

Sept. 28, 1926.

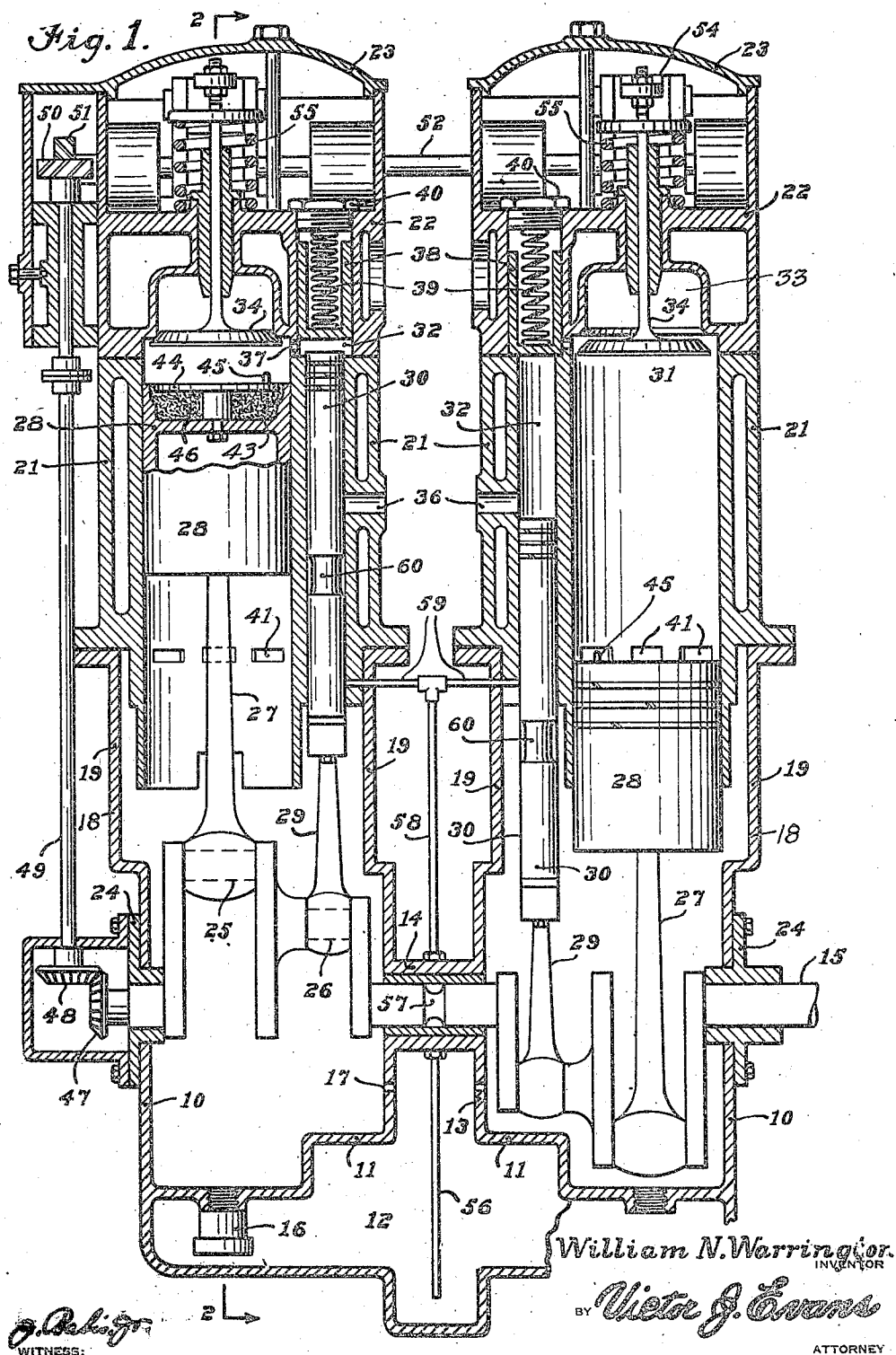
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W. N. WARRINGTON

