D. J. CARTWRIGHT.

CARBURETER FOR EXPLOSIVE ENGINES.

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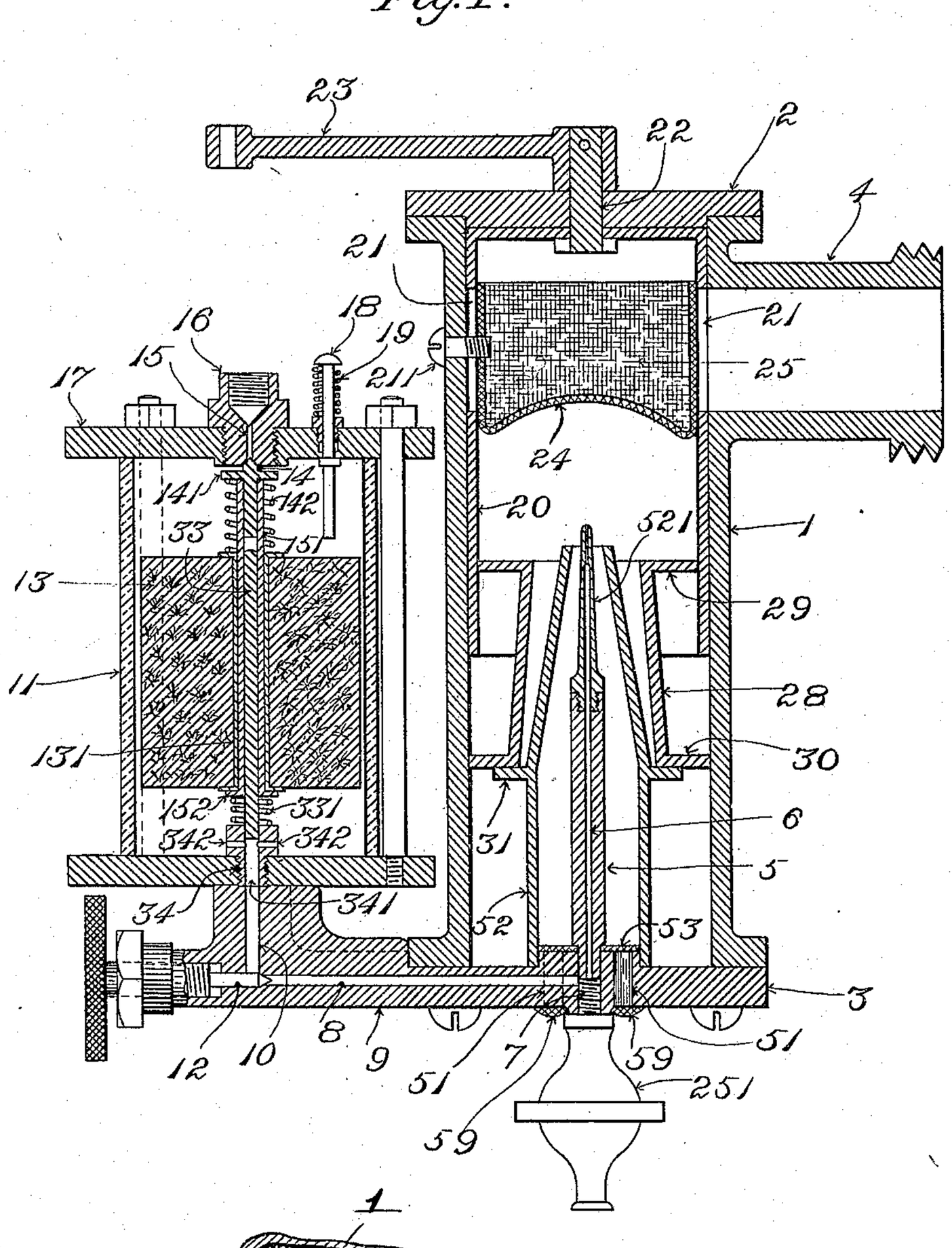
**916,103.** **Patented Mar. 23, 1909.**

