N. LOMBARD.

CARBURETER.

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1,387,420.

Patented Aug. 9, 1921.

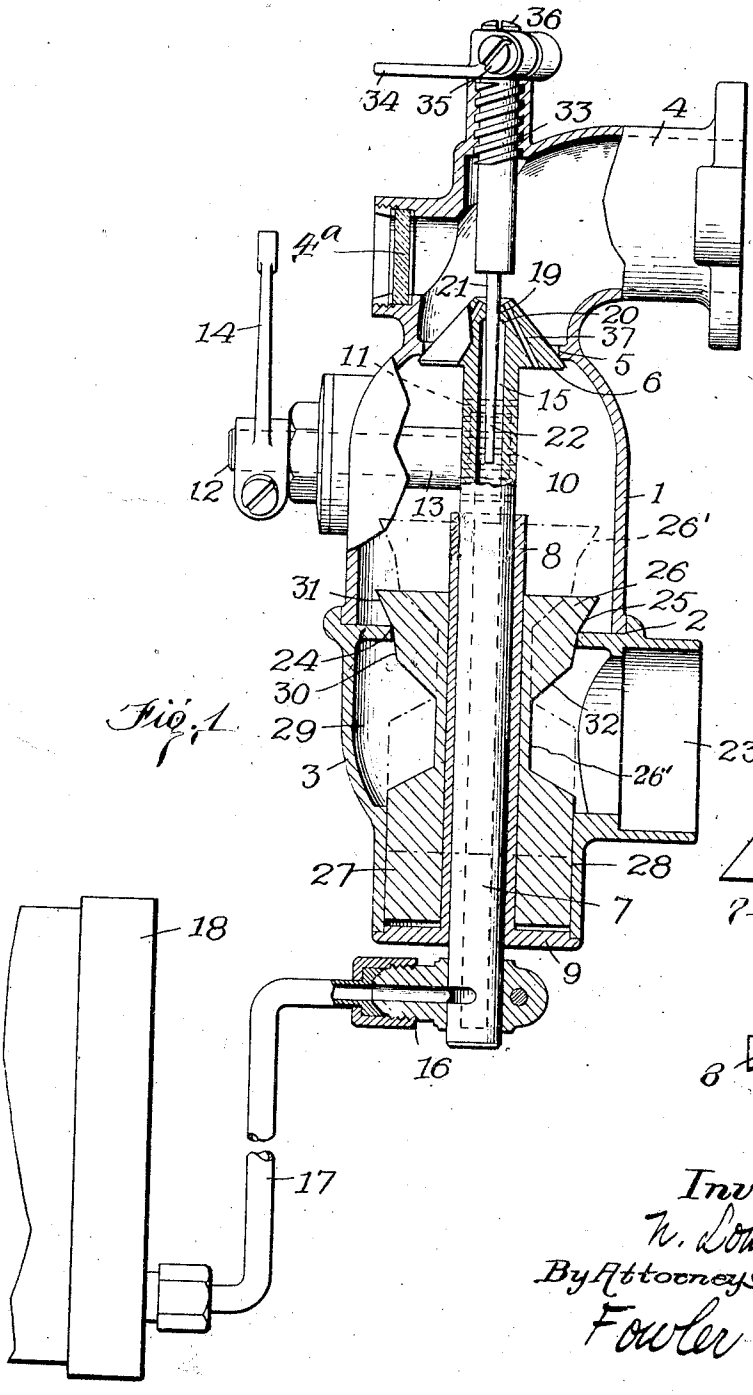

Fig. 1.

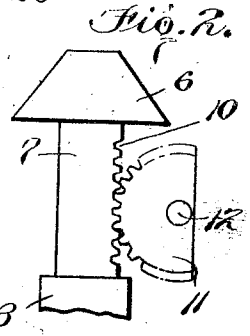

Fig. 2.

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CARBURETER.

1,387,420. Specification of Letters Patent. Patented Aug. 9, 1921.

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To all whom it may concern:

Be it known that I, NATHANIEL LOMBARD, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in Carbureters, of which the following, taken in connection with the accompanying drawings, is a specification.

The present invention relates to carbureters, for use with internal combustion engines and the like, to form an explosive mixture of air and gaseous fuel, such as gasolene or kerosene.

