Fairbanks-Morse Marine Engines

Cape Town Harbor, South Africa
Fishing Boat powered with a 7½ H. P. Fairbanks-Morse Single-Cylinder, Two-Cycle, Type "K" Marine Engine

Are Used All Over The World

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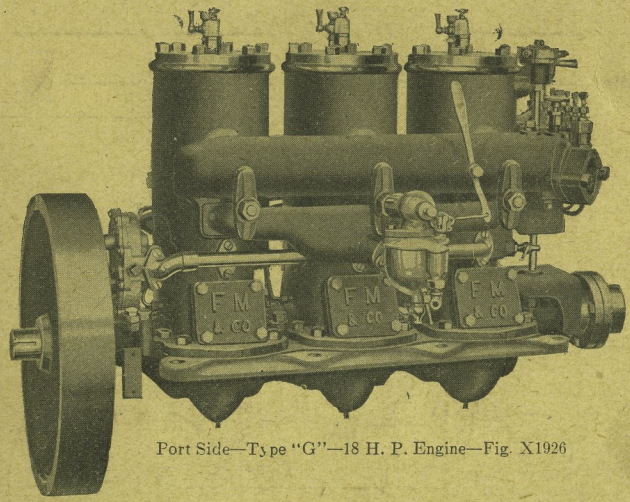
Sixth Edition 1M April, 1915

INSTRUCTIONS NO. 2145-G

FOR SETTING UP AND OPERATING

FAIRBANKS-MORSE

TYPE "E" AND TYPE "G" TWO-CYCLE GASOLINE MARINE ENGINES



Port Side—Type "G"—18 H. P. Engine—Fig. X1926

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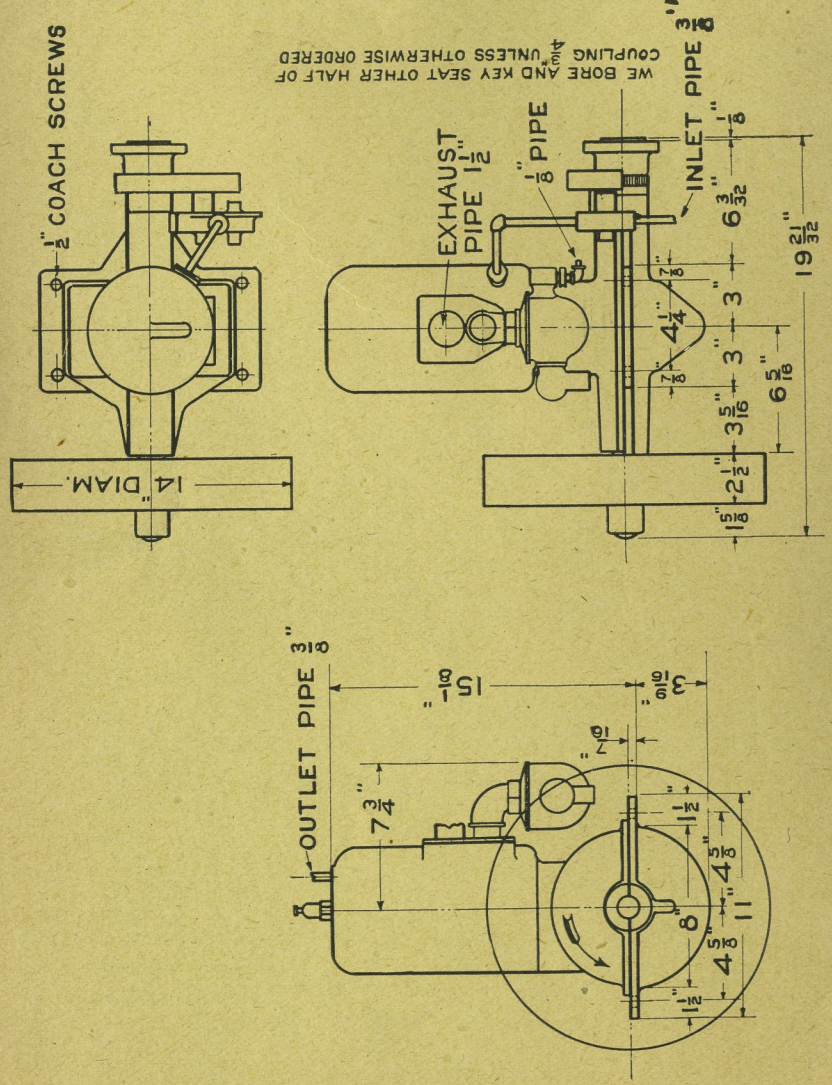

Foundation Plan Fairbanks-Morse 3½ H. P. Type "E" Marine Engine

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G2061X	14-16	G3800	14-16	A48429	19	R48858	19	A49502	17
G2062X	16	G3801	14-16	R48430	19	R48859	19	R49503	17
G2063X	14-16	G3802	14-16	R48431	19	R48860	19	A49504	17
G2064X	14-16	G3803	14-16	A48432	19	A48861	18	A49505	17
G2086X	17	G3823	18	A48438	19	A48862	18	R49507	17
G2087X	12	G3824	18	R48439	19	R48864	19	R49577	17
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G2129X	17	A31807	12	A48442	19	R48867	19	A49682	12
G2310	14-17	A31808	12	A48443	19	R48891	19	R49683	17
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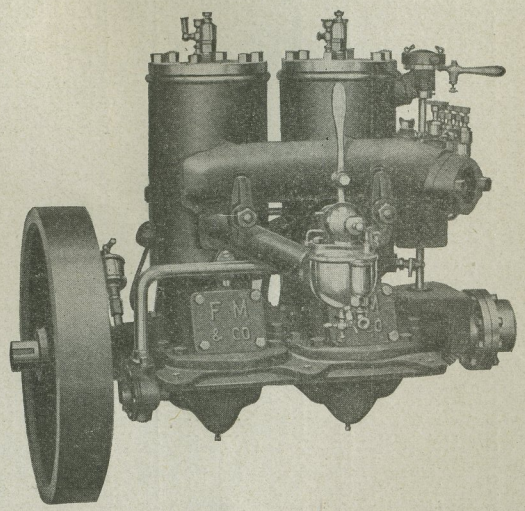


Port Side—Type "G", 12 H. P., Double Cylinder—Fig. X1925

ANNOUNCEMENT

As our motors are used by people varying widely in mechanical ability, we have endeavored to make the following instructions clear, complete and simple, and to cover every question liable to arise in the installing, operating and maintenance of the motor, and at the same time to be understood clearly by a person of slight mechanical knowledge.

If, however, any additional information is desired, and if any instructions are not clear, we shall always be pleased to give further instruction.

Our motors are entirely beyond the experimental stage, and the methods herewith set forth we believe to be the best. We would suggest rigid compliance with them; but court correspondence with our customers, who may discover better means to the same end. We cannot, nor is it possible for any one to suggest quick and ingenious methods of repairing parts that may accidentally become broken. When an accident of this nature occurs it is best to order a new part at once.

In writing for supplies or repairs, always give letter and number of motor and refer to part broken or wanted by the number of the part. To avoid misunderstanding, we have established a rule requiring the return of the broken part, charges paid, claimed under our guarantee, that we may examine or determine if the claim is correct. We also, in order to save unnecessary book-keeping, send all repairs not replaced by us, C.O.D.

OPERATION OF FAIRBANKS-MORSE TWO-CYCLE ENGINES.

Two Types "E" and "G"

In the following pages we describe in detail the parts and construction of the Fairbanks-Morse Two-cycle, Three-port, Gasoline Marine Engines. These we build in two types, differing only in the method of construction, the principle of operation being exactly the same in each. The type "E" engine is made with a solid cylinder head, and is made in two sizes only. The type "G" engine is made with a removable cylinder head and in four sizes.

Two-Cycle Principle

The two-cycle type is the simplest so far developed in gas-engine practice, and owing to the fact that there is an impulse every revolution run with a minimum amount of vibration, this, coupled with the fact that there are no valves or complicated mechanism, makes the two-cycle engine preferable to the four-cycle for some purposes.

Three-port Design

We have adopted the three-port type, as tests made during the last few years have demonstrated that the three-port engine, when properly designed, is more economical, will run faster and develop more power than the type which has a check valve in the base; the clatter, wear and trouble from a rapidly moving check valve are also eliminated.

The principle of operation can be clearly seen by a reference to the sectional view of the engine.

Operation

When the piston moves upward, a charge of vaporized gasoline is drawn from the carburetor and enters the crank chamber at the port "A." As the piston descends this vapor is compressed. (In the following pages note the length of the bearing especially designed to prevent leakage and consequent loss of fuel and power.) As the piston reaches the lower end of the stroke it uncovers the transfer port "B," allowing the compressed

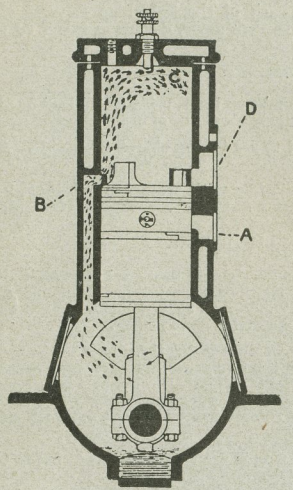


Fig. ME2474

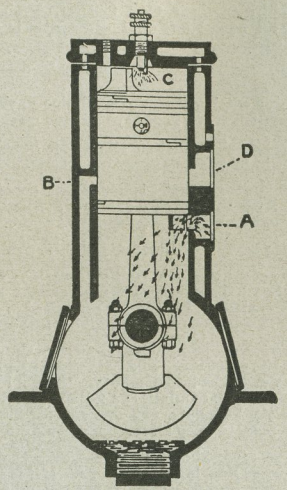


Fig. ME2475

vapor to pass into the upper end of the cylinder "C." At the beginning of the upward stroke of the piston, the transfer port has closed, and the gas that is held in the cylinder is highly compressed. The gas is then ignited by an electric spark in the ignition chamber. The expansion caused by the ignition of this gas forces the piston downward, producing the working stroke. As the piston passes downward the exhaust port is uncovered and the burnt products are entirely exhausted from the cylinder. The momentum of the fly-wheel carries the piston upward and the cycle of operations is repeated.

INSTALLATION.

Keelson and Bilge Keelsons.

Stringers

In constructing a power boat, a Keelson is usually notched over the ribs and bolted to the keel. In addition to this, bilge keelsons or stringers are recommended, one on either side, and running nearly parallel to the keelson.

Fasten Keelson Securely

These keelsons also should be notched to fit over and securely fastened to the ribs and planking. The keelsons, coming under the motor foundation timbers and over a number of ribs, distribute the strain over a large area and contribute largely to the stiffness of the structure.

Shaft Hole.

Bore Shaft Hole

The hole in the shaft log should be at least $\frac{1}{4}$" larger than the propeller shaft, otherwise the swelling of the wood may bind the propeller shaft, causing loss of power. Care should be taken to see that it is of such a pitch or angle that the propeller will be entirely submerged, and that no part of the motor bed or fly wheel will come in contact or touch the inside of boat aside from the foundation timbers.

Stuffing Box

With a properly constructed dead-wood, there is no shaft hole lining needed except where the stuffing box is placed on the inside of the boat. With the last named arrangement a brass or iron tube may be used, the stuffing box fastened to the inboard end and the stern bearing to the outboard end.

Line up Accurately

The shaft hole being bored, stretch a fine line through the center of it; fasten the outboard end to a stick nailed to the stern of the boat; make the other end fast inside of the boat, go over the line carefully and see that it is in the exact center of the hole throughout the swing, and if the shaft hole has been properly bored, a plumb bob held beside the line should point to the center of the keelson, provided boat sits level.

Face of Stern Post Smooth

The face of the stern post must be absolutely smooth and at exactly right angles with the line which has been stretched where the center of the shaft should be.

Foundation.

Foundation Timbers

The foundation timbers should be securely fastened to keelsons at the given distance from the line, and at the same pitch or angle as the line.

Check Measurements

These foundation timbers may run either athwart ship or fore and aft; in either case they must be securely fastened to every timber or plank over which they pass. The table of motor dimensions gives all necessary measurements, but it is well to check your measurements over when you receive the motor.

Placing Motor.

Place Motor in Position

Place the motor on the foundation at the proper position fore and aft, and in line with the center of the shaft. The shaft now being in place, compare the faces of flange couplings and see that their faces come together fairly. The least variation at this point, if allowed to remain, will cause undue friction and heating.

Motor and Shaft in Line

With motor securely bolted down and faces of flanges on the coupling coming up perfectly fair, you may feel reasonably sure your motor and shaft are in line. This is important.

Stern Bearing and Stuffing Box.

Stern Bearing

Bolt the stern bearing to stern-post with a film of white lead between. See that the shaft turns perfectly free after the stern bearing is fastened to place. If it binds the shaft, it would indicate that the face of the stern-post is not exactly at right angles to the shaft and must be dressed off until the shaft works freely.

Inside Stuffing Box

If a log is used, the inside stuffing box is bolted to the inboard end, after having squared the end the same as described for the stern post. If the log is not used, a sleeve, one end of which screws into the stern bearing, long enough to extend into the boat far enough to admit of the stuffing box being screwed on the inboard end, replaces it.

Reverse Gear

The Baldridge Gear Co., Detroit, Mich., will stand back of the Baldridge Reverse Gears, and take care of all complaints and difficulties in connection with their gears, if same is taken up with them direct by our customer.

Fresh or Salt Water Fitting

Piping.

Use care in cutting threads on all pipe so that they will make up tight, using white lead on all joints of water and exhaust. When boat is to be used on salt water, all piping should be of brass or galvanized iron.

Exhaust Pipe

In piping for exhaust where elbows are necessary it is best to use 45 deg. elbows if possible. An exhaust pipe 5 to 6 feet in length will give best results.

Exhaust Pipe Must not fill with Water

Be sure that exhaust piping is not arranged so that it fills with water, which may, by motion of boat, come back into engine cylinder. Many cases of "hard to start" are directly traceable to water in cylinder resulting from disregard of above.

Avoid Elbows and Bends

Make all pipe run as direct as possible, avoiding elbows and bends.

Expansion Tank

If underwater exhaust is used an expansion tank (not a muffler) should be placed in exhaust pipe as near engine as possible. This expansion tank should be at least six times as large (cubic content) as cylinder for single cylinder engine, and larger for engines of more than one cylinder. A cock should be in exhaust pipe between engine and expansion tank to provide free opening to air for starting and backing.

Intake Pipe to Pump

For the sea cock or intake to the pump, the pipe should have long running thread cut on the end intended to go through the planking. The hole should be bored through the bottom of the boat small enough so that the pipe will screw tight into planking. Have a lock-nut both inside and out after the pipe is screwed through the planking far enough to admit of a full thread on the lock-nut outside. Put a few turns of white-leaded candle wicking under the lock-nuts, and screw down firmly, fastening the strainer scoop sent out with engine, over the end of the pipe, to keep all foreign matter out of the pump.

Water Scoop

The water scoop should be placed over the water intake pipe in such a position as to **scoop the water to the pump** when boat is going forward. If it is not so placed, the pump will not work. In case scoop becomes clogged with drift, leaves or sand, it can usually be freed by reversing the engine (if rotary pump is used) and connecting the water discharge pipe to the water with hose. This allows the pump to work backward, throwing a stream of water outward through screen, thus clearing it of obstruction. If plunger pump is used, the screen must be cleaned by hand.

Short Hose and never bent

If hose is used for intake connection to pump, the piece should be very short, **and in no case should the hose serve as an elbow or bend.** If it is bent or flattened the pump will not draw water through the hose.

Drain Crank Cases

We strongly recommend piping the engine so that crank cases can be readily drained. A tapped hole will be found in bottom of crank case. Pipe from this hole should be run to either end of engine and provided with pet cock. This enables draining of crank case without reaching under engine, or removing crank case covers.

Discharge above Water Line

The discharge from the water-jacket overboard should be above the water line if possible, and should be fastened as described above for the sea-cock pipe; all water pipe should be no smaller than the openings in or out of the motor for same.

Gasoline Tank.

Prevent Overflow of Gasoline Tank

The gasoline tank should be securely fastened in boat and placed high enough to insure a good flow of gasoline to carburetor. If tank is placed under the deck, a threaded filling pipe with deck plate attached should be screwed into tank, and securely fastened to deck so that there will be no leak of gasoline into boat if tank should overflow when filling.

Strain Gasoline

All gasoline put into tank should be strained through chamois skin, so no water or other foreign matter will pass through it.

Gasoline Pipe.

Copper Gasoline Pipe —Keep Clean

Gasoline pipe should be of seamless copper, and should be run from the tank to the carburetor as directly as possible along the keelson. See that the gasoline tank and pipe are thoroughly clean before making up. This should be done with either shellac or soap, care being taken that it is used only on outside threads, as there would be the danger of stopping gasoline flow.

Shut-off Cock for Gasoline

A strainer should be placed at outlet of tank to catch any dirt or scale, which might get into the gasoline pipe or carburetor. A shut-off cock should be placed at gasoline tank and another at carburetor.

Muffler.

Drain Muffler

The exhaust muffler is provided with a threaded pipe opening, which should have pipe connection to outboard to drain any excess of water from muffler. The muffler should be so placed that this drain will be at the lowest part and above the water line.

Water to Exhaust.

Cool Exhaust Pipe

On the Type "G" engines provision is made for allowing a quantity of water into exhaust piping. **This should be just sufficient to keep exhaust pipe from getting too hot.** Flooding exhaust with water will result in reduced speed.

Lubrication.

Grease Cup

Where the engine shaft bearings are lubricated by grease cups these should be kept well filled. The handle should be screwed down a little when the engine is started and at such intervals while the engine is running as may be found necessary to keep the bearings in proper condition. As these bearings are fitted very close, it is best to lubricate them quite freely during the first few days the engine is in operation.

Good Quality Grease

Use a good quality of grease.

OILING SYSTEM, TYPE "E" ENGINE.

Oiling System for Type "E" Sight-feed Oil Cup and Grease Cups

Fig. ME2446. "A." Oil cup with sight feed. ("B." Two-cylinder engine has one cup with two sight feeds.) "C." Oil enters cylinder here, thoroughly lubricating cylinder, the surplus is conducted by hollow pin "D" and through opening "E" in piston pin to upper connecting rod bearing and through tube "F" (which is fastened to connecting rod) to crank bearing "G." Surplus oil falls to bottom of crank case, where it is caught by scoop on bottom of connecting rod. The crank shaft bearings "H" and "H" are lubricated by grease cups "I" and "I." Only one oil cup to fill, only one to watch.

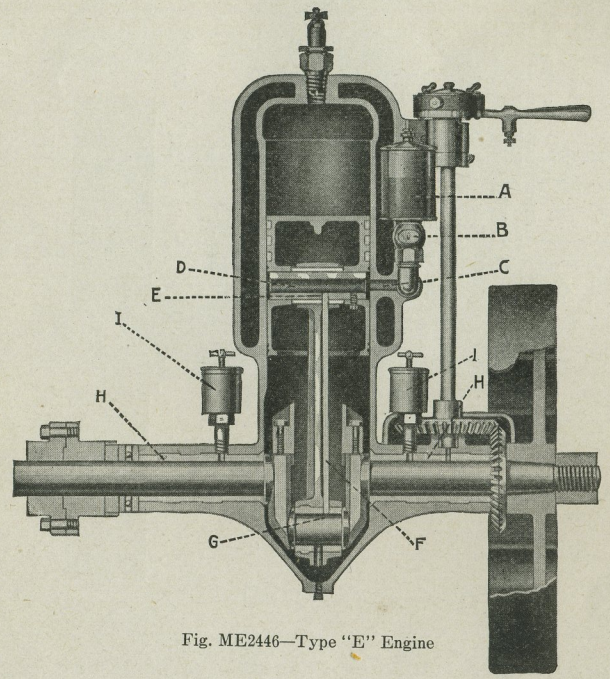


Fig. ME2446—Type "E" Engine

OILING SYSTEM, TYPE "G" ENGINE.

Oiling System for Type "G" Oil forced by Compression

Referring to figure ME2460, fill the reservoir "A" with a good quality gas-engine oil and screw filler cap down tight. The tube "B" connects upper part of oil reservoir with crank case, so that on first downward stroke of piston the crank case pressure is conducted to oil reservoir and pressure is maintained by check valve "C." The pressure in oil reservoir forces the oil up tube "D" to the sight feeds "E," where the rate of feed is regulated by thumb-nuts "F." From one of the sight feeds a tube conducts the oil to the cylinder at "G;" this lubricates the cylinder and (through hollow piston pin) the upper connecting-rod bearing "H."

One tube conducts oil from one of the sight feeds "E" to the crank case at "I." This tube projects into crank case, to allow the drip from it to be caught by the centrifugal ring oiler "J," which is connected to hole "K" drilled in crank shaft, "K" conducting oil directly to crank. Any surplus oil falls to bottom of crank case and is caught by oil scoop on bottom of connecting rod.

In engines of more than one cylinder the crank shaft bearings between crank cases are lubricated by oil, each having separate tube from sight feeds. The end bearings of all engines are lubricated by grease cups "L" and "L."

This system insures constant and thorough lubrication. It starts when the engine starts and stops when the engine stops. The oil is carried in one receptacle, which is a great improvement over the many oil cups usually used.

While the engine is new, allow the oiler to feed from fifteen to twenty drops a minute. This can be reduced after the engine has been in use for a short time.

Too much oil will foul the spark plugs. Too little oil will not give a free running engine.

Always use a good grade of gas engine cylinder oil.

Occasionally the worn oil in the base should be removed and replaced by fresh oil.

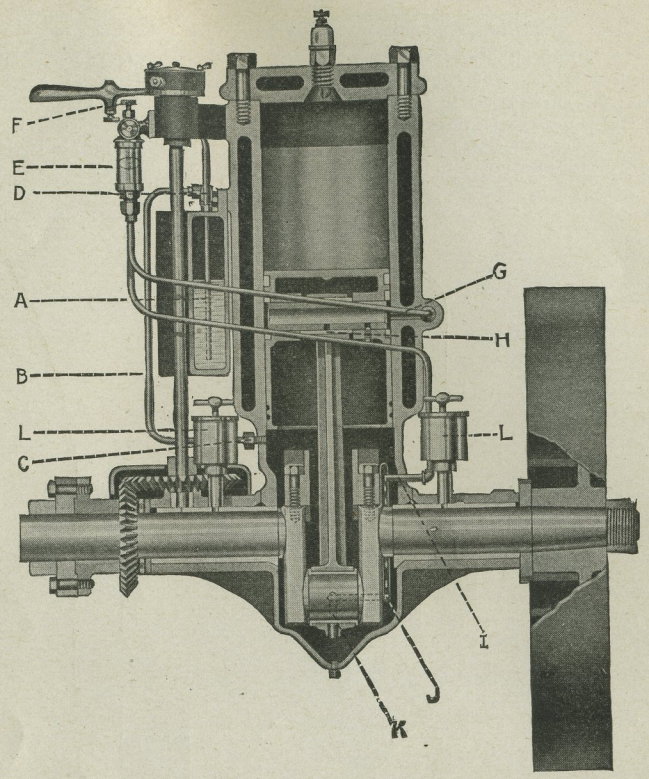
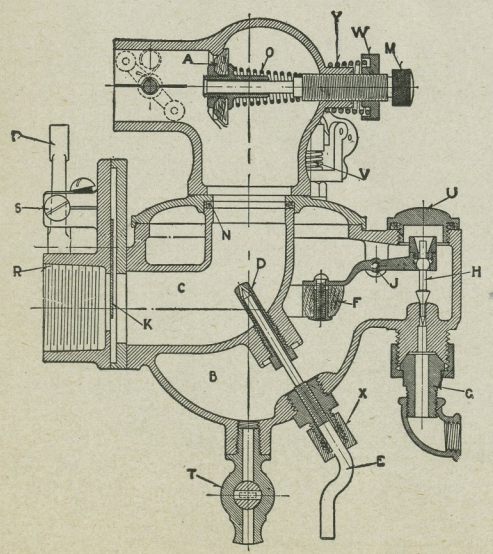


Fig. ME2460—Type "G" Engine

MODEL "D"



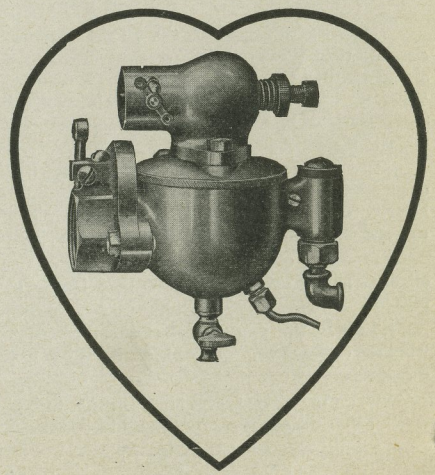


Fig. ME2470—Model "D" Schebler Carburetor

SCHEBLER CARBURETOR.

Model "D" Carburetor is adjusted by the following method:

To Slow Engine

Engine under load is slowed down by nearly closing throttle "P" and retarding spark. The gasoline valve "E" is closed until engine runs without missing.

Increase Speed

When the engine is running slow, all the air taken through carburetor goes through the fixed opening below valve "A" and to get the proper mixture gasoline is turned on at needle "E" to make the right proportion of gasoline vapor. This will allow engine being slowed down and yet be perfectly reliable. When throttle is opened and spark advanced, engine increases speed and causes a greater suction on valve "D." This increased suction also opens valve "A" and allows a greater supply of air, and if spring "O" is at the proper tension engine will get a perfect mixture at high speed and also at slow speed.

Increase Gasoline

If, on high speed, engine shows signs of not getting enough gasoline, tighten spring "O" by screwing in "M" or vice versa.

Dislodge Dirt

Flooding of carburetor may be caused by dirt getting under valve "H." By pressing down priming pin a few times, this may be dislodged.

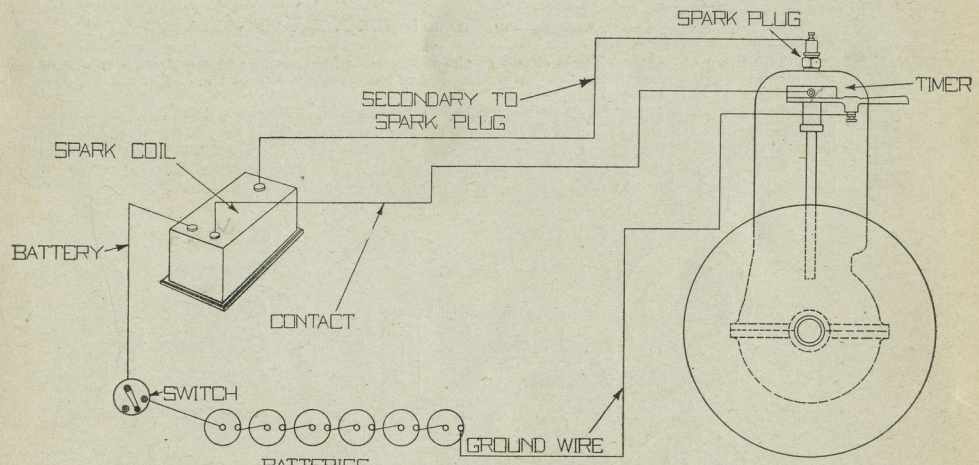
Prevent Excess Gasoline

A small hole is drilled in carburetor below throttle to prevent an accumulation of gasoline in intake pipe.

Defective carburetors, or trouble with same, should be taken up directly with the manufacturers. If Schebler carburetor, the Wheeler & Schebler Co., Indianapolis, Ind., will make any adjustments, replace carburetor, fill orders for repair parts, etc., if addressed direct.

Place Drip Pan under Carburetor

It is recommended that a pan be placed under carburetor to prevent any gasoline that might drip from carburetor getting into bottom of boat. Gasoline leaks to bottom of boat from piping or carburetor should not be allowed for a moment.



Wiring Diagram for 3½ H. P. Type "E" Marine Engine

Ignition.

The jump spark, which is the most popular system, consists of six important parts: the battery, switch, coil, timer, spark plug and connecting wires.

Jump Spark

Battery.

The battery should be so located in a boat that it will be kept dry, and so that it will be easily accessible. All connections should be securely made. An ammeter for testing the cells is a good investment. Each cell when new will test 15 to 20 amperes, and should not be used when exhausted below 8 or 9 amperes. Bear in mind that the least amount of tension on vibrator spring results in the least consumption of electric current and lengthens the life of battery.

Keep Battery Dry

Spark Coil.

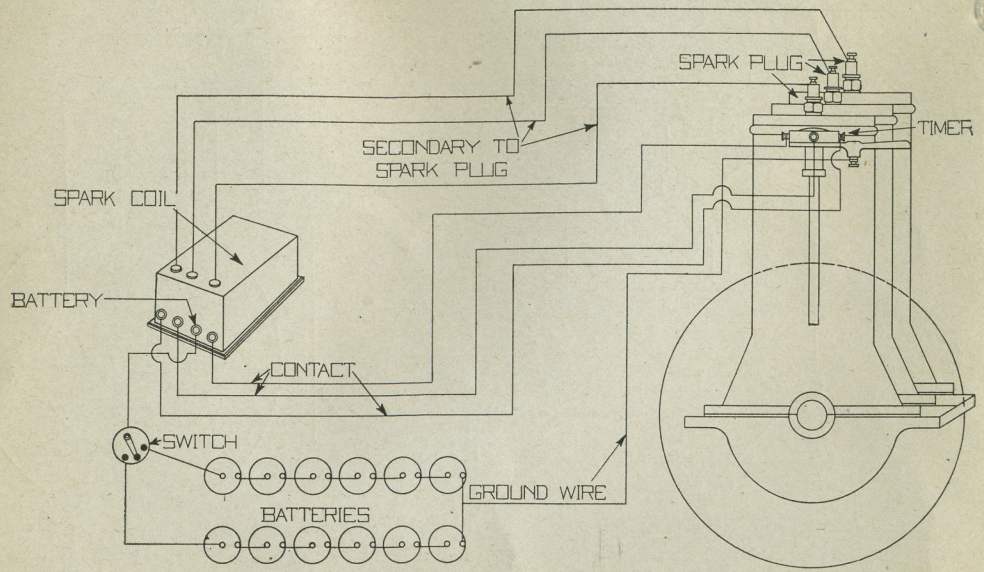
This consists of an iron core, a high tension winding, a low tension winding, a vibrator and suitable binding posts for the connecting wires. The wiring diagrams on the following pages show the method of wiring. The coil should be located in a dry place.

Keep Coil Dry

Adjust Tension on Coil Vibrator

In connection with the vibrator there is an adjustment for varying the tension on the vibrator. Increasing this tension gives a larger current consumption and a larger spark. Less tension means less current consumption and a weaker spark. It is better to adjust the vibrator for the least tension at which the coil will give a strong enough spark to operate the engine without missing. This will give longer life to the battery. A higher voltage and small current consumption is better for the coil than a low voltage and larger current consumption.

Orders for repair parts, defective coils, or any complaint regarding same, should be referred directly to the Coil Manufacturers. They will cheerfully answer all correspondence, and make good any trouble with their coils.



Wiring Diagram for 18 H. P. Type "G" Marine Engine

Proper Installation, Gasoline Supply, Piping, Ignition and Reverse Lever Position

Starting the Engine.

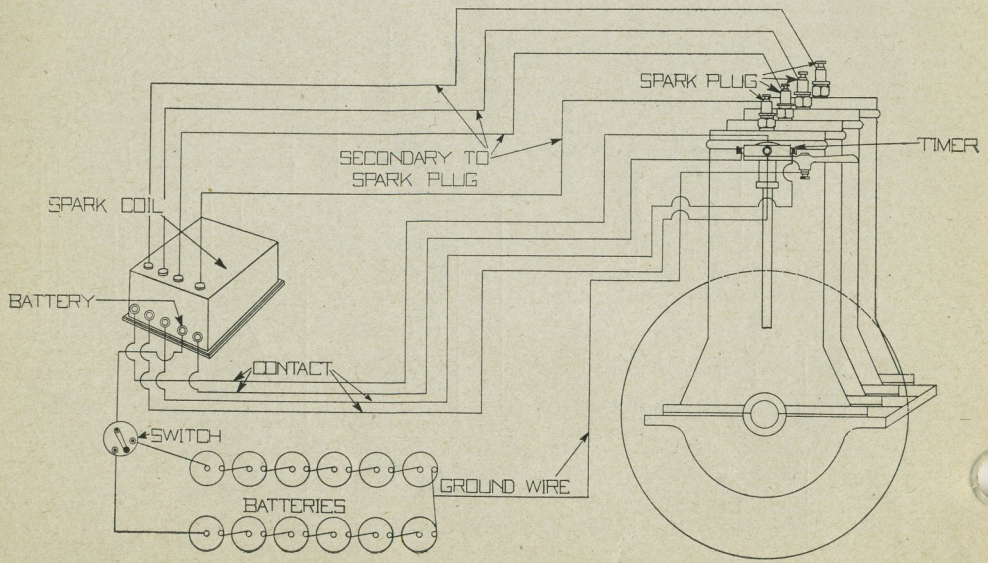
We will assume that the engine is properly installed in the boat; that the gasoline tank has a supply of fuel free from dirt and sediment; that the gasoline pipes have been properly flushed out and are not filled with dirt that will clog the carburetor; the oil cups and grease cups are full; the batteries are in good shape, properly placed and wired; the coil is in proper adjustment and the switch is in a convenient place, and that the propeller reverse lever is in the neutral position.

Make all Adjustments

Open valve in inlet pipe to the water pump. Screw down the grease cups a little. Open feed on cylinder oilers so that each will feed 15 to 20 drops a minute. See that the gasoline is turned on. Set the throttle of the carburetor about two-thirds open. Press down priming pin "V" a few seconds to allow a little gasoline to flow into carburetor intake. Close the switch. Fill the priming cup and allow the gasoline to pass into the cylinder

Retard the Spark

Retard the spark. (On Type "E" engines moving the timer lever to the left retards the spark. On Type "G" engines moving it to the right retards the spark.)



Wiring Diagram for 24 H. P. Type "G" Marine Engine

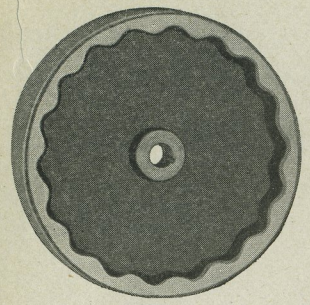


Fig. Z1779A

Grasp Fly-wheel

Grasp the fly wheel, using the corrugations on the inside of flange, and move the fly wheel as you would in cranking, or rock the engine backward sharply against the compression; either way will start it. While we furnish a crank with the equipment, we strongly advise against its use, as a little practice will allow you to start much easier with the fly wheel, and this eliminates all danger from "kick-back."

Start Engine

On multi-cylinder engines, prime each cylinder and proceed in the same way.

Increase Speed

Advance the ignition and open the throttle on the carburetor to increase the speed of the engine.

Speeding up

In speeding up it is preferable to advance the ignition and then increase the opening in the throttle of the carburetor.

Slowing Down

In slowing down it is usually best to partly close the throttle and then retard the ignition by moving the timer handle to the left.

To Stop the Engine.

Shut off Switch, Oil and Gasoline

Open the switch. Close the oil cups and the valve in gasoline pipe.

To start again within an Hour

To start again within an hour or so it is usually not necessary to use any gasoline in the priming cups, an explosive mixture having been left in the base of the engine when shutting down.

Cold or Warm Engine

A little experience, remembering that a cold engine needs more gasoline and a warm engine less gasoline through the priming cups, will make starting very easy.

In Cold Weather

In cold weather we would recommend that a supply of warm air from the exhaust pipe be piped to the carburetor.

To Start on Spark

In the case of an engine having three or more cylinders, before stopping, if the engine is speeded up for a moment or so by opening throttle, and the switch thrown out, the engine can generally be started by throwing in the switch and moving the timer handle to late ignition and then advancing.

Safety

CAUTION.—The boat should never be cut loose until the motor is running, nor should the motor be stopped until the boat is secured to its moorings.

Locating Trouble.

Examine Spark Plug in "Jump Spark"

If, after a proper trial, the motor fails to start, first of all examine the spark. If the jump spark is used, disconnect the wire and take out the spark plug. Reconnect the wire and lay the plug on the top of the cylinder, in such a position as to ground the metal part with the cylinder. Then turn the fly wheel until a circuit is formed when a spark should show between the points of the spark plug.

Test Spark in "Make and Break"

If make and break is used, test this by turning the engine over until the points or electrodes within the cylinder are brought into contact, then detach the wiring from the stationary electrodes and pass the end of the wire across its post and see if there is a spark. If the spark shows all right, turn the fly wheel until the electrodes are separated and try again the same way. This time there should not be any spark.

Examine wiring for Jump Spark

If no spark occurs with the jump spark, look over the insulation wires and spark coil and see that the coil is vibrating. Examine the insulation of the plug and see that same is not cracked; also that the inside of plug is clean and points not over $\frac{1}{32}$ inch apart.

Examine Wiring for Make and Break

If no spark occurs with the make and break, look over the insulation wires and all connections. See that no wire is broken under the insulation and that connections are firmly made.

Weak Battery

Ascertain if the battery is weak. When a motor stops and refuses to start, in ninety-nine cases out of every hundred the trouble will be found to be in the spark. In the case of dry cells, a weak battery will sometimes recuperate and show a good spark, but this will not last. This often puzzles the amateur, as he will try the spark and apparently it will be all right, and on the other hand the motor will stop after making only a few revolutions. Therefore, when testing the spark for weakness, try it repeatedly for at least a minute to ascertain if the spark holds its strength. We would recommend an ammeter, which is the only satisfactory way of testing the condition of a dry cell battery.

Never add New Cells to Old Set

Never add new battery cells to an old set of batteries to strengthen them, as one old weak cell will bring down the new ones to its strength or voltage.

Examine Gasoline and Air Mixture

If the spark and ignition are not at fault, then look into the mixture. This may be either too rich or too poor in gasoline. A mixture that is too rich will cause a smoky exhaust, resulting in fouling the cylinder, electrodes and valves. A mixture that is too poor will not ignite regularly and there is apt to be slow firing, which is one of the causes of back firing.

Clean Gasoline

Commercial gasoline frequently contains water. Always strain through a chamois leather, which will prevent either dirt or water going into the tank.

Test Compression

If neither the mixture nor the ignition is at fault, look to the compression of the cylinder. If the cylinder leaks or loses its compression through a leak, it will result in a loss of power and may cause the motor to stop. A two cycle motor may leak past the piston if the rings become fouled or worn, or it may leak at the spark plug or in the base, any of which will cause a loss of compression.

Vent in Gasoline Tank

It will sometimes happen that the flow of gasoline to the carburetor is interrupted by not having a proper vent in the tank. If this has not been provided for, it will be sufficient to unscrew the filler plug slightly at intervals.

Do not expose to Rust and Corrode

Care of Engine During Winter.

Prevent Freezing in Cold Weather

Gasoline engines often suffer from neglect during the winter months, when their services are no longer required. They rust and corrode, when an hour put in as the launch is hauled out would leave the engine in such condition that in the spring wiping off with a cloth would remove all traces of the winter's idleness. As soon as cool weather sets in, the water should be drained off the engine each time it is used, so that there will be nothing to freeze and crack the cylinder. When launch is hauled out and engine is still in position, give it about a minute's run with plenty of lubricating oil, and with water connections broken and cocks open. This will dry out any water that may remain. Next coat all parts, except the brass work, with grease or oil—the ordinary lubricating oil will do. Wipe all brass clean and dry. Remove coil, spark plugs and dry cells from the launch and store in a dry place.

Coat Parts with Oil or Grease

Store Coil, Cells and Spark Plugs in Dry Place

Excellent Condition in Spring

With these slight precautions, spring will find the engine in excellent condition.

Let us do the Overhauling when any is necessary

After considerable running there may be some slight repairs or adjustments to be made, in which case ship the engine to us, and we will have it overhauled by our experts and carefully adjusted. The charges for this service are as low as is consistent with first class work.

TO CALCULATE SPEED OF BOAT.

Measure Course Note Time

To find the speed of a boat over a course of known length, the following formula will be found useful:

A equals length of course.
B equals minutes in one hour.
C equals minutes required to run the course.

Ascertain Speed

Then A times B divided by C equals rate of speed per hour. For example, it is 2¼ miles from your dock to a given point, and the boat makes the run in 8 minutes 45 seconds. What is the rate of speed per hour?

A equals 2¼ miles, 2.25.
B equals minutes in hour.
C equals run in minutes, 8.75.

2 25 times 60 equals 135.00, divided by 8.75, equals 15.43 (speed per hour).

Good Judgment, Care and Thoughtfulness

Conclusion and Final Admonition.

In conclusion we wish to say that a little good judgment, care and thoughtfulness on the part of the operator will do more to keep the motor in good working order than a book full of instructions. We do not claim that our motor will run itself, or keep forever in repair without attention.

Thoroughly Understand your Motor

It requires judgment, patience, and mechanical ability to run any piece of machinery. It is of great importance that the owners of motors should personally understand them thoroughly and be qualified to operate them without having to depend on an engineer entirely.

Keep Motor Perfectly Clean

The motor should be kept perfectly clean, as nothing adds more to the looks and running qualities of a motor than cleanliness.

Care and Attention to Motor

We wish also to say to the purchasers and operators of our motors that success in producing good results would be to a mutual extent dependent, not only on the ability and accuracy of the motor, but also on care and attention exercised in the setting of the same in general, and in its several parts, as a motor, no matter how perfect, will do more or less work, good or bad, in proportion to the skill expended in setting and operating the same.

"DONT'S."

Don't try to start the motor with the switch off.
Don't try to start the motor without opening the gasoline valves.
Don't try to run with worn-out batteries.
Don't try to run with soot-fouled spark plugs.
Don't crank your head off—look for the cause.
Don't cast off until you have the motor running.
Don't stop the engine until the boat is secured to its moorings.
Don't forget to open the lubricators when the motor is started.
Don't forget to close the lubricators when the motor is stopped.
Don't forget to see that the pump is working.
Don't let the base of the motor get out of oil.
Don't get too much oil in the base of motor.
Don't forget to oil the motor frequently.
Don't use anything but gasoline cylinder oil in the motor.
Don't use more gasoline than the motor requires.
Don't forget to drain the motor in cold weather.
Don't forget to strain the gasoline when filling the tank.
Don't let batteries get wet.
Don't let bare wire come in contact with the motor.
Don't let wires run through bilge water.
Don't let wire connections and terminals get loose.
Don't forget that eighty-five per cent. of motor failures can be traced to electric trouble; either in the battery or the coil, or the wiring, or the plugs.

REPAIR PARTS FOR TYPE "E" TWO-CYCLE MARINE ENGINE

Name of Part	1 Cyl. 3½ H. P. Symbol.	2 Cyl. 7 H. P. Symbol.
Cylinders.		
Cylinder and upper base babbitted and with timer bushing	A2650	A1390
Cylinder hand hole plate	A48381	A48381
Cylinder hand hole plate gasket	R48384	R48384
Cylinder hand hole plate cap screws	G2673	G2673
Lower half crank case babbitted	A2651	A2654
Cylinder and lower half crank case cap screws, slotted	R49245	R49245
Cylinder and lower half crank case cap screws, plain	G2049	G2049
Inlet and exhaust flange	A48382	A48382
Inlet and exhaust flange gasket	R48383	R48383
Inlet and exhaust flange cap screws	G3251	G3251
Carburetor (1" Planhard)	G1319X	G1319X
Carburetor (1" Schebler)	G918X	G918X
Carburetor inlet pipe (Planhard)	A48789	A48789
Carburetor inlet pipe (Schebler)	A49682	A49682
Name plates	R48698	R48698
Name plate screws	G3298	G3298
Priming cups	G2087X	G2087X
Drain cock	G1826	G1826
Crank Shafts.		
Crank shaft complete, with counterweights and screws	G1406X	G1407X
Crank shaft only	R2652	R2660
Crank shaft counterweights	A48408	A48408
Crank shaft counterweight screws	R48585	R48585

Name of Part	1 Cyl. 3½ H. P. Symbol.	2 Cyl. 7 H. P. Symbol.
Flywheel.		
Flywheel	A31811	A31811
Flywheel key	G3239	G3239
Flywheel nut	R48401	R48401
Flywheel with timer gear and screws	G1404X	G1404X
Thrust Bearing.		
Ball thrust bearing comp., with ring and collars	G1455X	G1455X
Couplings.		
Coupling—engine end	A48366	A48366
Coupling—engine end key	R48409	R48409
Coupling—engine end set screw	G3243	G3243
Coupling—propeller end	A48365	A48365
Coupling—propeller end key	R48411	R48411
Coupling—propeller end set screw	G3252	G3252
Coupling flange cap screws	G3246	G3246
Pistons.		
Pistons complete with rings, pins and set screw	G1409X	G1409X
Piston body only	A31807	A31807
Piston rings each	A31808	A31808
Piston pin	R48372	R48372
Piston pin set screw	R44600	R44600
Piston pin bushing with dowel	R48369	R48369
Piston ring dowel	R48668	R48668

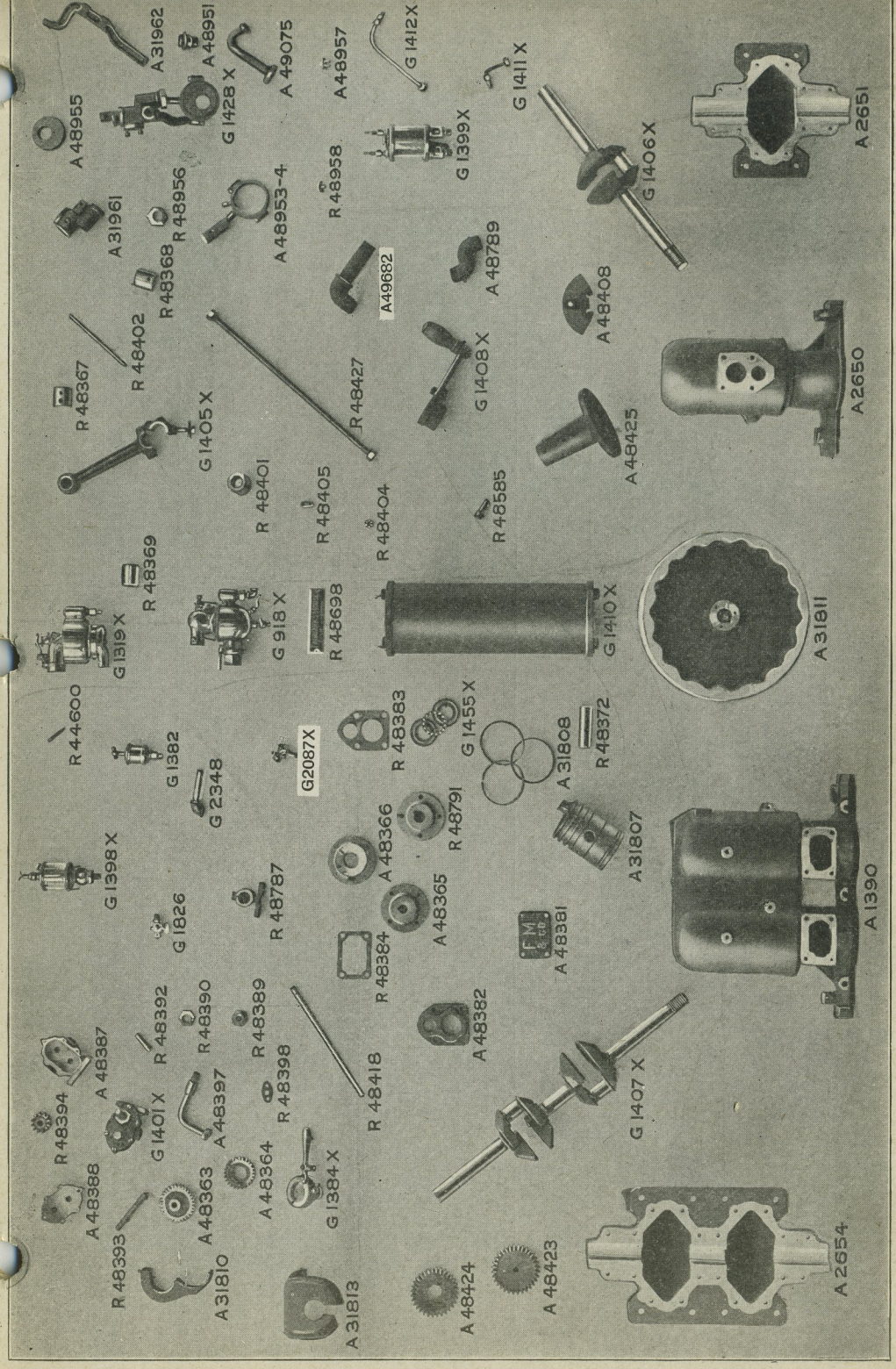


Chart Showing All Parts of Fairbanks-Morse Type "E" Marine Engine—Fig. X1938

REPAIR PARTS FOR TYPE "E" TWO-CYCLE MARINE ENGINE

Name of Part	1 Cyl. 3½ H. P. Symbol.	2 Cyl. 7 H. P. Symbol.
Connecting Rod.		
Connecting rod and cap complete with bushing eyebolt and nut, oil pipe, link and shims	G1405X	G1405X
Connecting rod and cap only	R31809	R31809
Connecting rod bushing upper half	R48367	R48367
Connecting rod bushing lower half	R48368	R48368
Connecting rod oil pipe	R48402	R48402
Connecting rod eyebolt	R48403	R48403
Connecting rod eyebolt nut	R48404	R48404
Connecting rod link	R48405	R48405
Connecting rod shims for 6	R48407	R48407
Connecting rod link and eyebolt pins	R48406	R48406
Bemus Timer used on part of engines for year of 1914.		
Bemus Timer.		
Timer only, complete with main casting, handle with circuit breaker, revolving center piece with collar and taper pin, fibre ring with contacts and cover	G2060X	G2061X
Timer main casting with handle and circuit breaker	G2063X	G2063X
Timer revolving center piece with pin	G3787	G3787
Timer collar for revolving center piece	G3788	G3788
Timer collar taper pin	G3773	G3773
Timer bevel contact roller	G3276	G3276
Timer bolt holding insulating ring	G3277	G3277
Timer two-piece lock nut for cover	G3278	G3278
Timer insulating ring only arranged for one contact socket	G3398	.....
Timer insulating ring only arranged for two contact socket	.....	G3279
Timer insulating ring contact complete, consists of ball, socket, spring and cap	G1452X	G1452X
Timer contact steel ball	G1607	G1607
Timer contact steel ball socket	G3280	G3280
Timer contact steel ball socket lock ring	G3281	G3281
Timer contact steel ball socket cap nut	G3282	G3282
Timer contact steel ball spring	G3283	G3283
Timer cover complete with ground contact	G2064X	G2064X
Timer circuit breaker brass post	G3799	G3799
Timer circuit breaker brass knurled nut	G3800	G3800
Timer circuit breaker spring	G3801	G3801
Timer circuit breaker fibre bushing	G3802	G3802
Timer circuit breaker fibre push plug	G3803	G3803
Long Bros. Timer used previous to 1914.		
Timer, complete	G1384X	G1413X
Timer cover	G3253	G3253
Timer wing nuts	G3254	G3254
Timer steel posts	G3255	G3255
Timer taper pins	G3249	G3249
Timer hex. trolley screw	G3256	G3256
Timer trolley spring	G3257	G3257
Timer circuit breaker spring	G3258	G3258
Timer circuit breaker bushing	G3259	G3259
Timer brass screws	G3260	G3260
Timer brass hex. nuts	G3261	G3261
Timer steel collars	G3262	G3262
Timer steel set screws	G3263	G3263
Timer trolley and roller	G3264	G3264
Timer circuit breaker screw	G3265	G3265
Timer circuit breaker nut	G3266	G3266
Timer circuit breaker push button	G3267	G3267
Timer self closing top oilers	G3268	G3268
Timer bracket clamp screw	G3297	G3297
Timer shaft	R48418	R48418
Timer bracket with set screws	A48787	A48787
Timer brass washer	G3294	G3294
Timer base and handle	G3288	G3288
Timer ring with contact	G3289	G3290
Timer gear on timer shaft	A48423	A48423
Timer gear on crank shaft	A48424	A48424
Timer gear on crank shaft cap screw	R48718	R48718
Timer gear shield	A31813	A31813
Timer gear shield screws	G2380	G2380
Timer shaft bushing	R48419	R48419
Timer bracket to cylinder screw	G2673	G2673

Name of Part	1 Cyl. 3½ H. P. Symbol.	2 Cyl. 7 H. P. Symbol.
Water Pump (Rotary).		
Water pump complete with inside gears and screws, shafts and nuts and packing	G1401X	G1401X
Water pump body only	A48387	A48387
Water pump cover	A48388	A48388
Water pump screws	G3241	G3241
Water pump packing nut	R48389	R48389
Water pump lock nut	R48390	R48390
Water pump gears	R48394	R48394
Water pump short gear shaft	R48392	R48392
Water pump long gear shaft	R48393	R48393
Water pump supporting stud and nut	R48396	R48396
Water pump pipe	A48397	A48397
Water pump close nipple brass	G2310	G2310
Water pump gasket to cylinder	R48398	R48398
Water pump pinion on pump shaft	A48363	A48363
Water pump pinion set screw	G3240	G3240
Water Pump Pipe, Screws, to Cylinder	G3236	G3236
Water Scoop with Screen	A48400	A48400
Water Pump Pinion on Engine Shaft	A48364	A48364
Water Pump Gear Shield	A31810	A31810
Water Pump Gear Shield Screws	G2380	G2380
Water Pump (Plunger)		
Water Pump, complete with Bracket Pipe, Gasket and necessary Screws to attach to Engine	G1428X	G1428X
Water Pump Bracket	A31962	A31962
Water Pump Body	A31961	A31961
Water Pump Inlet Valve	R48958	R48958
Water Pump Outlet Valve	A48957	A48957
Water Pump Cap	A48951	A48951
Water Pump Plug	R48960	R48960
Water Pump Plunger	A48952	A48952
Eccentric Strap, Upper Half	A48953	A48953
Eccentric Strap, Lower Half	A48954	A48954
Plunger Pin	R48962	R48962
Packing Nut	R48956	R48956
Eccentric	A48955	A48955
Gasket (Pipe to Cylinder)	R48398	R48398
Bracket to Crank Case Screw (½"x¾")	G3301	G3301
Water Pipe to Pump Screw	G3236	G3236
Bracket to Pump Cap Screw (5/16"x 1¼")	G3009	G3009
Water Pipe	A49075	A49075
No. 2 Winkley Oiler	G167X	G167X
Lubricating System.		
Cylinder, Oiler only	G1398X	G1398X
Cylinder, Oiler Nipple	G2348	.....
Cylinder Oiler Elbow	G2587	.....
Cylinder Oiler, Oil Pipe sightfeed to Cylinder No. 1, with connections	.....	G1411X
Cylinder Oiler, Oil Pipe sightfeed to Cylinder No. 2, with connections	.....	G1412X
Cylinder Grease Cups	G1382	G1382
Cylinder Grease Cup Nipples	G2348	G2348
Cylinder to Oiler Screw (12-20x5/8)	.....	.....
Oil Cup Glasses, each 3"x3"	.....	.....
Oil Cup Glasses (2¼"x2 1/8")	.....	.....
Oil Cup Glass Gasket	.....	.....
Sight Feed Glasses	.....	.....
Sight Feed Glass Gaskets	.....	.....
Cylinder Grease Cup Coupling	G2350	G2350
Starting Crank.		
Starting Crank, complete	G1408X	G1408X
Starting Crank Bolt with Nut	R48413	R48413
Starting Crank Handle	R48414	R48414
Starting Crank Pawl	R48415	R48415
Starting Crank Pawl Bolt with Nut	R48416	R48416
Muffler.		
Muffler, complete	G2124X	G2124X
Electrical Equipment.		
Dry Cells	G734	G734
Dry Cells Connecting Wires	G124X	G124X
Switch	G262X	G262X
Spark Coil	G1860X	G1861X
Spark Plug	G336X	G336X
Primary Wire, per foot	.....	.....
Secondary Wire, per foot	.....	.....

Accessories: G3691 No. 26 Wrench G3690 No. 727 Wrench Lubricating Oil and Can Can of Hard Grease

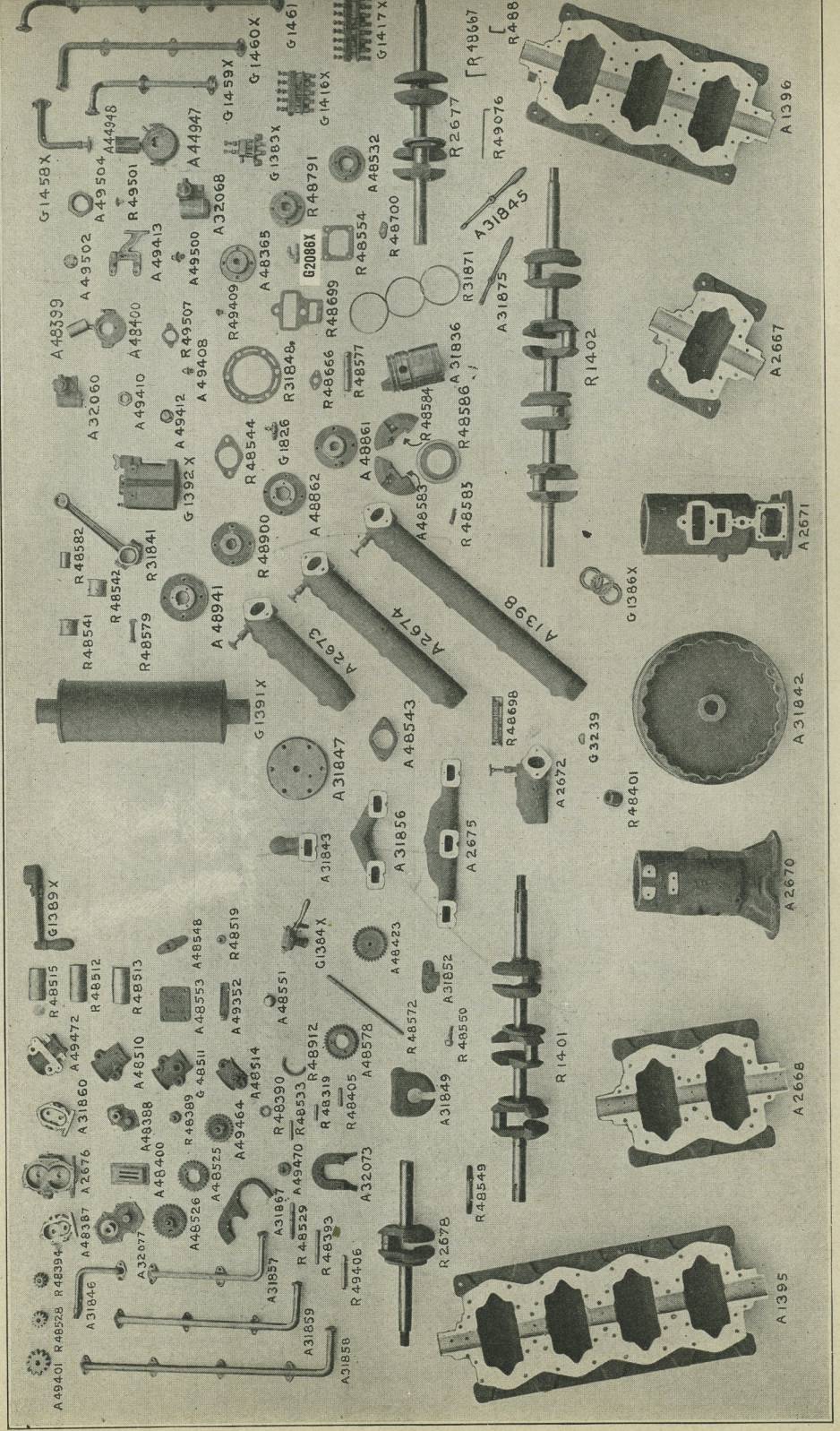


Chart Showing All Parts of Fairbanks-Morse Type "G" Marine Engine—Fig. X1855

Name of Part.	6 H. P. 1 Cylinder Symbol	12 H. P. 2 Cylinders Symbol	18 H. P. 3 Cylinders Symbol	24 H. P. 4 Cylinders Symbol
Cylinder				
Cylinder and Upper Base	A2670	A2670	A2670	A2670
Cylinder and Upper Base	.....	A2671	A2671	A2671
Cylinder Head, nickled	A31847	A31847	A31847	A31847
Cylinder Head Cap Screws	R48550	R48550	A48550	A48550
Cylinder Head Gasket	R31848	R31848	R31848	R31848
Cylinder Hand Hole Plate	A48553	A48553	A48553	A48553
Cylinder Hand Hole Plate Gasket	R48554	R48554	R48554	R48554
Cylinder Hand Hole Plate Cap Screws	G2373	G2373	G2373	G2373
Lower Half of Crank Case, babbitted	A2667	A2668	A1396	A1395
Cylinder to lower half Crank Case Cap Screws	G3242	G3242	G3242	G3242
Name Plate	R48698	R48698	R48698	R48698
Name Plate Screws	G3298	G3298	G3298	G3298
Exhaust Connection	A2672	A2673	A2674	A1398
Exhaust Pipe Flange	A48543	A48543	A48543	A48543
Exhaust Pipe Flange Gasket	R48544	R48544	R48544	R48544
Exhaust Pipe Dowel Nipple	R48670	R48670	R48670	R48670
Exhaust Pipe Flange Cap Screw	G3108	G3108	G3108	G3108
Exhaust Pipe Drain Plug	G2313	G2313	G2313	G2313
Exhaust Pipe Water Valve, complete	G1385X	G1385X	G1385X	G1385X
Exhaust Pipe Water Valve Bushing	R48566	R48566	R48566	R48566
Exhaust Pipe Water Valve Stem	R48545	R48545	R48545	R48545
Exhaust Pipe Water Valve Handle with Dowel	R48546	R48546	R48546	R48546
Exhaust Pipe Water Valve Packing Nut	R48547	R48547	R48547	R48547
Exhaust Pipe Clamp	A48548	A48548	A48548	A48548
Exhaust Pipe Clamp Stud	R48549	R48549	R48549	R48549
Exhaust Pipe Clamp Stud Nut	G3248	G3248	G3248	G3248
Intake Connection	A31843	A31856	A2675	A1433
Intake Connection Dowel Pins	R48640	R48640	R48640	R48640
Intake Connection Nipple	R48793	R48793	R48793	R48793
Intake Connection Gasket	R48699	R48699	R48699	R48699
Main Bearing Cap Bushing, Fly-wheel End	R48512	R48512	R49471	R49471
Main Bearing Cap Bushing Timer End	R48513	R48513	R48513	R48513
Main Bearing Cap Bushing, center	.....	R48515	R48515	R48515
Main Bearing Cap, Fly-wheel End	A48510	A48510	A49472	A49472
Main Bearing Cap, Timer End	A48511	A48511	A48511	A48511
Main Bearing Cap, Center	.....	A48514	A48514	A48514
Main Bearing Cap Screws	G3108	G3108	G3108	G3108
By-pass Opening Plug	A48551	A48551	A48551	A48551
By-pass Screen	A49352	A49352	A49352	A49352
Bearing Cap Packing	R411267	R411267	R411267	R411267
Bemus Timer used on part of engines for year of 1914.				
Bemus Timer.				
Timer only, complete with main casting, handle with circuit breaker, revolving center piece with collar and taper pin, fibre ring with contacts and cover	G2060X	G2061X	G2062X	G2059X
Timer main casting with handle and circuit breaker	G2063X	G2063X	G2063X	.....
Timer revolving center piece with pin	G3787	G3787	G3787	.....
Timer collar for revolving center piece	G3788	G3788	G3788	.....
Timer collar taper pin	G3773	G3773	G3773	.....
Timer bevel contact roller	G3276	G3276	G3276	.....
Timer bolt holding insulating ring	G3277	G3277	G3277	.....
Timer two-piece lock nut for cover	G3278	G3278	G3278	.....
Timer insulating ring only arranged for one contact socket	G3398	.....	.....	.....
Timer insulating ring only arranged for two contact socket	.....	G3279	.....	.....
Timer insulating ring only arranged for three contact sockets	.....	.....	G3789	.....
Timer insulating ring only arranged for four contact sockets	.....	.....	.....	G3868
Timer insulating ring contact complete, consists of ball, socket, spring and cap	G1452X	G1452X	G1452X	.....
Timer contact steel ball	G1607	G1607	G1607	.....
Timer contact steel ball socket	G3280	G3280	G3280	.....
Timer contact steel ball socket lock ring	G3281	G3281	G3281	.....
Timer contact steel ball socket cap nut	G3282	G3282	G3282	.....
Timer contact steel ball spring	G3283	G3283	G3283	.....
Timer cover complete with ground contact	G2064X	G2064X	G2064X	.....
Timer circuit breaker brass post	G3799	G3799	G3799	.....
Timer circuit breaker brass knurled nut	G3800	G3800	G3800	.....
Timer circuit breaker spring	G3801	G3801	G3801	.....
Timer circuit breaker fibre bushing	G3802	G3802	G3802	.....
Timer circuit breaker fibre push plug	G3803	G3803	G3803	.....
Long Bros., Timer used previous to 1914				
Timer, complete	G1384X	G1413X	G1414X	G1415X
Timer, Cover	G3253	G3253	G3253	G3253
Timer, Wing Nuts	G3254	G3254	G3254	G3254
Timer, Steel Posts	G3255	G3255	G3255	G3255
Timer, Taper Pins	G3249	G3249	G3249	G3249
Timer, Hex. Trolley Screws	G3256	G3256	G3256	G3256
Timer, Trolley Spring	G3257	G3257	G3257	G3257
Timer, Circuit Breaker	G3258	G3258	G3258	G3258
Timer, Circuit Breaker Bushing	G3259	G3259	G3259	G3259
Timer, Brass Screws, long	G3260	G3260	G3260	G3260
Timer Hex. Nuts	G3261	G3261	G3261	G3261
Timer Steel Collars	G3262	G3262	G3262	G3262
Timer Brass Screws, short	G3263	G3263	G3263	G3263
Timer Trolley and Roller	G3264	G3264	G3264	G3264

Name of Part.	6 H. P. 1 Cylinder Symbol.	12 H. P. 2 Cylinders Symbol.	18 H. P. 3 Cylinders Symbol.	24 H. P. 4 Cylinders Symbol.
Long Bros., Timer used previous to 1914—Continued				
Timer Circuit Breaker Screw	G3265	G3265	G3265	G3265
Timer Circuit Breaker Nut	G3266	G3266	G3266	G3266
Timer Circuit Breaker Push Button	G3267	G3267	G3267	G3267
Timer Shaft	R48572	R48572	R48572	R48572
Timer Bracket with Set Screw	A31852	A31852	A31852	A31852
Timer Gear on Timer Shaft	A48423	A48423	A48423	A48423
Timer Gear on Crank Shaft	A48578	A48578	A48578	A48578
Timer Gear on Crank Shaft Cap Screw	R48718	R48718	R48718	R48718
Timer Gear Shield	A31849	A31849	A31849	A31849
Timer Gear Shield Cap Screw	G2380	G2380	G2380	G2380
Timer Shaft Bushing	R48419	R48419	R48419	R48419
Timer Bracket to Cylinder Screw	G2373	G2373	G2373	G2373
Carburetor				
Carburetor (Schebler), 1¼"	G2129X	G2129X	G2129X	G2129X
Carburetor Control Lever	R31921	A31875	A31875	A31875
Carburetor Control Lever Fulcrum Pin	R48755	R48755	R48755	R48755
Carburetor Control Lever Link	R48667	R48667	.....	.....
Carburetor Control Lever Link	.....	.....	R49076	.....
Carburetor Control Lever Link	.....	.....	.....	R49683
Drain Cocks	G378X	G378X	G378X	G378X
Priming Cups	G2086X	G2086X	G2086X	G2086X
Water Pump (Rotary)				
Water Pump, complete with Gears, Shaft, Screws and Nuts	G1401X	G1402X	G1456X	G1456X
Water Pump Body	A48387	A31860	A 2676	A2676
Water Pump Cover	A48388	A48388	A32077	A32077
Water Pump Packing Nut	R48389	R48389	A49470	A49470
Water Pump Lock Nut	R48390	R48390	.....	.....
Water Pump Gears	R48394	R48528	A49401	A49401
Water Pump Supporting Stud and Nut	R48396	R48396	.....	.....
Water Pipe	A31846	A31857	A31859	A31858
Water Pipe Gasket (to Cylinder)	R48666	R48666	R48666	R48666
Water Pipe Gasket (to Pump)	.....	R48700	.....	.....
Water Pump Pinion on Pump Shaft	A48526	A48526	A49464	A49464
Water Pump Short Gear Shaft	R48392	R48533	R49405	R49405
Water Pump Long Gear Shaft	R48393	R48529	R49406	R49406
Water Scoop	A48400	A48400	A48400	A48400
Water Pump Pinion on Engine Shaft	A48525	A48525	A48525	A48525
Water Pump Gear Shield	A31867	A31867	A32073	A32073
Water Pump Close Nipple (Brass)	G2310	G2310	.....	.....
Water Pump Gear Shield Cap Screw	G2380	G2380	G3299	G3299
Water Pipe to Water Pump Screw, 5/16"x½"	.....	.....	.....	.....
Water Pump Body Screw	G3241	G3241	G3241	G3241
Water Pump Pinion on Pump Shaft Set Screw	G3240	G3240	G3240	G3240
Water Pump Pipe Screw to Cylinder	G3236	G3236	G3236	G3236
Water Pump (Plunger)				
Water Pump, complete with Bracket, Pipe, Gaskets and necessary Screws to attach to Engine	G1444X	G1457X	G1462X	G1463X
Water Pump only	G1403X	G1403X	G1464X	G1464X
Water Pump Body	A32060	A32060	A32068	A32068
Water Pump Eccentric Strap (Assembled)	A48399 / A48400	A48399 / A48400	A49497 / A49498	A49497 / A49498
Water Pump Outlet Valve	A49408	A49408	A49500	A49500
Water Pump Inlet Valve	R49409	R49409	R49501	R49501
Water Pump Packing Nut	A49410	A49410	A49504	A49504
Water Pump Plunger	A49411	A49411	A49499	A49499
Water Pump Check for Outlet Valve	A49412	A49412	A49502	A49502
Water Pump Bracket	A49413	A49413	A49505	A49505
Water Pump Plunger Pin	R49414	R49414	R49503	R49503
Water Pump Eccentric	A49398	A49398	A49496	A49496
Water Pump Drive Pin for Eccentric	R48639	R48639	R48639	R48639
Water Pump Plug for Drain	R48960	R48960	R48960	R48960
No. 2 Winkley Oiler	G167X	G167X	G167X	G167X
Bracket Supporting Stud and Nut, each	R48396	R48396	R48396	R48396
Bracket to Pump Screws, each	G3300	G3300	G3300	G3300
Water Pipe	G1458X	G1459X	G1460X	G1461X
Water Pipe Flange to Pump Gasket	R49507	R49507	R49686	R49686
Water Pipe to Cylinder Gasket	R48666	R48666	R48666	R48666
Water Pipe, Disconnecting Flange Gasket	.....	R49577	R49577	R49577
Water Pipe, Disconnecting Flange Cap Screw	.....	G3245	G3245	G3245
Thrust Bearing				
Ball Thrust Bearing, complete with Ring and Collars	G1386X	G1386X	G1386X	G1386X
Fly-wheel				
Fly-wheel	A31842	A31842	A31842	A31842
Fly-wheel Nut	R48401	R48401	R48401	R48401
Fly-wheel Key	G3239	G3239	G3239	G3239
Connecting Rod				
Connecting Rod and Cap, complete with Bushing, Bolts and Nuts	G1387X	G1387X	G1387X	G1387X
Connecting Rod and Cap	R31841	R31841	R31841	R31841
For engines numbered above 6,000:				
Connecting Rod Bushing, Upper Half	R49610	R49610	R49610	R49610
Connecting Rod Bushing (Lower Half)	R49611	R49611	R49611	R49611
For engines numbered below 6,000:				
Connecting Rod Bushing, Upper Half,	A410014	A410014	A410014	A410014
Connecting Rod Bushing, Lower Half,	A410015	A410015	A410015	A410015
Connecting Rod Shims (for 12)	R48580	R48580	R48580	R48580
Connecting Rod Bolt	R48579	R48579	R48579	R48579
Connecting Rod Nuts for Bolt	R48581	R48581	R48581	R48581
Connecting Rod Bushing, Piston End	R48582	R48582	R48582	R48582

REPAIR PARTS FOR TYPE "G" MARINE ENGINES.

