July 31, 1934. V. CHORVATH 1,968,671

INTERNAL COMBUSTION ENGINE

Filed Aug. 29, 1932 3 Sheets-Sheet 1

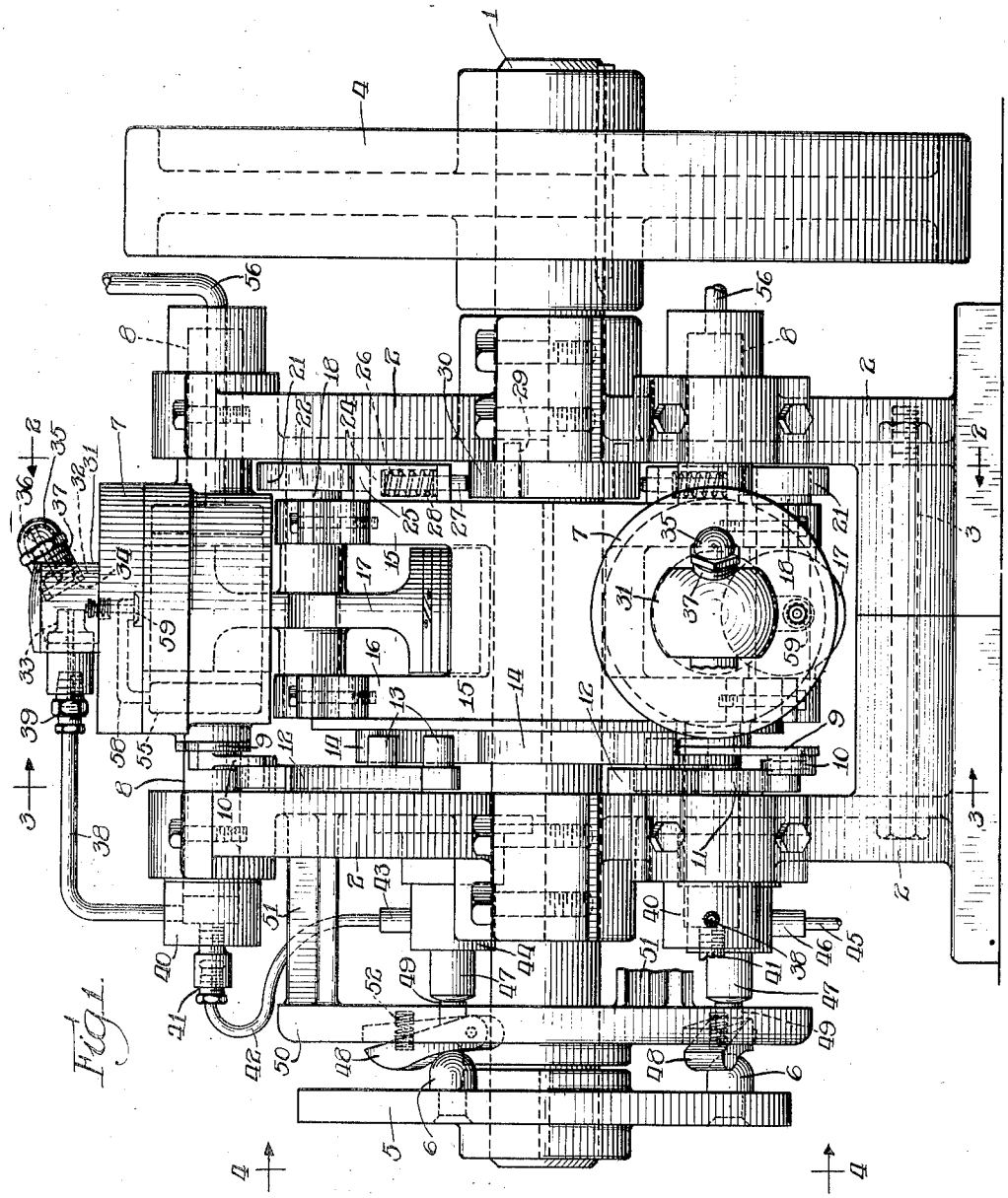


Fig. 1.

