J. DAY.

COMBUSTION ENGINE.

APPLICATION FILED DEC. 13, 1911.

1,039,705. Patented Oct. 1, 1912.

Fig. 1.

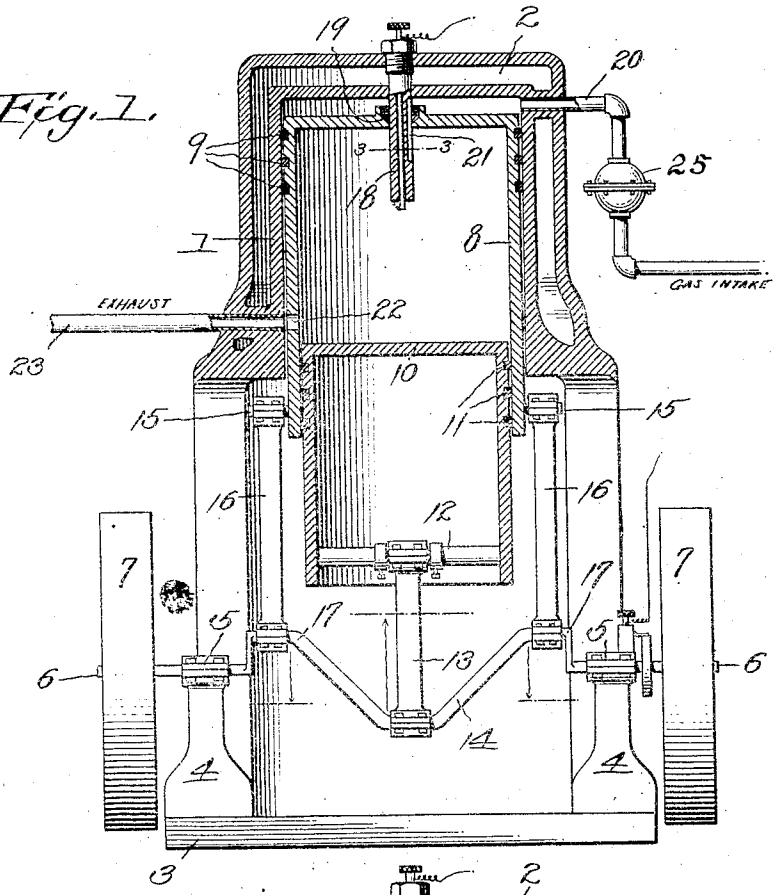


Fig. 2.

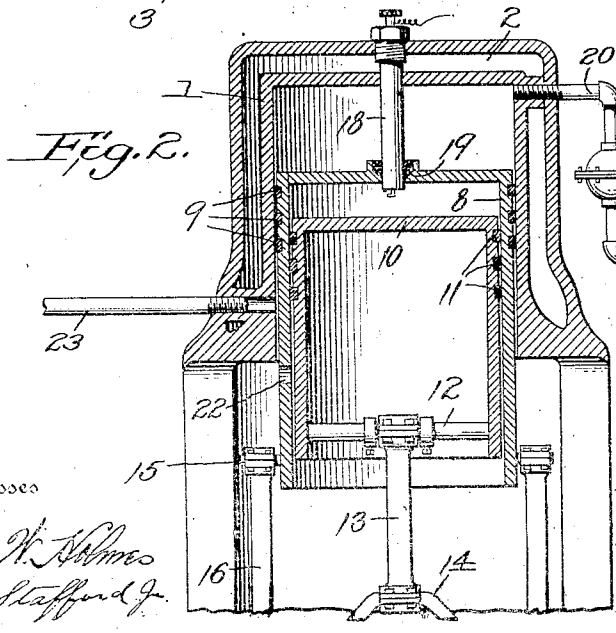
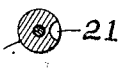


Fig. 3.



Witnesses

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COMBUSTION-ENGINE.

1,039,705. Specification of Letters Patent. Patented Oct. 1, 1912.

Application filed December 13, 1911. Serial No. 665,430.