Name of Part.	6 H. P. 1 Cylinder Symbol.	12 H. P. 2 Cylinders Symbol.	18 H. P. 3 Cylinders Symbol.	24 H. P. 4 Cylinders Symbol.
Crank Shaft				
Crank Shaft, complete with Oil Ring, Counterweights and Screws	G1388X	G1430X	G1431X	G1432X
Crank Shaft only	R2678	R2677	R1401	R1402
Crank Shaft Counterweight, Fly-wheel End	A48584	A48584	A48584	A48584
Crank Shaft Counterweight, Prop. End	A48583	A48583	A48583	A48583
Crank Shaft Counterweight Screw	R48585	R48585	R48585	R48585
Crank Shaft Oil Rings	R48586	R48586	R48586	R48586
Crank Shaft Oil Rings, Screws	G3238	G3238	G3238	G3238
Coupling				
Coupling Flange, Engine End	A48532	A48862	A48862	A48941
Coupling Flange, Engine End Key	R48409	R48409	R48409	R48409
Coupling Flange, Propeller End	A48365	A48861	A48861	A48861
Coupling Flange, Propeller End	R48791	R48900	R48900	.....
Coupling Flange, Propeller End Key	R48790	R48790	R48790	R48790
Coupling Flange Cap Screw	G3246	G3246	G3246	G3246
Coupling Flange, Engine End Screw Set	G3243	G3243	G3243	G3243
Coupling Flange, Propeller End Set Screw	G3244	G3244	G3244	G3244
Piston				
Piston, complete with Rings, Pin and Set Screw	G1390X	G1390X	G1390X	G1390X
Piston Body	A31836	A31836	A31836	A31836
Piston Rings	R31871	R31871	R31871	R31871
Piston Pin	R48577	R48577	R48577	R48577
Piston Pin Set Screw	R44600	R44600	R44600	R44600
Piston Ring Dowel	R48668	R48668	R48668	R48668
Piston Pin Bushing	R48582	R48582	R48582	R48582
Lubricating System				
Oil Reservoir, complete with Filler Plug, Sight Glass, Washers, Nipple and Elbows	G1392X	G1392X	G1392X	.....
Oil Reservoir only	A31844	A31844	A 31844	.....
Oil Reservoir Filler Plug	A48559	A48559	A48559	.....
Oil Reservoir Filler Plug Washer	R48560	R48560	R48560	.....
Oil Reservoir Sight Glass	R48556	R48556	R48556	.....
Oil Reservoir Sight Glass Washers	R48557	R48557	R48557	.....
Oil Reservoir Guide Plug	R48558	R48558	R48558	.....
Oil Reservoir Pressure Pipe Nipple	R48561	R48561	R48561	.....
Oil Reservoir Pressure Pipe Elbow	R48562	R48562	R48562	.....
Oil Reservoir Check Valve complete	G1393X	G1393X	G1393X	.....
Oil Reservoir Check Valve Ball Case	R48602	R48602	R48602	.....
Oil Reservoir Check Valve Ball Retainer	R48603	R48603	R48603	.....
Oil Reservoir Check Valve, 5/16" Ball	G3250	G3250	G3250	.....
Oil Reservoir, Inside Discharge Pipe with Nipple	G1327X	G1327X	G1327X	.....
Oil Reservoir, Compression Pipe with Connection	R48848	R48848	R48848	.....
Oil Reservoir, Feed Pipe to Sight Feed Connections	R48849	R48849	R48849	.....
Oil Pipe Union End Connection with Oil Ring Feed Pipe	G1328X	G1328X	G1328X	G1328X
Oil Pipe Union End Connection, 1/8"	R48470	R48470	R48470	R48470
Oil Pipe Union Nut, 1/8"	R48471	R48471	R48471	R48471
Feed Pipe, Sight Feed to Cylinder No. 1, with connections	R48850	R48850	R48850	R48850
Feed Pipe, Sight Feed to Oil Ring No. 1, with connection	R48851	R48851	R48851	R48851
Feed Pipe, Sight Feed to Cylinder No. 2, with connection	.....	R48852	R48852	R48852
Feed Pipe, Sight Feed to Oil Ring No. 2, with connection	.....	R48853	R48853	R48853
Feed Pipe, Sight Feed to Center Bearing Pipe No. 1, with connection	.....	R48854	R48854	R48854
Feed Pipe, Sight Feed to Cylinder No. 3, with connection	.....	.....	R48855	R48855
Feed Pipe, Sight Feed to Oil Ring No. 3, with connection	.....	.....	R48856	R48856
Feed Pipe, Sight Feed to Center Bearing Cap No. 2, with connection	.....	.....	R48857	R48857
Feed Pipe, Sight Feed to Cylinder No. 4, with connections	.....	.....	.....	R49435
Feed Pipe, Sight Feed to Oil Ring No. 4 with connections	.....	.....	.....	R49436
Feed Pipe, Sight Feed to Center Bearing Cap No. 3, with connections	.....	.....	.....	R49434
Cylinder Grease Cups	G1382X	G1382X	G1382X	G1382X
Cylinder Grease Cups Coupling	G2350	G2350	G2350	G2350
Cylinder Grease Cup Nipples	G2348	G2348	G2348	G2348
Cylinder to Oil Reservoir Screws	G2373	G2373	G2373	.....
Sight Feed to Cylinder Screws	.....	.....	.....	G2380
Sight Feed to Oil Reservoir Screw, 5/16x½"	.....	.....	.....	.....
Sight Feed Oilers, complete	G1383X	G1416X	G1417X	G1418X
Sight Feed Glasses, each	.....	.....	.....	.....
Sight Feed Glasses, Gaskets	.....	.....	.....	.....
Starting Crank				
Starting Crank, complete	G1389X	G1389X	G1389X	G1389X
Starting Crank Bolt for Handle with Nut	R48413	R48413	R48413	R48413
Starting Crank Handle	R48414	R48414	R48414	R48414
Starting Crank Pawl	R48415	R48415	R48415	R48415
Starting Crank Pawl Bolt with Nut	R48416	R48416	R48416	R48416
Muffler				
Muffler, complete	G2125X	G2125X	G2125X	G2125X
Electrical				
Dry Cells, each	G 734	G734	G734	G734
Dry Cells, connecting Wires	G124X	G124X	G124X	G124X
Spark Coil	G1860X	G1861X	G1862X	G1863X
Primary Wire, per foot	.....	.....	.....	.....
Spark Plug	G336X	G336X	G336X	G336X
Switch	G262X	G262X	G262X	G262X
Secondary Wire, per foot	.....	.....	.....	.....

Accessories

G3885 No.701A Wrench G3824 No.728 Wrench G3823 No. 35 Wrench Can of Hard Grease Lubricating Oil with Can

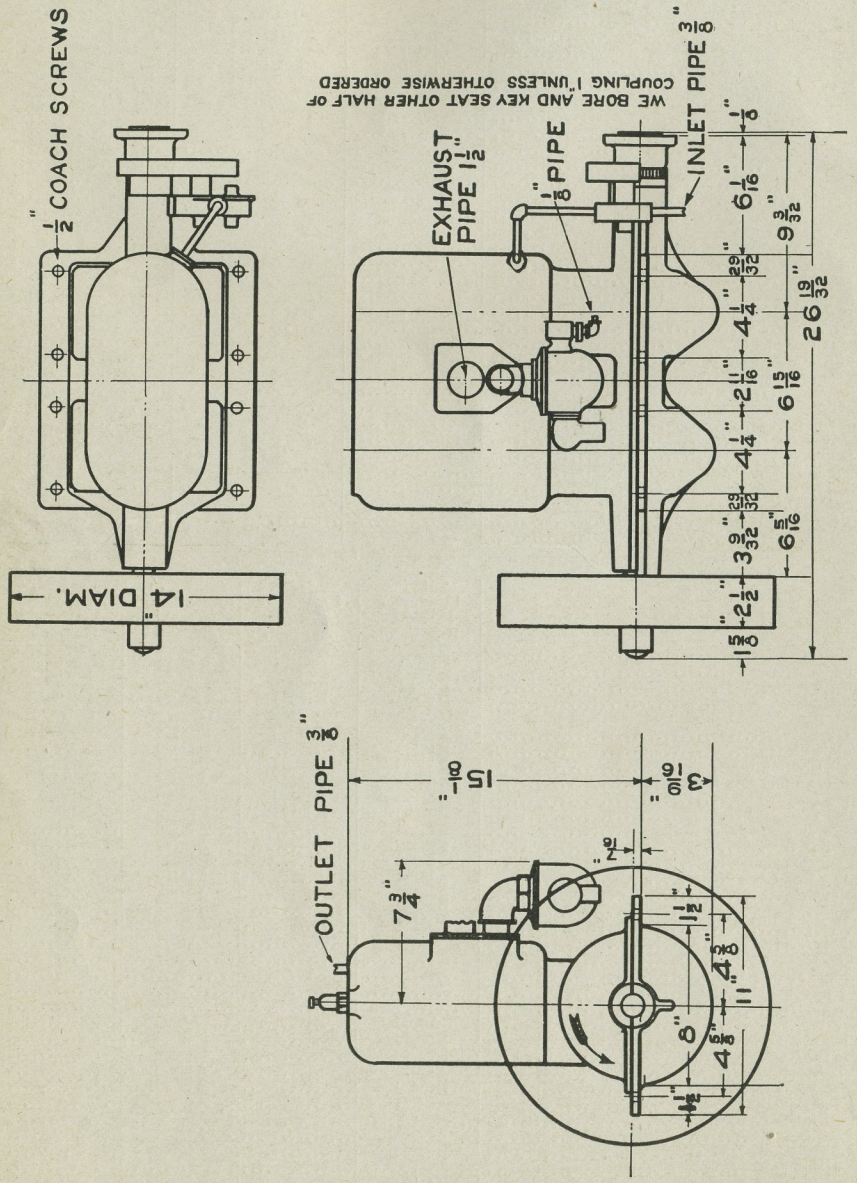
PROPELLER EQUIPMENT FOR TYPE "E" ENGINES.

Name of Part	3 1/2 H. P. 3/4" Solid Propeller Outfit	3 1/2 and 7 H. P. 3/4" Reverse Propeller Outfit	7 H. P. 1" Solid Propeller Outfit
Propeller Shaft (Steel)	R48428	R48451	R48788
Propeller Shaft (Bronze)	R48897	R48898	R48858
Propeller Shaft Key (Steel)	R48864	R48891	R48895
Propeller Shaft Key (Bronze)	R48865	R48892	R48896
Propeller Shaft Sleeve	.....	R48439	.....
Stern Bearing complete with Stuffing Box and Lock Nut	G1799X	G1800X	G1801X
Stern Bearing	A48429	A48438	R48903
Stern Bearing Stuffing Box	R48430	R48440	R48904
Stern Bearing Stuffing Box Lock Nut	R48431	R48441	R48441
Stern Bearing Lag Stud	R48189	R48189	R48189
Stern Bearing Lag Stud Nut	R49193	R49193	R49193
Inside Stuffing Box and Collar	.....	A48354	.....
Lock Collar	.....	R48355	.....
Inside Stuffing Box Cap	.....	R48452	.....
Inside Stuffing Box Lock Nut	.....	.....	.....
Shifting Collar	.....	A48353	.....
Shifting Collar Screws	.....	R48453	.....
Yoke	.....	A48442	.....
Yoke Bracket	.....	A48443	.....
Combination Bracket Pin for Reverse Mechanism	.....	R48444	.....
Tie Rod for Reverse Mechanism	.....	R48349	.....
Tie Rod Fork	.....	A48445	.....
Reverse Lever	.....	A31814	.....
Fulcrum Pin for Yoke	.....	.....	.....
Fulcrum Pin for Reverse Lever	.....	.....	.....
Link	.....	.....	.....
Upper Dog for Reverse Lever	.....	A48447	.....
Lower Dog for Reverse Lever	.....	A49446	.....
Bracket for Reverse Lever	.....	A48352	.....
Latch for Lever	.....	A48448	.....
Pin for Latch on Upper Dog	.....	.....	.....
Pin for Latch and Dog	.....	R48450	.....
Tie Rod for Reverse Lever	.....	R48350	.....
Spring for Lever	.....	R48449	.....
Pin for Latch on Lever Quadrant	.....	A48351	.....
3/8"x1" Hex. Head Cap Screw (For A48351).	.....	.....	.....
3/8"x3" Lag Screws (for A48352 and A1431)	.....	.....	.....
Spanner Wrench	A48432	A48432	A48432

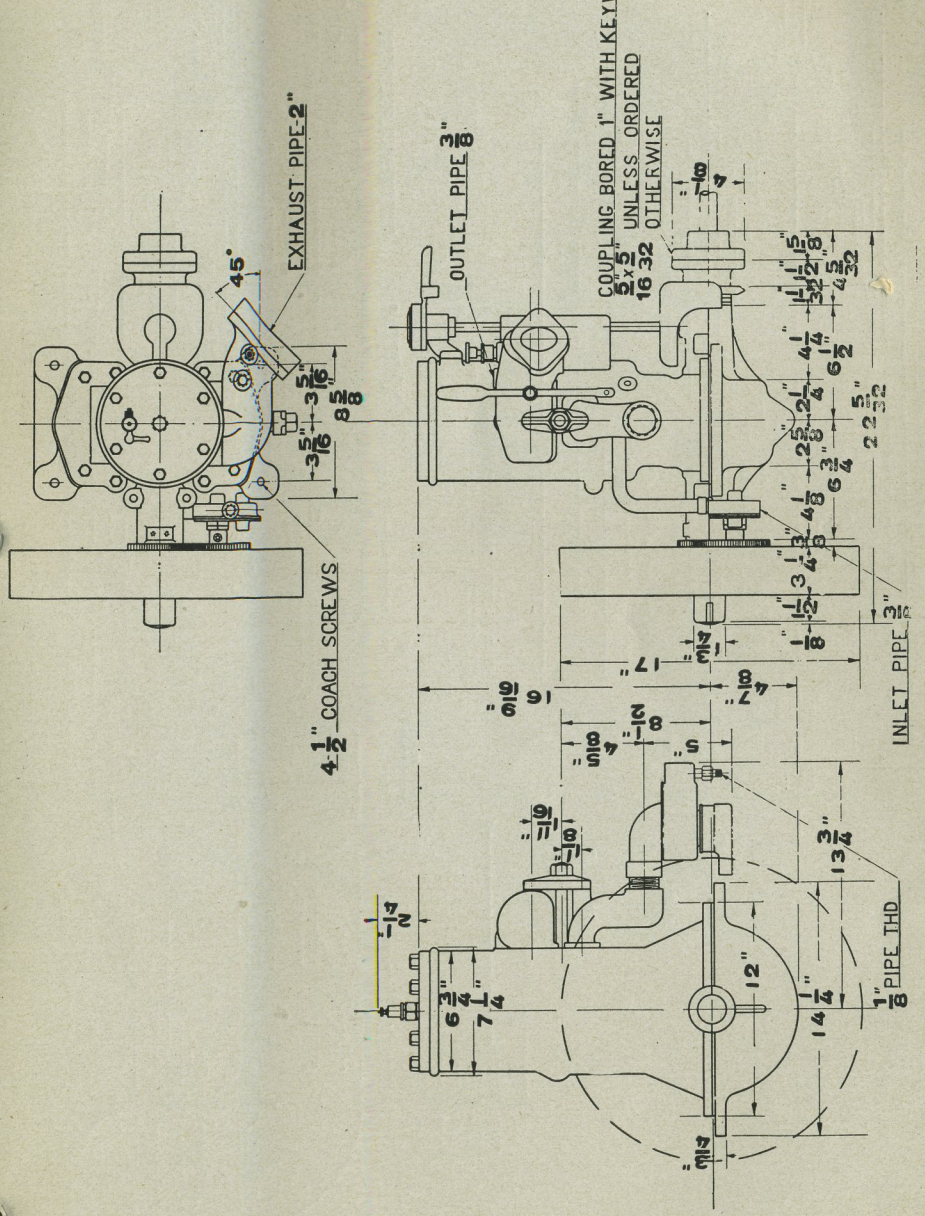
PROPELLER EQUIPMENT FOR TYPE "G" ENGINES.

Name of Part.	6 H. P. 1 Cylinder 3/4" Reversible, Symbol.	6 H. P. 1 Cylinder 1" Solid, Symbol.	12-18 H. P. 2-3 Cylinders 1" Reversible, Symbol.	12-18-24 H. P. 2-3-4 Cyl'ders 1 1/4" Solid, Symbol.
Propeller Shaft, Steel	R48451	R48788	R48944	R48859
Propeller Shaft, Bronze	R48898	R48858	R48945	R48860
Propeller Shaft Key, Steel	R48891	R48895	R48893	R48866
Propeller Shaft Key, Bronze	R48892	R48896	R48894	R48867
Stern Bearing complete with Stuffing Box and Lock Nut	G1800X	G1801X	G1802X	G1803X
Stern Bearing	A48438	R48903	R48913	A48905
Propeller Shaft Sleeve	R48439	.....	R49130	.....
Stern Bearing Stuffing Box	R48440	R48904	R49131	A48906
Stern Bearing Stuffing Box Lock Nut	R48441	R48441	A48907	A48907
Stern Bearing Lag Stud	R49189	R49189	R49190	R49190
Stern Bearing Lag Stud Nut	R49193	R49193	R49192	R49192
Inside Stuffing Box and Lock Collar	R49188	.....	A49135	.....
Lock Collar	R49138	.....	A49132	.....
Inside Stuffing Box Cap	A49080	.....	R49223	.....
Inside Stuffing Box Lock Nut	A49136	.....	A49136	.....
Shifting Collar	A49133	.....	A49133	.....
Shifting Collar Screws	R49137	.....	R49137	.....
Yoke	A49134	.....	A49134	.....
Yoke Bracket	A1431	.....	A1431	.....
Combination Bracket	.....	.....	.....	.....
Pin for Reverse Mechanism	.....	.....	.....	.....
Tie Rod for Reverse Mechanism	.....	.....	.....	.....
Tie Rod Fork	.....	.....	.....	.....
Reverse Lever	A2706	.....	A2706	.....
Fulcrum Pin for Yoke	R48949	.....	R48949	.....
Fulcrum Pin for Reverse Lever	R48948	.....	R48948	.....
Link	A49082	.....	A49082	.....
Upper Dog Reverse Lever	R49225	.....	R49225	.....
Lower Dog for Reverse Lever	A49224	.....	A49224	.....
Bracket for Reverse Lever	.....	.....	.....	.....
Latch for Lever	A49234	.....	A49234	.....
Pin on Latch for Upper Dog	R49240	.....	R49240	.....
Pin for Latch and Dog	.....	.....	.....	.....
Tie Rod for Reverse Lever	R49226	.....	R49226	.....
Spring for Lever	R49235	.....	R49235	.....
Pin for Latch on Lever	R49236	.....	R49236	.....
Quadrant	.....	.....	.....	.....
3/8"x1" Hex. Head Cap Screw (for A48351)	.....	.....	.....	.....
3/8"x3" Lag Screws (for A48352 and A1431)	.....	.....	.....	.....
Spanner Wrench	A48432	A48432	.....	.....
Spanner Wrench	A48908	.....	A48908	A48908

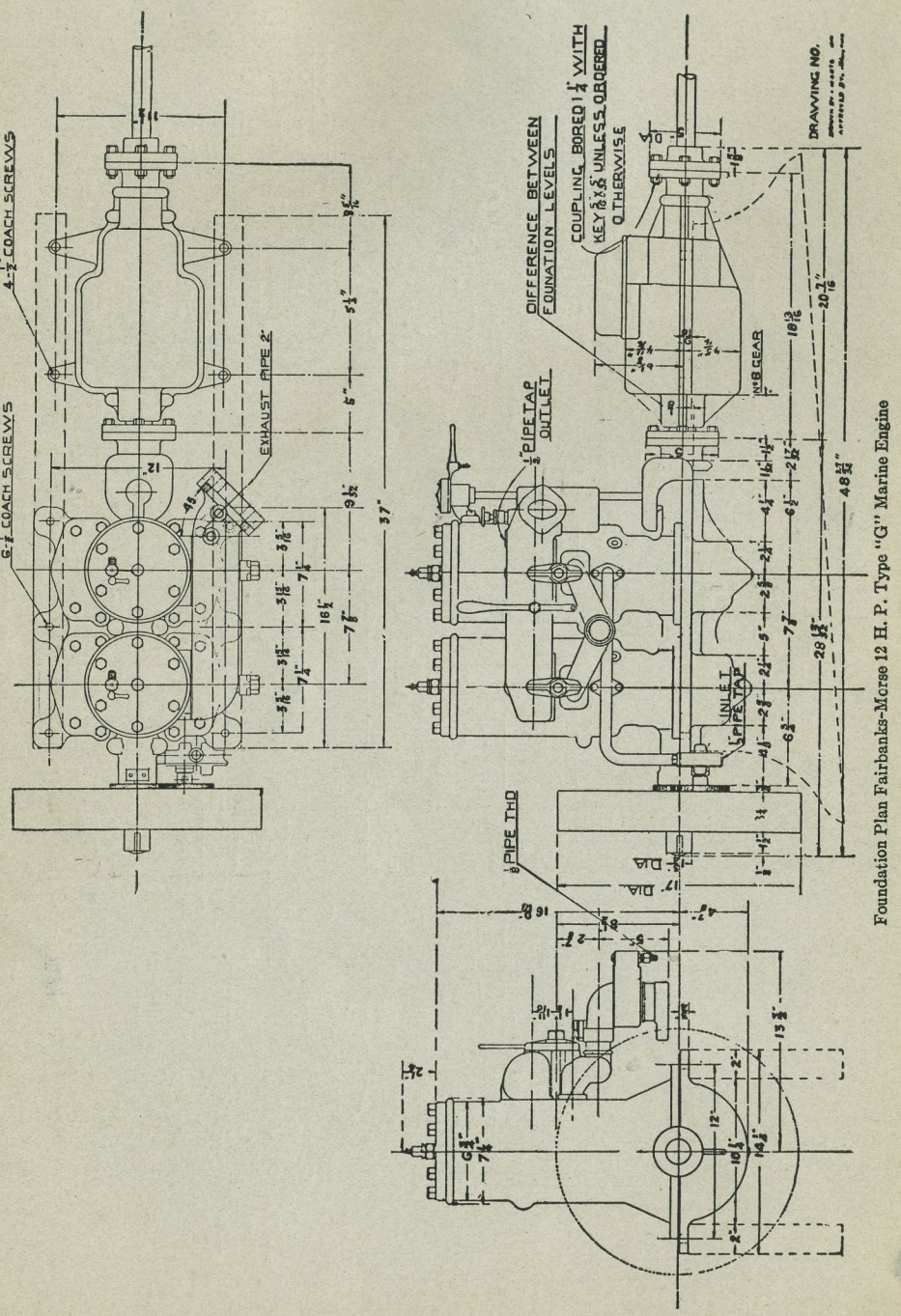
For Repairs Parts or Special information for the Baldridge Reverse Gear, please communicate directly with Baldridge Gear Co., Detroit, Mich.



Foundation Plan Fairbanks-Morse 7 H. P. Type "E" Marine Engine



Foundation Plan Fairbanks-Morse 6 H. P. Type "G" Marine Engine



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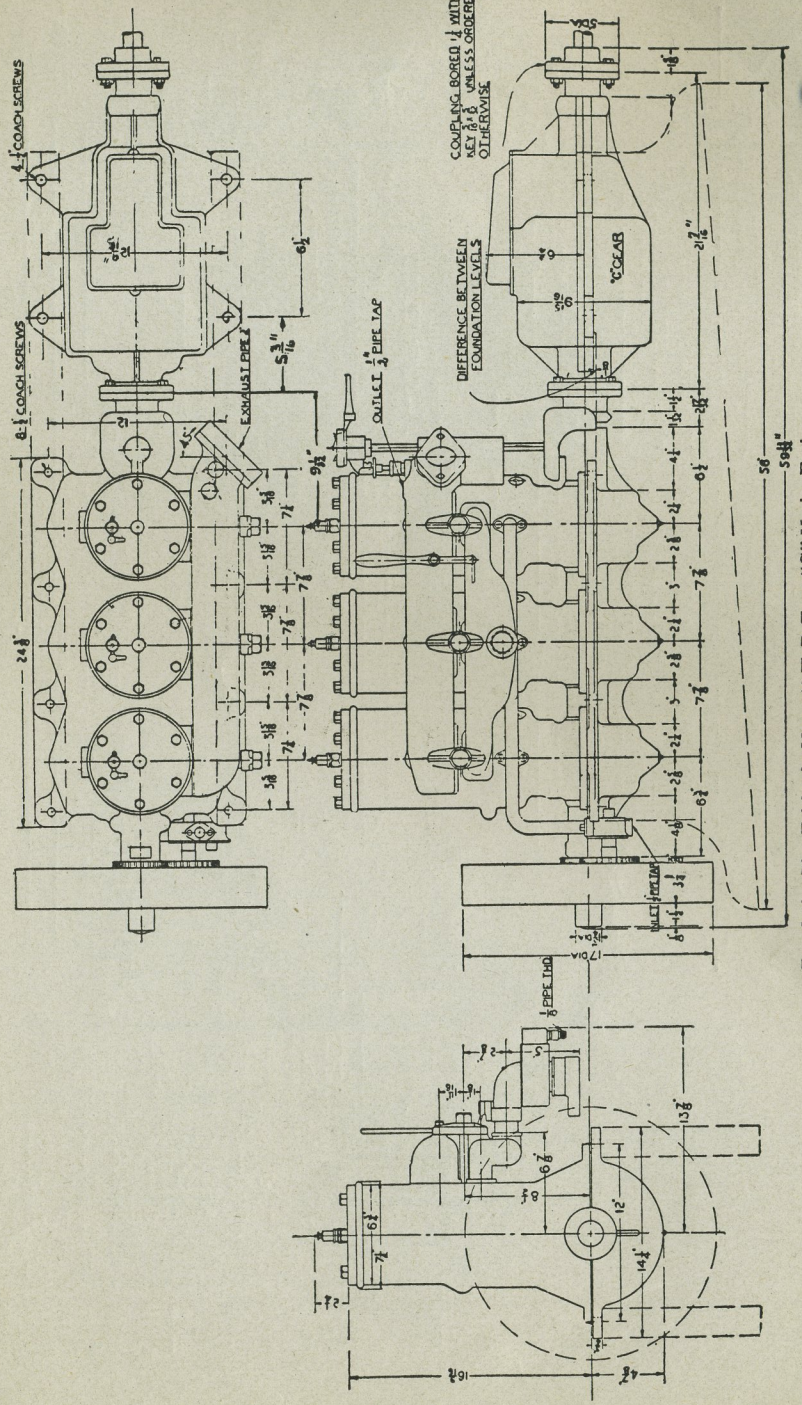

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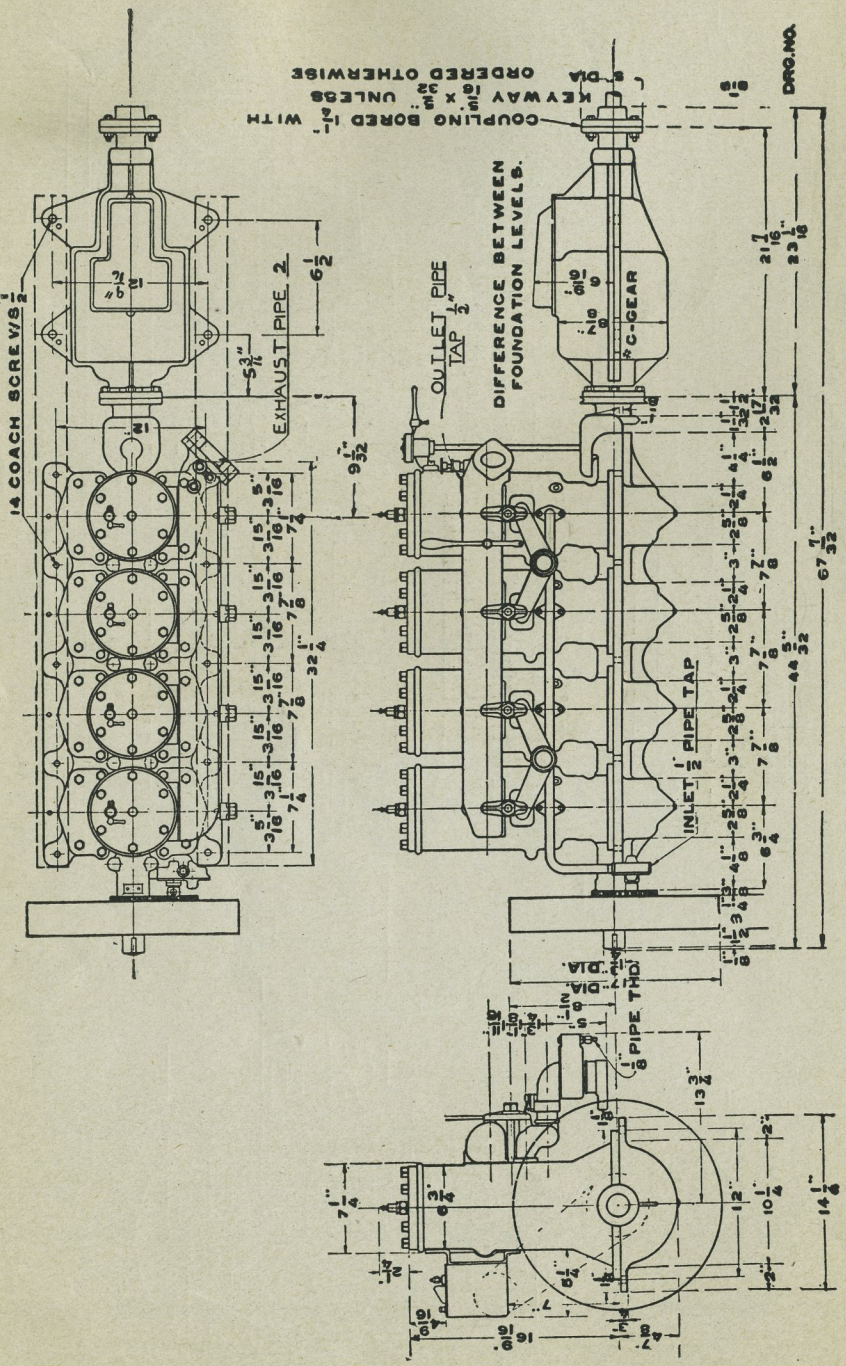
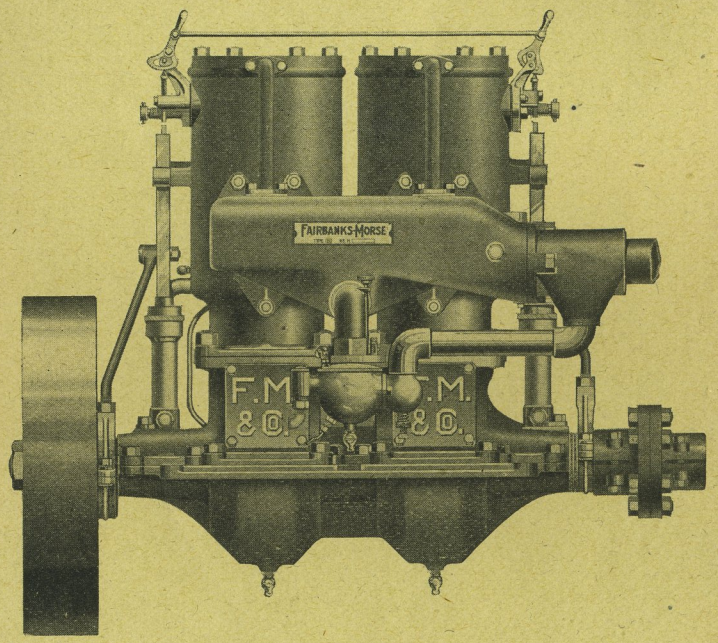


Foundation Plan Fairbanks-Morse 24 H. P. Type "G" Marine Engine with Baldridge Reverse Gear

Fairbanks-Morse Type "K" Marine Engine

A Two Cycle, Heavy Duty Engine for Cruisers, Fishing and work Boats



MADE in one and two cylinders, developing 7½ and 15 H. P. at 500 R. P. M. Cannot base fire. A simple device found on no other engine prevents base explosions and does not clog or choke the engine.

Remarkable economy—operates at lower cost than any other of its kind. Bearings extra large and all removable and renewable.

Accessibility is another strong feature—every part can be reached easily and without special tools.

Lubrication by gravity feed, centrifugal oil ring to crank—or oil in fuel. Make and break or self contained jump spark, requiring no battery for starting.

Water does not come in contact with cylinder head gasket but is by-passed through outside connections.

We will be glad to furnish further particulars regarding this engine upon your request.

FHG-C Brass Barrel Gas Starter Pump with Lever Handle (32 to 60 HP Type).

F2 Starter Pump Barrel.
FR2 Starter Pump Base.
FG2 Starter Pump Cap.
Cap to Engine Capscrews.
FD2 Starter Pump Piston (Top Section).
ZE2 Starter Pump Piston (Middle Section).
FE2 Starter Pump Piston (Bottom Section).
GO2 Starter Pump Piston Leathers.
FI2 Starter Pump Piston Rod.
FA2 Starter Pump Piston Rod End.
FF2 Starter Pump Lever Handle.
FAA2 Starter Pump Lever Handle Pin and Cotters.
FK2 Starter Pump Lever Handle Link.
FKA2 Starter Pump Lever Handle Link Pin and Cotters.
FL Starter Pump Lever Handle Link Bracket (32 and 40 HP).
FL2 Starter Pump Lever Handle Link Stud (50 and 60 HP).
Starter Pump Lever Handle Link Bracket Capscrews (32 and 40 HP).
FLA2 Starter Pump Lever Handle Link Stud Collar (50 and 60 HP).
Starter Pump Lever Handle Link Stud Cotter (50 and 60 HP).
FM2 Starter Pump Discharge Valve Seat.
FC2 Starter Pump Discharge Valve.
FJ2 Starter Pump Discharge Valve Spring.
FB2 Starter Pump Admission Valve.
FN2 Starter Pump Admission Valve Seat.
FS2 Starter Pump Mixer Valve Seat with FU2 Bushing and FT2 Valve.
Mach. Screws to attach FS2 to FR2.
Starter Pump Base to Engine Capscrews.

FY Pipe and Fittings to connect Starter Pump with Engine.

SYG-C Gas Valve.

SYG Gas Valve Body.
Body to Mixing Pipe Cap Screws.
PFG Gas Valve.
PGG Gas Valve Nut.
Gas Valve Nut Taper Pin.
PLG Gas Valve Tension Spring.
SZG Gas Valve Body Cover.
Gas Valve Body Cover Mach. Screws.

JDG-C Mixing Pipe.

JDG Mixing Pipe.
Mixing Pipe to Engine Short Capscrew.
Mixing Pipe to Engine Long Capscrew.
JFG Mixing Pipe Brace Rod.
Mixing Pipe Brace Rod Nut.
Mixing Pipe Brace Rod Capscrews.

PKG-C Gas Valve Operating Mechanism.

PKG Gas Valve Operating Rod.
Gas Valve Operating Rod Nut.
Gas Valve Operating Rod Set Screw.
Gas Valve Operating Rod Set Screw Nut.
PJG Gas Valve Operating Arm.
Gas Valve Operating Arm Cap Screw.
Gas Valve Operating Arm Cap Screw Nut.
QDG Gas Valve Operating Arm Spring.
QQG Gas Valve Operating Arm Spring Eyebolt.
Gas Valve Operating Arm Spring Eyebolt Nuts.
QCG Gas Valve Operating Arm Spring Eyebolt Clip.
QCG Clip to Engine Capscrews (32 to 60 HP).

GL-C Gas Starter Cock.

GL Gas Starter Cock Body fitted with GK Plug, GM Washer and GN Nut.

CH-C Combination Valve—Relief Valve for 5 and 7 HP. Check Valve for 10 to 60 HP.

GE Combination Valve.
Combination Valve Nut.
Combination Valve Nut Taper Pin.
CH Combination Valve Body.
G Combination Valve Body Cap.
GB Combination Valve Sleeve.
Combination Valve Sleeve to G Cap Mach. Screws.
GA Combination Valve Stem Nut.
GD Combination Valve Galvanized Steel Washers.
ZG Combination Valve Red Fibre Washer (10 to 60 HP).
Combination Valve Rubber Gasket.
GC Combination Valve Spring (10 to 60 HP).

CH2-C Brass Combination Cock (Old Style).

CH2 Brass Combination Cock Body.
G2 Brass Combination Cock Plug.
GA2 Brass Combination Cock Ball Valve.
GB2 Brass Combination Cock Half Union Nut.
GC2 Brass Combination Cock Half Union Coupling.
GE2 Brass Combination Cock Lever Handle.
GD2 Brass Combination Cock Lever Handle Washer.
GM2 Brass Combination Cock Lever Handle Nut.
CJ2 Brass Combination Cock Nipple (Cock to Engine).

FQ-C Detonator.

FP Detonator Tube.
FQ Detonator Plunger.
FV Detonator Plunger Cap.
FW Detonator Plunger Spring.
FO Detonator Screw Cap.

TC-C Exhaust Pot.

TC Exhaust Pot with Pipe Plug.
TD Exhaust Pot Cover fitted with Studs for TX Gland; also includes Studs for NB Flange on 32 to 60 HP.
Nuts for TX Gland Studs.
Nuts for NB Flange Studs (32 to 60 HP).
Capscrews for attaching NB Flange (5 to 25 HP).
Exhaust Pot to Cover Mach. Bolts and Washers.
Exhaust Pot to Cover Asbestos Gasket.
TX Exhaust Pot Gland.
Exhaust Pot Gland Asbestos Wick Packing.
NB Exhaust Pot Pipe Flange.

TE-C Gas Bunsen Burner.

TE Bunsen Burner Body.
TZ Bunsen Burner Needle Valve.
Bunsen Burner Needle Valve Nut.
TJ Bunsen Burner Tube.
TI Bunsen Burner Coupling.
TL Bunsen Burner Air Sleeve Ring.
Bunsen Burner Air Sleeve Ring Mach. Screw.
TH Bunsen Burner Air Collar.
TK Bunsen Burner Nozzle.

TJ-C Gas Bunsen Burner Outfit (Complete).

TE-C Gas Bunsen Burner (Complete).
DT Gas Bunsen Burner Bracket.
Mach. Screw to hold DH Fuel Pipe in DT Bracket.
DT Bracket to X Cyl. Capscrew.
GG Burner Chimney.
GJ Burner Chimney to X Cyl. Studs.
GH Burner Chimney Asbestos Lining.
DH Burner Fuel Pipe.
HI Burner Tube Bushings.
HH Burner Tubes (one set).
TFG Rubber Gas Bag for Burner.

DW-C Oil Shield.

DW Oil Shield.
Capscrews for attaching Oil Shield to Engine.
Additional Mach. Screws for attaching Oil Shield to Engine. (32 to 60 HP).

SP-C Engine Pulley (5 to 40 HP only).

SP Engine Pulley fitted with Key and Set Screws.

HP-C Engine Power Plate.

HP Power Plate.
Power Plate to Engine Mach. Screws.

NP-C Engine Patent Plate.

NP Patent Plate.
Patent Plate to Engine Brass Mach. Screws.
Patent Plate Mach. Screw Rubber Washers.

HC-C Plate over Air Suction Hole in Base.

HC Plate over Air Suction Hole in Engine Base.
Plate to Base RHM Screws.

HC1-C Plate over Reservoir Hole in Head.

HC1 Plate over Reservoir Hole in Head.
Plate to Cyl. Head RHM Screws.

CG-C Water Overflow Pipe and Funnel.

CG Water Overflow Pipe Funnel.
Water Overflow Pipe and Fittings.

S Cylinder Oiler.

SA Crank Pin Oiler (5 to 15 HP).

SAA Oiler for Ring Oiling Device (20 to 60 HP).

SAB Main Bearing Oiler (32 to 60 HP).

Complete Set of Springs for Engine.

NE Spring for Exhaust Valve.
OE Spring for Suction Valve.
MC Spring for Governor Weights (Two).
CA Spring for Governor Detent Catch.
ED Spring for Igniter Rocker Arm at Gear.
EO Spring for Pawl on Igniter Rocker Arm at Head.
ES Spring for Igniter Movable Electrode Catch.
ET Spring for Igniter Movable Electrode Collar.
GC Spring for Check Valve (10 to 60 HP).
FJ3 Spring for Starter Pump Discharge Valve (5 and 7 HP).
FJ2 Spring for Starter Pump Discharge Valve (10 to 60 HP).
FW Spring for Detonator Plunger (10 to 60 HP).
UU Spring for Main Bearing Oil Cup Covers (Two) 5 to 40 HP.
UU Spring for Gear Box Oil Cup Cover (10 to 40 HP).
QOG Spring for Relief Cam Shifter Handle Stop Pin.
PLG Spring for Gas Valve.
QDG Spring for Gas Valve Operating Arm.

2ND EDITION 3M February, 1910

INSTRUCTIONS NO. 2048

Supplementing Instructions No. 2099

FOR CONNECTING AND OPERATING

FAIRBANKS-MORSE

TYPE "N"

HORIZONTAL GAS ENGINES WITH HIT AND MISS GOVERNOR

This book, together with Instructions No. 2099, should be carefully read before attempting to do anything with the engine

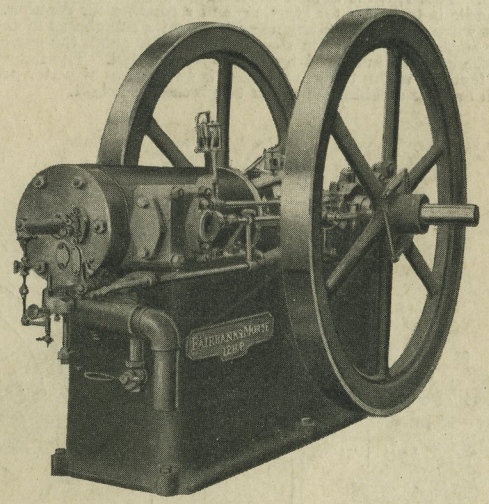


Fig. HE1425

FAIRBANKS, MORSE & CO.
(Incorporated)

Address Our Nearest Warehouse

Chicago, Ill.
Cincinnati, Ohio
Richmond, Va.
Jacksonville, Fla.
Atlanta, Ga.
New Orleans, La.
New York, N. Y.
Cleveland, Ohio
Louisville, Ky.
Detroit, Mich.
Milwaukee, Wis.
Indianapolis, Ind.
St. Louis, Mo.
St. Paul, Minn.
Minneapolis, Minn.
Omaha, Neb.
Salt Lake City, Utah
Spokane, Wash.
Kansas City, Mo.
Denver, Colo.
San Francisco, Cal.
Los Angeles, Cal.
Bakersfield, Cal.
Santa Maria, Cal.
Seattle, Wash.
Portland, Oregon
London, England

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INSTRUCTIONS No. 2048

For Connecting and Operating Fairbanks-Morse Type "N" Horizontal Gas Engine

Additional Instructions

Carefully read Instructions No. 2099 for the Gasoline Engine, accompanying this pamphlet. Matter referring to description, care of parts, starting engines, cleaning and taking apart, setting governor, electric gear and electric igniter, battery, lubricating oil, oiling and adjusting igniter is applicable to Gas Engines.

These Engines are Regularly Fitted with:

1. High compression piston.
2. Compression relief cam outfit, to be used when starting engines.
3. Patent self-starter on engines of 15 H. P. and larger.
4. Water reservoir on engines of 10 H. P. and larger.
5. Gas bag with one length of gas pipe.

Gas Connections

Arrangement

Gas connections should be made as shown below. Use large rubber gas bag (3) on supply pipe to engine. A gasometer may be substituted for this gas bag. Always use full size of pipe that throttle valve will take. Locate gas bag as close to engine as possible, as the function of this bag is to always keep sufficient gas at the engine for a few explosions, and keep the gas under the same conditions at all times.

Throttle Valve (9)

Valve Opening

The throttle valve is a dial cock, having a lever handle with indicator point. The dial plate on top is numbered. This valve is tagged when shipped, giving a number on dial at which the indicator point on the handle is to be set for starting, and a number for running. If the valve is not open to the proper point when running, the engine will not get a full charge of gas, and this will cause a cracking noise in the suction pipe. When the gas pressure is good, the engine will get its required supply with less than the opening indicated by figures on the dial. The figures are noted when the engine is tested at the factory, where the gas pressure is two inches of water pressure, which means that the gas pressure will balance a column of water two inches in height.

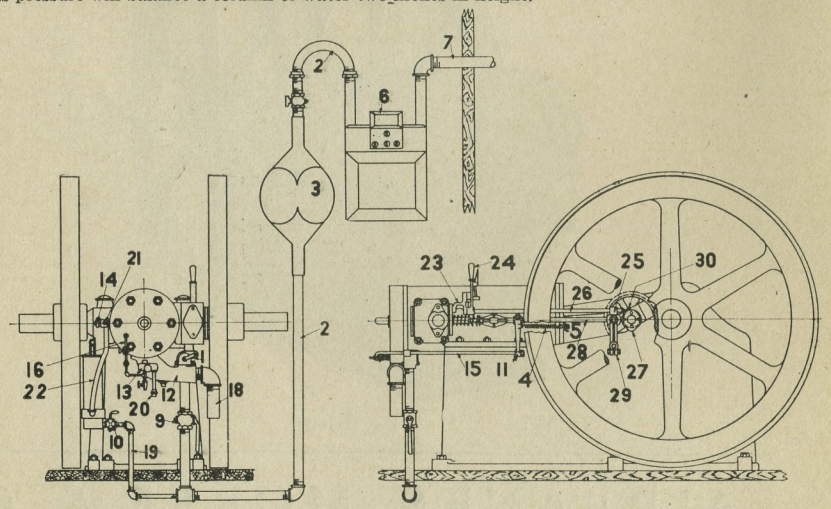

Chart No. 1004GN

Showing Connections for Engines Operating on Gas

1. Gas Valve.
2. Gas Supply Pipe.
3. Gas Bag.
4. Spring.
5. Spring Bracket.
6. Gas Meter.
7. From Gas Main.
10. Gas Cock to Feed Starter Pump.
11. Gas Valve Operating Arm.
12. Mixing Pipe.
13. Water Reservoir.
14. Starter Pump Cock.
15. Gas Valve Rod.
16. Water Reservoir Supply Pipe.
18. Air Pipe.
19. Supply Pipe to Starter Pump.
20. Water Reservoir Overflow Pipe.
21. Detonator.
22. Starter Pump Pipe.
23. Rear Relief Cam Bracket.
24. Relief Cam Shifter Handle.
25. Front Relief Cam Bracket.
26. Relief Cam Rod.
27. Relief Cam.
28. Exhaust Rod.

Gas Pressure Regulator

Reduce Pressure

Where the gas pressure is greater than three or four inches of water pressure, a gas pressure regulator must be used to reduce this pressure. This will often be the case with natural gas, but seldom with city gas, unless a high pressure system is in use.

To Start Engine—Important

Important

Read carefully all of Instructions No. 2099. Carefully see that the engine is well oiled at all points, including piston.

1st. Relief Cam—Shift exhaust roller by means of handle so that relief cam, which is outside of regular cam, comes into action.

2nd. Igniter—Set on late spark. See page 14, Instructions No. 2099.

3rd. Switch—Close switch in battery box.

4th. Throttle Valve—Turn throttle valve handle to number indicated on tag to start on.

5th. Gas Valve—Open gas valve by striking sharply two or three times with the hand in order to admit some gas to the mixing pipe for the first charge. **Admit Gas**

6th. Starter Pump—Engines 15 H. P. and larger are provided with patent self-starter. **Self-Starter** Open cock in self-starter pipe; also gas inlet to starter pump, then give several quick strokes of the pump. Hold fly wheel till it pulls hard, then strike the detonator previously charged with a parlor cracking match, which explodes the mixture previously pumped into the cylinder. This gives the engine momentum enough to draw in the charge in the regular manner, which will be fired by the regular igniting device. Close the valve leading to starter pump, then gradually turn on more gas at the throttle valve until open to the proper number for running.

7th. Starting by Hand—Patent self-starter is not used. After complying with sections 1 to 5, turn the fly wheel by hand. After the cylinder has been filled and exploded, the engine will take up explosions in the usual manner.

8th. After Engine is Running—Set igniter on early spark. **Engine Running** Shift exhaust roller from relief cam. Set throttle in running position. Turn on circulating water. Open water reservoir throttle. See Instructions No. 2099, page 4.

9th. Caution—The throttle valve should not be opened previous to starting unless the piston of engine is standing at a point where the operating rod is not in contact with the gas valve stem, otherwise gas will be admitted to engine. If engine stops for any considerable time, the throttle valve should be closed at once. **Caution**

To Stop

Turn off water reservoir. Turn off circulating water. Close throttle valve. Open battery switch. **Stop Engine**

REPAIR LIST FOR FAIRBANKS-MORSE "TYPE N" HORIZONTAL GAS ENGINES.

When ordering parts for repairs, give the description as given in this list by both letters and names of parts wanted; also the style, number and horse-power of the engine for which the parts are wanted. Too much care cannot be taken in giving these particulars.

The symbol at the head of each paragraph covers all items mentioned in that paragraph.

Before ordering a complete group of parts by the symbol in heavy type at head of paragraph, carefully check over such paragraph to make sure that all parts included therein are wanted, as they will all be furnished unless otherwise specified.

MM-C Lower Base (20 to 40 HP).

MM Lower Base fitted with XL and XM Studs.

LL-C Pillow Block Cap.

LL Pillow Block Cap, fitted with oil tube.
UC Pillow Block Cap Oil Cover.
Pillow Block Cap Oil Cover Rivet (5 to 40 HP).
UU Pillow Block Cap Oil Cover Spring (5 to 40 HP).
Pillow Block Cap Oil Cover Spring Screw (5 to 40 HP).

KK-C Engine Crank Base.

KK Crank Base, always fitted with following parts:
UD Main Bearing Brasses (Opposite Governor Side).
UE Main Bearing Brasses (Governor Side).
XD Crank Base to LL Cap Studs
Nuts for XD Studs.
Half Nuts for XD Studs.
XB Crank Base to X Cylinder Studs.
SW Exhaust Rocker Arm Pin in KK Base.
Exhaust Rocker Arm Pin Nut (32 to 60 HP).
TN Exhaust Rocker Arm Pin Collar.
Exhaust Rocker Arm Pin Collar Taper Pin (all sizes except 32 and 40 HP).
Exhaust Rocker Arm Pin Collar Dowel (32 and 40 HP).
Exhaust Rocker Arm Pin Collar Mach. Screw (32 and 40 HP).
LL-C Pillow Block Caps, with UC Covers, etc. (Two).
Oil Drain Pipe in Base (10 to 60 HP).

BBG-C Piston.

BBG Piston fitted with XK Piston Pin Set Screws and Nuts, Piston Ring Stop Pins, QM Oil Tube, and QN Eyebolt.
QE Piston Rings.
QH Piston Pin.

XCG-C Engine Cylinder.

X Engine Cylinder fitted with JK Cylinder Head Studs, XC Cyl. Ring Studs (5 to 25 HP) and Exh. Shell Studs (5 to 25 HP).
Nuts for XC Cyl. Ring Studs (5 to 25 HP).
XA Ring at open end of cylinder (5 to 25 HP).
BBG-C Piston complete with QE Rings, QH Pin, etc.

QL-C Connecting Rod.

QL Connecting Rod.
CB } Connecting Rod Crank Brass and
CC } Cap.
CD Connecting Rod Bolts with Nuts, Half Nuts and Cotters.
T } Connecting Rod Piston Pin Brasses,
TA } (Wedge Half and Back Half).
TM Piston Pin Brass Wedge.
UH Piston Pin Brass Wedge Bolt.
Piston Pin Brass Wedge Bolt Nut.
SB Connecting Rod Oiler.

QLC-C Connecting Rod with Crank Brasses (only).

QL Connecting Rod.
CB } Connecting Rod Crank Brass and
CC } Cap.
CD Connecting Rod Bolts with Nuts Half Nuts and Cotters.

QLT-C Connecting Rod with Piston Pin Brasses (only).

QL Connecting Rod.
T } Connecting Rod Piston Pin Brasses
TA } (Wedge Half and Back Half).
TM Connecting Rod Piston Pin Brass Wedge.
UH Connecting Rod Piston Pin Brass Wedge Bolt.
Connecting Rod Piston Pin Brass Wedge Bolt Nut.

QK-C Crankshaft.

QK Crankshaft, fitted with Y Pinion and YA Key.

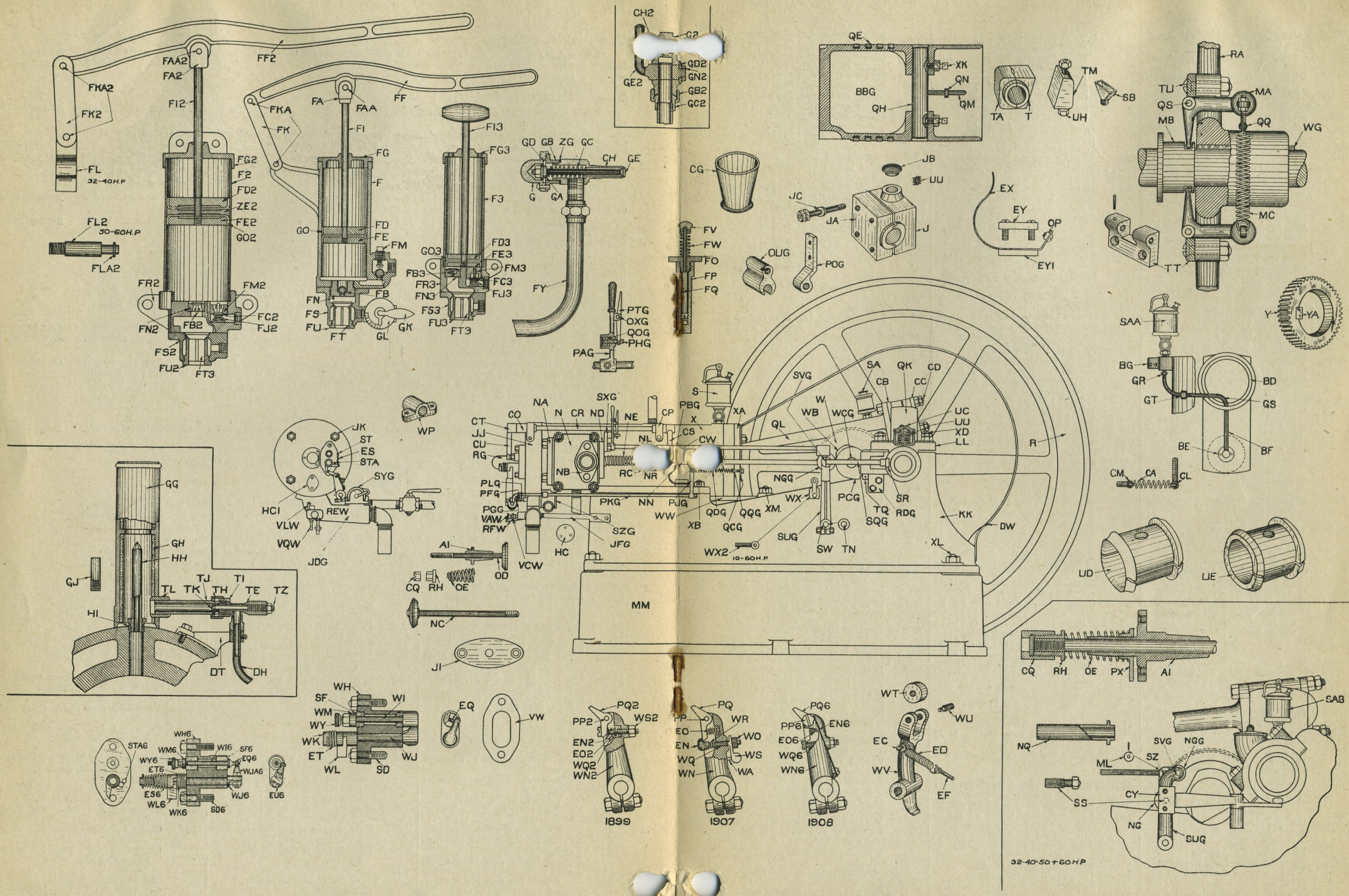

CHART No. 1149GN

Repair Chart for Fairbanks-Morse Horizontal Type "N" Gas Engines

QKB-C Crankshaft with Oil Ring (20 to 60 HP).

QK-C Crankshaft, fitted with Y Pinion and YA Key.
BF-C Oil Ring as attached to Crankshaft.

BF-C Oil Ring as attached to Crankshaft (20 to 60 HP).

BD Oil Ring on Crankshaft.
Oil Ring to QK Crankshaft Mach. Screws.
BF Oil Ring Brass Tube from BD to BE.
BE Oil Ring Flange for BF Tube.
Oil Ring Flange to QK Crankshaft Mach. Screws.

BD-C Ring Oiler Parts (20 to 60 HP).

BG Oiler Bracket, on engine base.
Oiler Bracket to engine cap screws.
GS, GR Brass Oil Tube with Bushing in BG Bracket.
GT Brass Oil Tube Eyebolt.
BF-C Oil Ring as attached to Crankshaft.

TT-C Governor Bracket.

TT Governor Bracket.
TU Gov. Bracket to RA Fly Wheel Bolts (5 to 15 HP).
TU Gov. Bracket to RA Fly Wheel Capscrews (20 to 60 HP).
Nuts for TU Bolts (5 to 15 HP).
MA Governor Weight.
QS Governor Weight Pin in TT Bracket.
Governor Weight Pin Taper Pin.

MA-C Governor Parts.

TT-C Governor Brackets with TU Bolts, MA Weights and QS Pins (Two of each).
MC Governor Springs (Two).
QQ Governor Spring Eyebolts (Two).
Nuts for Governor Spring Eyebolts (Four).
MB Governor Sleeve.

R Plain Fly Wheel (opposite Gov. side.)

RA Governor Fly Wheel.

WG Fly Wheel Keys.

RA-C Governor Fly Wheel with Gov. Parts.

RA Governor Fly Wheel.
TT-C Governor Brackets with TU Bolts, MA Weights and QS Pins (Two of each).
MC Governor Springs (Two).
QQ Governor Spring Eyebolts (Two).
Nuts for QQ Eyebolts (Four).

QKR-C Crankshaft fitted with Fly Wheels and Gov. Parts.

QK-C Crankshaft fitted with Y Pinion and YA Key (5 to 15 HP).
QKB-C Crankshaft with Oil Ring attached (20 to 60 HP).
RA-C Governor Fly Wheel with Governor Parts.
MB Governor Sleeve on Crankshaft.
R Plain Fly Wheel (Opposite Gov. Side).
WG Fly Wheel Keys.

WH-C Igniter as attached to Head.

WH Igniter Body.
WI Fixed Electrode fitted with EQ Point.
Fixed Electrode Nut.
SF Fixed Electrode Lava Insulation.
Fixed Electrode Asbestos Gaskets.
WM Fixed Electrode Collar.
WY Fixed Electrode Thumb Nut.
WJ Movable Electrode, fitted with WK Collar, Taper Pin and EQ Point.
WL Movable Electrode Catch.
STA Movable Electrode Catch Stop Pin.
ES Movable Electrode Catch Spring.
ST Movable Electrode Catch Spring Pin.
ET Movable Electrode Spring.

WH6-C "1910 Pattern" Igniter Complete as Attached to Head.

WH6 Igniter Body, fitted with STA6 Stop Pin.
WI6 Fixed Electrode, fitted with EQ Contact Disc.
Fixed Electrode Nut.
SF6 Fixed Electrode Lava Insulations(2).
Fixed Electrode Asbestos Gaskets(4).
WM6 Fixed Electrode Collar.
WY6 Fixed Electrode Thumb Nut.
WJ6 Movable Electrode, fitted with WK6 Collar and Collar Taper Pin.
WJA6 Movable Electrode Arm, fitted with EQ Contact Disc and EU6 Nut.
WL6 Movable Electrode Pawl.
ES6 Movable Electrode Pawl Spring.
Movable Electrode Pawl Spring Taper Pin.
ET6 Movable Electrode Return Spring.

OD-C Suction Valve.

OD Suction Valve.
RH Suction Valve Collar Nut.
CQ Suction Valve Lock Nut.
Suction Valve Lock Nut Cotter.

JJ-C Cylinder Head.

JJ Cylinder Head, fitted with SD Igniter Studs and with JI Igniter Cover Plate and Mach. Screws on 10 to 60 HP.; also includes Studs for N Exhaust Shell on 32 to 60 HP.
Nuts for SD Igniter Studs.
WH-C Igniter as attached to Head.
VW Igniter to Cyl. Head Asbestos Gasket.
OD-C Suction Valve, with RH and CQ Nuts and Cotter.
OE Suction Valve Spring.
RG Suction Valve Cap.
Suction Valve Cap to JJ Head Mach. Screws.
AI Suction Valve Stem Bushing.
Suction Valve Stem Bushing to JJ Head Screws.
PX Suction Valve Spring Adjusting Nut (32 to 60 HP).

JJO-C Cylinder Head with Suction Valve (only).

JJ Cylinder Head, fitted with SD Igniter Studs, and with JI Igniter Cover Plate and Mach. Screws on 10 to 60 HP; also includes Studs for N Exhaust Shell on 32 to 60 HP.
OD-C Suction Valve with RH and CQ Nuts and Cotter.
OE Suction Valve Spring.
RG Suction Valve Cap.
Suction Valve Cap to JJ Head Mach. Screws.
AI Suction Valve Stem Bushing.
Suction Valve Stem Bushing to JJ Head Screws.
PX Suction Valve Spring Adjusting Nut (32 to 60 HP).

JJW-C Cylinder Head with Igniter (only).

JJ Cylinder Head, fitted with SD Igniter Studs and with JI Igniter Cover Plate and Mach. Screws on 10 to 60 HP; also includes Studs for N Exhaust Shell on 32 to 60 HP.
Nuts for SD Igniter Studs.
WH-C Igniter as attached to Head.
VW Igniter to Head Asbestos Gasket.

WN6-C Igniter Rocker Arm at Head ("1908" Pattern).

