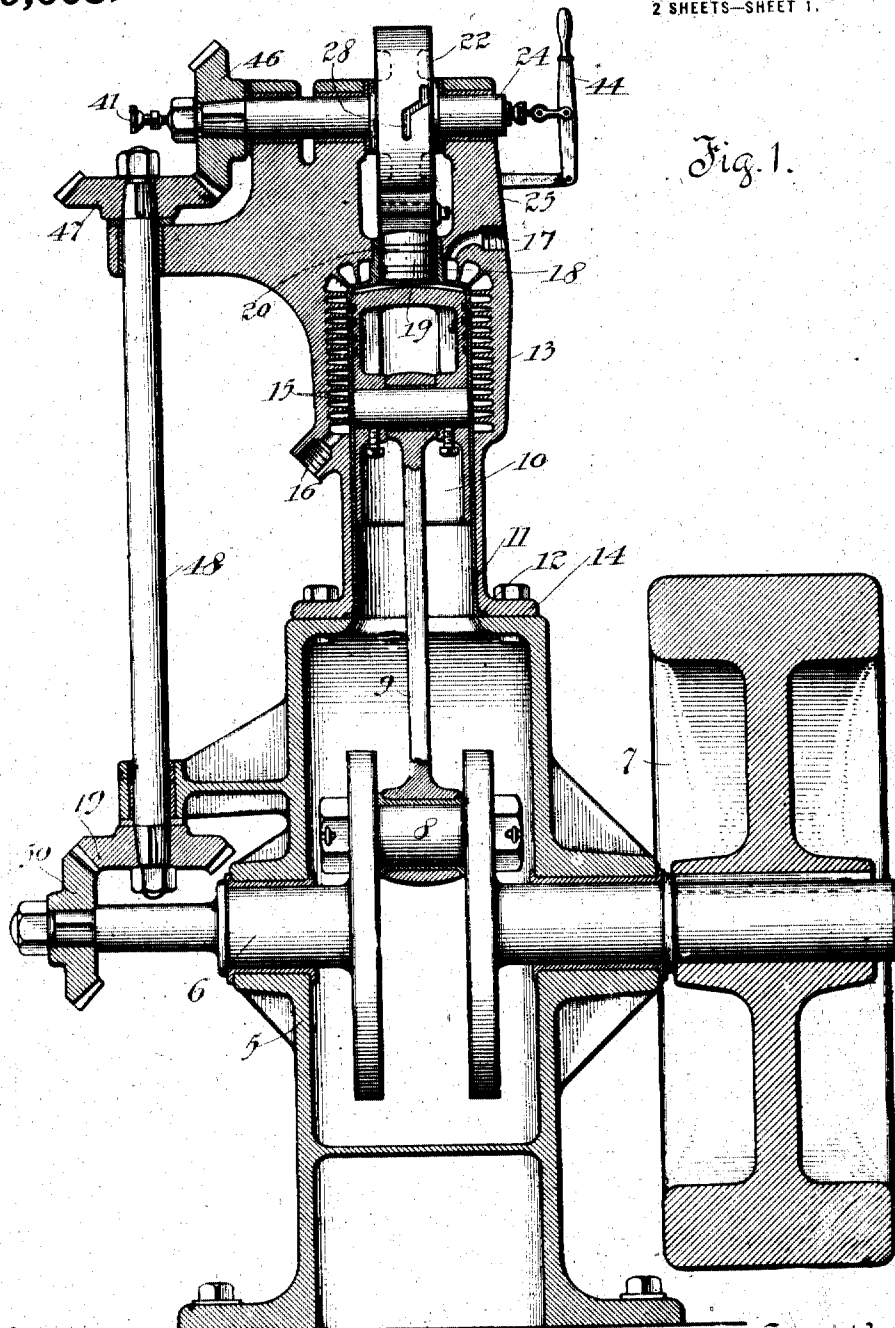


1,279,008.

