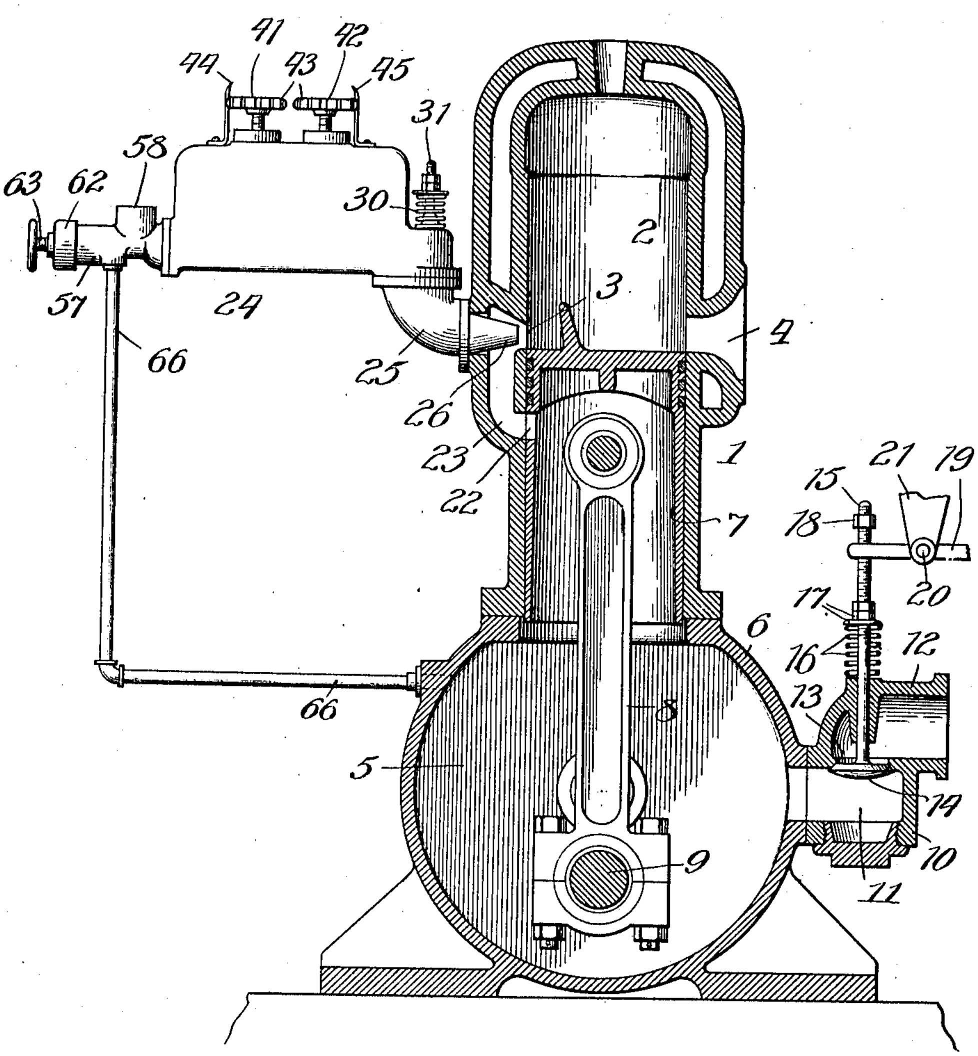
G. A. F. AHLBERG.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED NOV. 28, 1910.

1,035,513.

Patented Aug. 13, 1912.

2 SHEETS—SHEET 1.

Fig. 1.



