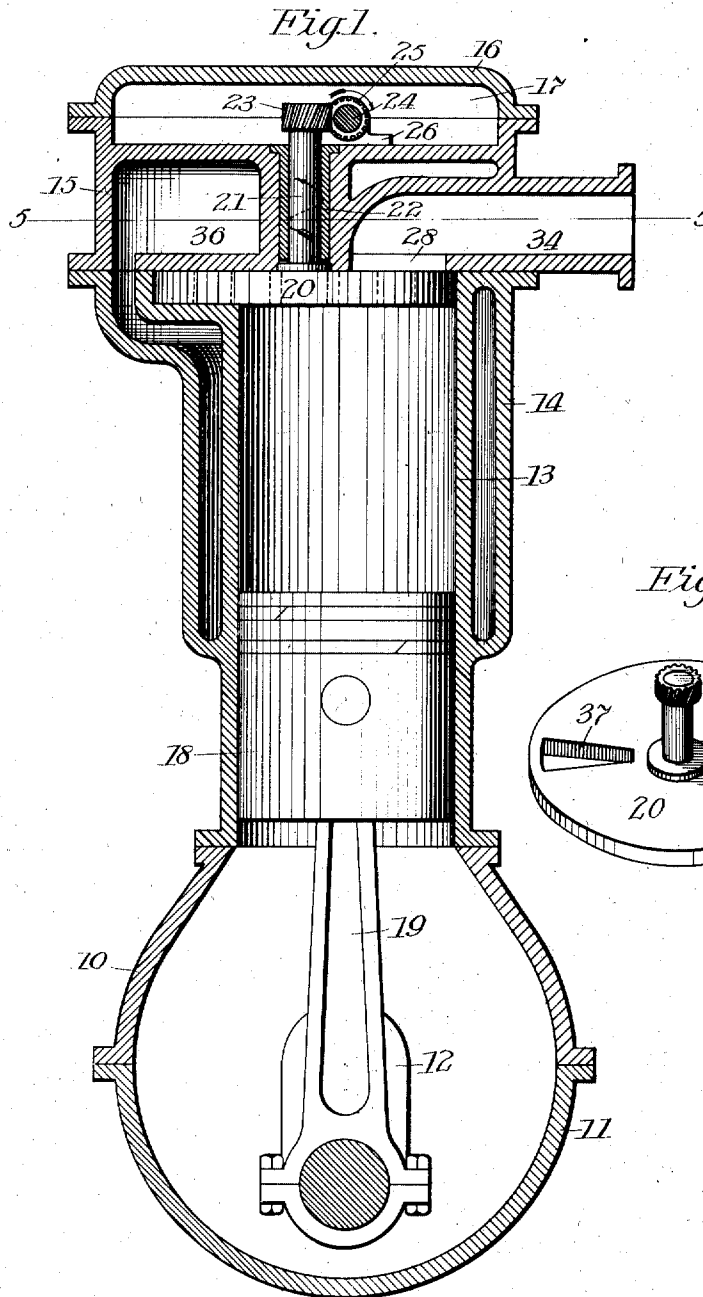


M. TIBBETTS.
HYDROCARBON MOTOR.
APPLICATION FILED JUNE 22, 1911.

1,227,698.

Patented May 29, 1917.
4 SHEETS—SHEET 1.