2 SHEETS—SHEET 1.



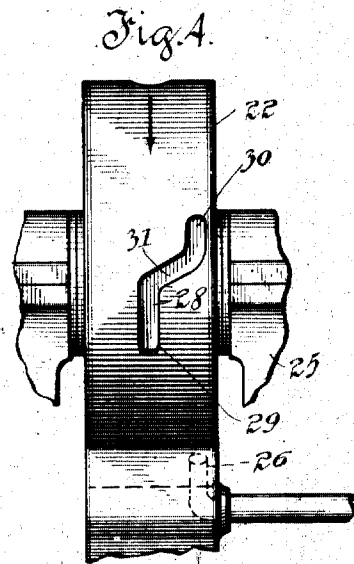
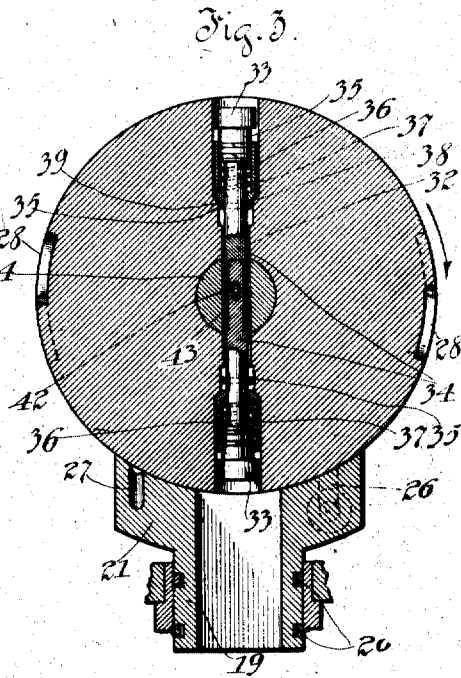
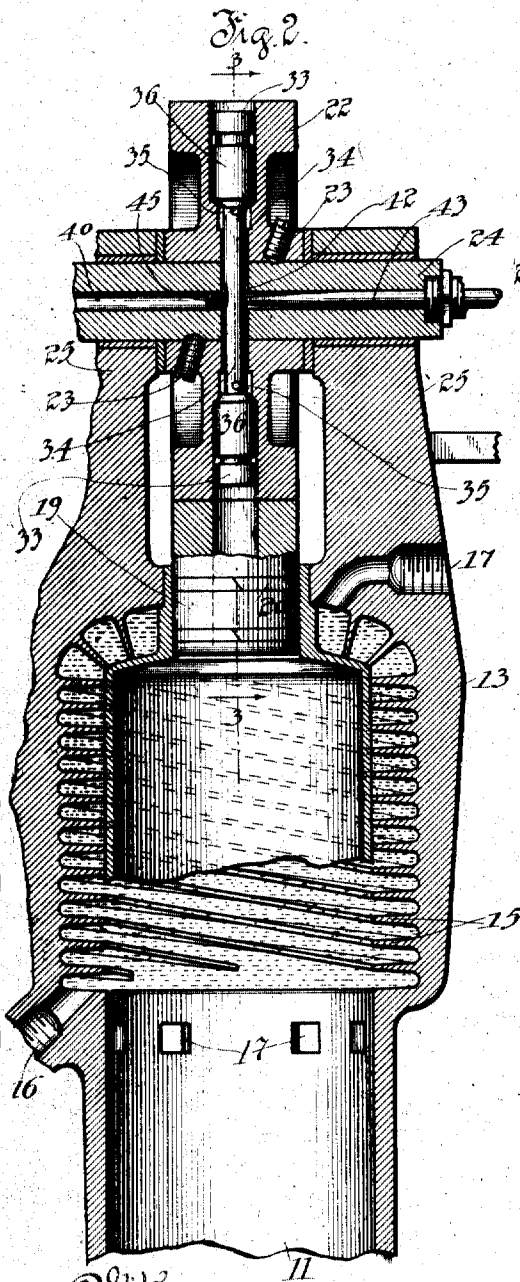
Witnesses
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C. A. ROSS.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED JUNE 10, 1914.

1,279,008.

Patented Sept. 17, 1918.
2 SHEETS—SHEET 2.



Witnesses
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UNITED STATES PATENT OFFICE.

CARL A. ROSS, OF SOUTH BEND, INDIANA.

INTERNAL-COMBUSTION ENGINE.

1,279,008.

Specification of Letters Patent.

Patented Sept. 17, 1918.

Application filed June 10, 1914. Serial No. 844,126.

