L. B. HARRIS.

ATOMIZER FOR INTERNAL COMBUSTION ENGINES.

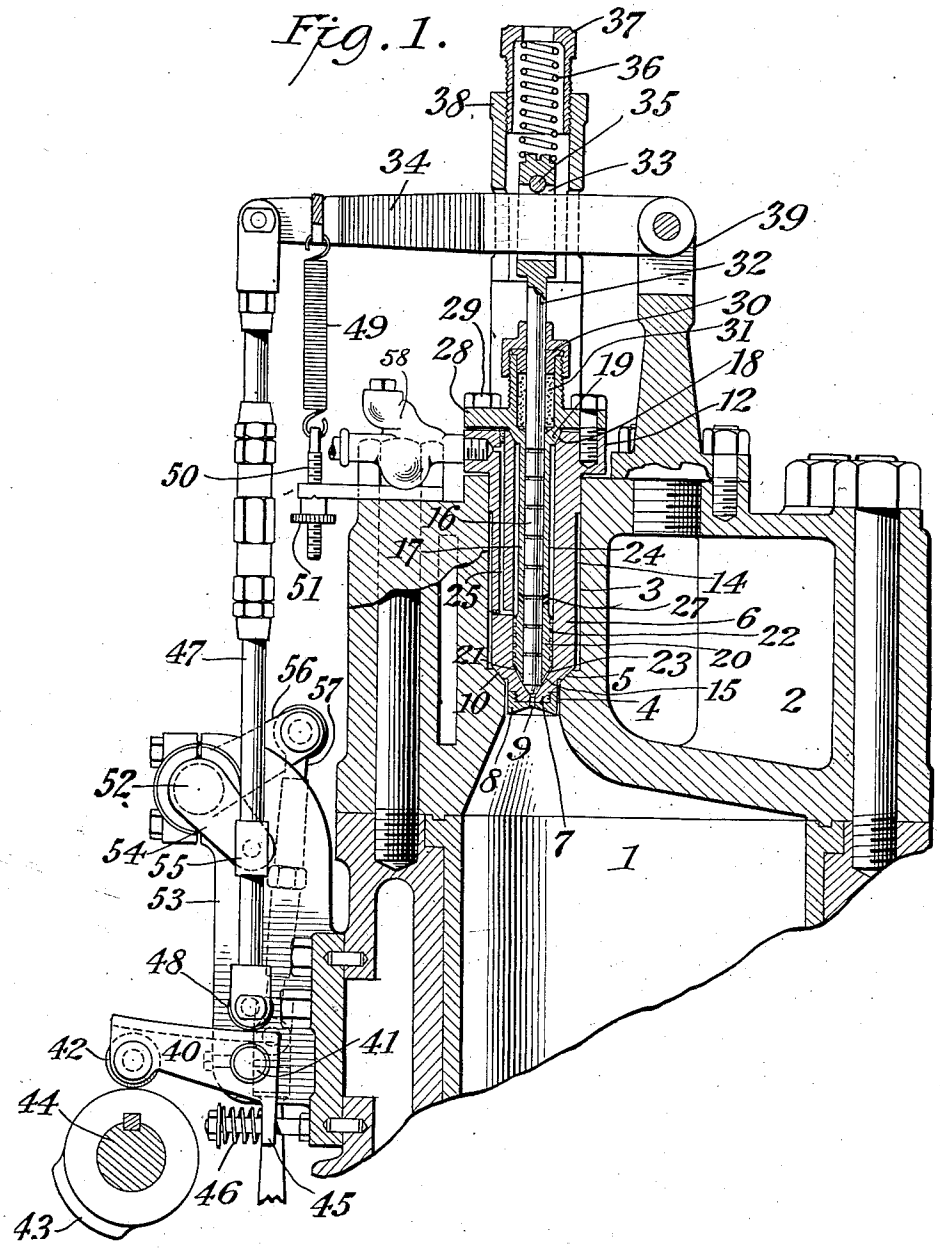
APPLICATION FILED MAY 26, 1913.

