H. H. SIMON.

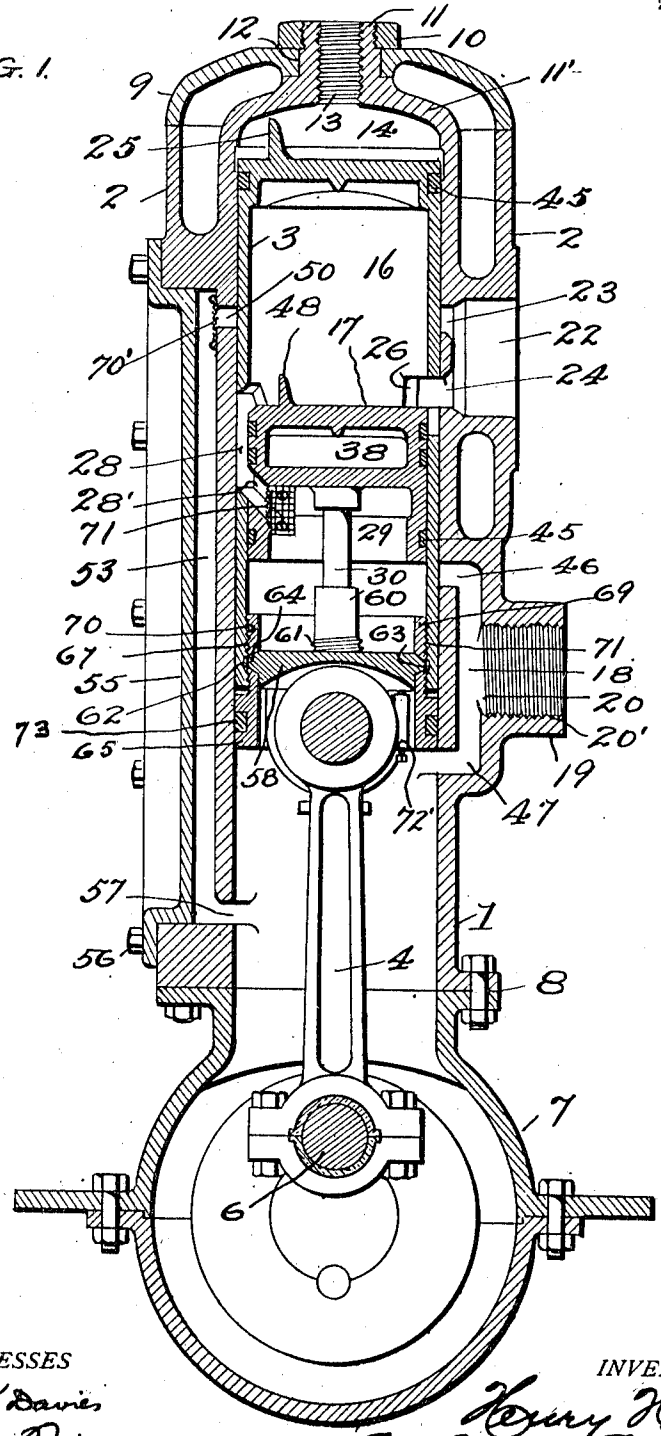
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JUNE 20, 1910.

**1,004,095.** Patented Sept. 26, 1911.

2 SHEETS—SHEET 1.

FIG. 1.

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2 SHEETS—SHEET 2.

FIG. 2.

