E. F. ABERNETHY.

CARBURETER FOR EXPLOSIVE ENGINES.

APPLICATION FILED MAY 2, 1903.

906,671.

Patented Dec. 15, 1908.

2 SHEETS—SHEET 1.

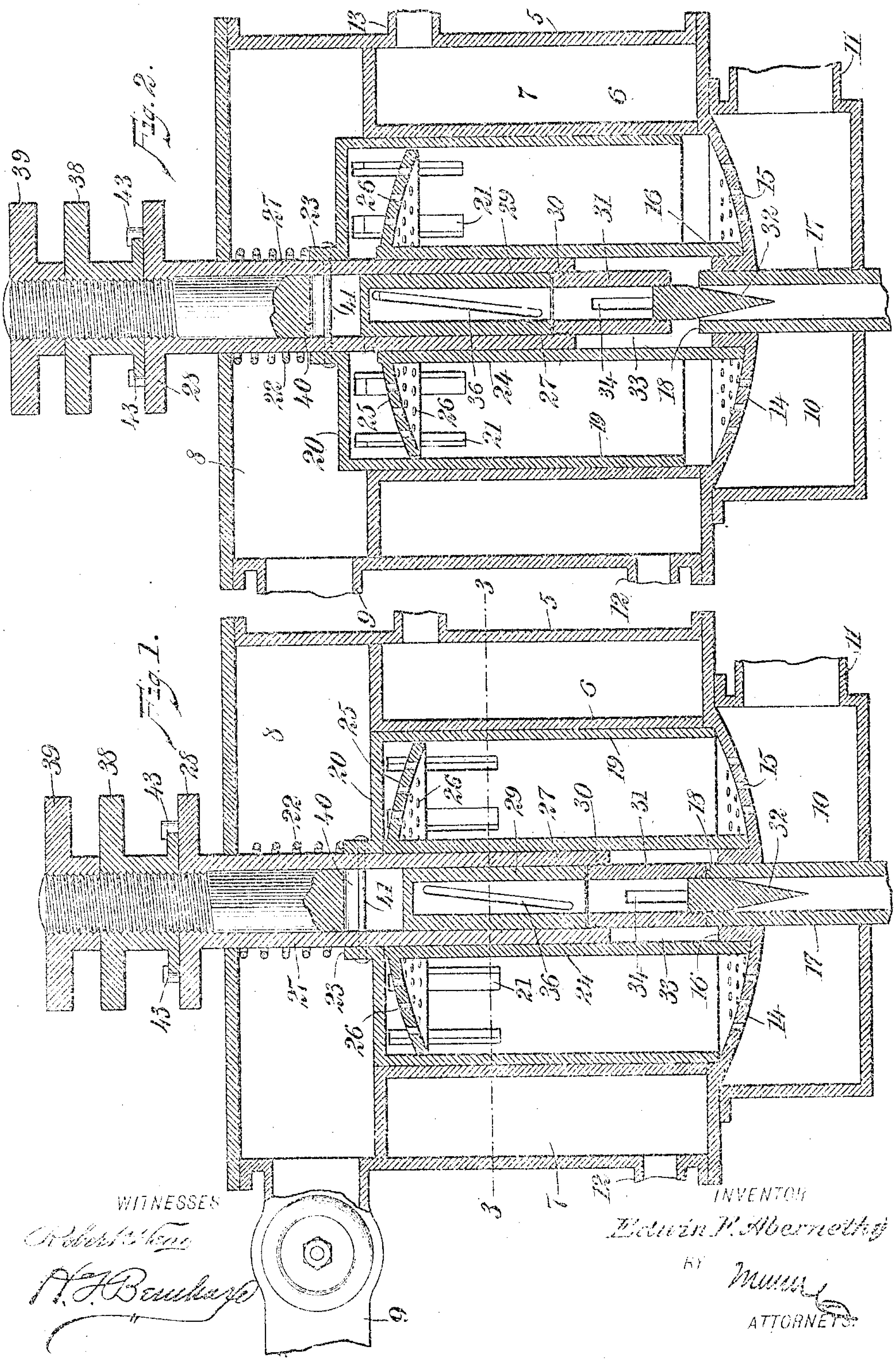

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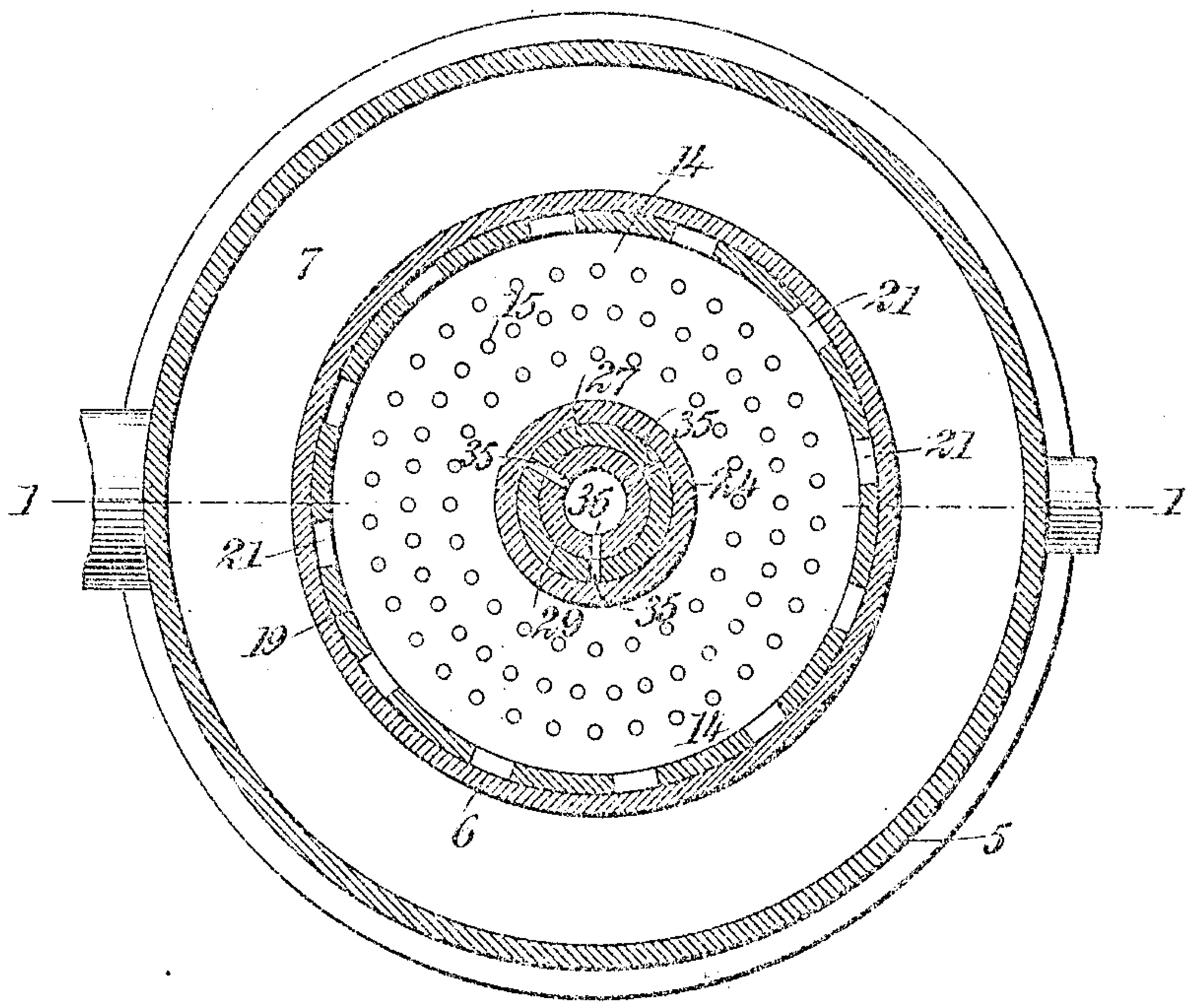
Fig. 3.



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CARBURETER FOR EXPLOSIVE-ENGINES.

No. 906,871. Specification of Letters Patent. Patented Dec. 15, 1908.

Application filed May 2, 1903. Serial No. 155,389.

To all whom it may concern:

Be it known that I, EDWIN F. ABERNETHY, a citizen of the United States, and a resident of the city of New York, borough of Brooklyn, in the county of Kings and State of New York, have invented a new and Improved Carbureter for Explosive-Engines, of which the following is a full, clear, and exact description.

My invention relates to improvements in carbureters especially adapted for use in connection with explosive engines, and one object that I have in view is the provision of a simple contrivance which is reliable, certain and positive in action under all conditions of service.

A further object is to make the carbureter automatic in service, so that when once adjusted or set it requires no further attention on the part of the engineer.

A further object is to provide means for regulating the fuel supply to compensate for variations in the quality or grade of the particular fuel employed, thereby securing the best results irrespective of the kind of fuel.

A further object is to make the carbureter deliver the same quality of mixture irrespective of the load or speed of the engine.

The improved device acts in a way to control the speed of the engine, by regulating the volume of vapor through the agency of a valve or governor on the pipe leading from the carbureter to the engine, so that the speed of the latter may be controlled by increasing or diminishing the amount of the carbureted vapor admitted to the engine, thus regulating the force of the explosion.

Further objects and advantages of the invention will appear in the course of the subjoined description, and the novelty will be defined by the annexed claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a vertical sectional elevation through a carbureter constructed in accordance with my invention, and illustrating the parts in their closed positions, the plane of the section being indicated by the dotted line 1—1 of Fig. 3; Fig. 2 is a similar view of the parts in their opened positions; and Fig. 3 is a transverse section on the line 3—3 of Fig. 1.

In the embodiment of the invention shown by the drawings, the casing 5 of the carbureter is provided with an internal shell 6, which is joined to the external casing in a way to produce a chamber 7 for the circulation of a heating medium, the latter being supplied to this chamber during cold weather; but the circulating chamber is not essential and may be omitted or employed, at will.

