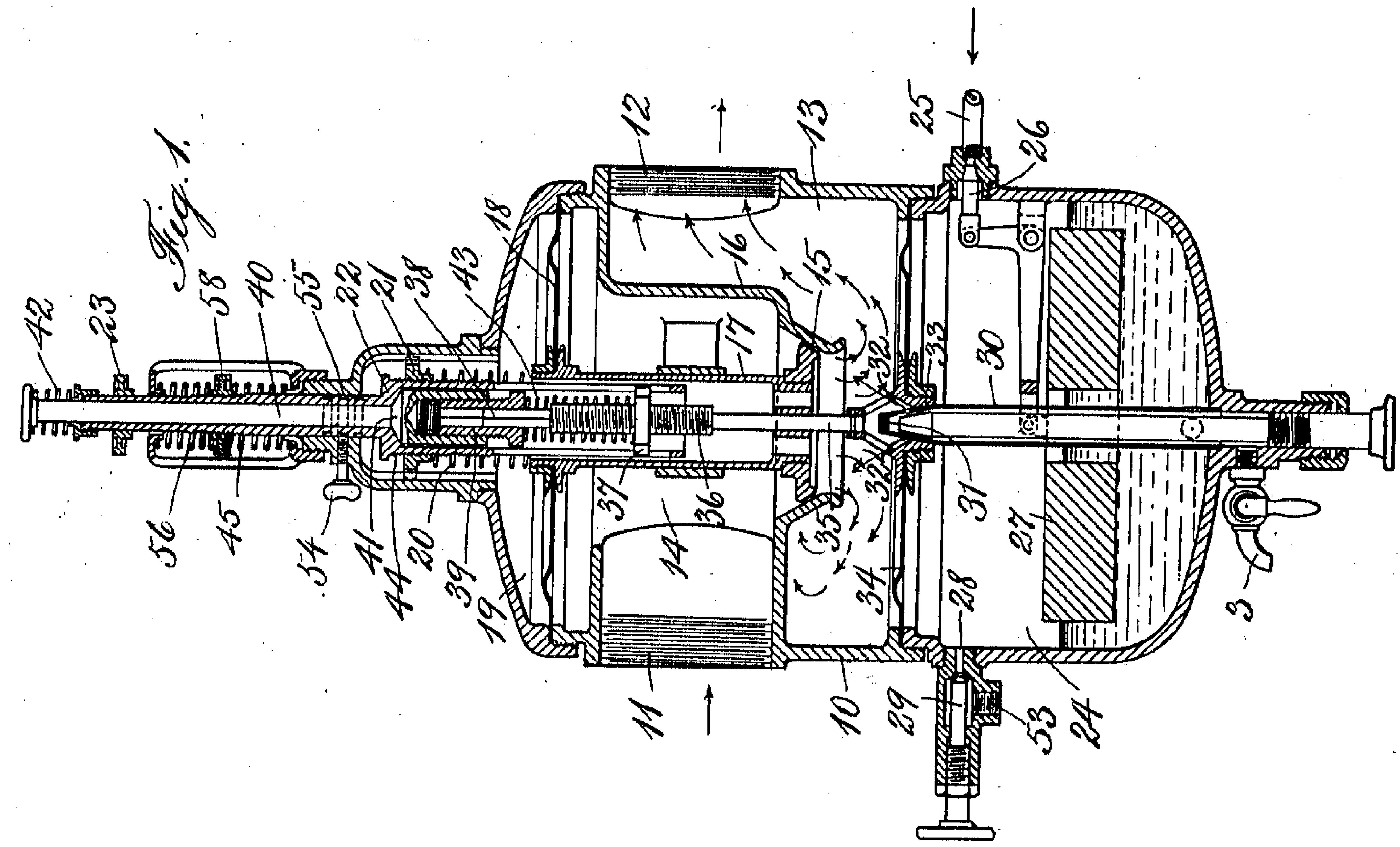
