Two-Stroke Cycle, Two-Port Engines
Models C, D and E

These models are of the single cylinder type. The two-stroke cycle, two-port engine completes the cycle of events, i.e., suction, compression, power, and exhaust, in two strokes of the piston. The engine, instead of having valves as in the four-stroke cycle type, has exhaust and intake ports, or openings, cast in the cylinders.

Principle of Operation

Consider the engine (Fig. 1) in operation with a fuel charge entering the cylinder D through the inlet port A from the crank case C.

The upward travel of the piston P closes the inlet port A, and the exhaust port EX compresses the explosive charge above the piston and draws a fresh mixture of fuel and air through the check valve B into the crank case C. As the piston reaches the top of its travel in cylinder D, a spark is produced at the spark plug I, exploding the charge and forcing the piston downward, which compresses the new charge in the crank case C and holds the check valve B closed.

As the piston nears the bottom of its stroke it starts to uncover the exhaust port EX and a little later also uncovers the inlet port A. This permits the burned gases to escape through the exhaust port EX, and the admission of the compressed charge in crank case C through the inlet port A. The incoming charge is deflected to the top of the cylinder by the lip cast on the piston opposite the inlet port, and aids in driving out the exhaust gases.
Do not try to set valve tappets close, as this is only done in high speed engines, and in automotive practice. This is a medium speed motor and will not develop full power if valve tappets are set too close.

**Model VH or YT**

Set valve rocker clearance at ten-thousandths while motor is cold, then set No. 1 piston 10 degrees past top center or with piston down about \( \frac{1}{16} \) inch, and set No. 1 exhaust cam just closed. Other cams naturally follow.

**Firing Order Old Type Palmer Four-Cylinder Motors**

On the type M4, R4 and NR4, the firing order is 1, 2, 3, 4. On the later models NR4 and RW4, also NK4 and F4, firing order is 1, 2, 4, 3. On the model VH high speed the firing order is 1, 3, 4, 2.

**Starting**

To start motor turn on gasoline, open needle valve as per instructions of carburetor or motor manufacturer; about one turn is right on most carburetors. Close all switches, flood carburetor by pressing down priming cup on same until a few drops leak out of bottom of carburetor or use choke on carburetor.

Open throttle about one-half or three-quarters.

Set timer or commutator so that motor will not kick back.

Grasp handle with fingers, do not close thumb around handle but take hold in such a way that if motor should back fire your hand will slip off handle. Rock balance wheel back and forth and give a quick pull over center the way you wish motor to go. If you have succeeded in drawing in a charge the motor will start. If a three-port motor we advise priming before turning over.

For priming, mix a little oil with gasoline in a priming can.

After motor is under way advance timer until motor speeds up a little then proceed to adjust needle valve in carburetor until you get the best results. A slight move on this valve will make a great difference; go slow and try at different points. Too lean a mixture will cause a back fire, too rich a mixture will cause motor to slow down. Be careful in starting that you don’t get too rich a mixture. This is shown by opening priming cock, when a red flame will show. In this case, close needle valve until a blue flame is shown through relief cock. If motor back fires on all adjustments your needle valve or gasoline pipe is clogged and does not allow a proper flow of gas. If motor does not start it is on account of one of the following reasons:

- Lack of gasoline; too much gasoline; open switch; broken wire; dirty plug; bad contacts; worn contacts; closed throttle; weak battery. Weak batteries are the most common, as after a battery is a few months old it gets too weak to start a cold motor. With a good mixture, proper timing, properly adjusted coil and switch closed your motor should start. They are all tested and made to run and all you need do is to get acquainted with it; use common horse sense.

- Don’t use a wrench, hammer, or a screw-driver on a motor unless you know why you are doing it. If you get a back kick or a sprained wrist from a motor, it is your own fault. Don’t try to start the motor with the spark advanced; the motor is quicker than you are; always retard the spark before you start.
DO NOT RUN MOTOR WITH LEVER IN STARTING POSITION.
DO NOT USE MOTOR LEVER TO SLOW DOWN WITH.
FOR CORRECT POSITION OF LEVER SEE CUTS.
Operating this motor on starting position will ruin valves and timing gears; it also does not give you full power.

System of Lubrication Four-Cycle Engines
Models NL, NR, RW, F and NK

These models are equipped with plunger oil pumps, located in reservoir in the base, actuated from the cam shaft, forcing the oil through a lead to an exposed oil glass, from which it discharges over the timing gears and forward crank bearings. From this point the oil drains by gravity to a forward compartment in the base, building up an oil level of proper height for connecting rod dip, thence similarly through perforations to succeeding compartments for each cylinder, finally returning to the pump reservoir.

The oil thrown by the timing gears is splashed to wells above the forward cam shaft bearings amply providing for their lubrication.

The dip or splash of the connecting rods in their various oil baths churns the oil into a vapor which permeates the entire crank case chamber, lubricating the wrist pins, cylinder walls, piston pins, and rear crank shaft and cam shaft bearings. Dippers are adjustable to allow for proper lubrication. After motor is installed, take off hand hole plate exhaust side and see that dippers enter oil to a depth of \( \frac{1}{8} \) to \( \frac{1}{4} \) inch.

The circulation of oil is continuous and this type of lubrication is known as the Splash Circulating System.

In certain cases where these engines are used in continuous slow speed operation, as in fishing and dredging, the dip of the connecting rod is not sufficiently violent to completely atomize the oil and provide proper lubrication for the cylinders. In such instances it has been found desirable to attach auxiliary force feed oilers for cylinder lubrication to model F and NK motors.

Determining The Correct Oil

These motors are operated in marine service and are built for medium and heavy duty work, imposing a load which tends toward a hot operating condition demanding a heavy-bodied lubricant for summer operation.

