

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

INSTRUCTIONS NO. 2519

FOR INSTALLING AND OPERATING

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

30, 45 and 60 H. P.

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

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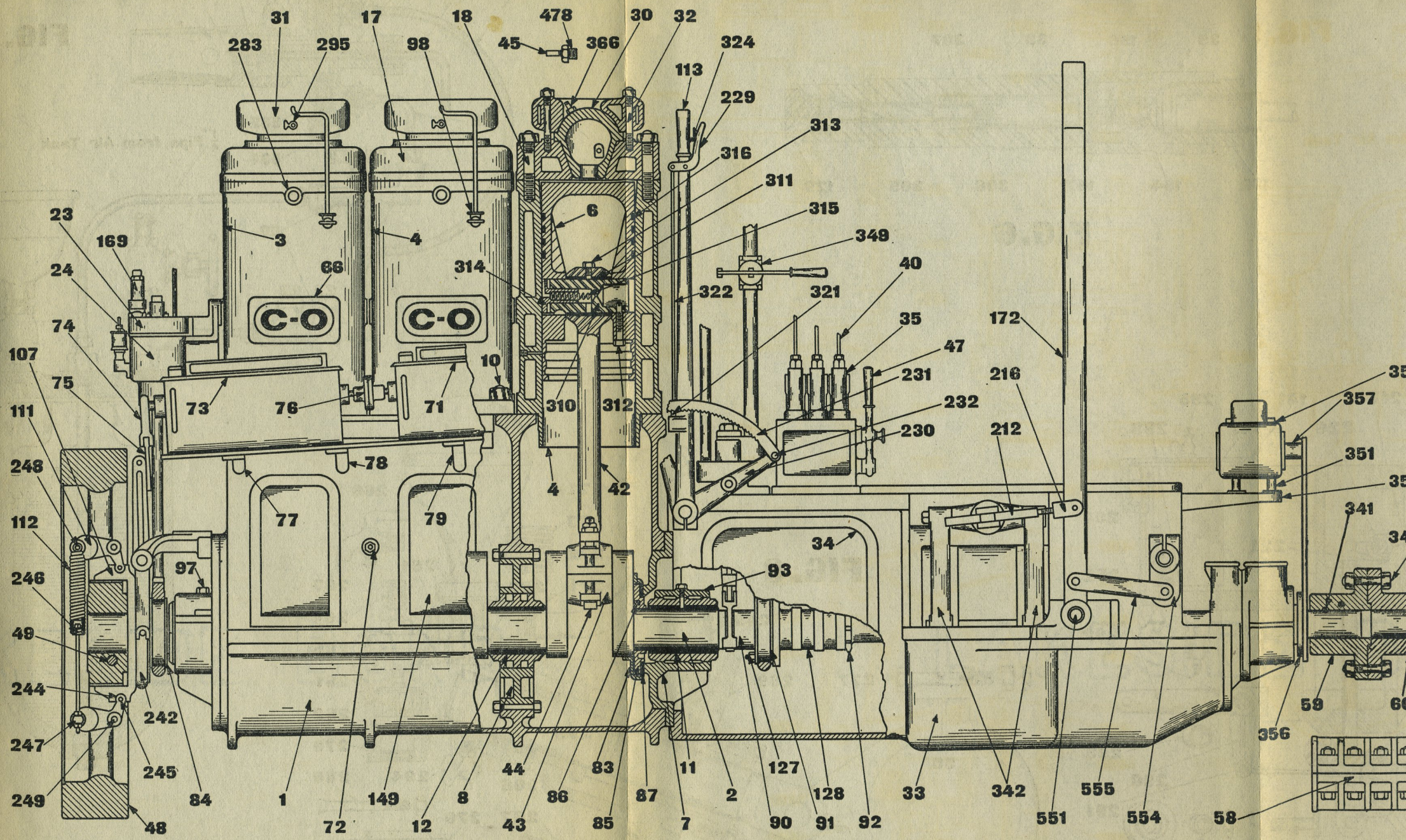


