

O. JOHNSON.  
INTERNAL COMBUSTION ENGINE.  
APPLICATION FILED FEB. 3, 1914.

1,156,846.

Patented Oct. 12, 1915.

2 SHEETS—SHEET 1.

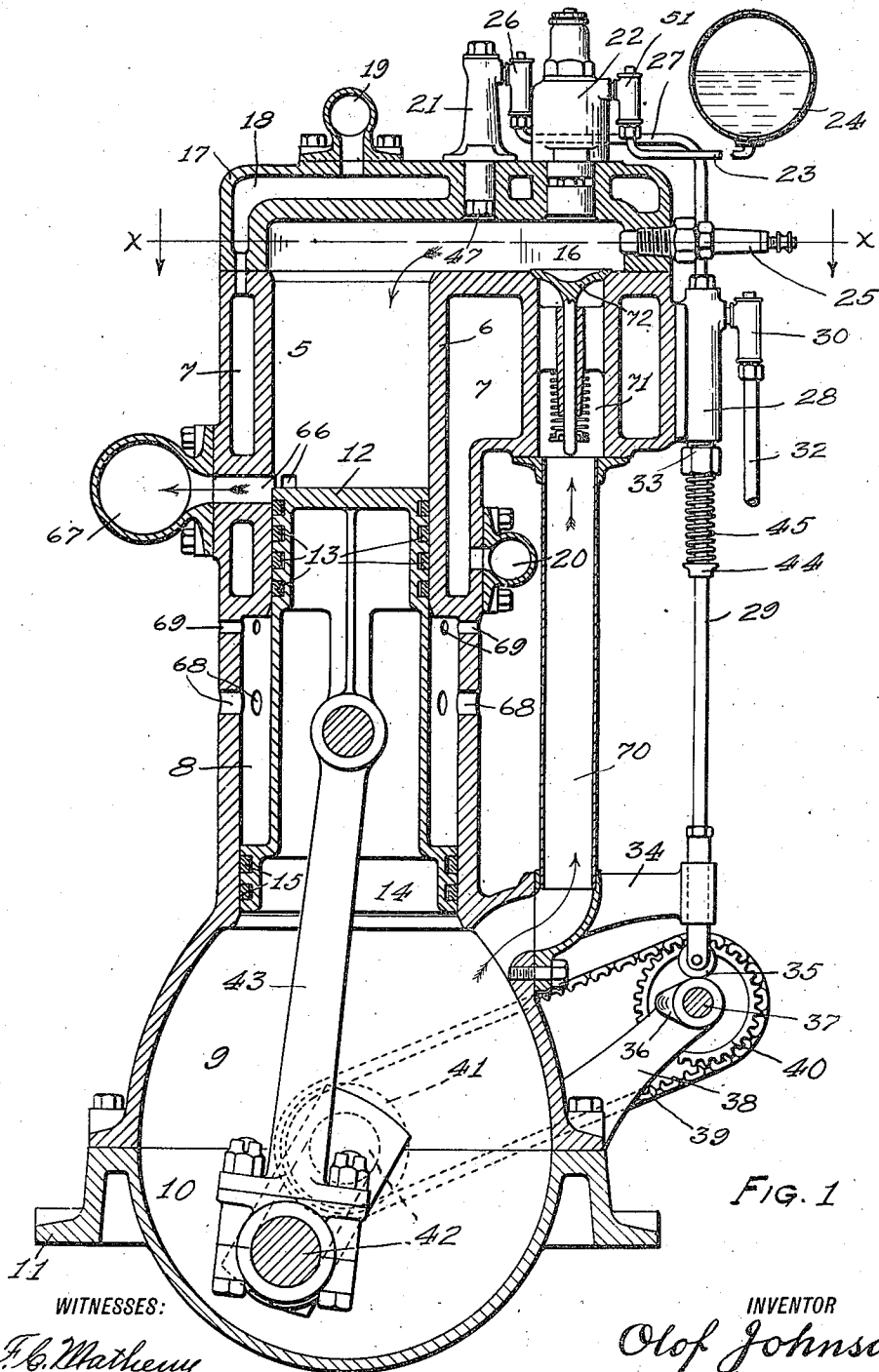


FIG. 1

WITNESSES:

