Dirty or warped valves.	Remove valve plugs and valves. If valves are damaged or warped, replace them. Examine valve seats to make certain that there are no irregularities which prevent proper seating of valves. Place valves in valve chambers. Reassemble valve plugs and spring, making certain that springs are around the lower stems of the valve plugs properly. Use new gaskets under valve plugs if necessary.

Fuel Leakage at Edge of Diaphragm

Check as follows:

CAUSE	REMEDY
Loose cover screws.	Tighten cover screws alternately and securely, also check inlet and outlet pipe connections.

NOTE: Check to see whether leak occurs at pipe fittings, allowing fuel to run down pump to flange, where it appears to originate. Do not use shellac or any other adhesive on diaphragm.

(2) Repairs which necessitate removal and disassembly of the pump.

IMPORTANT: Mark the top cover and body before disassembling so that in reassembling they are placed back in the same relative position.

c. Procedure in Assembling.

(1) Body, Rocker Arm, and Link Assembly.

The links used with the rocker arm are assembled together by a link pin in the hole nearest the larger rocker-arm pin hole. The movement of the linkage and pull rod is procured by the rocker arm striking this link pin.

(a) Assemble the two side pieces making up the linkage, using the link pin and clips.

(b) Attach the linkage to the pull rod, using link pin and clips. Make certain that the sheared corners of the two side-pieces are assembled upward.

(c) Insert the rocker-arm pin through the holes of the pump body, linkage and rocker arm. Place washer over counter-bored end of pin and then swedge pin over against washer.

(d) Check assembly to see that rocker arm and linkage move freely on rocker arm pin.

(2) Diaphragm Assembly.

(a) With fuel-pump body held in a bench vise, place the pull-rod gasket over threaded end of pull rod, seating the gasket against the shoulder of the pull rod.

(b) Place lower diaphragm washer over threaded end of pull rod, cup-side down.

Fuel Pump Trouble Chart

Trouble	*Cause*	*Remedy*
Broken rocker arm.	Visible.	Replace rocker arm.
Broken rocker arm spring.	Visible.	Replace rocker arm spring.
Defective or worn links.	Pump does not supply sufficient fuel.	Replace links. Also check for air leaks.
Broken diaphragm return spring.	Does not supply fuel to carburetor.	Replace spring.
Punctured or worn-out fuel pump diaphragm.	Fuel leaking through vent hole in body.	Replace complete diaphragm. Do not attempt to replace just one or two layers.
Leakage around pull rod.	Fuel leaking through vent hole in body.	Replace pull rod gasket, tightening pull-rod nut securely.

(c) Place diaphragm over threaded end of pull rod.

(d) Line up holes in diaphragm with screw holes in body diaphragm flange.

(e) Place upper diaphragm protector washer over threaded end of pull rod, cup-side up.

(f) Place hexagon-shaped diaphragm alignment washer over end of pull rod. Assemble lockwasher and pull-rod nut, using special wrench to hold diaphragm alignment washer stationary and prevent diaphragm from twisting or turning. Tighten pull-rod nut securely.

NOTE: It is extremely important that the diaphragm be held exactly in alignment while the pull-rod nut is being tightened. If it is allowed to twist or become distorted, unsatisfactory operation of the pump will result.

(3) **Valve Assembly.**

(a) Blow out each valve chamber and make certain that no foreign particles are present which might prevent valves from seating properly. Also make certain that no burrs or irregularities exist in the valve seats and that the valve seats are securely held in place in the upper cover.

(b) Place valves in proper position in valve chambers. Make certain that valves lie flat against the valve seats and are not standing on edge or tipped.

(c) Insert valve spring on top of valves.

(d) Place fiber gaskets on valve plugs and then place stems of valve plugs into the valve springs and tighten plugs securely. Be certain that the stems of the valve plugs do not distort the valve spring but fit properly inside of them.

(4) **Cover Assembly.** The position of the diaphragm when the fuel pump cover is assembled is the most important single item to be observed in repairing and assembling fuel pumps. If the diaphragm is not in the proper position when the top cover screws are tightened, the pump will not function correctly when replaced on the engine. Follow instructions carefully.

(a) Lay the cover on the pump in proper position, determined by marks made before pump was disassembled.

(b) Insert screws from top through lockwashers, upper cover and diaphragm.

(c) Tighten screws until they barely engage lockwashers.

(d) Pull priming lever up as far as possible, forcing diaphragm to its extreme high position; while it is held in this position, the cover screws should be tightened alternately and securely.

(5) **Bottom Cover Assembly.**

(a) Holding pump upside down, place rocker-arm spring cap and diaphragm-spring cap over the end of the pull rod and the projection on the rocker arm in their proper positions.

(b) Place gasket between pump body and lower cover.

(c) Locate springs for the diaphragm and rocker arm in their proper position on bosses in lower cover, then carefully fit lower cover to the pump body, making certain that the spring caps and spring remain in their proper positions.

(d) Tighten screws securely.

(6) **Final Assembly.**

(a) Assemble screen in pump cover. Make certain that it fits snugly around the gasoline inlet and edges of the casting.

(b) Place bowl gasket next to screen, then complete the assembly of the bowl and bail and screw assembly.

(7) **Service Hints.** Never stretch or in any way change the tension of the valve spring, as this will change its pressure against the valve and reduce the capacity of the pump, particularly under extreme conditions. Always use new valve springs if in doubt as to the condition of the old springs.

(8) **Valves.** Do not replace the fiber valves with makeshift valves, such as steel balls or metal disks. The fiber valve has proved superior to all other types of valves under all conditions.

(9) **Gum in Gasoline and Sticking Valves.** Field reports sometimes ascribe faulty operation of the fuel pump to the formation of a gum-like substance on the valves. When this trouble is encountered, clean and polish the pump valves, valve seats, and gas strainer parts thoroughly.

33. Governor.

a. General.

The governor acts, through oil pressure, to increase fuel supply. It has a useful work capacity of about six-inch-pounds over the full terminal-shaft range of 30 degrees. A spring, acting to cut off the fuel supply, has been incorporated in the fuel control linkage. This spring should oppose the action of the governor with a total resistance of 12-inch-pounds work for full terminal-shaft travel.

When the governor is installed, particular care should be taken to see that it is mounted squarely, and that the splined drive shaft of the ballhead is in exact alignment with the coupling sleeve on the drive from the engine. The hold-down bolts should be securely tightened and pulled down evenly.

The oil line between the engine-lubricating oil-pressure system and the governor should be installed. The proper linkage connections to the speed-adjusting shaft should also be made.

When making up the linkage connections between the TERMINAL SHAFT and fuel system, care should be taken to insure that when the TERMINAL SHAFT of the governor is in the fuel-off position, the fuel system will also be shut off.

After checking the foregoing carefully, so far as the governor is concerned, the engine may be started. After the governor begins to receive engine-lubricating oil, it will start to open the fuel, and continue in this direction until the engine fires. After the engine is running, it will control the speed at that value for which the governor speed adjustment is set.

The hydraulic feature of the governor is brought about by the admission of oil from the engine lubricating system, under pressure, to a gear pump in the governor base. The gear pump raises the oil pressure to a value determined by the relief valve spring opposing relief valve plunger. The oil under pressure is maintained, when the governor is operating, in the annular space between the reduced diameter on the pilot valve plunger, and the bore in the ballhead.

For any given speed-adjustment setting, the speeder spring has a definite compression, which must be opposed by the centrifugal force of the flyballs. When these two forces are in equilibrium, the land on the pilot valve plunger exactly covers the lower holes, or ports, in the ballhead. Under a steady load condition, speed will then remain constant and the pilot valve will pass only that amount of oil required to replace leakage, and maintain the required power piston position.

Assume that a certain amount of load is applied to the engine. The speed will drop below that corresponding to the speed adjustment setting on the speeder spring, the flyballs will be forced inward, and will lower the pilot valve plunger. This will admit oil pressure underneath the power piston, which will rise. The movement of the power piston is transmitted to the terminal shaft by the terminal lever. Rotation of the terminal shaft causes the fuel setting on the engine to be increased.

Simultaneously with the upward movement of the power piston, the droop rivet on the droop-adjusting bracket moves upward and raises the floating lever which pivots about the spring fork pin in the speed-adjusting lever.

When the load is applied, the engine speed drops slightly; as a consequence, the centrifugal force of the flyballs decrease. As the floating lever rises, the compression load on the speeder spring is reduced and this enables the flyballs to assume again their normal vertical position.

The land on the pilot valve plunger then again exactly covers the ports in the ballhead, and the power piston stops moving at a position corresponding to an increased fuel setting on the engine. The engine now carries the increased load at a slightly reduced speed because of the slight decrease in speeder-spring compression.

If the load is decreased, the engine speed rises and the flyballs move outward, lifting the pilot valve plunger. This opens the area under the power piston to the longitudinal drain hole in the ballhead, and allows the spring opposing the governor, which acts to decrease fuel, to force the power piston downward, and decreases the fuel setting on the engine. As this happens, the floating lever is depressed and increases the compression load on the speeder spring. The centrifugal force of the flyballs increases as the engine

speed is increased, and the increased compression on the speeder spring now forces the flyballs to return to their normal vertical position. The pilot valve ports are then closed, and the power piston movement ceases under the influence of the return spring.

If the governor is to be used for constant speed service, speed adjustment may be made by proper setting of the low limit adjustment screws. A wing nut is provided to lock the speed-adjusting screw in position.

The engine speed is then again steady at a reduced load and has increased slightly because of the increased compression load on the speeder spring.

b. Speed-Droop Adjustment. That operation may be stable (without hunting), speed droop is introduced into the gov-

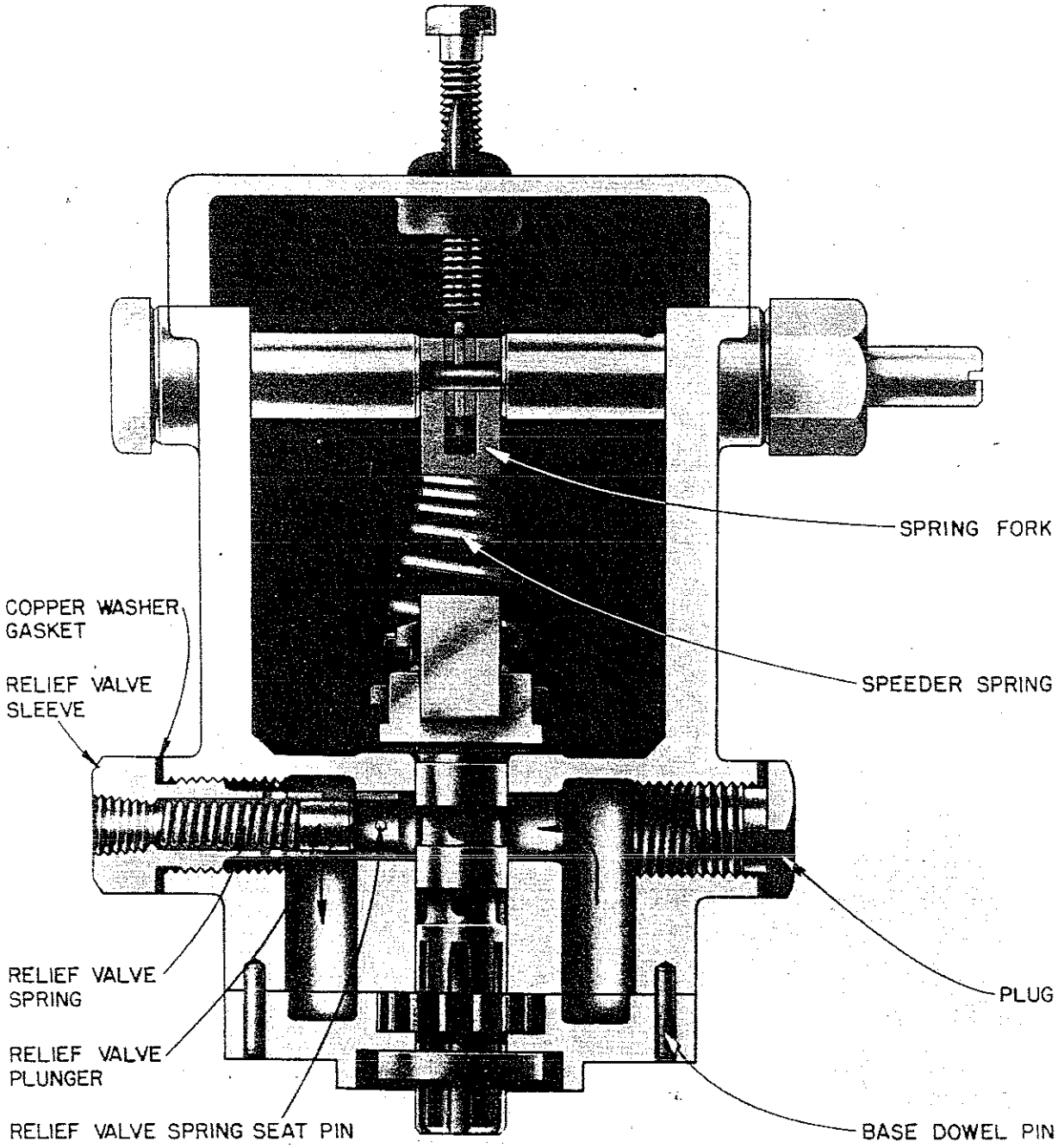

Fig. 40. Governor Cut-away Section—Front

erning system. By speed droop is meant the characteristic of decreasing speed with increasing load. The required magnitude of this speed droop varies with engine applications and may easily be adjusted to suit conditions.

The speed droop is adjusted internally. The cover must be removed to make this adjustment. A range may be covered of from approximately one-half of one percent to seven percent.

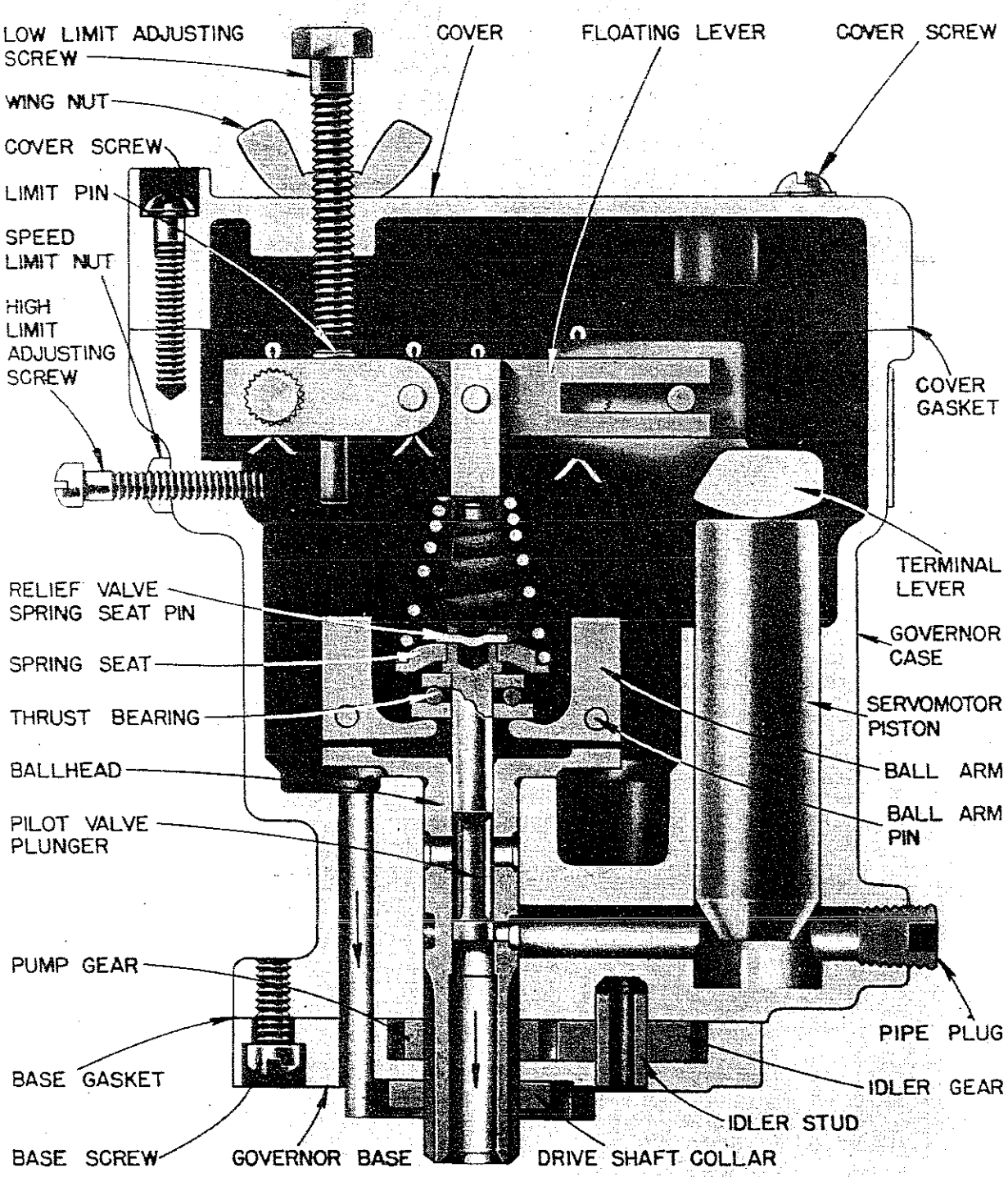

Fig. 41. Governor Cut-away Section—Side

If the governor allows the engine to hunt, shut down the engine and remove the cover. Loosen the droop-adjustment screw which holds the droop-adjusting bracket and move the droop-adjusting bracket away from the center of the governor about one-eighth inch. This increases the speed-droop setting. Tighten the droop-adjustment screw and replace the cover. Start the engine and observe whether the engine is still hunting. If it is, repeat the procedure outlined above until hunting stops.

As the droop-adjusting bracket is moved away from the center of the governor, the droop rivet moves away from the axis of the terminal shaft, and movement of the power piston, through the floating lever, causes a greater change of loading on the speeder spring, or increases droop.