*Fig. 1.*



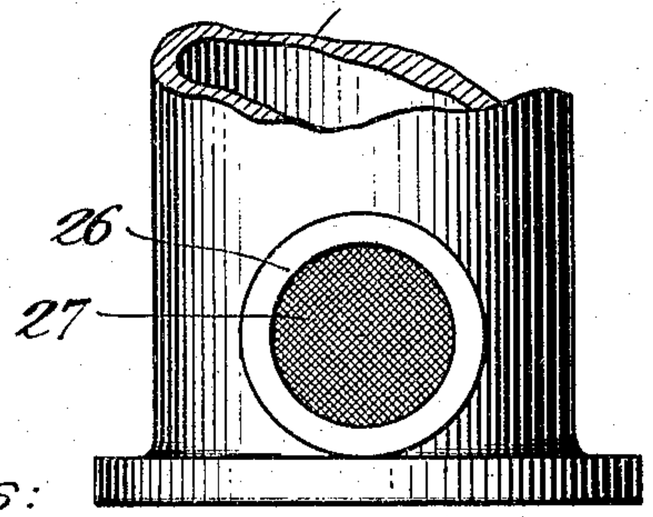




*Fig. 2.*

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# UNITED STATES PATENT OFFICE.

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## CARBURETER FOR EXPLOSIVE-ENGINES.

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Application filed December 5, 1904. Serial No. 235,471.

*To all whom it may concern:*

Be it known that I, DAVID J. CARTWRIGHT, a citizen of the United States, residing at Boston, in the county of Suffolk, State of Massachusetts, have invented a certain new and useful Improvement in Carbureters for Explosive-Engines, &c., of which the following is a specification, reference being had therein to the accompanying drawings.

The invention has relation to carbureters such as are employed with internal combustion or explosive engines, and in other connections where a fuel-mixture composed of air and hydrocarbon-vapor is consumed.

The invention comprises a novel arrangement of fuel-nozzle, air-passages, and movable valve, by which a proper supply of fuel-mixture composed of air and hydrocarbon-vapor in proper proportions is provided to suit all rates of speed of the engine.

An embodiment of the invention is represented in the accompanying drawings, in which latter—

Figure 1 shows in vertical transverse section a carbureter embodying the invention. Fig. 2 is a detail view in elevation showing a portion of cylindrical shell 1.

Having reference to the drawings,—1 is a hollow cylindrical shell, constituting the main body of the carbureter, 2 being the head at the top end of the said shell, and 3 the head at the bottom end thereof. Near the upper end thereof, the said shell is provided with a lateral extension 4, the latter having a passage therethrough communicating with the main interior space of the shell. The said lateral extension is adapted to have connected therewith in practice the feed-pipe of an engine or the like which is to be supplied with fuel-mixture, and through which feed-pipe the fuel-mixture flows from the carbureter to the engine.

5 is a fuel-nozzle, rising from the head 3 at the interior of the carbureter, and having a central passageway 6 opening at the upper end of the nozzle. The reduced lower end of the main portion or body of the said nozzle is externally threaded, and is screwed from above into a threaded hole 7, which is tapped through the head 3. The passageway 6 communicates with the said hole 7. The fuel-nozzle is surrounded by an inner wall or shell 52 that is located between the said nozzle and the shell 1 and in the present instance is connected at its lower end with the head 3, its upper end extending nearly to the upper end of the fuel-nozzle 5. The wall or shell 52 is separated from the fuel-nozzle by a space surrounding the latter and constituting a passageway for air, the said space or passageway being sufficient in cross-sectional area to permit of the movement therethrough of a volume of air which will supply the needs of the engine when running below a certain rate of speed. For the admission of the air to the said space or passageway, one or more inlets 51, 51, communicating therewith are provided. In the present instance, these inlets are constituted by holes or passages that are formed through the bottom head 3, alongside the threaded hole 7. A screen of wire-gauze, shown at 59, is applied exteriorly in connection with the said holes or passages to exclude dust, flyings, etc. The suction which is produced within the feed-pipe by the working of the engine draws external air in through the said holes or passages, and in flowing past the discharge orifice at the upper end of the fuel-nozzle the said air vaporizes the liquid hydrocarbon which occupies the central passage 6 of the said nozzle.