1,171,787.

Patented Feb. 15, 1916.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
H. R. Appleman
E. H. Bickerton

Inventor
Leonard B. Harris
By his Attorneys
Meyers, Cushman & Co.

L. B. HARRIS.

ATOMIZER FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED MAY 26, 1913.

1,171,787.

Patented Feb. 15, 1916.

2 SHEETS—SHEET 2.

Fig. 2.

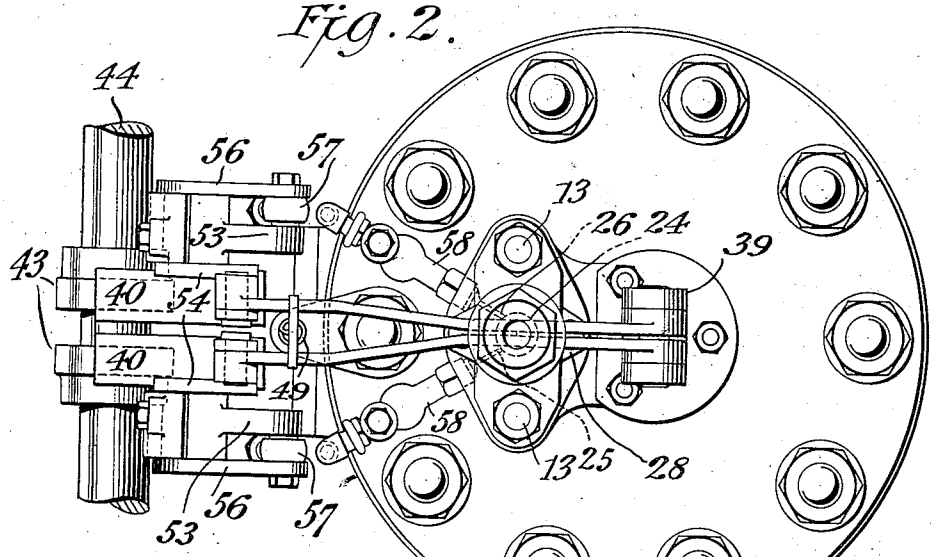


Fig. 3.

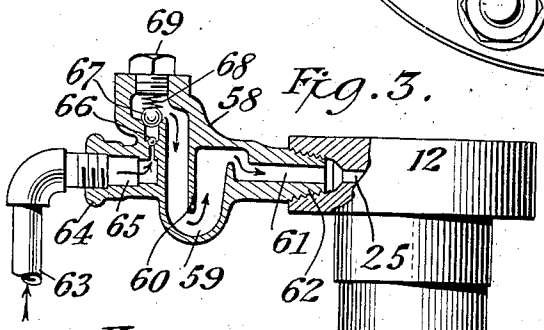


Fig. 4.

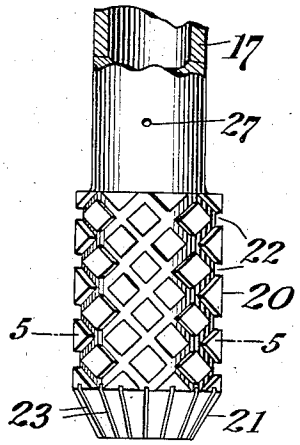


Fig. 5.

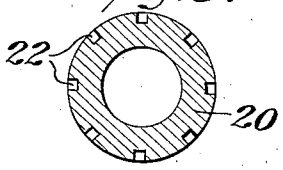
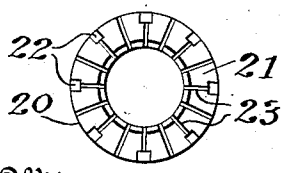