To all whom it may concern:

Be it known that I, CARL A. ROSS, a citizen of the United States, residing at South Bend, in the county of St. Joseph and State of Indiana, have invented a certain new and useful Improvement in Internal-Combustion Engines, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to internal combustion engines, and the principal object of my present invention is to provide means for effectually cooling the cylinder constituting the combustion chamber of the engine. My invention makes it possible to utilize an extremely thin cylinder for the combustion chamber and to bring the cooling water into direct contact with the exterior of this cylinder. Due to the fact that an extremely thin cylinder is used, the heat from the combustion chamber not utilized to perform useful work is readily taken up by the water-jacket surrounding the combustion chamber. Many engineers have realized the advantages of a thin engine-cylinder; but in the past, so far as I am aware, the provision of such a cylinder has not been practicable, inasmuch as the excessive pressure exerted upon the inner surface of such a cylinder will distort the same unless some means is provided for effectually supporting the cylinder to prevent this distortion. Owing to the fact that in water-cooled engines, the water-jacket must encircle the engine-cylinder, it is a difficult matter to properly support an engine-cylinder of the class mentioned.

In attaining the objects of my invention, I provide an extremely thin cylinder, and around this cylinder I dispose a relatively thick and heavy surrounding shell, which effectually prevents the thin cylinder from being distorted to any appreciable extent. Between the thin cylinder and its surrounding shell I provide a channel for cooling water, this channel being preferably helical, as will be more fully pointed out in the following detailed description. The inclosing shell illustrated in the accompanying drawings is provided with two parallel, inwardly projecting, helical flanges which engage and support the comparatively thin cylinder forming the combustion chamber. These

helical flanges also form helical passages for receiving cooling water.

The preferred embodiment of my invention herein shown and described, and subsequently claimed, also comprises improved mechanism for controlling the admission of air and fuel to the combustion chamber of the engine. This mechanism comprises a rotary valve member positively driven from the engine crank-shaft, controlling the admission of air to the combustion chamber, and carrying plungers operated by the compression produced within the combustion chamber to inject fuel into the combustion chamber at the proper times.

In the accompanying drawings illustrating my invention,—

Figure 1 is a vertical sectional view of my improved engine construction;

Fig. 2 is a fragmentary vertical section illustrating more clearly the cylinder, its surrounding shell and the rotary valve mechanism;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2, looking in the direction indicated by the arrow; and

Fig. 4 is a top plan view of the mechanism shown in Fig. 3, with the rotary valve-member advanced ninety degrees from the position illustrated in Fig. 3.

Similar reference numerals refer to similar parts throughout the several views.

In Fig. 1, the engine crank-case is illustrated at 5, and mounted in the crank-case 5, in suitable bearings, as illustrated, is the crank-shaft 6 having keyed thereon a fly wheel 7, which may also serve as a pulley, if desired. The crank-shaft 6 is provided with a crank 8, to which the lower end of the pitman-rod 9 is attached, the upper end of said pitman-rod 9 being operatively connected with a working piston 10, in a manner well known to those skilled in the art to which my invention relates.

The piston 10 reciprocates within a cylinder 11 provided with a lower annular flange 12 resting upon the top of the crank-case 5. Attention is directed to the fact that the wall of the cylinder 11 is extremely thin and that said cylinder 11 is provided with an inclosing shell 13, which is extremely thick and heavy as compared with the cylinder 11. The inclosing shell 13 effectually serves to prevent distortion of the cylinder 11 under

the high pressures produced therein. The inclosing shell 13 is provided with a lower annular flange 14 secured to the crank-case 5 by bolts or other equivalent means, as illustrated.

As is perhaps most clearly illustrated in Fig. 2, the inclosing shell 13 is provided with a pair of inwardly projecting, parallel, helical flanges 15, 15, which engage the upper end of the cylinder 11. It will be noted that these flanges 15, 15, form helical channels which may be utilized to contain water to cool the cylinder 11; the inclosing shell 13 having formed therein inlet and outlet openings 16 and 17, through which cooling water may circulate. By providing the arrangement just described, it will be seen that I am enabled to provide an extremely thin cylinder, thus securing the advantages of effective cooling without danger of the cylinder being distorted due to the pressure produced therein during the operation of the engine.

The cylinder 11 is provided with a plurality of exhaust ports registering with corresponding openings in the inclosing shell 13. The openings in the inclosing shell are illustrated at 17, 17. The cylinder 11 comprises an upper portion 18 of reduced diameter, and fitting within this portion 18 of the cylinder is a hollow plunger 19 provided with rings 20, said hollow plunger 19 having formed integral therewith a shoe 21 fitting snugly against the periphery of a rotary valve member 22. The valve member 22 is secured, by means of set screws 23, 23, upon a shaft 24 mounted in suitable bearings in the upwardly projecting portions 25, 25 of the shell 13.