WN6 Igniter Rocker Arm.
Igniter Rocker Arm Cap Screw.
Igniter Rocker Arm Cap Screw Nut.
PQ6 Igniter Rocker Arm Pawl.
PP6 Igniter Rocker Arm Pawl Pin.
Igniter Rocker Arm Pawl Pin Nut.
WQ6 Igniter Rocker Arm Pawl Bolt.
Igniter Rocker Arm Pawl Bolt Nut.
EN6 Igniter Rocker Arm Pawl Pin Stop.
Igniter Rocker Arm Pawl Pin Stop Mach. Screws.
EO6 Igniter Rocker Arm Pawl Spring.

WN-C Igniter Rocker Arm at Head ("1907" Pattern).

WN Igniter Rocker Arm.
Igniter Rocker Arm Cap Screw.
Igniter Rocker Arm Cap Screw Nut.
PQ Igniter Rocker Arm Pawl.
PP Igniter Rocker Arm Pawl Pin.
Igniter Rocker Arm Pawl Pin Nut.
WQ Igniter Rocker Arm Pawl Bolt.
WO Igniter Rocker Arm Pawl Bolt Nut.
WS Igniter Rocker Arm Pawl Bolt Lever.
WA Igniter Rocker Arm Pawl Bolt Lever Stop Pin.
EN Igniter Rocker Arm Pawl Bolt Head.
WR Igniter Rocker Arm Pawl Bolt Spring.
EO Igniter Rocker Arm Pawl Spring.

WN2-C Igniter Rocker Arm at Head ("1899" Pattern).

WN2 Igniter Rocker Arm.
Igniter Rocker Arm Cap Screw.
Igniter Rocker Arm Cap Screw Nut.
PQ2 Igniter Rocker Arm Pawl.
PP2 Igniter Rocker Arm Pawl Pin.
Igniter Rocker Arm Pawl Pin Nut.
WQ2 Igniter Rocker Arm Pawl Bolt.
WS2 Igniter Rocker Arm Pawl Bolt Nut.
EO2 Igniter Rocker Arm Pawl Bolt Spring.
EN2 Igniter Rocker Arm Pawl Bolt Spring Washer.

WV-C Igniter Rocker Arm at Gear.

WV Igniter Rocker Arm, fitted with EC Spring Stud.
WT Igniter Rocker Arm Roller working against gear.
WU Igniter Rocker Arm Roller Pin.
Igniter Rocker Arm Roller Pin Nut.

WVW-C Igniter Arm at Gear on WW Shaft.

WV-C Igniter Arm at Gear (Complete).
WW Igniter Rocker Shaft.
Igniter Arm to Shaft Key.

WW-C Igniter Rocker Shaft Mechanism.

WV-C Igniter Rocker Arm with EC Stud, WT Roller and WU Pin and Nut.
WW Igniter Rocker Shaft.
Igniter Rocker Arm to Shaft Key.
ED Igniter Rocker Arm Spring.
WP Igniter Rocker Shaft Bracket.
Igniter Rocker Shaft Bracket to JJ Head Cap Screws.

WX-C Igniter Rocker Arm Spring Bracket.

WX Bracket on Engine Base for ED Spring 5 and 8 HP).
WX2 Eyebolt on Engine Base for ED Spring (10 to 60 HP).
Cap Screw for WX Bracket (5 and 8 HP).
Nut for WX2 Eyebolt (10 to 60 HP).
EF Eyebolt in WX or WX2 for ED Spring.
Nuts for EF Eyebolt.

WCG-C Gear, Shaft and Cam.

W Gear.
WCG Cam and Gear Shaft, fitted with WB Cam, PCG Relief Cam and Mach. Screws.

PTG-C Relief Cam Shifter Handle.

PAG Relief Cam Shifter Handle.
Relief Cam Shifter Handle Set Screw.
PTG Relief Cam Shifter Handle Clip.
OXG Relief Cam Shifter Handle Clip Pin and Cotters.
PHG Relief Cam Shifter Handle Stop Pin.
QOG Relief Cam Shifter Handle Stop Pin Spring.

PAG-C Relief Cam Shifter Mechanism.

PBG Relief Cam Shifter Shaft.
SXG Relief Cam Shifter Shaft Bracket (Cylinder end).
SXG Bracket to Engine Cap Screws.
POG Relief Cam Shifter Shaft Bracket (Crank end).
POG Bracket to Engine Cap Screws.
OUG Relief Cam Shifter Block.
Relief Cam Shifter Block Taper Pin.
PTG-C Relief Cam Shifter Handle (Complete).

EX-C Circuit Breaker.

EX Contact Arm, fitted with EY 1 Bottom Insulation Block and Brass Contact Screw.
EY Insulation Block (Top Half).
OP Thumb Nut on Brass Contact Screw.
Mach. Screws for attaching to Engine.

CU-C Valve Lock Mechanism.

CR Valve Lock Shaft, fitted with CT Collar Hub, Taper Pin and CU Spring Blade.
CS Valve Lock Operating Arm, fitted with pin for CV Roller and Taper Pin.
CV Valve Lock Roller.
CW Valve Lock Block on NN Exhaust Rod, fitted with Taper Pin and Brass Contact Screw.
CO Valve Lock Shaft Bracket on Cylinder Head.
CP Valve Lock Shaft Bracket on Cylinder.
Cap Screws for either CO or CP Brackets.

NC-C Exhaust Valve.

NC Exhaust Valve.
NL Collar on Exhaust Valve for NE Spring.
NR Exhaust Valve Nut.
Exhaust Valve Cotter (5 to 40 HP).
Exhaust Valve Taper Pin (50 and 60 HP).

NA-C Exhaust Shell (5 to 25 HP Type).

N Exhaust Shell, fitted with Studs for NB Flange.
Nuts for NB Flange Studs.
NA Exhaust Shell Cap.
Exhaust Shell Cap Asbestos Gasket.
Exhaust Shell Cap to N Shell Cap Screws.
NB Exhaust Shell Pipe Flange.
Exhaust Shell Pipe Flange Asbestos Gasket.
ND Exhaust Shell Valve Guide.
Exhaust Shell Valve Guide to N Shell Cap Screws.
NC-C Exhaust Valve, fitted with NL Collar, NR Nut and Cotter.
NE Exhaust Valve Spring.

NA-C Exhaust Shell (32 to 60 HP Type).

N Exhaust Shell, fitted with NQ Valve Guide Bushing, Studs for NB Flange and Pipe Plugs.
Nuts for NB Flange Studs (32, 40 and 60 HP).
Machine Bolts for attaching NB Flange to N Shell (50 HP only).
NA Exhaust Shell Cap.
Exhaust Shell Cap Asbestos Gasket.
Exhaust Shell Cap to N Shell Cap Screws.
NB Exhaust Shell Pipe Flange.
Exhaust Shell Pipe Flange Asbestos Gasket.
NC-C Exhaust Valve, fitted with NL Collar, NR Nut, and Cotter or Taper Pin.
NE Exhaust Valve Spring.

NAD-C Exhaust Shell fitted with Valve Guide (5 to 25 HP).

N Exhaust Shell, fitted with Studs for NB Flange.
ND Exhaust Shell Valve Guide.
Exhaust Shell Valve Guide to N Shell Cap Screws.

SUG-C Exhaust Rocker Arm (5 to 40 HP Type).

SUG Exhaust Rocker Arm.
Exhaust Rocker Arm Cap Screws in Ear.
Nuts for Exhaust Rocker Arm Cap Screws.
SVG Exhaust Rocker Arm Catch Pin.
Taper Pin for SVG Pin.
NGG Exhaust Rocker Arm Roller on SVG Pin.

SUG-C Exhaust Rocker Arm (50 and 60 HP Type).

SUG Exhaust Rocker Arm, fitted with Studs for CY Catch Plate.
Nuts for CY Catch Plate Studs.
CY Detent Catch Plate on SUG Arm.
SZ Pin through SUG Arm and NN Rod.
ML Collar on SZ Pin.
Taper Pin through ML Collar.
SS Pin in SUG Arm for NG Roller.
Nut for SS Pin.
NG Exhaust Rocker Arm Roller on SS Pin.
NGG Roller on SVG Pin.
SVG Roller Pin for NGG Roller.
Roller Pin Taper Pin.

NN-C Exhaust Rod.

NN Exhaust Rod.
RC Exhaust Rod Guide.
Exhaust Rod Guide to X Cylinder Cap Screws.

SW-C Exhaust Rocker Arm Pin in KK Base.

SW Exhaust Rocker Arm Pin.
Exhaust Rocker Arm Pin Nut (32 to 60 HP).
TN Exhaust Rocker Arm Pin Collar.
Exhaust Rocker Arm Pin Collar Taper Pin. (All sizes except 32 and 40 HP).
Exhaust Rocker Arm Pin Collar Dowel (32 and 40 HP).
Exhaust Rocker Arm Pin Collar Mach. Screw (32 and 40 HP).

JA-C Gear Box.

J, JA Gear Box and Cap, fitted with Oil Tube.
JC Gear Box to KK Base Collar Studs.
Nuts for JC Collar Studs.
Half Nuts for JC Collar Studs.
JB Gear Box Oil Cup Cover.
Gear Box Oil Cup Cover Rivet (10 to 40 HP).
UU Gear Box Oil Cup Cover Spring (10 to 40 HP).
Gear Box Oil Cup Cover Spring Screw (10 to 40 HP).

REW-C Water Reservoir (10 to 60 HP).

REW Water Reservoir Body, fitted with Brass Tube Nozzle.
Water Reservoir Body to JL Suction Elbow Cap Screws.
VCW Water Reservoir Packing Nut.
VAW Water Reservoir Throttle Valve Stem with VDW Dial Handle.
RFW Water Reservoir Throttle Valve Pointer.
Water Reservoir Throttle Valve Pointer Mach. Screw.
VLW Water Reservoir Vent Pipe.
ZJW Water Reservoir Drain Plug.
Water Reservoir Brass Bushing $\frac{1}{4}$" x $\frac{1}{8}$".
Water Reservoir Brass Bushing $\frac{3}{8}$" x $\frac{1}{4}$".
VQW Water Reservoir Pipe and Fittings.

SQG-C Governor Detent.

SQG Governor Detent Catch, fitted with QF Roller Pin and CL Eye Screw.
SR Governor Detent Roller on QF Pin.
RDG Bracket with CM Eyescrew (5 to 40 HP).
CM Eyescrew in KK Base for CA Detent Spring on 50 and 60 HP. (Detent Bracket cast on base.)
Flat Head Capscrew for attaching RDG to KK (5 to 40 HP).
Hex. Head Capscrews for attaching RDG to KK (5 to 40 HP).
TQ Pin in RDG Bracket for SQG Detent Catch.
Cotter for TQ Pin (5 to 40 HP).
Nut for TQ Pin (50 and 60 HP).
CA Gov. Detent Catch Spring.

FH3G-C Brass Barrel Gas Starter Pump (5 and 7 HP Type).

F3 Starter Pump Cylinder.
FR3 Starter Pump Base.
FG3 Starter Pump Cap.
Cap to Cyl. RHM Screws.
FE3 Starter Pump Piston (Lower Half).
FD3 Starter Pump Piston (Upper Half).
GO3 Starter Pump Piston Leathers.
FI3 Starter Pump Piston Rod and Handle.
FB3 Starter Pump Admission Valve.
FN3 Starter Pump Admission Valve Seat.
FC3 Starter Pump Discharge Valve.
FM3 Starter Pump Discharge Valve Seat.
FJ3 Starter Pump Discharge Valve Spring.
FS3 Starter Pump Mixer Valve Seat with FU3 Bushing and FT3 Valve.
Mach. Screws to attach FS3 to FR3.
Starter Pump to Engine Capscrews.

FGG-C Cast Iron Gas Starter Pump with Lever Handle (10 to 25 HP Type).

F Starter Pump Barrel.
FG Starter Pump Cap.
Cap to F Barrel Mach. Screws.
FE Starter Pump Piston (Lower Half).
FD Starter Pump Piston (Upper Half).
GO Starter Pump Piston Leathers.
FI Starter Pump Piston Rod.
FA Starter Pump Piston Rod End.
FAA Starter Pump Piston Rod End Pin and Cotters.
FF Starter Pump Lever Handle.
FK Starter Pump Link.
FKA Starter Pump Link Pin and Cotters.
FB Starter Pump Suction and Discharge Ball Valves.
FN Starter Pump Suction Valve Seat.
FM Starter Pump Plug Fitted with Mach. Screw to hold Discharge Valve in Place.
FS Starter Pump Mixer Valve Seat with FU Bushing and FT Valve.
Mach. Screws to attach FS to F.
Starter Pump to Engine Capscrews.

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Fourteenth Edition

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INSTRUCTIONS No. 2072M

FOR SETTING UP AND OPERATING

FAIRBANKS-MORSE

TYPE "T"

Small Vertical Gasoline Engines

with Hit-and-Miss Governor

This book should be carefully read before attempting to do anything with the engine

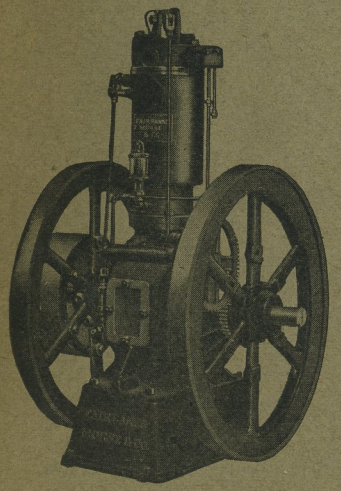

Fig. VE1637

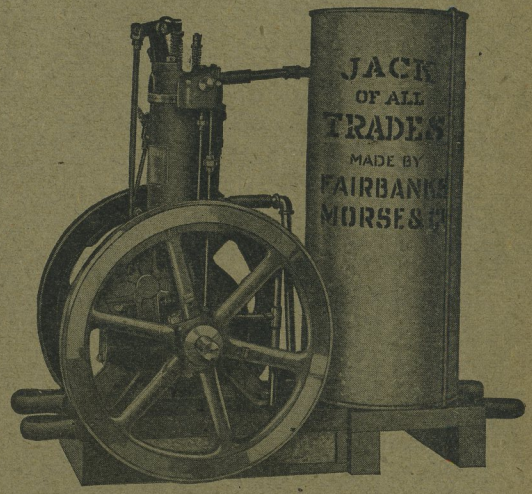

Fig. VE1607

Jack of All Trades and 2, 4, 6, 9 and
12 H. P. Vertical Engines

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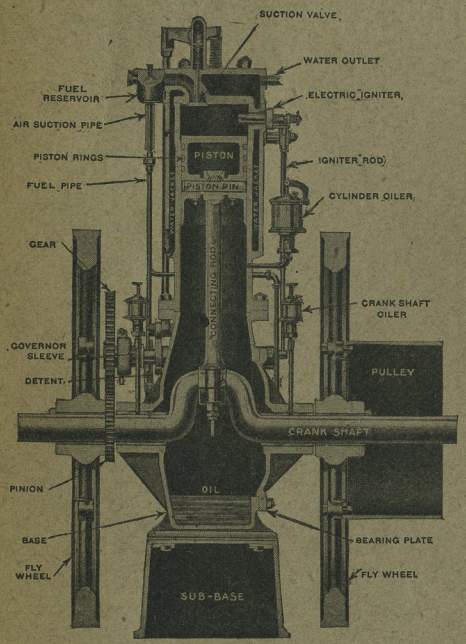


Chart "H."

Vertical Section Showing Inlet Valve and Principal Working Parts.

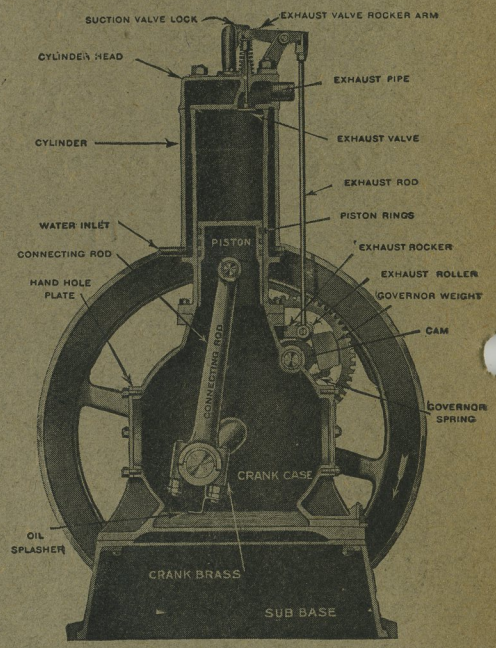


Chart "J."

Vertical Section Showing Exhaust Valve and Principal Working Parts.

INSTRUCTIONS No. 2072M

For Setting Up and Operating Fairbanks-Morse Type "T" Small Vertical and Jack of All Trades Gasoline Engines with Hit-and-Miss Governor

General Description.

Descript

The Fairbanks-Morse Type "T" Vertical and Jack of All Trades engines with hit-and-miss governors, have cylinders placed on top of the oil-tight base. The bearings run in an oil bath, and lubrication of the piston is effected by the centrifugal force of the crank which distributes the oil on the inside of the cylinder and perfectly lubricates the same. The whole is dust proof. The engines are equipped with "make and break" electric ignition and can be operated with gasoline, petrol, naphtha, distillate, or gas with very little change in equipment.

The Jack of All Trades is complete in itself, engine, cooling tank, fuel tank and necessary fittings mounted on wood base, all connected and ready to run.

Locating Engine.

Leave Space

In locating the engine, at least two feet of space should be left on all sides of the engine for convenience in starting and for having sufficient room to get to the valves and connections.

Having a thin bed of cement and fine sand to finish top of foundation, set the engine on its foundation, as per foundation plan, draw down bolts, keeping engine level.

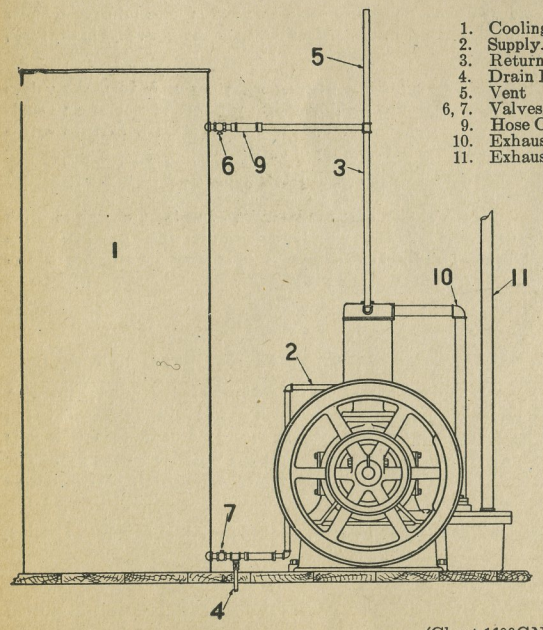
Directio Motion

The Fairbanks-Morse Vertical Engine runs in the direction of arrow shown on fly-wheel, page 3. The direction of motion is also shown by the direction of an arrow, cast on one side of the engine base.

Clean Out Pipe.

Read All Tags

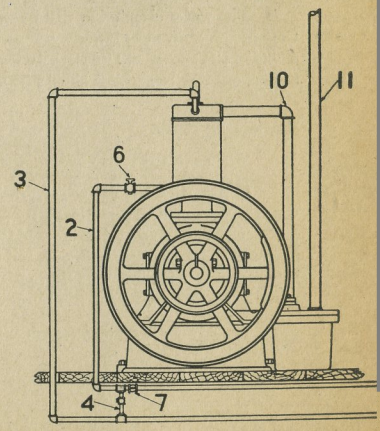
See that all pipes which are to be used have been carefully washed out with gasoline, to remove all scale and foreign matter. All openings and attachments are tagged with directions how to connect and operate. Be careful to follow directions on each tag.



1. Cooling Tank.
2. Supply.
3. Return.
4. Drain Pipe.
5. Vent
6, 7. Valves.
9. Hose Coupling.
10. Exhaust Pipe—Engine to Exhaust Pot.
11. Exhaust Pipe—Exhaust Pot to Open Air.

(Chart 1199GN)

Showing Water Connections Using Cooling Tank



Showing Water Connections Using Running Water

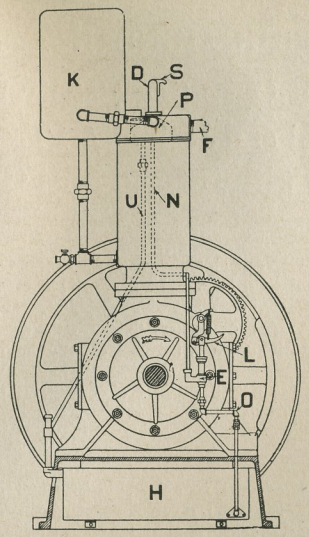


Chart No. 1189GN Showing Connections for Evaporator Tank and Fuel Tank in Base.

Water Tanks.

Full Size Pipe The opening for water inlet pipe is near lower end of cylinder, and if cooling tank is used, the pipe (2) connecting this opening with bottom of tank should be full size of this opening, and connected as shown. Flexible couplings (9) are furnished and should be used in pipes (2) and (3). The water outlet pipe (3) is in the cylinder head. If tank is used connect this with upper opening in tank. When tank used is of our standard dimensions the temperature will regulate itself under ordinary conditions. Tank should not be covered, as water should have exposure to atmosphere. It should be so arranged that the water can be drained from cylinder and connecting **Freezing** pipes, to prevent freezing and bursting in cold weather. Be sure to leave open end of pipe (5) over cylinder high enough to be above top of tank. In operation, the water must always be above the upper pipe in the tank, otherwise the water cannot circulate.

Inside Valves To obviate the necessity of draining tank entirely in freezing weather when engine is idle, the valves (6) and (7) may be placed inside the tank. This arrangement requires special fittings and nipples with sufficiently long thread to extend through bushing in tanks and allow two or three inches of water between valves and side of tank. These valves are then operated by key rod from top of tank.

To Drain Cylinder To drain cylinder and pipe connections, close valves (6) and (7) and open valve (4).

Elevated Tanks The water circulation will be much better if the cooling tank can be elevated at least enough to bring the bottom above the lower water opening on the engine cylinder. We advise doing this where possible, as the power of the engine will be slightly increased by this improved circulation. If the tank is not set close to the engine, one size larger pipe should be used between the tank and the engine.

Evaporator Tank.

When equipped with evaporator tank, engine is regularly sent out piped as per Chart 1189GN.

Boiling Water In operating the engine, the tank should not be filled more than three-fourths full of water; otherwise water will slop out more or less after it becomes boiling hot. The water level should never be allowed to fall as low as the top of the cylinder, as the cylinder will then get too hot. It should be understood that it is expected that the water will boil, but that the engine will work properly when the water is boiling hot. The rate of evaporation is from 3/10 to 6/10 gallons per horse-power hour, depending on the load. Arrangements must be made to replenish the water occasionally as it is boiled away.

Drain Tank In cold weather, the water should be drained from evaporator tank, when engine is idle, to prevent freezing.

Running Water.

Regulate Water If running water is used, place a valve (6) in the inlet pipe (2) close to the engine to regulate quantity of water admitted to the cylinder. Water flowing from cylinder should be from 160 degrees to 180 degrees Fahrenheit, for the maximum power capacity of the engine. To drain cylinder and pipe connections, close valve (7) and open valves (6) and (4).

Exhaust Pipe.

Exhaust Pipe The exhaust pipe from engine to exhaust pot is always shipped fitted for connecting up with the pot.

Long nipple (10) is to be placed in a vertical position and connected to the engine by means of an elbow and a horizontal nipple. On the two and four H. P. sizes this vertical nipple is screwed into a flange on the exhaust pot. On other sizes the vertical nipple is threaded on one end only, the end not threaded extending down through an expansion joint into the exhaust pot. This expansion joint is simply a stuffing box, the packing for which is asbestos wicking. This wicking is sent in the box of parts shipped with each engine.

The pipe (11) from the exhaust pot to open air should be the same size as openings in pot when straight, and larger for long and crooked runs; never use smaller pipe. It is dangerous to exhaust into any house flue.

Silencer Engines on wood bases are not equipped with exhaust pots, but are provided with silencers, shipped, piped up complete with engine. When installed in a house, additional pipe should be used in order to carry silencer outside of the building. Use a "T" on bottom of all upright exhaust pipes, with a drain fitted in the bottom of "T," as water collects in long pipes.

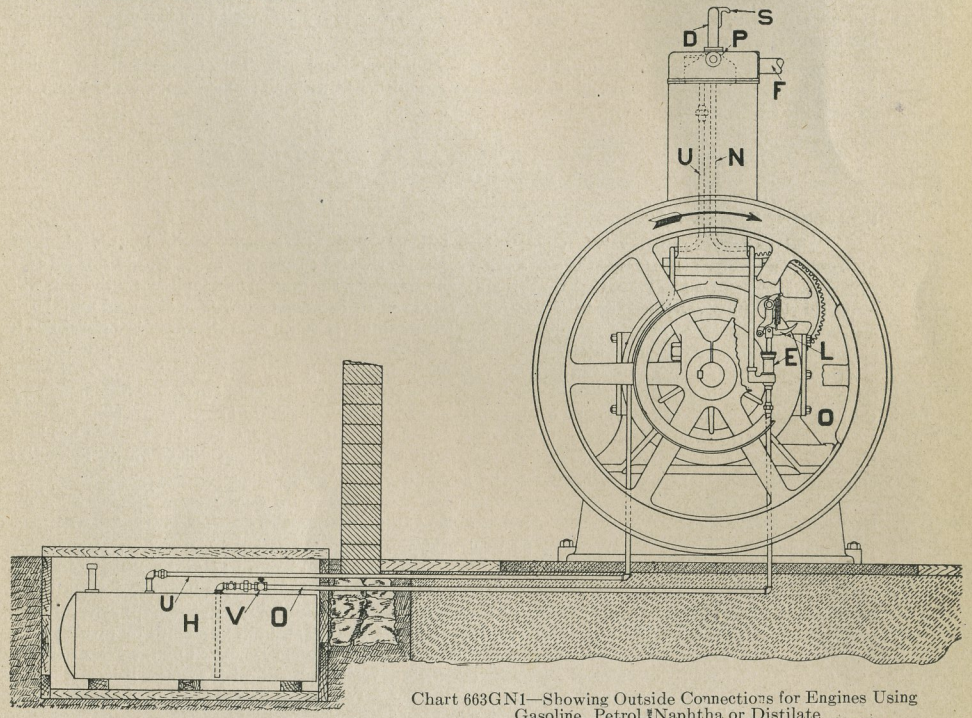


Chart 663GN1—Showing Outside Connections for Engines Using Gasoline, Petrol, Naphtha or Distilate

***Fuel Tank (H).**

Fuel Tank The fuel tank may be located outside of building, (Chart 663GN1) and should be placed in a horizontal position and sufficiently lower than the engine so that the oil will flow toward the tank from the engine. Anywhere from six to twenty-four inches drop will do. With this tank are furnished the proper connections for outlet and return pipe, which are carefully marked before shipping. Use the size pipe furnished. In connecting the fuel tank with engine, care must be taken to wash out every piece of pipe or joint with gasoline—this to remove all scale and loose matter, which, if left in pipes, would interfere with proper working of valves. Extra care must be taken in making all water and fuel pipe connections so they do not leak. Use soap or shellac in joints of fuel pipes and white lead in joints of water pipes.

Float Where gasoline engines are installed in basements, or in case where the engine room floor is below general level from which the gasoline tank will be filled, care should be taken to have the top of the gasoline tank slightly below the level of the engine room floor. In case the top of the filling pipe, connected to engine tank **has to be above** the level of the gasoline reservoir in the engine, the gasoline tank should be fitted with a reliable float device which will close the filling pipe before the tank is completely full. This float device will give warning so that the fuel will not overflow into the engine room in case there are any loose joints. Fuel tanks fitted with this float device will be furnished on special orders only.

*The word "fuel" in this instruction book applies to gasoline, petrol or naphtha.

Tank in Base

When engine is equipped with evaporator tank, the fuel tank is regularly placed in the base of the engine (Chart 1189 GN) and is shipped piped up complete.

Vent

Care should be taken to see that the cap on the fuel tank filler pipe is not screwed down to cover vent hole in the side of the filler pipe so the air cannot enter tank and maintain atmospheric pressure on the fuel.

Fuel Piping

The fuel pump (E) of the vertical engine is on the side of the engine base opposite the governor. To the bottom of pump is connected the suction pipe (O) from fuel supply tank (H) and the opening where this pipe should be connected is carefully tagged. From the pump the fuel is delivered to the small reservoir (P) on the cylinder head through the pipe (N) and the larger pipe (U) leading from the bottom of this reservoir is the overflow or return pipe for fuel. On the 9 and 12 H. P. sizes this pipe projects upward

Extra Care

and above the bottom of the reservoir inside and MUST NEVER BE DISTURBED, as it holds the fuel at the proper height in the reservoir, the fuel level on the other sizes is maintained by the peculiar construction of the reservoir.

Avoid Traps in Pipe

The engine is shipped with union attached to lower end of this pipe, and to this union connect return pipe (U) and carry down to floor or through floor, as required, and back to fuel tank with a gradual descent to assist free flow of surplus fuel back to tank.

Having all piping connected, it will be well to make yourself familiar with the following details, which describe all essential parts of the engine in their proper condition, and when all parts are connected as here described, the engine is sure to run.

DESCRIPTION AND INSTRUCTION AS TO THE ACTION AND CARE OF PARTS OF THE ENGINE

Fuel Inlet or Suction Valve.

Cotter Pin

This is an ordinary check valve, automatic in its action, located in the cylinder head. The lift is limited by means of a spring on the stem of the valve and a cotter pin through the nut on stem. Should this pin ever need renewing, care must be taken that the new pin is no longer than the original one, for if longer the ends will strike the side wall of shield (D) and the working of valve will be interfered with. The collar nut must be so set (except on 2 H. P.) as to hold valve closed when the catch (S) is down, as is the case when the engine is governing. Should the engine at any time on starting turn too easily or have lost the usual compression, it is evident that a leak is taking place, and this valve should be examined; it may not seat perfectly. This valve can be examined by taking out the screws and removing the shield (D). This will expose valve stem, and by

Lost Compression

working the valve, you can tell whether it works free, and by revolving backward and forward, clean the seat. On again putting the parts together, care must be taken that they are not twisted and that they do not bind the valve stem. Look at this very carefully. Also see that catch works free and locks valve, preventing all movement when exhaust valve is held open by governor.

Exhaust Valve.

To Reseat Exhaust Valve

This valve is constructed same as the inlet valve, also stands in a vertical position, with the stem extending through the casing, and a spring over the stem to hold it to its seat. The nut holds the spring under compression. Should there be a lack of compression, after making sure the leak is not in inlet valve, examination of the exhaust valve must be made to see that it does not leak. To clean this valve remove cylinder head from cylinder. Then the valve can be removed from the head, and the seat can be cleaned by revolving the valve while being pressed to its seat in the head. To reseat, grind with emery and oil by revolving valve on

To Replace Head

seat until it will hold compression. Carefully clean both valve and seat with gasoline before replacing cylinder head. Use gasket of asbestos soaked in boiled linseed oil to insure tight joint, and be sure that the nuts on the studs holding cylinder head to cylinder are turned tight.

Fuel Pump (E). (Page 3.)

Fuel Pump

The small fuel pump (E) which supplies the reservoir (P) through pipe (N) is operated from the large gear shaft taking supply from tank through pipe (O). The proper amount of fuel is maintained in the reservoir by an overflow pipe (U), which returns to fuel tank (H). Keep lubricating oil in cup on cap of pump to lubricate packing. Never screw cap down hard or the packing will cut the pump plunger.

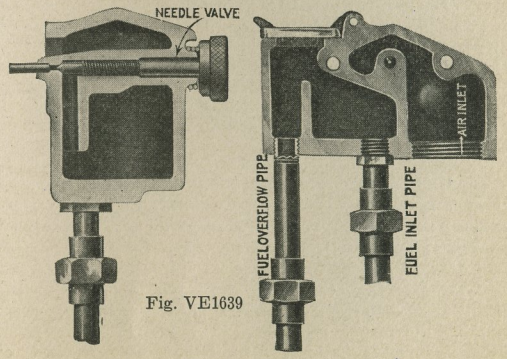


Fig. VE1639

Air Suction.

Explosive Mixture

The suction action of piston draws air through air inlet passage. By the swift velocity of this in-going air, sufficient oil is picked up and drawn through a small nozzle, which extends into the passage, to form an explosive mixture.

The Governor.

Valve L

The governor on the gear shaft controls movement of exhaust valve and also locks the inlet valve in its seated position by the vertical rod and catch (S). When the governor is not in action, the arm (S) is lifted clear of the collar nut on stem of inlet valve within the shield (D). The valve lock (S) is not fitted to the 2 H. P. size.

Throttle Valve.

Throttle

Throttle or needle valve (146) (see page 8) on 9 and 12 H. P. has a stuffing box (141) like the fuel pump, but in this case the gland should be kept drawn up tightly, so the valve will not turn from a set point while the engine is running. The function of this valve is to shut off the supply of fuel to the engine when engine is stopped and for regulating by set point, the proper quantity to be fed to engine to obtain the best results while running.

The marks on dial were found best on our test floor but it may be necessary to set differently after a time.

INSTRUCTIONS FOR STARTING THE ENGINE

Importa

IMPORTANT. BEFORE starting engine, examine carefully and be sure that the nuts on studs holding cylinder head to cylinder are turned tight.

Avoid Le

REPEAT this the first few times the engine is allowed to become cold, and whenever it has stood idle a considerable time. Attention to these points will prevent annoyances from leaks which otherwise might result from unequal expansion and contraction of metal and the drying and shrinking of gaskets.

How to Start the Engine.

Properly

Suppose the engine to be set, connected and ready to start. First see that all outside grease is removed and engine clean, fuel in the tank, and all parts properly oiled (see page 5).

Fill Reser

Pump fuel into reservoir attached to cylinder head. The pump is worked by the handle (L) on the pump plunger link. Operating this rapidly will soon fill the reservoir. Open throttle valve on reservoir to point marked "1," set igniter at late spark (see page 15) on 6, 9, and 12 H. P., close air damper about two-thirds off and CLOSE SWITCH ON BATTERY.

Starter C

Engines 2 to 6 H. P., inclusive, are provided with starter crank. Turn engine fly-wheels backward till you come against strong compression. This allows two revolutions of the fly-wheel before coming against the compression again. Engage the ratchet in crank-shaft key-way and turn rapidly (SO THAT THE FLY-WHEEL TURNS IN THE DIRECTION INDICATED BY THE ARROW CAST ON BASE) until the first ignition occurs; then remove the crank.

Relief Ca

Engines 9 and 12 H. P. are provided with relief cam to relieve compression. When starting (1) drop handle of relief cam, which is located on the rocker arm which carries the exhaust rod and roller, to a horizontal position. (2) Grasp arm of fly-wheel and turn engine over as with starter crank. (3) After regular explosions occur, return relief cam handle to the vertical position.

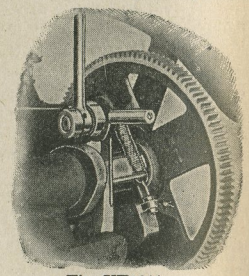


Fig. VE1644

Proper M

In all cases, as soon as engine starts, set igniter at early spark (see page 15), open air damper and turn throttle valve back to point marked "2," which is the running point of the engine as tested at the factory. The conditions under which the engine operates in the field may somewhat differ from those prevailing on the test floor. The operator will, therefore, use some discretion as to the exact point at which the throttle valve will give the best results. If point "2" does not seem to afford just the right supply of fuel, turn the throttle a trifle, using a very little less or a very little more, and with a little experience the operator will soon determine what is the best setting for the valve. If too much fuel is used, a slow-burning mixture is formed, which does not develop the power that the proper mixture should, and if too little fuel is used, the mixture is too weak to develop the power required. The machine to be driven should be detached from the engine until the engine is in motion either by shifting of belt to loose pulley, by slacking of belt by means of tightener, or by friction clutch pulley.

Priming C

It may be necessary, at times, to throttle the air when taking in the first charge of fuel, by partially restricting the air suction opening with the hand, or with the damper in the air suction pipe.

The 9 and 12 H. P. engines are fitted with a small priming cup tapped into the air suction passage of the head.

This cup is to be filled about three-fourths full with gasoline before starting. Then, when engine is ready to start, this gasoline is allowed to run into the air suction passage where on first suction stroke it is drawn into the cylinder with the air, making a mixture for the first explosion.

To Stop Engine t Drain Wa From Cyl

To stop engine, close the throttle valve and open switch on battery. In cold weather water should always be drained from engine cylinder and pipes to prevent freezing and bursting of same.

Close both cocks on water tank; then open the drain cock near the bottom of tank, and by so doing allow cylinder and pipe connections to be drained.

DIRECTIONS FOR CLEANING AND TAKING APART

Cleaning Pistons and Rings. (See page 9.)

To Remov Piston

Occasionally it may become necessary to remove the piston for the purpose of cleaning the rings, which may have become baked fast to piston and prevent the engine from holding its compression, if the proper amount or quality of lubricating oil has not been used. To remove the piston, take off hand hole plate (4) (page 9) from base, and remove cotters, oil dipper and nuts (28) from connecting rod studs. Now remove the bushing

cap(27A)and turn crank shaft so that wrist pin is in lowest position. Remove cotters and ear joint pin (81), and let exhaust rod (71) recline; also remove nut and washer (106) from igniter rod guide stud and slip igniter pawl block (100B or D)clear of same and allow igniter rod (98) to recline, being careful not to lose igniter slide bushing (105). Disconnect unions just below reservoir and remove the nuts from the studs which hold cylinder to base. Now cylinder may be lifted clear of the base and the piston withdrawn. In replacing piston, care must be taken to replace it in the same position as formerly. Care must also be taken to replace all parts in the reverse order from which they are removed and in the same positions. Spread all cotters and replace defective gaskets. The gaskets between cylinder and base and between hand hole plate and base may be of heavy paper.

To Remove Rings

The piston rings should be soaked with kerosene oil (for this is found best), and loosened up and grooves cleaned. Oil piston well before replacing it in cylinder. The rings can be removed by taking three strips of tin one-half inch wide and six inches long; slip one strip under each end of a ring; then take a third strip and slip it under the middle of the ring; the ring can then be slipped out of the groove and both cleaned and the ring replaced; then treat others in the same way.

Note the following conditions required to assure perfect working of engine:

Pump.

Fuel Supply

See that the fuel pump on engine works perfectly and that lubricating oil is always kept in cup on top of fuel pump. Each time, before starting, pump by hand until fuel flows into reservoir and back to tank. This is evidence that check valves are all right.

Inlet and Exhaust Valves.

Valves

Be sure that these valves are working properly. When turning the engine by hand, if compression is strong, the valves are tight. After the engine has been standing some time, it is advisable to insert a wire nail in the small hole drilled in shield and lift the suction valve off the seat to insure its working free.

Gaskets

If necessary to put in any new gaskets, be sure to soak the gasket in boiled linseed oil. This will insure a tight joint; whereas, if gasket is put in dry, it is more liable to blow out. Use asbestos gaskets only in all joints in the combustion chamber.

Clean.

Strainers

A wire screen is attached to end of suction pipe in fuel tank, to prevent any foreign substances from entering pump and reservoir. These may become clogged and require cleaning.

Lubricating Oil.

Never start engine without having first oiled all parts well with hand oil can, and see that there is plenty of oil in the cups on cylinder and journal of the large gear.

With these conditions the engine is sure to work easily.

Mineral Oil

The oil used for lubricating the piston must be strictly mineral, free from vegetable or animal matter, of a high fire test, and fluid enough to be fed by the oiler. We recommend our "Hytest" Gas Engine Oil. Steam engine cylinder oil is too thick.

Compression grease cups are furnished on the main bearings of Hit and Miss Governor Engines of 2 to 6 H. P. and in these should be used a good grade of hard oil or grease.

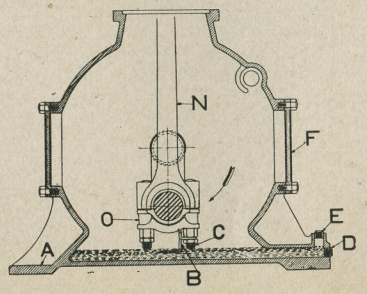
Splash Oiler.

Engines with H. & M. Governor are regularly furnished with Splash Oiler (B) for piston pin and crank pin. On the foot of the engine base are two openings closed by pipe plugs, (see cut below). The lower opening (D) is horizontal and is to drain the oil from the base (A), the upper opening (E) is vertical and is used for filling. Oil should be put in until the ends of connecting rod bolts (C) will just touch the surface when the crank is down. This can be seen by removing one of the hand hole plates (F). Before replacing, note the height of the oil in the opening (E) and it will not be necessary to again remove the hand hole plate when filling.

Oil in Base

Oil Cup

The sight feed oil cup on the lower part of the engine cylinder, which oils the piston, constantly supplies oil to the base, so it will seldom be necessary to introduce oil as above described.



REPAIR LIST

For Fairbanks-Morse Vertical Type "T" Gasoline Engines with Hit and Miss Governor

When ordering parts for repairs, give the description as given in this list by both numbers and names of parts wanted; also the style, number (which is stamped on cylinder head and cylinder at joint, also on patent plate) and horse-power of the engine for which the parts are wanted. Too much care cannot be taken in giving these particulars.

The number followed by "C" at the head of each paragraph covers all items mentioned in that paragraph.

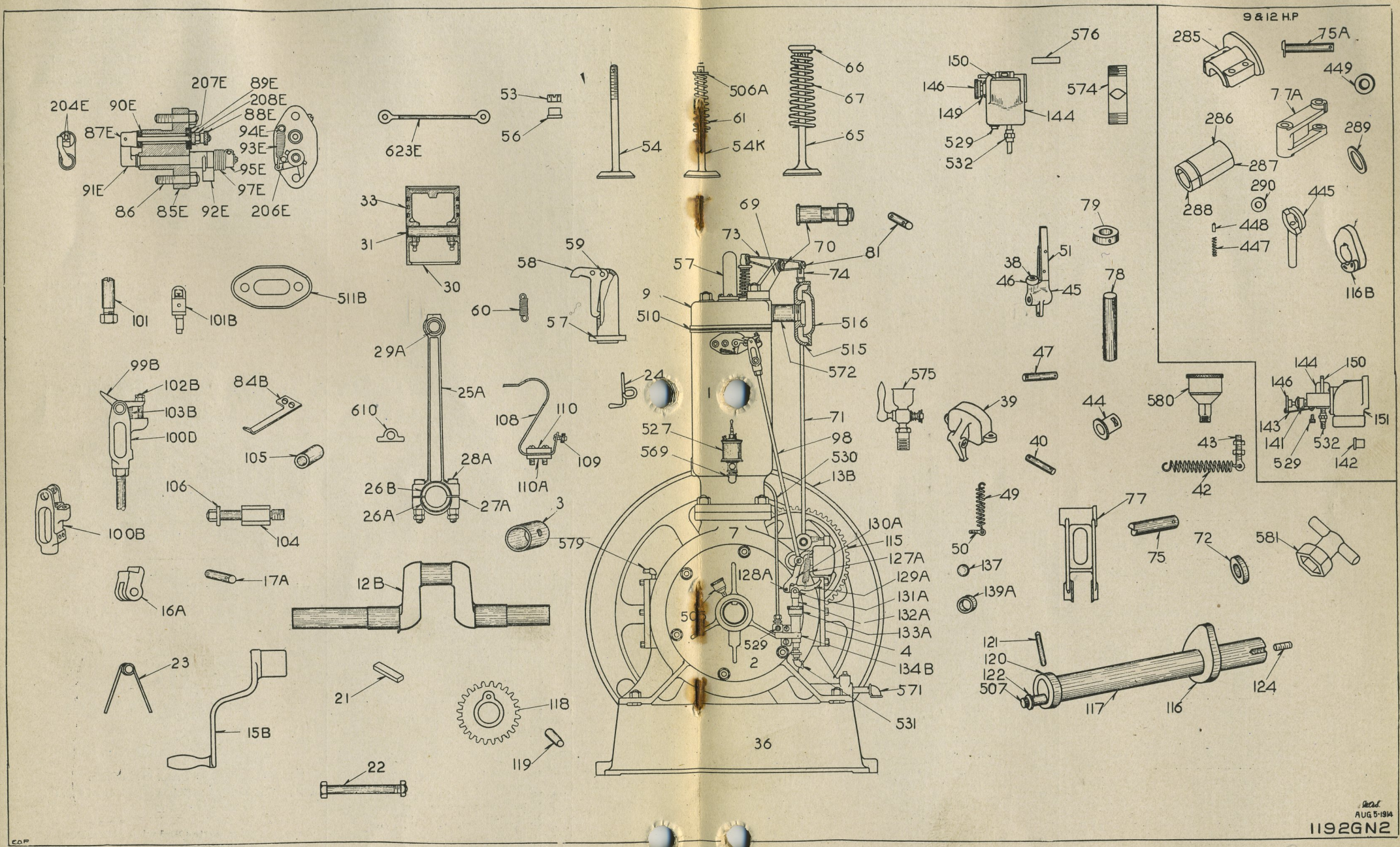
Before ordering a complete group of parts by the number in heavy type at head of paragraph, carefully check over such paragraph to make sure that all parts included therein are wanted, as they will all be furnished unless otherwise specified.

The figure in parenthesis shows the number used on the engine. The repair symbol covers one piece, regardless of the number on the engine.

NO.	DESCRIPTION.
	1-C. Cylinder.
1	Cylinder always fitted with:
	Burner Hole Plug.
	86 Igniter Studs (2 to 9 H. P.) (2).
	Cylinder Head Short Studs (2 on 2, 4 and 6 H. P., 4 on 9 and 12 H. P.).
	Cylinder Head Long Studs (2).
	566 Patent Plate.
	Patent Plate Machine Screws (4).
	Patent Plate Rubber Washers (4).
	Pipe Plug for Water Opening (4 to 12 H.P.).
	Pipe Plug for Oiler Opening.
30-C	Piston Complete with 33 Rings, 31 Pin, etc.
	Nuts for Cylinder Head Studs (4 on 2, 4 and 6 H. P., 6 on 9 and 12 H. P.).
	Nuts for Igniter Studs (2).
	7-C. Engine Crank Base (2 to 6 H. P.)
7	Engine Crank Base always fitted with:
	3 Main Bearing Bushing.
	78 Exhaust Rocker Arm Pin with 79 Collar and 80 Pin.
	Exhaust Rocker Arm Pin Set Screw.
	50 Detent Spring Eyescrew.
	Cylinder Studs (4 on 2 and 4 H. P., 6 on 6 H. P.).
	Bearing Plate Cap Screws.
	Hand Hole Plate Cap Screws (8).
	¼" Pipe Plugs in Base (2).
2	Bearing Plate fitted with 3 Main Bearing Bushing.
4	Hand Hole Plates (2).
	Nuts for Cylinder Studs (4 on 2 and 4 H. P., 6 on 6, 9 and 12 H. P.).
	7-C. Engine Crank Base (9 and 12 H. P.)
7	Engine Crank Base always fitted with:
	285 Main Bearing Cap.
	286, 287, 288 Main Bearing Bushing Complete with Ring.
	Main Bearing Bushing Ring Machine Screws (2).
	289 Main Bearing Bushing Felt Washer.
	290 Main Bearing Bushing Steel Washers (2).
	78 Exhaust Rocker Arm Pin with 79 Collar and 80 Pin.
	Exhaust Rocker Arm Pin Set Screw.
	50 Detent Spring Eyescrew.
	Main Bearing Cap Studs (4).
	Main Bearing Cap Stud Nuts (4).
	Main Bearing Cap Stud Half Nuts (4).
	Main Bearing Cap Cap Screws (3).
	Cylinder Studs (6).
	Bearing Plate Studs (8).
	Hand Hole Plate Studs (8).
	⅜" Pipe Plug in Base.
2	Bearing Plate always fitted with:
	285 Main Bearing Cap.
	286, 287, 288 Main Bearing Bushing Complete with Ring.
	Main Bearing Bushing Ring Machine Screws (2).
	289 Main Bearing Bushing Felt Washer.
	290 Main Bearing Bushing Steel Washers (2).
	Main Bearing Cap Studs (4).
	Main Bearing Cap Stud Nuts (4).
	Main Bearing Cap Stud Half Nuts (4).
	Main Bearing Cap Screws (3).
4	Hand Hole Plates (2).
	Nuts for Hand Hole Plate Studs (8).
	Nuts for Bearing Plate Studs (8).

NO.	DESCRIPTION
	9-C. Cylinder Head.
9	Cylinder Head, fitted with 86 Igniter Studs (2) on 12 H. P.
54K-C	Suction Valve Complete (2 H. P.).
54-C	Suction Valve Complete (4 to 12 H. P.).
61	Suction Valve Spring.
57-C	Suction Valve Cover Complete (4 to 12 H.P.).
65-C	Exhaust Valve Complete.
67	Exhaust Valve Spring.
	12B-C. Crankshaft with Fly-wheels and Pinion.
12B	Crankshaft.
13B	Fly-wheel (Governor Side) fitted with 119 Pinion Pin and 22 Clamp Bolt and Nuts.
13	Fly-wheel (opposite Governor Side) fitted with 22 Clamp Bolt and Nuts.
21	Fly-wheel Keys (2).
118	Pinion an Crankshaft.
	14-C. Pulley.
14	Pulley.
	Pulley to Fly-wheel Machine Bolts (3 on 2 and 4 H. P., 6 on 6 and 9 H. P.).
	Pulley Key (12 H. P.).
	Pulley Key Set Screw (12 H. P.).
	15B-C. Starter Crank (2 to 6 H. P.)
15B	Starter Crank.
16A	Starter Crank Pawl.
17A	Starter Crank Pawl Pin with Cotters (2).
23	Starter Crank Pawl Spring.
24	Connecting Rod Oil Splasher.
	Connecting Rod Oil Splasher Nut (9 and 12 H. P.).
	25A-C. Connecting Rod.
25A	Connecting Rod.
27A	Connecting Rod Cap.
28A	Connecting Rod Bolts with Nuts, Half Nuts and Cotters (2).
26A, 26B	Connecting Rod Crank Pin Bushing.
29A	Connecting Rod Piston Pin Bushing.
610	Connecting Rod Shims (4 on 2, 4 and 6 H. P., 8 on 9 and 12 H. P.).
	26A-C. Connecting Rod with Crank Pin Bearing Only.
25A	Connecting Rod.
27A	Connecting Rod Cap.
28A	Connecting Rod Bolts with Nuts, Half Nuts and Cotters (2).
26A, 26B	Connecting Rod Crank Pin Bushing.
610	Connecting Rod Shims (4 on 2, 4 and 6 H. P., 8 on 9 and 12 H. P.).
	29A-C. Connecting Rod with Piston Pin Bushing Only.
25A	Connecting Rod.
29A	Connecting Rod Piston Pin Bushing.

Repair Chart for Fairbanks-Morse Type "T" Vertical Engines



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#45-C Genuine Latest Parts

NO.	DESCRIPTION.
	30-C. Piston.
30	Piston fitted with Piston Pin Set Screws (2) and Nuts (2), and Piston Ring Stop Pins (3 on 2, 4 and 6 H. P., 4 on 9 and 12 H.P.).
33	Piston Rings (3 on 2, 4 and 6 H. P., 4 on 9 and 12 H.P.).
31	Piston Pin.
	36-C. Lower Base.
36	Lower Base fitted with Base to Engine Cap Screws (4) on 2, 4 and 6 H. P., and with Base to Engine Studs (4) on 9 and 12 H. P.
	Nuts for Lower Base to Engine Studs (9 and 12 H. P.) (4).
	44-C. Governor Sleeve and Weights.
44	Governor Sleeve.
39	Governor Weights (2).
40	Governor Weight Fulcrum Pins (2) with Cotters (4).
42	Governor Springs (2).
43	Governor Spring Eyebolts (2).
	Governor Spring Eyebolt Nuts (4).
	45-C. Governor Detent.
45	Governor Detent Rocker always fitted with: 51 Governor Detent Blade. 38 Governor Detent Roller Pin.
46	Governor Detent Roller.
47	Governor Detent Rocker Fulcrum Pin with Cotters (2).
49	Governor Detent Spring.
	54-C. Suction Valve (4 to 12 H. P.)
54	Suction Valve fitted with 56 Nut, 53 Lock Nut and Cotter.
	54K-C. Suction Valve (2 H. P.)
54K	Suction Valve fitted with 506A Washer and Cotter.
	57-C. Suction Valve Cover (4 to 12 H. P.)
57	Suction Valve Cover.
	Suction Valve Cover Machine Screws (3 on 4 and 6 H. P., 4 on 9 and 12 H. P.).
58	Suction Valve Lock fitted with Spring Pin.
59	Suction Valve Lock Pin with Cotters (2).
60	Suction Valve Lock Spring.
	65-C. Exhaust Valve.
65	Exhaust Valve fitted with 66 Nut and Cotter.
	69-C. Exhaust Rocker Lever Bracket.
69	Exhaust Rocker Lever Bracket.
73	Exhaust Rocker Lever.
70	Exhaust Rocker Lever Fulcrum Pin.
	Exhaust Rocker Lever Fulcrum Pin Nut.
	71-C. Exhaust Rod.
71	Exhaust Rod.
	Exhaust Rod Nut.
74	Exhaust Rod End.
81	Exhaust Rod End Pin with Cotters (2).
	77-C. Exhaust Rocker Arm (2 to 6 H. P.)
77	Exhaust Rocker Arm.
72	Exhaust Rocker Arm Roller.
75	Exhaust Rocker Arm Roller Pin.
	Exhaust Rocker Arm Roller Pin Taper Pin.
	77A-C. Exhaust Rocker Arm (9 and 12 H. P.)
77A	Exhaust Rocker Arm.
72	Exhaust Rocker Arm Roller.
75A	Exhaust Rocker Arm Roller Pin.
	Exhaust Rocker Arm Roller Pin Taper Pin.
445	Relief Cam Lever.
	Relief Cam Lever Set Screw.
447	Relief Cam Lever Spring.
448	Relief Cam Lever Stop Pin.
449	Relief Cam Lever Collar.

NO.	DESCRIPTION.
	85E-C. Igniter (1914 Pattern).
85E	Igniter Body always fitted with: 206E Movable Electrode Stop Pin. 94E Movable Electrode Pawl Return Spring Pin. Igniter Contact Screw.
87E	Igniter Fixed Electrode always fitted with: 204E Fixed Electrode Contact Point.
208E	Igniter Fixed Electrode Nut.
207E	Igniter Fixed Electrode Large Mica Insulation.
90E	Igniter Fixed Electrode Small Mica Insulation.
89E	Igniter Fixed Electrode Collar.
88E	Igniter Fixed Electrode Thumb Nut.
91E	Igniter MovableElectrode always fitted with: 95E Igniter Movable Electrode Collar. Igniter Movable Electrode Collar Taper Pin. 204E Igniter MovableElectrodeContactPoint. Igniter Movable Electrode Contact Screw.
92E	Igniter Movable Electrode Pawl.
93E	Igniter Movable Electrode Pawl Return Spring.
97E	Igniter Movable Electrode Collar Spring.
623E	Duplex Wire Connector.
	98-C. Igniter Rod.
98	Igniter Rod.
	Igniter Rod Nut.
	100B-C. Igniter Slide (1908 Pattern) 6, 9 and 12 H. P.
100B	Igniter Slide.
99B	Igniter Slide Pawl.
101B	Igniter Slide Pawl Eccentric Pin.
84B	Igniter Slide Pawl Eccentric Pin Stop Spring.
	Igniter Slide Pawl Eccentric Pin Stop Spring Screws (2).
102B	Igniter Slide Pawl Stop Stud.
	Igniter Slide Pawl Stop Stud Nut.
	Igniter Slide Pawl Stop Stud Lock Nut.
103B	Igniter Slide Pawl Spring.
104	Igniter Slide Stud.
105	Igniter Slide Stud Bushing.
106	Igniter Slide Stud Washer.
	Igniter Slide Stud Nut.
	100D-C. Igniter Slide (1914 Pattern) 2 and 4 H. P.
100D	Igniter Slide.
99B	Igniter Slide Pawl.
101	Igniter Slide Pawl Pin.
	Igniter Slide Pawl Pin Nut.
102B	Igniter Slide Pawl Stop Stud.
	Igniter Slide Pawl Stop Stud Nut.
	Igniter Slide Pawl Stop Stud Lock Nut.
103B	Igniter Slide Pawl Spring.
104	Igniter Slide Stud.
105	Igniter Slide Stud Bushing.
106	Igniter Slide Stud Washer.
	Igniter Slide Stud Nut.
	108-C. Circuit Breaker.
108	Circuit Breaker Contact Arm fitted with 110A Bottom Insulation Block and Brass Contact Screw.
109	Circuit Breaker Thumb Nut.
110	Circuit Breaker Top Insulation Block.
	Circuit Breaker to Engine Machine Screws (2).
	115-C. Governor Mechanism.
120-C	Governor Gear and Shaft Complete.
44-C	Governor Sleeve and Weights Complete.
116	Exhaust Cam fitted with Key, and with 116B Relief Cam on 9 and 12 H. P.
122	Gear Shaft Pump Pin Washer.
	Gear Shaft Pump Pin Cotter.
	120-C. Governor Gear and Shaft.
115	Governor Gear.
124	Governor Gear Screw Key.
117	Governor Gear Shaft always fitted with: 120 Governor Gear Shaft Collar with 121 Pin. 507 Governor Gear Shaft Pump Pin (6, 9 and 12 H.P.).
	130A-C. Fuel Pump Link.
130A	Fuel Pump Link.
129A	Fuel Pump Lever.
128A	Fuel Pump Link and Lever Pin with Cotters (2).
127A	Fuel Pump Link Spring.

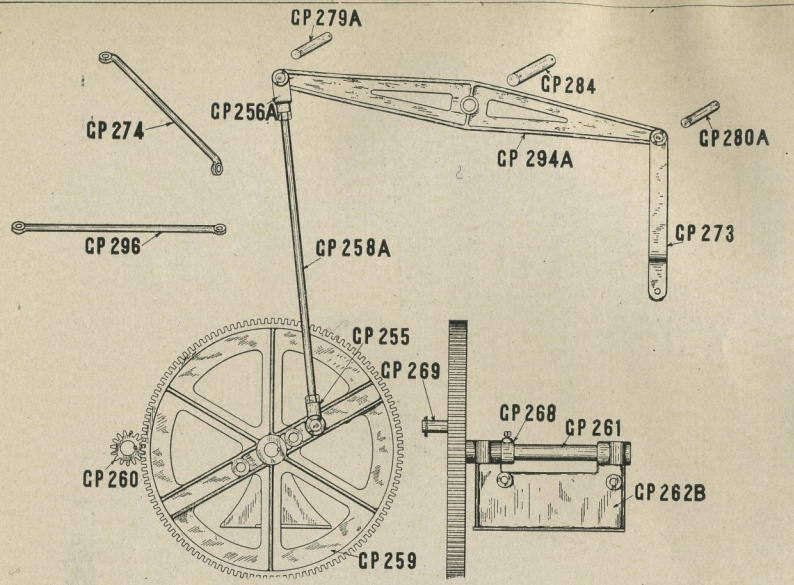
NO.	DESCRIPTION
	134B-C. Fuel Pump.
134B	Fuel Pump Body with 529 Brass Pipe Plug on 2 to 6 H. P.
136	Fuel Pump Bushing (2 to 6 H. P.).
137	Fuel Pump Ball Valves (2 to 6 H. P.) (2).
133A	Fuel Pump Cap.
139A	Fuel Pump Packing Gland.
132A	Fuel Pump Plunger.
131A	Fuel Pump Plunger Pin with Cotters (2).
130A-C	Fuel Pump Link Complete.
	Fuel Pump Body to Engine Cap Screws (2).
	144-C. Fuel Reservoir (2 to 6 H. P.)
144	Fuel Reservoir Body always fitted with: 150 Fuel Reservoir Cover. 576 Fuel Reservoir Cover Pin. 529 Fuel Reservoir Brass Pipe Plug. Fuel Reservoir Brass Tube Nozzle.
146	Fuel Reservoir Throttle Valve.
149	Fuel Reservoir Throttle Valve Spring.
	Fuel Reservoir to Engine Cap Screws (2).
	144-C. Fuel Reservoir (9 and 12 H. P.)
144	Fuel Reservoir Body fitted with Brass Tube Nozzles and 529 Brass Pipe Plug.
141	Fuel Reservoir Packing Nut.
142	Fuel Reservoir Packing Gland.
146	Fuel Reservoir Throttle Valve.
143	Fuel Reservoir Throttle Valve Pointer.
	Fuel Reservoir Throttle Valve PointerScrew.
150	Fuel Reservoir Vent Pipe.
532	Fuel Reservoir Overflow Pipe and Union.
	Fuel Reservoir to 151 Cap Screws (2).
	151-C. Air Suction Piping (9 and 12 H. P.)
151	Air Suction Ell with ¼" Pipe Plug.
	Air Suction Ell to Engine Cap Screws (2).
574	Air Suction Damper.
505	Main Bearing Grease Cups (2 to 6 H. P.) (2).
505	Main Bearing Oilers (9 and 12 H.P.) (2).
510	Cylinder Head Gasket.
511	Igniter Asbestos Gasket.
511B	Igniter Copper Asbestos Gasket.
	515-C. Exhaust Silencer.
515	Exhaust Silencer Base.
516	Exhaust Silencer Cap.
	Exhaust Silencer Cap to Base Bolts (2).
527	Cylinder Oiler.
530	Fuel Piping from Pump to Reservoir.
531	Fuel Pump Suction Fittings as attached to Pump.

NO.	DESCRIPTION
532	Fuel Reservoir Overflow Pipe and Union.
569	Cylinder Oiler Piping.
571	Base Drain Piping.
572	Exhaust Silencer Piping.
574	Air Suction Damper.
575	Priming Cup (6, 9 and 12 H.P.).
	577-C. Evaporator Tank.
577	Evaporator Tank.
	Evaporator Tank to Engine Studs (2).
578	Evaporator Tank Piping.
579	Base Vent Piping (6, 9 and 12 H.P.).
580	Gear Shaft Grease Cups (2).
581	Wrench for Connecting Rod Bolts (2 to 6 H.P.).
582	Main Bearing Oiler Piping (9 and 12 H. P.) (2).
	Exhaust Pot.
	Exhaust Pot, fitted with Pipe Plug on 6, 9 and 12 H. P.
	Exhaust Pot Cover, fitted with Studs (2) for Gland on 6, 9 and 12 H. P.
	Nuts (2) for Gland Studs (6, 9 and 12 H.P.).
	Exhaust Pot to Cover Machine Bolts and Washers.
	Exhaust Pot to Cover Asbestos Gasket.
	Exhaust Pot Gland (6, 9 and 12 H.P.).
	Exhaust Pot Gland Asbestos Wick Packing (6, 9 and 12 H.P.).
	Exhaust Pot Pipe Flange (6, 9 and 12 H. P.)
	Exhaust Pot Pipe Flange Gasket (6, 9 and 12 H.P.).
	Exhaust Pot Pipe Flange Cap Screws (6, 9 and 12 H. P.) (2).
	Complete Set of Springs.
61	Spring for Suction Valve.
67	Spring for Exhaust Valve.
23	Spring for Starter Crank Pawl.
42	Springs for Governor Weights (2).
49	Spring for Governor Detent.
60	Spring for Suction Valve Lock (4 to 12 H.P.).
447	Spring for Relief Cam Lever (9 and 12 H.P.).
93E	Spring for Movable Electrode Pawl.
97E	Spring for Movable Electrode Collar.
103B	Spring for Igniter Slide Pawl.
127A	Spring for Fuel Pump Link.
149	Spring for Fuel Reservoir Throttle Valve (2 to 6 H.P.).

INDEX OF REPAIR NUMBERS AND GROUPS

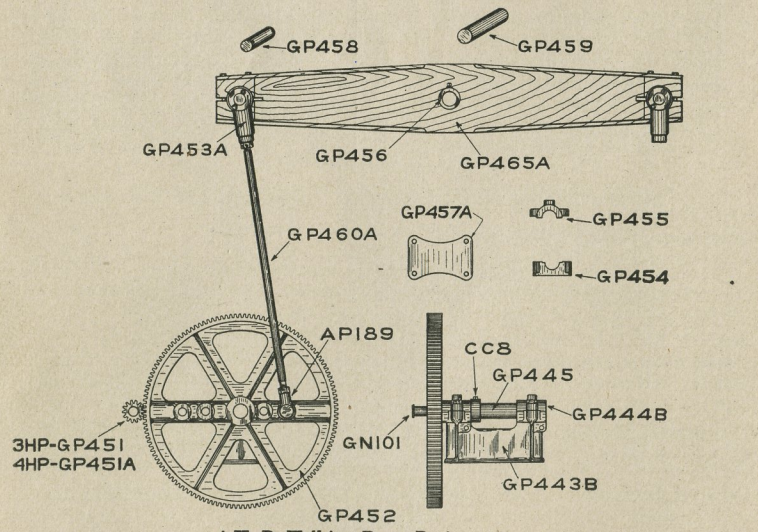
Repair No.	Group No.	Name of Part
1	1-C	Cylinder.
2	7-C	Bearing Plate.
3	7-C	Main Bearing Bushing.
4	7-C	Hand Hole Plate.
7	7-C	Crank Base.
9	9-C	Cylinder Head.
12B	12B-C	Crankshaft.
13	12B-C	Fly-wheel (opposite Governor Side).
13B	12B-C	Fly-wheel (Governor Side).
14	14-C	Pulley.
15B	15B-C	Starter Crank.
16A	15B-C	Starter Crank Pawl.
17A	15B-C	Starter Crank Pawl Pin.
21	12B-C	Fly-wheel Key.
22	12B-C	Fly-wheel Clamp Bolt.
23	15B-C	Starter Crank Pawl Spring.
24		Connecting Rod Oil Splasher.
25A	25A-C, 26A-C, 29A-C	Connecting Rod.
26A	25A-C, 26A-C	Connecting Rod Crank Pin Bushing—Cap Half.
26B	25A-C, 26A-C	Connecting Rod Crank Pin Bushing—Rod Half.
27A	25A-C, 26A-C	Connecting Rod Cap.
28A	25A-C, 26A-C	Connecting Rod Bolt.
29A	25A-C, 29A-C	Connecting Rod Piston Pin Bushing.
30	30-C	Piston.
31	30-C	Piston Pin.
33	30-C	Piston Ring.
36	36-C	Lower Base.
38	45-C	Governor Detent Roller Pin.

