J. SHAW.

INTERNAL COMBUSTION ENGINE.

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1,313,608. Patented Aug. 19, 1919.

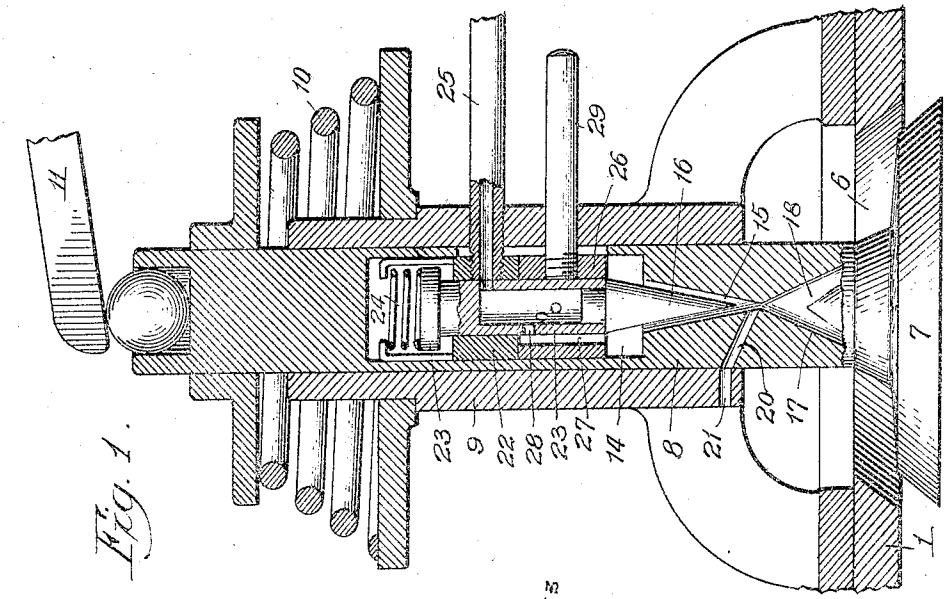


Fig. 1.

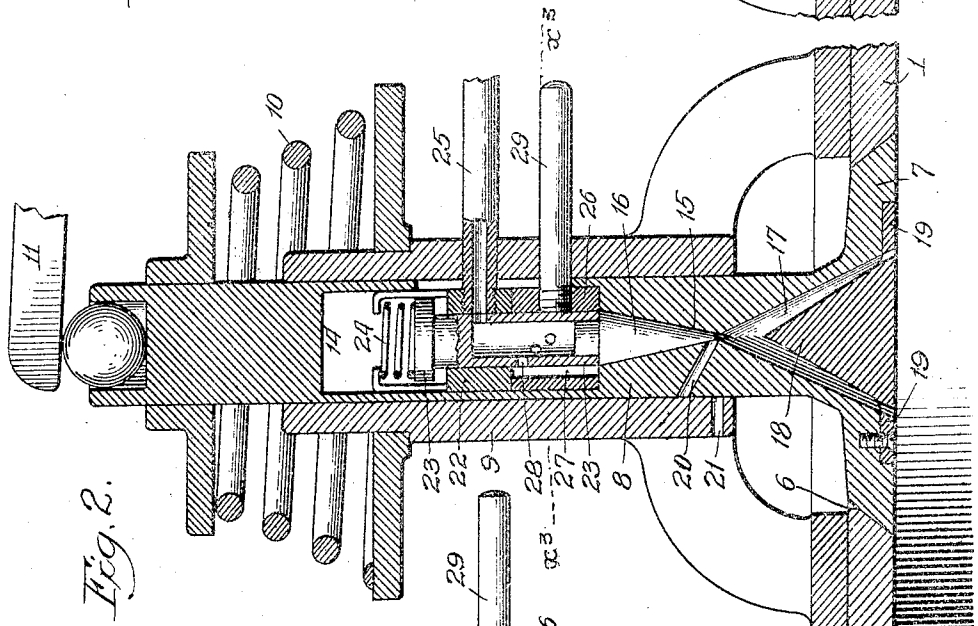


Fig. 2.