FIG. 1

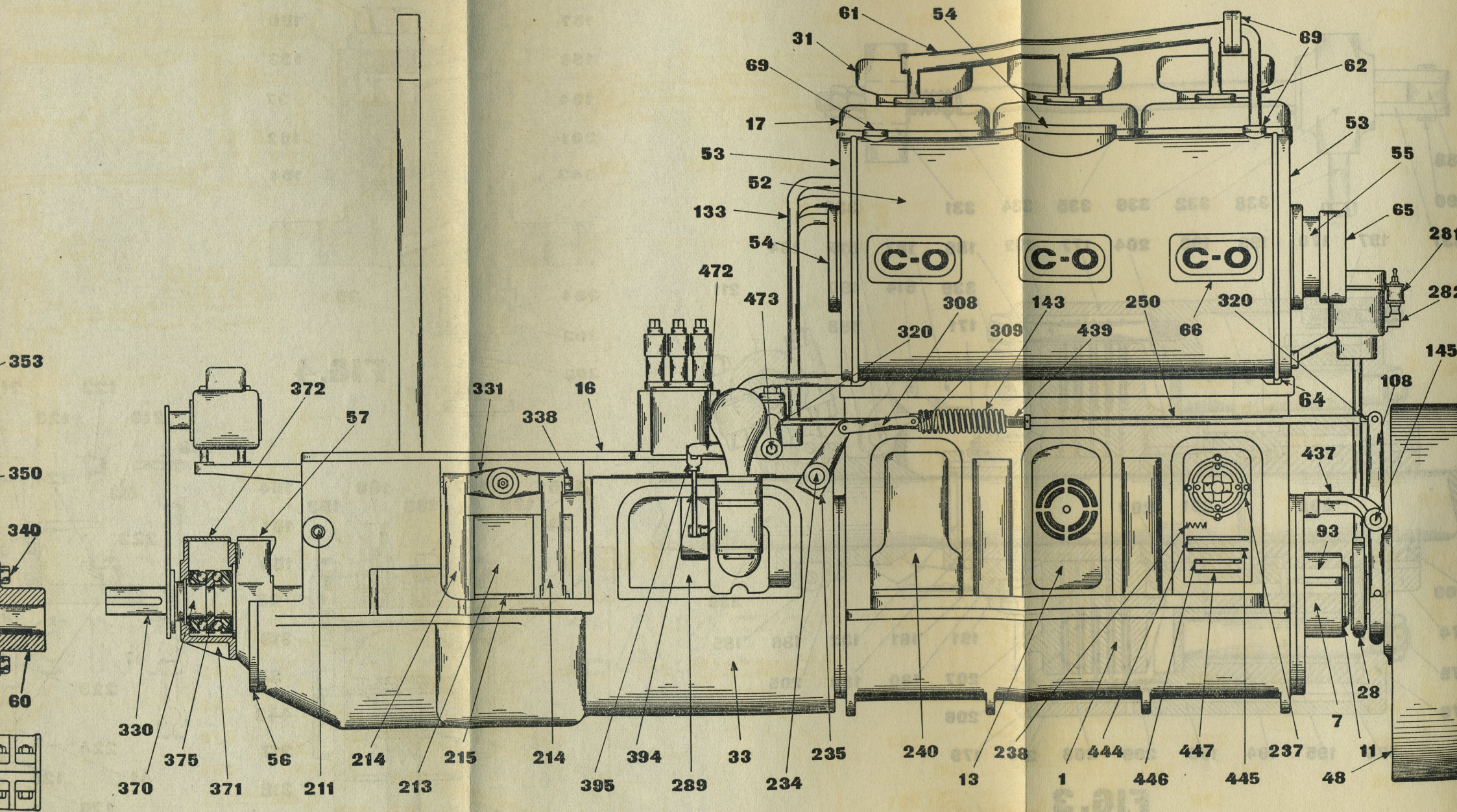


FIG. 2

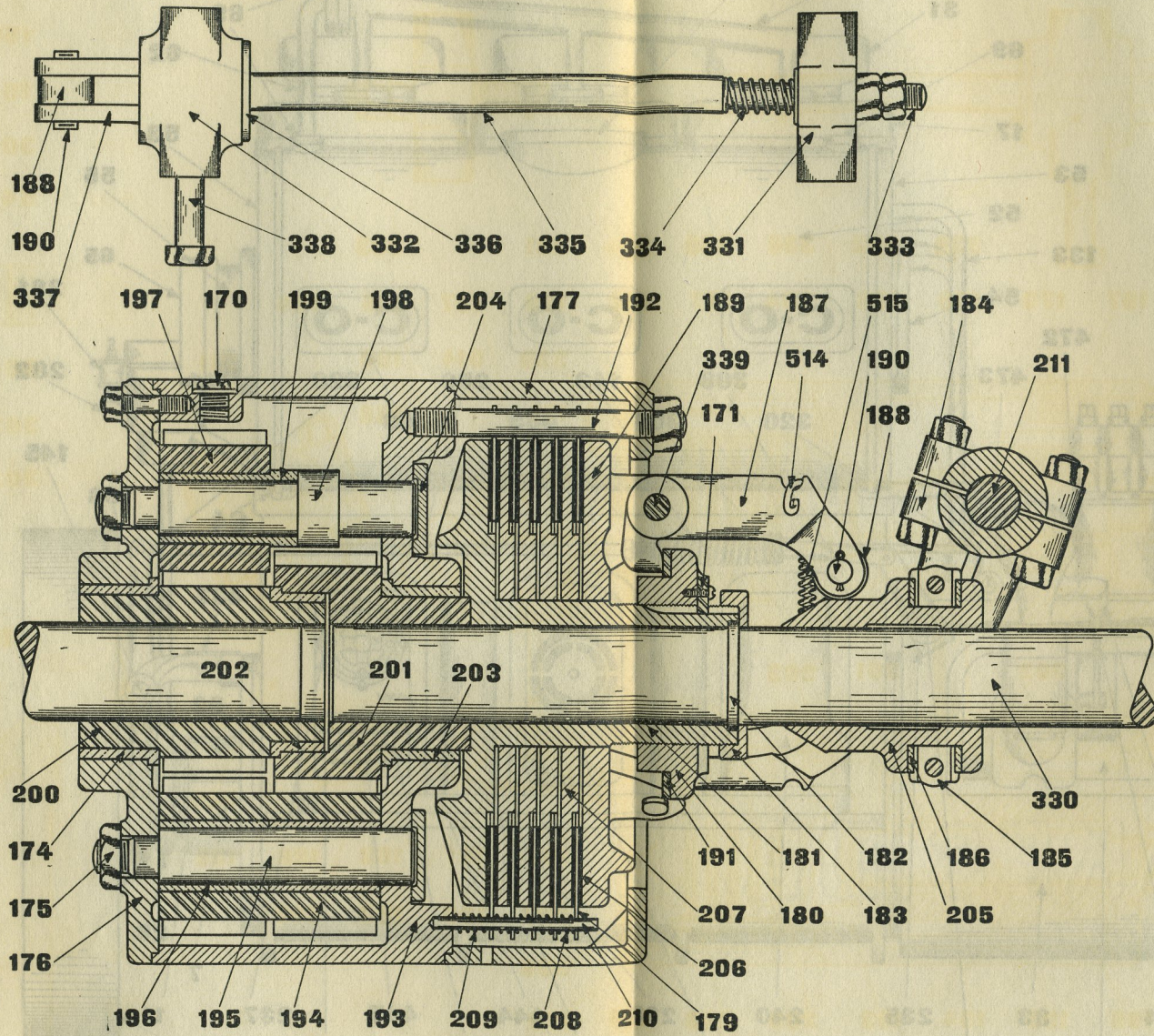


FIG. 3

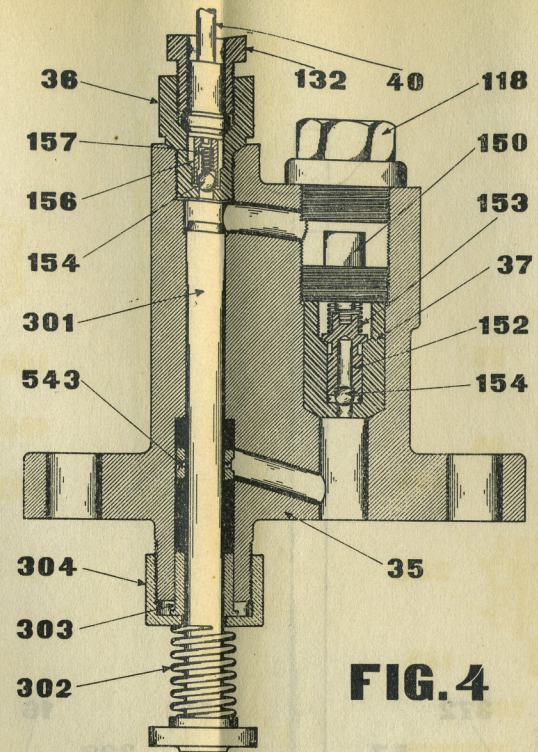


FIG. 4

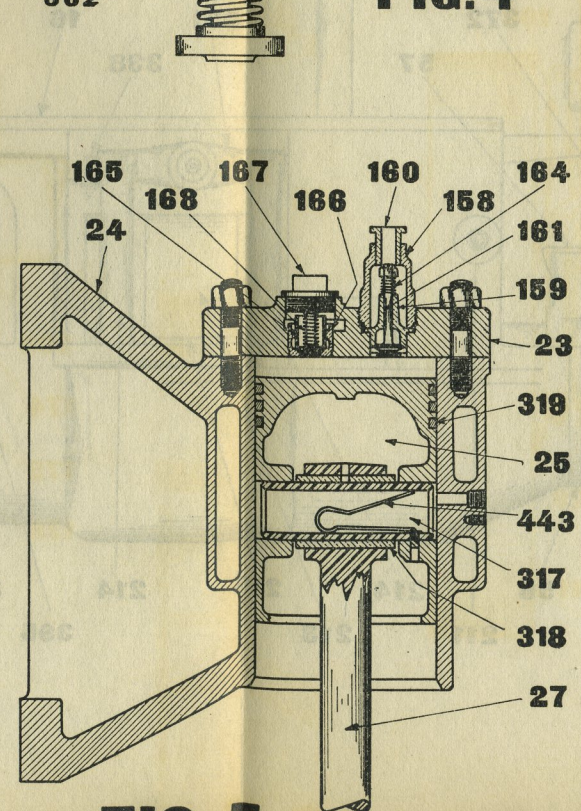
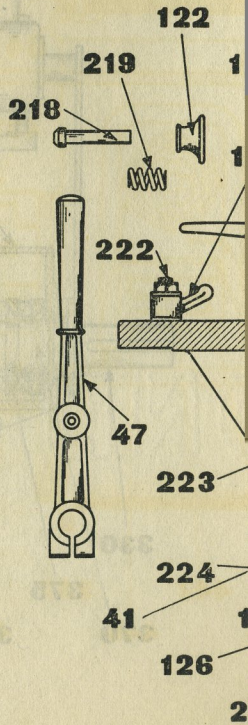