Fig. 6



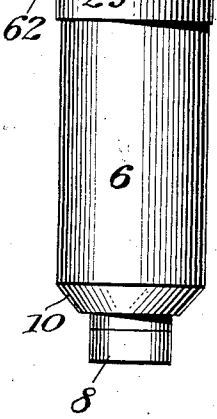
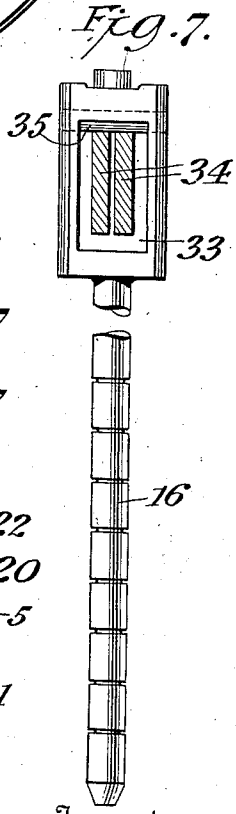


Fig. 7.



Witnesses:
A. R. Appleman
E. H. Bickerton

Inventor
Leonard B. Harris.
By his Attorneys
Messrs. Cushman & Rea

UNITED STATES PATENT OFFICE.

LEONARD B. HARRIS, OF WATERTOWN, NEW YORK.

ATOMIZER FOR INTERNAL-COMBUSTION ENGINES.

1,171,787. Specification of Letters Patent. Patented Feb. 15, 1916.

Application filed May 26, 1913. Serial No. 769,925.

To all whom it may concern:

Be it known that I, LEONARD B. HARRIS, a subject of the King of Great Britain, residing at Watertown, in the county of Jefferson and State of New York, have invented new and useful Improvements in Atomizers for Internal-Combustion Engines, of which the following is a specification.

My present invention relates to certain new and useful improvements in internal combustion engines operating on the Diesel principle and has to do more particularly with the atomizer parts of such engines.

As is well understood by those persons familiar with the construction and operation of engines working on the well known Diesel principle, the practicability and efficiency of such engines depend largely on the construction and operation of the atomizer through which the fuel-oil is fed to the engine cylinder or cylinders, complete or perfect combustion being essential, to the highest efficiency, and to bring about such a degree of combustion it is of the greatest importance that the fuel-oil be injected into the engine cylinder or cylinders in the form of a finely divided spray or mist.

One of the prime objects of the present invention is, therefore, to provide an atomizer that will have what might be termed a pulverizing effect on the molecules of oil, which, when acted upon by the high pressure air that drives the mixture into the engine cylinder, will cause said mixture to assume the form of a fine spray or mist, in which form it has the greatest efficiency since a more perfect combustion results.

It is also well understood by those familiar with the operation of internal combustion engines of the type herein referred to, that much trouble results from the atomizers burning out and also from stoppage or clogging, which troubles render the engine inoperative; and another object of the present invention is to obviate these troubles as far as possible and to materially reduce the time and lessen the trouble incident to making renewals or substitution of atomizer parts when renewals become necessary.

Another object of the invention is to provide means associated with the atomizer for preventing the oil from draining back out of the supply pipe leading to the atomizer during the periods of inactivity of the atomizer valve, thus insuring feeding of a full charge of fuel-oil at each stroke of the pump-plunger and maintaining a proper working charge in the atomizer at all times for starting purposes, thereby obviating hand-pumping when initially starting the engine and consequently making the engine far more reliable for maneuvering.

The invention has in view other more or less important objects all of which will be fully explained in the accompanying specification.

In order to enable others skilled in the art to understand, make and use my said invention I will now proceed to describe the same in detail, reference being had for this purpose to the accompanying drawing which is illustrative of a preferred embodiment thereof, and wherein—

Figure 1 is a vertical sectional view of the upper portion of an engine cylinder showing one of my improved atomizers in position therein, the view also showing one construction of atomizer valve actuating mechanism. Fig. 2 is a top plan view of the parts illustrated in Fig. 1. Fig. 3 is a side elevation of the plug part of the atomizer, the view also showing my improved trapped check-valve associated with the atomizer, the trap being shown in section. Fig. 4 is an elevation on an enlarged scale of the oil feed sleeve-portion of the atomizer. Fig. 5 is a transverse section of the sleeve portion taken on the line 5—5 of Fig. 4. Fig. 6 is a bottom plan view of the atomizer sleeve. Fig. 7 is a front elevation of the atomizer valve.

