

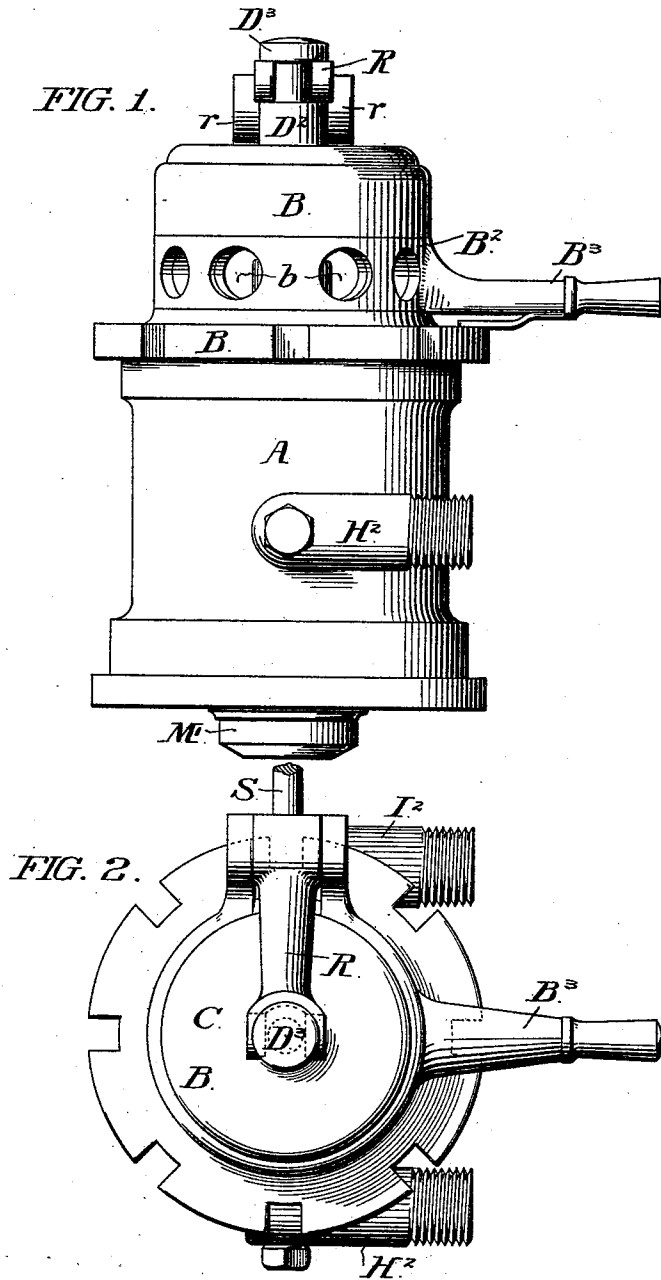
(No Model.)

3 Sheets—Sheet 1.

B. DRYSDALE.
VALVE FOR HYDROCARBON ENGINES.

No. 500,477.

Patented June 27, 1893.



WITNESSES,

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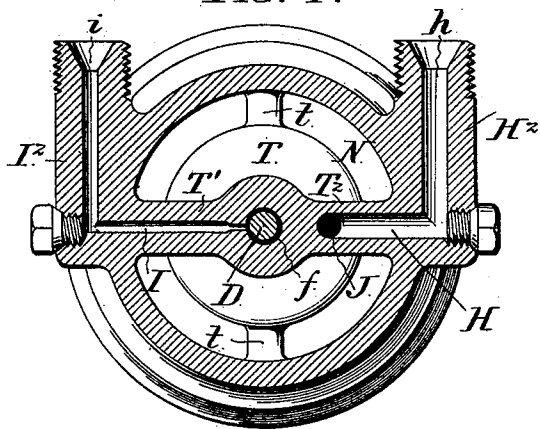
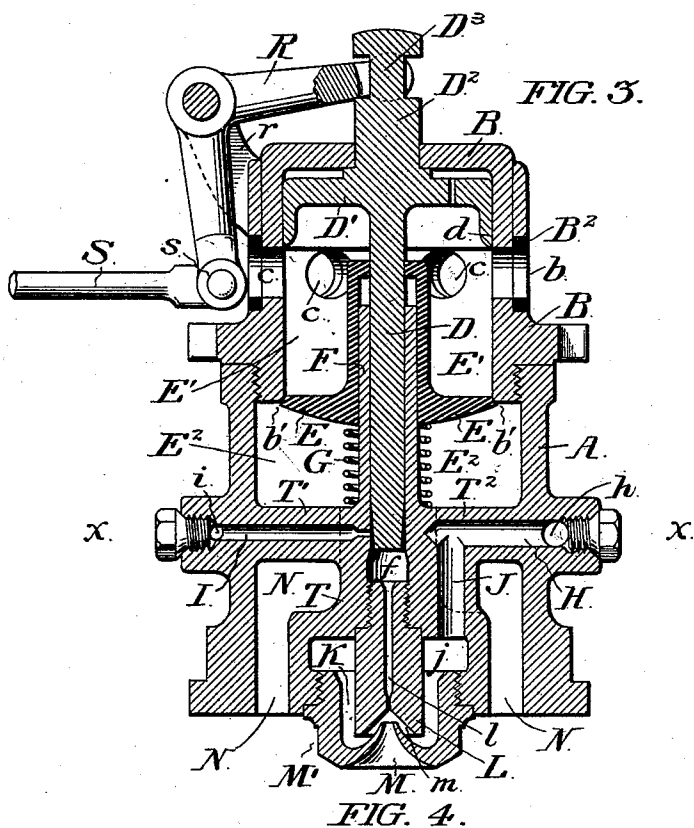
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Patented June 27, 1893.