It will be noted that when the droop-adjusting bracket is pushed toward the center of the governor as far as it will go, the droop rivet is near the axis of the terminal lever. Consequently, as the power piston moves,

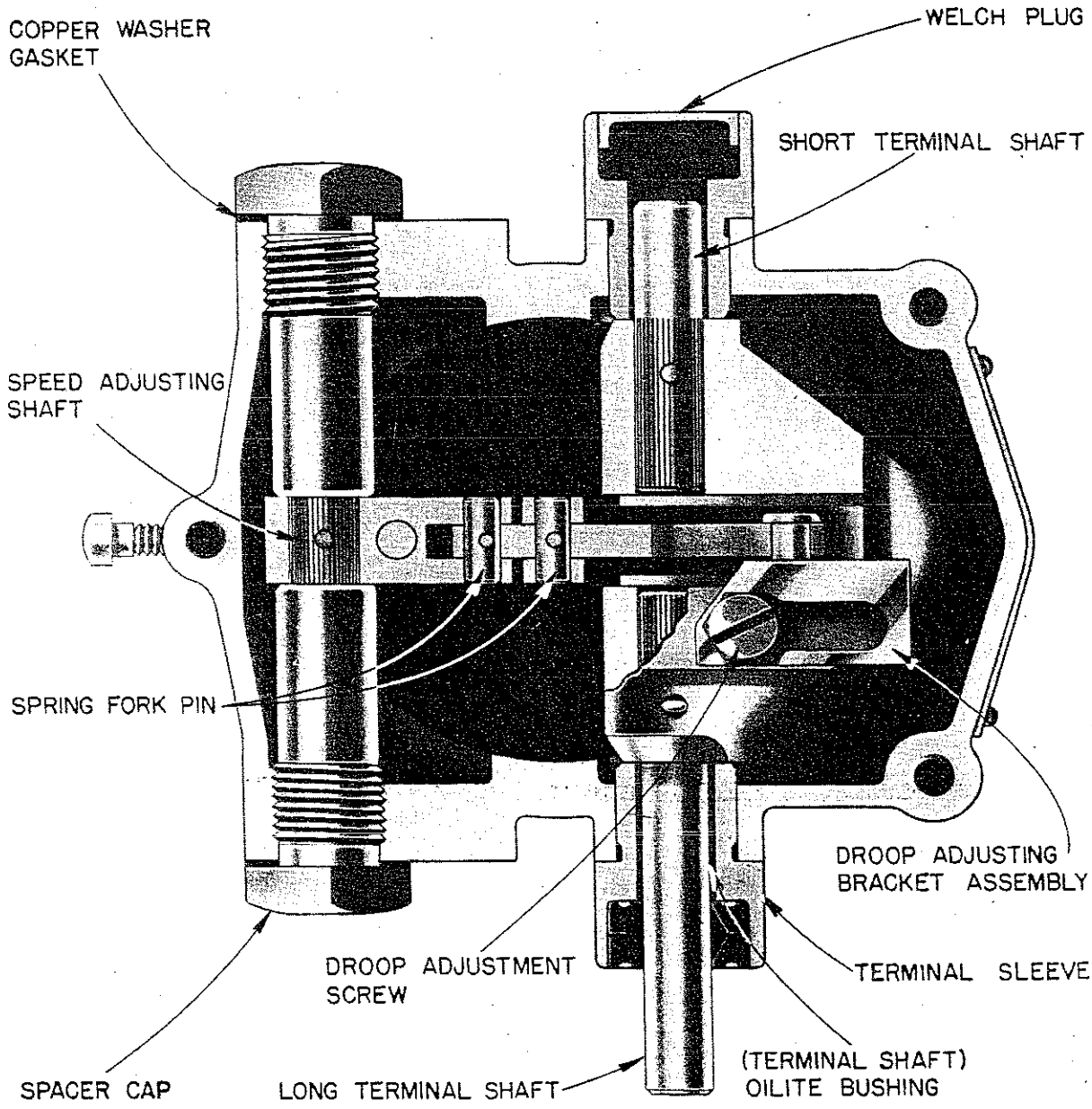

Fig. 42. Governor Cut-away Section—Top

there will be but a slight up-and-down movement of the floating lever. This, in turn, results in a minimum change of loading on the speeder spring, or minimum speed droop.

In general, the engine can be run with the least speed droop that will give the desired stabilization (without hunting) over the operating range. In special cases, as when two units are to be paralleled, greater speed droop may be required in order to match units and secure the proper division of load.

c. Application.

(Refer to Fig. 45.) The governor has been mounted vertically on the engine with a gasket between its base and the adapter pad. A $^{9}/_{16}$-inch six-splined coupling has been provided for driving the governor. This part should fit the governor drive shaft freely, but not so freely that excessive backlash exists.

Particular care has been used in manufacturing the governor drive parts to insure that these parts will run smoothly and not transmit speed irregularities, such as may be caused by shaft run-out or uneven gear teeth. The ballhead in the governor, being very sensitive, will pick up these impulses and governor performance will be erratic.

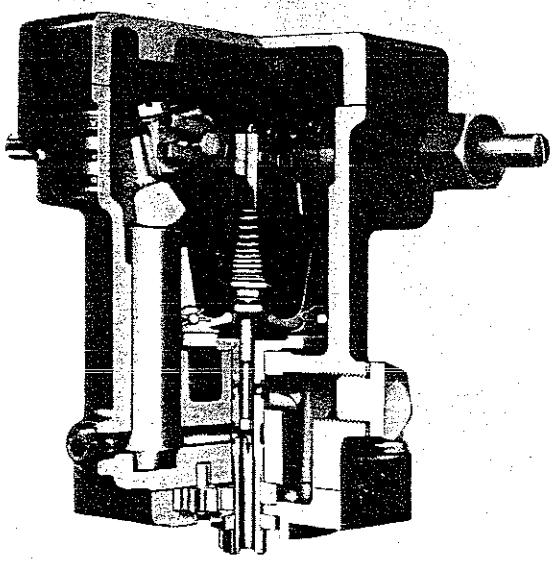

Fig. 43. Governor Operating Speed Position

d. Speed Level Adjustment.

Rotation of the speed adjusting shaft causes the speed adjusting lever to raise or lower the floating lever. Since the terminal lever is stationary when the load is steady, the floating lever pivots on the droop rivet and increases or decreases the compression on the speeder spring.

Increasing this compression causes the speed to rise; decreasing it causes the speed to drop.

Rotation of the speed-adjusting shaft sufficiently far in the decrease-speed direction (see Fig. 45), causes the floating lever to pick up the speeder spring and lift the pilot valve plunger. This opens the area under the power piston to drain and enables the fuel-return spring to shut off the fuel completely, thus shutting down the engine.

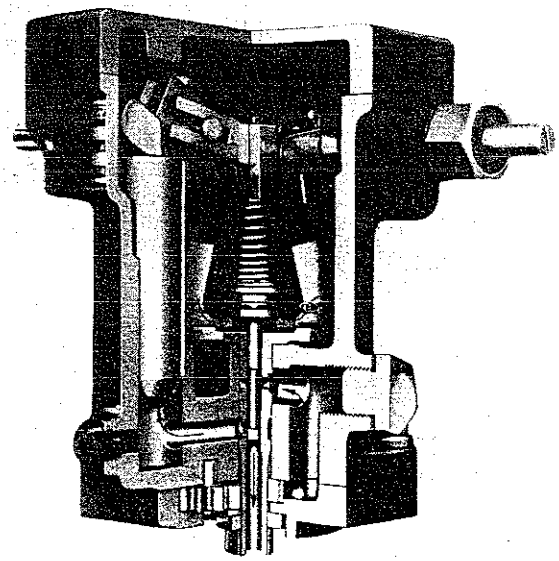

Fig. 44. Governor—Start Position

e. Governor Service.

Governor faults usually show up in speed variations of the engine, but this does not mean that all such speed variations indicate governor faults.

Therefore, when improper speed variations appear, the following procedure should be carried out.

(1) Check the load to be sure that the speed changes observed are not the result of load fluctuations.

(2) If the load is uniform check the engine carefully to be sure that all cylinders are firing properly.

(3) See that the governor is installed so that

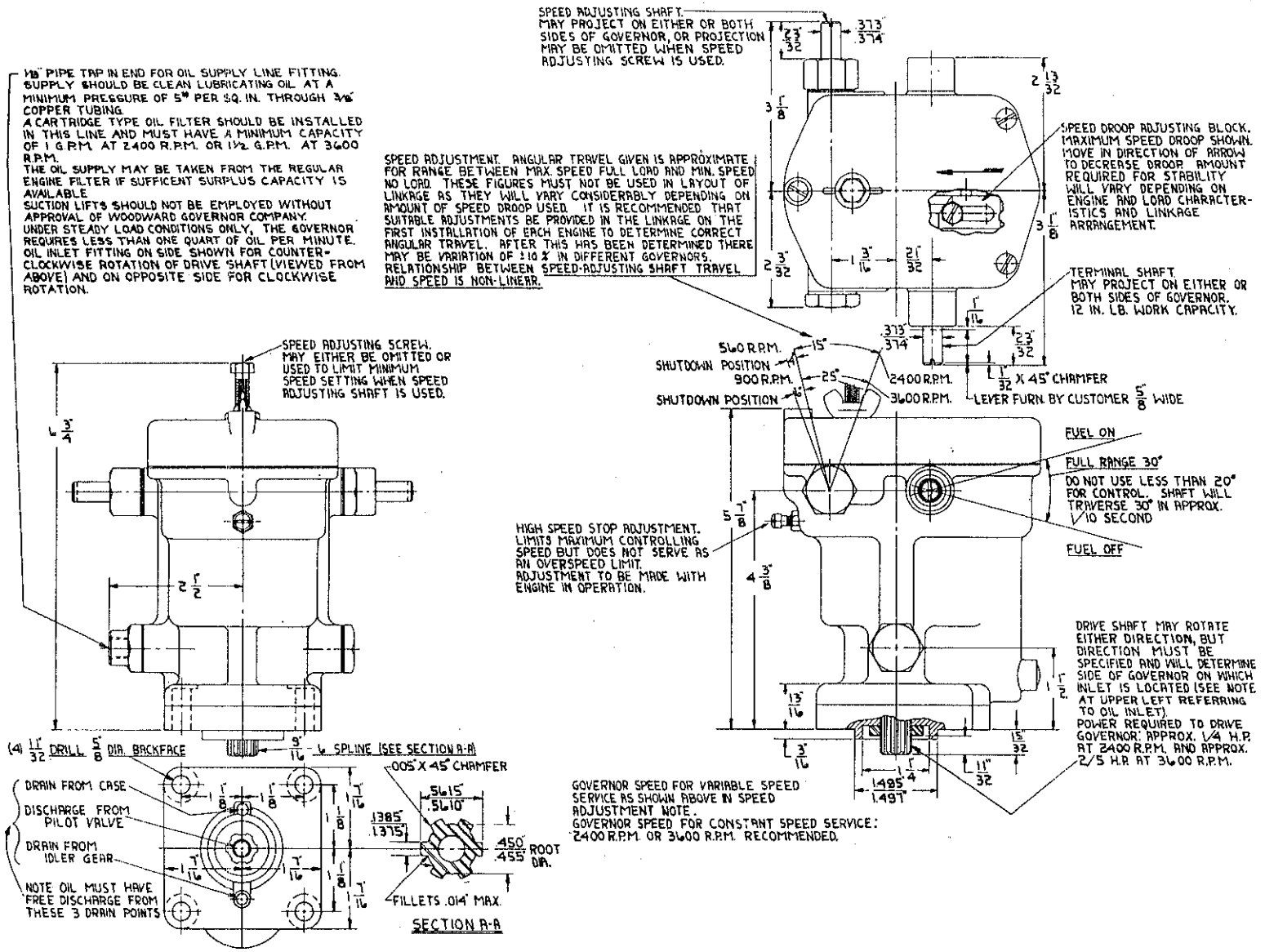

Fig. 45. Governor Installation and Dimensional Drawing

no bind exists in any of the governor control mechanism nor in the operating linkage between governor and engine; also, that no bind exists in the fuel mechanism on the engine.

If the speed variations are large and erratic, and unaffected (except, perhaps, in magnitude) by change of speed-droop adjustment, or if the governor simply fails to control at all, it is probably defective.

If the speed variations are erratic but small in magnitude, the fault may lie in the governor drive. Excessive backlash in the coupling or the drive gears, or too tight meshing of the latter, may cause this trouble. No amount of adjustment or other work on the governor can correct this fault.

34. Maintenance of Alternator.

a. Protection.

The alternator should be protected carefully against moisture, both before and after erection. It is particularly important to keep the windings dry since moisture lowers the insulation resistance and increases the likelihood of a breakdown.

Care should be taken in transporting and handling the machine to see that the windings are not damaged. A blow upon any part of the windings is liable to injure the insulation and result in a burnout of a coil.

b. Single Phase Operation.

The ability of a generator to operate single phase, depends largely on the design of the amortisseur or damper windings. Single phase operation produces heavy current in the damper windings, which may cause overheating in a machine not designed for such operation. If there is no damper winding, the field current required for a given load is increased to such an extent that the output is seriously limited. The damper winding in this generator is designed for satisfactory single phase operation.

c. Collector Rings and Brushes.

(1) Sparking.

If sparking between the brushes and the collector rings occurs, the following points should be checked:

Brush Pressure.

It may be that the pressure on the brushes is insufficient to make them follow the ring surface. Pressure is correct when sparking is negligible.

Brushholder Vibration.

Brush Chatter.

Oil Vapor.

Collector Ring Rough.

Spotted Rings.

This has been cured in certain cases by the use of a more abrasive brush.

(2) Selective Action Between Brushes.

This is generally aggravated by any of the causes of sparking at the brushes and if the same remedies are applied, it can generally be improved.

(3) Rings.

Should be maintained smooth and true. Grind or turn them if necessary to restore a smooth and true surface.

Occasionally ring trouble will arise from a ring not being of uniform hardness, so that it wears unevenly. Such a ring should be replaced.

Collector ring trouble is seldom due to high current density as the maximum current density, 40 amperes per square inch or less, is well below the maximum density specified for the brushes.

The brushes used should be light in weight, with a fairly high current capacity and should contain a slight amount of abrasive material. A suitable grade is furnished with the machine, and for the best results this grade should always be used.

(4) Brushes.

Should make good contact with the slip rings along the whole face of the brush. If necessary, grind the new brushes in with fine sandpaper. Maintain a free sliding fit between the brushes and the brushholder by cleaning both thoroughly when necessary.

There are two collector rings made of bronze alloy. Brushes applied on these machines are metal graphite and should have a brush pressure of approximately 3 lbs. per square inch. There are two brushes per ring.

(d) Operation and Care of Ball Bearings.

Quietness and life of ball bearings depend largely on cleanliness and proper lubrication.

d. Inspection.

(1) When the generator is installed, make certain that the rotor turns easily, particularly if the generator is not installed until some months after being shipped.

(2) Never open the bearing housing under conditions which would permit entrance of dirt.
(3) External inspection of the generator at the time of the first greasing soon after it is put into operation will determine whether the bearings are operating quietly and without undue heating. Further inspection will not be necessary except at infrequent intervals, probably at greasing periods.
(4) If practicable, it is desirable for the most satisfactory service to open the bearing housings once a year, or after every 5,000 hours operation, to check the condition of the bearings and grease. If difficult to inspect the pulley or pinion end bearing, the condition of the bearing of the opposite end will usually be representative of both.
(5) If grease deterioration has occurred or if dirt has gained entrance to the housing, the bearing and housing parts should be thoroughly cleaned out and new grease added.

e. Cleanliness.
Since ball bearings are sensitive to small amounts of dirt, they must be protected at all times. If necessary to disassemble the bearing housing, first thoroughly remove all dirt from adjacent parts, so no dirt will fall upon the bearing or interior of the housing. Cover the bearing and interior of the housing with clean wrapping material if they are to be left dismantled and exposed.

If dirt or deteriorated grease is found in the housing or bearing, the parts should be thoroughly cleaned with carbon tetrachloride (avoid allowing this liquid to remain on adjacent generator windings). In some cases, it may be necessary to entirely remove the bearing from the shaft in order to clean it properly.

f. Mechanical Damage.
In mounting or removing bearings, pressure should be applied only against the inner race, always using a sleeve or other intermediate piece if mounting or removal is accomplished by hammer blows. Cover bearing carefully during these operations if there is danger of flying particles getting in amongst the balls. Never attempt to remove a ball bearing by exerting pressure against the outer race, as the bearing may be seriously damaged.

In mounting or removing pulleys, couplings or pinions, the bearing must not be subjected to axial pressure, especially hammer blows as when these accessories are driven on the shaft with a mallet. Any pressure of this kind should be taken by supporting the opposite end of the shaft against a stop of some kind.

g. Spare Parts.
The electrical spare parts on this set consist of exciter and generator brushes and exciter and generator brush holders. When brushes have worn to the place where correct spring pressure cannot be obtained, new brushes should be installed. When new brushes are installed, follow instructions listed under "Brushes."

h. Flashing Exciter Field.
If the exciter field loses residual magnetism due to vibration or other causes, this may be restored by passing a d-c current through the field. The 12-volt battery may be used for this purpose. First, raise the brushes in the brush holders and place a piece of heavy dry paper between each brush and the commutator. The field leads are marked F1 and F2. The positive terminal of the battery should be connected to F1 and the negative to F2.

If either battery terminal is grounded it is not necessary to remove the ground, but the corresponding field lead should be grounded and the other field lead and battery terminal connected. This application of d-c current should be made for 30 seconds and repeated three or four times. Tapping the exciter frame with a hammer during the application will help to restore the residual magnetism.

35. Maintenance of Voltage Regulator.

a. Detailed Description of Operation.
The voltage of the alternator is connected across the regulator coil circuit. An iron magnetic circuit in the shape of a square "C" passes through and mounts the regulator coil. The movable arm of the element is mounted so that the iron armature attached to its lower end can move, against the pull of a spring, in the air gap of the magnetic circuit. Thus any change in the value of the voltage being regulated correspondingly

changes the magnetizing effect of the coil on the iron magnetic circuit. This in turn causes a change in the flux in the air gap and changes the attractive force on the iron armature of the moving arm, causing it to change its position.

