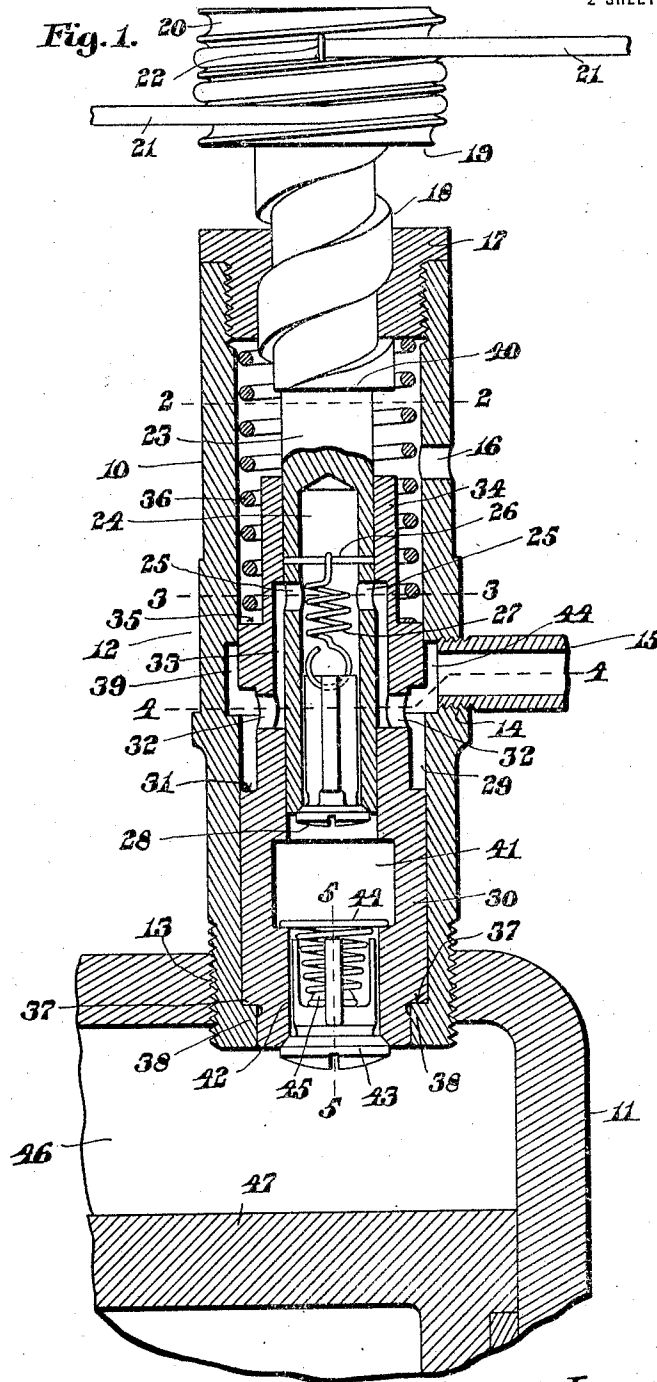


L. W. LOMBARD.
 INJECTOR FOR INTERNAL COMBUSTION ENGINES.
 APPLICATION FILED JULY 28, 1919.

1,349,515.

Patented Aug. 10, 1920.
 2 SHEETS—SHEET 1.



Inventor:
 Levi W. Lombard,
 by Walter E. Lombard, Atty.

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Fig. 2.

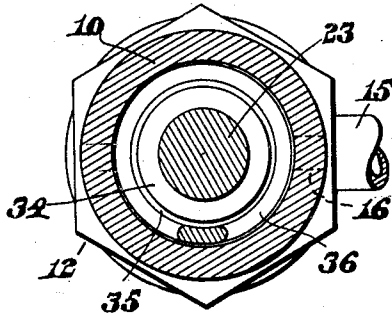


Fig. 3.

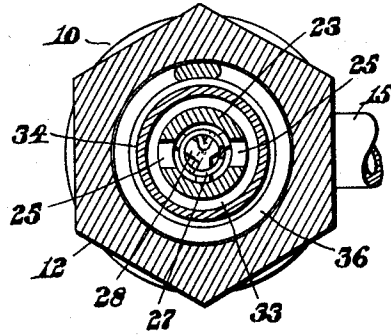


Fig. 4.

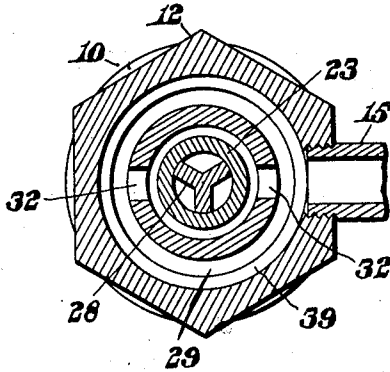
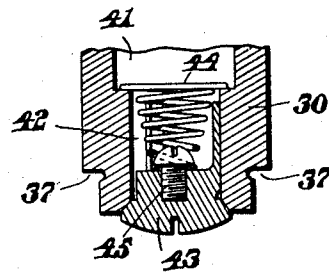


Fig. 5.