The casing 5 is provided in its upper part with a delivery chamber 8, from which leads a pipe 9 adapted to carry the carbureted vapor of the suction inlet of an explosive engine, said chamber 8 thus serving as the suction chamber of the carbureter. At the lower part of said casing 5 is an air inlet chamber 10, having an air inlet 11 open to the atmosphere. The circulating chamber 7 is adapted to be supplied with a heating medium, such as hot water, by a pipe 12 communicating with the lower part of said chamber 7, and from the upper part of this chamber leads a return pipe 13, the pipes 12, 13 being disposed on opposite sides of the chamber 7 to provide for the circulation of the heating medium through said chamber.

Between the chamber of the internal shell 6 and the air chamber 10, is arranged a baffle plate 14, which may be an integral part of the casing or attached thereto in a suitable way. Said baffle plate is preferably of concavo-convex form in cross section, and it has a plurality of air perforations 15, and a short upstanding nipple 16, the latter being centrally disposed with relation to the baffle plate and to the axis of the carbureter. A fuel inlet pipe 17 passes through the air chamber 10 and the nipple 16 of the baffle plate 14, the upper extremity of this fuel inlet pipe terminating at a point above the nipple 16 and forming a valve seat 18.

The internal shell 6 of the carbureter accommodates a hollow valve adapted to be lifted a limited distance by the suction created through the chamber 8, from the engine which is to be supplied with the carbureted vapor produced by the operation of the apparatus, the said valve being shown as consisting of a hollow cylindrical shell

19 and a head 20. The shell 19 of said hollow valve is equal in length to the internal shell 6 of the carbureter casing, and the external diameter of this hollow valve shell is equal to the internal diameter of the shell 6, whereby the hollow valve is adapted to fit snugly in said internal shell of the carbureter casing, but it is free to have a slidable movement therein in a vertical direction. The lower end of the cylindrical shell 19 forming a part of the hollow valve, is adapted in the lowered position of said valve to rest upon the baffle plate 14, which limits the movement of said valve in a downward direction, and in this normal, closed position of said cylindrical valve shell, the head 20 thereof lies flush with the bottom of the suction chamber 8.

The shell 19 of the hollow valve is provided with a plurality of ports 21, which are shown in the form of elongated slots disposed near the upper part of the valve shell below the head 20, and these ports are adapted to be closed by the internal casing 6 when the valve is in its normal lowered position, thus cutting off the passage of air or vapor from the valve into the suction chamber 8. From this description it will be seen that the cylindrical shell 19 of the hollow valve is open at its lower end and closed at its upper end by the head 20, and this valve is normally pressed to its closed position by the energy of a coiled spring 22. The head 20 of the hollow valve is provided with a collar or with suitable lugs, indicated at 23, and one end of the spring 22 rests on this collar 23, while the other end of said spring is seated against the top plate of the carbureter which closes the suction chamber 8.

24 designates a vertical stationary tube which is arranged centrally within the carbureter casing and the hollow valve therein, said tube being secured in any suitable way at its lower end to the nipple 16 of the baffle plate 14, this construction serving to maintain the tube 24 in a stationary position. The upper end of this tube 24 is equipped with a spreading or diffusing plate 25, which is concavo-convex in cross section and provided with a plurality of transverse ports 26. The diameter of this diffusing plate is somewhat less than the internal diameter of the shell 19 forming a part of the hollow valve, and said diffusing plate is arranged in a reverse position to the baffle plate 14 at the bottom of said hollow valve. The convex face of the diffusing plate 25 is presented to the under face of the head 20 of said hollow valve, and this diffusing plate lies at the upper extremity of the stationary tube 24 in order that liquid fuel when it escapes through said tube may flow or spread over said convex face of the perforated plate 25, thus spreading a thin film of fuel in the path of air as it flows through the plate, for the purpose of making the air absorb or take up the fuel.

27 designates a guide tube which passes through the suction chamber 8 and extends into the stationary tube 24 for a suitable distance, the lower end of said guide tube terminating above the valve seat 18 on the upper extremity of the fuel inlet pipe 17. The upper end of this guide tube 27 is formed with an external head 28, and around this guide tube is coiled the spring 22 which acts against the hollow valve to normally force it to a closed position. Within the guide tube 27 is arranged an internal regulating tube 29, the latter being movable with the guide tube 27 and with the head 20 of the suction valve, but this internal regulating tube is capable of a limited adjustment in an endwise direction within the guide tube, for the purpose of varying the effective area of certain fuel egress ports which are provided in the concentric tubes 27, 29.