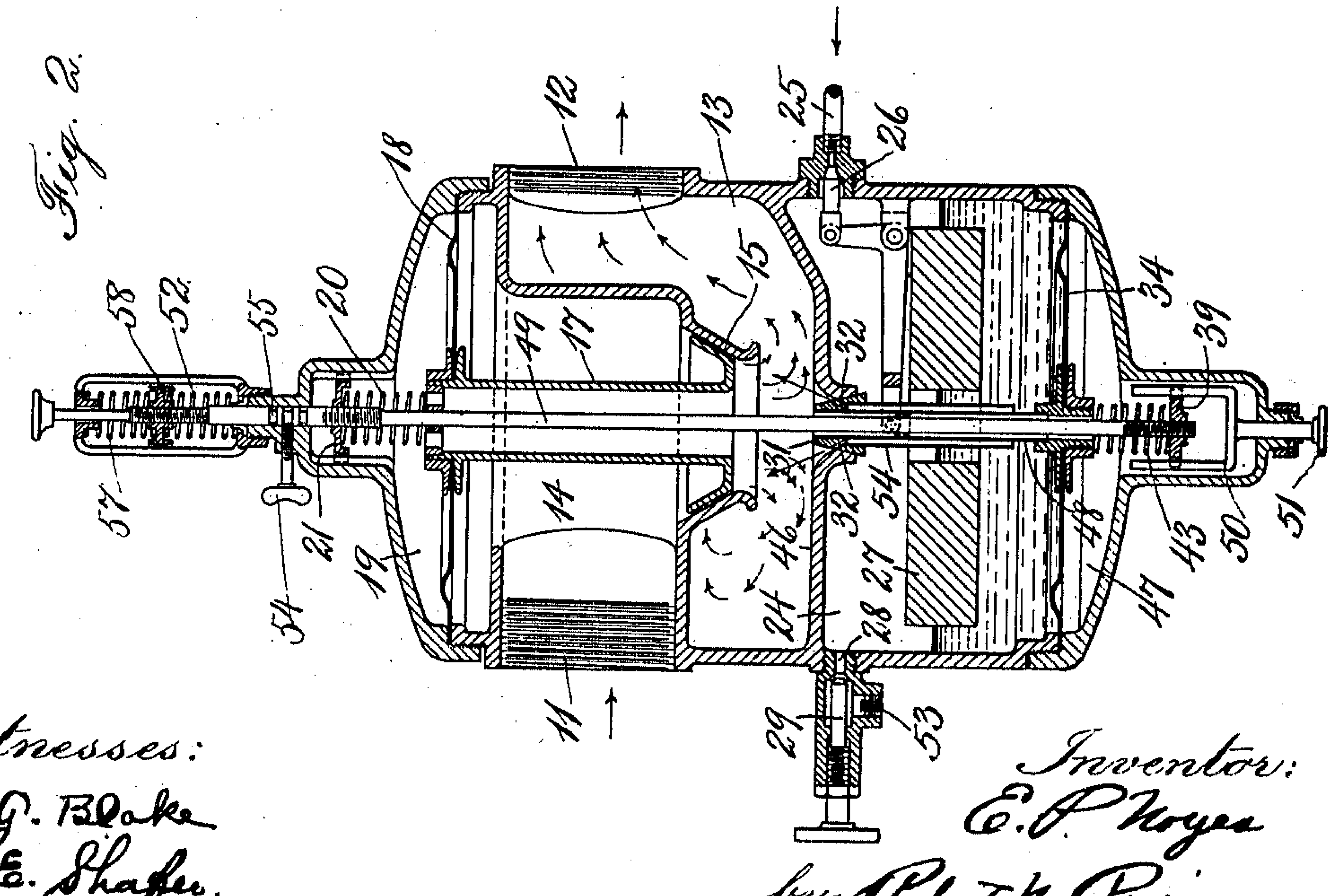
E. P. NOYES.