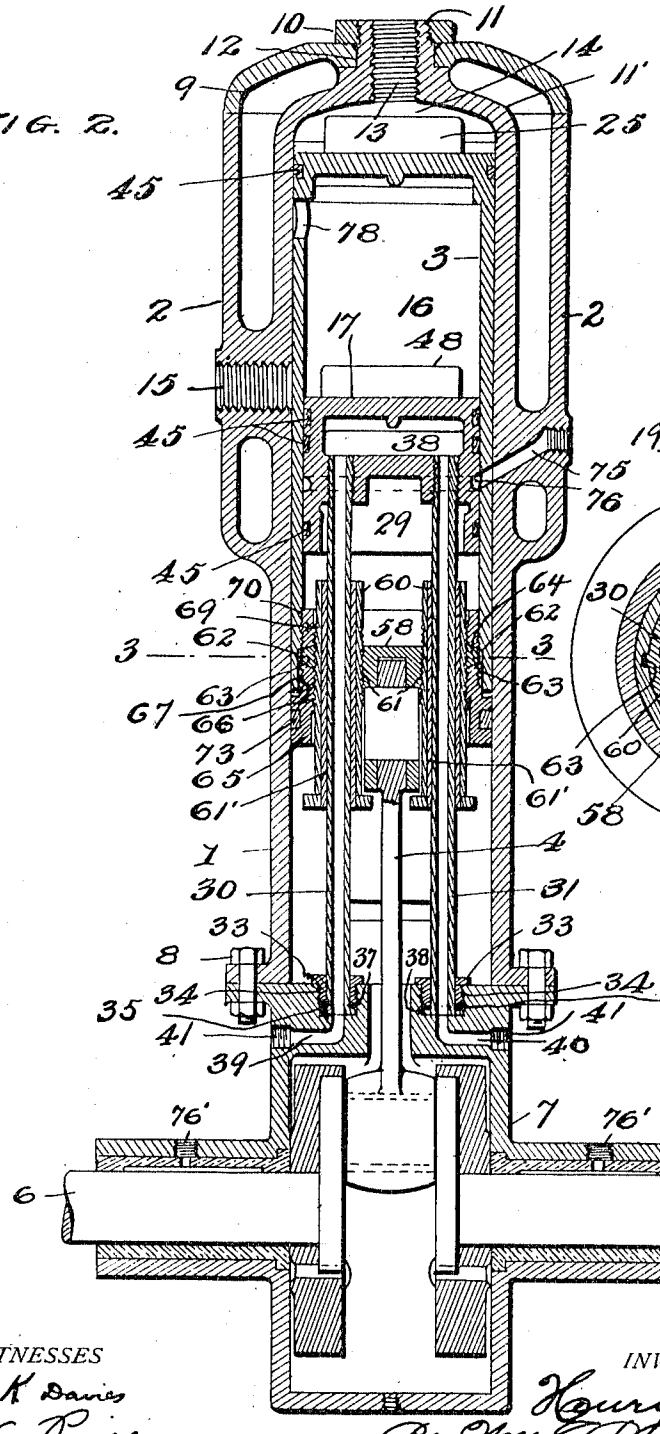
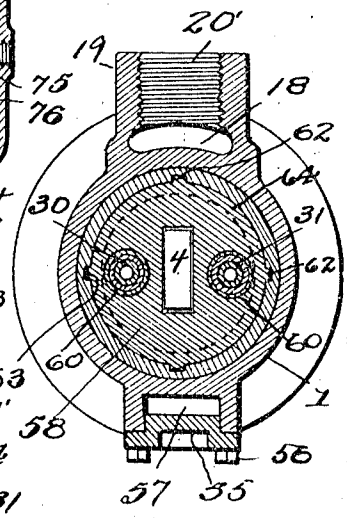



FIG. 3.

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# UNITED STATES PATENT OFFICE.

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## INTERNAL-COMBUSTION ENGINE.

1,004,095. Specification of Letters Patent. **Patented Sept. 26, 1911.**

Application filed June 20, 1910. Serial No. 568,020.

*To all whom it may concern:*

Be it known that I, HENRY H. SIMON, citizen of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to internal combustion engines and among the objects in view is to provide an engine of the described character which will be extremely simple and compact in construction, inexpensive to manufacture, economical in operation, and wherein two power explosions are obtained in each cylinder employed at each revolution of the crank shaft.

Other objects and advantages of the invention will appear from the following description when taken in connection with the accompanying drawings.

The invention consists in the novel construction, arrangement and combination of parts as hereinafter fully described, illustrated in the drawings and pointed out in the appended claims.