The movement of the upper end of the movable arm directly controls, depending on the direction of its motion, the closing or opening, in succession, of a series of silver buttons. Each of these silver buttons is mounted at the free end of an individual leaf spring of conducting material. The other end of the leaf spring is fixed and the assembly holding the fixed ends is arranged so that each one is individually insulated from the others. Each silver button is connected electrically, by means of a wire from the fixed end of its leaf spring, to a tap on the stationary regulating resistance. The silver buttons, in this manner are connected in sequence to consecutive taps or steps of the regulating resistance.

The regulating resistance is connected directly in the field circuit (exciter shunt field). At one end of the travel of the moving arm, all of the silver buttons are apart from each other, thus, placing maximum resistance in the field circuit. At the other end of the arm's travel all of the silver buttons are closed thus shorting out the resistance in the field circuit through a silver path, which reduces the resistance to a negligible value. Thus, as the moving arm operates through its travel, depending on the direction of its motion, it successively opens or closes the silver buttons, to increase or decrease the resistance in the field circuit. Since the moving arm has a short travel all resistance can be inserted or cut out quickly or it can be varied gradually, depending on the change in excitation required.

An important operating feature of the Silverstat design is the smooth control of excitation made possible by the use of the silver buttons. Although the operation of these buttons in sequence apparently cuts small steps of resistance in or out in a definite, step by step manner, this is not actually the case. When the moving arm operates the silver buttons in sequence, there is a progressive change in pressure between the faces of the buttons, due to the action of the moving arm in deflecting the leaf springs that mount the buttons. Since the effective resistance between silver surfaces is dependent upon the pressure, this effect combined with the small value of resistance per step, acts to produce an infinite number of steps from practically zero to the maximum. In this manner the Silverstat design inherently provides for smooth variation of the stationary regulating resistance.

The regulating action of the regulator is that of a semi-static device which operates only when a correction in voltage is necessary. For a given value of regulated voltage and load on the machine being regulated there is a corresponding value of regulating resistance required in the field circuit; and a corresponding position of the moving arm and silver buttons which will give this value of resistance. Under such conditions the magnetic pull on the moving arm is balanced against the spring pull, at that position of its travel. A change in load on the machine being regulated causes a corresponding change in the voltage. To restore the voltage to its correct regulated value, the moving arm and the silver buttons take a new position corresponding to the changed value of load.

Should additional load be placed on the machine whose voltage is being regulated, the voltage will drop and an increase in field current is required to bring the voltage back to normal. The drop in voltage decreases the magnetizing effect of the regulator coil and reduces the flux in the air gap of its magnetic circuit. This in turn decreases the magnetic pull on the iron armature attached to the moving arm and allows the coil spring to move the arm in a direction to begin closing in sequence the silver buttons. This action shorts out in small steps additional portions of the regulating resistance, which being connected in the field circuit, causes the field current to be increased and the voltage raised back to its normal value. When the voltage is restored to its normal value the moving arm of the regulator is again in a balanced state. However, the moving arm has changed its position to correspond to the change in load on the machine.

In case some load is taken off the machine and the voltage rises, the sequence as de-

scribed in the foregoing paragraph is reversed. The rise in voltage increases the current and magnetizing effect of the regulator coil. This increases the pull on the armature and moves it in opposition to the pull of the coil spring, to start opening in sequence, the silver buttons. This action inserts additional steps of the regulating resistance in the field circuit, thereby decreasing the field current and reducing the voltage to its normal value. With normal voltage restored the moving arm is again in a balanced state in its new position.

From the foregoing description of operation it becomes apparent that the Silverstat regulator can increase the excitation to its ceiling value (ceiling voltage of exciter) where necessary. Also, the excitation can be quickly reduced to the lowest value required. The maximum travel of the moving arm being only a fraction of an inch permits the regulating resistance to be very quickly varied from maximum to practically zero when operating conditions require such control.

b. Damping Transformer.

To stabilize the regulated voltage and prevent excessive swinging under various conditions of excitation change, a damping effect is introduced into the regulator coil circuit by means of a damping transformer. See illustrations. The use of this device eliminates the need for dashpots or similar mechanical anti-hunting devices, which require adjustment and maintenance.

The damping transformer is of a special type having a small air gap in the laminated iron magnetic circuit. One winding is connected across the field of the generator whose voltage is being regulated. (See illustrations, for a-c applications.) The other winding is connected in series with the regulator coil. When there is a change in excitation voltage as a result of the regulating action of the regulator, there is an induced transfer of energy from one winding to the other of the damping transformer. The energy thus introduced into the circuit of the regulator coil acts by reason of its direction, magnitude and time to electrically damp excessive action of the moving arm, thus preventing the moving arm from carrying the change in regulating resistance and consequent change in excitation, too far. Since the damping transformer operates only when the excitation of the generator is changing, it being remembered that the excitation circuit is d-c, the damping transformer has no effect when the regulated voltage is steady and the regulator is in a balanced condition. The damping transformer is arranged for mounting separate from the regulator as outlined under "Accessories."

c. Voltage Adjusting Rheostat.

A small voltage adjusting rheostat is included in the regulator assembly and provided a convenient means of setting the voltage at the value at which it is to be regulated. The rheostat knob is located outside the regulator cover where it is always accessible. The rheostat has a range which makes it possible to change the value of the regulated voltage approximately 10 per cent above or below normal on the type SRA a-c regulators.

d. Assembly and Mounting.

The main control element with its moving arm and the required number of silver button assemblies, together with the voltage adjusting rheostat are mounted on the front of a metal plate which serves as a base. A second metal plate is attached to the rear of the base and held a short distance behind it by means of a post at each corner. The regulating resistance is mounted in the space between the base and the rear metal plate. The top and sides of this space are enclosed by a perforated removable cover. Each of the projection mounting type regulators is provided with a protective removable cover, held in place by thumbnuts, which fits on and encloses the front of the regulator. A gasket of long life, flexible material, around the end of the cover provides a dust-tight fit which protects against dust and dirt collecting in the main assembly. This gives adequate protection in case a regulator is installed where the air is dust laden or contains foreign materials due to manufacturing processes, etc.

e. Installation.

The method of mounting the regulator and the fact that only four to six wires are con-

nected to it makes it easy to install. Since all internal adjustments are made in the factory it is also easy to place into operation. The usual field rheostat (exciter field rheostat) is normally left in the circuit in series with the regulating resistance of the regulator. Setting the field rheostat in the proper position to permit the regulator to take control places the regulator in service.

f. Sensitivity.

The rated sensitivity of the type SRA regulator is as follows: SRA-1 X1 2½%.

Only sensitivity, as listed, is specified in connection with the performance of generator voltage regulator. Sensitivity represents the band or zone of voltage, expressed in terms of percentage of the normal value of regulated voltage, within which the regulator will normally hold the voltage under steady load conditions. This does not mean that the regulated voltage will not vary outside of the sensitivity zone. It does mean, however, that when the regulated voltage varies more than the percentage sensitivity from the regulator setting, due to sudden changes in load or other conditions, the regulator will immediately apply corrective action to restore the voltage to the sensitivity zone.

Regulator sensitivity must not be confused with overall regulation, which involves not only regulator sensitivity, but also the time constants of the machines, and the character and magnitude of load changes. A regulator cannot get more from a machine than it is inherently capable of delivering and cannot change machine characteristics. The magnitude and rate of load change determines how far the voltage will vary outside of the regulator sensitivity zone and the time constants of the machines chiefly determines the time required to restore the voltage to the sensitivity zone of the regulator. For these reasons only sensitivity can be specified insofar as the regulator is concerned and not overall regulation which involves factors over which a regulator has no control.

The design of the Silverstat regulator has been coordinated so that any change of regulated voltage with respect to temperature of the regulator parts is very small, over the range of ambient temperatures usually encountered in normal operating practice. The standard design of Silverstat regulator will maintain its rated sensitivity, when operated in ambient temperatures between +15° and +40° Centigrade (+59° and +104° Fahrenheit). This means that the regulator will hold practically the same voltage whether it is cold or warm. Special designs are available where it is desired to maintain rated sensitivity over wider ranges of ambient temperature than listed.

g. Accessories.

(1) Rectox Rectifier—Damping Transformer Unit.

On the type SRA a-c regulator a full wave Rectox rectifier is used. The function of the Rectox unit is to rectify the single phase a-c supply to the regulator to a proportional value of d-c energy, the regulator element being a d-c operated device. The rectified d-c energy is to all practical purposes independent of frequency changes, and the a-c regulator is correspondingly free from frequency error due to small changes in speed of the a-c machine. The Rectox unit is completely dry and requires no maintenance.

A damping transformer is supplied with each regulator. This transformer functions to stabilize the regulated voltage by acting as an electrical anti-hunting device. This device does not require any adjustment or maintenance.

The Rectox rectifier and damping transformer are mounted on a steel plate to form a single unit as shown. This unit is arranged for mounting separate from the regulator and is designed so that it can be readily mounted at the rear of a switchboard panel or in any convenient location. The sides of the steel plate are bent to form flanges and mounting holes in both the base and flanges facilitates mounting. The damping transformer and Rectox rectifier are wired to a terminal block mounted at the bottom of the steel plate.

36. Maintenance of Type WL Field Rheostat.

a. Construction.

In the manufacture of type WL rheostats a pressed steel plate forms a rigid base, durable but light in weight. After the entire surface is sand blasted to remove foreign particles the thoroughly cleaned plate is cov-

CLASS 3	COMPLETE REWINDING MATERIAL PLUS MECHANICAL DETAILS AND MOULDED MICA PARTS	3
CLASS 2	COMPLETE REWINDING MATERIAL‡	2
CLASS 1	CUT WINDING INSULATION	1

SUB CLASSIFICATIONS	MATERIAL INCLUDED*	MATERIAL INCLUDED*	MATERIAL INCLUDED*
A CUT CORE INSULATION	All cut insulating material used to prepare the ends of the core for winding, such as treated cloth caps, coil support moulded paper rings, fibre rings and canvas caps.	Cut winding insulation (Class 1) plus all bulk materials such as tapes, twines, varnishes, solder, soldering flux and banding wire. Note: This bulk material is placed in a separate class since the larger motor users generally find it more satisfactory to purchase in bulk from the Company.	Complete rewinding material (Class 2) plus all necessary cleats, bolts, tie rings, formed copper connectors, and brace or support arms. All moulded mica rings and parts. The following parts are supplied, when used: Temperature indicating coil wiring details. Wood forming blocks for closing the open end of shove through type of coils.
B SLOT AND END INSULATION	All cut insulating material used when winding, such as cells, fillers, wedges, spacing blocks, wood bracing blocks, micarta tubes, etc.		
C CONNECTING MATERIAL FOR A-C STATORS OR ROTORS	All cut material used when winding, such as cable for leads and for star or parallel rings and jumpers, figure 8 or sleeve connectors, wood wedge blocks for soldering, canvas caps, etc.		
or			
CROSS CONNECTING MATERIAL FOR D-C ARMATURES	All cut material used for cross-connections, such as cable, wood supporting or spacing blocks, micarta tubs, mica washers, etc.		
D CUT BANDING MATERIAL†	All cut insulating material necessary to install the bands, and segmental bands with keys and wedges, wood wedge blocks for soldering riser neck commutators and tin clips. (For banding wire, see Class 2.)		

Cut Insulating Material means any item that is cut to a definite size or shape. It does not include bulk material.

‡Complete Rewinding Material, Class 2, corresponds to the Rewinding Material listed in the various Parts Sections of this Manual.

*Any desired combination may be obtained by combining the Class Number and Sub Letter. For example 1-B includes the slot and end Insulation only, or 2-B includes 1-B plus the bulk material pertaining to 1-B. Similarly, 3-A includes the cut core insulation (1-A) plus the necessary material of Classes 2 and 3 for installing it.

Part set orders for any class will include only the items necessary to install the number of coils involved except:

†Cut Banding Material (3-D) will be supplied in whole sets only.

Banding tools will be supplied only when specially ordered.

IMPORTANT: ALWAYS GIVE THE COMPLETE NAMEPLATE READING AND STATE DEFINITELY THE CLASSIFICATION OR SUB CLASSIFICATION DESIRED.

ered with a ground coat which protects the surface of the plate and forms an electrical insulating, heat conducting surface upon which to mount the resistance elements of approximately zero temperature coefficient wire. To these wires the heavy contacts are fastened by a patented process which gives a mechanically and electrically perfect joint. Vitrohm insulation is applied over the resistance wire. It holds the wire and contacts securely and protects them against corrosion and mechanical injury. A porcelain terminal block, movable contact arm with its bearing together with back cover and handwheel form a complete plate.

When looking at the handwheel side the all out or high capacity step is reached by turning the handwheel counter-clockwise. Clockwise rotation cuts resistance into the circuit.

b. Adjustable Stop.

Each rheostat is provided with an adjustable arm stop, which consists of a movable angle piece clamped in a slot on the rear cover. To limit the maximum voltage of a generator set clamp to limit the clockwise rotation. To limit the speed of a motor set clamp to limit clockwise rotation. After clamp has been adjusted it should be held in position by tightening set screw securely.

c. Rating.

The ampere rating stamped on the name plate is calculated on the basis that the hottest spot temperature on the enamel does not exceed 250° C. rise, which is the NEMA standard for imbedded resistors. It is permissible to use a rheostat on voltages lower than the name plate rating provided the maximum current is not exceeded.

37. Rewinding Material Classifications.

A careful analysis of what constitutes rewinding material has been made, and the following classifications for different types of rewinding material have been prepared. These classifications will meet all conditions.

All orders for rewinding material should be in line with these classifications.

38. Lubrication of Power Unit.

The following chart gives the grade of oil which should be used in this engine. Care must be exercised to replenish the supply daily if necessary, and to drain it as advised in the paragraphs that follow.

High-grade, highly refined oils, corresponding in body to the SAE (Society of Automotive Engineers) viscosity numbers listed below will prove economical and assure long engine life. SAE viscosity numbers classify

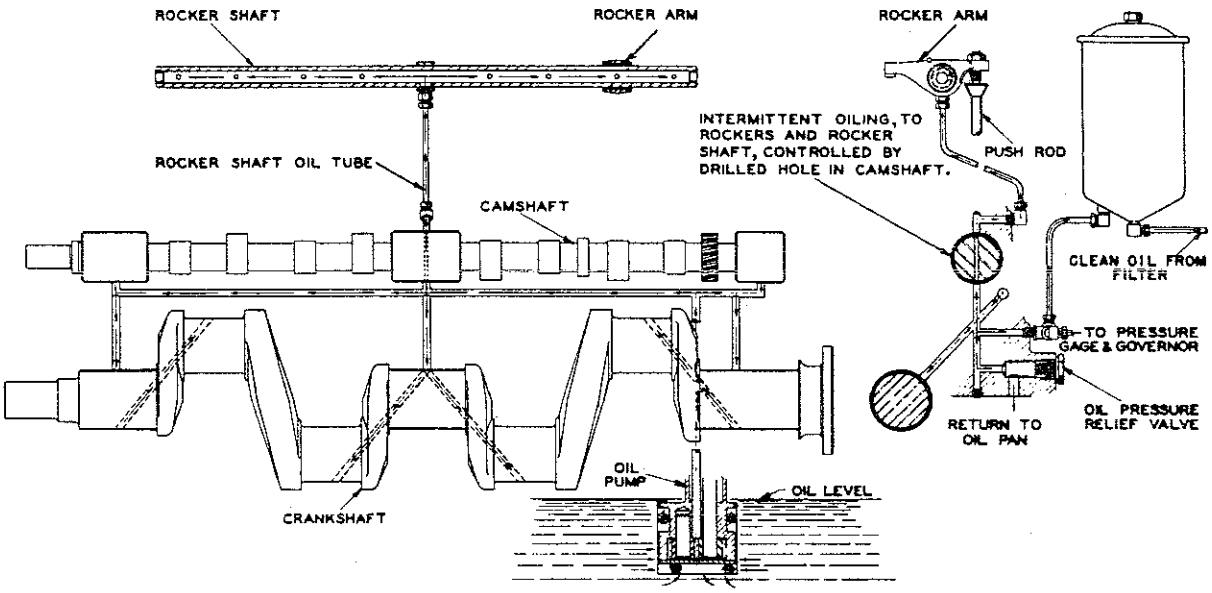

Fig. 46. Oil Circulation Diagram

oils in terms of body only, without consideration of quality or character. Only lubricating oil of the best quality should be used.

a. Oil Recommendations.

The recommendations that follow are for new or well-maintained engines:

Temperature	*Engine Crankcase*	*Air Cleaner*
Below 32° F.	OE SAE 10	OE SAE 10
Above 32° F.	OE SAE 30	OE SAE 30

NOTE: Follow summer recommendations if engine is housed in a warm building.

b. Force-Feed System.

Lubrication to crankcase bearings, camshaft bearings, connecting rod bearings, valve mechanism, timing gears, and governor is full-force feed. Pistons and piston pins are splash-lubricated.

The oil supply is contained in the oil pan and oil is fed to the moving parts of the engine by a gear-type pump. This pump draws oil out of the oil pan, through a screen of small mesh which prevents foreign material from being drawn into the lubricating system.

An oil-pressure relief valve is provided to prevent the oil pressure from building up to an excessive degree. Normal oil pressure for the engine is from 20 to 30 pounds under average working conditions. Extreme temperatures, load conditions, or the use of improper grades of oil may cause these pressures to vary.

c. Filling.

The oil in the engine should be replenished daily, if necessary, in order to maintain the level to the FULL mark on the dipstick. The capacity of the crankcase is 28 quarts, U. S.

Overfilling should also be avoided as this may permit the connecting rods to dip into the oil supply, thus splashing an excessive quantity of oil on the cylinder walls, causing smoking, oil pumping, waste of oil, excessive carbon deposit, fouled spark plugs, and sticky valves.

Be sure the filler cap is replaced after each refilling to prevent dirt from entering the engine.

d. Draining.

It is essential that the oil pan be drained and refilled with new oil regularly, since the oil gradually accumulates small particles of dust, grit, and metal, which will cause wear, and is also diluted by unburned fuel which passes by the piston rings.

Draining the oil while hot will aid in the removal of sediment. Refill the oil pan to the proper level with new oil and replace filler cap.

e. Cleaning the Oil Pan.