GAS AND LIQUID MIXER.

APPLICATION FILED JUNE 29, 1906.

993,096. Patented May 23, 1911.





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UNITED STATES PATENT OFFICE.

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GAS AND LIQUID MIXER.

993,096. Specification of Letters Patent. Patented May 23, 1911.

Application filed June 29, 1906. Serial No. 324,004.

To all whom it may concern:

Be it known that I, EDWARD P. NOYES, a citizen of the United States, residing at Winchester, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Gas and Liquid Mixers, of which the following specification and accompanying drawings illustrate the invention in a form which I now regard as the best out of the various forms in which it may be embodied.

This invention relates to devices, such as suction carbureters, for mixing a gaseous fluid and a liquid spray or vapor, and one of its objects is to exercise control over the density of the mixture, while maintaining its ingredients in a constant or combustible ratio throughout the ordinary throttling range of the motor, from a point in the air-pipe anterior to the mixing-chamber. This object I attain by substituting for the usual posterior or mixture-throttling valve, an anterior valve which controls the air-supply to the mixing-chamber, and by the further provision of means adjustable at will for automatically maintaining a working preponderance of air pressure in the fuel reservoir at all degrees of mixing-chamber vacuum.

A further object is to attain increased uniformity in the composition of the mixture at varying speeds of the air or other gaseous current, and this object may be carried out as hereinafter described by making the anterior throttle-valve automatically responsive to the varying volumes of air flow, establishing a secondary air flow through the fuel reservoir, controlling this secondary flow by means of a valve automatically responsive to the volume of said flow, and interconnecting the devices for controlling the respective valves.

Of the accompanying drawings, Figure 1 represents a vertical section of a carbureter or other mixer constructed in accordance with my invention. Fig. 2 represents a similar view showing a modification.

The same reference characters indicate the same parts in both views.

Referring at first to Fig. 1 of the drawings and considering for purposes of explanation that the device is a suction carbureter, 10 represents a casing having an inlet-passage 11 leading from the atmosphere, and an outlet-passage 12 leading to the engine and opening from a carbureting or mixing chamber 13. 14 is an initial-pressure or atmospheric air-inlet chamber into which the inlet-passage 11 opens, and 15 is a main air-valve here shown of conical shape seating downwardly in a partition 16 and controlling an opening which connects the chambers 14 and 13. This valve has a hollow stem 17 attached to a flexible septum or diaphragm 18 which separates the chamber 14 below it from a terminal-pressure chamber 19 above, the interior of the latter communicating with mixing-chamber 13 through the interior of valve-stem 17. Therefore when suction creates a partial vacuum in chamber 13 the air in chamber 19 above chamber 13 becomes rarefied and the diaphragm tends to rise and open valve 15. A spring 20 pressing downwardly on the diaphragm and coöperating with the weight of the parts, aids the terminal pressure and tends to create a choke upon the air current flowing past valve 15. A nut 21 which slides vertically but cannot rotate receives the upward thrust of spring 20 and engages a thread 44 upon a rotary adjusting-stem 22. The latter fits a bearing in the top of the casing and carries a small handwheel 23 on its upper end for rotating it and thus adjusting the tension of spring 20. Any increase of tension in the spring will tend to increase the choke or throttle of the air current by valve 15, and vice versa, and this capability would, if desired, enable the valve 15 to take the place of the usual throttle valve in the outlet mixture passage 12.

In the lower part of the casing is the liquid-fuel or float-chamber 24 adapted to contain a pool of liquid fuel as shown, and having a liquid-inlet at 25 controlled by a valve 26 which is as usual operated by a float 27, so that normally a constant level of liquid is maintained in the float-chamber. This chamber also has an air-inlet 28 controlled by a small hand-valve 29. The fuel-outlet from chamber 24, is by way of a fixed stand-pipe 30 open at its lower end to receive the fuel and having at its upper end a spray-nozzle 31 with a series of small spray-apertures 32 leading into the mixing-chamber 13. This nozzle is tapered and constitutes a valve-seat coöperating with a movable auxiliary air-valve 33 formed in the hub of a flexible septum or diaphragm 34 which separates mixing-chamber 13 from the fuel-chamber 24.

The hub-piece of the diaphragm 34 is attached to the lower end of a rod 35 bearing a screw-thread 36 with which is engaged a nut 37 sliding in the forked lower end of the adjusting-stem 22 and held from rotation with respect thereto. The rod 35 also has a squared upper end 38 having a sliding but non-rotating fit in a nut 39 which engages an interior thread in the lower end of a spindle 40. At 41 is a shoulder on this spindle forming a joint with a seat on the spindle 22 and held against its seat by a strong spring 42 interposed between the upper ends of the stem 22 and spindle 40. Between the nuts 37 and 39 is interposed a spring 43 which furnishes a downward pressure on rod 35 and diaphragm 34 in aid of the terminal pressure in the mixing-chamber 13, whereby the valve 33 tends to close upon the seat 31 and choke the air flowing into chamber 13 from chamber 24. The thread 36 upon which nut 37 travels is a right-hand thread while the thread 44 upon which nut 21 travels is a left-hand thread. Therefore by a rotation of spindle 22 which would depress nut 21 and increase the pressure of spring 20 the nut 37 is likewise depressed and the pressure of spring 43 decreased, and vice versa. This affords a reciprocal adjustment of the two springs. Independent adjustment of the spring 43 is obtained by rotating spindle 40, which raises or lowers the non-rotatable nut 39.