The hydrocarbon is supplied to the passage 6 of the fuel-nozzle by means of a passageway 8, which extends radially within the head 3 and also through a lateral projection 9 of the said head. At its inner end, the said passageway communicates with the hole 7, while within the said lateral projection 9 it is intersected by a vertical passageway 10 communicating with the interior space of the float-chamber 11. The rate of the flow of hydrocarbon through the passageways 10 and 8, from the said float-chamber to the fuel-nozzle, is regulated by the needle-valve 12 within the passageway 8. The hydrocarbon is kept at a uniform level within the float-chamber by means of the float 13 and valve 14. The said valve coöperates with a valve-seat at the delivery-end of a passageway 15 that extends through a coupling or union 16, screwed into a threaded hole that is made through the top head 17 of the float-chamber. In practice, the said coupling or union has connected therewith a pipe, (not shown), or the like, leading to a supply-tank or the like from which the hydrocarbon flows under a moderate head or pressure to the float-chamber, as well understood.

A so-called "tickler" is shown at 18, it comprising a pin working loosely in a vertical

position within a hole that is made through the top head 17 of the float-chamber. The lower end of the said pin projects into the interior space of the float-chamber, while the upper end thereof rises above the head 17. An expanding spiral spring 19 surrounding the upper portion of the pin is confined between the head 17 and an enlargement or collar upon the pin. The said spring normally holds the pin in an elevated position with the lower end thereof clear of the float, but allows the pin to be pushed down by hand for the purpose of depressing the float, to separate the valve 14 from its seat so as to permit flow of hydrocarbon from the source of supply into the float-chamber, to thereby raise the level of the liquid within the same, thus causing overflow at the upper end of the fuel-nozzle for the purpose of starting-up the engine, all as usual. Any such overflow, or any drip, finding its way to the base of the fuel-nozzle is caught by wire-netting or gauze 53 around the base of the fuel-nozzle at the lower end of the space between the latter and the wall or shell 52, and is held thereby until converted into vapor by the air entering at 51.

A throttle-valve 20 is located within the upper portion of shell 1, it comprising a hollow cylinder fitting within the shell 1 with capacity to turn therein, and having a lateral opening or openings at 21, 21, one of which is caused to register with the passageway of lateral extension 4 to permit the fuel-mixture to pass from the interior of shells 1 and 20 through the said passageway into the feed-pipe (not shown). A central spindle 22, rising from the head of the cylindrical throttle-valve, passes through a central hole which is formed through the top head 2 of the shell 1, and has affixed to its upper end the operating arm or lever 23. Above the fuel-nozzle is located a diaphragm 24 of wire gauze. This serves to break up the flow of air and vapor into a number of fine streams, and cause a complete commingling thereof. This diaphragm is located within the cylinder of the throttle-valve 20, and for convenience of application and removal it is furnished with a cylindrical body 25 having a sliding fit within the said cylinder.

The main passageway 6 within the fuel-nozzle 5 is of sufficient diameter to permit the liquid hydrocarbon to rise freely therein. Adjacent the discharge orifice at the free extremity of the fuel-nozzle, however, the passageway is reduced in diameter, as heretofore.

In order to enable the extremity of the fuel-nozzle to be removed and replaced, whenever required, as for the purpose of cleaning out the reduced portion of the passageway, or for repairs, and to enable a change in the diameter of the said reduced portion to be effected when desired, the fuel-nozzle is furnished with a tip-portion 521 which is formed separately from the main or base-portion of the said nozzle, and is detachably connected therewith. I have shown the said top-portion in screw-threaded engagement with the base-portion. It contains the reduced portion of the passageway 6. When it is desired to make a change in the area of the orifice at the upper end of the vaporizing nozzle, the tip-portion is removed and replaced by one having a passageway of different diameter. In other words the tip-portion is made interchangeable to enable the volume of hydrocarbon which is presented for vaporization to be varied. This employment of a removable and interchangeable tip enables the height of the vaporizing orifice to be varied as may be found desirable in practice.

