

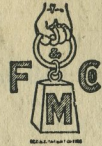
FOR INSTALLING AND OPERATING

Fairbanks-Morse
Type "C-O"
Heavy Duty Marine
Oil Engines

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150 and 200 H. P. Direct Reversible

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

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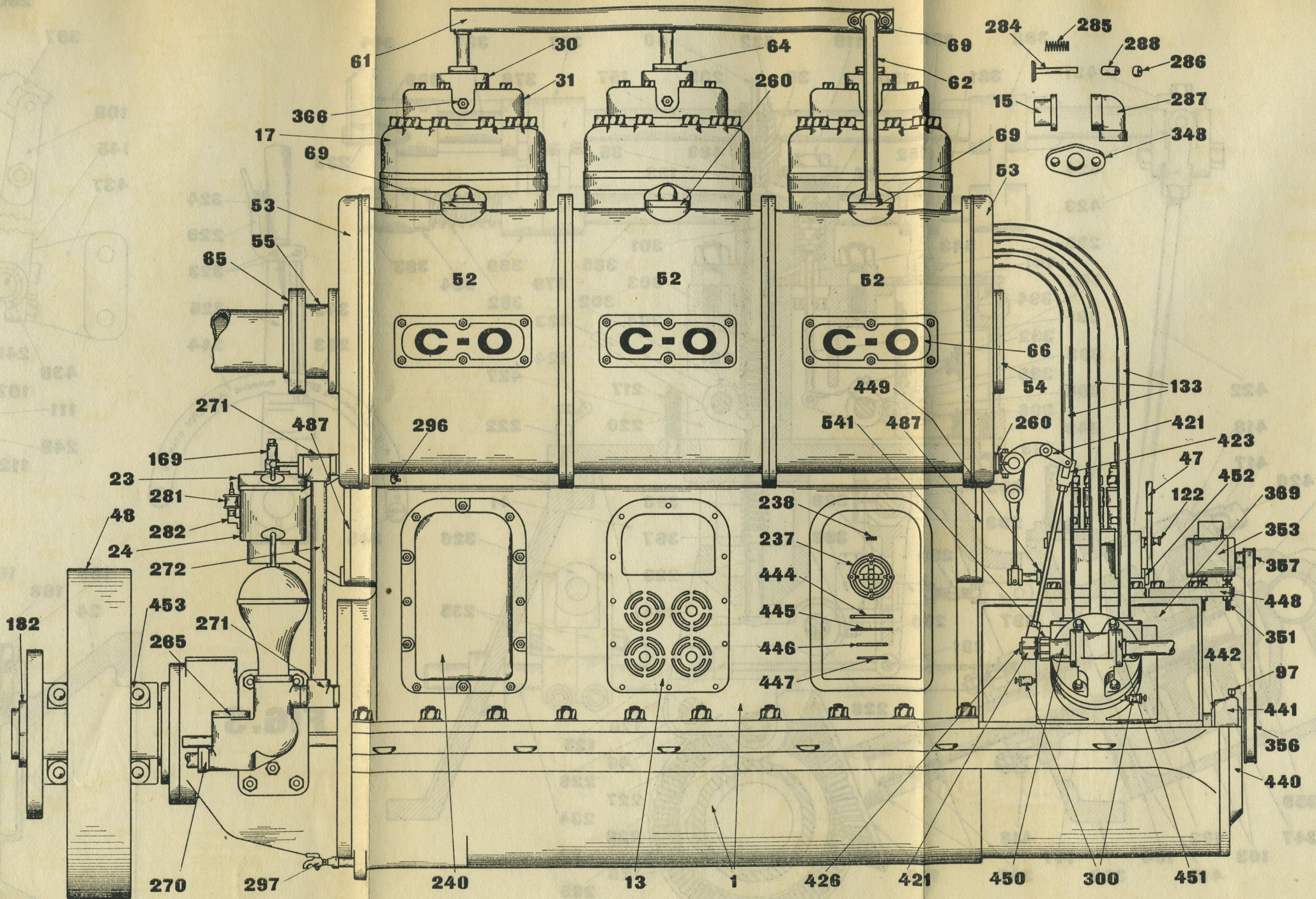


FIG. 2

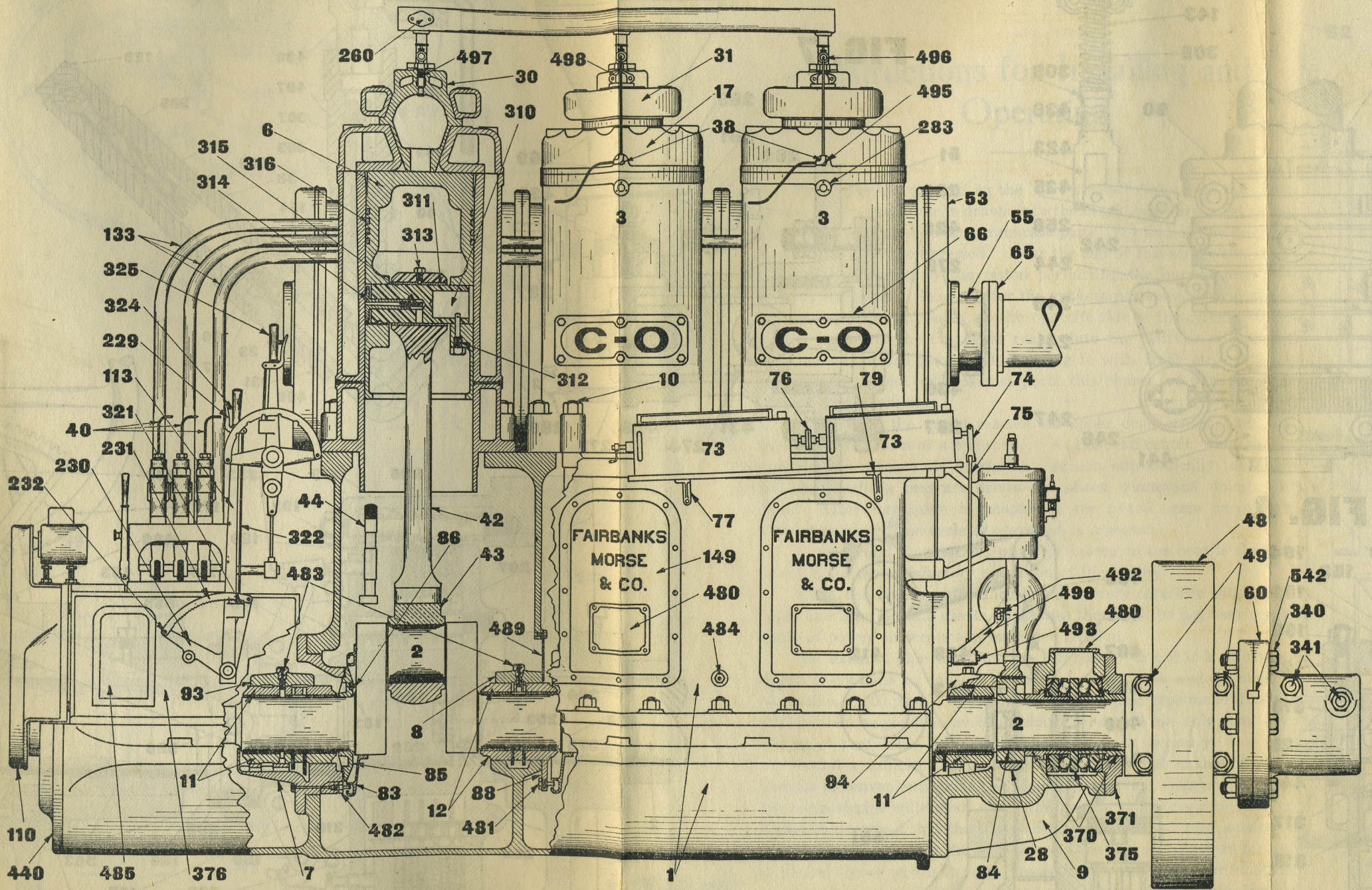
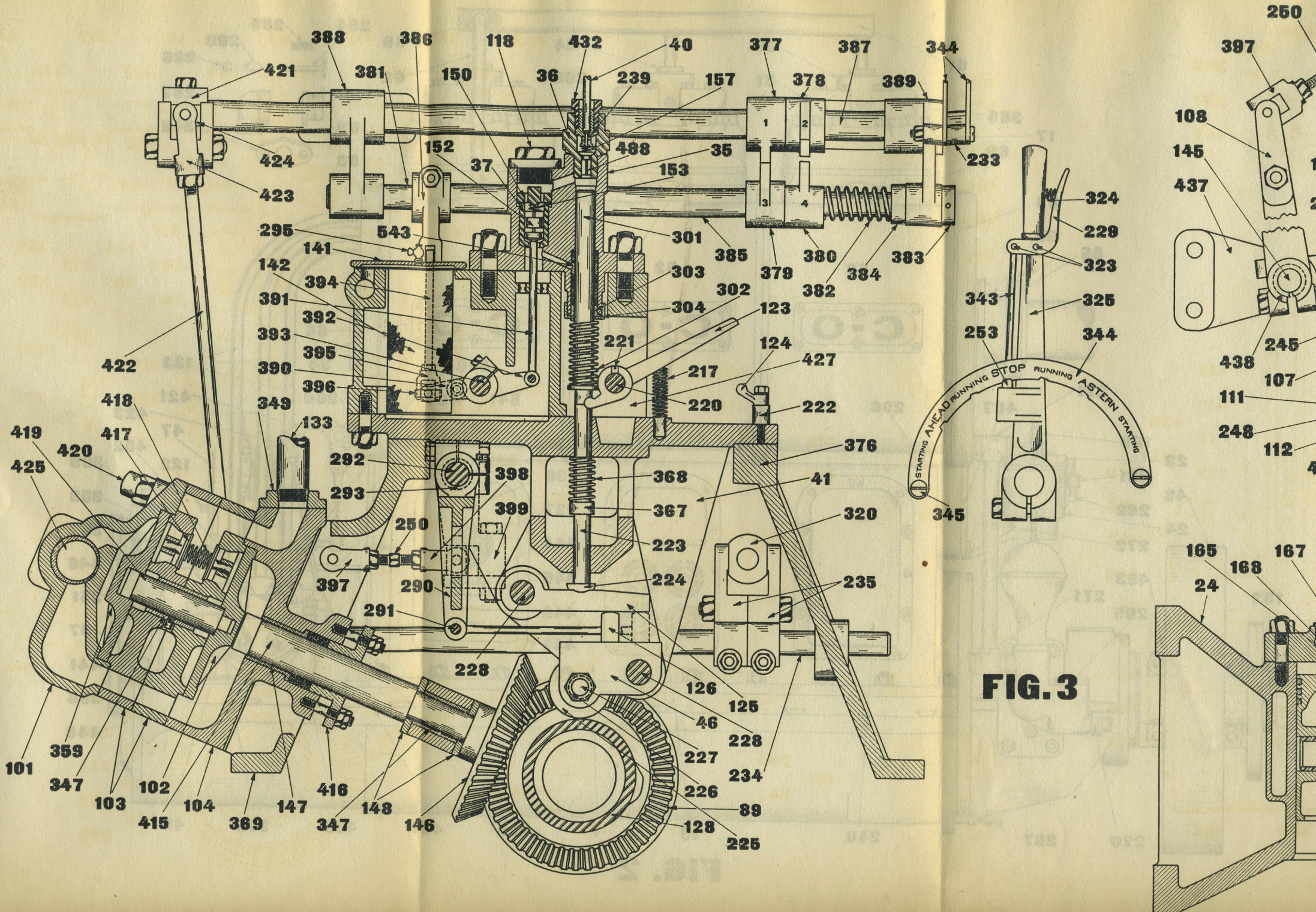