The object of my present invention is to provide a carbureter of extreme simplicity of structure, with a minimum of operating parts due to the elimination of the usual float control of the liquid fuel, the air valve mechanism, and the throttle or "butterfly" valve between the carbureter and engine.

Further objects are, to provide for a more intimate mixture of the liquid fuel and air; to control the proper proportions of air and liquid fuel by means of a single manually movable part; to momentarily increase the richness of the mixture in starting the engine or producing a sudden increase in the speed of the engine, and to make the suction of the engine available under varying conditions of operation; to maintain a supply of liquid fuel without utilizing the force of gravity, thereby obviating the necessity of intermediate fuel reservoirs between the carbureter and a source of fuel supply.

These objects, among others, I accomplish by the construction and arrangement of parts as hereinafter described, the features of novelty being pointed out in the appended claims, reference being had to the accompanying drawing, in which Figure 1 is a vertical sectional view of my improved form of carbureter, with portions of the shell broken away to disclose the interior construction more clearly. Fig. 2 is a detail view illustrating a part of the carbureter.

As herein shown, my improved carbureter is inclosed by a two part shell, the upper part 1 of said shell being joined in any suitable way at 2 to the lower part 3, whereby to constitute a single continuous inclosure. Said inclosure communicates with the engine manifold by an integral extension 4 near the top of shell portion 1, as is usual in devices of this class. Below the extension 4 the shell portion 1 provides an annular valve seat 5, for coöperation with a frusto-conical valve member 6 to control the flow of air which is admitted for mixture with the liquid fuel, as hereinafter described. The shell or casing opposite the spindle 21 is provided with a sight glass 4^a to provide means for the inspection of the mixing chamber.

The valve 6 is carried on a stem 7, which is vertically slidable in an elongated bearing 8 that projects upwardly from a bottom closure 9 for the lower shell portion 3. The valve 6 is raised or lowered with respect to its seat 5 by means of a rack 10 on stem 7, which is in mesh with a segmental gear 11 on rock shaft 12. The shaft 12 is journaled in a suitable bearing 13 projecting inwardly from the side wall of shell portion 1, and said shaft is operated by a lever arm 14 which may be connected in any desired manner to the usual hand or foot throttle device, as commonly employed in the usual form of carbureter to actuate the "butterfly" or mixture valve of the engine. In the position shown, the valve 6 is effective to shut off the flow of air past its seat 5; as said valve is lowered, by movement of lever arm 14 a constantly increasing volume of air will be drawn past said seat, due to the frusto-conical shape of said valve.

The valve 6 and stem 7, throughout the length of the latter, are centrally bored to provide a liquid fuel passage 15, which at the lower end of stem 7 is connected by a suitable coupling 16 to a pipe 17 leading directly to a liquid fuel supply tank 18, the latter being here shown as disposed at a lower level than the carbureter. The pipe 17 may be flexible, or otherwise freely suspended so as to permit the movement of stem 7, as above described. The passage 15 is contracted at its upper end, near the top of valve 6, to form an annular valve seat 19, opening through the center of valve 6, and expanding downwardly as at 20, to the size of passage 15. The seat 19 coöperates with a downwardly tapering normally stationary member 21, which projects therethrough into the passage 15. The upper end of member 21 is substantially cylindrical and of a size to close the valve seat 19; from said upper end, the member 21 gradually tapers downwardly and merges finally into a cylindrical section of smaller diameter 22. As will be apparent, the raising and lowering of valve

6 will control the size of the restricted annular nozzle which is thus formed between seat 19 and member 21, and thus the liquid fuel which passes through said nozzle and is thereby broken up into a finely divided mist or spray will vary in volume proportionately to the volume of air passing the valve seat 5. Such variation is due to the downward taper of member 21, and the maximum volume of liquid fuel will flow past the valve seat 19 when the reduced cylindrical section 22 is opposite said valve seat; at this time the maximum volume of air will obviously pass the seat 5.

All the air for admixture with the liquid fuel above the valve seat 19 is admitted through an opening 23 in the side wall of lower shell portion 3. Said shell portion 3 provides an annular seat 24 for coöperation with an annular shoulder 25 on a valve member 26, which surrounds and is guided by the bearing 8. The valve member 26 has a cylindrical weighted extension 27 which has a snug sliding fit in a cylindrical bore 28 at the lower end of shell portion 3. Said valve member 26 is preferably reduced in section near the middle, forming a waist 26′ connecting the inverted conical part 26 with the cylindrical part 27, to afford an ample air space 29 within the shell portion 3 and below the valve seat 24, so the atmospheric pressure against the under side of the valve 26 will lift the valve 26 when the operation of the engine produces a vacuum in the vacuum chamber between the valve seats 5 and 24.