The cylinder bores are comparatively large, in the majority of models, being 5 inches or greater, furnishing large cylinder wall areas which influence towards the selection of an especially rich lubricant to provide ample protection in severe service. The splash system of lubrication, however, would necessitate the use of medium-bodied oil in winter lubrication to insure atomization and complete distribution.

The cylinder walls are carefully finished by grinding and the pistons are closely fitted, having three concentric rings above the piston pin (the F models being provided with an additional ring also above the piston pin), indicating that excellent piston ring seal will be accomplished with a heavy or medium-bodied oil of high character under the slow speed operation of these units.

Oil gauge float wire should be level or \( \frac{1}{2} \) inch above gauge guide located at rear of top base when engine is idle.
Palmer Brothers Valve-in-Head High Speed Engines

Models VH and YT

Model VH is a four-cylinder, four-stroke cycle, valve-in-head engine, with the cylinders cast en bloc, having a 3 inch bore and a 4½ inch stroke, operating at 1,000 to 1,200 r. p. m., and developing approximately 14 horse power.

The valve mechanism is driven by an overhead cam shaft, which is inclosed in the cylinder head cover.

System of Lubrication:

Model VH

Oil from the reservoir in the base is forced by a geared type oil pump located outside the crank case and positively driven by the vertical shaft, through leads to the main crank shaft, vertical shaft, and cam shaft, supplying these bearings under pressure. Other leads supply the splash troughs in the sub-base in which the connecting rods dip, atomizing the oil and effecting the lubrication of the connecting rod bearings, cylinder walls, and piston pin bearings by the oil vapor produced.

After effecting lubrication the oil drains back to the pump reservoir and is recirculated through this Force Feed and Splash Circulating System of Lubrication.

All oil is strained and cooled before using. Clean strainer every 100 hours by removing cap and taking out gauze. Strainer is located at side of engine back of water pump.

This engine is of comparatively small bore and stroke and is provided with an excellent water circulating cooling system, which conducts the cooling water around exhaust valve outlet passage, thence around the exhaust valve seats, across to the admission valves, and finally out of the cylinder head on the admission side of the motor. The circulation of water in the cylinder jackets is by thermostatic action through ports in the cylinder communicating with the head, allowing an even expansion between pistons and cylinders. The careful working out of this system tends towards a uniformly comparatively cool condition of operation, indicating the “heat” lubrication factor for this motor will be satisfied with a high grade oil of medium body.

Such an oil is ideal for the Force Feed and Splash Distributing System, insuring complete atomization and perfect distribution. The gear type oil pump will easily handle an oil of this grade in winter running; circulation will start immediately with the start of the motor, eliminating any lack of lubrication due to sluggishness of the oil.

The pistons used in this model are of close grain gray iron, closely fitted in ground cylinder walls and are provided with three concentric piston rings. With the motor running at 1,000 to 1,200 r. p. m. a medium body oil will provide excellent ring seal, holding the crank case dilution to a minimum.

Model YT

This is a single-cylinder, four-stroke cycle, valve-in-head motor, having a 3 inch bore and 3½ inch stroke, developing about 2 horse power at 800 r. p. m.

It is a light-weight motor that can be throttled from maximum to minimum speed and is admirably adapted for use in small power tenders, rowboats, skiffs, canoes, etc.
Adjustments

The idling mixture and low speed closed throttle running are controlled by the upper knurled button or idle adjusting screw B. This operates on the air, so that screwing it in gives a richer mixture and out a leaner one.

Turn screw B outward until motor slows down, then turn B in notch by notch until the proper idling mixture is reached. When motor is idling properly there should be a steady hiss in the carburetor. If there is a weak cylinder or a manifold leak the hiss may be unsteady. For a motor to idle steadily on present heavy fuel the spark plug gaps must not be less than .022 inches.

If after adjusting the low speed needle as above described the motor idles too fast, turn the small throttle stop screw E to the left or counter clockwise, until the proper idling speed is reached. If motor idles too slow and stops, turn screw E to the right or clockwise until proper speed is reached.

The high speed and main driving adjustment is regulated by the high speed needle A, which regulates the opening through which the fuel flows to the jets. Turning A to the left, counter clockwise, gives more gasoline, to the right, clockwise, less gasoline.

To make the proper high speed adjustment, advance spark lever to normal position; set throttle lever; then adjust the high speed needle to the minimum opening that will give the greatest engine speed for that throttle opening. This should give a good average adjustment, for continuous operation.

To prevent a wrong high speed adjustment from giving a harmful rich mixture a gasoline nozzle reducer is inserted beyond the high speed needle opening, inside the plug D. The reducer placed in the carburetor at the factory will permit about twenty per cent more gas to pass through than is generally needed. However, under some conditions a larger reducer may be needed in order to secure a richer mixture. These reducers can be obtained from the Stromberg factory or the nearest Stromberg service station.

In all cases adjustments should be made when the motor is hot and the richer adjustment necessary for a cold motor should be obtained by using the choker.

Use of Choke

For starting and warming up with the present-day fuel, it is absolutely necessary to use the choke until the proper operating temperature is attained. Ordinarily the motor will start readily with the choke closed one half to three quarters of the way. In very cold weather it may be necessary to pull the choke up all the way, but this should be done only for an instant, as this cuts off all the air and delivers raw gasoline only.

In starting with electric starter, the throttle should be nearly closed, or better still, it may be successively opened part way and closed while the starter turns the motor over. Never keep this choke up more than a moment at a time.

After starting, allowing the motor a moment to steady itself, the control should be set at the point of best power, yet not too rich for smooth running; it should then be gradually lowered as the motor warms up. While the motor is cold, care should be taken not to open the throttle too far so that motor misfires, as this is a frequent cause of sooted spark plugs and gasoline (kerosene) in the crank case.