
1. Improper connections.	Cable CD-1334 connections.	Connect properly.	12
2. Defective generator.	Generator.	See *b* and *c* above.	
3. Defective batteries.	Cells.	Replace batteries.	

Section XIV. SPECIAL TOOLS.

61. Tool for Undercutting Mica (fig. 14).

To improvise a tool for undercutting the mica between the commutator segments, grind a piece of broken hack-saw blade to the exact width of the mica. Grind one end of the blade to enable fitting of a wood handle, and fit the handle to the blade.

62. Commutator-dressing Tool.

To improvise a commutator-dressing tool, cut a strip of wood 1/8 inch thick and 1/2 inch wide. Glue or tack No. 00 sandpaper over the end of the stick (fig. 45).

Section XV. DISASSEMBLY AND REPAIR.

63. Engine Disassembly.

a. General. Remove the engine from the tubular frame only if it is necessary to disassemble the engine completely. Disassembly, repair, and assembly of the various components are described in the following paragraphs.

b. Engine Disassembly.

(1) *Removal.* Remove engine and generator from tubular frame as follows:

(a) Close fuel shut-off valve (fig. 20) and disconnect fuel line at carburetor.

(b) Remove nut and washers from each stud that holds the engine base to the rubber-shock mountings (fig. 15).

(c) Remove engine from its mounting base by taking out the four screws holding it in place (fig. 15).

(d) To remove generator from engine, disconnect lead wire from control box at the governor. Unscrew three hexagonal head cap screws from back side of bearing adapter. Tap generator until it is disengaged from the splined shaft of the engine crankshaft (fig. 17).

(2) *Disassembly.* Disassemble the engine in the following manner:

(a) Unscrew nuts holding control box to frame and unfasten wires at terminals.

(b) See *(d)*.

(c) Remove carburetor, governor, and air cleaner as a unit from the crankcase by removing the four screws and lockwashers.

(d) Power Unit PE-210-(FR) is equipped with a shielded spark-plug and a spark plug adapter. Unscrew the shielded ignition cable from the spark plug. Remove the spark plug from the sparkplug adapter. Remove the cylinder head baffle and then the spark plug adapter from the cylinder head.

(e) Remove the flywheel housing (fig. 7), which is attached by three screws with lockwashers. Insert a punch (or rod) through the starter pulley, turn counterclockwise, and unscrew pulley from crankshaft. Screw the flywheel removal tool onto the crankshaft and tap its end with a hammer until the flywheel loosens on the crankshaft taper (fig. 18). Pull on flywheel to take advantage of any crankshaft end play Remove flywheel from crankshaft.

(f) Remove magneto, magneto-cam ground brush, and magneto back plate with ignition cable and shielding from the engine. Remove magneto back plate gasket (par. 71d).

(g) Remove cylinder head and gasket (par. 74a).

(h) Remove the four nuts and lockwashers that attach cylinder to crankcase and withdraw cylinder from crankcase (fig. 19). Remove cylinder gasket.

(i) Remove the piston and connecting rod assembly (par. 72a).

(j) Remove the crankshaft and bearings from crankcase (par. 73a).

64. Engine Reassembly.

a. Insert crankshaft and bearing into crankcase.

b. Assemble connecting rod and piston assembly to the crankshaft.

c. Place cylinder gasket over studs on the crankcase and assemble cylinder to crankcase. Draw the four nuts with lockwashers down securely against the cylinder flange.

d. Assemble cylinder head to cylinder.

e. Place magneto back plate gasket against the crankcase and install back plate on crankcase. The back plate is held in place with two screws and lockwashers. Install the magneto cam and magneto-cam ground brush. Before assembling flywheel to crankshaft, check magneto timing (par. 71e).

f. Install the flywheel on the crankshaft, being careful to see that the flywheel key is positioned properly in the keyway on the crankshaft and flywheel. Install starter pulley washer an and pulley. Screw the pulley up tight against the flywheel by using a punch or steel rod inserted through the pulley for leverage. Install the magneto flywheel housing assembly with three screws and lockwashers.

g. On Power Unit PE-210-(FR), screw the spark plug adapter into the cylinder head, install the cylinder head baffle, place

a new gasket on the spark plug and install the spark plug. Attach the shielded ignition cable to the spark plug.

h. Install muffler and head assembly to cylinder. Use a new gasket. This assembly is attached to the cylinder with two screws and lockwashers.

i. Use a new gasket, and attach the carburetor, governor, and aircleaner assembly unit to the crankcase. This unit is held in place with four screws and lockwashers.

65. Engine Installation.

Install engine assembly in power unit as fowlows:

a. Smear a small amount of grease in the recess around the crankshaft splined end and also on the spline (fig. 17).

b. Insert hollow splined generator shaft over splined end of engine crankshaft and attach generator to engine with three screws and lockwashers.

c. Connect leads from the generator to the electric governor (fig. 20). Insert the engine and generator assembly in power unit frame and attach to subframe with the four screws and lockwashers. Place the lockwashers between the engine and the subframe as well as under the screw heads. Attach the muffler to the mounting stud with the nut and lockwasher. Connect the control box lead wire to the insulating block on the electric governor. Remove the control box cover and attach the generator leads according to the wiring diagram (fig. 12). Reinstall cover.

d. Connect the fuel line to the fuel shut-off valve under the fuel tank. Install drain valve in bottom of crankcase (fig. 15).

e. Run in the engine and test according to procedure given in paragraph 75.

66. Muffler.

a. Removal. Remove the nut that attaches muffler to rubber mounting. Remove the two screws and lockwashers that attach muffler to cylinder and remove the muffler assembly from the engine. Remove the exhaust flange gasket. Remove the nut and washer on the stud that holds the muffler body to the muffler head and lift the body off. Remove the body gasket.

b. Cleaning, Inspecting, and Repairing. Clean the muffler body, stud, and head with solvent (SD). Dry thoroughly. Inspect the condition of head and body for dents, breaks, or cracks. Replace all defective parts. Pay particular attention to condition of gaskets, and if they are defective in any way, replace with new gaskets. Turn the engine over by hand until the piston reaches bottom dead center. Using a screwdriver, remove carbon

from exhaust ports (fig. 43). Be sure to turn the engine over several times to blow out carbon chips before the muffler is reinstalled

c. Installation. Place the muffler body gasket on muffler head and install muffler body over stud. Fasten body in place with lockwasher and nut. Install the muffler assembly on the cylinder, using new gasket and two screws with lockwashers. Attach the muffler to the engine sub-base mounting screw stud with nut and lockwasher.

67. Power Unit PE-210-(FR), Carburetor Disassembly.

Remove and disassemble the carburetor as follows :

a. Remove the carburetor and governor assembly from the engine.

b. Separate the carburetor from the electric governor (fig.53).

c. Remove the two screws that hold the carburetor to the governor mounting bracket.

d. Loosen the screw that clamps the throttle lever to the throttle shaft. Slide the throttle lever from the throttle shaft and separate the governor from the carburetor.

e. Remove the main adjustment screw and gland assembly from the carburetor fuel bowl (fig. 51).

f. Remove the body retaining screws and separate the upper carburetor body and fuel bowl assemblies.

g. Remove the float-lever-pinion pin and remove the float from the fuel bowl.

h. Remove the large plug screw (19, fig. 51) and then remove the inlet needle and seat (25, fig. 51).

i. Remove the idle adjustment screw (20, fig. 51), spring (21, fig. 51), and the idle tube and gasket (22 and 23, fig. 51). Also remove the main nozzle channel plug screw (X, fig. 22) from the upper body.

j. Remove the throttle shutter, shaft, and lever assembly.

67.1. Power Unit PE-210-(FR). Carburetor Cleaning.

a. After the carburetor has been disassembled, thoroughly wash all parts in clean solvent (SD). Remove any gum formation with acetone, benzine, or alcohol. Replace any parts that cannot be

cleaned without damage. Blow out the following with clean compressed air:

(1) Main nozzle (Y) and air-bleed vent tube (U) (fig. 22). If replacement of the main nozzle is necessary, remove it from the upper body and install the new nozzle.

(2) Idle fuel supply channel (J) (fig. 22). Install the idle tube (L) and gasket in the upper body. Place the air hose at the open end of the fuel supply channel (J) at the point where the idle adjustment screw (D) is installed.

(3) Fuel inlet channel (A) (fig. 22). Place the air hose at the point where the fuel connection is made to the fuel body and carefully blow out the fuel inlet channel. Make sure that the fuel inlet screen is clean and in place.

67.2. Power Unit-PE-210-(FR), Carburetor Reassembly (fig. 51).

a. Insert the throttle shaft (34) in the upper carburetor body and attach the throttle shutter (36) to the shaft with the screw (37).

b. Install the main nozzle (32) and the channel plug screw (33) in the upper body (1).

c. Install the idle tube and gasket (22 and 23). Place the idle adjustment retaining spring (21) on the idle adjustment screw (20) and install the assembly in the upper body.

d. Install the inlet needle and seat with gasket (25) in the fuel bowl and replace the large plug screw (19).

e. Set the float (14) in the fuel bowl. Make sure that the tangs of the float pivot arm straddle the inlet needle in the groove at its outer end. Insert the float pin (15) through the fuel bowl and float pivot.

f. Before attaching the fuel bowl to the upper carburetor body, check the float setting and adjust it, if necessary proceed as follows:

(1) With the float and inlet needle installed in the fuel bowl, hold the assembly upside down (fig. 23).

(2) Place the straight edge of a steel scale across the lowest projecting point of the float at the free end of the float.

(3) Be careful not to lift the float and insert a.015-inch thickness gage between the edge of the steel scale and the rim of the fuel bowl. The gage should just fit between the edge of the bowl and the edge of the scale.

(4) If adjustment is necessary, remove the float and bend the

arm of the float lever, that engages the inlet needle, very slightly until the proper measurement is obtained.

Note: If the fuel level rises beyond the float-setting point with the float lever properly adjusted, inspect the seating of the needle valve in its seat. If the fault appears to be in the needle valve and seat, clean them with a soft cloth. Place the needle valve in its seat and tap it very lightly, while turning it with the thumb and forefinger. If this does not remedy the condition, replace the needle and seat. *Do not change the float setting from the manufacturer's specifications.*

g. Set the gasket (3, fig.51) in place and attach the upper carburetor body (1) to the fuel bowl (16) with the four screws and lockwashers. Tighten the screws securely.

h. Assemble the main adjusting screw (27), nut (31), packing (30), and gland (28). Place the gasket (29) on the gland and install the complete assembly in the fuel bowl.

i. Insert the choke shaft (10) in the upper carburetor body (1). Make sure that the longer end of the shaft projects from the body. Install the choke shutter (11) and fasten it to the shaft screw (12).

j. Attach the choke lever to the choke-shaft.

k. Replace all remaining small parts and plugs.

l. Install the air cleaner elbow to the carburetor air intake with the two screws and lockwashers.

m. Reassemble the electric governor to the mounting bracket and install the carburetor, governor, and bracket assembly to the engine. Make sure that all gaskets are installed and in good condition. Inspect the reed valve before the carburetor is installed to see that the valve is properly installed and secure.

n. Reassemble the air cleaner assembly to the air cleaner elbow.

67.3. Power Unit PE-210-(FR), Carburetor Adjustment

Two separate adjustments are provided: The main adjusting screw (27, fig. 51) and the idle adjustment screw (20, fig. 51).

a. Initial Adjustment. Turn the idle adjustment screw clockwise until it is fully seated. Do not force this screw; damage to both the needle valve and seat will result. Turn the idle adjustment screw counterclockwise about 3/4 turn from its fully closed position. Perform the same operations on the main ad-

justing screw (27). When both of these adjustments have been made, close the carburetor choke and start the engine.

b. Power Range Adjustment. Allow the engine to reach operating temperature. Hold the throttle in approximately one-half open position and turn the main adjusting screw clockwise until the engine begins to lose speed. When this occurs, turn the main adjusting screw counterclockwise (usually about 1/8 turn) until maximum speed and power are obtained.

c. Idle Adjustment. After the power range adjustment has been made, close the engine throttle to idle position. Turn the idle adjusting screw clockwise until the engine begins to lose speed and flutter. Turn the idle adjustment screw back (counterclockwise) until the engine runs smoothly.

d. Final Adjustment. Alternately open and close the throttle a few times to test the adjustment. If acceleration hesitancy or stalling at idle speed occurs, repeat the entire adjustment procedure.

68. Air Cleaner.

The air cleaner prevents dust and grit from entering the engine and thus causing wear to moving parts of the unit. If the engine is operated under extremely severe, dusty conditions, remove the cover and brush dust accumulations from the filter element every 28 hours. *Do not dip filter element in oil.* When operating conditions are normal, clean the element every 56 hours. Examine the filter element periodically to see that no openings are present which might allow entry of foreign material. Replace clogged or damaged element.

69. Electric Governor (figs. 13, 25, and 26).

Replace the governor if the solenoid, tube, or plunger is defective. If the plunger-return spring is replaced, install a new governor spring as follows:

a. Disconnect the two wires at the terminal block on the side of the governor housing.

b. Disconnect the fuel line at the carburetor.

c. Remove the carburetor and solenoid as a unit by removing the four screws that hold the carburetor to the engine (par. 67*a*).

d. Remove the solenoid top cover and release the wire connector by bending the connector up and loosening the screw in the upper swing support.

e. Remove the two screws that hold the electric governor to the carburetor. Lift the assembly straight up until it is clear of the plunger. Loosen the throttle-lever retaining screw and slide the governor plunger off the carburetor throttle shaft.

f. With a small punch, drive out the upper brass pin in the plunger and remove the spring (fig. 54).

g. Insert the large end of the new spring in the plunger and install the brass pin in the plunger engaging the lower spring loop. Lightly peen the pin ends to secure them and file the pin ends sufficiently to secure necessary clearance.

h. Assemble the plunger to the carburetor throttle shaft. Insert the hook on the free end of solenoid plunger spring into the hole in the flatted adjusting screw. Screw the adjusting nut onto the screw and turn it down until the hole in the screw is approximately 3/8 inch below the support. Connect the spring support so that the spring loop is about 3/8 inch from the support. This setting may have to be changed after the engine is running to obtain the proper voltage.

i. Note the position of the plunger when the throttle is closed. The top of the plunger should be 1/16 to 3/32 inch above the top of the solenoid tube for closer voltage regulation. If it is not, move the throttle lever on the throttle shaft for correct positioning. After the plunger is properly set, tighten the lever lockscrew.

j. Check the plunger linkage and the attached throttle shaft to see that the parts are working freely and not binding.

k. Install the governor and carburetor on the engine. Make a final adjustment (*l* below) for speed and voltage after the engine has been warmed up and is running evenly. To increase the output voltage turn down the adjusting screw. This increases the tension of solenoid spring. While proper governor spring tension is important, it is not too critical. Insufficient tension results in failure of the reverse-current relay to close when the engine is started which causes the engine to idle, and the ammeter to show no charge, regardless of the control knob position. However, a quick counterclockwise movement of the control knob will cause the relay to close even with insufficient spring tension.

l. On Power Unit PE-210-(FR), turn the governor adjusting nut up or down until the desired charging rate is obtained.

70. Spark Plug.

Power Unit PE-210-(FR) is equipped with a HOT-Type shielded spark plug with a built-in suppressor. The shielded

ignition cable attaches directly to the spark plug. These units are equipped also with a spark plug adapter, in the cylinder head, into which the spark plug is screwed. This adapter must be inspected and cleaned every time the spark plug is cleaned or adjusted.

a. Removal. To remove the spark plug, unscrew the shielding nut from the spark plug and lift the spark plug shielding and cable from the spark plug. Unscrew the spark plug from the spark plug adapter in the cylinder head.

b. Cleaning and Inspecting. Wash the spark plug thoroughly in solvent (SD) and dry it with air pressure. Carefully inspect the spark plug insulator for cracks and chips and other unsatisfactory conditions. Check the gap between the spark plug electrodes and adjust it to .035 inch. When adjusting this gap, never bend the center electrode. Bend the electrode attached to the shell of the plug only. Inspect the spark plug adapter in the engine cylinder head to see that the holes are not obstructed. If the holes in the adapter are obstructed, clean them with a small wire. Clean all carbon from the inside of the adapter before reinstalling the spark plug.

c. Testing. Attach the spark plug to the ignition cable and shielding assembly, and lay the shell of the spark plug on the frame of the unit. Make sure that the shell of the spark plug is making good contact with the unit frame and that it will not jar off when the engine is cranked. Spin the engine by means of the starting rope and watch for a spark between the electrodes of the spark plug. If no spark occurs between the spark plug electrodes, check the magneto. To do this, disconnect the ignition cable and shielding assembly from the spark plug. Hold the cable and shielding assembly so that the small spring projecting from the shielding elbow is about 3/16 inch away from the unit frame. Spin the engine with the starting rope and watch for a spark between the end of the ignition cable and the unit frame. If a spark occurs, install a new spark plug in the engine.

d. Spark plug Installation. Before replacing the old spark plug or installing a new one, always check that the spark plug adapter is clean (insert) and that the holes in the adapter are not clogged. Screw spark plug into the spark plug adapter. Press the spring contact which extends from the end of the shielding elbow onto the spark plug and screw on the shielding nut.

71. Magneto.

If the magneto spark is not satisfactory, clean and adjust the breaker points. If, after the breaker points have been cleaned and adjusted or replaced, the magneto does not generate a satisfactory spark, check the capacitor and replace if necessary

(*g* below). If this does not correct faulty ignition, the coil is probably defective. Replace the entire magneto.

a. Testing Magneto. Test the magneto spark as instructed in paragraph 70*c*. If the magneto is operating properly, a spark should jump the gap between the end of the ignition cable and the unit frame. If no spark occurs or it is noticeably weak, check the magneto breaker points and capacitor. Also inspect the magneto cable and shielding to see that the cable is not short-circuited to the shielding. Check that the stop switch is not short-circuited.

b. Breaker Point Adjustment (fig. 31). Adjust breaker points as follows:

(1) Remove spark plug shield cap, spark plug, and shield body.

(1.1) Disconnect the spark plug ignition cable and the shielding assembly from the spark plug.

(2) Remove flywheel housing and flywheel (par. 63*b*(2)(*e*)).

(3) Turn engine clockwise by hand until breaker points are *fully opened*. Check breaker point gap with feeler gauge. Correct opening is 0.020 inch.

Note. The highest point on the cam is the end of the flat portion of the cam which passes under the breaker arm fiber as the engine is turned clockwise. The breaker arm fiber must rest on this point when measuring the breaker point gap.

(4) Inspect the points. If they are uneven or pitted, restore them to an even condition with the point cleaner furnished with the equipment. Be sure to remove all dust particles after servicing the points. If points are excessively pitted or damaged, replace them.

(5) To reset a point, loosen screws which hold the breaker plate in position and move plate up or down, as necessary, to obtain proper point opening. After setting is accomplished, tighten lockscrews. Recheck point gap after tightening lockscrews. Lubricate the cam (par. 38*b*(1)).

Note. Breaker plate setting should be made only in the manner prescribed above. At no time should the contact on the plate be loosened or the breaker arm be bent.

(6) Install flywheel housing and spark plug with shield.

c. Breaker Point Replacement (figs. 32 and 33). If either contact point is badly pitted or worn away, replace both points at the same time to assure satisfactory operation. Replace breaker points as follows:

(1) Remove the screw that holds the breaker plate to the stator plate. Remove the breaker arm lock and washer. Lift breaker arm from plate, being careful not to lose the spring.

(2) Remove the nut and lockwasher from stud end of the capacitor. Remove lead and breaker-plate leaf spring. Remove breaker plate from stator plate.

(3) Install a new breaker plate assembly, attaching the leaf spring and primary-lead wire to capacitor. Before installing the new breaker arm, form a horizontal loop in the breaker arm wire and position it between the head of the ground screw and breaker-arm mounting stud (fig. 33). When forming this loop, that part of the lead that protrudes from the lower end of the hole in the arm should be bent sharply to the right to prevent up-and-down movement. Follow these instructions carefully to avoid breakage of the lead.

(4) Before installing the breaker arm, lubricate the breaker arm pivot as described in paragraph 38*b*(2).

(5) After the breaker arm is in place, insert the flat washer, then the spring clip. Tighten the assembly with the screw.

(6) Adjust the breaker point gap (*b* above).

(7) Install the magneto, flywheel, flywheel housing and spark plug and attach the spark plug cable and shielding assembly to the spark plug.

d. Magneto Removal and Replacement. If the coil is defective, replace the entire magneto assembly.

(1) Disconnect the spark plug shielding and the ignition cable assembly from the spark plug. Remove the spark plug. flywheel housing and flywheel. Remove the magneto cam brush.

(2) Remove the two screws and lockwashers that attach the stator plate to back plate (fig. 34) and remove the stator plate.

(3) Remove the two screws and lockwashers that hold the back plate to the crankcase (fig. 34). Remove the back plate and back plate gasket from the crankcase. Ignition (spark plug) cable and shielding will come off with the back plate.

(4) Inspect the oil seal in the magneto back plate. If this seal is damaged or worn, press the seal out and replace.

(5) Install the back plate (with ignition cable and shielding attached) on the engine crankcase with the two screws and lockwashers. Use a new gasket if the old gasket is defective. Reinstall the magneto cam brush.

(6) Install the magneto assembly on the back plate with the two screws and lockwashers. Connect the ignition cable to the lead wire on the coil. Time the magneto in accordance with instructions in *e* below.

(7) Install the flywheel, flywheel housing, and spark plug.

Attach the ignition cable and the shielding assembly to the spark plug.

e. *Magneto Timing (fig. 33).* When installing a new magneto or replacing the breaker points, time the engine as follows:

(1) Check the breaker-contact-point opening (*b* above).

(2) Remove the spark-plug shield cap, spark plug, and spark-plug shield body and cylinder head baffle.
Also remove the spark plug adapter from the cylinder head.

(3) Turn the engine crankshaft in the direction of rotation until the piston reaches top dead center.

(4) Insert the timing gauge furnished with the equipment (fig. 33) in the spark plug hole and cylinder head until it touches the top of the piston. If necessary, turn the engine slightly until the lower edge of recess on the gauge is flush with the top of the spark plug hole. Withdraw gauge.

(5) Turn the engine against direction of rotation about 1/4 turn. Insert the gauge again through the spark plug hole until it touches the top of piston. Then turn the engine in direction of rotation until the *top edge* of recess in gauge is flush with top of the spark plug hole.

(6) Loosen the stator plate screws and move the stator plate until the breaker points begin to break. Tighten the plate screws.

(7) Recheck to determine if the *top edge* of the recess in the gauge is flush with the top of the spark plug hole when the magneto points begin to break. If setting is exactly as described, the timing is then set so a spark occurs when the piston is 1/8 inch from the top dead center.

f. Magneto Cable Replacement. If inspection and tests indicate a defective magneto cable, replace as follows:

(1) Power Unit PE-210-(FR) is equipped with a shielded spark plug which has a built-in suppressor. Unfasten the ignition cable from the magneto coil. Loosen the screw and locknutthat secure the shielding and cable assembly to the magneto backplate. Disconnect the shielding nut from the spark plug. The ignition cable can now be removed from the shielding.

(2) Remove the magneto-flywheel housing and flywheel.

(3) Unfasten the wire end of the magneto cable from around bracket in coil. Loosen shielding-retaining locknut on the rear of the magneto back plate (fig. 34) and withdraw the cable and shielding. With the suppressor removed, the magneto cable can be removed from the shielding.

(4) Strip the insulation back about 1/2 inch from the end of the replacement cable and twist the wire strands together. Install replacement cable inside shielding. Screw suppressor on end of shielding.

(5) Insert the shielding through the opening in the magneto back plate until the collar is flush with the shoulder. Tighten the screw and locknut to hold the shielding to the back plate. Insert the wire end of the cable in the bracket on the coil, then wrap it around the bracket securely.

(6) Bring cable and shield assembly forward between the cylinder and magneto back plate.

(6.1) On Power Unit PE-210-(FR), screw the nut on the elbow of the shielding assembly to the spark plug.

(7) Install flywheel and flywheel housing.

g. Capacitor. If no spark or a weak spark occurs after the magneto point is adjusted, the trouble may be in the capacitor. Replace capacitor as follows:

(1) Remove flywheel housing and flywheel (par. 63*b*(2)*(e)*).

(2) Remove nut and lockwasher on end of capacitor and disconnect lead and breaker plate leaf spring.

(3) Remove the two screws and the clamp that hold the capacitor to the stator plate and take off capacitor.

(4) Install a new capacitor with the clamp and two screws. (The clamp screw on the inner side of the capacitor receives the ground wire from the coil).

(5) Attach breaker plate leaf spring and black lead wire from coil to end of capacitor with the nut and lockwasher.

(6) Install flywheel and flywheel housing.

72. Piston, Piston Rings, and Connecting Rod.

The piston is made of a special aluminum alloy which is very light. The standard clearance between the piston skirt and cylinder is 0.0025 to 0.0035 inch to compensate for the expansion of the hot piston. The lands of the piston are smaller than the skirt to allow for greater expansion at the piston head. Three compression piston rings are used. The connecting rod is made of a special bronze material and uses no inserts. The piston pin end of the rod has a needle bearing.

a. Disassembly. Disassemble, clean, and reassembly piston rings and connecting rod as follows:

(1) Disconnect the spark plug cable shielding assembly from the

spark plug. Remove the spark plug, the cylinder head baffle, and the spark plug adapter.

(2) Remove muffler and carburetor assemblies (pars. 66*a* and 67*a*).

(3) Remove magneto assembly (par. 71*d*).

(4) Remove cylinder head and gasket (par. 74*a*).

(5) Remove the four nuts that attach cylinder to crankcase and pull off cylinder (fig. 19).

(6) Working through the opening in the crankcase where carburetor has been removed, unscrew the two capscrews and lockwashers that hold connecting rod cap to the connecting rod, and remove cap (fig. 35). Push connecting rod and piston up through crankcase.

(7) To remove cotter pin from piston, turn the pin 90° and straighten out the bulge, using hammer and punch. Then turn the pin 180° and straighten out the opposite side of the bulge. Using a pair of pliers, withdraw cotter pin (fig. 36). Tap piston pin from piston.

(8) Spread the top piston ring and remove from piston. Remove second and third rings in same manner.

b. Cleaning and Inspecting. Clean all carbon from piston head and piston ring grooves. Clean piston and rings in solvent (SD). Thoroughly clean the piston grooves. Inspect piston for cracks and condition of grooves and ring lands. If there are any cracks, the piston should be replaced. Clean the connecting rod bearings with solvent (SD) and inspect them for excessive wear or defects. If a connecting rod bearing is worn or defective, replace the entire rod. Check all clearances and tolerances as follows:

(1) Insert skirt of piston in cylinder with pin in its normal direction and measure clearance at bottom of skirt at a point 90° from the axis of the piston pin (fig. 37). This clearance should be from 0.0025 to 0.0035 inch. Remove piston from cylinder and measure the diameter of the piston skirt at 90° from the axis of the pin. If the skirt diameter is less than 1.993 inch, replace the piston.

(2) Take several readings of the inside diameter of the cylinder wall with an outside micrometer. Take the readings at points from top to bottom of the space in which the piston operates, both parallel to the crankshaft and at right angles to it. Standard cylinder bore is 2.0010 to 2.0015 inches. If the micrometer reading of the standard bore is exceeded by 0.005 inch, or if it is more than 0.003 inch out of round, replace the cylinder. Inspect inside of cylinder wall for marks. If it is scored or marred seriously, replace the cylinder.

(3) Insert each piston ring in cylinder. (Use the piston to

push the ring in). Check gap between the ends of the piston rings with the feeler gauge (fig. 38). If this gap measures more than 0.030 inch, discard the ring. Before installing a new ring, check gap as before. If there is not at least 0.010-inch clearance between the ends of new rings, file end until this clearance is obtained. Check each piston ring in this manner.

(4) Spread each piston ring with a tool to allow the ring to slip over the piston and into its groove. Rings must move freely in the piston grooves. Check clearance between the ring and the piston land with the feeler gauge (fig. 39). This side clearance should be 0.004 to 0.006 inch. If the piston ring grooves are worn to 0.008 inch or more (side clearance), replace the piston or rings, whichever is required to obtain proper fit.

(5) Check piston pin for wear. If pin is worn to 0.002 inch or more from the new diameter 0.3751-0.3753, replace the pin. The piston pin should be a light tap fit in the piston. If the piston pin is loose, the cotter pin will shear off.

(6) Install the connecting rod on the crankshaft. The bearing should fit without noticeable looseness and should not bind even when dry. If the connecting rod bearing is loose on the crankshaft, remove the connecting rod cap and file the mating surfaces, keeping the surfaces perfectly flat and even, until the proper fit is secured. In fitting the cap, always be sure to assemble it to the connecting rod with the matching marks on the same side.

c. *Reassembly*. When all parts have been cleaned and inspected, and defective parts replaced, reassemble piston rings and connecting rod as follows:

(1) Spread the piston rings and install them in the piston grooves. If the old rings are being re-used, transpose them by installing the bottom ring in the top groove and the top ring in the bottom groove.

(2) Position connecting rod in piston and install piston pin. This should be a light tap fit. If the piston pin is loose in the piston, it will shear the cotter pin. Side movement of the pin may occur and cut grooves in the cylinder liner. Install a new cotter pin to lock the piston pin in the piston. Spread the center of the cotter pin with a sharp V-shaped tool after the pin is in place (fig. 40).

(3) After the piston and connecting rod are joined and the rod is properly fitted to the crankshaft, remove the connecting rod cap. Assemble piston to cylinder with a ring-installing tool or with the fingers. Be sure the hump or intake side of piston is opposite the side where the muffler is attached.

(4) Set the cylinder gasket over the studs on the crankcase. Use a new gasket. Next insert the crankshaft in the crankcase. Attach the cylinder to the crankcase. Replace the connecting rod cap. Make sure the matching marks are on the same side.

73. Crankshaft and Main Bearings.

The crankshaft is a one-piece drop forging and is counterweighted to reduce vibration. It is installed on two ball bearings which are lubricated by the oil component of the fuel-oil mixture.

a. Disassembly. Remove crankshaft and main bearings as follows:

(1) Disassemble the engine to the point where the crankshaft can be removed (par. 63).

(2) Remove the three screws and lockwashers that attach the crankcase adapter to the crankcase.

(3) Screw the flywheel-removal tool over the end of the crankshaft and drive the shaft end bearing and adapter out of the crankcase (fig. 41).

(4) The main bearings are pressed on the crankshaft and should be removed only if they are worn. (Always replace main bearings when crankshaft requires replacement). To replace a worn bearing, place the crankshaft in an arbor press, with the bearing properly supported, and press off.

b. Cleaning and Inspection.

(1) After bearings have been removed, cover them carefully (if they are to be re-used) to keep dust and dirt out of the ball races. Bearings must be thoroughly cleaned with solvent (SD) and carefully dried before being reinstalled.

(2) Check the crank pin diameter (diameter should be 0.6230 to 0.6235 inch). Crank pin width should be 0.8120 to 0.8170 inch. Inspect the crank pin. If it is roughened or grooved, replace the crankshaft. Inspect the keyway of the crankshaft and if the shaft has been chipped at these points, replace the crankshaft.

c. Reassembly.

(1) Press the old bearings or replacement bearings on the crankshaft. This must be done on a press and the bearings must be properly supported. Press crankcase adapter over bearing on splined end of crankshaft.

(2) Replace gasket and install crankshaft assembly in the crankcase. This will be a light drive fit. Avoid cocking the

bearing when inserting it in the crankcase. Attach the adapter to the crankcase with the three screws and the lockwashers.

74. Cylinder Head, Intake Ports, and Exhaust Ports.

Make a check of engine exhaust portholes about every 24 operating hours to make sure no carbon has built up at these points (fig. 43). Carbon deposits in exhaust and intake portholes restrict the scavenging of exhaust gases from the cylinder and reduce power output. The cylinder head must be removed for cleaning carbon deposits from intake ports and piston head. Remove carbon as follows:

a. Disassembly.

(1) Disconnect the spark plug cable shielding assembly from the spark plug. Remove the spark plug and the spark plug adapter from the cylinder head.

(2) Remove the four screws and lockwashers that attach the cylinder head baffle and remove baffle (fig. 44).

(3) Remove the four nuts, lockwashers, and plain washers that attach cylinder head to cylinder and lift off cylinder head.

(4) Remove the cylinder head gasket. Do not damage it.

b. Cleaning and Inspection.

(1) Scrape and blow accumulated dirt and oil out of the air passages in the cylinder head fins. These fins must allow free circulation of air to prevent overheating of engine. Clean carbon deposits from inside of cylinder head and wash head thoroughly in solvent (SD). Inspect the spark plug hole. Be sure it is clean and threads are not stripped.

On engines equipped with a spark plug adapter, inspect the threads on the adapter to see that they are not damaged, and thoroughly clean the adapter. Make sure that the small holes in the adapter are not obstructed.

(2) Turn the engine over by hand until the piston is at bottom dead center. Using a screwdriver, remove carbon from the intake ports and piston head (fig. 44). Be sure no carbon chips are left in the cylinder.

c. Reassembly.

(1) Coat both sides of the cylinder head gasket with grease and place the gasket on top of the cylinder. If the gasket which was removed is damaged or bent, replace it with a

new gasket. Place the cylinder head over the studs and on the cylinder head gasket.

(2) Insert a plain washer and lockwasher over each stud and install the cylinder head nuts. Tighten the cylinder head nuts evenly a little at a time while the engine is cold. Tighten nuts in diagonally opposite pairs.

(3) Attach the cylinder head baffle with the four screws and lockwashers.

(4) Install the spark plug adapter in the cylinder head. Place a new gasket on the spark plug and screw the sparkplug into the adapter. Screw the nut on the elbow of the ignition cable shielding assembly to the spark plug.

(5) Install the spark plug shield cap with the magneto cable and shielding attached to the shield body.

75. Engine Run-in and Test.

Engine should be run in after overhauling. This run-in should in no case be less than 2 hours.

a. Preliminary Inspection. Examine engine thoroughly for loose nuts, bolts, and screws. Do not tighten head nuts unless there is definite indication of looseness or leaks. Leaks or *blow-by* in gasket around spark plug or head studs is usually indicated by black carbon streaks. Inspect governor linkage to carburetor for binding. Inspect spark plug gap.

b. Test Runs. Run engine for 1 hour with no load. After this 1-hour run, if engine has shown no indication of trouble, such as compression leaks or loose parts, run engine for 1 hour with a full load (15 volts at 30 amperes). Test Set I-199 or a suitable battery may be used.

c. Final Inspection. Inspect the engine for compression leaks or loose parts. Check fuel system for leaks, particularly at fuel-line connections and at carburetor and intake shut-off valve.

76. Cleaning Generator Commutator.

The generator may be inspected by removing the end cover which is held in place by four screws and lockwashers. Inspect for flats or any unevenness. The space between the segments should be free of metallic material, and the mica insulation between the segments should be undercut.

a. A highly polished commutator surface is very desirable, and

a dark color should not be mistaken for a burned condition. If the surface of the commutator is smooth and polished and the operation is satisfactory the commutator should not be cleaned. Slight sparking is not necessarily evidence of poor commutation. If the surface of the commutator is slightly rough, smooth with the commutator-dressing tool (par. 62) as shown in figure 45. Apply the tool with slight pressure. Remove the abrasive material after cleaning. Use a piece of canvas in the same manner as the sandpaper and the commutator will be properly burnished. *Do not use emery cloth or crocus cloth.*

b. Clean metallic material from the slots between the segments and cut down the high spots of mica insulation. Use the tool described in paragraph 62.

Caution: Avoid roughing the edges of the commutator segments with the undercutting tool.

77. Fitting Generator Brushes (fig. 46).

Replace excessively worn, chipped, or broken brushes as follows:

a. Removal. Remove the screws and lockwashers that attach the generator cover and take off cover. Unscrew the brush-lead terminal screw and remove the terminal. Remove brushes by lifting the brush pressure arm with a stiff wire formed into a hook and by pulling brush out by the pigtail.

b. Installation. Insert new brushes in position and release the brush pressure arm. New brushes must be fitted to have 100 percent effective contact with the commutator. Wrap a piece of N° 00 sandpaper (the exact width of the commutator) around the commutator with the sand on outside. Dress brushes by turning armature slowly in clockwise direction. After dressing, blow all carbon dust out of commutator. Replace the generator cover.

78. Generator Disassembly, Repair, and Reassembly (fig. 47).

a. Disassembly. Disassemble generator for replacement of armature or end bearing as follows:

(1) Remove engine and generator from the tubular frame and disassemble generator from engine (par. 63).

(2) Remove the screws that attach cover and remove cover (fig. 47). Remove the four brushes.

(3) Remove four locknuts and holding nuts of the generator through-bolts and remove bolts with a screwdriver at the commutator end.

(4) The armature, engine end bearing plate, and coupling and fan assembly are removed as a unit. Proceed as instructed in subparagraphs (1), (2), and (3) above. Substitute a longer screw or stud for the retaining screw just removed, and screw it into the end of the armature shaft. Drive the armature assembly out by tapping on the end of the screw. When the armature assembly has been removed, remove the Allen-head set screw from the hub of the fan and loosen the second screw which is in the same hole. Pull the fan from the armature shaft. The engine end bearing is a light press fit in the bearing plate and can be pressed out with the fingers.

b. Cleaning and Inspection. Clean the end shields and cover with solvent (SD) but do not get solvent on any of the wires. Brush accumulations of dirt or oil out of the windings and stator. Clean the armature in the same way. The armature end bearing is a double-seal ball bearing and should not be cleaned in solvent (SD). If the bearing is defective, replace it. No lubricant is necessary on the bearing.

c. Reassembly (PE-210-(FR)). When reassembling the generator, refer to the cross-sectional view. (fig. 47.)

(1) Insert the armature in the magnet frame assembly. The brushes should be removed for ease of installation. If necessary, tap the end of the armature to drive the shaft into the outboard end bearing. Protect the end of the shaft with a block of wood when tapping, and drive the shaft into the bearing only far enough to engage the retaining screw. Pull the shaft the rest of the way into the bearing by turning up on the screw.

(2) Turn the stator (magnet frame) on the end bell until the matching marks are alined. Insert the through-bolts and install the engine end bearing plate and bearing. Place the Woodruff key in the keyway on the splined end of the shaft and install the coupling and fan assembly onto the shaft. Insert one of the Allen-head set screws in the hole in the fan hub and turn it down tight. Insert the second Allen-head screw in the same hole and turn it down tightly on top of the first screw.

(3) Engage the driving half of the coupling with the driven half. Check that the rubber inserts in the driven half of the coupling are in good condition and that the pins on the driving half fit snugly into the rubber inserts in the driven half of the coupling.

(4) Install the engine end bell, and install and tighten the nuts on the through-bolts.

(5) Install the generator brushes and then install the outboard end cover. Before installing the end cover, make

sure that all brushes move freely in their holders and that they are properly seated on the commutator.