Repair No.	Group No.	Name of Part
39	44-C	Governor Weight.
40	44-C	Governor Weight Fulcrum Pin.
42	44-C	Governor Spring.
43	44-C	Governor Spring Eyebolt.
44	44-C	Governor Sleeve.
45	45-C	Governor Detent Rocker.
46	45-C	Governor Detent Roller.
47	45-C	Governor Detent Rocker Fulcrum Pin.
49	45-C	Governor Detent Spring.
50	7-C	Detent Spring Eyescrew.
51	45-C	Governor Detent Blade.
53	54-C	Suction Valve Lock Nut.
54	54-C	Suction Valve.
54K	54K-C	Suction Valve.
56	54-C	Suction Valve Nut.
57	57-C	Suction Valve Cover.
58	57-C	Suction Valve Lock.
59	57-C	Suction Valve Lock Pin.
60	57-C	Suction Valve Lock Spring.
61	9-C	Suction Valve Spring.
65	65-C	Exhaust Valve.
66	65-C	Exhaust Valve Nut.
67	9-C	Exhaust Valve Spring.
69	69-C	Exhaust Rocker Lever Bracket.
70	69-C	Exhaust Rocker Lever Fulcrum Pin.
71	71-C	Exhaust Rod.
72	77-C, 77A-C	Exhaust Rocker Arm Roller.
73	69-C	Exhaust Rocker Lever.
74	71-C	Exhaust Rod End.
75	77-C	Exhaust Rocker Arm Roller Pin.
75A	77A-C	Exhaust Rocker Arm Roller Pin.
77	77-C	Exhaust Rocker Arm.
77A	77A-C	Exhaust Rocker Arm.
78	7-C	Exhaust Rocker Arm Pin.
79	7-C	Exhaust Rocker Arm Pin Collar.
80	7-C	Exhaust Rocker Arm Pin Collar Pin.
81	71-C	Exhaust Rod End Pin.
84B	100B-C	Igniter Slide Pawl Eccentric Pin Stop Spring.
85E	85E-C	Igniter Body.
86	1-C, 9-C	Igniter Stud.
87E	85E-C	Igniter Fixed Electrode.
88E	85E-C	Igniter Fixed Electrode Thumb Nut.
89E	85E-C	Igniter Fixed Electrode Collar.
90E	85E-C	Igniter Fixed Electrode Small Mica Insulation.
91E	85E-C	Igniter Movable Electrode.
92E	85E-C	Igniter Movable Electrode Pawl.
93E	85E-C	Igniter Movable Electrode Pawl Return Spring.
94E	85E-C	Igniter Movable Electrode Pawl Return Spring Pin.
95E	85E-C	Igniter Movable Electrode Collar.
97E	85E-C	Igniter Movable Electrode Collar Spring.
98	98-C	Igniter Rod.
99B	100B-C, 100D-C	Igniter Slide Pawl.
100B	100B-C	Igniter Slide.
100D	100D-C	Igniter Slide.
101	100D-C	Igniter Slide Pawl Pin.
101B	100B-C	Igniter Slide Pawl Eccentric Pin.
102B	100B-C, 100D-C	Igniter Slide Pawl Stop Stud.
103B	100B-C, 100D-C	Igniter Slide Pawl Spring.
104	100B-C, 100D-C	Igniter Slide Stud.
105	100B-C, 100D-C	Igniter Slide Stud Bushing.
106	100B-C, 100D-C	Igniter Slide Stud Washer.
108	108-C	Circuit Breaker Contact Arm.
109	108-C	Circuit Breaker Thumb Nut.
110	108-C	Circuit Breaker Top Insulation Block.
110A	108-C	Circuit Breaker Bottom Insulation Block.
115	120-C	Governor Gear.
116	115-C	Exhaust Cam.
116B	115-C	Relief Cam.
117	120-C	Governor Gear Shaft.
118	12B-C	Pinion on Crankshaft.
119	12B-C	Pinion Pin in Fly-wheel.
120	120-C	Governor Gear Shaft Collar.
121	120-C	Governor Gear Shaft Collar Pin.
122	115-C	Gear Shaft Pump Pin Washer.
124	120-C	Governor Gear Screw Key.
127A	130A-C	Fuel Pump Link Spring.
128A	130A-C	Fuel Pump Link and Lever Pin.
129A	130A-C	Fuel Pump Lever.
130A	130A-C	Fuel Pump Link.
131A	134B-C	Fuel Pump Plunger Pin.
132A	134B-C	Fuel Pump Plunger.
133A	134B-C	Fuel Pump Cap.
134B	134B-C	Fuel Pump Body.
136	134B-C	Fuel Pump Bushing.
137	134B-C	Fuel Pump Ball Valve.
139A	134B-C	Fuel Pump Packing Gland.
141	144-C	Fuel Reservoir Packing Nut.
142	144-C	Fuel Reservoir Packing Gland.
143	144-C	Fuel Reservoir Throttle Valve Pointer.
144	144-C	Fuel Reservoir Body.
146	144-C	Fuel Reservoir Throttle Valve.
149	144-C	Fuel Reservoir Throttle Valve Spring.
150	144-C	Fuel Reservoir Cover (2 to 6 H.P.).
150	144-C	Fuel Reservoir Vent Pipe (9 and 12 H.P.).
151	151-C	Air Suction Ell.
204E	85E-C	Igniter Electrode Contact Point.
206E	85E-C	Igniter Movable Electrode Stop Pin.
207E	85E-C	Igniter Fixed Electrode Large Mica Insulation.
208E	85E-C	Igniter Fixed Electrode Nut.
285	7-C	Main Bearing Cap.
286	7-C	Main Bearing Bushing—Upper Half.
287	7-C	Main Bearing Bushing—Lower Half.
288	7-C	Main Bearing Bushing Ring.
289	7-C	Main Bearing Bushing FeltWasher.
290	7-C	Main Bearing BushingSteelWasher.
445	77A-C	Relief Cam Lever.
447	77A-C	Relief Cam Lever Spring.
448	77A-C	Relief Cam Lever Stop Pin.
449	77A-C	Relief Cam Lever Collar.
505		Main Bearing Grease Cup (2 to 6 H.P.).
505		Main Bearing Oiler (9 and 12 H.P.).
506A	54K-C	Suction Valve Washer.
507	120-C	Governor Gear Shaft Pump Pin.
510		Cylinder Head Gasket.
511		Igniter Asbestos Gasket.
511B		Igniter Copper Asbestos Gasket.
515	515-C	Exhaust Silencer Base.
516	515-C	Exhaust Silencer Cap.
527		Cylinder Oiler.
529	134B-C, 144-C	⅛" Brass Pipe Plug.
530		Fuel Piping from Pump to Reservoir.
531		Fuel Pump Suction Fittings as attached to Pump.
532	144-C	Fuel Reservoir Overflow Pipe and Union.
566	1-C	Patent Plate.
569		Cylinder Oiler Piping.
571		Base Drain Piping.
572		Exhaust Silencer Piping.
574	151-C	Air Suction Damper.
575		Priming Cup.
576	144-C	Fuel Reservoir Cover Pin.
577	577-C	Evaporator Tank.
578	577-C	Evaporator Tank Piping.
579		Base Vent Piping.
580		Gear Shaft Grease Cup.
581		Wrench for Connecting Rod Bolts.
582		Main Bearing Oiler Piping.
610	25A-C, 26A-C	Connecting Rod Shim.
623E	85E-C	Duplex Wire Connector.



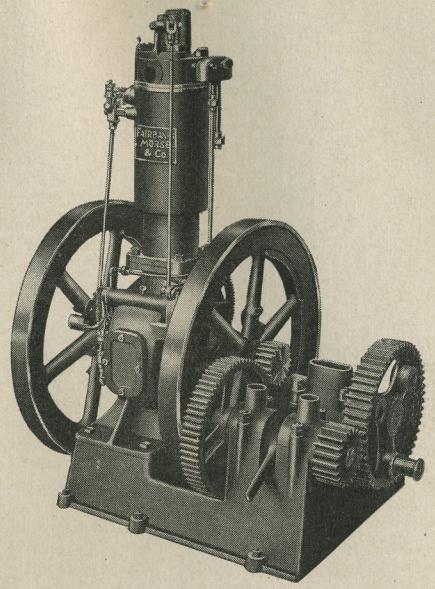
2 H. P. Walking Beam Parts. CHART NO. 116GP

255	Pitman Rod End. Lower.	626	Platform Complete with Upright.
256	Pitman Rod End. Upper.	626A	Platform Complete less Upright.
258	Pitman Rod.	274	Upright Brace.
259	Gear.	275	Rod Connecting Engine and Base.
260	Pinion.		Rod Connecting Engine and Base Nuts.
261	Gear Shaft.	279	Walking Beam Pin. Short.
262	Gear Shaft Bearing.	280	Walking Beam Pin. Long.
268	Gear Shaft Collar and Set Screw.	284	Walking Beam Fulcrum Pin.
269	Wrist Pin and Nut.	294	Walking Beam.
273	Pump Connecting Strap.	296	Upright Brace at End.



4 H. P. Walking Beam Parts CHART NO. 570GP

CC8	Gear Shaft Collar and Set Screw.	GP453A	Pitman Rod End. Upper.
GN101	Wrist Pin and Nut.	GP454	Walking Beam Fulcrum Pin Box.
AP189	Pitman Rod End. Lower.	GP455	Walking Beam Fulcrum Pin Box Cap.
GP443B	Gear Shaft Bearing.	GP456	Walking Beam Bushing.
GP444B	Gear Shaft Bearing Cap.	GP457A	Walking Beam Plates.
GP445	Gear Shaft.	GP458	Pitman Rod End Pin.
GP451	Pinion—3 H. P.	GP459	Walking Beam Fulcrum Pin.
GP451A	Pinion—4 H. P.	GP460A	Pitman Rod.
GP452	Gear.	GP465A	Walking Beam.



Parts Used for 3 and 4 H.P. Type "T" Geared Base with Eccentric Gear Shaft.

REPAIR NOS.	DESCRIPTION.
4	Base.
	Base ¼″ Pipe Plug.
5	Gear—52 Tooth.
5A	Gear—46 Tooth.
	Gear Key.
6	Pinion—16 Tooth.
6A	Pinion—22 Tooth.
	Pinion Key.
7	Gear Shaft Box Cap.
	Gear Shaft Box Cap Oil Cup Cover.
8	Eccentric Shaft Box Caps.
	Eccentric Shaft Box Oil Cup Cover.
9	Eccentric.
	Gear Shaft for Eccentric.
	Gear Shaft for Stroke Gear.
	Gear Shaft for Stroke Gear Plate.
39	Stroke Gear—42 Tooth—8-9-10″ Strokes.
39A	Stroke Gear—84 Tooth—16-20-24″ Strokes.
42	Pinion on Gear Shaft for Eccentric—15 Tooth.
60	Stroke Gear Crank Pin and Nut.

INSTRUCTIONS FOR ADJUSTING, OPERATING AND CLEANING

Instructions for Setting Governor Gear.

Approximate Setting

The approximate setting of the governor gear can most readily be secured by setting engine with crank in horizontal position and toward the exhaust side of the engine. This position may be noted by noticing key-way for fly-wheel, which is in line with the crank and on the same side. Then place the governor gear so that the cam also stands in the same relative position as the crank and mesh the gear and pinion.

Exhaust Valve Opens

Exhaust Valve Closes

A more accurate setting can be obtained by taking note of the following points: The crank shaft of the engine and the gear cam should be in such positions relative to each other that when the crank AB is in the position as shown in Fig. 1 of the Chart 215ND7, the cam will just begin to open the exhaust valve. The cam should close the exhaust valve when the crank is just above the dead center on the in-stroke, or in about the position as shown on Fig. 2 of the cut. The instant the valve is free from its seat (begins to open), or is seated (closed), may be accurately ascertained by rotating the valve slightly with the fingers, grasping the spring collar at the top of the valve stem. The ease of rotation when valve is open or closed is very evident.

Instructions for Setting Electric Igniter. See page 8.

Contact

Snap Off

In setting the electric igniter, the igniter pawl (99B) on the sliding block (100B or D) on the side of the cylinder should begin to press against the catch (92E) carried on the movable electrode of the igniter when the crank is horizontal and coming up. This is the position at which the points of the electric igniter should be brought into contact. The igniter should "snap" or spark when the crank is before the dead center coming up and in about the position shown on Fig. 3 of the cut (page 15).

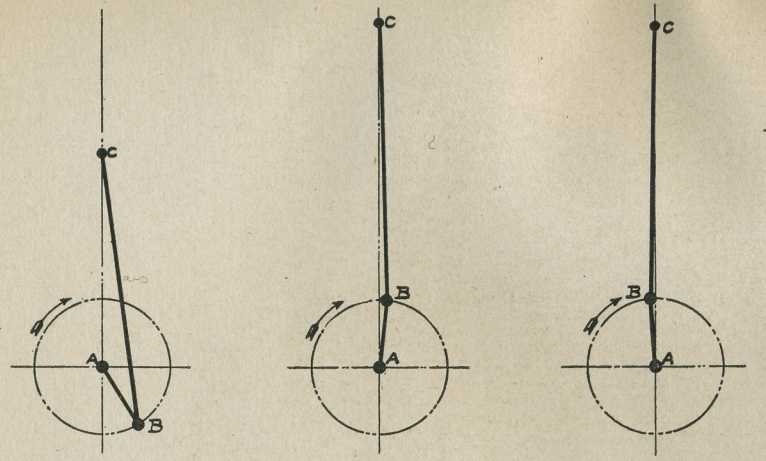


FIG.1. FIG.2. FIG.3

CHART 215ND7

To get the above setting it may be necessary to lengthen or shorten the exhaust rod, which may be done by turning the ear joint which is fastened to the rocker arm on the cylinder head.

Exhaust I

Electric Igniter, Mechanically Operated. See page 8.

Action of Igniter

The casting (85E) is provided with a gasket (511B), acting as a packing between the igniter and head. The fixed electrode (87E) is held between mica washers (90E) placed on each end—a nut clamps this electrode firmly in position. The nut should be kept set tight to prevent the electrode from turning. Special metal contact points (204E) are used in igniter. When the electrode (87E) is in its proper position the point on this electrode and also on the movable electrode (91E) will be in such a position that as the movable electrode is brought into position by the operating mechanism, the two points are brought together and as the catches release outside of the engine, the points inside of the engine also separate, and a spark is formed between them.

The Circu

The movable electrode (91E) is in circuit with the engine. Contact is made by means of circuit breaker placed on the cylinder head and acted upon by the exhaust rocker. The movement of the rocker is such that the circuit is completed previous to the closing of points and is held closed sufficiently long to permit the points to separate and form the spark, when the circuit is again opened by a movement of the exhaust rocker. The circuit breaker spring (108) should be kept clean and in such position to form an electrical connection with the engine as above described.

The Movement.

The Spark

The movement of the loose catch (92E) on the movable electrode is about one-fourth of an inch, sufficient to bring the points together inside of the engine and hold them for a short period, permitting the current to start to flow, and then by continued motion of the rod (98), the igniter pawl (99B), which is carried in the arm, snaps off, allowing the movable electrode (91E) to be returned to its normal position by means of the spring (93E). As this movement takes place and at the instant the points separate, the spark is produced. Motion is given to the igniter rod (98) by means of a crank pin in the end of gear shaft (117).

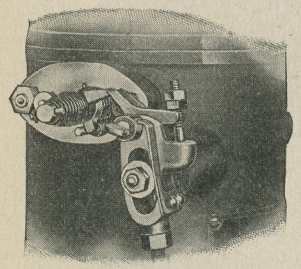


Fig. VE1618

Early and Late Spark 1908 Patter

On 6, 9 and 12 H.P. engines the time of ignition, or the separating of the electrode points, which produces the ignition, can be varied by merely turning the eccentric pin (101B) by means of the flattened handle with thumb and finger. The turning of this pin so as to bring the spring (84B) into the notch provided, which brings the letter "E" into most prominent view, has the effect of making the ignition earlier, and when the letter "L" shows, it has the effect of making the ignition later. This device is used in starting and when the handle of the pin shows the letter "L," the ignition is so set that it will not spark until the engine is past dead center, and thus avoids the possibility of the engine suddenly turning backward, as it may otherwise do, because of an early ignition, when being slowly turned forward. Be sure to turn the handle to show the letter "E" for an early spark, as soon as the engine speeds up. If this is forgotten, the ignition will be too late, causing loss of power and waste of fuel. The time of ignition can be permanently changed by moving the nuts on the stud (102B).

The Igniting Point.

Igniting Point

It is easy to determine at what point the ignition takes place by turning the engine slowly in the direction in which it runs and noting the position of the crank (the key is on the same side of shaft and in line with crank) at the moment the pawl (99B) snaps off from the loose catch (92E) on the movable electrode (91E). If correctly set, the position of the crank will be slightly before upper dead center.

The word "spark," stamped on face of fly-wheel, should be opposite the point where it passes the exhaust rod (71) when igniter snaps, while engine is turned over by hand. This is about the best running position. For starting 6, 9 and 12 H. P. set the igniter to snap late, as above.

Renewing Points

If by continued use the points of contact become worn or corroded, and a good spark cannot be obtained the old plugs containing the points can easily be removed by first filing off the riveted portion of the plugs and then driving them out. New plugs with new contact points can readily be replaced and the plugs lightly riveted over in the electrodes.

Testing Electric Circuit.

To test the electric circuit, turn the engine to a point slightly before the ignition should occur, leaving the igniter pawl (99B) in a position which has brought the contact points (204E) together and thus closed the circuit; then loosen the wire from the insulated electrode (87E) and by striking same on the binding nut (88E) a spark should be produced, thus showing that the current passes through the timer spring (108) and through the engine returning through the insulated electrode (87E). Turn the engine in the direction in which it runs until the pawl (99B) snaps off, then again strike the wire on the nut, and no sparks should occur; but if the wire is struck on any part of the engine, a spark should take place, showing that the current is still passing through the timer spring (108) which does not separate from the exhaust rocker until the engine has turned a considerable distance after the ignition should occur. **The switch in the battery box should be closed when testing circuit or when the engine is running, but open at all times when the engine is not running.**

Battery Switch

Keep Igniter Clean.

The igniter will require cleaning from time to time. The conditions will vary this period. Ordinarily, we would say that cleaning would be required each thirty days. In order to remove the Igniter for cleaning remove the pin (101 or 101B) which holds the igniter pawl (99B), thus allowing the pawl to be taken out. Then by loosening the two nuts retaining the igniter body (85E) to the engine cylinder, the igniter can be withdrawn for cleaning. All carbon or corrosion which would interfere with the proper contact of the igniter points should be removed, and any deposit on the mica washers should be brushed off and washers separated and thoroughly washed with gasoline. The hole or opening through the cylinder head will require scraping to remove the deposit of carbon at the inner end, thus preventing short circuiting due to carbon.

To Remove Igniter

The Electric Battery and Connections.

One binding post of the first cell should be connected with the binding post on spark coil, which is packed in the end of the box. The other post on the spark coil has a long conductor wire attached, which should lead to the insulated fixed electrode (87E) of the igniter, at the cylinder head, and from the binding post of the last cell in the battery the wire should lead to the switch attached to the battery box, and the second long conductor wire should lead from the other binding post of the switch to the binding post (109) on the timer spring (108). Always see that the binding posts are clean and thumb nuts turned tight, so as to hold the conductor wires firmly in position, and that no foreign material of any kind gets between the wires and metal of binding posts and nuts. If the above directions have been carefully followed, the arrangement is such that battery is required to operate only at such times as the engine requires ignition, while at all other times the circuit is broken and the battery is at rest, thus adding to its durability and perfect operation.

Battery Connections

Inside the battery box will be found a small switch box with lever for opening and closing the circuit. When the switch is open, no current can pass. Care should be taken when the engine is at rest for any length of time to open the switch in battery box, so that in case the engine has stopped at the point where the electric circuit is closed, it will be broken by opening the switch, thereby saving the drain on the battery while the engine is idle.

Open Switch When Engine Stops

Test Battery.

The long conductor wires between the battery and engine may be safely handled by the insulation, but avoid touching the bare copper. Having all connections made, close the switch, hold one of the long conductor wires in each hand and strike their ends together. The efficiency with which the battery is working will be indicated by intensity of the spark produced when the wires are separated quickly. If no spark is produced, either the connections are not perfect or short circuit is caused at some point by dirt or foreign material, or the cell is not right. Ascertain the cause and remove it.

Testing Electric Parts

If the engine stops for any cause, test the battery immediately to see if you are still getting a good spark. When the battery is nearly exhausted it soon ceases to give a spark after the engine is started and should be renewed.

If Engine Stops

Instructions for Setting and Connecting the Jack of All Trades with Walking Beam.

This engine is sent out complete, ready to run, it being only necessary to supply gasoline to the gasoline tank, fill the water tank with water, the grease cups with grease and the oil cups with oil; also connect battery wires to igniter and timer spring. Close switch when ready to start.

Height of Foundation Box

1st. If the engine is to rest upon the ground, level off same in order to form an even bearing for the base or foundation box to rest upon.

2nd. To obtain the distance above the ground at which to place the platform carrying the engine, raise the pump plunger or sucker rod to the center of the cylinder, or half of the up-stroke; then make measurement from the bolt hole in the pump rod, to which you are to connect the links of the walking beam, down to the ground. The distance from the strap on the walking beam to the bottom side of the engine platform is three feet. Any extra height of the pump over that to the center of links on walking beam must be made up with framework of timbers, or a plank box can be arranged of the proper height, as obtained from the difference between the measurement so made and the three feet as given. This box should be filled with sand or stone. By this means a solid foundation upon which to bolt the platform of the engine will be made. Use five bolts to bolt platform to box or foundation.

3rd. In locating the box, the end of the walking beam, to which the straps are attached, used for driving the pump, should be placed directly over the pump rod. The beam must stand in its center or horizontal position, when located as above.

Windmill a Engine

4th. If pump is to be worked by windmill, in connection with gasoline engine, the walking beam can be disconnected and swung out of the way, when windmill pole can then be connected in the usual manner to the pump rod. After engine has been placed in proper position in relation to pump, the same should be secured.

Before starting, carefully read all directions contained in this book for standard vertical engines.

Fairbanks-Morse Type "Z" Oil Engines

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Fifth Edition 0917015

INSTRUCTIONS No. 2417D

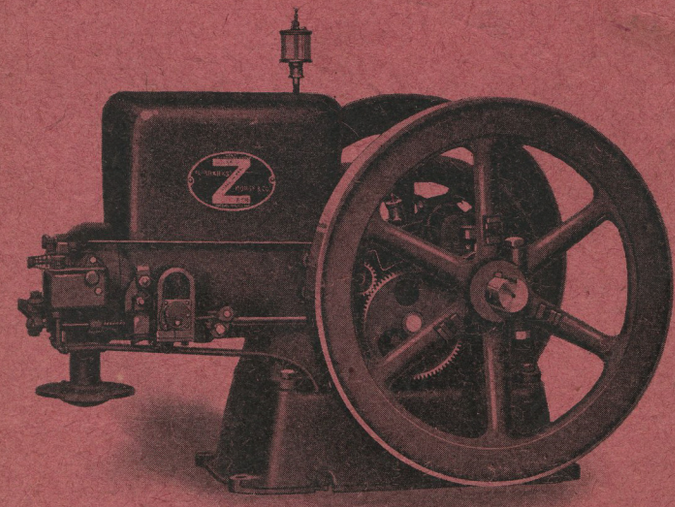
FOR SETTING UP AND OPERATING

Fairbanks-Morse

3 H. P. "Z" 6 H. P.

Throttling Governor Oil Engine

This book should be carefully read before attempting to do anything with the engine



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6 H. P. Type "Z" Oil Engine

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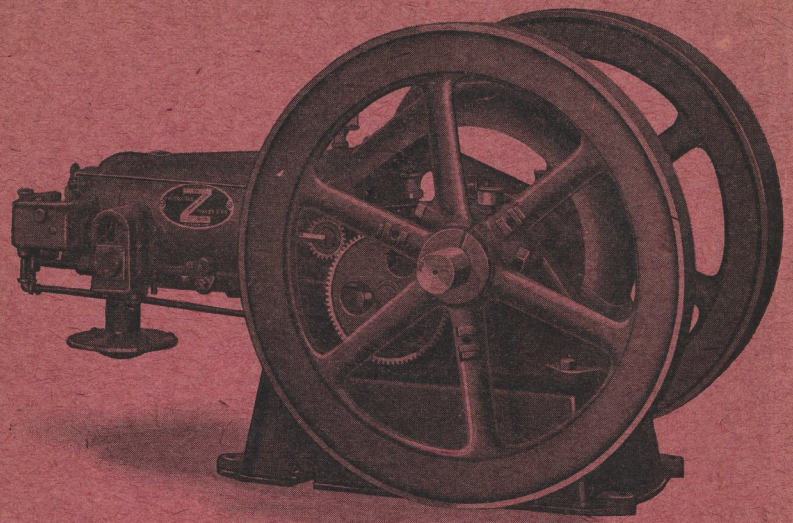

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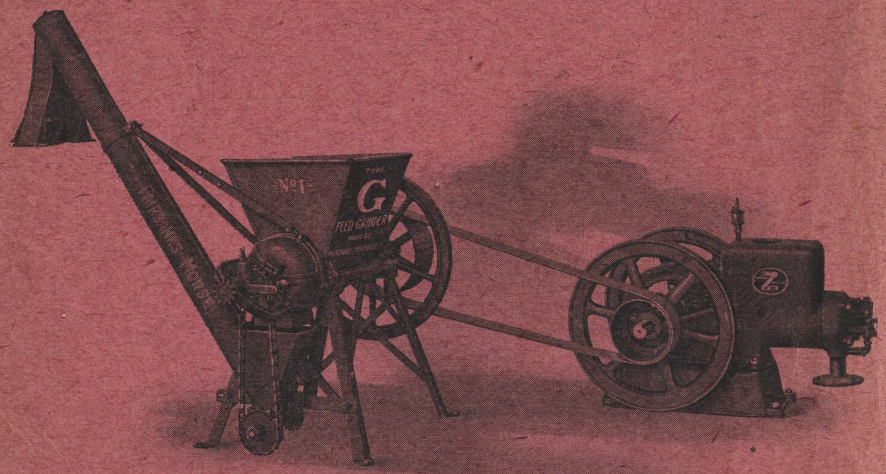
6 H. P. Closed Jacket Type "Z" Engine



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6 H. P. Type "Z" Engine Belted to No. 1 Type "G" Feed Grinder

INSTRUCTIONS No. 2417D

For Setting Up and Operating Fairbanks-Morse 3 and 6 H. P. Type "Z" Oil Engines

When Engine is Received.

1. Remove engine from crate, being very careful to avoid damage.

In the bundle of parts is the cylinder oil cup which is to be placed on the cylinder oil pipe (on the "Closed Jacket" Engines a nipple is included which is to be screwed into the cylinder). Put the pulley on the side opposite the governor using the bolts sent. With the Steel Pulleys small clips are furnished to catch inside the rim so the bolts will hold fast. When it is desired to place the pulley on the governor side, it will be necessary to reverse the small dog in the starter crank so as to use it on the other side, the direction of motion always being as shown in Fig. 3375, page 3.

Foundation.

2. If engine is to be located on a foundation, follow the regular foundation plans, leaving two or three feet of room all round.

If Located in a Building.

3. If the engine is installed in a building the silencer (270A, page 3) may be removed and the exhaust pipe attached and carried outside. It should be short and with few bends. Water may collect in long exhaust pipes so a small hole or other drain should be provided at the lowest place. When the pipe is long (20 feet) or has several elbows (4) the pipe should be increased in size and better results will be observed if a cast iron exhaust pot is installed near the engine.

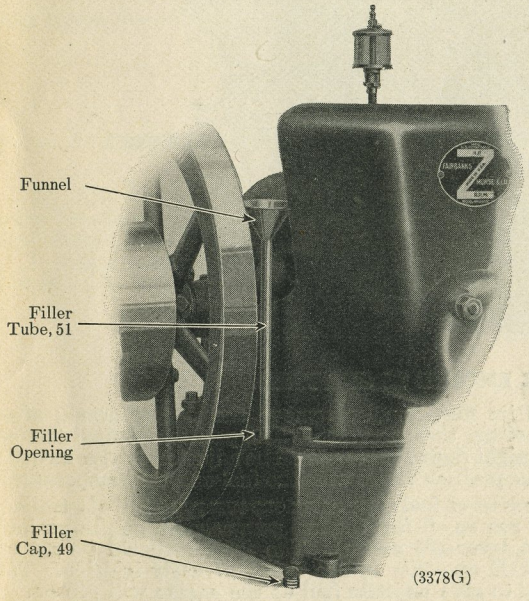
Fuel.

4. These engines can use as fuel, Gasoline, Motor Spirits, Kerosene and some varieties of Power Distillate. In this book we will call the fuel "oil fuel."

Read Tags.

5. **Read the tags on the engine but do not remove them** until you are familiar with its operation.

WHAT TO DO BEFORE STARTING.



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Fill Fuel Tank.

6. Fill fuel tank with the oil fuel to be used regularly, using the tube (51 at the left) and funnel that is packed in the crate. Remove funnel and tube after filling tank.

Cooling Water.

7. Put water in hopper but only enough at first to cover top of cylinder. This can be seen through the hole in top of hopper. In cold weather hot water will make the engine easier to start.

Oiling.

8. Fill oil cup (527, page 3) with good **Gas Engine Oil** (we recommend Hytest), and adjust oiler to feed 12 drops per minute on 3 H. P., 20 drops per minute on 6 H. P. Gradually cut down the amount as the engine becomes worn in until in a month one-half the above quantities are used.

Fill the four grease cups. Two (505, page 3) are on main bearings, a small one is on the cam gear hub (506, page 3). These should be screwed down one or two turns until grease is forced freely into bearings. The fourth one (509, page 3) is on the crank pin bearing. This has a spring plunger that is drawn up to the top by a wing nut on a screw. After filling this cup the wing nut must be screwed back to bring the spring plunger against the grease so that the grease will feed out gradually.

Oil by Hand.

9. With a hand oil can go over the engine and oil the governor and all other places where there are oil holes, and where one part moves against another.

Starting and Fuel Reservoir.

10. Drain the oil fuel from the fuel reservoir (4A, page 2) by unscrewing the overflow valve (105, page 2) one or two turns, until the oil fuel runs back to tank. Open

cover to see when it is drained. When empty close the overflow valve tightly. Fill the reservoir with gasoline for starting and throw the fuel pump out of action by pushing the pump lever (66, below) back away from its driving screw on the exhaust rod, by means of the lock out lever (75, below). This is located on the cylinder head side of the fuel reservoir.

Lock-Out Lever.

Fuel Valve.

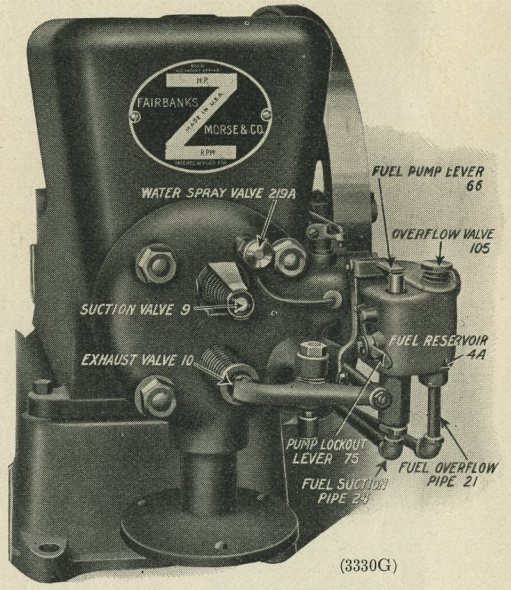
11. Open needle valve (76A, page 9) about one turn.

12. Set the "Early and Late" pin (333, page 3) with the mark "L" up, indicating late ignition.

TO START ENGINE.

Starting.

13. Holding the suction or upper valve open with the left hand, with the starter crank spin the engine. After getting the engine in motion, release the suction valve and half close the air inlet opening in bottom of reservoir with fingers of left hand **for one revolution only,** and then remove fingers while still continuing to crank. If held longer too much fuel will be drawn in. The mixture will not ignite if there is too much fuel in it, and the fuel must be forced out by cranking.



(3330G)

AFTER ENGINE IS STARTED.

14. After the engine takes its first impulse remove the starter crank; after the engine is running nicely adjust the throttle valve. The position at final test on distillate was with the mark straight down, but it should be adjusted to give as little fuel as the engine will run on. The position varies with the fuel and the temperature.

Running on Oil Fuel.

15. The engine will usually run on oil fuel after using one reservoir full of gasoline. When engine is warm enough to run on oil fuel the fuel pump should be thrown into action by throwing out lock-out lever (75 above). The igniter should be set on running position with the mark E up—this is the point of early ignition. The throttle should be again adjusted to give as little fuel as the engine will run on.

Water Spray.

16. The water throttle valve (219A above) on cylinder head should not be opened except to quiet hard explosions which may be noticed when engine is on heavy continuous load, and only enough to serve the purpose. This valve must be closed a few minutes before stopping engine so that the interior of the cylinder will be dry.

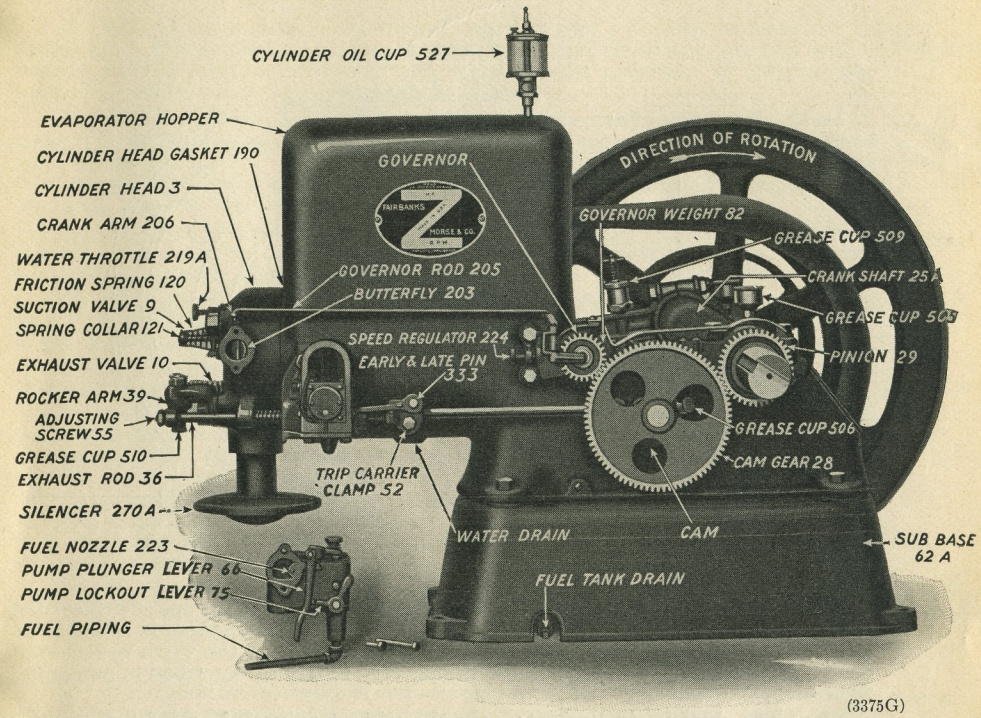
Fill Hopper.

17. Fill water hopper two-thirds full and replenish this water as it evaporates. It is expected to boil away.

TO STOP ENGINE.

To Stop.

18. To stop engine, first close water throttle valve (219A), then close throttle valve (76), then close cylinder oiler (527, page 3), and in freezing weather, drain out the water.



(3375G)

DESCRIPTION OF PARTS OF ENGINE AND MANNER OF ADJUSTMENT.

19. The cam gear is marked with two center punch marks on face of tooth. The pinion (29 above) on crank shaft has one tooth with two center punch marks. This tooth should come between the two marked ones on the large gear. (28 above.)

If engine is taken apart and the marks on gears cannot be found, or if old gear is replaced by a new one, the engine should be timed as follows:

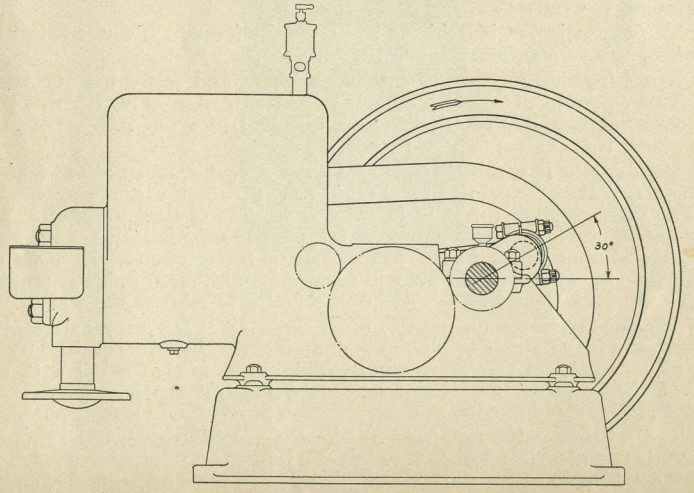


FIG. 1 (1833GN)

At this position of the crank on the exhaust stroke, the exhaust valve begins to open.

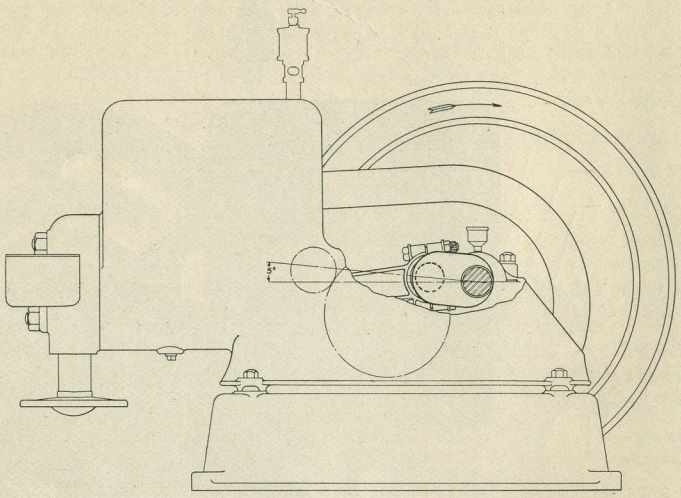


FIG. 2

(1834GN)

At this position of the crank on the suction stroke, the exhaust valve closes.

Setting Gears. Place the crank (25A page 3) in a vertical position and pointing up. Then set the cam gear with the nose of the cam straight up. Next see that there is about 1/16″ clearance between end of exhaust rod and adjusting screw in the valve rocker arm. Such a setting should bring the valve timing very nearly as described in paragraph 20 below.

Valve Timing. 20. The cam should begin to open the exhaust valve 30° to 35° before outer dead center (Fig. 1833GN). The cam should close the exhaust valve when the crank AB is in the position shown in Fig. 1834GN, or about 5° above the inner dead center. The valve can be turned with the fingers the instant it is lifted from its seat.

Temperature of Cooling Water. 21. While operating engine the hopper should not be filled more than three-fourths full of water, otherwise water will splash out more or less when it boils. The water should never be allowed to fall as low as the top of the cylinder wall, as the cylinder will then get too hot. It is to be expected that the water will boil under heavy load and the engine will work properly when the water is boiling. Put in more water as it evaporates.

Engine Jacket Broken by Freezing. 22. The engine jacket is liable to be broken by freezing if water is left in during cold weather unless non-freezing solution is used.

Non-Freezing Solution. 23. A non-freezing mixture of calcium chloride and water may be used in the jacket. Three pounds of calcium chloride to each gallon of water will not freeze solid at zero Fahrenheit. It is advisable, however to drain the jacket in freezing weather when the engine is not in use.

Fuel Supply. 24. Each engine is regularly equipped with a cast iron sub-base (62A, page 3) containing a galvanized steel fuel tank (15A, page 8) which is sent out piped up complete. The filler opening (page 1) in tank is on side of engine opposite governor. In filling, use the tin funnel and filler tube (51, page 1) supplied with engine. Replace cap (49, page 1) after filling to prevent water and foreign matter entering and keep small vent hole in cap open. Water will separate from the oil fuel and remain at the bottom, so the tank should be drained occasionally to remove the water.

Suction Valve. 25. The suction valve (9, page 3) is an ordinary check valve, automatic in its action and has a lift of about three-eights of an inch. The lift is limited by means of a spring (310, page 8) on the valve stem. This valve is also fitted with a friction spring (120, page 3) causing a friction on the suction valve spring collar (121, page 3) thus retarding the rapid motion of the valve and preventing noise.

Exhaust Valve. 26. The exhaust valve (10, page 3) like the suction valve, lies in a horizontal position with the stem extending through a guide in the cylinder head. A spring held under compression by a washer and pin on both the suction and exhaust valves holds these valves to their seats. If valve stem shows tendency to stick, squirt a little kerosene on the stem and work it back and forth.

Lost Compression. 27. Should the engine at any time on starting turn too easily or have lost its compression, it is evident that a leak is taking place, and the suction valve as well as exhaust valve should be examined; they may not seat properly. If they do seat properly examine piston (see paragraph 34 below).

Cleaning and Regrinding Valves. 28. If it is necessary to reseat the suction or exhaust valve the cylinder head (3, page 3) must be removed and the valve ground with fine abrasive, such as ground glass or emery and oil. Revolve valve on its seat in alternate directions, lifting from its seat frequently to distribute the abrasive. Carefully clean both valve and seat with gasoline before replacing.

Gaskets. 29. Asbestos gaskets hold better if covered with linseed or lubricating oil when applied. After putting on new gasket (190, page 3) the nuts should be tightened again when engine is hot.

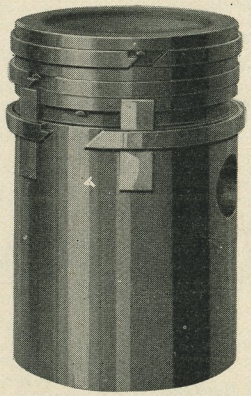
Action of Governor. 30. The governor located on the side of the engine base driven from the cam gear (28, page 3), controls the movement of the butterfly valve (203, page 3) located in the suction passage in the cylinder head.

Butterfly Valve. 31. If it is necessary for any reason to reset the butterfly crank arm (206, page 3) it will be well to remove the reservoir first so that the butterfly (203) can be seen. Pull one governor weight (82, page 3) out as far as it will go and then put a wedge under it to hold it in that position. Take cotter pin out of butterfly crank end of governor rod (205, page 3) remove end of governor rod (205) from crank (206, page 3). Slightly loosen clamp screw of crank (206). Close butterfly with finger and set crank so that governor rod lacks 1/16″ from dropping in hole of crank. Next tighten clamp screw of crank (206) and reassemble parts removed. Be sure to remove the wedge from under the governor weight. If the above instructions are followed the engine can under no conditions run away.

Decreasing Engine Speed. 32. The governor normally holds the engine at its rated speed, but each engine is provided with a speed regulator which decreases the speed by screwing the knurled head screw (224, page 3) in.

REMOVING FUEL PIPING.

Piping. 33. If it should be necessary to remove fuel piping, be careful in swinging reservoir and piping out for removal or in replacing same be careful not to bend the fuel nozzle (223, page 2) on the reservoir. The engine would not run properly if the relative position of this nozzle with the governing butterfly valve were changed.



(3383G)

CLEANING PISTON AND RINGS.

To Remove Piston. 34. After some months of use the piston may be removed to clean the rings. To do this take off oil shield and unbolt crank bearings. Turn crank to extreme out position. The piston may now be withdrawn. Replace piston in **its original position,** and all parts in the **reverse order** from which they were removed. The piston may be cleaned with kerosene or a hot solution of lye and water, the rings loosened and the grooves cleaned. Oil piston well before replacing.

The rings can be removed from piston by taking three strips of tin about one-half inch wide and six inches long, slip one piece of tin under the middle of the ring and over the ring groove, then with the help of a screw driver the other strips can be slipped under the ends and the rings in turn slipped off the piston.

REPAIR PARTS LIST

For Fairbanks-Morse 3 and 6 H. P. Throttling Governor Type "Z" Oil Engines

This list covers 3 H.P. engines after No. 268918 and 6 H.P. engines after No. 267230.

When ordering parts, always give the size, type and **Shop Number** of the engine. The Number is **very important.** It is stamped on the top of the cylinder and cylinder head flanges. **Do not fail to give it.**

Parts may be ordered individually or in groups.

A **GROUP NUMBER** printed in **HEAVY TYPE,** followed by the letter **"C,"** such as **"3-C"** covers all items in that paragraph down to the first horizontal line, thus————. An ordinary repair number printed in light type (such as "3"), covers that one part only.

A group may be ordered **less** certain specified parts, for example **"3-C** less Nos. 9-C and 10-C."

Any part without a repair number is listed directly after the numbered part with which it is used.

For repairs on 3 H. P. engines previous to No. 185864 and 6 H. P. engines previous to No. 185978, see repair parts and price list No. 9417.

For repairs on 3 H. P. engines between 185864 and 268918, and 6 H. P. engines between 185978 and 267250 see Instructions 2417C.

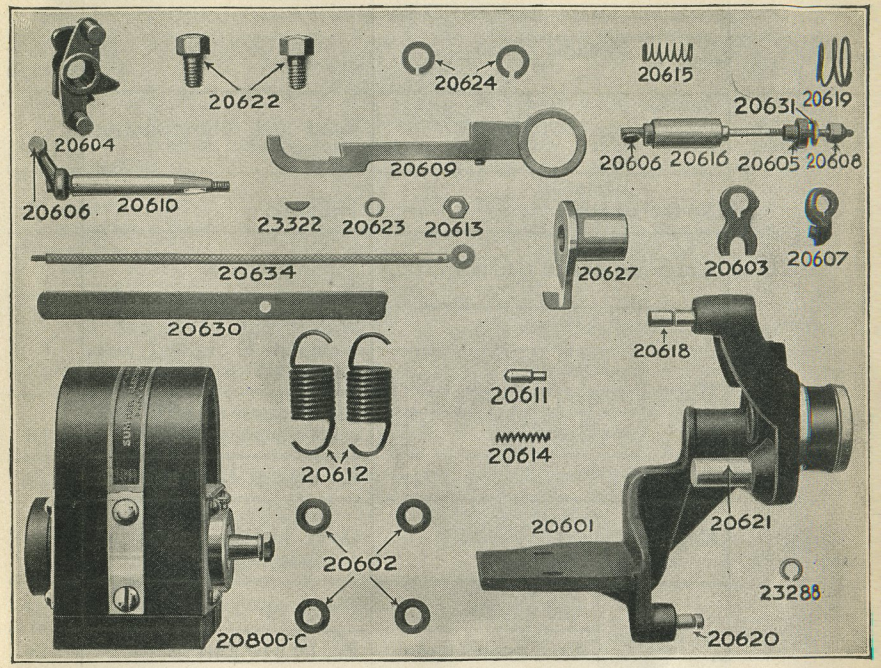
Repair Nos. Arranged Numerically	The Group Number in heavy type, when shown at the head of a group of parts, includes all items mentioned in that group.	Included in Group Number	No. of Pieces used for 3 or 6 H. P.
1-C	**1-C Cylinder and Base**		1
	1 Cylinder and base always fitted with		
	327 Cylinder drain plug		
	328 Base drain plug		
	301 Igniter clamp stud (1)		
	312 Cylinder to head long stud (1)		
	313 Cylinder to head short studs (3)		
1	12 Main bearing caps (2)	1-C	1
	Main bearing cap cap screws (4)		
	Main bearing cap cap screw lock washers (4)		
	126 Main bearing shims (set of 8)		
	195 Name plate		
	Name plate rubber washers (2)		
	Name plate brass machine screws (2)		
	22 Main bearing upper liners		2
	23 Main bearing lower liners		2
	Cylinder to Sub-base Cap Screw		4
3-C	**3-C Cylinder Head**		1
	3 Cylinder head—always fitted with		
	203 Butterfly valve		
3	204 Butterfly valve shaft	3-C	1
	Butterfly valve shaft screws (2)		
	Butterfly valve shaft screw lock washers (2)		
	9-C Suction valve—complete		1
	10-C Exhaust valve—complete		
	217-C Water throttle fitting—complete		
4A-C	**4A-C Combination Fuel Reservoir**		1
	4A Reservoir body, always fitted with		
4A	223 Reservoir nozzle and bushing	4A-C	1
	Reservoir pipe plug		
	Reservoir cotter (through boss for 75 lockout lever)		
	60 Reservoir cover		1
	314 Reservoir cover spring		1
	65-C Reservoir fuel pump plunger complete		1
	66 Reservoir fuel pump plunger lever		1
	67 Reservoir fuel pump plunger lever fulcrum pin with cotter		1
	75 Reservoir fuel pump plunger lever lockout lever		1
	76A Reservoir needle valve		1
	311 Reservoir needle valve spring		1
	105 Reservoir overflow valve		1
	302 Reservoir pump valve		1
	300 Reservoir plunger spring		1

Repair Nos. Arranged Numerically	The Group Number in heavy type, when shown at the head of a group of parts, includes all items mentioned in that group.	Included in Group Number	No. of Pieces used for 3 or 6 H. P.
	Reservoir pipe plug	4A-C	1
	Reservoir to cylinder head short cap screw		1
	Reservoir to cylinder head long cap screw		1
5-C	**5-C Piston**		1
5	5 Piston, always fitted with	5-C	1
	Piston ring stop pins (3) (not furnished separately)		
6	6 Piston rings	5-C	3
7	7 Piston pin	5-C	1
	71 Piston pin taper lock pin		1
	72 Piston pin taper lock pin screw		1
	Piston pin taper lock pin lock washer		1
9-C	**9-C Suction Valve**	3-C	1
9	9 Suction valve	9-C	1
	120 Suction valve friction spring		1
	121 Suction valve spring collar		1
	88 Suction valve spring collar pin		1
	Suction valve spring collar pin tie wire		1
	310 Suction valve spring		1
10-C	**10-C Exhaust Valve**	3-C	1
10	10 Exhaust valve	10-C	1
11	11 Exhaust valve spring washer	10-C	1
	309 Exhaust valve spring washer pin		1
	317 Exhaust valve spring		1
12	Main bearing cap	1-C	2
	Main bearing cap cap screw	1-C	4
	Main bearing cap cap screw lock washer	1-C	4
13	13 Flywheel (opposite governor side), always fitted with		1
	Flywheel clamp bolt		
13A	13A Flywheel (governor side), always fitted with		1
	Flywheel clamp bolt		
	316 Crankshaft pinion drive pin		
	Flywheel clamp bolt	13 and 13A	2
14-C	**14-C Starter Crank**		1
14	14 Starter crank	14-C	1
	265 Starter crank pawl		1
	266 Starter crank pawl fulcrum pin with (two) cotters		1
	267 Starter crank pawl spring		1
15A	15A Fuel tank always fitted with		1
	49 Fuel tank Filler cap		
	Fuel tank drain pipe plug		
16	Oil shield		1
	Oil shield to cylinder stove bolt with lock washer		1
17	Connecting rod piston pin bushing	18-C	1
18-C	**18-C Connecting Rod**		1
	18 Connecting rod, always fitted with		
18	17 Connecting rod piston pin bushing	18-C	1
	Connecting rod piston pin bushing dowel		
20	20 Connecting rod cap	18-C	1
	176 Connecting rod crank pin bearings (halves)		2
	110 Connecting rod crank pin bearing shims (set of four)		1 set
	150 Connecting rods bolts with cotters		2
	151 Connecting rod bolt castle nuts		2
21	Fuel return pipe reservoir to tank complete		1
22	Main bearing upper liner	1-C	2
23	Main bearing lower liner	1-C	2
24	Fuel suction pipe pump to tank complete		1
25A	Crank shaft		1
28	Cam gear		1
29	Crank shaft pinion		1

Repair Nos. Arranged Numerically		The Group Number in heavy type, when shown at the head of a group of parts, includes all items mentioned in that group.	Included in Group Number	No. of Pieces used for 3 or 6 H. P.
30-C		**30-C Cam Gear Pin**		1
	30	Cam gear pin	30-C	1
30		Cam gear pin nut	30-C	1
		Cam gear pin lock washer	30-C	1
33		Governor weight friction spring	92-C	1
34		Exhaust rod rocker roller	50-C	1
35		Exhaust rod rocker roller pin, with cotter	50-C	1
	36	Exhaust rod, always fitted with		
36	318	Fuel pump plunger lever drive screw		1
		Fuel pump plunger lever drive screw lock washer		
39C		**39-C Exhaust Valve Rocker Arm**		1
39	39	Exhaust valve rocker arm	39C	1
	55	Exhaust valve rocker arm adjusting screw		1
		Exhaust valve rocker arm adjusting screw nut		1
		Exhaust valve rocker arm adjusting screw lock washer		1
	329	Exhaust valve rocker arm return spring		1
40		Exhaust valve rocker arm fulcrum pin		1
		Exhaust valve rocker arm fulcrum pin nut		1
41		Exhaust valve rocker arm bracket		1
42		Exhaust valve rocker arm bracket screw dowel		1
48		Governor gear	92-C	1
49		Fuel tank filler cap	15A	1
50-C		**50-C Exhaust Rod Rocker**		1
50	50	Exhaust rod rocker	50-C	1
	58-C	Exhaust rod rocker fulcrum pin—complete		1
	34	Exhaust rod rocker roller		1
	35	Exhaust rod rocker roller pin, with cotter		1
51		Fuel tank filler tube		1
52-C		**52-C Plugoscillator Trip Carrier**		1
	52	Plugoscillator trip carrier—always fitted with	52-C	1
52	333	Plugoscillator trip fulcrum pin		
	334	Plugoscillator trip fulcrum pin ring		1
	324	Plugoscillator trip spring		1
		Plugoscillator trip carrier clamp screw		1
55		Exhaust valve rocker arm adjusting screw	39-C	1
		Exhaust valve rocker arm adjusting screw nut	39-C	1
		Exhaust valve rocker arm adjusting screw lock washer	39-C	1
58-C		**58-C Exhaust Rod Rocker Fulcrum Pin**	50-C	1
58	58	Exhaust rod rocker fulcrum pin, with cotter	58-C	1
		Exhaust rod rocker fulcrum pin nut	58-C	1
	63	Exhaust rod rocker fulcrum pin washers (set of five)		1 set
60		Reservoir cover	4A-C	1
62A		Engine sub-base		1
63		Exhaust rod rocker fulcrum pin washers (set of five)	58-C	1set
65-C		**65-C Fuel Pump Plunger**		1
65	65	Fuel pump plunger	65-C	1
	302	Fuel pump plunger ball valve		1
	69	Fuel pump plunger cap		1

Repair Nos. Arranged Numerically		The Group Number in heavy type, when shown at the head of a group of parts, includes all items mentioned in that group.	Included in Group Number	No. of Pieces used for 3 or 6 H. P.
66		Fuel pump plunger lever	4A-C	1
67		Fuel pump plunger lever fulcrum pin, with cotter	4A-C	1
69		Fuel pump plunger cap	65-C	1
71		Piston pin taper lock pin	5-C	1
72		Piston pin taper lock pin screw	5-C	1
		Piston pin taper lock pin lock washer	5-C	1
75		Fuel pump plunger lever lockout lever	4A-C	1
76A		Fuel reservoir needle valve	4A-C	1
79		Governor weight fulcrum pin, with (two) cotters each	92-C	2
80		Governor plunger pin	92-C	1
81		Governor hub	92-C	1
82		Governor weight	92-C	2
83		Governor lever	92-C	1
85		Governor lever fulcrum pin, with (two) cotters	92-C	1
88		Suction valve spring collar pin	9-C	1
92-C		**92-C Governor**		1
92	92	Governor bracket	92-C	1
	80	Governor plunger pin		1
	81	Governor hub		1
	82	Governor weights		2
	79	Governor weight fulcrum pins, with (two) cotters each		2
	33	Governor weight friction spring		1
	321	Governor weight friction spring adjusting screw, with lock nut		1
	308	Governor weight spring		1
	156	Governor weight spring adjusting screw		1
	48	Governor gear		1
	83	Governor lever		1
	85	Governor lever fulcrum pin, with (two) cotters		1
	209-C	Governor speed regulator		1
	325	Governor speed regulator fulcrum pin		1
		Governor bracket to base cap screw		2
		Governor bracket to base cap screw lock washer		2
104		Fuel tank strap		1
		Fuel tank strap to base carriage bolt		2
105		Fuel reservoir overflow valve	4A-C	1
106		Pulley clips for 3 H. P.		3
110		Connecting rod crank pin bearing shims (set of four)	18-C	1 set
117		Pulley		1
		Pulley to flywheel machine bolt		3
120		Suction valve friction spring	9-C	1
121		Suction valve friction spring collar	9-C	1
126		Main bearing shims (set of eight)	1-C	1 set
139		Igniter clamp		1
150		Connecting rod bolt, with cotter only	18-C	2
151		Connecting rod bolt castle nut	18-C	2
156		Governor spring adjusting nut	92-C	1
157		Flywheel keys		2
160		Opposite governor flywheel to bearing thrust washer		1
176		Connecting rod crank pin bearing (halves)	18-C	2
190		Cylinder head gasket		1
192		Reservoir to cylinder head gasket		1
195		Name plate	1-C	1
		Name plate rubber washer	1-C	2
		Name plate brass machine screw	1-C	2
201		Butterfly valve shaft washer		1
203		Butterfly valve	3-C	1
204		Butterfly valve shaft	3-C	1
205		Governor lever link with (two) cotters		1
206		Butterfly valve shaft lever		1
		Butterfly valve shaft lever clamp screw		1
209-C		**209-C Governor Speed Regulator**	92-C	1
209	209	Governor speed regulator lever, always fitted with	209-C	1
	222	Governor speed regulator lever leaf spring (not furnished separately)		
	224	Governor speed regulator lever screw		1

Repair Nos. Arranged Numerically		The Group Number in heavy type, when shown at the head of a group of parts, includes all items mentioned in that group.	Included in Group Number	No. of Pieces used for 3 or 6 H. P.
217-C		**217-C Water Throttle Fitting**	3-C	1
217	217	Water throttle fitting	217-C	1
218	{218 {220	Water throttle tube packing ring always fitted with Water throttle tube (not furnished separately)	217-C	1
	311	Water throttle valve spring		1
219A	219A	Water throttle valve	217-C	1
220		Water throttle tube (not furnished separately)	217-C	
222		Governor speed regulator leaf spring (not furnished separately)	209-C	
223		Fuel reservoir nozzle and bushing	4A-C	1
224		Governor speed regulator lever screw	209-C	1
225		Gear guard		1
226		Exhaust rocker return spring collar and set screw		1
265		Starter crank pawl	14-C	1
266		Starter Crank Pawl Fulcrum pin with (2) cotters	14-C	1
267		Starter crank pawl spring	14-C	1
270-A		Silencer complete with nipple		1
271		Cylinder oiler pipe		1
300		Fuel pump plunger spring	4A-C	1
301		Igniter clamp stud	1-C	1
		Igniter clamp stud nut		1
302		Fuel pump ball valve	{4A-C and 65-C	2
308		Governor weight spring	92-C	1
309		Exhaust valve pin	10-C	1
310		Suction valve spring	9-C	1
311		Needle valve spring for either fuel or water valve	{4A-C and 217-C	2
312		Cylinder to head long stud	1-C	1
313		Cylinder to head short stud	1-C	3
		Cylinder to head stud nut		4
314		Fuel reservoir cover spring	4-C	1
316		Flywheel crankshaft pinion drive pin	13A	1
317		Exhaust valve spring	10-C	1
		Fuel pump plunger lever drive screw lock washer	36	1
319		Exhaust rod return spring		1
320		Exhaust valve rocker adjusting screw clamp screw	39-C	1
321		Governor weight friction spring adjusting screw	92-C	1
324		Plugoscillator trip spring	52-C	1
325		Governor speed regulator lever fulcrum pin	92-C	1
326		Butterfly Valve shaft torsion spring		1
327		Cylinder drain plug	1-C	1
328		Base drain plug	1-C	1
333		Plugoscillator trip fulcrum pin (not furnished separately)	52-C	1
334		Plugoscillator trip fulcrum pin ring	52-C	1
505		Main bearing grease cup		1
506		Cam gear grease cup		1
509		Connecting rod grease cub		1
510		Exhaust valve rocker arm grease cup		1
527		Cylinder oiler		1
695		Plugoscillator—Complete (for separate repairs on this see Instruction Book No. 2479)		1
696		Magneto—Complete (for separate repairs on this see Instruction Book No. 2479)		1
		Adjustable wrench		1
		Tin funnel		1
		Hand oiler		1

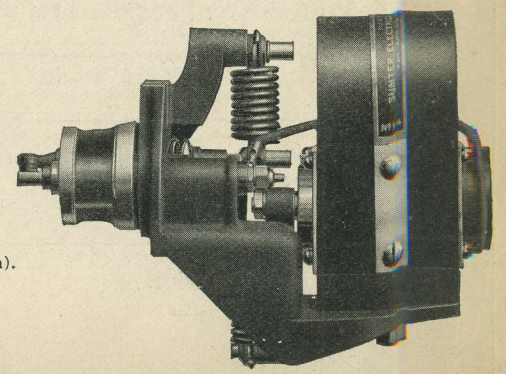


Repair Parts List Model "C" Plugoscillator

For 3 and 6 H. P. Type "Z" Engines

Always mention the **direction of rotation** and the **serial** number when ordering repairs.

20601 Body only.
20604 Trip and break lever.
20621 Trip and break lever fulcrum pin.
20603 Magneto crank arm.
20610 Moveable electrode and point.
20607 Moveable electrode arm.
20618 Spring roller pin, long.
20620 Spring roller pin, short.
20602 Spring roller.
20612 Trip and break lever spring.
20630 Starting lever.
20619 Moveable electrode seating spring.
20615 Moveable electrode arm spring.
20616 Stationary electrode.
23288 Spring roller stud spring ring.
20605 Stationary electrode insulating bushing.
20608 Stationary electrode special nut.
20617 Stationary electrode copper gasket (not shown).
20800-C Magneto complete.
20624 Magneto fastening screw lock washer.
20634 Magneto terminal and wire.
20622 Magneto fastening screw.
20613 Moveable electrode nut.
23322 Moveable electrode woodruff key.
20606 Igniter points.
20623 Moveable electrode nut lock washer.
20609 Trip finger.
20627 Early and late eccentric.
20614 Early and late eccentric plunger spring.
20611 Early and late eccentric plunger.



Model "C" Plugoscillator
Used on 3 and 6 H. P. Type "Z" Oil Engines

TROUBLE CHART

Trouble	Possible Cause		Remedy	See Paragraph
Engine Will Not Start	Instructions not followed.		Read and follow instructions.	1 to 13
	No fuel in tank.		Fill tank.	6
	Water in gasoline used in starting.		Strain gasoline.	
	Water in engine cylinder.		Water will work out if engine is turned over slowly.	13
			Close water throttle valve before engine stops.	16
			See that gasket is unbroken	29
	Engine Flooded		Open suction valve and crank Engine.	13
	Poor Compression	Valve leaks.	Grind valve.	28
		Head gasket leaks.	Put on new gasket.	29
		Piston blows.	Remove rings and clean.	34
	Engine very cold.		Put but little water (preferably hot water) in hopper.	2
	Igniter Short Circuited		Take out igniter, clean points.	Inst. 2479
			See that wire from magneto is not grounded.	Inst. 2479
Engine Misses Fire After Being Started	Ignition	Magneto out of time.	Correct.	Inst. 2479
		Short Circuit.	Clean. See that insulation on wire is good.	Inst. 2479
	Water in fuel collects in bottom of reservoir and fuel tank.		Drain water from reservoir through plug in bottom.	
			Drain water out of tank.	24
Engine Knocks	Hard Explosion.		Remove head and clean carbon.	29
			Open water spray.	16
	Loose crank pin bearing.		Take up bearing.	

Trouble	Possible Cause	Remedy	See Paragraph
Engine Runs Irregularly	Governor stuck.	See that governor parts are free. Use kerosene to loosen. Adjust (33) spring.	
	Weak exhaust valve spring.	Put washer under spring till new spring can be obtained.	
Engine tends To Run Away	Butterfly may not close.	Adjust butterfly crank and governor travel.	31
Engine Will Not Carry Load	Exhaust valve setting off.	Reset.	19–20
	Poor Compression.	See "Engine will not start"	28–29–34
	Late ignition.	Correct.	Inst. 2479
	Too rich mixture.	Close throttle.	14
	Carbon in combustion space.	Remove head and clean.	
	Silencer clogged.	Clean out.	
	Butterfly moved.	Reset.	31
Engine Uses Too Much Fuel	Throttle open too far.	Close.	14
	Poor Compression.	See "Engine will not start"	28–29–34
	Late ignition.	Time correctly.	Inst. 2479
	Exhaust valve setting off.	Reset.	19–20
	Exhaust pipe or silencer choked.	Clean.	
	Suction valve friction spring too weak causing oil fuel to drip from suction pipe.	Bend spring or put on new one.	
Carbon forms	Too much fuel	Close throttle.	14
	Too much lubricating oil.	Adjust lubricator.	8
	Engine too cold.	See that engine is hot before turning on oil fuel.	15
Water Boils Away Too Rapidly	Mixture too rich.	Close throttle.	14
	Late ignition.	Correct.	Inst. 2479
		Never let the water get below top of cylinder.	17

Fairbanks-Morse Type "Z" Oil Engines

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First Edition

0618003

INSTRUCTIONS No. 2494

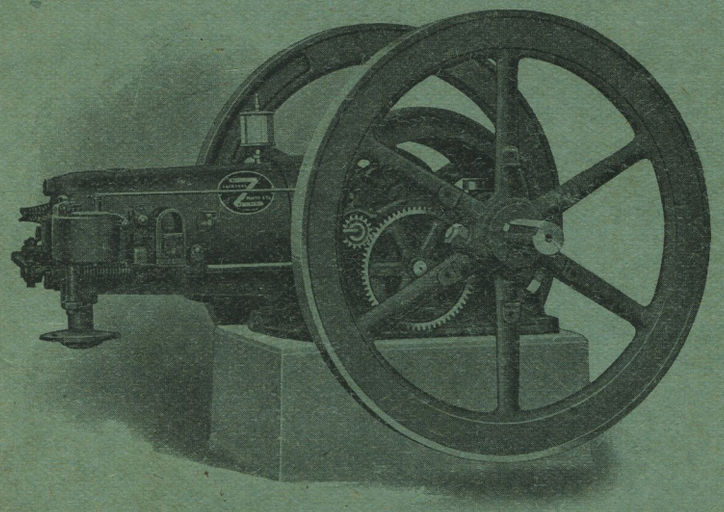
FOR STARTING AND OPERATING

Fairbanks-Morse

Type "Z" Horizontal Oil Engines

10 H. P. and Larger

This pamphlet, together with Instructions 2479, covering the magneto should be carefully read before attempting to do anything with the engine



(3396G)
10 H. P. Type "Z" Oil Engine showing Built-in Oscillating Magneto and Throttling Governor

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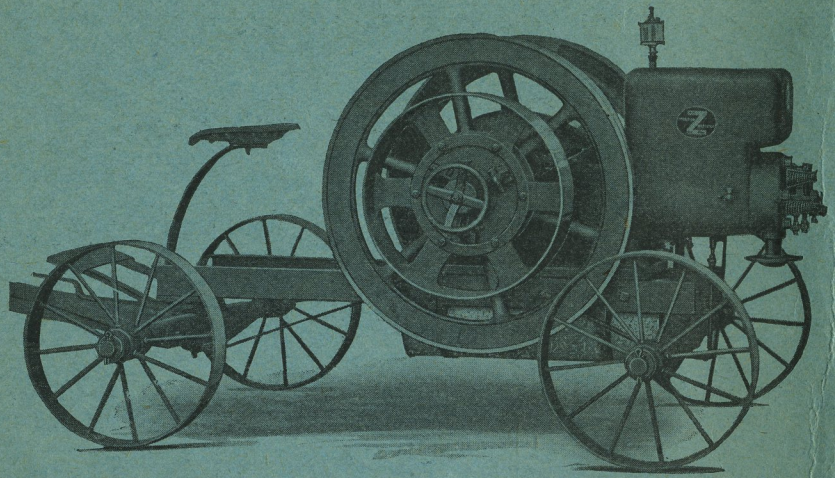

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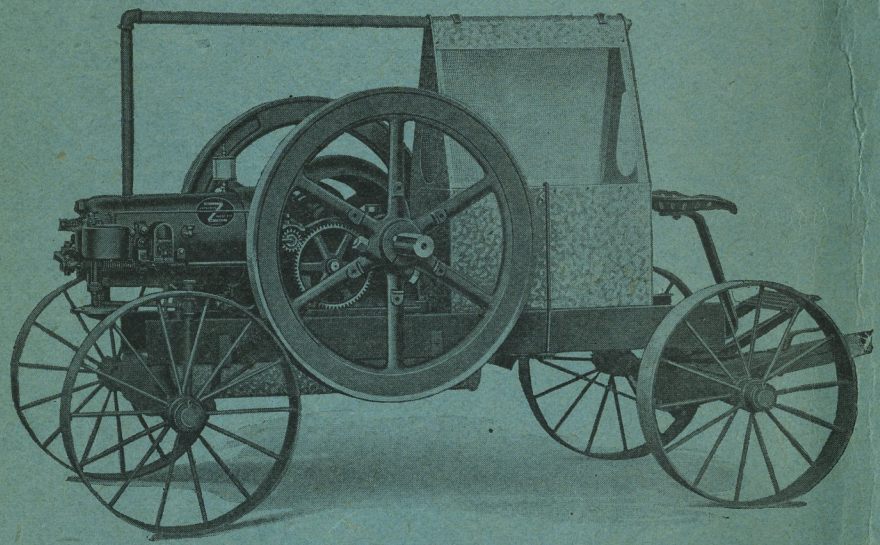
10 H. P. Type "Z" Portable Oil Engine, showing the Hopper Cooler and Friction Clutch Pulley



(3156G)

15 H. P. Type "Z" Portable Oil Engine, 1918 Pattern, with Screen Cooler

INSTRUCTIONS No. 2494
For Setting up and Operating Fairbanks-Morse Type "Z" Oil Engines

When Engine is Received

1. Remove engine from crate, being very careful to avoid damage.
In the bundle of parts is the cylinder oil cup, which is to be placed on the cylinder.
Put the pulley on the side opposite the governor, using the bolts sent.
Remove the plugs from the openings in the cylinder and head.
Clean all parts.
See that the governor parts are free from dirt or paint.
Oil all moving parts and turn the flywheel over by hand slowly to see that all parts are free.