FIG. 5



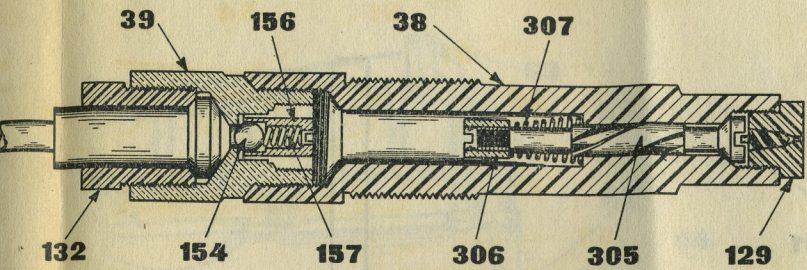


FIG. 6

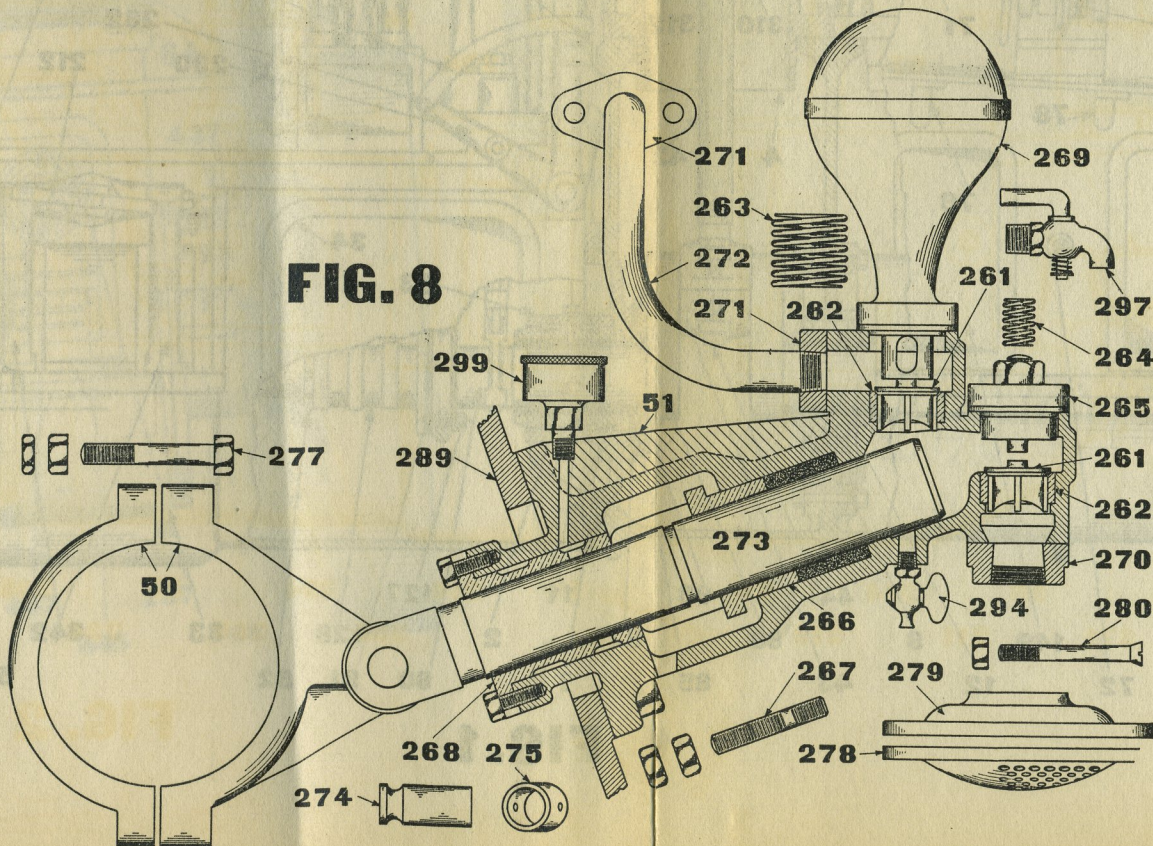
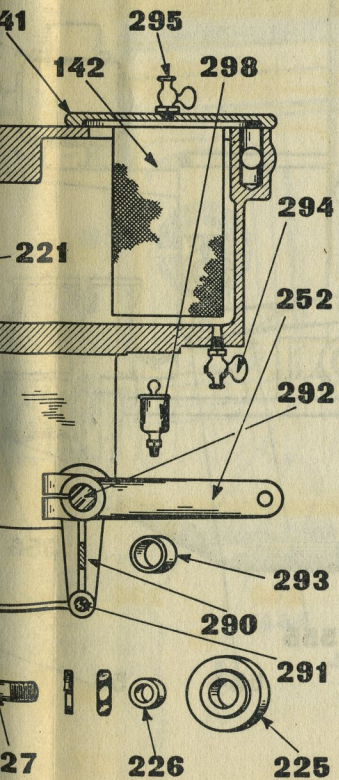