In the drawings:—Figure 1 is a vertical sectional view of my improved engine, showing the movable piston at about the limit of its outward or upward stroke and the compressed charge above the piston about to be exploded. Fig. 2 is a central vertical sectional view of Fig. 1. Fig. 3 is a horizontal section on line 3—3 of Fig. 2.

While I have shown in the drawings and will hereinafter describe a single cylinder engine yet it will be understood that I may employ any number of cylinders whose pistons will be coupled to a common crank shaft for imparting power thereto. It will also be understood that I may construct the engine of any desired power capacity. Furthermore while I have shown my invention applied to a water-cooled engine it is equally well adapted for application to air-cooled engines.

In the drawings, 1 indicates the cylinder of my engine having, preferably, an integral water jacket 2.

3 indicates the hollow piston which is adapted to reciprocate within the cylinder and coupled by connecting rod 4 to the crank-shaft 6 suitably mounted in the crank case 7, bolted as at 8 to the lower end of the cylinder. The upper end or head 9 of the water jacket is preferably cast separately and is secured in position by means of a nut 10 screwing upon the threaded extension 11 on the head 11′ of the cylinder 1.

The head 9 has a central bore 12 which fits over the extension 11 and the clamping nut 10 seats upon the upper face of the head 9, as shown. The head 11′ of the cylinder is provided with a threaded bore or opening 13 for the reception of a spark-plug for furnishing the spark for the compressed explosive charge in the explosion chamber 14 between the upper face of the piston and the head 11′ of the cylinder. At one side the cylinder is also provided with a threaded bore or opening 15 to receive a spark-plug for furnishing the spark to the compressed explosive charge in the explosion chamber 16 between the lower face of the piston and the abutment 17 presently referred to. Toward its lower end the cylinder is provided with a port or passage 18 which constitutes the gas intake, the cylinder having an extension 19 provided with a bore 20 leading to or, in reality, forming a continuation of the intake port 18 and being threaded as at 20′ for the attachment of a pipe leading to a suitable carbureter. Toward its upper end the cylinder is provided with a port or passage 22 constituting the exhaust port for the spent gases. Adjacent to the inner wall of the cylinder the port 22 is divided forming two portions or branches 23, 24, located one above the other. A suitable exhaust pipe is adapted to be attached to the cylinder to communicate with the port 22.

25 indicates a deflecting plate on the upper face of the piston and cast integrally therewith adjacent to the peripheral edge of the piston.

The piston is provided in its wall with a port 26 which is adapted to communicate with the exhaust port 22, *i. e.* with the branch 24 thereof, when the piston is at or about at the limit of its upward or outstroke, thus placing the explosion chamber 16 in communication with the said exhaust port. When the piston is at or about at the limit of its downward or instroke the upper face of the piston will clear or uncover the

branch 23 of the exhaust port thus placing the explosion chamber 14 in communication with said exhaust port.

In its wall opposite the port 26, the piston is provided with a port 28, which, when the piston is at or about at the limit of its upward or outstroke, will place the explosion chamber 16 in communication with the space 29 below the abutment 17 by way of a port 28′ in said abutment. The latter is stationarily arranged within the piston and has a close bearing upon the inner wall of the same. It is arranged at such a point that its upper face will be about on a line with the lower edge of the branch 24 of the exhaust port, and for the purpose of stationarily supporting the abutment in position, I employ two supports 30, 31, preferably in the form of hollow pipes, whose upper ends thread into the abutment while their lower ends are suitably secured to the crank-case, as by means of gland nuts 33, which fit over the lower ends of the pipes and screw into threaded recesses 34 in the crank case and having beveled seats 35, 36 for a packing 37 confined between said seats and flanges 38 on the pipes.

In order to provide for water-cooling of the abutment I make the abutment 17 hollow, thereby providing a water space 38 therein and with which space the bores of the pipes 30, 31, communicate. I also provide the crank case with passages 39, 40, the inner ends whereof communicate with the bores in the pipes 30, 31 respectively. The passages 39, 40, extend through the metal of the crank case to the outer faces thereof and their outer ends are threaded as at 41 for the attachment of pipes forming part of the water-circulation system of the engine. Thus, I obtain a circulation of water which entering by way of the passage 39, flows upward through pipe 30 and into the space 38 and thence downward through pipe 31 and out through passage 40.