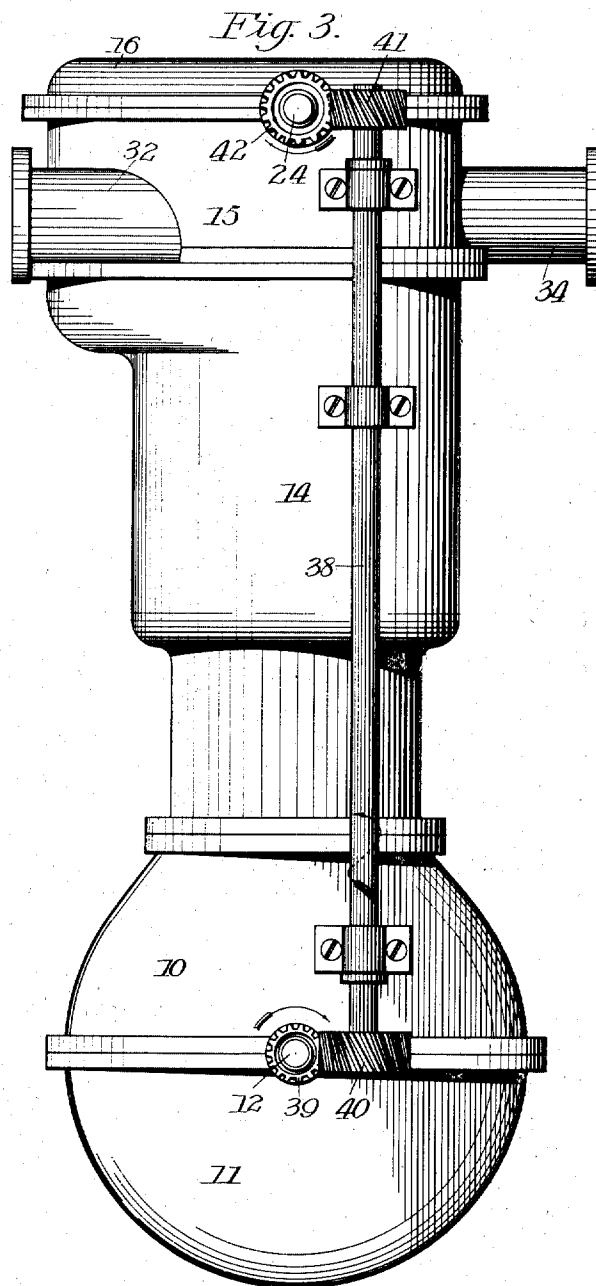
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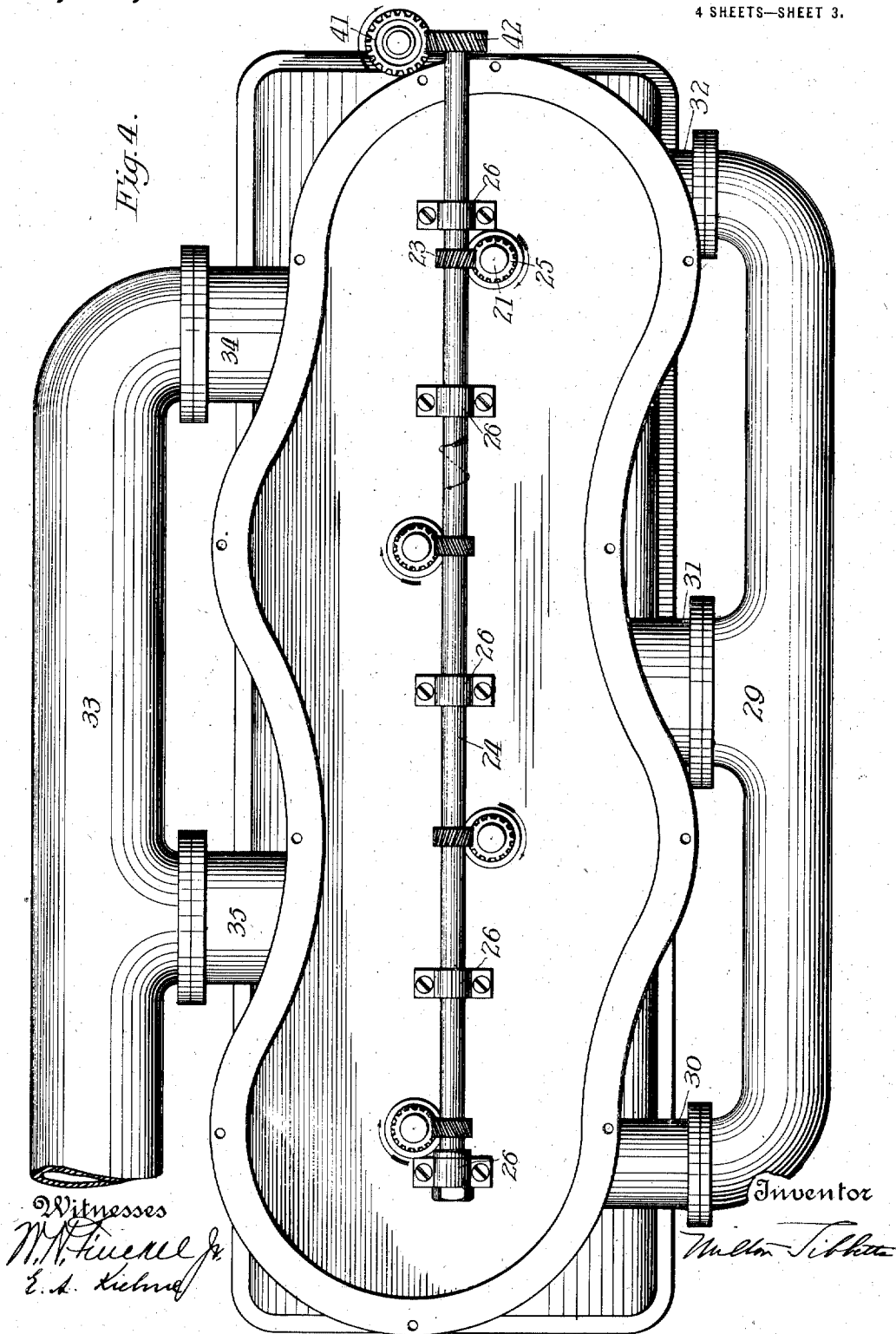
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