FIG. 8

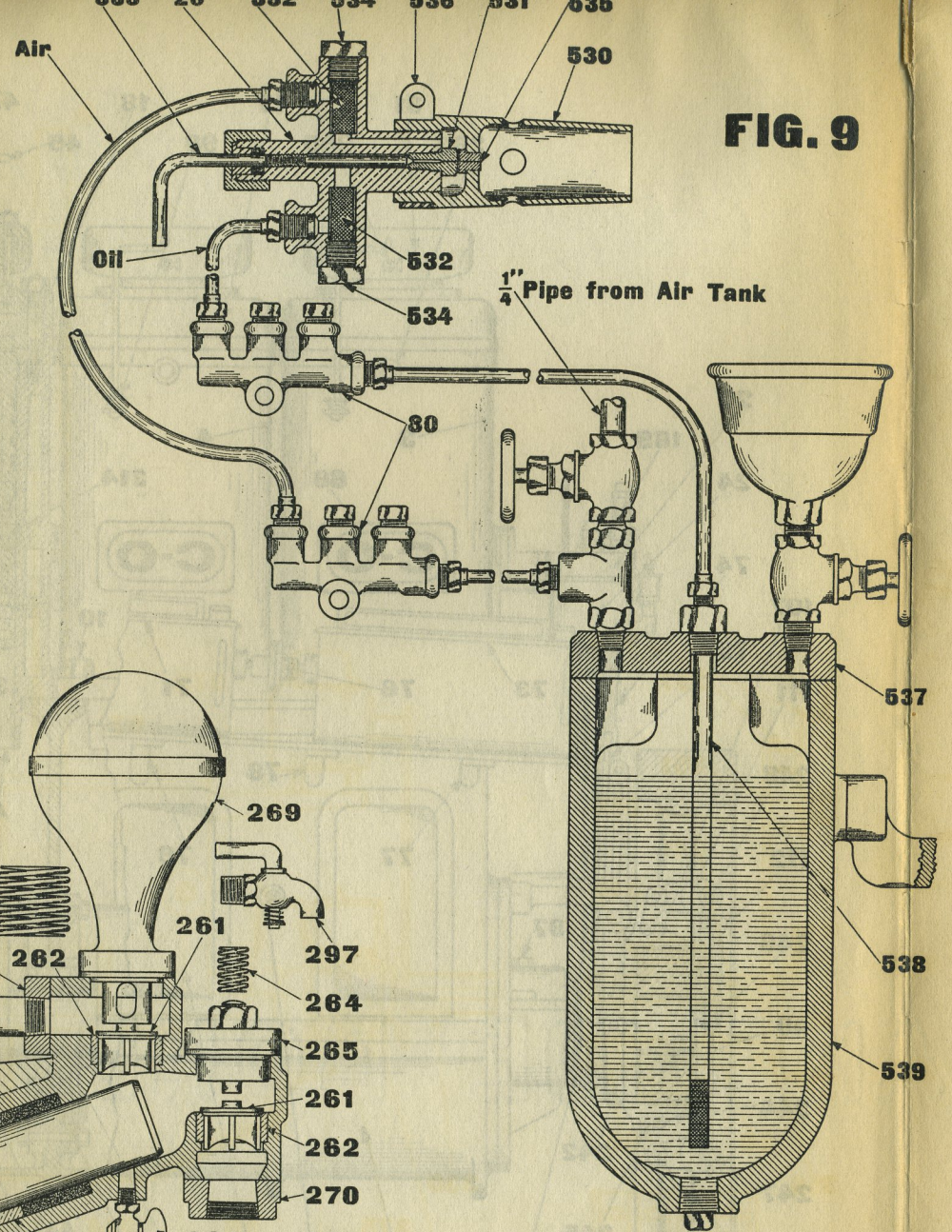


FIG. 9

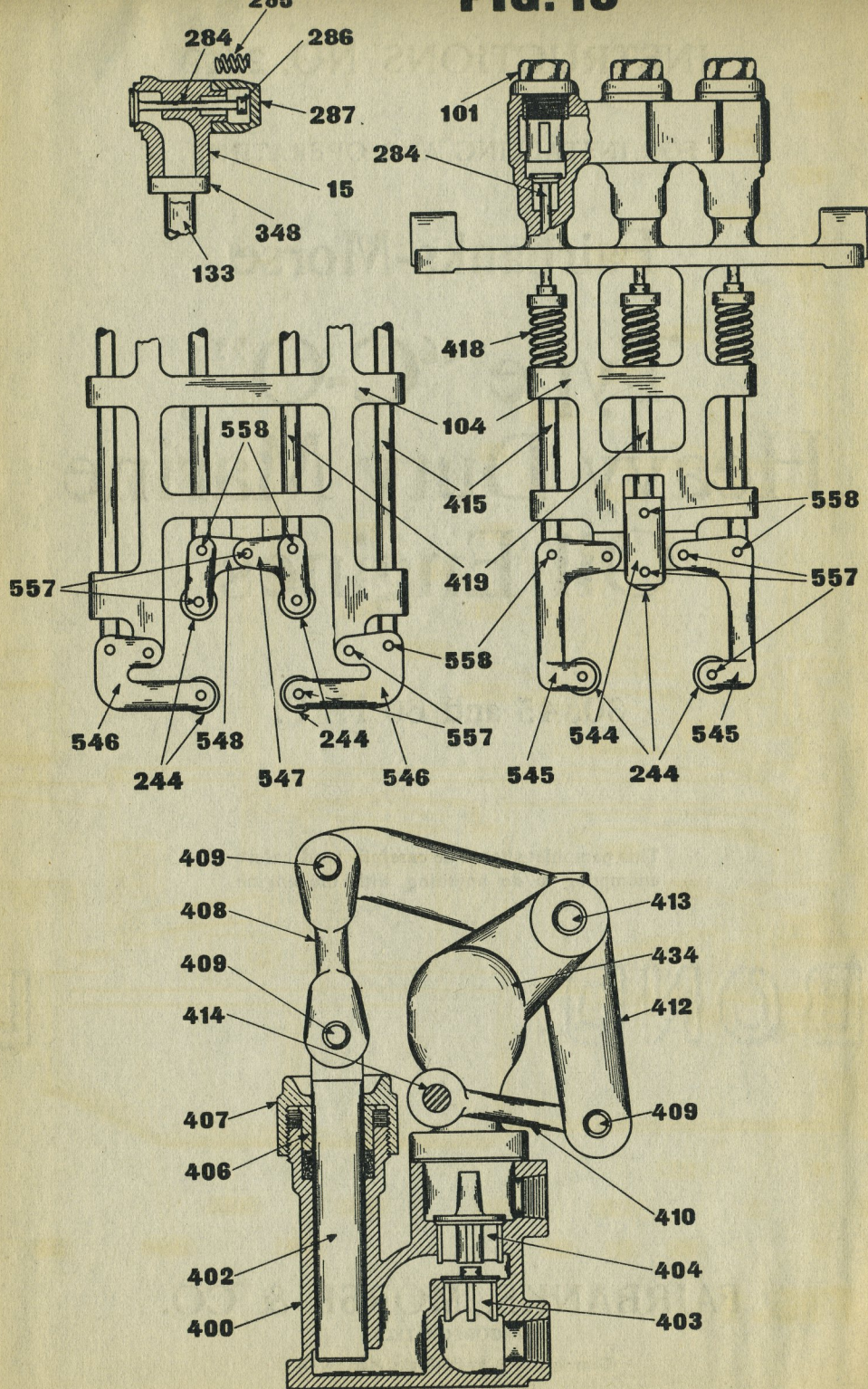


FIG. 11

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 gasses 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, clearing the latter of the burned gases 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.

Cycle of Operation

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.

Injection

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

Foundation Bed

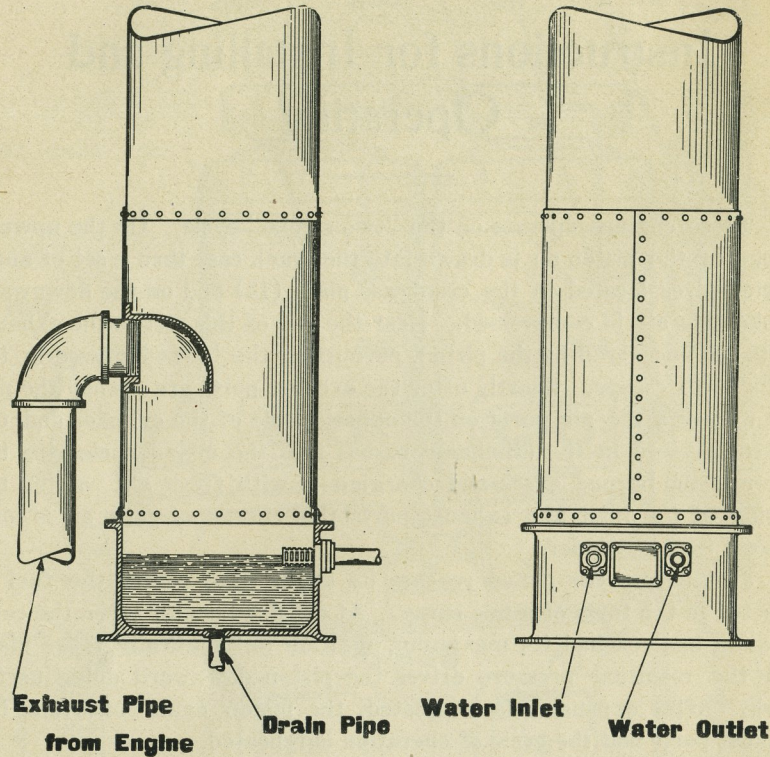
When the engine is installed line it up very carefully with the propeller and intermediate shafts, otherwise there will be hot bearings and waste of power on account of excessive friction.

The exhaust pipe must not be less than 5" and if it is of excessive length or contains an unusual number of bends, it is well to make the whole line of 6" 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, when a turn is necessary.

Exhaust Pipe

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-



Exhaust Stack

Exhaust Pipe from Engine

Drain Pipe

Water Inlet

Water Outlet

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 above. 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 an exhaust stack 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 outlet from the rings which clamp down the vaporizers must run directly overboard by means of pipe independent of the main cooling water. The water outlet pipe from the exhaust manifold jacket should be from 4' to 6' higher than the pipe from the rings.