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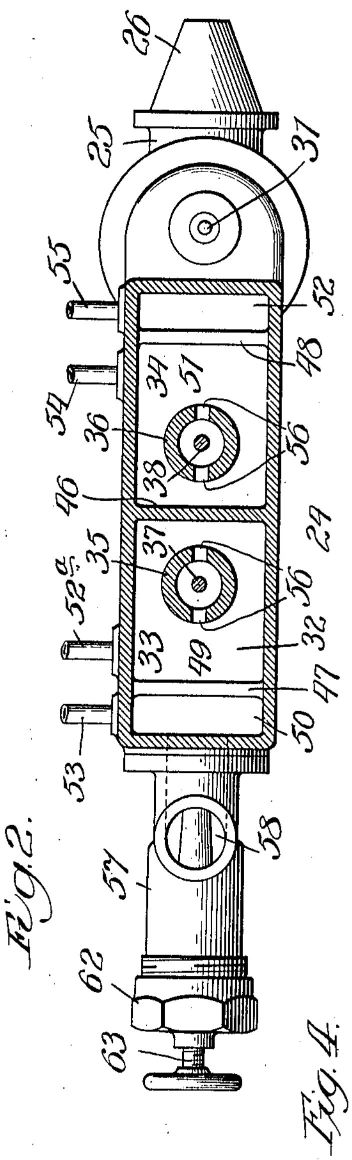

Fig. 2.

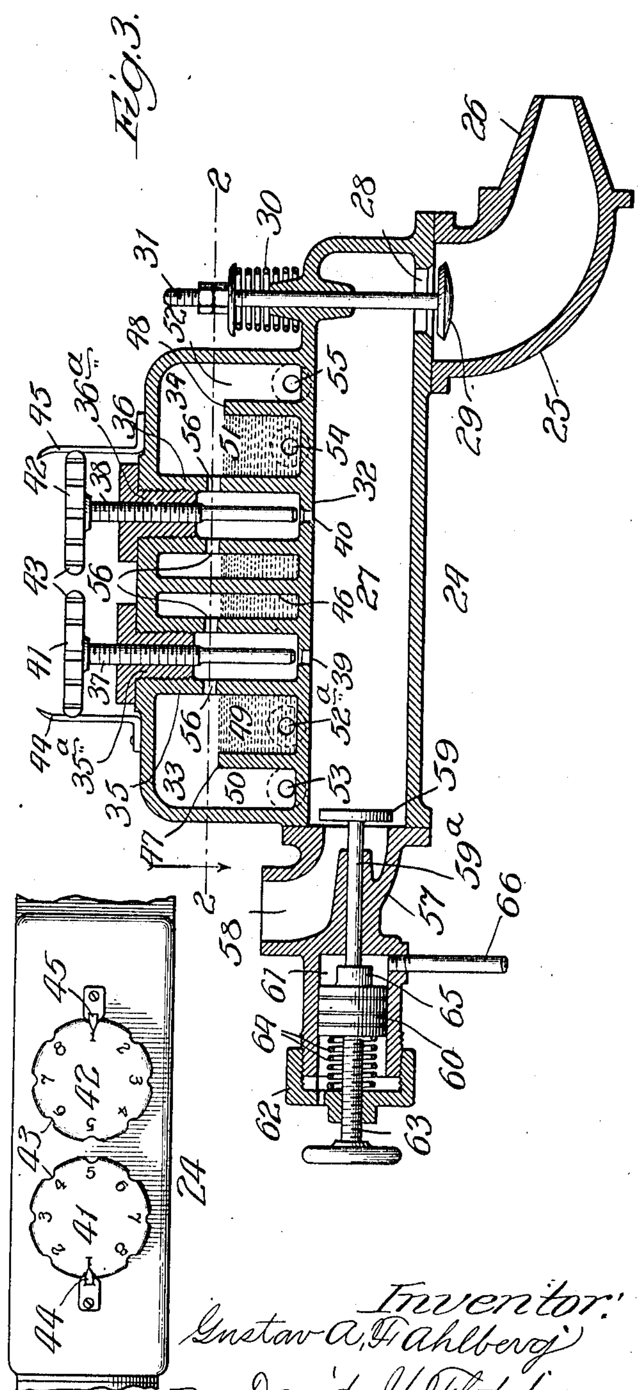

Fig. 3.