FIG. 1



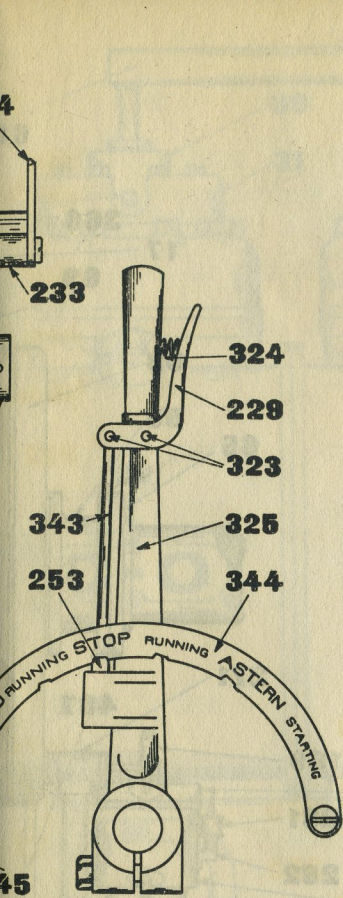


FIG. 3

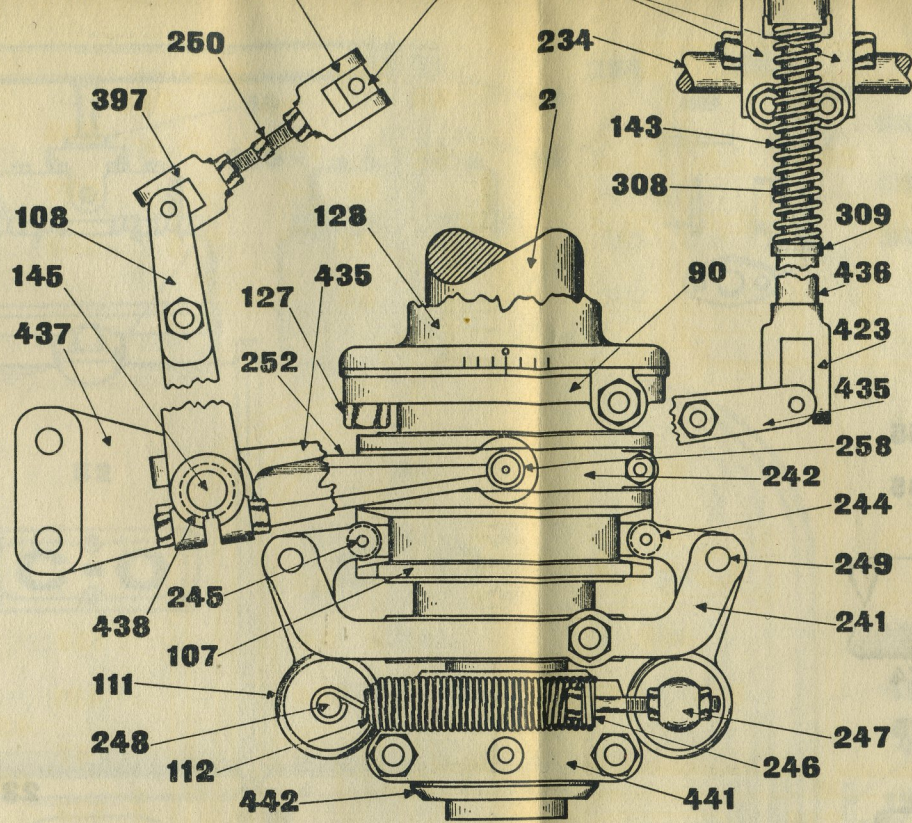


FIG. 4

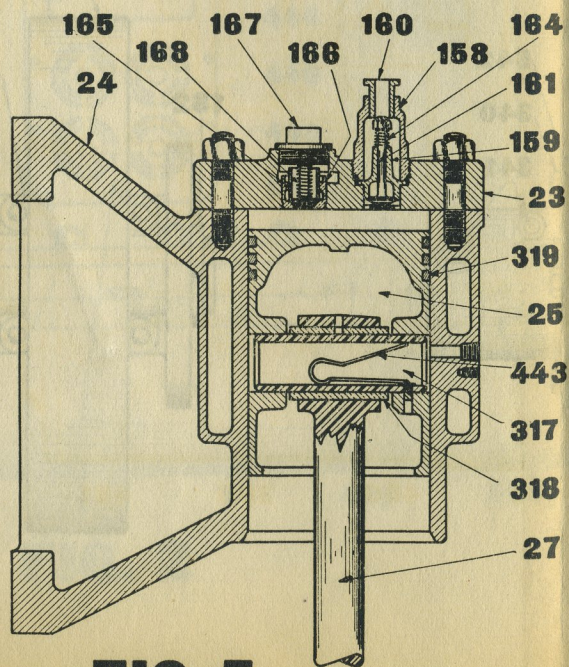


FIG. 5

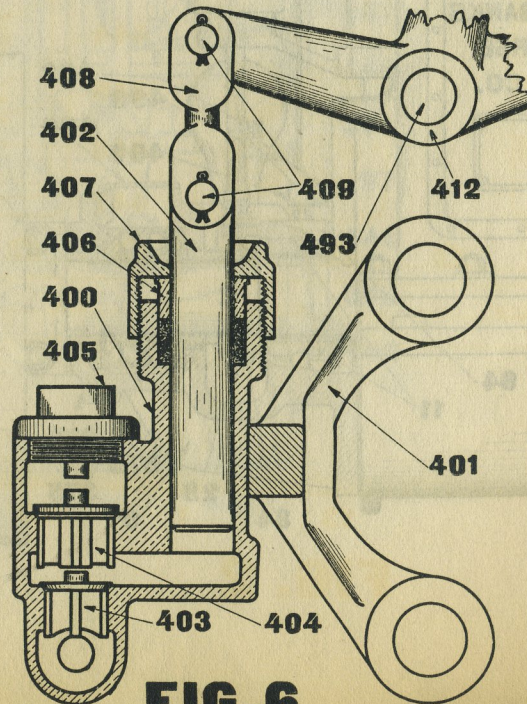


FIG. 6

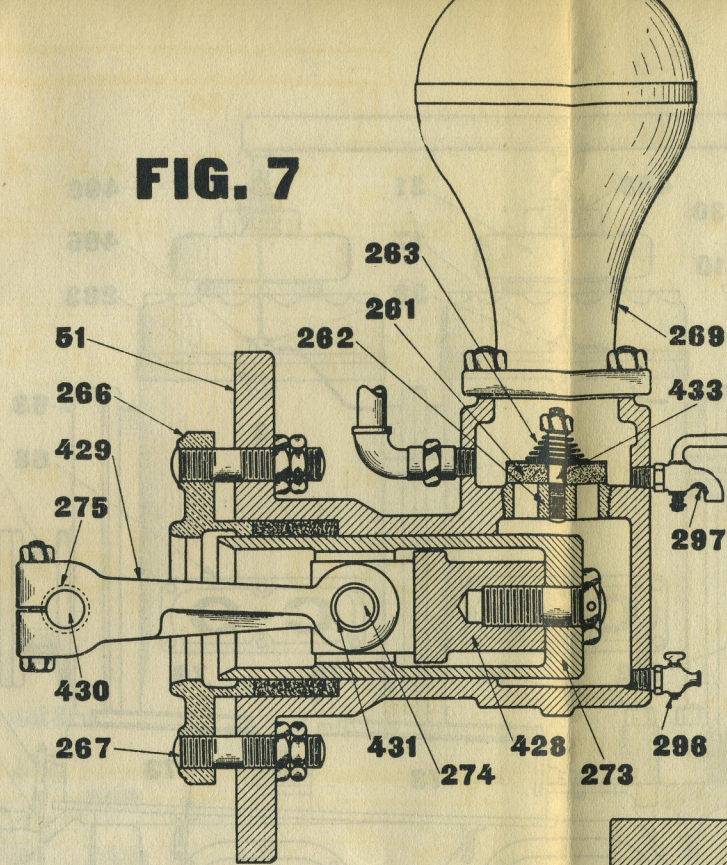


FIG. 7

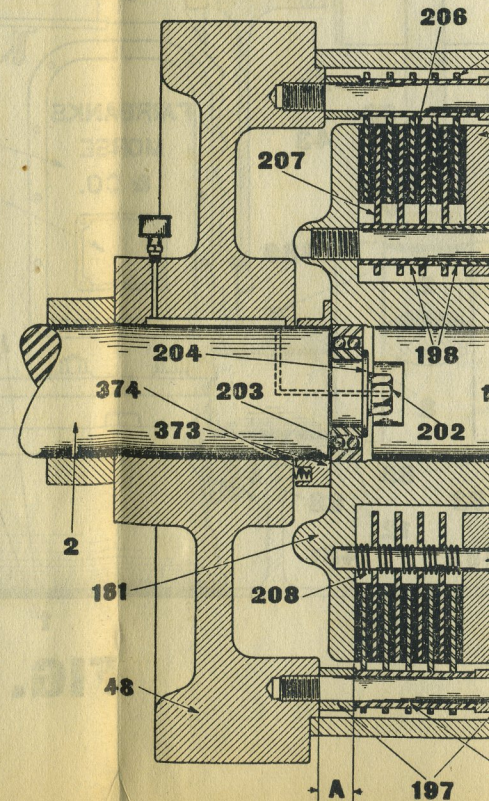


FIG. 8

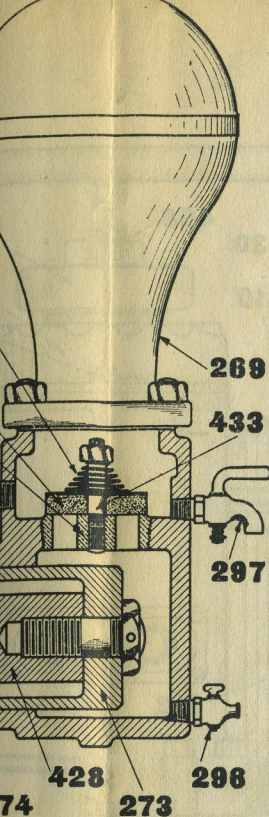


FIG. 8

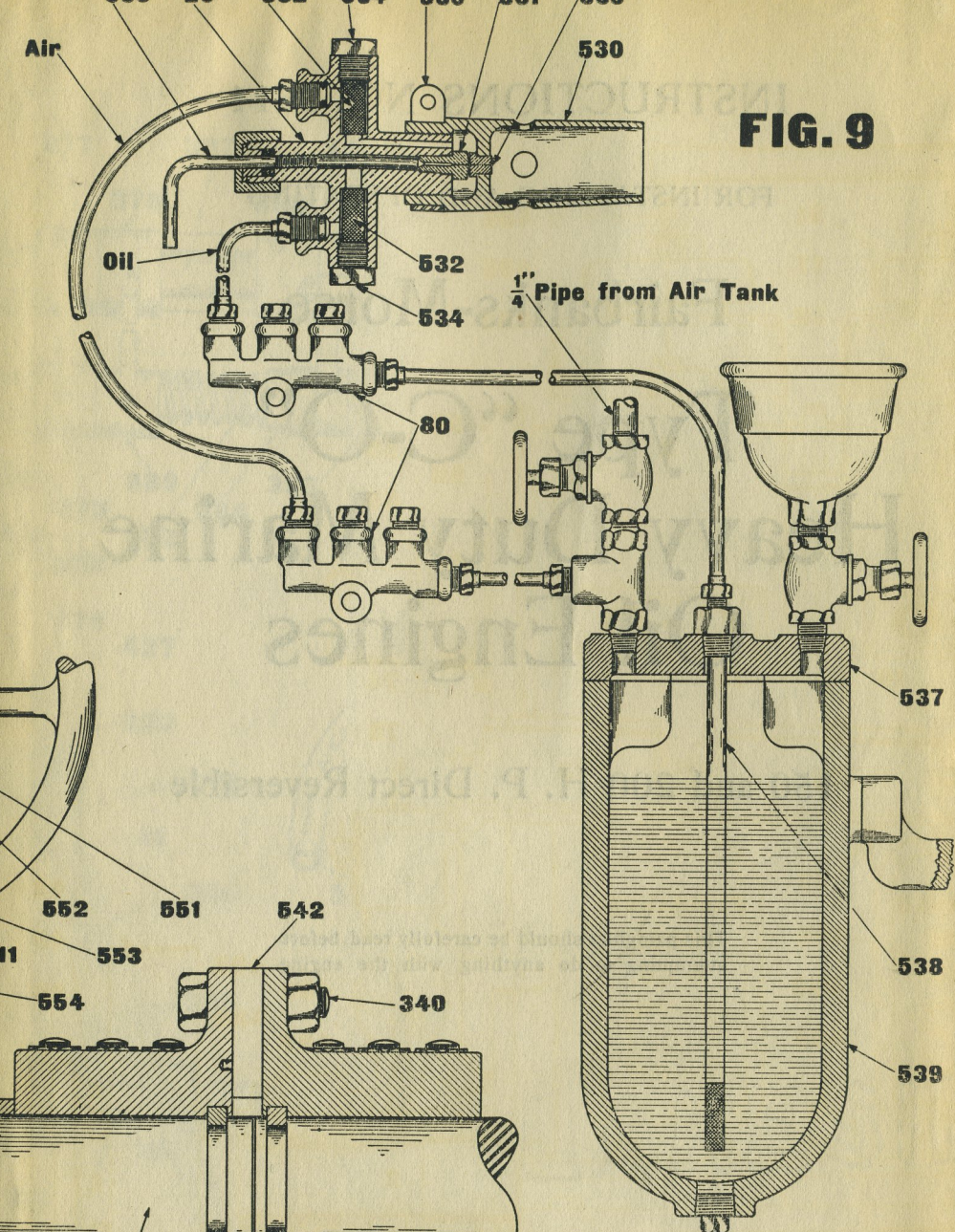
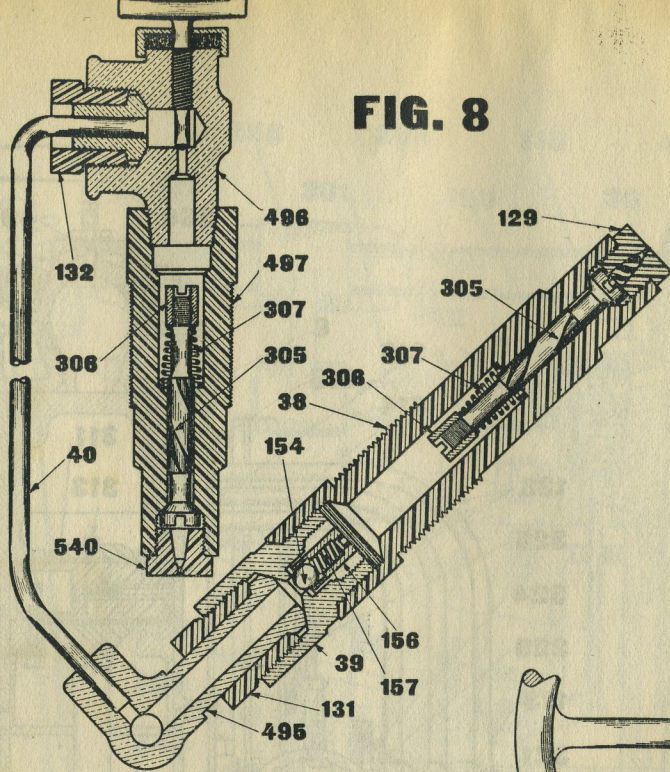


