G. A. F. AHLBERG.

INTERNAL COMBUSTION ENGINE.

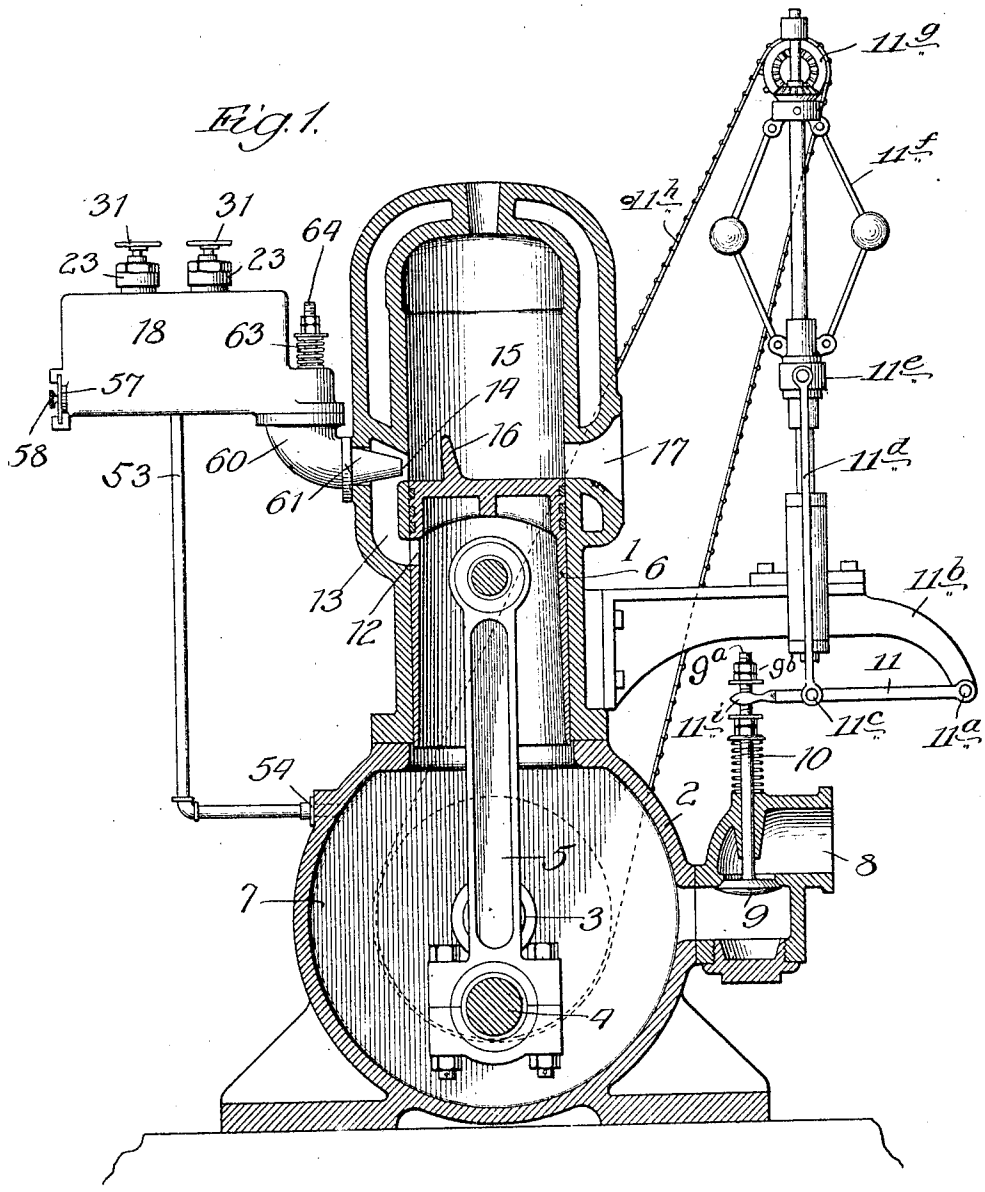
APPLICATION FILED NOV. 28, 1910.