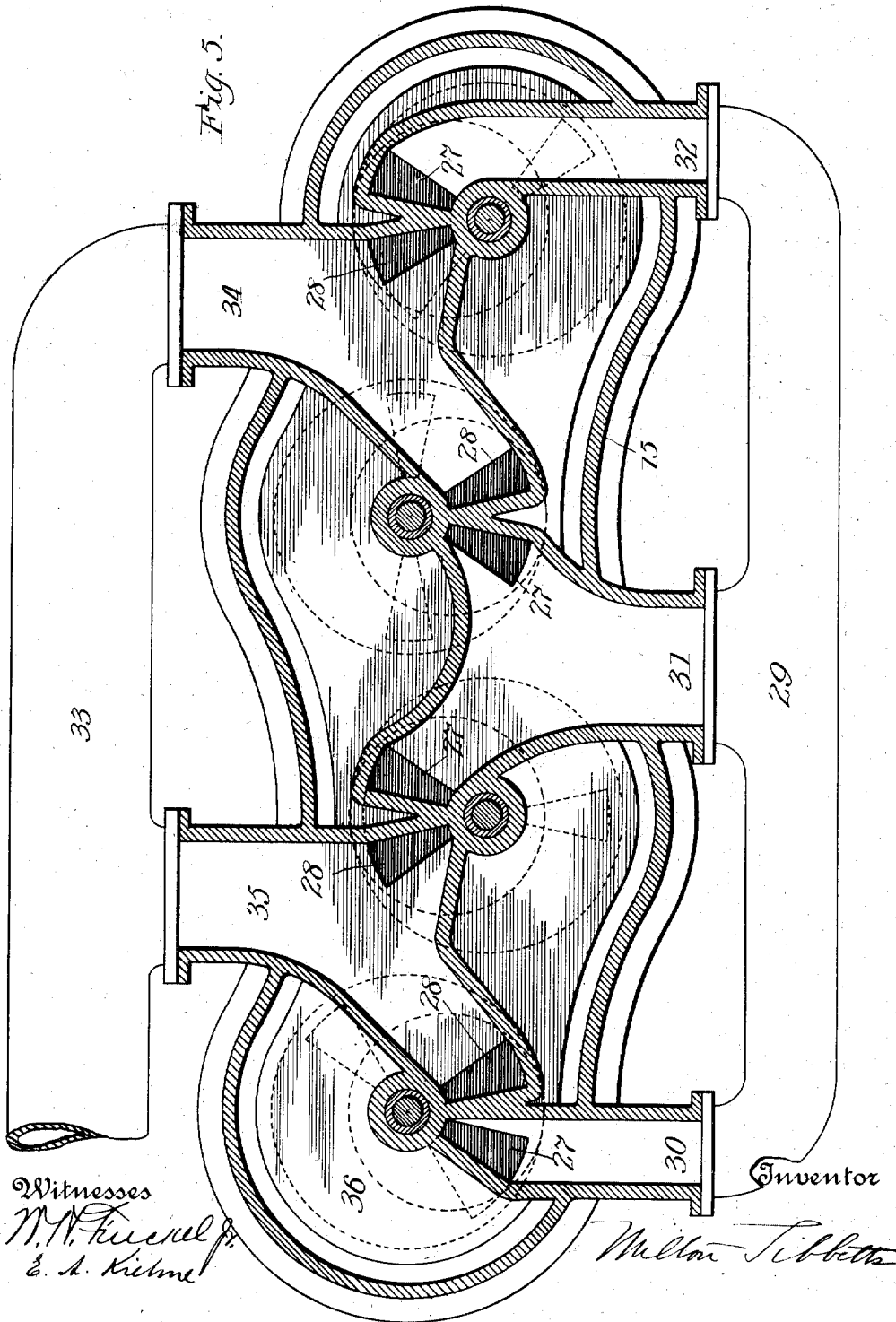
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Patented May 29, 1917.
4 SHEETS—SHEET 4.