INTERNAL COMBUSTION ENGINE

Filed Feb. 5, 1923

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

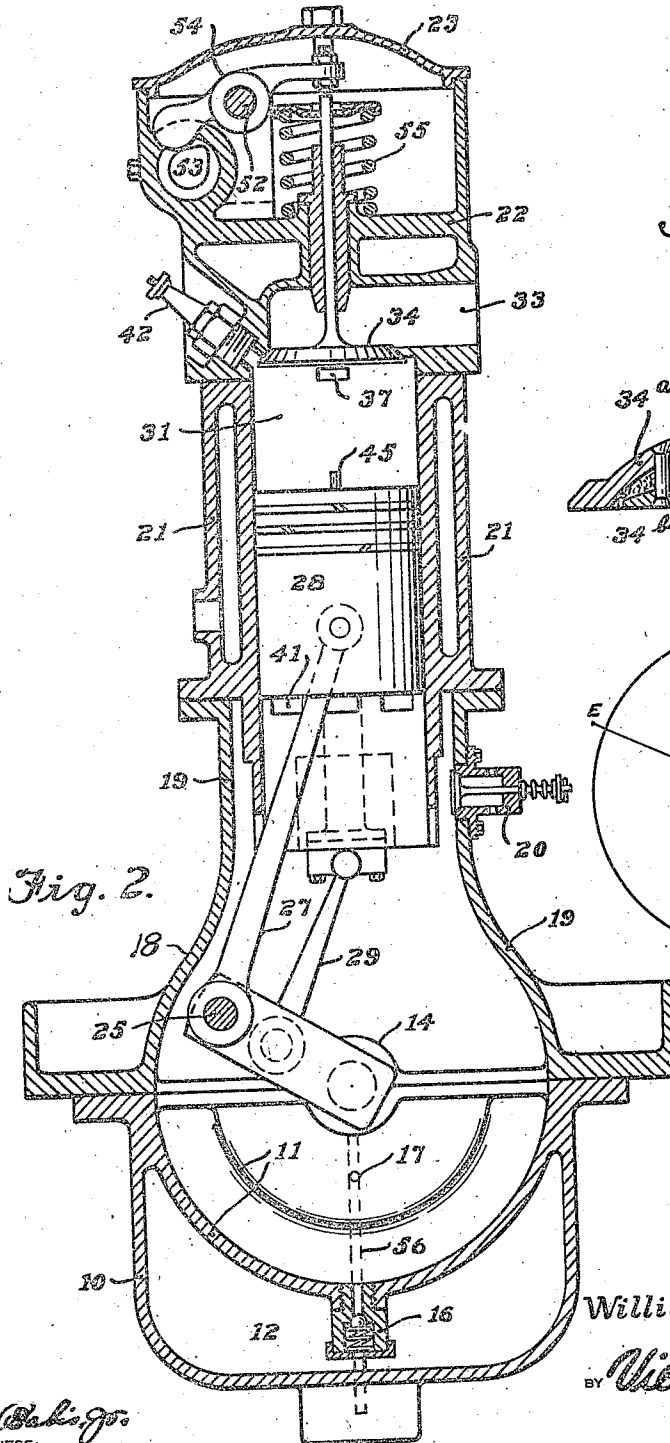


Fig. 2.

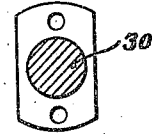


Fig. 3.

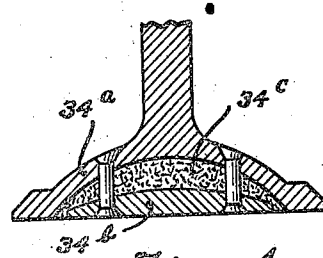


Fig. 4.

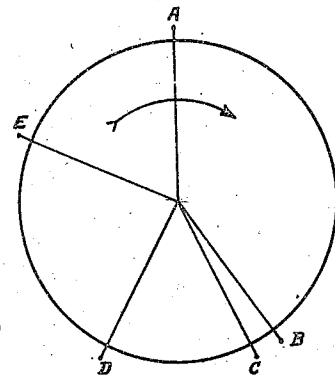


Fig. 5.

WITNESS:  
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# UNITED STATES PATENT OFFICE.

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## INTERNAL-COMBUSTION ENGINE.

Application filed February 5, 1923. Serial No. 617,099.

This invention relates to internal combustion engines, and while it is here illustrated as applied to a two-cycle engine, it will be obvious that by slight changes which will suggest themselves to anyone skilled in the art, the invention can be applied to four-cycle engine.

The principal object of the invention is to produce an engine in which substantially the complete expansion of the fuel may be utilized before exhausting.

Another object is to provide novel and efficient means of scavenging the cylinders.

Another object is to provide novel and efficient means for injecting fuel into the cylinder under pressure.

Another object is to provide novel means for firing the charge.