Fig. 4.

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UNITED STATES PATENT OFFICE.

GUSTAV A. F. AHLBERG, OF CHICAGO, ILLINOIS.

INTERNAL-COMBUSTION ENGINE.

1,035,513. Specification of Letters Patent. Patented Aug. 13, 1912.

Application filed November 28, 1910. Serial No. 594,520.

To all whom it may concern:

Be it known that I, Gustav A. F. Ahlberg, a citizen of the United States, 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 of the two cycle type and my object is to so construct such an engine, together with a carbureter therefor, that the two may coact to regulate the fuel charge, so that the latter, while maintaining its quality, may be caused to vary in quantity in conformity to the relative variations in the load and speed of the engine.

To these ends, my invention consists in the combination of elements 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 showing in elevation a carbureter connected therewith, Fig. 2, is an enlarged plan view of the carbureter partly in section, said section being taken upon the line 2—2, Fig. 3. Fig. 3, is an enlarged central longitudinal vertical sectional view of the carbureter and Fig. 4, is a plan view of the main body of the carbureter with the graduated hand-wheels.

Referring to the drawings, 1 represents generally the cylinder of an internal combustion engine which is provided with the usual combustion chamber 2, having an induction port 3 and exhaust port 4. An air compression chamber 5 is formed in what is commonly known as the crank-case 6, constituting a part of the engine frame. A hollow piston 7, is located in the cylinder and is connected by means of a pitman 8 to a crank 9 upon the engine shaft. A casing 10 is provided with a chamber 11 opening into the crank-case 6, and also in communication with a pipe 12, through an opening 13, which is normally closed by means of a valve 14, the stem 15, of which is screw-threaded and surrounded by a light closing spring 16. The tension of the latter may be controlled by means of adjusting nuts 17. A like nut 18 is placed upon the upper end of an extended portion of the valve stem in operative proximity to, but normally out of contact with, the end of a governor controlled lever 19, pivoted at 20 to a stationary support 21. The valve stem is passed loosely through an opening or fork in the end of said lever and the nut 18, is so adjusted that when the engine is working under full load, the valve will be free to open to its utmost limit, thereby permitting the maximum volume of air to be drawn in through the pipe 12, when the piston is upon the upward stroke; it being understood that the pipe 12 is open to the atmosphere. On the other hand, when the load is reduced, resulting in a correspondingly increased speed, the movement of the governor causes the lever 19 to be moved so as to contact with the nut 18, thereby throttling the valve 14 and reducing the quantity of air admitted to the crank chamber for the purposes hereinafter stated. The piston 7 is provided with an eduction port 22, which, when the piston reaches the limit of its downward stroke, is adapted to communicate with a channel 23, in the engine casing which leads to the induction port 3 of the combustion chamber. A carbureter, generally designated by 24, is provided with a nozzle 25, which is rigidly attached to the engine casing, the inner end 26 of said nozzle being tapered as shown and extended into the conduit 23 in direct communication with the induction port 3.