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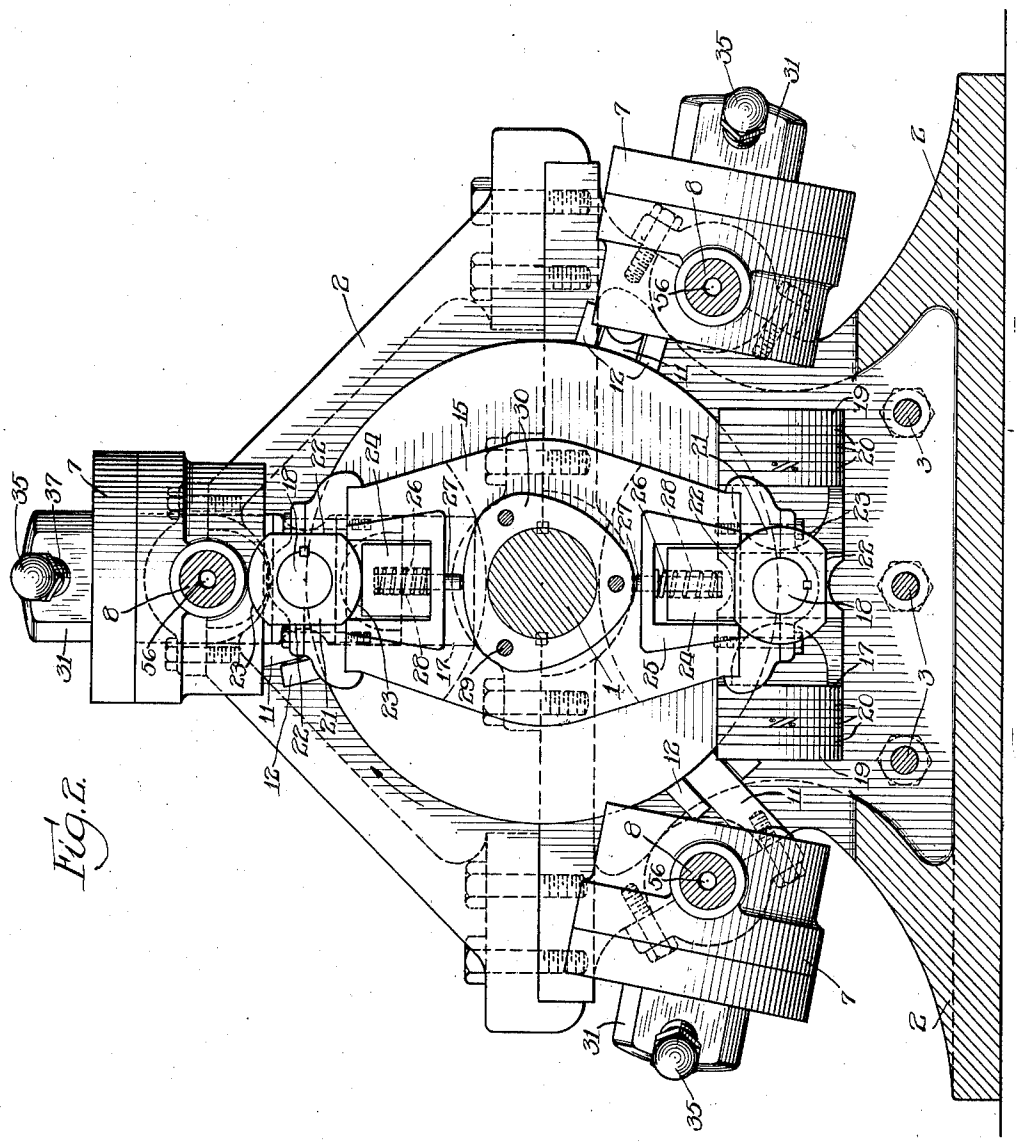


Fig. 2.