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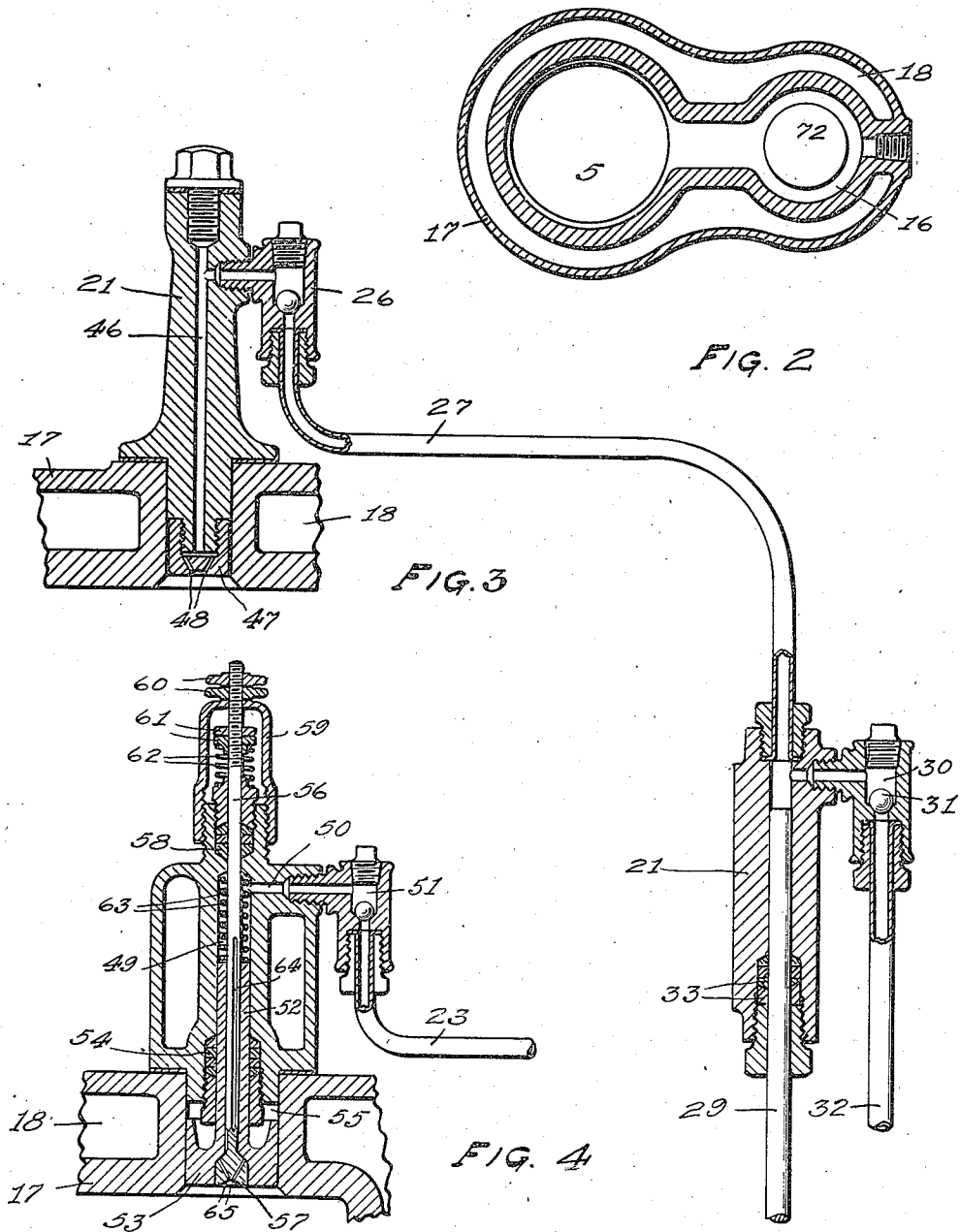
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# UNITED STATES PATENT OFFICE.

OLOF JOHNSON, OF SEATTLE, WASHINGTON.

## INTERNAL-COMBUSTION ENGINE.

1,156,846.

Specification of Letters Patent.

Patented Oct. 12, 1915.

Application filed February 3, 1914. Serial No. 816,153.

*To all whom it may concern:*

Be it known that I, OLOF JOHNSON, citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented a certain new and useful Improvement in Internal-Combustion Engines, of which the following is a specification.