The carbureter is provided with a fuel mixing chamber 27, Fig. 3, which is in communication through an opening 28, at one end with the nozzle 25. An outwardly opening valve 29, serves to normally close said opening through the action of a spring 30, located upon the valve stem 31. A horizontal partition 32, also shown in Fig. 2, in the carbureter serves to separate the mixing chamber from fuel chambers 33 and 34. Hollow cylindrical casings 35 and 36 are located in the chambers 33 and 34 respectively, being extended upwardly from the partition 32 to the top of the main casing. The openings in said casings are closed at the top by means of screw-plugs 35^a, 36^a, which are centrally bored for the reception of screw threaded needle valves 37, 38, the lower ends of which are adapted to regulate the passage of liquid through valve openings 39 and 40 respectively, leading to the mixing chamber. Said valves are provided with graduated hand-wheels 41, 42, having numbered notches 43, in the periphery thereof adapted to be engaged by spring indicator stops 44, 45 to enable the operator to control the admission of fuel to the mixing chamber. A central vertical partition 46 serves to separate the chambers 33 and 34. Transverse partitions 47 and 48, of limited height, are located in the chambers 33 and 34 respectively, so as to form compartments 49 and 50 in the one chamber and 51 and 52 in the other. The compartment 49 is connected by means of a feed pipe 52[a], to a source of water supply, not shown, while the chamber 50 is connected in like manner with a discharge pipe 53. Like feed and discharge pipes 54 and 55 serve to connect the compartments 51 and 52 with a source of liquid hydro-carbon supply not shown. This construction enables a supply of water to be maintained at a constant level in the compartment 49 and a like supply of oil to be so maintained in the compartment 51. Openings 56, in the casings 35 and 36 are located at a level slightly above that of the tops of the partitions 47 and 48 to enable liquid fuel to be drawn from the compartments 49 and 51 respectively into the valve chambers and thence to the mixing chamber, when a vacuum is produced in the latter, the quantity of fuel so drawn, being proportionate to the degree of vacuum. Upon the opposite side of the carbureter casing from that to which the eduction nozzle is attached, is a fitting generally designated by 57, having an air inlet channel 58 leading to the mixing chamber. A throttle valve 59 is located opposite to the inner end of the channel 58, being connected by means of a stem 59[a] with a piston 60, located in a cylindrical chamber 61. Tapped in a central bore of a screw cap 62, is an adjusting screw 63 the inner end of which is adapted to bear against the outer end of the piston for the purpose of adjusting the minimum opening of the valve 59, which should never be entirely closed. A light spring 64, located between the cap and piston, the tension of which may be regulated by said cap, tends to open the valve 59, the extent of which opening is intended to be limited by means of a hub or stop 65, upon the piston. The chamber 61 in which the piston is located is in communication with the crank chamber of the engine by means of a pipe 66 which serves to equalize the pressure in the two chambers for the purpose hereinafter stated.

Having thus described the various parts of my improved device, I will now explain its operation: Assuming the engine to be running at full load and hence at reduced speed, and assuming further that the needle valves 37 and 38 are adjusted to admit the maximum quantity of liquid fuel desired when the greatest vacuum is produced in the mixing chamber, the engine piston upon its upward stroke would, by its suction, cause the valve 14 to be opened to its full limit, thereby permitting the maximum volume of air to be drawn into the crank-chamber for compression upon the return stroke. When the piston reaches the limit of the downward stroke, the discharge port 22, is opened, which permits the compressed air from the crank chamber to enter the conduit 23 and thence pass into the combustion chamber around the tapered portion 26 of the nozzle 25. This action causes a vacuum to be formed in the nozzle 25, thereby opening the valve 29 and producing in turn a vacuum in the mixing chamber, which induces a flow of water and oil through the valve openings 39 and 40 respectively. Inasmuch as the pressure of air in the crank chamber is greater at full load than at other times, the degree of pressure in the piston chamber 61 will be governed accordingly thus regulating the opening of the valve 59 to a corresponding degree, and likewise limiting the quantity of air entering through the channel 58 and increasing the vacuum in the mixing chamber. This increased vacuum in turn, causes a greater quantity of liquid fuel to be drawn into the mixing chamber for delivery to the combustion chamber. It is obvious that the vacuum in the mixing chamber and the pressure in the piston chamber 61, must bear a fixed ratio to the volume of air compressed in the crank-chamber; and inasmuch as the volume of air admitted to the latter is at all times dependent upon the extent to which the valve 14 is permitted to open, and inasmuch as the opening of said valve is subject to limitation by the governor lever, it follows that the degree of vacuum in the mixing chamber, the quantity of air and fuel admitted to the latter through the channel 58 and the needle valve openings, respectively, and hence the quantity and character of the charge introduced to the combustion chamber, are all primarily controlled by the action of the governor, in exact proportion to the load and speed of the engine. Should the load be decreased, the speed would, of course, be proportionately increased, when the governor lever would be moved accordingly to throttle the valve 14, thereby decreasing the volume of air admitted to the crank chamber, decreasing the vacuum in the mixing chamber, lessening the amount of liquid fuel drawn through the needle valves, decreasing the pressure in the piston chamber 61, permitting the valve 59 to open further and increasing in like proportion the quantity of air admitted to the mixing chamber thereby regulating in turn, the quantity and character of the explosive charge delivered to the combustion chamber in proportion to the changes in the load and speed.