With the valve member 26 in full line position herein shown, the flow of any air past the seat 24 is prevented, due to the contact of shoulder 25 with said seat. However, the slightest raising of valve member 26 permits the passage of an appreciable volume of air, since said member, just below the shoulder 25 is smaller in diameter than the valve seat 24, and gradually tapers downwardly as at 30. Therefore as the valve member 26 is gradually raised, an increasing volume of air is rendered available for admixture with the liquid fuel, and the rush of said air through the seat 24 is effective to assist in maintaining the valve member 26 in raised position, due to the outward taper 31 of said valve member above the shoulder 25. In the maximum open position of said valve member 26, as indicated herein by the broken lines 26′, the rush of air through the seat 24 is effective against the downwardly tapering portion 32 thereof, to assist in sustaining said member in its raised position, against the force of gravity tending to lower and close the same.

The operation of my improved device as thus far described is as follows:—The tapers of air valve 6 and the liquid fuel controlling member 21 may be so proportioned, that, in normal operation, the relative amounts of air and fuel in the mixture which is formed above valve 6 will be substantially constant, in all positions of said valve, between the full open position and the entirely closed position. The liquid fuel is subjected to the full suction of the engine cylinders, and likewise, this suction, as soon as the valve 6 is lowered, is available to lift the valve member 26, and thus to inaugurate the flow of air for admixture with said liquid fuel. However, on account of the inertia of the member 26, and also the dashpot action of its extension 27 within the bore 28, an appreciable interval of time will elapse before said member responds fully by its up and down motion to the suction thereon, and assumes a height commensurate with the degree of said suction. In other words, in normal operation, the member 26 will be sustained by the suction and by the rush of air through seat 24, at a height which varies with the above two forces,—but invariably this height is not reached for an appreciable time after the suction to ultimately produce the same has become available, and an appreciable time will also elapse, when the suction is decreased, before the valve member 26 will assume the full line position as represented in the drawing.

The above described action is extremely useful when the engine is being started up, as will be seen, since a very rich mixture is automatically produced, owing to the initial suction being exerted almost entirely on the liquid fuel nozzle, and notwithstanding the fact that the air valve 6 may be wide open. Furthermore, when the engine is running slowly, or idling, on a throttled explosive charge, a sudden lowering of valve 6, to cause the engine to "pick up" quickly, will be responded to by an extremely gradual elevation of the member 26 from its former relatively low level of flotation. Thus a richer mixture is automatically produced in this contingency, which prevents "knocking" and strain on the engine while it is being accelerated.

In normal continued operation, both air and fuel are subjected to the suction from the engine cylinders, to the same degree, and the formation of the mixture being thus dependent upon this suction, it is clear that no "butterfly" or mixture valve in the extension 4, or in the engine manifold, is necessary, since the valve 6 and member 21 perform all the functions of such a "butterfly" valve in controlling the amount of mixture passing to the engine. Moreover, a distinct advantage is gained by the elimination of this "butterfly" valve, since the latter, when in partly closed or throttled position in the ordinary carbureter, reduces the degree of suction acting on the fuel; in the present

construction, however, the full suction of all the cylinders is constantly exerted to draw the fuel in passage 15 at a high velocity through the variable nozzle, thus promoting the action of said nozzle in forming a readily aerated mist or spray.

The member 21 is carried on a screw 33 of relatively large pitch which is threaded through the top of shell portion 1 and is capable of limited movement in its bearing, so as to vary and adjust the position of member 21. To this end the screw 33 has attached thereto, outside of shell portion 1, a lever 34 which may be connected, if desired, to the usual mixture regulating lever, not shown, which is commonly employed to give, temporarily, a rich mixture for starting purposes. The actuation of lever 34, as will be seen, varies the normally fixed position of member 21, by means of screw 33, so that, the valve 6 being considered as stationary at any given moment, the quantity of gaseous fuel entering the combustible mixture may be varied by such manipulation, the quantity of air remaining constant. To provide for a further adjustment, such as might be necessary owing to extreme temperature changes, the lever 34 may be disconnected by loosening screw 35, to allow the movement of screw 33 by its head 36, and thereafter the screw 35 may be tightened to secure the parts together in the new position of adjustment.