FIG. 9

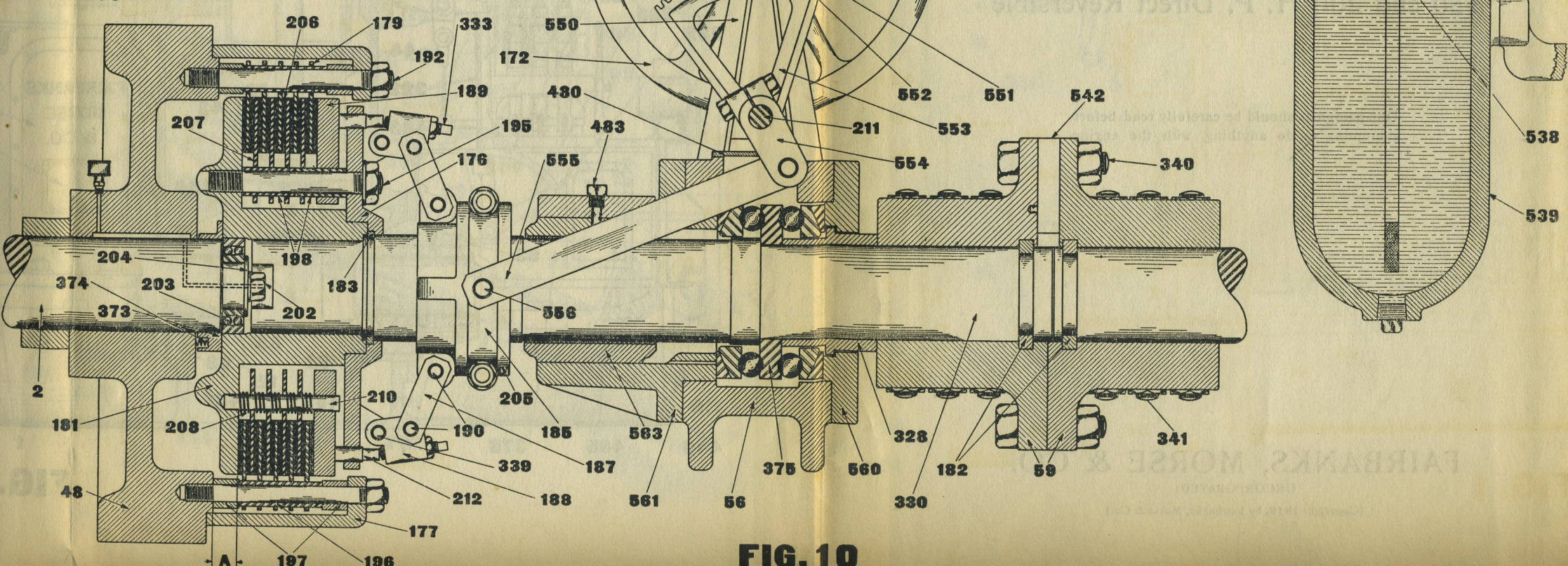
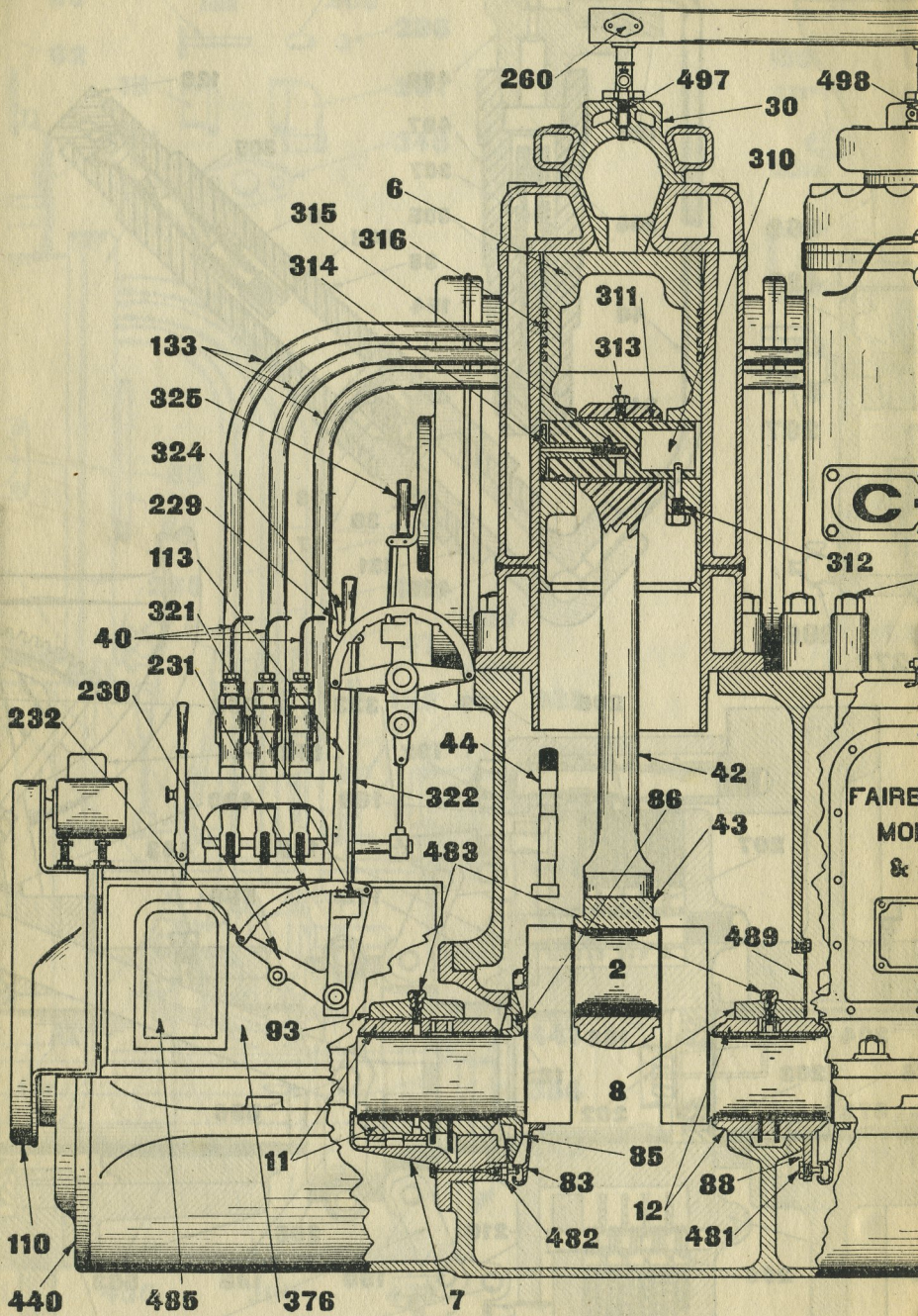


FIG. 10

Instructions for Installing and Operating



These engines operate on the "two stroke" cycle. On the upward stroke of the piston air is drawn into the crank case thru a set of automatic valves located in the crankcase plate (13) and on the downward stroke this air is compressed. Near the end of this stroke the exhaust ports are uncovered by the piston permitting the burned gases in the cylinder to escape. Shortly after the exhaust ports are opened the piston uncovers the air ports on the opposite side of the cylinder and the air compressed in the crankcase rushes into the cylinder, cleaning the latter of the burned gasses and charging it with fresh air. After the closing of the inlet and exhaust ports this charge of pure air is compressed in the cylinder.

Just before the piston reaches its upper dead center, the fuel is injected in the form of a fine spray. At the dead center, when the compression has reached its maximum, ignition automatically takes place and the resulting pressure drives the piston downward doing useful work. After expansion is completed, the piston again uncovers the exhaust ports and the cycle of operation is repeated.

A very rigid foundation, properly bolted to the boat is absolutely essential for the satisfactory operation of the engine.

When the engine is installed line it up very carefully with the propeller and intermediate shafts, otherwise there will be hot bearings and waste of power on account of excessive friction.

The exhaust pipe must not be less than 8" and if it is of excessive length or contains an unusual number of bends, it is well to make the whole line of 10" pipe. In making up the exhaust pipe make it as short and as direct as possible, avoid all sharp bends and use only long sweep elbows, or preferable 45° elbows, where a turn is necessary.

Install a sufficient number of flanges in the line so that it will be possible to conveniently take the pipe apart for an occasional cleaning. The exhaust pipe will be hot while the engine is in operation and care should be exercised that there is no danger of the hot pipe setting the vessel on fire. Insulate the pipe where necessary and leave an air space of several inches where the pipe passes thru wooden decks or bulkheads. Arrange the exhaust line in such a way that it will not interfere with work on the engine, such as removing pistons, etc.

A free exhaust is essential to the satisfactory operation of the en-

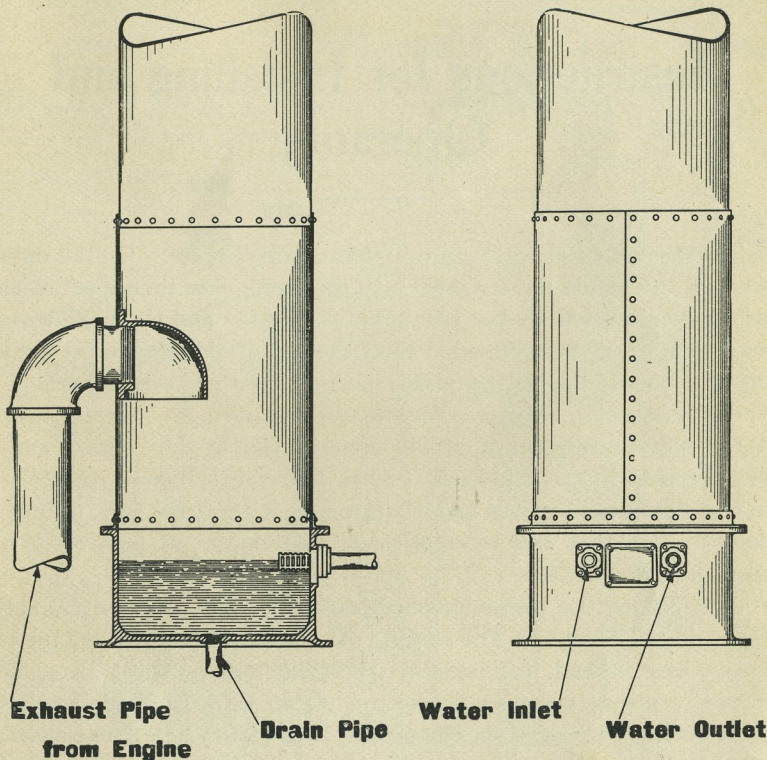


FIG. 11

gine, and no reasonable expense should be spared to provide a good exhaust line.