The practice of removing the crankcase handhole covers for inspection at monthly intervals or after 600 hours of service, is recommended. At that time the oil pan should be washed thoroughly with gasoline and a stiff brush. **Do not use cotton or wool waste,** as fibers from it may stick to rough surfaces, ultimately causing stoppage of the screen and oil lines in the lubricating system.

f. Sludge.

The formation of sludge in the oil pan is due to oil contamination caused by exhaust gases which pass the pistons and come in contact with the oil and condense to form an acid. This condition will be found more often and to a greater extent when an engine is operated at too low a temperature. Sludge is very detrimental, and if the oil, when drained, appears to be thick and congealed, the oil pan should be thoroughly cleaned of all slude. See paragraph 38d above.

g. Lubrication of the Water Pump.

Turn down grease cup snugly after every eight hours of service and replenish lubricant when necessary. Use WB-2.

h. Lubrication of Fan.

The fan is mounted on the water-pump shaft and requires no lubrication.

i. Lubrication of the Governor.

The governor is lubricated by oil introduced into the governor housing past the power piston and pilot-valve plunger. The oil is broken up into a fine mist by the rotation of the governor flyballs. It collects in the bottom of the governor case, and is discharged through the base by a drain hole. No additional lubrication is required.

j. Lubrication of the Magneto.

The cam-lubricating felt wick (31) (see Fig. 5) is saturated with grease at the factory and should be relubricated periodically with a small quantity of SAE 50 or 60 oil. The magnet-rotor ball bearings (2), packed with high temperature American Bosch U. S. 508

grease, and the distributor gear oil-less composition bearing (9) require no additional lubrication between overhauls. Extreme care must be exercised that the contact points remain free from oil and grease.

k. Lubrication of the Air Cleaner. After every eight hours of service unscrew the wing nut and remove assembly to open the entire air cleaner for inspection. Dispose of accumulated dust in sump, refill to lower bead with the same grade of OE as used in crankcase, and replace top. Should filter element need cleaning, swish up and down and sidewise in fuel oil or gasoline. When gasoline is used, allow to dry thoroughly before reassembling.

l. Lubrication of the Starting Motor. No lubrication is required, since all three bushings are of the oil-less type. However, at any time that the cranking motor is disassembled for cleaning, put a few drops of light OE in each bushing.

m. Lubrication of the Generator (12-Volt) Add from eight to ten drops of OE SAE-10 to each hinge-cap oiler after every 128 hours of operation.

n. Lubrication of the Alternator. A small amount of WB-3, sufficient to maintain a film of lubricant over the surface of the balls and races, is essential. Too much grease will cause churning, overheating and grease leakage. If grease leakage occurs, the bearing has been overfilled, or the grease used is not suitable for the particular application.

If high pressure guns are used, great care should be used to avoid over-lubrication.

When shipped from the factory, grease lubricated ball bearings have sufficient grease of the right grade to last for a limited period. However, a charge of grease should be added soon after the generator is put in operation, and thereafter at suitable intervals, as determined by experience. As a guide, it is suggested that grease should be added every six months of operation. If experience indicates that these quantities result in a surplus of grease in the bearing, the quantity should be reduced or the greasing periods lengthened, or both. The ideal condition is that the bearing housing be from one-third to one-half full of grease. **See Lubrication plate on generator.**

New grease is introduced at the side of the bearing farthest from the body of the generator. A sufficient charge will force the old grease through the rolling members and out a partially restricted escape port during operation.

A surplus grease sump below bearing is supplied and it should be kept empty at all times. Excess grease is removed from the sump through pipe plug openings. Periodic greasing and cleaning of the surplus grease sump will prevent damage to the bearings from deteriorated grease and will reduce or eliminate the need for bearing overhaul.

After every 1,024 hours of service add WB-3 to ball bearings. The following procedure should be observed.

(1) Stop engine.

(2) Remove drain plugs located beneath ball-bearing retainers.

(3) Remove any hardened grease in the drain-plug holes.

(4) Turn down grease cups until lubricant is expelled through drain holes.

(5) With drain plugs removed, start the engine and run for several minutes, or until all excess lubricant is expelled through drain holes.

(6) Stop the engine.

(7) Replace the drain plugs and carefully wipe away any excess lubricant from surrounding parts.

SECTION IV. PARTS LIST

INDEX TO PARTS LISTS FOR POWER UNIT PE-145-A

MANUFACTURER'S CODE INDEX

Code	*Name and Address*
A	Le Roi Company Milwaukee, Wis.
B	Air-Maze Corporation Cleveland, Ohio
C	Zenith Carburetor Division Bendix Aviation Corp. Detroit, Mich.
D	Allen-Bradley Company Milwaukee, Wis.
E	Thomas Flexible Coupling Company Warren, Pa.
F	Delco-Remy Division General Motors Corporation Anderson, Ind.
G	A-C Spark Plug Division General Motors Corporation Flint, Mich.
H	Woodward Governor Company Rockford, Ill.
I	American Bosch Corporation Springfield, Mass.
J	Westinghouse Electric and Manufacturing Company East Pittsburgh, Pa.
K	Briggs Clarifier Company Washington, D. C.

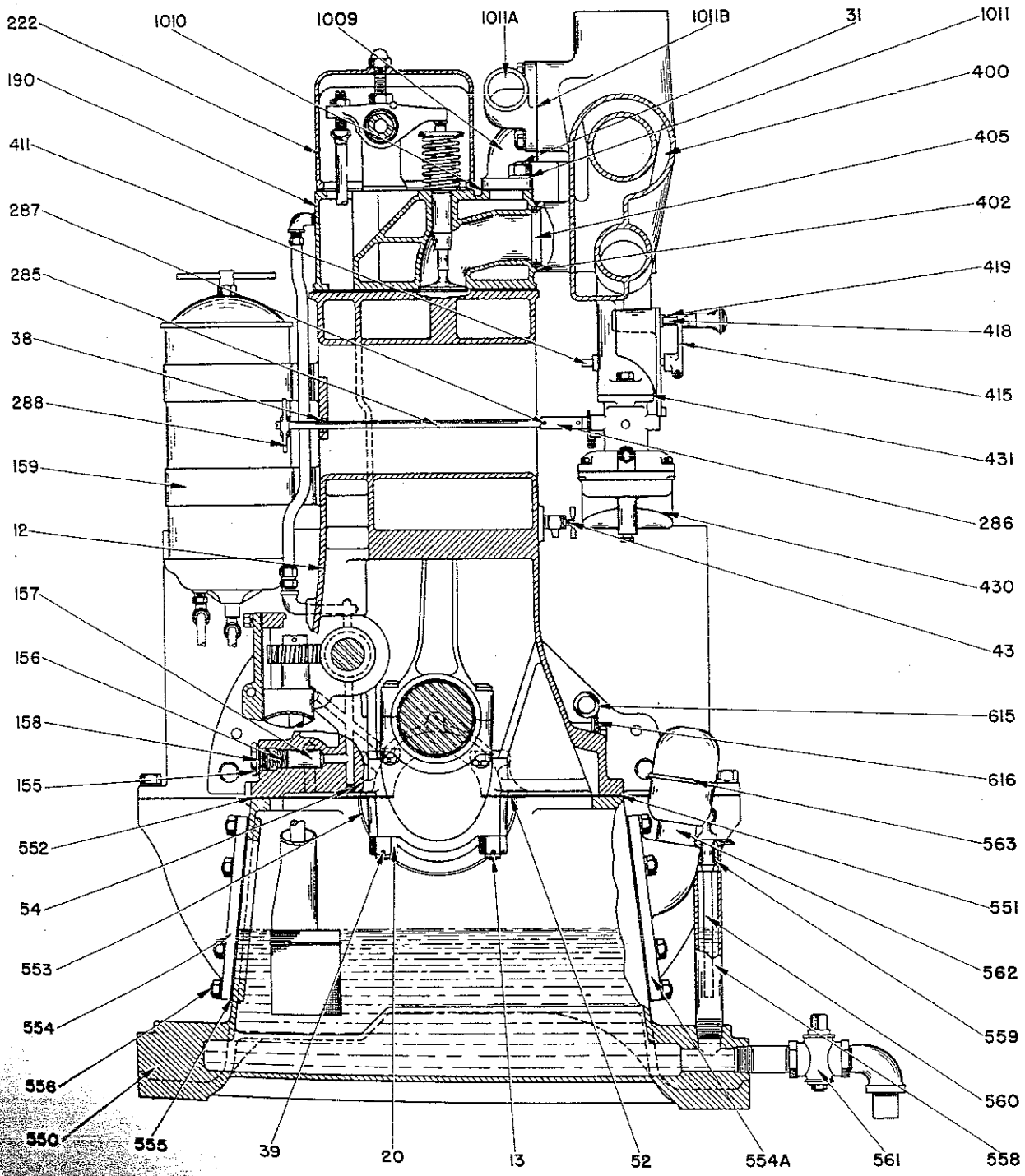

Fig. 47. Cross Section through Engine

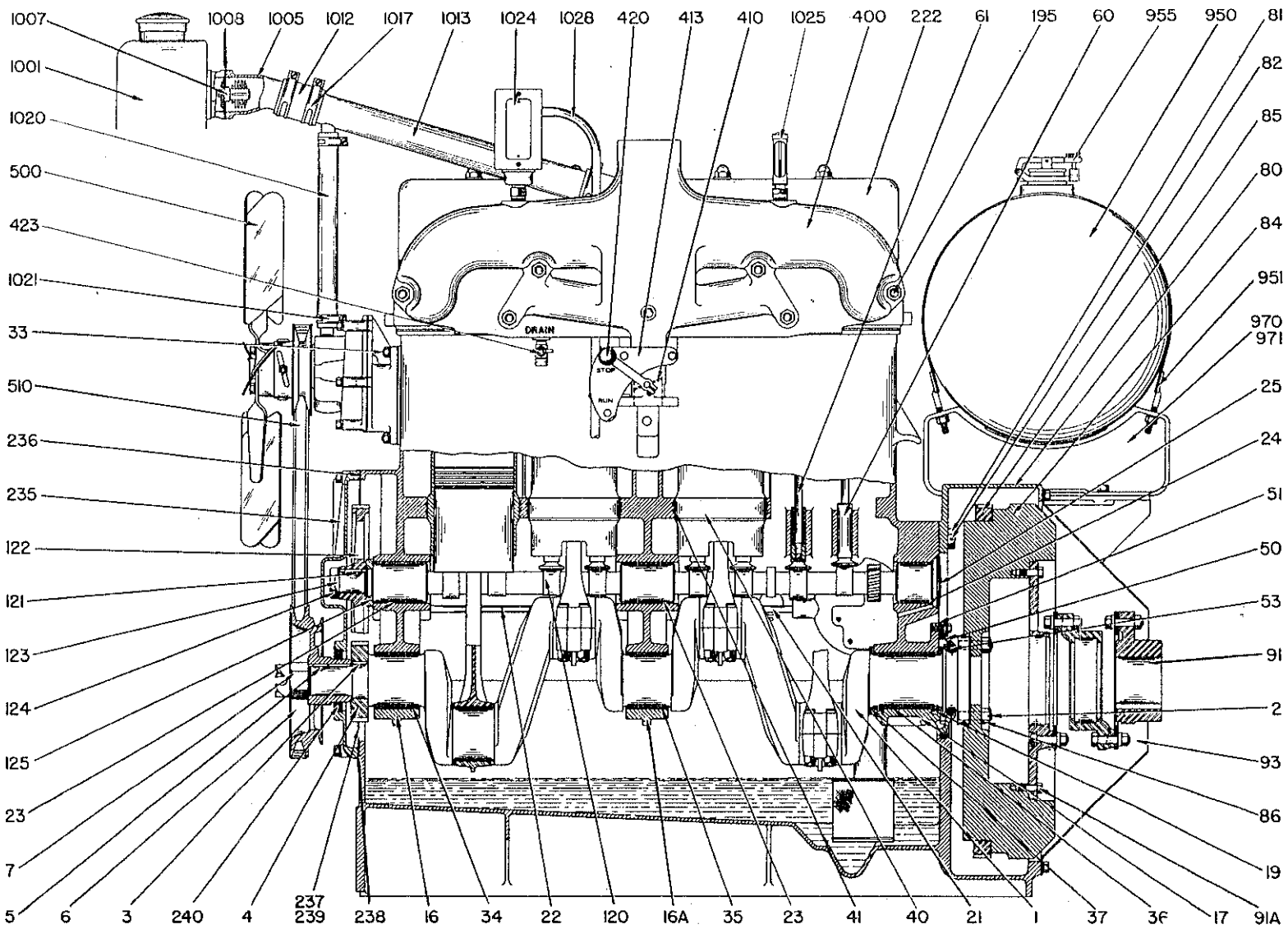

Fig. 48. Longitudinal Section through Engine

39. Crankshaft

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
1		1	Crankshaft Assembly, Includes next 3 items	A5-372	A
2	3H4584A/S58	6	Stud—Crankshaft flange	105-338	A
3	3H4574/K5	1	Key—Crankshaft gear, Woodruff #A	09-15	A
4		1	Crankshaft gear	26-325	A
5	3H4574/K5	1	Key—Crankshaft pulley, Woodruff #A	09-15	A
6	3H4574/P21	1	Pulley—Crankshaft	36-518	A
7		1	Cranking jaw	96-27	A

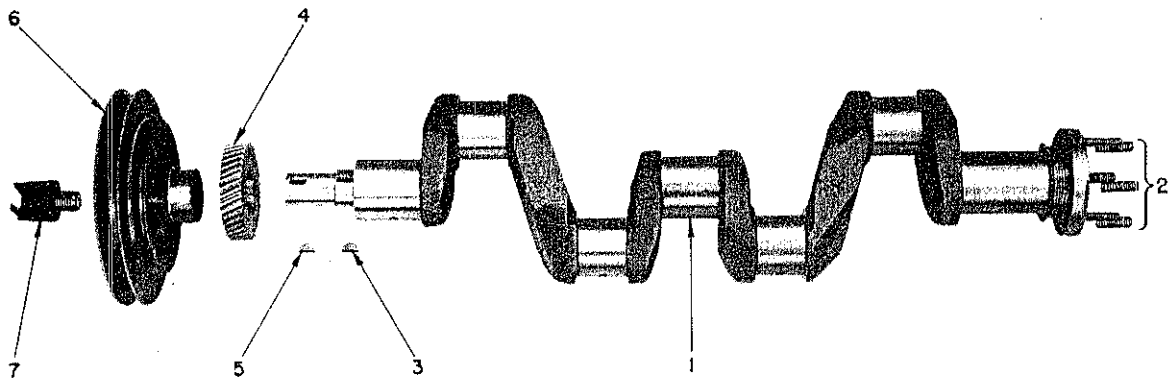

Fig. 49. Crankshaft and Component Parts

40. Crankcase

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
12		1	Crankcase assembly (A to D Incl.)	A100-149-5	A
12		1	Crankcase assembly (A to E Incl.)	1A100-149-5	A
12		1	Crankcase assembly (A to F Incl.)	3A100-149-5	A
13		12	Capscrew—Main Bearing	34-217	A
16	3H4584A/C31	1	Bearing cap—Front main	4-177	A
16A	3H4584A/C13	1	Bearing cap—Center main	4-181	A
..		2	Dowel pin, for rear bearing cap	17-400	A
17	3H4574/P7	1	Bearing cap—Rear main, Includes part #17-299	A4-178	A
19		2	Thrust washer pin	17-299	A

40. Crankcase (Cont'd)

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Function	Mfgr's. Part No.	Mfgr's. Code
21	3H4574/T16	1	Rear oil tube		55-397	A
22	3H4574/T17	1	Front oil tube		55-398	A
23	3H4574/B19	2	Bushing, Front and center camshaft		11-134	A
24	3H4574/B18	1	Bushing, Rear camshaft		11-133	A
25		1	Welch plug, 3″	D	019-40	A
..	3H4574/S18	4	Screw—Parker Kalon #2 x 3/16″, Type U		03-2001	A
..	3H4574/P21	1	Name Plate		62-48	A
..	3H4574/S25	14	Stud—Cylinder head 1/2 x 5 1/4″ lg		105-232	A
31	3H4574/S26	4	Stud—Cylinder head 1/2 x 5 3/4″ lg		B105-31	A
32		4	Stud—Oil cleaner, 5/16 x 1″ lg		B105-39	A
33		4	Stud—Water pump brkt. 3/8 x 1 5/16″ lg		105-245	A
..		1	Stud—Ignition wire brkt., 5/16 x 1″ lg		B105-39	A
34		2	Bearing shell—Front main, 1/2		21-348	A
35		2	Bearing shell—Center main, 1/2		21-347	A
36		2	Bearing shell—Rear main, 1/2		21-349	A
37	3H4584A/W5	4	Thrust washer—Rear main bearing		20-370	A
38	3H4574/B20	1	Bushing—Governor cross shaft		21-324	A
39	3H4574/W10	6	Locking wire—main bearing	E	61-44	A
40	3H4574/S15	4	Cylinder sleeve		175-6-1	A
41	3H4574/P1	8	Packing—Cylinder sleeve	F	74-41	A
43	3H4574/C28	1	Drain cock, 1/4″ M. and F. M. P. thrd		15-338	A
..	3H4574/D7	1	Decal. (Water drain)		62-109	A
50	3H4584D/R7	1	Oil retainer		31-325-1	A
51	3H4574/G27	1	Gasket—Oil retainer		16-777	A
52	3H4574/G38	2	Gasket—Oil retainer parting		16-907-1	A
..		3	Capscrew, 5/16—18 x 7/8″ hex		02-19	A
..		3	Lockwasher, 5/16″		05-50	A
53	3H4584A/S57	2	Oil seal—felt		125-67	A
54		3	Pipe Plug—1/8″ Slotted		19-13	A
55		5	Pipe plug, 1/8″		011-1	A
59	3H4574/P13	1	Pipe plug, 3/8″ ctrsk, special		011-103	A
60	3H4574/T1	8	Valve tappet		23-12	A
61	3H4574/R25	8	Push rod		99-72	A
..		1	Instr. plate		62-110	A
..	3H4574/S18	4	Screw—Parker Kalon #2 x 3/16″ Type U		03-2001	A
..		1	Stud, oil line clamp, 5/16 x 1″		B105-39	A