The guide tube 27 is internally threaded at its lower extremity, as at 30, and into this tube is screwed a short length of tubing 31, the latter being thus attached rigidly to the guide tube 27 and adapted to occupy the valve seat 18 on the upper extremity of the tube 17, thus constituting a valve which, in connection with the needle valve 32, serves as the means for cutting off the inflow of liquid fuel from the pipe 17 into the lower part of the stationary tube 24. The needle valve 32 is in the form of a tapering piece of metal which is secured rigidly in the lower end of the tubular valve 31, in a position to project below said tubular valve and into the fuel inlet pipe 17, said needle valve serving to close the upper end of said pipe in a plug-like manner and thereby "choke off" the escape of fuel from said pipe 17. The valve tube 31 is movable in an upward direction with the tubes 27, 29, and in its upward movement said valve tube 31 is lifted away from the seat 18, and it serves as the means for raising the needle valve 32 for the purpose of partially withdrawing said valve from the pipe 17, thus opening a passage for the flow of a limited volume of fuel from said pipe 17 into the space 33 between the lower part of the stationary tube 24 and the tubular valve 31. This tubular valve 31 is provided with a return port 34 at a point above the needle valve 32, said port 34 permitting the fuel to pass from the chamber 33 into the tubular valve 31. This tubular valve is attached to the guide tube 27 to occupy a coaxial relation to the regulating tube 29, said tubes 29, 31 being in direct communication, as shown by Figs. 1 and 2. The tubes 27 and 29 are provided with longitudinal slots 35, 36 respectively, each tube having a series of three or more slots, as shown by Fig. 3, and said slots being arranged preferably in inclined positions, as shown by Figs. 1 and 2; although the particular number of slots is not essential. The fuel slots 35 of the guide tube 27 register or coincide with the slots 36 of the regulating tube 29, said slots being of equal length when the tube 29 is lowered within the tube 27 to have abutting engagement with the valve 31, as shown by Fig. 1.

The area of the slots through which the liquid fuel makes its exit from the tubes 27, 29, may be varied by adjusting the tube 29 in an endwise direction within the tube 27, and this endwise movement of the regulating tube is effected by means of a nut 38, which is screwed on a threaded upper portion of the tube 29, and is arranged to bear on or be seated against the head 28 of the guide tube 27. A jam-nut 39 is screwed on the upper threaded portion of the regulating tube 29, to have engagement with the nut 38 and prevent accidental rotation of said nut 38 during the operation of the engine and the moving parts of the carbureter.

The regulating tube 29 is provided, in addition to the slots 36, with transverse slots 40, through which passes a pin or bolt 41, which also passes through the guide tube 27 and through the collar or lugs 23 of the hollow valve. This pin or bolt serves to make the tube fast with the head of said hollow valve, in order that said tube will slide with the valve. The regulating tube 29 is adapted to slide with the tube 27 and the hollow valve, because the nut 38 engages with the head 28 of said tube 27, and thus the hollow valve and the concentric tubes 27, 29, will rise and fall at one and the same time. It is evident, however, that the jam-nut 39 and the regulating nut 38 may be successively turned in the proper direction for the purpose of moving the tube 29 endwise for a limited distance within the tube 27 to regulate the area of the outlet port formed by the coincident slots 37, 36. The bolt also prevents the inner regulating tube 29 from turning when the nut is rotated to impart the endwise adjustment thereto.

In the service of the invention, the pipe 9 of the carbureter is connected with the suction inlet of an explosive engine, while the pipes 11, 17 communicate with a source of air supply and with a source of fuel supply respectively. If desired, the pipes 12, 13 may communicate with means for supplying hot water to the circulating chamber 7, thus raising the temperature of the carbureter to the desired point during cold weather, but at other seasons of the year the circulating medium may be cut off from communication with said chamber 7. The fuel stands in the pipe 17 ready to enter the chamber 33 when the hollow valve, the tubes 27, 29, the tubular valve 31, and the needle valve 32 are lifted, this operation of raising said parts being effected by the suction created by the operation of the engine, through the chamber 8, on the hollow valve. The upper ends of the ports 35, 36 in the tubes 27, 29, terminate below the upper end of the stationary tube 24 exactly the same distance that the slots 21 terminate below the shoulder formed at the bottom of the suction chamber 8. When the hollow valve is raised, the ports 21 are lifted above the bottom of the suction chamber, and the valves 31, 32 are lifted away from the seat 18 and the pipe 17, so that liquid fuel will pass into the chamber 33 and through the slot 34 into the tubes 31, 29. The elevation of the tubes 27, 29 brings the upper ends of the slots 35, 36 above the end of the stationary tube 24 and the diffusing plate 25, so that oil will spread itself over said diffusing plate. On the opening of the hollow valve the air is free to pass in thin streams through the perforations in the plate 14 and through the hollow valve shell 19, and also through the perforated diffusing plate 25, the air making its escape through the slots 21 into the suction chamber 8, from whence the carbureted vapor passes through the pipe 9 to the suction inlet of the engine. When the suction from the engine is closed, the spring 22 becomes effective in lowering the hollow valve, the tubes 27, 29, and the valves 31, 32, to their closed positions, thus cutting off the passage of air through the slots 21 of the hollow valve, making the needle valve 32 plug up the pipe 17 and forcing the tubular valve 31 to its seat 18 on the inlet pipe.