With these and other objects in view as will be more apparent, the invention consists in certain novel construction and combination and arrangement of parts, the essential features of which are hereinafter fully described, are particularly pointed out in the appended claims, and are illustrated in the accompanying drawing, in which:—

Figure 1 is a vertical sectional view of my improved internal combustion engine, showing the two pistons at opposite extremes of their movement.

Figure 2 is a transverse section on line 2—2 of Figure 1.

Figure 3 is a detail of the pump plunger connection.

Figure 4 is a detail view of valve used in large engines.

Figure 5 is a diagrammatic indication of the operation.

Like characters of reference refer to like parts in all the views.

Referring to the drawing in detail, 10 represents the base frame casing which is divided by a partition 11 so as to define an oil sump 12 and a portion of the crank-case. The partition 11 extends upwardly at 13 so as to form a bearing 14 for the central portion of the crank-shaft 15, and at the same time forms part of a division wall operating the crank-case into chambers one for each cylinder. The partition 11 is provided with ball check valves 16 for preventing return of oil to the crank-case and still to permit any oil that may be in the crank-case to be forced into the sump under pressure. Small apertures 17 form leads from the oil sump 12 to the crank-case chambers and act as

relief valves when the machine is stopped so that the oil does not remain under pressure. While the apertures 17 are shown of some size in the drawing, they are really very small, using about a 70 drill for this purpose.

Secured on the casing 10 is an upper crank-case casting 18 which forms the upper portions of the several crank-case chambers and is provided with a plurality of walls 19 arranged opposite the members 13 and co-operative therewith for forming bearings 14 and for dividing the crank-case into the separate chambers as previously mentioned. In the casting 18 there are arranged a plurality of spring-controlled air inlet valves 20, each of these valves affording means whereby atmospheric air may be drawn into a respective crank chamber, although preventing the escape of air which has once been drawn in.

A plurality of cylinder blocs are indicated at 21 and are bolted or otherwise secured in place on the member 18 in proper relation with each of the crank chambers. Secured to the top of each cylinder body 21 is a respective cylinder head 22, the mechanism of which will be hereinafter fully described. All of the cylinder heads are provided with overhead covers 23 for covering the cam and valve mechanism.

As indicated in the drawing, the crank-shaft 15 is mounted centrally in the bearing 14 and at each side is bearings 24 mounted in the sides of the base member 10 and the co-operating upper crank case member 18. Within each of the crank-case chambers above referred to are provided two crank-pins 25 and 26 with the proper arrangement of crank-throws or crank cheeks. The bearings on the crank-shaft may be oiled by drilling the crank-shaft as is old and well-known in the art, although this is not shown in the drawing. The crank-pin 25 carries the connecting rods 27 of the main cylinder piston 28 while the crank-pin 26 carries the connecting rod 29 of the fuel pump piston 30. The main cylinder chamber or combustion chamber is indicated at 31, while the fuel pressure chamber is indicated at 32. Exhaust from the chamber 31 passes through exhaust passage 33, entrance to the passage being controlled by valve 34, the operating mechanism of which will be later described. The fuel passes from the carburetor through ports 36 into the pressure chamber 32, (and

upon compression by the piston 30) the fuel is injected into the cylinder 32 through port 37. Entrance through this port is controlled by a plunger 38 pressed by a spring 39, the tension of the spring being adjustable at 40.

Fresh air after being drawn into the crank-case chambers through the valves 20 is forced through ports 41 into the combustion chambers 31 when the piston of the respective chamber is in its lowermost position. It will be readily understood that as the piston 28 moves upwardly in the combustion chamber 31 a suction is created in the respective crank-case chamber which draws the air through the respective valve 20. Upon the reversed movement the piston 28 compresses the air in the crank chamber forcing any oil in the bottom thereof through the ball check 16 and placing the oil in the oil sump under pressure. At the same time, the air in the crank chamber is so compressed that when the piston reaches the end of its stroke the air rushes in through the ports 41 with considerable pressure as at this time the valve 34 stands open. This inrush of the fresh air scavenges the cylinder, and on the up-stroke of the piston, the valve is so timed as to permit further scavenging during the first two-thirds of the upward movement of the piston.

When the piston has completed this two-thirds of its upward travel, valve 34 closes, and compression begins. After the valve 34 closes pressure in the fuel chamber 32 overcomes spring 39 and the plunger 38 is raised to permit the inrush of the fuel from chamber 32. As indicated in the drawing, port 37 is cut horizontally so as to keep the fuel from being ignited immediately upon being forced into the compression chamber 31. When the compression is complete, the charge is ignited.

