F. J. C. F. KNAAK.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAY 13, 1913

1,138,575.

Patented May 4, 1915.

2 SHEETS—SHEET 1.

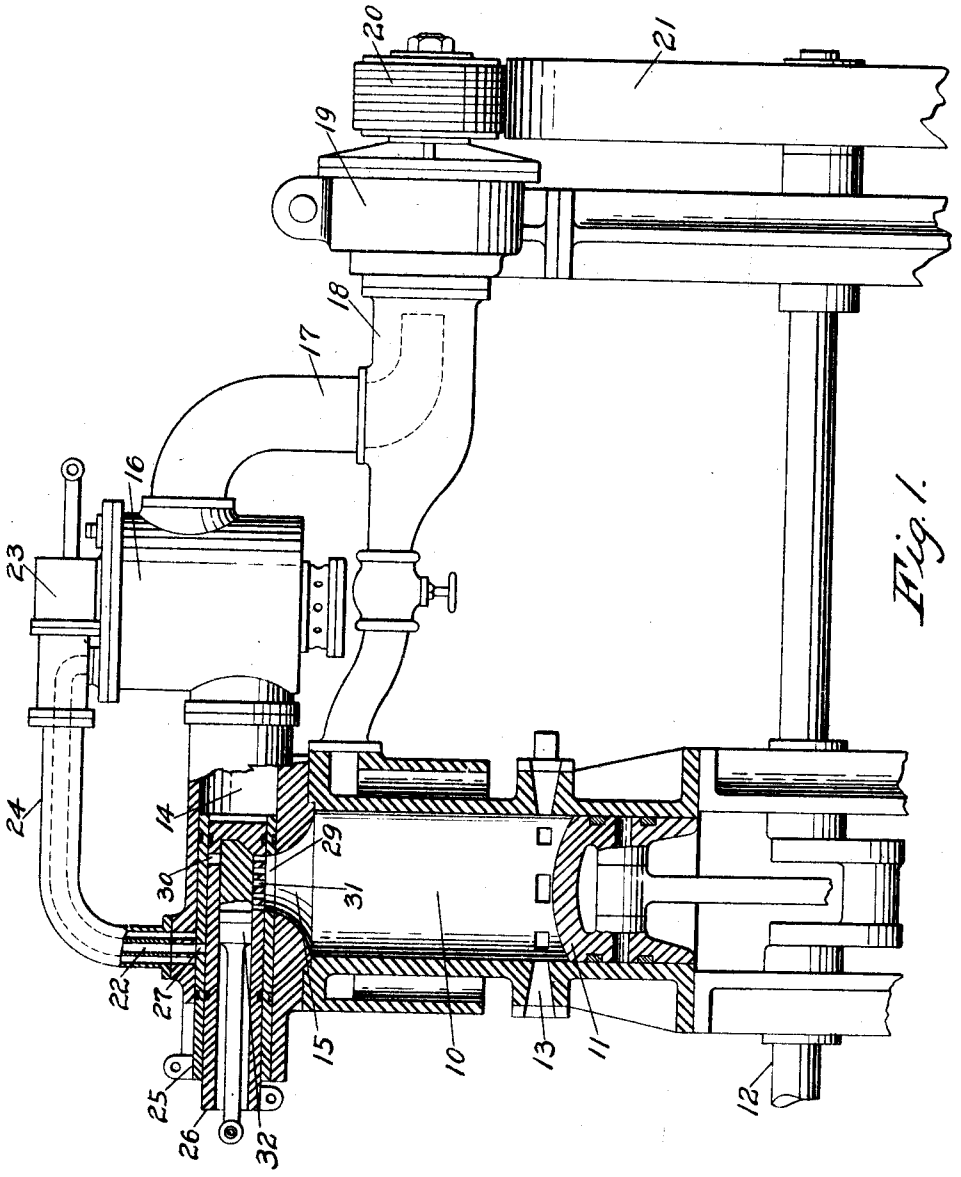


Fig. 1.

Witnesses:
Wm. J. Cohen
Minnie S. Miller

Inventor
Frank J. C. F. Knaak
By his Attorneys
Cohen & Cohen

F. J. C. F. KNAAK.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAY 13, 1913.

1,138,575.

Patented May 4, 1915.