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 four 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 11, 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 (132) at the fuel pump discharge valve. Set the 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 (132) 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. 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 injector in the form of a fine spray without any heavy core. If a core

Circulating Water Outlet

Installation of Fuel Tank

Auxiliary Fuel Pump

To Prime Pump

exists renew the tip and spiral (129). 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 7). 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). 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.

Air Compressor Compressed air is used for starting 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 small auxiliary air compressor or hand pump 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 the discharge valve 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) 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. **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 top segments and proceed in the same manner as explained above, for removing the main bearing bushing. Replace all of the bolts and 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. **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**

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

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.

The thrust bearing is of the ball-bearing type and should require no adjustment. However, if this bearing should slightly wear it will probably first be detected by warming up of the forward end bearing, which is caused by the crankshaft being pushed ahead by the propeller thrust to such an extent that the air sealing has to carry part of the thrust. To remedy this fault the crankshaft should be pushed aft and a shim placed between the thrust bearing (56) and the ball bearing (375). 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. **Thrust Bearing**

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.

The forward drive consists of a clutch of the multiple disc type. The plates (179) must run dry, and for this reason two holes are provided in the clutch case (177) to drain any oil which may run along **Reverse Gear**

the bushing of the gear drum into the clutch case. **(Do not put oil on clutch plates).**

A threaded collar (180) mounted on the clutch hub (181) serves, when tightened up, to increase the pressure on the plates (179) to prevent slipping. This collar is held in place by a lock (171). The clutch plates (179) can be inspected by removing the clutch case (177). The clutch hub is prevented from slipping by the split collar (182), which is let into the shaft, and the nut (183).

The reverse drive consists of a set of gears and pinions and two shoes to clamp the drum. The gears must run in oil. A heavy steam engine cylinder oil must be used. **(Use no grease).** A plug (170) is provided for pouring oil into gear drum. Sufficient oil must be kept in the drum to lubricate all the gears and pinions thoroughly, however, not to such an extent that it flows out of the drum head bushing (174) too freely.

The clamping shoes are connected by a rod which runs across the gear drum. This rod is threaded and provided with a nut to take up wear and increase the pressure on the shoes. Care should be used not to adjust the shoes so that they will drag on the drum when the operating lever (172) is in its neutral or go-ahead position.

To inspect the gears and pinions remove the nuts (175) and then the split drum head (176).

The slip collar (185) is under pressure at the moment the clutch or the reverse is thrown in and, therefore, requires oil, and must not be neglected.

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
Water pump eccentric	6 to 8 drops
Fuel pump mechanism	6 to 8 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. **Adjusting Feeds**

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. **Turn Lubricator When Starting**

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. **Governor Action**

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 400 R. P. M., the governor is arranged so that it does not come into action until the speed of the engine reaches about 385 R. P. M., and up to this point the engine receives about twice as much oil as required at full load. At approximately 420 R. P. M., the governor cuts off the oil entirely so that the entire governor action takes place within a range of about 35 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 385 R. P. M., a condition which obtains when the governor springs are counteracted by pulling backward the speed control lever (113). Therefore if the engine runs about 420 R. P. M. idle and when loaded runs only around 385 R. P. M., with the speed control lever in its forward position, it is probably getting the maximum amount of fuel 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 speed control lever back. This may be necessary when towing a heavy tow or when running in shallow water.

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 **Signs of Overload**

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 1. 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—400 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 speed control lever (113) backward. For temporarily reducing the speed, it is satisfactory to use the 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 400 R. P. M. the governor springs (112) must be tightened. 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 400 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 7. 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 speed control lever (113) backward, 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 its stop on the flywheel hub. 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 length of the fuel control rod (394). After the correct adjustment has been made, tighten up the lock nut on the fuel control 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 4. To examine the pump unscrew the pipe gland (132) 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 1, 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 eccentric (91) Figure 1, 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 operation is not entirely satisfactory a different timing should be tried.

To do this, take off the cover plate (34) at the reverse gear housing and loosen the two nuts (127) and crankshaft nut (92). On the face of the eccentric (91) 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. 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.

The engine is equipped with an air starter, Figure 10. Pipes (133) lead from this starter to the check valves (15) bolted to the cylinder. **Air Check Valves** 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.

The air starter consists of a set of poppet valves, one for each cylinder. These valves are operated by a cam located on the crankshaft. **Air Starter** They are only in operation when the air is turned on and disengage themselves automatically when the air is shut off. Under no circumstances replace the springs around the valve rods with stronger ones than furnished by the factory.

It is not necessary to set the four cylinder engine for starting, it will start from any position. However, if after opening the gate valve the two or three cylinder engine does not start it must be turned over about one-quarter turn. Make sure that the compression relief valves are open before putting the bar into the flywheel, and that the fuel pump plungers are held up; in other words move the lever (47) until its spring plunger jumps into the hole. Never stand directly in front of the starting bar. **To Set the Engine for Starting**

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 12.

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) ahead into its highest position. Pump about two strokes of fuel into each cylinder by means of the handle (123). When the electric plugs or the starting tubes are heated sufficiently, open the globe valves in the air line and then the gate valve on the engine, and keep it open until the engine fires. Do not leave the gate valve open any longer than necessary, or you will waste compressed air. As the engine speeds up, pull the hand control lever (113) backward 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, open up the gate valve again until the engine picks up speed again. **To Start Engine**

Do not forget to pull out the knife switches or shut off the burners about three minutes after starting.

Always make sure that the air pressure is sufficient for starting, before the engine is shut down. **Watch Air Pressure**

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

The engine can 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. **To Stop Engine**

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 Cut Out One Cylinder**

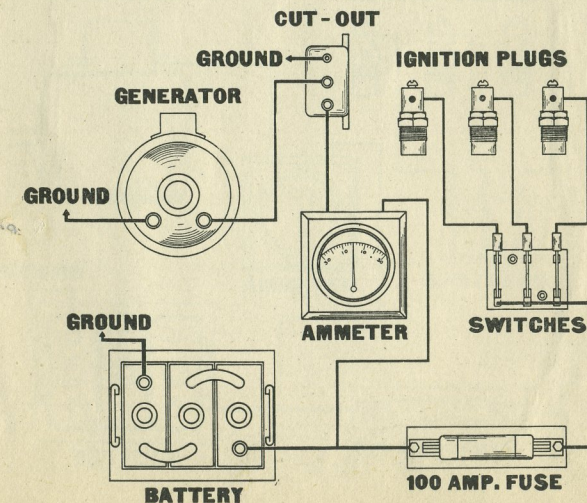
A six-volt storage battery of 80 ampere hours is used for the 30 H. P. and 120 ampere hour capacity for the 45 and 60 H. P. in connection with the electric starting equipment. **Storage Battery**

When installing the engine the negative terminal of the battery should be connected to the charging generator and to the set of small knife switches located on one of the cylinders, 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. **Electric Wiring**

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 **Connecting Ammeter**

WIRING DIAGRAM



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.

Starting With Electric Plugs 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.

Pull Out Switches 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.

Cylinder Missing 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.

Removing Plug 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.

Starting While Engine is Warm 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.

Kerosene Burners 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.

Starting Burners 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 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.

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 $\frac{1}{4}$ 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

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

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.

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.

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.

Shut Off Burners

Cleaning Burners

Adjustment

Smoky Exhaust

Keep Air Suction Valves Clean

Inspect Cylinders

Piston Rings

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.

Drain Jackets 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.