UNITED STATES PATENT OFFICE.

MILTON TIBBETTS, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

HYDROCARBON-MOTOR.

1,227,698.

Specification of Letters Patent.

Patented May 29, 1917.

Application filed June 22, 1911. Serial No. 634,776.

To all whom it may concern:

Be it known that I, MILTON TIBBETTS, a citizen of the United States, and resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful improvements in Hydrocarbon-Motors, of which the following is a specification.

This invention relates to hydrocarbon motors, and particularly to motors of the four stroke cycle type in which rotary valves are employed. The form of rotary valve shown is a rotary disk valve mounted in the top of the cylinder and operated through suitable mechanism from the motor crank shaft.

More specifically, this invention is an improvement in that type of four cycle hydrocarbon motor in which a rotary disk valve is employed to open and close the inlet and exhaust ports of the cylinder head.

One of the objects of the invention is to adapt the above referred to type of valve mechanism to larger-sized motors than it has heretofore been found practicable to apply it, and without sacrificing speed or port area.

Another object of the invention is to design a motor of the above type so that, for a given size of motor, the disk valves may be moved slower relative to the crank shaft while the rapidity and size of the port openings are not decreased, or on the other hand, the rapidity and size of the port openings may be increased considerably without increasing the relative speed of rotation of the disk valves.

Various other objects will appear from the following description, taken in connection with the accompanying drawings which form a part of this application, and in which:—

Figure 1 is a vertical transverse sectional view through a motor embodying this invention;

Fig. 2 is a detail perspective view of one of the rotary disk valves;

Fig. 3 is a front elevation of the motor shown in Fig. 1;

Fig. 4 is a plan view of a four cylinder motor embodying this invention, with the top gear cover removed; and

Fig. 5 is a horizontal section through the cylinder heads of a motor similar to that

shown in Figs. 1 and 4, and taken approximately on the line 5—5 of Fig. 1.

The motor base and crank case may be formed in upper and lower halves, marked 10 and 11 respectively, between which the crank shaft 12 is mounted.

As shown the cylinders 13 of the four cylinder motor illustrated are cast in a single block together with their water jackets 14, and this block casting is mounted upon the crank case with the cylinders in proper relation to the crank shaft. It will be noted that the motor is of the vertical type with the four cylinders alined and preferably also in line with the crank shaft.

Mounted on top of the cylinders is a cylinder head block casting 15 which forms the heads of the various cylinders and in which are suitable inlet and exhaust ports and passages leading therefrom and suitable water jacket space.

Above the cylinder head casting and mounted on a flange extending around the edge of the latter, is a top cover 16 forming between it and the cylinder head casting an inclosed space 17 for the gear operating mechanism hereinafter described.

The usual piston 18 and connecting rod 19 are shown.

The upper end of each of the cylinders is swelled out at one side and the interior thereof is bored out somewhat larger than the cylinder bore and offset therefrom. This large bore extends only a short distance down into the cylinder and is shown substantially tangent to the cylinder wall at one point, and it is for the purpose of receiving a disk valve 20 which is somewhat larger than the diameter of the cylinder, being shown about half as large again. Being offset from the cylinder this disk valve has its axis eccentric thereto, and the spindle 21 upon which the disk valve is mounted operates in a bearing 22 in the cylinder head casting 15 and projects through said casting into the space 17. Upon the upper end of the spindle 21 is a spiral gear 23 through which the spindle and disk are rotated from the operating shaft 24 and its gear 25, which shaft is mounted in suitable bearings 26 on top of the cylinder head casting 15 and in the space 17.