Referring more particularly to Fig. 1 the reference numeral 1 designates the upper portion of the working or power cylinder of an internal combustion engine through the head 2 of which is formed a bore 3, the lower end of which is contracted as at 4, there being a conical seat 5, adjacent the said contracted end, or between said end and the portion of larger diameter.

Fitted within the bore 3 is a hollow plug 6, the lower end of which is provided with a threaded nipple 7, upon which a removable and renewable cap 8 is screwed, said cap having an outlet aperture 9 through which the fuel oil is injected into the engine cylinder as will be more fully hereinafter explained. The plug 6 is provided adjacent its lower end with an external conical face 10, adapted to make a ground joint fit with the conical seat 5, at the base of the bole 3, and is provided at its upper end with a

laterally projecting flange 12, through which bolts 13, Fig. 2, pass whereby the plug is securely held within its bore. The plug 6, for the major portion of its length is of less diameter than the bore 3, so that when inserted therein there will be an annular space 14, around the same through which a cooling medium may be caused to circulate to keep the atomizer parts from becoming overheated when the engine is running. The plug 6 is provided at the lower end of its bore with an interiorly arranged conical wall 15, the lower portion of which constitutes a seat for the conical end of the atomizer valve 16, and the remainder of said wall constituting an abutment for the end of the atomizer cage or sleeve 17, presently to be described. The upper end of the bore of the plug is preferably formed with a conical seat 18, against which a correspondingly shaped projection 19 formed on the cage or sleeve 17 makes a ground joint connection.

The atomizer cage or sleeve 17, is provided at or adjacent its lower end with a head 20, that is of substantially the same diameter as the diameter of the bore of the plug 6, and said head fits closely in said bore. The lower extremity 21 of the head is of conical form and seats against the interior conical wall 15 within the plug. The head is provided with a plurality of intersecting or crossing grooves 22 formed in the peripheral wall thereof, said grooves being inclined in opposite directions and extending from the conical extremity 21 toward the upper end of the head, forming circuitous or interrupted oil passages, the grooves in the present instance forming what is commonly known as a diamond screw separated by diamond shaped projections as more clearly shown in Fig. 4. The conical extremity 21 of the head is provided with narrow longitudinally extending slits or ways 23, that intersect with and form a continuation of the said grooves 22, the said slits or ways serving to convey a plurality of fine streams of oil to the outlet opening 9 in the plug, from whence said streams emerge in the form of a fine spray or mist, this being due to the fact that the oil in being forced by high pressure air through the conflicting grooves 22, is thoroughly broken up or pulverized.

The sleeve or cage 17 for a portion of its length is of less diameter than the bore in the plug 6, so as to provide an annular space or chamber 24, around the same, said chamber having communication with the intersecting grooves 22. An oil passage 25, extends longitudinally through the plug 6, and enters the lower portion of the chamber 24, and a passage 26 for air under high pressure enters the chamber 24, at the upper end thereof, said high pressure air at all times acting upon the charge of oil in the chamber 24, and grooves 22. I also prefer to form a plurality of apertures 27, through the wall of the shell 17, leading from the annular chamber 24 into the bore of the shell in order to feed a small quantity of air under pressure along with and in addition to the oil passing through the conflicting grooves 22, in order to aid in the combustion of the fuel fed to the cylinder.