10. Never pour lubricating oil into the crankcase compartments.

Repair Parts List

For Fairbanks-Morse 30, 45 and 60 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		
			30 H. P.	45 H. P.	60 H. P.
1-C	Crank Case with Studs	1-2	1	1	1
2	Crankshaft	1	1	1	1
3	Forward Cylinder with Studs	1	1	1	1
4	Center or Rear Cylinder with Studs	1	1	2	3
6	Piston	1	2	3	4
6-C	Piston # 6 with # 310, 312 and 316		2	3	4
7	Main Bearing with Cap # 93	1-2	2	2	2
8	Center Bearing Body (4 pieces) with bolts	1	1	2	3
10	Cylinder Stud	1	8	12	16
11	Main Bearing Bushing (2 halves)	1-2	2	2	2
12	Center Bearing Bushing (2 halves)	1	1	2	3
13	Air Suction Valve Plate	2	2	3	4
13-C	Air Suction Valve Plate # 13 with # 237, 238, 444, 445, 446, 447		2	3	4
15	Air Check Valve Body	10	2	3	4
15-C	Air Check Valve Body # 15, with # 284, 285, 286 and 287		2	3	4
16	Reverse Gear Housing Top Plate	2	1	1	1
17	Cylinder Head with Studs	1-2	2	3	4
18	Cylinder Head Stud	1	12	18	24
20-C	Burner Complete	9	2	3	4
23	Air Compressor Cylinder Head	1-5	1	1	1
23-C	Air Compressor Cylinder Head # 23 with #158, 159, 160, 161, 164, 165, 166, 167 and 168		1	1	1
24	Air Compressor Cylinder	1-5	1	1	1
24-C	Air Compressor Cylinder # 24 with # 23-C and # 282		1	1	1

Do not forget to give Shop Number of Engine when ordering repair parts

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON		
			30 H. P.	45 H. P.	60 H. P.
25	Air Compressor Piston	5	1	1	1
25-C	Air Compressor Piston # 25 with # 317, 319, and 443		1	1	1
27	Air Compressor Rod with # 318	5	1	1	1
28	Air Compressor Eccentric Strap with Studs, Bolts and Shims	2	1	1	1
30	Vaporizer	1	2	3	4
31	Vaporizer Clamping Ring	1-2	2	3	4
32	Clamping Ring Stud	1	12	18	24
33	Reverse Gear Housing with Studs	1-2	1	1	1
34	Reverse Gear Housing Cover Plate	1	1	1	1
35	Fuel Pump Body	1-4	2	3	4
35-C	Fuel Pump Body # 35 with # 301, 302, 303, 304, 543, 37-C, 36-C, 118 and 150		2	3	4
36	Fuel Pump Discharge Valve Body	4	2	3	4
36-C	Fuel Pump Discharge Valve Body # 36, with # 154, 156 and 157		2	3	4
37	Fuel Pump Suction Valve Cage	4	2	3	4
37-C	Fuel Pump Suction Valve Cage # 37 with # 152, 153 and 154		2	3	4
38	Fuel Injector Body	6	2	3	4
38-C	Fuel Injector Body # 38 with # 305, 306, 307 and 129		2	3	4
39	Fuel Injector Check Valve Body	6	2	3	4
39-C	Fuel Injector Check Valve Body # 39 with # 154, 156 and 157		2	3	4
40	Fuel Pipe (state for which cylinder)	1-4	2	3	4
41	Fuel Pump Bracket	7	1	1	1
42	Connecting Rod	1	2	3	4
43	Connecting Rod Box—Two Halves	1	2	3	4
43-C	Connecting Rod Box #43 with Bolts #44 and nuts		2	3	4
44	Connecting Rod Box Bolt	1	4	6	8
45	Starting Tube	1	2	3	4
46	Cam Follower	7	2	3	4
46-C	Cam Follower #46 with # 225, 226 and 227		2	3	4
47	Fuel Pump Lever	1-7	1	1	1
48	Flywheel	1-2	1	1	1
49	Flywheel Stud	1	1	1	1
50	Circulating Pump Eccentric Strap with Bolts and Shims	8	1	1	1
51	Circulating Pump Body	8	1	1	1
51-C	Circulating Pump Body # 51, with # 269, 273, 266, 267, 268, 274, 262, 261, 263, 264, 265, 270, 294 and 297		1	1	1
52	Exhaust Manifold with Studs	2	1	1	1
53	Exhaust Manifold End with Studs	2	2	2	2
54	Exhaust Manifold Cover Plate	2	2	2	2
55	Exhaust Pipe Fitting	2	1	1	1
56	Thrust Bearing Body	2	1	1	1
57	Thrust Bearing Oil Cup Cover	2	1	1	1
58	Clamp Coupling (state size of bore)	1			
59	Flange Coupling—Male Half (state size of bore)	1	1	1	1
59-C	Flange Coupling—Two Halves with bolts (state size of bore)	1	1	1	1
60	Flange Coupling—Female Half (state size of bore)	1	1	1	1
61	Water Outlet Header	2	1	1	1
62	Water Outlet Pipe	2	1	1	1

Do not forget to give Shop Number of Engine when ordering repair parts

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON		
			30 H. P.	45 H. P.	60 H. P.
64	Blind Flange	2	1	1	1
65	Exhaust Pipe Flange	2	1	1	1
66	Handhole Plate	1-2	4	6	8
69	Water Outlet Flange	2	3	3	3
71	Lubricator Plain Drive (state number of feeds)	1			
72	Center Bearing Set Screw	1	1	2	3
73	Lubricator—Ratchet Drive (state number of feeds)	1	1	1	1
74	Lubricator Ratchet Arm	1	1	1	1
75	Lubricator Drive Rod	1	1	1	1
76	Lubricator Half Coupling	1	2	2	2
77	Forward Lubricator Bracket	1	1	1	1
78	Center Lubricator Bracket	1	1	1	1
79	Rear Lubricator Bracket	1	1	1	1
80	Torch Tube Fitting	9	2	2	2
83	Crank Pin Oil Ring (two halves with bolts)	1	2	3	4
84	Air Compressor Eccentric	1	1	1	1
85	Flanged Side Washer	1	2	2	2
86	Flanged Side Washer Spring	1	6	6	6
87	Babbitt Side Washer	1	2	2	2
90	Air Starter Cam	1	1	1	1
91	Circulating Pump Eccentric	1	1	1	1
92	Crankshaft Nut	1	1	1	1
93	Main Bearing Cap	1-2	2	2	2
97	Oil Tube and Dowel	1	2	2	2
98	One Quarter Inch Needle Valve Complete	1	2	3	4
101	Air Starter Valve Stop	10	2	3	4
104	Air Starter Body	10	1	1	1
107	Governor Sleeve	1	1	1	1
108	Governor Lever	2	1	1	1
111	Governor Weight	1	2	2	2
112	Governor Spring	1	2	2	2
113	Speed Control Lever	1	1	1	1
118	Fuel Pump Plug	4	2	3	4
122	Fuel Pump Lever Knob	7	1	1	1
123	Fuel Pump Handle	7	2	3	4
124	Fuel Pump Handle Catch	7	2	3	4
125	Intermediate Regulating Lever	7	2	3	4
126	Regulating Link	7	2	3	4
127	Cam Bolt	1	2	2	2
128	Cam	1	1	1	1
129	Fuel Injector Tip	6	2	3	4
132	Gland Nut	4-6	4	6	8
133	Air Pipe (state for which cylinder)	2-10	2	3	4
141	Filter Cover	7	1	1	1
142	Filter	7	1	1	1
143	Speed Control Spring	2	1	1	1
145	Governor Lever Shaft	2	1	1	1
149	Crankcase Handhold Plate	1	2	3	4
150	Fuel Pump Suction Valve Plug	4	2	3	4
152	Fuel Pump Suction Valve	4	2	3	4
153	Fuel Pump Suction Valve Spring	4	2	3	4
154	Fuel Valve Ball	4-6	6	9	12
156	Fuel Valve Ball Guide	4-6	4	6	8
157	Fuel Pump Discharge Valve Spring	4-6	2	3	4
158	Air Compressor Suction Valve Cap	5	1	1	1
159	Air Compressor Suction Valve Seat	5	1	1	1
160	Air Compressor Cut-Out	5	1	1	1
161	Air Compressor Suction Valve	5	1	1	1