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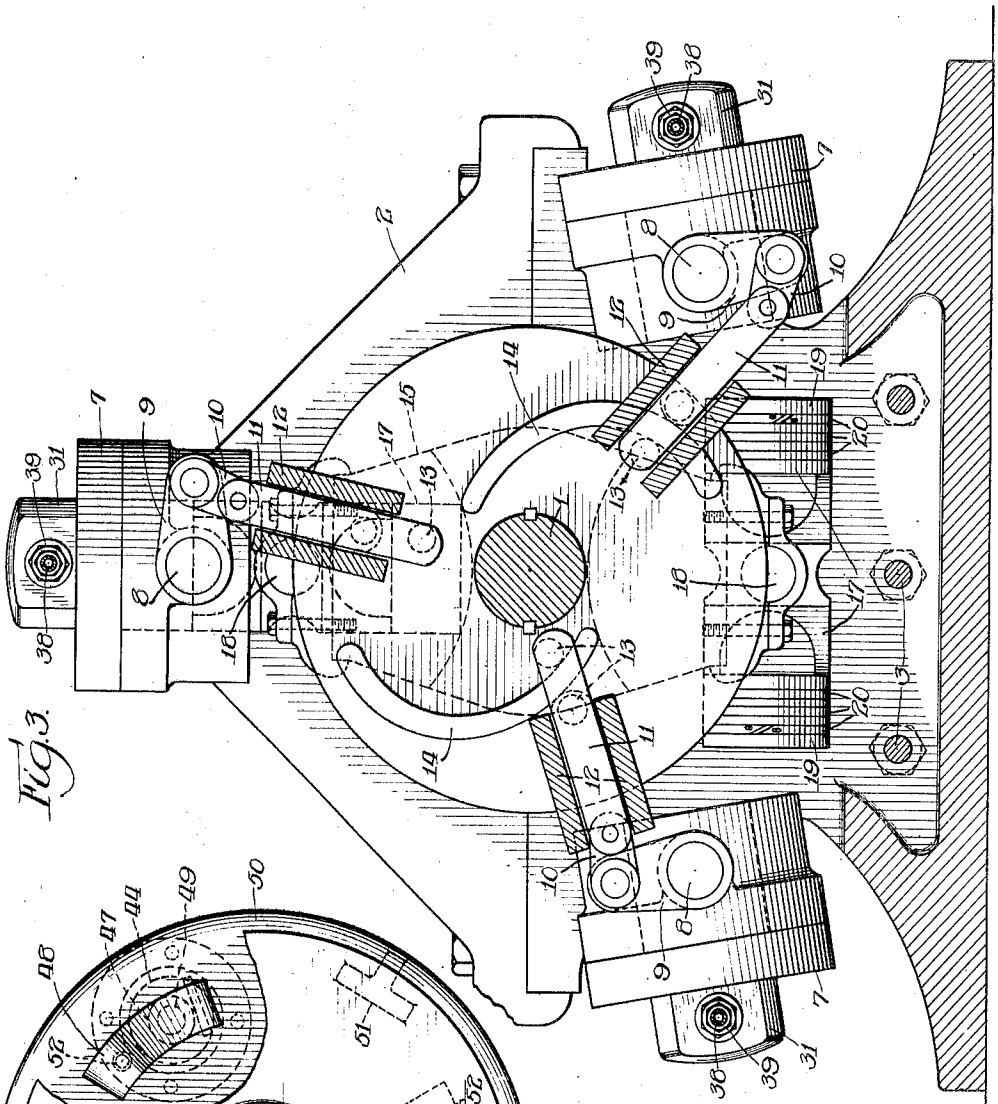


Fig. 3.