My invention relates to improvements in internal combustion engines, and the object of my improvement is to provide an internal combustion engine in the operation of which a relatively small quantity of highly volatile fuel, as gasolene, alcohol and the like, together with a much larger quantity of a less volatile fuel, as kerosene oil or crude mineral oil, may, at required times, be drawn into its cylinder whereupon the vapor of the more volatile fuel is ignited by suitable means whereby the flame due to the combustion of such highly volatile fuel serves to ignite the less volatile fuel whose combustion serves to expand the resultant gases to create pressure to move its piston.

A further object of my invention is to provide suitable valve controlled mechanism for delivering the two grades of fuel into the cylinder at the proper instants of time and to provide simple and efficient means whereby a supply of fresh air may be forced through the cylinder to drive out all the gases due to the explosion thus thoroughly to scavenge such cylinder while the exhaust port is open.

I accomplish these objects by devices illustrated in the accompanying drawings wherein—

Figure 1 is a view in vertical mid-section of a two cycle internal combustion engine, embodying my invention; Fig. 2 is a view in cross-section of the same on broken line *x, x* of Fig. 1, and Figs. 3 and 4 are enlarged views in vertical section of fuel injecting devices embodied in my invention.

Referring to the accompanying drawings, throughout which like reference numerals indicate like parts, 5 is the cylinder of a two cycle internal combustion engine within whose wall 6 are provided water jacket spaces 7, 7 through which water may be

caused to circulate to prevent the inner walls 6 of the cylinder 5 from becoming overheated. A larger cylinder 8 is formed at the lower end of the cylinder 5 such larger cylinder 8 terminating in a bell shaped bottom portion 9 that is secured to a concave base portion 10 to form a crank case which may serve also as a compression chamber, the base portion 10 having a flange 11 upon which the engine may be supported.

A cylindrical piston 12 provided with the usual piston rings 13, 13 is adapted for reciprocal movements within the cylinder 5, such piston 12 having an enlarged bottom portion 14 that is provided with other piston rings 15, 15 and is disposed to fit and move reciprocally within the larger cylinder 8 to compress air within the compression chamber formed by bottom portions 9 and 10.

The cylinder 5 is of the well known L type and is provided with an ignition chamber 16, as more clearly shown in Fig. 2, such cylinder 5 being herein illustrated as having a removable top or cover portion 17 within the walls of which are provided water jacket spaces 18, 18 that communicate with the spaces 7, 7 and which are connected with a water inlet pipe 19, the spaces 7, 7 being connected with a water outlet pipe 20. The cover portion 17 is further provided with a valve controlled injecting device 21 for crude oil and with another valve controlled injecting device 22 for more volatile fuel, such last named injecting device 22, preferably being connected by a pipe 23, with any suitable source of fuel supply as a fuel tank 24, that is disposed at a point that is at a higher elevation than is the injecting device 22, whereby fuel that may be contained therein may flow through the pipe 23 into the injecting device 22.

A spark plug 25 is provided in the cover portion 17 at a point adjacent to the point of inlet of the more volatile fuel, such spark plug 25 being adapted to be connected with a source of electrical current whereby such spark plug may be caused to ignite fuel within the valve chamber 16 at certain desired instants of time.

The injecting device 21, as more clearly

shown in Fig. 3, is connected through a check valve 26 with a pipe 27 which pipe 27 connects with a pump 28 wherein is disposed a plunger 29, such pump 28 communicating with a valve chamber 30 which has a ball valve 31 disposed therein, the valve chamber 30 being connected by a pipe 32 that may lead to a source of supply of crude oil, not shown. The plunger 29 passes through a stuffing box 33 on the lower end of the pump 28 and thence downwardly through a bearing bracket 34 that is connected with the frame of the engine, such plunger 29 being provided with a bifurcated lower end in which is pivotally mounted a small roller wheel 35 that is adapted to engage with and be moved by a cam 36 which is secured to a shaft 37 which is journaled in a bracket 38 and which is adapted to be rotated by a sprocket chain 39 which engages with a sprocket wheel 40 on such shaft 37 the chain 39 being driven by another sprocket wheel 41, which is illustrated by dotted lines in Fig. 1, and which is secured to a crank shaft 42 that is connected by a rod 43 with the piston 12 in such manner that when the piston 12 is caused to reciprocate within the cylinder 5 the crank shaft 42 will rotate and thereby motion will be transmitted by the sprocket chain 39 to the cam shaft 37 thus causing the cam 36 to lift the plunger 29 at each double stroke of the piston, such plunger 29 being provided with a fixed collar 44 against which a helical compression spring 45 is adapted to bear to cause the plunger 29 to move downwardly after it has been raised by the cam 36. In such manner the plunger 29 is operated within the pump cylinder 28 to draw liquid fuel inwardly through the valve chamber 30 on the downward stroke of such plunger 29 and to force such fuel upwardly through the pipe 27 on the upward stroke of such plunger 29.