The element 32 of the improved carbureter serves a peculiar purpose in the operation of the device. This element 32 is tapered for a part of its length, and is cylindrical for the remainder of its length, and said element is slidably fitted in the fuel inlet pipe 17 which is of annular shape in cross-section. The element or valve 32 is controllable by the movement of the suction-operated valve 19, and when said valve 19 is raised to its open position, the element or member 32 is correspondingly raised so as to partly withdraw it from the circular fuel inlet pipe 17, whereby a tapering passage is formed between the pipe and the tapering member 32 for the flow of fuel from said pipe into the stationary tube 33 of the device. The endwise movement of the member 32 varies according to the extent of lifting movement of the suction valve 19, and the cross-sectional area of the fuel passage provided by and between the fuel inlet pipe 17 and the valve 32 is determined by the extent of lifting movement of the member 32, and is proportioned to the area of the ports formed by the slots in the suction valve 19. The member 32 serves as a choke-off which coöperates with the fuel inlet and as a regulator to determine the area of the fuel passage and consequently the volume of fuel admitted to the carbureter, but the fuel inlet valve proper is formed by the seat face 18 at the upper extremity of the inlet pipe 17, and by the tube 31 which is movable with the choke-off and regulating valve 32, and with the suction-operated valve 19.

A peculiarity of the invention resides in the conjoint operation of the air valve and the fuel valve to secure a fixed and predetermined proportion of the quantity of fuel to the quantity of air so as to secure a uniform grade or quality of mixture under varying conditions of load or speed of the engine. It is well known to those skilled in the art that ordinary carbureters employ a fuel valve which opens a predetermined distance to admit a certain invariable quantity of fuel under any and all conditions of load or speed of the engine, that is whether the engine is running at fast or slow speed; and furthermore, such fuel valves are not of themselves capable of regulating their movement so as to effect the desired increase or decrease in the volume of fuel and thereby automatically establish an increase or decrease in the quantity of fuel proportionately to a variation in the area of the air opening or port due to the operation of the air valve under the suction created by the movement of the engine-piston.

Under slow speed, the suction of the piston does not move the air valve to a full opened position, while under high speed, the air valve is opened wider and acts with increased speed. It is found in the use of my carbureter that under high or slow speed conditions, the volume of air admitted by the air valve is substantially the same, because when the valve opens and closes quickly the air passes through the carbureter at increased speed due to the variation in the strength of the suction created by the engine piston.

As hereinbefore indicated, the fuel-valve of an ordinary carbureter becomes wide open when the air valve is opened a short distance to admit a small volume of air under slow speed conditions, but when high speed prevails, the air valve is opened wider to admit a larger volume of air without, however, admitting a larger quantity of fuel because the fuel valve is opened its full distance under slow speed conditions as well as under high speed conditions, hence the same amount of fuel is admitted at all times without regard to the speed, and therefore, under high speed conditions, a weaker mixture is admitted to the engine cylinder.

In my carbureter, the area of the fuel-port is always proportionate to the area of the air port, hence an increase or decrease in the volume of the air admitted secures a corresponding increase or decrease in the admission of the fuel, whereby a uniform quality or grade of the combustible vapor is supplied to the engine. It is to be noted that under low-speed conditions, the air valve and the fuel valve are each opened a limited distance to secure a mixture of a certain grade or richness, but as the strength of the suction increases due to higher speed of the engine, the air valve is lifted higher to expose a greater area of the air port, and the movement of the fuel valve is correspondingly increased to enlarge the fuel port, thereby increasing the area of the fuel port proportionately to an increase in the area of the air port, to secure the uniform grade or quality of mixture under variations in the speed of the engine.

The improved carbureter is susceptible of regulation manually to secure the desired regulation of the fuel in proportion to the air, for the purpose of changing the quality or grade of the mixture as may be desired. Although the needle valve, 32, and the tubular valve 31, operate in unison with the air valve so as to be controllable directly thereby, to admit a certain quantity of air proportionately to the volume of fuel when the two valves are opened, still the quantity of fuel supplied to the suction chamber of the carbureter through the ports in the concentric tubes, 27, 29, may be varied or regulated to a nicety by the adjustment of the tube, 27, with respect to the tube, 29, so as to vary the area of the fuel port or outlet formed by the coincident ports in the two tubes. It is evident that the tube, 27, may be raised with respect to the tube, 29, so as to increase the area of the fuel outlet formed by the ports in the two tubes when the air valve and the two fuel valves, 31, 32, are opened; but by lowering the tube 27, with respect to the tube, 29, the area of the fuel outlet formed by the ports in the two tubes may be decreased when the air and fuel valves are opened. Of course, this relative adjustment of the two tubes, 27, 29, should be effected by hand through the medium of the nut, 38, but after the parts shall have been once adjusted, the two tubes 27, 29, work or slide together so as to preserve or maintain their adjusted relation and coöperate one with the other in admitting the fuel from the valves, 31, 32, to the chamber of the carbureter.