1,085,233.

Patented Jan. 27, 1914.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
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Inventor,
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3 SHEETS—SHEET 2.

Fig. 2.

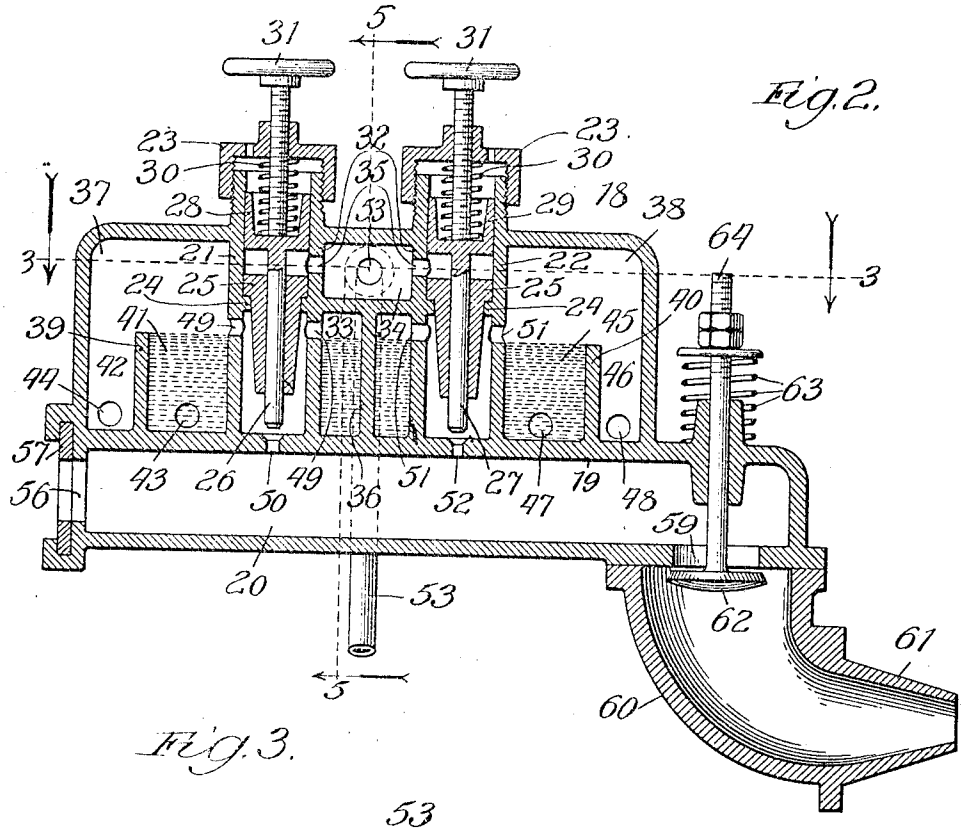
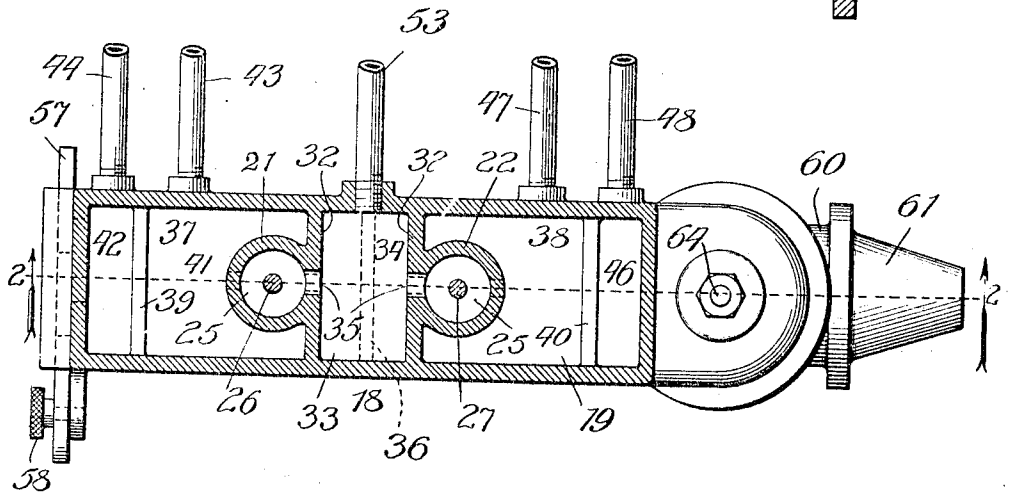