The ignition means in the present instance is unique. During the first operations of the machine spark plugs 42 and the usual well-known ignition system are utilized for firing the charges, but as the machine warms up, another agent is brought into play. The upper end of each piston 28 is countersunk and in this countersink which is indicated at 43, there is mounted a hot plate 44 having an upstanding point 45. The plate 44 is insulated from the piston proper by asbestos cement or the like as indicated at 46. As the hot plate 44 becomes heated, it will fire the charges without the necessity of using the regular electrical ignition. After the machine has been started going and has "warmed up", the fuel injecting apparatus may be "throttled" or at least only a small amount of fuel may be fed to it. In this case, where there is a small charge, it is desirable that the hot point 45 be arranged directly opposite the intake port 37 so as to effect firing of the charge. The parts are shown

in this relation in the drawings, and the invention contemplates the positioning of the parts as thus described.

Secured on the crank-shaft 15 is a gear 47 which meshes with a gear 48 to operate a shaft 49 having a bearing in one of the cylinder heads 22 and carrying a gear 50 which operates a gear 51 to effect rotation of the cam-shaft 52. Cams are indicated at 53 and operate cam levers 54 which effect the opening and closing of the valves 34. The valves are provided with the usual return springs 55.

By the pressure created in the oil sump through the operation of the pistons as herebefore explained, the oil in the sump is forced upwardly through a tube 56 into a groove 57 in the crank-shaft 15 and from thence through a tube 58 and laterals 59, the oil is fed against the pistons 30. Annular grooves 60 trap a certain amount of oil at each operation and carry this oil along the wall of the main cylinder 21 permitting it to run down from the extreme low position and drop into the crank-case.

In Figure 4, is shown a detail view of a slightly modified form of valve 34 for use in large engines. The drawing shows the valve at 34<sup>a</sup> and provided with a face plate 34<sup>b</sup> which is insulated from the main body 34<sup>a</sup> by means of asbestos cement 34<sup>c</sup> or other suitable packing or insulation.

In Figure 5, there is shown a diagram of the operation of the device which will clearly indicate the beneficial result of this structure, particularly in attempting it to utilize the full expansibility of the explosive mixture. The circle represents the complete revolution of the crank-shaft and A indicates the firing point. From A to B is the expansion or power stroke of the engine. At B the exhaust port or valve 34 is opened and at C the ports 41 have been reached. The distance from C to D represents the travel of the piston across the port 41 and back again to position to close the said port. The piston now moves up in the cylinder which has been charged with air during the passage from C to D, and a portion of this air together with the remaining products of combustion are for the most part forced out during travel from D to E. When point E is reached, valve 34 closes and the compression stroke begins. This compression stroke occupies one-third of the one-half circle and approximately therefore one-third of the expansion or power stroke so that I have at times termed this device, a triple expansion engine.

It will be well understood that the fuel is injected during the compression stroke and the fuel and the remainder of the air are mixed together and compressed during the travel from E to A.

While I have described what I deem to be

the most desirable embodiment of my invention, it is obvious that many of the parts may be varied without in any way departing from the spirit of my invention, and I therefore do not limit myself to the exact details of construction herein shown nor to anything less than the whole of my invention limited only by the appended claims.

What I claim is:—

10 1. In an internal combustion engine, a cylinder structure including an explosion chamber and a fuel chamber, said cylinder provided with an elongated port establishing communication between the fuel and explosion chambers, a substantially cylindrical valve, a spring engaged in said valve for normally causing said valve to cut off communication between said chambers, said valve adapted to be moved against the tension of said spring upon the creation of a predetermined pressure in the fuel chamber to permit fuel to pass into the combustion chamber, said cylinder provided with an ex-

haust port opening into the top of the combustion chamber, a relatively large valve for controlling said exhaust port, and means for controlling operation of said exhaust valve whereby the latter will be held open for substantially two-thirds of the upward stroke of the piston of the engine. 25

2. In a constant compression engine, a cylinder having a combustion chamber, a piston movable therein, an exhaust valve associated with said cylinder, said cylinder provided with air inlet ports, means controlling inlet of said scavenging air into said cylinder through said ports whereby air will be admitted to the combustion chamber when the piston is at its lowermost position, means controlling operation of said exhaust valve whereby scavenging of the combustion chamber will continue for substantially two-thirds of the upward stroke of the piston after the closing of said air ports. 30 35 40

In testimony whereof I affix my signature.  
WILLIAM N. WARRINGTON.