For the purpose of providing for the collection and discharge of water or other impurities, a pet-cock or drip-cock 251 has the upper end of its pipe screwed into the lower part of the screw-threaded hole 7 through the bottom head 3 of the shell 1. The bore of the said pipe receives the water and all other settlings, and the cock enables them to be drawn off or discharged from time to time without interrupting the running of the engine, and also without the expenditure of time and loss of hydrocarbon which are incident to the removal of a cap or the like. In the event of clogging of the passageway of the nozzle or its tip, a wire or the like may be pushed through the pet-cock or drip-cock and said passageway after the said cock has been opened, to thereby clean out the passageway.

I provide for affording a proper supply of fuel-mixture to suit all rates of speed of the engine, and for maintaining uniformity in the proportions of air and hydrocarbon-vapor in the said fuel-mixture as follows:—The space or passageway which is inclosed by the inner shell or wall 52 surrounding the fuel-nozzle 5 supplies air in quantity sufficient to produce enough fuel-mixture to meet the demands of the engine in running up to a certain speed, but when the engine is to be run above such speed an increased supply of fuel-mixture is necessary. In order to provide for this increased supply of fuel-mixture, a space for the passage of air exists between the said inner shell or wall 52 and the outer shell 1. At or near the base of the shell 1, the said base is provided with one or more inlets 26 for the admission of external air to this latter space, the said inlet being furnished with a wire-gauze screen 27 to exclude dust, etc. The flow of air through this space is controlled by means of a vertically-movable sleeve 28. The said sleeve surrounds the upper portion of the inner shell 52. In the present instance it is furnished with an upper flange 29 and a

lower flange 30, the flange 29 having a sliding fit within the cylindrical portion of the throttle-valve, while the flange 30 has a similar fit within the shell 1. Thus fitted, the sleeve is adapted to be moved up and down with relation to the inner shell or wall and tip of the fuel-nozzle. When the sleeve is uplifted from its normal position, a space is opened between the sleeve and the upper portion of the inner shell or wall 52, through which air entering by way of the inlet 26 may flow. The sleeve occupies normally the lowered position in which it is represented. In this position its lower end makes contact with a valve-seat and thus arrests the flow of air through the interior of the sleeve. In the present embodiment of the invention, the valve-seat is constituted by the upper surface of a shoulder or flange 31 with which the exterior of the inner shell 52 is furnished. Flow of air, therefore, ordinarily takes place through the inlets 51, 51, into the space or passage that in inclosed by the inner shell, and the air issuing at the upper end of the said inner shell around the vapor end of the fuel-nozzle, from within the inclosure of the inner shell, acts to vaporize the liquid hydrocarbon which occupies the passageway of the fuel-nozzle. When the sleeve is lifted, an additional volume of air entering by way of the inlets 26, 26, is permitted to pass between the inner shell 52 and the sleeve-portion of the valve, it combining at the upper end of the fuel-nozzle with the stream from the inner passageway.

The upper portion of the inner shell 52 is tapering, the wall thereof converging toward the centrally-located fuel-nozzle 5, and thereby forming what I term the stationary cone. This form of the said inner shell or stationary cone causes the air which passes therethrough to converge from different sides at and above the upper end of the fuel-nozzle, increasing somewhat its pressure and velocity as it passes the top of the fuel-nozzle, thereby enhancing the action in vaporizing the liquid hydrocarbon, and by the convergence of streams traveling in different directions causing the air and vapor to commingle more effectually. The sleeve-portion of the valve 28 is similarly tapered, forming thus what I term the sliding cone or conical sleeve. This shape of the said valve acts similarly in causing convergence of the air passing upward around the stationary cone 52 from the outer inlets 26, 26, and in addition produces a constriction or portion of least internal diameter at the upper end of the passage through the valve. This place of constriction defines the position of the point of greatest pressure and velocity of the on-flowing stream of mixed air and vapor and it will be perceived that when the valve is lifted from its seat the said place of constriction is raised relative to the top end of the fuel-nozzle. The effect of this is to increase the height or vertical extent of the zone of suction and maintain uniformity in the rate of vaporization of the liquid hydrocarbon, obviating the tendency of such rate to decrease in consequence of the increase in the diameter of the stream of air flowing past the tip of the fuel-nozzle which occurs when the valve is lifted. Thereby, uniformity in the proportions of air and hydrocarbon-vapor in the fuel-mixture is maintained notwithstanding the increased volume of such fuel-mixture which is applied to the engine at the higher speed of the latter.