The pipe 9 which leads from the suction chamber of the carbureter to the engine is supplied with a valve or governor which makes the carbureter act in a way to regulate the speed of the engine, because said valve or governor may be adjusted to increase or diminish the volume of carbureted vapor which may pass to the engine, thus regulating the force of the explosion and effecting a regulation in the speed of the engine. My carbureter may be used with either a liquid fuel, or I may supply illuminating or natural gas to said carbureter by simply using a larger valve. The carbureter is positive and reliable in its action, because it is not affected by the rolling of a marine vessel in which the engine may be installed, nor by the jolting of the vehicle on which the engine is mounted. The apparatus acts as a thoroughly reliable and positive automatic mixer and speed controller.

The adjusting nut, 38, may be held from movement away from the head, 28, by any suitable form of stop device such as the headed pins, 43, which are attached to the head, 28, and are adapted to engage with a foot flange on said adjusting nut. When the nut, 38, is turned to the right on the threaded tube, 29, it bears on the head, 28, and thus raises the regulating tube 29; but when the nut is turned to the left, the headed pins, 43, hold the nut against movement away from the head, 28, and thus the nut serves to lower the regulating tube, 29.

It is to be understood from the foregoing description taken in connection with the drawings that my carbureter embodies two kinds of valves adapted for the regulation of the fuel supply, together with an air valve or suction operated element that is acted on by the inrush of air due to the vacuum created by the suction from the engine, thus making three valves in one device. Of these three valves, two control and regulate the fuel, one being actuated automatically by the third valve and the second being controllable at will to vary the quantity of fuel admitted by the opening movement of the first valve. One of the two fuel valves may be designated as the cut off valve, although it also serves the function as an automatic regulating valve, and the other as a tubular or piston valve in order to distinguish them one from the other; but said valves perform different functions, although both are used in the same organization of elements to produce what I regard as a superior type of carbureter.

The cut-off valve just referred to performs the function of primarily cutting off the inlet of fuel and the further function of regulating automatically the quantity of fuel proportionately to the volume of air admitted at each opening movement of the air valve; said cut-off valve comprising, in the example shown by the drawings, the fuel passage 17, the seat 18, the valve tube 31, and the tapering plug or needle, 32. The action of this needle or plug has been heretofore explained in so far as it serves to regulate the area of the throat or passage in the fuel inlet according to the area of the air passage, but there is a further peculiar feature of this valve to which it is desired to invite attention, the same consisting in the fact that the travel of the needle, 32, in the inlet, 17, is equal to the travel of the air valve, so that any increase or decrease in the area of the air passage is effective in securing a like increase or decrease in the travel of the needle and a consequent increase or decrease in the area of the fuel passage or throat; said needle valve 32 being not withdrawn fully from the passage, 17, under an extreme or abnormal opening movement of the air valve.

The tubular or piston valve just referred to consists of the tubes 27, 29, and a suitable means, such as the nut, 38, for giving a limited endwise adjustment to the tube, 27, with respect to the tube, 29, for the purpose of effecting a variation in the fuel port formed by the registering openings of the tubes. This tubular or piston valve is capable of adjustment manually for effecting a variation in the quantity of fuel that passes or is admitted by the cut-off valve to the path of the air, said tubular or piston-valve being effective in regulating the fuel subsequently to the operation of the cut-off valve, and the said tubular or piston-valve operating in unison with the movement of the air valve and of the cut-off valve so as to admit the predetermined quantity of fuel to the path of the air, whereby an increase or decrease in the quantity of fuel supplied by the cut-off valve and demanded by a proportionate increase or decrease in the air supply, is subsequently regulatable by a manual adjustment, at any proper interval of time, of the tubular or piston valve. This tubular or piston valve, however, is responsive in its action to the increase of fuel demanded by the air supply because the two fuel valves operate synchronously to govern and control, both automatically and manually, the volume of fuel admitted to the carbureter.

It should be observed that the tubular or piston valve is opened at the same time the cut-off valve is opened, and by the operation of the suction-operated element or air valve; and said tubular piston valve remains open for such a period as will permit the passage of fuel from the cut-off valve to the spreader, because the openings in the tubes remain in register until the cut-off valve and the air valve are nearly seated.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A carbureter comprising a casing having a suction chamber, an inlet pipe, a hollow valve open at one end for the free admission of air, closed at the other end and provided with exit ports in its shell or body, said valve being slidable in the casing and normally occupying a position wherein its ports are cut off from communication with the said suction chamber, means for spreading fuel through said hollow valve, and means controllable by the movement of said valve for opening and closing said inlet pipe.

2. A carbureter comprising a casing hav-

ing a suction chamber, a hollow valve mounted for slidable movement in said casing and having a plurality of ports which are normally cut off from communication with said suction chamber, means for spreading fuel through said hollow valve, a fuel inlet pipe, concentric tubes one of which is movable with the valve and forming a fuel eduction passage from the inlet pipe to the fuel spreading means, and a valve controllable by the movement of said hollow valve for opening and closing said inlet pipe.