It will be seen that the disk valve 20 seats against the underside of the cylinder head casting 15 and that all of the rotating parts may be supplied with lubricating oil from the space 17 to which the oil may be constantly fed.

It will be seen also that the valves 20 are offset from the cylinder centers in staggered relation, that is, the valves of cylinders No. 1 and No. 3 are offset to one side of the cylinders and the valves of cylinders No. 2 and No. 4 are offset to the other side. Thus larger valves may be used without separating the cylinders or unnecessarily crowding the valves. It will be understood, however, that it is not essential that the valves should be arranged in staggered relation as the other features of the invention are not dependent upon it.

The cylinder head casting 15 has formed therein an inlet port 27 and an exhaust port 28 for each of the cylinders and as shown these ports are of segmental shape on the axes of the valve spindles 21 and are separated from each other approximately 45 degrees on their centers.

In the four cylinder motor shown, there is an intake manifold 29 connected to the cylinder head casting and communication between the interior of this manifold and the intake ports is had through passages 30, 31 and 32 formed in the cylinder head casting as shown particularly in Figs. 4 and 5. There is also an exhaust manifold 33 connected with the cylinder head casting and communication is had between it and the exhaust ports through passages 34 and 35 also formed in the cylinder head casting.

It will be understood that the water jacket space 36 in the cylinder head casting extends around all of the passages above referred to and is in communication with the water jackets 14 of the cylinders, thus furnishing ample cooling facilities for the cylinder heads and the exhaust passages therein.

The disk valve 20 is formed with two segmental ports 37 arranged opposite each other and of approximately the same size as the intake and exhaust ports in the cylinder head casting.

In Fig. 3 it will be seen that the forward end of the crank shaft 12 extends slightly through the crank case, and parallel thereto and directly above the crank shaft the forward end of the valve operating shaft 24 extends through the cover 16. These shafts are coupled together by a vertical shaft 38 and spiral gears 39, 40, 41 and 42. If desired, these gears and shaft bearings may be suitably housed to protect them and to retain oil on the wearing parts.

The size and pitch of one of the pairs of gears, preferably gears 39 and 40, are such that the disk valve 20 will be rotated once

for each four revolutions of the crank shaft, or, since the crank shaft rotates twice for each complete cycle of a four stroke cycle motor, the disk valve 20 rotates once for each two complete cycles of the motor.

From the above description it will be seen that each of the ports 37 of the disk valve 20 will control the intake and exhaust ports of the cylinder through a complete cycle, and therefore these ports act during alternate cycles, *i. e.*, one of the ports 37 opens and closes the exhaust and opens and closes the inlet during the first cycle of the motor and the opposite port 37 of the same valve opens and closes the exhaust and opens and closes the inlet on the next succeeding cycle. With this form of valve therefore, one-half of the valve is controlling the cylinder ports while the other half, or the greater part of it, is rotating slowly between the water jacketed offset parts of the cylinder and cylinder head, thus cooling the valve to a considerable extent.

It will be understood that the valve 20 may be provided with a greater number of ports and turned still more slowly relative to the crank shaft to any reasonable extent without departing from the spirit of the invention. Moreover, it is not essential for certain features of the invention that there should be as many as two ports in the valve, as the latter may be operated at one revolution to two of the crank shaft and consequently provided with but one port, and by offsetting the valves as shown, provide a much larger and quicker port opening than has heretofore been possible with this type of motor.

Other changes and forms are also possible in the various features of the motor without departing from the scope of the invention.

Having thus described my invention, what I claim is:

1. In a multi-cylinder hydrocarbon motor, the combination with the aligned cylinders, of a single inlet and exhaust valve for each cylinder offset from the cylinder and set in staggered relation to the valves of adjacent cylinders.

2. In a multi-cylinder hydrocarbon motor, the combination with the aligned cylinders, of offset rotary valves for the cylinders set in staggered relation, and means extending along the tops of the cylinders for rotating said valves.