45, indicate metallic rings provided in the outer faces of the piston and the abutment for maintaining tight joints between the piston and the cylinder and between the abutment and the piston to prevent leakage of the explosive mixture.

The intake port 18 for the charges of explosive mixture is divided, forming branches 46, 47. When the parts are in the position seen in Fig 1, *i. e.* with the piston at the limit of its outstroke, the branch 46 is covered by the piston, while the branch 47 is uncovered thereby, placing the interior of the crank case in communication with the intake port to receive a charge of explosive mixture. The upper face of the abutment 17 is provided with an integral deflecting plate 48 on the side adjacent the port 28. The cylinder is provided in its wall with a port 50 which is covered by the piston when the latter is at the limit of its outstroke and remains covered until the piston is at or about at the limit of its instroke.

The port 50 is for the purpose of conducting explosive mixture from the crank case into the explosion chamber 14 when the piston is at the end of its instroke so as to be compressed on the next outstroke of the piston, and for this purpose said port 50 is in communication at all times with the interior of the crank case by means of a conduit or pasage 53, formed preferably by casting the cylinder so as to provide a recess constituting said passage which is covered by a plate 55 bolted as at 56 to the cylinder, and also providing the cylinder with a port 57 which places the passage 53 in communication with the space within the lower end of the cylinder as well as the crank chamber. The lower end of the piston is closed by a cross-head 58 in the form of a plate, through which extend sleeves 60 which are threaded within the cross head, as seen at 61, and through the sleeves 60 extend the pipes 30, 31. Sleeves 61′ of antifriction metal, as Babbitt metal, are arranged between the sleeves 60 and the pipes 30, 31, which latter thus form points of bearing for the cross-head and the sleeves 60 during their reciprocating movements, thus affording additional rigidity for the parts during the operation of the engine.

For the purpose of securely locking the cross-head to the piston and preventing any turning or twisting movement of said cross-head I provide the inner wall of the piston adjacent its lower end with a plurality of recesses 62 (four for instance, as shown) within which engage lugs 63 provided on the circumferential edge of a flange 64 on the cross-head. A ring or collar 65 is threaded as at 66 to engage the threads 67 on the piston and the upper edge or face of which collar is adapted to seat against the lower face of the flange 64 on the cross-head. A ring or collar 69 is threaded as at 70 and engages the threads 67 on the piston and the lower edge or face of which collar 69 seats against the upper face of the flange 64 of the cross-head. It will thus be seen that after the lugs 63 on the cross-head have been engaged within the recesses 62 in the piston and the collars or rings 65, 69 have been screwed tightly up against the flange of the cross-head, the latter will be locked firmly in position and prevented from turning. For the purpose of securely locking the collar 65 in position I employ a set-screw 72′ which screws within collar 65 and impinges against the cross-head 58. I preferably bevel the upper and lower faces of the flange 64 and correspondingly bevel the upper face of collar 65 and lower face of collar 69 to obtain a tighter union of the parts. I preferably secure a wire-gauze screen 70′ over the port

50 to prevent back-firing through said port into the passage 53, while a similar screen 71 is secured over the port 28′ to prevent back-firing through said port into the space below the abutment.

73 indicates a metallic packing ring provided in the collar 65 between the latter and the inner wall of the cylinder. The cylinder is provided with a passage 75 adapted to communicate with a suitable supply of lubricant and communicating with an oil duct or passage 76 formed in the outer wall of the abutment for conducting lubricant to the inner surface of the piston.

76′ are threaded openings in the tubular extensions of the crank-case supporting the crank shaft and adapted to receive suitable compression grease-cups.

The piston is provided toward its upper end with a port 78 adapted to come opposite the bore 15 when the piston is at the limit of its instroke, whereby the spark which then occurs might ignite the compressed charge in the chamber 16.