3. A carbureter comprising a casing having a suction chamber, a hollow slotted valve slidable in said casing, means for supplying fuel to the chamber of said valve and spreading it through said valve, concentric tubes having coincident ports and adjustable with relation to one another to vary the effective area of the fuel-outlet formed by said ports, and an inlet regulating valve controllable by the movement of said hollow valve for opening and closing said inlet pipe.

4. A carbureter comprising a casing having a suction chamber, an air valve therein, a stationary tube having a fuel diffusing plate, a fuel inlet pipe arranged to discharge into said stationary tube, a tube movable with said air valve, and a fuel-controlling valve actuated by said tube and arranged to open and close the inlet pipe.

5. A carbureter comprising a casing having a suction chamber, a suction-operated air valve, a stationary tube having a spreader, concentric tubes having ports in registration with one another and fitted within said stationary tube, a fuel inlet arranged to discharge within the concentric tubes, and means connecting said concentric tubes with said air valve to insure simultaneous movement of the parts.

6. A carbureter comprising a casing having a suction chamber, a valve therein, a stationary tube having a spreader, a guide tube attached to said valve and fitted slidably in the stationary tube, a regulating tube fitted within said guide tube for movement therewith, said guide tube and regulating tube being concentric and having coincident ports, means for moving the regulating tube relatively to the guide tube, a fuel inlet arranged to discharge within said concentric tubes, and a fuel valve controllable by the movement of said air valve.

7. A carbureter comprising a casing having a suction chamber, an air valve in said casing, a baffle plate having air ports in communication with said air valve, a perforated spreader stationary within said hollow valve, concentric tubes movable with said hollow valve and provided with coincident ports, a fuel inlet arranged to supply fuel within said concentric tubes, means for adjusting one of said tubes with relation to the other tube, and a fuel valve controllable by the movement of the air valve.

8. A carbureter comprising a casing having a suction chamber, an air valve in said casing, a stationary tube having a spreader, a guide tube attached to the air valve and provided with a head and with ports, a regulating tube having ports and fitted in said guide tube for its ports to register with the ports in said guide tube, an adjusting nut screwed on the regulating tube and bearing on the head of the guide tube, a fuel inlet pipe adapted to communicate with said tubes, and a fuel valve controllable by the movement of the air valve.

9. A carbureter comprising a casing having a suction chamber, an air valve therein, a fuel inlet pipe having a valve seat, a stationary tube having a spreader said tube being adapted for communication with said inlet pipe, a guide tube movable with said hollow valve, a regulating tube adjustable within the guide tube, a valve tube attached to the guide tube and adapted to occupy the seat, and a needle valve attached to the tubular valve and fitted within the fuel pipe.

10. In a carbureter, the combination with a vapor valve, of a stationary tube, concentric tubes having ports, a fuel inlet arranged to discharge within the concentric tubes, means for limiting the inner tube to slidable movement, means for adjusting the inner tube endwise within the tube surrounding the same and varying the effective area of the fuel outlet by changing the relation of the ports in the concentric tubes, and a fuel valve.

11. A carbureter having a fuel inlet, a tapering choke-off and regulating valve slidable in the fuel inlet to variable positions therein and adapted to produce a fuel passage which varies in area according to the partial withdrawal movement of said valve, a valve seat around the fuel inlet, a tubular cut-off movable with said tapering valve and adapted to said surrounding valve seat, and a suction controlled member having operative connection with said tubular cut-off and with the tapering regulating valve for automatically moving the two simultaneously.

12. A carbureter comprising a casing, a suction-operated member therein, and a tubular valve controllable by said member and constituting a fuel passage to said casing, said tubular valve having a member adapted for adjustment to regulate the fuel admitted thereby to said casing.

13. A carbureter comprising a casing, a suction-operated member, and a tubular valve adapted to be opened and closed by said member, said valve comprising a plurality of members and adapted for adjustment independently of the opening and clos-

ing movement given automatically thereto by the suction-operated member.

14. A carbureter having a casing provided with an air inlet, a valve controlling the passage of air through said casing, a fuel valve, and means connecting said air valve and said fuel valve and operating in unison therewith, said means being adapted for adjustment independently of the operation of the fuel valve for regulating the quantity of fuel admitted to the casing irrespective of the predetermined quantity admitted by the fuel valve when opened.

15. A carbureter having a casing, an air valve adapted to be opened by a suction draft through the casing, a fuel valve controllable by the air valve and having an opening movement proportionately to a similar movement of said air valve under variations in the speed or load of an engine, and another fuel valve operating in unison with the fuel-valve, said last mentioned valve being regulatable independently of its movement with said fuel valve.

16. A carbureter having a casing provided with a suction connection, an air valve in said casing and operable by a suction draft therethrough, a fuel valve, and a tubular fuel valve between the two valves for operating said fuel valve, said tubular valve being adjustable for regulating the quantity of fuel admitted to the casing.

17. A carbureter having a casing provided with a suction connection, an air valve in said casing, a fuel valve, and a tubular fuel valve between the two aforementioned valves for automatically controlling the fuel valve by the movement of the air valve, said tubular valve being adjustable independently of the travel given thereto with the air valve by the operation of a suction draft through the casing.