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

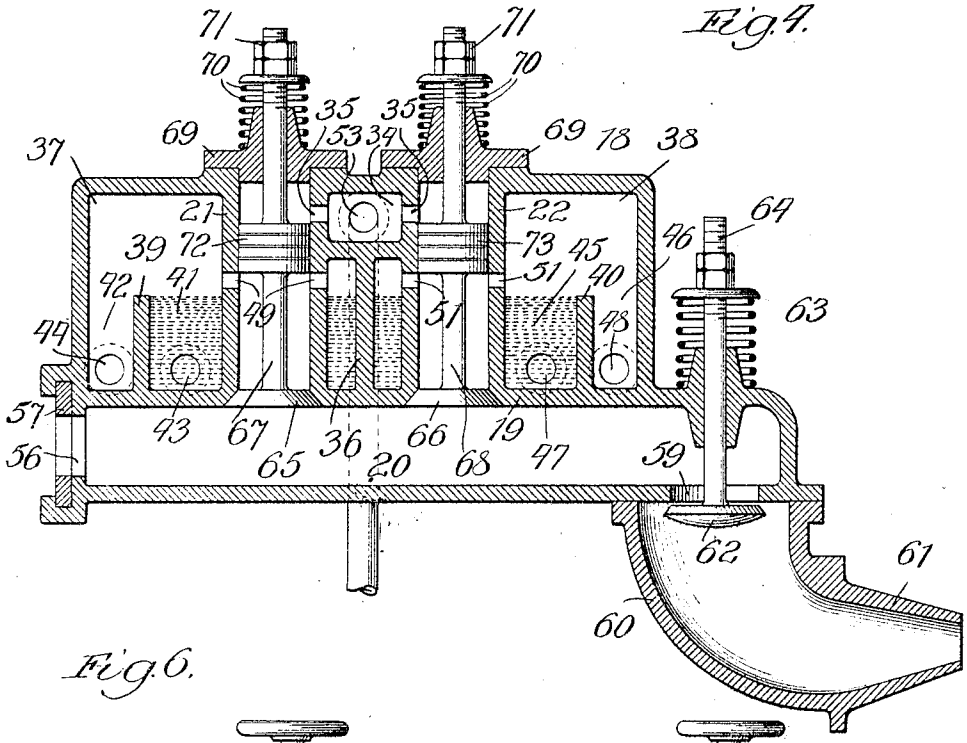


Fig. 6.

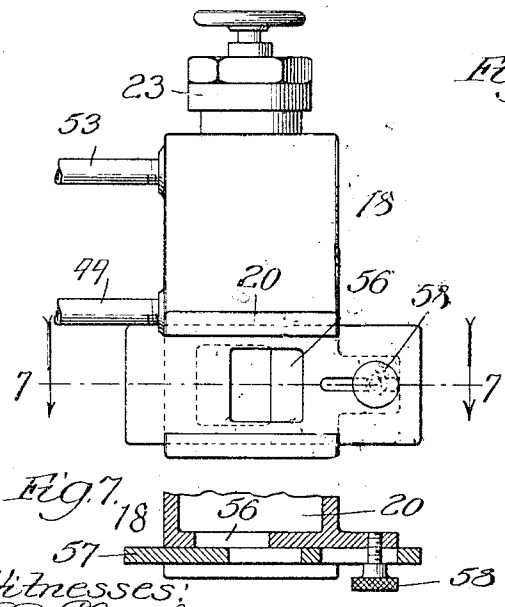
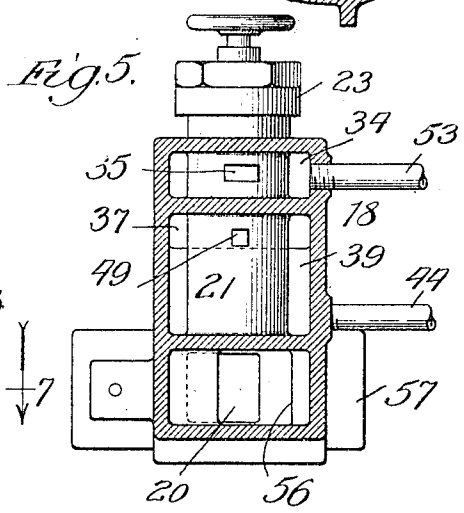