As is most clearly illustrated in Fig. 3, the shoe 21 is provided with a port 26 connected with a source of air under pressure, and said shoe may also, if desired, be provided with a port 27 through which oil may be forced to lubricate the rotary valve-member 22 as the same is rotated.

Disposed 180 degrees apart and cut in the periphery of the rotary valve-member 22 are the channels 28, 28, each of which comprises a portion 29 located at substantially the middle of the periphery of the rotary valve-member, a portion 30 parallel to the portion 29 and located adjacent the edge of the periphery of the rotary valve-member, and a portion 31 connecting the portions 29 and 30, as illustrated in Fig. 4. When in the operation of the engine the rotary valve-member 22 is operated by mechanism to be subsequently described, the portion 30 of one of the channels 28 comes into register with the port 26, air under pressure is forced through the hollow plunger 19 into the combustion chamber, inasmuch as at this time the portion 29 of the channel registers with the opening through the plunger 19 and shoe

21. The opening through the plunger and shoe is substantially rectangular in cross section, as is clearly illustrated in Figs. 2 and 3 of the drawings.

Passing through the rotary valve-member 22 and the shaft 24 on a radial line substantially at right angles to a radial line passing through both of the channels 28 in the periphery of the valve member, is an opening 32 in which works a pair of connected plungers 33, 33. The plungers 33 are connected by suitable rods 34, 34, threaded one within the other, as is clearly illustrated in Fig. 3. In practice, there is a slight clearance between the plungers 33, 33 and the walls of the opening 32, as well as a slight clearance between the walls of the opening 32 and the rods 34, 34, which connect the plungers. These clearances have, in the accompanying drawings, been enlarged to indicate that they do exist, but one skilled in the art to which my invention relates will be able to provide the proper clearances. Each of the plungers 33 has a portion 35 of reduced diameter, upon which is slidably mounted a sleeve 36, and interposed between the reduced portion 35 of the plunger and the end of the sleeve nearest the axis of the rotary valve-member 22 is a coiled spring 37 normally tending to force the beveled end 38 of the sleeve tightly into engagement with a beveled seat 39 therefor formed in the wall of the opening 32 through the rotary valve-member. As is illustrated in Fig. 3, there is a slight clearance between each of the sleeves 36 and the walls of the opening 32, within which the plungers 33, 33 operate. Passing through each of the rods 34, 34 is a pin 35, which is adapted to be brought into engagement with one of the sleeves 36, 36, to lift the sleeve from its seat in a manner to be more fully hereinafter described.

As is illustrated in Fig. 2 of the drawings, the shaft 24 carrying the rotary valve-member 22 is provided with a longitudinal axial bore 40, the left-hand end of which (Fig. 1) is arranged to be connected through a suitable coupling 41 with a source of liquid fuel, preferably under a pressure of from three to five pounds. It will be seen by referring to Fig. 2 that, inasmuch as the connecting rods 34, 34 do not engage the walls of the opening 32, fuel admitted through the opening 40 in the shaft 24 may flow into the opening 32 and past the sleeves 36, provided the sleeves 36 do not engage their seats 39. Formed in the connecting rods 34, 34 is an opening 42, into which extends the tapered end of a rod 43 projecting into the axial bore 40 from the right-hand end thereof (Fig. 1), the position of the rod 43 being determined by a lever 44 supported by the engine framework. At its left-hand end, the rod 43 is provided with a spider 45, 130

which serves to center the rod 43 within the bore 40. It will be seen that the rod 43 determines the amount of reciprocation that may be imparted to the connected plungers 33, 33.

The shaft 24 and rotary valve-member 22 are driven at one-half crank-shaft speed through suitable gearing most clearly illustrated in Fig. 1. This gearing comprises a bevel gear 46 fixed upon the shaft 24, this gear 46 meshing with a bevel gear 47 fixed upon a vertical shaft 48, the upper end of which is supported in a bearing carried by the shell 13, and the lower end of which is supported in a suitable bearing carried by the crank-case. At its lower end, the shaft 48 is provided with a bevel gear 49 meshing with a bevel gear 50 fixed to the crank-shaft 6.