The most satisfactory exhaust installation is made up by using a stack as shown in Figure 11. A single stack with two exhaust inlets can be furnished for twin screw installations if so ordered. This stack with the base and other necessary special fittings can be supplied from the factory. As can be noted from the cut, the base of the stack is kept filled with water from the engine circulating water system. This water will extinguish all sparks that might be thrown out with the exhaust gases and thus eliminate any danger of the sails or any part of the vessel catching fire.

Generally an intake well or box, provided with a grating or screen is installed in the vessel. The circulating water should be taken from this well to the circulating pump by using pipe not smaller in size than the flange on the pump, and this pipe should be run as directly as possible. If it is more than ten feet long, it is advisable to use larger size pipe. A sea cock is placed next to the intake well so that it is possible to shut off the water in case work has to be done on the pipe line. To

insure a quiet running pump an air chamber must be put into the suction pipe as close to the pump as possible.

If the exhaust stack as shown on Figure 11 is used, the circulating water is piped from the exhaust manifold to the inlet on the exhaust stack, and from the stack it should run overboard as directly as possible. In every case use pipe the same size as the flanges provided or larger. If no exhaust stack is used, the outlet water should be piped overboard as directly as possible. Never place any valves in the outlet line.

The fuel tank must be securely fastened in the boat and should be placed high enough so that the fuel pumps do not have to lift the fuel. An elevation of from one to six feet above the level of the pumps is desirable. The tank must be provided with an air vent so as to maintain atmospheric pressure on the oil level. If it is necessary to have the tank placed below the oil pump level, an auxiliary pump should be used to pump the fuel into a small auxiliary tank placed above the fuel pumps. This tank supplies the injection pumps, the overflow being led back to the main tank.

An auxiliary pump as shown in Figure 6, ready to attach to the engine, can be furnished by the factory.

Place a valve at the fuel tank and also at the other end of the fuel line next to the inlet or the pump bracket. Make sure that the pipes used for the fuel line are absolutely clean. Use shellac on all connections to insure tight joints.

After the fuel line has been completed, it becomes necessary to fill the pipes (40) leading to the fuel injectors. Disconnect these pipes at (432) at the fuel pump discharge valve. Set the operating lever (325) in one of the running positions and fuel pump lever (47) against the small stop pin. By means of the handle (123) work the pump plunger up and down until the oil comes out at the discharge valve (36). Should the pump refuse to work, unscrew the discharge valve, prime the pump and hold your hand over the outlet. Work the pump again, as before, and if required, prime again. Continue this until all air is out of the pump. Now, put back the discharge valve (36) and work the pump until the oil comes out at the top. Connect the discharge pipe (40) at (432) and disconnect it at the fuel injector. Pump until oil comes out at the end of the pipe. Then take the injector out of the cylinder head and screw it onto the pipe. Now work the pump again until all the air is driven out. This is the case when after working the handle (123) with a jerk, the flow of oil stops, abruptly. The oil must come out of the lower injector in the form of a fine spray without any heavy core. If a core exists renew the tip and spiral (129). The tip (540) in the top injector has no spiral and consequently discharges a solid jet without spray. It is, however, very important that this jet is in line with the center line of the nozzle body and not thrown off to one side.

Circulating
Water
Outlet

Installation
of
Fuel Tank

Auxiliary
Fuel
Pump

To Prime
Pump

These operations have to be gone thru on all pumps and injectors.

**To Clean
Fuel
Strainer**

A strainer (142) of fine mesh wire gauze, to strain the fuel is located in the pump bracket (Figure 3). If necessary this strainer can be cleaned without stopping the engine. To do this, proceed as follows: Shut off the fuel at the pump bracket and immediately open pet cock (295). Now take off the strainer cover (141) pull out the strainer (142) and clean it thoroughly with kerosene or gasoline. While doing this take care that the oil level does not drop too low or the engine will stop. Have a can of clean fuel ready and if necessary pour some into the fuel reservoir, in the pump bracket. Replace the strainer and cover, leaving the pet cock (295) open, and turn on the fuel again. When all the air has passed out thru the pet cock (295) close it.

Compressed air is used for starting and reversing these engines. An air compressor mounted on the engine is used to charge the air tanks while the engine is in operation, but it is advisable to have an independent auxiliary air compressor to fill the tanks, if thru an error of the operator the air should be lost while the engine is standing still. Such a set is also used to pump up the tanks for the first start.

**Installation
of
Air Tanks**

When installing the air tanks place a high grade valve next to each tank so that it can be closed when the pressure reaches 175 pounds, and the safety valve on the compressor blows off. These valves should always be closed when the engine is shut down for any length of time, so that there is no danger of losing the air thru leaks in the pipe line. Care must be taken to get the air line absolutely tight, preferably use extra heavy fittings and make up all joints with a mixture of litharge and glycerine.

When all tanks are filled to the maximum safe pressure—175 pounds, the cut-out (160) should be screwed down. This will hold the suction valve off the seat and the compressor will not deliver any more air.

When in good working order the compressor will easily pump up to 175 pounds. If the air pressure builds up too slowly, examine the air compressor valves, also check up the clearance between the piston and cylinder head.

**To Check
Clearance of
Compressor
Piston**

A simple way to do this is to remove one of the discharge valves and drop a small piece of lead wire in between the piston and head. Then turn the engine over and the thickness of the lead wire when taken out will give the exact clearance. This should be $\frac{1}{16}$ " but may increase due to wear of the eccentric strap or piston pin bushing. If this wear is excessive the strap should be re-babbitted and the bushing replaced. If the wear is only slight, the correct clearance may be obtained by putting in shims between the foot of the rod (27) and the eccentric strap.

The construction of the engine is such that it is possible to take out any of the main and center bearing bushings without dismantling the engine.

To remove the main bearing bushing (11), relieve the pressure of

the shaft by jacking or wedging it up and take off the cap (93 or 94) and the upper half of the bushing. Then start to roll out the lower half by tapping it with a hammer, using a wooden driver to protect the bearing from being marred by the hammer. After the bushing is started, use a bar under the projections cast in the center of the bushing for this purpose, and pry the bushing out.

**Main
Bearing
Removal**

To remove any of the center bearing bushings take off the corresponding plate (13 or 149) on the crankcase, next remove the plate (489) and proceed in the same manner as explained above, for removing the main bearing bushing. When bushing and bearing cap are replaced, put back plate (489) taking care that the gasket is in good condition to prevent leakage of air between the crankcase compartments. Replace all of the lock washers and draw the nuts up even all around to make a tight joint.

**Center
Bearing
Removal**

The upper and lower halves of the main and center bearing bushings are interchangeable and it is possible to make a temporary repair of a worn lower bushing by changing the upper half to the bottom. In doing this also change the felt wick to the new lower half.

**Bearing
Renewal**

New bushings to interchange with those on the engine can be furnished from the factory, or the old bushings can be re-babbitted. When doing this, care should be taken that the bore is exactly concentric with the outside of the bushing, and a high grade babbitt must be used.

To remove the piston pin, take out the cotter pin in set screw (312) then take out the set screw (312) and drive the piston pin out from the set-screw end. If the piston pin bushing (311) shows excessive wear, it should be replaced.

**Removing
Piston Pin**

The connecting rod box can be readily adjusted, if it should become too loose. After loosening the nuts on the connecting rod box bolts, take out as many of the thin metal shims as required. Be sure, however, not to adjust the box too tight.

**Removing
Connecting
Rod Box**

If the connecting rod box has been replaced or re-babbitted, it should be carefully fitted to the crank pin.

If any of the connecting rod boxes or the crankshaft bushings have been replaced, run the engine slowly for about ten minutes, then examine the bearings and if they do not heat, run the engine slowly for about thirty minutes and examine the bearings again, before putting on load.

On engines where the thrust bearing is located on the crankshaft, the end play of the shaft is held within close limits by the ball thrust bearing and no adjustment is necessary as the ball bearing should not show any appreciable wear for several years.

**Crankshaft
End Play**

When the engine is equipped with a clutch as shown in Figure 10, the thrust bearing is not located on the crankshaft and the end play of the shaft is held within permissible limits by means of the end bearing

bushing (442) (Figure 2.) If the end play becomes more than about $\frac{1}{32}$ " take off the sprocket (356) and remove some of the shims and replace the sprocket taking care to draw all nuts up even. In making this adjustment always leave at least $\frac{1}{64}$ " end play.

Thrust Bearing The thrust bearing is of the ball bearing type and requires no adjustment. Always make sure that there is a sufficient supply of lubricant in the bearing housing. Use only high grade neutral grease, preferably one of the special lubricants made for ball bearings.

From time to time the old grease should be taken out, the bearing washed in kerosene or gasoline, and packed in a fresh supply of lubricant.

Clutch If a clutch (Figure 10) is installed, be sure that the ball bearing (203) is well lubricated when the clutch is not engaged. A grease cup located on the flywheel hub supplies lubricant to this bearing. The clutch should never be allowed to slip. If it does not hold, tighten up the four set screws (333) taking care that all are tightened up evenly, and screw down the lock nuts again.

Installing Clutch When assembling the clutch to the engine, care must be taken that it is not pushed up too close to the flywheel. There should be about $\frac{1}{16}$ " clearance between the collar (373) and the hub of the flywheel (48) (Figure 10). In order to get this, set the clutch so that the distance from the after face of the clutch hub (191) to the after face of the flywheel is $1\frac{3}{4}$ ". This dimension is indicated on Figure 10 by the letter "A".

Mechanical Lubricator The engine is provided with a ratchet driven mechanical sight feed oiler, forcing oil to the cylinders, piston pins, crank pins and crankshaft bearings. A high grade medium heavy gas engine lubricating oil should be used. It is advisable to use lubricating oil approved by Fairbanks, Morse & Company.

Strain Lubricating Oil The oil must be run thru a fine mesh wire strainer when the lubricator is filled. It is a good plan to have this strainer soldered in the funnel used for filling. Always replace the cover of the oiler after it has been filled. The lubricator should be drained occasionally and washed out with kerosene or gasoline.

Quantity of Lubricant Required The quantity of oil fed to the various parts should be approximately as follows:

Cylinder, by-pass side	30 to 35 drops
Cylinder, exhaust side	12 to 15 drops
Piston pin	12 to 15 drops
Main and intermediate bearings	15 to 20 drops
Crank pins	20 to 25 drops
Air compressor eccentric	6 to 8 drops
Governor collar	6 to 8 drops

Fuel pump mechanism	6 to 8 drops
Thrust bearing	8 to 10 drops
Forward bearing	8 to 10 drops

In some cases the number of drops fed can be reduced but this should be done very carefully. The amount of oil fed is regulated by turning the small adjusting screws on the cover of the lubricator, by means of a screw driver. Be sure that there is always a sufficient quantity of oil in the lubricator and that all feeds are working properly.

Before starting the engine, the lubricator should be cranked by hand to make sure that all pipes are filled. Otherwise the bearings and cylinders may be damaged before oil reaches them, after the engine is started.

One of the most difficult points to explain in the operation of an injection type engine, is the action which takes place when the fuel is controlled by a governor.

In the suction type engine, the load may be increased until a certain maximum is reached. If the load is increased further it will result in slowing down the engine, or stopping it, the limit being controlled by the amount of mixture introduced into the combustion space by atmospheric pressure.

This is not the case with the injection type engine, as atmospheric pressure has no control over the amount of fuel injected. Consequently an overload within a reasonable limit does not result in a marked reduction in speed. To insure reliable action and ease in starting, the capacity of the fuel injection pumps is made about double the full load requirements. The amount of fuel injected at any time is controlled directly by the governor and any tendency to lower the speed of the engine, as from increased load is met by the governor by increasing the amount of fuel and thus trying to keep up the speed of the engine.

The rated speed being 250 R. P. M., the governor is arranged so that it does not come into action until the speed of the engine reaches about 220 R. P. M., and up to this point the engine receives about twice as much oil as required at full load. At approximately 270 R. P. M. the governor cuts off the oil entirely so that the entire governor action takes place within a range of about 50 R. P. M. change in speed.