The injecting device 21 is provided with a vertical passageway 46 and has a cap 47 screwed onto its lower end, the cap 47 being formed with perforations 48, 48 which converge toward the bottom side, and which are adapted to be slightly spaced from the end surface of the member 21 whereby oil that flows downwardly through the passageway 46 may fill the space between the cap 47 and the end of the member 21 and thence flow downwardly through the perforations 48, 48, such perforations 48, 48 being angularly disposed, as illustrated in Fig. 3, in order that the high pressure due to the burning of the fuel on the downward stroke of the cylinder may not be transmitted directly to the column of fuel in the passageway 46, and a plurality of such perforations 48, 48 being provided in order that the fuel

may be more finely divided when it enters the cylinder.

The fuel injecting device 22 is provided with a vertically disposed cylindrical chamber 49 that is adapted to communicate through a passageway 50 with a check valve 51 which is connected with the pipe 23 and is adapted to permit the more volatile fuel, as gasoline, to flow therethrough into the chamber 49. A tubular plunger 52, having an enlarged bottom end portion 53, extends upwardly through a stuffing box 54 in the bottom of the member 22 and projects its upper end within the cylindrical chamber 49, as clearly shown in Fig. 4, the lower enlarged end portion 53 being adapted to fit within an opening 55 provided in the cover 17, and the plunger 52 being adapted to be held in its proper position by a shaft 56 which is provided with an enlarged lower end 57 and which extends upwardly through a stuffing box 58 and thence through the top portion of a hollow cap 59 that is screwed onto the top end of the member 22, such shaft 56 being secured to the cap 59 by nuts 60, 60 to prevent a downward movement thereof, as clearly shown in Fig. 4, and being provided with nuts 61, 61 against which a helical compression spring 62 is adapted to bear to keep the shaft 56 at the limit of its upward movement, another and stronger compression spring 63 being provided in the chamber 49 to press downwardly on the plunger 52 to counteract the upward pressure of the spring 62 and to keep the enlarged lower end 57 of the shaft 56 snugly seated in the opening that is provided for it in the enlarged portion 53 of the plunger 52, such shaft 56 having on its periphery a plurality of longitudinally extended slots 64, through which fuel may flow, and the enlarged lower end 57 of such shaft 56 being provided with a plurality of angularly disposed perforations 65, 65 through which such fuel may issue into the ignition chamber 16.

The cylinder 5 is provided with suitable exhaust ports 66, 66 that communicate with an exhaust pipe 67 and the lower enlarged cylinder 8 is provided with air inlet openings 68, 68 and with air outlet openings 69, 69, the inlet openings 68, 68 being adapted to admit air into the lower compression chamber as the piston approaches the upward limit of its stroke and the outlet openings 69, 69 forming a means of escape for the air in the cylinder 8 upon the upward stroke of such piston, the fresh cool air which is drawn into the space between the walls of the cylinder 8 and the walls of the piston 12 on each downward stroke of such piston 12 helping to cool said piston 12.

The lower compression chamber formed

by the base portions 9 and 10 is connected by a pipe 70 with a passageway 71 in which is disposed a valve 72, the passageway 70 being adapted to communicate with the ignition chamber 16 as clearly shown in Fig. 1.

The ignition chamber 16 is preferably formed, as illustrated in Fig. 2, and injecting device 22 for the more volatile fuel is positioned adjacent to the spark plug 25, as shown in Fig. 1.