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UNITED STATES PATENT OFFICE.

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INJECTOR FOR INTERNAL-COMBUSTION ENGINES.

1,349,515.

Specification of Letters Patent. Patented Aug. 10, 1920.

Application filed July 28, 1919. Serial No. 314,345.

To all whom it may concern:

Be it known that I, LEVI W. LOMBARD, a citizen of the United States of America, and a resident of Mattapan, in the county of Suffolk and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Injectors for Internal-Combustion Engines, of which the following is a specification.

This invention relates to devices for injecting water into the combustion chambers of internal combustion engines in order to increase the efficiency of said engines.

The object of the invention is to simplify the construction of devices of this character and produce a simple and effective injector which may be readily installed in an engine and which will be operated by the force of the explosion in the engine.

The invention consists in a small casing adapted to be screwed into the wall of the explosion chamber of an internal combustion engine and in which is installed a pumping device of peculiar construction which whenever an explosion occurs in the engine will be automatically actuated by the expansion of the gases to inject into said chamber a predetermined quantity of water.

The invention further consists in certain novel features of construction and arrangement of parts which will be readily understood by reference to the description of the drawings and to the claims to be hereinafter given.

For the purpose of illustrating the invention, one preferred form thereof is illustrated in the drawings, this form having been found to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and the invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described, except as required by the scope of the appended claims.

Of the drawings:

Figure 1 represents a vertical section of a device embodying the principles of the present invention.

Fig. 2 represents a horizontal section on line 2, 2, on Fig. 1.

Fig. 3 represents a horizontal section on line 3, 3, on Fig. 1.

Fig. 4 represents a horizontal section on line 4, 4, on Fig. 1, and

Fig. 5 represents a vertical section on line 5, 5, on Fig. 1.

Similar characters indicate like parts throughout the several figures of the drawings.

In the drawings, 10 is a cylindrical casing, the lower end of which is threaded and adapted to be screwed into the wall 11 of an internal combustion engine.

The casing 10 is provided with a hexagonal portion 12 by means of which and a wrench applied thereto, said casing may be inserted into or removed from the threaded opening 13 in the wall of the engine.

This casing 10 has a threaded opening 14 in the vertical wall thereof into which is screwed one end of a water supply pipe 15, and above the water supply pipe 15 a vent 16 extends into the interior of the casing 10.

The upper end of the casing 10 is closed by a cap 17 threaded thereto, said cap 17 being provided with a central opening having a coarse female thread to receive the screw 18 having secured to its upper end the head or drum 19 provided with the helical groove 20 in its periphery.

Coiled about the head 19 and in the groove 20 is a cord 21 or similar flexible member which is adapted to be connected with the engine throttle whereby any movement of the throttle will impart rotary movement to the head. The cord 21 is secured to the head 19 by means of a staple 22 or similar securing member.

This rotary movement of the head 19 will cause the screw 18 to move endwise in the cap 17.

The lower end of the screw 18 is provided with a cylindrical extension 23, the lower end of which has a chamber 24 therein with openings 25 extending therefrom through the wall of said extension 23.

Transversely disposed in the chamber 24 is a pin 26 to which one end of a spring 27 is secured, the opposite end of said spring 27 being secured to a valve 28 normally closing the lower end of the chamber 24.

Surrounding the extension 23 and fitting the chamber 29 of the casing 10 is a piston 30 having an annular peripheral groove 31 therein from which openings 32 extend inwardly into a chamber 33 within said piston.

The upper end of the piston 30 is provided with a tubular extension 34 of less diameter than the body portion of the piston thereby forming a shoulder 35 between which and the inner end of the cap 17 is interposed a helical spring 36 which normally retains the piston 30 in its lowest position with a shoulder 37 thereof in contact with the inwardly extending flange 38 of the casing 10. The interior of the casing 10 is provided with an annular groove 39 always in communication with the annular groove 31 in the piston 30.

The upward movement of the piston 30 is limited by the upper end of the extension 34 thereof coming into contact with the lower end 40 of the screw 48.

The piston 30 is provided with a central chamber 41 from which a cylindrical passage 42 extends downwardly to the bottom thereof.

This passage 42 is normally closed by a valve 43 having a spring 44 secured thereto by means of a screw 45, the upper end of the spring 44 being expanded so as to rest upon the bottom of the piston chamber 41.

The passage 42 opens into the combustion chamber 46 above the reciprocating piston 47 of the engine.

While the device is shown in the drawings as being mounted on the top of the cylinder, it is obvious that it may be applied equally as well to the side of said cylinder provided the passage 42 communicates with the combustion chamber 46.

In the operation of the injector a continuous supply of water flows into the annular chamber 29 through the ports or opening 32 into the piston chamber 33 and then through the ports or openings 25 into the inner chamber 24 of the extension 23.

The pressure of the water within the various chambers is insufficient to open either of the valves 28 and 43, the springs 27 and 44 having sufficient tension to retain said valves upon their seats under all normal conditions.