The exact speeds at which the governors of different engines begin to act vary somewhat, due to slight variations in adjustments, but the range of change in speed from rated load remains approximately the same, even tho the governor begins to act at a much lower speed than 220 R. P. M., a condition which obtains when the governor springs are counteracted by pulling forward the speed control lever (113). Therefore if the engine runs about 270 R. P. M. idle and when loaded runs only around 220 R. P. M., it is probably getting the maximum amount of fuel

Adjusting Feeds

Turn Lubricator When Starting

Governor Action

possible, and is sure to be overloaded. The reduction in speed from no load to rated load should never be more than approximately 25 R. P. M. If the speed is reduced more than this, it is proof that the engine is overloaded. The load may be decreased by changing the propeller or by slowing down the engine, by pulling the hand control lever forward. This may be necessary when towing a heavy tow or when running in shallow water.

Signs of Overload

An overload is indicated by the appearance of the exhaust, by excessive fuel consumption or by choking up and slowing down of the engine, and general unsatisfactory and noisy operation. The reason for this is that as the load increases tending to slow the engine down, the governor gives the engine more fuel in an attempt to keep up the speed of the engine, injecting more fuel than the engine can burn. The fact that the engine does not materially decrease in speed when further load is put upon it does not show that the load it is carrying is too light. If the engine is operated on an overload and receives an excessive amount of fuel for any length of time, carbon will be formed in the vaporizers and unless the load is reduced very unsatisfactory operation will be the result.

Maximum Speed Loaded

The engine speed is controlled by a centrifugal governor, shown on Figure 4. When the engine leaves the factory the governor is adjusted so that with the rated load, the engine runs the speed stamped on the name plate—250 R. P. M. This speed should never be exceeded when the engine is pulling its rated load.

To Reduce Speed

It is permissible, however, to lower the speed and this can be done in two ways, by releasing the tension on the governor springs (112) or by pulling the hand control lever (113) forward. For temporarily reducing the speed, it is satisfactory to use the hand control lever, but if the speed is to be reduced permanently, it is advisable to slacken the governor springs until the desired speed is reached. This is necessary if the propeller pitch is too large, and the engine is unable to turn it up to rated speed without being seriously overloaded.

To Increase Speed

If with rated load the engine speed is below 250 R. P. M. the governor springs (112) must be tightened. Take off the guard (110) and tighten both springs the same amount, and not more than $\frac{1}{4}$ " at a time. Remember that the speed at rated load must not exceed 250 R. P. M.

Adjusting Governor

The governor is properly adjusted when the engine leaves the factory, but slight adjustments may become necessary from time to time.

One very important point for the successful operation of the governor is to have the face of the regulating link (126) flush with the end of the intermediate regulating lever (125), when the governor sleeve (107) is as far forward as it will go. This position of the regulating link is shown in dotted lines on Figure 3. To get the governor sleeve as far forward as it will go take off the governor springs and pull the

governor weights out, or pull the hand control lever (113) forward, use a bar to pry the governor weights out and block the governor sleeve in this position. When doing this take care that the governor sleeve actually comes up against the face of the bracket (241). If the link (126) does not line up with the end of the lever (125), it should be brought into this position by adjusting the regulating rod (250) which has right and left hand thread. After the correct adjustment has been made, tighten up the two lock nuts on the regulating rod. No attempt must be made to increase or reduce the amount of fuel with this adjustment. It is not proper to run the engine otherwise than having the link (126) flush with the end of the lever (125) when the governor sleeve (107) is in its forward position.

One essential feature of the engine, which, for best results, must always be in perfect mechanical condition, is the fuel injection pump (35), Figure 3. To examine the pump unscrew the pipe gland (432) and hold your hand over the opening, or preferably screw a plug into the opening. If the plunger can be moved quite easily by means of the handle (123) it is a sign that the suction valve or stuffing box leaks, or that there is air entrapped in the pump. If there is no air in the pump, the plunger will move hard and only slowly for the only means of escape for the oil is along the pump plunger and with a well packed stuffing box, the oil will leak past only very slowly.

To remove the suction valve, proceed as follows: Unscrew plug (118) then by means of the socket wrench furnished, take out the plug (150). Turn the socket wrench end for end, screw it into the valve cage (37) and pull the latter out of the pump body. When replacing the valves clean the parts thoroughly with gasoline and convince yourself that all valves hold tight. A properly ground valve, filled with gasoline and set aside should hold it for a long time without leaking, even with the valve springs removed.

The fuel injectors have to be examined occasionally to make sure that the valves do not leak and that the spirals are clean and free from carbon.

Use only the finest grade of carborundum, flour of glass or pumice stone for grinding the valves. Never use emery as even the finest grade of this is too coarse.

The fuel pump is operated by a cam (128) Figure 3, thru a series of levers. This cam is held on the shaft in such a position that the fuel injection occurs when the corresponding piston is near its upper dead center. In order to get the best results with various grades of fuel this cam is not keyed to the shaft but is clamped to the collar (90) Figure 4, in such a way that the timing can be changed slightly.

When the engine leaves the factory it will operate satisfactorily on many oils without changing the position of the cam. However, if the

Fuel
Injection
Pump

Removing
Suction
Valve

Clean
Fuel
Injectors

Injection
Cam

operation is not entirely satisfactory a different timing should be tried.

**To Change
Timing**

To do this, take off the guard (110) at the forward end of the engine and loosen the two nuts (127). On the flange of the collar (90) will be found a heavy graduation line and the flange of the cam is graduated from 0° to 15° ahead and from 0° to 15° back. Carefully note how the cam is set then turn it about 2½° or one-half the space between graduations. No set rules can be given as to which way to turn the cam but it is advisable to try earlier injection first. To do this turn the cam ahead or in the same direction in which the engine runs ahead. Never turn the cam more than 5° at a time as a slight change in timing the injection will often show remarkable results. Be sure and tighten the clamping nuts well before starting the engine, taking care that the cam is not rotated while doing so.

**Air Check
Valves**

The engine is equipped with an air starting and reversing valve, Figure 3. Pipes (133) lead from this valve to the check valves (15) bolted to the cylinder. These check valves are only in operation while the air is turned on, but nevertheless they should be examined occasionally, any carbon formation present cleaned out, and the valves ground in if necessary.

**To Set
Gears**

The air starter discs (102) and (359) are driven by gears. Two adjacent teeth on the crankshaft gear (89) and one tooth on the air starter shaft gear (146) carry center punch marks. If the gears are taken off, make sure in reassembling that the marked tooth on the air starter shaft gear goes in between the marked teeth on the crankshaft gear.

If the air starter is taken apart, take care that it is reassembled correctly. There are lines marked on the two plates (103) and these should line up with the mark on the bracket (104).

A grease cup on one of the plates (103) and one on the bracket (104) serve for lubricating all parts of the air starter valve.

To start the engine when cold it is necessary to heat the vaporizers either by electric plugs, as described on page 12 or by kerosene burners, as described on page 13.

**To Start
Engine**

When ready to start, drain the crankcase compartments by means of the drain cocks provided. Open the sea cock. See that the lubricators are filled, and turn the hand crank long enough to make sure that the lubricator pipes are filled with oil. Also fill the lubricator cup on the air compressor cylinder and set it to feed about two or three drops per minute. Push the speed control lever (113) back into its highest position and shut off the needle valves (496) on the top fuel injectors. Next set the operating lever (325) in one of the "running" positions and let the lever (47) fall back against the small stop pin. Pump about two strokes of fuel into each cylinder by means of the handle (123) and set the starting lever (325) back into the "stop" position. When the elec-

tric plugs or the starting tubes are heated sufficiently, open the globe valves in the air line and move the operating lever (325) to the "starting" position, towards "ahead" when the engine is to run ahead, and towards "astern" when it is to run astern. Keep the lever in this position until the engine fires, then bring it back to the "running" position. Do not leave the operating lever in the starting position any longer than necessary, or you will waste compressed air. As the engine speeds up, pull the hand control lever (113) forward for a few seconds to prevent the governor from giving an excessive amount of fuel. If the engine stops firing, pump one or two strokes of fuel into the cylinder by hand and if necessary, move the operating lever (325) again to the "starting" position, until the engine picks up speed again.

As soon as the engine fires, open the needle valves (496) two or three turns and bring the hand control lever (113) back to the full speed position.

Be sure and open these valves immediately after the engine has been started or the nozzles will carbonize. These valves do not have to be closed for starting when the engine is warm. Do not forget to pull out the knife switches or shut off the burners about three minutes after starting.

If the engine is to be reversed while running, bring the operating lever (325) to the "stop" position and hold it there until the engine almost stops. Then move it astern to the "starting" position and as soon as the engine starts running astern and fires bring the lever back to the astern "running" position.

To change the direction of rotation from running astern to running ahead, proceed in a similar manner.

Always make sure that the air pressure is sufficient for starting, before the engine is shut down, and if necessary start the auxiliary compressor set to pump the tanks up.

If everything is in good working order the engine will start on about 75 pounds air pressure and over.

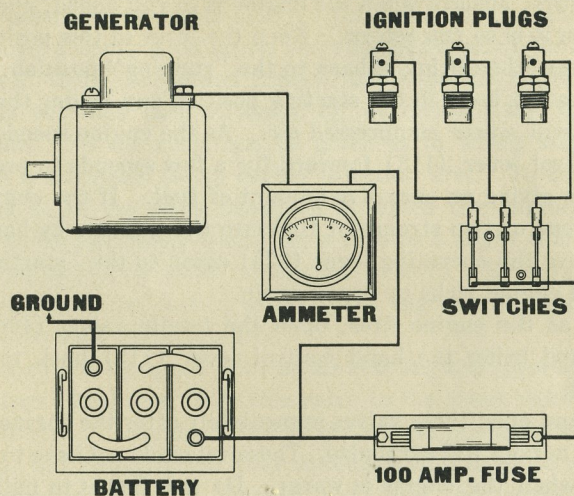
To stop the engine, move the operating lever (325) to the "stop" position. This, by means of a series of cams and levers lifts the suction valves of the fuel pumps off their seats and holds them in this position, so that the pumps will not deliver any fuel to the cylinders.

The engine can also be stopped by pulling up the lever (47) so that the little spring plunger will jump into the hole in the pump bracket. This operation should be performed very slowly.

If it is desired to shut off the fuel to one cylinder only, the pump plunger can be raised by means of the handle (123) and held in this position by the catch (124). This should be done if one of the vaporizers should get cold, and has to be reheated. It would be unwise to keep on pumping fuel into the cylinder while the vaporizer is too cold to ignite the charge.

**To
Reverse****Watch Air
Pressure****To Stop
Engine****To Cut
Out One
Cylinder**

WIRING DIAGRAM



A six-volt storage battery of 120 ampere hours capacity is used in connection with the electric starting equipment.

When installing the engine this battery should be connected to the charging generator and to the set of small knife switches located on the forward cylinder, as shown on the wiring diagram. The ignition plugs take about 22 amperes each, and a Number 6 cable should be used from the battery to the switches, and also from the battery to ground providing the total length of these two cables is not over 25'. If the length is greater use proportionately heavier cable to avoid excessive voltage drop.

Number 10 cable should be used to connect the generator and the battery. For all wiring, cable is preferable to solid wire, on account of the possibility of the wire being broken by the continuous slight vibrations.

The ammeter furnished with the engine is not of sufficient capacity to measure the current required for the ignition plugs, and care must be taken that the ammeter is connected as indicated in the diagram. It will then only show the rate at which the battery is being charged. At the rated engine speed, this charging current will be 10 amperes and proportionately less at lower speeds.

For any information required regarding the operation of the generator or battery write direct to the nearest agency of their respective manufacturer.

If the engine is to be started by means of the electric plugs, screw one ignition plug into each vaporizer and connect each one to one of the leads from the knife switches. When ready to start, throw in all knife

switches and after waiting about 30 seconds, start the engine as directed on page 10.

After the engine has been running about three minutes, pull out all of the switches. **THIS IS VERY IMPORTANT**, as otherwise the plugs will become overheated and possibly burn out. An excessive discharge might also result in serious damage to the battery.

If for some reason one of the cylinders should refuse to fire regularly, the corresponding switch should be thrown in again for a short time. If the cylinder still misses, the trouble may be due to a burned-out plug or to a loose connection. If the plug and connections are O. K. small sparks will show at the switch when it is thrown in or out.

A special socket wrench is furnished for removing the ignition plugs when this becomes necessary. When replacing the plug, apply graphite to the threads so that there will be no chance of the plug burning fast.