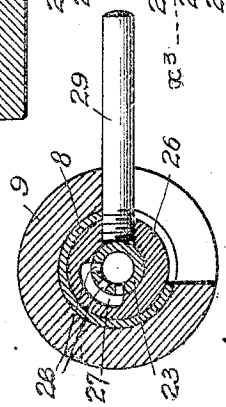


Fig. 3.

Witness:
John Enders

Inventor:
James Shaw,
by Robert A. Burns
Atty.

UNITED STATES PATENT OFFICE.

JAMES SHAW, OF CHICAGO, ILLINOIS.

INTERNAL-COMBUSTION ENGINE.

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To all whom it may concern:

Be it known that I, JAMES SHAW, a citizen of the United States of America, and a resident of Chicago, in the county of Cook, State of Illinois, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to gas engines of the high compression fuel type and adapted for use in either the two or the four cycle class of such engines, and the present improvement has for its objects:—

To provide a simple and durable structural formation and association of parts whereby the supply of liquid fuel is fed to the explosive chamber of the engine in an effective manner, and through a single inlet-outlet opening of said explosion chamber, all as will hereinafter more fully appear.

In the accompanying drawings:—

Figures 1 and 2 are comparison enlarged sectional elevations of the duplex inlet-outlet valve and associated liquid fuel feeding means, in the two different positions of the same.

Fig. 3 is a detail horizontal section on line x^3—x^3, Fig. 2.

Like reference numerals indicate like parts in the several views.

Referring to the drawings, 1 designates the upper portion of an engine cylinder provided with an opening or orifice 6, preferably formed in the central portion of the closure head of the engine cylinder, and providing communication between the outer atmosphere and the explosion chamber of the engine, as shown.

7 designates the main valve of the engine having its seat in the aforesaid opening 6, with its shank or stem 8 guided vertically in a guide housing 9, of the arched spider type, mounted on the head of the engine cylinder 1 aforesaid.

10 designates a spring interposed between the valve stem 8 and the housing 9 and adapted to exert a constant resilient closing stress upon said stem of the valve 7.

11 designates the free end of a rock lever having operative engagement with the upper end of the valve stem 8. Said rock arm has the usual pivotal association with the engine cylinder 1, and receives motion from the main shaft of the engine through any usual and suitable intermediate means.

In the present improvement the main valve 7 and its stem 8 forms part of the fuel feeding appliance by which the liquid fuel is introduced at proper intervals into the explosion chamber of the engine, and accordingly comprises a detail formation of the valve, the valve stem and fuel feeding means as follows:—

14 designates a vertical cylindrical chamber formed midway the height of the valve stem 8 and adapted to contain the fuel supply head and regulator sleeve hereinafter described.

15 designates a central orifice or passage formed at the lower end of the chamber 14, with the upper end of said orifice forming a seat for a valve member 16 carried by the fuel supply head above referred to, and said valve member and its seat are preferably of the needle type shown in Figs. 1 and 2.

17 designates a downwardly flaring chamber formed centrally in the valve head 7 and its stem 8, and having communication at its upper end with the passage 15 aforesaid, while its lower end opens freely into the explosion chamber of the engine and on the underside of the main valve 7 aforesaid.

18 designates a spreading cone arranged in the chamber 17 and adapted to receive the liquid fuel as it passes into said chamber and direct and spread said fuel in an even and very extended manner. In the preferred construction shown the spreading cone 18 is formed with an orificed marginal flange 19 by which it is secured in place, for convenience of manufacture and for removal and replacement when required.

20 designates a lateral passage formed in this valve stem 8 and opening into the communicating passage 15 above described, and adapted to register with a lateral passage 21 in the guide housing 9 aforesaid, when the main valve 7 is in its fully open condition as shown in Fig. 1. With the described arrangement and at proper periods in the operation of the engine, air is drawn in through the passages 20, 21 into and through the lower chamber 17 to effectually clear the same of any waste gases remaining therein after an explosion of a fuel charge.