From the foregoing it will be apparent that when the several valves are adjusted to the conditions required for a full load, the different coacting elements will be automatically controlled and required to conform with the utmost nicety to any and all variations in load and speed.

I do not wish to be confined to the exact construction shown for regulating the inflow of air either to the air compression chamber or to the mixing chamber as it is obvious that either may be varied without departing from the principle involved. In the latter case for example, it is apparent that a diaphragm would constitute the mechanical equivalent of the piston 60.

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

1. In an internal combustion engine, the combination of a combustion chamber, an air compression chamber, a piston for compressing air in said compression chamber with each expansion stroke thereof, means for regulating the volume of the successive charges of air to be admitted to said chamber for compression, means for admitting said air to the combustion chamber at the end of each expansion stroke of the piston, a carbureter having an air inlet, a mixture outlet, the latter of which leads to said combustion chamber, and a liquid fuel inlet, the feed from which inlet is subject to variation in conformity to the relative vacuum in the mixing chamber, a valve for varying the area of the air opening leading to said mixing chamber and means controlled by the variations of pressure in said air compression chamber for actuating said valve in conformity to said variations.

2. In an internal combustion engine, the combination of a combustion chamber, an air compression chamber, a piston arranged to draw air into said air compression chamber with the compression stroke of the piston to be compressed upon the reverse stroke thereof, means for regulating the volume of the successive charges of air drawn into said compression chamber, a normally closed channel leading from said compression chamber to said combustion chamber, means for opening communication between said chambers through said channel at the end of each expansion stroke of the piston, to permit a flow of compressed air to the combustion chamber, a carbureter having a mixture outlet in communication with said channel, together with an air-inlet and a liquid fuel-inlet the feed from which fuel-inlet is subject to variation in conformity to the relative vacuum in the mixing chamber, a valve for varying the area of the air passage leading to said mixing chamber, and means in operative communication with and controlled by the variations of pressure in said air compression chamber, for actuating said valve in conformity to said pressure variations.

3. The combination with an internal combustion engine having a combustion chamber and piston, of an air compression chamber, means for controlling the volume of air to be admitted thereto upon each compression stroke of the engine piston, means for compressing the same on each expansion stroke of the piston, means for permitting said air at the end of said stroke to expand into said combustion chamber, a carbureter having a mixture outlet leading to said combustion chamber, a liquid fuel-inlet, the feed of which is controlled by the vacuum in the mixing chamber, an air inlet, means for varying its area and means actuated by the pressure in said air compression chamber for actuating said area varying means.

4. The combination in an internal combustion engine, having a combustion chamber and piston, of an air compression chamber into which air is drawn with each successive compression stroke and compressed with each expansion stroke of the piston, means for regulating the volume of air admitted to said compression chamber, a normally closed channel leading from one of said chambers to the other, a port arranged to be uncovered at the end of each expansion stroke of the piston to permit a flow of air from said compression chamber through said channel, a carbureter having a mixture eduction nozzle extending into said channel, fuel and air inlets leading to said mixing chamber, a valve for throttling said air inlet, a piston chamber in communication with said air compression chamber and a piston therein connected with said valve whereby the relative pressure in said compression chamber may serve to regulate the extent to which the valve may be opened by the suction in the mixing chamber.