If the engine is stopped after running for some time, it will retain sufficient heat for a period of from 5 to 10 minutes to start without the use of the plugs. If the engine is shut down for a longer time, it will be necessary to switch on the current but only for a short time, say about one minute.

These engines are also equipped with kerosene burners which can be used in place of the electric plugs for heating the vaporizers when starting the engine.

When it is desired to use the burners, take out the electric plugs and put in their place the starting tubes furnished. Fill the fuel tank with kerosene taking care to strain the kerosene well to keep out dirt and foreign matter. The fuel tank must be connected to the air pressure tank and the tank pumped up to about 90 pounds pressure. The burners will operate satisfactorily with any pressure between 80 pounds and 175 pounds; 80 to 110 pounds, however, are preferred.

To start the burners, turn the top of the hood (530) as far as it will go towards the "oil" side of the burner. Open the valve on the fuel tank. Then open the fuel valve (533) one or more turns and ignite the mixture at the end of the hood with a match or torch. Adjust the yellow flame by turning the top of the hood (530) toward the "air" side of the burner. In about one minute when the burner is hot it should take all the air that can be given by turning the top of the hood (530) as far as it will go toward the "air" side of the burner. Under these conditions the flame should be a reddish blue and in about five minutes the starting tubes should be hot enough to start the engine.

To shut off the burner, close the fuel valve (533) then the air valve on the kerosene tank.

For satisfactory operation it is essential that the kerosene and air used with this burner be free from dirt. In nearly every case improper

**Pull Out
Switches**

**Cylinder
Missing**

**Removing
Plug**

**Starting
While
Engine is
Warm**

**Kerosene
Burners**

**Starting
Burners**

**Shut-off
Burners**

**Cleaning
Burners**

action will be found to be due to dirt stopping up the screens or the fine holes in the tips. If this is the case, take out the plugs (534) and clean the screens (532) thoroughly. If this does not improve the operation of the burner, remove the hood (530), the screen plugs (534) and the fuel valve (533) and clean all parts and passages thoroughly, especially the tips (535) and (531), using gasoline and compressed air.

Adjustment If it becomes necessary to readjust the burners, loosen the screw clamping the adjusting stop (536) and turn the top of the hood (430) as far as it will go toward the "oil" side of the burner, then turn it back about $\frac{1}{6}$ of a turn towards the "air" side of the burner and hold it in this position. Turn the top of the adjusting stop (536) as far as it will go toward the "air" side of the burner and tighten the clamping screw. While setting the adjusting stop the position of the hood (530) must not be changed.

Miscellaneous Instructions

Smoky Exhaust 1. If the exhaust is smoky, due to an overload, pull forward the speed control lever one notch at a time until the exhaust is almost clear.

Keep Air Suction Valves Clean 2. Keep the air suction valves, mounted on the crankcase hand-hole plates in good working order. Inspect them occasionally and if necessary wash them out in kerosene. When replacing them be sure that the small springs are not lost.

Inspect Cylinders 3. If the engine seems to lag in power capacity after it has been in use for some time, inspect the crankcase air suction valves, cylinder ports, pistons and piston rings. The ports, as well as the pistons and piston rings can be examined by taking off the plates (66) on the cylinders and on the exhaust manifold. If the engine is not overloaded, frequent cleaning of the ports, exhaust manifold and exhaust pipe should not be necessary. To remove the pistons take off the cylinder head and connecting rod box.

Piston Rings 4. The piston rings should be free in their grooves. If they tend to stick due to an accumulation of carbon from lubricating oil, they should be washed with alcohol or kerosene. If the rings have been allowed to stick fast, compression and explosion will blow past them and combustion will be poor due to the poor compression. If the rings are gummed fast, a hot solution of lye and water will assist to free them.

5. The fuel must at all times be kept fluid and warm enough for pumping.

Strain Fuel 6. Always strain the fuel oil when filling the tanks, using a strainer made of wire gauze of not less than 50 mesh.

Grind Fuel Valves 7. If the fuel pump and injector valves become leaky, carefully grind them into their respective seats, using a fine grade of carborundum

paste, flour of glass or pumice stone. Do not use emery, as even the finest grades of this are too coarse.

8. All bolts and nuts should be carefully tightened up after the engine has been installed and thereafter the inside of the crankcase should be inspected about once a week.

9. The water should always be drained off after shutting down the engine when there is any danger of freezing. Drain cocks will be found on the circulating pump and on the exhaust manifold. **Drain Jackets**

Repair Parts List

For Fairbanks-Morse 150 and 200 Horsepower
Type "C-O" Marine Engines

INSTRUCTIONS

When ordering parts for repairs, use the descriptions found in this list, giving

- FIRST:—Repair number;
- SECOND:—Name of part wanted;
- THIRD:—Serial or factory number of engine, which will be found stamped on the name plate and on the crank case;
- FOURTH:—Horsepower of engine for which repairs are wanted.

TOO MUCH CARE CANNOT BE TAKEN IN GIVING THE ABOVE PARTICULARS

Cylinders and bearings are numbered 1, 2, 3 and 4, beginning at the governor end of the engine.

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
1-C	Crank case—upper and lower half with center bearing caps # 8 and all studs	1-2	1	1
	Stud for upper half		22	28
	Nut for Above Stud		22	28
	Crank Case Dowel Pin		4	4
2	Crankshaft	1-4-10	1	1
3	Cylinder with Studs	1	3	4
6	Piston	1	3	4
6-C	Piston # 6 with # 310, 312 and 316		3	4
7	Forward Main Bearing with Cap # 93	1	1	1
	Stud for # 7		12	12
	Nut for Above Stud		12	12
8	Center Bearing Cap	1	2	3
	Stud for # 8		4	6
	Nut for Above Stud		8	12
	Shim for # 8		4	6
9	Rear Main Bearing with Cap # 94 for engine built without sailing clutch	1	1	1
9	Rear Main Bearing with Cap # 94 for engine built with sailing clutch		1	1
	Stud for # 9		12	12
	Nut for above Stud		12	12
10	Cylinder Stud	1	24	32
	Nut for above stud		24	32
11	Main Bearing Bushing (2 halves)	1	2	2
	Felt Wick for # 11		2	2
12	Center Bearing Bushing (2 halves)	1	2	3
	Felt Wick for # 12		2	3
13	Air Suction Valve Plate	2	3	4

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
13-C	Air Suction Valve Plate # 13 with # 237, 238, 444, 445, 446, 447		3	4
	Short Stud for # 13		15	20
	Long Stud for # 13		21	28
	Nut for Above Stud		36	48
	Gasket for # 13		3	4
15	Air Check Valve Body	2	3	4
15-C	Air Check Valve Body # 15, with # 284, 285, 286, 287, and 288		3	4
	Stud for # 15		6	8
	Nut for Above Stud		6	8
	Gasket for # 15		6	8
17	Cylinder Head with Studs	1-2	3	4
	Stud for # 17		36	48
	Nut for Above Stud		36	48
	Gasket for # 17		3	4
19	Burner Guard		3	4
	Stud for # 19		6	8
	Nut for Above Stud		6	8
20-C	Burner Complete	9	3	4
	Bracket for # 20		3	4
23	Air Compressor Cylinder Head	2-5	1	1
23-C	Air Compressor Cylinder Head # 23 with # 158, 159, 160, 161, 164, 165, 166, 167 and 168		1	1
	Stud for # 23		6	6
	Nut for Above Stud		6	6
	Gasket for # 23		1	1
24	Air Compressor Cylinder	2-5	1	1
24-C	Air Compressor Cylinder # 24 with # 23-C and # 282		1	1
	Stud for # 24		4	4
	Nut for above Stud		4	4
	Dowel Pin for # 24		1	1
25	Air Compressor Piston	5	1	1
25-C	Air Compressor Piston # 25 with # 317, 319, and 443		1	1
27	Air Compressor Rod with # 318	5	1	1
	Stud for # 27		2	2
	Nut for Above Stud		4	4
28	Eccentric Strap with Studs and Shims	1	1	1
30	Vaporizer with Studs	1-2	3	4
	Gasket for # 30		6	8
31	Vaporizer Clamping Ring	1-2	3	4
	Stud for # 31		24	32
	Nut for Above Stud		24	32
35	Fuel Pump Body	3	3	4
35-C	Fuel Pump Body # 35 with # 301, 302, 303, 304, 37-C, # 36-C, 118 and 150		3	4
	Stud for # 35		6	8
	Nut for Above Stud		6	8
	Gasket for # 35		3	4
36	Fuel Pump Discharge Valve Body	3	3	4
36-C	Fuel Pump Discharge Valve Body # 36, with # 157 and 488		3	4
37	Fuel Pump Suction Valve Cage	3	3	4
37-C	Fuel Pump Suction Valve Cage # 37 with # 152 and 153		3	4
38	Fuel Injector Body	1-8	3	4
38-C	Fuel Injector Body # 38 with # 129, 305, 306 and 307		3	4

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
39	Fuel Injector Check Valve Body	8	3	4
39-C	Fuel Injector Check Valve Body # 39 with # 154, 156 and 157		3	4
40	Fuel Discharge Pipe with # 495, Glands and Gland Nuts	3-8		4
	For Cylinder # 1		1	1
	For Cylinder # 2		1	1
	For Cylinder # 3		1	1
	For Cylinder # 4		1	1
41	Fuel Pump Bracket—Lower Half	3	1	1
	Stud for # 41		4	5
	Nut for Above Stud		4	5
42	Connecting Rod	1	3	4
43	Connecting Rod Box—Two Halves	1	3	4
44	Connecting Rod Bolt	1	6	8
	Nut for # 44		12	16
45	Starting Tube		3	4
	Bushing for # 45		3	4
46	Cam Follower	3	3	4
46-C	Cam Follower # 46 with # 225, 226 and 227		3	4
47	Fuel Pump Lever	2	1	1
48	Flywheel, Both Halves with Studs and Nuts for Engine built without Sailing Clutch	1-2	1	1
48	Flywheel, Both Halves, with Studs and Nuts for Engine built with Sailing Clutch	10	1	1
	Key for # 48		1	1
49	Long Flywheel Stud	1	4	4
	Nut for # 49		4	4
	Short Flywheel Stud		4	4
	Nut for Above Stud		8	8
51	Circulating Pump Body	7	1	1
51-C	Circulating Pump # 51, with # 273, 428, 274, 429, 431, 430, 266, 267, 262, 261, 263, 433, 269, 265, 270, 296 and 297		1	1
52	Exhaust Manifold	2	3	4
	Bolt and Nut for # 52		32	48
	Gasket for # 52		2	3
	Gasket for # 52 and 3		3	4
53	Exhaust Manifold End with Studs	1-2	2	2
	Bolt and Nut for # 53		32	32
	Gasket for # 53		2	2
54	Exhaust Manifold Cover Plate	2	1	1
	Stud for # 54		8	8
	Nut for Above Stud		8	8
	Gasket for # 54		1	1
55	Exhaust Pipe Fitting	1-2	1	1
	Stud for # 55		8	8
	Nut for Above Stud		8	8
	Gasket for # 55		1	1
56	Thrust Block with Cap and Studs	10	1	1
59	Flange Coupling—two halves with studs # 341 (State Size of Bore)	10	1	1
60	Flange Coupling—one half with Studs # 341 (State Size of Bore)	1	1	1
	Key for # 60		1	1
61	Water Outlet Header	2	1	1
61-C	Water Outlet Header # 61 with Nipples and Flanges # 64 and 260		1	1
62	Water Outlet Pipe	2	1	1
64	Water Outlet Header Nipple Flange	2	3	4
	Stud for # 64		6	8