Fig. 5.



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

1,085,233. Specification of Letters Patent. Patented Jan. 27, 1914.

Application filed November 28, 1910. Serial No. 594,519.

To all whom it may concern:

Be it known that I, GUSTAV A. F. AHLBERG, a citizen of the United States, late of Laporte, Indiana, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a description, reference being had to the accompanying drawings, forming a part of this specification, in which corresponding numerals of reference in the different figures indicate like parts.

My invention relates to internal combustion engines including carbureters or charge forming and delivering devices therefor, and my object is to provide simple and effective means for producing and maintaining an explosive mixture of standard or uniform quality while varying the quantity thereof to conform in ratio to the successive variations of the engine load. Stated in general terms, I accomplish said object by providing a fuel mixing chamber having an air induction opening leading thereto and an eduction opening leading therefrom to the combustion chamber of an engine, a source of hydro-carbon fluid maintained at a constant level, valves actuated by fluid pressure for controlling the outlet of the hydro-carbon fluid or liquid fuel to the mixing chamber, means for compressing air with varying degrees of pressure in conformity to the successive variations of the engine load and means for releasing said air in relative conformity to the impulses of the engine, so as to induce a flow of the gaseous or air and fuel mixture from the mixing chamber to the combustion chamber, there to be again commingled with an additional volume of air in such relative proportion thereto as to insure complete combustion when ignited, the quantity of each charge from the mixing chamber being varied by the relative pressure and velocity of the inducing air current or jet, all of which is hereinafter more particularly described and definitely pointed out in the claims.

In the drawings, Figure 1, is a central vertical sectional view of an engine embodying the features of my invention, the carbureter connected therewith being shown in elevation. Fig. 2, is an enlarged vertical sectional view of said carbureter taken upon the line 2—2, Fig. 3, viewed in the direction of the arrows there shown. Fig. 3, is a sectional view in plan taken upon the line 3—3, Fig. 2, Fig. 4, is a longitudinal vertical sectional view similar to that shown in Fig. 3, of a modified form of carbureter, Fig. 5, is a sectional view thereof taken upon the line 5—5, Fig. 2, Fig. 6, is an end elevation thereof, and Fig. 7, is a sectional view in plan of a portion thereof taken upon the line 7—7, Fig. 6.

Referring to the drawings 1, Fig. 1, represents generally the cylinder of an internal combustion engine mounted upon a hollow casing 2, in which is fitted a crank-shaft 3, having a crank 4 connected by means of a pitman 5 in a well known way to the interior of a hollow piston 6. The crank is arranged to operate in a compression chamber 7, which is in direct communication with the engine cylinder and also with an air-inlet 8, which latter is provided with a valve 9 adapted to be normally closed by means of a spring 10 and opened by piston suction in the manner hereinafter stated. A lever 11, is pivoted at 11^a to a rigid arm 11^b attached to the engine frame. Said lever is connected at 11^c by means of a link 11^d to any well known form of sleeve or collar 11^e upon an engine governor of the usual type generally designated by 11^f, the driving gear of which is provided with a short shaft upon which is mounted a sprocket-wheel 11^g connected by a sprocket-chain 11^h to a like wheel not shown, upon the engine shaft. Said lever is provided with a fork 11^i adapted to straddle the valve-stem 9^a which is threaded and provided at its upper end with an adjusting nut 9^b with which said fork is adapted to engage when the speed of the engine is sufficient to cause the governor to move said lever-fork upward into the path of said nut so as to contact therewith and thereby act to throttle the valve and limit the extent to which it may be opened as a result of the piston suction, which action will be more fully explained in describing the operation of the engine. An eduction port 12 is formed in the piston in position to register with the lower end of a conduit 13 when the piston is at the end of its downward stroke as shown. The upper end of the conduit 13 terminates in an induction port 14 leading to the combustion chamber 15. A deflector 16 is formed upon the piston to deflect the incoming fluids to the upper end of the combustion chamber. An exhaust port 17 is located opposite to the port 14.