The upper end of the cage or shell 17 is provided with an attaching flange 28, through which bolts 29 pass for attaching the cage to the plug 6, and said upper end is also preferably provided with a gland 30, and stuffing box 31, through which the stem 32 of the atomizer valve 16 passes, said valve stem having a closed jaw or slot 33, at its upper end, through which the valve lifting lever or levers 34 pass, said lever or levers exerting their lifting energy on hardened steel removable and renewable pins 35, as more clearly shown in Figs. 1 and 7. The valve 16 is held to its seat by means of a coiled spring 36, acting upon the upper end of the valve-stem 32, the tension of the spring being adjustable by means of the screw-cap or plug 37, that has threaded engagement with a vertically extending tubular bracket 38.

The valve-lifting lever 34 is pivoted at one end to a bracket 39, rising from the head of the engine cylinder and said lever is operated at regular intervals to lift the atomizer valve 16, from its seat. The lever operating means in the instances shown comprises a rocker-arm 40, pivoted at 41, and having a roller 42, at its free end, said roller being acted upon by means of a cam 43, mounted upon the cam shaft 44, said cam operating to rock the arm 40, at regular intervals and through the connections now to be described, lift the atomizer valve 6. The rocker arm 40 is provided with a toe 45, against which a coiled spring 46, acts to normally hold its roller 42, in contact with the actuating cam.

Pivotally connected to the free end of the valve actuating lever 34 is a depending rod 47 carrying a roller 48 at its lower end, said roller normally lying above the pivotal point 41 of the rocker arm 40, which may be termed the idle or inactive position of the parts. The depending rod 47 is mounted to swing so that the lower end thereof carrying the roller 48 may be adjusted back and forth over the upper face of the rocker arm 40, or in other words adjusted back and forth or toward and from the pivotal point 41 of the rocker arm. Obviously the further the free end of the rod 47 is moved toward the outer end of the rocker arm 40, the greater will be the lift of the rod 47, and consequently the greater the lift of the atomizer valve 16. The roller 48 of the rod 47 is normally held in contact with the upper face of the rocker

arm 40 by means of a coiled spring 49 connected at its upper end to the rocker arm 34, and having its lower end connected to an adjustable pin 50, a thumb nut 51 being employed to adjust the tension of the spring, all as more clearly shown in Fig. 1.

The means for adjusting the position of the free end of the rod 47 upon the face of the rocker arm 40 consists of a rock shaft 52 journaled in a bracket 53 carried by the engine cylinder, said rock shaft having a crank arm 54 provided with a sleeve 55 that has a sliding connection with the rod 47, and said rock shaft 52 is provided with another crank arm 56 with which a link 57 is connected, said link being jointed at its lower end to suitable operating mechanism connected to the control lever of the engine, all as more clearly shown in my co-pending application Serial No. 726,025. By imparting proper movements to the link 57 it will be apparent that the free end of the rod 47 may be moved or adjusted and set to any desired position over the face of the rocker arm 40.

In the present instance I have shown only one valve operating lever and associated actuating and setting or controlling devices, such for instance as will be employed in a non-reversing or straight away engine. Where the engine is of the reversing type, I propose to employ two valve actuating levers 34 associated with each atomizer valve, and I also employ two sets of actuating and controlling or setting mechanisms, one associated with each of the levers 34. When the two sets of levers are employed either one or the other may be set for operation depending upon whether the engine is to be driven "ahead" or "astern."

The operation of the atomizer and its associated parts as thus far described is as follows: During the operation of the engine air at high pressure is maintained in the annular chamber 24 between the atomizer sleeve or cage 17 and the plug 6, which annular chamber is in communication through a suitable conduit with an air compressor or air reservoir not shown. At a certain time during the travel of the engine pistons, the fuel pumps of the engine inject a variable quantity of fuel oil or other liquid fuel medium into the said annular chamber 24, which lodges in the intersecting grooves 22 in the atomizer sleeve or cage, in which grooves the fuel oil remains until the atomizer valve 16 is lifted from its seat by the action of the lever 34, and its actuating mechanism above described. When the atomizer valve 16 is lifted from its seat as before mentioned, the high pressure air in the annular chamber 24 forces the fuel oil that is lodged in the intersecting or conflicting grooves 22 through said grooves with great force, the action of the high pressure air upon the oil having a pulverizing effect on the molecules of oil which now pass through the narrow slits or ways 23 in the end of the atomizer sleeve or shell and out through the aperture 9 in the cap 8 entering the cylinder head in the form of a fine spray or mist. Inasmuch as each charge of fuel oil, before being injected into the engine cylinder is lodged in the intersecting or conflicting grooves, immediately the atomizer valve 16 is lifted from its seat to admit oil into the cylinder, the high pressure air acting upon the oil thoroughly breaks up or pulverizes the same, thus putting the oil in the best possible condition for combustion when it enters the engine cylinders.