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
	Nut for Above Stud		6	8
	Gasket for # 64		3	4
65	Exhaust Pipe Flange	1-2	1	1
	Bolt for # 65		8	8
	Gasket for # 65		1	1
66	Handhole Plate	1-2	6	8
	Stud for # 66		36	48
	Nut for Above Stud		36	48
	Gasket for # 66		6	8
69	Water Outlet Flange	2	3	3
	Stud for # 69		2	2
	Nut for Above Stud		2	2
	Cap Screw for # 69		4	4
	Gasket for # 69		3	3
73	Lubricator—9 Feed	1	1	
73	Lubricator—12 Feed			1
73	Lubricator—13 Feed	1	1	
73	Lubricator—15 Feed			1
74	Lubricator Ratchet Arm	1	1	1
	Pin for # 74		1	1
75	Lubricator Upper Drive Rod	1	1	1
	Pin for # 75		1	1
76	Lubricator Half Coupling	1	2	2
	Pin for # 76		2	2
77	Forward Lubricator Bracket	1	1	1
79	Rear Lubricator Bracket	1	1	1
	Long Stud for # 77 and # 79		2	2
	Short Stud for # 77 and # 79		2	2
	Nut for Above Studs		4	4
80	Distributor Fitting		2	2
83	Crank Pin Oil Ring	1	3	4
	Gasket for # 83		3	4
	Long Cap Screw for # 83		3	4
	Short Cap Screw for # 83		12	16
	Lock Washer for Above Screw		15	20
	Bolt for # 83		6	8
	Lock Washer for Above Bolt		6	8
84	Eccentric	1	1	1
	Key for # 84		1	1
85	Air Stop Ring	1	2	2
86	Air Stop Ring Spring	1	12	12
88	Oil Spout Bracket	1	1	2
	Stud for # 88		2	4
	Nut for Above Stud		2	4
89	Crankshaft Gear	3	1	1
	Key for # 89		1	1
90	Cam Sleeve	4	1	1
	Bolt and Nut for # 90		1	1
93	Forward Main Bearing Cap	1	1	1
	Bolt with Nuts for # 93		2	2
	Shim for # 93		2	2
94	Rear Main Bearing Cap	1	1	1
	Bolt with Nuts for # 94		2	2
	Shim for # 94		2	2
97	Oil Tube and Dowel	2	1	1
101	Air Starter Cover	3	1	1
	Long Stud for # 101		2	2
	Short Stud for # 101		6	6
	Gasket for # 101		1	1
102	Forward Air Starter Disc	3	1	1

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
103	Air Starter Plate	3	2	2
	Gasket for #103		1	1
104	Air Starter Bracket	3	1	1
	Gasket for #104		1	1
	Stud for #104		6	6
	Nut for Above Stud		6	6
107	Governor Sleeve	4	1	1
	Long Key for #107		1	1
	Short Key for #107		1	1
108	Upper Governor Lever	4	1	1
	Clamping Bolt with Nut for #108		1	2
110	Governor Guard	1	1	1
	Short Stud for #110		2	2
	Long Stud for #110		2	2
	Nut for Above Studs		4	4
111	Governor Weight	4	2	2
112	Governor Spring		2	2
	Cap Screw for #112		2	2
	Nut for Above Screw		4	4
113	Speed Control Lever	1	1	1
	Key for #113		1	1
	Cap Screw for #113		1	1
118	Fuel Pump Plug	3	3	4
122	Fuel Pump Lever Lock Knob	2	1	1
	Pin for #122		1	1
	Spring for Above Pin		1	1
123	Fuel Pump Handle	3	3	4
124	Fuel Pump Handle Catch	3	3	4
125	Intermediate Regulating Lever	3	3	4
126	Regulating Link	3	3	4
127	Stud for Cam	4	2	2
	Nut for #127		2	2
	Lock Washer for #127		2	2
128	Cam	3-4	1	1
129	Fuel Injector Tip with Spiral	8	3	4
131	Split Gland Nut	8	3	4
132	Gland Nut	8	3	4
133	Air Pipe to Cylinder #1	1-2-3	1	1
133	Air Pipe to Cylinder #2	1-2-3	1	1
133	Air Pipe to Cylinder #3	1-2-3	1	1
133	Air Pipe to Cylinder #4	1-2-3	1	1
141	Filter Cover	3	1	1
	Stud for #141		4	4
	Nut for Above Stud		4	4
	Gasket for #141		2	2
142	Filter	3	1	1
143	Speed Control Spring	4	1	1
145	Governor Lever Shaft	4	1	1
	Thrust Washer for #145		1	1
	Spacer for #145		1	1
146	Air Starter Shaft Gear	3	1	1
	Key for #146		1	1
	Set Screw for #146		2	2
147	Air Starter Large Bushing	3	1	1
	Dowel Pin for #147		1	1
148	Air Starter Shaft Thrust Washer	3	2	2
	Dowel Pin for #148		1	1
149	Crankcase Handhold Plate	1	3	4
	Stud for #149		36	48
	Nut for Above Stud		36	48
	Gasket for #149		3	4

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
150	Fuel Pump Suction Valve Plug	3	3	4
152	Fuel Pump Suction Valve	3	3	4
153	Fuel Pump Suction Valve Spring	3	3	4
154	Fuel Valve Ball	8	3	4
156	Fuel Valve Ball Guide	8	3	4
157	Fuel Pump Discharge Valve Spring	3-8	6	8
158	Air Compressor Suction Valve Cap	5	2	2
159	Air Compressor Suction Valve Seat	5	2	2
160	Air Compressor Cut-Out	5	1	1
161	Air Compressor Suction Valve	5	2	2
161-C	Air Compressor Suction Valve #161 with #159 and 164		2	2
164	Air Compressor Suction Valve Spring	5	2	2
165	Air Compressor Discharge Valve	5	2	2
165-C	Air Compressor Discharge Valve #165 with #166 and 168		2	2
166	Air Compressor Discharge Valve Guide	5	2	2
167	Air Compressor Discharge Valve Plug	5	2	2
168	Air Compressor Discharge Valve Spring	5	2	2
169	Air Compressor Safety Valve	2	1	1
172	Hand Wheel	10	1	1
	Key for #172		1	1
176	Clutch Hub Plate	10	1	1
177	Clutch Drum	10	1	1
179	Clutch Friction Plate with Facing #206	10	5	5
181	Clutch Hub	10	1	1
	Key for #181		1	1
182	Split Collar (2 halves)	2-10	1	1
183	Split Collar (2 halves)	10	1	1
185	Operating Yoke (2 halves)	10	1	1
	Bolt and Nut for #185		2	2
187	Toggle Link	10	8	8
188	Toggle Lever	10	4	4
189	End Friction Plate	10	1	1
190	Toggle Link Pin	10	8	8
192	Clutch Drum Stud	10	16	16
	Nut for #192		16	16
195	Clutch Hub Stud	10	12	12
	Nut for #195		12	12
	Lock Washer for #195		12	12
196	Clutch Stud Long Sleeve	10	16	16
197	Clutch Spacer	10	32	32
198	Clutch Stud Short Sleeve	10	24	24
202	Ball Bearing Retaining Screw	10	1	1
203	Radial Ball Bearing	10	1	1
204	Ball Bearing Retaining Washer	10	1	1
205	Sliding Collar	10	1	1
206	Clutch Friction Plate Facing	10	30	30
207	Clutch Hub Friction Plate	10	4	4
208	Clutch Spring	10	20	20
210	Clutch Spring Pin	10	4	4
211	Operating Lower Shaft	10	1	1
212	Clamping Pin	10	4	4
217	Fuel Pump Handle Spring	3	3	4
220	Fuel Pump Handle Shaft	3	1	1
	Collar for #220		1	1
221	Fuel Pump Handle Shaft Pin	3	3	4
222	Fuel Pump Handle Catch Stud	3	3	4
	Nut for #222		3	4
	Washer for #222		3	4
223	Plunger Rod	3	3	4

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
224	Plunger Rod Shoe	3	3	4
225	Cam Roller	3	3	4
226	Cam Roller Bushing	3	3	4
227	Cam Roller Pin	3	3	4
228	Cam Follower Pin	3	2	2
	Set Screw for #228		2	2
229	Quadrant Handle	1-3	2	2
230	Quadrant Bracket	1	1	1
	Stud for #230		1	1
	Nut for Above Stud		1	1
231	Quadrant Rack	1	2	2
232	Quadrant Rack Bolt	1	2	2
	Nut for #232		2	2
233	Quadrant Rack Spacer	3	4	4
234	Speed Control Shaft	3-4	1	1
235	Control Lever	3-4	2	2
	Key for #235		2	2
	Long Bolt and Nut for #235		1	1
	Short Bolt and Nut for #235		2	2
237	Air Suction Valve Stop	2	12	16
	Cap Screw and Nut for #237		12	16
238	Air Suction Valve Spring	2	96	128
239	Discharge Valve Gland	3	3	4
240	Air Suction Valve Cover	2	3	4
	Gasket for #240		3	4
241	Governor Bracket	4	1	1
	Bolt and Nut for #241		1	1
	Key for #241		1	1
242	Governor Collar (2 halves)	4	1	1
	Bolt and Nut for #242		2	2
244	Governor Weight Roller	4	2	2
245	Governor Weight Roller Pin	4	2	2
246	Governor Spring Block	4	2	2
247	Governor Spring Adjusting Block	4	2	2
248	Governor Spring Pin	4	2	2
249	Governor Weight Pin	4	2	2
250	Regulating Rod	3-4	1	1
	Nut for #250 right hand		1	1
	Nut for #250 left hand		1	1
252	Governor Lever	4	2	2
	Key for #252		2	2
	Bolt and Nut for #252		2	2
258	Operating Lever Latch	3	1	1
258	Governor Lever Bushing	4	2	2
260	Blind Flange	1-2	3	4
	Gasket for #260		3	4
	Stud for #260		6	8
	Nut for Above Stud		6	8
261	Circulating Pump Valve	7	2	2
	Circulating Pump Valve Washer		2	2
262	Circulating Pump Valve Seat	7	2	2
263	Circulating Pump Valve Spring	7	2	2
265	Circulating Pump Suction Valve Cover	2	1	1
	Stud for #265		4	4
	Nut for Above Stud		4	4
	Gasket for #265		1	1
266	Circulating Pump Stuffing Box Gland	7	1	1
	Circulating Pump Packing, per set of 5 rings		1	1
267	Circulating Pump Stuffing Box Gland Stud	7	2	2
	Nut for #267		4	4
269	Circulating Pump Air Chamber	7	1	1

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
	Stud for #269		4	4
	Nut for Above Stud		4	4
	Gasket for #269		1	1
270	Circulating Pump Suction Flange	2	1	1
	Cap Screw for #270		2	2
	Gasket for #270		1	1
271	Circulating Pump Discharge Pipe Fitting	2	2	2
	Cap Screw for #271		4	4
	Gasket for #271		2	2
272	Circulating Pump Discharge Pipe	2	1	1
273	Circulating Pump Plunger	7	1	1
274	Circulating Pump Plunger Pin	7	1	1
275	Circulating Pump Eccentric Strap Bushing	7	1	1
281	Oil Cup	2	1	1
282	Oil Cup Fitting	2	1	1
	Screw for #282		1	1
283	Relief Valve Complete	1	3	4
284	Air Check Valve	2	3	4
285	Air Check Valve Spring	2	3	4
286	Air Check Valve Collar	2	3	4
287	Air Check Valve Elbow	2	3	4
288	Air Check Valve Stop	2	3	4
290	Regulating Lever	3	1	1
	Key for #290		1	1
	Bolt and Nut for #290		1	1
291	Regulating Lever Pin	3	1	1
292	Regulating Lever Shaft	3	1	1
	Grease Cup for #292		1	1
293	Regulating Lever Shaft Bushing	3	2	2
294	1/4" Pet Cock		1	1
295	1/2" Pet Cock	3	1	1
296	3/8" Pet Cock	2-7	4	4
297	3/8" Drain Cock	2-7	5	6
300	Grease Cup	2	2	2
301	Fuel Pump Plunger	3	3	4
302	Fuel Pump Plunger Spring	3	3	4
303	Fuel Pump Packing Gland	3	3	4
304	Fuel Pump Packing Nut	3	3	4
	Fuel Pump Packing per Set of 9 Rings		3	4
305	Fuel Injector Valve	8	6	8
306	Fuel Injector Valve Nut	8	6	8
307	Fuel Injector Valve Spring	8	6	8
308	Control Spring Rod	4	1	1
309	Control Spring Rod Collar	4	1	1
310	Piston Pin	1	3	4
	Key for #310		3	4
311	Piston Pin Bushing	1	3	4
312	Piston Pin Set Screw	1	3	4
313	Piston Pin Bushing Set Screw	1	3	4
314	Piston Pin Oiler	1	3	4
315	Piston Pin Oiler Spring	1	3	4
316	Piston Ring	1	12	16
	Dowel Pin for #316		12	16
317	Air Compressor Piston Pin	5	1	1
318	Air Compressor Rod Bushing	5	1	1
319	Air Compressor Piston Ring	5	3	3
	Dowel Pin for #319		3	3
320	Control Spring Yoke	3-4	1	1
321	Quadrant Latch	1	1	1
322	Quadrant Rod	1	1	1
323	Quadrant Handle Pin	3	4	4