To all whom it may concern:

Be it known that I, JAMES DAY, citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Combustion-Engines, of which the following is a specification.

The present invention relates in general to internal combustion engines, and has for its object to provide an engine of this character which includes two pistons working in opposite directions and which embodies novel features of construction whereby the force of the explosion is very effectively utilized.

A further object of the invention is to provide an internal combustion engine of this character which is comparatively simple and inexpensive in its construction, which operates automatically to draw in the fresh charges and discharge the exhaust gases, and which will run with a smooth and even motion.

With these and other objects in view, the invention consists in certain novel combinations and arrangements of the parts as will more fully appear as the description proceeds, the novel features thereof being pointed out in the appended claims.

For a full understanding of the invention, reference is to be had to the following description and accompanying drawing, in which:—

Figure 1 is a vertical sectional view through an internal combustion engine constructed in accordance with the invention, the two pistons being shown as moved apart to the maximum amount. Fig. 2 is a similar view of the upper portion of the engine, the pistons being shown as moved together so as to compress the charge preparatory to exploding the same, and Fig. 3 is a horizontal sectional view through the spark plug, on the line 3—3 of Fig. 1.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

Specifically describing the present embodiment of the invention, the numeral 1 designates an upright cylinder which is closed at the top and open at the bottom, the said cylinder being surrounded by a water jacket 2 of the usual construction. This cylinder is rigidly mounted upon a base or support 3 from which a pair of standards 4 project, the said standards being formed with bearings 5 within which the horizontal shaft 6 is journaled. In the present instance, this shaft is shown as provided at each end thereof with a fly wheel 7.

An upper piston 8 is slidably mounted within the cylinder 1, the exterior of the piston being provided with the packing rings 9 which form a tight joint with the cylinder. The piston 8 is hollow and open at the lower end thereof for the reception of the lower piston 10 which is mounted within the interior of the piston 8, the said piston 10 being provided upon the exterior thereof with the packing rings 11 which form a tight joint with the interior of the upper piston.

The upper piston 8 and lower piston 10 are designed to move in opposite directions, the explosive mixture being compressed between the same when the pistons are brought together preparatory to exploding the charge. The lower piston 10 also has a hollow formation and is open at the bottom thereof, the lower end of the piston being provided with a transverse rod 12 which is connected by a link 13 to a crank portion 14 of the main shaft. The lower end of the upper piston 8 is provided upon opposite sides thereof with the laterally projecting pins 15 which are connected by the links 16 to crank portions 17 of the shaft 6. The said crank portions 17 of the shaft 6 and crank portion 14 of the shaft 6 are oppositely disposed so that the pistons are alternately moved toward and away from each other when the shaft is revolved, the position assumed by the pistons when moved apart to the maximum amount being indicated by Fig. 1, while the position assumed by the pistons when brought together is indicated by Fig. 2.

A spark plug 18 passes through the head or closed end of the cylinder 1 and also passes through the upper piston 8 so as to project into the explosion chamber between the pistons. The upper piston 8 is shown as provided with packing 19 which surrounds the spark plug to provide a tight joint therewith. An inlet pipe 20 communicates with the upper end of the cylinder 1, and upon the downward movement of the upper piston 8, a fresh charge is sucked through the inlet pipe 20 into the space between the cylinder head and the upper piston. The spark plug is formed in one side