Do not forget to give Shop Number of Engine when ordering repair parts

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON		
			30 H. P.	45 H. P.	60 H. P.
161-C	Air Compressor Suction Valve #161 with #159 and 164		1	1	1
164	Air Compressor Suction Valve Spring	5	1	1	1
165	Air Compressor Discharge Valve	5	1	1	1
165-C	Air Compressor Discharge Valve #165 with #166 and 168		1	1	1
166	Air Compressor Discharge Valve Guide	5	1	1	1
167	Air Compressor Discharge Valve Plug	5	1	1	1
168	Air Compressor Discharge Valve Spring	5	1	1	1
169	Air Compressor Safety Valve	1	1	1	1
170	Oil Plug	3	1	1	1
171	Adjusting Nut Lock	3	1	1	1
172	Hand Lever	1	1	1	1
174	Gear Drum Head Bushing	3	1	1	1
175	Pinion Shaft Nut	3	6	6	6
176	Gear Drum Head (2 halves)	3	1	1	1
177	Clutch Case	3	1	1	1
179	Clutch Friction Plate with Facing	3	4	4	4
180	Adjusting Nut	3	1	1	1
181	Clutch Hub	3	1	1	1
182	Split Collar (2 halves)	3	1	1	1
183	Clutch Hub Nut	3	1	1	1
184	Shifting Yoke (2 halves)	3	1	1	1
185	Operating Yoke (2 halves with bolts)	3	1	1	1
186	Operating Yoke Washer (2 halves)	3	2	2	2
187	Finger	3	3	3	3
188	Roller	3	4	4	4
189	Clutch Hub End Plate	3	1	1	1
190	Roller Pin	3	4	4	4
191	Adjusting Nut Collar	3	1	1	1
192	Clutch Case Stud	3	12	12	12
193	Gear Drum	3	1	1	1
194	Long Pinion	3	3	3	3
194-C	Long Pinion with 2 Bushings #196 and keys		3	3	3
195	Long Pinion Shaft	3	3	3	3
196	Long Pinion Bushing	3	6	6	6
197	Short Pinion	3	3	3	3
197-C	Short Pinion with Bushing #199 and key		3	3	3
198	Short Pinion Shaft	3	3	3	3
199	Short Pinion Bushing	3	3	3	3
200	Engine Shaft Gear	3	1	1	1
201	Propeller Shaft Gear	3	1	1	1
202	Propeller Shaft Gear Bushing	3	1	1	1
203	Gear Drum Bushing	3	1	1	1
204	Packing Washer	3	6	6	6
205	Operating Collar	3	1	1	1
206	Clutch Friction Plate Facing	3	8	8	8
207	Clutch Hub Friction Plate	3	3	3	3
208	Short Clutch Spring	3	12	12	12
209	Long Clutch Spring	3	4	4	4
211	Shifting Yoke Shaft	2-3	1	1	1
212	Brake Rod	1	1	1	1
213	Brake Shoe with Wood Blocks	2	2	2	2
214	Bent Brake Shoe Lever	2	2	2	2
215	Brake Shoe Lever Pin	2	4	4	4
216	Brake Rod End	1	1	1	1
217	Fuel Pump Handle Spring	7	2	3	4
218	Fuel Pump Lever Lock	7	1	1	1
219	Fuel Pump Lever Lock Spring	7	1	1	1
220	Fuel Pump Handle Shaft	7	1	1	1

Do not forget to give Shop Number of Engine when ordering repair parts

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON		
			30 H. P.	45 H. P.	60 H. P.
221	Fuel Pump Handle Shaft Pin	7	2	3	4
222	Fuel Pump Handle Catch Stud	7	2	3	4
223	Plunger Rod	7	2	3	4
224	Plunger Rod Shoe	7	2	3	4
225	Cam Roller	7	2	3	4
226	Cam Roller Bushing	7	2	3	4
227	Cam Roller Pin	7	2	3	4
228	Cam Follower Pin	7	2	2	2
229	Quadrant Handle	1	1	1	1
230	Quadrant Bracket	1	1	1	1
231	Quadrant Rack	1	2	2	2
232	Quadrant Rack Bolt	1	2	2	2
233	Quadrant Rack Spacer		2	2	2
234	Speed Control Shaft	2	1	1	1
235	Control Spring Lever	2	1	1	1
237	Air Suction Valve Stop	2	2	3	4
238	Air Suction Valve Spring	2	16	24	32
240	Air Suction Valve Cover	2	2	3	4
242	Governor Collar	1	1	1	1
244	Roller	1-10	4	5	6
245	Roller Pin	1	2	2	2
246	Governor Spring Block	1	2	2	2
247	Governor Spring Adjusting Block	1	2	2	2
248	Governor Spring Pin	1	2	2	2
249	Governor Weight Pin	1	2	2	2
250	Regulating Rod	2	1	1	1
252	Fuel Control Lever	7	1	1	1
261	Circulating Pump Valve	8	2	2	2
262	Circulating Pump Valve Seat	8	2	2	2
263	Circulating Pump Discharge Valve Spring	8	1	1	1
264	Circulating Pump Suction Valve Spring	8	1	1	1
265	Circulating Pump Suction Valve Cover	8	1	1	1
266	Circulating Pump Stuffing Box Gland	8	1	1	1
267	Circulating Pump Stuffing Box Gland Stud	8	2	2	2
268	Circulating Pump Bushing	8	1	1	1
269	Circulating Pump Air Chamber	8	1	1	1
270	Circulating Pump Suction Flange	8	1	1	1
271	Circulating Pump Discharge Flange	8	1	1	1
272	Circulating Pump Discharge Pipe	8	1	1	1
273	Circulating Pump Plunger	8	1	1	1
274	Circulating Pump Plunger Pin	8	1	1	1
275	Circulating Pump Eccentric Strap Bushing	8	1	1	1
277	Circulating Pump Eccentric Strap Bolt	8	2	2	2
278	Sea Strainer	8	1	1	1
279	Sea Strainer Flange	8	1	1	1
280	Sea Strainer Bolt with Nut	8	6	6	6
281	Oil Cup	2	1	1	1
282	Oil Cup Fitting	2	1	1	1
283	Relief Valve Complete	1	2	3	4
284	Air Check Valve	10	4	6	8
285	Air Check Valve Spring	10	2	3	4
286	Air Check Valve Collar	10	2	3	4
287	Air Check Valve Clamping Flange	10	2	3	4
289	Circulating Pump Plate	2-8	1	1	1
290	Regulating Lever	7	1	1	1
291	Regulating Lever Pin	7	1	1	1
292	Regulating Lever Shaft	7	1	1	1
293	Regulating Lever Shaft Bushing	7	2	2	2
294	1/4" Pet Cock	7-8	4	5	6
295	3/8" Pet Cock	7	1	1	1