41. Bell Housing, Flywheel and Coupling

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
80	3H4574/H20	1	Bell housing—upper half	37-221	A
81		3	Capscrew, ¾—16 x 1½" hex.	34-37	A
82	3H4574/W10	1	Locking wire	61-44	A
..		2	Capscrew, ½—13 x 1¼" hex.	02-70	A
..		2	Lockwasher, ½"	05-53	A
84	3H4584A/F5	1	Flywheel assembly, Includes ring gear	A9-486-3	A
85	3H4574/G36	1	Ring gear, 8/10 pitch	26-270	A
86	3H4574/N3	6	Nut, ½"—20 hex. slotted	B53-25	A
..	3H4584A/P33	6	Cotter pin, 3/32 x 1" lg.	07-23	A
91A		8	Capscrew, ⅜—16 x 1¼" hex. hd.	34-209	A
..		8	Lockwasher, ⅜"	05-51	A
92	3H4574/K6	1	Key (Furnished with Alternator)	09-213	A
93	3H4584A/G10	2	Coupling guard	156-116	A
..		6	Capscrew, ⅜—16 x ⅝" hex.	02-33	A
..		6	Lockwasher, ⅜"	05-51	A
91		1	Coupling—Thomas flexible No. 312, Includes next 7 items	A28-256	A
..	3H4584A/F7	1	Flywheel adapter plate	30702	E
..	3H4584A/R36	1	Center ring	20752	E
..	3H4584A/H25	1	Hub—rear flange, 2⅝" Bore, special	21188	E
..	3H4584A/R38	2	Laminated rings—Flexible (20 pieces)	10957	E
..	3H4584A/B40	16	Bolt, ½—20 x 2" lg. special	10966	E
..	3H4584A/W5	16	Washer—Beveled, ½	10965	E
..	3H4584A/N50	16	Nut, ½"—20, "Stay-on"	11118-6	E

42. Connecting Rod

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. PartNo.	Mfgr's. Code
100	3H4584A/R6	4	Connecting rod assembly, Includes parts A to B	1A7-74	A
101	3H4584A/B25	16	Bolt—Connecting rod.....A	34-201	A
103		16	Nut—Connecting rod bolt, 1/16" x 20 hex. special	53-31	A
104		8	Bearing shell—Connecting rod, ½	21-350	A
105	3H4574/W54	4	Capscrew—Piston pin clamp	B35-8	A
106		4	Lock wire	61-5-3	A
..	3H4584A/P33	16	Cotter pin, 3/32 x 1" lg.....B	07-23	A

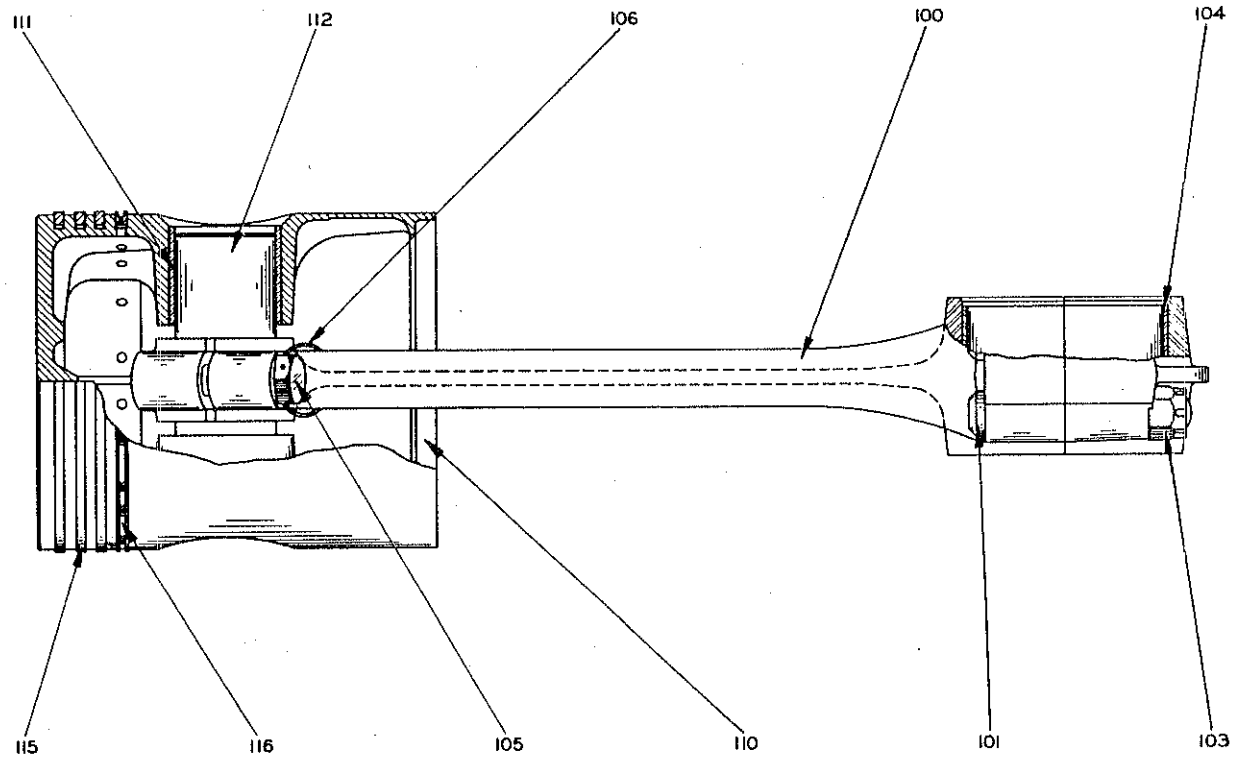

Fig. 50. Cross Section through Connecting Rod and Piston Assembly

43. Piston

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Function	Mfgr's. Part No.	Mfgr's. Code
110		4	Piston Assembly, includes pin and bushings,		1A8-208-3	A
111	3H4584D/B18	8	Bushing—Piston pin		21-334	A
112		4	Piston pin		B17-17	A
115	3H4584A/R7	12	Compression ring—P. C. 4½ x ⅛"		18-233	A
116	3H4584A/R8	4	Oil Ring—P. C. 4½ x 3/16"		18-114	A

44. Camshaft

120	3H4574/C8	1	Camshaft		6-132	A
121	3H4574/K4	1	Key—Camshaft gear, Woodruff #13		09-17	A
122	3H4574/G35	1	Camshaft gear		26-326	A
123	3H4574/W5	1	Lockwasher—Camshaft gear, special		20-276	A
124	3H4574/N11	1	Nut—Camshaft gear, 1⅛"—12 special		53-171	A
125	3H4574/R5	1	Camshaft retainer		31-327	A
126	3H4574/S52	2	Capscrew, 5/16"—18 x ¾" hex.		02-18	A
127		2	Lockwasher, 5/16", special		20-274	A

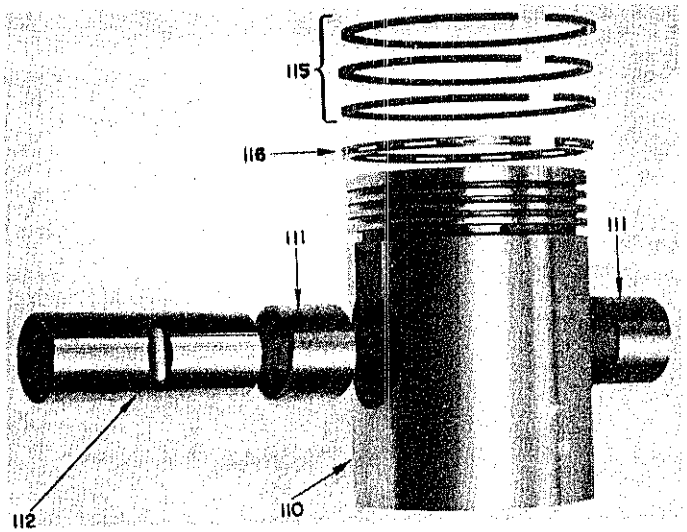

Fig. 51. Piston and Component Parts—Left

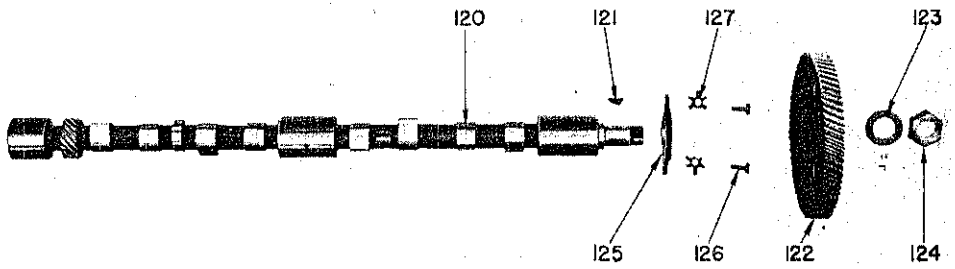

Fig. 52. Camshaft and Component Parts

45. Lubrication, Oil Pump, Lines and Filter

Ref. No.	*S. C. Stock No.*	*No. Req'd*	*Name and Description*	*Mfgr's. Part No.*	*Mfgr's. Code*
130		1	Oil pump assembly, Includes 1A13-260-2 plus parts A to B	2A13-260-2	A
130		1	Oil pump assembly, Includes bushings	1A13-260-2	A
131		3	Bushing—Oil pump body	21-370	A
132		1	Shaft—Oil pump A	27-850	A
136		1	Key—Pump drive gear, Woodruff #6	09-6	A
137	3H4574/D3	1	Pump drive gear	26-327	A
138		1	Taper pin—Pump drive gear, #2 x 1" lg	010-29	A
139		1	Shaft—Oil pump idler gear	27-1337	A
133-140		2	Key—Oil pump gear, Woodruff #6	09-6	A
134-141		2	Oil pump gear	26-519	A
135-142		1	Lock wire—Oil pump gear	64-29	A
143		1	Cover—Oil pump	14-538	A
148		6	Capscrew, ¼—20 x ⅝" hex	02-3	A
149		6	Lockwasher, ¼"	05-49	A
144	3H4584A/526	1	Screen—Oil pump	43-70	A
145		1	Wire—Oil pump screen	61-5-2	A
146	3H4574/G39	1	Gasket—Oil pump body to cover	16-636	A
151		2	Capscrew, 5/16—18 x 1¼" hex	02-21	A
152	3H4574/S52	1	Capscrew, 5/16—18 x ¾" hex	02-18	A
153		3	Lockwasher, 5/16"	05-50	A
147		1	Cover—Oil pump	14-536-1	A
...		1	Pipe plug, ⅛" slotted B	19-13	A
150	3H4574/G24	1	Gasket—Oil pump cover flange	16-635	A
154	3H4574/S52	5	Capscrew, 5/16—18 x ¾" hex	02-18	A
154A		5	Lockwasher, 5/16"	05-50	A
148	3H4574/P47	1	Pipe plug, ¼" ctrsk	011-102	A
155		1	Plug—Oil relief	53-150	A
156	3H4574/41	1	Spring—Oil relief plunger	24-236	A
157	3H4574/P17	1	Plunger—Oil relief	25-54	A
158	3H4574/G23	1	Gasket—Oil relief plug	B16-117	A
159	3H4574/F10	1	Oil filter assembly—Briggs Model G400, Includes parts marked*	A77-176	A
160	3H4584D/32	1	*Element—For oil filter, Briggs Model G-41 Cel	A77-180-1	A
M-4	3H4574/G76	1	*Gasket—For top cover, Vellum	M-4	K
M-16	3H4574/M16	2	*Strap—Mounting	M-16	K
M-17	3H4574/P77	1	*Drain plug—Sump	M-17	K
M-50	3H4574/F17	1	*Restrictor fitting—Brass	M-50	K
M-105	3H4574/S142	1	*Capscrew—Bar handle	M-105	K
M-107	3H4574/A86	1	*Cork washer	M-107	K
M-108	3H4574/N35	1	*Check nut	M-108	K
M-110	3H4574/W84	1	*Steel washer	M-110	K

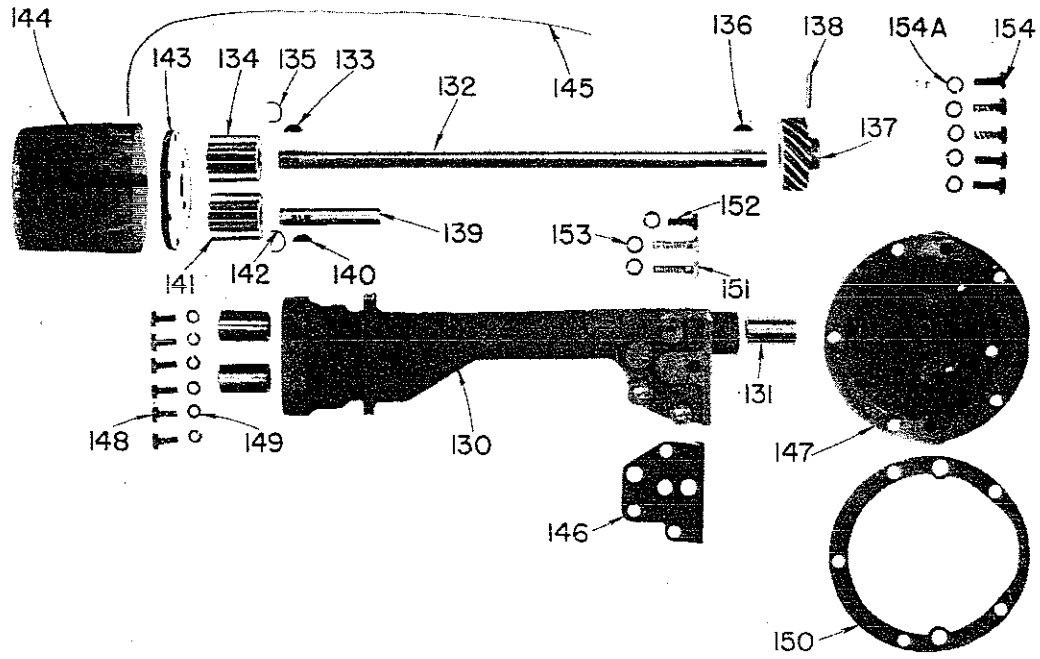

Fig. 53. Oil Pump and Component Parts

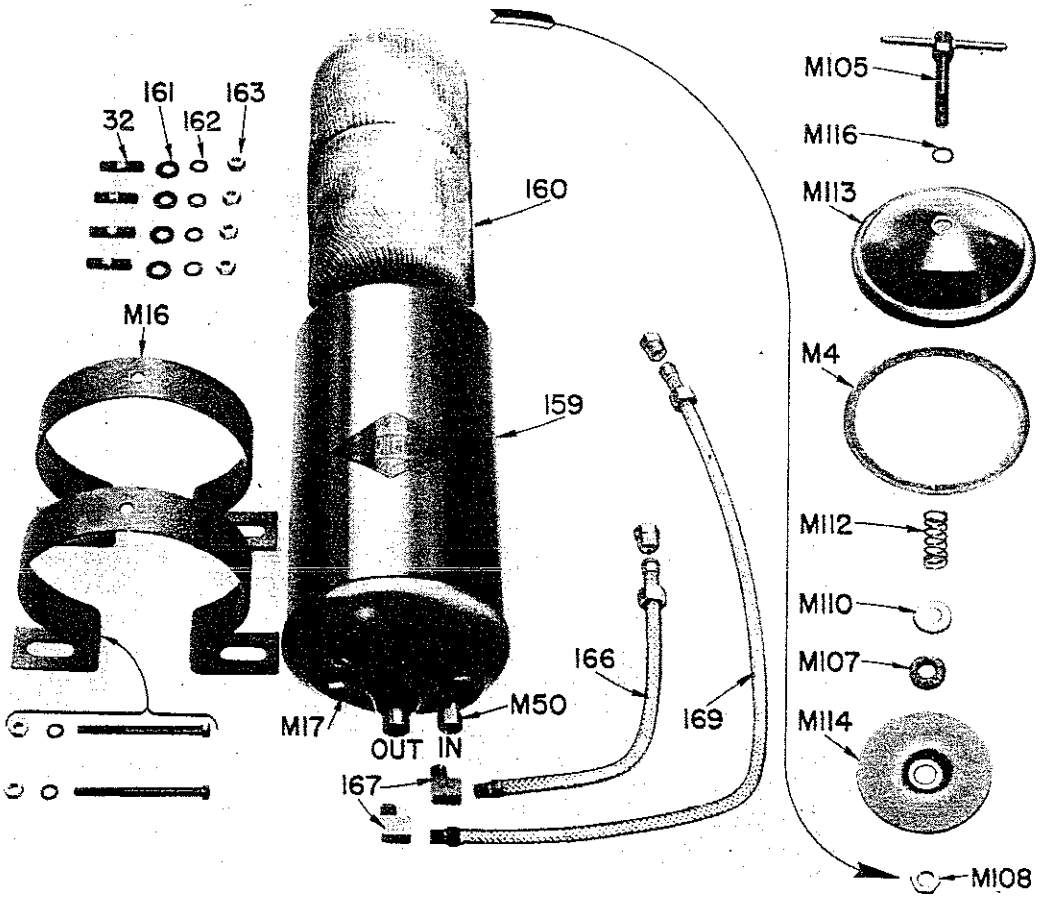

Fig. 54. Oil Filter and Component Parts

45. Lubrication, Oil Pump, Lines and Filter (Cont'd)

Ref. No.	*S. C. Stock No.*	*No. Req'd*	*Name and Description*	*Mfgr's. Part No.*	*Mfgr's. Code*
M-112	3H4574/S140	1	*Hold down spring	M-112	K
M-113	3H4574/C121	1	*Top cover	M-113	K
M-114	3H4574/P77	1	*Plate—Top hold down	M-114	K
M-116	3H4574/W85	1	*Copper washer	M-116	K
32		4	Stud—Oil filter support, 5/16 x 1" lg. (also listed in Group)	B105-39	A
161		4	Plain washer, 5/16"	06-3	A
162		4	Lockwasher, 5/16"	05-50	A
163	3H4574/N4	4	Nut, 5/16"—24 hex. for #B105-39	04-602	A
166	3H4574/L8	1	Oil line—Filter inlet, Titeflex metal, 10 1/4" lg.	A55-642-5	A
167	3H4574/E18	4	Connection, 1/8" x 90° brass str. ell	33-542	A
169	3H4574/L34	1	Oil line—Filter outlet, Titeflex metal, 21 1/2"	A55-642-7	A
171	3H4574/C48	2	Connection—Filter lines, 1/8" brass nipple	33-544	A
172	3H4574/L9	1	Oil line—To cyl. hd., Titeflex metal hose, 16 1/4" lg.	A55-642-4	A
173	3H4574/E18	2	Connection—Cyl. hd. oil line, 1/8" 90° brass str. ell	33-542	A
174	3H4574/C48	1	Connection—Cyl. hd. oil line, 1/8" brass close nipple	33-544	A
175	3H4574/C48	1	Connection—Oil line crankcase, 1/8" brass close nipple	33-544	A
176		1	Connection—Oil line, 1/8" cross	54-101	A
164		1	Gauge—Oil pressure	60-80	A
177	3H4574/L11	1	Oil line—To oil gauge, Titeflex metal hose, 29 3/4" lg.	A55-642-8	A
178	3H4574/C48	1	Connection—Oil line to oil gauge, 1/8" brass close nipple	33-544	A
179	3H4574/L10	1	Oil line—To governor, Titeflex metal hose, 22 1/2" lg.	A55-642-6	A
...	3H4574/E18	1	Connection—Oil line to gov., 1/8" 90° brass str. ell	33-542	A
180	3H4574/C48	1	Connection—Oil line to gov., 1/8" close nipple	33-544	A
181		2	Clamp—Oil line	83-49	A
...		1	Lockwasher, 5/16"	05-50	A
...	3H4574/N4	1	Nut, 5/16"—24 hex.	04-602	A
...	3H45884A/T5	1	Brass tee, 1/8 x 1/8 x 1/8"	33-554	A
...	3H4574/E16	1	Brass elbow, 1/4 x 1/8", special reducing	33-547	A
...	3H4574/L14	1	Oil line—Pressure switch to gauge, Titeflex metal hose, 11 5/8" lg.	A55-642-13	A
...	3H4574/C48	2	Brass close nipple, 1/8"	33-544	A