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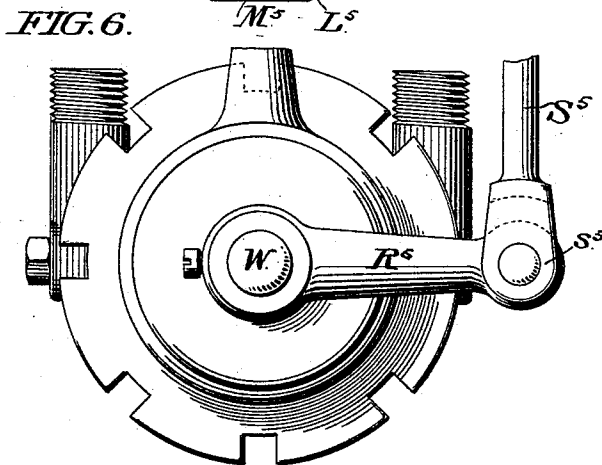
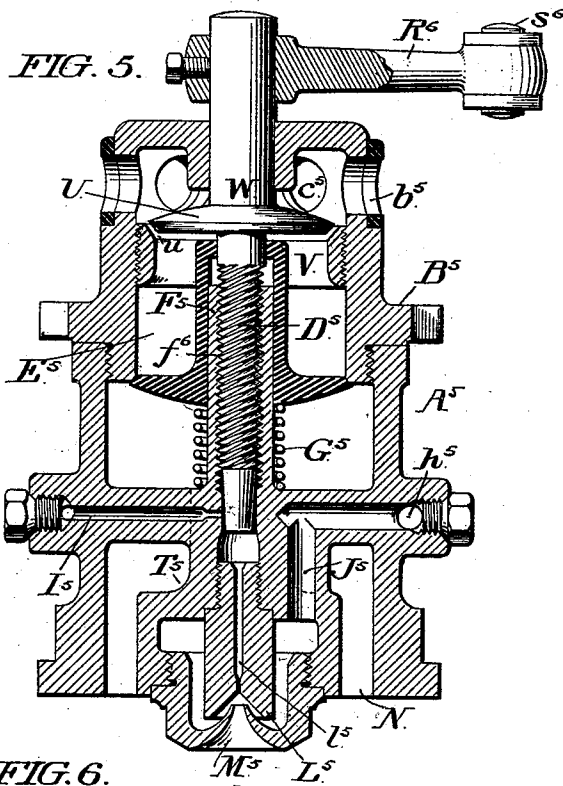
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Patented June 27, 1893.



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UNITED STATES PATENT OFFICE.

BRUCE DRYSDALE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO
ALBERT PRIESTMAN, OF SAME PLACE.

VALVE FOR HYDROCARBON-ENGINES.

SPECIFICATION forming part of Letters Patent No. 500,477, dated June 27, 1893.

Application filed February 10, 1892. Serial No. 421,022. (No model.)

To all whom it may concern:

Be it known that I, BRUCE DRYSDALE, a native of England and a subject of the Queen of Great Britain and Ireland, but now residing at Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Valves for Hydrocarbon-Engines, whereof the following is a specification, reference being had to the accompanying drawings.

In said drawings, Figure 1 represents an exterior side elevation of an apparatus embodying my invention. Fig. 2 is a top or plan view thereof. Fig. 3 is a vertical central section and Fig. 4 a horizontal section, on the line *xx* of Fig. 3. Figs. 5 and 6 are respectively a vertical central section and a top or plan view of a modified form of the apparatus.