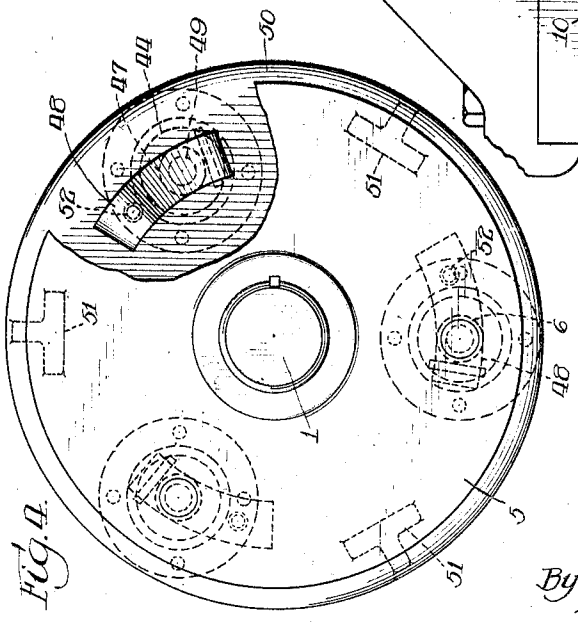


Fig. 4.

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UNITED STATES PATENT OFFICE

1,968,671

INTERNAL COMBUSTION ENGINE

Vladimir Chorvath, Chicago, Ill.

Application August 29, 1932, Serial No. 630,850

21 Claims. (Cl. 123—42)

This invention relates in general to a combustion engine and has more particular reference to an engine of the Diesel type in which a rotatable piston enters and leaves a cylinder or cylinders in producing the compression and combustion strokes.

Among the objects of the invention are to provide an internal combustion engine in which a cylinder or cylinders are moved to receive a rotating piston which enters the cylinders in succession, turns with them, and leaves them at a different angle in forming the compression and combustion strokes; to provide means for controlling the movements of pistons and cylinders in an engine of this type; to provide improved fuel feeding means; and in general to provide an engine of the construction herein shown and described.

Other objects of the invention will appear hereinafter, the preferred construction being shown in the accompanying drawings.

In the drawings, Fig. 1 is a side elevation of an engine constructed in accordance with the principles of this invention;

Fig. 2 is a section taken on the line 2—2 of Fig. 1;

Fig. 3 is a section taken on the line 3—3 of Fig. 1; and

Fig. 4 is an end elevation partly broken away as taken on the line 4—4 of Fig. 1.

There are many internal combustion engines of the rotary or semi-rotary type but the present invention is believed to differ from them in providing a movable and rotating piston which is entirely free from any connection with a cylinder or cylinders mounted about the periphery of the path of the piston so that the piston will enter a cylinder in a substantially tangential position, will compress a fuel charge therein and turn with the cylinder to an opposite position at which the piston leaves the cylinder, the combustion of the fuel taking place as the piston leaves the cylinder. Means are provided for moving the cylinders and for accurately positioning the pistons to enter the cylinders, and as herein shown and described, each piston is double ended to obviate the necessity of reversing the piston after it leaves each cylinder. The result is that with a double ended piston at each end of the carrier acting in conjunction with three equally spaced cylinders, an action is obtained similar or equivalent to a twelve cylinder engine of the reciprocating type.

Many of the details of engine operation are not shown in the present application. It is intended that this engine shall use a low grade of fuel such as kerosene, distillate, and the like, and no provision is made for disposing of the exhaust which escapes from the cylinders as soon as the piston leaves them. Cooling the cylinders is not a difficult problem and may be effected by means of cooling fins, water jackets or an air jacket reached through one of the cylinder trunnions as shown. The exhaust may escape into the open air or the entire engine may be covered with a sheet metal housing with a fan attached to one of the rotating parts and acting to drive the exhaust therefrom.

Referring now more particularly to the drawings, a driving shaft 1 is suitably mounted for rotation in bearings of side frames 2 which are spaced apart and held together at the base by bolts 3. At one end of the shaft is a fly wheel 4 and at the other end of the shaft is a pump operating plate 5 with inward projections 6 thereon.