(6) Assemble the engine to the generator. Attach the subbase to the engine, and install the complete assembly in the unit frame.

79. Generator Control C-890/U-(FR) (fig. 50).

Do not attempt any repairs to the control box other than the replacement of meters. If meter replacement is necessary, proceed as follows:

a. Remove the four screws from the control box front panel and slide the panel assembly from the control box.

b. Disconnect the red and the yellow generator field leads from the terminal board, and disconnect the green tracer lead and the brown tracer lead from the reverse current relay and from the rheostat. Tag the terminals and wires to insure correct reinstallation.

c. Disconnect the governor lead wires from their respective terminals and tag the wires for identification.

d. Tag the leads attached to the faulty meter, disconnect the leads, and remove the meter.

e. Install the new meter and reassemble by reversing the disassembly procedures.

Section XVI. OTHER REPAIR PROCEDURES.

80. Painting and Refinishing.

Rust and corrosion may be prevented by thoroughly cleaning and then touching up damaged or worn painted surfaces. Paint wears off the tubular frame and blisters on engine parts.

a. Where paint has worn off, remove all traces of oil or grease with solvent (SD) and thoroughly sandpaper the spot or spots. Apply two light, even coats of paint with a small brush.

b. Where engine surfaces have been blistered, remove the old paint with paint remover and thoroughly clean with sandpaper or steel wool. Apply a smooth, even priming; sand the priming light-

ly with fine sandpaper and apply two light, even coats of finish paint.

c. Refinish the entire unit whenever it has received a complete overhaul.

Caution: Avoid getting paint on moving parts. Do not paint electrical contacts.

81. Emergency Repairs.

If a power unit has been submerged in either salt or fresh water, proceed as follows:

a. To minimize damage by corrosion, remove the water from all parts. If this is not possible, treat the parts to prevent their contact with the atmosphere. As soon as possible after removal from the water, coat all parts with oil in order to keep air from contacting the wet metal parts. Do not attempt to operate the unit immediately.

b. Dismantle the unit promptly and thoroughly clean and re-oil each part. If the submersion occurred in salt water, all parts other than electrical equipment should be washed in hot, fresh water, dried, and flushed with lubricating oil that has been heated to 180° F.

c. Electrical equipment should be thoroughly flushed with fresh water, dried, and overhauled before using. While these parts are being overhauled, they should be checked visually for corrosion, the condition of all insulation determined, and all electrical circuits thoroughly tested before reassembly. All windings that are otherwise serviceable should be baked in an oven at 140° F. for 4 hours before reassembly. The shielded high-tension ignition wire must be replaced.

d. A careful inspection must be made of each part salvaged to ascertain not only the extent of the damage caused by corrosion, but also to locate any defects caused by the sudden cooling action of the water in cases where the engine was at operating temperature at the time of submersion.

Note. In cases where the engine has been submerged in salt water for any length of time, parts made of aluminum will invariably be damaged beyond further use.

82. Rustproofing.

Apply this treatment immediately after the power unit is shut down, while it is still warm.

a. Drain the entire fuel system, including the crankcase.

b. Turn the power unit upside down.

c. Remove the spark plug (par. 70*a*) and crankcase drain cock (fig. 15).

d. While the engine is being rotated by hand, spray preservative engine oil (PL) (Ordnance stock No. 14-0-2833-120 (1 qt.)) through the spark plug hole and drain cock hole to coat the interior surfaces of the engine. Use an air-atomizing type of spray gun and dry air.

e. After the engine has cooled, remove grease and dirt from the exterior.

f. Seal the exhaust pipe, and cover the air cleaner with Tape, Adhesive, Waterproof Cloth (Signal Corps stock No. 6Z8624-1).

g. Be sure all surfaces are dry, then spray all unpainted exterior surfaces, including wiring, with Compound, Insulation, Ignition (Ordnance Spec. No. AXS-858).

83. Use of Gum Preventive Compound.

a. When exposed to air, gasoline tends to oxidize and form a resinous, gummy compound. Partially filled fuel containers, high temperatures, and the presence of certain metals, such as copper, accelerate the formation of gum. This gummy compound eventually settles in fuel lines, fuel tank, carburetor, and other parts of the fuel system of stored equipment. Since this gum is not readily soluble in fresh gasoline, clogged screens and filters and sticking parts result. The gum in partially decomposed gasoline may be carried into the combustion chamber, where it is not entirely consumed in the burning of the fuel. The remaining gum causes deposits which act as a binder for other products of combustion. Sticking valves and excessive carbon formation in the combustion chamber and on other engine parts result. Addition of an oxidation inhibitor and metal deactivator to gasoline which has not begun to deteriorate reduces formation of gum during storage periods up to 6 months.

b. Gum preventive compound (Federal stock No. 51-C-1587-225) will be used to treat fuel used in all equipment powered by gas gasoline-fueled engines or having gasoline-fueled auxiliary equipment which is to remain idle for 30 days or longer. This compound, which is issued in 4-ounce containers, will be used in accordance with the following:

(1) The fuel system must be free from accumulated gum. Unless equipment is entering its first storage, inspect and clean the entire fuel system from the fuel tank to the reed valve of the carburetor.

(2) It may be necessary to remove dried gum by scraping, brushing, or other mechanical means. Parts which cannot be thoroughly cleaned and freed from gum deposits without damage should be replaced. The following solvents may be used:

(a) Benzine may be obtained in 1-quart containers on Signal Corps stock No. 6G100.

(b) Acetone, grade B, may be obtained in 1-gallon containers on Signal Corps stock No. 6G4.1.

(c) Alcohol, denatured, grade 2, may be obtained on Signal Corps stock No. 6G16.1 for 1-quart container.

c. After thorough cleaning and reassembly of equipment, half fill the fuel tank with fresh gasoline mixed with the proper proportion of fresh oil (par. 15). Add gum preventive compound in the proportion of 1 ounce of compound to 5 gallons of fuel mixture.

d. Add enough untreated, fresh gasoline and oil mixture to fill the fuel tank to capacity and operate the engine for at least 5 minutes.

e. When a fuel system is to be drained for storage or for a period of idleness in excess of 30 days, gum preventive compound will be used as follows:

(1) Add gum preventive compound to a small quantity of fresh gasoline mixed with correct proportion of oil in the ratio indicated in *c* above or approximately one-quarter container of compound to 5 gallons of gasoline and oil mixture.

(2) Put enough of the treated gasoline and oil mixture in the fuel system to operate the engine for a minimum period of 5 minutes.

(3) Run the engine for at least 5 minutes.

(4) Drain the entire fuel system, including the carburetor, float bowl, and fuel line.

Note. The use of gum preventive compound is a preventive measure only and cannot be considered as a corrective treatment. Therefore, it can neither be expected to remove existing deposits of gum nor prevent formation of deposits in gasoline which has already deteriorated in storage. This compound is for use in gasoline only under the conditions set forth above.

Section XVII. REPAIR AND ANALYSIS DATA

84. Engine Specifications, Tolerances, and Clearances.

Spark plug gap	0.035 inch
Magneto point gap	0.020 inch
Piston skirt diameter	1.9980 to 1.9985 inch
Piston skirt and cylinder clearance	0.0025 to 0.0035 inch
Piston ring gap	0.010 to 0.030 inch
Piston ring to land side clearance	0.004 to 0.006 inch
Piston pin diameter	0.3751 to 0.3753 inch
Piston pin bore in piston	0.3750 to 0.3753 inch
Piston pin clearance in piston	0.002 to 0.003 inch
Cylinder bore	2.001 to 2.0015 inch
Maximum wear tolerance on cylinder bore	0.005 inch
Maximum out-of-round tolerance	0.003 inch
Crank pin diameter	0.6230 to 0.6235 inch
Crank pin width	0.8120 to 0.8170 inch
Connecting rod bearing clearance (crank pin end)	0.0025 to 0.0035 inch

85. Unsatisfactory Equipment Report.

a. WD AGO Form 468 (War Department Unsatisfactory Equipment Report) for Equipment Used by the Army. WD AGO Form 468 will be filled out and forwarded through channels to the office of the Chief Signal Officer, Washington 25, D.C., when trouble occurs more often than is normal, as determined by qualified repair personnel.

b. AF Form 54 (Unsatisfactory Report) for Equipment Used by Air Forces. AF Form 54 will be filled out and forwarded to the Commanding General, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio, in accordance with AFR 15-54.

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APPENDIX I

IDENTIFICATION TABLE OF REPLACEABLE PARTS

1. General.

The fact that an item appears in this manual is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as T/O & E, T/A, T/BA, SIG 6, SIG 7 & 8, SIG 7-8-10, SIG 10, list of allowances of expendable material, or other authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7 & 8 PE-210. For an index of available catalog pamphlets, see the latest issue of SIG 1, Introduction and Index.

2. Identification Table of Parts for Power Unit PE-210-(FR)

Ref symbol	Name of part and description	Function of part	Signal Corps stock N°
	POWER UNIT, gasoline: Sig C Power Unit PE-210-B;450w, 15 v, 30 amp, dc; 18 1/4"lgx12" wdx12 13/16"h; Sig C Generator GN-52-B, directly coupled to Sig C Engine GE-12-G; 3000 rpm; self-excited; air cooled; rope starting.	Generates dc for battery charging.	3H4600-210
	ENGINE, gasoline: Sig C Engine GE-12-G; 1 1/4 hp at 3600 rpm, 1 cyl, 2 cyc, horiz; 2" borex1 1/2" stroke; air cooled; flywheel magneto ignition; rope starting; elec governor.	Provides power to drive generator	3H1912G
	GENERATOR, DC: Sig C Generator GN-52-B; 450 w, 15 v, 30 amp, dc; 3600 rpm; self-excited; 6" diax8 3/4" lg o/a.	Generates dc.	3H2352B
	ENGINE GROUP		
	ENGINE,skeleton: incl spark plug adapter; does not incl carburetor, air cleaner, muffler, governor, fuel tank, tool box, tools, running spares, or canvas cover; 1 1/4 hp at 3600 rpm; 1 cyl, 2 cyc, air cooled, flywheel magneto ignition; 2" bore x 1 1/2" stroke.	Basic component of Sig C Engine GE-12-G.	3H1922-1
	ADAPTER, bearing: engine rear bearing support; irregular oblong shape; 4 5/16" lg x 3 1/16" wd x 1 5/64" thk; p/o Sig C Power Unit PE-210-B.	Provides support for rear engine bearing.	3H5J-1
	ADAPTER, exhaust pipe: die-cast; bowl shaped w/connecting neck to mtg flange; 4 3/32" lg x 3 1/4" wd x 1 5/8" h o/a; mts w/two.275" dia mtg holes;	Provides exhaust outlet from cylinder.	3H1912B/H15

2. Identification Table of Parts for Power Unit PE-210-(FR) (contd).

Ref. symbol	Name of part and description	Function of part	Signal Corps stock N°
	ADAPTER, spark plug: bushing closed one end, closed end drilled w/12 holes; screws into cyl head.	Acts as shield to prevent fouling of spark plug.	3H5J
	BEARING, ball: single row radial; unshielded.	Antifriction support for engine crankshaft.	3H4575A/199
	COCK, drain: removable screw plug; T handle; single 1/8" male std pipe thd; 1 3/16" lg;	Provides drain for engine crankcase	3H1912A/C3
	CRANKSHAFT: steel; mtd on ball bearings, one ea end; male spline on one end;	Converts reciprocating motion of piston connecting rod assembly to rotary motion.	3H1912A/C70
	GASKET: crankcase head; 3 7/16" lg x 3" wd x .015" thk; 4 holes.	Provides seal between cylinder and crankcase.	3H1912A/G5
	GASKET: exhaust flange; 2 15/16" lg x 1 5/32" wd x 1/16" thk; 3 holes.	Provides seal between cylinder and exhaust flange.	3H1912B/G3
	GASKET: intake passage; 2 1/16" lg x 2 1/4" wd x 1/32" thk; 7 holes.	Provides seal between cylinder and intake passage cover	3H1912B/G1
	GASKET: fan housing plate; 3" lg x 2 1/8" wd x .015" thk; 3 holes.	Provides seal between crankcase and magneto backplate.	3H1912A/G6
	GASKET: cylinder head; 2 5/8" lg x 2 5/8" wd x 1/16" thk; 1 cyl opening;	Provides seal between cylinder head and cylinder.	3H1912A/G4
	GASKET: carburetor adapter; compressed asbestos; 2 13/16" lg x 1 7/8" wd x .028/.036" thk; 5 holes;	Provides seal between crankcase and carburetor adapter.	3H1912A/G3

GASKET: cyl mtg; 2 15/16" lg x 2 15/16 wd x .015" thk; 5 holes.	Provides seal between cylinder and crankcase.	3H1912A/G2
HEAD, cylinder: 4 1/8" dia x 1 1/4" thk o/a; rd w/16 rows of fins on top; spark plug adapter;	Provides covering for cylinder opening.	3H2500-13
NUT, hexagonal: 5/16"-24 NF 3/8" d on bottom for cyl head stud, drilled and tapped #10-24 on top for baffle screw.	Secures cylinder head to cylinder	6L3505-24-9
NUT, hexagonal: 5/16"-18 NCT-2; 1/2" thk; 17/64" across flats.	Secures cylinder to crankcase.	6L3505-18-4Z
PIN: cotter; steel; 3/32" dia x 3/4" lg o/a.	Secures piston pin in piston.	6L974-6-48
PIN, wrist: connecting rod to piston;	Provides axle through which piston end of connecting rod is connected to piston.	3H1912A/P22
PISTON, engine: metal ring seal; std; 3 ring grooves; 2" dia x 2 1/2" lg.	Receives impulse caused by combustion of fuel within combustion chamber and transmits it to crankshaft through the wrist pin and connecting rod assembly.	3H4216.6
PLUG, spark: 14mm mach thd; hot type; 13/16" hex.; integrally shielded and suppressed aircraft type; 5/8"-24 NFT-3 shielding connection; 3/8" dia x 1 3/4" wire socket;	Provides means for introducing ignition spark into combustion chamber.	3H4412-8.1
PULLEY, starter: 1 groove, notched for starting rope.	Provides means for cranking engine.	3H1912A/P55
RING SET, piston: 3 compression type rings; std; 2" dia, .090" wd.	Provide seal between cylinder and piston.	3H1912A/R21
ROD ASSEMBLY, connecting: crankshaft to piston; p/o Sig C Engine GE-12-G.	Transfers reciprocating motion of piston to crankshaft.	3H1912A/R31
SCREW, machine: slot drive; Fil H; 1/4"-20 NCT-2; 7/8" lg; 7/8" lg thd.	Mounts magneto backplate to crankcase.	6L7920-14.3S

2. Identification Table of Parts for Power Unit PE-210-(FR) (contd).

Ref. symbol	Name of part and description	Function of part	Signal Corps stock N°
	SCREW, machine: slot drive; RH; #10-24 NCT-2; 5/16" lg; 5/16" lg thd.	Mounts cylinder head baffle to cylinder head.	6L7024-5.49S
	SCREW, machine: slot drive RH; #10-24 NCT-2; 1/4" lg; 1/4" lg thd.	Mounts fan housing to magneto backplate.	6L7024-4.49S
	SCREW, machine: slot drive; RH; #8-32 NCT-2; 1/4" lg; 1/4" lg thd.	Mounts fan housing to cylinder block.	6L6832-4.1P
	SCREW, machine: slot drive; RH; #6-32 NCT-2; 5/16" lg; 5/16" lg thd.	Mounts intake passage cover to cylinder.	6L6632-5.1SP
	SCREW, machine: hex. head; 5/16"-18 thd; 3/4" lg; 3/4" lg thd.	Mounts bearing adapter to crankcase.	6L7918-5-12.81C
	SEAL, oil 668" ID x 1.254" OD x 3/8" thk; mtd on brg adapter and magneto backplate; spring loaded seal;	Preyents oil seepage at crankshaft bearing.	3H1912A/S3
	WASHER, lock: rd, 320" ID, .594" OD, .030" thk; shakeproof type, internal twisted teeth.	Secures cylinder head fastenings.	6L72218C
	WASHER, lock: rd, .256ID, .466" OD,.025" thk; shakeproof type, internal twisted teeth.	Secures backplate to crankcase mounting fastenings.	6L72214
	WASHER, lock: rd, .195 ID, .395" OD, .022" thk; shakeproof type, external twisted teeth.	Secures fan housing to backplate fastenings.	6L7111 0C
	WASHER, lock: rd, .320" ID, .588" OD, .030" thk; shakeproof type, external teeth.	Secures cylinder block to crankcase fastenings.	6L72118C
	WASHER, lock: rd, .168" ID, .325" OD, .020" thk; shakeproof type, internal twisted teeth.	Secures fan housing to cylinder block fastenings.	6L72208C

WASHER, lock: rd, .195" ID, .370" OD, .022" thk; shakeproof type, internal twisted teeth.	Secures cylinder head to cylinder head baffle fastenings.	6L72210C
WASHER, lock: rd, .141" ID, .267" OD, .040" thk; splitring type.	Secures intake passage cover fastenings.	6L71002-14
WASHER, lock: rd, .256" ID, .494" OD, .025" thk; shakeproof type, external teeth.	Secures generator to crankcase adapter fastenings.	6L72114C
WASHER, lock: rd, 7/16" ID, .078" OD, .085" thk; splitring type.	Secures starter pulley fastening.	6L71007C
WASHER, lock: irregular shape; 17/32" wd x 15/32" lg x .0359" thk; 15/64" dia hole; 2 locking outer prongs bent over head of cap screw;	Secures connecting rod cap fastenings.	6L71004-28
WASHER, spring: 1" OD, 23/32" ID in flat, .030" thk, 1/16" concave;	Secures magneto cam.	6L73041
WASHER, lock: rd, .168" OD, .020" thk; shakeproof type, internal twisted teeth.	Secures shorting bar to backplate fastenings.	6L72208C

AIR CLEANER GROUP

CLEANER, air: cartridge type; aluminum; replaceable element; 3 1/2" h x 2 7/16" OD;	Filters air entering engine through carburetor.	3H1912A/C30
ELEMENT, air cleaner: felt; re-useable; cylindrical, 3 1/2" h, 2 1/4" OD;	Filters air passing through air cleaner.	3H1912A/C18
GASKET, cork: 1 hole; 17/16" OD, 31/32" ID, 3/32" thk;	Seal between air cleaner and carburetor air intake.	3H1912A/G8
STUD: steel, 6 1/8" lg o/a; thd ea end 3/4" lg; #12-24 NCT-2;	Mounts air cleaner to air cleaner elbow.	3H1912A/S63

2. Identification Table of Parts for Power Unit PE-210-(FR) (contd).

Ref. symbol	Name of part and description	Function of part	Signal Corps stock N°
	WASHER, lock: rd, .221" ID, .394" OD, .022" thk; shakeproof type, internal twisted teeth.	Secures air cleaner to air cleaner elbow fastenings.	6L72212C
	CARBURETOR GROUP		
	CARBURETOR: gravity feed; horizontal draft; 4" lg x 3 1/4" wd x 3" h o/a;	Meters and mixes fuel and air entering engine.	3H753-4.1
	ADAPTER, carburetor: irregular oblong shape; 4 13/16" lg x 2 7/16" wd x 9/16" thk;	Spacer and mounting for carburetor and governor.	3H5J-2
	ADAPTER, breather pipe; 90° elbow; 1 3/8" dia x 1 3/4" wd x 2" h o/a;	Air cleaner mounting elbow.	3H5J-3
	BOWL, carburetor: c/o float bowl assy, float assy and float bowl cover assy irregular shape.	Provides fuel reservoir for carburetor.	3H1912B/B20
	FLOAT, carburetor: hollow annular ring w/lever; 1 13/16" wd x 2" lg x 7/8" h; 1 lever fulcrum hole 3/32" dia x 9/16" lg;	Regulates fuel level in carburetor float bowl by controlling opening and closing of float bowl valve.	3H2050-4
	GASKET, set, cork and plant fiber; 1 float cover gasket, 1 needle valve packing 1 packing gland gasket 1 bypass plug screw gasket	Provides spare parts for carburetor.	3H2155-14

GASKET: carburetor to adapter; irregular shape; 2 3/8" lg x 1 7/16" wd x .016/.019" thk; 3 holes;	Seal between carburetor and carburetor adapter.	3H2154-25
GASKET: air cleaner elbow; 1 3/4" lg x 1" wd x .016/.019" thk; 3 holes.	Seal between carburetor and air cleaner elbow.	3H2154-4
GASKET: carburetor mtg; irregular shape; 2 13/16" lg x 1 11/16" wd x 1/32" thk; 5 holes.	For carburetor adapter.	3H1912A/G3
LEVER: throttle control; oblong; 1/16" saw cut in center.	Operates throttle control from governor.	3H2681.9
MAINTENANCE PARTS KIT: c/o choke friction pin, spring, screw, float lever pinion screw, fuel bowl drain screw (small), idle adjusting screw w/spring, idle tube, inlet connection screen, inlet seat, needle seat and gasket, main adjusting screw, main nozzle, throttle shaft return spring, throttle shutter screw, gasket, and packing set.	Provides replacement parts.	3H2700.10
NUT, hexagon: steel; 1/4"-20 NCT-2; 13/64" thk; 7/16" across flats.	Secures adapter to carburetor.	6L3504-20-1
NUT, packing: hex.; brass; 5/16"-32 NFT-2; 9/32" thk; 3/8" across plate.	Closure for packing seal and adjusting screw.	3H6226/S9.
PLUG, machine thread: fuel bowl plug screw (large); 1/2" dia x 1/4" lg; slot drive.	Plugs hole in carburetor fuel bowl.	3H4419-9
PLUG, machine thread: fuel bowl plug screw (med); 5/16" lgx 5/16" dia, 5/16-24 NFT-2; p/o.	Plugs hole in carburetor fuel bowl.	3H4419-10
PLUG, machine thread: main nozzle channel plug; slot drive; 7/32" lg x 1/4" dia, 1/4-28 NFT-2.	Plugs hole in main fuel channel.	3H4419-8
SCREW, machine: slot drive; straight side, Bind H; # 8-32 NCT-2; 5/32" lg; 5/32" full thd; 1/16" thk x 1/4" dia head.	Holds choke shuttle to choke shaft.	6L6632-3.3S-2
SCREW, machine: slot drive; Fil H; 1/4-20 NCT-2; 7/8" lg; 7/8"lg. thd.	Mounts carburetor to adapter.	6L4904-14.3S
SCREW, machine: slot drive; Fil H; # 8-32 NCT-2; 7/8" lg; 7/8" full thd; lockwasher attached.	Mounts float bowl to carburetor body.	6L20980-14.3Z

2. Identification Table of Parts for Power Unit PE-210-(FR) (contd).

Ref. symbol	Name of part and description	Function of part	Signal Corps stock N°
	SCREW, machine: slot drive; Fil H; #12-24 NCT-2; 5/8" lg; 5/8" lg thd.	Mounts carburetor adapter to crankcase.	6L7224-10.3S1
	SCREW, machine: slot drive; RH; #8-32 NCT-2; 5/8" lg; 5/8" lg thd.	Secure air cleaner elbow to carburetor.	6L6832-10.49S
	SCREW, machine: slot drive; RH; #6-32 NCT-2; 5/16" lg o/a.	Mounts reed valve to carburetor adapter.	6L6632-5.49S
	VALVE, reed: Swedish, high carbon, blue tempered, spring steel; engine intake check valve.	Prevents backflow of fuel misture from crankcase through carburetor.	3H1912A/V1
	WASHER, lock: rd .256" ID, .466" OD, .025" thk; shakeproof type, internal twisted teeth.	Secures fastenings for carburetor adapter to carburetor.	6L72214
	WASHER, lock: rd .068" ID, .325" OD, .020" thk; shakeproof type, internal twisted teeth.	Secures float bowl to carburetor body fastenings.	6L72208
	WASHER, lock: rd .221" ID, .394" OD, .042" thk; shakeproof type, internal twisted teeth.	Secures carburetor adapter to crankcase fastenings.	6L7221-2C
	WASHER, lock: rd .168" ID, .325" OD, .020" thk; shakeproof type, internal twisted teeth.	Secures air cleaner elbow to carburetor fastenings.	6L72208
	WASHER, lock: rd .142" ID, .275" OD, .018" thk; shakeproof internal twisted teeth.	Secures reed valve and clamp to carburetor fastenings.	6L72106C

MAGNETO GROUP

BRUSH, electrical contact: radio suppression, magneto cam ground brush.	Provides ground for magneto cam.	3H2351B/B10
CAM, magneto: rd cam offset from center; 1 1/16" lg, 15/16" OD on cam end, 7/8" OD on free end, 1 1/16" ID; mts to crankshaft w/ #3 Woodruff key.	Actuates magneto breaker points.	3H680-2
CAPACITOR, fixed: 1 section; 160,000 uuf min, 200,000 uuf max; working voltage, 200 v dc.	Suppresses sparking at magneto breaker points.	3H2699-9/C1
COIL, magneto: ignition type; copper wire, tape wrapped and varnished; cylindrical air core w/2 wire leads 2 1/8" dia x 1 1/4" lg w/ 5/8" x 5/8" cored hole for mtg; fits over stator lamination.	Generates voltage for ignition	3H986-1
CONTACT ASSEMBLY, magneto: c/o breaker plate w/ contact points, felt cam wiper and 1 breaker plate spring, 1 breaker arm w/ point and connecting lead wire; steel and brass breaker plate, tungsten points; breaker arm, fungus treated; mts to stator plate w/ # 10-32 x 5/16" screw.	Interrupts primary magneto circuit.	3H1032A-13
FLYWHEEL: mts magneto magnets, cools, and balances engine; aluminum, die cast; rd w/ fan blades on outside; 6 1/2" dia x 2 11/16" thk; mts to taper end of crankshaft w/ # 3 Woodruff key.	Carries engine through non-power producing stroke, provides cooling air for engine, and contains magnetic field of magneto.	3H2103W
KEY, machine: 1/8" thk x 3/4" lg; Woodruff # 7.	Prevents flywheel from turning on crankshaft.	6L995-7
NUT, hexagon: # 6-32 NCT-2; 3/32 thk; 5/16" across flats.	Mounts capacitor to magneto stator.	6L3106-32.1S
NUT, hexagon: # 6-32 NCT-2; 7/64" thk; 9/16" across flats.	Locknut for spark plug shielding on backplate.	6L3606-32-19

2. Identification Table of Parts for Power Unit PE-210-(FR) (contd).

Ref. symbol	Name of part and description	Function of part	Signal Corps stock N°
	SCREW, machine: slot drive; pan head, semifinished; # 8-32 NCT-2; 7/16" lg; 7/16" lg thd.	Mounts capacitor to magneto stator.	6L6632-7.86SF
	SCREW, machine: slot drive; RH; # 6-32 NCT-2, 3/8" lg; 3/8" lg. thd.	Secures ignition cable shielding to backplate.	6L6632-6.49S
	SCREW, machine: slot drive; RH; # 8-32 NCT-2; 3/16" lg; 3/16" lg thd.	Secures shorting switch lever.	6L6832-3.87
	SCREW, machine: slot drive; pan head; # 10-32 NFT-2; 5/16" lg; 7/32" lg thd; # 10 kantlink lockwasher permanently fastened to screw.	Mounts breaker arm and plate assembly to stator.	6L20910-5.93
	SCREW, machine: slot drive; pan head; # 6-32 NFT-2; 5/16" lg; 1/4" lg thd; # 8 kantlink lockwasher permanently fastened to screw.	Fastens lead from coil and breaker points to capacitor.	6L20906-5.93
	SCREW, machine: slot drive; Fil H; 14"-20 NCT-2; 1/2" lg; 1/2" lg thd.	Mounts magneto stator to backplate.	6L7920-408.3E1
	STATOR, magneto: flywheel type; plate mtd w/ magneto coil, capacitor, stop switch plate, breaker arm and plate w/ contact points, felt cam oiler, and coil lead wires; irregular shape; 4 5/8" lg x 4 9/32" wd x 2 1/8" h o/a; mtd w/two 1/4"-20 NCT-2 Fil H screws.	Provides ignition spark.	3H5340D
	WASHER, lock: rd .256" ID, .670 OD, .035 thk; shakeproof type, external-internal teeth.	Secures stator to backplate fastenings.	6L72114-20
	WASHER, lock: rd .140" ID, .251 OD, .031" thk; split-ring type.	Secures capacitor and stop switch plate to stator.	6L71002-15
	WICK, lubricating: magneto cam; grease impr; 1 1/16" lg x 7/16" wd x 5/32" thk.	Lubricates magneto cam.	6Z9446-2

GOVERNOR GROUP

BOARD, terminal: mtg strip for clip and term.; 3/4" between mtg holes; 25/32" between term. holes; paper base micarta; 1 1/8" wd x 2/32" h x 1/4" thk o/a; mts w/2 holes 11/64" diam 3/4" between centers.	Insulator for fastening solenoid terminals and lead clip.	3Z770-2.90
COIL, solenoid: silica steel shell, copper wire winding; glass or stainless steel sleeve cylindrical; 1 1/8" dia x 2 1/4" lg; mts in governor housing.	Exerts magnetic pull on plunger which actuates throttle.	3H5248-13
GOVERNOR: engine speed control; coil, 5 ohms, 5 v, 1 amp; 5 1/4" lg x 1 5/8" wd x 1 5/16" h, w/2 mtg holes # 8-32 NC.	Controls engine speed and generator voltage.	3H2475-6
LEVER, throttle: oblong shape, 1/16" saw cut in center; 21/32" lg x 3/8" wd x 9/32" h; mts to throttle shaft w/ # 8-32 screw; pinned to governor link.	Transmits governor action to throttle.	3H2681.2
MOUNTING: A bkt for governor adj spring screw.	Supports governor adjusting spring and screw.	3H3900.10
NUT, knurler: # 6-32 NC; 3/16" thk; 5/16" dia; knurled top, 90° V groove through center of bottom face to lock in place.	Adjusts solenoid plunger spring.	6L3406-32K.3
SCREW, adjusting: permits adjustment of governor plunger spring.		6L4716-11
SCREW, machine: slot drive; Fil H; # 8-32 NCT-2; 1/2" lg, 1/2" lg thd.	Mounts solenoid throttle lever to carburetor throttle shaft.	6L832-8.12S
SCREW, machine: slot drive; RH; # 6-32 NCT-2; 3/8" lg; 3/8" lg thd.	Mounts generator lead to solenoid.	6L6632-6.49S
SCREW, machine: slot drive; Fil H; 1/4"-20 NCT-2; 1/2" lg; 1/2" lg thd.	Mounts solenoid to adapter.	6L7920-4-8.3E1
SCREW, machine: slot drive; RH; # 8-32 NCT-2; 5/8" lg; 5/8" lg thd.	Mounts lead clip to insulating block on solenoid.	6L6832-10.49S

2. Identification Table of Parts for Power Unit PE-210-(FR) (contd).

Ref. symbol	Name of part and description	Function of part	Signal Corps stock N°
	SPRING: helical expansion type; .016 wire size, .190" OD x 7/8" lg; 41 turns; parallel eye term; 5/64" dia; mts w/. 0625" dia pin; c/o spring w/pin;	Governor plunger return spring.	3H5255.3
	WASHER: rd .172" ID, 3/8" OD, .032" thk.	Mounts under lead clip on solenoid insulator strip.	6L58023-54
	WASHER, lock: rd .168" ID, .325" OD, .020" thk; shakeproof type, internal twisted teeth.	Secures fastenings for lead clip.	6L72208C
	WASHER, lock: rd .256" ID, .670" OD, .035" thk; shakeproof type, internal-external teeth.	Secures solenoid to adapter fastenings.	6L72114-20
	WASHER, lock: steel, rd .142" ID, .275" OD, .018 thk, shakeproof type, internal twisted teeth.	Secures generator to solenoid lead fastening.	6L72106C
	WASHER, lock: rd .168" ID, .325" OD, .020" thk; shakeproof type, internal twisted teeth.	Secures solenoid throttle lever fastening.	6L72208
	FUEL TANK GROUP		
	CAP, fuel container (tank): measuring cup for lubricating oil attached cap; rd w/protruding lugs on top of cap; 2 5/8" wd x 2 1/4" lg x 2 3/8" h.	Cap for fuel tank filler opening and cup for measuring lubricating oil.	3H685.2-2
	COCK, air vent: rotary plug type valve; single male, 1/8"-27 male pipe thd.	Air vent for fuel tank.	6Z2118-3
	COCK, drain: removable screw plug type; 1/8" male std pipe thd.	Drain cock for fuel tank.	3H1912A/C35

CONTAINER (fuel tank): # 22 U.S. gage; 1 gal; oval oblong shape; 12 19/32" lg x 6 5/32" wd x 5 3/64" h; mts to loop frame w/2 steel straps and 4 studs; p/o Sig C Power Unit PE-210-B.	Storage container for fuel and lubricant mixture.	3H1095.4
FITTING, pipe: 45° street elbow; 1/8" male x 1/8" female IPS.	Extension for fuel tank drain cock.	6Z3888-107
FITTING, tubing: 90° elbow; for 3/16" dia tubing; 3/8"-24 female thd, inverted flare one end, 1/8" male std pipe thd other end; p/o Sig C Power Unit PE-210-B.	Fuel line to carburetor connection.	6Z3888A-11
GASKET: corprene; 1 hole; 2 1/4" OD, 1 3/4" ID, 1/8" thk.	Seal for fuel tank filler cap.	3H1912B/G2
LINE, fuel: straight; 3/8" OD, 12 1/2" lg; flexible wall, comp, hose neoprene covered; 3/8"-24 NFT-2; std; inverted type, brass flare nut both ends; resists water, gasoline, and oil; p/o Sig C Power Unit PE-210-B.	Fuel line between fuel tank and carburetor.	3H2689.1-39
Valve, angle: 1/4" male std pipe thd screen one end, other end tapped 3/8"-24 thd for inverted flare fitting.	Fuel shut-off valve.	3H1922/V1

ENGINE SUB-BASE GROUP

BASE, engine: 9 7/16" wd x 9 1/8" lg x 1 5/32" h o/a; mts w/ four 17/64" dia holes, 21/64" dia off center for engine mtg.	Mounts engine and generator to loop frame.	3H175-4
MOUNT, vibration: square mtg; 1 3/4" lg x 1 3/4" wd x 5/8" thk o/a.	Shock mounting for engine.	6Z8502-1
SCREW, machine: hex, hd; 5/16"-18 NCT-2; 5/8" lg; 5/8" lg thd.	Secures crankcase to engine base.	6L7918-5-10.1s
SCREW, machine: hex. hd; 1/4"-20 NCT-2; 1 1/4" lg; 3/4" lg thd.	Mounts engine base to shock mounts.	6L7920-4-20.18C
WASHER, lock: rd.320" ID, .588" OD, .030" thk; shakeproof type, external teeth.	Secures crankcase to engine base to loop frame.	6L72118C

2. Identification Table of Parts for Power Unit PE-210-(FR) (contd).

Ref. symbol	Name of part and description	Function of part	Signal Corps stock N°
	WASHER, lock: rd .320" ID, .594" OD, .030" thk; shakeproof type, internal twisted teeth.	Secures crankcase to engine base fastenings.	6L72218C
	LOOP FRAME GROUP		
	SCREW, machine: slot drive; RH; #8-32 NCT-2; 1/4" lg; 1/4" lg thd.	Secures shock mounts to loop frame	6L6832-4.1P
	SCREW, machine: slot drive; RH; #10-24 NCT-2; 5/16" lg; 5/16" lg thd.	Mounts tool and spare parts box to loop frame.	6L7024-5.49S
	WASHER, flat: flat disk, 1 3/8" dia. x .0747" thk o/a; one .252" / .258" dia hole for mtg;	Prevents shock mount rebound.	6L58024-51
	WASHER, lock: rd .256" ID, .494" OD, .025" thk; shakeproof type, external teeth.	Secures ground lead to loop frame and fuel tank fastening.	6L72114C
	WASHER, lock rd .195" ID, .395" OD, .022" thk; shakeproof type, external teeth.	Secures spare parts and tool box fastenings.	6L71110C
	WASHER, lock: rd .168" ID, .370" OD, .020" thk; shakeproof type, external teeth.	Secures ground lead to shock mount fastenings.	6L71108C
	WASHER, lock: rd .168" ID, .325" OD, .020" thk; shakeproof type, internal teeth.	Secures shock mount to loop frame fastenings.	6L72208C
	WIRE BRAID: 5/16" wd when flat; opens to 1/4" ID.	Suppression ground strap.	1F6C1-5

STRAP, steel strip, strt. lgth. 7 15/64" - 3/4" wd. with studs each end 13/16" lg.	Secures fuel tank on loop frame	
NUT, hex. 1/4" I D 20 N C T 2	Mounts strap on frame	6L3504-20-1
WASHER, 1/4" I D ext. Teeth	Mounts strap on frame	6L72514-Z
MUFFLER GROUP		
GASKET : 2 33/64" OD x 2 9/32" ID x 1/16" thk;	Seal between muffler body and exhaust flange.	3H2154.9-7
MUFFLER : cylindrical; horizontal operating; 5 27/32"h x 5 1/8" wd x 4 9/16" lg; 2 1/2" dia flared inlet opening; 1/4" std male pipe thd outlet opening; 1/4" water drain hole on bottom;	Silences engine exhaust.	3H3981-18
NUT, hexagon: 1/4"-28 NFT-2; 7/32" thk; 7/16" across flats.	Secures muffler to exhaust flange.	6L3504-28.1
NUT, hexagon: 1/4"-20 NCT-2; 7/32" thk; 7/16" across flats.	Secures muffler to engine base on loop frame.	6L3504-20G
SCREW, machine: hex. hd; 1/4"-20 NCT-2; 1/2" lg; 1/2" lg thd.	Secures muffler to engine base on loop frame.	6L7920-4-8.81C
SCREW, machine: slot drive; hex. head; 1/4"-20 NCT-2; 7/8" lg; 7/8" lg thd; 13/64" thk head; 7/16" across flats; slotted;	Mounts muffler adapter to cylinder.	6L7920-14.81S
STUD, muffler mtg: 1/4" dia x 5 3/8" lg; 1/4"-20 NCT 7/8" lg, one end, 1/4"-20 NFT, 5/8" lg, other end, chamfered both ends;	Mounts muffler body to exhaust flange.	6L31186
WASHER, lock: rd.256" ID, .466" OD, .025" thk; shakeproof type, internal teeth.	Muffler flange to cylinder mounting.	6L72214