46. Cylinder Head

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
190		1	Cylinder head assembly optional, Includes parts A to C Incl.	1A2-149-3	A
190	3H4574/H1	1	Cylinder head assembly optional, Includes parts A to D Incl.	2A2-149-3	A
190	3H4574/H7	1	Cylinder head comp. assembly optional, Includes parts A to L Incl.	3A2-149-3	A
191		4	Seat insert—Exhaust valve.....A	64-33	A
192	3H4584A/G2/1	4	Guide—Intake valve	58-26	A
193	3H4584A/G2/2	4	Guide—Exhaust valve	58-27	A
194		4	Stud—Rocker arm bracket	105-216	A
195		6	Stud—Manifold	105-191	A
...		16	Stud—Spark plug shield (not illustrated).....C	105-315	A
196	3H4574/V2	4	Intake valve	15-200	A
197	3H4574/V8	4	Exhaust valve	15-201-1	A
198	3H4574/S17	8	Valve spring	B24-26	A
199	3H4584A/R4	8	Washer—Valve spring	20-278	A
200	3H4574/W6	16	Lockwasher—Valve stem, special.....D	20-279	A
201	3H4574/L36	1	Oil line—rocker arm to cylinder head 5/16 x 8"	A55-51-24	A
205	3H4574/S22	1	Rocker arm shaft assembly, Includes sleeve and plugs	1A27-839	A
205		1	Rocker arm shaft assembly, Includes 1A27-839 plus parts E to L, Incl.	4A27-839	A
206	3H4574/S114	1	Sleeve—Rocker arm shaft	63-41	A
207		2	Plug—Rocker arm shaft	19-87	A
210	3H4584A/A7	4	Rocker arm assembly—Intake includes bushing and parts G and H.E	A98-19-2	A
212	3H4574/B27	4	Bolt—Valve adjusting.....G	B34-25	A
213	3H4574/N31	4	Lock nut—Valve adjusting bolt.....H	B53-8	A
210A	3H4584A/A1	4	Rocker arm assembly—Exhaust includes bushing and parts J and K	A98-19-3	A
212	3H4574/B27	4	Bolt—Valve adjusting.....J	B34-25	A
213	3H4574/N31	4	Lock nut—Valve adjusting bolt.....K	B53-8	A
216		4	Bracket—Rocker arm shaft	40-795-2	A
217		4	Spring—Rocker arm shaft	24-86	A
218		8	Washer—Rocker arm shaft	20-74	A
219		2	Lock Wire.....L	61-59	A
219A	3H4574/W7	14	Washer—Cylinder head stud, 1/2"	B20-1	A
219B	3H4574/N8	14	Nut—Cylinder head stud, 1/2"—20 hex	04-605	A
219C	3H4574/N27	4	Nut—Rocker arm bracket	04-604	A
...		4	Washer—Rocker arm bracket stud, 1/16" plain	06-70	A
221	3H4574/G22	1	Cylinder head gasket	16-629	A
...	3H4574/G59	1	Cylinder head cover assembly, Includes parts M to N Incl.	A14-535	A
222		1	Cover—Cylinder head.....M	14-535	A
223	8H4574/B9	1	Breather—Air Maze ZOH, includes parts marked †	A77-137	A
223A		1	†Breather top, includes name plate #Z0-3	Z0-001	B
223B		1	†Breather base	Z0-003	B
223C		1	†Breather element	Z0-18	B

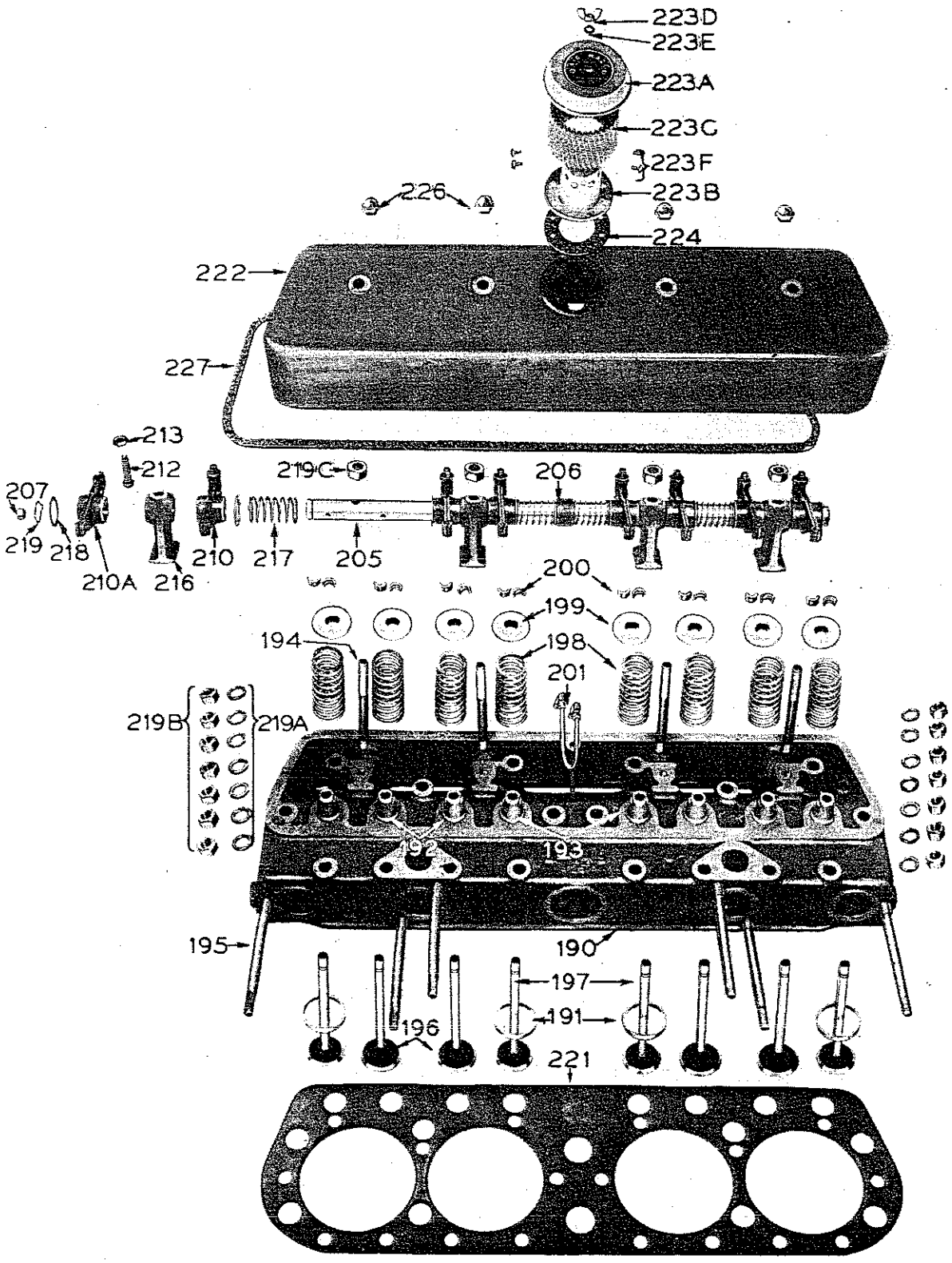

Fig. 55. Cylinder Head and Component Parts

46. Cylinder Head (Cont'd)

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
223D		1	†Wing nut, ⅜″ std	04-1002	A
223E		1	Lockwasher, ⅜″	05-51	A
223F	3H4574/S63	4	Screw—Breather, Parker Kalon, Type Z Stove head #10 x ⅜″	03-1538	A
224	3H4574/G21	1	Breather gasket N	16-643-1	A
226	3H4574/N7	4	Nut—Cylinder head cover, 7/16″—20 Acorn	04-1129	A
227	3H4574/G20	1	Gasket—Cylinder head cover	16-634-1	A

47. Gear Cover

235		1	Gear cover	14-540-2	A
236	3H4574/G19	1	Gasket—Gear cover (upper)	16-650	A
237	3H4574/G18	1	Gasket—Gear cover (manifold side)	16-651	A
238	3H4574/G17	1	Gasket—Gear cover (lower)	16-652	A
239	3H4574/G16	1	Gasket—Gear cover (magneto side)	16-653	A
240		1	Oil retainer, 2½″ I.D.	125-58-2	A
243		11	Capscrew, ⅜—16 x 1¾″ hex	02-39	A
244		2	Capscrew, ⅜—16 x 1½″	02-38	A
245		14	Lockwasher, ⅜″	05-51	A
241		2	Taper pin, #7 x 2″ lg	010-315	A
242		2	Nut, ⅜″—24 hex	04-603	A

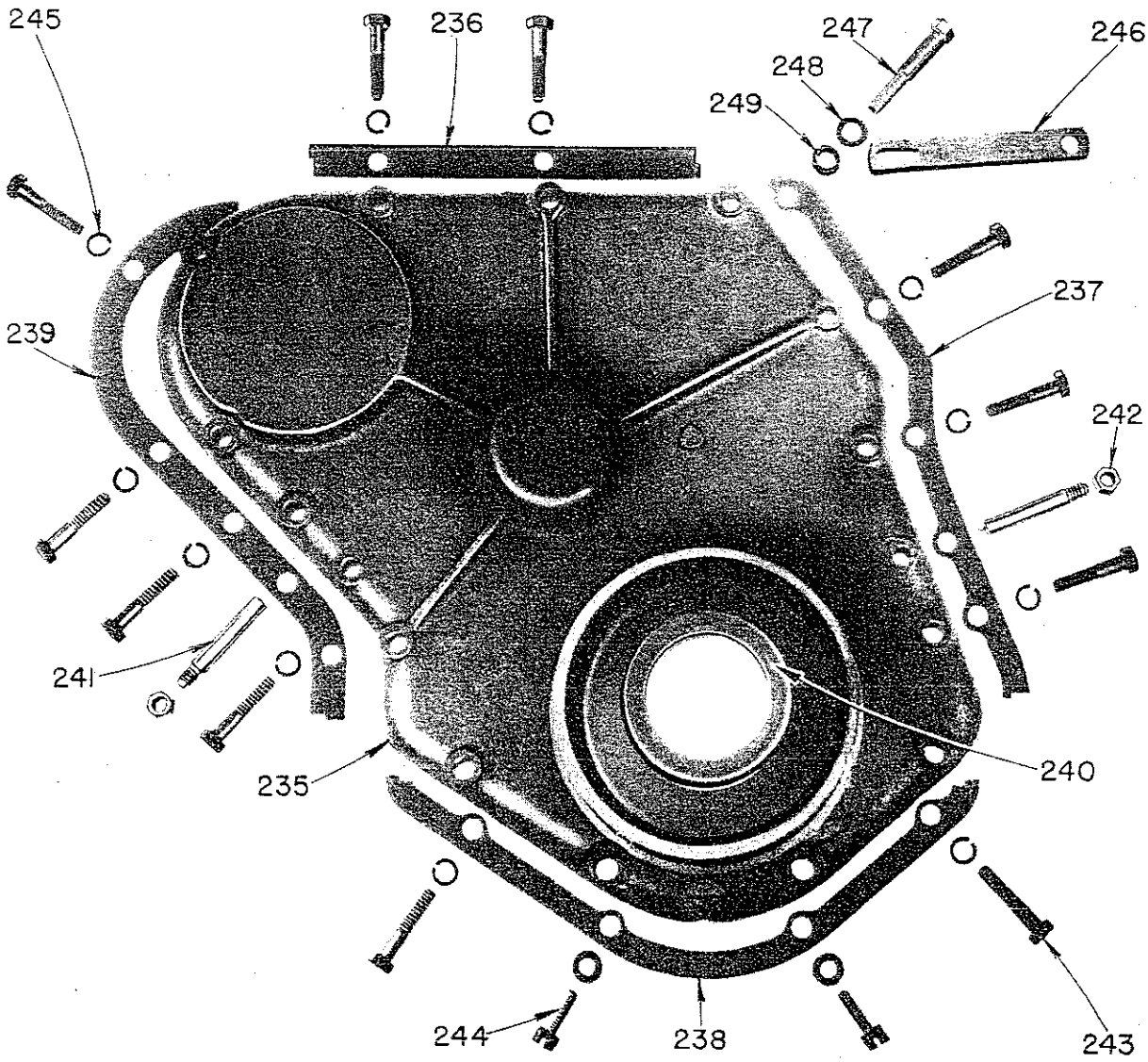

Fig. 56. Gear Cover and Component Parts

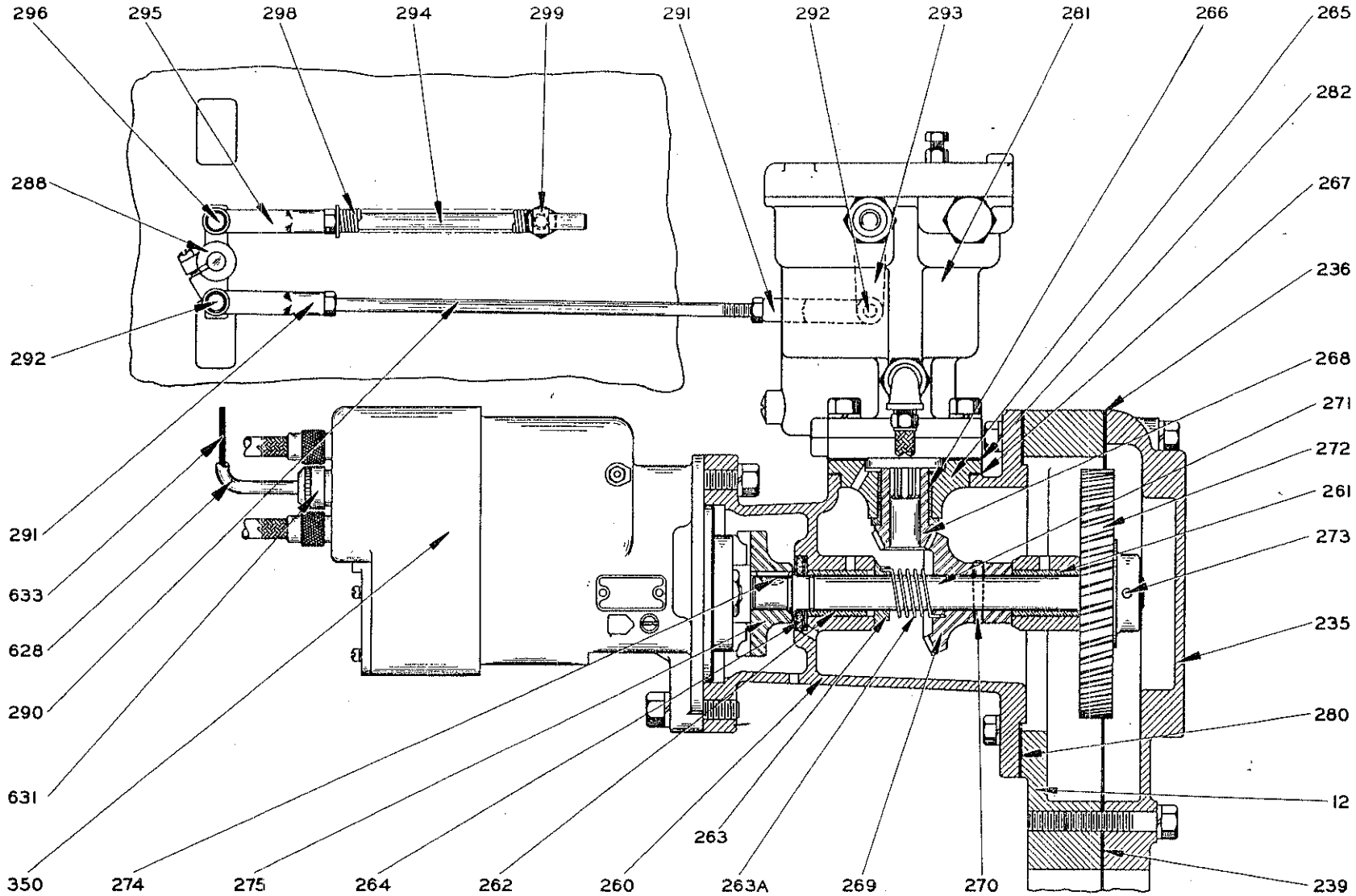

Fig. 57. Cross Section through Governor Drive Assembly

48. Governor Drive Assembly

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
260	3H4574/D20	1	Governor drive assy., Optional, Includes parts A to F	2A116-51	A
260		1	Governor drive assy., Optional, Includes parts A to E	1A116-51	A
260		1	Governor drive assy., Optional, Includes parts A to B	A116-51	A
260		1	Body—Governor drive A	116-51	A
261	3H4574/S71	1	Bushing—Governor shaft, front	21-339	A
262	3H4584A/B21	1	Bushing—Governor shaft, rear	21-354	A
263	3H4584A/S64	1	Oil slinger	202-1	A
263A	3H4584A/S53	1	Spring	24-310	A
264	3H4584A/S56	1	Oil seal	125-56-1	A
265		1	Bearing cap assy., Includes bushing B	A4-167	A
266	3H4574/B64	1	Bushing—Governor drive pinion	21-327	A
267	3H4574/G15	1	Gasket—for bearing cap	16-873	A
268		1	Bevel pinion—Governor drive E	26-504	A
269		1	Bevel gear—Governor drive shaft	26-503	A
270		1	Taper pin, for bevel gear, #3—1¼" lg.	010-42	A
271	3H4574/S14	1	Shaft—Accessory drive	27-1325	A
272		1	Gear—Accessory drive shaft	26-334-2	A
273		1	Taper pin—Governor drive gear, #3—1¼" lg.	010-42	A
274		1	Key—Magneto coupling, Woodruff #6	09-6	A
275		1	Magneto coupling F	28-159	A
...	3H4574/S2	4	Capscrew, for drive shaft bracket, ⅜—16 x 1" hex.	02-36	A
...		4	Lockwasher, for #02-36, ⅜"	05-51	A
280	3H4574/G14	1	Gasket—Drive shaft bracket	16-669	A