Mounted between the side plates 2 are three engine cylinders 7, each open at its inner end and rotatable upon trunnions 8 for which bearings are provided in the side plates. These cylinders are equally spaced about the shaft 1 and at one side of each cylinder is an arm 9 connected by a ring 10 with a bar 11 slidable axially between fixed guides 12 formed on one of the side plates 2. At the inner end of each bar 11 are projections 13 spaced apart and adapted to engage a cam rib 14 therebetween, two of such ribs being shown in Figure 3 projecting from the outer circular face of a rotor 15 attached to the main shaft 1. As the rotor 15 moves with the shaft it is obvious that the cam ribs 14 engaging between the projections 13 will rotate the cylinders from a position as shown at the lower left side of Figure 3 to the receiving position as shown by the cylinder at the right lower side of Fig. 3. For a distance between the discharging end of one rib 14 and the engaging end of the other rib 14 each cylinder is free to rotate with its piston as shown by the upper cylinder in Fig. 3.

In opposite edges of the rotor 15 are recesses 16 in each of which is mounted a double ended piston 17 having a central bearing 18 upon which it is rotatable and each head 19 of the piston being provided with piston rings 20 of a limited expansion type holding them in place and causing each piston to make a tight connection with a cylinder into which it is moved.

In order to accurately position the pistons at the time they enter the cylinders, one end of the bearing 18 of each double ended piston is

extended beyond the rotor 15 at one side thereof (see Figure 2) and has a cam 21 attached thereto, the cam having opposite flat faces 22 and intermediate opposite rounded or arcuate faces 23. The flat faces 22 extend parallel with the sides of the pistons and are engaged when the pistons are in a tangential position by a bearing block 24 at each end of the rotor 15 each movable axially in a guide 25 at the side of the rotor pressed outwardly by a spring 26 surrounding a pin 27 in a recess 28 of the block, each bearing pin extending from the block through the guide 25 and in contact with a cam 30 secured to the side frame by fastening bolts or pins 29, this cam having high points disposed between each pair of cylinders so that the block 24 is forced outwardly by the high point of the cam to position of the piston for entering the next cylinder. As soon as the piston enters the cylinder the cam service is reduced in size, relieving the pressure of the block against the cam 21 and allowing the piston 17 to turn upon the curved portion 23 of its cam and to reverse the position of the double ended piston for engagement with the opposite flat side 22 of its cam for positively positioning the piston for engagement with the next cylinder.

As soon as either end of the piston engages in a cylinder the cam rib 14 which engages the projections 13 of the controlling bar 11 moves from engagement therewith, and the piston being freed from the rigid engagement of its positioning block 24 is free to turn with the cylinder and as the rotor continues to move the piston first compresses a charge within the cylinder and then the explosion expels the piston from the cylinder whereupon the projections 13 of the guide bar 11 for that cylinder are engaged by the next cam rib 14 of the rotor plate.

Each cylinder has a head or cap portion 31 with an inside recess 32 in which is a fuel nozzle 33 preferably of a type to spray the fuel as it is forced into the recess. Also communicating with the recess 32 is an ignition or firing gland 34 having an outer rounded bulb or dome 35, an inside firing partition 36, and outside threads 37 adapting it to be removably inserted in the cap portion 31.

Communicating with each nozzle 33 is a pipe 38 having a packing gland connection 39 with the nozzle at one end and extending at its other end into a fitting block 40 carried by one of the mounting trunnions 8 of the piston which extends beyond the side bearing at that side so that the block 40 and the pipe 38 rock with that cylinder. Connected into the end of the block 40 upon the turning axis thereof is a fitting 41 which receives the end of a pipe 42 and makes a tight connection therewith permitting a slight rocking movement of the fitting with respect to the pipe, the other end of the pipe being connected through a check valve 43 with a pump cylinder 44 which receives a fuel supply from any suitable source through an inlet pipe 45, and a check valve 46. Movable in the pump cylinder 44 is a plunger 47 actuated by a cam member 48 having a projection 49 to engage the plunger and pivoted in a support 50 which extends from the adjacent side plate 2 on arms 51, the cam member 48 being pressed outwardly from the support by a spring 52, and the cam member being in the path of and engaged by each projection 6 of the cam plate 5 as it rotates with the main shaft 1.