My invention is especially applicable to that class of engines in which a liquid hydrocarbon, atomized by means of an air blast, is, in the form of vapor, commingled with a secondary or supplemental charge of air and ignited within the power cylinder. In engines of this class it is very desirable that the quantity of hydro-carbon admitted as the basis of each charge should be susceptible of delicate regulation, and that a corresponding or coordinate regulation of the supplemental air charge should be insured.

The object of my present invention is to provide a means for automatically effecting such regulation by devices under the control of a common governing mechanism, the whole being organized in a most compact form for combination with the mixer.

Referring to the type of apparatus shown in Figs. 1 to 4, inclusive, A represents the cylindrical casing of the apparatus, whose lower end is in immediate proximity to, and communicates with the mixer (not shown in the drawings) and whose upper end is provided with a cap or cover B, screwed thereto as indicated in Fig. 3. Within the lower portion of the casing A, is a central body T, which is supported by means of radial arms *t*, *t'*, *T*², and from whose center a tubular standard F projects vertically upward axially within the casing A forming a guide and support for a piston valve E, which moves

longitudinally thereon. Said valve is normally held up against its seat *b'* by means of the coiled spring G. This seat is preferably situated around the lower edge of the cap B, which, as the latter is screwed within the top of the casing A, forms an internally overhanging flange adapted for the purpose.

When the valve E is closed it divides the interior into two chambers, E', E², respectively, the lower one of which, E², is in constant communication with the interior of the mixer through the annular passage way, N, around the body T. The upper chamber, E', lies within the cap B and is maintained in constant communication with the outside air as follows: Radial holes *c* are formed through the wall of the cap at suitable intervals, and a ring B² pierced with holes *b*, registering with the holes *c*, fits snugly but so as to rotate freely around that part of the periphery of the cap. Said band is provided with a handle, B³, whereby it may be turned into any desired position so that the openings may be made to register exactly as shown in Figs. 1 and 3, or may be cut off to any desired extent. The openings *c*, I term the supplemental charge inlets, since the air admitted through them constitutes the supplemental charge which is mixed with the atomized hydro-carbon.

Within the hollow standard F is closely fitted a longitudinally movable stem D, tapered at its lower end, as shown in Fig. 3, and carrying near its upper end a horizontal piston D', which has a downwardly depending rim *d*, normally located above the supplemental-charge inlets *c*, but capable of cutting off or partially closing them from within, by its downward movement. This piston I term the supplemental-charge valve.

The upper end D², of the stem D, extends out through a central opening in the top of the cap B, and terminates in a head D³, to which is attached one arm of a bell-crank lever R, having its fulcrum upon the arms *r*, *r*, mounted upon the exterior of the cap. A connecting rod S, pivoted at *s* to the other arm of the bell-crank R, leads to any suitable governor adapted for this class of engines.

At the bottom of the body T are atomizing

devices for the liquid hydro-carbon, which are of the character described in Letters Patent of the United States No. 386,029, dated July 10, 1888. They consist of a pair of nozzles one arranged within the other, the inner one, L, having a central passage, *l*, for the liquid and terminating in an inwardly coned orifice *m*, while the outer nozzle, M', surrounds the tube L, leaving an intermediate annular passage K, and has its inner surface in the form of a backwardly directed cone, which enters the coned orifice *m*, so as to leave a tapering or inclined annular passage converging toward the end of the inner nozzle. An orifice M is formed in the end of the outer nozzle M' in line with the passage *l*, and the exterior surface adjacent to the orifice is coned or flared, as indicated in Fig. 3. The object of this arrangement is, as described in said patent, to cause the air blast conveyed through the annular or outer passage to impinge against the stream of liquid hydro-carbon issuing from the inner nozzle, so as to measurably retard or retract said stream, thus effecting a most complete atomizing of the liquid.

In the present instance the inlet for the liquid hydro-carbon is at *i*, through a tubular projection, I², arranged tangentially to one side of the casing, and communicating at right angles with the passage I, which extends through the arm T' to the central cavity *f*, of the hollow vertical standard F. The lower end of said cavity is enlarged slightly, as shown in Fig. 3, and from the bottom thereof the passage *l* leads through the inner nozzle L, before described.