The operation of my improved engine may be described as follows: The parts being in the position seen in Fig. 1, there is a compressed explosive charge in the space 14; the port 26 is in communication with the exhaust port 22 allowing the spent gases from the previous explosion in chamber 16 to exhaust therefrom; the port 28 is also in communication with the space 29 below the abutment allowing a charge of mixture compressed therein to flow into space 16 to assist in driving out the exhaust therefrom. The spark now occurring at the plug contained in opening 13 the explosion in chamber 14 will drive the piston inward, thus compressing in the crank chamber the charge already admitted through port 47, and when the piston has about reached the limit of its instroke its upper end will uncover the port 50 thus permitting the charge to flow from the crank chamber through port 57, passage 53, and port 50 into the chamber 14. During the said instroke of the piston the same will close the port 24 and will compress the charge of mixture contained in space 16, and as soon as the port 78 registers with opening 15 the spark from the plug in said opening will ignite the charge to drive the piston upwardly. When the piston is about reaching the limit of its instroke the port 26 therein will register with the branch 46 of the mixture intake-port and also come into communication with the space 29, and by reason of the partial vacuum created in chamber 29 by the instroke of the piston the mixture will be drawn into chamber 29 from intake branch 46, through port 26. At the same time the upper face of the piston will have come below the branch 23 of the exhaust port and the exhaust from chamber 14 will pass out through said exhaust port. This exhausting of the spent gases will be hastened by the fresh charge flowing through port 57, passage 53, and port 50 into the chamber 14.

By reason of the explosion occurring in chamber 16, as just above referred to, the piston will be driven upwardly, creating a partial vacuum in the crank chamber, and also compressing the charge in chamber 14, and as soon as port 26 registers with branch 24 of the exhaust port 22, the exhaust gases will pass out through said port 22, being hastened by the charge previously compressed in space 29 by the outstroke of the piston flowing through ports 28′ and 28. When the piston in its upward movement uncovers port 47, mixture will flow therethrough into the crank chamber owing to the partial vacuum therein, ready to be compressed when the piston makes its next instroke, preparatory to being admitted through port 57, passage 53, and port 50 into the explosion chamber 14.

What I claim is:—

1. In an internal combustion engine, the combination with a cylinder and a piston reciprocably arranged within said cylinder, of an abutment stationarily arranged within the piston, a cross-head carried by the piston, a connecting rod jointed to the cross-head, rods on which said cross-head is slidingly arranged, lugs on the cross-head engaging in recesses in the piston, rings threaded within the piston on opposite sides of the cross-head and adapted to bear upon said cross-head, and means for locking one of said rings to the cross-head.

2. In an internal combustion engine, the combination with a crank-case having fluid admission and fluid outlet ports, of a cylinder, a piston reciprocably arranged within said cylinder, a hollow abutment stationarily arranged within the piston and forming an explosion chamber between it and the outer head of the piston, a cross-head carried by the piston, a connecting rod jointed to the cross-head, hollow rods constituting supports for the abutment and communicating at one end with the interior of the abutment and at the other end with the ports in the crank-case and upon which rods the said cross-head is slidingly arranged, lugs on the cross-head engaging in recesses in the piston, rings threaded within the piston on opposite sides of the cross-head and adapted to bear upon said cross-head, and means for locking one of said rings to the cross-head.

3. In an internal combustion engine, the combination with a cylinder, and a piston reciprocably arranged within said cylinder, of an abutment stationarily arranged within the piston, rods constituting supports for said abutment, a cross-head carried by the piston, a connecting rod jointed to the cross-head, sleeves carried by the cross-head and

having a sliding bearing on the said rods, lugs on the cross-head engaging in recesses in the piston, rings threaded within the piston on opposite sides of the cross-head and adapted to bear upon the latter, and means for locking one of said rings to the cross-head.

4. In an internal combustion engine, the combination with a cylinder having an oil duct, and a piston reciprocably arranged within the cylinder and having a port, of an abutment stationarily arranged within the piston and having an oil duct in its exterior wall, said piston being adapted in its reciprocation to bring the said port into register with the ducts in the cylinder and abutment.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY H. SIMON.

Witnesses:
M. W. DARG,
W. E. BOULTER.