In the preferred construction shown in Figs. 1 and 2 the fuel inlet head heretofore referred to, comprises an outer annular member 22 having a sliding fit in the vertical chamber 14 of the valve stem 8, and an inner tubular member 23 carrying at its lower end the valve member 16 heretofore

described, and with a view to an effective seating of said valve member 16, the aforesaid inner tubular member is adapted to have limited vertical movement in relation to the outer annular member 22 against the stress of an interposed spring 24, the tendency of which is to force the member 23 downward and resiliently hold the valve 16 in its closed condition.

25 designates the fuel inlet pipe passing through a receiving orifice formed therefor in the guide housing 9 aforesaid, through a vertically elongated slot in the valve stem 8 and screwed or otherwise attached to the outer member 22 of the fuel inlet head and adapted to maintain said head in a stationary condition, while the valve stem 8 has its normal vertical reciprocation in relation to said inlet head and the valve member 16 carried thereon.

The fuel regulating sleeve heretofore referred to, comprises an annular member 26 surrounding a lower portion of the inner tubular member 23 and formed with a vertical passage 27 the lower end of which communicates with the lower portion of the chamber 14 aforesaid. The upper end of said passage 27 is adapted to register with one or more of a plurality of lateral orifices 28 in the wall of the tubular inner member 23 of the fuel supply head in accordance with a turning adjustment of said regulating sleeve.

29 designates an operating arm attached to regulating sleeve 26 and extending out through horizontally elongated slots in the guide housing 9 and valve stem 8, for effecting the turning adjustment of the regulating sleeve above described.

In the above described construction the associated fuel inlet head and regulating sleeve 26 constitute a stationary piston, while the upper chamber 14 containing the same constitutes a movable cylinder for said piston, so that in an upward movement of the valve stem 8, the fuel contained in the lower portion of the chamber 14 will be forcibly ejected through the passage 15 onto the spreading cone 18 aforesaid.

The operation of the present improvement in connection with the two-cycle engine construction shown in Figs. 1 and 2 is as follows:—

Assuming the explosion to have taken place and the engine piston to have moved down to its lower position uncovering the usual outlet orifice of the engine to permit the escape of the waste products from the explosion chamber. With the uncovering of said orifice, the main valve 7 is moved to its open position to admit air to the explosion chamber to effect a cooling of the same, as well as to introduce the required supply of air for the succeeding compression and explosion actions of the engine. Coincident with said opening of the main valve 7 the lateral passages 20 and 21 register to admit a supply of air to the lower chamber 17 of the valve stem 8 to remove the waste gases, etc., therefrom.

In the succeeding up-stroke of the piston, and as the same is covering the outlet opening aforesaid, the main valve 7 is moved to its closed position, and the further up movement of the piston acts to compress the contents of the explosion chamber to the density required to effect the explosion of the fuel charge as said piston reaches the end of said up stroke. With the described closing movement of the main valve 7, the passages 20, 21 are moved out of register, and with the final upward movement of said main valve, the supply of liquid fuel contained in the lower portion of the upper chamber 14 of said valve is forcibly ejected down onto the spreader cone 18 to be exposed to and absorbed by the hot and highly compressed charge of air in the explosion chamber to enrich the said charge of air and render it explosive. With a subsequent explosion of said charge a fresh cycle of the operations just described takes place.

In an engine of the four-cycle type, substantially the same operations as above take place, except that the opening and closing movements of the main valve 7 are slower so that the main valve will open near the end of the down stroke of the piston due to an explosion, remain open during the succeeding up stroke and down stroke of the engine piston, and then move to a closed position as the piston commences a succeeding up stroke, at the end of which the explosion takes place and during the down stroke following such explosion.