Do not forget to give Shop Number of Engine when ordering repair parts

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON		
			30 H. P.	45 H. P.	60 H. P.
296	3/8" Pet Cock		2	2	2
297	3/8" Drain Cock	8	3	4	5
298	1/2" Spring Top Oiler	7	2	2	2
299	Grease Cup	8	1	1	1
301	Fuel Pump Plunger	4	2	3	4
302	Fuel Pump Plunger Spring	4	2	3	4
303	Fuel Pump Packing Gland	4	2	3	4
304	Fuel Pump Packing Nut	4	2	3	4
305	Fuel Injector Valve	6	2	3	4
306	Fuel Injector Valve Nut	6	2	3	4
307	Fuel Injector Valve Spring	6	2	3	4
308	Control Spring Lever Link	2	2	2	2
309	Control Spring Block	2	1	1	1
310	Piston Pin	1	2	3	4
311	Piston Pin Bushing	1	2	3	4
312	Piston Pin Set Screw	1	2	3	4
313	Piston Pin Bushing Set Screw	1	2	3	4
314	Piston Pin Oiler	1	2	3	4
315	Piston Pin Oiler Spring	1	2	3	4
316	Piston Ring	1	8	12	16
317	Air Compressor Piston Pin	5	1	1	1
318	Air Compressor Rod Bushing	5	1	1	1
319	Air Compressor Piston Ring	5	3	3	3
320	Regulating Rod End	2	2	2	2
321	Quadrant Latch	1	1	1	1
322	Quadrant Rod	1	1	1	1
324	Quadrant Handle Spring	1	1	1	1
330	Stub Shaft	2-3	1	1	1
331	R. H. Brake Shoe Lever Spacer	2-3	1	1	1
332	L. H. Brake Shoe Lever Spacer	3	1	1	1
333	Brake Lever Rod	3	1	1	1
334	Brake Lever Rod Spring	3	1	1	1
335	Brake Lever Rod Tube	3	1	1	1
336	Brake Lever Rod Washer	3	1	1	1
337	Brake Lever Rod End	3	1	1	1
338	Brake Shoe Lever Spacer Bolt	2-3	4	4	4
339	Finger Pin	3	4	4	4
340	Coupling Bolt with Nut	1	6	6	6
341	Coupling Clamp Bolt with Nut	1	4	4	4
342	Straight Brake Shoe Lever	1	2	2	2
348	Air Check Valve Flange	10	2	3	4
349	Gate Valve	1	1	1	1
350	Generator Bracket	1	1	1	1
351	Generator Stud	1	2	2	2
353	Generator	1	1	1	1
356	Generator Drive Sprocket with Hub	1	1	1	1
357	Generator Sprocket	1	1	1	1
366	Ignition Plug	1	2	3	4
370	Thrust Bearing Sleeve	2	1	1	1
371	Thrust Bearing Guard	2	1	1	1
372	Thrust Bearing Guard Cover	2	1	1	1
375	Ball Bearing Complete	2	1	1	1
394	Fuel Control Rod	2	1	1	1
395	Fuel Control Rod End	2	1	1	1
400	Fuel Supply Pump Body	11	1	1	1
400-C	Fuel Supply Pump Body #400, with #402, 403, 404, 406, 407, 408, 409, 410, 412, 413, 414 and 434				
402	Supply Pump Plunger	11	1	1	1

Do not forget to give Shop Number of Engine when ordering repair parts

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON		
			30 H. P.	45 H. P.	60 H. P.
403	Supply Pump Suction Valve	11	1	1	1
404	Supply Pump Discharge Valve	11	1	1	1
406	Supply Pump Stuffing Box Gland	11	1	1	1
407	Supply Pump Stuffing Box Nut	11	1	1	1
408	Supply Pump Drive Link	11	1	1	1
409	Supply Pump Drive Link Pin	11	3	3	3
410	Supply Pump Drive Rod	11	1	1	1
412	Supply Pump Bell Crank	11	1	1	1
413	Supply Pump Pivot Pin	11	1	1	1
414	Drive Rod Stud	11	1	1	1
415	Long Push Rod	10	1	2	2
418	Push Rod Spring	10	2	3	4
419	Short Push Rod	10	1	1	2
434	Air Chamber	11	1	1	1
437	Governor Lever Shaft Bracket	2	1	1	1
439	Control Spring Adjusting Block Screw	2	1	1	1
443	Air Compressor Piston Pin Lock Spring	5	1	1	1
444	Air Suction Valve Large Steel Ring	2	2	3	4
445	Air Suction Valve Large Leather Ring	2	2	3	4
446	Air Suction Valve Small Steel Ring	2	2	3	4
447	Air Suction Valve Small Leather Ring	2	2	3	4
472	Regulating Rod Bell Crank	2	1	1	1
473	Regulating Rod Bell Crank Stud	2	1	1	1
478	Starting Tube Bushing	1	2	3	4
490	16" by 50" Air Tank				
500	2" Bronze Stuffing Box for Brass Stern Tube				
501	2" Cast Iron Stuffing Box for Iron Stern Tube				
502	2" Bronze Stuffing Box for Lead Stern Tube				
503	2 1/2" Bronze Stuffing Box for Brass Stern Tube				
504	2 1/2" Cast Iron Stuffing Box for Iron Stern Tube				
505	2 1/2" Bronze Stuffing Box for Lead Stern Tube				
506	3 1/4" Bronze Stuffing Box for Brass Stern Tube				
507	3 1/4" Cast Iron Stuffing Box for Iron Stern Tube				
508	3 1/4" Bronze Stuffing Box for Lead Stern Tube				
514	Finger Spring Connector	3	3	3	3
515	Finger Spring	3	3	3	3
520	2" Bronze Stern Bearing for Brass Stern Tube				
521	2" Cast Iron Stern Bearing for Iron Stern Tube				
522	2" Bronze Stern Bearing for Lead Stern Tube				
523	2 1/2" Bronze Stern Bearing for Brass Stern Tube				
524	2 1/2" Cast Iron Stern Bearing for Iron Stern Tube				
525	2 1/2" Bronze Stern Bearing for Lead Stern Tube				
526	3 1/4" Bronze Stern Bearing for Brass Stern Tube				
527	3 1/4" Cast Iron Stern Bearing for Iron Stern Tube				
528	3 1/4" Bronze Stern Bearing for Lead Stern Tube				
530	Burner Hood	9	2	3	4
531	Burner Body Tip	9	2	3	4
532	Burner Screen	9	4	6	8
533	Burner Fuel Valve	9	2	3	4
534	Burner Screen Plug	9	4	6	8
535	Burner Hood Tip	9	2	3	4
536	Burner Adjusting Stop	9	2	3	4

Do not forget to give Shop Number of Engine when ordering repair parts

Repair No.	NAME OF PART	Shown on Fig.	NUMBER USED ON		
			30 H. P.	45 H. P.	60 H. P.
537	Burner Tank Cover	9	1	1	1
538	Kerosene Outlet Pipe	9	1	1	1
539	Burner Tank	9	1	1	1
539-C	Burner Tank #539, with #537, 538, Inlet Strainer, 2 Needle Valves, Air Inlet and Outlet Fittings	9	1	1	1
543	Collar for Fuel Pump Stuffing Box	4	1	1	1
544	Short Roller Guide	10	2	3	4
545	Long Roller Guide	10		1	
546	Long Roller Guide	10		2	
547	Wide Short Roller Guide	10	1		2
548	Narrow Short Roller Guide	10			1
551	Hand Lever Stud	1	1		1
554	Shifting Lever	1	1	1	1
555	Shifting Link	1	1	1	1
557	Roller Pin	1	2	2	2
558	Push Rod Pin	10	4	6	8
		10	2	3	4

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(Faint, mirrored text from the reverse side of the page, including a list of parts and shop numbers.)