Thus it will be seen that by properly timing the operation of the pumps, one for each cylinder, a charge of fuel is pumped and sprayed into the cylinder before a piston entering the cylinder reaches the end of its compression stroke, the fuel is ignited, an explosion occurs ejecting or forcing the piston entirely from the cylinder, which opens it to exhaust, allowing the burnt gases to escape freely. If the engine is enclosed with a casing a fan or suction may be applied to remove the fumes and burnt gases from the casing.

Instead of cooling the cylinders by means of cooling fins or water jackets, an air cooling jacket 55 may be provided surrounding the cylinder wall having communication through one of its trunnions 8 with an air inlet pipe 56 from any suitable source of pressure supply. This air jacket may discharge directly into the atmosphere or may be connected through a passage 58 and a spring pressed valve 59 in the head of the cylinder to discharge air through the cylinder for scavenging the cylinder when the cylinder is not under compression.

In starting this engine it may be necessary to preheat the domes of one or more of the firing glands but when the engine is in running condition the partition 36 of the firing glands retains sufficient heat to assist in igniting the charge compressed in the cylinder. When the engine is running the piston leaves the cylinder at the greatest angle from the driving shaft 1 so that the maximum force of the explosion is obtained upon the full length of the arm which connects the piston to the shaft. As viewed in Fig. 3 the piston at the lower end has just left the cylinder at the left side and the piston is substantially in line with the cylinder and at right angles to the shaft at the full length of the roller arm which supports the piston, thereby obtaining the full force of the explosion and transmitting it directly through the rotor to the shaft. The inversion of each double ended piston and the separation of the piston from the cylinder gives time for cooling even though each cylinder is fired two times for each rotation of the drive shaft, and additional cooling means either by air or by water may be provided for the cylinder as set forth.

This construction is compact and simple, easily operated, and will take unrefined fuels without the necessity of any fuel mixer or carburetor and without any spark plugs. Although a fly wheel of considerable size is shown, the rotor itself has sufficient momentum to make a large fly wheel unnecessary so that the fly wheel is of use principally in starting. The engine may be started by ordinary starter mechanism engaging the fly wheel and if difficulty is experienced in starting at any time external application of heat to the firing glands will make starting much easier. Although a single rotor is shown upon the shaft it is obvious that the same mechanism may be duplicated, thereby correspondingly increasing the power.

I claim:

1. A combustion engine having a relatively fixed but individually oscillatable cylinder, and a double-ended piston of which one end or the other is movable thereinto and entirely out of the cylinder at each stroke.

2. A combustion engine, a pivoted cylinder mounted for separate oscillation, a piston having opposite ends movable alternately into and entirely out of the cylinder at each stroke.

3. In a combustion engine, a relatively fixed cylinder open at one end and separately mounted

to swing back and forth, and a piston movable in a continuous path to engage in the cylinder, to swing therewith and to pass entirely out of the cylinder.

4. In a combustion engine, an open-ended cylinder fixed in place, but independently mounted to swing back and forth, a piston, and means for carrying it in a continuous path to enter the cylinder to turn therein with the cylinder, and to pass therefrom at the end of the combustion stroke.

5. In a combustion engine, a relatively fixed cylinder open at one end and separately mounted to oscillate, a piston and means for mounting it to turn in a circular path, to engage in the open end of the cylinder, turn with the cylinder, and pass from the cylinder.

6. In a combustion engine, a relatively fixed cylinder open at one end and individually mounted to oscillate; a piston movable in a path to enter the cylinder, to turn therewith and to leave the cylinder at an angle to the entry position; and means to control the movement of the cylinder.

7. In a combustion engine, a relatively fixed cylinder open at one end and independently mounted to swing its open end back and forth, a piston movable in a circular path to enter the cylinder at an angle thereto and to turn with the cylinder, and to leave the cylinder at an opposite angle, and means for returning the cylinder to again receive the piston at the entering angle.