By sliding the stem 22 downwardly in its bearing within the top-piece of the casing, against the resistance of a spring 45, the tension of springs 20 and 43 will be simultaneously increased, which is the converse of the reciprocal adjustment just mentioned.

In the operation of this form of my invention, when there is no suction from the engine, both air-valves 15 and 33 are closed and atmospheric pressure exists in all the chambers. When the engine draws and creates a partial vacuum in the mixing-chamber 13 the air will become partially exhausted in chamber 19 above the diaphragm 18 and the atmospheric pressure below the diaphragm will lift valve 15 against the tension of spring 20 because the area of said diaphragm is greater than the area of valve 15. In other words the greater area of the diaphragm enables it to assume control of the valve and predominates over the influence of fluid pressures upon the valve. So long as there is an air-flow to the engine and the tension of spring 20 remains fixed, the valve 15 imposes an arbitrary and substantially constant drop in air pressure between the chambers 14 and 13, so that since the atmospheric pressure in the inlet 11 is constant, the terminal pressure in chamber 13 will be substantially constant irrespective of the volume of atmospheric air flowing per stroke or per minute, inasmuch as the valve, in the constant exercise of its function of maintaining a constant pressure drop, is opening and closing according to whatever the volume-requirement may be. If the suction of the engine increases and tends to create an increased vacuum in the mixing-chamber 13 the valve 15 will open wider and admit more air past it to satisfy this increased vacuum and if the suction decreases, valve 15 will move toward its seat and admit a smaller quantity of air. The terminal pressure in chamber 13 being more nearly constant than it would be without the differential valve 15, there will be a tendency to deliver fixed quantities of fuel from the nozzle 31 per volume of air, the aspirating effect of the air current on the fuel being, by reason of the substantially constant vacuum, more nearly proportionate to the velocity of the air in the fuel-entraining passage than would be the case without this differential valve. The motive air pressure in the float-chamber 24 acting upon the surface of the gasolene is, by reason of the choke in the air passage 28, maintained at a slight reduction from the atmospheric pressure but somewhat in excess of the terminal pressure in chamber 13, the amount of this air choke at 28 being regulated by adjusting valve 29. The fuel accordingly tends to rise in pipe 30 and stand at or near the level of the orifices 32 ready to be swept off and mixed with the current of air issuing past the valve 15, upon the well-known atomizer principle. I introduce, however, a slight additional atomizing action which is effected by the small volume of air passing the orifices 32 from chamber 24.

By the exercise of mechanical skill, the construction may be made such that the fuel stands normally more nearly at the level of the nozzle 31 than is here shown, this being a feature common in carbureters, and such change is specially applicable to the form of my invention shown in Fig. 2 and hereinafter more fully described, where a fixed partition 46 takes the place of diaphragm 34 in Fig. 1.

With a free air-opening between chambers 24 and 13, there would be no substantial pressure-difference between these chambers, hence the primary purpose of the air-choke between the valve seat of nozzle 31 and the movable valve 33 is to produce a motive pressure upon the surface of the fuel in chamber 24 additional to the impulse made effective by the mere entrainment or aspiration of fuel incidental to the passage of the air current across the gasolene-nozzle orifice in the mixing chamber, the said additional motive pressure causing the fuel to rise more positively and controllably in pipe or duct 30. As the natural level of the fuel, by suitably fixing the float and the height of the jet-nozzle, is caused to reside nearer to that nozzle, this motive pressure may in like proportion be modified, and its adjustment is within the control of the operator either by regulating the push of spring 43 or by adjusting valve 29, or by a combination of these two adjustments. My invention includes the employment of either or both of these means. Various equivalents may be substituted for the specific instrumentalities here shown for regulating this motive pressure. The primary purpose of making this air-choke at the outlet of chamber 24 automatically adjustable, by means of a diaphragm 34 or similar differential-pressure device, is to have this air-choke vary in correspondence with variations in the main air-choke at valve 15. If the vacuum in mixing-chamber 13 were increased, as by augmenting the push of spring 20, without changing the motive pressure in the float chamber 24, there would be a relatively increased fuel flow from nozzle 31 at the time when a relatively decreased flow should be occurring, to correspond with the relatively decreased quantity of air. Hence, in order to balance matters, the push of spring 43 is decreased by the same adjustment-movement as that which increases the push of spring 20, namely by the rotation of stem 22 so as to depress both nuts 21 and 37 at the same time. The decreased push of spring 43 diminishes the pressure-difference between chambers 24 and 13 by allowing a wider opening and less air-choke between the valve-seat of nozzle 31 and the valve 33.