The means and manner of operating the valve may vary in some cases. I have herein shown an embodiment of the invention in which the valve is operated automatically by the suction that is produced within the feed-pipe and carbureter by the engine. In the case of the present embodiment, with the engine running below the predetermined rate of speed the suction is not sufficient to lift the valve-sleeve, and the latter remains in its normal position, cutting off the flow of air from the secondary passageway. When the speed of the engine increases, increasing the rate of flow of the air through the feed-pipe and the suction within the feed-pipe and carbureter, the said increasing suction causes the automatic valve to be lifted from its seat by the pressure of the external air acting through inlet 26. The weight of the automatic valve may be depended upon to hold it to its seat until the predetermined degree of suction within the feed-pipe and carbureter occurs, or the supplemental air-inlet 26 may be furnished with a check-valve opening inwardly and held to its seat by the tension of a spring until such tension is overcome by the suction.

The throttle-valve 20 is formed with a plurality of openings 21, 21, either of which is adapted to be presented in position to register with the passageway through the lateral extension 4 of the shell 1 of the carbureter. This enables the said valve to be shifted so as to present the operating arm or lever at the one side of the shell or body 1, or the other, according as may be required to suit the position of the connections pertaining to the engine with which the carbureter is used and by means of which the throttle-valve is operated. In the present instance the said openings are located opposite to each other. After the throttle-valve has been given the required position to accommodate the position of the said connections, a stop-screw 211 is screwed in through the shell 1 until its inner end projects into the opening 21 which for the time being is in the idle position By

engagement of the edges of said opening with the said screw the range of movement of the throttle-valve in being operated to control the flow of fuel-mixture into the feed-pipe is regulated.

I have shown herein a preferred float-valve arrangement, which, however, is not claimed herein, it being intended to constitute the subject of a separate application for United States Letters Patent. Thus, the valve 14 which is employed in connection with the inlet-passageway 15, Figs. 8 and 9, consists of a valve-plug which is carried by the upper end of a sleeve 151. The said valve-plug and sleeve constitute in effect a needle-valve, the sleeve being the valve-stem. The said sleeve fits upon the pin or spindle 33 rising from the bottom of the float-chamber, and is adapted to move up and down thereon. In the present instance, the pin or spindle 33 is supported in place by having its lower end securely inserted into the upper portion of the central bore 341 extending vertically through the plug 34, which last is screwed into a socket formed in the lower head of the float-chamber. The lower portion of the bore 341 is in communication with the passageway 10, the contents of the float-chamber finding their way into bore 341 through lateral passages 342, 342, which are made in the plug 34. Between the upper end of the screw-plug 34 and the lower end of the sleeve 151 the pin or spindle 33 is surrounded by an expanding spiral spring 331, which supports the needle-valve and acts with a tendency to hold the working end of the latter against or adjacent the valve-seat at the inner end of the passageway or inlet 15. The lower end of the sleeve 151 is furnished with a flange, as 152, which affords a wider bearing for the upper end of spring 331. The float 13 is furnished with a central bushing or sleeve 131, which is fitted to the exterior of the sleeve 151 with capacity for independent vertical movement thereon. An expanding spiral spring 142 surrounds the upper portion of the sleeve between the top of the float, or the flanged upper end of the bushing or sleeve 131, and a flange 141 with which the valve-plug is furnished. In practice, should the float-chamber be empty, or should the level of the liquid hydrocarbon within the same be lowered so as to permit the float to descend far enough, the float would rest upon the lower flange 152 of the sleeve 151, and the weight of the float would be added to that of the sleeve and plug and would operate to compress the spring 331 more or less and correspondingly depress the valve. Thereby the valve would be separated from the valve-seat of the inlet or passage 15 so as to permit liquid hydrocarbon to flow in freely from the source of supply. When the level of the liquid hydrocarbon rises within the float-chamber, the float rises also and acting through the spring 142 it presses the valve toward and against the valve-seat, until by the continued rise of the float, and the resulting compression of the spring 142 between the float and the flange 141 of the valve, the tension of the said spring 142 is raised to a degree sufficient to press the valve to its seat firmly enough to arrest the inflow of liquid hydrocarbon. The spring maintains its action against the valve so long as the level of the liquid within the float-chamber remains substantially the same. It permits vertical oscillations, etc., of limited extent of the float to occur, as in consequence of jars, vibrations, etc., without causing the valve to open, and hence further liquid is not admitted in consequence of accidental oscillations of the float. As the level of the liquid lowers, and the float descends, the tension of the spring 142 decreases until the pressure or head within the inlet passageway 15 forces open the valve against the pressure of such spring, whereupon fresh liquid enters by way of such inlet passageway to restore the level. Spring 331 is intended chiefly to act to sustain the weight of the valve 14 and its valve-stem constituted by the sleeve 151, so as to relieve the float of such weight.