2. Identification Table of Parts for Power Unit PE-210-(FR) (contd).

Ref. symbol	Name of part and description	Function of part	Signal Corps stock N°
	WASHER, lock: rd.256" ID, .466" OD, .025" thk; shakeproof type, internal teeth.	Muffler to engine base mounting.	6L72214
	WASHER, lock: rd .256" ID, .670" OD, .035" thk; shakeproof type, internal-external teeth.	Muffler body to exhaust flange mounting.	6L72114-20
	GENERATOR GROUP		
	BEARING, ball: .5906" bore, 1.3780" OD, .567" wd;.	Supports generator rotor shaft.	3H2351A/B10
	BRUSH, electrical : 1v commutator brush.	Collects electrical current from armature	3H2352/B5
	CAPACITOR, fixed : paper; 500,000 uuf + 20%, -10%; 150vdcw.	Noise filter.	3DA500-217
	COUPLING, flexible : drive half;	Drives driven half of generator coupling.	3H2551-4
	CUSHION : flexible drive coupling.	Provides cushion between drive and driven half of coupling.	3H1420

HUB, coupling: driven half of coupling; cylindrical w/12 fan blades and 6 holes to receive rubber cushions; 4 3/4" dia x 13/16" thk; mts to generator shaft w/ # 3 Woodruff key and two # 10-32 NFT-2 Allen-head set screws;	Driven half of coupling; provides circulation of air to cool generator.	3H2551-8
KEY, machine: # 3 Woodruff; 1/8" wd x 1/2" lg;	Secures driven half of coupling from turning on shaft.	6L995-3
NUT, hexagon: # 10-24 NCT-2; 1/8" thk; 3/8" across flats.	Secures end bell through bolts.	
NUT, lock: palnut type; 3/32" thk; 23/64" across flats.	Locknut for end bell through bolts.	6L3660-24-8
ROTOR, generator: 15 v dc, 30 amp 450 watt contrating; 3000 rpm;7 3/8" lg x 3.595" dia o/a;mts in end bells on 2 ball bearings;	Generator voltage.	3H5199-9
SCREW, captive: slot drive; RH; # 10-24 NCT-2; 8 1/2" lg; 1" thd lgth; head 11/16" dia x.136" thk; .159"/.162" dia body x 7 1/2" lg;	Interlock end bells.	6L4770-136.49S
SCREW, machine: hex. head.; 1/4"-20 NCT-2; 3/4" lg; 3/4" lg thd.	Mounts generator to bearing adapter.	6L7920-4-12.81CS
SCREW, machine: slot drive; RH; # 6-32 NCT-2; 3/8" lg; 3/8" lg thd.	Mounts capacitor to end bell.	6L6632-6.49S
SCREW, machine: slot drive; RH; # 8-32 NCT-2; 3/8"lg; 3/8" lg thd.	Mounts outer end bell cover.	6L6832-6.49S

2. Identification Table of Parts for Power Unit PE-210-(FR) (contd).

Ref. symbol	Name of part and description	Function of part	Signal Corps stock N°
	SCREW, machine: slot drive; FH; # 10-32 NFT-2; 11/16" lg; 11/16" lg thd.	Mounts bearing retainers to outer end bell.	6L7032-11.78
	SCREW, machine: slot drive; sp Bind H, 5/16"-18 NCT-2; 5/8" lg; 5/8" lg thd; 3/32" thk head, 3/4" dia of head.	Retains rotor bearing on shaft.	6L20925-10.96
	SCREW, machine: slot drive; Bind H; # 8-32 NCT-2; 5/16"lg; 5/16" lg thd.	Mounts brush terminal to brush holder.	6L6832-5.8
	SCREW, set: Allen-head; # 10-32 thd; 3/16" lg; cup point;	Secures driven disk to generator shaft.	6L18510-4.39
	WASHER, flat: rd. .193 ID, 7/16" OD, .036" thk.	Mounts under head and nut of through bolts.	6L50010
	WASHER, lock: rd .178 ID, .296" OD, .040" thk; split-ring type.	Mounts brush terminal to brush holder.	6L71003-22
	WASHER, lock: rd .168 ID, .325" OD, .020" thk; shakeproof type, internal teeth.	Mounts outer end bell cover	6L72208
	WASHER, lock: rd .142" ID, .275" OD, .018" thk; shakeproof type, internal teeth.	Mounts capacitor to end bell.	6L72206-9C

WASHER, lock: rd .0578 OD, .328" ID, 1/16" thk; split-ring type.	Mounts under rotor bearing retaining screw.	6L71005-12C
GENERATOR CONTROL GROUP		
BOARD, terminal: 3 double-screw type term.; 7/16" between centers of term.; 2 1/16" lg x 1 1/8" wd x 1/2" d o/a; four .177" dia mtg holes on 1 3/4" x 2 7/64" mtg/c.	Mounts generator lead to generator control.	2Z9403.6
CAPACITOR, fixed: Sig C type # CA-461; paper; 500,000 uuf ± 10 %; 100 vdcw.	Suppression bypass.	3D462
CAPACITOR, fixed: Sig C type # CA-448; paper; 100,000 uuf ± 10 %; 100 vdcw.	Noise suppression.	3D448
CONTROL, generator: Sig C Generator Control C-890/U; p/o Sig C Power Unit PE-210-B; box and chassis; relay, switch term. strip, binding post and ammeter, voltmeter.	Contains generator control components.	3H1098-890
GASKET: 4 holes; sq 2" lg x 2" wd x 1/16" thk o/a; u/w Generator Control C-890/U.	Absorbs shock between generator control and loop frame.	3H2154-24
GROMMET: .437" dia hole; 1/4" hole dia, 1/16" wd groove; 5/8" dia 3/16" thk; p/o Generator Control C-890/U.	Prevents wires from rubbing on edges of panel cover.	3H2479-4
GROMMET: 5/8" dia slot; 3/8" dia hole, 1/16" wd groove; 7/8" dia, 5/16" thk; p/o Generator Control C-890/U.	Prevents wires from rubbing on edges of panel base.	3H2479-5
KNOB: bar type.	Permits rotation of rheostat.	3H2678-3
METER, ammeter: dc.	Indicates amperage.	3F1050-47
METER, voltmeter: dc.	Indicates voltage.	3F8030-32
NUT, hexagon: steel, # 4-40 thd; 3/32" thk; 1/4" across flats.	Mounts ammeter and voltmeter to panel.	6L3604-40-4.4
NUT, hexagon: # 6-32 thd; 7/64" thk; 5/16" across flats.	Mounts terminal board to panel base.	6L3106-32.1S

2. Identification Table of Parts for Power Unit PE-210-(FR) (contd).

Ref. symbol	Name of part and description	Function of part	Signal Corps stock N°
	NUT, hexagon: # 8-32 NCT-2; 1/8" thk; 11/32" across flats	Mounts solenoid lead harness to cover.	6L3108-32S.P
	NUT, hexagon: 1/4"-20 NCT-2; 3/16" thk; 7/16" across flats.	Mounts capacitor and armature relay to panel base.	6L3504-20Z
	RELAY, armature:SPST, normally open; 30 amp rating, closing voltage 3 v dc, withstands 5 v continuously; silver contacts; 2 concentric windings, 5 v dc, 1/4 amp on operating current, 10 amp on release current, 20 ohm inductive winding, 5 ohm noninductive winding, insulated; solder lug term. on coils, silver contacts riveted; 3 3/4" lg x 2 13/16" wd x 2 1/4" h o/a; mts w/two 1/4"-20 NCT RH mach screws on 1 7/8" mtg/c; fast acting; dustproof cover;	Charging circuit relay.	2Z7599-102
	RESISTOR, variable: wire wound; 12 ohm ± 10%; 50 w, 300° hot spot temp rise.	Regulates battery charging rate.	3RP3602
	SWITCH, push button type 5 amp, 30 vdc; momentary contact, closed only when button is held in position;	Starting switch.	3Z9849.238
	SCREW, machine: slot drive; RH; # 4-40 thd; 1/4" lg; 1/4" lg thd;	Mounts cover to panel	6L6440-4.49S
	SCREW, machine: slot drive; RH; steel, # 4-40 thd; 1/2" lg; 1/2" lg thd;	Mounts ammeter and voltmeter to panel	6L6440-8.49S
	SCREW, machine: slot drive; RH; # 6-32 thd; 1/2" lg, 1/2" lg thd.	Mounts terminal board to base of generator control.	6L6632-8.49S

SCREW, machine: slot drive; RH; # 8-32;thd: 1/2" lg; 1/2" lg thd.	Mounts governor lead harness to cover.	6L6832-8.49S
SCREW, machine: slot drive; RH; # 8-32 NCT-2; 5/16" lg; 5/16" lg thd.	Mounts generator control to frame.	6L6832-5.87
SCREW, machine: slot drive; RH; 1/4"-20 NCT-2; 1/2" lg; 1/2" lg thd.	Mounts capacitors and armature relay to generator control base.	6L7920-6-8.49S
WASHER, lock: rd .123" ID, .265" OD, .016" thk; shakeproof type, internal teeth.	Mounts ammeter and voltmeter to panel.	6L72204C
WASHER, lock: rd .142" ID, .275" OD, .018" thk; shakeproof type, internal teeth.	Mounts terminal board to panel base.	6L72206-9C
WASHER, lock: rd .168" ID, :370" OD, .020" thk; shakeproof type, external teeth.	Mounts generator control to loop frame.	6L71108C
WASHER, lock: rd .176" ID, .510" OD, .025" thk; shakeproof type, external-internal teeth.	Mounts solenoid lead harness to cover.	6L72008-14P
WASHER, lock: rd .256" ID, .466" OD, .025" thk; shakeproof type, internal teeth.	Mounts capacitors and relay to panel base.	6L72214
WIRING ASSEMBLY: shielded cable w/term. one end, 2 Stak-on and 1 Stak-on other end, 2 lead wires w/1 gnd wire connected to shielding.	Lead from generator control to solenoid.	3E10000-15
WASHER, lock; rd .123" ID, .255" OD, .016" thk; shakeproof Type; external Teeth	Mounts Cover to mounting Panel	6L7204C
TOOL GROUP		
ABRASIVE, sheet: class A ream flint finishing; grit size 4/0.	For cleaning breaker points and commutator.	6Z7500-0000.2
BRUSH, cleaning: hammer shape; wire bristles; 5 1/2" lg x 2 1/2" wd x 1/4" thk.	For cleaning unit and removing carbon.	6Z1415-3
GAGE SET, thickness: flat type; 6 leaves .025", .015", .020", .018", .022", and .030".	To check clearances.	6Q5706-3
GAGE, spark timing.	To time ignition.	6Q45684

2. Identification Table of Parts for Power Unit PE-210-(FR) (contd).

Ref. symbol	Name of part and description	Function of part	Signal Corps stock N°
	PULLER, flywheel: knock-off type.	Removal of flywheel.	6R7395-2
	SCRAPER, carbon.	Remove carbon from cylinder head, ports, and piston.	6R14010-1
	SCREW DRIVER: for slot drive screws; 4" lg blade; 1/4" ed bit.		6R15610
	WRENCH, socket: special double-end w/sliding handle; 27/32" and 1 3/32" openings.	Removal of spark plug and adapter.	6R55526-32
	WRENCH: double open-end; 3/8" and 7/16" openings.		6R55514-12
	WRENCH: double-end hex. socket; 5/16" and 7/16" openings.		6R55510-14.1
	WRENCH: double-end box; 1/2" and 9/16" openings.		6R59347.2
	MISCELLANEOUS GROUP		
	BAG, canvas: olive drab.	Cover for unit.	3H161
	BAG, tool: olive drab.	Container for tools.	6Q2104-9.2
	CABLE ASSEMBLY: Sig C Cord CD-1334; 72" lg, excluding terminations.	Connects battery to generator for charging.	3E1999-334
	NUT, hexagon: 10-24 NCT-2; 1/8" thk; 3/8" across flats.	Mounts handle to canvas cover.	6L3610-24.3
	ROPE ASSEMBLY: cotton sash cord; 1/4" dia.	Starting rope.	3H1922/R25
	WASHER, lock: rd .194 ID, .353" OD, .068" thk; split-ring type.	Secures carrying handle fastenings.	6L71003-23

APPENDIX II

REFERENCES

1. Supply Publications *

SIG 1, Introduction and Index.
SIG 3, List of Items for Troop Issue.
SIG 4-1, Allowances of Expendable Supplies.
SIG 4-2, Allowances of Expendable Supplies for Tactical Organizations, Training Centers, Boards, and Fixed Installations.
SIG 7 & 8, Organizational and Higher Echelon Spare Parts.
SB 11-76, Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

2. Shipping Instructions. *

U.S. Army Spec. No. 100-14A, Army-Navy General Specification for Packaging and Packing for Oversea Shipment.

3. Decontamination *

TM 3-220, Decontamination.

4. Demolition. *

FM 5-25, Explosives and Demolitions.

5. Camouflage. *

FM 5-20, Camouflage, Basic Principles.

6. Other Technical Publications (see FM 21-6). *

The following is a list of manuals and technical bulletins pertaining to the care and use of Power Unit PE-210 and its associated equipment:
TM 38-650, Basic Maintenance Manual.
TM 1-455, Electrical Fundamentals.
TM 9-850, Cleaning, Preserving, Sealing, and Related Materials Issued for Ordnance Material.
TM 10-580, Automotive Electricity.
TM 11-430, Storage Batteries for Signal Communication Except Those Pertaining to Aircraft.
TM 11-2525, Miller Utility Heater Model OG-31-A.

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* *See Note page 88*

TB 11-2525, Starting Power Units in Arctic Areas, Using Miller Utility Heater Model OG-31-A.
TM 37-2810, Motor Vehicle Inspections and Preventive Maintenance Services.
TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 23, Rustproofing of Engines.
TB SIG 25, Preventive Maintenance of Power Cords.
TB SIG 66, Winter Maintenance of Signal Equipment.
TB SIG 72, Tropical Maintenance of Ground Signal Equipment.
TB SIG 75, Desert Maintenance of Ground Signal Equipment.
TB SIG 183, Preventive Maintenance Guide for Power Equipment.

7. Forms. *

The following forms are referred to in this manual:
NME Form No. 110, Vehicle and Equipment Operational Record.
WD AGO Form 460, Preventive Maintenance Roster.
DA AGO Form 464, Work Sheet for Preventive Maintenance and Technical Inspection of Engineer Equipment.
WD AGO Form 468, Unsatisfactory Equipment Report.
AF Form 54, Unsatisfactory Report.

8. Abbreviations and Symbols.

A	adjust	in.	inch
ac	alternating current	incl	inclusive
amp	ampere	lb	pound
approx	approximately	ma	milliamperes
AWG	American Wire Gauge	NEG	negative
C	clean	POS	positive
CL	compound, rust preventive, light	rpm	revolutions per minute
		rps	revolutions per second
dc	direct current	L	lubricate
diam	diameter	mf	microfarad
F	Fahrenheit	MFP	moistureproofing and fungiproofing
F	feel		
GL	grease, lubricating, special	PM	preventive maintenance
		T	tighten
hex.	hexagonal	V	volts
hp	horsepower	TI	technical inspection.
I	inspect		

* ***NOTE*** : *The use of forms and records referred to in paragraphs 39 - 41 - 42 - 44 - 45 and Appendix II - 1 - 2 - 3 - 4 - 5 - 6 - 7 apply only to U.S. Army.*

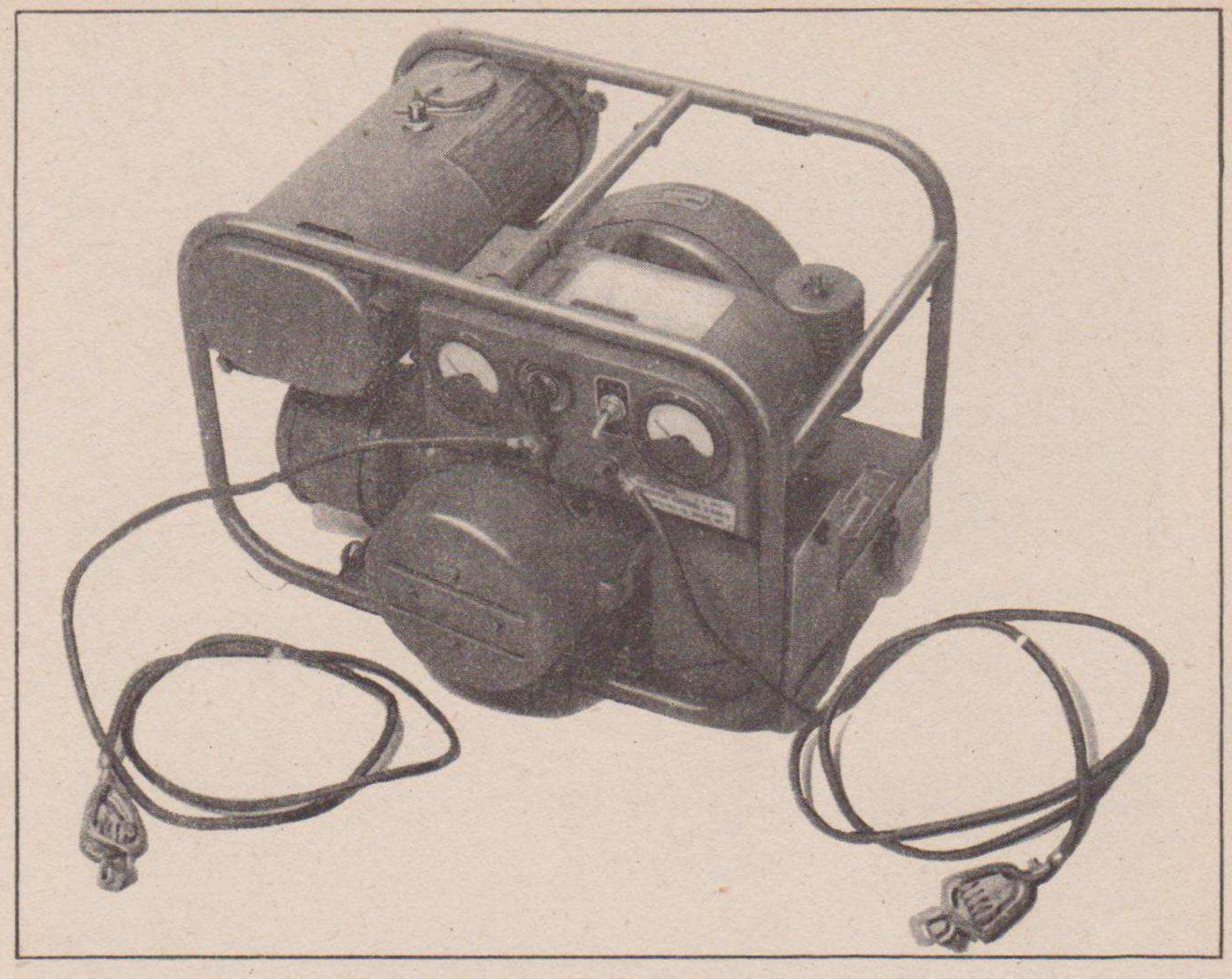


Fig. 1. Power Unit PE 210 B, set-up for use

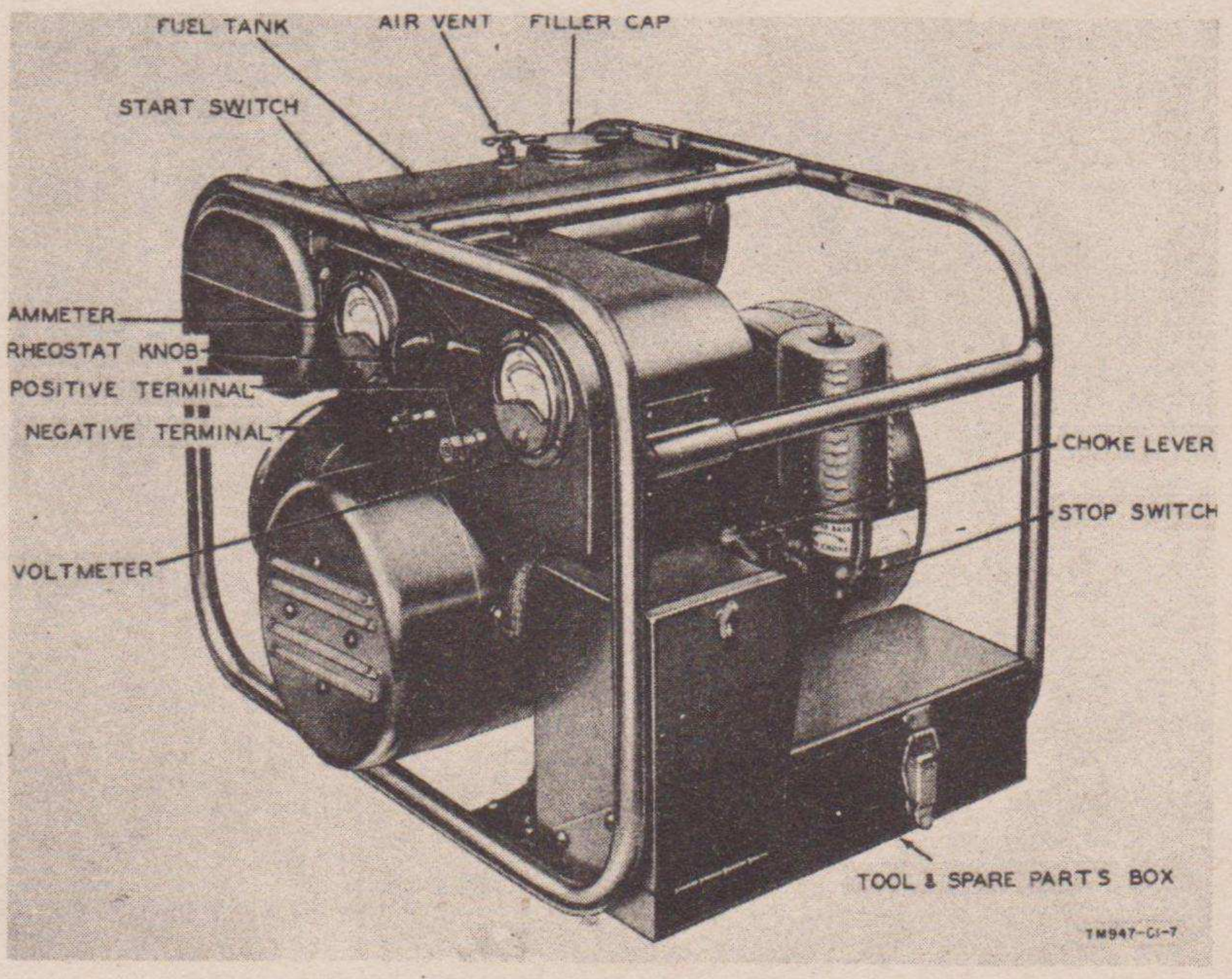


Fig. 2. Power Unit PE 210 B, three-quarter view

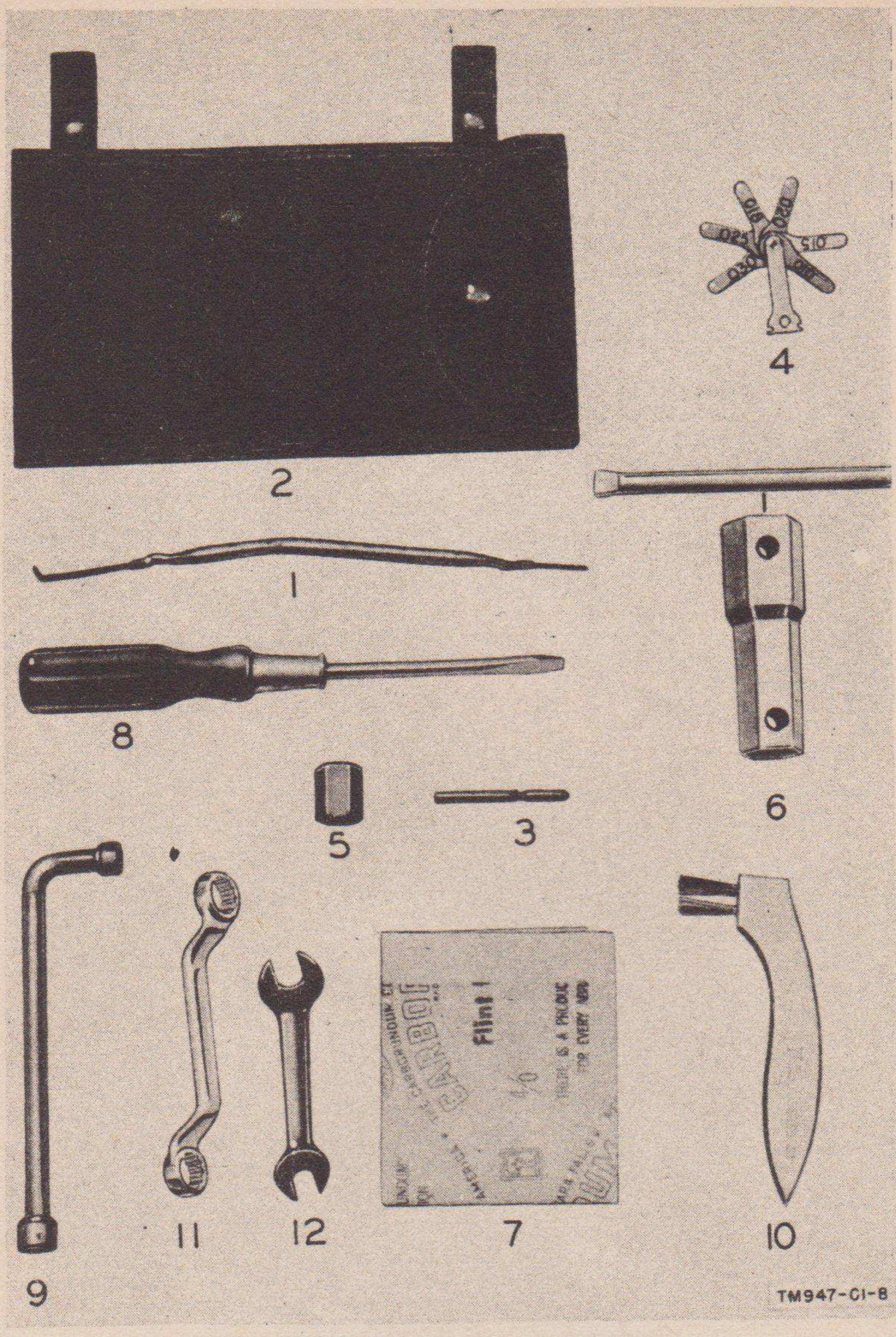


Fig. 3. Tools

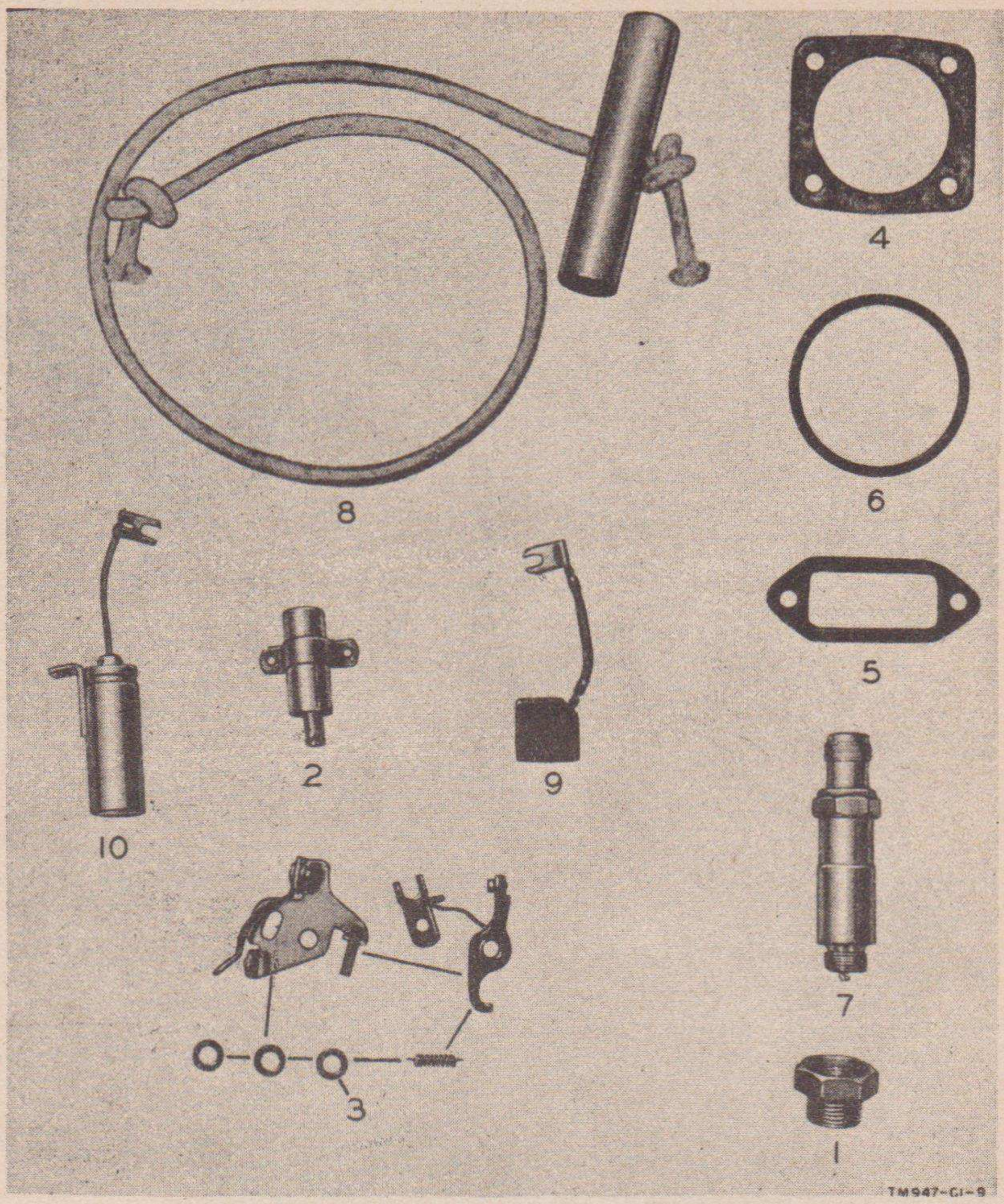


Fig. 4. Running spare parts

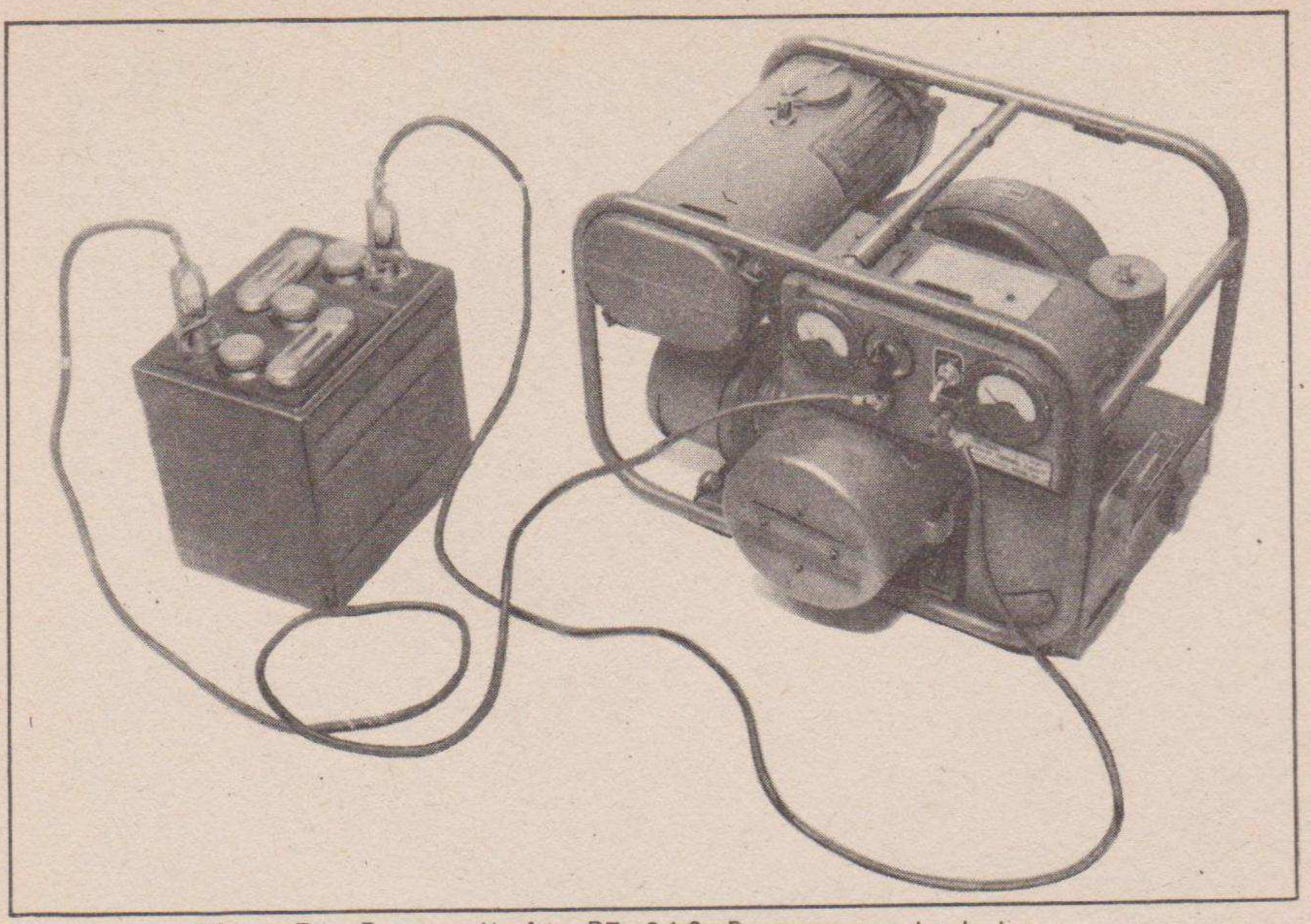


Fig. 5. Power Unit PE 210 B, connected to a 6-Volt battery for charging or starting