Obviously, if a fixed opening were substituted for an automatically adjustable opening at the main air entrance to the mixing chamber 13,—as could be substantially accomplished by withdrawing valve 15 from commission, the vacuum in the mixing chamber 13 would then tend to vary with the varying speed and suction of the engine. If furthermore the downward spring pressure of spring 43 were removed from diaphragm 34, there would still remain an automatic compensating action. In consequence of the choking of the air inlet at 28, the vacuum in chamber 24 would be free to follow the vacuum in chamber 13, and more nearly, because of the diminution of downward mechanical force upon partition 34 in consequence of the freeing of spring 43. I thus obtain a uniformity of mixture at different speeds of air-current, equivalent to that obtained by the use of an auxiliary or secondary air-entrance valve supplying additional air to the exit passage of the mixing chamber, but without such valves or any moving parts in the sense ordinarily understood; for it will be seen that the disabling of the diaphragms 18 and 34, by means of the adjustments provided in the mechanism, amounts, practically, to the omission of these diaphragms or the substitution of fixed walls and passages therefor, and to allowing the varying vacuum in chamber 24, to accomplish the desired regulation. Such omission might be desirable under some circumstances, although the functions performed by these diaphragms lend an additional delicacy to the control of the mixture under all the conditions met with in practice.

Reverting now, to the condition where both diaphragms 18 and 34 are operative, it will be seen that by depressing the stem 22 axially against the spring 45 the pressure of both springs 20 and 43 is increased, and this would tend to increase the motive force upon the gasolene in chamber 24 at the same time that the throttling of the air by valve 15 is increased, thereby varying the proportions of the mixture, which may be desired momentarily or for a period of time under certain conditions.

In Fig. 2 I have shown a modification in which a fixed partition 46 is substituted in the position of the diaphragm 34 in Fig. 1 and diaphragm 34 is made the bottom wall of the float-chamber 24. Intermediate air pressure in chamber 24 now presses downwardly on diaphragm 34 and the terminal pressure of chamber 13 is carried to a chamber 47 underneath the diaphragm through a hollow tube 48 which connects the diaphragm with the air-valve and spray-nozzle 31. Fuel is carried to the orifices 32 through a tube 54 surrounding 48 and depending from the valve. On the upper portion of a central rod 49 is screwed the nut 21 for adjusting the tension of spring 20 and on the lower end of said rod is screwed the nut 39 for adjusting the tension of spring 43. The upper nut 21 is held from rotating as in Fig. 1, and the lower nut 39 is normally held from rotating by a forked adjuster 50 having an external knob 51 for rotating it. Thus by rotating 49 and 50 in the same direction, the tension of spring 20 can be adjusted independently of spring 43, and by rotating member 50 alone, the tension of spring 43 is adjusted independently of spring 20. Normally however the increase of tension on spring 20 is accompanied by a decrease of tension on spring 43 and vice versa, just as in the case of Fig. 1. For this purpose the two threads on stem 49 in Fig. 2 are right-hand. Depression of rod 49 against the tension of a spring 52 will also increase the pressure of spring 20 and simultaneously decrease the pressure of spring 43. Hence a reciprocal adjustment of the differential pressures acting on the two valves is effected both by axial and rotary movement in Fig. 2, but by rotary movement only (of stem 22) in Fig. 1. The axial sliding motion of the rod in Fig. 2 may be utilized for a quick throttling without substantial variation of mixture.