When the piston 12 is in the position shown in Fig. 1, and the exhaust port is open, then the various parts of the injecting device 22 will be in the position shown in Fig. 4, and the chamber 49 and valve 51 and connected passageways will be filled with volatile fuel from the tank 24. As the piston 12 moves upwardly the compression in the cylinder 5 and the ignition chamber 16 increases and just before such piston reaches the highest point in its upward stroke the compression in the chamber 16 becomes high enough to move the plunger 52 upwardly against the force of the spring 63, the shaft 56 moving upwardly at the same time, which movement of the plunger 52 by compressing the fuel in the chamber 49 forces a portion of such fuel to flow downwardly through the slots 64 and to be sprayed from the perforations 65 into the ignition chamber 16. When the piston reaches the highest point in its upward stroke the compression in the cylinder 5, and in the ignition chamber 16, is greatest and the gasified volatile fuel from the injecting device 22 is compressed immediately around the spark plug 25 and at this instant a spark is delivered from the spark plug 25 to ignite such volatile fuel to cause a flame to sweep from the ignition chamber 16 to the cylinder 5 and at the same instant the cam 36 causes the plunger 29 to begin to move upwardly in the pump 28 thus causing crude fuel to be sprayed into the flame produced by the refined fuel to be ignited and burned in suspension to generate a constant pressure on the downward stroke of the piston 12, the pump 28 being adapted to cause the injecting device 21 to deliver crude fuel for any desired portion of the downward stroke of the piston 12.

As the piston 12 moves downwardly in the cylinder 5 the lower enlarged portion 14 moves downwardly in the larger cylinder 8 and compresses the air in the compression chamber formed by the base portions 9 and 10 and when the piston 12 shall have approached the lower limit of its movement and shall have opened the exhaust ports 66, 66, as shown in Fig. 1, then the pressure in the cylinder 5 will drop below the pressure in the pressure chamber formed by the base portions 9 and 10 and the air from such pressure chamber will open the valve 72

and sweep through the ignition chamber 16 and the cylinder 5 and out at the exhaust ports 66, 66 thus completely scavenging the cylinder 5 and filling such cylinder 5 with fresh air which will be compressed for the next explosion.

Obviously the cam 36 may be so formed that any desired amount of crude oil may be admitted for any desired portion of the downward stroke the injecting device 22 being adapted automatically to close when the pressure within the ignition chamber 16 drops and being adapted to be regulated by varying the compression of the spring 62 to admit any desired amount of the more volatile oil.

If desired a mechanically operated injecting device similar to the injecting device 21 may be used to inject the more volatile fuel into the cylinder 5 or such more volatile fuel may be introduced in the form of gas instead of in the form of liquid as herein described, the essential principle of this feature of my engine being that a highly inflammable fuel is used to ignite a crude cheap grade of fuel as crude oil and the crude fuel is caused to burn to generate a pressure and furnish power at a low cost.

Obviously many changes may be made in mechanical details and arrangement of parts of my invention without departing from the spirit thereof or sacrificing any of its advantages.

What I claim is:

1. The method of operating a two cycle internal combustion engine that is provided with a passageway adapted to admit into its cylinder two different grades of fuel each at required different times together with air requisite for combustion, which method consists, first, admitting to said passageway a spray of highly inflammable and refined fuel and a charge of air under pressure in opposition to the spray whereby to thoroughly commingle the spray and air, then in compressing the vapor of the charge of highly inflammable and refined fuel in said passageway by a compression stroke of the engine's piston, then igniting the vapor thus compressed, then admitting a spray of a lower grade of fuel into said compression space to mix with and be ignited by the flame of said compressed vapor whereby pressure is created to produce a power stroke of said piston.

2. In an internal combustion engine, the combination with a cylinder that is provided on one side thereof near its top portion with an ignition chamber that is connected therewith by a passageway, of a piston disposed to reciprocate within said cylinder, an injector adapted to be operated by pressure within said cylinder to deliver a highly in-

flammable fuel into said ignition chamber  
whereby said fuel may be compressed with-  
in said ignition chamber upon the upward  
stroke of said piston, a spark plug to ignite  
5 said fuel whereby a flame will be produced  
in said passageway, an injector disposed in  
said passageway to spray crude fuel into  
said flame, and means for causing a current  
of fresh air to circulate through said igni-  
10 tion chamber and said cylinder to cool said

spark plug and said injectors and scavenge  
said cylinder.

In witness whereof, I, hereunto subscribe  
my name this 29th day of January A. D.  
1914.

OLOF JOHNSON.

Witnesses:

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A. HASKINS.