Foundation

2. The foundation should be prepared in accordance with foundation plan for the engine. This drawing gives the location of driving belts and all outside dimensions. A sufficient space, at least two feet, should be allowed on all sizes for easy access by the attendant.

Leave Space

Depth of foundation shown is for firm footing and good concrete only. Fairbanks, Morse & Co. will not be responsible for solidity of foundation.

Level the Engine

The foundation being prepared, with bolts firmly imbedded and projecting the proper distance, the engine should be set over them and leveled with four wedges. A thin grout of cement and sand should be poured over the top of the foundation, a dam of wet sand around the engine base serving to retain the grout. When thoroughly set, the nuts on the foundation bolts may be tightened. Extreme care must be taken to keep the engine level on the foundation.

If Located in a Building

3. If the engine is installed in a building the silencer (26A, page 5) may be removed and the exhaust pipe attached and carried outside. It should be short and with few bends. The silencer must be attached to end of the pipe. Water may collect in long exhaust pipes, so a small hole or other drain should be provided at the lowest place. When the pipe is long (20 feet) or has several elbows (4) the pipe should be increased in size and better results will be observed if a cast-iron exhaust pot is installed near the engine.

Fuel

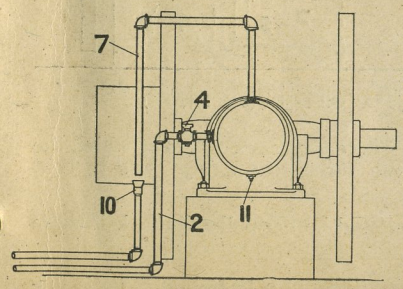
4. These engines can use as fuel Gasoline, Motor Spirits, Kerosene and some varieties of Power Distillate. In this book we will call the fuel "oil fuel."

Read Tags

5. **Read the tags on the engine but do not remove them** until you are familiar with its operation.

Cooling by Running Water

6. The usual arrangement for cooling with running water is shown by Chart 1844GN. The water supply pipe (2) is connected to the opening in the side of cylinder, the cock (4) being provided to regulate the supply to the cylinder jacket.



(1844GN)

Overflow

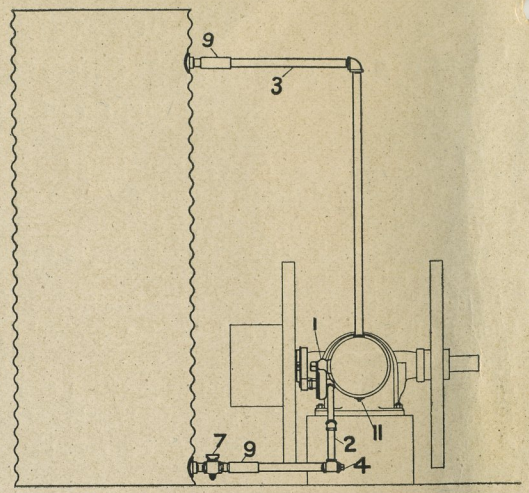
The water outlet from this jacket is at the top of the cylinder as shown, the water rising in the pipe (6) and flowing out freely through the overflow pipe (7). The funnel (10) is provided so that the amount and flow of water can readily be seen.

Drain

Through the plug (11) the cooling water can be drained from the engine. All water should always be drained, after each run of the engine, when there is even the remotest danger of frost, otherwise a frozen water jacket and cracked cylinder may result.

Cooling

7. Chart 1842GN shows the connection when cooling tank is used without the use of circulating pump. The water circulation will be much better if the cooling tank can be elevated at least enough to bring the bottom opening of the tank level with the water opening in the engine cylinder. We advise doing this where possible. If the tank is not set close to the engine, one size larger pipe should be used between the tank and the engine. The inlet pipe (2) connecting the opening in the side of cylinder jacket and the lower opening in the tank, should be connected up as shown. Flexible couplings (9) are furnished and should be used in pipe lines (2) and (3). The outlet pipe (3) should be connected up as shown. When tank used is of our standard dimensions, the temperature will regulate itself under ordinary conditions. If conditions should be such that all water is heated above 180 degrees, the temperature should be lowered by adding cold water to tank. The tank should not be covered, as the water should have exposure to the atmosphere and so arranged that the water can be drained from cylinder and connecting pipes, to prevent freezing. Plug (11) is provided so that engine cylinder can be drained.



Pipe Connections for Tank Cooling—Type "Z" Oil Engine (Fig. 1842GN)

Temperature

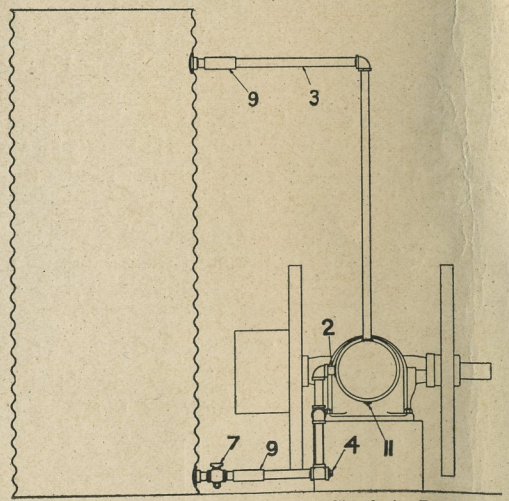
Drain

Height of Water in Tank

The water in the tank must be above the top of opening in the tank, otherwise the water cannot circulate.

Cooling Tank with Circulating Pump

8. When a tank is used for cooling with centrifugal pump for circulating, the connections should be made according to Chart 1843GN. In this case the suction of the centrifugal pump (1) is connected to the bottom of the cooling tank. The pump is attached directly to the engine cylinder and is driven by means of a belt from a pulley on the flywheel. The overflow pipe from the cylinder head is connected to the top opening of the tank.



Pipe Connections: Cooling Tank with Circulating Pump—Type "Z" Oil Engine (Fig. 1843GN)

Outlet Temperature

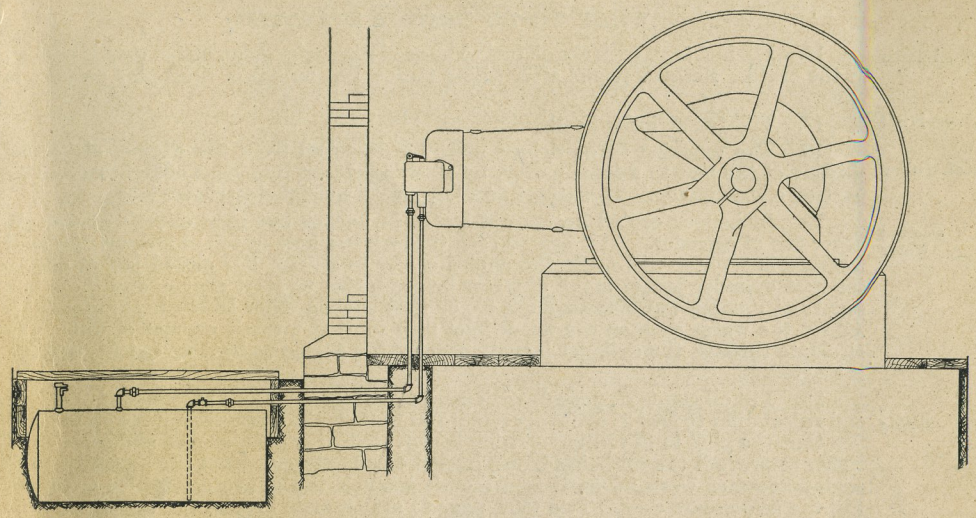
9. When running the engine, the jacket water supply should be regulated so that the temperature is from 160 degrees to 180 degrees Fahrenheit. The most favorable temperature will be different for different fuels and some care should be taken to note the temperature at which the operation is best, and an effort made to keep the outlet reasonably close to that figure.

Drain

10. The cylinder, tank, pump and piping should be carefully drained, if there is the slightest danger of frost.

Fuel Tank

11. A galvanized iron fuel tank having a capacity of a barrel or more is furnished with each engine, and should be connected as shown on Chart 1845GN.


Fuel Piping—Type "Z" Oil Engine (Fig. 1845GN)

Fuel Tank Location

11. The fuel tank may be located outside of the building, as shown, and should be placed in a horizontal position and sufficiently lower than the engine so that the fuel will flow toward the tank from the engine. Any amount of fall, from six to twenty-four inches, will do. With this tank are furnished the proper connections for outlet and return pipe, which are carefully marked before shipping. Use the size pipe furnished. In connecting the fuel tank with the engine, care must be taken to wash out every piece of pipe or joint with gasoline or kerosene. This removes all scale and loose matter, which, if left in the pipes, would interfere with the proper working of valves. Extra care must be taken in making all water and fuel pipe connections so that they do not leak. Soap or shellac should be used in joints of fuel pipes and white lead in joints of water pipes.

Size of Oil Piping

Clean the Pipes

When Installed in Basements

12. When an engine is installed in a basement, or in case the engineroom floor is below the general level from which the fuel tank will be filled, care should be taken to have the top of the fuel tank slightly below the level of the engineroom floor. In case the filling pipe connected to the fuel tank is extended to a point higher than the fuel reservoir on the engine, the fuel tank should be fitted with a reliable float device which will close the filling pipe before the tank is completely full. This float device will give warning so that the fuel will not overflow into the engineroom in case there are any loose joints. Fuel tanks fitted with this float device will be furnished on special orders only.

Vent

13. Care should be taken to see that the cap on the fuel tank filler pipe is not screwed down so far as to cover the vent hole in the side of the filler pipe. If this vent is covered, the air cannot enter the tank and maintain atmospheric pressure on the fuel.

Fuel Piping

14. To the bottom of the fuel pump is connected the suction pipe from the supply tank.

Avoid Traps in Pipe

The engine is shipped with a union attached to the lower end of the overflow pipe from the fuel reservoir, and to this union the return pipe is to be connected and carried down to the floor or through the floor, as required, and back to the fuel tank, with a gradual descent, to assist the free flow of surplus fuel back to the fuel tank.

Screen

15. The filler pipe is provided with a screen to prevent dirt getting into the tank; see that the screen is cleaned out occasionally.

The fuel suction pipe in the tank is also provided with a screen.

If water collects in the fuel tank, it can be pumped out through the filler pipe opening.

WHAT TO DO BEFORE STARTING.

Fill Fuel Tank 16. Fill fuel tank with the oil fuel to be used regularly, using funnel that is packed in the crate. Remove funnel after filling tank. Put on cap of filler pipe so vent is open.

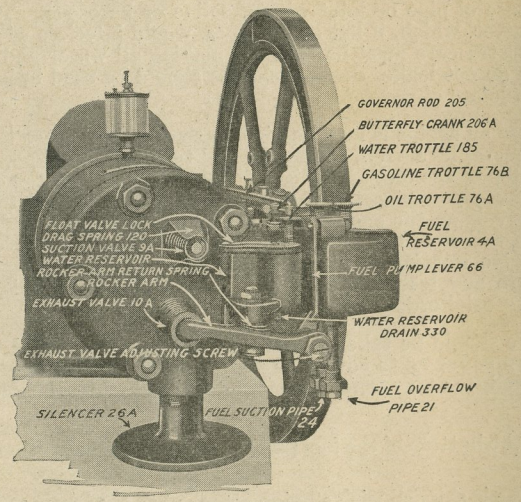
Tighten Nuts 17. Tighten cylinder head nuts.

Clutch Pulley 18. The machine to be driven must be detached from the engine, either by shifting of the belt to a loose pulley, by slacking of belt by means of tightener or by friction clutch pulley. This is not necessary with special electric engines.

Cooling Water 19. In hopper cooled engine put water in hopper but only enough at first to cover top of cylinder. This can be seen through the hole in top of hopper. In cold weather hot water will make the engine easier to start. For closed jacket engine see that cylinder jacket is full of water before trying to start engine, and there is a supply of running water (paragraph 6), or that cooling tank is filled (paragraph 7). Adjust the water cock on the water inlet pipe so that a small amount of water will circulate through the cylinder jacket, causing the engine to heat up quickly after it is started.

Oiling 20. Fill oil cup (527, page 6) with good Gas Engine Oil (we recommend Hytest), and adjust oiler to feed 25 drops per minute on 10 H. P., 35 drops per minute on 15 H. P. See that the plug in the filling opening is provided with good gasket and screwed in tight, to prevent the oil being blown back. Gradually cut down the amount as the engine becomes worn in, until in a month one-half the above quantities are used. Fill the five grease cups. Two (505, page 6) are on main bearings; small ones are on the cam gear (506, page 6) and governor bracket (507, page 6). These should be screwed down one or two turns until grease is forced freely into bearings. The fifth one (509, page 6) is on the crank pin bearing. This has a spring plunger that is drawn up to the top by a wing nut on a screw. After filling this cup the wing nut must be screwed back to bring the spring plunger against the grease so that the grease will feed out gradually.

Oil By Hand 21. With a hand oil can go over the engine and oil the governor and all other places where there are oil holes, and where one part moves against another.



(Fig. 3402G)

Gasoline for Starting 22. Close oil throttle (76A), open cover (60), fill gasoline compartment with gasoline.

Air Damper 23. Close air damper (61).

24. Open gasoline needle valve (76B, page 9) about one turn.

Fuel Valve 25. Set the "Early and Late" pin (333, page 6) with the mark "L" up, indicating late ignition.

Igniter 26. Make sure that igniter is properly timed. Read carefully Instructions 2479 before attempting to start engine.

TO START ENGINE.

Priming Cup 27. Turn nose of cam down. Set crank just above inner dead center. Fill priming cup full of gasoline and open the cock admitting this fuel into the cylinder. While the priming cup is still open, turn the flywheels in the direction they run, thus drawing air into the cylinder, making an explosive mixture. Turn the flywheels in the direction they run and when the igniter snaps the first impulse will take place. The force of this impulse will keep the engine in motion until the next charge is drawn in through the starting valve.

ANOTHER METHOD OF STARTING ENGINE.

28. Turn nose of cam up. Set crank just above inner dead center. Cock the igniter or magneto with hand firing lever. Fill priming cup full of gasoline and open the cock admitting this fuel into the cylinder. While the priming cup is still open turn the flywheels in the direction they run one-half revolution, thus drawing air into the cylinder, making an explosive mixture. Close priming cup. Turn engine backward as strongly as possible, compressing the mixture and at the same moment, when the flywheels are stopped by the compression, trip the igniter by pushing the hand lever toward the head. A strong explosion will result if a good mixture and considerable compression have been obtained. This method requires more skill than the preceding method, and there is danger of injury if one does not let go of the flywheels just before tripping the igniter.

Flooded Engine 29. Too much fuel used in starting (particularly with a hot engine) will flood the engine. When flooded relieve the compression by holding suction valve open with the finger and turn the flywheel over a number of revolutions in order to blow out the excess fuel.

AFTER THE ENGINE IS STARTED.

Air Damper 30. Open air damper.

Early and L 31. Turn early and late pin so that the letter (E) is up, indicating the early or running position.

Cock 32. Close the priming cup on side of cylinder.

Gasoline Throttle 33. Adjust the gasoline throttle valve until the engine runs smoothly.

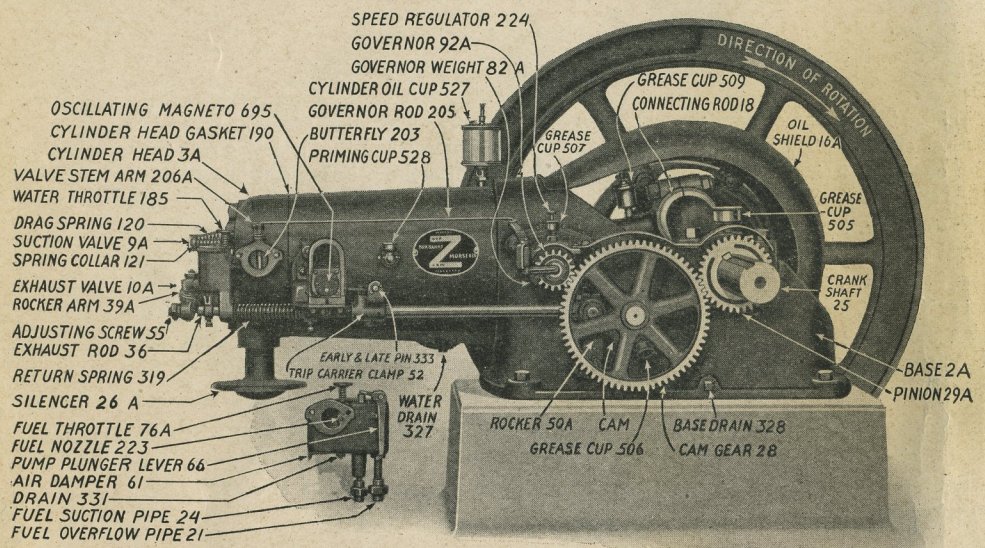
Oil Throttle 34. When the circulating water has reached the temperature of about 120 to 140 degrees F., gradually open the oil throttle valve and close the gasoline valve until the engine is hot enough to run well on the oil fuel alone. It is well to have the gasoline throttle slightly open. The handle of the oil fuel throttle valve is marked at the factory when the engine is tested. The mark should generally point to the center of the gasoline throttle valve when the engine is in operation. But depending upon various influences, the engine may operate best with slightly different setting. After closing gasoline throttle, the oil throttle valve should again be adjusted until the engine operates smoothly.

Water Spray 35. The water throttle valve (185) should not be opened until the engine is about up to full load and then care should be taken not to admit too much water. With a little practice the operator can readily determine the amount of water required by the operation of the engine.

TO STOP ENGINE.

To Stop

36. To stop engine, first close water throttle valve (185), then close throttle valve (76A), then close cylinder oiler (527), and in freezing weather drain out the water. Turn the engine over until the exhaust valve is closed. This is a precaution against the formation of rust on the cylinder walls and exhaust valves in case the engine stands idle for some time.



(3401G)

DESCRIPTION OF PARTS OF ENGINE AND MANNER OF ADJUSTMENT.

Suction Valve

37. The suction valve (9A) is an ordinary check valve, automatic in its action and has a lift of about three-eights of an inch. The lift is limited by means of a spring (310) on the valve stem. This valve is also fitted with a drag spring (120), causing a friction on the suction valve spring collar (121), thus retarding the rapid motion of the valve and preventing noise. Oil friction spring and collar.

Exhaust Valve

38. The exhaust valve (10A), like the suction valve, lies in a horizontal position with the stem extending through a guide in the cylinder head. A spring held under compression by a washer and pin on both the suction and exhaust valves holds these valves to their seats. If valve stem shows tendency to stick, squirt a little kerosene on the stem and work it back and forth. Then oil with lubricating oil.

Lost Compression

39. Should the engine at any time on starting turn too easily or have lost its compression, it is evident that a leak is taking place, and the suction valve as well as exhaust valve should be examined; they may not seat properly. If they do seat properly, examine piston (see paragraph 42).

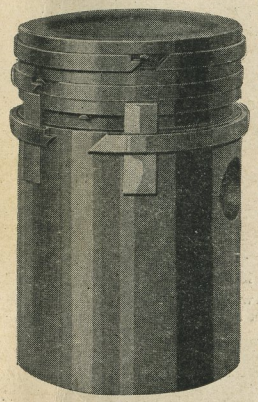
Cleaning and Regrinding Valves

40. If it is necessary to reseat the suction or exhaust valve the cylinder head (3A) must be removed and the valve ground with fine abrasive, such as ground glass or emery and oil. Revolve valve on its seat in alternate directions, lifting from its seat frequently to distribute the abrasive. Carefully clean both valve and seat with gasoline before replacing.

Head Gaskets

41. Asbestos gaskets hold better if covered with linseed or lubricating oil when applied. Before applying gasket scrape off all traces of old gasket. After putting on new gasket (190) the nuts should be tightened again when engine is hot.

To Remove Piston



(3383G)

42. After some months of use the piston may be removed to clean the rings. To do this take off oil shield and unbolt crank bearings. Turn crank to extreme out position. The piston may now be withdrawn. Replace piston in **its original position,** and all parts in the **reverse order** from which they were removed. The piston may be cleaned with kerosene or a hot solution of lye and water, the rings loosened and the grooves cleaned. Oil piston well before replacing. In replacing piston turn it bottom side up so that the piston ring stop pins can be seen, otherwise the rings may be broken. Be sure to turn it right side up before connecting up connecting rod, otherwise the pin will get no oil.

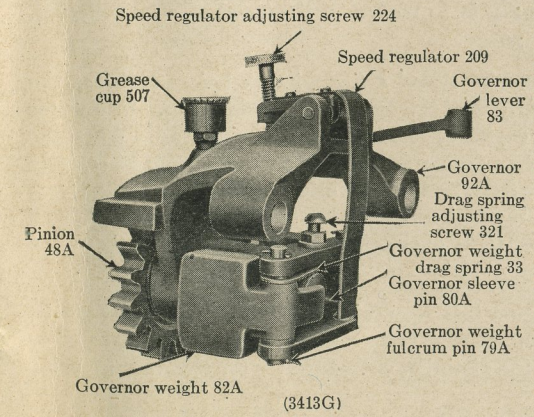
The rings can be removed from piston by taking three strips of tin about one-half inch wide and six inches long, slip one piece of tin under the middle of the ring and over the ring groove, then with the help of a screw driver the other strips can be slipped under the ends and the rings in turn slipped off the piston.

Removing Piston Pin

43. To remove piston pin (7A) use screw driver to take out taper dowel pin screw (72A). Force out taper dowel pin (71) from inside of hollow pin. This allows the pin to be driven out. In returning parts be sure to put the lock pin lock washer in between the lock pin and screw.

Piston Pin Bearing Renewal

44. The piston pin is hollow, of hardened steel and ground to exact size, and will wear very little. Its bearing is of special phosphor bronze. After long use, if necessary, it can be replaced by driving out the bushing, then inserting a new one furnished to exact dimensions. After the connecting rod and piston pin are replaced in the piston, care should be taken to see that the oil tube leading from the top of the piston is directly over oil hole in connecting rod.



(3413G)

Governor

45. The governor, located on the side of the engine base, driven from the cam gear (28), controls the movement of the butterfly valve (203), located in the suction passage on the cylinder head. The governor is fitted with a drag spring (33), the purpose of which is to steady the governor action. The force of the spring can be easily adjusted by small screw (312). If there is too much tension the governor will be slow to respond to change in load. If not enough tension, the engine will race.

Action of Governor

The grease cup (507) lubricates the governor hub, and should be filled occasionally. The governor weight pins (79A) requires oiling with hand oil can.

Butterfly Valve

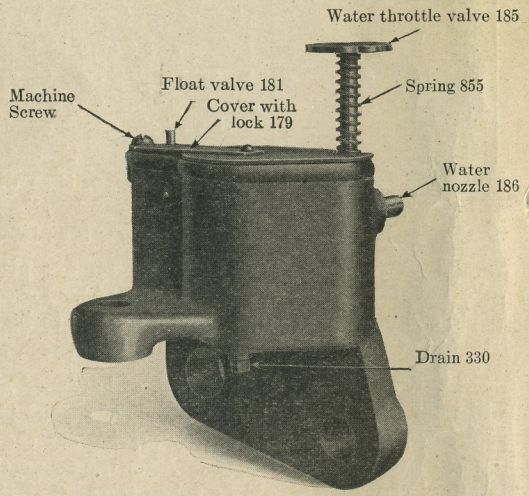
46. If it is necessary for any reason to reset the butterfly crank arm (206A), it will be well to remove the reservoir first so that the butterfly (203) can be seen. Take cotter pin out of butterfly crank end of the governor rod (205) remove end of governor rod (205) from crank (206A). Pull one governor weight (82A) out as far as it will go and then put a wedge under it to hold it in that position. Slightly loosen clamp screw of crank (206A). Close butterfly with finger and set crank so that governor rod lacks 1/16″ from dropping in hole of crank. Tighten clamp screw of crank (206A) remove wedge from under governor weight and reassemble parts removed. If the above instructions are followed the engine can, under no condition, run away.

Decreasing Engine Speed

47. The governor normally holds the engine at its rated speed, but each engine is provided with a speed regulator (209) which decreases the speed by screwing the knurled head screw (224) in. It is not intended that the engine be run continually at a slow speed.

Water Reservoir

48. The water reservoir Fig. 3414G is bolted to the cylinder head and is for the purpose of allowing a fine spray of water to be drawn in with the mixture. The water enters the reservoir from an opening in the cylinder head. A screen (187) prevents entrance of sediment. A float valve (181) controls the flow of water into reservoir. The water enters the suction passage through nozzle (186). The amount of water is regulated by the throttle valve (185). This throttle valve should not be opened until the engine has been running some time and until the load calls for it. Set the valve so that no more water is used than will make engine run nicely. The effect of the water spray is to moderate the force of the explosion. Too much water will reduce the power.



(3414G)

The water throttle valve should be closed a few minutes before stopping the engine so as to have the interior surface of the cylinder dry and clean. The water spray is only of service when the engine is running at about full load. When the engine load falls to about one-half of its power, or below, the water should be entirely cut off to prevent the suction valve from rusting and also to prevent sediment from being deposited upon the points of the igniter. This can be done by pressing down float valve (181) and swinging lock (179) over top of stem. The reservoir can be drained by removing plug (330).

Rain Water for Reservoir

49. In some cases the water from this reservoir causes a troublesome deposit, particularly about the exhaust valve. In such cases rain water may be used, or some simple arrangement may be made for distilling enough water for this use, by using the heat from the exhaust pipe.

(Continued on page 19)

PEPAIR PARTS LIST

For Fairbanks-Morse Type "Z" Horizontal Oil Engines 10 H. P. and Larger—1918 Pattern

This List covers 10 H.P. engines after No. 315526 and 15 H.P. engines after No. 318933.

When ordering parts, always give the **size** or **horsepower, type** and **shop number** of the engine. **The number is very important.** It is stamped on the top of the base and cylinder. **Do not fail to give it.**

Parts may be ordered in groups, or individually, except where noted.

A **Group Number** printed in **heavy type,** followed by the letter **"C,"** such as **"3A-C Cylinder Head,"** covers all items in that paragraph down to the first horizontal line.

An ordinary repair number printed in light type (such as "33") covers that part only, including any parts which are "always fitted" to it. For example: In Group 92A-C, No. 33, 321 or 83, covers one part only, but "33" covers the part No. 33 and all parts "always fitted" to it.

A group may be ordered, **less** certain specified parts. For example: "92A-C, less Nos. 33 and 83."

Any part without a repair number is listed directly after the numbered part with which it is used.

For engines before No. 315526, see Instruction Book 2410C.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
	1A-C Cylinder		
1A	Cylinder, always fitted with head studs, base studs, igniter clamp stud (301), drain plug (327), name plate (195), name plate screws and rubber washers	1	
	Piston (5A-C).		
	Cylinder to head long studs	1	**1A-C**
	Cylinder to head short studs	4	**1A-C**
	Cylinder to head stud nuts	5	
	Cylinder to base studs	6	**1A-C**
	Cylinder to base stud nuts	6	
	2A-C Base		
2A	Base, always fitted with drain plug (328), main bearing caps (12A), main bearing cap, cap screws and lock washers, main bearing shims (126 B and C), exhaust rocker fulcrum pin (58A)	1	
	Main bearing liners (23).		
	3A-C Cylinder Head	1	
3A	Cylinder head, always fitted with reservoir studs	1	
	Suction valve (9A-C), exhaust valve (10A-C).		
	Cylinder head to reservoir studs	2	**3A-C**
	Cylinder head to reservoir stud nuts	2	
	4A-C Fuel Reservoir	1	
4A	Fuel reservoir, always fitted with fuel nozzle and bushing (223), drain plug (331), air damper fulcrum plug (521)	1	
	Reservoir cover (60), throttle valves (76A) and (76B) and springs (311), air damper (61) and air damper spring (821), fuel pump rocker arm (66-C), fuel pump plunger (65-C), plunger spring (300), ball valve (302), suction union and nipple and overflow union and nipple.		

Before ordering parts, read the instructions above.

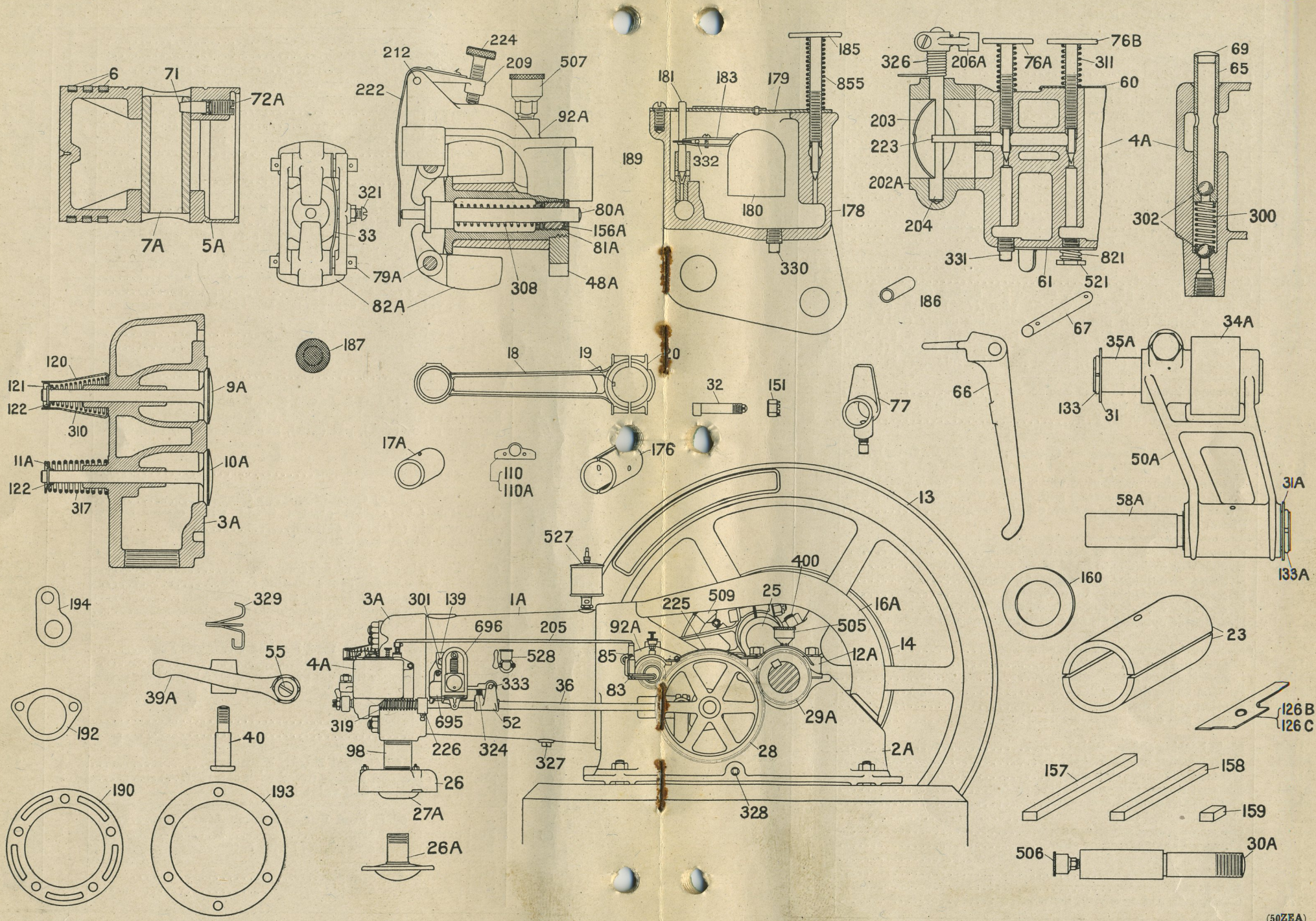
Repair Parts List—Fairbanks-Morse Type "Z" Oil Engines

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
	5A-C Piston	1	**1A-C**
5A	Piston, always fitted with ring stop pins	1	
	Piston rings (6), piston pin (7A), dowel pin (71), dowel pin screw (72A), lock washer.		
6	Piston rings	3	**5A-C**
7A	Piston pin	1	**5A-C**
	9A-C Suction Valve	1	**3A-C**
9A	Suction valve	1	
	Suction valve drag spring (120), spring collar (121), spring collar lock (122), suction valve spring (310).		
	10A-C Exhaust Valve	1	**3A-C**
10A	Exhaust valve	1	
	Exhaust valve spring collar (11A), spring collar lock (122), exhaust valve spring (317).		
11A	Exhaust valve spring collar	1	**10A-C**
12A	Main bearing cap	2	**2A-C**
	Main bearing cap, cap screws	4	**2A-C**
	Main bearing cap, cap screw lock washers	4	**2A-C**
13	Flywheel (opposite governor side), always fitted with clamp stud (400) and nuts, flywheel key (158)	1	
13A	Flywheel (governor side), always fitted with clamp stud (400) and nuts, flywheel key (157)	1	
14	Pulley (on standard engines only)	1	
	Pulley to flywheel machine bolts	6	
16A	Oil shield	1	
	Oil shield to base cap screw	1	
17A	Connecting rod piston pin bushing	1	**18-C**
	18-C Connecting Rod	1	
18	Connecting rod, always fitted with piston pin bushing (17A), crank pin liner dowel (19), cap (20) bolts (32) with nuts (151) and cotters, shims (110 and 110A)	1	
	Connecting rod crank pin liner halves (176).		
19	Crankpin liner dowel	1	**18-C**
20	Connecting rod cap	1	**18-C**
23	Main bearing liner half	4	**2A-C**
	25A-C Crank Shaft	1	
25	Crankshaft	1	
	Crankshaft pinion (29A) with key (159).		
26A	Silencer complete (for 10 H. P. only)	1	
	26-C Silencer (15 H. P.)	1	
26	Silencer base	1	
	Silencer cover (27A) nipple (98) and bolts with nuts.		
	Silencer cover to silencer base bolts with nuts	3	**26-C**
27A	Silencer cover	1	**26-C**
28	Cam gear	1	
29A	Crank shaft pinion	1	**25A-C**
	30A-C Cam Gear Stud	1	
30A	Cam gear stud	1	
	Cam gear stud nut and lockwasher.		

Before ordering parts, read the instructions on page 9.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
	Cam Gear Stud Nut	1	**30A-C**
	Cam gear stud lockwasher	1	**30A-C**
31	Exhaust roller pin washer	1	**50A-C**
31A	Exhaust rod rocker fulcrum pin washer	1	
32	Connecting rod bolt	2	**18-C**
	Connecting rod bolt cotters	2	**18-C**
33	Governor weight drag spring	1	**92A-C**
34A	Exhaust roller	1	**50A-C**
35A	Exhaust roller pin	1	**50A-C**
36	Exhaust rod	1	
	39A-C Exhaust Valve Rocker Arm	1	
39A	Exhaust valve rocker arm	1	
	Exhaust valve rocker arm adjusting screw (55) with jam nut and lockwasher, return spring (329).		
	40-C Exhaust Valve Rocker Arm Pin	1	
40	Exhaust valve rocker arm pin	1	
	Exhaust valve rocker arm pin nut and lockwasher.		
	Exhaust valve rocker arm pin nut	1	**40-C**
	Exhaust valve rocker arm pin lockwasher	1	**40-C**
48A	Governor gear	1	**92A-C**
	50A-C Exhaust Rod Rocker	1	
50A	Exhaust rod rocker always fitted with clamp screw	1	
	Exhaust roller (34A), pin (35A), pin washer (31), ring cotter (133).		
	Exhaust rocker clamp screw	1	**50A-C**
	52-C Oscillator Trip Carrier	1	
52	Oscillator trip carrier always fitted with clamp screw, fulcrum pin (333) and cotters	1	
	Oscillator trip spring (324).		
	Oscillator trip carrier clamp screw	1	**52-C**
55	Exhaust valve rocker arm adjusting screw	1	**39A-C**
	Exhaust valve rocker arm adjustable screw nut	1	**39A-C**
	Exhaust valve rocker arm adjustable screw lockwasher	1	**39A-C**
	58A-C Exhaust Rod Rocker Fulcrum Pin	1	
58A	Exhaust rod rocker fulcrum pin	1	**2A-C**
	Exhaust rod rocker fulcrum pin washer (31A) and ring cotter (133A).		
60	Fuel reservoir cover	1	**4A-C**
61	Air damper	1	**4A-C**
	65-C Fuel Pump Plunger	1	**4A-C**
65	Fuel pump plunger, always fitted with cap (69)	1	
	Fuel pump plunger ball valve (302).		
	66-C Fuel Pump Rocker Arm	1	**4A-C**
66	Fuel pump rocker arm	1	
	Fuel pump rocker arm pin (67) with cotter.		
67	Fuel pump rocker arm pin	1	**66-C**
	Fuel pump rocker arm pin cotters	2	**66-C**

Before ordering parts, read the instructions on page 9.


6
71
72A
7A
5A
212
224
209
507
222
92A
321
33
80A
156A
81A
79A
308
48A
82A
189
181
183
179
185
855
332
180
178
330
326
206A
76A
76B
311
60
203
223
202A
4A
204
331
821
61
521
186
69
65
302
300
67
187
120
121
122
310
9A
11A
10A
317
3A
18
19
20
32
151
17A
176
110
110A
77
66
34A
35A
133
31
50A
58A
31A
133A
160
23
126B
126C
194
329
55
39A
192
40
190
193
527
13
400
225
509
25
16A
505
14
12A
29A
28
2A
3A
301
139
1A
696
205
92A
4A
528
85
83
36
333
319
695
52
98
226
324
327
26
27A
26A
328
157
158
159
506
30A

(50ZEA)

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
69	Fuel pump plunger cap	1	65-C
71	Piston pin dowel pin	1	5A-C
72A	Piston pin dowel pin screw	1	5A-C
	Piston pin dowel pin lockwasher	1	5A-C
76A	Fuel throttle valve	1	4A-C
76B	Gasoline throttle valve	1	4A-C
77	Fuel pump rocker arm dog with set screw	1	
	Fuel pump rocker arm dog set screw	1	
79A	Governor weight pins, with 2 cotters each	2	92A-C
80A	Governor sleeve pin	1	92A-C
81A	Governor spindle	1	92A-C
82A	Governor weight	2	92A-C
83	Governor lever	1	92A-C
85	Governor lever pin, with 2 cotters	1	92A-C
	92A-C Governor	1	
92A	Governor bracket	1	
	Governor sleeve pin (80A), sleeve pin spring (308), spindle (81A), weights (82A), weight pins (79A) with cotters, drag spring (33), drag spring adjusting screw (321) with locknut, gear (48A), governor lever (83), lever pin (85) with cotters, sleeve pin spring adjusting screw (156A), speed regulator (209-C), speed regulator fulcrum pin (212).		
	Governor bracket to base cap screw	2	92A-C
	Governor bracket to base cap screw lockwashers	2	92A-C
98	Silencer nipple (15 H. P.)	1	26-C
	101A-C Evaporator Cylinder (10 H. P. Only)	1	
101A	Evaporator cylinder, always fitted with head studs and base studs, igniter clamp stud (301), drain plug (327), name plate (195), name plate screws and rubber washers, oil pipe with lock nut and leather gasket, oil pipe coupling	1	
	Piston (5A-C).		
	Evaporator cylinder to head long stud	1	101A-C
	Evaporator cylinder to head short studs	4	101A-C
	Evaporator cylinder to head stud nuts	5	
	Evaporator cylinder to base studs	6	101A-C
	Evaporator cylinder to base stud nuts	6	
	Evaporator cylinder oil pipe with lock nut and leather gasket	1	101A-C
	Evaporator cylinder oil pipe coupling	1	101A-C
110	Connecting rod shims—thick	6	18-C
110A	Connecting rod shims—thin	18	18-C
120	Suction valve drag spring	1	9A-C
121	Suction valve spring collar	1	9A-C
122	Suction and exhaust valve spring collar lock	2	9A-C 10A-C
126B	Main bearing shims—thick	8	2A-C
126-C	Main bearing shims—thin	24	2A-C
133	Exhaust roller pin ring cotter	1	50A-C
133A	Exhaust rocker fulcrum pin ring cotter	1	58A-C
139	Cylinder to oscillator clamp	1	
151	Connecting rod bolt castle nuts	2	18-C
156A	Governor spring adjusting screw	1	92A-C
157	Flywheel key—governor side	1	13A
158	Flywheel key—opposite governor side	1	13
159	Crankshaft pinion key	1	25A-C
160	End thrust washer	1	
176	Connecting rod crank pin liner halves	2	18-C

Before ordering parts, read the instructions on page 9.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
	178-C Water Reservoir	1	
178	Water reservoir body, always fitted with drain plug (330) nozzle (186) float valve seat (189)	1	
	Water reservoir cover (179) with float valve lock and rivet, reservoir cover screw, float (180), float fulcrum pin (332), float valve (181), throttle valve (185), throttle valve spring (855).		
179	Water reservoir cover, always fitted with float valve lock and rivet	1	178-C
	Water reservoir cover screw	1	178-C
180	Water reservoir float, always fitted with lower lever, upper lever (183) and screw	1	178-C
181	Water reservoir float valve	1	178-C
183	Water reservoir float lever upper half	1	180-C
	Water reservoir float lever machine screw	1	180-C
185	Water reservoir throttle valve	1	178-C
186	Water reservoir nozzle	1	178-C
187	Water reservoir screen	1	
189	Water reservoir float valve seat	1	178-C
190	Cylinder to head gasket	1	
192	Cylinder head to butterfly valve casing gasket	1	
192	Reservoir to butterfly valve casing gasket	1	
193	Cylinder to base gasket	1	
194	Cylinder to water reservoir gasket	1	
	202A-C Butterfly Valve Casing		
202A	Butterfly valve casing	1	
	Butterfly valve (203) with screws and lock washers, valve stem (204) with rivet, valve stem arm (206A) with clamp screw, valve stem arm spring (326).		
203	Butterfly valve	1	202A-C
204	Butterfly valve stem with rivet	1	202A-C
205	Governor pull rod, with 2 cotters	1	
206A	Butterfly valve stem arm, with clamp screw	1	202A-C
	Butterfly valve stem arm clamp screw	1	202A-C
	209-C Speed Regulator	1	
209	Speed regulator lever, always fitted with leaf spring (222)	1	
	Speed regulator adjusting screw (224) lever pin (322).		
212	Speed regulator lever pin	1	209-C
222	Speed regulator leaf spring (not furnished separately)	1	209-C
223	Fuel nozzle with bushing	1	4A-C
224	Speed regulator adjusting screw	1	209-C
225	Gear guard	1	
226	Exhaust rod spring collar with set screw	1	
	Exhaust rod spring collar set screw	1	
300	Fuel pump plunger spring	1	4A-C
301	Igniter clamp stud	1	1A-C 101A-C
302	Fuel pump ball valve	1	4A-C 65-C
308	Governor sleeve pin spring	1	92A-C
310	Suction valve spring	1	9A-C
311	Fuel or gasoline throttle valve spring	2	4A-C
317	Exhaust valve spring	1	10A-C
319	Exhaust rod return spring	1	
321	Governor weight drag spring adjusting screw	1	92A-C
	Governor weight drag spring adjusting lock nut	1	92A-C

Before ordering parts, read the instructions on page 9.

Repair Parts List—Fairbanks-Morse Type "Z" Oil Engines

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
324	Oscillator trip spring	1	52-C
326	Butterfly valve stem arm spring	1	202A-C
327	Cylinder drain plug	1	1A-C 101A-C
328	Base drain plug	1	2A-C
329	Exhaust valve rocker arm return spring	1	39A-C
330	Water reservoir drain plug	1	178-C
331	Fuel reservoir drain plug	1	4A-C
332	Water reservoir float valve fulcrum pin	1	178-C
333	Oscillator trip fulcrum pin	1	52-C
400	Flywheel clamp stud with nuts	2	13 13A
	Flywheel clamp stud nuts	8	400
505	Main bearing grease cup	2	
506	Cam gear pin grease cup	1	
507	Governor grease cup	1	
509	Connecting rod compression grease cup	1	
521	Air damper fulcrum plug	1	4A-C
527	Cylinder oiler	1	
528	Cylinder priming cup	1	
	601A-C Circulating Pump	1	
601	Circulating pump bearing plate	1	
	Circulating pump packing nut (602), packing, flange to body gasket (638), flange to body cap screws, pump body (603A) with drain plug, impeller (606), impeller shaft (604), with key, pulley (605) with set screw, nipple bracket (609), clamping nut (608), pump to cylinder gaskets (610).		
602	Circulating pump packing nut	1	601A-C
603A	Circulating pump body with drain plug	1	601A-C
	Circulating pump body drain plug	1	601A-C
	Circulating pump body to flange cap screw	6	601A-C
604	Circulating pump shaft	1	601A-C
	Circulating pump impeller key	1	601A-C
605	Circulating pump pulley, with set screw	1	601A-C
	Circulating pump pulley set screw	1	601A-C
606	Circulating pump impeller	1	601A-C
607	Circulating pump drive pulley, with 2 bolt and lock washers	1	
	Circulating pump pulley bolts and lockwashers	2	
	Circulating pump drive belt	1	
608	Circulating pump clamping nut	1	601A-C
609	Circulating pump nipple bracket	1	601A-C
610	Circulating pump to cylinder gaskets	2	601A-C
638	Circulating pump body to flange gasket	1	601A-C
683	Circulating pump grease cups	2	
695	Oscillator complete (for separate repairs on this, see page —.	1	
696	Magneto only—complete (for separate repairs on this, see page 17)	1	
	697-C Exhaust Pot	1	
697	Exhaust pot, always fitted with drain plug	1	
	Exhaust pot cover (698) with packing gland studs and nuts, cover to pot gasket (699), cover to pot machine bolts with two washers each, outlet elbow (700A), outlet elbow gasket (701), outlet elbow capscrews, packing gland (702), packing inlet pipe (703).		
	Exhaust pot drain plug	1	697-C
	Exhaust pot to cover machine bolts with 2 washers each	9	697-C
698	Exhaust pot cover, always fitted with gland studs	1	697-C
	Exhaust pot cover gland studs	2	697-C
	Exhaust pot cover gland stud nuts	2	697-C
699	Exhaust pot cover gasket	1	697-C
700A	Exhaust pot outlet elbow	1	697-C

Before ordering parts, read the instructions on page 9.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
	Exhaust pot outlet elbow capscrews	2	697-C
701	Exhaust pot outlet elbow gasket	1	697-C
702	Exhaust pot inlet packing gland	1	697-C
703	Exhaust pot inlet pipe	1	
821	Air damper fulcrum spring	1	4A-C
855	Water throttle valve spring	1	178-C
	Springs		
300	Fuel pump plunger spring	1	4A-C
308	Governor sleeve pin spring	1	92A-C
310	Suction valve spring	1	9A-C
311	Fuel or gasoline throttle valve spring	2	4A-C
317	Exhaust valve spring	1	10A-C
319	Exhaust rod return spring	1	
324	Oscillator trip spring	1	52-C
326	Butterfly valve stem arm spring	1	202A-C
329	Exhaust valve rocker arm return spring	1	39A-C
821	Air damper fulcrum spring	1	4A-C
855	Water throttle valve spring	1	178-C
	Gaskets		
190	Cylinder to head gasket	1	
192	Cylinder head to butterfly valve casing or fuel reservoir gasket	2	
193	Cylinder to base gasket	1	
194	Cylinder to water reservoir gasket	1	
638	Circulating pump body to flange gasket	1	601A-C
610	Circulating pump body to cylinder gasket	2	601A-C
699	Exhaust pot cover gasket	1	697-C
701	Exhaust pot outlet elbow gasket	1	697-C
	Adjustable wrench	1	
	Tin funnel (½-pint)	1	
	Hand oil can	1	

Repair Parts List for Imp. Model 14 Magneto

Part No.	Name of Part
20018	Ground brush assembly.
20156	End plate screw.
20340	Magnet clamp.
20346	Terminal end bearing plate.
20353	Oil well tube screw.
20360	Drive end bearing plate.
20362	Top plate assembly.
20363	Oil wick assembly.
20633	Drive shaft lock washer.
20816	Lock washer for end plate screw No. 20156.
20819	Lock washer for magnet clamp screw No. 20852.
20822	Magnet (one only).
20831	Frame assembly (Base and two pole pieces).
20843	Armature assembly.
20852	Magnet clamp screw (without seal).
20858	Terminal cap screw (not shown).
20872	Terminal cap assembly complete.
20883	Magnet band.
20888	Drive shaft nut.
23322	Drive shaft Woodruff key.

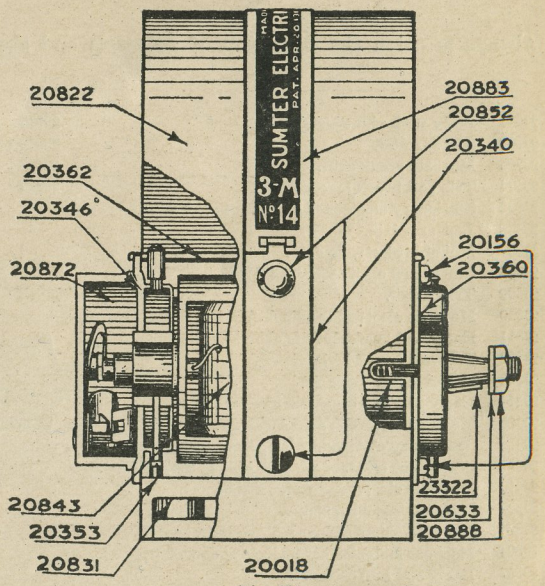
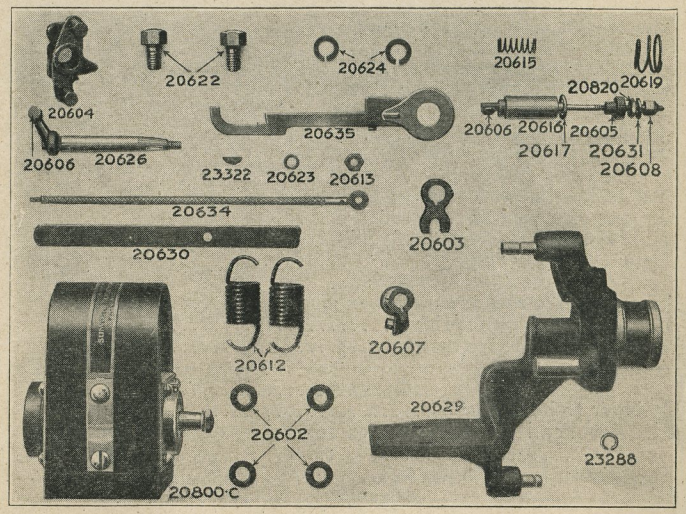


Fig. 674
Parts of Sumter Imp. Model 14 Magneto

Always give serial number and state whether magneto has oil well bearing end plates.

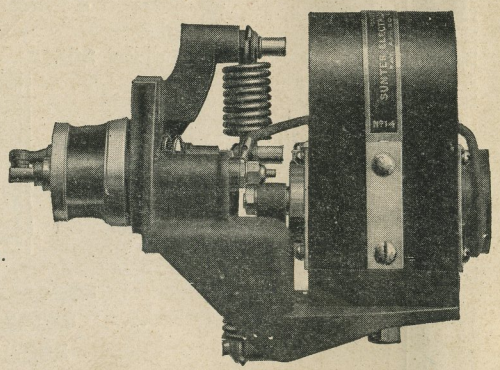


Repair Parts List Model "C" Oscillating Magneto

For 3 H. P. and Larger Type "Z" Engines

Always mention the **direction of rotation** and the **serial** number when ordering repairs.

20601 Body with pins assembled.
20602 Spring roller.
20603 Magneto crank arm.
20604 Trip and break lever.
20605 Stationary electrode insulating bushing.
20606 Igniter points.
20607 Movable electrode arm.
20608 Stationary electrode special nut.
20609 Trip finger.
20610 Movable electrode and point.
20611 Early and late eccentric plunger.
20612 Trip and break lever spring.
20613 Movable electrode nut.
20614 Early and late eccentric plunger spring.
20615 Movable electrode arm spring.
20616 Stationary electrode with point.
20617 Stationary electrode copper gasket (not shown).
20619 Movable electrode seating spring.
20622 Magneto fastening screw.
20623 Movable electrode nut lock washer.
20624 Magneto fastening screw lock washer.
20627 Early and late eccentric.
20630 Starting lever.
20634 Magneto terminal and wire.
20635 Trip finger assembly complete.
20800-C Magneto complete.
23288 Spring roller stud spring ring.
23322 Movable electrode woodruff key.



Model "C" Oscillating Magneto
Used on 3 H. P. and Larger Type "Z" Oil Engines

Fuel Reservoir

50. The fuel is pumped into the fuel reservoir (4, page 6), located on the side of the cylinder head, where a constant level is maintained, the overflow pipe carrying the surplus back to the supply tank. By means of a small nozzle (223, page 6) which terminates in the air suction passage, a small quantity of the fuel is drawn into the cylinder with the air on the intake stroke of the piston. The throttle valve adjustment determines positively the amount of fuel admitted into the cylinder for each charge. The location of the nozzle with respect to the butterfly valve (203, page 6) s of utmost importance and is such as to keep the mixture right, when the load changes.

Setting Gears

51. The cam gear is marked with two center punch marks on face of tooth. The pinion (29A page 6) on crank shaft has one tooth with two center punch marks. This tooth should come between the two marked ones on the large gear. (28 page 6.)

If engine is taken apart and the marks on gears cannot be found, or if old gear s replaced by a new one, the engine should be timed as follows:

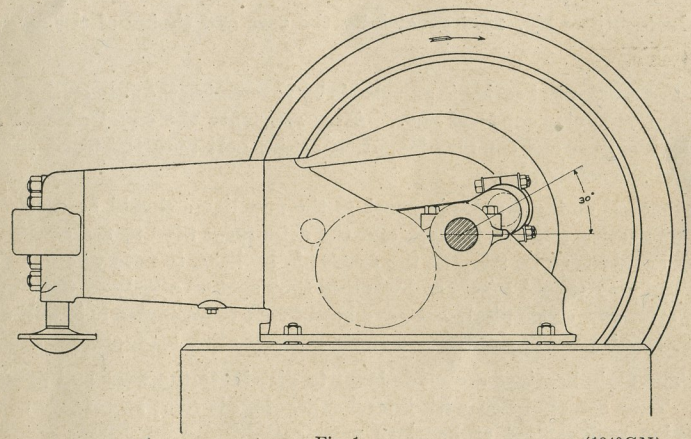


Fig. 1 (1840GN)
At this position of the crank on the exhaust stroke, the exhaust valve begins to open.

Valve Timing

Place the crank (25A page 6) in a vertical position and pointing up. Then set the cam gear with the nose of the cam straight up. Next see that there is about 1/16″ clearance between end of exhaust rod and adjusting screw in the valve rocker arm. Such a setting should bring the valve timing very nearly as described in paragraph 52 below. Adjust open and closing of valve by means of adjusting screw (55).

52. The cam should begin to open the exhaust valve 30° to 35° before outer dead center (Fig. 1840GN). The cam should close the exhaust valve when the crank AB is in the position shown in Fig. 1841GN, or about 5° above the inner dead center.

Care of Removing Cam Gear

53. If it is found necessary at any time to remove the cam gear, remove the nut on the cam gear stud on the inside of base, and by lightly driving on the end of stud it can be driven out through the gear. In replacing the cam gear be sure that the marked teeth mesh together, otherwise the engine will not be properly timed.

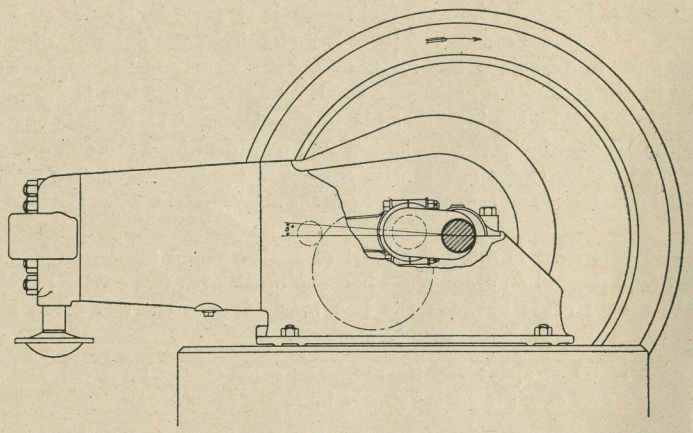


Fig. 2 (1841GN)

At this position of the crank on the suction stroke, the exhaust valve closes.

Magneto

54. Instructions No. 2479 cover fully the care and timing of the magneto and igniter.

Crank Pin Bearing

55. The crank pin bearing is adjustable by unscrewing the nuts on the connecting rod bolts and removing caps and liner. After removing the equal amount of shims from each side, liner and cap may be put on again, bolt nuts tightened and secured by means of the cotter pins.

Renewal

In a renewal of the crank pin bearing, the new liners should be carefully fitted into the connecting rod and its cap, and the shim faces filed to the general surface. The liners should then be tried on the crank pin by hand to note whether they have sufficient end play (about 1/64″) and whether they spot up evenly on the surface. In any case, after new crank pin liners have been fitted to an engine it is well to inspect them after running the engine for five or ten minutes at no load, and again after that.

56. The main bearings are made large to distribute the wear and to make them durable. They are equipped with interchangeable, die cast, accurately fitted bushings, making replacement of bearings very easy.

Main Bearing Adjustment

Adjustment is necessary when excessive play in the bearings can be detected by applying a bar under the flywheel. Vibration of the flywheels when the engine is in operation, may also indicate a necessity for main bearing adjustment. This should be made in the following manner: First remove the bearing cap, then lift off the upper half of the bearing liner. After removing the shell one or more of the thin metal shims between it and the lower shell may be removed from each side of the bearing, after which the top half of the bearing may be replaced and the cap again clamped down securely. End play can be adjusted by means of the flywheels. The end adjustment should not be brought up closer than with a play of 1/64″, which can be felt when moving the parts in question with a bar. After adjustments have been made and the engine is put into operation, the parts adjusted should be watched for a time to note whether the running temperature grows excessive.

Main Bearing Renewal

The main bearings may be completely renewed by first relieving the pressure of the crankshaft by means of a jack or bar under the flywheel, then proceeding as above and in addition, rolling out the lower half of the bearing liner or shell in the manner, which is self-evident on inspection. New liners which will interchange with those on the engines can be furnished from the factory.

To Remove Flywheel

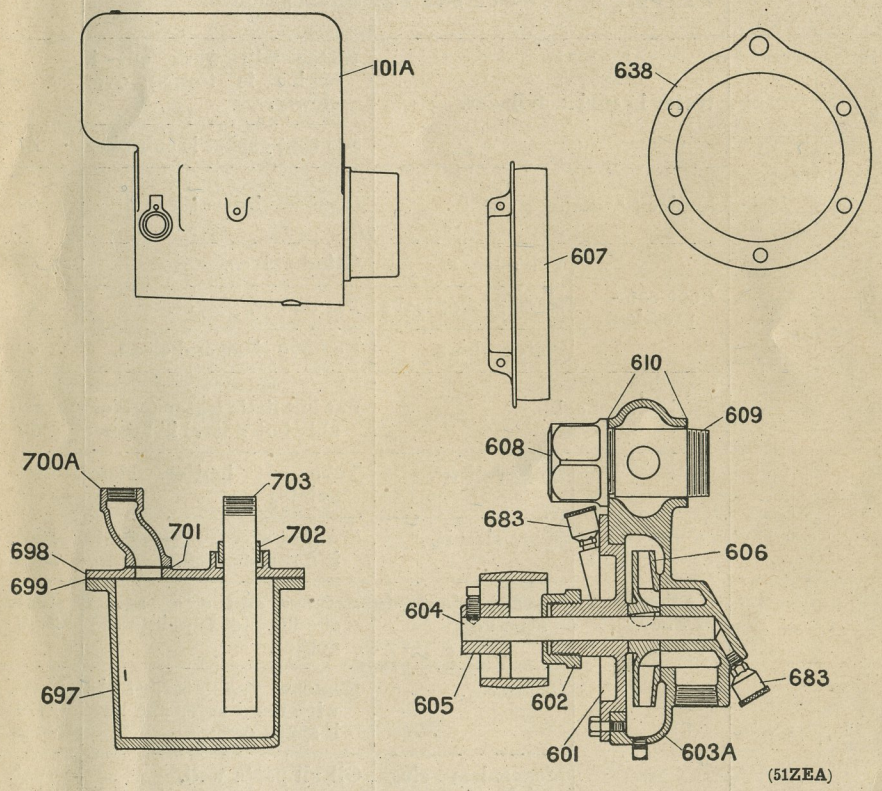
57. Loosen bolt and drive wedges into the split on each side of arms, generally the wheel is then loosened so it can be easily pulled off. If not, drive it by placing piece of hard wood against the inside hub of wheel. In replacing, tighten the bolt before driving the key.

Crank Shaft End Play

58. The flywheels should be slightly set out from main bearings so that there will be about 1/32″ end play to the shaft.

Removing Scale of Deposit

59. While the deposit or scale varies in character in different localities it can usually be removed by draining the engine cylinder jacket, and fitting the jacket with a solution consisting of one part commercial sulphuric acid to ten parts water. And leaving it stand over night. Most of the deposit can be washed out by draining out the water and allow it to run half an hour before starting the engine.



(51ZEA)

TROUBLE CHART

Trouble	Possible Cause	Remedy	See Paragraph
Engine will not start.	Instructions not followed.	Read and follow instructions.	16–30
	No fuel in tank.	Fill tank.	11–15
	Water in gasoline used in starting.	Strain gasoline.	
	Water in engine cylinder.	Water will work out if engine is turned over slowly.	
		See that gasket is unbroken	41
	Engine flooded.	Open suction valve.	29
	Poor compression. — Valve leaks.	Grind valves.	40
	Poor compression. — Head gasket leaks.	Put on new gasket.	41
	Poor compression. — Piston blows.	Remove rings and clean.	42
	Engine very cold.	Put but little water (preferably hot water) in hopper	19
	No Spark or Poor Spark. — Igniter dirty.	Take out igniter, clean points.	Inst. 2479
	No Spark or Poor Spark. — Short circuit.	See that wire from magneto is not grounded.	Inst. 2479
	No Spark or Poor Spark. — Movable electrode sticking.	Remove and clean spring should hold points together.	Inst. 2479
	No Spark or Poor Spark. — Oscillator.	Remove oscillator, trip with hand lever and note if spark occurs.	Inst. 2479
	No Spark or Poor Spark. — Mechanism sluggish.	Oil all parts well.	Inst. 2479
Engine misses fire after being started.	Ignition. — Mechanism sluggish.	Oil all parts.	Inst. 2479
	Ignition. — Short circuit.	Clean. See that insulation on wire is good.	Inst. 2479
	Ignition. — Igniter dirty.	Clean.	Inst. 2479

Trouble	Possible Cause	Remedy	See Paragraph
Engine knocks.	Igniter dirty.	Clean.	Inst. 2479
	Water in fuel collects in bottom of reservoir and fuel tank.	Drain water from reservoir through plug in bottom.	
		Pump water out of tank.	
	Fuel. — Dirty.	Clean out tank piping, reservoir and nozzle tube.	
	Fuel. — Throttle adjustment.	Carefully set throttle.	34
	Engine cold.	Keep temperature of jacket water to 160°.	9
	Hard Explosion.	Remove head and clean carbon.	41
		Open water throttle.	48
	Loose crank pin bearing.	Take up bearing.	55
	Loose flywheel.	Tighten bolts.	57
	Roller jumps on pawl.	Adjust spring when rollers are on low cam spring should be $6\frac{1}{4}''$ long.	
	Scale formation in jacket causes engine to overheat.	Clean out scale.	59
Engine runs irregularly.	Governor struck.	See that governor parts are free. Use kerosene to loosen.	45
		Adjust (33) spring.	45
	Weak exhaust valve spring.	Put washer under spring till new spring can be obtained.	
Engine tends to run away.	Butterfly may not close.	Adjust butterfly crank and governor travel.	46
	Excessive fuel causes engine to hit and miss.	Carefully set throttle.	34
Engine will not carry load.	Exhaust valve setting off.	Reset.	51–52
	Poor compression.	See "Engine will not start"	
	Late ignition.	Correct.	Inst. 2479
	Too rich mixture.	Adjust fuel throttle.	34
	Carbon in combustion space.	Remove head and clean.	41
	Silencer clogged.	Clean out.	
	Butterfly moved.	Reset.	46

Trouble Chart—Fairbanks-Morse Type "Z" Oil Engines

Trouble	Possible Cause	Remedy	See Paragraph
Engine uses too much fuel.	Throttle open too far.	Close.	34
	Poor compression.	See "Engine will not start."	40, 41, 42
	Late Ignition.	Time correctly.	Inst. 2479
	Exhaust valve setting off.	Reset.	52
	Exhaust pipe or silencer choked.	Clean.	
	Fuel drips from suction pipe. — Weak suction valve spring.	Lengthen spring by stretching small coils.	
	Fuel drips from suction pipe. — Friction spring too weak or too strong.	Bend spring or put on new one.	
Carbon forms.	Too much fuel.	Close throttle.	34
	Too much lubricating oil.	Adjust lubricator.	20
	Engine too cold.	See that engine is hot before turning on oil fuel.	34
		Keep temperature about 160°.	
Engine smokes.	Exhaust. — Too much lubricating oil.	Adjust lubricator.	20
	Exhaust. — Too much fuel.	Adjust fuel throttle.	34
	Piston. — Oil thrown into piston by crank.	Open crank case, drain clean out crank case.	
	Piston. — Piston blows.	Remove piston, clean rings, may need new rings.	42
Cylinder oiler will not feed properly.	Filler opening left open.	Screw in plug after filling.	20
	Piston blows.	Clean piston and rings, may need new rings.	42
Water boils away too rapidly.	Mixture too rich.	Close throttle.	34
	Late ignition.	Correct.	Inst. 2479
		Never let the water get below top of cylinder.	