Connected with the engine cylinder in any approved way, so as to communicate therewith in the manner hereinafter described, is a carbureter generally designated by 18. Said carbureter is provided with a horizontal partition 19, Figs. 2 and 3, which serves to separate the fuel holding chambers from a mixing chamber 20. Said partition as well as the other parts constituting the casing with its divisions, are integral and are preferably formed by casting. Cylindrical casings 21 and 22 are formed apart from each other and are extended upwardly from the partition 19 through the top of the casing and are provided with screw-caps 23. Each of said cylinders is provided with an internal annular shoulder 24. Each of said cylinders is accurately bored above said shoulder and a plug 25 is fitted therein. Each plug has a central bore which serves as a guide, one for the stem of a needle-valve 26 and the other for that of a like valve 27, a piston 28 being formed upon the upper end of the stem of the valve 26 and a like piston 29 upon the upper end of the stem of the valve 27. Each of said pistons is bored out for the reception of a coiled spring 30 interposed between the piston and cap to hold the valve normally closed. An adjusting screw 31 is projected through each cap with its lower end in proximity to the piston for the purpose of limiting the upward movement of the valve. Transverse partitions 32, Fig. 3, are extended across the casing between the cylinders 21 and 22, which partitions extend from the top of the casing to a horizontal partition 33, thereby forming a chamber 34 which is in communication with the interior of the cylinders 21 and 22 respectively by means of ports 35 located beneath the pistons 28 and 29. A central vertical partition 36 shown in Fig. 2 and indicated in dotted lines in Fig. 3, serves to divide the casing into two main chambers 37 and 38, in the former of which is located a transverse partition 39 of about half the height of the chamber and in the latter a like partition 40. The partition 39 serves to divide the chamber 37 into two compartments 41 and 42 respectively, the former of which is connected by means of a pipe 43 and a suitable pump, not shown, with a source of water supply and the latter with a pipe 44 which serves as an overflow leading back preferably to said source of water supply, so that water pumped into the compartment 41 will overflow the partition 39 and be maintained at a constant level. The chamber 38 is divided in like manner by the partition 40 into two compartments 45 and 46, the former of which is connected by means of an inlet pipe 47 with a pump and reservoir of liquid hydro-carbon and the latter with an outlet pipe 48 to provide for the overflow in the manner described with reference to said water supply. Eduction ports 49 lead from the compartment 41 to the lower portion of the cylinder valve chamber which is provided with an opening 50 communicating with the mixing chamber 20, while like ports 51 are formed in like manner to communicate with the lower portion of the cylinder 22 to deliver liquid hydro-carbon to the valve opening 52 therein. A pipe 53 is interposed between the air-chamber 34 and the compression chamber 7 of the engine, preferably by connecting the same directly with said chamber, as, for example, at 54, Fig. 1. The mixing chamber 20 is provided with an air induction opening at the left-hand end, better shown at 56 in Fig. 7, the area of which is adapted to be varied by means of a slide valve 57, adapted when adjusted, to be secured by means of a set-screw 58. An opening 59 serves to connect the mixing chamber with a conduit 60, the end of which is tapered in the form of a nozzle 61, which is projected through the conduit 13 into the port 14, the latter being of sufficient diameter to form an annular space around said nozzle. A valve 62, Figs. 2 and 4, has its seat beneath the opening 59 and is held normally closed by means of a spring 63 which is adjustably connected by means of lock-nuts to the projecting stem 64 of the valve.