The inlet for the air which is to effect the atomizing of the liquid is at *h*, in a second tangential tubular projection H², arranged at the other side of the casing A, and the inlet passage communicates at right angles with a tubular passage H, formed within the arm T², but terminating, as shown, some distance short of the central cavity F. From the inner end of the passage H, a downwardly extending passage J, leads to an annular chamber *j*, from which the annular passage K, before referred to, extends to the inwardly coned outward nozzle M'.

The operation of the apparatus is as follows: The liquid to be admitted at the inlet *i*, and the atomizing air to be admitted at the inlet *h*, are both under pressure and are injected constantly, in the proper relation to the load being carried by the engine, as is usual in the operation of this class of engines. Assuming that a charge has just been ignited within the power cylinder and that under the impulse thus given, the power piston, having made its initial forward stroke, has, on its return stroke, expelled the products of combustion from the cylinder through the exhaust, a second forward stroke of the piston now commences, due to the momentum of the fly wheel. This movement of the piston draws into the cylinder the atomized

hydro-carbon and air and creates a partial vacuum in the chamber E², thus opening the valve E, and drawing in the supplemental-charge of air through the inlets *c*. During the return stroke of the piston the partial vacuum in the chamber E² is filled, and the valve E is closed by the spring G. When the charge has been compressed by the completion of the return stroke of the power piston it is again ignited and the operation repeated. If the charge is excessive and the governor is thus thrown out of normal operation by the increase of speed, the pull of the governor rod S, upon the bell-crank R, shifts the latter so as to depress the stem D, whose lower tapered portion is in immediate juxtaposition to the inlet passage I, near the lower end of the cavity *f*. This downward motion of the stem D diminishes the area of the opening through which the hydro-carbon is admitted and thus reduces the amount which is injected for the next succeeding charge. This simultaneous depression of the supplemental-charge valve throws the downwardly depending flange *d* thereof, across the upper portion of the supplemental-charge inlets *c*, so as to cut off the volume of the supplemental charge of air in conformity with the reduction of the hydro-carbon charge. The movement of the bell-crank in the opposite direction by the governor, of course produces a contrary result, increasing both the hydro-carbon charge and the supplemental air charge. In addition to the automatic control thus maintained over the supplemental air charge, the operator can establish any desired fixed control thereof by means of the band B, which as before stated can be shifted so as to expose any desired area of the openings *c*.

The type of apparatus shown in Figs. 5 and 6 differs from that just described in the form and arrangement of the supplemental-charge valve, and in the means whereby it and the stem which controls the hydro-carbon charge are actuated.

Those parts of the apparatus which are identical in form and location with parts of the structure above specified will not be described in detail, but are indicated as far as necessary by the use of corresponding letters with the prime mark "5."

In this device the hollow standard F⁵ is internally threaded as indicated at *f*⁵, and a portion of the stem D⁵ is correspondingly threaded to the point where its taper commences, thus engaging operatively with the standard instead of merely sliding within it as in the former case. The upward prolongation W, of said stem carries a mushroom valve U, which is provided with a seat *u*, around the inner periphery of a ring V, mounted within the upper portion of the body B⁵, at a point below the supplemental-charge inlets *c*⁵. The stem W extends out through the cap of the casing and is rigidly connected with a lever arm R⁵, pivoted at *s*⁵ to the connecting rod S⁵ which is controlled by the governor.

The longitudinal movement of the rod S⁵ will of course turn the stem D⁵ in one direction or the other and the engagement of the thread upon the stem with the thread upon the fixed standard F⁵ will cause the stem to be shifted longitudinally, thus not only increasing or diminishing the area of the inlet for hydro-carbon, but (since the supplemental-charge valve U is thereby also moved toward or from its seat), varying the area of the inlet for the supplemental air charge in conformity with the variation of the hydro-carbon charge.

Having thus described my invention, I claim—

1. The combination of a casing having supplemental-charge inlets; atomizing devices substantially as set forth; a hydro-carbon inlet; a tapered stem adapted by longitudinal movement to control the area of said hydro-carbon inlet; a supplemental-charge valve carried by said stem, and means substantially as set forth whereby said stem is moved lon-

gitudinally in conformity with the movements of the governor.

2. The combination of the casing having supplemental-charge inlets; the atomizing devices; the body mounted within said casing and provided with internal passages for the hydro-carbon and for the atomizing air; the vertical hollow standard carried by said body; the longitudinally movable stem having a tapered end adapted to control the area of the hydro-carbon passage within said body; the spring actuated piston-valve mounted upon said standard; the supplemental charge valve fitting within the upper portion of the casing and controlling the lateral openings thereof, and means substantially as set forth whereby said stem is moved longitudinally in conformity with the movements of the governor.

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Witnesses:

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