The spring 36 has sufficient strength to prevent the injector piston being moved during the compression stroke of the engine piston but as soon as an explosion occurs in the combustion chamber the expansion of the gas will force the piston 30 upwardly and the extension 23, being stationary, will enter the chamber 41 and displace the water contained therein.

This water must escape and in order to do so it will force open the valve 43 sufficiently to permit the water to pass from said chamber 30 into the combustion chamber 46 in the form of an annular spray.

After the explosion has occurred and water from the chamber 41 has been admitted to the combustion chamber 46, the spring 36 will return the piston 30 to its seat.

This downward movement of the piston

will create a vacuum in the chamber 41 and the resulting suction will cause the valve 28 to open and draw into the chamber 41 a fresh supply of water from the chamber 24 in the extension 23.

The chamber 24 will then be filled again with water entering the casing 10 from the supply pipe 15.

The volume of the charge of water to be injected into the combustion chamber may be varied by turning the head or drum 19 and thereby adjusting the position of the shoulder 40 which limits the upward movement of the piston 30 in the chamber 29.

It is obvious that when the limiting shoulder 40 is in a low position less water will be displaced in the chamber 41 than when the shoulder 40 is in a high position and the piston 30 has greater movement.

The screw 18 has a steep pitch in order that this shoulder 40 may be quickly adjusted into any desired position.

While the cord 21 is preferably connected to the throttle, it is obvious that it may extend to any desired location accessible to the operator whereby he may vary the volume of charge to the combustion chamber 46 while the engine is operating.

By means of the device herein shown and described, a charge of water of any desired volume may be injected into the combustion chamber of the engine at such a time as it will be most effective as for instance when the engine piston is starting on its working stroke.

The port 16 is provided to prevent any pressure accumulating behind the piston 30 and thus retard its outward movement when moved in that direction by the expansion of the gases due to the explosion in the combustion chamber 46.

It is believed that the operation and many advantages of the invention will be readily understood without further description.

Having thus described my invention I claim:

1. In a device of the class described, a casing; a reciprocating piston therein having a water chamber and a passage therefrom communicating with the combustion chamber of an internal combustion engine; a valve normally closing said passage; a normally stationary member extending into said reciprocating piston and threaded to the outer end of said casing and adapted, during the outward movement of said piston, to force the water from said piston chamber into said combustion chamber; said member being provided with a shoulder in the path of said reciprocating piston; and means on the outer end of said normally stationary member for rotating said normally stationary member and thereby adjusting its shoulder endwise to vary the movement of said reciprocating piston.

2. In a device of the class described, a casing; a reciprocating piston therein having a water chamber and a passage therefrom communicating with the combustion chamber of an internal combustion engine; a valve normally closing said passage; a normally stationary member threaded to the outer end of said casing and provided with a cylindrical extension positioned in said reciprocating piston and adapted, during the outward movement of said piston, to force the water from said piston chamber into said combustion chamber, said member having a stop shoulder to limit the movement of said piston; a head on the outer end of said normally stationary member; and means for rotating said head.

3. In a device of the class described, a casing; a reciprocating piston therein having a water chamber and a passage therefrom communicating with the combustion chamber of an internal combustion engine; a valve normally closing said passage; a normally stationary member threaded to the outer end of said casing and provided with a cylindrical extension positioned in said reciprocating piston and adapted, during the outward movement of said piston, to force the water from said piston chamber into said combustion chamber and said member having a stop shoulder to limit the movement of said piston; a head on the outer end of said normally stationary member; and a flexible member secured to and adapted to rotate said head.

4. In a device of the class described, a cylindrical casing having an annular chamber in its inner wall; a reciprocating piston having an annular peripheral groove always communicating with said annular chamber and provided with a water chamber communicating by lateral ports with said peripheral groove and a passage at one end

communicating with the combustion chamber of an internal combustion engine; a supply pipe leading to said annular chamber; a normally stationary member positioned in a passage in the opposite end of said piston and provided with a water reservoir; a valve normally closing the outlet from said water chamber; means for limiting the movement of said piston in each direction; and means for returning said piston to its normal position.

5. In a device of the class described, a casing; a normally stationary member axially disposed in said casing and having a water reservoir therein communicating by lateral ports with water chambers surrounding said member and in turn communicating with a water supply; a valve normally closing the outlet from said reservoir; a piston within said casing surrounding said stationary member and having a water chamber and an outlet passage communicating with the combustion chamber of an internal combustion engine; a valve normally closing said piston outlet; a spring adapted to be compressed when said piston is forced outwardly by the explosion in said combustion chamber to permit water in said piston chamber to be discharged therefrom and adapted subsequently to force said piston to its normal position and draw a fresh supply of water into said water chamber; and means controlled by the rotation of said normally stationary member for varying the amount of water drawn into and discharged from said water chamber at each reciprocation of said piston.

Signed by me at 4 Post Office Square, Boston, Mass., this 8th day of July, 1919.

LEVI W. LOMBARD.

Witnesses:

WALTER E. LOMBARD,
NATHAN C. LOMBARD.