Having thus described the various parts of my improved device, I will now explain its action.

Assuming the engine to be in operation and running under a full load, the governor acting upon the lever 11, serves to move the fork 11^1, downwardly away from the nut 9^b which leaves the valve 9 free to be opened to its full limit upon the upward stroke of the piston, thereby drawing into the chamber 7, a maximum volume of air to be compressed by the return stroke of the piston. A portion of the air so compressed passing through the pipe 53 into the air chamber 34 and thence through the ports 35, acts upon the pistons 28 and 29 to lift them to the full limit permitted by the stems 31, thereby in turn fully opening the needle valves 26 and 27. At the same instant the port 12 of the engine piston is opened which permits the air from the compression chamber to pass into the conduit 13 and thence around the nozzle 61, through the port 14 into the combustion chamber 15. Being deflected by the part 16 it passes upwardly and thence downwardly and out through the exhaust port 17, thus scavenging said chamber and at the same time forming an annular jet around the mouth of the nozzle, the velocity of which is sufficient by its suction to open the valve 62 and cause a flow of air into the mixing chamber, and the valves 26 and 27 being then open, a charge of water is likewise caused to flow therein through the valve

opening 50 and one of liquid hydro-carbon through the valve opening 52. The several elements being there mingled, the vaporous charge is caused to flow from the mixing chamber to the combustion chamber where it is compressed by the upward stroke of the piston 6. As soon as the port 12 is closed by the upward movement of the piston, the valves 26, 27 and 62 are likewise closed, and after each explosion the described operation is repeated, but constantly modified by the varying air pressure, which, in turn, is controlled by the relative extent to which the valve 9 is opened and hence by the volume of air admitted. The movement of the engine piston being constant, it follows that a maximum volume of air would be compressed to a maximum degree which would result in opening the fuel valves to their full limit and drawing into the mixing chamber by suction a full volume of fuel and air. On the other hand any decrease in load and consequent increase in speed would be followed by a reverse movement of the lever 11, so as to cause the fork 11^1, to be moved nearer to the nut 9^b, thereby serving to prevent the full opening of the valve 9 upon the upstroke of the piston and hence to throttle the air intake in proportion to the degree of limitation of the valve movement. It is obvious that the lever might be so adjusted with reference to the governor and the nut 9^b, that in case the engine should attain an excessive speed the valve 9 would be entirely prevented from opening and inasmuch as no air could then enter the chamber 7 to be compressed by the expansion or downward stroke of the piston, it follows that there would be no air pressure at that time to open the valves 26 and 27 and hence no fuel would be delivered to the mixing chamber upon said down-stroke and no explosive charge to the combustion chamber. The speed of the engine would at once be reduced and with it the throttling action upon the valve 9, when explosive charges would again be delivered in the manner described, said charges varying as stated in proportion to the varying demands of the load.

From the foregoing it will be seen that however much the load may be changed the explosive charge delivered will be controlled automatically to conform thereto and that to the utmost nicety of variation by the air pressure; but notwithstanding the variation in quantity, the quality of the fuel charge will remain constant. The desired position of the valve 57 may be determined by experiment to admit the requisite quantity of air to form an explosive mixture with a given adjustment of the fuel valves; when once adjusted, however, it may remain unchanged.

In Fig. 4, I have shown a modification of said invention which varies only from that shown in Fig. 2 in the construction and direction of movement of the fuel valves, the other features, except the caps upon the valve cylinders being the same in every respect, they have been given corresponding reference numerals. In the modification shown, the valves 65 and 66 in the cylinders 21 and 22 are formed to open outwardly and downwardly and are seated in openings of the full size of the cylinders. The valve stems 67 and 68 extend upwardly through central bores in caps 69 and are held normally closed by means of springs 70 the tension of which may be adjusted by nuts 71 upon the valve stems. The pistons 72, 73 are mounted upon said valve stems respectively below the air ports 35 so that the air pressure in the chamber 34 serves to press the pistons downwardly instead of upwardly as in the preferred construction.