5. The combination with an internal combustion engine having an air compression chamber, of means for admitting air to said chamber with each compression stroke of the engine piston, a carbureter in which is combined a mixing chamber having a fuel inlet, a mixture-outlet leading to the combustion chamber of the engine, an air inlet, a valve for regulating the volume of air to be admitted therethrough, a piston chamber having a piston therein connected with said valve, and a conduit leading from said compression chamber to said piston chamber, said conduit communicating with that side of the piston which would tend to close the valve against a vacuum in the mixing chamber by the pressure of the air in said piston chamber.

6. The combination with an internal combustion engine having an air compression chamber, of means for admitting air to said

chamber with each compression stroke of the engine piston, a carbureter having a mixing chamber, a fuel inlet in communication with a source of liquid fuel supply maintained at a constant level, a mixture outlet leading to the combustion chamber of the engine, an air inlet, a valve for throttling said inlet, a piston chamber, a piston therein connected with said valve, a pipe leading from said chamber to said air compression chamber and means for preventing said valve from being fully closed at any time.

7. The combustion with an internal combustion engine having a combustion chamber and an air compression chamber, of a piston, means for regulating the volume of air to be admitted to the compression chamber with each compression stroke of the engine piston, means for compressing said air on each expansion stroke of the piston, means for permitting said air at the end of said stroke to expand into said combustion chamber, a carbureter having a mixture outlet leading to said combustion chamber, a normally closed outwardly opening valve located in said outlet, a hydro-carbon fuel inlet, the feed of which is varied by the vacuum in the mixing chamber, an air inlet, means for varying its area and means actuated by the pressure in said air compression chamber for actuating said area varying means.

8. The combination with an internal combustion engine having a combustion chamber, an air compression chamber and a piston, of governor controlled means for regulating the volume of air to be admitted to the compression chamber with each compression stroke of the piston to be compressed by the expansion stroke thereof, means for releasing said air at the end of said expansion stroke to expand into said combustion chamber, a carbureter having a mixture outlet leading to said combustion chamber, means for preventing a back-flow therein, a liquid hydro-carbon fuel inlet, the feed of which is produced by and subject to variations of vacuum in the mixing chamber, an air inlet, a valve located therein and means controlled by the air pressure in said air compression chamber, for governing the relative opening of said valve.

9. The combination with an internal combustion engine having a piston, a combustion chamber, and an air compression chamber provided with an opening leading therefrom to the atmosphere, of a normally closed inwardly opening valve located in said opening, means for limiting the extent to which said valve may be opened by an inflow of air, means for conveying and releasing air from said compression chamber to said combustion chamber at the end of each expansion stroke of the piston, a carbureter having a mixing chamber provided with a mixture outlet leading to said combustion chamber, means for preventing a back-flow of the charge from the combustion chamber, a liquid hydro-carbon fuel inlet the feed of which is subject to fluctuation in conformity to variations of vacuum in the mixing chamber, graduated means for arbitrarily regulating the area of said fuel inlet, an air inlet, a valve located therein and means controlled by the air pressure in said air compression chamber for governing the extent to which said valve may be opened.

10. The combination with an internal combustion engine having a governor, a piston, a combustion chamber and an air compression chamber, the latter being provided with an opening leading to the atmosphere, of a valve for varying the volume of air to be admitted to said opening, means adapted to be actuated by the engine governor for reducing the extent to which said valve may be opened below a given maximum, means for releasing and conveying air from said compression chamber to said combustion chamber at the end of each expansion stroke of the piston, a carbureter having a mixture outlet leading to said combustion chamber, a liquid hydro-carbon fuel inlet and a water inlet the feed of each of which is subject to fluctuation in conformity to variations of vacuum in the mixing chamber, graduated means for regulating the area of said fuel and water inlets respectively, an air inlet, a valve for varying the area of the latter and means controlled by the air pressure in said air compression chamber for governing the extent to which said valve may be opened.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses, this 23d day of November 1910.

GUSTAV A. F. AHLBERG.

Witnesses:

DAVID H. FLETCHER,

JENNIE L. FISKE.