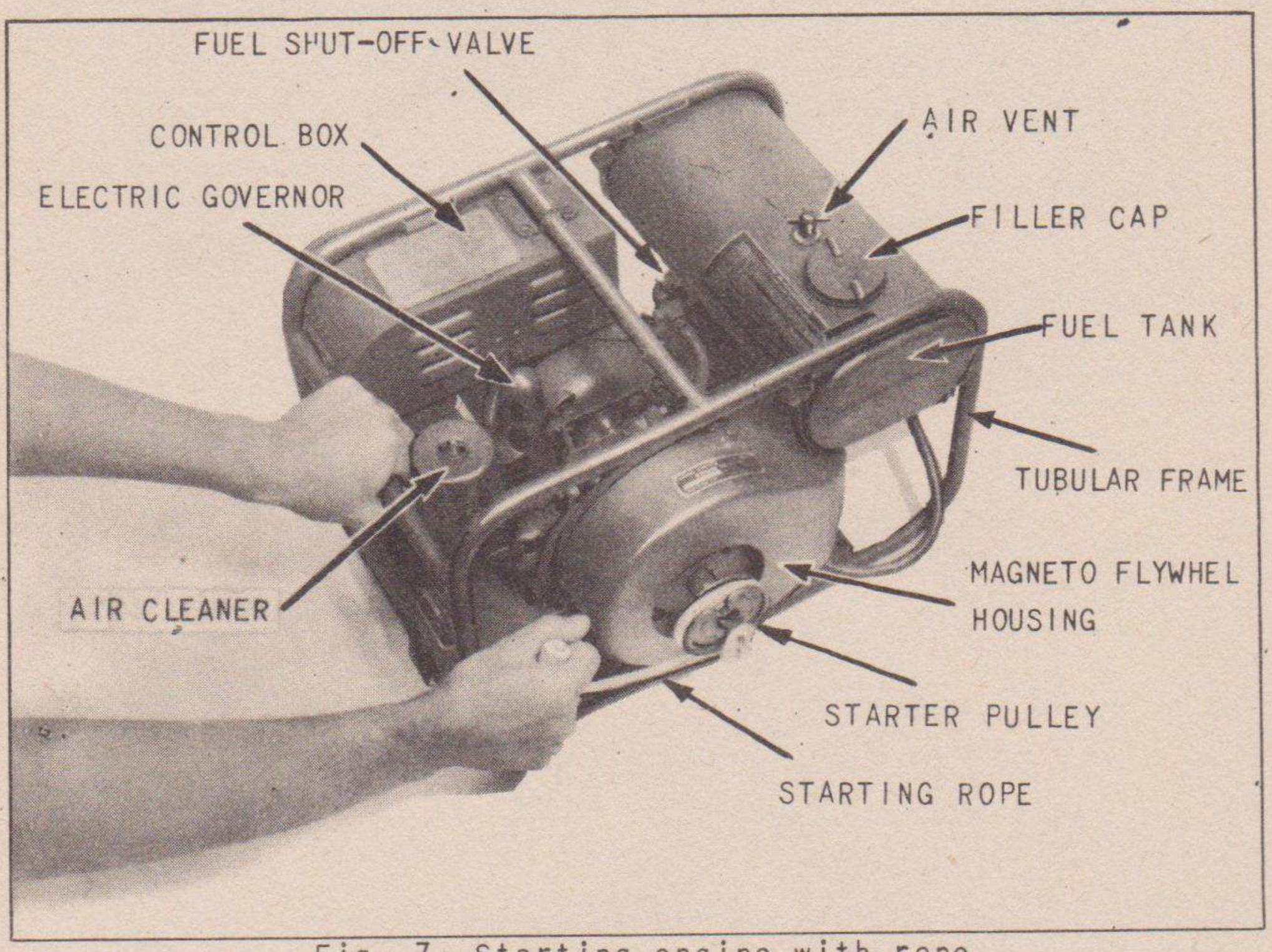


Fig. 7. Starting engine with rope

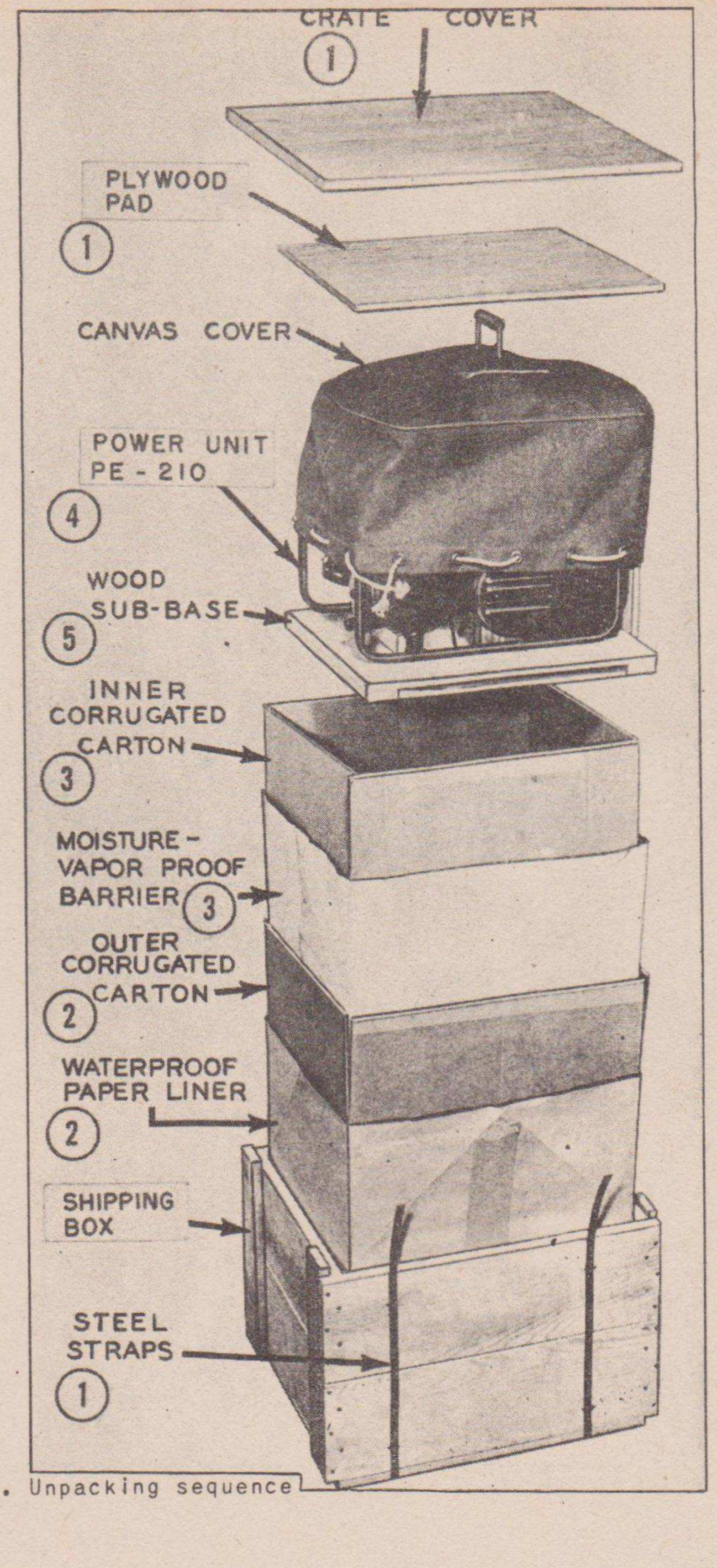


Fig. 6. Unpacking sequence

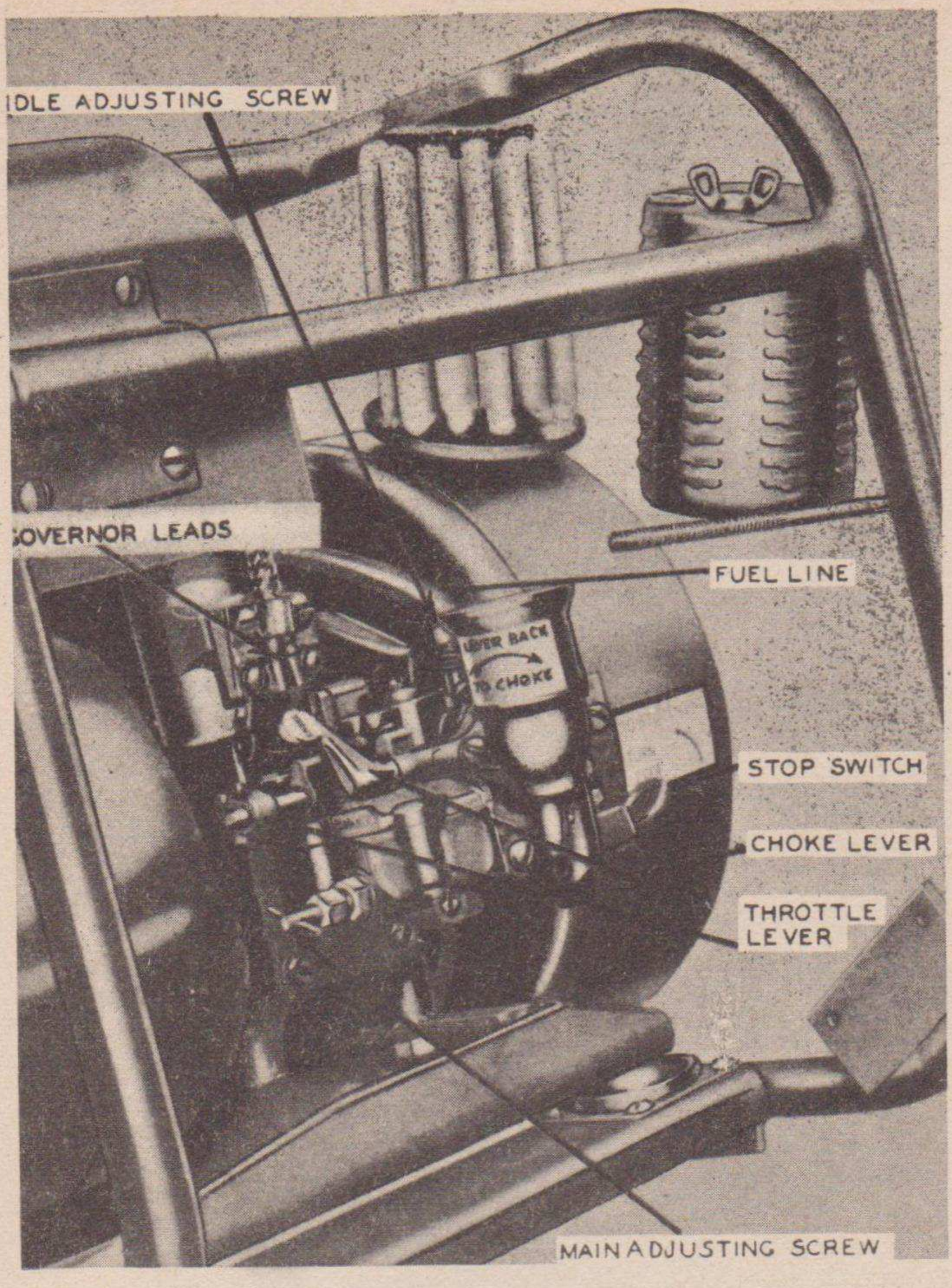


Fig. 8. Carburetor adjustments and controls

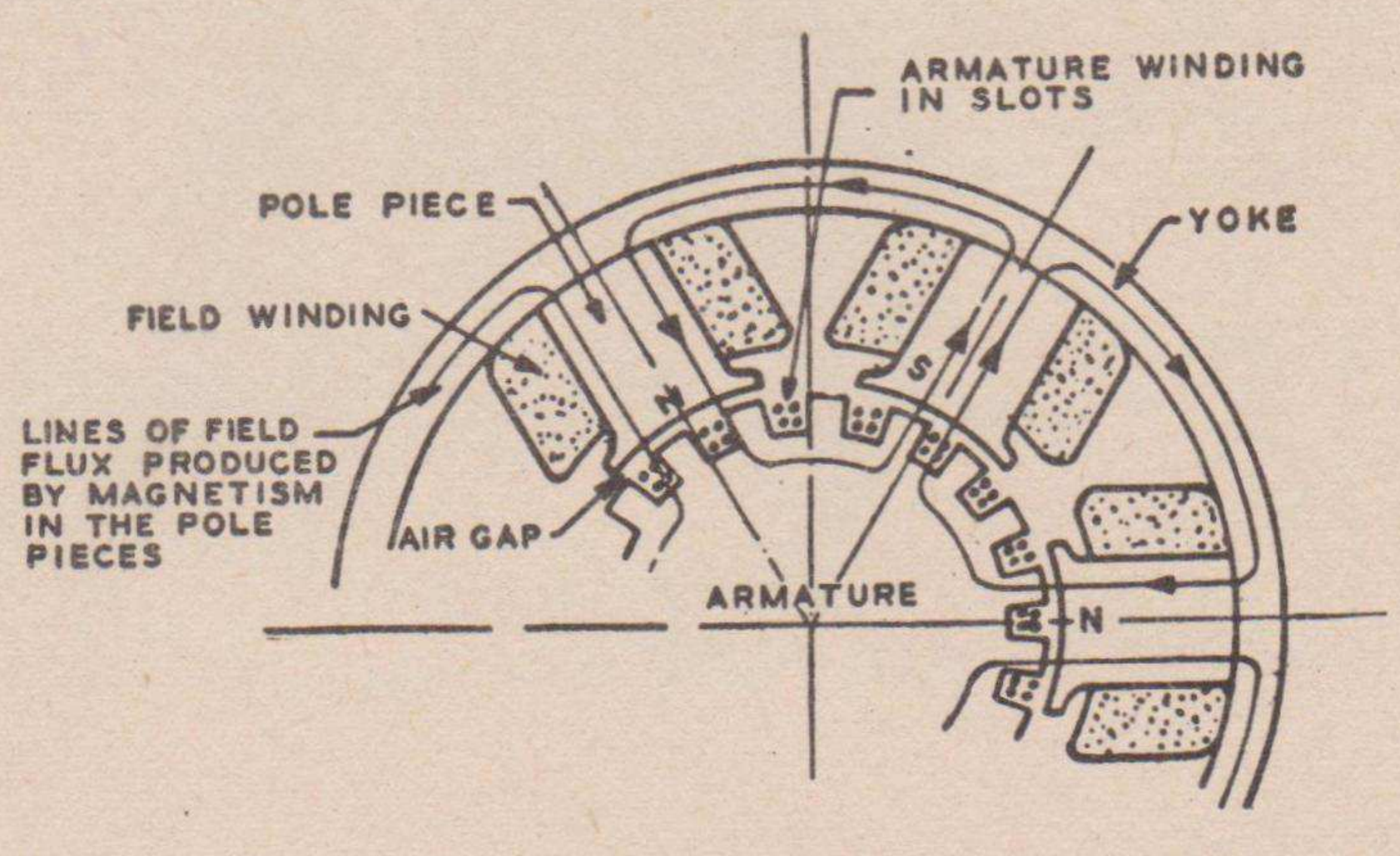


Fig. 10. Generator theory diagram

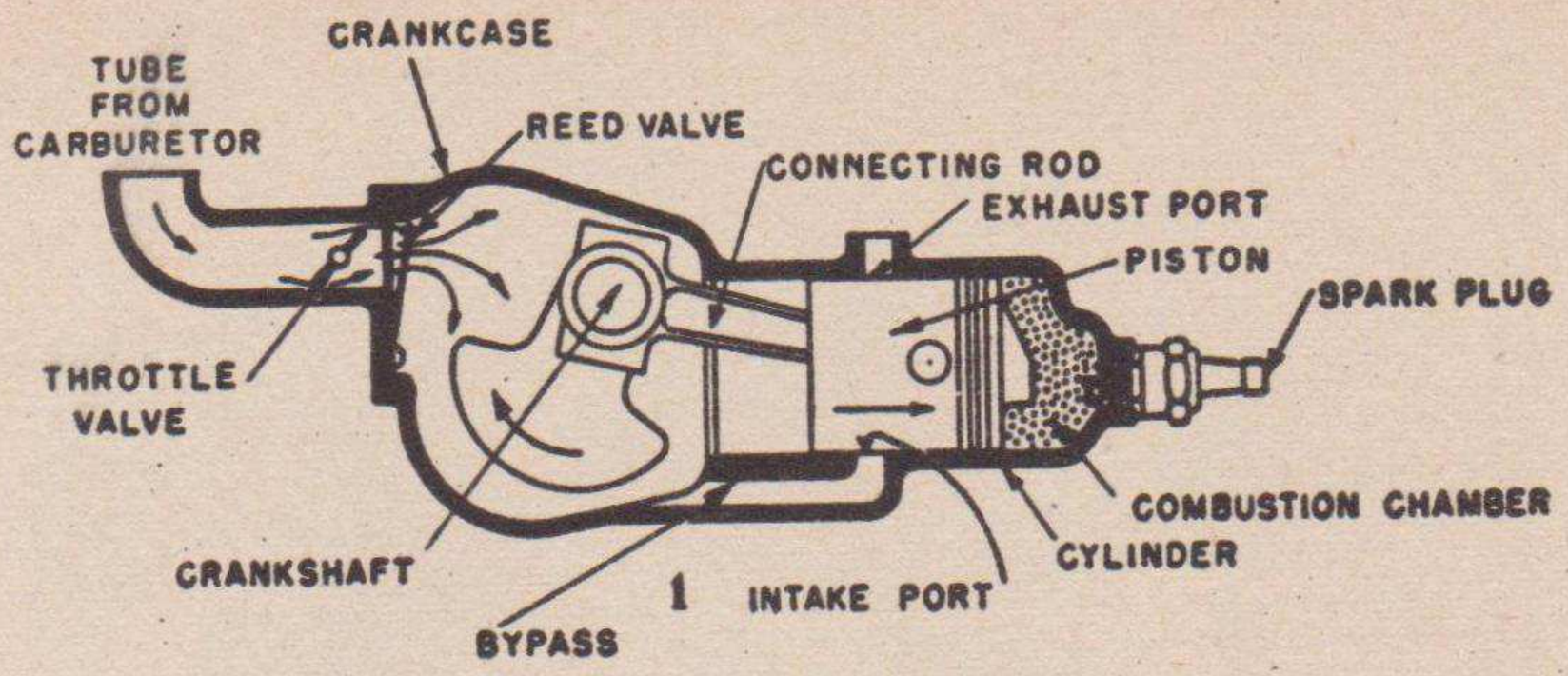


Fig. 9. Principle of two-cycle engine

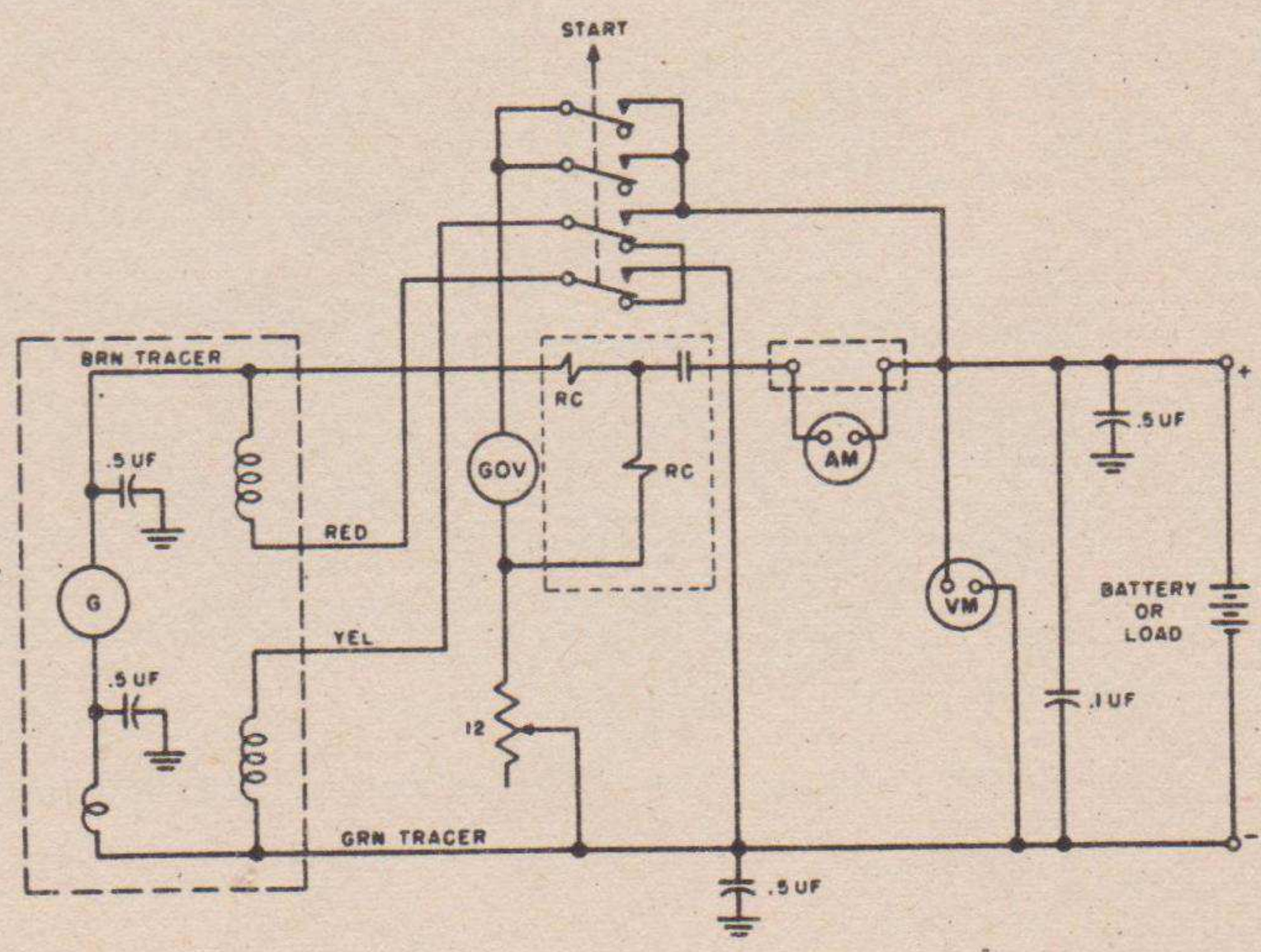


Fig. 11. Electrical system, schematic diagram

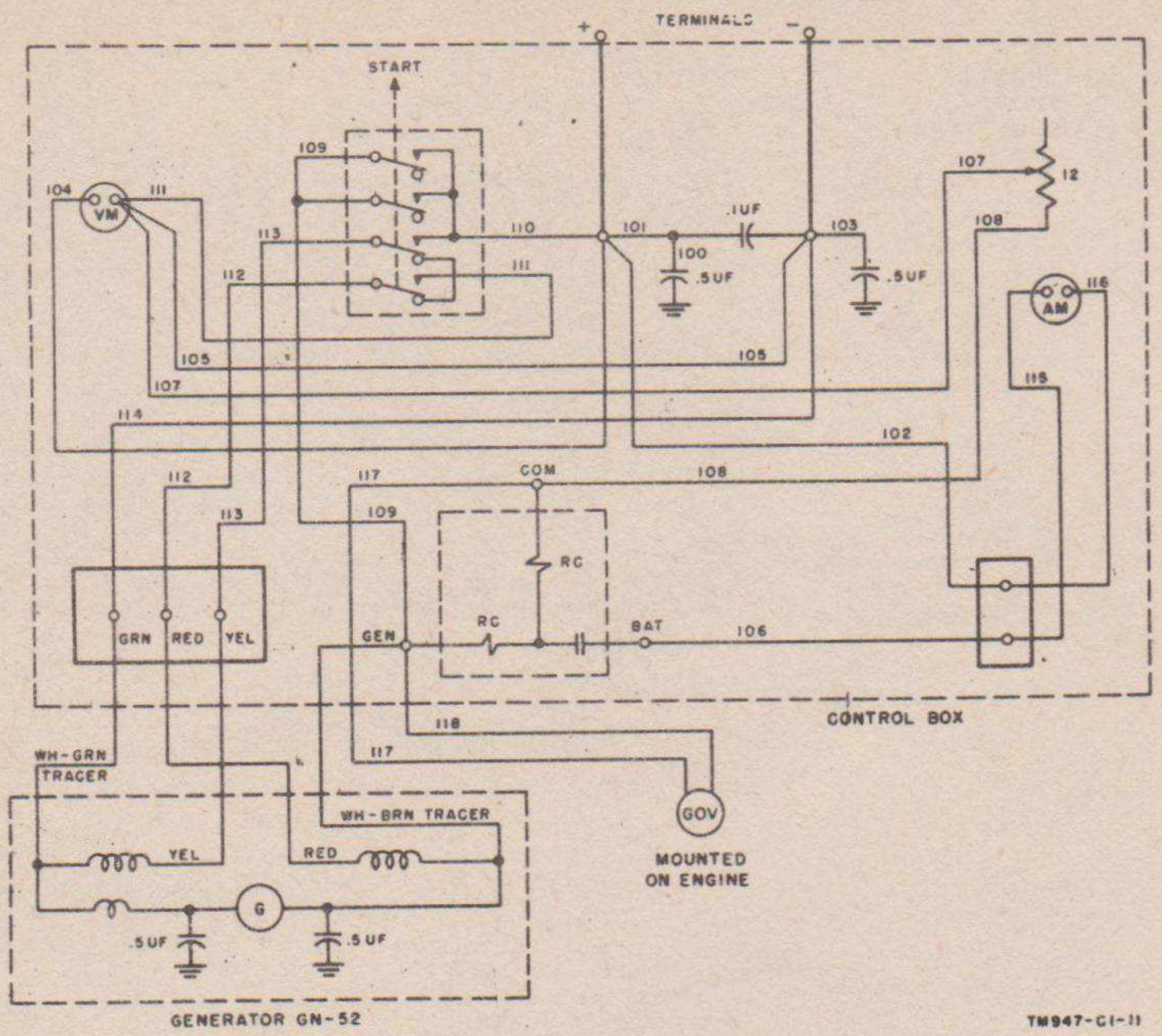


Fig.12 Power Unit PE-210-B, electrical system, wiring diagram

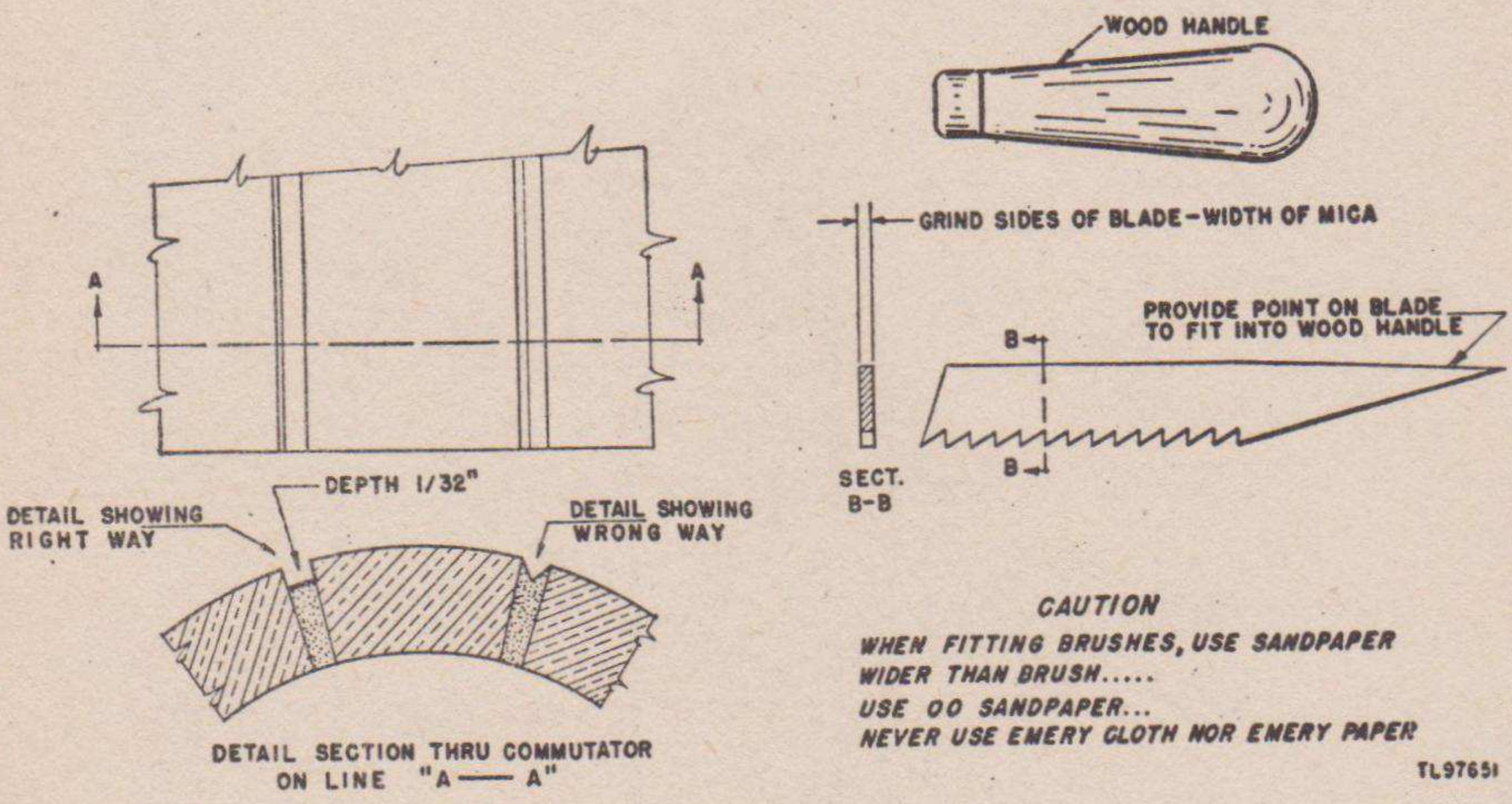


Fig. 14. How to undercut mica of commutator

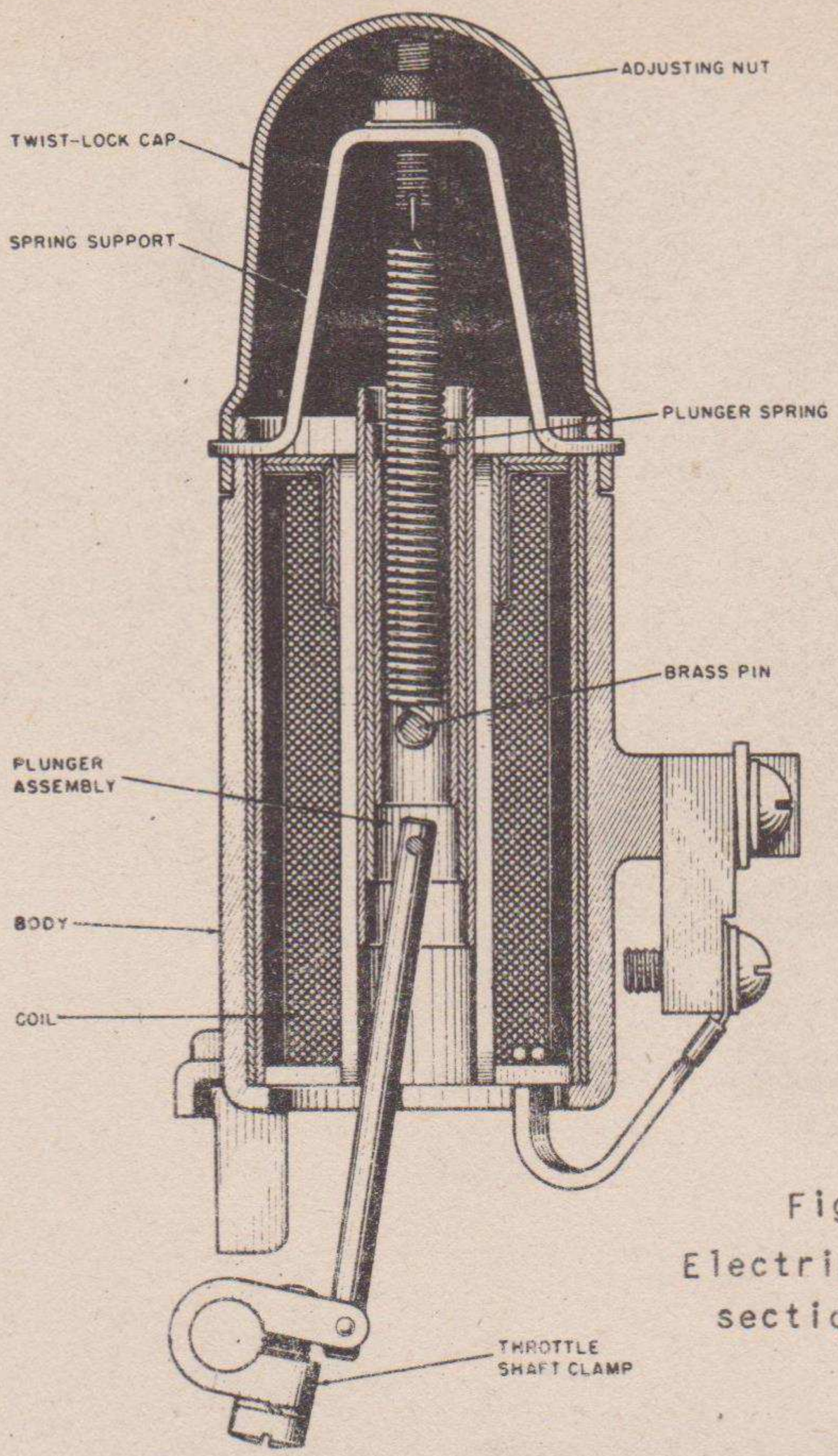


Fig. 13.
Electric governor, sectional view

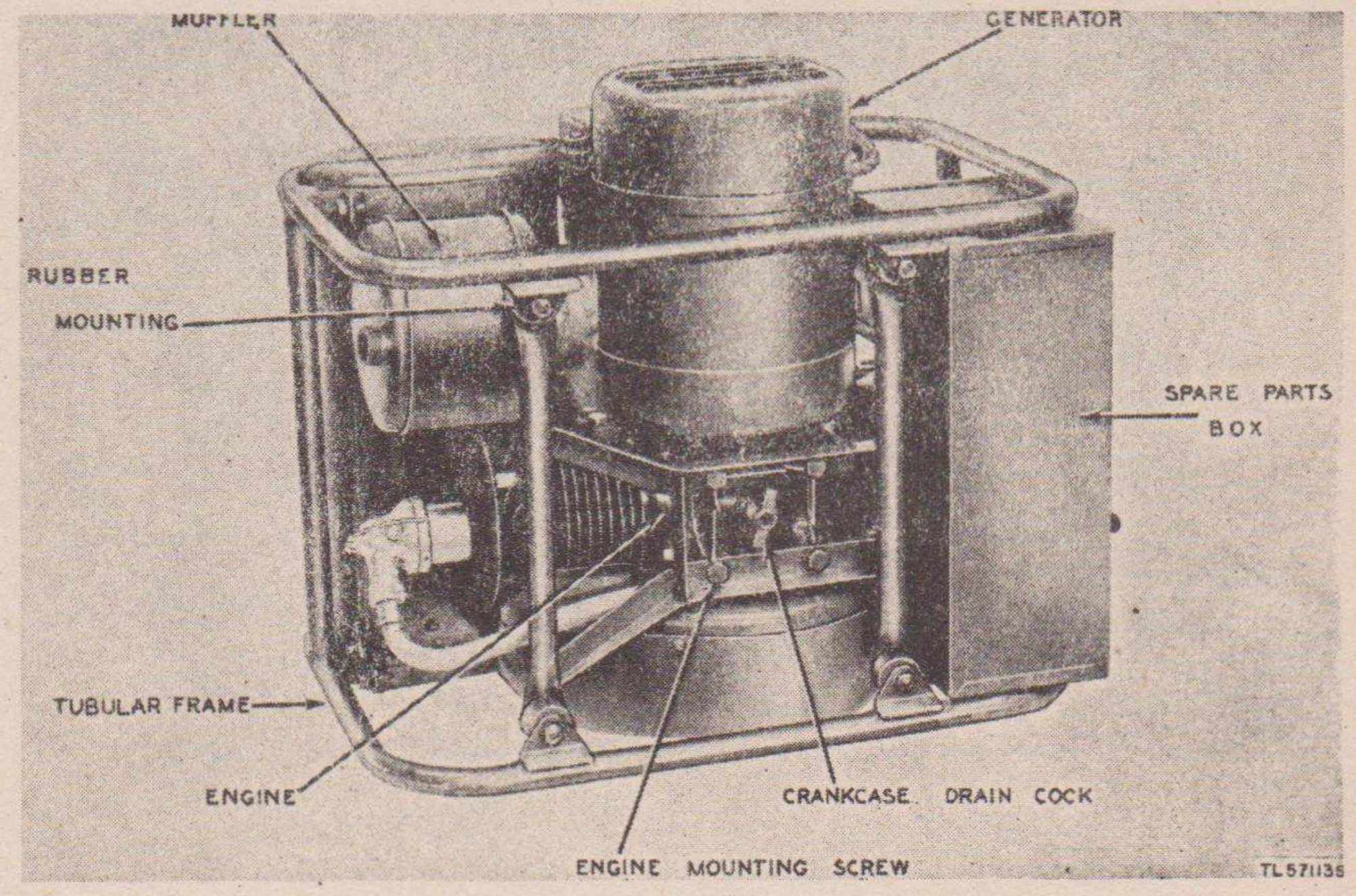


Fig. 15. Bottom view

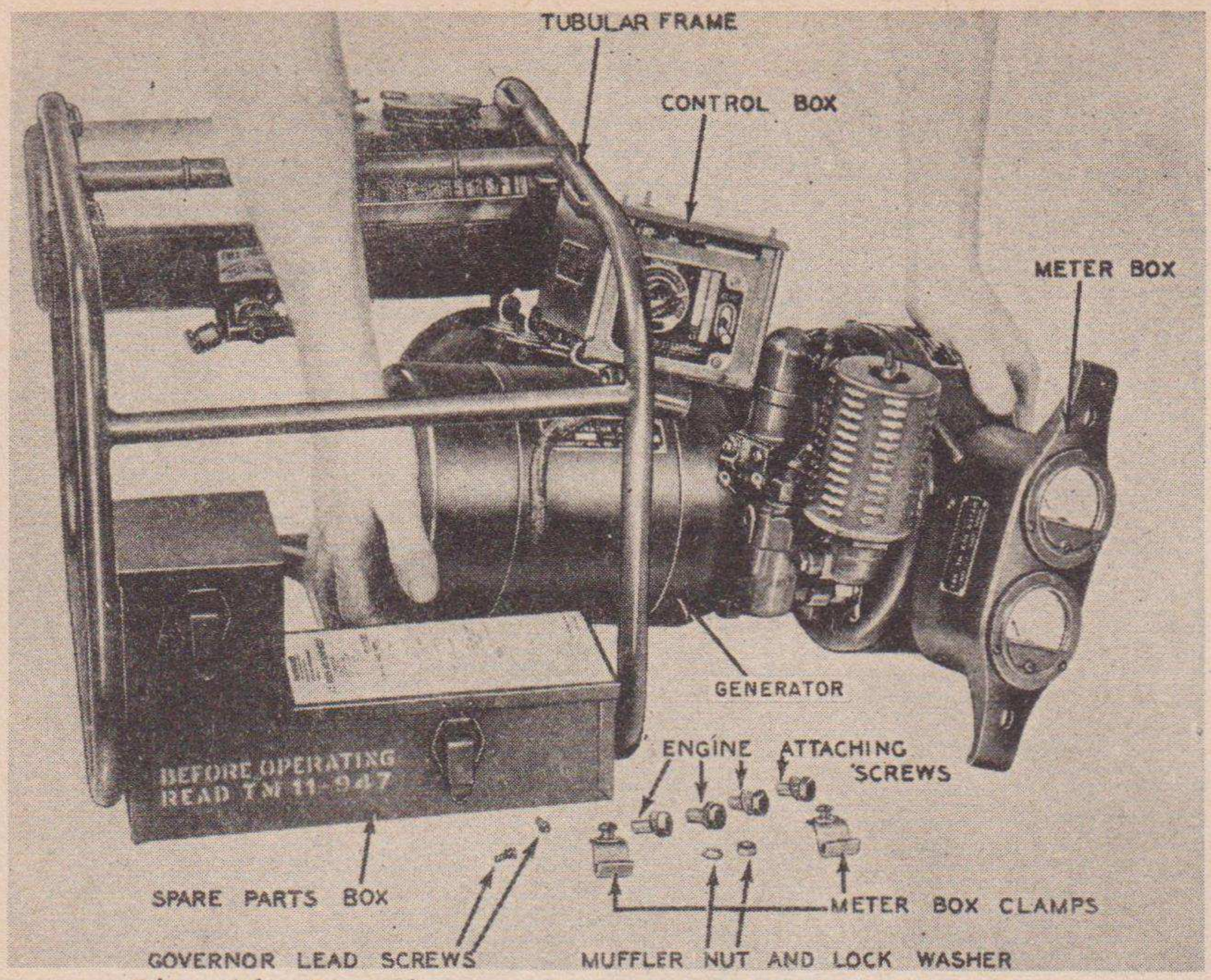


Fig. 16. Removing engine and generator from frame

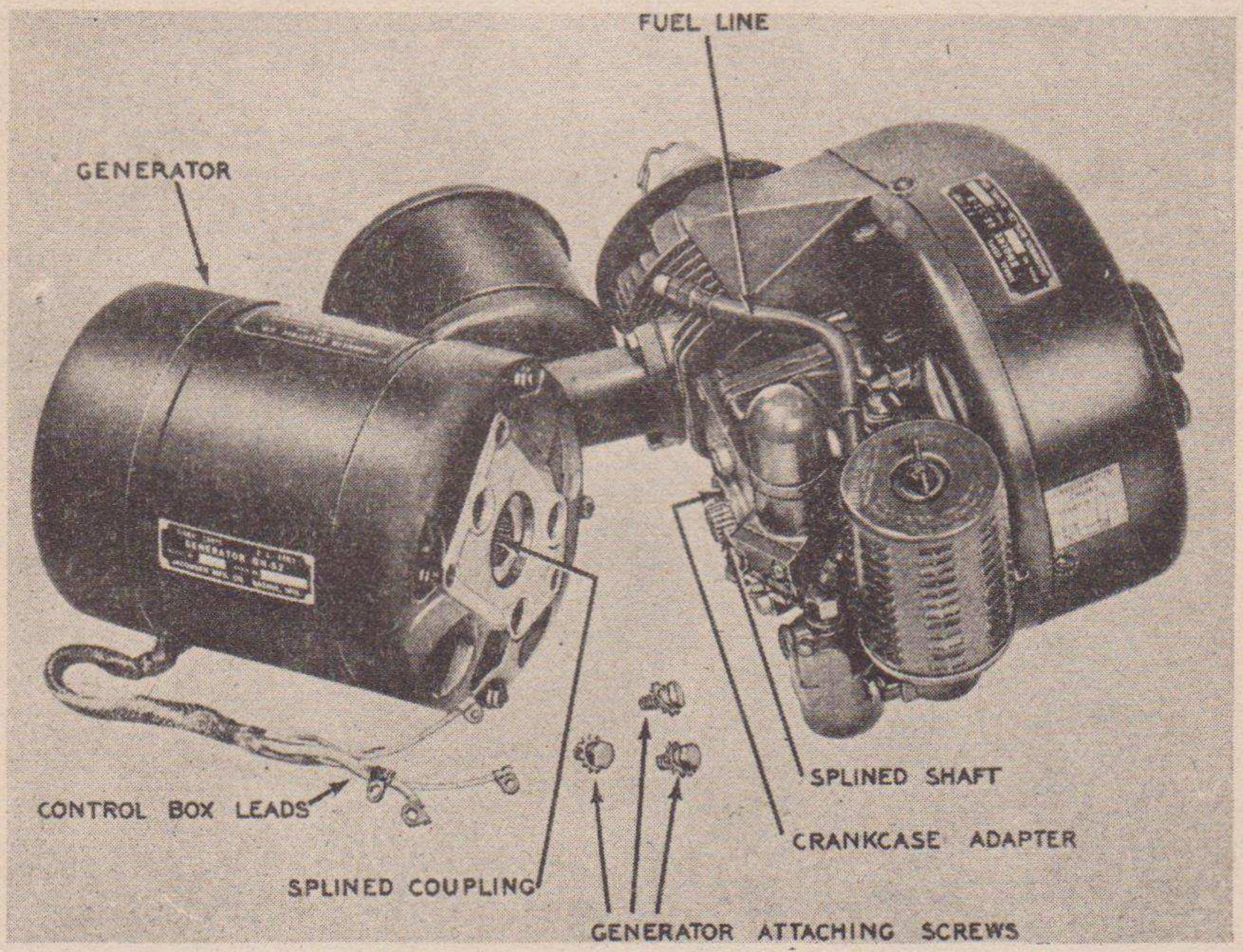


Fig. 17. Generator disassembled from engine

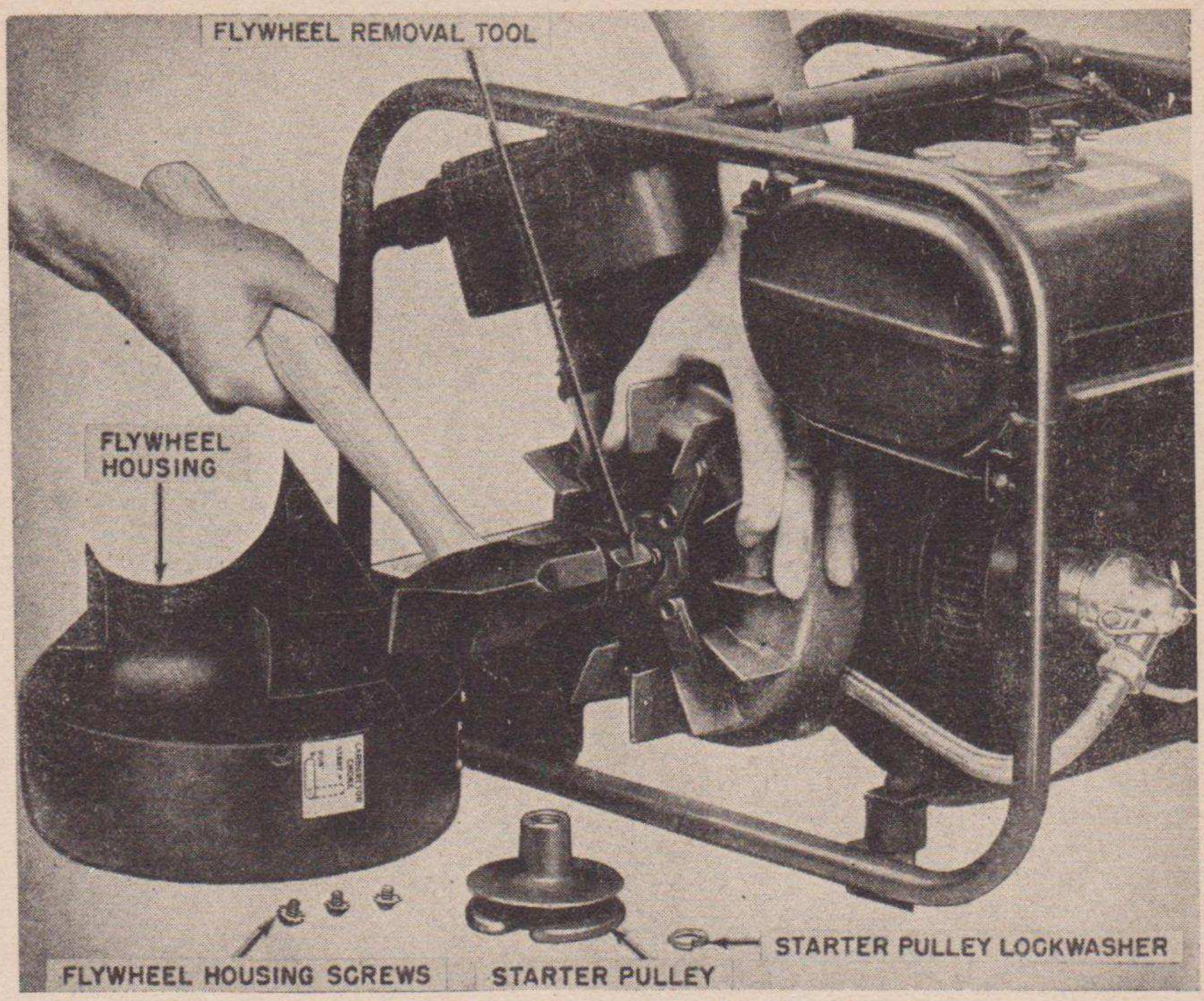


Fig. 18. Removing flywheel

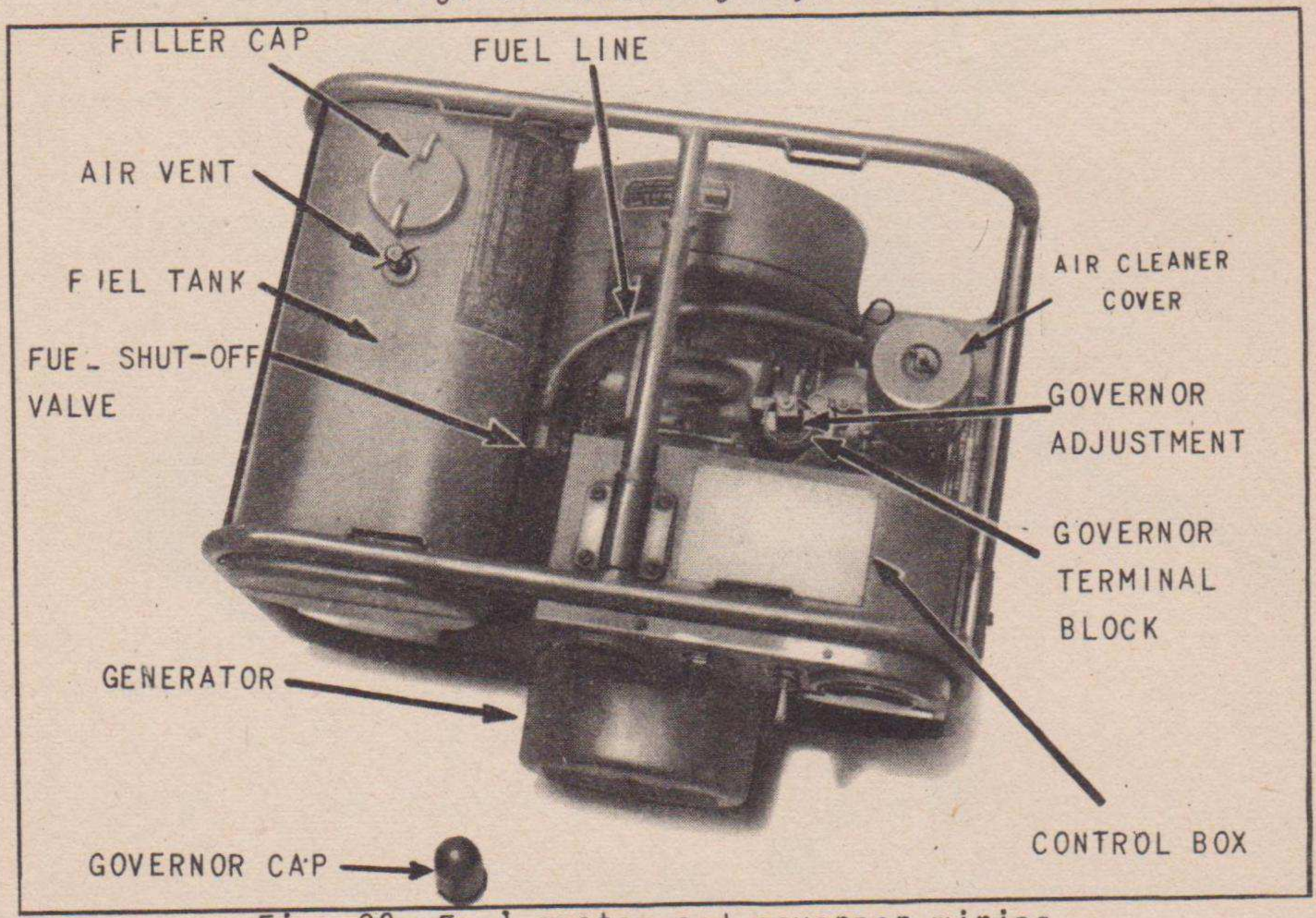


Fig. 20. Fuel system and governor wiring connections

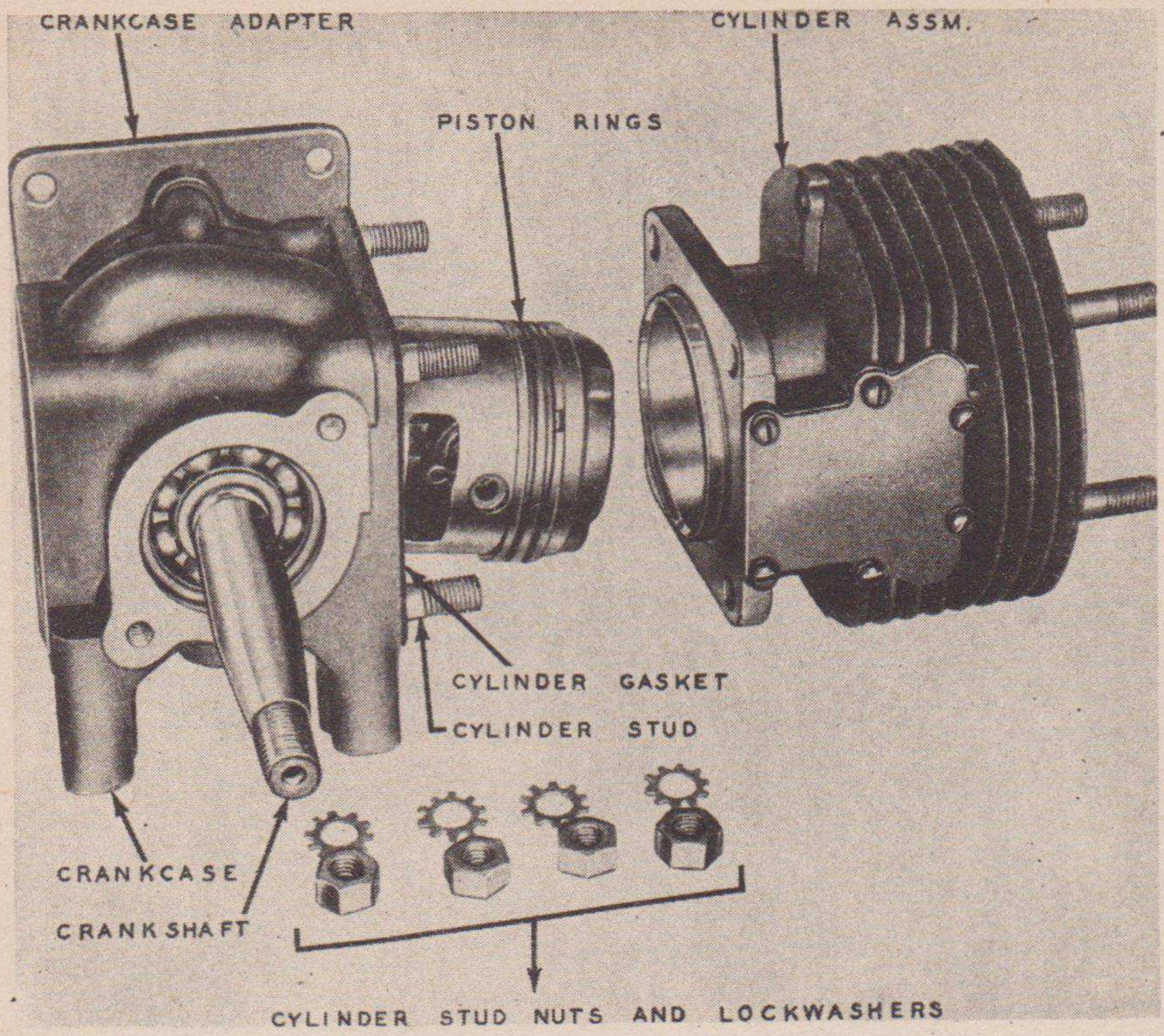