49. Governor Controls

285	3H4574/S13	1	Cross shaft assy., Governor operating, Includes next 5 items		
285		1	Cross shaft	A27-1152	A
286	3H4584A/C11	1	Coupling—Cross shaft	27-1152	A
287		1	Taper pin, for coupling #000 x ½"	28-232	A
...		1	Screw, for #48-493, #10-24 x ½"	010-201	A
288	3H4574/L3	1	Lever—Governor operating cross shaft	03-92	A
290	3H4574/R28	1	Rod—Governor operating	48-493	A
291	3H4574/C52	2	Clevis end—Governor rod	47-264	A
...		2	Nut, for #031-2, ¼"—28 hex.	031-2	A
292	3H4574/P8	2	Clevis pin	04-601	A
...	3H4574/P9	2	Cotter pin, 1/16 x 7/16"	031-62	A
294		1	Rod—Governor control spring	07-2	A
295	3H4574/C52	1	Clevis end—Spring rod	47-524	A
...		1	Nut, for #031-2, ¼"—28 hex.	031-2	A
				04-601	A

49. Governor Controls (Cont'd)

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
296	3H4574/P8	1	Clevis pin	031-62	A
...		1	Cotter pin, 1/16 x 7/16"	07-2	A
298	3H4574/P9	1	Spring—Governor control	24-300	A
299	3H4574/G58	1	Guide assy.—Governor spring rod, Includes bushing	A58-38	A
300	3H4574/N5	1	Bushing, for guide	21-345	A
...		1	Nut, for guide, 5/16"—18	04-102	A

50. Manifold

400	3H4574/M5	1	Manifold assembly (Includes Welch plugs)	A10-355-1	A
...	3H4574/P29	4	Welch plug, 1¼" dia.	019-19	A
...	3H4574/G13	2	Gasket—Intake	16-630	A
402	3H4574/G28	1	Gasket—Exhaust center	16-885	A
...	3H4574/G29	2	Gasket—Exhaust end	16-632	A
...	3H4574/W7	6	Plain washer, ½"	B20-1	A
405	3H4574/C42	1	Collar—Manifold center outlet	63-94	A
...	3H4574/N8	6	Nut, ½"—20 hex	04-605	A
410		1	Butterfly valve	15-329	A
411		1	Shaft for butterfly valve	27-1327	A
...		2	Screw, ⅛"—40 flat head	34-187	A
413		1	Bracket assembly, Includes stop pin for start and stop control	A116-52	A
...		2	Capscrew for control bracket, ¼—20 x 2" hex	02-10	A
...		2	Lockwasher, ¼" dia	05-49	A
415		1	Control lever	48-489	A
...	3H4574/S3	1	Screw for control lever, #10—24 x ½" lg. fil. hd.	03-92	A
418	3H4574/R27	1	Rod for control lever	47-542	A
419	3H4574/S48	1	Spring for control lever rod	24-308	A
420		1	Handle for control lever	50-88	A
...		1	Pipe plug, ⅛" slotted	19-13	A
423	3H4574/C28	1	Drain cock, ¼" male x ¼" female	15-338	A

51. Muffler

800		1	Muffler Assy	78-73	A
802		1	Exhaust Pipe	33-178-23	A
803		1	Retainer muffler packing	31-426	A
804	3H4574/P4	1	Muffler packing, ⅜ x 24" lg	16-886	A

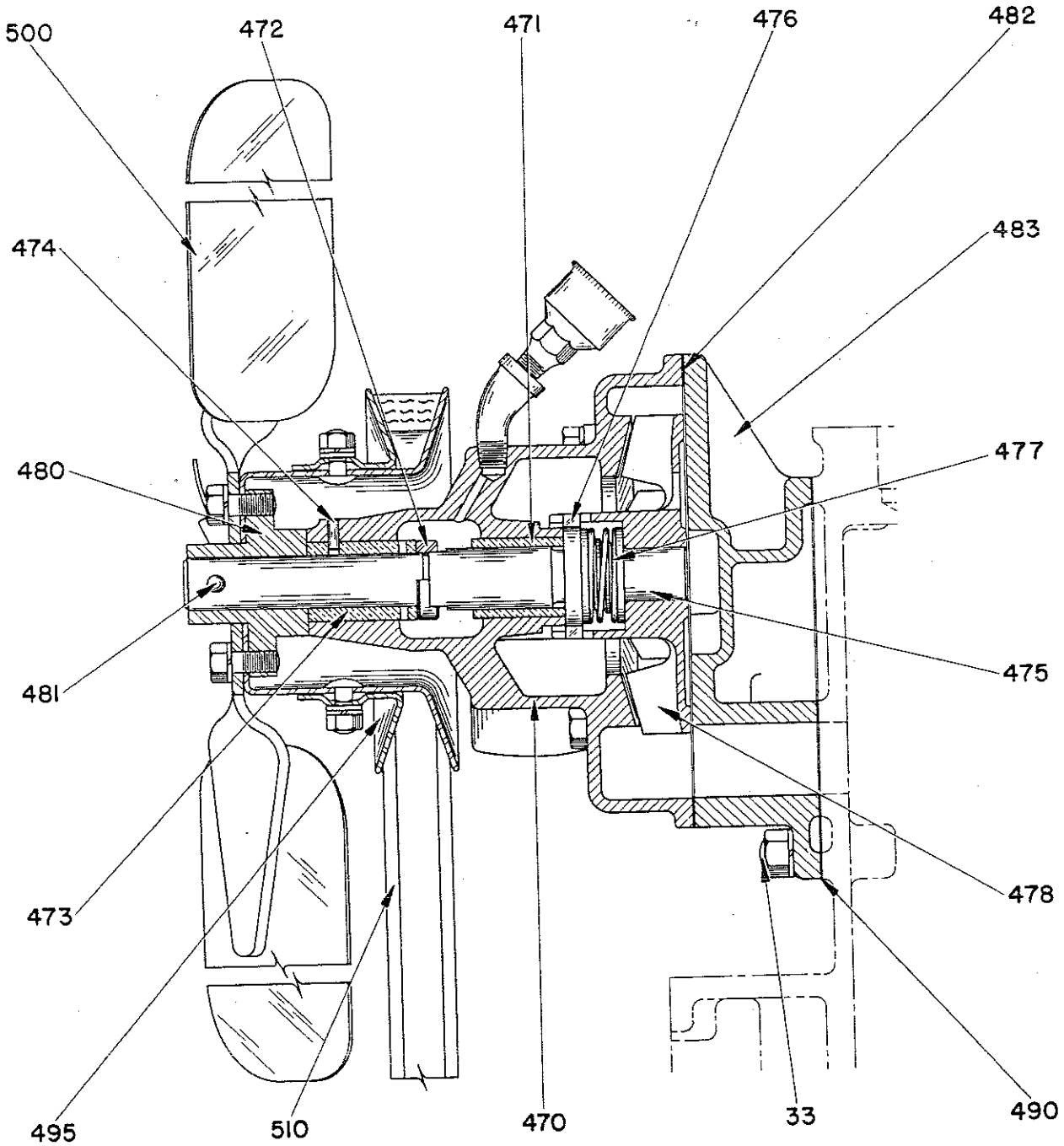

Fig. 58. Cross Section through Water Pump (Up to Serial No. 165842)

52. Water Pump and Fan (Up to Serial No. 165842)

Ref. No.	*S. C. Stock No.*	*No. Req'd*	*Name and Description*	*Mfgr's. Part No.*	*Mfgr's. Code*
...		1	Water pump assembly, Includes A13-360-1 plus items marked †	1A13-360-1	A
470	3H4574/B58	1	Body—Water pump, Includes next 4 items	A13-360-1	A
471		1	Bushing	21-368	A
472	3H4574/W76	1	Thrust washer	20-378	A
473		1	Bushing	21-367	A
474	3H4574/P75	1	Bushing pin	17-418	A
475	3H4574/S133	1	†Shaft—Water pump	27-1381	A
476	3H4574/W77	1	†Seal washer	20-379	A
477	3H4574/B3	1	†Bellows seal assembly	125-68	A
478		1	†Impeller—Water pump	101-28	A
480		1	†Fan hub	132-73	A
481	3H4574/P74	1	†Taper pin—Fan hub, #4 x 1"	010-53	A
482	3H4574/G9	1	†Gasket—Pump body	16-754	A
483		1	†Bracket—Pump body	40-1075	A
...	3H4574/S55	5	†Capscrew, 5/16—18 x 1¾"	02-23	A
...		5	†Lockwasher, 5/16"	05-50	A
...		1	†Street ell, ⅛" P. T. x 45°	013-531	A
...	3H4574/C117	1	†Grease cup, ⅛" MPT	017-11	A
...	3H4574/N32	1	Nipple, ½ x 2½" thread one end	33-114-21	A
490	3H4574/G8	1	Gasket—Water pump bracket to cylinder	16-638	A
...		4	Hex. nut, ⅜"—24	04-603	A
...		4	Lockwasher, ⅜"	05-51	A
495		1	Fan pulley assembly	1A36-249	A
510		1	Fan belt	41-235	A
500	3H4574/B63	1	Fan blade assy	42-107	A
...	3H4574/S52	4	Capscrew—Fan blade, 5/16"—18 hex	02-18	A
...		4	Lockwasher, for #02-18, 5/16"	05-50	A
...	3H4584A/P2	1	†Pin, Taper, Impeller hub, #4 x 1½"	010-55	A

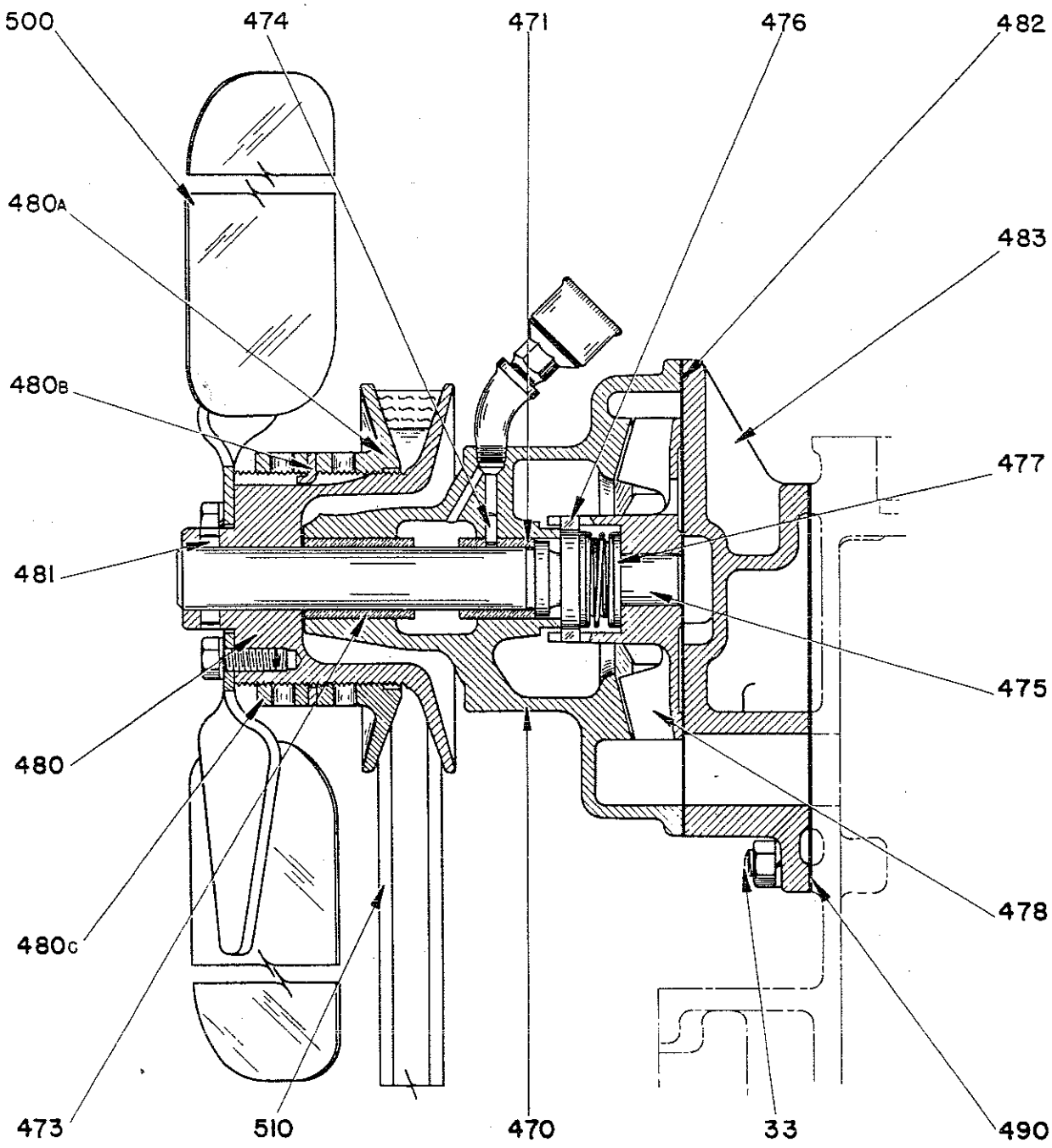

Fig. 59. Cross Section through Water Pump (Serial No. 165843 and up)

53. Water Pump and Fan (Serial No. 165843 Up)

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
		1	Water pump assembly, Includes parts marked †	5A13-360-1	A
470		1	†Body—Water pump (Not sold for service, Order 5A13-360-1)	13-360-1	A
471		1	†Bushing—Water pump shaft, Rear	21-380	A
473		1	†Bushing—Water pump shaft, Front	21-381	A
474	3H4574/P75	1	†Pin—Rear bushing retainer	17-418	A
475		1	†Shaft—Water pump and fan	27-1397	A
476	3H4574/W77	1	†Washer—Water pump seal, Carton	20-379	A
477	3H4574/B3	1	†Bellows seal assembly	125-68	A
478		1	†Impeller—Water pump	101-28	A
479		1	†Pin—Impeller hub retainer, #4 taper x 1½" lg	010-55	A
...		1	†Steel Ell—⅛" P. T.—45°	013-531	A
...		1	†Pulley assembly—Includes next 4 items	A36-529	A
480		1	Pulley—Inner half	36-529	A
480A		1	Pulley—Outer half	36-528	A
480B		1	Lockwasher—Special	20-386	A
480C		1	Locknut—Special	53-521	A
481		1	†Pin—Fan pulley retainer, #4 taper x 1¼" lg	010-54	A
		1	Grease Cup—⅛" M. P. T	017-12	A
484		1	Nipple—Water by-pass, Thread one end, ½" x 2½" lg	33-114-21	A
482	3H4574/G9	1	Gasket—Water pump body to cover	16-754	A
483		1	Bracket—Water pump body	40-1075	A
	3H4574/S55	5	Capscrew—5/16—18 x 1¾" lg	02-23	A
		5	Lockwasher—5/16"	05-50	A
490	3H4574/G8	1	Gasket—Water pump bracket to cylinder	16-638	A
		4	Nut—⅜"—24, hex.	04-603	A
		4	Lockwasher—⅜"	05-51	A
510		1	Belt—Fan and water pump drive	41-235	A
500		1	Fan blade assembly	42-107-1	A
	3H4574/S52	4	Capscrew—Fan blade, 5/16"—18 hex.	02-18	A
		4	Lockwasher—For #02-18, 5/16"	05-50	A