I have provided in association with the atomizer valve of an internal combustion engine, means for preventing the oil leading from the oil pumping mechanism of the engine from draining back out of the atomizer or the supply pipe leading to the atomizer during the periods of inactivity of the atomizer valve, thus insuring a full charge of fuel oil being fed at each stroke of the pump plunger and maintaining a proper working charge in the atomizer at all times for starting purposes, and I have provided similar means associated with the atomizer valve to overcome the danger of the fuel oil being forced out of the atomizer and into the air bottles or compressor. The means referred to, as more clearly illustrated in Fig. 3, consists of what might be generally termed a trapped check valve comprising a body member 58 having a bulb or pocket 59 in which is arranged a baffle plate 60; said pocket and baffle plate constituting a trap, the outlet passage 61 of which passes through an attaching nipple 62 and leads to the oil passage 25 in the plug 6, the attaching nipple 62 of the trapped valve having a threaded connection with the flange of the plug 6. The oil inlet pipe 63 leading from the oil pump is attached to the inlet nipple 64 of the trap valve, the passage 65 from the inlet nipple being normally held closed by means of a double check valve consisting in the instance shown of two balls 66 and 67 of unequal size, and which balls rest upon individual seats as shown. The larger ball valve 67 is held normally to its seat by means of a spring 68 acted upon by a threaded cap 69 screwed in an aperture formed in the body portion 58 as shown. An identically similar valve is associated with the compressed air inlet passage 26.

In operation when the fuel oil is pumped through the pipe 63 and passage 65 past the ball valves 66 and 67 into the trap 59 on its way to the atomizer there will always be maintained in said trap a charge of fuel oil which will be prevented, by reason of the check valves 66, 67 from draining back out of the supply pipe owing to the inability of the air to leak back into the pipe through

the liquid seal. This, therefore, does away with the hand pumping necessary with other types of atomizers when starting the engine. The similarly arranged trap check associated with the compressed air supply leading to the atomizer serves to prevent danger of oil fed to the atomizer passing back into the air bottles or compressor, the check valves acting to prevent any back flow of oil as will be apparent.

It will be apparent from the foregoing description taken in connection with the drawings that my improved atomizer parts may be readily and quickly attached to and removed from the cylinder head for purposes of cleaning, and for renewal of parts when necessary. The atomizer being water jacketed the oil stored therein is prevented from overheating and as will be seen the cap 8 of the plug 6 that is exposed to the combusting charges is made removable and replaceable.

So far as I am aware I am the first to associate with the atomizer valve of an internal combustion engine check valves or trap checks to maintain at all times a charge of fuel oil in the atomizer, and to prevent fuel oil passing through the piping system into the air bottle.

I do not wish to be understood as limiting myself to the precise construction and arrangement of parts herein shown and described, except as I may be limited by the terms of the appended claims, it being obvious that various changes or additions may be made without departing from the spirit of the invention.

What I claim is:—

1. An atomizer for internal combustion engines, embodying a sleeve open at both ends and provided at one end with a head portion of larger diameter than the sleeve, said head portion terminating in a beveled annular seating face having radial slits formed therein, and said head portion having diagonally arranged intersecting grooves formed in the periphery thereof, some of which grooves intersect the said radial slits.