First Edition 1218036

INSTRUCTIONS No. 2528

FOR SETTING UP AND OPERATING

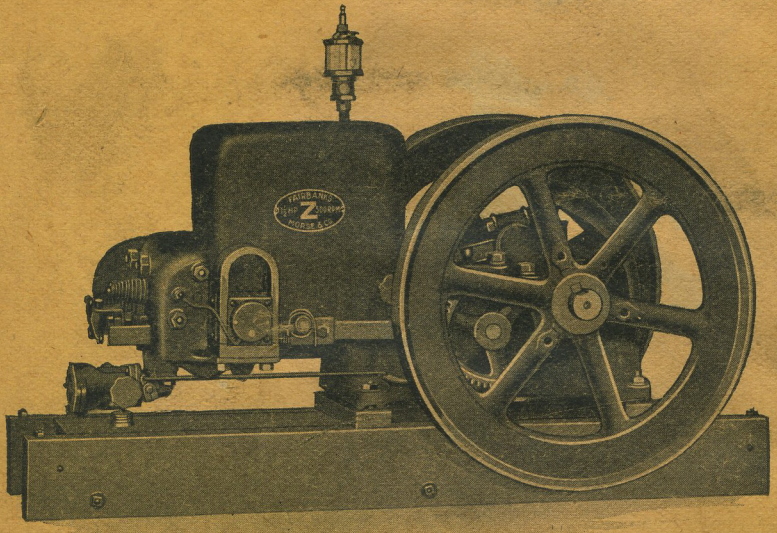
Fairbanks-Morse

1½ H. P. Type "Z"

Throttling Governor Oil Engines

1919 Pattern

This book should be carefully read before attempting to do anything with the engine



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FAIRBANKS, MORSE & CO.
(INCORPORATED)

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INSTRUCTIONS No. 2528

For Setting Up and Operating Fairbanks-Morse 1½ H. P. Type "Z" Oil Engines

1. Remove engine from crate, being careful to avoid damage. Screw oil cup 527, on cylinder oil pipe. Bolt the pulley on the flywheel opposite the governor using the bolts sent. With the Steel Pulleys small clips are furnished to catch inside the rim. Clean all parts. See that the governor parts are free from dirt or paint. Oil all moving parts and turn the flywheel over by hand slowly to see that all parts are free. **When Engine is Received**

2. If engine is to be put on a foundation, make this 4 feet long, 2 feet wide, 2 feet deep, setting 5/16" rods in position to match the bolt holes in the wood base under the engine. **Foundation**

3. If the engine is installed in a building the silencer (26A page 3), may be removed and an exhaust pipe attached and carried outside. It should be short and with few bends. When the pipe is long (20 feet) or has several elbows (4) the pipe should be increased in size. The silencer must be attached to the end of the pipe. **If Located in Building**

4. These engines can use as fuel, Gasoline, Motor Spirits, Kerosene and some Distillates. **Fuel**

5. Read the tags on the engine but do not remove them until you are familiar with its operation. **Read Tags**

WHAT TO DO BEFORE STARTING.

6. Fill fuel tank with the oil fuel.

7. Put water in hopper, but only enough at first to cover top of cylinder. In cold weather hot water will make the engine easier to start. **Fill Fuel Tank** **Cooling Water**

8. Fill oil cup (527, page 3), with good Gas Engine oil (we recommend Hytest) and adjust oiler to feed about eight drops per minute. See that the plug in the filling opening on the oil cup is provided with a good gasket and screwed in tight to prevent the oil being blown back. Gradually cut down oil feed as the engine becomes worn in until in a month, one-half the above quantities will do. Fill the three grease cups. Two (505, page 3) are on main bearings, and one (509A, page 3), is on the crank pin bearing. These should be screwed down one or two turns until grease is forced freely into bearings. **Oiling**

9. With a hand oil can go over the engine and oil the governor and all other places where there are oil holes, and where one part moves against another. In freezing weather squirt a little oil on piston until engine heats up. **Oil by hand**

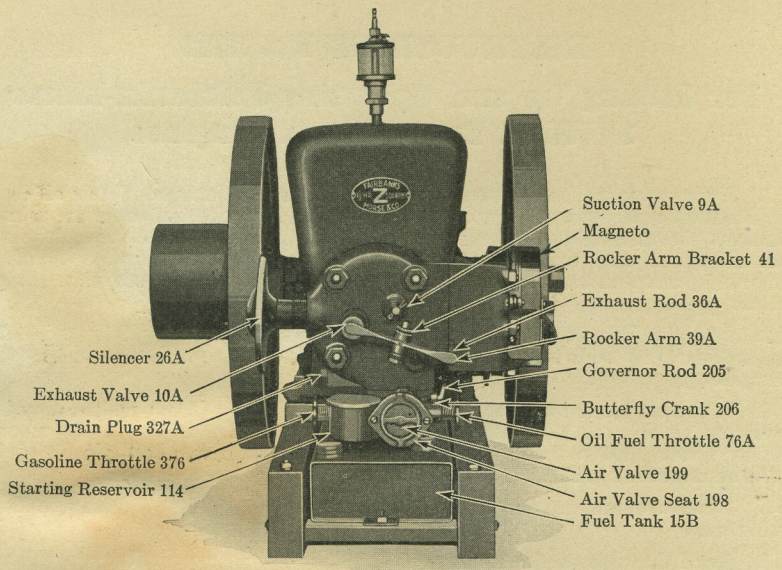
TO START ENGINE.

10. Fill reservoir (114) with gasoline. **Gasoline for Starting**

11. Close oil throttle (76A), open gasoline throttle valve (376, page 2) about one turn. If the engine is run on gasoline, throttle valve 76A may be used for starting as well as running. **Fuel Valve**

12. Holding the suction or upper valve open with the left hand, with the starter crank spin the engine. After getting the engine in motion, release the suction valve and close the air inlet opening in end of air suction fitting with fingers of left hand for one revolution only, and then remove fingers while still continuing to crank. If held longer, too much fuel will be drawn in. The mixture will not ignite if there is too much fuel in it. **Starting**

13. Too much fuel used in starting (particularly with a hot engine) will flood the engine. When flooded close the fuel throttle, relieve the compression by holding suction valve open with the finger and turn the flywheel over a number of revolutions in order to work out the excess fuel **Flooded Engine**



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AFTER THE ENGINE IS STARTED.

14. After the engine takes its first impulse, remove the starter crank; adjust the gasoline throttle valve to the point where engine runs best.

Running on Oil Fuel

15. The engine will usually run on oil fuel after using one reservoir full of gasoline. When engine is warm enough gradually open the oil throttle valve (76A) and close gasoline throttle valve (376). It is well to have the gasoline throttle valve slightly open until the engine is hot enough to run well on the oil fuel alone. After closing gasoline throttle the oil fuel throttle should again be adjusted to give as little fuel as the engine will run on and operate smoothly. The handle of the oil fuel throttle is marked at the factory when the engine is tested and should generally point down when the engine is in operation.

Fill Hopper

16. Fill water hopper two-thirds full and replenish this water as it boils away.

Tighten Nuts

17. Tighten cylinder head nuts after engine has been run and warmed up.

TO STOP ENGINE.

To Stop

18. To stop engine close throttle valve (76A), then close cylinder oiler (527, page 3) and in freezing weather, drain out the water.

DESCRIPTION OF PARTS OF ENGINE AND MANNER OF ADJUSTMENT

Valves

19. If either exhaust or suction valve sticks, squirt kerosene on the stem and work free.

Lost Compression

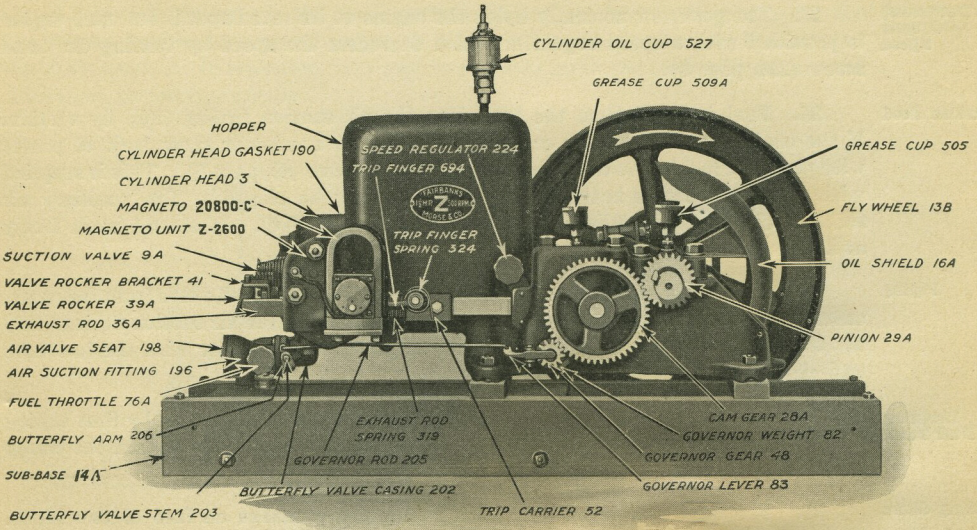
20. Should the engine at any time on starting turn too easily, it has lost compression because some leak is taking place. The suction valve as well as exhaust valve should be examined. If they seat tightly, examine piston (see paragraph 23).

Cleaning and Regrinding Valves

21. If it is necessary to grind suction or exhaust valve, the cylinder head (3) must be removed and the valves ground in with ground glass or fine emery and oil. Carefully clean both valve and seat with gasoline before replacing.

Gaskets

22. Asbestos gaskets hold better if covered with linseed or lubricating oil when applied. Before applying new gasket scrape off all of old one. After putting on new



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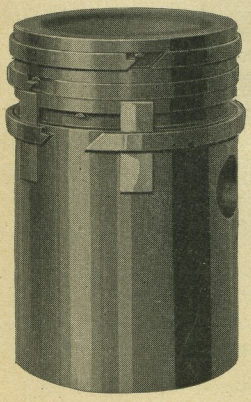
gasket (190) the nuts should be tightened again when engine is hot. Gasket material should be long fibre asbestos 3/64″ thick.



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To Remove Piston

23. After some months of use the piston may be removed to clean the rings. To do this take off shield and unbolt the rod. Turn crank to out position. The piston may now be withdrawn. Clean with gasoline or a hot solution of lye and water. Loosen the rings and clean the grooves. Oil the piston well before replacing. In replacing piston turn it bottom side up so that the stop pins can be seen, otherwise the rings may be broken. Be sure to turn it right side up before connecting up connecting rod otherwise the pin will get no oil. The rings can be removed from piston by taking three strips of tin about one-half inch wide and six inches long, slip one piece of tin under the middle of the ring and over the ring groove, then with the help of a screw driver the other strips can be slipped under the ends and the rings in turn slipped off the piston.

To Remove Piston Rings

Removing Piston Pin

24. To remove piston pin (7A) use screw driver to take out taper dowel pin screw (72). Force out taper dowel pin (71) from inside of hollow pin. This allows the pin to be driven out. In returning parts be sure to put the lock washer in between the lock pin and screw.

Action of Governor

25. The governor is fitted with a friction spring (33, page 8), the purpose of which is to steady the governor action. The force of the spring can be adjusted by small screw. If there is too much tension the governor will be slow to respond to change in load. If not enough tension, the engine will run irregularly.

Butterfly Valve

26. If it is necessary for any reason to reset the butterfly crank arm (206, page 3) remove the air suction fitting first so that the butterfly (203) can be seen. Take cotter pin out of butterfly crank end of governor rod (205, page 3), remove end of governor rod (205) from crank (206, page 3), Pull one governor weight (82) out as far as it will go and then put a wedge under it to hold it in that position. Slightly loosen clamp screw of crank (206). Close butterfly with finger and set crank (206) pointing up so that governor rod lacks 1/16″ from going in hole of crank. Remove wedge from under governor weight. Tighten clamp screw of crank (206) and reassemble parts removed. If these instructions are followed the engine cannot run away.

Decreasing Engine Speed

27. The governor normally holds the engine at its rated speed, but each engine is provided with a speed regulator which decreases the speed by turning the head screw (224, page 3).

Suction Feed

28. Fuel is lifted from the tank into the air suction fitting (196) by suction. If the engine should miss fire or back fire in the air suction or show lack of power with plenty of fuel in the tank, examine the check valve (89, page 9). This is supplied with a fine wire screen in the lower end which may be clogged. The auxiliary air suction valve is at the inlet of the air suction fitting (196). It should work freely at all times.

Piping

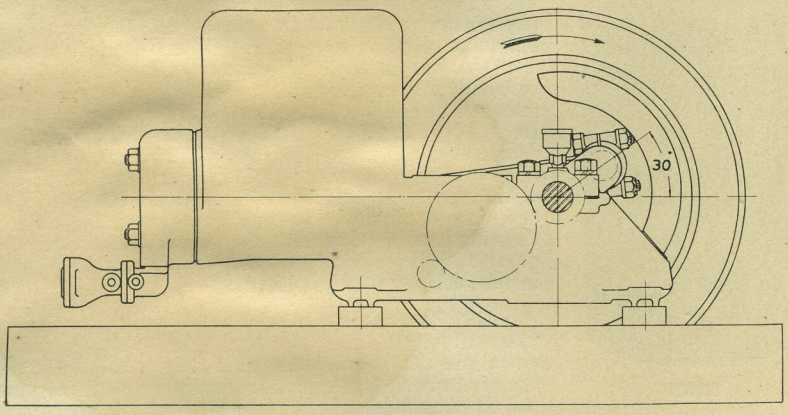
29. If it should be necessary to remove fuel piping and check valve from fuel tank, unscrew the cap (47) and take out the two screws, holding the air suction fitting (196) to butterfly valve casing (202). The air suction fitting together with the fuel tube and check valve can then be removed.

Draining Fuel Tank

30. If water collects in bottom of fuel tank this can be taken out by first taking off the air suction fitting with fuel tube (see paragraph 29). Then loosen the clamp bolts holding tank, and take it out.

Setting Gears

31. The cam gear is marked with center punch marks on face of two teeth. The pinion (29A page 3) on crank shaft has one tooth with two center punch marks. This tooth should come between the two marked ones on the large gear (28A, page 3). If engine is taken apart and the marks on gears cannot be found, or if old gear is replaced by a new one, the engine should be timed as follows:



(40ZA)

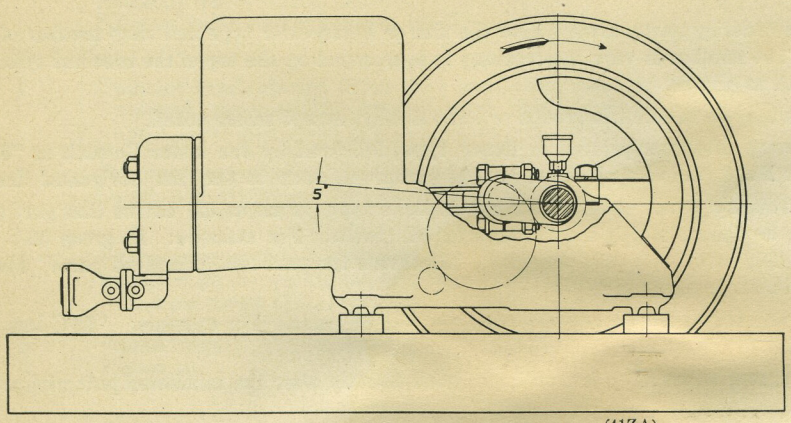
Valve Timing

32. Turn the engine to where the crank (25A, page 9) is straight up and pointing up. Then set the cam gear with the nose of the cam straight up. Next see that there is about 1/16″ clearance between end of exhaust rod and the valve rocker arm. Adjust to this clearance by the two nuts on rocker bracket stud (42A). Such a setting should bring the valve timing very nearly as described in paragraph 33.

33. The cam should begin to open the exhaust valve 30° to 35° before outer dead center (40ZA). The cam should close the exhaust valve when the crank is in position shown in Fig. (41ZA) or about 5° above the inner dead center. The valve can be turned with the fingers, when it is lifted from its seat.

Removing Cam Gear

34. In order to remove the cam gear first take off the igniter, then take out the two screws holding cam gear bracket to base. All parts attached to bracket can then be inspected. In replacing, take care to properly mesh the teeth of cam gear and crankshaft pinion (paragraph 31).



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Bearing Adjustment

35. Crank shaft bearings can be adjusted by unbolting parts and removing one or two of the thin shims provided. In reassembling, the bolts must be drawn up tight and the shaft must turn perfectly free.

Renewals

36. These bearings all have removable linings which may be renewed. A little fitting and scraping of the new linings may be needed to make them fit the shaft nicely.

Temperature of Cooling Water

37. The water should never be allowed to fall as low as the top of the cylinder wall, as the cylinder will get too hot. It is expected that the water will boil under heavy load. Put in more water as it boils away.

Engine Jacket Broken by Freezing

38. The engine jacket is liable to be broken by freezing if water is left in during cold weather unless non-freezing solution is used.

Non-freezing Solution

39. A non-freezing mixture of calcium chloride and water may be used in the jacket. Three pounds of calcium chloride to each gallon of water will not freeze solid at Zero Fahrenheit. It is advisable, however, to drain the jacket in freezing weather when the engine is not in use.

Removing Scale or Deposit

40. While the deposit or scale varies in character in different localities it can usually be removed by draining the engine cylinder jacket, and filling the jacket with a solution consisting of one part commercial sulphuric acid to ten parts water. Allow to stand over night and then wash out with fresh water.

Magneto

41. Instructions No. 2530 cover the care and timing of the magneto and igniter.

REPAIR PARTS LIST

For Fairbanks-Morse 1½ H. P. Throttling Governor Type "Z" Oil Engine

When ordering parts, always give the size or horsepower type and shop number of the engine. The number is very important. It is stamped on the top of the base and cylinder. Do not fail to give it.

Parts may be ordered in groups or individually, except where noted.

A **Group Number** printed in **heavy type,** followed by the letter C, such as **"3A-C Cylinder Head,"** covers all items in that paragraph down to the first horizontal line.

An ordinary repair number printed in light type (such as 52) covers that part only, including any parts which are "always fitted" to fit. For example: In group 52-C No. 334, 324, 694, covers one part only, but, "52 covers the part No. 52 and all parts" always fitted to it.

A group may be ordered, less certain specified parts. For example: "52-C less Nos. 334 and 634."

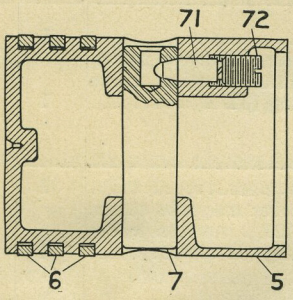
Any part without a repair number is listed directly after the numbered part with which it is used.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
	1A-C Cylinder and Base	1	
1A	Cylinder and base, always fitted with head studs, main bearing cap (12), with cap screws and lock washers, main bearing shims (126 and 126A)	1	
	Main bearing liners (23A).		
	Cylinder to head studs	4	**1A-C**
	Cylinder to head stud nuts	4	
	Cylinder to subbase bolts	4	
	Cylinder to subbase bolt nuts	4	
	Cylinders to subbase washers	4	
	3-A Cylinder Head	1	
3	Cylinder head, always fitted with oscillating magneto studs, exhaust valve rocker bracket stud (42A), suction valve (9A-C), exhaust valve (10A-C), drain plug (327A)	1	
	Cylinder head to oscillating magneto studs	2	**3-C**
	Cylinder head to oscillating magneto stud nuts	2	**3-C**
	Exhaust valve rocker bracket stud nut	1	**3-C**
	Exhaust valve rocker bracket stud jam nut	1	**3-C**
	3A-C Cylinder Head	1	
3	Cylinder head, always fitted with oscillating magneto studs, exhaust valve rocker bracket stud (42A), suction valve (9A-C), exhaust valve (10A-C), drain plug (327A)	1	
	Butterfly valve casing (202-C).		

Before ordering parts, read the instructions above.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
3	**3B-C Cylinder Head**	1	
	Cylinder head, always fitted with oscillating magneto studs, exhaust valve rocker bracket stud (42A), suction valve (9A-C), exhaust valve (10A-C), drain plug (327A)	1	
	Butterfly valve casing (202-C).		
	Exhaust valve rocker bracket (41-C).		
3	**3C-C Cylinder Head**	1	
	Cylinder head, always fitted with oscillating magneto studs, exhaust valve rocker bracket stud (42A), suction valve (9A-C), exhaust valve (10A-C), drain plug (327A)	1	
	Butterfly valve casing (202-C).		
	Exhaust valve rocker bracket (41-C).		
	Oscillating Magneto (Z-2600).		
5	**5-C Piston**	1	
	Piston, always fitted with ring stop pins	1	
	Piston rings (6), piston pin (7), piston pin taper lock pin (71), lock pin screw (72), lock pin screw lock washer.		
6	Piston rings	3	5-C
7	Piston pin	1	5-C
9A	**9A-C Suction Valve**	1	3-C
	Suction valve with cotter	1	
	Suction valve spring (310).		
10A	**10A-C Exhaust Valve**	1	3-C
	Exhaust valve	1	
	Exhaust valve spring (317), spring collar (11A), spring collar lock (122).		
11A	Exhaust valve spring collar	1	10A-C
12	Main bearing caps	2	1A-C
	Main bearing cap cap screws	4	1A-C
	Main bearing cap cap screw lock washers	4	1A-C
13B	Flywheel, always fitted with clamp bolt	2	
	Flywheel clamp bolt	2	13B
14A	**14A-C Subbase**	1	
	Subbase, always fitted with engine fill-up pieces (234), subbase spacer (233), spacer bolts, end bolts, name plate (195A)	1	
	Fuel tank (15B), fuel tank clips (104), fuel tank clip bolts.		
15B	**15-B Fuel Tank**	1	
	Fuel tank, always fitted with filler opening cap (44)	1	
16A	**16-A Oil Shield**	1	
	Oil shield, always fitted with oil shield brackets	1	
17	Piston pin bushing	1	18-C
18	**18-C Connecting Rod**	1	
	Connecting rod, always fitted with connecting rod cap (20), piston pin bushing (17)	1	
	Connecting rod shims (110-110A), connecting rod bolts (150), connecting rod bolts nuts (151), connecting rod bolt cotters, connecting rod crank pin liners (176).		

Before ordering parts, read the instructions on page 5.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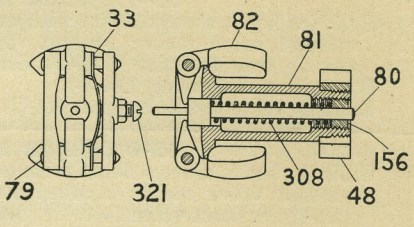
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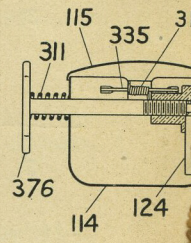
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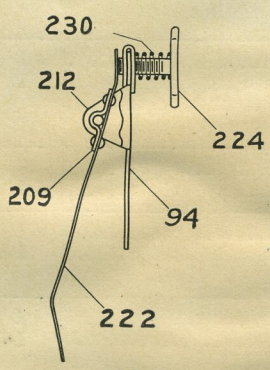
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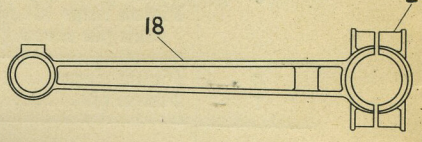
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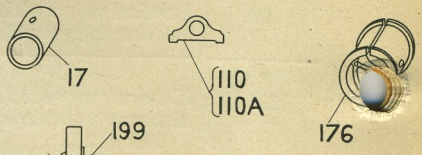
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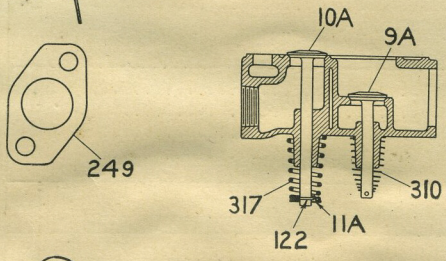
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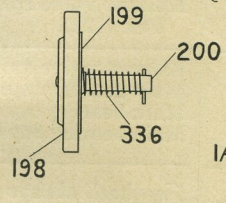
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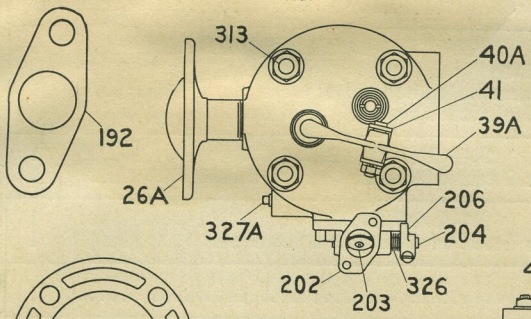
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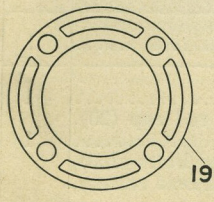
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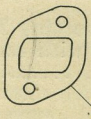
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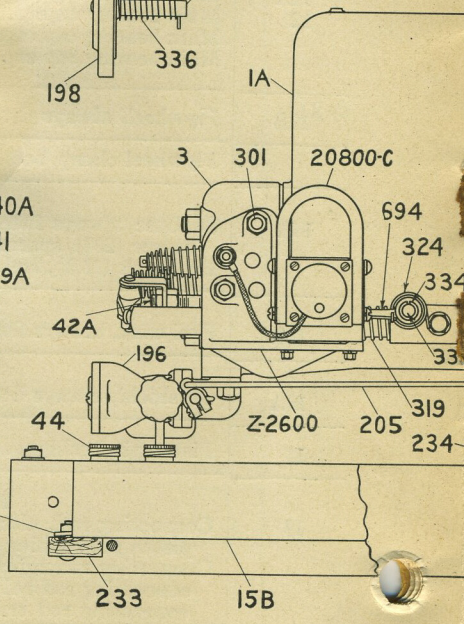
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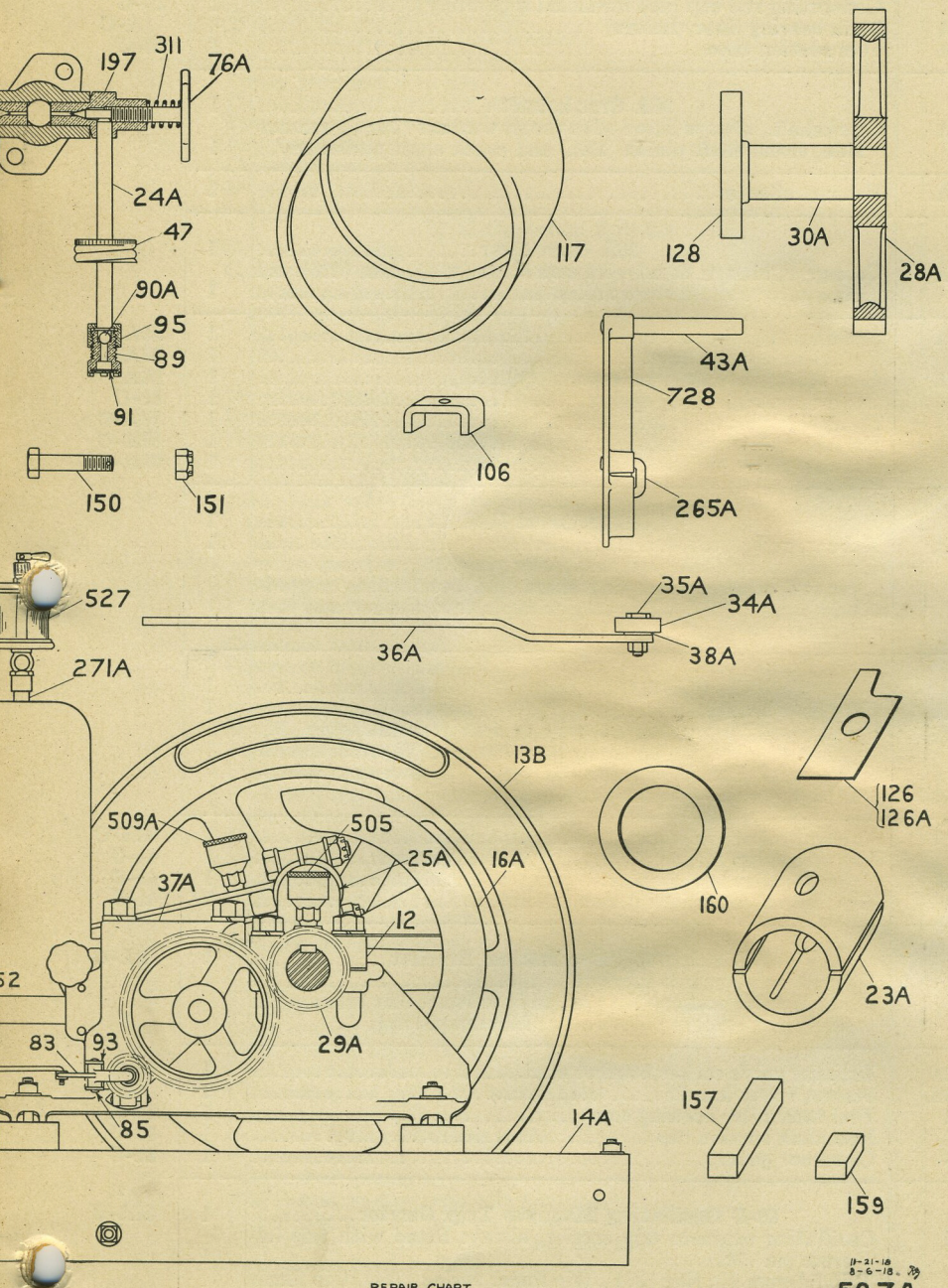


REPAIR CHART
FOR 1½ HP. TYPE "Z" ENGINE — 1919 PATTERN

11-21-18
8-6-18.
50 ZA

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
20	Connecting rod cap (not furnished separately)	1	18-C
23A	Main bearing liner (halves)	4	1A-C
24A	Fuel suction tube	1	89-C
	25A Crankshaft	1	
25A	Crankshaft, always fitted with thrust washers (160), governor side, crank shaft pinion (29A) and crank shaft pinion key	1	
26A	Exhaust silencer	1	
	28A Cam Gear	1	
28A	Cam gear, always fitted with cam shaft (30A), cam (128) and cam gear to shaft screw	1	
29A	Crankshaft pinion	1	25A
	Crankshaft pinion key	1	25A
30A	Cam shaft (not furnished separately)	1	28A
33	Governor weight drag spring	1	81-C
34A	Exhaust roller	1	36A-C
35A	Exhaust roller pin	1	36A-C
	Exhaust roller pin nut	1	36A-C
	36A-C Exhaust Rod	1	
36A	Exhaust rod	1	
	Exhaust roller (34A), exhaust roller pin (35A), exhaust roller pin nut, exhaust roller pin washer (38A), oscillating magneto trip carrier (52-C), trip carrier cap screw, washer and lock washer.		
	37A-C Cam Gear Bracket	1	
37A	Cam gear bracket	1	
	Speed regulator bracket (94) with screws, governor lever (83), governor lever pin, governor lever bracket (93) with screws, cam gear (28A), exhaust rod (36A-C), governor spindle (81-C), speed regulator (209-C).		
38A	Exhaust roller pin washer	1	36A-C
39A	Exhaust valve rocker	1	41-C
40A	Exhaust valve rocker fulcrum pin	1	41-C
	Exhaust valve rocker fulcrum pin nut	1	41-C
	41-C Exhaust Valve Rocker Bracket	1	3B-C
41	Exhaust valve rocker bracket	1	
	Exhaust valve rocker (39A), exhaust valve rocker fulcrum pin (40A) and exhaust valve rocker fulcrum pin nut.		
42A	Exhaust valve rocker bracket stud	1	3-C
43A	Starter crank handle	1	728
44	Fuel tank filler opening cap	1	15-A
47	Fuel tank suction cap	1	89-C
48	Governor gear	1	81-C
	52-C Oscillating Magneto Trip Carrier	1	36A-C
52	Oscillating magneto trip carrier, always fitted with trip fulcrum pin (333)	1	
	Trip fulcrum pin ring (334), trip finger spring (324), trip finger (694).		

Before ordering parts, read the instructions on page 5.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
	Trip carrier cap screw	1	
	Trip carrier cap screw washer	1	
	Trip carrier cap screw lock washer	1	
71	Piston pin taper lock pin	1	5-C
72	Piston pin taper lock pin screw	1	5-C
	Piston pin taper lock pin lock washer	1	5-C
76A	Fuel throttle valve	1	196-C
79	Governor weight pins	2	81-C
80	Governor sleeve pin	1	81-C
	81-C Governor Spindle	1	37A-C
81	Governor spindle	1	
	Governor sleeve pin (80), governor weights (82), governor weight spring (308), governor weight spring adjusting screw (156), governor weight drag spring (33), drag spring adjusting screw and nut, governor gear (48), governor weight pins (79).		
82	Governor weights	2	81-C
83	Governor lever	1	37A-C
85	Governor lever fulcrum pin	1	37A-C
	89-C Fuel Check Valve	1	
89	Fuel check valve body, always fitted with strainer (91), fuel suction tube (24A), suction tube connection (95), check valve ball (90A).		
90A	Fuel check valve ball	1	89-C
91	Fuel check valve strainer (not furnished separately)	1	89-C
93	Governor lever bracket	1	37A-C
	Governor lever screw	1	37A-C
	Governor lever screw lock washer	1	37A-C
94	Speed regulator bracket	1	37A-C
	Speed regulator bracket screws	2	37A-C
	Speed regulator bracket screw lock washers	2	37A-C
95	Fuel suction tube connection	1	89-C
104	Fuel tank clips	2	232-C
	Fuel tank clip bolts with nuts	2	232-C
106	Pulley clips	3	
	Pulley clips to flywheel bolts	3	
	Pulley clip to flywheel bolt nuts	3	
110	Connecting rod shims (thick)	2	18-C
110A	Connecting rod shims (thin)	6	18-C
114	Starting reservoir (not furnished separately)	1	196-C
115	Starting reservoir cover	1	196-C
117	Pulley	1	
122	Exhaust valve spring collar lock	1	10A-C
124	Starting fuel suction tube (not furnished separately)	1	196-C
126	Main bearing shims (thick)	4	1A-C
126A	Main bearing shims (thin)	12	1A-C
128	Cam (not furnished separately)	1	28A-C
150	Connecting rod bolt with cotter only	2	18-C
151	Connecting rod bolt nut	2	18-C
156	Governor spring adjusting screw	1	81-C
157	Flywheel keys	2	
159	Crank shaft pinion key	1	
160	End thrust washer (opposite governor)	1	
160	End thrust washer (governor side)	2	25-A
176	Connecting rod crank pin bearing (halves)	2	18-C
190	Cylinder to head gasket	1	
192	Head to butterfly valve casing gasket	1	
195A	Name plate	1	232-C

Before ordering parts, read the instructions on page 5.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
	196-C Air Suction Fitting	1	
196	Air suction fitting, always fitted with throttle valve seats (197), starting reservoir (114), starting reservoir cover (115), starting reservoir cover spring (314), starting fuel tube (124), starting reservoir cover pin (335)	1	
	Fuel throttle (76A), starting fuel throttle (376), fuel tank suction opening cap (47), fuel suction tube (89-C), auxiliary air valve seat (198-C).		
197	Fuel throttle valve seat (not furnished separately)	2	196-C
	198-C Auxiliary Air Valve Seat	1	196-C
198	Auxiliary air valve seat, always fitted with air valve guide (200)	1	
	Auxiliary air valve (199), air valve spring (336), air valve guide, cotter.		
	Auxiliary air valve seat to air suction fitting screws	2	
199	Auxiliary air valve	1	198-C
200	Auxiliary air valve guide (not furnished separately)	1	198-C
	Auxiliary air valve guide cotter	1	
	202-C Butterfly Valve Casing	1	
202	Butterfly valve casing	1	
	Butterfly valve (203), butterfly valve stem (204), butterfly valve to stem screw and lock washer, butterfly valve stem arm (206), butterfly valve stem arm screw, butterfly valve spring (326).		
	Butterfly valve casing to air suction fitting screws	2	
	Butterfly valve casing to head cap screws	2	
203	Butterfly valve	1	202-C
204	Butterfly valve stem	1	202-C
	Butterfly valve stem screw	1	202-C
	Butterfly valve stem lock washer	1	202-C
205	Governor pull rod with 2 cotters	1	
206	Butterfly valve stem arm with clamp screw	1	202-C
	Butterfly valve stem arm clamp screw	1	202-C
	209-C Speed Regulator Lever	1	
209	Speed regulator lever, always fitted with speed regulator leaf spring (222)	1	
	Speed regulator adjusting screw (224), adjusting screw spring (230).		
212	Speed regulator lever fulcrum pin	1	
222	Speed regulator leaf spring (not furnished separately)	1	209-C
224	Speed regulator adjusting screw	1	209-C
230	Speed regulator adjusting screw spring	1	209-C

Before ordering parts, read the instructions on page 5.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	Number Pieces Used	Included in Group No.
233	Subbase spacers	2	14A-C
	Subbase spacer bolts	2	14A-C
	Subbase spacer bolt nuts	2	14A-C
	Subbase spacer bolt washers	2	14A-C
234	Subbase to engine fill-up pieces	2	14A-C
	Subbase end bolts	4	14A-C
	Subbase end bolt nuts	4	14A-C
	Subbase end bolt washers	4	14A-C
249	Air suction fitting gasket	1	
250	Oscillating magneto to head gasket	1	
265A	Starter crank pawl	1	728
271A	Cylinder oiler pipe	1	
301	Oscillating magneto studs	2	3-C
308	Governor weight spring	1	81-C
310	Suction valve spring	1	9A-C
311	Fuel throttle valve spring		196-C
313	Cylinder head studs	4	1-C
314	Starting reservoir cover spring	1	196-C
317	Exhaust valve spring	1	10A-C
319	Exhaust rod return spring	1	
321	Governor weight drag spring adjusting screw	1	81-C
324	Oscillating magneto trip torsion spring	1	52-C
326	Butterfly valve shaft torsion spring	1	202-C
327A	Cylinder head drain plug	1	3-C
333	Oscillating magneto trip fulcrum pin (not furnished separately)	1	
334	Oscillating magneto trip fulcrum pin ring		52-C
335	Starting reservoir cover pin	1	196-C
336	Auxiliary air valve spring	1	198-C
505	Main bearing grease cup	2	
509A	Connecting rod grease cup	1	
527	Cylinder oiler	1	
694	Oscillating magneto trip finger	1	52-C
Z-2600	Oscillating magneto unit, complete, less magneto. (For separate repairs on this, see Instruction Book No. 2530)	1	
20800-C	Magneto only, complete. (For separate repairs on this, see Instruction Book No. 2530)	1	
728	Starter crank always fitted with handle (43) and pawl (265A).		
	Springs		
308	Governor weight spring	1	81-C
310	Suction valve spring	1	9A-C
311	Throttle valve springs	2	196-C
314	Starting reservoir cover spring	1	196-C
317	Exhaust valve spring	1	10A-C
319	Exhaust rod spring	1	
324	Oscillating magneto trip torsion spring	1	52-C
326	Butterfly valve torsion spring	1	202-C
336	Auxiliary air valve spring	1	198-C
	Gaskets		
190	Cylinder head gasket	1	
192	Cylinder head to butterfly valve casing gasket	1	
249	Air suction fitting gasket	1	
250	Oscillating magneto gasket	1	
	Tools		
	Large wrench	1	
	Small wrench	1	

Before ordering parts, read the instructions on page 5.

TROUBLE CHART

Trouble	Possible Cause		Remedy	See Paragraph
Engine will not start.	Instructions were not followed.		Read and follow instructions.	6–13
	No fuel in tank.		Fill tank.	6
	Water in gasoline used in starting.		Separate water.	
	Water in engine cylinder.		Water will work out if engine is turned over slowly several times.	
			See that gasket is unbroken.	22
	Engine flooded.		Close fuel throttle and crank engine.	13
	Poor compression.	Valve leaks.	Grind valves.	21
		Head gasket leaks.	Put on new gasket.	22
		Piston blows.	Remove rings and clean.	23
	Engine very cold.		Put little water in hopper (preferably hot water).	7
	No spark or poor spark.	Oscillator.	Remove oscillator; trip with hand lever and note if spark occurs.	Inst. 2530
		Mechanism sluggish.	Oil all parts well and loosen with kerosene.	Inst. 2530
		Igniter dirty.	Take out igniter; clean points.	Inst. 2530
		Short circuit.	Clean insulated electrode.	Inst. 2530
		Movable electrode sticking.	Remove and clean. Spring should hold points together.	Inst. 2530
Engine misses fire after being started.	Ignition.	Mechanism sluggish.	Oil all parts.	Inst. 2530
		Short circuit.	Clean. See that insulation on wire is good.	Inst. 2530
		Igniter dirty.	Clean.	Inst. 2530
Engine uses too much fuel.	Throttle open too far.		Close partly.	15
	Poor compression.		See "Engine will not start."	21, 22, 23
	Late ignition.		Time correctly.	Inst. 2530

Trouble Chart—Fairbanks-Morse Type "Z" Oil Engines

Trouble	Possible Cause	Remedy	See Paragraph
Engine uses too much fuel. (continued)	Exhaust valve setting off.	Reset.	33
	Exhaust pipe or silencer choked.	Clean.	
	Fuel drips from suction pipe. — Weak suction valve spring.	Lengthen spring by stretching. Order new spring.	
Carbon forms.	Too much fuel.	Close throttle partly.	15
	Too much lubricating oil.	Adjust lubricator.	8
	Engine too cold.	See that engine is hot before turning on oil fuel.	15
Engine smokes.	Exhaust. — Too much lubricating oil.	Adjust lubricator.	8
	Exhaust. — Too much fuel.	Adjust fuel throttle.	15
	Piston. — Piston blows.	Remove piston; clean rings; may need new rings.	23
Cylinder oiler does not feed properly.	Filler opening left open.	Screw in plug after filling.	8
	Piston blows.	Clean piston and rings; may need new rings.	23
Water boils away too rapidly.	Mixture too rich.	Close throttle.	15
	Late ignition.	Correct.	Inst. 2530
		Never let the water get below top of cylinder.	
Engine misses fire after being started.	Igniter dirty.	Clean.	Inst. 2530
	Water in fuel collects in bottom of fuel tank.	Remove water from tank.	30
	Fuel. — Dirty.	Clean out tank, check valve	31
	Fuel. — Throttle adjustment.	Carefully set throttle.	15
	Engine cold.	Use less water.	7
Engine knocks.	Hard explosion.	Remove head and clean carbon.	21
	Loose crank pin bearing.	Take up bearing.	36
	Roller jumps on cam.	See that rod slides freely.	
	Scale formation in jacket causes engine to overheat.	Clean out scale.	40

Trouble Chart—Fairbanks-Morse Type "Z" Oil Engines

Trouble	Possible Cause	Remedy	See Paragraph
Engine runs irregularly.	Governor stuck.	See that governor parts are free. Use kerosene to loosen.	25
		Adjust (33) spring.	25
	Weak exhaust valve spring.	Put washer under spring till new spring can be obtained.	
	Auxiliary air valve.	See that valve moves freely and spring is not broken.	28
Engine tends to run away.	Butterfly may not close.	Adjust butterfly crank and governor travel.	26
Engine will not carry load.	Exhaust valve setting off.	Reset.	32, 33
	Poor compression.	See "Engine will not start."	21, 22, 23
	Late ignition.	Correct.	Inst. 2530
	Too rich mixture.	Adjust fuel throttle.	15
	Carbon in combustion space.	Remove head and clean.	21
	Silencer clogged.	Clean out.	
	Butterfly moved.	Reset.	26
	Scale formation in jacket causes engine to overheat.	Clean out scale.	40

INSTRUCTIONS No. 2532 FOR STARTING 1½ H. P. THROTTLING GOVERNOR TYPE "Z" ENGINE

(1) **FILL 3 GREASE CUPS**

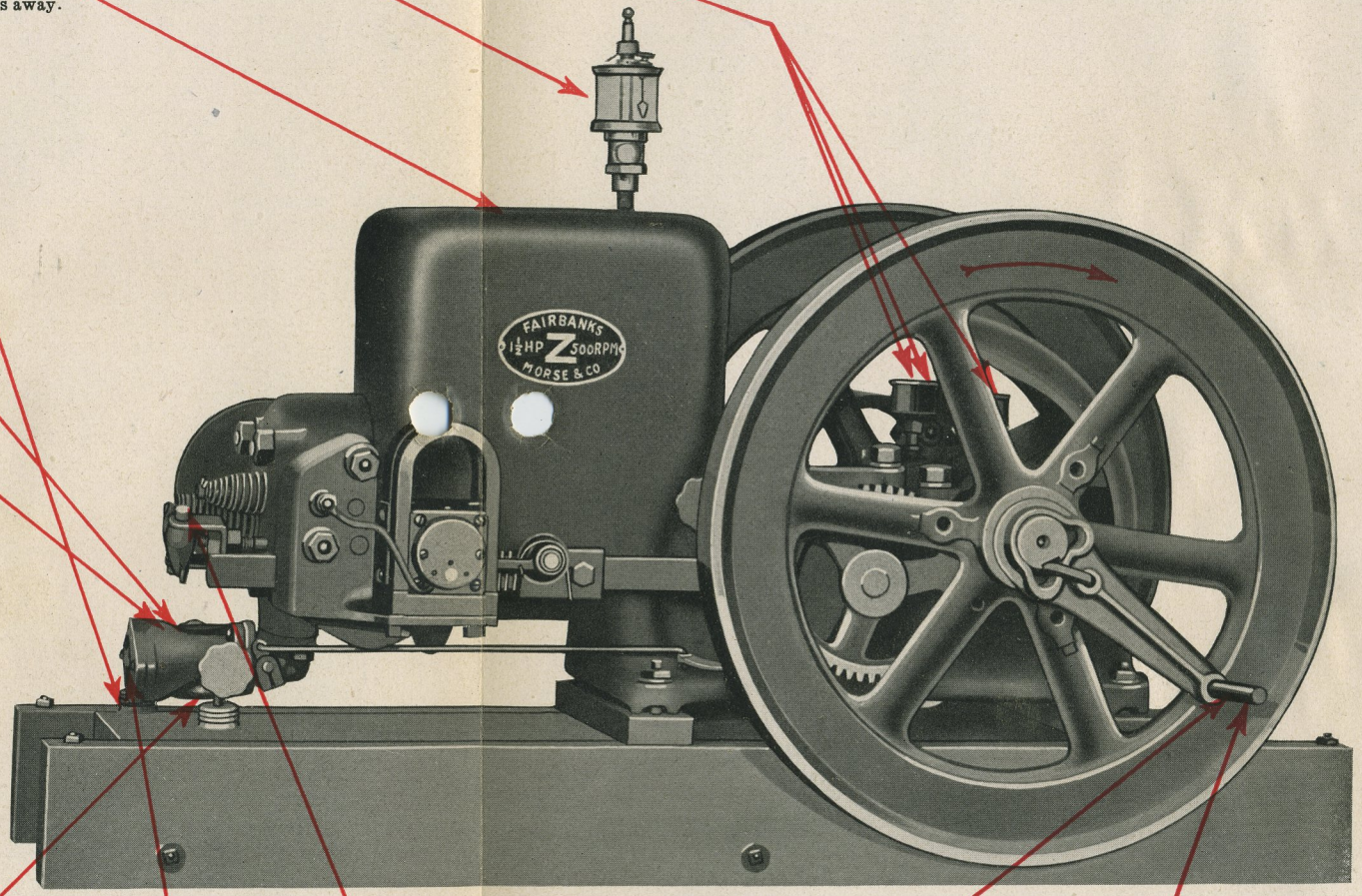
(2) **FILL OIL CUP AND ADJUST FLOW**

(3) **PUT WATER IN HOPPER** to just cover cylinder, using hot water in winter. When engine has run awhile fill two-thirds full and add more as water boils away. Never let it get below top of cylinder.

(4) **FILL OIL FUEL TANK**

(5) **FILL GASOLINE RESERVOIR**

(6) **OPEN GASOLINE THROTTLE** about one turn. As soon as engine starts set this where engine runs best.



(7) **HOLD SUCTION VALVE OPEN** and spin engine with starter crank. Release valve after one or two turns, then close air suction with fingers for one suction, then remove fingers continuing to crank. Engine will be flooded if suction is closed too long.

(8) **REMOVE STARTER CRANK**

(9) **AS ENGINE HEATS UP**, gradually open oil fuel throttle and close gasoline throttle. Adjust to point where engine runs best.

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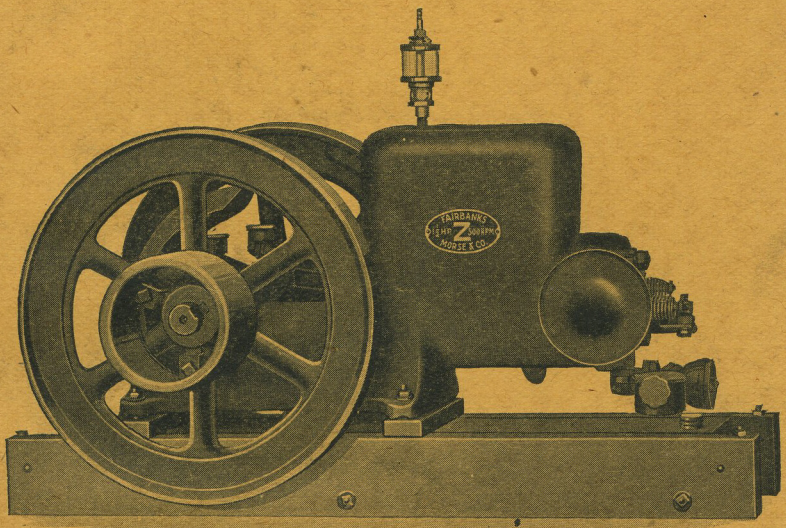
Fairbanks-Morse Type "Z" Oil Engines



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INSTRUCTIONS NO. 2548A

FOR SETTING UP AND OPERATING

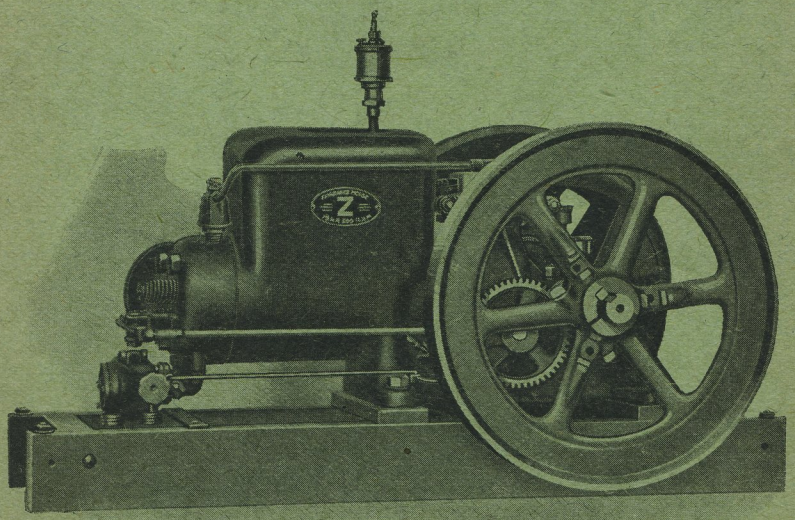
Fairbanks-Morse

1½, 3 and 6 H. P. "Z"

Throttling Governor Engines

Model "ZA"

This book should be carefully read before attempting to do anything with the engine



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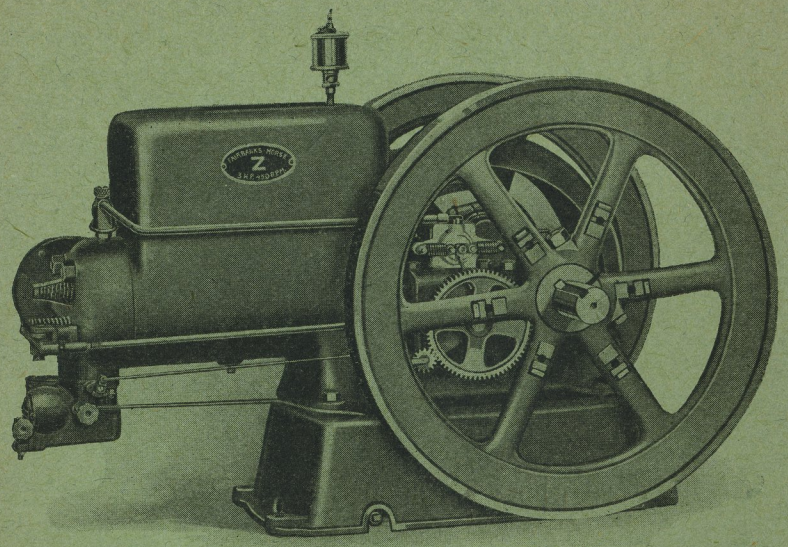

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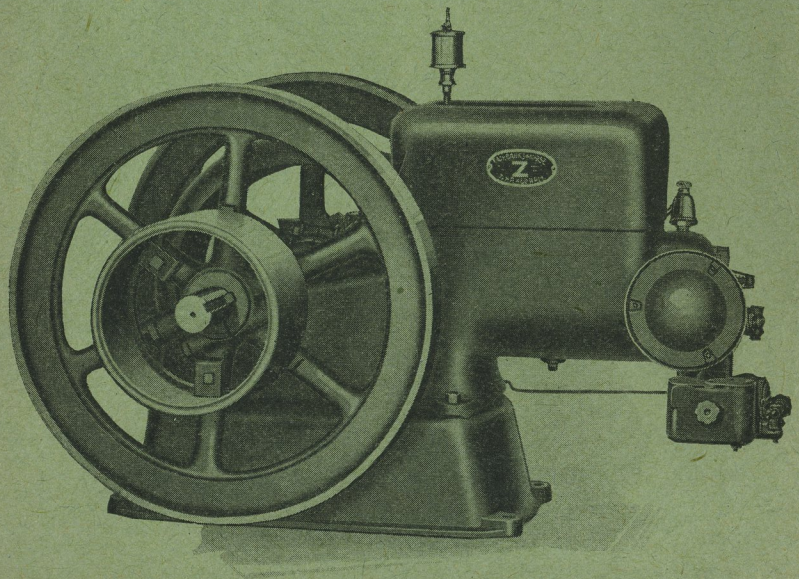


(3522G)

INSTRUCTIONS No. 2548A

For Setting Up and Operating Fairbanks-Morse 1½, 3 and 6 H. P. "Z" Oil Engines

(MODEL "ZA")

When Engine is Received

1. Remove engine from crate, being careful to avoid damage. Screw oil cup 527, on cylinder oil pipe. Bolt the pulley on the flywheel opposite the governor using the bolts sent. With steel pulleys larger than 4 inch 3 bent, steel clips are furnished, to catch inside the curled rim and take the bolts.

2. When it is desired to place the pulley on the governor side, it will be necessary to reverse to the small dog in the starter crank so as to use it on the other side, the direction of motion always being as shown in Fig. 40ZAA.

3. **Clean All Parts.**

4. **See That the Governor Parts Are Free From Dirt or Paint.**

5. Oil all moving parts and turn the flywheel over by hand slowly to see that all parts are free.

Foundation

6. If engine is to be located on a foundation, follow the foundation plans, which will be furnished free on request. Leave two or three feet of room all around the engine.

If Located in a Building

7. If the engine is installed in a building the exhaust should be piped outside. This pipe should be short and with few bends. Water may collect in long exhaust pipes so a small hole or other drain should be provided where water might collect. When the pipe is long (20 feet), or has several elbows (4), the pipe should be increased in size and better results will be obtained if an exhaust pot is installed near the engine.

Fuel

8. These engines can use as fuel, Gasoline, Motor Spirits, Kerosene and some varieties of Power Distillate. In this book the fuel will be called **"Oil Fuel".**

Read Tags

9. **Read the Tags on the Engine But Do Not Remove Them Until** you are familiar with its operation.

WHAT TO DO BEFORE STARTING.

Fill Fuel Tank

10. Fill the **oil fuel tank.**

Cooling Water

11. Put water in hopper, but only enough at first to cover top of cylinder. In cold weather hot water will make the engine easier to start.

Tighten Nuts

12. **Tighten Cylinder Head Nuts.**

Oiling

13. Fill oil cup (527, page 3), with good Gas Engine oil (we recommend Hytest), and adjust oiler to feed 8 drops per minute on 1½ H. P., 12 drops per minute on 3 H. P., 20 drops per minute on 6 H. P. Gradually cut down the amount as the engine becomes worn in, until in a month one-half the above quantities are used.

Fill the three grease cups. Two (505, page 3), are on main bearings. The other is on the crank pin bearing 509A, page 3). They should be screwed down one or two turns until grease is forced freely into bearings.

Oil by Hand

14. With a hand oil can go over the engine and oil the governor and all other places where there are oil holes, and where one part moves against another. In freezing weather, squirt a little oil on piston where end comes out of cylinder. The cylinder oiler may not feed until it is warmed up.

TO START ENGINE.

Gasoline for Starting

15. Fill reservoir (4B) with gasoline.

Fuel Valve

16. Close oil throttle (76B), open gasoline throttle valve (376A, page 2), about one turn. If the engine is run on gasoline, throttle valve 76B may be used for starting as well as running.

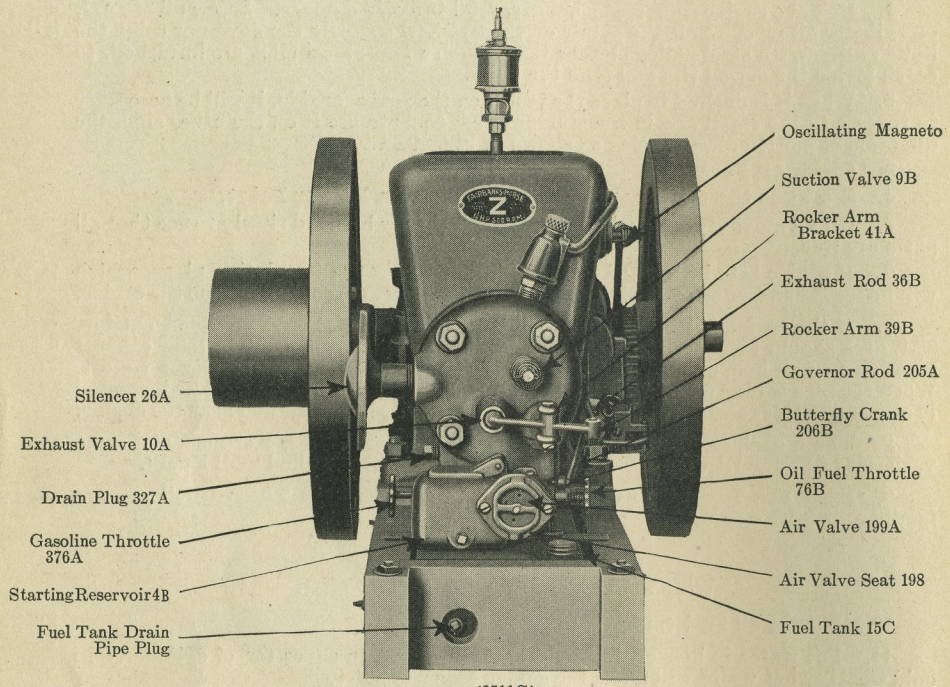
Starting

17. Holding the suction or upper valve open with the left hand, with the starter crank spin the engine. After getting the engine in motion, release the suction valve

and close the air inlet opening in end of air suction fitting with fingers of left hand for one revolution only, and then remove fingers while still continuing to crank. If held longer, too much fuel will be drawn in. The mixture will not ignite if there is too much fuel in it.

Flooded Engine

18. Too much fuel used in starting (particularly with a hot engine).will "**FLOOD**" the engine. When flooded, close the fuel throttle, relieve the compression by holding suction valve open with the finger and turn the flywheel over a number of revolutions in order to work out the excess fuel.



(3511G)

AFTER THE ENGINE IS STARTED.

19. After the engine takes its first impulse, remove the starter crank; adjust the gasoline throttle valve to the point where engine runs best.

Running on Oil Fuel

20. The engine will usually run on oil fuel after using one reservoir full of gasoline. In cold weather it may require two fillings. When engine is warm enough gradually open the oil throttle valve (76B), and close gasoline throttle valve (376A). It is well to have the gasoline throttle valve slightly open until the engine is hot enough to run well on the fuel oil alone. After closing gasoline throttle, the oil fuel throttle should again be adjusted to give as little fuel as the engine will run on smoothly. The handle of the oil fuel throttle is marked at the factory when the engine is tested and should generally point down when the engine is in operation.

Fill Hopper

21. Fill water hopper two-thirds full and replenish this water as it boils away.

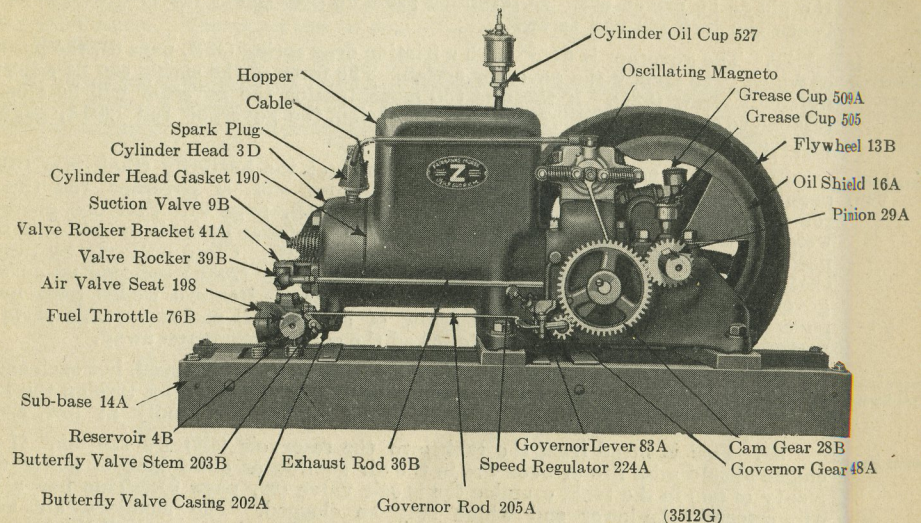
Tighten Nuts

22. **Tighten Cylinder Head Nuts** after engine has been run and warmed up. Attention to this matter will prevent the blowing out of cylinder head gaskets.

TO STOP ENGINE.

To Stop

24. To stop engine, first close oil fuel throttle valve (76-B), then close cylinder oiler (527), and in freezing weather drain out the water from cylinder jacket through plug (327A) provided.



(3512G)

DESCRIPTION OF PARTS OF ENGINE AND MANNER OF ADJUSTMENT.

Lost Compression

25. Should the engine on starting turn too easily, it has lost compression because some leak is taking place. The suction valve as well as exhaust valve should be examined. If they seat tightly, examine piston (see paragraph 30).

Suction Valve

26. The suction valve (9B), is an ordinary check valve, automatic in its action and has a lift of about three-eights of an inch. The lift is limited by means of a spring (310), on the valve stem. This valve on 3 and 6 H. P. engines is also fitted with a friction spring (120), (patented), causing a friction on the suction valve spring collar (121), and prevents chattering. Oil this occasionally.

Exhaust Valve

27. The exhaust valve (10A), like the suction valve is in the cylinder head with spring and stem outside in plain sight. If it sticks, use kerosene, work it by hand, then put on some lubricating oil.

Cleaning and Regrinding Valves

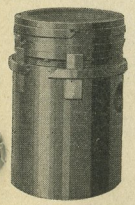
28. If it is necessary to grind suction or exhaust valve, the cylinder head may be removed and the valves ground in with ground glass or fine emery and oil. Carefully clean both valve and seat before replacing.

Carbon

28½. Carbon may best be cleaned out by taking off the cylinder head.

Head Gaskets

29. Asbestos gaskets hold better if covered with linseed or lubricating oil when applied. Before applying gasket **scrape off all traces of old gasket.** Gasket material should be long fiber asbestos sheet about 3/64″ inch thick. After putting on new gasket (190) the nuts should be tightened and again when engine is hot.



(3883G)

To Remove Piston

30. The piston may be taken out without unbolting cylinder head. Take off shield and unbolt the rod. Turn crank to out position. The piston may now be withdrawn. Clean with gasoline or a hot solution of lye and water. Loosen the rings and clean the grooves, scrape off all carbon found inside. Oil the piston well before replacing. In replacing piston, turn it bottom side up so that the stop pins can be seen, otherwise the rings may be broken. Be sure to turn it right side up before bolting on connecting rod cap otherwise the pin will get no oil. The rings can be removed from piston by taking three strips of tin about one-half inch wide and six inches long, slip one piece of tin under the middle of the ring and over the ring groove, then with the help of a screw driver the other strips can be slipped under the ends and the rings in turn slipped off the piston.

To Remove Piston Rings

Removing Piston Pin

31. To remove piston pin (7) use screw driver to take out taper dowel pin screw (72). Force out taper dowel pin (71) from inside of hollow pin. This allows the pin to be driven out. In returning parts be sure to put the lock washer in between the lock pin and screw.

Action of Governor

32. The governor is fitted with a friction drag spring (33B, page 9), the purpose of which is to steady the governor action. The force of the spring can be adjusted by small screw (321). If there is too much tension the governor will be slow to respond to change in load. If not enough tension, the governor rod (205A, page 3) will jump at each explosion.

Butterfly Valve

33. If it is necessary for any reason to reset the butterfly crank arm (206B, page 9), take cotter pin out of butterfly arm end of governor rod (205A), remove end of governor rod (205A) from arm (206B, page 9). Pull one governor weight (82A) out as far as it will go and then put a wedge under it to hold it in that position. Slightly loosen clamp screw of arm (206B). Close butterfly by turning shaft in clockwise direction with fingers and set arm (206B) pointing up so that governor rod lacks 1/16″ from going in hole of arm. Remove wedge from under governor weight. Tighten clamp screw of arm (206B) and reassemble parts removed. If these instructions are followed the engine cannot run away.

Decreasing Engine Speed

34. The governor normally holds the engine at its rated speed, but each engine is provided with a speed regulator which decreaess the speed by turning the head screw (224A, page 3). The engine should not be run continually at low speed.

Suction Feed

35. Fuel is lifted from the tank into the reservoir (4B) by suction. If the engine should miss fire or back fire in the air suction or show lack of power with plenty of fuel in the tank, examine the check valve (89, page 9). This has a fine wire screen in the lower end which may be clogged. The auxiliary air valve is at the air inlet of the reservoir (4B). It should work freely at all times.

Piping

36. To remove fuel piping and check valve from fuel tank on 1½ H.P., unscrew cap (47) and take out the two screws that hold the air suction fitting. This fitting together with the fuel tube and check valve can then be removed. On 3 and 6 H. P. take out the two screws that hold valve seat clamp (297); this fitting together with fuel tube and check valve can then be removed.