It is obvious that in cases where the engine load is constant as, for example, in propelling motor boats, the air inlet valve 9 may be subject to arbitrary control. It is also manifest that other features of the device may be modified without departing from the principle involved which is based upon a varying air pressure to control and deliver fuel charges proportioned to variations in load while maintaining uniformity in quality.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. In an engine of the class described, the combination of a combustion chamber, a piston, a carbureter having a mixing chamber with air and fuel inlets the former of which is open to the atmosphere, and a mixture outlet in communication with a conduit leading to the combustion chamber, an air container, means for compressing air therein with each expansion stroke of the piston, means for regulating the volume of air to be admitted for compression in relative conformity to variations in the engine load, means for releasing said air and conveying the same into said combustion chamber, a normally closed valve for admitting fuel to the mixing chamber of said carbureter and means actuated by air pressure from said air container for actuating said valve to admit fuel to said mixing chamber when the air in said container is under pressure.

2. The combination with an engine having a combustion chamber, of a mixing chamber having air and fuel inlets, a mixture outlet leading to the combustion chamber, a container, means for drawing air therein with one stroke and for compressing it with the reverse stroke of the engine piston, means for regulating the volume of air so admitted in relative conformity to the speed of the engine, means for releasing said

air into the combustion chamber to first scavenge said chamber and then deliver said mixture as a result of the suction thereby produced, means for normally closing said fuel inlet and means controlled by the action of said compressed air for opening the same at a predetermined time.

3. The combination with an internal combustion engine, of a carbureter comprising a mixing-chamber having air and fuel inlets, the former of which is open to the atmosphere, a mixture outlet in restricted form leading to a conduit in communication with the combustion chamber of the engine, a compression chamber, means for admitting air therein with each piston stroke in a given direction to be compressed upon the reverse stroke, means for regulating said air admitting means in relative conformity to variations in the engine load, means for closing communication between said compression chamber and said conduit leading to said combustion chamber, and means for opening said communication at the end of the compression stroke to release said compressed air into said conduit with each expansion stroke; whereby a partial vacuum may be produced in said mixing chamber, varying in degree in conformity to the variation in said air pressure.

4. The combination with an internal combustion engine, of a carbureter having a mixing-chamber, an air inlet leading from the atmosphere thereto, means for varying the area of said inlet, a fuel inlet, a mixture outlet leading to a conduit in communication with the combustion chamber, an air compression chamber in communication with said conduit, means for regulating in relative conformity to variations of the engine load, the volume of air to be admitted to said compression chamber with each alternate piston stroke and means for releasing said air into said conduit leading to the combustion chamber to cause a partial vacuum in said mixing-chamber and deliver a proportionate charge of mixed air and fuel to the combustion chamber to be further mixed with said air simultaneously admitted thereto.

5. The combination with an engine of the class described, of a carbureter, provided with a mixing chamber having air and fluid inlets respectively, a mixture outlet nozzle in communication with the combustion chamber of the engine, an air compressing chamber, means for compressing air therein with each expansion stroke of the engine piston, means for regulating the volume of air delivered thereto at each return stroke in relative conformity to variations in the engine load, means for releasing said compressed air and conducting the same against and around said nozzle outlet and thence to said combustion chamber, to cause the delivery of the explosive mixture to said combustion chamber, a valve for normally closing said fuel inlet to said mixing chamber and means for opening said valve by the action of said compressed air.

6. The combination of an engine of the class described, of a carbureter, provided with a mixing chamber having air, water and fuel inlets respectively, a mixture outlet nozzle in communication with the combustion chamber of the engine, an air compression chamber, means for compressing air therein with each expansion stroke of the engine piston, means for regulating the volume of air delivered thereto at each return stroke in relative conformity to variations in the engine load, means for releasing said air and directing the same to impinge upon said outlet nozzle and thence to pass to said combustion chamber to induce a delivery of the explosive mixture to said combustion chamber, valves for normally closing said water and fuel inlets respectively to said mixing chamber and means for opening said valves by the action of said compressed air to induce a delivery of said water and fuel to said mixing chamber.