What I claim is:—

1. A carbureter for explosive engines and the like, constructed with a mixing chamber, a fuel-nozzle, an air passage surrounding and coöperating with the said fuel-nozzle, a second air-passage also surrounding and coöperating with the said fuel-nozzle and operating to admit additional air to the mixing chamber at a point anterior to the orifice of the fuel-nozzle, so that the combined volume of air flows past the said nozzle in arriving at the mixing chamber, and a valve which controls the flow of air through the second air-passage.

2. A carbureter for explosive engines and the like, constructed with a mixing chamber, a fuel-nozzle, an air-passage coöperating with the said fuel-nozzle, a second air-passage also coöperating with the said fuel-nozzle and operating to admit additional air at a point immediately adjacent the orifice of the fuel-nozzle, but somewhat anterior thereto, so that the combined volume of air flows past the said orifice in arriving at the mixing chamber, and a valve which controls the flow of air through the second air-passage.

3. A carbureter for explosive engines and the like, constructed with a mixing chamber, a fuel-nozzle, an air-passage coöperating with said fuel-nozzle, a second air-passage also cooperating with the said fuel-nozzle and operating to admit additional air at a point immediately adjacent the orifice of the fuel-nozzle, but somewhat anterior thereto, so that the combined volume of air flows past the said orifice in arriving at the mixing

chamber, and a valve which controls the flow of air through the second air-passage and which is opened by increase of suction.

4. A carbureter constructed with a fuel-nozzle, a mixing chamber, an air-passage cooperating with the said fuel-nozzle, a second air-passage also coöperating with the said fuel-nozzle and operating to admit additional air at a point anterior to the orifice of the latter so that the combined volume of air flows past the said orifice in arriving at the mixing-chamber, and a valve which controls the supply of air through said second air-passage, and which in its open position encircles the orifice of the fuel-nozzle.

5. A carbureter constructed with a fuel-nozzle, a mixing-chamber, an air-passage cooperating with the said fuel-nozzle, a second air-passage also coöperating with the said fuel-nozzle and operating to admit additional air at a point anterior to the orifice of the latter so that the combined volume of air flows past the said orifice in arriving at the mixing chamber, and a valve which is operated by increase of suction to control the supply of air through the second passage and also is caused to assume a position encircling the orifice of the fuel-nozzle.

6. A carbureter constructed with the fuel-nozzle, the inner passageway for air converging toward the tip of the fuel-nozzle, the outer passageway for air, and the sleeve-valve having the shell thereof converging toward the said tip.

7. In a carbureter, in combination, a fuel-nozzle, the inner shell surrounding the fuel-nozzle converging toward the tip of the latter, the outer shell, and the valve movable within the outer shell and having the upper and lower flanges and the shell thereof converging toward the said tip.

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

DAVID J. CARTWRIGHT.

Witnesses:
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EDITH J. ANDERSON.