Draining Fuel Tank

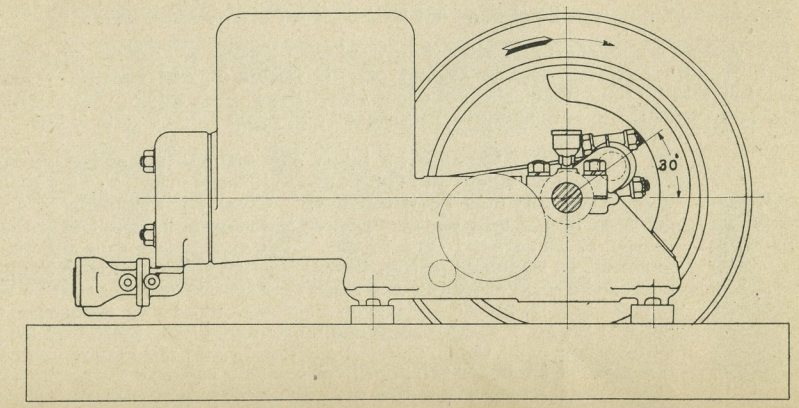
37. This tank is provided with a drain closed by a pipe plug.

Setting Gears

40. The cam gear is marked with center punch marks on face of two teeth. The pinion (29A, page 3), on crank shaft has one tooth with two center punch marks. This tooth should come between the two marked ones on the large gear (28B, page 3). If engine is taken apart and the marks on gears cannot be found, or if old gear is replaced by a new one, the engine should be timed as follows:

Valve Timing

41. Turn the engine to where the crank (25B, page 8), is straight up. Then set the cam gear with the nose of the cam straight up. Next see that there is about 1/32″ clearance between end of exhaust rod and the valve rocker arm. Adjust to this clearance by the two nuts on exhaust rod. Such a setting should bring the valve timing very nearly as described in paragraph 42.

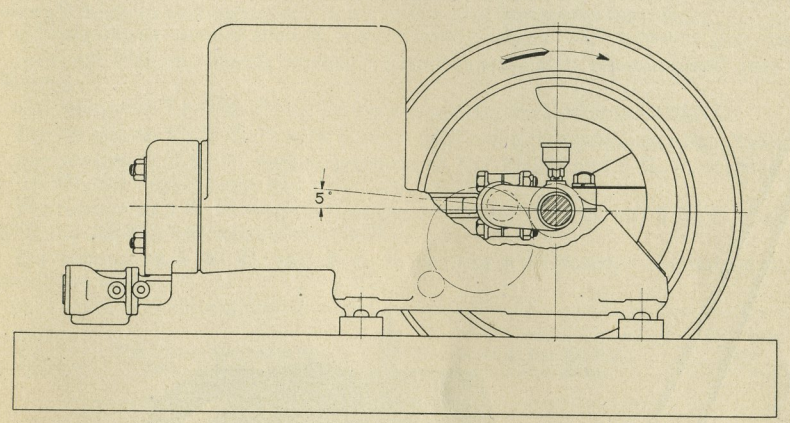


(40ZAA)

42. The cam should begin to open the exhaust valve 30 degrees to 35 degrees before outer dead center (40-ZAA) of crank. The cam should close the exhaust valve when the crank is in position shown in Fig. (41-ZAA) or about 5 degrees above the inner dead center. The valve can be turned with the fingers as soon as it is lifted from its seat.

Removing Cam Gear

43. In order to remove the cam gear, take out the two screws holding cam gear bracket to base. All parts attached to bracket can then be inspected. In replacing, take care to properly mesh the teeth of cam gear and crankshaft pinion (paragraph 40.)



(41ZAA)

Bearing Adjustment

44. Crank shaft bearings can be adjusted by unbolting caps and removing one or two of the thin shims. In reassembling, the bolts must be drawn up tight and yet the shaft must turn perfectly free. If not free, shims should be put back until bolts can be drawn tight without clamping the shaft.

Renewals

45. These bearings all have removable linings. A little fitting and scraping of new linings may be needed to make them fit perfectly.

Cooling Water

46. THE WATER SHOULD NEVER BE ALLOWED TO FALL AS LOW AS THE TOP OF THE CYLINDER WALL, as the cylinder will get too hot. It is expected that the water will boil under heavy load. Put in more water as it boils away.

Engine Jacket Broken by Freezing

47. THE ENGINE JACKET IS LIABLE TO BE BROKEN BY FREEZING IF water is left in during cold weather unless non-freezing solution is used.

Non-Freezing Solution

48. A non-freezing mixture of calcium chloride and water may be used in the jacket. Three pounds of calcium chloride to each gallon of water will not freeze solid at Zero Fahrenheit. It is better, however, to drain the jacket in freezing weather when the engine is not in use.

Removing Scale or Deposit

49. While the deposit or scale varies in character in different localities it can usually be removed by draining the engine cylinder jacket, and filling the jacket with a solution of one part commercial sulphuric acid to ten parts water. Allow to stand over night and then wash out with fresh water.

To Remove Flywheel

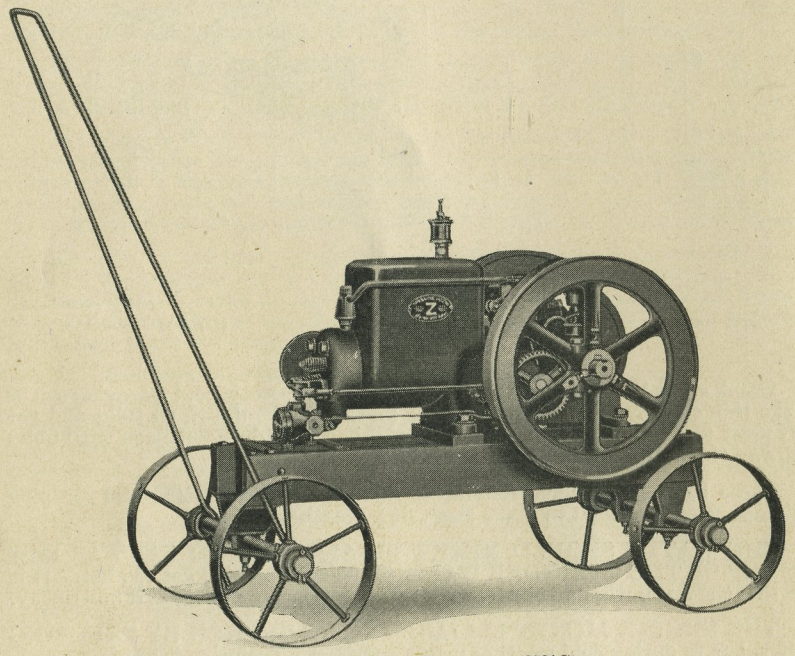
50. Loosen bolt and drive wedges into the split on each side of arms, generally the wheel is then loosened so it can be easily pulled off. If not, drive it by placing piece of hard wood against the inside hub of wheel. In replacing, tighten the bolt before driving the key.

Crank Shaft End Play

51. The flywheels should be slightly set out from main bearings so that there will be about 1/32″ end play to the shaft.

Magneto

52. Instructions 2550 cover the care of the magneto and spark plug.



(3531G)

1½ H. P. "Z" Throttling Governor Kerosene Engine on Hand Truck

REPAIR PARTS LIST

For Fairbanks-Morse 1½, 3 and 6 H. P. Throttling Governor "Z" Oil Engine

When ordering parts, always give the size, the type and shop number of the engine. The number is very important. It is stamped on the top of the cylinder and cylinder head flanges. Do not fail to give it.

Parts may be ordered individually or in groups.

A **Group Number** printed in **heavy type,** followed by the letter C, such as **"3D-C"** covers all items in that paragraph down to the first horizontal line, thus.....
An ordinary repair number printed in light type (such as "3D"), covers that one part only.

Any part without a repair number is listed directly after the numbered part with which it is used.

For repairs on 1 1/2 H. P. with rotary magneto, see instructions 2407D.

For repairs on 1 1/2 H. P. with Sumter oscillating magneto, see instructions 2528.

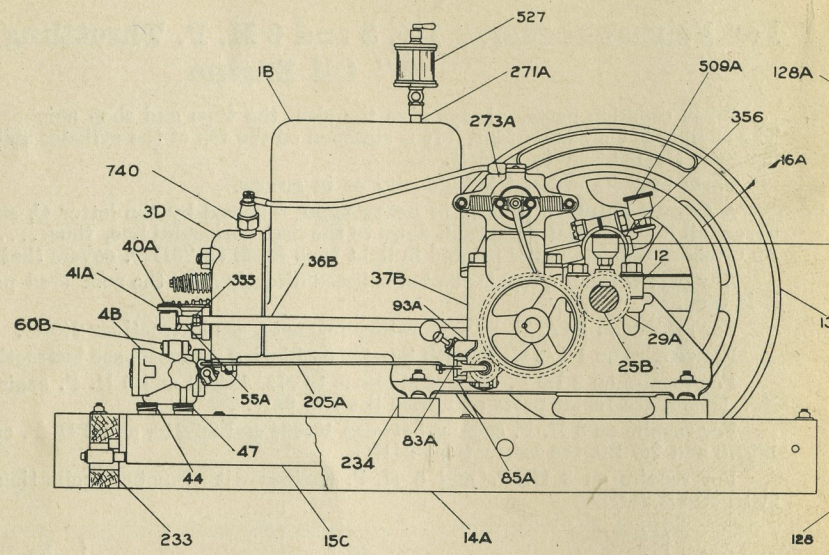
For repairs on 3 H. P. engines previous to No. 185864 and 6 H. P. engines previous to No. 185978, see repair parts and price list No. 9417.

For repairs on 3 H. P. engines between 185864 and 268918, and 6 H. P. engines between 185978 and 267250, see instructions 2417C.

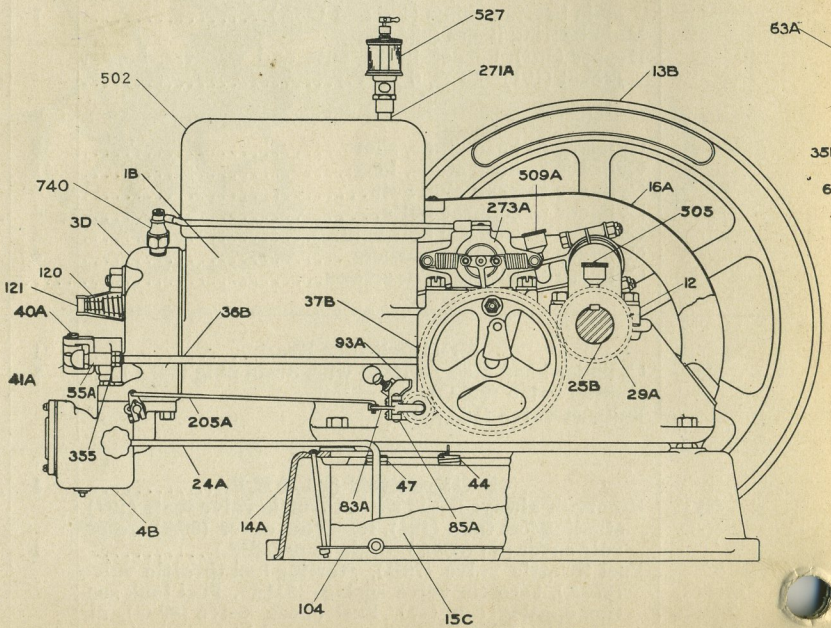
For repairs on 3 H. P. and 6 H. P. engines with Sumter oscillating magneto, see instructions 2417D.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	No. Pieces Used 11/2 H.P.	No. Pieces Used 3 or 6 H.P.	Included in Group No.
1B	**1B-C Cylinder and Base**.....	1	1	
	Cylinder and base, always fitted with head studs, main bearing caps (12) with cap screws and lock washers, main bearing shims (126 and 126A).....	1	1	
	Main bearing liners (23A).			
	Hopper (502), hopper bolts, nuts and washers, hopper gasket (191)—(3 & 6 H. P.).....			
	Cylinder to head studs, short.....	3	3	**1B-C**
	Cylinder to head studs, long.....	1	1	**1B-C**
	Cylinder to head stud nuts.....	4	4	
	Cylinder to subbase bolts.....	4	.....	
	Cylinder to subbase bolt nuts.....	4	.....	
	Cylinder to subbase washers.....	4	.....	
	Cylinder to subbase cap screws.....	.....	4	
3D	**3D-C Cylinder Head**.....	1	1	
	Cylinder head always fitted with drain plug (327A)....	1	1	
	Suction valve (9B-C).			
	Exhaust valve (10A-C).			
4B	**4B-C Reservoir (1 1/2 H.P.)**.....	1	.....	
	Reservoir always fitted with, throttle valve seats (197), starting fuel tube (124), reservoir cover (60A), reservoir cover pin (335A), drain plug (331A)	1	.....	
	Fuel throttle valve (76B), starting fuel throttle valve (376A), throttle valve springs (311A), Fuel tank suction opening cap (47), Fuel check valve (89-C), air valve seat (198-C) with screws and lock washers....			

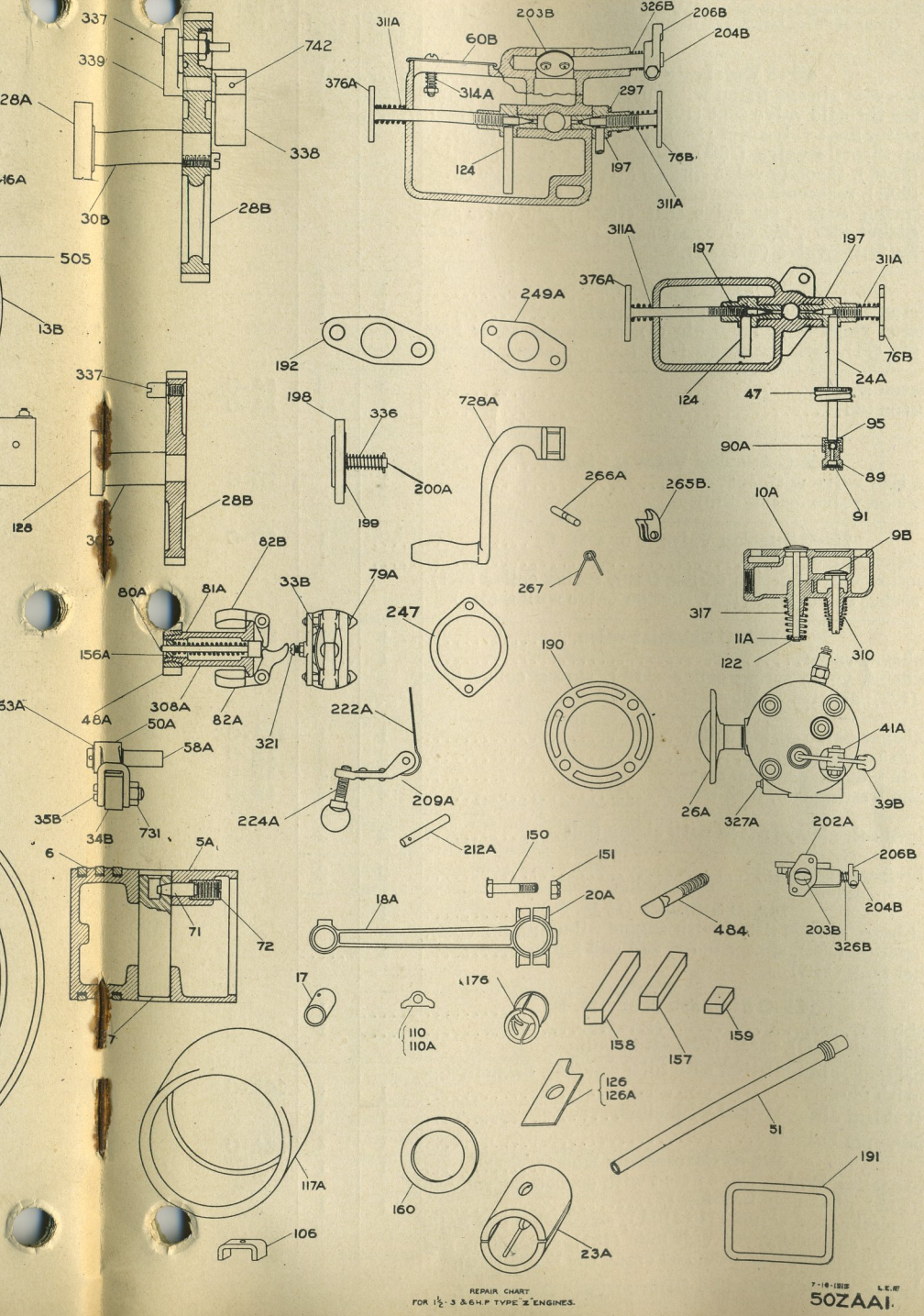
Before ordering parts, read the instructions above.



1½ H. P. ENGINE



3 OR 6 H. P. ENGINES



REPAIR CHART
FOR 1½-3 & 6 H.P. TYPE 'Z' ENGINES.

7-16-1915 L.E.W.
50ZAA1.

Repair Parts List—Fairbanks-Morse "Z" Oil Engines

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	No. Pieces Used 1 1/2 H.P.	No. Pieces Used 3 or 6 H.P.	Included in Group No.
	4B-C Reservoir (3 or 6 H.P.)	.....	1	
4B	Reservoir always fitted with, drain plug (331A), starting throttle valve seat (197), starting fuel tube (124).	.....	1	
	water float valve seat (189), float valve guide (289)...			
	Fuel throttle valve (76B), starting fuel throttle valve (376A), throttle valve springs (311A), reservoir cover (60B), reservoir cover screw and nut, reservoir cover spring (314A), air valve seat (198-C), air valve seat gasket (247), air valve seat screws and lock washers, butterfly valve (203B-C).			
	5A-C Piston	1	1	
5A	Piston always fitted with ring stop pins	1	1	
	Piston rings (6), piston pin (7), piston pin taper lock pin (71), lock pin screw (72), lock pin screw washer.			
6	Piston rings	3	3	5A-C
7	Piston pin	1	1	5A-C
	9-B-C Suction Valve (1½ H.P.)	1		
9B	Suction valve with cotter	1		3D-C
	Suction valve spring (310)			
	9B-C Suction Valve (3 or 6 H. P)	.....	1	3D-C
9B	Suction valve	.....	1	
	Suction valve friction spring (120), spring collar (121), spring collar lock (122), suction valve spring (310)			
	10A-C Exhaust valve	1	1	3D-C
10A	Exhaust valve	1	.....	
	Exhaust valve spring collar (11A), spring collar lock (122), exhaust valve spring (317)			
11A	Exhaust valve spring collar	1	1	10A-C
12	Main bearing cap	2	2	1B-C
	Main bearing cap, cap screws	4	4	1B-C
	Main bearing cap, lock washers	4	4	1B-C
13B	Flywheel, always fitted with clamp bolt	2	2	
	Flywheel clamp bolt	2	2	
	14A-C Subbase (1½ H. P.)	1		
14A	Subbase, always fitted with engine fill-up pieces (234), spacers (233), spacer bolts, and end bolts	1	.....	
	Fuel tank (15C)			
	14A-C Subbase (3 or 6 H. P)	.....	1	
14A	Subbase	.....	1	
	Fuel tank (15C), strap (104) strap bolts			
15C	Fuel tank, always fitted with filler cap (44), drain fitting with plug	1	1	14A-C
16A	Oil shield always fitted with clips	1	1	
17	Piston pin bushing	1	1	18A-C
	18A-C Connecting Rod	1	1	
18A	Connecting Rod, always fitted with connecting rod cap (20A), piston pin bushing 17	1	1	
	Connecting rod shims (110-110A), connecting rod bolts (150), connecting rod bolt nuts (151), connecting rod bolt cotters, connecting rod crank pin liners (176).			

Before ordering parts, read the instructions on page 7.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	No. Pieces Used 1 1/2 H.P.	No. Pieces Used 3 or 6 H.P.	Included in Group No.
20A	Connecting rod cap (not furnished separately)	1	1	18A-C
23A	Main bearing liner (halves)	4	4	1B-C
24A	Fuel suction tube (not furnished separately)	1	1	89-C
25B	Crankshaft, always fitted with crankshaft pinion (29A) and pinion key 159 (and thrust washer (160) 1½ H. P.	1	1	
26A	Exhaust silencer	1	1	
	28B Cam Gear 1½ H. P	1		37B-C
28B	Cam Gear, always fitted with cam shaft 30B, cam 128A, cam shaft to gear screw, magneto trip pin (337)	1	.....	
	28B-C Cam Gear 3 or 6 H. P	.....	1	37B-C
28B	Cam gear, always fitted with cam shaft 30B, cam 128A, cam shaft to gear screw	.....	1	
	Magneto trip pin (337), trip pin nut, and early and late device 339-C.			
29A	Crankshaft pinion	1	1	25B
30B	Cam shaft (not furnished separately)	1	1	28B-C
33B	Governor drag spring	1	1	81A-C
34B	Exhaust roller	1	1	50A-C
35B	Exhaust roller pin	1	1	50A-C
	36B-C Exhaust Rod	1	1	
36B	Exhaust Rod	1	1	
	Exhaust rod end (55A), exhaust rod end nut (355).			
	37B-C Cam Gear Bracket	1	1	
37B	Cam gear bracket always fitted with exhaust roller rocker fulcrum pin (58A)	1	1	
	Cam gear (28B, 1½ H. P.), cam gear(28B-C, 3 & 6 H. P.) governor lever bracket (93A-C), with screws, lock washers, governor (81A-C) exhaust roller (50A-C), fulcrum and pin washer.			
39B	Exhaust valve rocker always fitted with oil cup (741)	1	1	41A-C
	40A-C Exhaust Valve Rocker Fulcrum Pin	1	1	41A-C
40A-C	Exhaust valve rocker fulcrum pin, always fitted with oil cup 741	1	1	
	Exhaust valve rocker fulcrum pin nut	1	1	
	Exhaust valve rocker fulcrum pin lock washer	1	1	
	41A-C Exhaust Valve Rocker Bracket	1	1	
41A	Exhaust valve rocker bracket	1	1	
	Exhaust valve rocker (39B), exhaust valve rocker fulcrum pin (40A-C).			
44	Fuel tank filler opening cap	1	1	15-C
47	Fuel tank suction opening cap	1	1	89-C
48A	Governor gear	1	1	81A-C
	50A-C Exhaust Roller Rocker	1	1	37B-C
50A	Exhaust roller rocker	1	1	
	Exhaust roller (34B), exhaust roller pin (35B) and exhaust roller pin nut (731).			
51	Fuel tank filler tube	.....	1	
55A	Exhaust rod end	1	1	36B
58A	Exhaust roller rocker fulcrum pin with cotter	1	1	37B
60B	Reservoir cover	1	2	4B-C
63A	Exhaust roller rocker fulcrum pin washer	1	1	37B-C
71	Piston pin taper lock pin	1	1	5A-C
72	Piston pin taper lock pin screw	1	1	5A-C
	Piston pin taper lock pin lock washer	1	1	5A-C
76B	Fuel throttle valve	1	1	4B-C
79A	Governor weight pins	2	2	81A-C
80A	Governor sleeve pin	1	1	81A-C

Before ordering parts, read the instructions on page 7.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	No. Pieces Used 1 1/2 H.P.	No. Pieces Used 3 or 6 H.P.	Included in Group No.
	81A-C Governor Spindle	1	1	**37B-C**
81A	Governor spindle	1	1	
	Governor sleeve pin (80A), governor weight (82A), governor weight (82B), governor weight spring (308A), governor weight spring adjusting screw (156A), governor weight friction spring (33B), friction spring adjusting screw and nut, governor gear (48A), governor weight pins (79A).			
82A	Governor weight with ball	1	1	**81A-C**
82B	Governor weight, plain	1	1	**81A-C**
83A	Governor lever	1	1	**93A-C**
85A	Governor lever fulcrum pin	1	1	**93A-C**
	89-C Fuel Check Valve	1	1	**4B-C**
89	Fuel check valve body, always fitted with strainer (91), fuel suction tube (24A), suction tube connection (95), check valve ball (90A), throttle valve seat (197).			
90A	Fuel check valve ball	1	1	**89-C**
91	Fuel check valve strainer (not furnished separately)	1	1	**89-C**
	93A-C Governor Lever Bracket	1	1	**37B-C**
93A	Governor lever bracket	1	1	
	Governor lever (83A), governor lever fulcrum pin (85A), speed regulator lever 209A-C, speed regulator fulcrum pin (212A).			
	Governor lever bracket screws	2	2	**37B-C**
	Governor lever bracket lock washers	2	2	**37B-C**
95	Fuel suction tube connection	1	1	**89-C**
104	Fuel tank strap	.....	1	**14A-C**
	Fuel tank strap bolts with nuts	.....	2	**14A-C**
106	Pulley to flywheel clips	.....	3	
	Pulley to flywheel bolts	3	3	
	Pulley to flywheel bolt nuts	3	3	
110	Connecting rod shims (thick)	4	4	**18A-C**
110A	Connecting rod shims (thin)	12	12	**18A-C**
117A	Pulley	1	1	
120	Suction valve drag spring	.....	1	**9B-C**
121	Suction valve spring collar	.....	1	**9B-C**
122	Suction and exhaust valve spring collar lock	1	2	**9B-C10A-C**
124	Starting fuel tube (not furnished separately)	1	1	**4B-C**
126	Main bearing shims (thick)	4	4	**1B-C**
126A	Main bearing shims (thin)	12	12	**1B-C**
128A	Cam (not furnished separately)	1	1	**28B-C**
150	Connecting rod bolt with cotter only	2	2	**18A-C**
151	Connecting rod bolt nut	2	2	**18A-C**
156A	Governor spring adjusting screw	1	1	**81A-C**
157	Flywheel key opposite Governor	1	1	
158	Flywheel key governor side	1	1	
159	Crankshaft pinion key	1	1	**25B**
160	End thrust washer (opposite governor)	1	1	
160	End thrust washer (governor side)	2	.....	**25B**
176	Connecting rod crank pin liner (furnished in pairs (2 pieces) only)	2	2	**18A-C**

Before ordering parts, read the instructions on page 7.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	No. Pieces Used 1 1/2 H.P.	No. Pieces Used 3 or 6 H.P.	Included in Group No.
190	Cylinder to head gasket	1	1	
191	Cylinder to hopper gasket	.....	1	**1B-C**
192	Cylinder head to butterfly valve casing gasket	1	.....	
195B	Name plate	1	1	
	Name plate screws	2	2	
	Name plate washers	2	2	
197	Fuel throttle valve seat (not furnished separately)	2	2	**4B-C** / **89-C**
	198-C Air Valve Seat	1	1	**4B-C**
198	Air valve seat, always fitted with air valve guide (200A)	1	1	
	Air valve (199), air valve spring (336), air valve guide cotter			
	Air valve seat to reservoir screws	2	2	**4B-C**
	Air valve seat to reservoir lock washers	2	2	**4B-C**
199	Air valve	1	1	**198-C**
200A	Air valve guide	1	1	**198-C**
	Air valve guide cotter	1	1	**198-C**
	202A-C Butterfly Valve Casing (1½ H.P.)	1	.....	
202-A	Butterfly valve casing	1	.....	
	Butterfly valve (203B-C).			
	203B-C Butterfly Valve	1	1	**202A-C** 1½ H.P.
203B	Butterfly valve	1	1	**4B-C** 3&6H.P.
	Butterfly valve stem (204B), valve screws and lock washers, butterfly valve stem arm (206B), butterfly valve stem arm screw, butterfly valve stem spring (326B).			
	Butterfly valve screws	1	2	**203B-C**
	Butterfly valve screw lock washers	1	2	**203B-C**
204B	Butterfly valve stem	1	1	**203B-C**
205A	Governor pull rod with two cotters	1	1	
206B	Butterfly valve stem arm with clamp screw	1	1	**203B-C**
	Butterfly valve stem arm clamp screw	1	1	
	209A-C Speed Regulator Lever	1	1	**93A-C**
209A	Speed regulator lever always fitted with speed regulator leaf spring (222A)	1	1	
	Speed regulator adjusting screw (224).			
212A	Speed regulator lever fulcrum pin	1	1	
222A	Speed regulator leaf spring (not furnished separately)	1	1	**209A-C**
224A	Speed regulator adjusting screw	1	1	**209A-C**
233	Subbase spacers	2	.....	**14A-C**
	Subbase spacer bolts	2	.....	**14A-C**
	Subbase spacer bolt nuts	2	.....	**14A-C**
	Subbase spacer bolt washers	2	.....	**14A-C**
234	Subbase to engine fill-up pieces	2	.....	**14A-C**
	Subbase end bolts	4	.....	**14A-C**
	Subbase end bolt nuts	4	.....	**14A-C**
	Subbase end bolt washers	4	.....	**14A-C**
247	Air valve seat gasket	.....	1	**4B-C**
249A	Reservoir gasket	1	1	
265B	Starter crank pawl	1	1	**728A-C**
266A	Starter crank pawl fulcrum pin	1	1	**728A-C**
267	Starter crank pawl spring	1	1	**728A-C**
271A	Cylinder oiler pipe	1	1	
297	Fuel throttle valve seat clamp	.....	1	**4B-C**
308A	Governor weight spring	1	1	**81A-C**
310	Suction valve spring	1	1	**9B-C**

Before ordering parts, read the instructions on page 7.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all items mentioned in that Group.	No. Pieces Used 1 1/2 H.P.	No. Pieces Used 3 or 6 H.P.	Included in Group No.
311A	Fuel throttle valve spring	2	2	4B-C
314A	Reservoir cover spring	.....	1	4B-C
317	Exhaust valve spring	1	1	10A-C
321	Governor weight friction spring adjusting screw	1	1	81A-C
326B	Butterfly valve stem torsion spring	1	1	203B-C
327A	Cylinder head drain plug	1	1	3B
328A	Base drain plug	.....	1	1B
336	Auxiliary air valve spring	1	1	198-C
337	Magneto trip pin	1	1	28B-C
	Magneto trip nut	.....	1	28B-C
338	Magneto early and late weight	.....	1	339-C
	339-C Early and Late	.....	1	28B-C
339	Early and late arm	.....	1	
	Early and late weight (338), with pin (742).			
355	Exhaust rod end nut	1	1	36B-C
356	Grease cup support	1	.....	
376A	Starting fuel throttle	1	1	4B-C
484	Pulley bolts, 1½ H. P.	3	.....	
502	Hopper	.....	1	1B-C
	Hopper to cylinder bolts	.....	4 or 6	1B-C
	Hopper to cylinder bolt nuts	.....	4 or 6	1B-C
	Hopper to cylinder washers	.....	4 or 6	1B-C
505	Main bearing grease cup	2	2	
509A	Connecting rod grease cup	1	1	
527	Cylinder oiler	1	1	1B-C
	728A-C Starter Crank	1	1	
728A	Starter crank—always fitted with Starter crank pawl (265B), starter crank pawl pin (266A), starter crank pawl spring (267)	1	1	
731	Exhaust roller pin nut	1	1	50A-C
735	Spark plug cover	1	1	
736	Spark plug nut	1	1	
737	Magneto cable conduit	1	1	
740	Spark plug	1	1	
741	Exhaust valve rocker oil cup	2	2	39B 40A-C
742	Early and late weight pin	.....	1	339-C
	748A-C Complete Set of Springs.			
308A	Governor weight spring	1	1	81A-C
310	Suction valve spring	1	1	9B-C
311A	Throttle valve springs	2	2	4B-C
317	Exhaust valve spring	1	1	10A-C
326B	Butterfly valve torsion spring	1	1	203B-C
336	Auxiliary air valve spring	1	1	198A-C
314A	Reservoir cover spring	.....	1	4B-C
	749A-C Complete Set of Gaskets.			
190	Cylinder head gasket	1	1	
191	Cylinder to hopper gasket	.....	1	
192	Butterfly valve casing gasket	1	.....	
247	Air valve seat gasket	.....	1	
249	Reservoir gasket	1	1	
	Tools.			
	Magneto tripping handle	1	1	
	Large wrench	1	1	
	Small wrench	.....	1	
	Funnel	.....	1	
273A	Magneto complete with trip lever and cable	1	1	
	Magneto trip lever	1	1	
	Magneto cable	1	1	

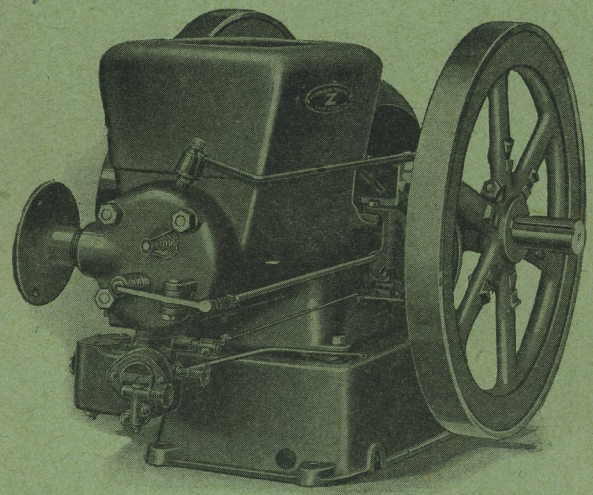
Before ordering parts, read the instructions on page 7.

TROUBLE CHART

Trouble	Possible Cause		Remedy	See Paragraph
Engine will not start.	Instructions not followed.		Read and follow instructions.	1–18
	No fuel in tank.		Fill tank.	10
	Water in gasoline used in starting.		Drain out water.	
	Water in engine cylinder.		Spin engine by hand, holding suction valve open.	18
			See that gasket is unbroken.	29
	Engine flooded with fuel.		Close fuel needle valve, open suction valve and crank engine.	18
	Poor compression.	Valve leaks.	Grind valves.	28
		Head gasket leaks.	Put on new gasket.	29
		Piston blows.	Remove rings and clean.	30
	Engine very cold.		Put but little water (preferably hot water), in hopper.	11
	No spark or poor spark.	Spark plug dirty.	Take out and clean.	
		Grounded.	Porcelain broken in plug. See that wire from magneto is not grounded.	
		Gap too wide.	Set spark plug gap to thickness of a smooth dime.	
		Oscillator	Remove spark plug, trip oscillator with hand lever, note if spark occurs.	
		Mechanism sluggish cold weather.	Oil all parts well, using a little kerosene	
Engine misses fire after being started.	Ignition.	Spark plug dirty.	Take out and clean.	
		Spark plug grounded.	Porcelain broken in plug.	
		Wire grounded.	See that wire from magneto is not grounded.	
Engine runs irregularly.	Governor stuck.		See that governor parts are free. Use kerosene to loosen.	33
			Adjust (33B) spring.	32
	Weak exhaust valve spring.		Put washer under spring till new spring can be obtained.	
	Auxiliary air valve.		See that valve moves freely and spring is not broken.	35
Engine tends to run away.	Butterfly may not close.		Adjust butterfly crank and governor travel.	33

Trouble Chart—Fairbanks-Morse "Z" Oil Engines

Trouble	Possible Cause	Remedy	See Paragraph
Engine will not carry load.	Exhaust valve setting off.	Re-set.	41, 42
	Poor compression.	See "Engine will not start."	28, 29, 30
	Too rich mixture.	Adjust fuel throttle.	20
	Carbon in combustion space.	Remove head and clean.	28½, 29
	Silencer clogged.	Clean out.	
	Butterfly moved.	Re-set.	33
Engine knocks.	Hard explosion.	Remove head and clean carbon.	28½, 29
	Loose crank pin bearing.	Take up bearing.	44
	Loose flywheel.	Tighten bolts.	50
	Scale formation in jacket.	Clean out scale.	49
Engine smokes.	Exhaust. Too much lubricating oil.	Adjust lubricator.	13
	Exhaust. Too much fuel.	Adjust fuel throttle.	20
	Piston. Oil thrown into piston by crank.	Drain and clean out crank case.	
	Piston. Piston blows.	Remove piston, clean rings, may need new rings.	30
Engine uses too much fuel.	Throttle open too far.	Close partly.	20
	Poor compression.	See "Engine will not start."	28, 29, 30
	Exhaust valve setting off.	Re-set.	41
	Exhaust pipe or silencer choked.	Clean.	
	Fuel drips from suction pipe. Weak suction valve spring.	Lengthen spring by stretching. Order new spring.	
Cylinder oiler does not feed properly.	Piston blows.	Clean piston and rings; may need new rings.	30
	No vent in shank of oiler.	Drill 3/16″ hole into the oil feed pipe below oiler.	
Carbon forms.	Too much fuel.	Close throttle partly.	20
	Too much lubricating oil.	Adjust cylinder oiler.	13
	Engine too cold.	See that engine is hot before turning on oil fuel.	20
Water boils away too rapidly. Should use 1 gallon per horse-power hour.	Mixture too rich.	Close throttle.	20
		Never let the water get below top of cylinder.	



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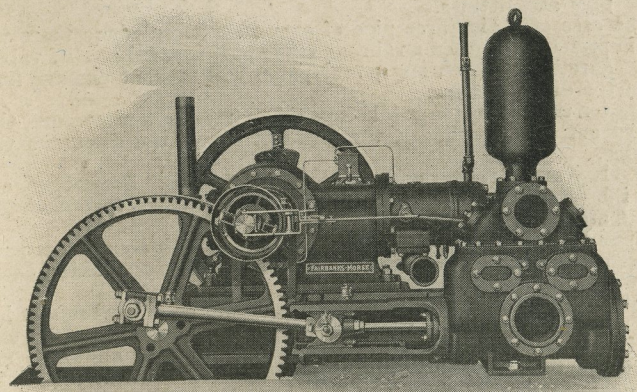
INSTRUCTIONS NO. 2498

FOR

Fairbanks-Morse

Type "Y" Horizontal Oil Engine Combined Pumpers



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INSTRUCTIONS No. 2498

Fairbanks-Morse Type "Y" Horizontal Oil Engine Combined Pumpers

To be used in connection with Engine Instruction Book.

Foundation The foundation should be prepared in accordance with the drawing furnished and the instructions in the Engine Instruction Book.

Size of Piping The suction and discharge pipe sizes specified on the foundation plans are correct for moderate lengths. When the suction pipe is over 100 feet in length it is desirable to increase its diameter, as the friction head will add to the work done and must be considered.

Suction Pipe Care should be taken in making up the suction pipe to get it tight. A very small leak will cause trouble. The suction pipe should be laid from the pump on a grade, with the pump end the highest point, and without air pockets. Long sweep fittings are preferred. A drain may be provided below frost line to let out water in freezing weather.

Foot Valve Where the suction pipe is over about 100 feet long, or the lift is more than 10 feet a foot valve is desirable enabling the pump to get water more quickly. This may however give some trouble by collecting refuse and should be located where it is accessible.

Vacuum Chamber A vacuum chamber is always desirable and is necessary on suction lines of over about 50 feet, and when the suction lift is over about 10 feet. The chamber should located close to the pump where it will best absorb the shock when the valves close.

Discharge Pipe The discharge pipe line should have a gate valve near the pump to shut off water from the pump when the pump is opened for inspection.

Air Chamber An air chamber is regularly furnished. Where the pipe line is 2000 feet long or the pipe is small, a large additional air chamber may be needed. This can be made up out of pipe and fittings.

Relief Valves In the case of a discharge pipe of over 2000 ft. or where there will be sudden changes in pressure (as when a railroad stand pipe is used) a relief valve will prevent damage. A relief valve on any power pump will prevent damage from accidental closure of the discharge line.

Drains Whenever the pump stands idle exposed to freezing temperature, the water must be drained out of the cylinder, the chamber above the discharge valve, and the suction pipe.

Water Valves The valves are of rubber and the seats are of brass. Sometimes, after the pump has been idle the valves may stick to their seats and may then have to be loosened. Handholes are provided to give access to the valves.

Packing The pump is regularly packed for cold water, with square flax packing both in the piston and in the piston rod stuffing box. This flax packing does not require any allowance for expansion.

Hot Water If hot water is to be pumped the valves should be of hard rubber in place of the standard medium grade. The packing in the piston should be square canvas packing instead of flax. In putting in the square canvas packing allowance must be made for the packing to swell about 1/4 to 3/8″ in circumference at the joint between the ends of packing rings. For the piston rod use Garlocks or other packing specially made for hot water use.

Pumping Oil When the pumper is to be used for pumping oil, the valves are of brass, the gaskets of heavy paper, and the regular flax packing is used on the piston and in the piston rod stuffing box.

Lubrication The cross head and pins have sight feed oil cups. The clutch pinion has two spring top oilers which should be filled with oil from a hand oil can occasionally. The outer cone of the clutch has two oil holes. A little oil should be applied from an oil can occasionally. When shutting down the punper for a considerable period, some oil should be put on the clutch cone to prevent rusting. The several working joints of the clutch should be oiled by hand occasionally. The gear should be lubricated by the application of heavy grease.

Clutch The clutch should be so adjusted by means of the adjusting nuts (45P and 46P) that it can be readily thrown in by hand but tight enough so clutch will not slip. If slipping occurs wear will be rapid.

Operation Before throwing in the pump clutch, be sure that the engine is running properly and that the gate valve in the discharge line is open, then gradually apply the load with the clutch lever. Before shutting the outfit down, throw the load off by releasing clutch.

REPAIR PARTS LIST

Fairbanks-Morse Type "Y" Horizontal Oil Engine Combined Pumpers

When ordering parts, always give the **size** or **horsepower, type** and **shop number** of the engine. **The number is very important.** It is stamped on the top of the cylinder and cylinder head flanges. **Do not fail to give it.**

Parts may be ordered in groups, or individually, except where noted.

A **GROUP NUMBER** printed in **HEAVY TYPE,** followed by the letter **"C",** such as **"15P-C Piston,"** covers all items in that paragraph down to the first horizontal line.

An ordinary repair number printed in light type (such as "15P"), covers that part only, including any parts which are "always fitted" to it. For example: In Group 15P-C, No. 16P, 17P or 18P, covers one part only, but "15P" covers the part No. 3 and all parts "always fitted" to it.

A group may be ordered, **less** certain specified parts. For example: 15P-C, less Nos. 18P and 17P.

Any part without a repair number is listed directly after the numbered part with which it is used.

Note that the pumper parts as here listed have repair numbers followed by the letter "P," and these numbers should not be confused with repair numbers for engine parts, as shown in the engine instruction book, which do not have the letter "P" attached.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all Items mentioned in that Group.	Number Pieces Used	Included in Group No.
	1P-C Lower Base	1	
1P	Lower base, always fitted with bearing studs, bearing dowels, engine frame studs, waterbox studs, bearing caps (2P), bearing shims (79P) and bearing stud nuts	1	
	Bearing cap grease cups and bearing shells (91P).		
	Lower base bearing studs	8	
	Lower base bearing stud nuts	16	
	Lower base water box studs	4	
	Lower base water box stud nuts	4	
	Lower base bearing shell dowels	2	
	Lower base engine frame studs	4	
	Lower base engine frame stud nuts	4	
2P	Bearing caps, always fitted with bearing shell dowel	2	1P-C
	Bearing cap shell dowels	2	
3P	Bearing cap grease cups	2	1P-C
	4P-C Pump Water End	1	
4P	Water box, always fitted with engine base stud, head studs bonnet studs, suction and blind flange studs, hand hole plate studs, stuffing box studs, removable cylinder studs, priming plugs and valve seats (19PS and 19PD)	1	
	Drain plugs (93P), valves (21PS-C and 21PD-C), stuffing box (13P-C), stuffing box gasket (115P), stuffing box stud nuts, head (7P-C), head gasket (116P), head stud nuts, hand hole plates (9P), hand hole plate gaskets (117P), hand hole plate stud nuts, bonnet (5P-C), bonnet gasket (118P), bonnet stud nuts, air chamber (6P-C), air chamber gasket (120P), air chamber stud nuts, suction flange (11P), suction flange gasket (119P), suction flange stud nuts, blind flange (12P), blind flange gasket (119P), blind flange stud nuts, valves (21PS and 21PD), piston rod (23P-C), cross head (26P-C), cross head pin (29P-C), cross head shoe and cross head oiler (38P), cross head oiler nipple and elbow, engine base stud nut, removable cylinder and piston (8P-C), removable cylinder stud nuts and removable cylinder stud jam-nuts.		

Before ordering parts, read the instructions above.

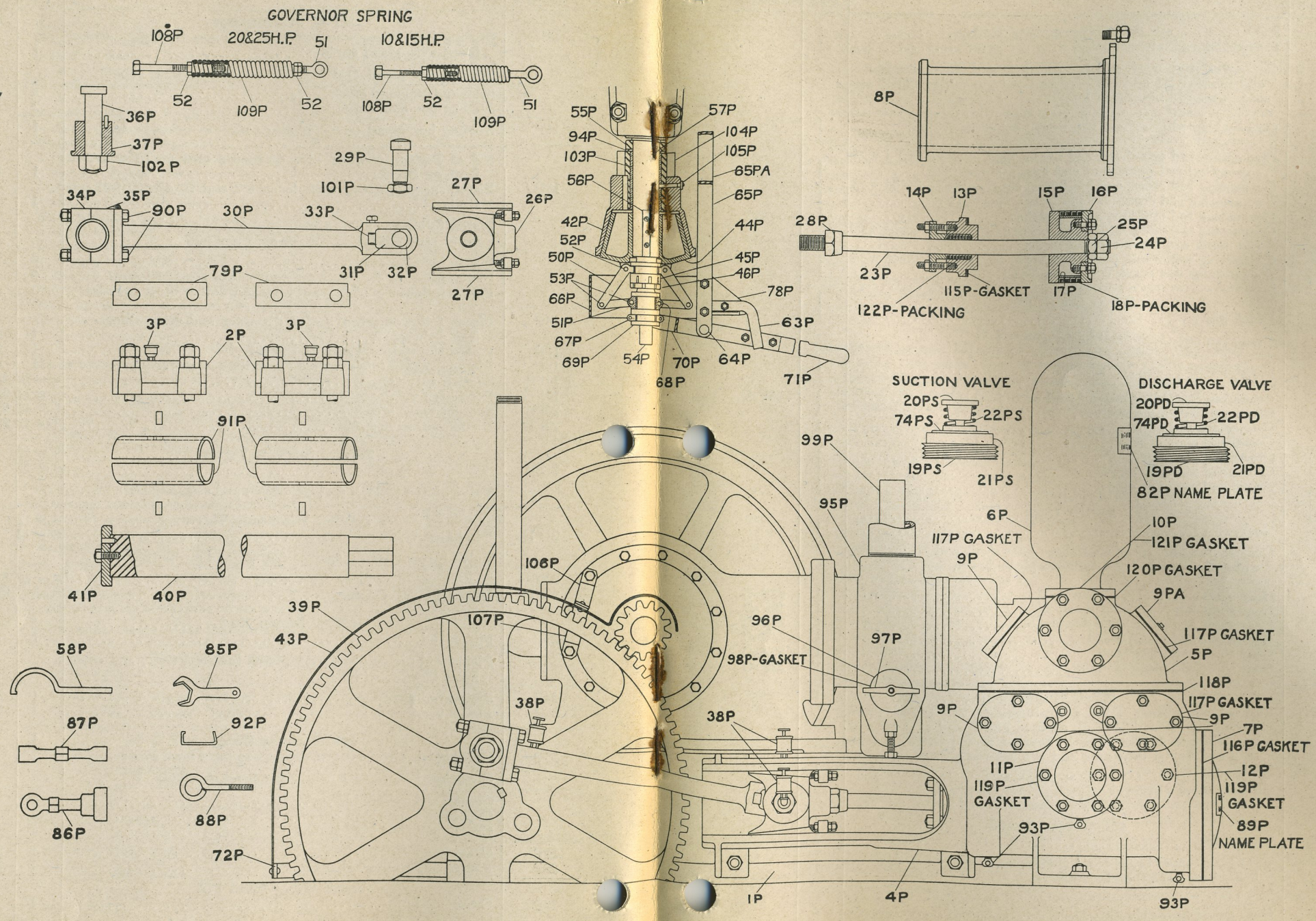
Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all Items mentioned in that Group.	Number Pieces Used	Included In Group No.
	Waterbox engine lower base stud	1	
	Waterbox engine lower base stud nut	1	
	Waterbox bonnet studs	16, 20 or 30	
	Waterbox bonnet stud nuts	16, 20 or 30	
	Waterbox suction flange studs	6 or 8	
	Waterbox suction flange stud nuts	6 or 8	
	Waterbox blind flange studs	6 or 8	
	Waterbox blind flange stud nuts	6 or 8	
	Water box engine frame dowels	2	
	Waterbox hand hole plate studs	8	
	Waterbox hand hole plate stud nuts	8	
	Waterbox stuffing box studs	3	
	Waterbox stuffing box stud nuts	3	
	Waterbox removable cylinder stud	6 or 8	
	Waterbox removable cylinder stud nuts	6 or 8	
	Waterbox removable cylinder stud jam nuts	6 or 8	
	Waterbox head studs	12or14	
	Waterbox head stud nuts	12or14	
	Waterbox priming plugs	2	
	5P-C Water Box Bonnet	1	**4P-C**
5P	Waterbox bonnet, always fitted with air chamber studs, hand hole plate studs and discharge flange studs	1	
	Discharge flange (10P), discharge flange gasket (121P), discharge flange stud nut, hand hole plates (9P and 9PA), hand hole plate plug, hand hole plate gaskets (117P) and hand hole plate nuts.		
	Waterbox bonnet air chamber studs	4 or 6	
	Waterbox bonnet air chamber stud nuts	4 or 6	
	Waterbox bonnet hand hole plate studs	8	
	Waterbox bonnet hand hole plate stud nuts	8	
	Waterbox bonnet discharge flange studs	6	
	Waterbox bonnet discharge flange stud nuts	6	
	6P-C Air Chamber	1	**4P-C**
6P	Air chamber, always fitted with pipe plug (25HP standard and 10, 15 and 20 HP large waterbox also fitted with eye plug)	1	
	Air chamber name plate (82P) with screws and washers.		
	7P-C Water Box Head	1	**4P-C**
7P	Waterbox head	1	
	Waterbox head plate showing diameter of pump cylinder (89P) with screws and washers.		
	8P-C Removable Cylinder with Piston	1	
8P	Removable cylinder (always give diameter and state whether plain or brass lined)	1	
	Piston 15P-C.		
9P	Hand hole plates	3	**4P-C & 5P-C**
9PA	Hand hole plate with pipe plug	1	**5P-C**
	Hand hole plate pipe plug	1	
10P	Discharge flange	1	
11P	Suction flange	1	
12P	Blind flange	1	

Before ordering parts, read the instructions on page 6.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all Items mentioned in that Group.	Number Pieces Used	Included in Group No.
	13P-C Stuffing Box	1	**4P-C**
13P	Stuffing box (state whether plain or brass bushed), always fitted with gland studs	1	
	Stuffing box gland (14P), gland nut and packing (122P).		
	Stuffing box gland studs	2	
	Stuffing box gland stud nuts	2	
14P	Stuffing box gland (state whether plain or brass bushed)	1	**4P-C**
	15P-C Piston (always give diameter and state whether iron or brass)	1	**4P-C**
15P	Piston, always fitted with (except 7 and 7½ diam.) follower studs	1	
	Piston follower (16P), piston ring (17P), packing (18P), follower stud nuts and follower stud jam nuts.		
	Piston follower studs	6	
	Piston follower stud nuts (state whether steel or brass)	6	
	Piston follower stud jam nuts (state whether steel or brass)	6	
16P	Piston follower (always give diameter and state whether of iron or brass)	1	**15P-C**
17P	Piston ring (always give diameter)	1	**15P-C**
18P	Piston packing (always give diameter and material)	1	**15P-C**
19PS	Suction valve seats	8 or 12	**21PS-C**
19PD	Discharge valve seats	8 or 12	**21PD-C**
20PS	Suction valve stems	8 or 12	**21PS-C**
20PD	Discharge valve stems	8 or 12	**21PD-C**
	21PS-C Suction Valves	8 or 12	**4P-C**
21PS	Suction valve rubbers	8 or 12	
	Valve plates (74PS), springs (22PS) and stems (20PS)		
	21PD-C Discharge Valves	8 or 12	**4P-C**
21PD	Discharge valve rubbers	8 or 12	
	Valve plates (74PD), springs (22PD) and stems (20PD)		
22PS	Suction valve springs	8 or 12	**21PS-C**
22PD	Discharge valve springs	8 or 12	**21PD-C**
	23P-C Piston Rod	1	**4P-C**
23P	Piston rod	1	
	Piston rod piston nut (24P), piston lock nut (25P) and cross-head check nut (28P).		
24P	Piston rod piston nut	1	**23P-C**
25P	Piston rod piston lock nut	1	**23P-C**
	26P-C Cross Head	1	
26P	Cross head, always fitted with cross head shoe studs	1	
	Cross head shoes (27P) and cross head shoe nuts.		
	Cross head shoe studs	2	
	Cross head shoe stud nuts	2	
	Cross head shoe stud jam nut	2	
27P	Cross head shoes	2	**26P-C**
28P	Piston rod cross head check nut	1	**23P-C**
	29P-C Cross Head Pin	1	
29P	Cross head pin		
	Cross head pin nut (101P).		

Before ordering parts, read the instructions on page 3.

Repair Chart for Fairbanks-Morse Type "Y" Horizontal Oil Engine Combined Pumpers



Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all Items mentioned in that Group.	Number Pieces Used	Included In Group No.
	30P-C Connecting Rod	1	
30P	Connecting rod, always fitted with set screw	1	
	Connecting rod crank end brasses (34P and 35P), cross head end brasses (31 and 32P), cross head pin wedge (33P) and connecting rod bolts (90P)		
	Connecting rod crosshead pin wedge set screw	1	
31P	Connecting rod crosshead end brass, long, always fitted with connecting rod crosshead end brass, short (32P)	1	
32P	Connecting rod crosshead pin brass, short, always fitted with connecting rod crosshead pin brass, long (31P)	1	
33P	Connecting rod crosshead pin wedge	1	
34P	Connecting rod crank end brass, always fitted with connecting rod crank end brass cap (35P)	1	
35P	Connecting rod crank, crank end brass cap, always fitted with connecting rod crank end brass (34P)	1	
	36P-C Crank Pin	1	
36P	Crank pin	1	
	Crank pin nut (102P) and bushing (37P)		
	Crank pin nut	1	
37P	Crank pin bushing, always fitted with dowel	1	36P-C
	Crank pin bushing dowel	1	
38P	Connecting rod oiler	1	
38P	Crosshead shoe oiler	1	
38P	Crosshead pin oiler	1	
	Crosshead pin oiler nipple	1	
	Crosshead pin oiler elbow	1	
	39P-C Gear		
39P	Gear	1	
	Gear shaft (40P), gear shaft key, gear shaft end plate (41P), end plate stud and nut, and end plate dowel.		
40P	Gear shaft	1	39P-C
	Gear shaft key	1	39P-C
41P	Gear shaft end plate with dowel	1	39P-C
	Gear shaft end plate dowel	1	39P-C
	Gear shaft end plate stud	1	39P-C
	Gear shaft end plate stud nut	1	39P-C
	42P-C Pinion Cone	1	
42P	Pinion cone, always fitted with bushing (103P) and screw dowels; (on 20 and 25 H. P. engines, pinion and cone are cast one piece; on 10 and 15 H. P. engines, pinion (104P) is separate and keyed into cone and the cone is always furnished with pinion)	1	
	Oil hole cover (105P)	1 or 2	
	43P-C Gear Guard	1	
43P	Gear guard	1	
	Gear guard upper brace No. 1 (106P), upper brace No. 2 (107P), lower brace (72P) and rivets.		
	Gear guard brace rivets	4	
	Gear guard brace cap screws	2	

Before ordering parts, read the instructions on page 3.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all Items mentioned in that Group.	Number Pieces Used	Included in Group No.
	44P-C Friction Clutch	1	
44P	Friction clutch inner cone	1	
	Friction clutch inner cone adjusting nut (45P), lock nut (46P), toggle levers (50P), toggle lever pins (52P), toggle lever links (51P), toggle lever link pins (53P), shifter collar (69P), shifter collar yoke (67P) and friction cone yoke (68P)		
45P	Friction clutch cone adjusting nut	1	44P-C
46P	Friction clutch cone adjusting lock nut	1	44P-C
50P	Friction clutch toggle levers	2	44P-C
51P	Friction clutch toggle lever links	4	44P-C
52P	Friction clutch toggle lever pins with cotters	2	44P-C
	Friction clutch toggle lever pin cotters	4	
53P	Friction clutch toggle lever link pin with cotters	4	44P-C
	Friction clutch toggle lever link pin cotters	8	
54P	Engine crankshaft extension stud	1	44P-C
55P	Engine crankshaft collar	1	57P-C
56P	Engine crankshaft cone key	1	57P-C
	Engine crankshaft cone key screw	2	
	Engine crankshaft cone key dowel	1	
	57P-C Engine Crankshaft	1	
57P	Crankshaft, always fitted with air stop ring dowel (252), crank pin oiler ring studs, counterweight dowels (138), counterweights (26), counterweight strap bolts (139) and nuts, oil thrower rings (164), extension stud (54P), collar (55P), key (56P) with screws and dowels, and distance ring (94P)	1	
	Crank pin oiler ring (253) with gasket (405) screw and nuts, air stop rings (165) and air stop ring springs (280)		
58P	Friction clutch adjusting nut wrench	1	
63P	Friction clutch shifter lever lock	1	71P-C
64P	Friction clutch shifter lever fulcrum pin with cotter	1	71P-C
	Friction clutch shifter lever fulcrum cotter	1	
65P	Friction clutch shifter bracket, upper	1	71P-C
65PA	Friction clutch shifter bracket, lower	1	71P-C
66P	Friction clutch guard	1	71P-C
67P	Friction clutch shifter collar yoke, always two halves furnished with screws, nuts and cotters	1	
	Friction clutch shifter collar yoke screws	2	
	Friction clutch shifter collar yoke screw nuts	2	
	Friction clutch shifter collar yoke cotters	2	
68P	Friction clutch yoke, always two halves furnished with screws and nuts	1	
	Friction clutch yoke screws	2	
	Friction clutch yoke screw nuts	2	
69P	Friction clutch shifter collar	1	
70P	Friction clutch shifter lever, short	1	
	71P-C Friction Clutch Shifter Lever	1	
71P	Friction clutch shifter lever, long	1	
	Friction clutch shifter lever (70P), screws and nuts, shifter locks (63P), shifter lock screw, shifter lever brackets (65P and 65PA), bracket cap screws, shifter lever fulcrum pin (64P), shifter lever spreader (78P), shifter lever spreader screws with nuts, and clutch guard (66P).		
	Friction clutch shifter lever screw	2	
	Friction clutch shifter lever screw nut	2	
	Friction clutch shifter lock screw	1	
	Friction clutch bracket screw	2	
	Friction clutch shifter spreader screw	2	
	Friction clutch shifter spreader screw nuts	2	

Before ordering parts, read instructions on page 3.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all Items mentioned in that Group.	Number Pieces Used	Included In Group No.
72P	Gear guard lower brace	1	**43P-C**
	Gear guard lower brace rivets	2	
	Gear guard lower brace screws	2	
74PS	Suction valve plates	8 or 12	**21PS-C**
74PD	Discharge valve plates	8 or 12	**21PD-C**
78P	Friction clutch lever spreader	1	**71P-C**
79P	Lower base bearing cap shims	4	**1P-C**
82P	Air chamber name plate	1	**4P-C**
	Air chamber name plate screws	2	
	Air chamber name plate screw washers	2	
85P	Valve stem wrench	1	
86P	Piston nut socket wrench	1	
87P	Removable cylinder nut socket wrench	1	
88P	Piston eye bolt	1	
89P	Water boxhead pump diameter plate	1	**7P-C**
	Water boxhead pump diameter plate screws	2	
	Water boxhead pump diameter plate washers	2	
90P	Connecting rod bolts with nuts, jam nuts and cotters	2	**30P-C**
	Connecting rod bolt nuts	2	
	Connecting rod bolt jam nuts	2	
	Connecting rod bolt cotters	2	
91P	Lower base bearing shells (furnished in pairs only)	2 pair	**1P-C**
92P	Valve assembling clips	2	
93P	Water box drain plugs	3	**4P-C**
94P	Engine crank shaft distance ring	1	**57P-C**
	95P-C Exhaust Pot	1	
95P	Exhaust pot, always fitted with pipe plug	1	
	Hand hole plate (96P), hand hole plate clamp (97P) with set screw, hand hole plate gasket (98P), jack screw and jack scew nut, inlet flange (229), inlet flange gasket (415), inlet flange screws.		
96P	Exhaust pot hand hole plate	1	**95P-C**
97P	Exhaust pot hand hole plate c'amp with set screw	1	**95P-C**
	Exhaust pot hand hole plate c'amp set screw	1	
98P	Exhaust pot hand hole plate gasket	1	**95P-C**
	Exhaust pot jack screw	1	
	Exhaust pot jack screw nut	1	
99P	Exhaust pot outlet nipple	1	
100P	Exhaust pot inlet nipple (not shown on chart)	1	
101P	Crosshead pin nut	1	**29P-C**
102P	Crank pin nut	1	**36P-C**
103P	Pinion cone bushing	1	**42P-C**
	Pinion cone bushing screw dowels	2	
104P	Pinion (one 10 and 15 H. P. engines only), always furnished with 42P	1	**42P-C**
105P	Pinion cone oil hole cover	1 or 2	**42P-C**
106P	Gear guard upper brace No. 1	1	**43P-C**
107P	Gear guard upper brace No. 2	1	**43P-C**
	Gear guard upper brace rivets	2	
108P	Governor spring adjusting screw		
	109P-C Governor Spring		
109P	Governor spring, always fitted with one spring nut (52) and eye bolt (51) for 10 and 15 H. P. engines, and with two spring nuts for 20 and 25 H. P. engines		

Before ordering parts, read instructions on page 3.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type when shown at the Head of a Group of Parts, includes all Items mentioned in that Group.	Number Pieces Used	Included In Group No.
	Gaskets and Packings		
115P	Water box stuffing box gasket	1	**4P-C**
116P	Water box head gasket	1	**4P-C**
117P	Water box hand hole plate gasket	4	**4P-C**
118P	Water box bonnet gasket	1	**4P-C**
119P	Water box suction flange gasket	1	**4P-C**
119P	Water box blind flange gasket	1	**4P-C**
120P	Water box bonnet air chamber gasket	1	**4P-C**
121P	Water box bonnet discharge flange gasket	1	**5P-C**
122P	Stuffing box packing (always give material)	1 set	**13P-C**
18P	Piston packing (always give material)	1 set	**15P-C**
	Cooling water piping from engine to water box bonnet, including stop cock	1 set	
	Tools		
58P	Friction clutch adjusting nut wrench	1	
85P	Valve stem wrench	1	
86P	Piston nut socket wrench	1	
87P	Removable cylinder with socket wrench	1	
88P	Piston eye bolt	1	
92P	Valve assembling clips	2	

Before ordering parts, read the instructions on page 3.

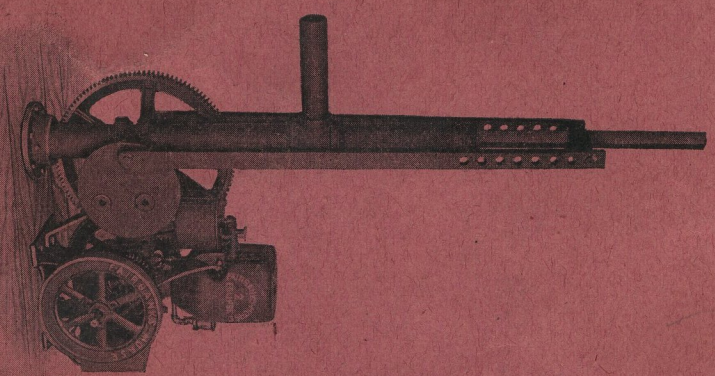
TROUBLE CHART

TROUBLE	POSSIBLE CAUSE	REMEDY
Engine does not start.	Instructions to start engine not followed.	Read and follow carefully.
	No gasoline in tank.	Fill tank.
	Battery circuit broken.	Examine all battery and electrical connections carefully and see that timer makes contact with pin on gear at proper time. Close switch and listen for buzz of vibrator.
	Vibrator points dirty.	Separate contact points and blow between them or clean with fine emery cloth or a fine file.
	Foul spark plug.	Remove center part of plug and clean carefully. Replace and test for spark. (See page 5.) See that points are $\frac{1}{32}$ in. apart.
	Batteries run down.	Replace with new battery cells, connecting up same as before.
	Cold weather, batteries dead.	Warm batteries. Provide shelter for pumper.
	Water in Gasoline.	Remove suction elbow with gasoline tank attached. Empty into glass dish and see if water settles to bottom. If so, fill tank with fresh gasoline. Straining gasoline through chamois skin will remove water.
Engine misses or stops after being started.	Dirt under check valve in gasoline tank.	Clean check valve. (See page 3.)
	Weak batteries.	Test batteries and spark plug. (See pages 4 and 10.) Renew if necessary.
	Loose electrical connections.	Examine all electrical connections and tighten if necessary. Cables may be broken inside insulation. Test each.
Lack of compression.	Dirt or carbon under valves.	Remove valves, clean or regrind if necessary. (See page 3.)
	Valve stems may stick.	Remove valves, clean stems, oil and replace.
Uses too much fuel.	Too much clearance between exhaust valve stem and push block cap screw head, caused by wear.	Remove cap screw and shim up under cap screw head with thin tin washers to make valve stem clearance 1/32″ to 1/64″ when valve is closed.
	Exhaust pipe line too small when run outside building or too many bends.	Increase pipe to $1\frac{1}{4}$ inch from engine out. (See page 3.)
	Silencer may be plugged with carbon.	Take silencer apart and clean.
Engine races or runs away.	Relation of governing parts may be incorrect—caused by wear or injury.	See paragraph on governing, and set detent parts according to this.

INSTRUCTIONS No. 2301E

FOR SETTING UP AND OPERATING

Fairbanks-Morse No. 2 Eclipse Pumper



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The No. 2 Eclipse Pumper

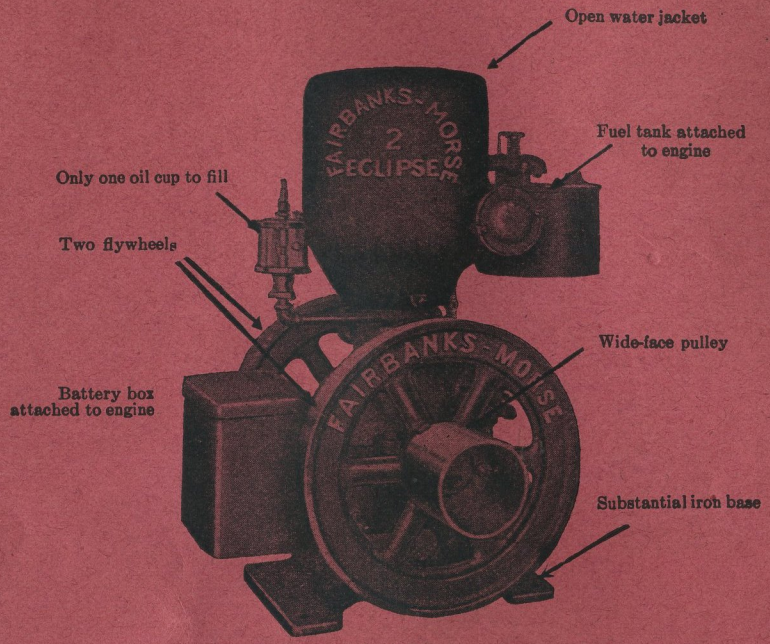


Fig. 960M

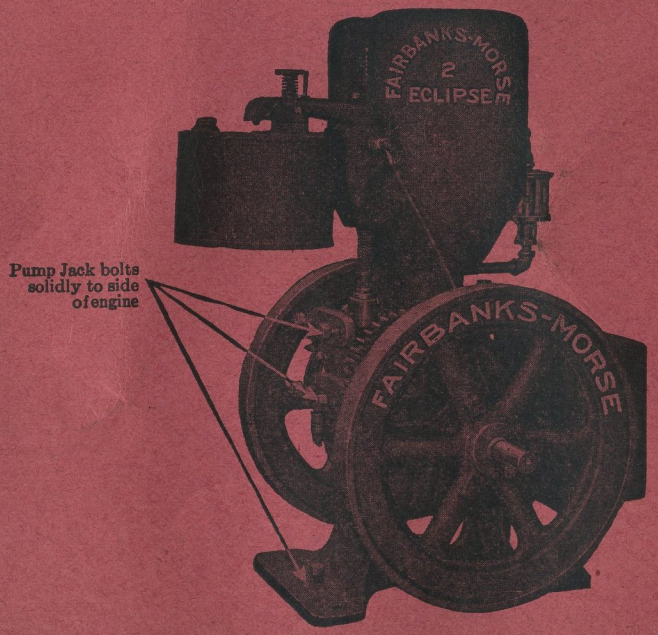


Fig. 961M

INSTRUCTIONS No. 2301E
For Setting Up and Operating Fairbanks-Morse No. 2 Eclipse Pumper

These Pumpers are Regularly Fitted with:

1. Evaporator tank, cast with cylinder.
2. Jack frame, carrying pumper gear and crank.
3. Suction fuel feed, with fuel tank attached to inlet elbow.
4. Closed base, with splash lubrication.
5. Jump spark ignition.