Fig. 19. Cylinder removed from crankcase

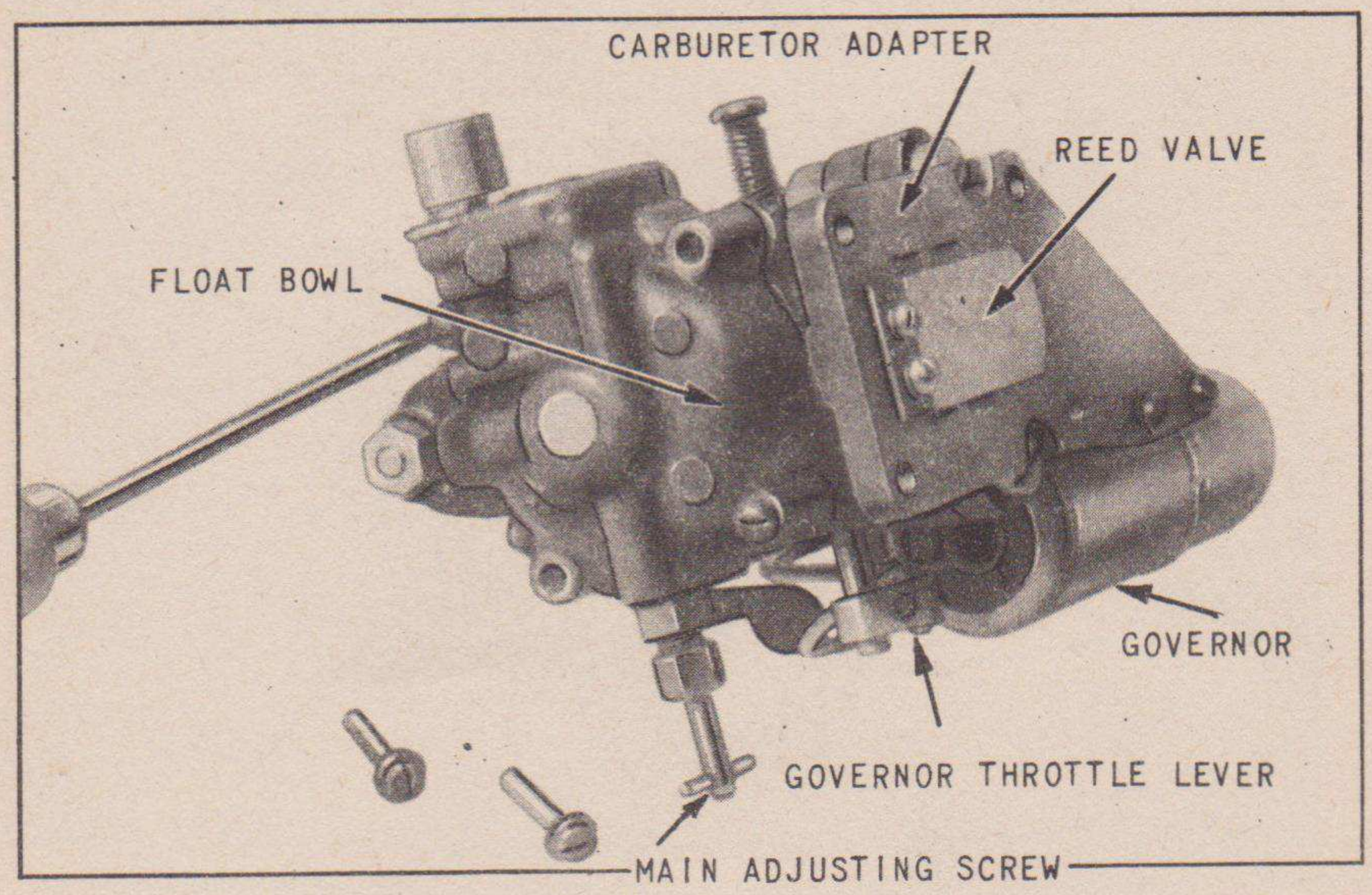
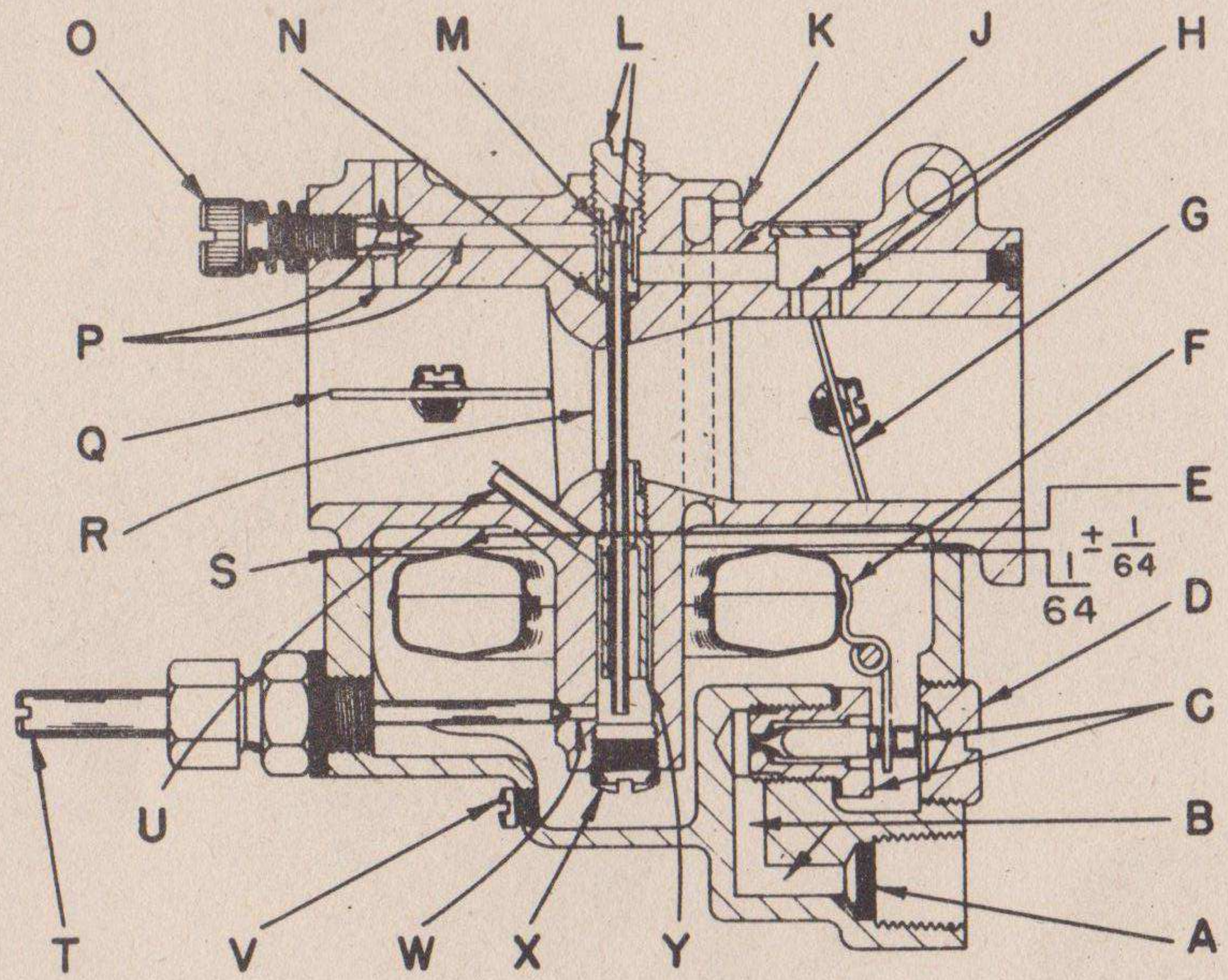


Fig. 21. Removing carburetor float bowl



A Fuel Inlet Screen
B Fuel Inlet Supply Channel
C Inlet Needle and Seat
D Fuel Bowl Plug Screw
E Float Setting
F Float
G Throttle Shutter
H Idle Fuel Discharge Ports
J Idle Fuel Channel
K Fuel Bowl Air Vent
L Idle Tube
M Idle Tube Fuel Outlet Orifice
N Idle Tube Gasket
O Idle Adjustment Screw
P Idle Air Bleed Supply Channels
Q Choke Shutter
R Venturi
S Body Gasket
T Main Adjustment Screw
U Main Nozzle Air Bleed Tube
V Fuel Bowl Drain Screw
W Main Fuel Adjustment Orifice
X Main Nozzle Channel Plug Screw
Y Main Nozzle

TM 947-CI-17

Fig. 22. Power Unit PE 210 B, carburetor, cross-sectional view

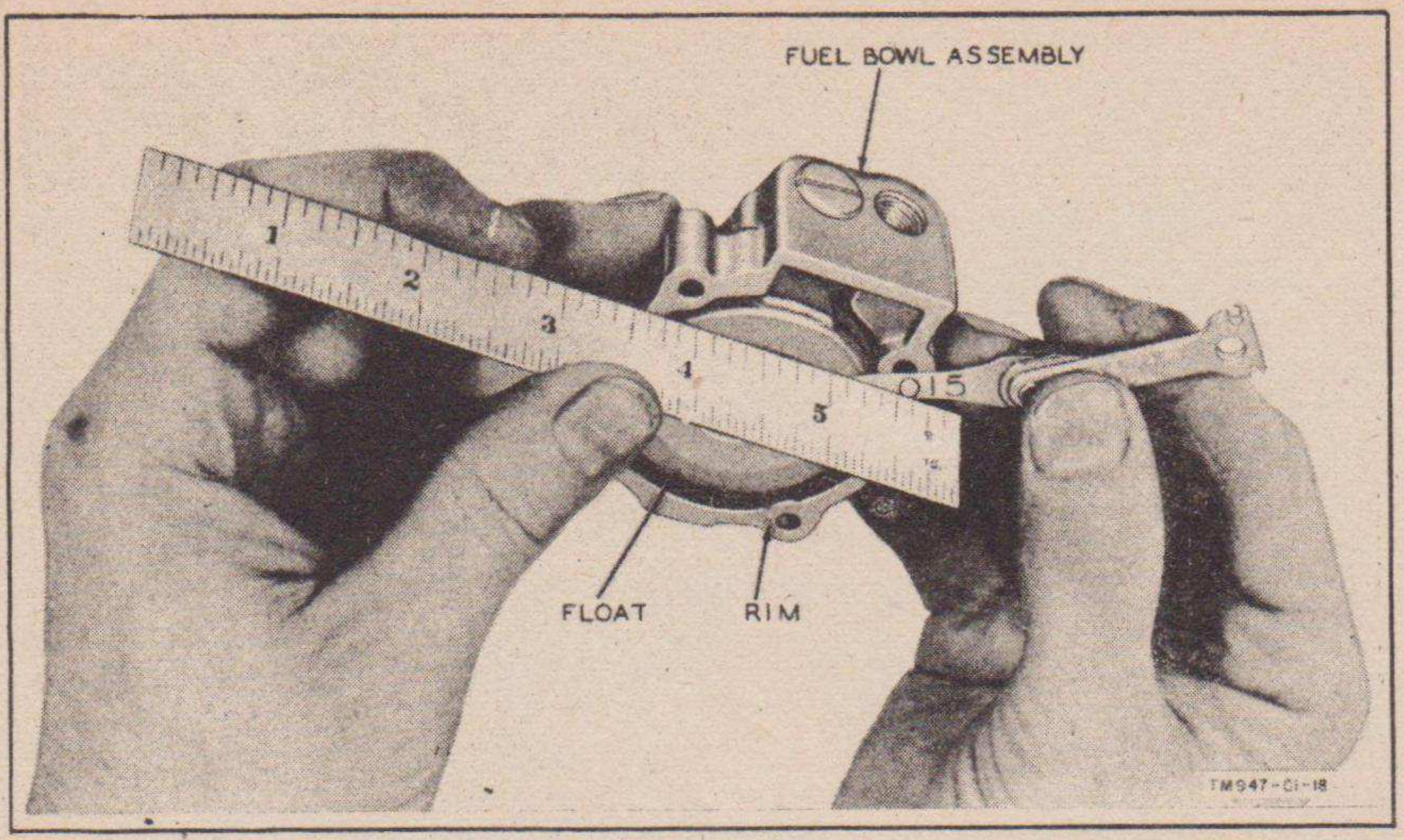


Fig. 23. Carburetor float, lever adjustment

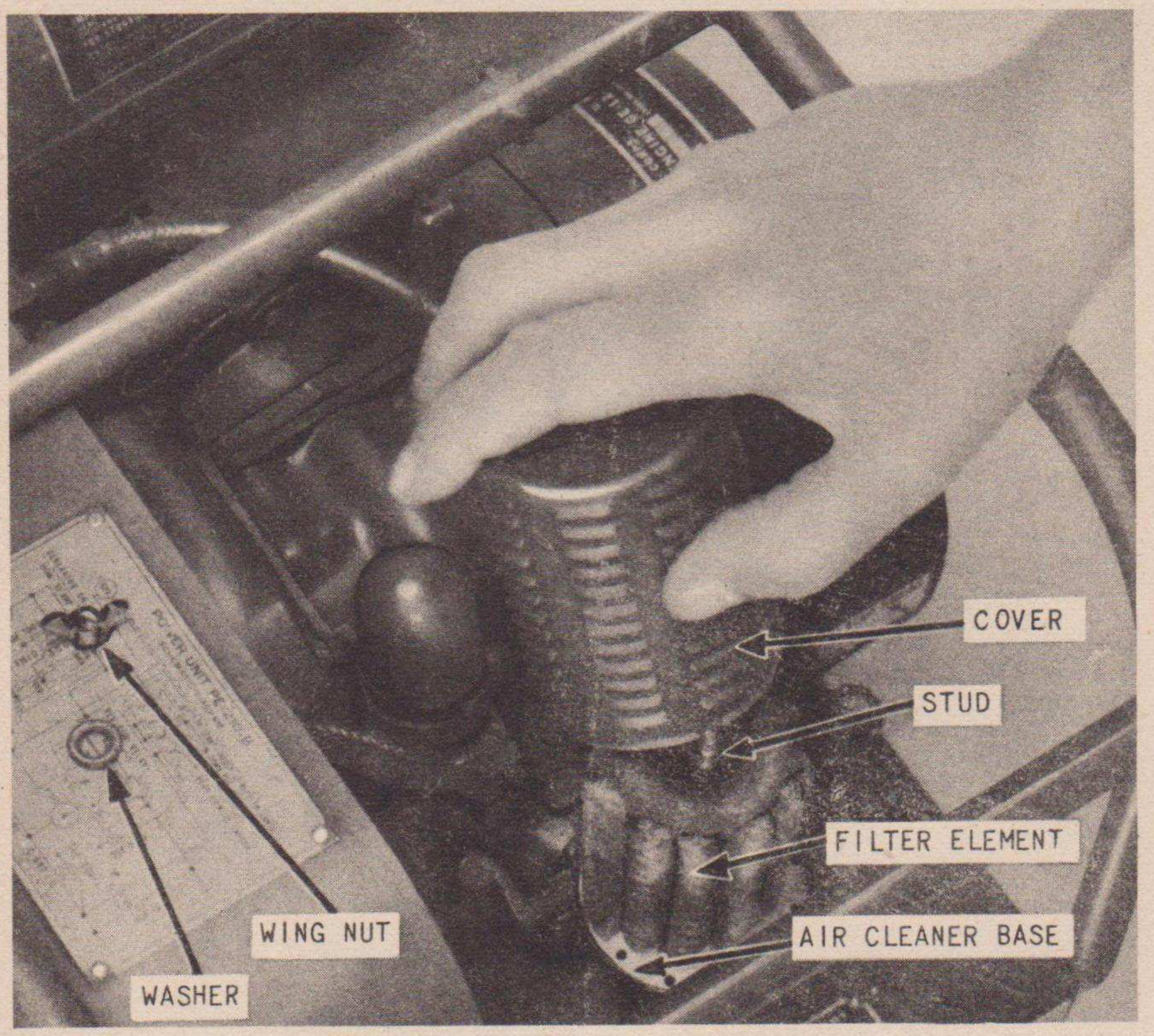


Fig. 24. Removing air cleaner Cover

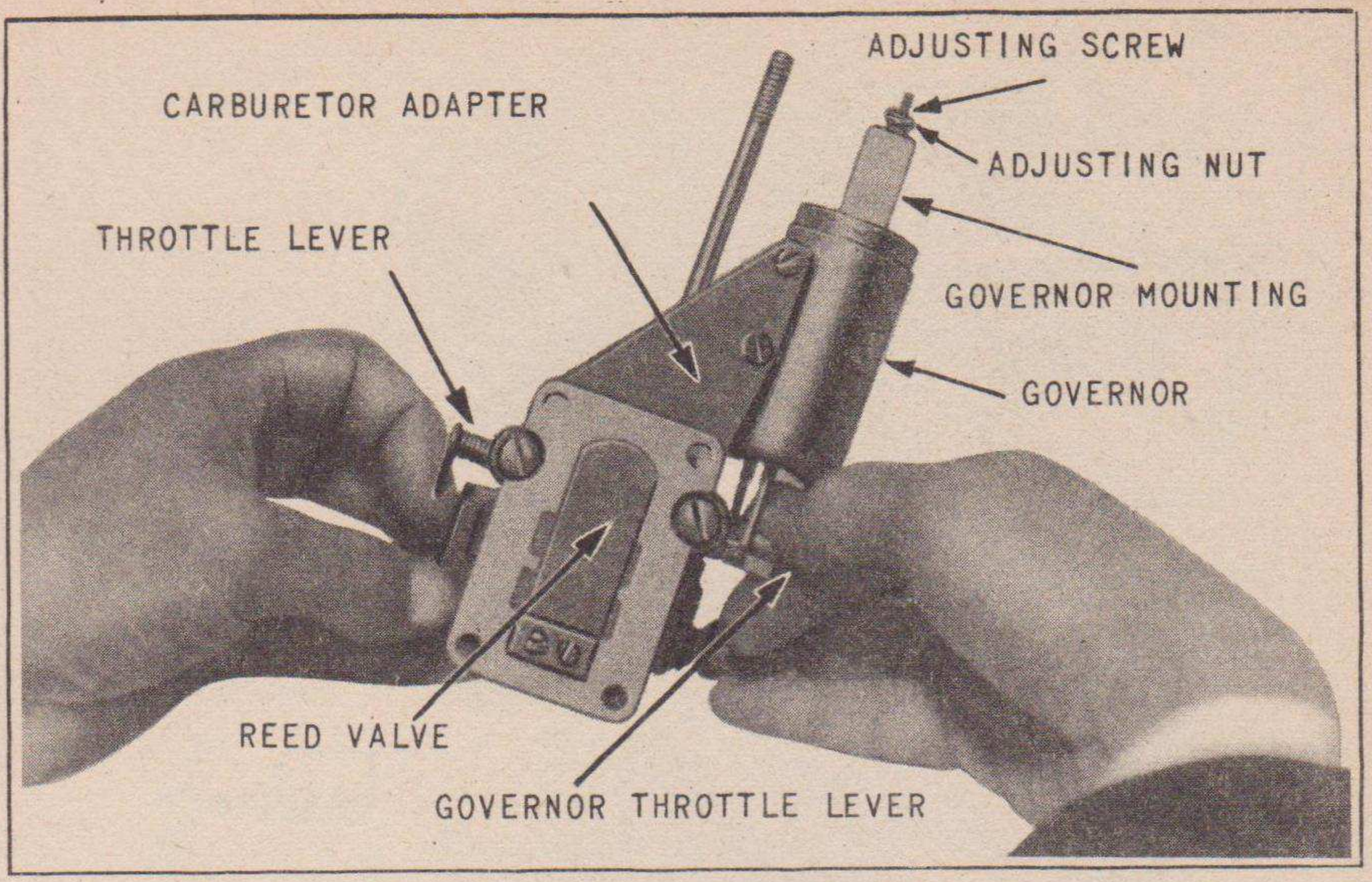


Fig. 25. Adjusting governor and throttle

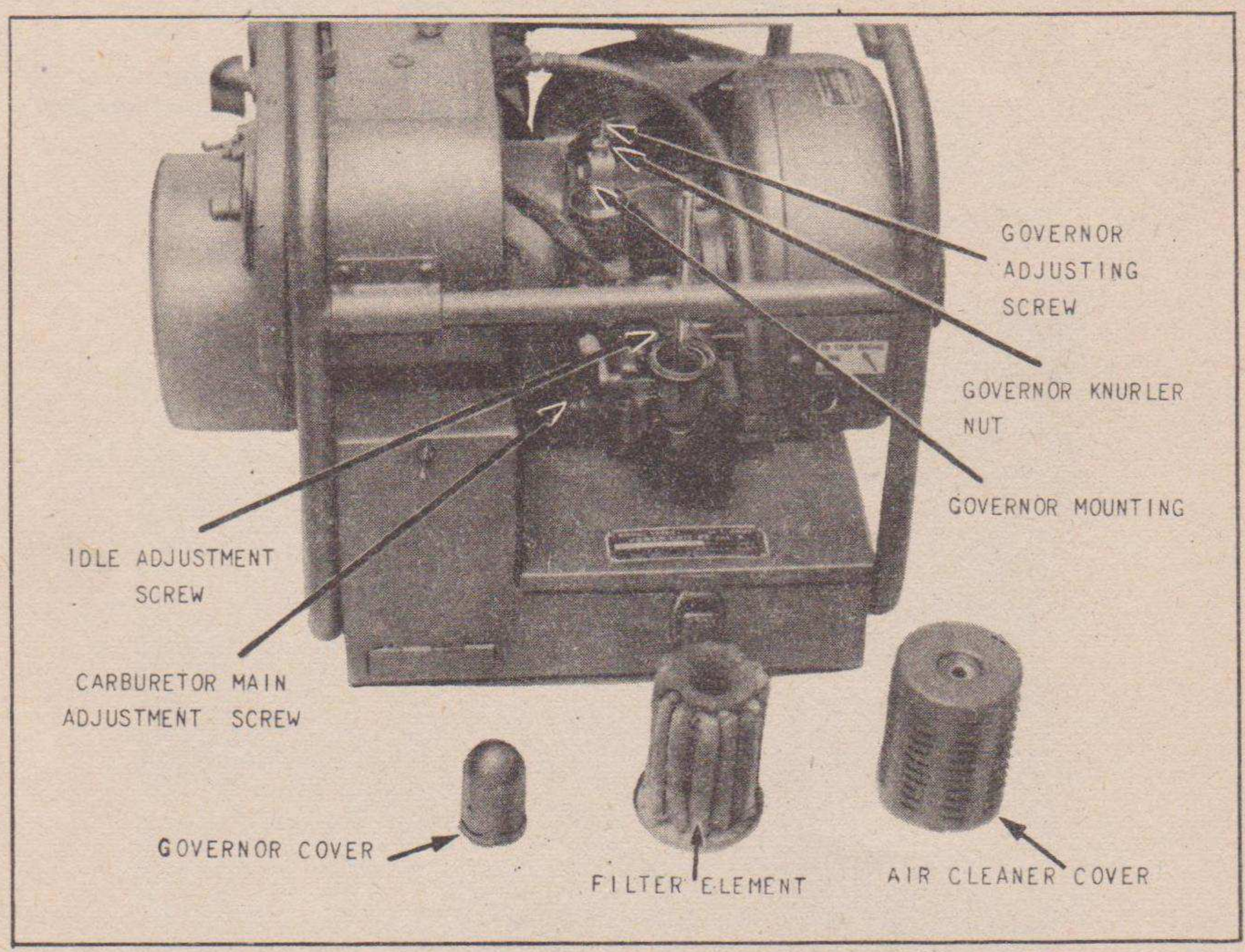


Fig. 26. Governor and Carburetor adjustment

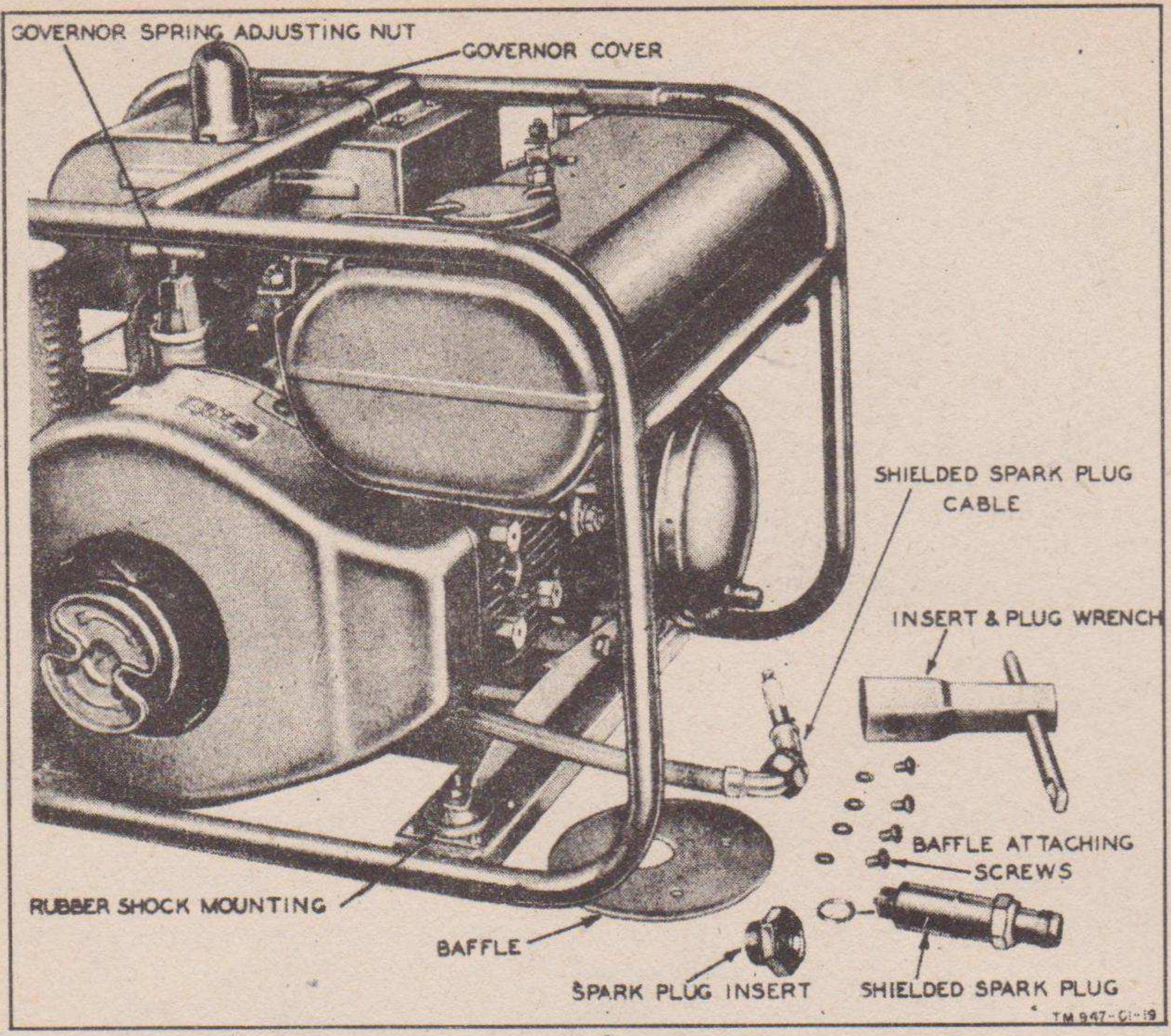


Fig. 27. Power Unit PE 210 B, spark plug, spark plug adapter, and ignition shielding