2 SHEETS—SHEET 2.

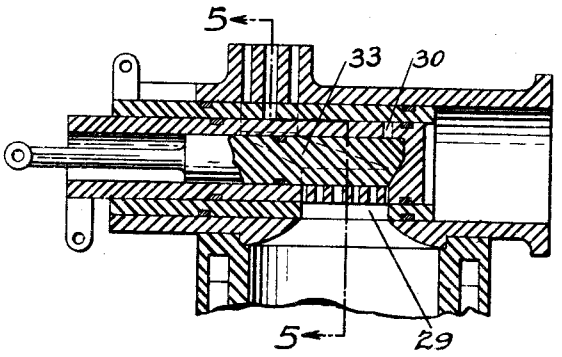


Fig. 4

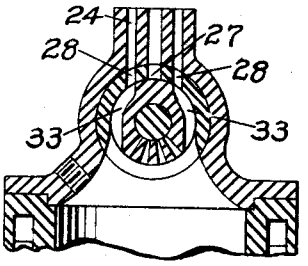


Fig. 5

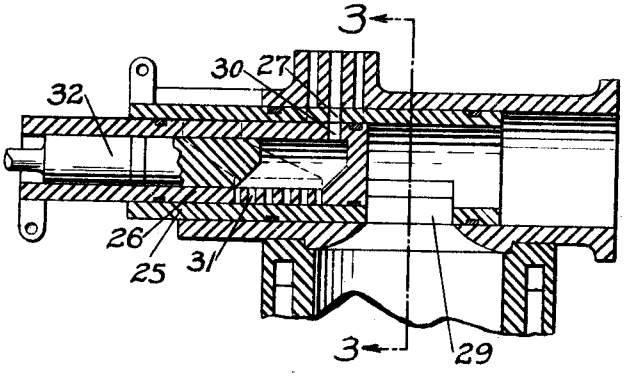


Fig. 2.

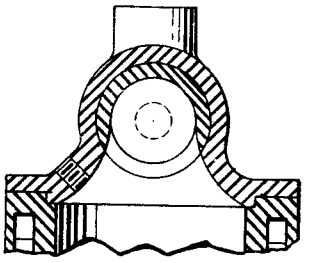


Fig. 3.

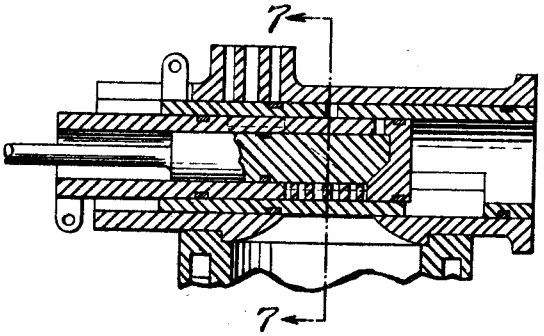


Fig. 6

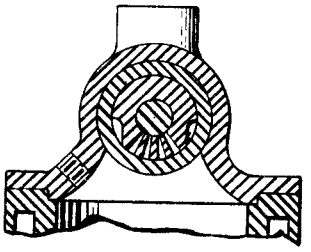


Fig. 7.

Witnesses:
Wm. L. Cohen
Minnie S. Miller

Inventor
Frank J. C. F. Knaak
By his Attorneys
Ashley & Cohen

UNITED STATES PATENT OFFICE.

FRANK J. C. F. KNAAK, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO JOSEPH H. MACDONALD, OF NEW YORK, N. Y.

INTERNAL-COMBUSTION ENGINE.

1,138,575. Specification of Letters Patent. Patented May 4, 1915.

Original application filed February 13, 1911, Serial No. 608,189. Divided and this application filed May 13, 1913. Serial No. 767,487.

To all whom it may concern:

Be it known that I, FRANK J. C. F. KNAAK, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to methods of operating oil engines and has for its principal object to devise a method of operating an oil engine which insures thorough vaporization of the oil and precludes the possibility of carbonization of the oil on the walls of parts through which it is conducted.