18. A carbureter having a casing provided with a suction connection, an air valve in said casing, a cut-off valve controllable automatically by the air valve, and a tubular fuel valve between the two valves and controllable with the cut-off valve by the movement of the air valve, said tubular fuel valve being adjustable independently of the movement given thereto by the operation of a suction draft through the casing on the air valve.

19. A carbureter having a casing provided with a suction connection and with an air inlet, an air valve seated in said casing between the suction connection and the air inlet, a cut-off fuel valve, a spreader independent of the two valves, and a tubular valve constituting an operative connection between the air valve and the cut-off valve and producing a fuel passage from a fuel inlet to said spreader.

20. The combination of an air valve, a fuel inlet, and a tubular valve for cutting off the inflow of fuel from said inlet, said tubular valve having a plurality of concentric fuel tubes provided with ports, said tubes being movable with the air valve, and one of the tubes being adjustable with respect to the other tube for regulating the area of the fuel outlet from the tubular valve into the carbureter.

21. The combination of a casing, an air valve, a cut-off valve, and a tubular valve forming a fuel passage from the inlet to the casing, said tubular valve consisting of tubes which are provided with ports and one of the tubes being adjustable to vary the area of the fuel outlet produced by said ports.

22. The combination of a casing, an air valve, a fuel inlet, a tubular valve forming a passage from the fuel inlet to the casing and controllable by the air valve, and a tapering choke-off movable in the fuel inlet and operating in unison with the tubular valve.

23. The combination of an air valve, a fuel inlet, and a tubular valve forming a fuel passage leading from said inlet to the casing, said tubular valve comprising a plurality of tubes, one of which is adjustable to vary the quantity of fuel admitted by the passage.

24. The combination of a casing, an air valve, a fuel inlet, and concentric fuel tubes forming a tubular valve with an inside liquid passage and both tubes being controllable by the air valve, said tubes being relatively adjustable for varying the quantity of fuel admitted by the inlet.

25. The combinaton of a casing, a fuel inlet, a suction-operated element, a stationary tube, a cut-off fuel valve, and adjustable fuel tubes provided with ports and controllable with the cut-off valve by said suction-operated element.

26. The combination of a casing, a fuel inlet, a suction-operated element, a cut-off valve for closing said inlet, and fuel tubes having ports and controllable with said cut-off valve by said element, said tubes being relatively adjustable for varying the quantity of fuel admitted on the opening movement of the cut-off valve.

27. The combination of a casing, a fuel inlet, a suction-operated element, a guide tube, and other tubes movable in the guide tube by the operation of said element, said tubes forming a fuel passage from said inlet to said casing.

28. The combination of a casing, a fuel inlet, a stationary tube, a suction operated element, a cut-off valve controllable by the element, and adjustable tubes forming a fuel passage and adapted to vary the quantity of fuel admitted to a chamber by said tubes.

29. The combination of a casing, a fuel inlet, a cut-off valve, a suction-operated ele-

ment, and adjustable tubes forming a fuel passage and constituting an operative connection between the cut-off valve and the suction-operated element.

30. The combination of a casing, a fuel inlet, a cut-off valve, a stationary tube, a perforated spreader adjacent to said tube, other tubes forming a fuel passage and an operative connection between the cut-off valve and the suction-operated element, and means for adjusting said last mentioned tubes with relation to one another for varying the quantity of fuel supplied to the stationary tube by the inlet.

31. A carbureter having a fuel-inlet, a valve-seat adjacent to said fuel-inlet, a reciprocating valve adapted to said seat, said valve and said seat having abutting surfaces adapted when engaged for cutting off the inflow of fuel, a tapering member movable with said valve and operating in said fuel-inlet for regulating automatically the quantity of fuel admitted to a chamber of the carbureter, and a suction-operated member for reciprocating said valve.

32. A carbureter having a mixing chamber, a fuel-inlet, a suction-operated member in said mixing chamber, a fuel-valve adapted to be operated by said member, and fuel regulating means movable with the fuel valve and adapted to be adjusted for varying the quantity of fuel admitted to said mixing chamber on the opening movement of said fuel valve.

33. In a carbureter, a casing having a fuel inlet and an air inlet, an automatic cut-off valve coöperating with the fuel inlet, and fuel regulating means consisting of tubes, one of which is adjustable relative to the other.

34. In a carbureter, a casing having a fuel inlet and an air inlet, a cut-off for shutting off the fuel inlet, means for operating said cut-off valve, and separate fuel regulating means consisting of a pluraliity of perforated tubes, one of said tubes being adjustable relative to the other tube for varying the area of the fuel port.

35. In a carbureter, a casing having an air inlet and a fuel inlet, an automatic fuel cut-off valve, a tubular fuel regulating valve consisting of a plurality of perforated tubes, and means for adjusting one of said tubes relative to the other tube of said tubular valve.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWIN F. ABERNETHY.

Witnesses:

JNO. M. RITTER,

H. I. BERNHARD.