3. In a multi-cylinder hydrocarbon motor, the combination with the aligned cylinders, of an offset valve for each cylinder of greater diameter than the cylinder set in staggered relation to the valves of adjacent cylinders, and a shaft extending along the tops of the cylinders substantially in the plane of their axes for operating all of said valves.

4. In a multi-cylinder hydrocarbon motor, the combination with the alined cylinders, of an offset valve for each cylinder of greater diameter than the cylinder set in staggered relation to the valves of adjacent cylinders.

5. In a multi-cylinder hydrocarbon motor, the combination with the cylinders, each having its intake and exhaust ports adjacent each other and formed in one side of the cylinder head and the ports of each alternate cylinder being arranged on the side opposite to that in which the ports of the other cylinders are arranged, of valves controlling said ports, and means for operating said valves.

6. In a multi-cylinder hydrocarbon motor, the combination with the cylinders, each having its intake and exhaust ports adjacent each other and formed in one side of the cylinder head and the ports of each alternate cylinder being arranged on the side opposite to that in which the ports of the other cylinders are arranged, of a valve for each cylinder for controlling the ports thereof, and means for operating said valves.

7. In a four cycle hydrocarbon motor the combination with a cylinder and head having water jacketed portions separated to form a valve space between them, said head having inlet and exhaust ports, of a rotary valve operating in said valve space and having two oppositely arranged ports each port being adapted to register first with the exhaust port and then immediately with the inlet port, and means for rotating said valve once for every two complete cycles of the motor, whereby the part of the valve containing one of the ports controls the cylinder ports in immediate succession, while the part of the valve containing the other or opposite port is traveling between water jacketed portions of the cylinder and head, and vice versa.

8. In a four cycle hydrocarbon motor the combination with a cylinder and head having offset water jacketed portions separated to form a valve space between them, said head having inlet and exhaust ports, of a rotary disk valve mounted eccentrically of the cylinder and operating in said valve space, said valve having two oppositely arranged ports, each port being adapted to register with the exhaust port and then immediately with the inlet port, and means for rotating said disk valve once for every two complete cycles of the motor, whereby the part of the valve containing one of the ports controls the cylinder ports in immediate succession while the part of the valve containing the other or opposite port is traveling

between water jacketed portions of the cylinder and head, and vice versa.

9. In a multi-cylinder hydrocarbon motor, the combination with the cylinders each having its intake and exhaust ports adjacent each other and formed in one side of the cylinder head and the exhaust ports of alternate cylinders being arranged on one side of transverse vertical planes through the centers of the respective cylinders and opposite to that in which the exhaust ports of the other cylinders are arranged, of a rotary valve for each cylinder for controlling the ports thereof, and means for operating said valves.

10. In a multi-cylinder hydrocarbon motor, the combination with the crank shaft and the cylinders mounted above the same and having intake and exhaust ports, each cylinder having its inlet and exhaust ports offset at one side of the crank shaft, the ports of one cylinder being arranged on the side opposite to that on which the ports of another cylinder are arranged, of valve means controlling said ports, and means for operating said means.

11. In a motor having an even number of cylinders, the combination with the crank shaft and the cylinders mounted above the same and having intake and exhaust ports, each cylinder having its intake and exhaust ports offset at one side of the crank shaft, the ports of one half of the cylinders being arranged on the side opposite to that on which the ports of the other half of the cylinders are arranged, of valve means controlling said ports, and means for operating said means.

12. In a four cycle hydrocarbon motor, the combination with a cylinder and head, said head having inlet and exhaust ports, of a rotary disk valve mounted eccentrically of the cylinder and operating between the cylinder and head, said valve having two oppositely arranged ports, each port being adapted to register first with the exhaust port and then immediately with the inlet port, and means for rotating said valve once for every two complete cycles of the motor, whereby the part of the valve containing one of the ports controls the cylinder ports in immediate succession, while the part of the valve containing the other or opposite port is inoperative and vice versa.

In testimony whereof I affix my signature in the presence of two witnesses.

MILTON TIBBETTS.

Witnesses:

W. H. FINCKEL, Jr.,
E. S. KIEHNE.