Read all tags attached to engine, and change no adjustments of moving parts until instructions are carefully read.

Locating Pumper.

In locating pumper on well curb, it is well to place it in such a position that the pumper gear will clear a pail hanging on the spout of the pump.

If Pump is to be Operated by Hand

If an arrangement is desired which will enable the pump to be operated by hand, place pump handle opposite to engine. After engine has been set around so that gear will not strike a pail hanging on the pump spout, the pump handle will be in such a position that it will not strike the spout.

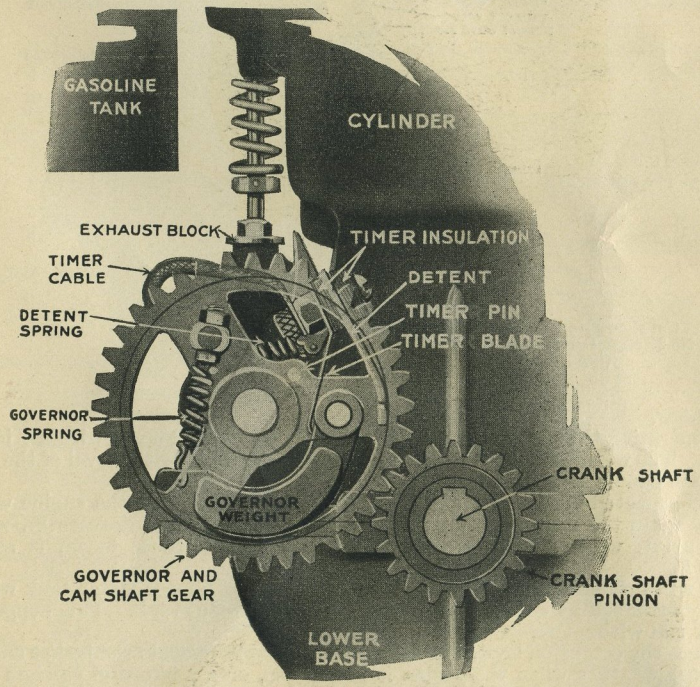


Fig. P7—Fly-wheel removed to show Governor and Timer

Attaching Pumper

To attach pumper to pump, clamp the jack frame to the pump standard, being careful to set the pumper flat on the well platform, and then fasten down with bolts or lag screws to the platform. Put cross-head on the pump rod and turn the flywheel of the engine until crank pins on gear and crank are at their lowest position. Now put pump pitman rods on the pins and attach cross-head on pump rod at the nearest holes, being careful to have pump rod about ½ inch to 1 inch from its lowest point of stroke. After attaching pitmans, turn the engine slowly to see that there is sufficient clearance at both ends of the stroke. To get this proper clearance it may be necessary, in some cases, to place a board under the pumper to raise it. If cross-head is to be attached to wood pump pole, remove the clamp piece used with standard well pump and clamp the cross-head directly to wood pump pole.

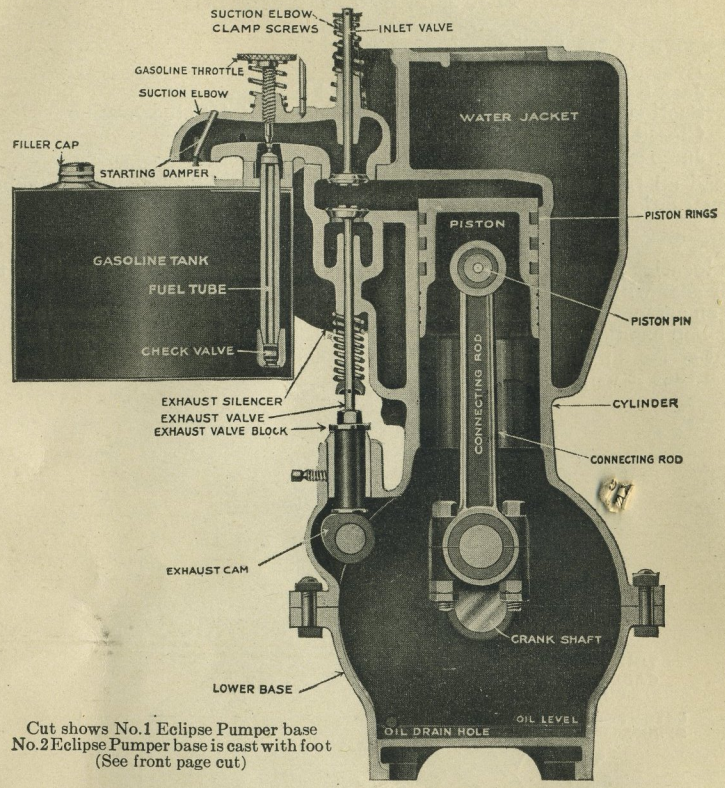
Lowest Point of Stroke

Strokes

The pumper is furnished with 5, 7½ and 10-inch strokes.

Small Pump Standards

Unusually small pump standards may require fill-up pieces or special cap to allow pumper to be attached to standard.



Cut shows No. 1 Eclipse Pumper base
No. 2 Eclipse Pumper base is cast with foot
(See front page cut)

Evaporator.

Water Level

In operating the engine the water tank should be filled up to within ¾ inch from the top. The water level must never be allowed to fall below the level of the cylinder top, which can be seen inside.

Boiling Water

It is expected that water will boil under heavy load, but the engine will work properly when the water is boiling. This temperature is 212 degrees F., while the danger point, where the lubricating oil will burn and cause harm, is about 420 degrees F.

Extension Water Tank

We will furnish at a small extra cost an extension hopper water tank which can be easily attached by any one on the top of regular jacket tank. This hopper allows a longer run without replenishing cooling water.

Drain Extension Hopper in Freezing Weather

Non-freezing Solution

Where the extension hopper is used, it is advisable to drain the jacket and hopper in freezing weather when the engine is not in use, or a mixture of calcium chloride and water may be used and left in the jackets. This mixture will not harm the jacket, as it will not freeze solid. A proportion of three pounds of calcium chloride to a gallon of water will not freeze hard in zero weather.

Exhaust Silencer.

Exhaust Piped Outside

Engines are shipped with exhaust silencer attached to exhaust outlet.

In case it is desired to locate the silencer outside of the building, use 1-inch pipe, with a "T" on the bottom of the upright portion, provided with a drain in the bottom of the "T," as water will collect in long pipes. Use as few bends as possible.

If extension pipe is longer than 8 feet, it is advisable to increase to 1¼-inch size, decreasing at outlet to 1-inch for silencer.

Fuel Tank.

Filling Tank

Each engine is regularly fitted with a fuel tank, attached to the inlet or suction elbow. This tank is provided with a screw cap filler. The fuel is drawn from the tank by the suction of the engine and held by a check valve placed in the fuel pipe in the tank.

Check Valve

Cleaning Check Valve

If dirt from the fuel gets under this valve, it can usually be dislodged by disconnecting the tank and shaking it. Tank can be removed by unscrewing the two nuts from the studs which hold the elbow in place. The tank, with elbow, can then be lifted out. Care must be taken when replacing elbow to have it come against the packing gasket squarely to avoid leaks at one side.

Removing Tank

Replacing Elbow

Always keep filler cap on tank and supply can to prevent entrance of water.

Exhaust Valve.

Removing Valve

This valve is similar to the inlet valve, with the stem extending downward through its guide and a spring on this stem to hold it to its seat. The spring nut or washer, secured by a pin through the stem, holds this spring. This valve can be removed by first taking out the inlet elbow, as described above, then removing springs as follows: Raise the spring washer which holds the exhaust valve spring clear from its pin. After removing the pin, the spring washer will drop down the stem and the valve can be taken out.

Lost Compression

Loss of compression may be due to leaky valves, caused by small particles of carbon or other substances. To remedy this, the valves should be cleaned and reground. The valves may be reground with fine emery and oil by revolving the valve on its seat, rotating it with a screw driver a few times in alternate directions and lifting it clear from its seat frequently to allow the cutting emery to distribute evenly. Carefully clean both valve and seat with gasoline before replacing.

Regrinding Valve

Timer.

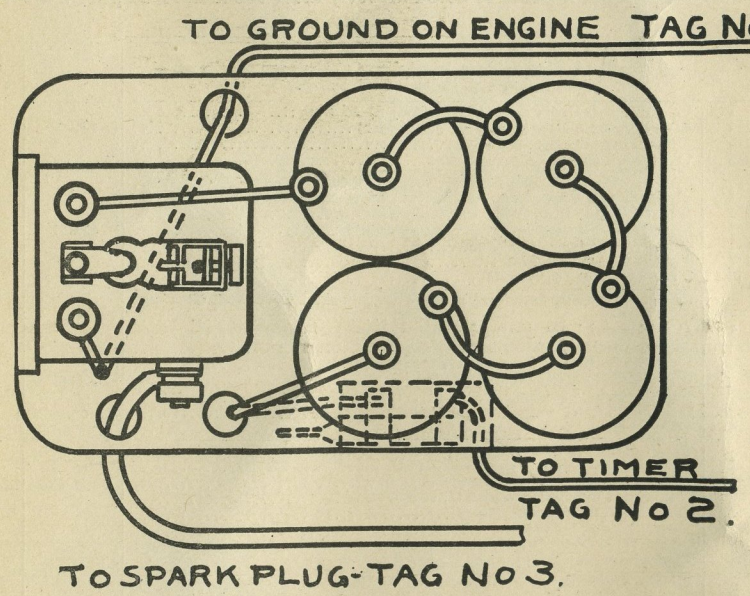
Timing Ignition

See that the timer blade is so placed that the spark will take place when the "spark" mark on the engine flywheel is straight up. Keep timer free from dirt.

Battery and Coil Box.

Wiring Diagram

This box, attached by a bracket to the engine sub-base, carries the spark coil and four 2½x6-inch dry battery cells, and has a switch placed on the bottom of the box. These batteries are sent out from the factory properly connected, with a diagram to show the connections to the engines, as follows: Each contact on the engine has



a tag attached to show the wire connections to correspond with this diagram. Connect the large cable to the spark plug. The longer of the two small cables is connected from the switch to the timer and the shorter one from the coil to the ground connection on the engine base. Close the switch and turn the engine slowly until "spark" mark on the flywheel is straight up and the timer in contact. The vibrator on the coil should then buzz. Open switch immediately, as the continuous contact will exhaust batteries in a short time. The battery cells are connected in series. See that none of the wires are broken, and that all binding nuts are tight.

Test Battery

Open Switch

Renewing Batteries

To renew battery, order new 2½x6-inch dry cells from the nearest supply and connect up the same as this diagram. Keep the outer binding posts of the batteries from touching the other cells. The batteries we furnish will be of full strength, properly connected up, and in working order when shipped. With proper care they should be sufficient to ignite the engine for six months or more, but if improperly connected may be ruined in a short time. We do not replace batteries without charge. Owner must see that it has proper attention.

Proper Care

High Tension Magneto

There can be furnished on special orders a high tension magneto with proper bracket, gears and bolts which can be attached to engine and do away with the use of batteries. Engine can be started and run with the magneto.

Spark Plug.

Testing Spark

To test spark plug, unscrew it complete from the cylinder and connect the large cable to it. Lay it on the top of the cylinder, being sure that it is in metallic contact, then turn the engine over to the "spark" point. Close the switch for an instant, and if the connections and plug are in proper condition a spark will be seen between the two sparking points of the plug. This plug can be easily cleaned by unscrewing

Cleaning Plug

(*Continued on page 10*)

REPAIR PARTS LIST
for Fairbanks-Morse No. 2 Eclipse Pumper

When ordering parts always give the size, type and **Shop Number** of the engine. The Number is **very important.** It is stamped on the top of the cylinder. **Do not fail to give it.**

Parts may be ordered individually or in groups.

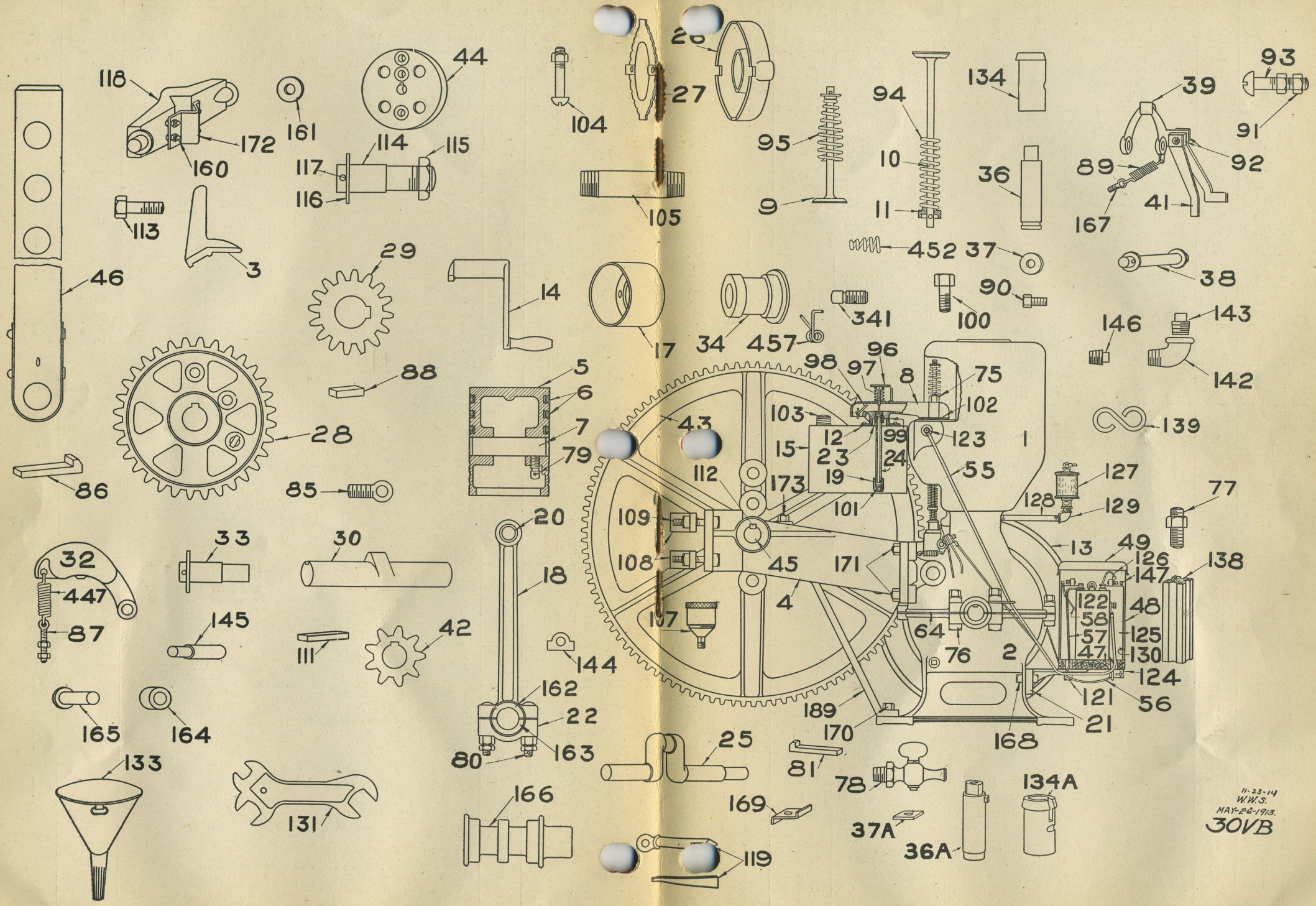
A **Group Number** printed in **heavy type,** followed by the letter "c", such as "5-C" covers all items in that paragraph down to the first horizontal line, thus————————: An ordinary repair number printed in light type (such as "5"), covers that one part only.

A group may be ordered **less** certain specified parts, for example "1D-C less 10-C and 28-C."

Any part without a repair number is listed directly after the numbered part with which it is used.

Repair Nos. Arranged Numerically	The Group Number in Heavy Type, when shown at the head of a Group of parts, includes all items in that Group.		Included in Group No.	No. Used.
	1	Cylinder and Upper Base (Babbitted) fitted with		1
	171	Jack to Engine Base Studs and Nuts (four)	1A-C	
	146	Drain Plug in Cylinder Jacket		
	146	Overflow Plug in Cylinder Jacket		
1A-C		**1A-C. Cylinder and Upper Base, with Exhaust Valve**		
	1	Cylinder and Upper Base (Babbitted) fitted with 146 (2)		
	171	Jack to Engine Base Studs and Nuts (four)		
	34	Cam Shaft Bearing Opposite Governor Side	1D-C	
	341	Cam Shaft Bearing Set Screw		
	167	Detent Spring Eye-Bolt		
	10C	Exhaust Valve (complete)		
1B-C		**1B-C. Cylinder and Upper Base with Cam Shaft Gear and Governor**		
	1	Cylinder and Upper Base (Babbitted), fitted with 146 (2)		
	171	Jack to Engine Base Studs and Nuts (four)		
	34	Cam Shaft Bearing Opposite Governor Side		
	341	Cam Shaft Bearing Set Screw	1D-C	
	167	Detent Spring Eye-Bolt		
	28C	Cam Shaft Gear and Governor (complete)		
	30	Cam Shaft		
1C-C		**1C-C. Cylinder and Upper Base, Fitted with Lower Base**		
	1	Cylinder and Upper Base (Babbitted), fitted with 146 (2)		
	171	Jack to Engine Base Studs and Nuts (four)		
	34	Cam Shaft Bearing Opposite Governor Side		
	341	Cam Shaft Bearing Set Screw		
	167	Detent Spring Eye-Bolt		
	2	Lower Base (Babbitted), fitted with 77 Ground Contact Stud and Nut		
	64	Liners between Cylinder and Lower Base (one set)		
1D-C		**1D-C. Cylinder and Upper Base, Fitted with Exhaust Valve, Exhaust Block Guide, Cam Shaft Bearing, Cam Shaft, Gear, Governor and Detent**		
	1	Cylinder and Upper Base (Babbitted), fitted with 38 Detent Fulcrum Pin, Washers, Cotters and 146 (2) Plugs		
	171	Jack to Engine Base Studs and Nuts (four)		
	34	Cam Shaft Bearing Set Screw		
	341	Cam Shaft Bearing Opposite Governor Side		
	167	Detent Spring Eye-Bolt		
	10C	Exhaust Valve (complete)		
	36C	Exhaust Block (complete)		
	28C	Cam Shaft Gear and Governor (complete)		
	30	Cam Shaft		
	39	Detent		
	89	Detent Spring		

Repair Nos. Arranged Numerically	The Group Number in Heavy Type, when shown at the head of a Group of parts, includes all items in that Group.		Included in Group No.	No. Used.
2	2	Lower Base (Babbitted), fitted with 77 Ground Contact Stud and Nut	1C-C	1
3	3	Gear Guard, for Gear on Jack Shaft and Pinion on Cam Shaft		1
4C		**4C. Jack Frame**		1
4	4	Jack Frame		
	189	Jack Frame Brace	4A-C	
	170	Jack Frame Brace to Engine Foot Cap Screw		
	173	Jack Frame Brace to Jack Machine Bolt		
4A-C		**4A-C. Jack Complete**		
	4C	Jack Frame		
	107	Jack Shaft Bearing ½-inch Grease Cup		
	108	Jack Frame Clamp Caps (two)		
	109	Jack Frame Clamp Cap Bolts (four)		
	45C	Gear with Jack Shaft and Crank Pin		
	44C	Crank Disc with Crank Pin		
	46	Pump Pitman (two)		
	118C	Pump Cross Head (complete)		
5C		**5C. Piston**		1
5	5	Piston		
	79	Piston Pin Set Screw		
		Piston Pin Set Screw Cotter		
6	6	Piston Rings (Three)		3
7	7	Piston Pin		1
8C		**8C. Inlet or Suction Elbow**		1
8	8	Inlet or Suction Elbow, always fitted with 23 Gasoline Nozzle and Valve Seat, Needle Valve Index and 98-C Starting Damper		1
	101	Gasoline Check Valve	8A-C	
	24	Tube		
	19	Tube Fitting		
8A-C		**8A-C. Inlet or Suction Elbow, Fitted with Inlet Valve**		1
	8C	Inlet or Suction Elbow	8B-C	
	9C	Inlet Valve (complete)		
8B-C		**8B-C. Inlet or Suction Elbow, fitted with Inlet Valve and Gasoline Needle Valve**		1
	8A-C	Inlet or Suction Elbow		
	96	Gasoline Needle Valve and Handle		
	97	Gasoline Needle Valve Spring		
9C		**9C. Inlet Valve.**		1
9	9	Inlet Valve		
		Inlet Valve Washer		
		Inlet Valve Washer Cotter		
		Inlet Valve Spring		
10C		**10C. Exhaust Valve**		1
10	10	Exhaust Valve		1
11	11	Exhaust Valve Spring Washer		1
		Exhaust Valve Spring Washer Pin		
		Exhaust Valve Spring		
13	13	Flywheel, fitted with 81 Key		2
14	14	Starter Crank		1
15	15	Gasoline Tank, fitted with 103 Set Screw Cap		1
17	17	Pulley, with Machine Bolts (three)		1
18C		**18C. Connecting Rod.**		1
18	18	Connecting Rod		
	22	Connecting Rod Cap		
	162	Connecting Rod Crank Babbitt Liner (Upper)		
	163	Connecting Rod Crank Babbitt Liner (Lower)		
	20	Connecting Rod Piston Pin Bushing		
	80	Connecting Rod Studs, with Nuts, Half Nuts and Cotters		
	144	Connecting Rod Shims (Crank End)		
19C		**19C. Check Valve**		1
	19	Check Valve Seat, with Screen		
	101	Check Valve		
		19C-C. Check Valve, With Tube		1
	19C	Check Valve Seat, with Screen		
	24	Check Valve Tube		
20	20	Connecting Rod Piston Pin Bushing	18-C	1
21	21	Battery Box Bracket	48-C	1
22	22	Connecting Rod Cap	18-C	1
24	24	Tube	8C-19C-C	1
25	25	Crank Shaft		1
26C		**26C. Exhaust Silencer**		
26	26	Exhaust Silencer Casting		1
27	27	Exhaust Silencer Plate		1
	104	Exhaust Silencer to Plate Stove Bolts (two)		1
	105	Exhaust Silencer Nipple		
28C		**28C. Cam Shaft Gear and Governor**		1
28	28	Cam Shaft Gear, fitted with 145 Timer Pin		
	164	Timer Roller		
	165	Timer Roller Pin		
	33	Governor Weight Fulcrum Pin, with Washer and Cotter		
	85	Governor Spring Eye-Bolt		
	86	Key		
	32	Governor Weight		
	87	Governor Spring Eye-Bolt with Nuts		
	447	Governor Spring		



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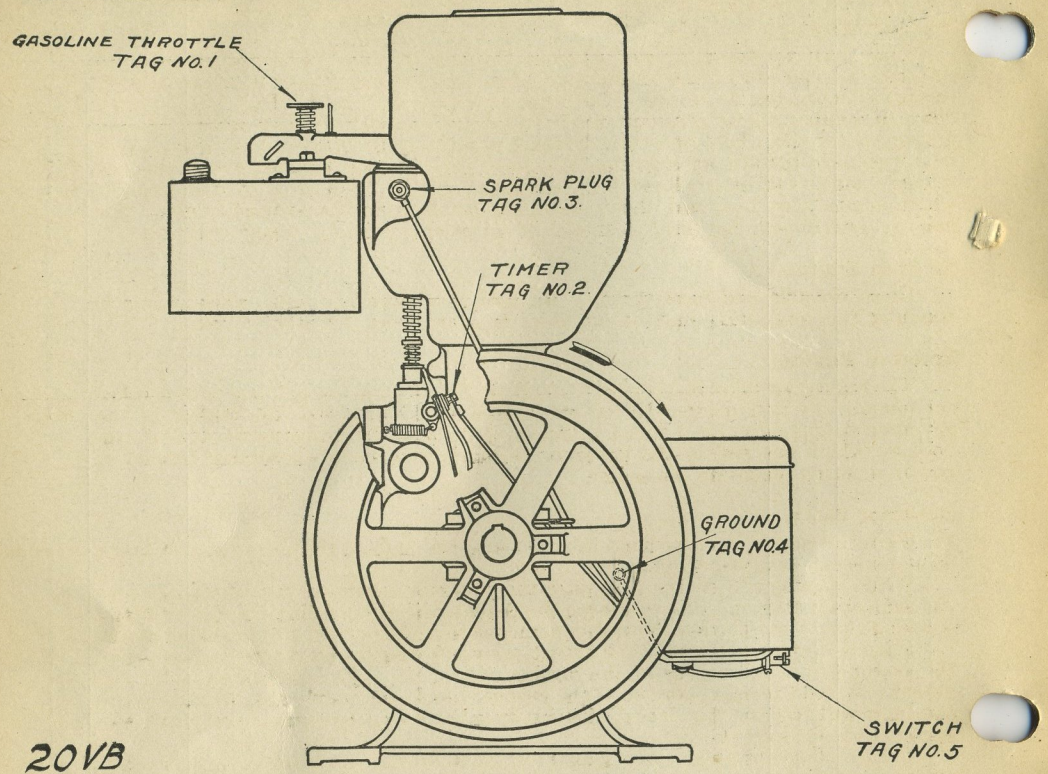
MAY-26-1913.
30VB

Repair Nos. Arranged Numerically	The Group Number in Heavy Type, when shown at the head of a Group of parts, includes all items in that Group.		Included in Group No.	No. Used.
29	29	Pinion on Crank Shaft, with 88 Key		1
30	30	Cam Shaft	1B-C, 1D-C	1
32	32	Governor Weight	28C	1
33	33	Governor Weight Fulcrum Pin, with Washer and Cotter	1A-C, 1B-C	
34	34	Cam Shaft Bearing Opposite Governor Side	1C-C	
36		See 36A-C.		
37				
36A-C		**36A-C. Exhaust Valve Push Block**		1
36A	36A	Exhaust Valve Push Block		
37A	37A	Exhust Valve Push Block Washer		
	169	Exhaust Valve Push Block Washer Cap		
	90	Exhaust Valve Push Block Washer Cap Screws		
	134A	Exhaust Valve Push Block Guide Bushing		
	36	Exhaust Valve Push Block, used on Engines before 14400		
	37	Exhaust Valve Push Block Washer, used on Engines before 14400		
	134	Exhaust Valve Push Block Guide Bushing, used on Engines before 14400		
	36A-C	To be used for repairs in place of 36, 37, 90 and 134		
38	38	Detent Fulcrum Pin with Washers and Cotters	1D-C	1
39	39	Detent with 92 Timer Insulation		1
41C		**41C. Timer Blade.**		1
41	41	Timer Blade		
	93	Brass Machine Screw for Attaching to Detent		
	91	Binding Post Nuts		
42	42	Cam Shaft Pinion, with 111 Key		1
43C		**43C. Gear, With Crank Pin**	45C	1
43	43	Gear on Jack Shaft, with 112 Key		
	114C	Crank Pin (complete)		
44C		**44C. Crank Disc, With Crank Pin**	4A-C	1
44	44	Crank Disc, with 112 Key		
	114C	Crank Pin (complete)		
44A-C		**44A-C. Crank Disc, With Jack Shaft and Crank Pin**		1
44	44	Crank Disc, with 112 Key		
	114C	Crank Pin (complete)		
	45	Jack Shaft		
45C		**45C. Gear, With Jack Shaft and Crank Pin**		1
45	45	Jack Shaft	4A-C	1
	114C	Crank Pin (complete)		
	43	Gear on Jack Shaft, with 112 Key		
46	46	Pump Pitman	4A-C	2
48A-C		**48A-C. Battery Box, with Coil, Dry Battery, Switch, Wire Connection, Bracket and Cover**		1
48	48	Battery Box, with Coil Holder		1
49	49	Battery Box Cover		1
	21	Battery Box Bracket		
	168	Bracket to Engine Base Machine Bolts (two)		
	121	Battery Box to Bracket Carriage Bolts (two)		
	130	Battery Box Lining		
	122	Single Unit Spark Coil		
	124	Single Throw Switch		
		Single Throw Switch, Wood Screw (two)		
	125	2½ x 6 inch Dry Batteries (four)		
	147	Dry Battery Loop Nuts (eight)		
	126	Duplex Battery Connectors (four)		
	138	Packing Block for Dry Batteries		
55	55	High Tension Cable from Coil to Spark Plug		1
56	56	Low Tension Cable from Switch to Timer on engine		1
57	57	Low Tension Cable from Coil to Ground on Engine		1
58	58	Low Tension Cable from Batteries to Switch		1
64	64	Liners between Cylinder and Lower Base (one set)	1C-C	1 Set
72	72	Jack Shaft Frame Clamp Cap for Extra Small Pump Standard		1
75	75	Clamp Studs, with Nuts for Inlet Elbow (two)		2
76	76	Cylinder to Lower Base Machine Bolts, with Lock Nuts, set of six		6
78	78	Drain Cock for Lower Base		1
79	79	Piston Pin Set Screw	5C	1
		Piston Pin Set Screw Cotter		1
80	80	Connecting Rod Cap Studs and Nuts, Half Nuts and Cotters	22C	2
85	85	Governor Spring Eye-Bolt	28C	1
86	86	Key		1
87	87	Governor Spring Eye-Bolt with Nuts		1
89	89	Detent Spring		
90	90	Exhaust Valve Push Block Washer Cap Screws	36A-C	1
91	91	Binding Post Nuts	41C	2
92	92	Insulation for Timer		3
93	93	Brass Machine Screw for Attaching to Detent	41C	1
94		Exhaust Valve Spring	10C	1
95	95	Inlet Valve Spring		1
96	96	Gasoline Needle Valve and Handle	8A-C	1
97	97	Gasoline Needle Valve Spring		1

Repair Nos. Arranged Numerically	The Group Number in Heavy Type, when shown at the head of a Group of parts, includes all items in that Group.		Included in Group No.	No. Used.
98C		**98C. Starting Damper**		
98	98	Starting Damper, with Handle and Cotter		
	457	Starting Handle Damper Spring		
99	99	Inlet or Suction Elbow to Gasoline Tank Gasket		1
100	100	Inlet or Suction Elbow to Gasoline Tank Cap Screw		2
101	101	Check Valve		1
102	102	Inlet or Suction Elbow to Cylinder Gasket		1
104	104	Exhaust Silencer to Plate Stove Bolts (two)		2
105	105	Exhaust Silencer Nipple	26C	1
107	107	Jack Shaft Bearing ¼-inch Grease Cup		1
108	108	Jack Frame Clamp Caps (two)	4A-C	2
109	109	Jack Frame Clamp Caps Bolts (four)		2
113	113	Gear Guard Cap Screw		1
114C		**114C. Crank Pin (for either Gear or Crank Disc)**		2
114	114	Crank Pin		2
115	115	Crank Pin Half Nut		2
116	116	Crank Pin Washer		2
117	117	Crank Pin Cotter		2
118C		**118C. Pump Cross Head (complete)**		1
118	118	Pump Cross Head		
119	119	Pump Rod Clamp Piece, with Leather Cotter		
	172	Pump Cross Head Clamp Cap		
	160	Pump Cross Head Clamp Bolts (four)		
	161	Pump Cross Head Pitman Washers		
	117	Pump Cross Head Pitman Washer Cotters		
	166	Pump Rod Clamp Piece		
121	121	Battery Box to Bracket Carriage Bolts (two)		2
122	122	Single Unit Spark Coil		1
124	124	Single Throw Switch	48A-C	1
		Single Throw Switch Wood Screw (two)		2
123	123	Spark Plug		1
125	125	2½ x 6-inch Dry Batteries (four)		4
126	126	Duplex Battery Connectors (four)		4
127	127	Cylinder Oil Cup		1
128	128	Cylinder Oil Cup Nipple		1
129	129	Cylinder Oil Cup Elbow		1
130	130	Battery Box Lining		1
131	131	Double End Wrench		1
133	133	Tin Funnel		1
142	142	Oil Filler Elbow in Cylinder		1
143	143	Oil Filler Elbow Plug		1
144	144	Connecting Rod Shims (Crank End)	18C	10
145	145	Tinner Pin		
146	146	Drain Plug in Cylinder Jacket	1A-C	1
146	146	Overflow Plug in Cylinder Jacket	1A-C	1
147	147	Dry Battery Loop Nuts (eight)	48A-C	8
160	160	Pump Cross Head Clamp Bolts (four)	118C	4
161	161	Pump Cross Head Pitman Washers		4
162	162	Connecting Rod Crank Babbitt Liner (upper)		1
163	163	Connecting Rod Crank Babbitt Liner (lower)	18C	
164	164	Timer Roller	28C	1
165	165	Timer Roller Pin		1
166C		**166C. Pump Rod Clamp Piece (Complete)**		1
166	166	Pumper Rod Clamp Piece		
	119	Pump Rod Pin, with Leather Cotter		
167	167	Detent Spring Eye-Bolt	1A-C	1
168	168	Bracket to Engine Base Machine Bolts (two)	48A-C	2
169	169	Exhaust Push Block Washer Clip	26A-C	1
170	170	Jack Frame Brace to Engine Foot Cap Screw	4C	1
171	171	Jack to Engine Base Studs and Nuts (four)	1A-C	4
172	172	Pump Cross Head Clamp Cap	118C	1
173	173	Jack Frame Brace to Jack Machine Bolt	4C	1
189	189	Jack Frame Brace	4C	1
341	341	Cam Shaft Bearing Set Screw	1AC	1
447	447	Governor Spring		
452	452	Exhaust Block Spring		
457	457	Starting Handle Damper Spring		
		EXTRA PARTS		
		59C. Extension Hopper		
	59	Extension Hopper		
	60	Extension Hopper Clamp		
	61	Extension Hopper Gasket		
	70	Extension Hopper Clamp Machine Bolt		
		180C. Gear Driven High Tension Magneto Outfit		
	180	High Tension Magneto, with Cable		
	181	High Tension Magneto Bracket		
	182	High Tension Magneto Bracket to Engine Machine Bolts, with Lock Washers (two)		
	183	High Tension Magneto to Bracket Cap Screws (two)		
	184	High Tension Magneto Idler Gear		
	185	High Tension Magneto Idler Gear Pin, with Nut		
	186	High Tension Magneto Drive Pinion		



(Continued from page 4)

the center part from the shell, which may be left in the cylinder, then wiping the soot or oil from the center porcelain insulation with a piece of cloth or paper. The gap between the sparking points on the plug should be a little less than 1/32 inch. If the center porcelain of the spark plug is coated with greasy burnt carbon, it indicates that too much oil is being fed. If the right amount of fuel is fed, the plug should remain comparatively clean, but it should be examined occasionally.

Spark Cap

Too Much Oil

Extra Plug

It is recommended that an extra plug be kept on hand.

Lubrication.

Oil Level

Cold Weather

Shut Off Oil Supply

Oil Throwing

Engine is oiled by splash lubrication, the oil being fed through a sight feed oil cup attached to the cylinder. Oil should be carried in crank case to a level where it will begin to overflow when drain cock in lower base is opened. Oil cup should be set to feed about 3 to 5 drops per minute. In cold weather the oil is sluggish and will work much freer if 25 per cent of kerosene be added, but, in that case, feed eight drops per minute, using nothing but good mineral gas engine oil. If white smoke comes from the exhaust, it may indicate too high a level of oil in the base. The remedy is to reduce the feed somewhat. Be sure to shut off the oil cup when engine is stopped.

If oil works out of the bearings and is thrown from the gears or flywheels, reduce feed of oil at oil cup and leave plug out of filling elbow on cylinder casting.

Instructions for Running the Engine.

Attaching Engine

Fill Tanks and Oiler

Put Oil in Engine Base

Test Ignition Circuit

Connect the engine as shown by Figs. P1 and P2. Unpack the battery box and bolt it to base under engine (holes drilled for this). See that movable parts about the governor are free from dirt and paint and work easily. Put glass oil cup in place on side opposite Jack. Screw spark plug into place in cylinder tight enough to avoid loss of compression. Connect wires from battery box as indicated by tags. Fill gasoline tank. Fill water jacket to within $\frac{3}{4}$ inch from top. Fill glass oil cup with gas engine oil, and put oil into base of engine up to the level of small drain cock near bottom of base opposite flywheel side. Now close switch under battery box and turn engine over slowly a few times, listening for the buzz of the vibrator in the battery box. If this is heard, the engine is ready to start.

To Start Engine.

Starting Engine

Close Starting Damper

Starter Crank

Release Starting Damper

Regular Running Position

Close battery switch. Open gasoline throttle to point "1." Set cylinder oil cup to feed about 3 to 5 drops per minute. Now close starting damper in suction elbow, turning damper handle down. Place starter crank on crank shaft end, turned down to smaller size for that purpose, with ratchet or tooth of crank against head of gib key in flywheel hub, and turn flywheel rapidly in direction indicated by arrow in cut on page 10 until an explosion occurs. The damper handle should then be released and the throttle closed back about to point "2." Set this by trial to point where engine runs best and shows no black smoke from the exhaust. When this point is determined, the throttle should be set at this point for regular running.

To Stop Engine.

Close throttle and open switch. Be sure that switch is open when engine is standing idle, as battery may be run down in a few hours if switch is closed.

Speed of Engine.

Reducing Speed

The regular speed of the engine is 700 R. P. M., driving the pump gear 28 strokes per minute. If it is desired to run the engine at slower speed, the tension of the governor spring must be reduced. This may be done by adjusting it at the eye-bolt, to which one end of the governor spring is attached. Increasing tension of governor spring speeds up the engine.

Governor Parts.

Governing

Turn the engine over by hand thus causing the cam to push the exhaust block up and open the exhaust valve.

While turning the engine over push the governor weight in the cam shaft gear out against its stop and this will force the detent tail out causing the detent blade to swing under the square plate washer attached to the upper end of the exhaust block.

With the proper relation of the detent, governor weight and detent washer plate, the detent will in the course of the turning over of the engine be pushed under the detent plate and remain there until the exhaust block and valve are lowered by the cam and will rest on this detent thus holding the valve open until the next revolution of the engine cam shaft.

If the detent swings in and out again without holding the block up it shows that either the detent plate is too high or that the tail of the detent is bent too far out.

To remedy the first remove some of the tin washers under the plate and lower same until the detent blade swings in with a clearance not to exceed 1/32 inch.

To remedy the last bend the detent tail in slightly to give the above clearance of blade with plate.

If the detent blade strikes the plate before the cam has raised the block and plate high enough the tail of the detent should be bent out slightly, but care should be taken to see that when this is done the clearance between the detent blade and the plate does not exceed the 1/32 inch noted above.

Gears.

Replacing Cam Gears

Closing Point of Valve

If engine is taken apart, the cam gears must be correctly timed when replacing. There is a zero mark stamped on the outer end of one pinion tooth. This tooth must come between two teeth on the gear, both of which are stamped with a corresponding zero mark. If marks are not found, the gear should be set so that the exhaust valve is just closed when the key-way on the crank shaft is a little past its straight-up position, when the wheel is turned in the direction of the arrow. The closing point of the valve is felt by rotating it by means of the spring washer before it seats. When the valve is open it turns freely, but, at the closing point, it can scarcely be turned.

Cleaning Piston and Rings.

Removing Piston

Draining Jacket and Base

Removing Piston Pin

The piston may be removed as follows: Remove the suction elbow complete in the manner already described. Remove the engine from the jack and turn it bottom upward, having first drained the water from the jacket and oil from the base. Now remove the six bolts holding the upper to the lower base, and lift off the lower base. Now remove the connecting rod bolts and lift out the crank shaft. The piston, with connecting rod, may now be drawn out. Clean the rings and piston with kerosene. To remove the piston pin, loosen the set screw (located in the boss on the inside of the piston), which holds the pin in place. The pin may now be driven out, using a wood stick as a punch, and striking it with a hammer. Oil the piston well and replace in reverse order.

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NOVEMBER, 1916

INSTRUCTIONS No. 2402-B

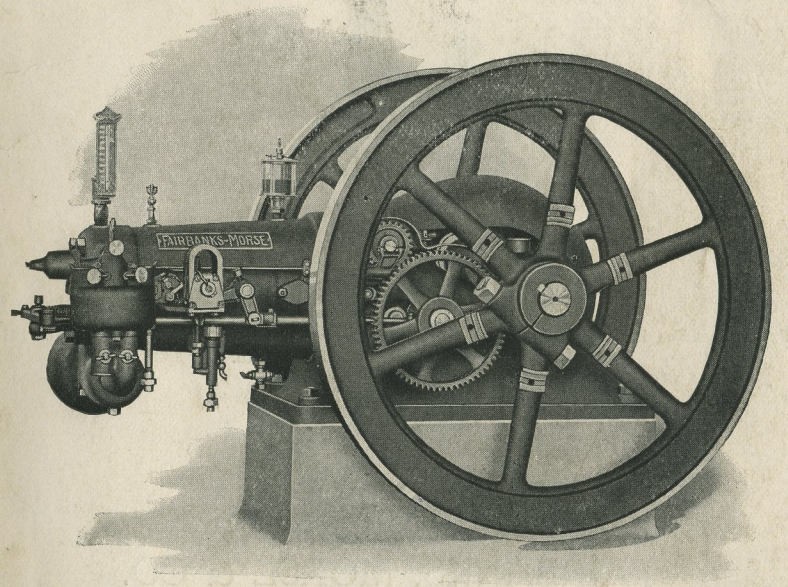
FOR THE CARE AND TIMING OF

SUMTER PLUGOSCILLATOR

USED IN CONNECTION WITH

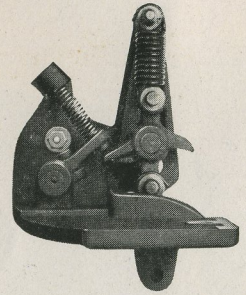
FAIRBANKS-MORSE

10 AND 15 H. P. TYPE "Z" OIL ENGINES



TYPE "Z" OIL ENGINE FIG. 3095G

FAIRBANKS, MORSE & CO.
(INCORPORATED)



THE PLUGOSCILLATOR

Patents pending in U. S. and other countries. Made under British patent No. 13815 of 1915; under French patent SGDG 480,546.

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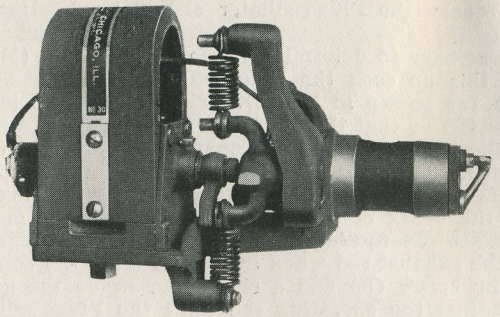


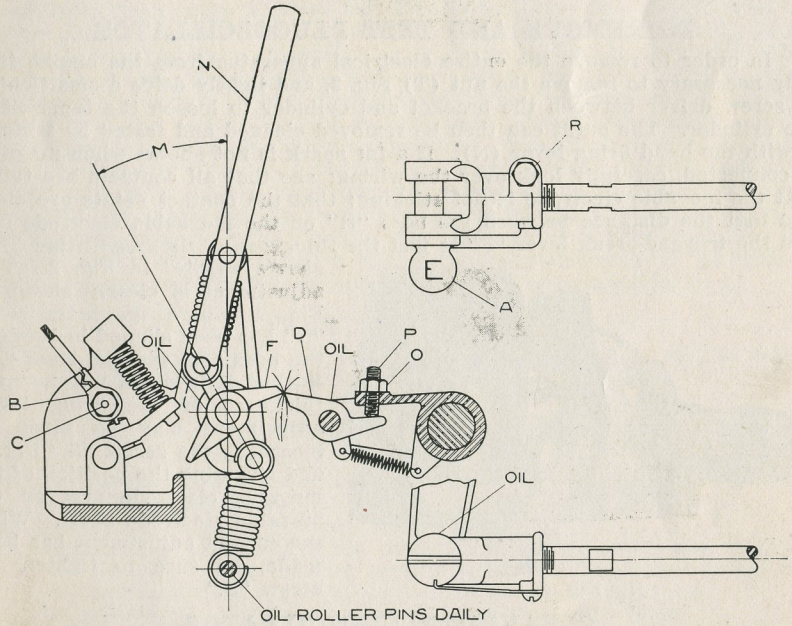
Fig. 1.

PLUGOSCILLATOR AND MAGNETO

METHOD OF TIMING SUMTER PLUGOSCILLATOR WITH FAIRBANKS-MORSE 10 and 15 H. P. TYPE "Z" ENGINES

All Sumter Plugoscillators are timed and tested on the engines at the factory and the timing is again checked just before the engines are shipped.

It is well, however, to check over the timing from time to time with the engine crank. This can readily be done by turning the "Early and Late" pin(A) so that the letter (E) (indicating the early position) is up, and then turn the flywheels in the direction they run until the Plugoscillator snaps. The spark mark on the governor flywheel should coincide with the exhaust rod at this time.



Note angle of lever for setting or hand firing.

Fig. 2.

If for any reason the Plugoscillator should need adjusting proceed as follows:

It is first necessary to determine if the spring angle (M) is correct. In order to check this up cock the Plugoscillator with the setting and hand firing lever (N) (as shown in Fig. 2). Then loosen the lock nut (O) and adjust the screw (P) so that the pawl (D) just touches the pawl (F) slightly thus loosening the lever (N) before it snaps. Be sure that the lock nut (O) is again tightened. The "Early and Late" pin should of course be in the early position (Letter E up) when the Plugoscillator is being timed.

Next, time the break of the Plugoscillator with the engine crank. To accomplish this set the flywheels so that the "spark" mark on the wheel coincides with the exhaust rod when the piston is on the compression stroke. Loosen the clamp screw (R) and a similar screw on the gear end of operating rod and adjust the operating rod until the Plugoscillator just snaps. Then tighten both clamp screws and the Plugoscillator is correctly timed.

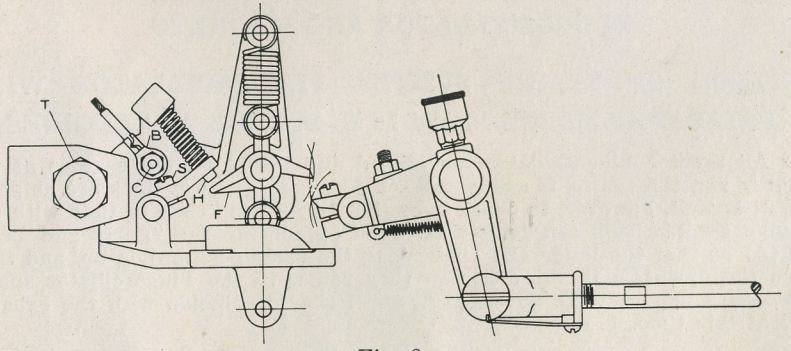


Fig. 3

TO REMOVE AND TEST PLUGOSCILLATOR

In order to remove the entire electrical apparatus from the engine it is only necessary to remove the nut (T) Fig. 3, and lightly drive a small chisel or screw driver between the bracket and cylinder to loosen the taper fit in the cylinder. The outfit can then be removed cleaned and tested by tripping it with the hand firing lever (N). If a fat spark is not shown when magneto is connected, carefully look over the wiring; see that all contacts are tight; that the movable electrode is not sticking; that the contact points are clean and that the distance between the boss "H" on the moveable electrode arm and the trip-and-break lever "F" is just the thickness of the hand firing lever shown as "N" in Fig. 2. This adjustment is clearly shown in Fig. 4, where the firing lever "N" has been slipped in between the boss "H" and the lever "F." If this distance is not just the thickness of the firing lever, adjustment may be made by loosening the screw "S," Fig. 3, and changing the position of the movable electrode arm on the movable electrode shaft. When the correct adjustment has been made, be sure to tighten the screw "S."

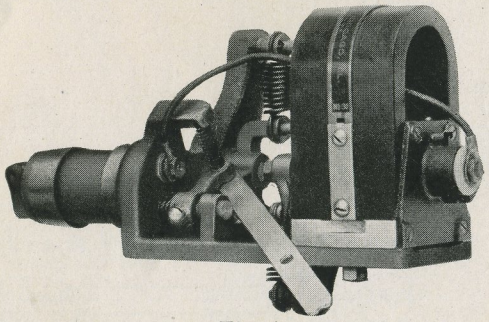


Fig. 4.

CLEANING PLUGOSCILLATOR

The Plugoscillator should be removed occasionally, (about once a week), and cleaned, carbon brushed from electrodes and carbon scraped off the end.

When the Movable Electrode sticks or Engine blows around the Movable Electrode, probably the Movable Electrode Seat needs cleaning. This can be done by loosening screw on end and slipping Movable Electrode off the seat.

The Electrode Points can be cleaned without removing the Plugoscillator from Engine by sliding the Movable Electrode back and forth from the outside.

INSTALLATION OF BATTERIES AND COIL

If by any means the magneto is damaged it can be removed from the bracket by removing two cap screws, as shown in Fig. 5.

A battery and coil can be attached and the engine kept in service, while the magneto can be returned to its maker for repairs.

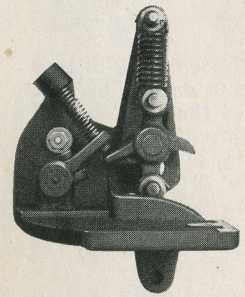


Fig. 5.

Fig. 6.

With the plugoscillator, when magneto is used, the points are normally closed. When battery is used, it will be necessary to adjust the position of the movable electrode arm in relation to the trip-and-break-lever "F," so that the contact points will be open excepting for a very short interval, just preceeding the instant when the spark occurs. This is in order to save the life of the battery. With the plugoscillator in its neutral position, Fig. 3, loosen the screw "S" and allow the boss "H" on the moveable electrode arm to come in contact with the lever "F." Then force it down just a little further. This should open the ignitor points slightly. This can be tested by the following method: Attach battery and coil in the regular manner by grounding one battery terminal on the engine frame. Be sure that the wire leading from the magneto to the stationary electrode "C" has been removed; then tap the end of the wire leading from the battery, lightly on "C" and if the plugoscillator is in the neutral position, no spark should be produced. If a spark occurs, the points are still closed and the movable electrode arm should be adjusted downward just a trifle more. Then cock the plugoscillator with the hand firing lever "N" and again tap the stationary electrode with the battery wire. A spark should occur with the outfit in this position. It is very important that the wire leading from the magneto to the stationary electrode "C" be removed before you attach the battery wire to any part of the plugoscillator.

STARTING ENGINE

There are two methods by which the Type "Z" engines can be readily started with the Sumter Plugoscillator.

First Method

1st. See that the engine is ready to start as covered by the instructions sent with the engine.
2nd. Set the "Early and Late" pin (A) so that the letter "L" is up (indicating the late position).
3rd. Prime engine in the regular manner.
4th. Turn engine flywheels in the direction they run and when the Plugoscillator snaps the first impulse will occur. The next charge will be drawn from the fuel reservoir in the regular manner.
5th. Set the "Early and Late" pin so that the letter "E" is up.
6th. Make other adjustments according to the regular engine instruction book.

Second Method

1st. See that the engine is ready to start as covered by the instructions sent with the engine.

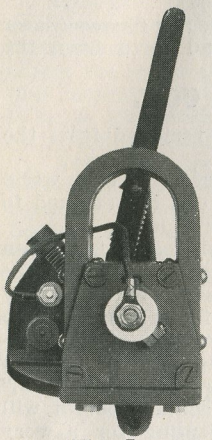


Fig. 7.

2nd. Set the "Early and Late" pin (A) so that the letter "E" is up.

3rd. Cock Plugoscillator with the hand firing lever (N) always in the direction as shown in Figs. 2 and 7, and prime the engine in the regular manner.

4th. Turn the engine flywheels backward as strongly as possible, compressing the mixture and at the same moment when the flywheels are stopped by the compression, trip the Plugoscillator by pushing the lever (N) towards the flywheel. A very strong explosion will result if a good mixture and considerable compression have been obtained.

This method requires more skill than the other method and there is danger of injury if one does not let go of the flywheels just before tripping the Plugoscillator.

5th. After the first explosion is obtained proceed exactly as covered by the preceding method.

THE FOLLOWING POINTS ARE IMPORTANT AND SHOULD BE CLOSELY OBSERVED

Carefully Note—

1. That the spring roller and Pawl fulcrum Pins are oiled daily.
2. That the magneto bearings receive a drop or two of fresh light oil every day—Avoid heavy cylinder oil, etc.
3. That Plugoscillator is kept clean.
4. That movable electrode works freely.
5. That screw on movable electrode arm is kept tight.
6. That wire terminals are tight.
7. That timing is correct.
8. That Plugoscillator is clamped tightly into cylinder.
9. That magneto is not taken apart.
10. That Pawl for the operating arm works freely.
11. That **instructions are carefully read** before making adjustment.
12. That there are other things that will cause the engine to miss as well as the magneto.

WHY THE PLUGOSCILLATOR EQUIPMENT IS BEST

The following points are **facts,** and a careful comparison of the Sumter with other makes that our competitors may offer, will prove our statements.

First: Sumter Plugoscillators and Magnetos are fully warranted and guaranteed against defective material and workmanship. When repairs are necessary as result of accident or ordinary wear-and-tear, attention is directed to the chain of Service Stations as listed on back cover.

Second: The magnetos are equipped with magnets of the highest grade steel, carefully aged, and made in the Sumter plant. The **pole pieces** are machined all over from special

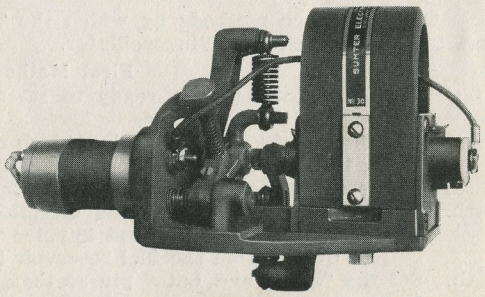


Fig. 8.

iron; the **armature** has **laminated core** for the winding, whereas most other makes use a solid core, which is not efficient. The **winding** is an enamel and cotton-covered wire, **wound by hand;** and the **shafts** are ground to fit the bearings.

Third: The **bearings** are **solid bronze,** provided with **spiral oil grooves** and **drain holes.** The **ground brush** is placed where **wear is reduced** to a **minimum,** and the **collector brush** supported in **imported porcelain,** which is instantly removable for cleaning. This brush runs on a **hardened steel** end in the armature shaft. See Figs. 10 and 11.

Fourth: Sumter Magnetos are dust-, oil-, and water-proof, and can be used on portables exposed to the weather. Neither heat nor cold affects their effective output.

Fifth: Workmanship in Sumter Magnetos is of the finest, a fact which will be realized when it is noted that they are selected by the largest manufacturers of stationary engines, whose engineers are in a position to test all makes, and who naturally want the **very best ignition,** so that the reputation and performance of the engine will not suffer.

Sixth: Sumter Magnetos are made in a factory which devotes itself exclusively to the manufacture of Magnetos for stationary engine service, and the Sumter factory is the largest of its kind in the world; and therefore the Magneto is backed by a responsible corporation, having a perfect manufacturing and service organization.

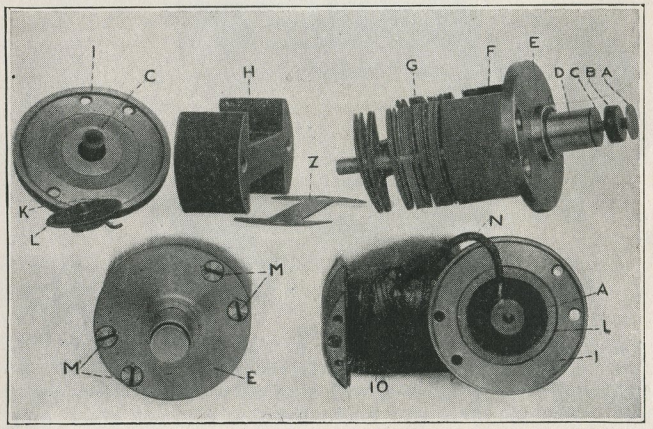


Fig. 9.

In the Sumter Armature Assembly the center "G" Fig. 8, is made from punching "Z" of a special grade of iron. These are threaded on two long bolts, which screw into the endpiece "F." The reason for making this part of the armature on which the wire is wound laminated instead of one solid piece (which would be much cheaper), is to reduce current losses to a minimum. This **extra efficiency** is particularly valuable when starting an engine, where all the reserve power of the magneto is necessary. A solid armature cannot compare with the laminated, owing to the greater internal losses; this is a fundamental fact, readily verified by reference to any text book on the design of electrical apparatus.

The core of the armature being laminated, is of the highest electrical efficiency, and superior in this respect to an armature in which a steel shaft passes all the way through. The Sumter armature has brass heads, and the shafts have square ends, and are pressed in these heads, and then ground to fit the bearings. In the No. 30 machine these heads are reinforced so as to relieve all strain from the screws (M).

With some types of magnetos, it is impossible to determine whether the magneto is at fault or not, owing to its being so inefficient as not to produce any noticeable current when revolved by hand, whereas with the Plugoscillator its maximum efficiency may be tested by hand.

Hand firing, originally patented and introduced by SUMTER, has been applied to the Plugoscillator in a most simple and effective manner. The hand lever operates the mechanism same as the engine push rod, thereby producing a spark enabling the engine to be started from a standstill, provided the necessary compressed charge is in the cylinder.

Provision is made for properly lubricating all working parts, and, as there is less side thrust, less care in this connection is necessary than with other types.

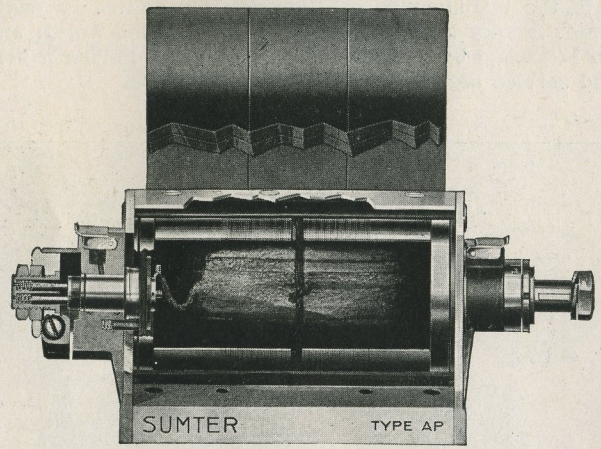


Fig. 10.

The sectional view (Fig. 10), will give some idea of the construction of the magneto. The magnets are made from high-grade steel, and are carefully aged. The pole pieces are machined all over from special iron.

The winding is of enamel- and cotton-covered wire, covered with an oil and waterproof tape, and varnished. The wire is wound in smooth layers, carefully insulated, and permanently free from short circuits, burnouts, etc.

The end plates are of genuine bronze, with the bearings integral, the same being provided with Osgood spiral oil grooves. There are drain holes in the end plate for carrying off the surplus oil, and if a good grade of light oil is used the machine will not gum up.

The ground brush, it will be noted, eliminates the necessity of the bearings having to conduct the current out of the armature, which is the case in machines in which no ground brush is provided.

The **igniter equipment** is worthy of special mention. The movable electrode is a heavy drop forging. The insulated electrode is N. G. E. A. Standard, see Fig. 12, and can be taken out and replaced in a moment's time without disassembling the mica insulation from around the stem. We claim this is the most efficient and durable electrode known, as it will stand a high tension spark without break down—a test which few electrodes in make and break igniters will withstand.

All wearing parts are of high carbon steel, carefully hardened. The construction permits of a large heavy bearing for the trip lever, and all thrust is taken by this bearing, supported by a heavy web in the bracket casting. In other designs, the thrust and wear is taken by the magneto shaft.

It should be noted that the Plugoscillator bracket carries ALL the actuating mechanism for both magneto and igniter. See Fig. 7. The vanadium steel actuating springs are mounted on the bracket, and carried on easily replaceable hardened rollers.

As a standard magneto is used, all well known methods of testing same, by revolving the armature by hand in case of suspected trouble, can be applied.

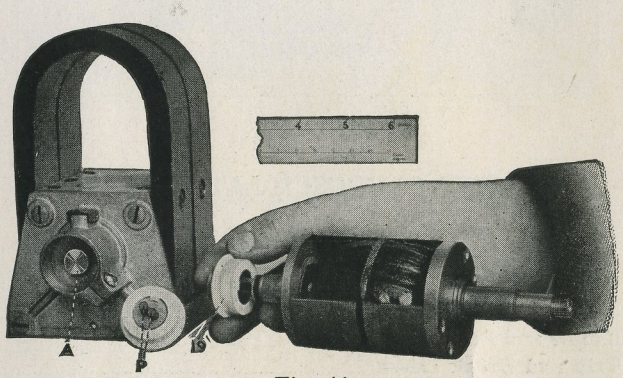


Fig. 11

The terminal brush is carried in solid porcelain insulation and the connection between the brush and terminal is soldered. This brush runs on a hardened steel end in the armature shaft, which eliminates all copper rings and other parts that wear or require cleaning.

The Pawl or Trip Lever, engaged by the engine push rod, is also mounted on this bracket, and has an **independent bearing.** There is no tendency for the arm to lift the magneto off the bracket, as in other types, and no side thrust on any part of the magneto, he armature receiving only a true radial impulse. The necessity for a solid armature shaft, which is admittedly inefficient, is removed, as the heavy actuating springs or trip lever are not attached to the shaft. One piece shafts may be necessary where the armature shaft carries the strain of the oscillating springs on one end and trip lever on the other; in otherwords, where the magneto carries the operating mechanism. The Plugoscillator eliminates this condition.

The insulation throughout is of the very highest quality, same being oil-, heat- and moisture-proof. There is no exposed fiber or rubber insulation.

From the foregoing, it will be seen that every precaution is taken to insure the Magneto giving long and satisfactory service. Every screw is locked in place, and the construction is such that the machine will run for years without any attention beyond oiling. This being the case, it is useless to tear up the Magneto in case of trouble.

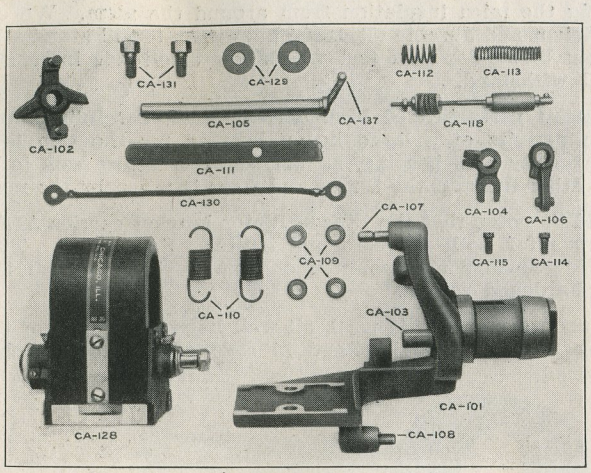


Fig 12.

SUMTER PLUGOSCILLATOR PARTS

Part No.	Part Name	Price
CA—100	Plugoscillator without magneto	$ 8.00
CA—101	Igniter and Bracket, body only	4.00
CA—102	Trip and Break Lever	2.50
CA—103	Trip and Break Lever Fulcrum Pin	.20
CA—104	Magneto crank arm	1.00
CA—105	Moveable Electrode and Point	1.00
CA—106	Moveable Electrode Arm	1.00
CA—107	Spring roller pin—long (upper pin)	.25
CA—108	Spring roller pin—short (lower pin)	.25
CA—109	Spring roller (each)	.15
CA—110	Trip and break lever spring (each)	.20
CA—111	Starting lever	.15
CA—112	Moveable Electrode seating spring	.20
CA—113	Moveable electrode arm spring	.20
CA—114	Moveable electrode arm fastening screw	.10
CA—115	Magneto Crank fastening screw	.10
CA—118	Stationary Electrode (Standard N. G. E. A. No. 4)	.50
CA—122	Spring roller stud spring ring	.05
CA—128	Magneto only, JR No. 30	12.00
CA—129	Magneto fastening screw washer (each)	.05
CA—130	Magneto terminal	.25
CA—131	Magneto fastening screw (each)	.05
CA—137	Igniter Points (each)	.10

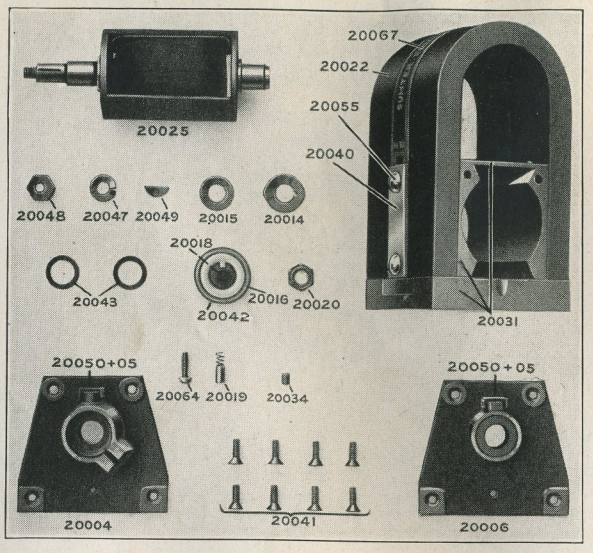


Fig. 13.

JR. No. 30 MAGNETO PARTS LIST

Part No.	Name of Part	Price
20004—	Terminal end plate	$2.00
20006—	Drive end plate	2.00
20014—	Timing disc	.10
20015—	Timing disc washer	.05
20016—	Porcelain bushing	.15
20018—	Terminal brush (each)	.16
20019—	Ground brush (each)	.16
20020—	Hex nut for terminal	.12
20022—	Magnet	2.50
20025—	Armature assembly	3.50
20031—	Frame assembly	3.00
20034—	Oil hole wick (per set)	.05
20040—	Magnet clamp (each)	.16
20041—	End plate screws (per set)	.20
20042—	Assembly of porcelain bushing complete terminal, etc., with nuts and brush	.65
30043—	Thrust washers (per set of 3)	.05
20047—	Lock washer for shaft	.05
20048—	Hex nut for shaft	.05
20049—	Woodruff key No. 1	.05
20050-05—	Oil hole cover and pin	.10
20055—	Magnet clamp screw (per set of 4)	.15
20064—	Porcelain clamp screw	.05
20067—	Magnet band	.10

Prices subject to change without notice. Always mention number of this bulletin when ordering repairs.