8. In a combustion engine, a plurality of relatively fixed cylinders open at one end and each pivoted for individual oscillation, a piston movable in a circular path into and out of the cylinders in succession forming compression and combustion strokes.

9. A combustion engine having a plurality of cylinders each individually mounted to swing back and forth, a piston movable in a rotary path to enter, swing with and leave each cylinder in succession, means for controlling the positions of the cylinders, and means for positioning the piston to enter each cylinder.

10. In a combustion engine having an open ended cylinder separately mounted to swing back and forth, a piston and a rotor on which it is mounted, and means to engage and hold the piston on the rotor in a position to engage in the open end of the cylinder.

11. In a combustion engine, a cylinder open at one end and mounted to swing back and forth, a double-ended piston movable into and out of the cylinder, and means for reversing the piston end for end for successive alternate engagements with the cylinder.

12. A combustion engine having a plurality of open ended cylinders relatively fixed about a common center but each separately oscillatable, a piston with double and opposite ends movable in a path about the center and rotatable upon an axis between its ends to enter and leave each cylinder and to present the opposite end to the next cylinder, and means for rigidly holding the piston for engagement with each cylinder.

13. In an engine structure according to claim 12, cam means for returning each cylinder to a position to re-engage the piston moving in its path, said means releasing the cylinder to swing with the piston when it moves therein.

14. In a combustion engine structure in accordance with claim 12, a cam member in connection with the piston having flat and rounded portions, a spring pressed bearing block to engage the flat portions for holding the piston rigidly, and a cam member for said block having high and low portions, the low portions permitting the piston to turn upon its axis when in engagement with a cylinder.

15. In a combustion engine, a relatively fixed cylinder open at one end and mounted to swing back and forth, a piston movable in a circular path to enter, swing with and leave the cylinder in its compression and explosion strokes, and a fuel pump actuated as the piston moves in its path to inject fuel into the cylinder before the compression stroke is complete.

16. In a combustion engine, supporting side frames and a driving shaft, a relatively fixed cylinder mounted to oscillate in the frames, a rotor secured to the shaft comprising a piston pivoted at the end of an arm to move into and out of the cylinder, fuel pumping means in connection with the shaft and one of the frames, and a piped connection from the pump to the cylinder mounting and thence to the cylinder, a part thereof oscillating with the cylinder.

17. In a combustion engine, a relatively fixed cylinder open at one end and mounted to swing back and forth, a piston movable in a circular path to enter the cylinder, turn therewith and leave the cylinder, the cylinder having a cooling jacket and a passage communicating therewith through the axis of its mounting.

18. In a combustion engine, a relatively fixed cylinder and a pivotal mounting therefor upon which it oscillates, a piston movable in a circular path to enter, oscillate with and leave the cylinder, and means in connection with the cylinder including a valved passage into the cylinder to scavenge the cylinder after the piston leaves it.

19. In a combustion engine, a cylinder and a fixed mounting upon which it oscillates, a piston movable in a circular path to enter, oscillate with and leave the cylinder, means for supplying fuel to the cylinder, and means to cool the cylinder and scavenge it of burnt gases after the piston leaves it.

20. A structure in accordance with claim 19 in which the means to cool and scavenge the cylinder comprises a cooling jacket, means to admit a cooling fluid thereto, and a valved passage in the head of the cylinder communicating with the jacket whereby the cooling fluid is discharged into the cylinder to expel burnt gases therefrom when the piston leaves.

21. In a combustion engine, a relatively fixed cylinder mounted at one end and mounted to oscillate, a double-ended piston mounted to turn in a circular path and to rotate upon an axis between the ends thereof, to engage in the open end of the cylinder to turn with the cylinder as it oscillates, to pass from the cylinder as the piston is turned in its circular path, and to invert the piston end for end in entering and leaving the cylinder as the piston is turned in its circular path.

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