2. An atomizer for internal combustion engines, comprising a hollow plug having a beveled valve seat and an outlet opening at its lower end, said plug being provided with means for removably attaching the same for insertion within a bore of an engine cylinder, an atomizer sleeve removably fitted in said bore, said sleeve being open at both ends and having a head portion near one end of larger diameter than the sleeve, said head portion terminating in a beveled annular seating face, having radial slits formed therein, and said head portion having diagonally arranged intersecting grooves formed in the periphery thereof, some of which grooves intersect the said radial slits, and a valve normally closing the outlet opening in the end of the plug, said valve having a stem extending longitudinally through the sleeve with a portion thereof projecting beyond the upper end of the sleeve.

3. In combination with the head of an engine cylinder having a bore therethrough provided at its lower end with a conical seating face, a hollow plug having an opening at its lower end, said plug removably fitted in said bore and having a seating face making a ground joint connection with the corresponding seating face in the bore, an atomizer sleeve open at both ends removably fitted in said plug and provided at one end with a head portion of larger diameter than the sleeve, terminating in a beveled annular seating face having radial slits formed therein, and said head portion having diagonally arranged intersecting grooves formed in the periphery thereof, some of which grooves intersect the said radial slits, and a valve normally closing the outlet opening in the plug, said valve having a stem extending longitudinally through the sleeve with a portion thereof extending beyond the upper end of the sleeve.

4. In combination with the head of an engine cylinder having a bore therethrough, said bore terminating at its lower end in a conical seating face, a hollow plug having a conical seating end making a ground joint connection with said seating face, and said plug having an outlet opening in its lower end, an atomizer sleeve removably fitted in said plug and having an enlarged head near one end in the periphery of which is formed a plurality of diagonally arranged intersecting ways communicating with said opening and constituting interrupted passages for fuel oil, and a valve having a stem extending longitudinally through the sleeve with a portion projecting beyond the upper end thereof, said valve normally closing the outlet opening in the plug.

5. In combination with the head of an engine cylinder having a bore therethrough, a hollow plug mounted in said bore, said plug having an outlet opening at its lower end, means for removably attaching the plug to the head of the engine cylinder, a sleeve open at both ends removably mounted in said plug, said sleeve being of less diameter than the opening in the plug to provide an annular chamber around the sleeve, and said sleeve having an enlarged head portion at one end, the periphery of which is provided with diagonally arranged intersecting grooves forming interrupted oil passages leading from said chamber to said outlet opening, and said plug having separate oil and air passages leading to said annular chamber, and a valve with the sleeve normally closing the outlet opening in the plug, said valve having a stem extending longitudinally through the sleeve.

6. The combination with the head of an engine cylinder having a bore therethrough, a hollow plug removably mounted in said bore and provided with an outlet opening in its lower end, an atomizer sleeve removably mounted in said plug and having oil passages communicating with said outlet opening, a valve normally closing said opening and having a stem reciprocally mounted in the sleeve, said stem having a transverse slot through its upper end, an actuating lever for the valve passing through said slot, a removable pin 35, interposed between said lever and a wall of the slot in the stem, and a spring normally acting on the upper end of the stem for urging the valve toward its seat.

7. In combination with the atomizer of an internal combustion engine having a fuel oil supply pipe leading thereto, a check valve in said supply pipe, and a liquid seal adjacent said check valve and intermediate the latter and the atomizer.

8. In combination with the atomizer of an internal combustion engine having an oil supply pipe leading thereto, a fitting embodying a combined check valve and trap associated with said supply pipe, the said fitting being directly connected to a part of the atomizer.

9. In combination with the atomizer of an internal combustion engine having an oil supply pipe and an air supply pipe leading thereto, of a combined check valve and trap associated with said air supply pipe.

10. In combination with the atomizer of an internal combustion engine, having separate oil and air supply pipes leading thereto, of a check valve in each of said pipes, and a trap in each pipe located between its valve and point of connection with the atomizer.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

LEONARD B. HARRIS.

Witnesses:
H. D. MATTESON,
G. W. CARPENTER.