In operating oil engines suitable for burning the heavier oils, it has hitherto been found extremely difficult to secure thorough vaporization of the oil and to prevent the oil from carbonizing along the walls of the ducts and chambers through which it is led into the cylinder and also upon the walls of the cylinder itself. To overcome these difficulties, I have devised the following method of operation: The oil is heated under pressure up to substantially the cracking point of the oil at atmospheric pressure. The pressure is maintained upon the oil up to the time of its admission into the cylinder, this admission being a positive force feed which insures that a requisite amount of oil is admitted and the proper pressure on the oil maintained up to the point of admission. As soon as the oil is so admitted, a large portion, consisting of the more volatile matter, immediately vaporizes by reason of the pressure being released. To maintain the temperature of the oil and to insure the proper mixing and vaporizing of the heavier portions, a hot stream of air is forced directly into the cylinder adjacent to the spray of oil. This air not only mixes with the oil and helps atomize the heavier particles, but also maintains the temperature of the entire mixture and thus prevents any condensation due to the expansion upon the release of pressure as above described. The streams of oil and air are admitted directly into the cylinder without passing through any mixing chambers or valves on the surfaces of which the heavier particles of oil may lodge and clog the apparatus. It will be obvious that various constructions may be provided for carrying out this method. I shall describe a preferred construction such as used in my copending application Serial Number 608,189, filed Feb. 13th, 1911, of which this application is a division.

Referring to the drawings, Figure 1 is an elevation partly in section illustrating the general form and arrangement of parts which may be used in carrying out my improved method. Fig. 2 is a detail sectional view of the valve and force feed pump showing the latter in position for receiving the oil charge. Fig. 3 is a section taken along line 3—3 of Fig. 2. Fig. 4 is a sectional detail view of the parts illustrated in Figs. 2 and 3 with the valves and force pump shown in position at which the oil and air are injected into the cylinder. Fig. 5 is a section taken on line 5—5 of Fig. 4. Fig. 6 is a view similar to Figs. 2 and 4, showing the admission valve closed. Fig. 7 is a section taken along line 7—7 of Fig. 6.

The engine is preferably of the two cycle type having a cylinder 10, in which works a piston 11, connected by a suitable connecting rod to a crank shaft 12. The cylinder is provided with the air admission ports 13 which are uncovered by the piston at the end of its power stroke shortly after the opening of the exhaust duct 14. The latter communicates with the exhaust opening 15 of the cylinder which is also used for admission of the mixture. The exhaust, after passing through the duct 14, is carried through a heater 16 and passes out through a conduit 17, the mouth of which opens into a chamber 18, communicating with an exhaust fan 19. The latter is driven in any suitable manner as through friction wheels 20 and 21, the latter of which is fixed to the crank shaft. The exhaust fan 19 serves to accelerate the passage of the exhaust gases and thus secures a better scavenging effect through the fresh air admitted through the air admission port 13.

The fuel oil for the engine is heated under pressure in a heater 16 in any suitable manner, as by being led through the same in a coiled pipe or the like, and thence is led through a duct 22 to a point where it can be admitted to a force pump which forces the same directly into the cylinder. The oil is always maintained under high pressure, so that it may be heated clear up to a point at which the more volatile constituents

would vaporize under atmospheric pressure. This is known as the cracking point of the oil. By maintaining the oil under pressure throughout its course until admitted into the cylinder, it is prevented from cracking until the moment of admission and then the whole jet vaporizes more readily, the volatile constituents of the oil by their expansion assisting the vaporization of the heavier constituents, while the entire oil charge is further assisted in vaporizing by a charge of hot air admitted adjacent to the oil spray and adapted to intimately mix therewith. This charge of air may be heated in the same heater 16 in which the oil is heated and forced by a force pump 23, through a conduit 24, preferably surrounding the oil duct 22 to a point where it may be admitted into the cylinder adjacent to the point of admission of the oil.

I have illustrated herein, valve mechanism for the oil and hot air and also a force pump for the oil such as illustrated and disclosed in detail in my copending application Serial Number 608,189, above mentioned. However, it will be understood that other forms of valve and oil injecting means may be used without departing from the scope of the improved method herein set forth.