54. Cooling Group

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
1001	3H4574/B3	1	Radiator assembly	A71-243-9	A
1002	3H4574/P3	2	Packing, radiator	B74-4	A
....		2	Capscrew—For radiator, 5/8—11x1 1/2"	02-101	A
....		2	Plain washer, 5/8"	06-73	A
....		2	Lockwasher, 5/8"	05-55	A
1003	3H4584A/G11	1	Fan guard	156-170	A
1003A	3H4584A/G12	1	Radiator guard	156-169	A
....		6	#10 x 3/8" Binding head screw	03-1537	A
....	3H4584A/S22	9	Machine screws, 1/4—20 x 1/2" lg. rd. hd	03-619	A
....		9	Square nut, 1/4"—20	04-18	A
....		9	Flat washer, 1/4"	06-2	A
....		1	Street ell, 1/4"—45°	013-532	A
1004	3H4574/C28	1	Drain cock, 1/4 M. & F. M. PT	15-338	A
1005	3H4574/C60	1	Inlet connection—Radiator	65-626	A
1007		1	Thermostat	116-54	A
1008	3H4574/G3	1	Gasket—Inlet conn	B16-123	A
....		2	Capscrew—Inlet conn. 7/16—14 x 1 1/4"	02-55	A
....		2	Lockwasher, 7/16"	05-52	A
1009	3H4574/C54	2	Connection—Cyl. hd. water	65-624	A
1010	3H4574/G2	4	Gasket—Cyl. hd. water connection	16-646	A
1011	3H4574/W7	4	Plain washer	B20-1	A
....		4	Nut, 1/2"—20 hex	04-605	A
....		4	Capscrew—Cyl. hd. water conn. to mfld., 1/2—13 x 1 1/4"	02-70	A
....		4	Lockwasher, 1/2"	05-53	A
1011A	3H4574/655	1	Connection—Manifold water outlet	65-625	A
1011B		1	Gasket—connection	16-146	A
....	3H4574/S2	2	Capscrew—Outlet conn. to mfld. 3/8 x 16 x 1"	02-36	A
....		2	Lockwasher, 3/8"	05-51	A
1012	3H4574/H13	2	Hose—Outlet conn. to rad., 1 3/4 x 2 1/2"	73-5-20	A
1013	3H4574/668	1	Outlet conn.—to radiator	65-627	A
....	3H4584A/T9	1	Tube—Radiator to pump conn	55-208-8	A
....	3H4574/H3	2	Hose—Radiator to pump, 1 3/4 x 3"	73-5-14	A
1017	3H4584A/625	8	Hose clamp assembly	83-93	A
1020	3H4574/H14	1	Hose—By-pass, 3/4 x 11 1/2"	73-29-8	A
1021	3H4574/669	2	Hose clamp assembly	83-92	A
1025		1	Thermometer	60-146	A
....	3H4584A/S27	1	Bug Screen	43-131	A
....	3H4584A/S54	8	Spring—Bug Screen	24-311	A
....	3H4574/C62	1	Clamp—Tubing	83-91	A
....		1	Capscrew, 3/8 x 1/2" hex. hd	02-32	A
....		1	Lockwasher, 3/8"	05-51	A

55. Engine Base (Oil Pan Group)

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
550		1	Engine base (Oil Pan)	118-250-1	A
551	3H4574/G7	1	Gasket—Eng. base flange, carb. side	16-647	A
352	3H4574/G8	1	Gasket—Eng. base flange, mag. side	16-648	A
553	3H4574/G5	1	Gasket—Eng. base, rear	16-649-1	A
....		16	Capscrew—Eng. base flange, 3/8—16 x 1¼" hex.	02-37	A
....	3H4574/C58	16	Lockwasher, 3/8"	05-51	A
554		3	Hand hole cover	14-807	A
554A	3H4574/657	1	Hand hole cover, Includes oil filler tube	14-804	A
...		48	Lockwasher, 3/8"	05-51	A
...		48	Nut, 3/8"—24 hex.	04-603	A
555	3H4574/G1	4	Gasket, Hand hole cover	16-359-1	A
556		48	Stud—For hand hole cover	105-61	A
558		1	Nipple—For dipstick	33-101-2	A
559	3H4584A/B22	1	Bushing—For dipstick	21-355	A
560		1	Dipstick—Oil level gauge	A60-43-19	A
561	3H4574/V11	1	Oil drain valve, ¾" bronze	15-349	A
...		1	Oil drain line, ¾ x 2½" lg.	013-131	A
...	3H4574/E9	1	Street ell—oil drain, ¾"—90°	013-505	A
...	3H4574/N33	1	Nipple—Oil drain, ¾ x 1½", thrd., one end	33-101-7	A
562		1	Tube—For oil breather	49-43	A
563	3H4574/B62	1	Breather—Oil pan	A49-44-1	A

56. Bed Plate (Engine and Alternator)

...		1	Bedplate—Engine and alternator	118-464	A
...		6	Capscrew—Engine to base, ¾"—10 x 2" hex.	02-118	A
...		6	Lockwasher—For #02-118, ¾"	05-57	A
...		4	Capscrew—Generator to base, ¾—10 x 2¾"	02-150	A
...		4	Lockwasher—For #02-121, ¾"	05-59	A
...		4	Dowel pin, #9 x 3"	010-325	A
...		4	Shim—For generator base, .005" thick	22-190-1	A
...		8	Shim—For generator base, .015" thick	22-190	A
...		4	Shim—For generator base, .030" thick	22-190-2	A
...	3H4574/S144	1	Radiator support	39-1377	A
...		6	Capscrew—Rad. Supp. 3/8—16 x 7/8" hex.	02-35	A
...		6	Lockwasher—For #02-35, 3/8"	05-51	A
...		1	Support—Starting crank	39-1225	A
...		2	Capscrew—For crank supp., ½—13 x 1½" hex.	02-71	A
...		2	Lockwasher—For #02-71, ½"	05-53	A
...		2	Nut, ½"—13 hex.	04-105	A

56. Bed Plate (Engine and Alternator) (Cont'd)

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
...		1	Front cover—For support	14-802	A
...		8	Screw—For cover, 5/16—18 x 3/4" button head machine	03-628	A
...		8	Lockwasher, 5/16"	05-50	A
...	3H4574/C82	1	Cover—For battery	14-828	A
...		1	Support—For control cabinet	39-1387	A
...		4	Capscrew—For supp., 5/8—11 x 1 1/4" hex.	02-100	A
...		4	Lockwasher—For #02-100, 5/8"	05-55	A
...	3H45840/M9	4	Rubber mounting—For cabinet	39-1180-1	A
...		16	Capscrew—For rubber mountings, 1/4—20 x 1/2" lg. hex.	02-2	A
...		16	Lockwasher—For #02-2, 1/4"	05-49	A
...		2	Wire—Cabinet to ground	61-451	A
...		2	Capscrew, 1/4—20 x 1/2" hex.	02-2	A
...		2	Plain washer, 1/4"	06-67	A
...	3H4584A/S20	4	Capscrew—For rubber mountings, 3/8—16 x 2" hex.	34-205	A
...		4	Plain washer, 3/8"	06-69	A
...	3H4584A/N42	4	Nut, 3/8"—16 castle	04-303	A
...	3H4584A/P33	4	Cotter pin, 3/32 x 1" lg.	07-23	A
...		1	Name plate, Signal Corps Unit Number	62-123-2	A
...		1	Decal.—Installation Instruction	62-148	A
...	3H4574/S18	8	Screw, Parker Kalon, #2 x 3/16", Type U	03-2001	A
...	3H4574/D8	1	Decal.—Instr. for water capacity	62-113	A
...	3H4574/D7	2	Decal.—Instr. for water drain	62-109	A
...	3H4574/D9	1	Decal.—Instr. for weight	62-116	A
...		1	Lug—For ground	121-31	A
...		1	Capscrew, 5/16—18 x 1/2"	02-16	A
...		1	Lockwasher, 5/16"	05-50	A
...	3H4574/11	1	Decal.—Oil capacity	62-115	A

57. Cranking Motor

...	3H4574/M5	1	Cranking Motor—Delco Remy Model 412, 12 volt	A107-37	A
...	3H4574/S2	3	Capscrew—Cranking motor mounting, 3/8—16 x 1" hex.	02-36	A
...		3	Lockwasher—For #02—36, 3/8"	05-51	A
...		1	Bearing plate	16199	F
...		1	Drive housing	16999	F
...		1	Insulation strip	33345	F
...		6	Brush spring	34846	F
...		1	Bushing	35048	F

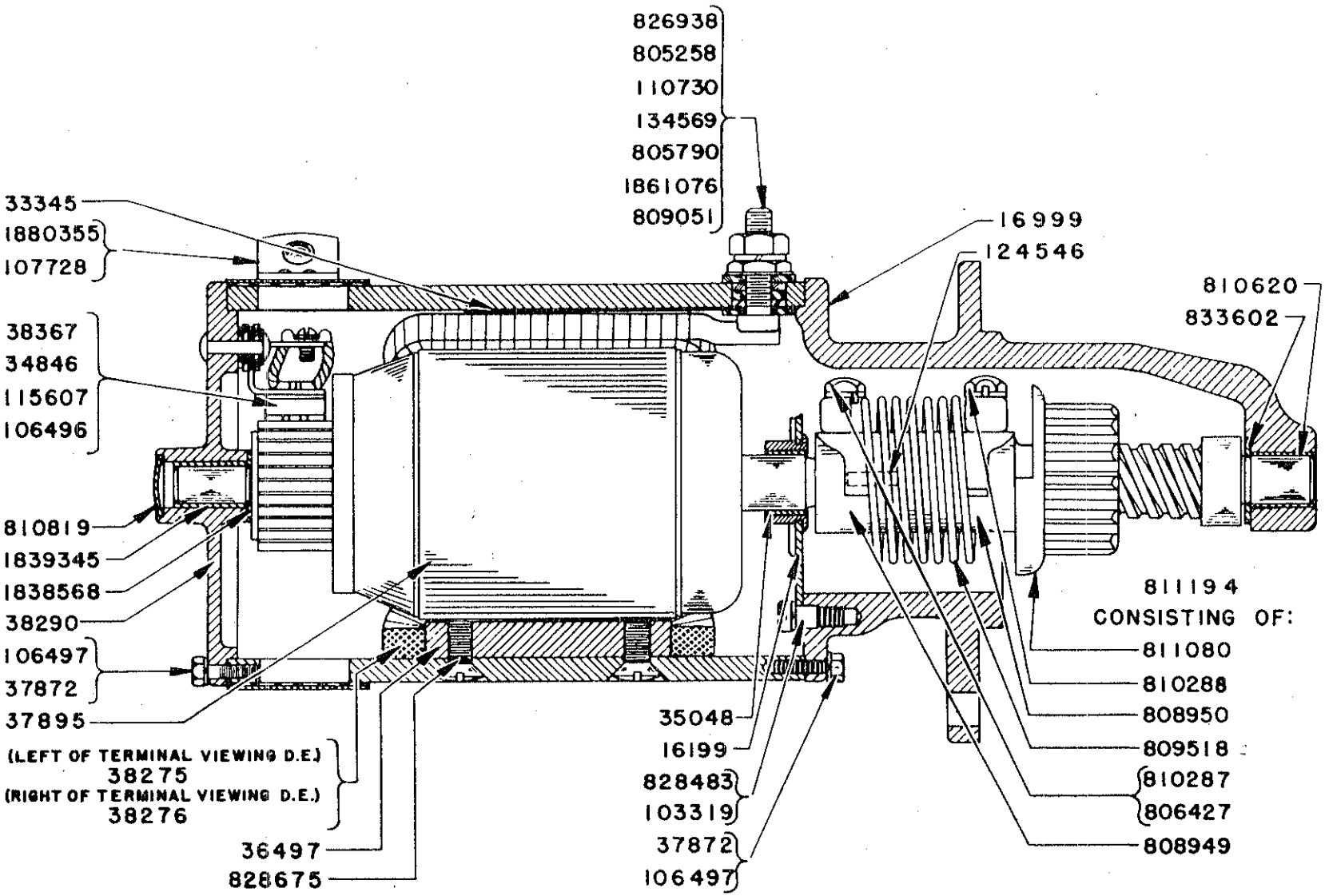

Fig. 60. Longitudinal Section through Cranking Motor

57. Cranking Motor (Cont'd)

Ref. No.	*S. C. Stock No.*	*No. Req'd*	*Name and Description*	*Mfgr's. Part No.*	*Mfgr's. Code*
...		6	Pole Shoe	36497	F
...		12	Screw	37872	F
...		1	Armature	37895	F
...		1	Field coil assem. (left)	38275	F
...		1	Field coil assem. (right)	38276	F
...		1	Comm. end frame	38290	F
...		6	Brush	38367	F
...		2	Lockwasher	103319	F
...		6	Lockwasher	106496	F
...		12	Lockwasher	106497	F
...		1	Screw	107728	F
...		2	Lockwasher	110730	F
...		6	Screw	115607	F
...		1	Woodruff key	124546	F
...		1	Nut (¼" thick)	134569	F
...		1	Nut (5/32" thick)	805258	F
...		1	Washer	805790	F
...		2	Lockwasher	806427	F
...		1	Head	808949	F
...		1	Sleeve	808950	F
...		3	Insulation washer (9/16" O.D.)	809051	F
...		1	Spring	809518	F
...		1	Head screw	810287	F
...		1	Sleeve screw	810288	F
...		1	Bushing	810620	F
...		1	Plug	810819	F
...		1	Gear and shaft	811080	F
...		1	Bendix drive	811194	F
...		1	Terminal stud	826938	F
...		2	Screw	828483	F
...		12	Screw	828675	F
...		1	Washer	833602	F
...		1	Washer	1838568	F
...		1	Bushing	1839345	F
...		2	Insulation washer (¾" O.D.)	1861076	F
...		1	Cover band	1880355	F

58. Magnetic Switch

Ref. No.	S. C. Stock No.	No. Req'd	Name and Description	Mfgr's. Part No.	Mfgr's. Code
...	3H4574/S45	1	Magnetic Switch—Delco-Remy Model 1422	A76-46	A
...		2	Spacer—For magnetic switch	22-189	A
...		2	Capscrew—Mag. switch mounting, ¼—20 x ½"	02-2	A
...		2	Lockwasher—For #02-2, ¼"	05-49	A
...		4	Lockwasher	110730	F
...		3	Nut	120614	F
...		4	Nut (Terminal)	120622	F
...		2	Nut (Thick)	134569	F
...		3	Lockwasher	802731	F
...		2	Nut (Thin)	805258	F
...		2	Washer	805790	F
...		1	Bent insulation	811492	F
...		2	Washer (outside)	813731	F
...		2	Bushing (insul.)	816863	F
...		1	Cover plug	820657	F
...		2	Stud	822205	F
...		1	Spring	825227	F
...		1	Plunger	825228	F
...		1	Pin	825229	F
...		2	Washer (inside)	826319	F
...		4	Lockwasher	826498	F
...		2	Washer (insul.)	1838591	F
...		1	Push rod and contact	1843456	F
...		1	Case and bracket	1843458	F
...		2	Terminal stud	1843464	F
...		1	Base insulation	1843465	F
...		1	Insulation strip	1843466	F
...		1	Coil	1862901	F
...		3	Screw	1866970	F
...		1	Stop and base	1869463	F
...		1	Base and terminal assem.	1869467	F

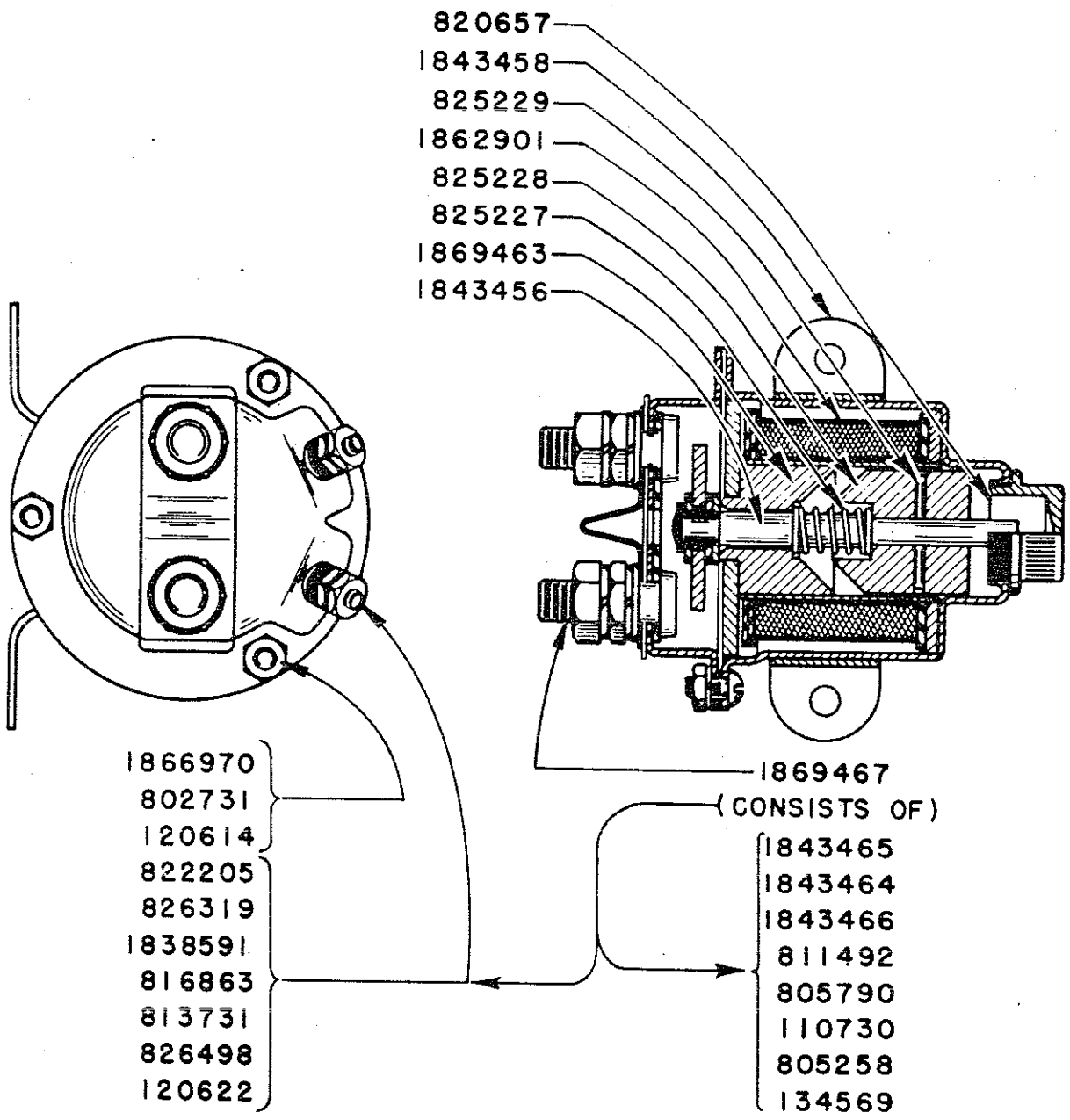

Fig. 61. Cross Section through Magnetic Switch