thereof with a groove or passage 21, and when the upper piston reaches the upper limit of its movement, the said piston is moved above the lower end of the passage 21 so that the said passage opens communication between the explosion chamber and the space within the cylinder above the piston. The fresh charge which was previously sucked into this space then flows through the passage 21 into the explosion chamber. An exhaust opening 22 in one side of the upper piston 8 is simultaneously brought into registry with an exhaust pipe 23, so that the exhaust gases are discharged through the exhaust pipe at the same time that a fresh charge enters the explosion chamber through the passage 21 of the spark plug. Upon the downward movement of the upper piston 8, the lower end of the passage 21 is closed so as to shut off communication between the explosion chamber and the space within the cylinder above the pistons. Simultaneously, the exhaust opening 22 of the upper piston is moved out of registry with the exhaust pipe 23 and closed by the upward movement of the lower piston 10. As the two pistons are then brought together, the charge is compressed, and when the maximum degree of compression is reached, the charge is exploded, through the medium of the spark plug 18 in the usual manner, the downward movement of the upper piston 8 in compressing the charge having served, as previously described, to draw a fresh charge through the inlet pipe 20 into the space above the upper piston 8. This operation is repeated as long as the engine is running, the full force of the explosion in opposite directions being exerted against the two pistons and utilized in driving the engine. A check valve 25 is provided in the inlet pipe 20, the said check valve permitting the charge to enter the closed end of the cylinder, although it prevents the charge from being forced out of the cylinder upon the upward movement of the hollow piston 8.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In an internal combustion engine, the combination of a cylinder having a closed end, a hollow piston mounted within the cylinder, a charge inlet pipe communicating with the closed end of the cylinder, a second piston mounted within the hollow piston, the said pistons being movable in opposite directions, a member projecting from the closed end of the cylinder and passing through the hollow piston, the said member being formed with a passage which is closed by the first piston when it is moved away from the closed end of the cylinder and opened by the first piston when it is moved toward the closed end of the cylinder, the movement of the piston away from the closed end of the cylinder serving to draw a fresh charge into the cylinder and the said fresh charge flowing through the passage into the space between the two pistons when the said first piston is moved toward the closed end of the cylinder, means for igniting the charge between the pistons, and means for carrying away the exhaust gases.

2. An internal combustion engine including a cylinder formed with a closed end, a piston mounted within the cylinder, a second piston mounted within the cylinder, the said pistons being movable in opposite directions, a charge supply pipe communicating with the closed end of the cylinder whereby a fresh charge is sucked into the cylinder when the first mentioned piston is moved away from the closed end of the cylinder, a member projecting from the closed end of the cylinder and passing through the first mentioned piston into the space between the two pistons, the said member being formed with a passage through which the fresh charge sucked into the cylinder flows into the space between the pistons when the first mentioned piston is moved toward the closed end of the cylinder, the said passage being closed when the said first piston moves away from the closed end of the cylinder, means for igniting the charge between the two pistons, and means for withdrawing the exhaust gases.

3. An internal combustion engine comprising a cylinder formed with a closed end, a piston mounted within the cylinder, a second piston mounted within the cylinder, the two pistons being movable in opposite directions, a charge inlet pipe leading to the closed end of the cylinder, a spark plug projecting from the closed end of the cylinder and passing through the first mentioned piston into the space between the pistons, the said spark plug being formed with a passage which establishes communication between the closed end of the cylinder and the space between the pistons when the first mentioned piston is moved toward the closed end of the cylinder and is closed by the said first piston when it moves away from the closed end of the cylinder, the said first piston upon its movement away from the closed end of the cylinder serving to suck a fresh charge into the cylinder and this fresh charge flowing through the passage into the space between the pistons when the said first piston is moved toward the closed end of the cylinder, and means for exhausting the products of combustion from the cylinder.

4. An internal combustion engine including a cylinder formed with a closed end, a charge inlet pipe communicating with the closed end of the cylinder, an exhaust pipe communicating with one side of the cylinder, a hollow piston mounted within the cyl-

inder and formed in one side thereof with an opening adapted to be brought into registry with the exhaust pipe for discharging the products of combustion, a second piston mounted within the hollow piston, a shaft formed with oppositely disposed crank portions connected to the respective pistons, and a spark plug projecting from the closed end of the cylinder and passing through the first mentioned piston into the space between the pistons, the said spark plug being formed with a passage which establishes communication between the closed end of the cylinder and the space between the pistons when the first piston is moved toward the closed end of the cylinder and is closed by the said first piston when it is moved away from the closed end of the cylinder, the movement of the first piston away from the closed end of the cylinder serving to suck a fresh charge into the cylinder and this fresh charge being forced through the passage into the space between the pistons when the first piston is moved toward the closed end of the cylinder.

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

JAMES DAY.

Witnesses:
EUGENE W. LEVY,
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