7. In an engine of the class described, the combination with a combustion chamber of a compression chamber, a conduit leading thereto from the atmosphere, a normally closed spring controlled valve interposed in said conduit, an element arranged to be moved into engagement with the valve stem to limit the opening movement of the latter in proportion to the increase of speed of the engine from a predetermined normal, whereby the air volume to be admitted to the compression chamber may be proportionately varied, a carbureter having a fuel mixing chamber, air and fuel inlets leading thereto the former of which is open to the atmosphere, an eduction conduit leading therefrom with its terminal in immediate proximity to said combustion chamber, a conduit leading from said compression chamber to said combustion chamber around the mouth of said terminal and means for releasing said compressed air into said last named conduit substantially at the end of the expansion stroke of the piston.

8. The combination with an internal combustion engine, of a compression chamber, a normally closed valve adapted to be opened by piston suction for admitting air thereto, an engine governor, means controlled by the engine governor for limiting the extent to which said valve may be opened in proportion to the speed of the engine, means for compressing the air admitted with each expansion stroke of the piston, a fuel mixing chamber having an induction air port open to the atmosphere, a fuel chamber, means for maintaining liquid hydro-carbon at a constant level therein, a normally closed fuel

releasing valve located between said fuel chamber and mixing chamber, means actuated by fluid pressure for opening said valve with each expansion stroke of the piston, an injector element leading from said mixing chamber to the combustion chamber of the engine and means for admitting and directing a jet of compressed air from said compression chamber to and around said injector element and into said combustion chamber simultaneously with the opening of said fuel releasing valve.

9. In an internal combustion engine, the combination of a carbureter comprising a mixing chamber open to the atmosphere, a fuel chamber having liquid hydro-carbon therein maintained at a constant level, a piston-actuated valve for normally closing the passage between said fuel and mixing chambers, an air container, means for compressing air therein with each expansion stroke of the engine piston, governor controlled means for automatically varying the volume of air to be compressed in conformity to load variation, means for conveying a portion of said air so compressed to the piston of said piston-actuated valve, a combustion chamber, a nozzle in communication with said mixing chamber, a conduit leading from said air container to the combustion chamber of the engine, said nozzle being projected into said conduit, the latter being of greater diameter than that of said nozzle and means for delivering said compressed air from said air container to said conduit around said nozzle and into said combustion chamber at the end of each expansion stroke of the main piston.

10. In an engine of the class described, the combination of a combustion chamber, a piston, a carbureter having a mixing chamber provided with an air induction opening, a discharge nozzle leading to the combustion chamber of the engine, normally closed valves, the respective openings of which lead to said mixing chamber from water and liquid hydro-carbon reservoirs respectively, water and liquid hydrocarbon reservoirs, the fluid in each of which is maintained at a constant level, means for opening said water and liquid hydro-carbon controlling valves with each expansion stroke of the piston, a container, means for compressing air therein with each expansion stroke of the piston, means for admitting air to said container and means for releasing said air with each expansion stroke of the piston into impingement with said discharge nozzle to induce a flow of fuel vapor through the eduction opening of said mixing chamber into the combustion chamber in quantity conforming to the relative degree of air pressure produced by each expansion piston stroke.

11. The combination with an internal combustion engine of a carbureter, provided with a mixing chamber having air and fuel inlets respectively the former of which is open to the atmosphere, a mixture outlet, a normally closed outwardly opening valve located in said mixture outlet, said valve being adapted to be opened by outward suction, a compressed air chamber, in communication with the engine cylinder, means for compressing air therein with each expansion stroke of the piston, means for regulating the volume of air to be admitted thereto for compression at each return stroke of the piston in relative conformity to variations in the engine load and means for releasing said air and directing the same to impinge upon said mixture outlet to deliver a previously mixed air and fuel charge to the combustion chamber together with the supplemental air charge by which said air and fuel charge is sucked in.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses, this 25th day of November 1910.

GUSTAV A. F. AHLBERG.

Witnesses:
DAVID H. FLETCHER,
JENNIE L. FISKE.