The valve and oil injecting mechanism comprises two telescoping sleeves 25 and 26 operated in any suitable manner from a moving part of the engine. The sleeve 25 is open at both ends and has a port 27 registering with the duct 22 and preferably two ports 28, (Fig. 5), registering with the duct or conduit 24. This sleeve is also provided with a large port 29 which is the admission port for the fuel and also constitutes the exhaust port for the burned gases. The sleeve 26 is closed at one end and has a port 30 which may be brought into registration at the proper time with the port 27 of sleeve 25 and conduit 22 to receive a charge of fuel which is subsequently forced out through small spray apertures 31, by means of a plunger 32, which is suitably operated from a moving part of the engine and the throw of which is controlled by the governor. The hot air which is admitted simultaneously with the fuel charge passes through ports 28 in the sleeve 25 and through passages 33 (Figs. 4 and 5) and through admission port 29 into the cylinder simultaneously with the fuel spray.

In Figs. 2 and 3, the valve and fuel feed mechanism is illustrated in position at which the fuel charge is admitted into the interior of the closed sleeve 26, the ports 30 and 27 at this time being in registration as both the sleeves 25 and 26 are moved to the furthest out of their [illegible] left and the port 29 being [illegible] to allow the burned gases to escape. The charge [illegible] position to the left, leaving a closed chamber for the admission of the oil as the apertures 31 are at that time covered by the outer sleeve 25. In the next position illustrated in Figs. 4 and 5, the sleeve 25 is maintained in the position assumed in Figs. 2 and 3, while the sleeve 25 has been moved over to bring the apertures 31 into registration with the port 29, and the plunger 32 is likewise advanced to force the charge of oil through the apertures, thus spraying the same into the cylinder. While the plunger is so actuated, the charge of hot air is admitted into the cylinder through the port 29 by reason of the registration of the passages 33 with the ports 28 in the sleeve 25. Immediately thereafter, or if desired, simultaneously with the admission of the fuel and hot air, the piston commences its compression stroke and the sleeve 25 is then moved forward into the position illustrated in Figs. 6 and 7, in which the port 29 is advanced out of registration with the mouth of the cylinder closing up both the apertures for the oil and the passages for the hot air. The compression stroke is then completed and the charge ignited. During the power stroke, the sleeve 26 is moved to the left to bring the same out of registration with the mouth of the cylinder and then when the engine has about completed its power stroke, the sleeve 25 is quickly moved to the left into the position illustrated in Fig. 2, whereupon the burned gases exhaust through the conduit 14 and are sucked out by the fan 19, the suction of the fan causing a supply of fresh air to be admitted to the admission ports 13 which thoroughly scavenges the cylinder and leaves in the cylinder a supply of pure air when the piston commences its compression stroke.

I have hereinabove described the air charge admitted adjacent to the fuel charge, as being preheated. This is preferable in connection with the use of the heaviest kinds of oils. However, with lighter oils, this preheating of the air may be dispensed with. I do not wish to be limited, therefore, to a mode of operation in which this air charge is heated.

It will be readily understood from the above description, that I have devised a method of operation for an oil engine whereby a heavy oil may be used and thorough vaporization thereof secured, and carbonization prevented, as the oil is heated up previous to admission in the cylinder to a temperature at which the more volatile constituents would vaporize at ordinary pressures. As soon as the oil is admitted, the lighter constituents immediately volatilize and by reason of their expansion assist an atomizing effect upon the heavier portions and the charge is completed [illegible]

prevents the fall in temperature of the oil, and, by mixing intimately with the particles of oil, aids in the atomization and vaporization of the entire charge.

By reason of the admission of the charge to expand directly in the cylinder, assurance is had that no condensation or carbonization takes place, as the fuel, together with the charge of hot air, is intimately mixed with the entire charge of air admitted into the cylinder, and thus no portion of the fuel comes in contact with the cylinder walls until it has become thoroughly atomized and vaporized and mixed with the air charge.

Having thus described my invention, I claim—

The method of operating an oil engine consisting in heating the oil to a temperature at which the lighter constituents would volatilize under ordinary pressures, maintaining the heated oil under pressure sufficient to prevent said lighter constituents from volatilizing, then admitting directly into the cylinder a charge of said oil under said temperature and pressure simultaneously with a charge of hot air adjacent thereto, to mix with another charge of air previously introduced into the cylinder.

Signed at New York city, in the county of New York, and State of New York, this 20th day of January A. D. 1913.

FRANK J. C. F. KNAAK.

Witnesses:

FRANK M. ASHLEY,

NATHAN COHEN.