To provide for a constant supply of air impinging directly on the fuel spray where the mixture is formed, I prefer to form a series of air ducts 37 through the body of valve 6, which are at all times subject to the suction from the cylinders. The air ducts 37 converge toward their delivery ends to cause the air currents passing therethrough to impinge against the current of liquid fuel delivered from the valve 6. The operation of my improved carbureter is sufficiently clear from the foregoing detailed description, it being obvious that various changes and modifications may be introduced without departing from the spirit of the invention as defined in the annexed claims.

In the operation of my improved carbureter, the space inclosed in the extension 4 constitutes a mixing chamber in which the thorough mixture of the air and liquid fuel is promoted by the cross currents of air passing through the converging passages 37 and directed against the current of liquid fuel. The space inclosed in the casing 1 between the valve seats 5 and 24 I term the vacuum chamber, as the vacuum produced therein by the suction of the engine controls the movement of the air valve 26. The space inclosed in the case 3, surrounding the waist of the air valve 26 I term the air pressure chamber as it subjects the air valve 26 to the normal atmospheric pressure through the opening 25. The lower cylindrical part of the casing 3 fitting the cylindrical base of the air valve 26 constitutes a dashpot to restrain the movement of the air valve 26.

I claim,

1. In the carbureter of an internal combustion engine, the combination of a casing inclosing three separate chambers, namely, mixing, vacuum and air chambers located one above the other in the order named with the mixing chamber uppermost, with valve controlled openings between each of said chambers, said air chamber having a communication with the outside air, a valve for closing the opening between the mixing and vacuum chambers, provided with a hollow valve stem extending through the bottom of the casing and having a connection outside the casing between said valve stem and a source of fuel supply.

2. In the carbureter of an internal combustion engine, the combination of a casing inclosing three separate chambers, namely, mixing, vacuum and air chambers located one above the other in the order named, with the mixing chamber uppermost, with valve controlled openings between each of said chambers, a valve for closing the opening between the mixing and vacuum chambers, provided with a hollow valve stem extending through the bottom of the casing and having a connection at its lower end with a source of fuel supply, said hollow valve stem having a contracted opening at its upper end leading to the mixing chamber, a downwardly tapered pin extending through the mixing chamber and said contracted opening, and means for manually imparting a longitudinal movement to said valve stem, whereby the movement of said valve and the admission of fuel to the mixing chamber is simultaneously controlled at will.

3. In the carbureter of an internal combustion engine, the combination of a casing inclosing three separate chambers, namely, mixing, vacuum and air chambers located one above the other in the order named, with the mixing chamber uppermost, with valve controlled openings between each of said chambers, a valve for closing the opening between the mixing and vacuum chambers, carried upon the upper end of a hollow valve stem, a valve stem extending through the bottom of the casing and having a connection at its lower end with a source of fuel supply, said valve stem having a contracted opening at its upper end and said valve having a series of passages therethrough converging toward the top of the valve, whereby air currents passing through said converging openings will impinge against the current of fuel passing through the contracted opening of the valve stem.

4. In the carbureter of an internal combustion engine, the combination with a

casing inclosing three separate chambers, namely, mixing, vacuum and air chambers located one above the other in the order named, with the mixing chamber uppermost, with valve controlled openings between each of said chambers, of a valve for closing the opening between the mixing and vacuum chambers provided with a hollow valve stem opening into the mixing chamber and extending through the bottom of the casing and having a connection outside the casing with a source of fuel supply, an elongated bearing extending upwardly from the bottom of the casing for said valve stem, and means for manually moving said valve stem in said elongated bearing at will.

5. In the carbureter of an internal combustion engine, the combination with a casing inclosing three separate chambers, namely, mixing, vacuum and air chambers located one above the other in the order named, with the mixing chamber uppermost and having valve controlled openings between each of said chambers, of a valve for controlling the opening between the mixing and the vacuum chambers, means for manually opening said valve to subject the vacuum chamber to the suction produced by the operation of the engine, means for supplying fuel through said valve to the mixing chamber, and a gravity valve closing the opening between the vacuum and air chambers.

Dated this 23rd day of August, 1917.

NATHANIEL LOMBARD.

Witnesses:

NELLIE WHALEN,

GEO. H. KENNEDY, Jr.