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
324	Quadrant Handle Spring	1-3	2	2
325	Operating Lever	1-3	1	1
	Key for #325		1	1
	Bolt and Nut for #325		1	1
328	Thrust Bearing Sleeve	10	1	1
330	Clutch Shaft	10	1	1
333	Set Screw	10	4	4
	Nut for #333	10	4	4
339	Toggle Lever Pin	10	4	4
340	Coupling Bolt	1-10	5	5
	Nut for #340		5	5
341	Coupling Stud	1-10	2	2
	Nut for #341		4	4
343	Operating Lever Quadrant Rod	3	1	1
344	Operating Lever Quadrant Rack	3	2	2
345	Operating Lever Quadrant Rack Bolt	3	2	2
	Nut for #345		2	2
347	Air Starter Small Bushing	3	2	2
	Oil Tube for #347		1	1
348	Air Check Valve Flange	2	3	4
	Bolt and Nut for #348		6	8
	Gasket for #348		3	4
349	Air Starter Bracket Flange	3	3	4
	Stud for #349		12	16
	Nut for Above Stud		12	16
	Gasket for #349		3	4
351	Generator Stud	2	2	2
	Nut for #351		4	4
353	Generator with Control Box	2	1	1
	Knife Switch		1	1
356	Generator Driving Sprocket	2	1	1
	Hub for #356		1	1
	Stud for Hub		3	3
	Nut for Above Stud		3	3
357	Generator Sprocket	2	1	1
	Key for #357		1	1
	Set Screw for #357		1	1
	Roller Chain for Driving Generator	2	1	1
359	Reverse Air Starter Disc	3	1	1
366	Ignition Plug	2	3	4
	Gasket for #366		3	4
367	Plunger Rod Collar	3	3	4
368	Plunger Rod Spring	3	3	4
369	Right Hand Pump Bracket Standard—Left Hand Engine	2-3	1	1
369	Right Hand Pump Bracket Standard—Right Hand Engine		1	1
	Stud for #369		4	4
	Nut for Above Stud		4	4
370	Thrust Bearing Sleeve	1	2	2
371	Thrust Bearing End Plate	1	1	1
	Stud for #371		12	12
	Nut for Above Stud		12	12
373	Grease Retaining Collar	10	1	1
374	Grease Retaining Collar Spring	10	3	3
375	Ball Thrust Bearing with Levelling Washers	1-10	1	1
376	Left Hand Pump Bracket Standard—Left Hand Engine	1-3	1	1
376	Left Hand Pump Bracket Standard—Right Hand Engine		1	1
	Stud for #376		4	4

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
	Nut for Above Stud		4	4
377	Fuel Control Cam #1	3	1	1
378	Fuel Control Cam #2	3	1	1
	Key for #377 and #378		2	2
	Set Screw for #377 and #378		2	2
379	Fuel Control Cam #3	3	1	1
380	Fuel Control Cam #4	3	1	1
	Key for #379 and #380		2	2
381	Fuel Control Shaft	3	1	1
382	Fuel Control Shaft Spring	3	1	1
383	Fuel Control Shaft Outer Collar	3	1	1
384	Fuel Control Shaft Inner Collar	3	1	1
385	Fuel Control Shaft Spacer	3	1	1
386	Fuel Control Upper Lever	3	1	1
	Bolt and Nut for #386		1	1
	Key for #386		1	1
387	Operating Shaft	3	1	1
388	Operating Shaft Bracket	3	1	1
	Stud for #388		2	2
	Nut for Above Stud		2	2
389	Operating Lever Rack Bracket	3	1	1
	Stud for #389		2	2
	Nut for Above Stud		2	2
390	Fuel Control Lower Lever	3	1	1
	Key for #390		1	1
	Bolt and Nut for #390		1	1
391	Push Rod	3	3	4
392	Push Rod Lever	3	2	3
	Key for #392		2	3
	Cap Screw for #392		2	3
	Pin for #391 and #392		1	1
393	Push Rod Lever Shaft	3	1	1
	Collar for 393		1	1
394	Fuel Control Rod	3	1	1
	Nut for #394		1	1
	Pin for #394		2	2
395	Fuel Control Rod End	3	1	1
396	Universal Joint Pin	3	1	1
397	Regulating Rod End—Right Hand	3-4	1	1
398	Regulating Rod End—Left Hand	3-4	1	1
	Pin for #397 and #398		2	2
399	Regulating Shaft Lever	3	1	1
	Key for #399		1	1
	Bolt and Nut for #399		1	1
400	Fuel Supply Pump Body	6	1	1
400-C	Fuel Supply Pump #400, Complete with #400 to 412		1	1
	Stud for #400		2	2
	Nut for Above Stud		2	2
401	Fuel Supply Pump Bracket	6	1	1
402	Supply Pump Plunger	6	1	1
403	Supply Pump Suction Valve	6	1	1
404	Supply Pump Discharge Valve	6	1	1
405	Supply Pump Plug	6	1	1
406	Supply Pump Stuffing Box Gland	6	1	1
407	Supply Pump Stuffing Box Nut	6	1	1
	Supply Pump Stuffing Box Packing, Set of 3 rings	6	1	1
408	Supply Pump Drive Link	6	1	1
409	Supply Pump Drive Link Pin	6	2	2
412	Supply Pump Bell Crank	6	1	1

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
415	Air Starter Shaft	3	1	1
416	Air Starter Stuffing Box Gland	3	1	1
	Air Starter Stuffing Box Packing, set of 4 rings	3	1	1
	Stud for # 416		2	2
	Nut for Above Stud		4	4
417	Air Starter Check Valve	3	6	8
418	Air Starter Check Valve Spring	3	3	4
419	Air Starter Disc Shaft	3	1	1
	Dowel Pin for #419		2	2
420	Air Starter Cover Stud Nut	3	8	8
	Copper Gasket for # 420		8	8
421	Air Starter Lever	2-3	2	2
	Key for #421		2	2
	Bolt and Nut for #421		2	2
422	Air Starter Valve Rod	3	1	1
	Nut for # 422		2	2
423	Air Starter Valve Rod End	2-3-4	3	3
	Pin for # 423		3	3
424	Universal Joint Pin	3-4	5	5
425	Air Starter Valve	3	1	1
426	Air Starter Valve Shaft	2	1	1
427	Fuel Pump Bracket—Upper Half	3	1	1
	Long Stud for # 427		10	10
	Stud for # 427		1	1
	Short Stud for # 427		2	3
	Gasket for #427		1	1
428	Circulating Pump Plunger Link	7	1	1
	Stud for # 428		1	1
	Nut for Above Stud		1	1
429	Circulating Pump Eccentric Link	7	1	1
430	Circulating Pump Eccentric Link Pin	7	1	1
431	Eccentric Link Bushing	7	1	1
432	Discharge Valve Gland Nut	3	3	4
433	Circulating Pump Valve Stem	7	2	2
	Nut for # 433		2	2
435	Control Spring Lever	4	1	1
	Key for # 435		1	1
	Bolt and Nut for # 435		2	2
436	Control Spring Spacer	4	1	1
437	Governor Lever Shaft Bracket	4	1	1
	Stud for # 437		2	2
	Nut for Above Stud		2	2
	Dowel Pin for #437		2	2
438	Governor Lever Shaft Bushing	4	2	2
440	End Bearing Body with Cap #441	1-2	1	1
	Stud for # 440		6	6
	Nut for Above Stud		6	6
441	End Bearing Cap	2-4	1	1
	Stud for # 441		2	2
	Nut for Above Stud		4	4
	Dowel Pin for # 441		2	2
442	End Bearing Bushing for Engine Built Without Sailing Clutch (2 halves)	2-4	1	1
442	End Bearing Bushing for Engine Built with Sailing Clutch (2 halves)		1	1
	Dowel Pin for #442		2	2
443	Air Compressor Piston Pin Lock Spring	5	1	1
	Pin for #443		1	1
444	Air Suction Valve Large Steel Ring	2	12	16
445	Air Suction Valve Large Leather Ring	2	12	16
446	Air Suction Valve Small Steel Ring	2	12	16

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
447	Air Suction Valve Small Leather Ring	2	12	16
448	Generator Bracket Plate	2	1	1
	Cap Screw for #448		2	2
	Stud for #448		2	2
	Nut for Above Stud		2	2
449	Fuel Pump Bracket Stuffing Box Gland	2	1	1
	Stud for # 449		2	2
	Nut for Above Stud		2	2
	Fuel Pump Bracket Stuffing Box Packing, Set of 4 Rings		1	1
450	Air Starter Valve Shaft Bracket	2	1	1
450-C	Air Starter Valve Shaft Bracket #450 with #541, Lock and Screw	2	1	1
	Stud for #450		4	4
	Nut for Above Stud		4	4
	Gasket for # 450		1	1
	Grease Cup for #450		1	1
451	Air Starter Cover Flange	2	1	1
	Stud for # 451		4	4
	Nut for Above Stud		4	4
	Gasket for # 451		1	1
452	Fuel Pump Bracket Blind Flange	2	1	1
	Stud for # 452		2	2
	Nut for Above Stud		2	2
	Gasket for # 452		1	1
453	Flywheel Stud Nut	2	4	4
480	Cover Plate	1-10	4	5
	Stud for #480		16	20
	Nut for Above Stud		16	20
	Gasket for #480		4	5
481	Center Ring Oil Spout	1	1	2
482	End Ring Oil Spout	1	2	2
483	Main Bearing Oil Tube	1-10	4	5
484	Crank Case Oil Pipe Connection	1	3	5
485	Handhole Plate	1	1	1
	Stud for #485		6	6
	Nut for Above Stud		6	6
487	Air Inlet Screen	2	2	2
	Stud for # 487		12	12
	Nut for Above Stud		12	12
488	Fuel Pump Discharge Valve	3	3	4
489	Crankcase Center Plate	1	2	3
	Stud for #489		22	33
	Nut for Above Stud		22	33
	Lock Washer for Above Stud		22	33
	Gasket for # 489		2	3
490	16" by 50" Air Tank for Whistle Equipment		1	1
491	22" by 60" Air Tank for Air Starting Equipment		4	4
492	Lower Lubricator Drive Rod	1	1	1
	Pin for #492		1	1
	Bearing Stud and Collar for #492		1	1
493	Lubricator Drive Bell Crank Stud	1	1	1
	Lockwasher for #493		1	1
	Washer for #493		1	1
495	Fuel Pipe Fitting	1-8	3	4
496	3/8" Needle Valve Complete with Stem and Packing Nut	1-8	3	4
	Stem for #496		3	4
497	Top Fuel Injector Body	1-8	3	4
497-C	Top Fuel Injector #497, Complete with #305, 306, 307 and 540		3	4

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON	
			150 H. P.	200 H. P.
498	Vaporizer Water Connection	1	3	4
	Gasket for # 498		6	8
	Cap Screw for # 498		12	16
499	Lubricator Drive Bell Crank	1	1	1
530	Burner Hood	9	3	4
531	Burner Body Tip	9	3	4
532	Burner Screen	9	6	8
533	Burner Fuel Valve	9	3	4
534	Burner Screen Plug	9	6	8
535	Burner Hood Tip	9	3	4
536	Burner Adjusting Stop	9	3	4
537	Burner Tank Cover	9	1	1
538	Kerosene Outlet Pipe	9	1	1
539	Burner Tank	9	1	1
539-C	Burner Tank #539, with #537, 538, Inlet and Outlet Fittings, two Globe Valves and Funnel with Screen		1	1
540	Top Fuel Injector Tip	8	3	4
541	Air Starter Valve Shaft Packing Nut	2	1	1
	Lock for #541		1	1
	Screw for Above Lock		1	1
542	Coupling Key	1-10	2	2
	Dowel Pin for #542		2	2
543	Collar for Fuel Pump Stuffing Box	3	3	4
550	Operating Shaft Standard	10	2	2
	Stud for # 550		8	8
	Nut for Above Stud		8	8
551	Operating Upper Shaft	10	1	1
552	Operating Shaft Pinion	10	1	1
	Key for # 552		1	1
	Set Screw for # 552		1	1
553	Operating Quadrant	10	1	1
	Key for # 553		1	1
	Bolt and Nut for #553		1	1
554	Shifting Lever	10	2	2
	Key for #554		2	2
	Bolt and Nut for # 554		2	2
555	Shifting Link	10	2	2
	Pin for #555		2	2
556	Shifting Link Stud	10	2	2
560	Thrust Block End Plate	10	1	1
	Cap Screw for #560		12	12
561	Intermediate Shaft Bearing Body with Cap	10	1	1
	Cap Screw for #561		12	12
563	Intermediate Shaft Bearing Bushing (2 halves)	10	1	1

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