The operation of the engine illustrated in the accompanying drawings is as follows:

Assuming the several parts to be in the positions shown at Figs. 1 to 3 of the drawings, and assuming that there is a quantity of liquid fuel between the enlarged portion of the lowermost one of the plungers 33 and its associated sleeve 36, when the working piston 10 reaches the position shown in Fig. 1, the compression produced in the combustion chamber will force the connected plungers 33, 33 upwardly, thus forcing into the combustion chamber a portion of the liquid fuel contained in the space between the enlarged portion of the lowermost one of the plungers 33 and its associated sleeve 36. At the same time, the uppermost one of the sleeves 36 is engaged and unseated by its associated pin, thus permitting fuel to flow from the bore in the shaft 24, up around the said uppermost sleeve 36, to the space between said sleeve and the portion of greatest diameter of the associated plunger 33. While it has not been possible to clearly illustrate the clearance in the drawings, I will say that, in practice, the clearance between the enlarged portion of the plunger 33 and the walls of the opening in which the plunger reciprocates is not so great as the clearance between the other parts, so that therefore the fuel, under a few pounds pressure forced upwardly past the sleeve 36, as just described, is not forced past the plunger 33, but remains in the pocket between the enlarged portion of the plunger 33 and the sleeve 36.

When fuel is injected into the combustion chamber as above described, the heat of the compressed fluid within the combustion chamber serves to ignite the combustible mixture of fuel and air. The piston is then driven on its working stroke. Shortly before the piston reaches the limit of its working stroke, it uncovers the exhaust ports at the lower end of the cylinder and

permits the major portion of the burned gases to escape from the engine cylinder. By this time the rotary valve-member 22 has advanced ninety degrees, thus bringing one of the channels 28 into position to permit the admission of air under pressure from the port 26 in the shoe 21. This air serves effectually to scavenge the engine cylinder, and supplies the air to be compressed on the succeeding upward stroke of the piston. The portion 30 of the channel 28 remains in register with the port 26 but a short time, so that shortly after the piston has reached the limit of its down stroke, the passage of air from the port 26 to the combustion chamber is cut off, and the upward stroke of the piston serves to compress the air previously admitted to the combustion chamber.

By the time the piston reaches the top of the combustion chamber, the rotary valve-member 22 has moved another ninety degrees in the direction of the arrow shown in Fig. 3, thus bringing the second one of the plungers 33, 33 into register with the opening through the shoe 21. The compression produced within the combustion chamber serves to move the connected plungers 33, 33 upwardly, thus forcing fuel into the combustion chamber. The cycle of operation just described will be then repeated. It will be seen that the amount of reciprocation that may be imparted to the connected plungers 33, 33, and consequently the amount of fuel admitted to the combustion chamber, may be adjusted by operating the rod 43 by means of the controlling lever 44.

While I have illustrated my invention in the particular embodiment herein shown and described, I do not wish to be limited to this construction, but desire to claim any equivalent arrangements embodying my invention that may suggest themselves to those skilled in the art.

What I claim as new, and desire to secure by Letters Patent of the United States, is:—

1. An internal combustion engine comprising in combination with a cylinder constituting a combustion chamber, said cylinder being constructed of relatively thin material and being alone incapable of withstanding the pressure created therewithin without distortion, a relatively thick and heavy shell including said cylinder and provided with inwardly-projecting helical ribs engaging and supporting said cylinder, together with means for circulating cooling water through the passages between said helical ribs.

2. An internal combustion engine comprising in combination with a cylinder constituting a combustion chamber, said cylinder being constructed of thin material, together with a relatively thick and heavy shell inclosing said cylinder and provided with an inwardly-projecting rib engaging

said cylinder in a helical line from top to bottom and serving to support said cylinder in operative position.

5 8. An internal combustion engine comprising in combination with a cylinder constituting a combustion chamber, said cylinder being constructed of thin material, together with a relatively thick and heavy shell enclosing said cylinder and provided with a pair of inwardly-projecting ribs, each of
10 which engages said cylinder in a helical line,

said ribs constituting with the cylinder and shell a pair of independent passages for cooling water, together with means for circulating cooling water through said passages.

In witness whereof, I hereunto subscribe my name this sixth day of June, A. D. 1914.

CARL A. ROSS.

Witnesses:

EDNA A. KOCHENDERFER,
RUTH SCHUTT.