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

1. In a gas engine, an engine cylinder having an inlet opening at one end and an outlet orifice at its other end adapted to be uncovered by the piston, a main valve closing said inlet opening and having a carrying stem formed with upper and lower chambers connected by a communicating passage, the lower chamber opening into the explosion chamber, a hollow fuel supply head arranged in the upper chamber aforesaid and forming a piston therefor, a valve member carried by said head and adapted to control the communicating passage aforesaid, means for holding said supply head in stationary relation to the main valve stem, and means for imparting intermittent reciprocation to said main valve and stem, substantially as set forth.

2. In a gas engine, an engine cylinder having an inlet opening at one end an outlet orifice at its other end adapted to be uncovered by the piston, a main valve closing

said inlet opening and having a carrying stem formed with upper and lower chambers connected by a communicating passage, the lower chamber opening into the explosion chamber, a hollow fuel supply head arranged in the upper chamber aforesaid and forming a piston therefor, a valve member carried by said head adapted to control the communicating passage aforesaid, a supply pipe carried by a fixed part of the engine and attached to said supply head to hold the same stationary in relation to the stem of the main valve, and means for imparting intermittent reciprocation to said main valve and stem, substantially as set forth.

3. In a gas engine, an engine cylinder having an inlet opening at one end and an outlet orifice at its other end adapted to be uncovered by the piston, a main valve closing said inlet opening and having a carrying stem formed with upper and lower chambers connected by a communicating passage, the lower chamber opening into the explosion chamber, a hollow fuel supply head arranged in the upper chamber aforesaid and forming a piston therefor, a valve member carried by said head and adapted to control the communicating passage aforesaid, a regulating sleeve associated with said supply head and formed with a vertical passage, the supply head having outlet passages adapted to register with said vertical passage, means for imparting a turning adjustment to said regulating sleeve, means for holding the supply head and regulating sleeve in stationary relation to the main valve stem, and means for imparting intermittent reciprocation to said main valve and stem, substantially as set forth.

4. In a gas engine, an engine cylinder having an inlet opening at one end and an outlet orifice at its other end adapted to be uncovered by the piston, a main valve closing said inlet opening and having a carrying stem formed with upper and lower chambers connected by a communicating passage, the lower chamber opening into the explosion chamber, a hollow fuel supply head arranged in the upper chamber aforesaid and forming a piston therefor, a valve member carried by said head and adapted to control the communicating passage aforesaid, a regulating sleeve associated with said supply head and formed with a vertical passage, the supply head having outlet passages adapted to register with said vertical passage, a lateral arm attached to said regulating sleeve and adapted to effect a turning adjustment of the same, means for holding the supply head and regulating sleeve in stationary relation to the main valve stem, and means for imparting intermittent reciprocation to said main valve and stem, substantially as set forth.

5. In a gas engine, an engine cylinder having an inlet opening at one end and an outlet orifice at its other end adapted to be uncovered by the piston, a main valve closing said inlet opening and having a carrying stem formed with upper and lower chambers connected by a communicating passage, the lower chamber opening into the explosion chamber, a hollow fuel supply head arranged in the upper chamber aforesaid and forming a piston therefor, a valve member carried by said head and adapted to control the communicating passage aforesaid, the said inlet head comprising two sections and an interposed spring adapted to yieldingly hold said sections in proper relation, means for holding said supply head in stationary relation to the main valve stem, and means for imparting intermittent reciprocation to said main valve and stem, substantially as set forth.

6. In a gas engine, an engine cylinder having an inlet opening at one end and an outlet orifice at its other end adapted to be uncovered by the piston, a main valve closing said inlet opening and having a carrying stem formed with upper and lower chambers connected by a communicating passage, the lower chamber opening into the explosion chamber, a hollow fuel supply head arranged in the upper chamber aforesaid and forming a piston therefor, a valve member carried by said head and adapted to control the communicating passage aforesaid, the said inlet head comprising an outer annular section, and inner tubular section carrying the movable valve member of the aforesaid communicating passage and a spring interposed between said sections and adapted to hold the same in proper relation, means for holding said supply head in stationary relation to the main valve stem, and means for imparting intermittent reciprocation to said main valve and stem, substantially as set forth.

Signed at Chicago, Illinois, this 9th day of September 1918.

JAMES SHAW.