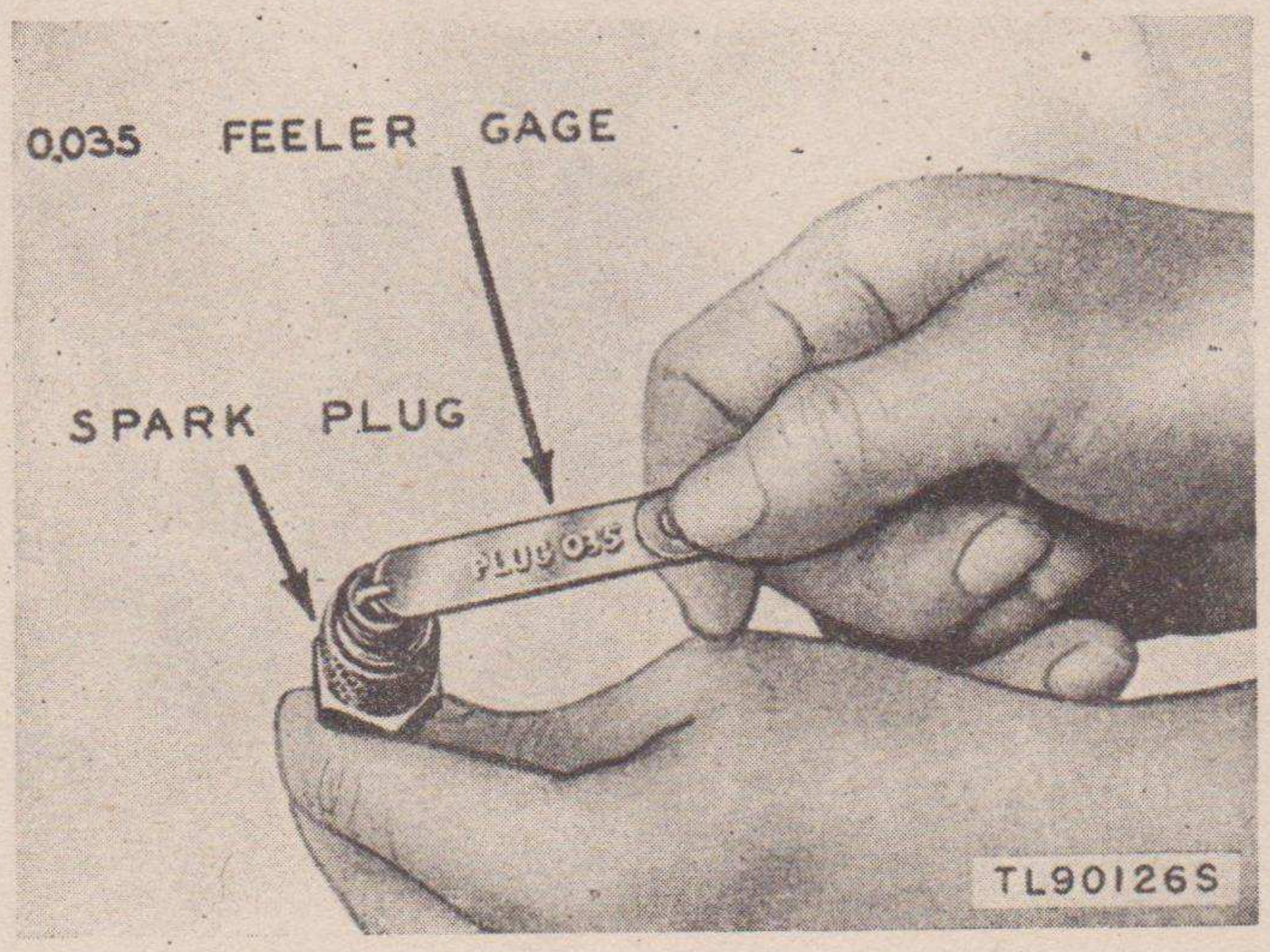


Fig. 28. Checking spark plug gap

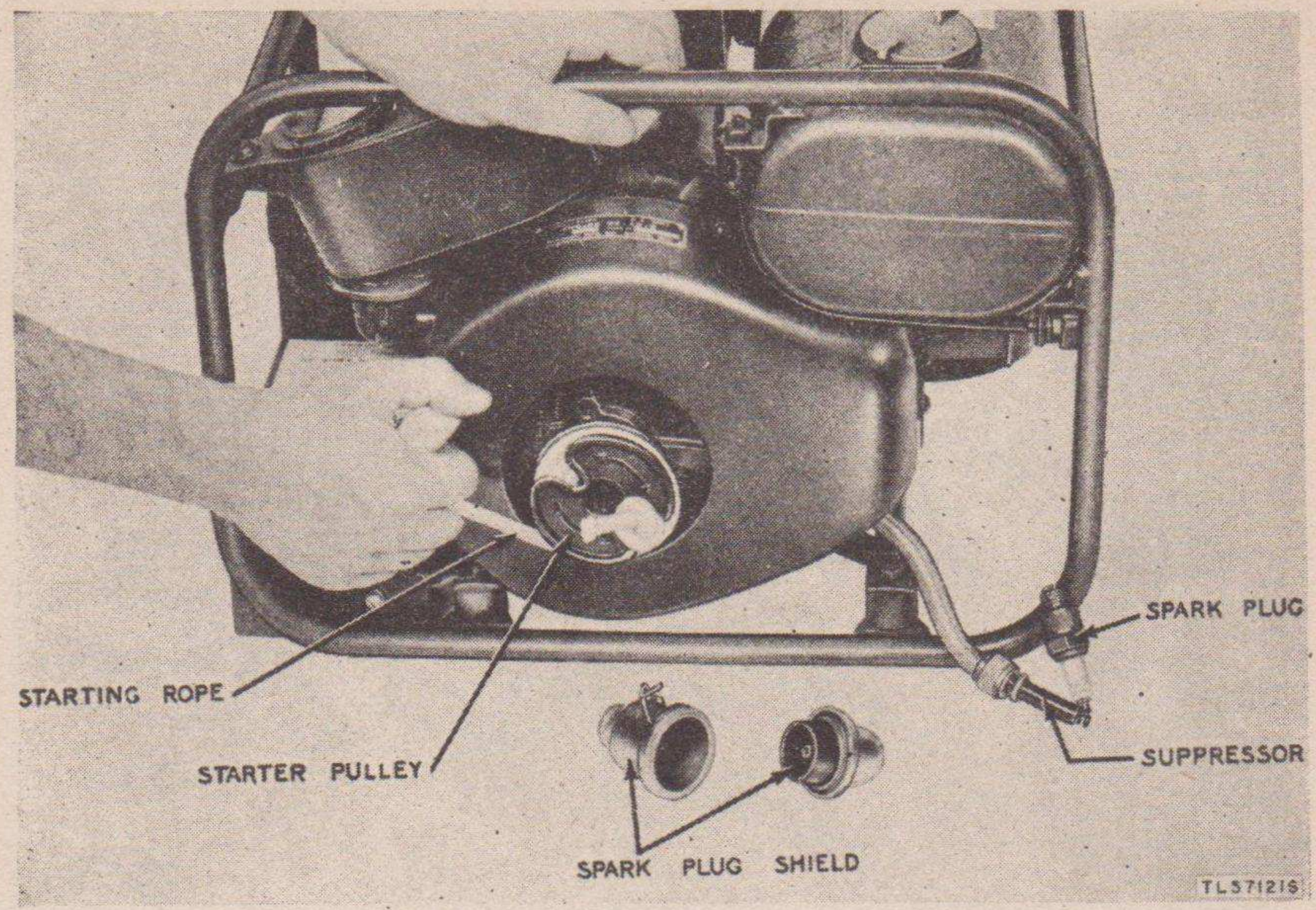


Fig. 29. Testing spark plug for spark

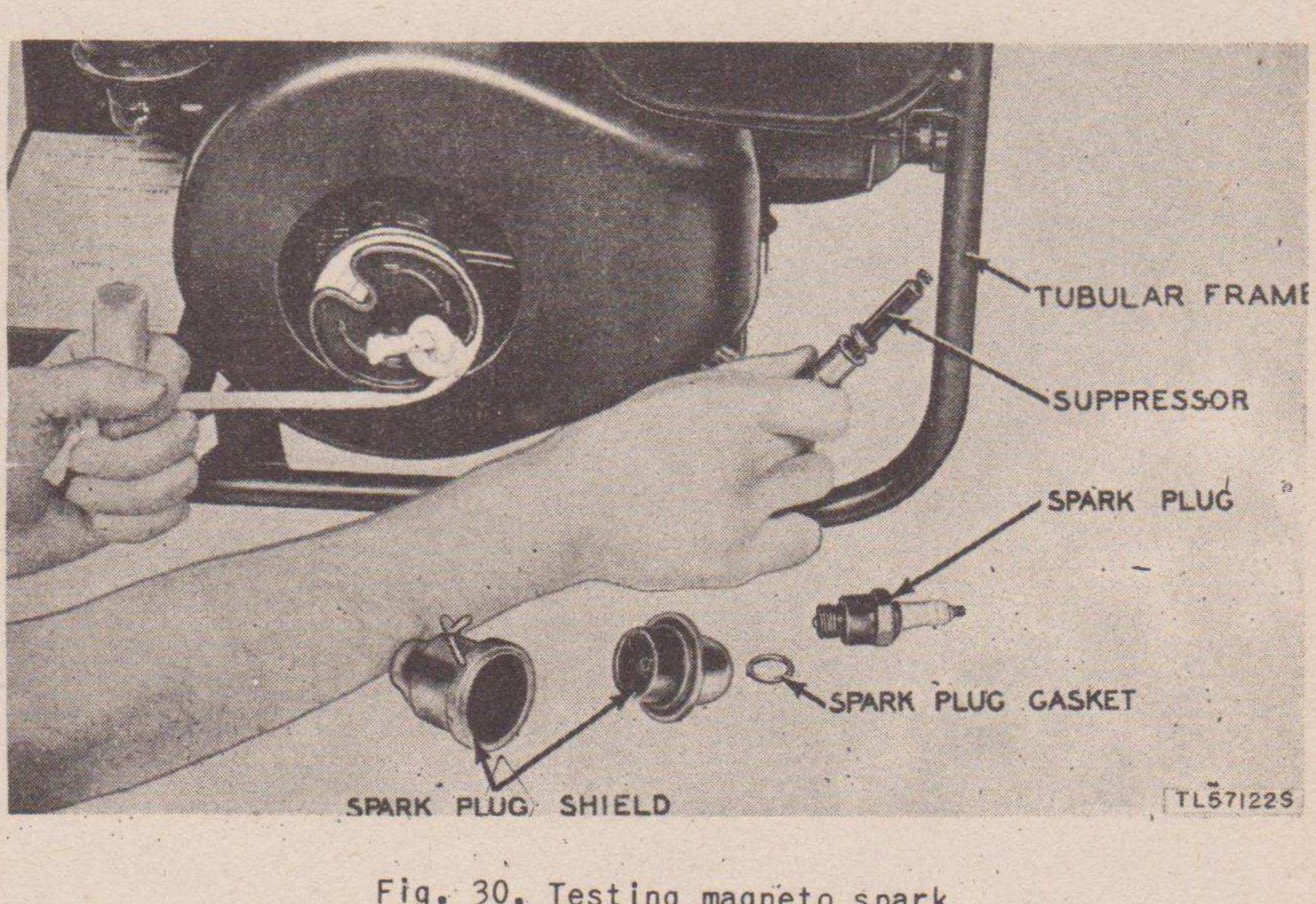


Fig. 30. Testing magneto spark

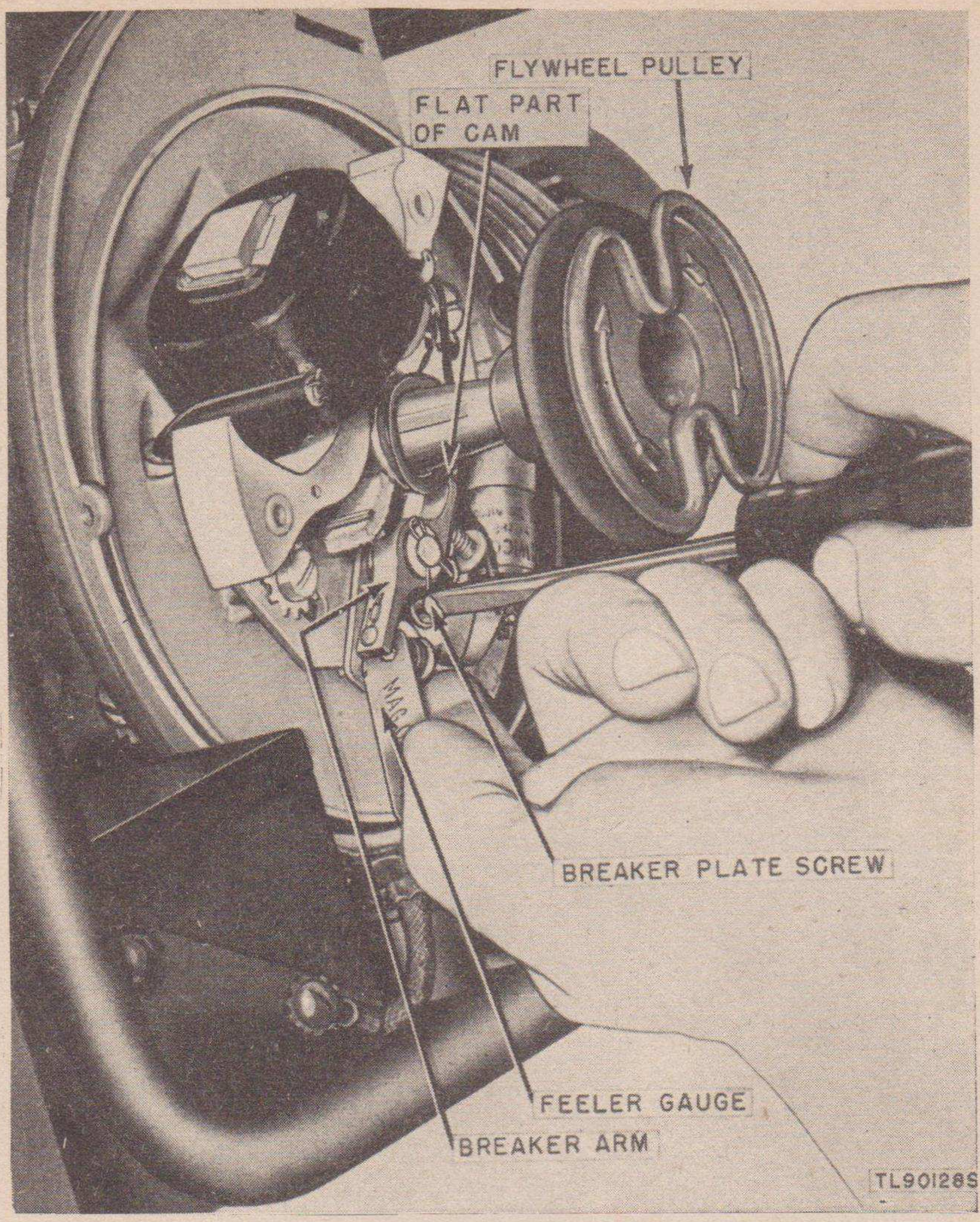


Fig. 31. Adjusting magneto breaker points

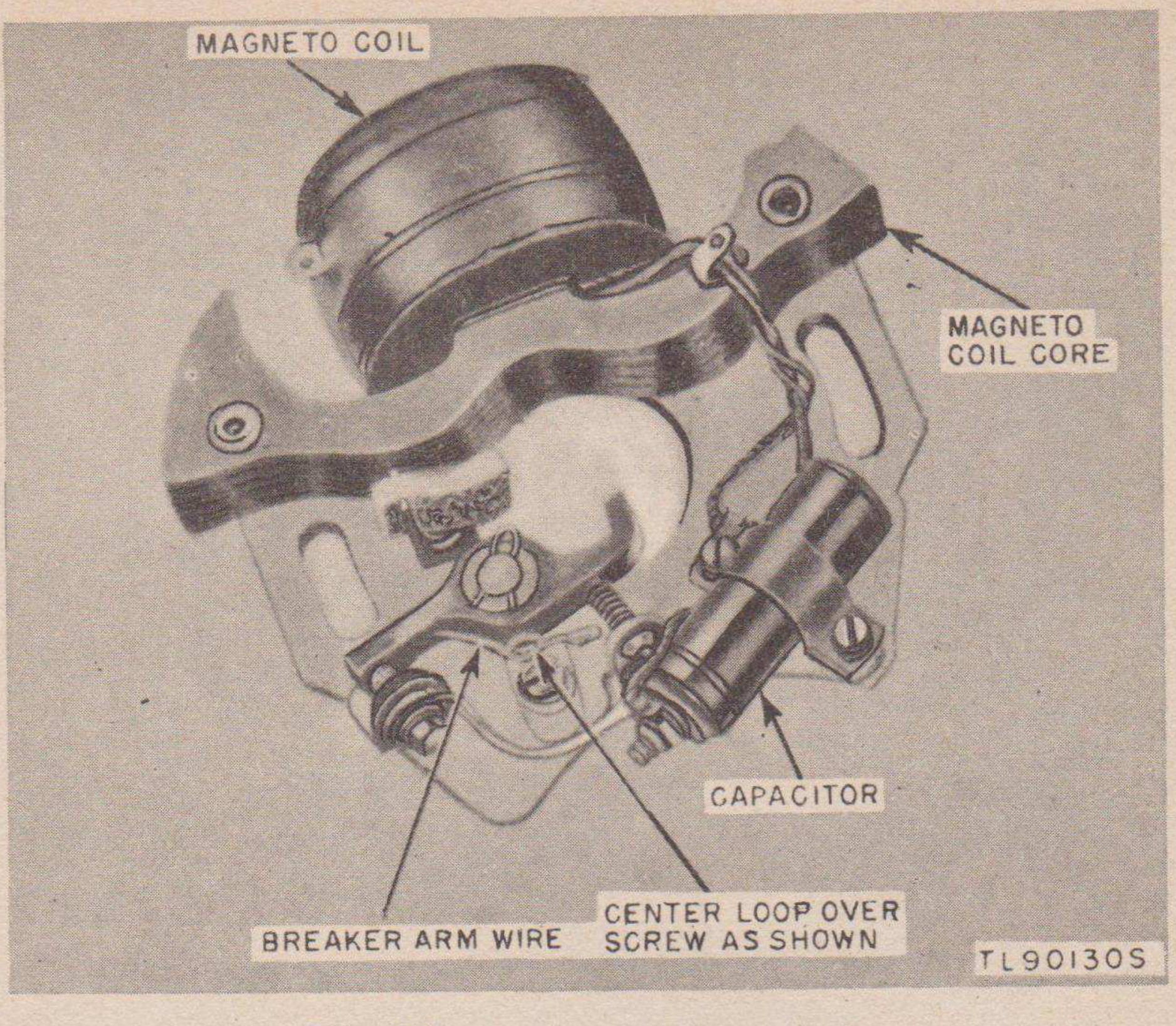


Fig. 32. Magneto stator plate

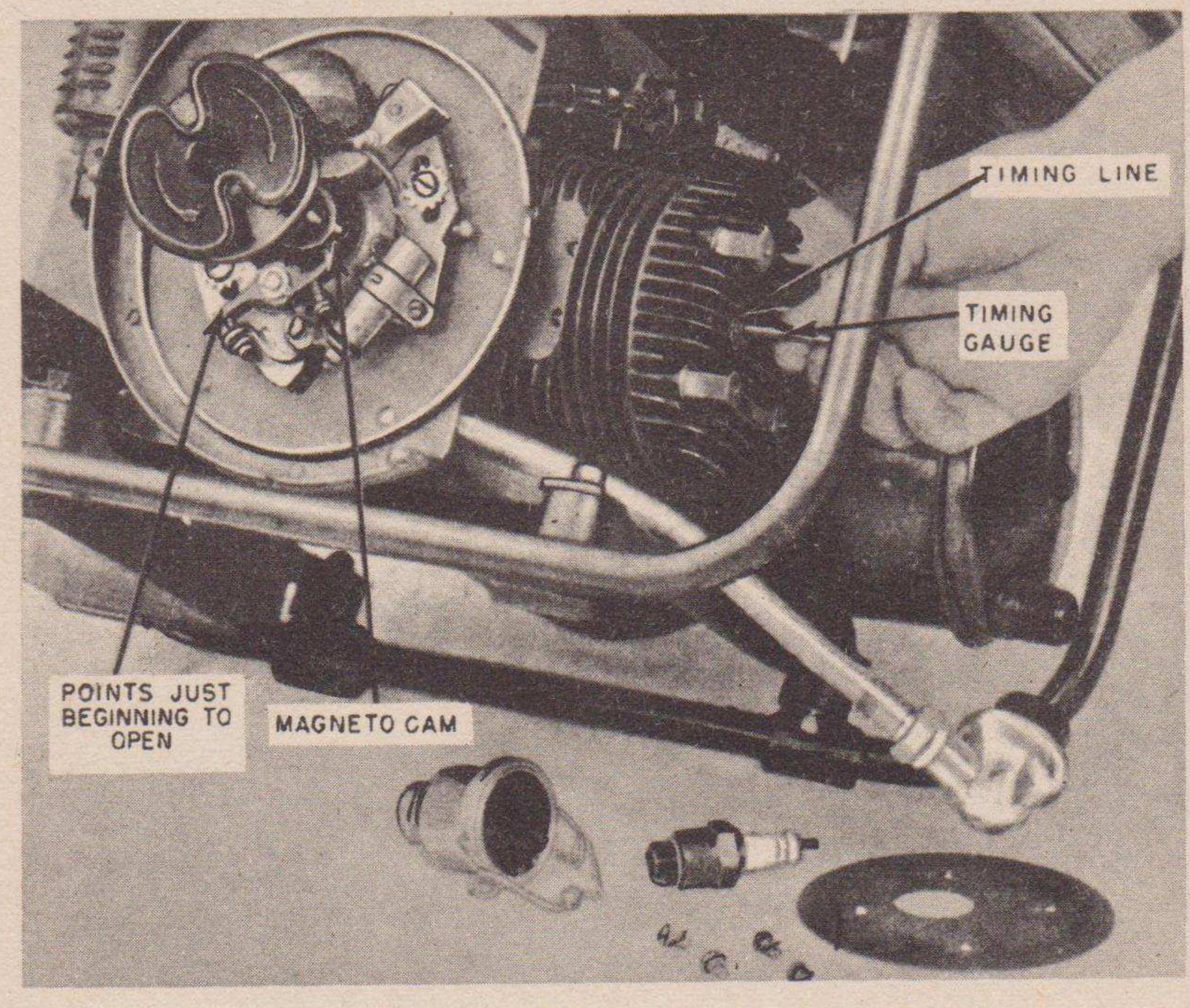


Fig. 33. Timing the magneto

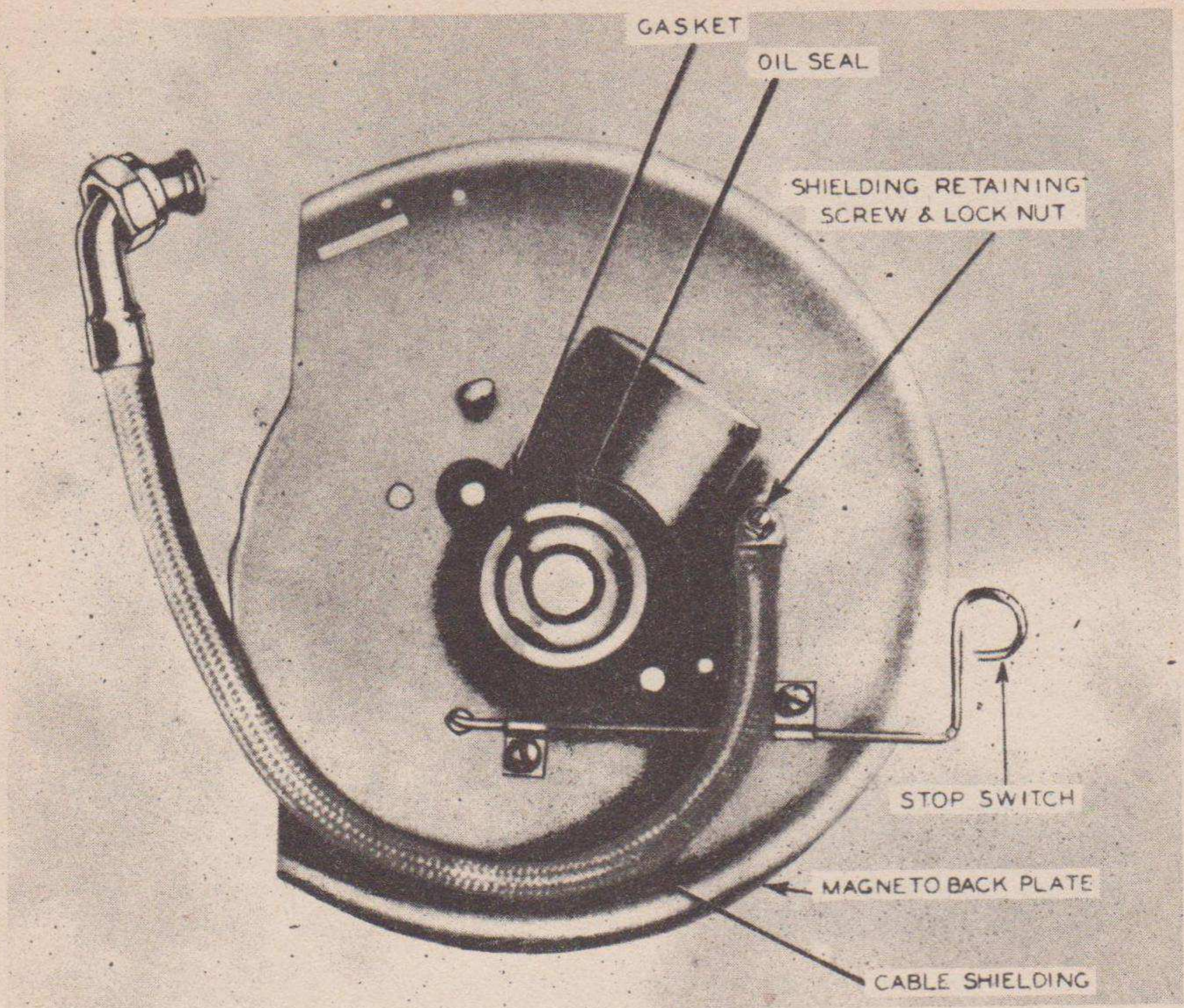


Fig. 34. Power Unit PE 210 B, magneto backplate and cable

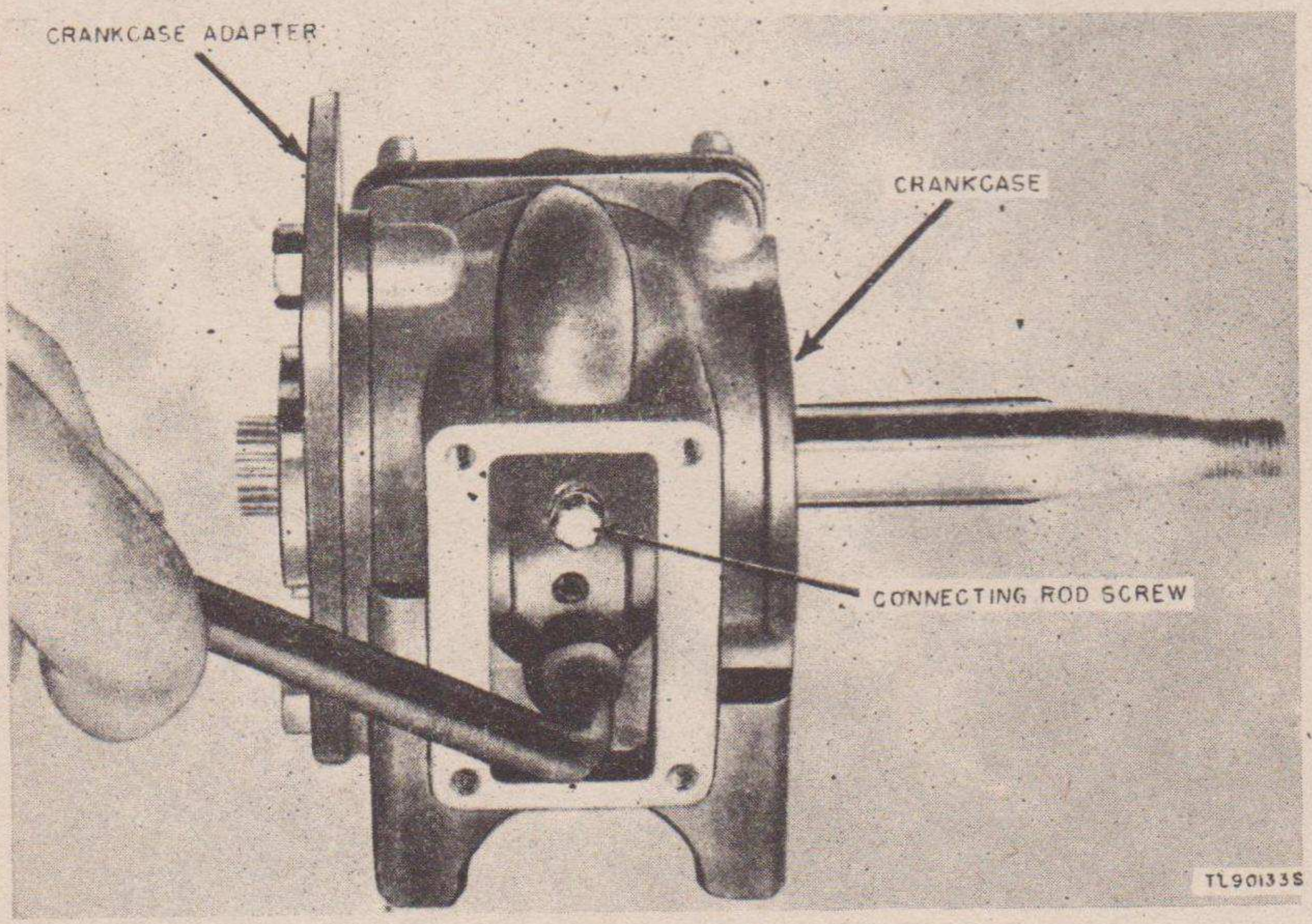


Fig. 35. Removing connecting rod screws

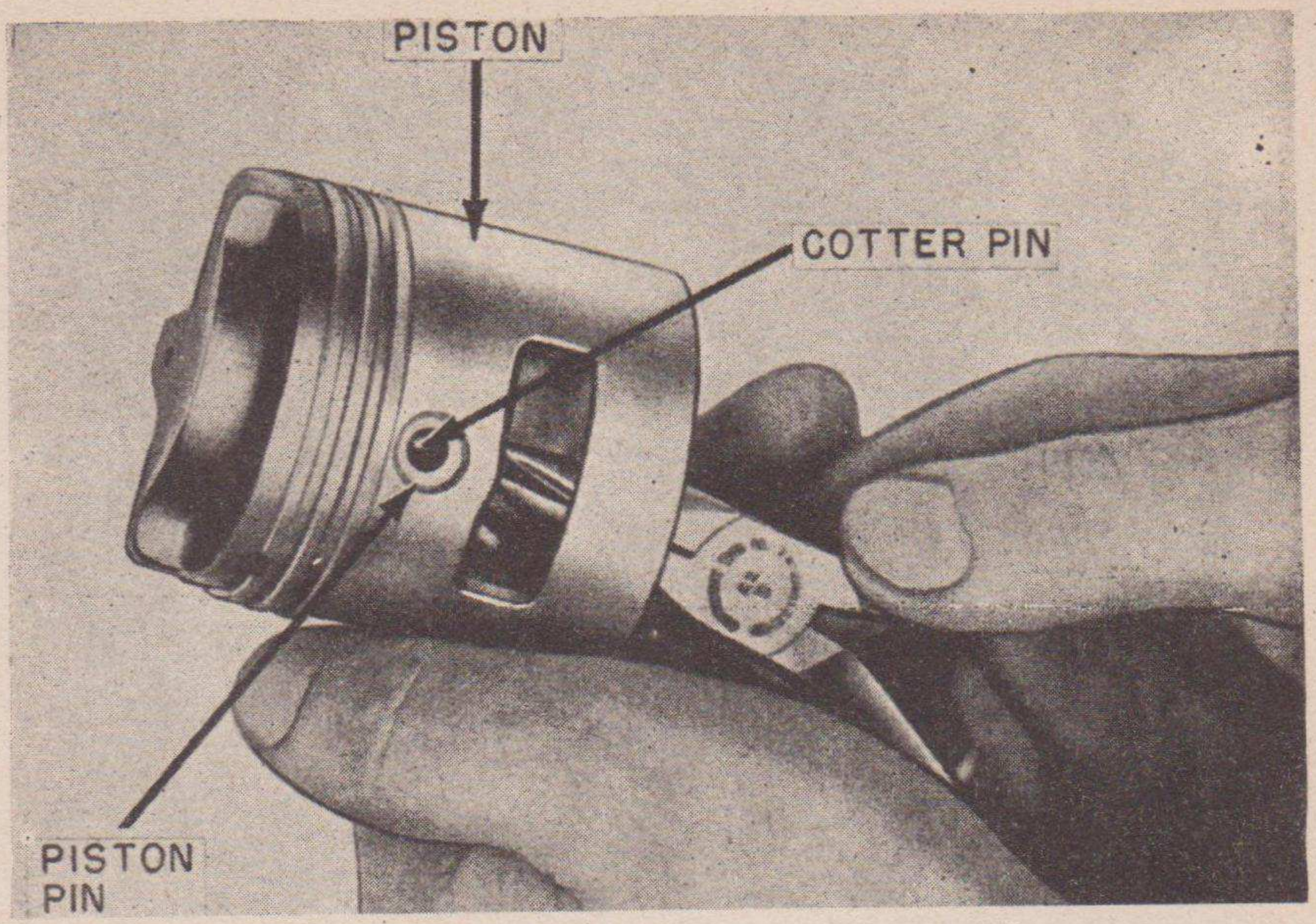


Fig. 36. Removing cotter pin from piston

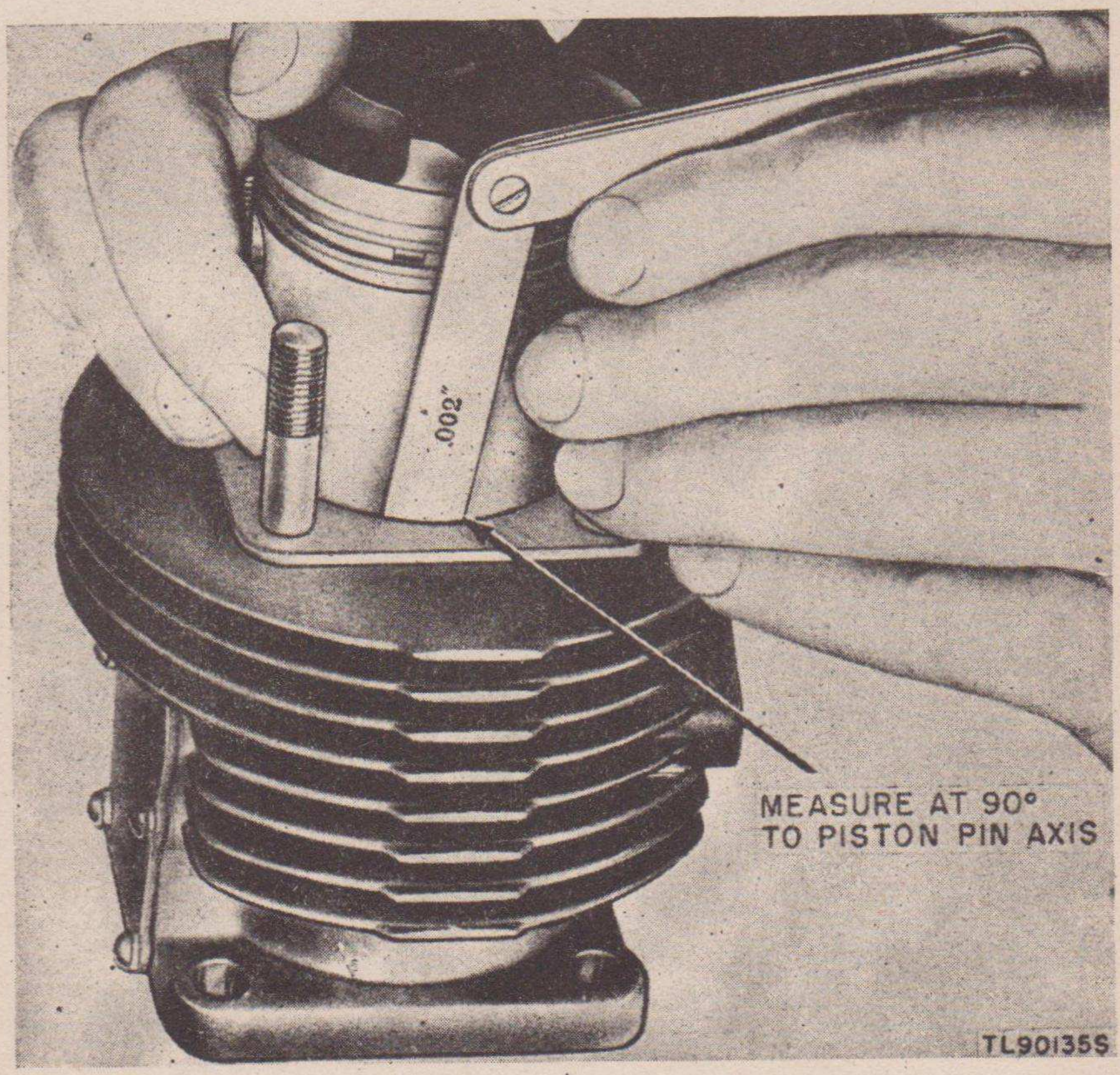


Fig. 37. Checking piston skirt clearance

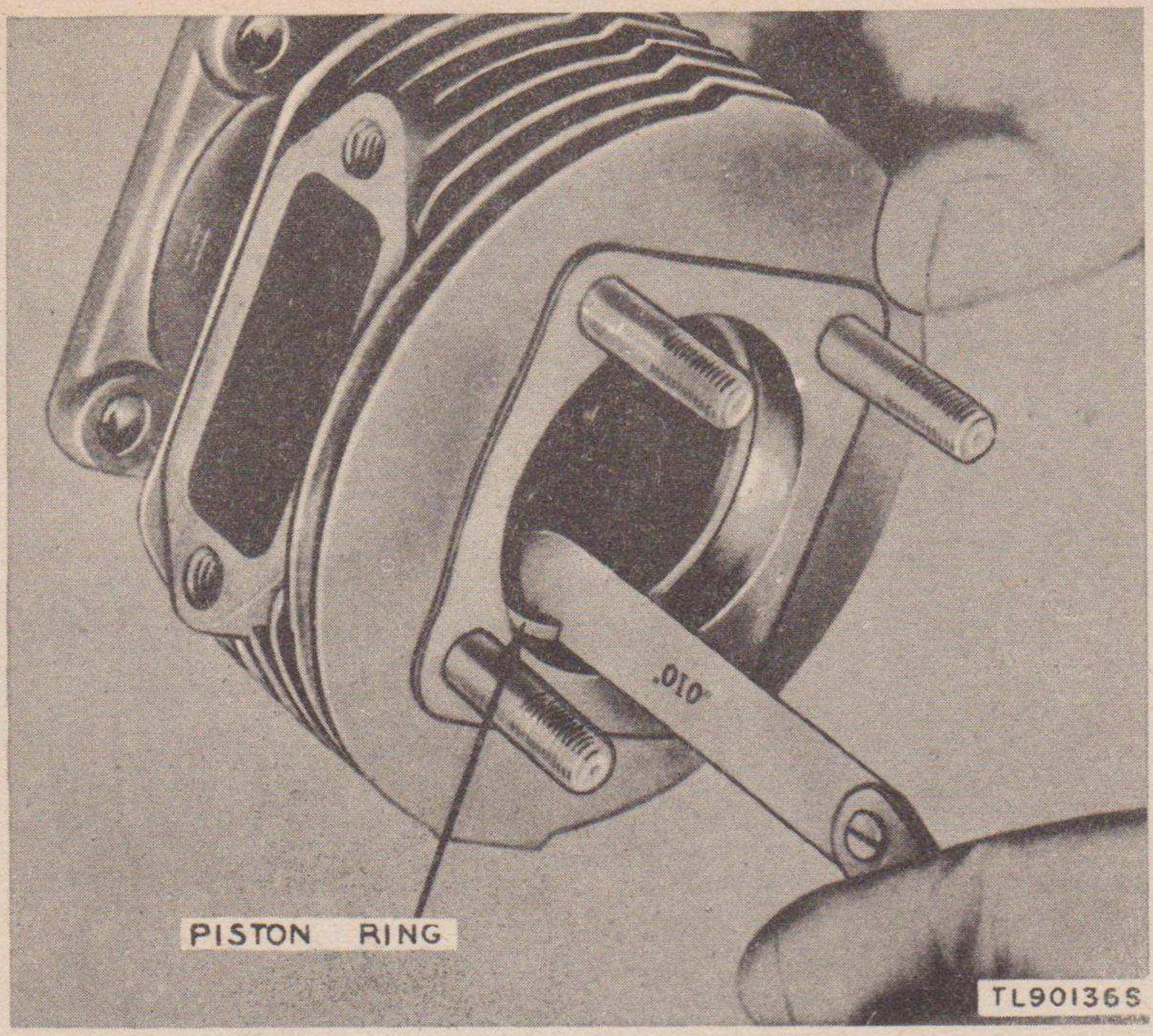


Fig. 38. Checking piston ring gap

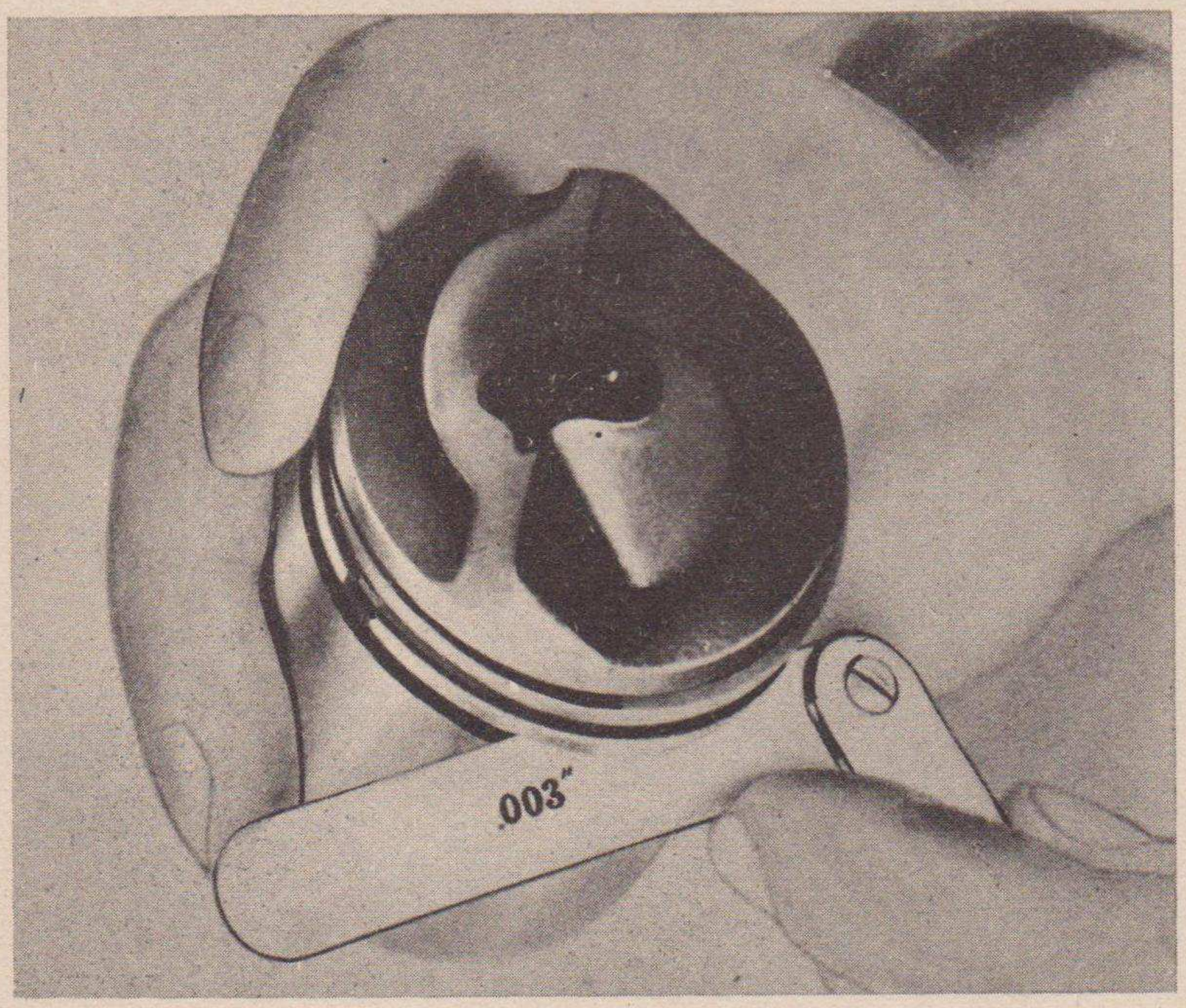


Fig. 39. Checking piston ring clearance

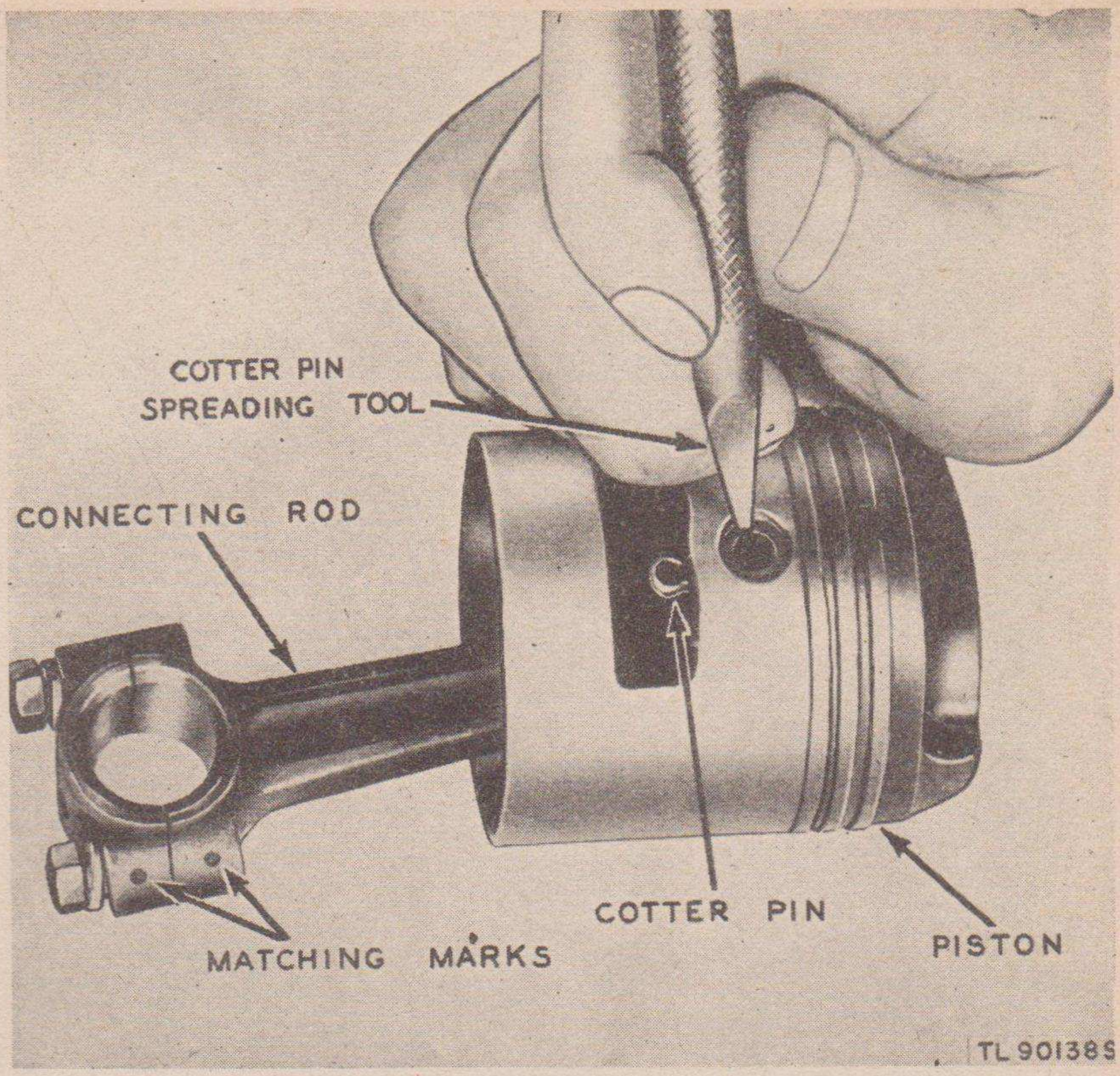


Fig. 40. Installing cotter pin in piston

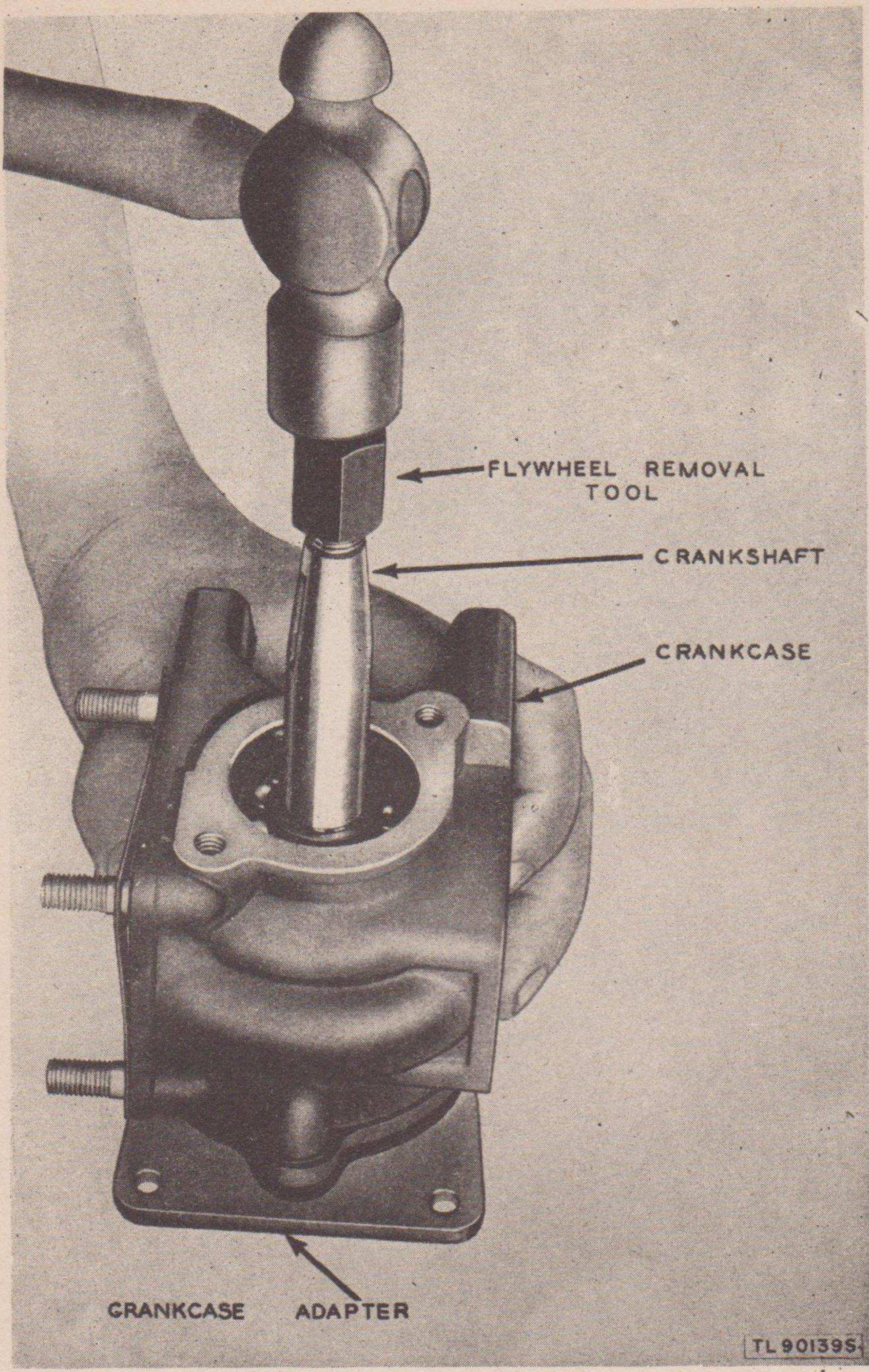


Fig. 41. Removing crankshaft and crankcase adapter

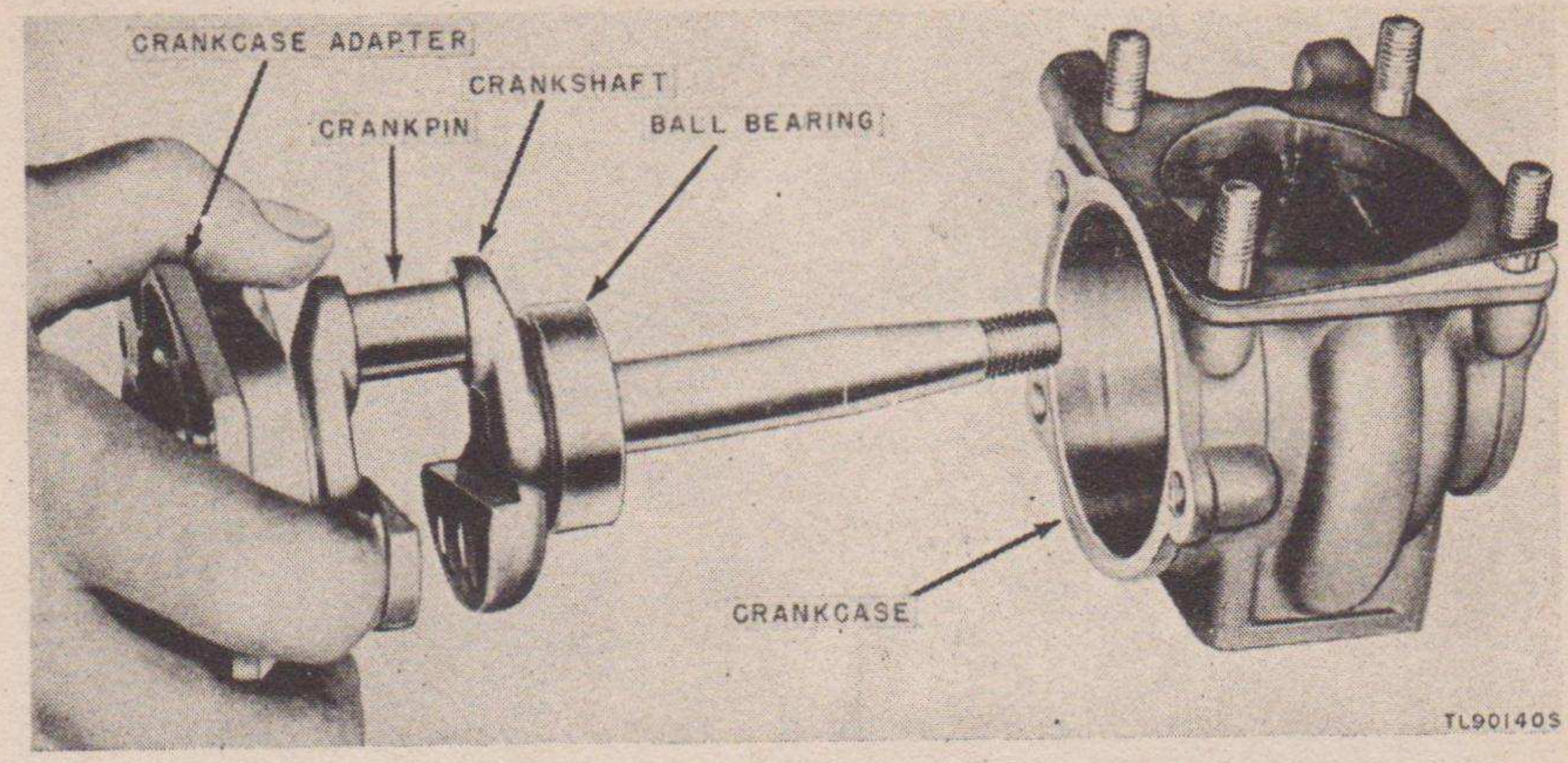


Fig. 42. Crankcase bearings and crankcase adapter removed from crankcase

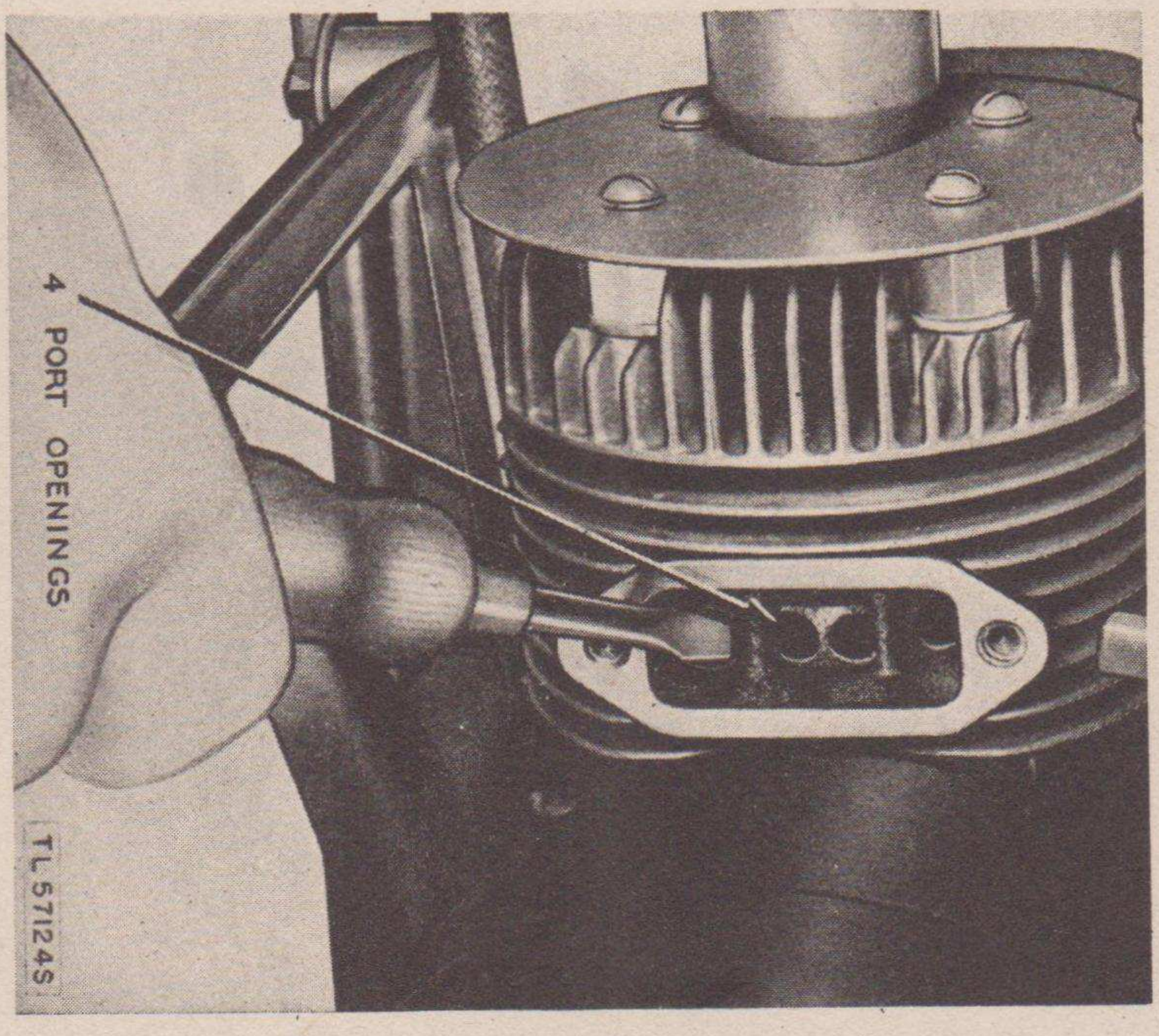


Fig. 43. Carbon removal, exhaust ports

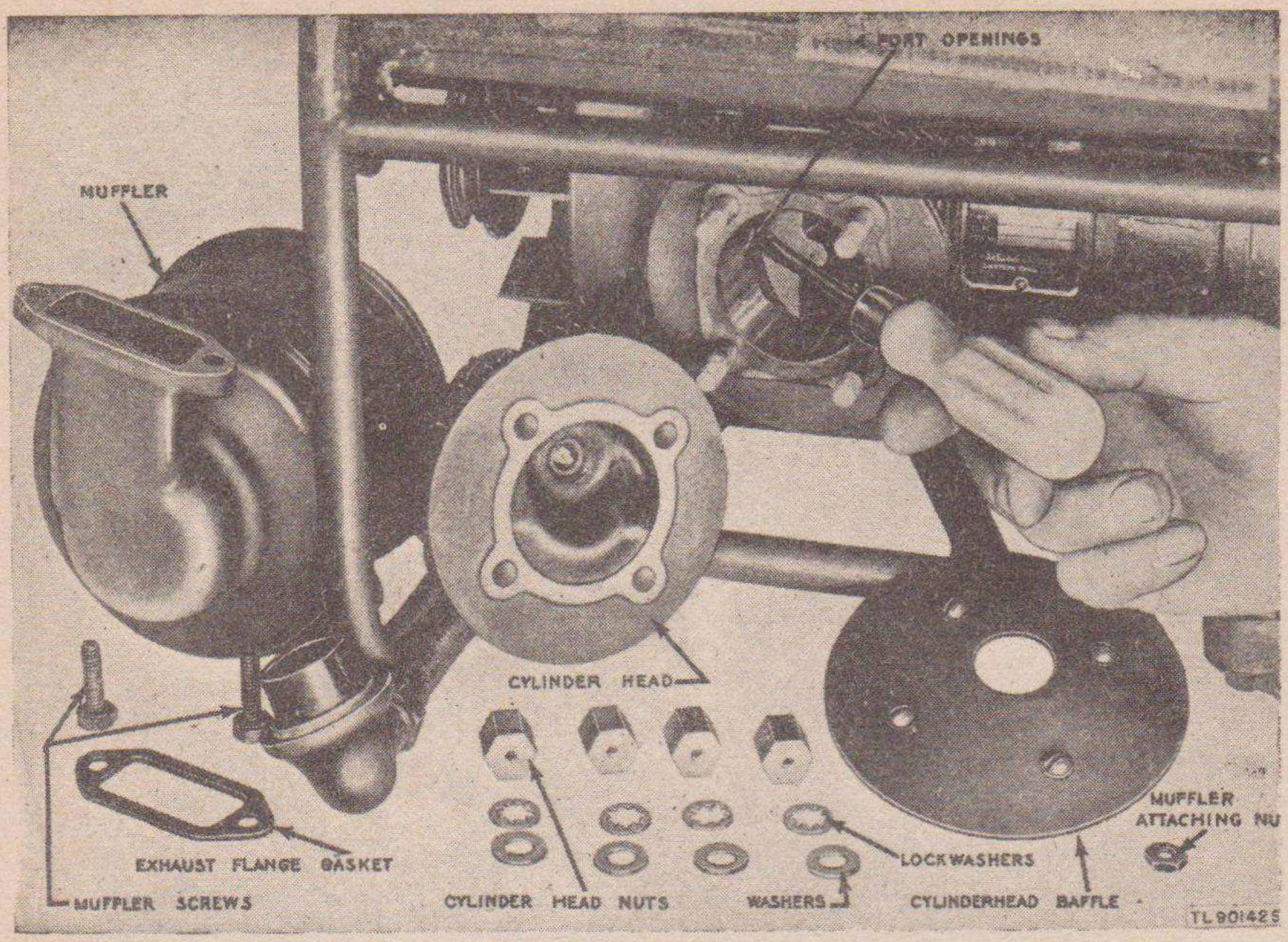


Fig. 44. Carbon removal, intake ports

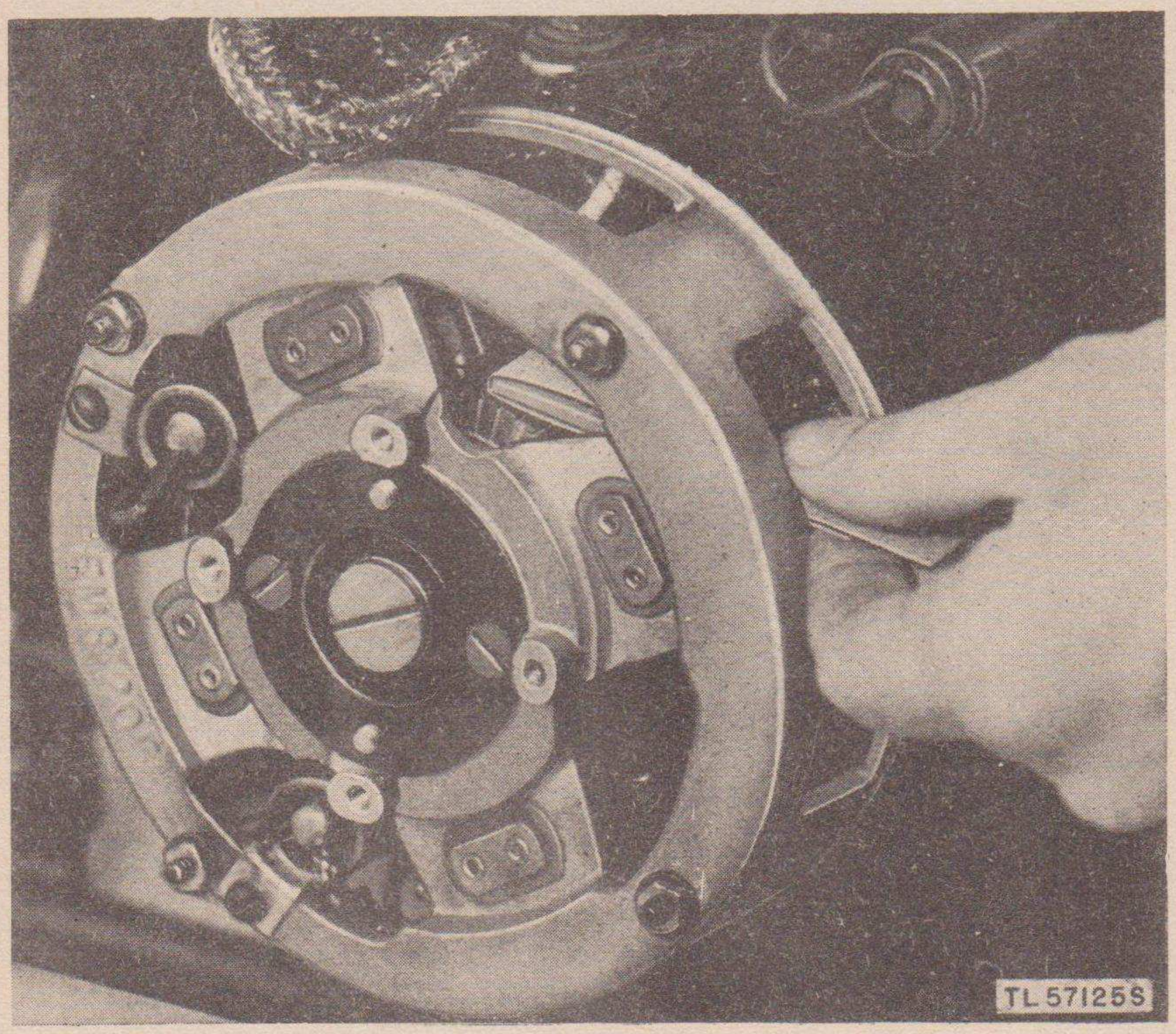


Fig. 45. Dressing the commutator

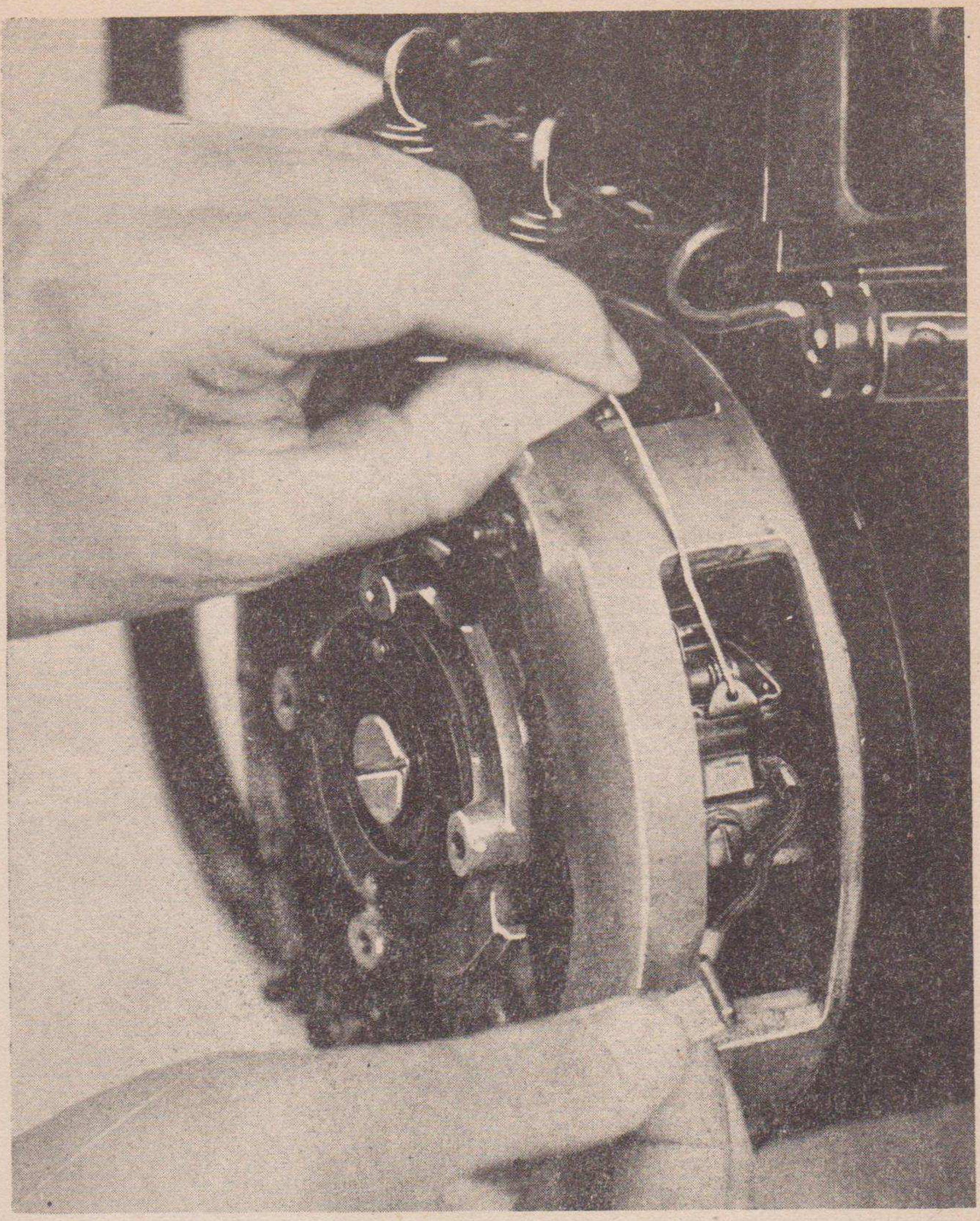


Fig. 46. Removing generator brush

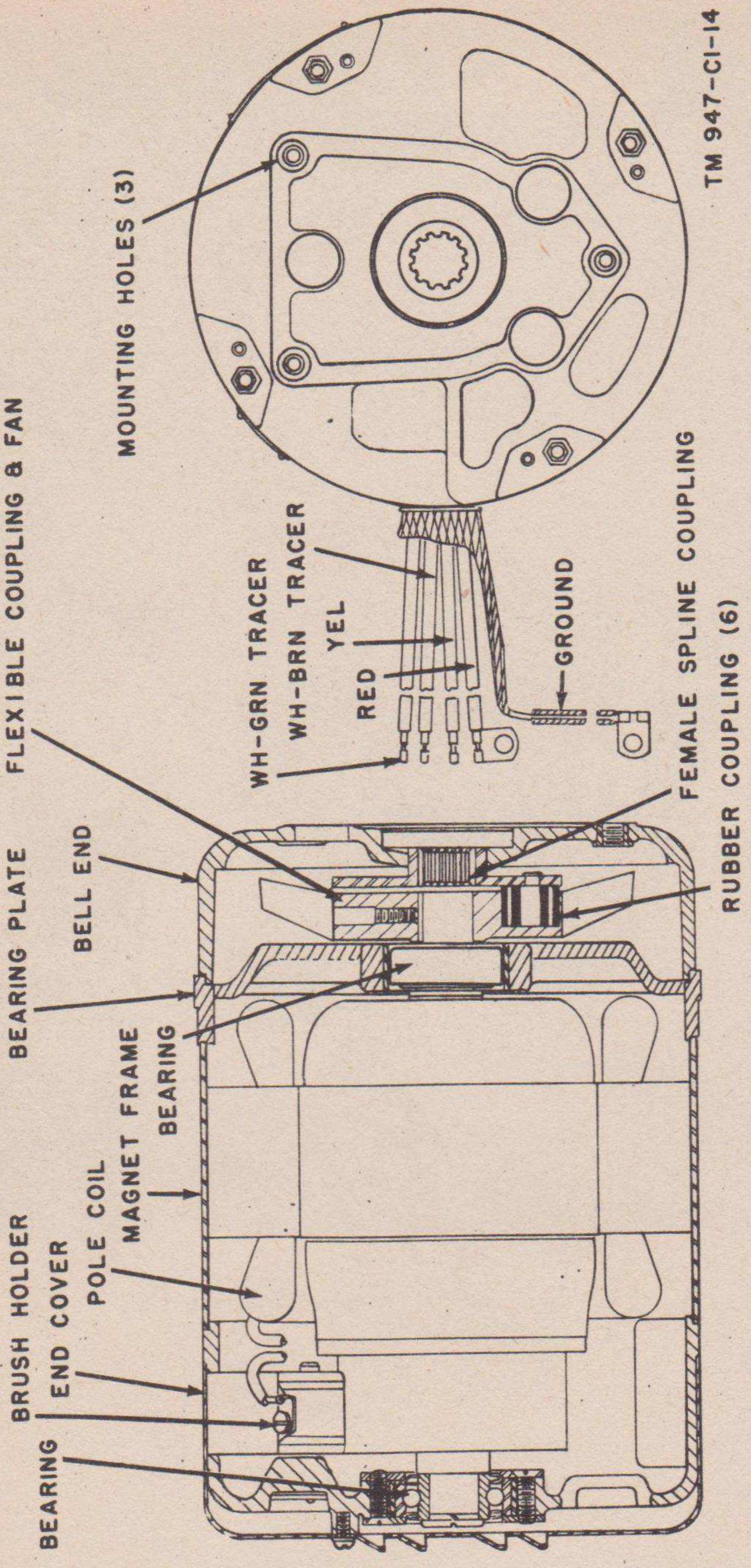


Fig. 47. Power Unit PE 210 B, generator, cross-sectional view

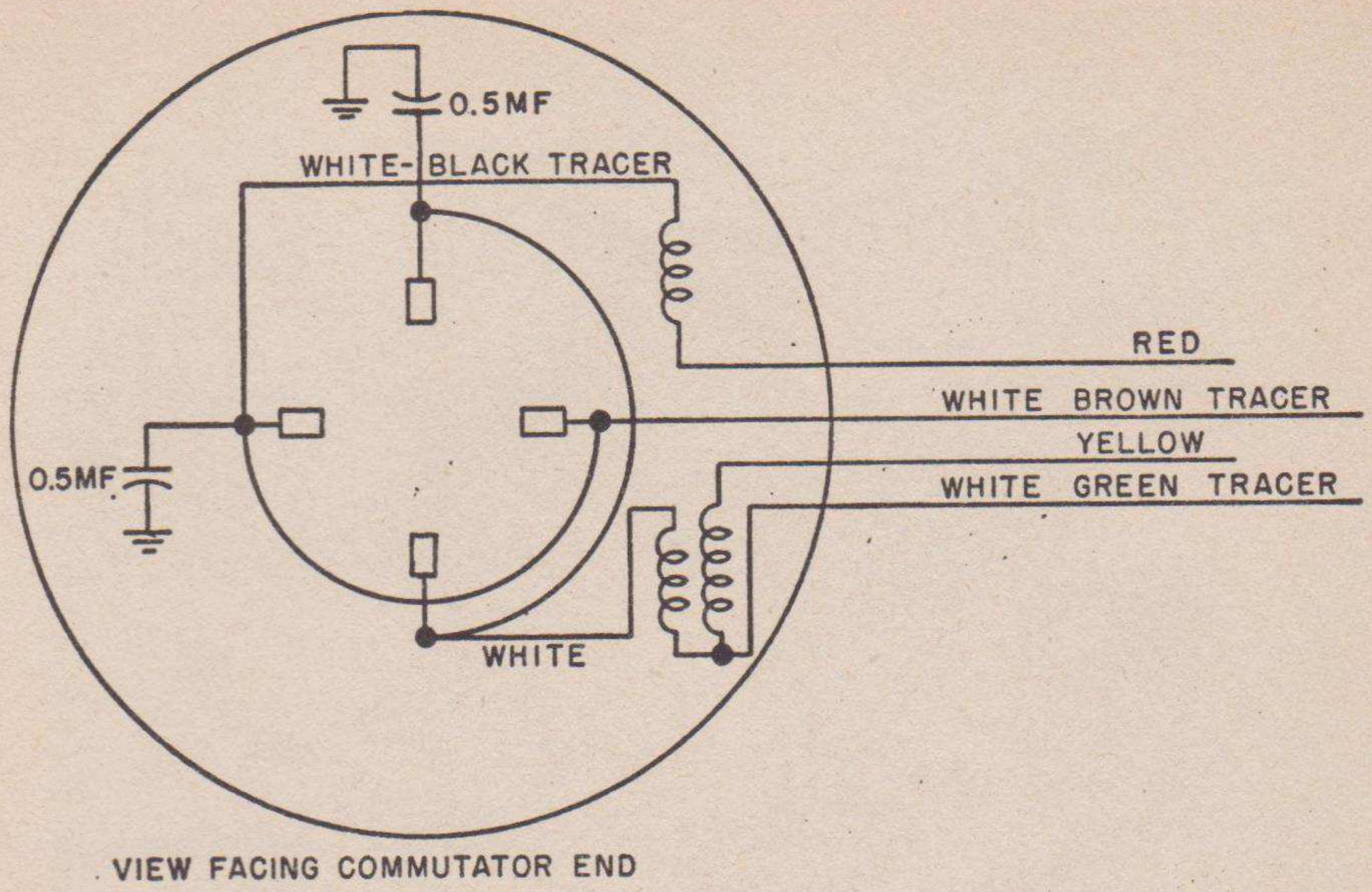


Fig. 48. Generator brush connections

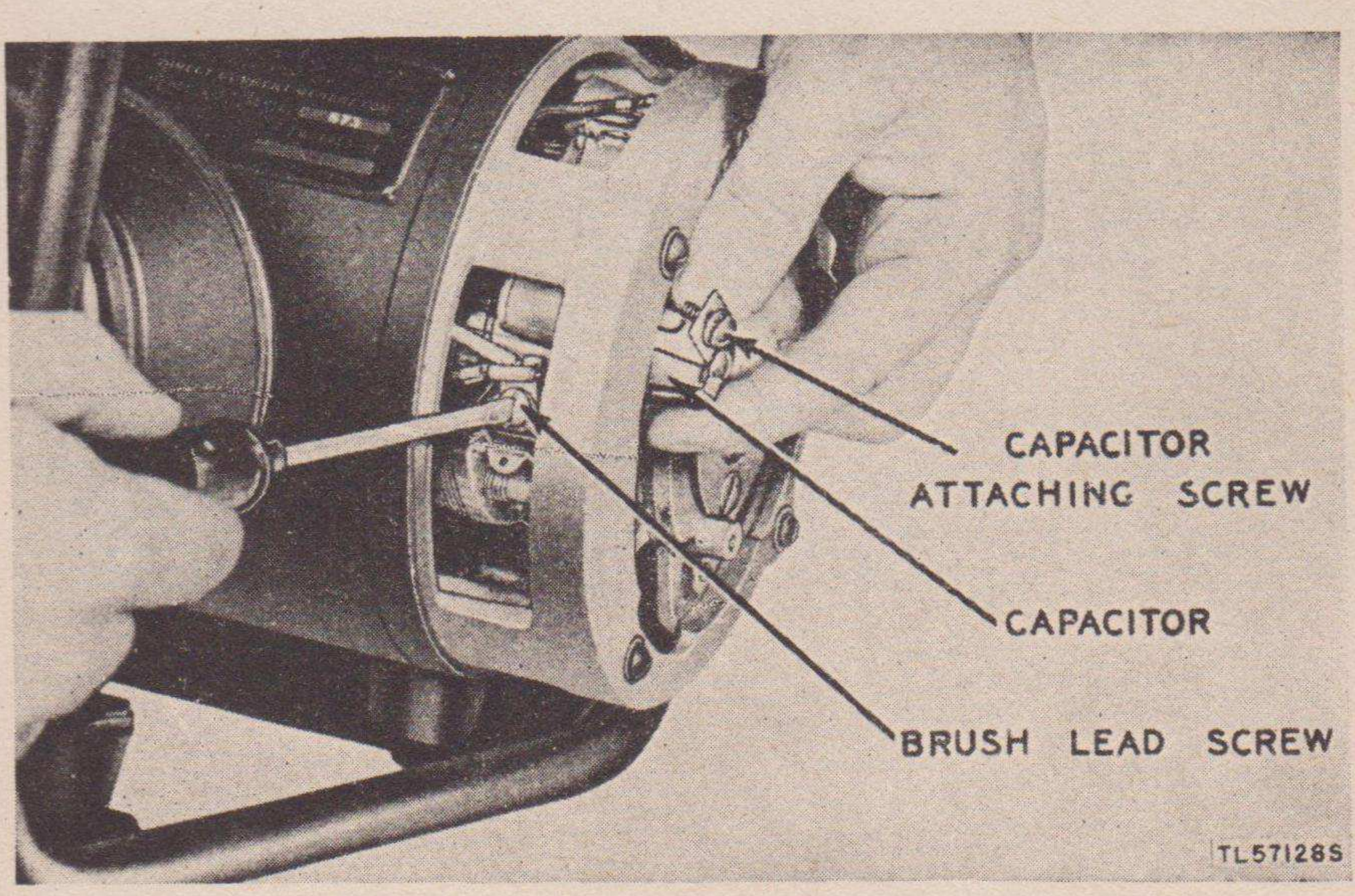


Fig. 49. Replacing generator capacitor

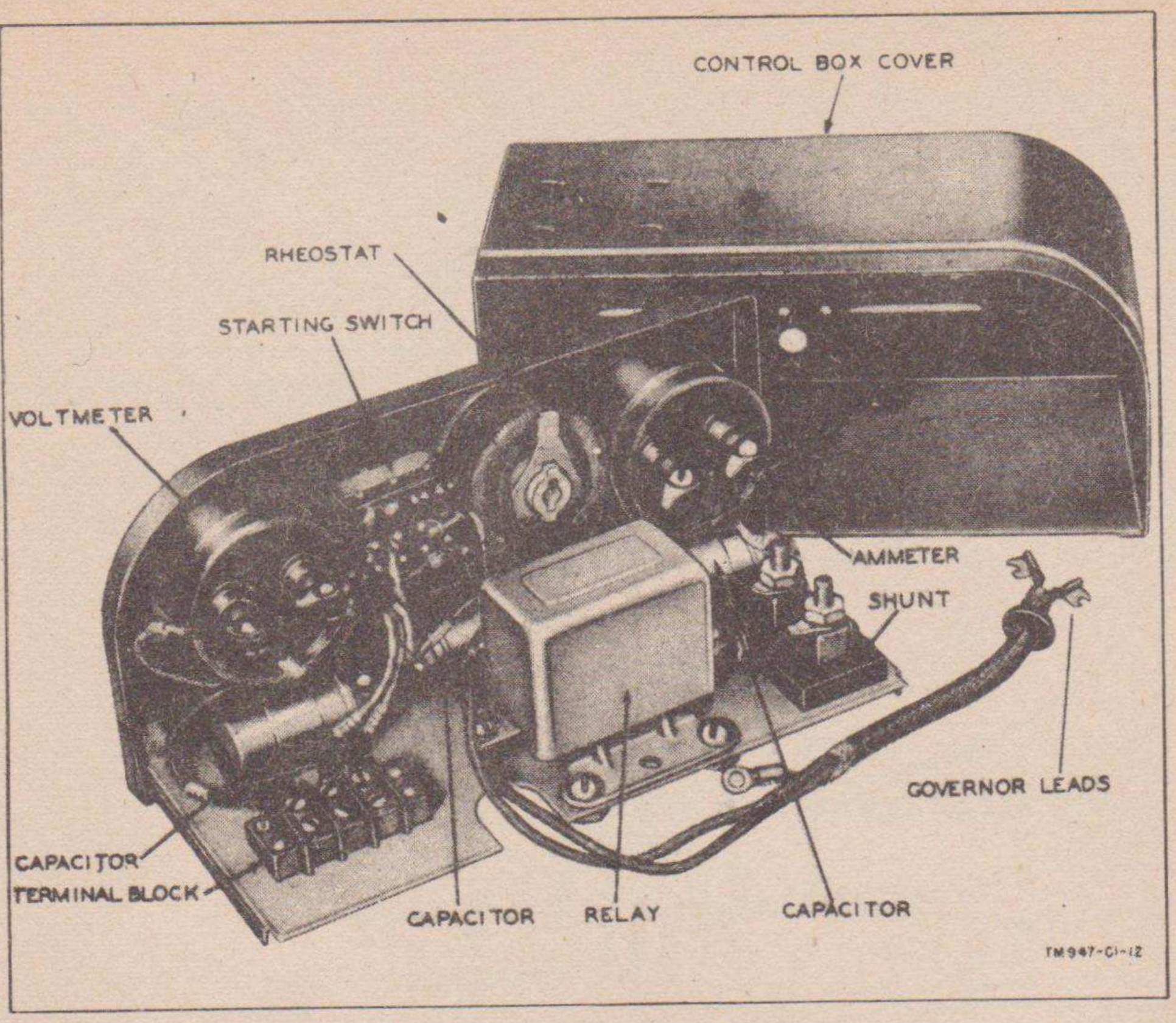


Fig. 50. Power Unit PE 210 B, Generator Control C-890/U

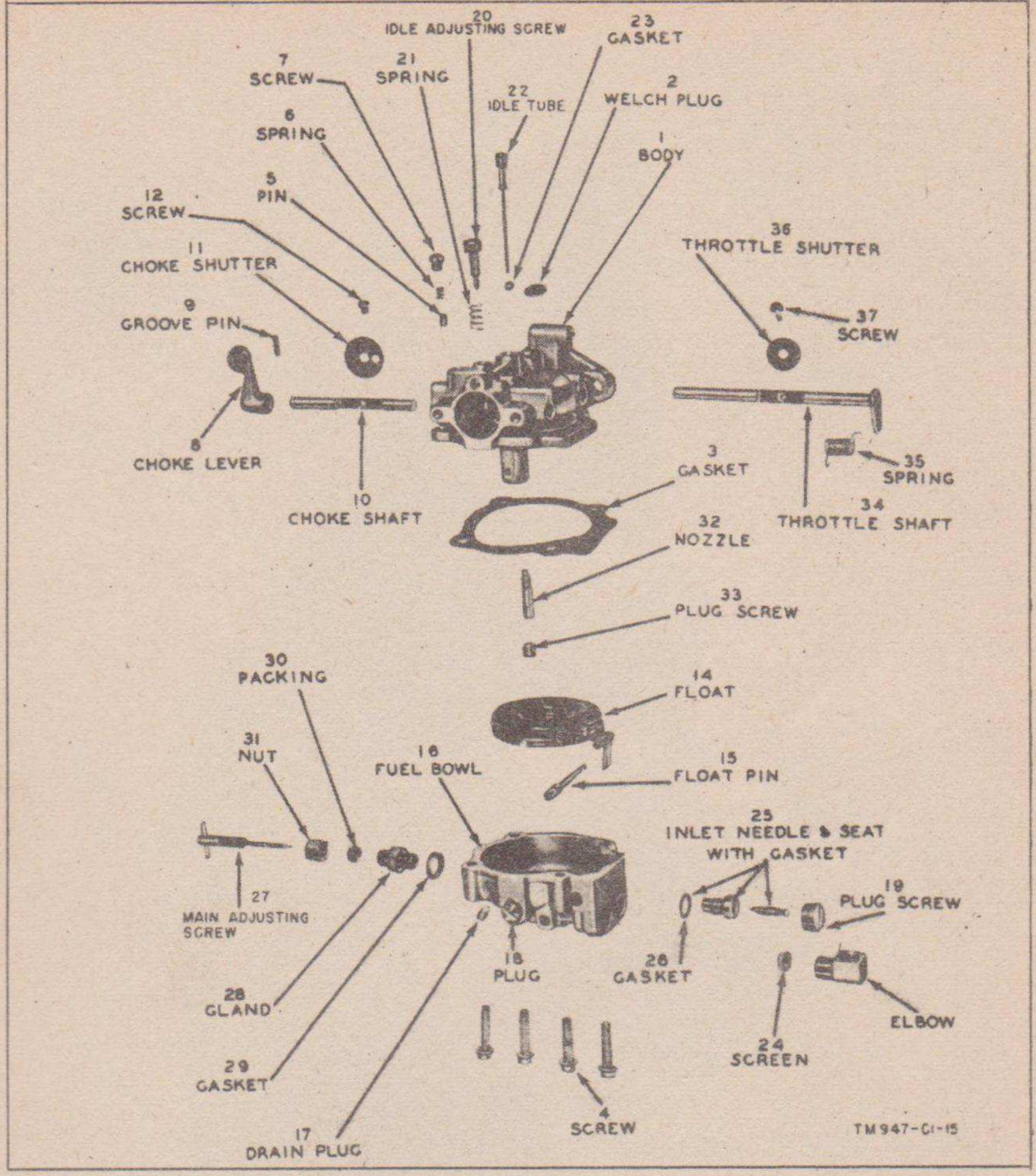


Fig. 51. Power Unit PE 210 B, Carburetor, exploded view

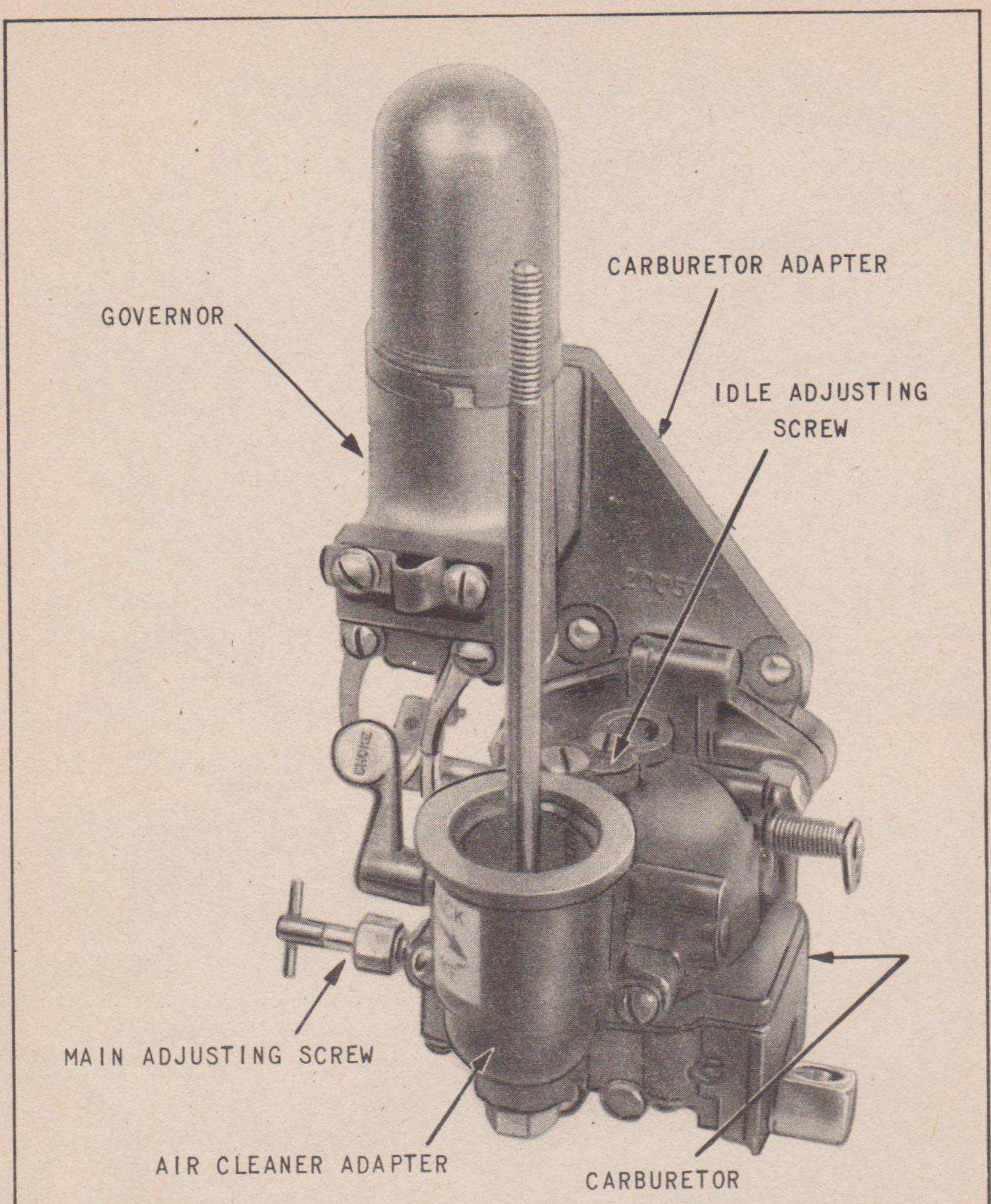


Fig. 52. Carburetor, carburetor adapter and governor

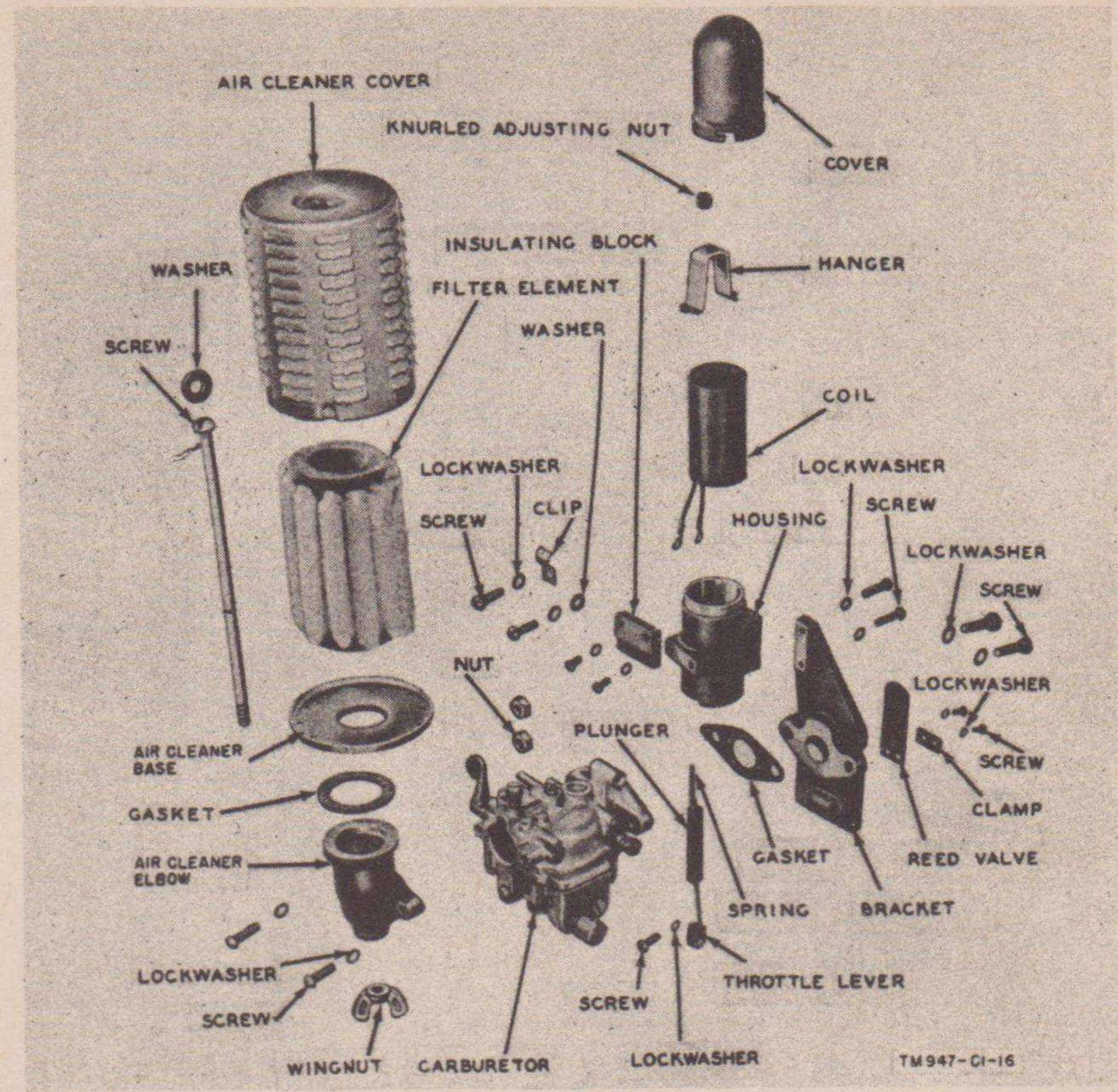


Fig. 53. Power Unit PE 210 B, governor, carburetor and air cleaner, exploded view

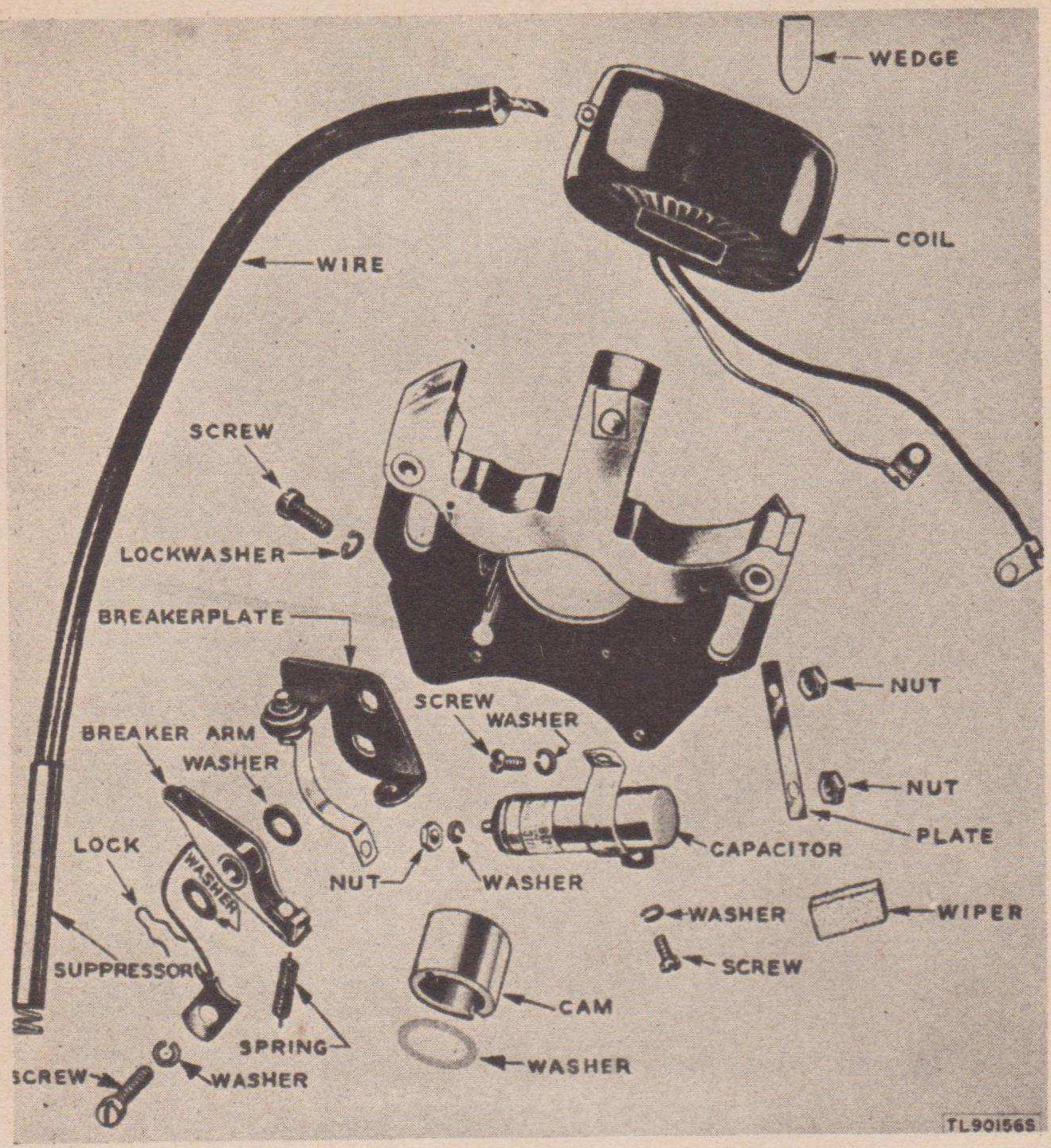


Fig. 54. Magneto stator-plate assembly

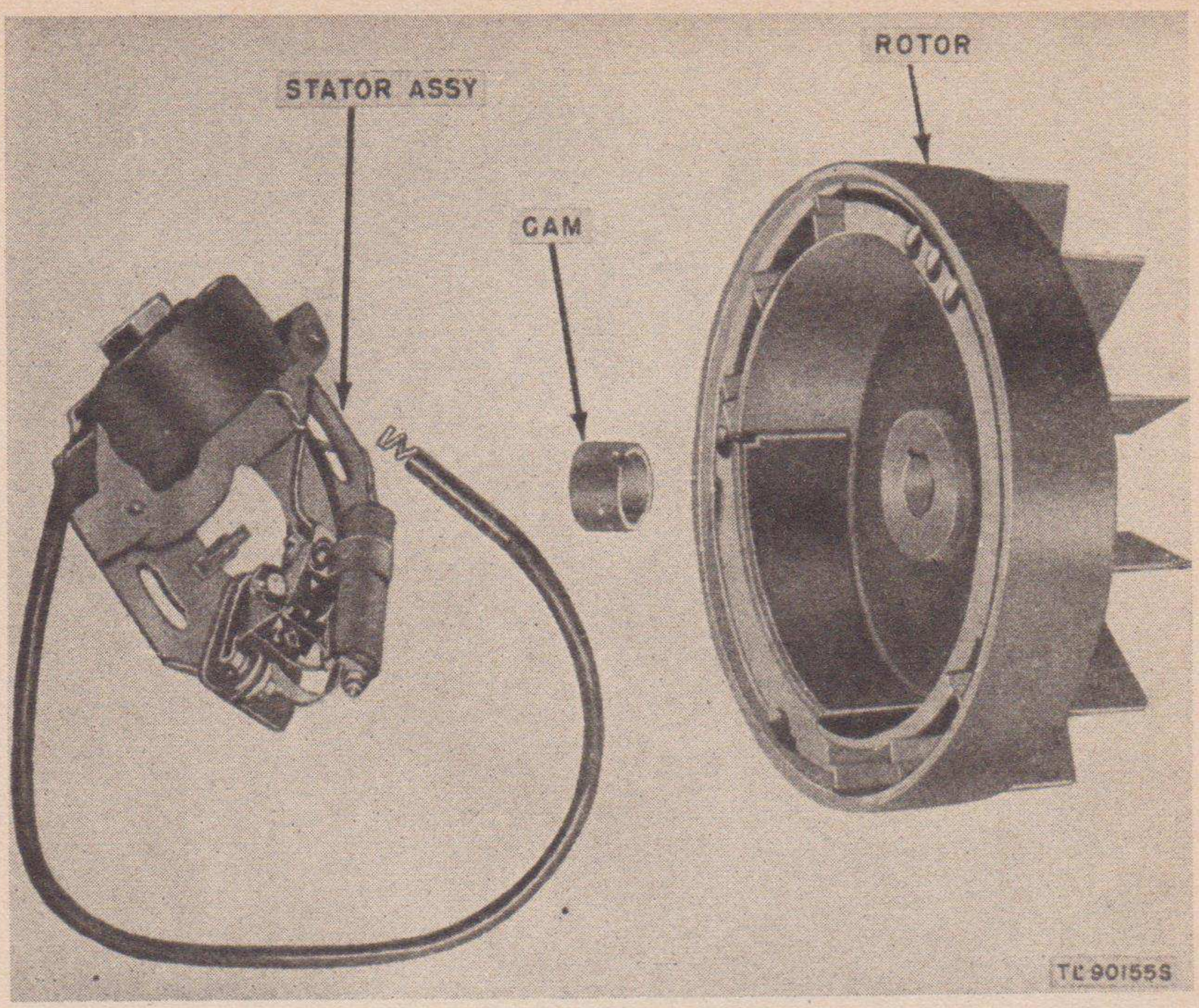


Fig. 55. Magneto assembly

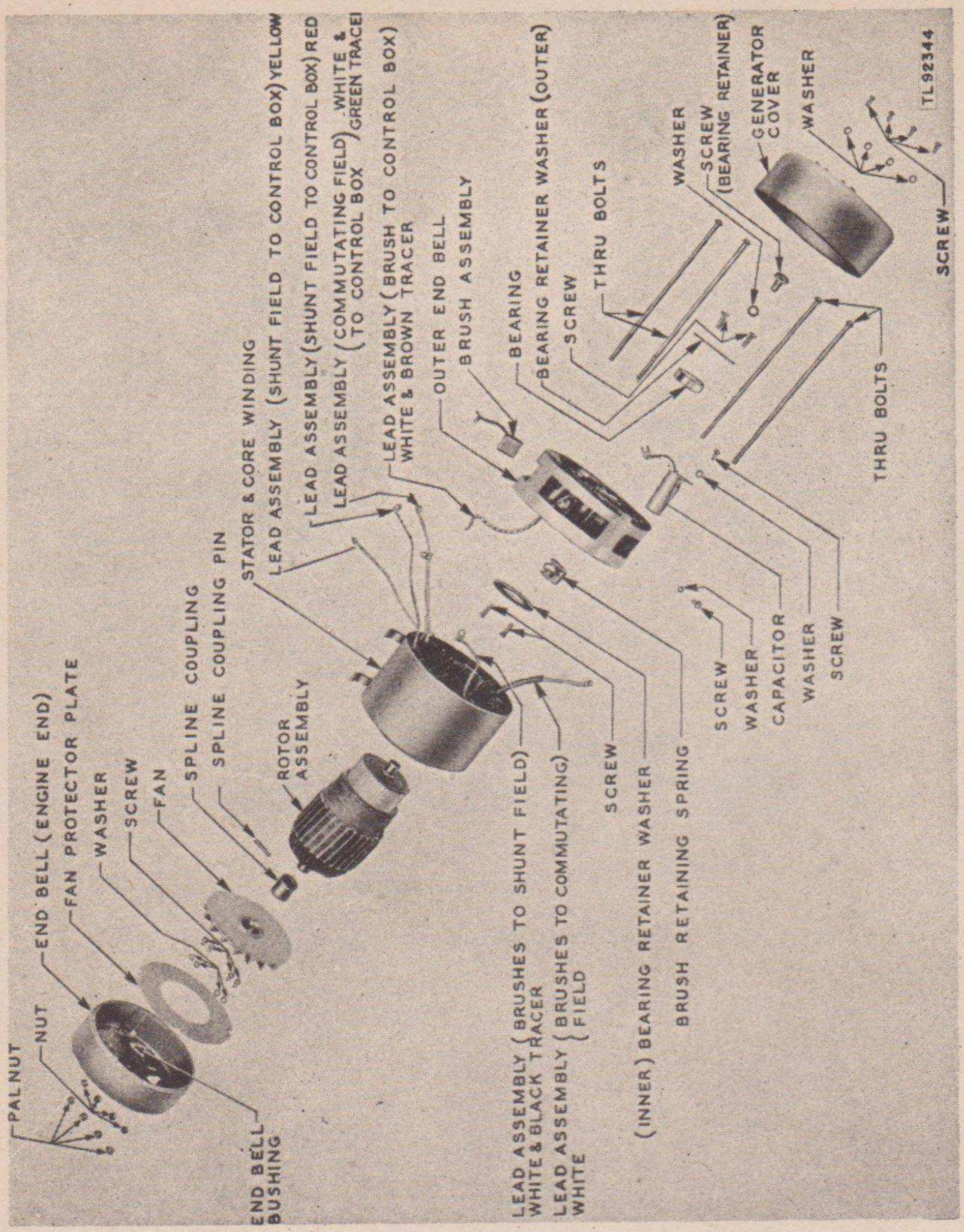


Fig. 56. Generator assembly

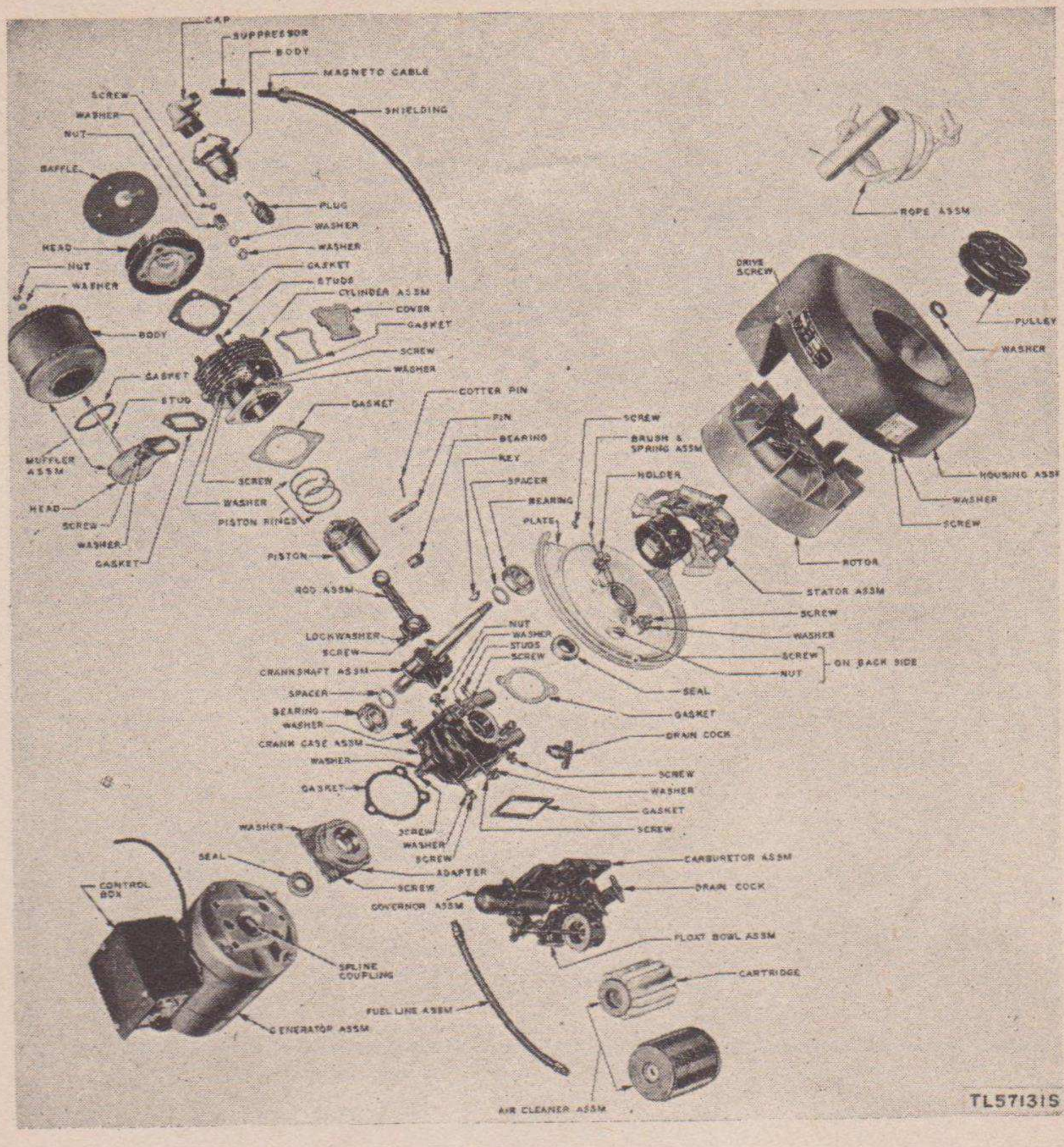


Fig. 57. Engine and generator, exploded view

WAR DEPARTMENT LUBRICATION ORDER

LO 11-947

15 September 1947 (Supersedes WDLO 3054, 4 May 44)

POWER UNITS, PE-210 AND PE-214-B

References: TM 11-947 (PE-210) and TM 11-945 (PE-214-B).

Interval	Lubricant	
Each Refill	OE	**FUEL TANK** Fuel mixture must consist of 1 part oil to 16 parts gasoline or ½ pint oil to each 1 gallon of gasoline. Use separate container to mix fuel. Oil measure is attached to fuel tank cap. Use 2 full measures of OE to 1 gallon of gasoline. Mix oil and gasoline **THOROUGHLY** before pouring into fuel tank. Open fuel tank air vent cock before operating. **CAUTION:** Do not operate engine with gasoline only. Approximate capacity: 1 gallon.

KEY

OE—Oil, engine, OE 10. All temperatures

NOTES

1. **Do Not Lubricate—**
   Generator Bearing, Carburetor Air Cleaner.
2. **Lubricated After Disassembly by Higher Echelon—**
   Magneto, Breaker Arm Pivot and Cam Wiper Felt Pad.

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

BY ORDER OF THE SECRETARY OF WAR:

DWIGHT D. EISENHOWER
Chief of Staff

OFFICIAL:
EDWARD F. WITSELL
Major General
The Adjutant General

Fig. 58. Lubrication Order 10-11-947