Either of the described forms of my mixer may be operated under super-atmospheric pressure which can be effected by simply placing the carbureter in a compressed-air or gas-line which might lead to an explosive engine, or a constant-pressure burner, or other locality, and connecting inlet 53 of the float-chamber 24 with the initial pressure,—namely, to the compressed-air pipe connected with passage 11, as will be readily understood.

In the foregoing discussion it has been assumed that the stems 22 in Fig. 1 and 49 in Fig. 2, during the normal automatic action of the carbureter were held against axial movement, and such holding may be effected in either case by a set-screw 54 adapted to fit any one of a number of grooves 55 in the stem, which permit rotation of said stem. If, however, the upward movement of diaphragm 18, which takes place when the valve 15 opens to admit a greater flow of air, is permitted (in Fig. 1) to raise the stem 22, the latter will carry with it the spindle 40 (through friction and spring 42) and diminish the tension of spring 43. Accordingly the differential pressure on diaphragm 34 is decreased, which diminishes the air-choke at valve 33 and by lessening the motive pressure on the gasolene it tends to diminish the relative quantity of gasolene per stroke at increased engine speeds. The action in such a case is automatic, and is secured in the arrangement shown in Fig. 1, by merely loosening the set-screw 50 and making of 22 a floating stem or spindle. The uplifting of valve 15 by diaphragm 18 is then not subjected to the limitation of spring 20, since it and the other immediately related parts are set afloat, together with spindle 22, by the freeing of said spindle, but valve 15 is controlled simply by the weight of its connected parts, or, it may be, by spring 56 which is not interrelated to spring 43, or by hand. In this way the air-choke at valve 15 may be made anything desired, the differential pressure on diaphragm 34 varying the while, according to the high or low position of valve 15, as above made plain.

In Fig. 2 the automatic adjustment of rod 49 permitted by loosening set screw 54 secures, as respects spring 43 and its function, a result just the opposite from that described above; namely, with a freeing of rod 49 a wider opening of valve 15 increases the compression of spring 43 and increases the motive pressure on the gasolene. In either case, the motive pressure on the fuel is automatically varied by an adjustment of the differential air-pressure acting thereon, effected through the normal automatic movements of the air-valve. Whether the one adjustment or the other shall be used depends largely on the conditions of operation, which are difficult to meet for all services with a single instrument. It is often a matter of the operator's choice, whether there shall be a relative increase in fuel-feeding effect at high air-velocities or a relative decrease, or neither. The adjustment which I have just described renders it optional with the operator to vary the normal law of the carbureter at will.

In both Fig. 1 and Fig. 2, the floating stem or rod is yieldingly centralized by oppositely-acting springs, namely, 45 and 56 in Fig. 1 and 52 and 57 in Fig. 2, acting against fixed abutments at their remote ends and against an adjustable nut 58 between them.

Where a volatile fluid is used, it will be noted that the air passing through the float-chamber 24 becomes partly charged with fuel vapor, so that the engine obtains mixture by surface carburation independently of the jet, thus conducing to an easy start and a proper mixture at low speeds when the suction is weak.

Without any variation in structural principle, my described invention may be applied as a mixer for other gaseous fluids and liquids than air and liquid fuel, and I therefore employ the word "gas" to include the various aeriform fluids.

The terms "initial" and "terminal" employed herein, refer to the pressures anterior and posterior to valve 15, whose tendency, as already stated, is to maintain a constant choke or pressure reduction on the fluid flowing past it, the amount of this reduction being determined by the tension of spring 20 and the weight of the moving parts, and being independent of the absolute amount of the anterior pressure. The "intermediate" pressure referred to, is that maintained in float-chamber 24, which is a mean between the anterior and posterior pressures.

By arbitrarily adjusting the pressure of spring 20 in either form of my invention, the valve 15 may, as previously stated, be caused to control the density of the mixture in chamber 13 and thus to indirectly exercise the function performed by the ordinary posterior throttle-valve located directly in the path of the mixture, the valve attached to diaphragm 34 meanwhile maintaining at all degrees of mixing-chamber vacuum, a working preponderance of air pressure in the float-chamber 24, the amount of which is subject to variation at will by the arbitrary adjustment of the pressure of spring 43 through the medium of nut 39. Obviously this control of mixture density without disturbance of the combustible ratio of air and fuel may extend throughout the usual range of engine-pipe pressure or vacuum, which in the ordinary motor governed on the constant-mixture throttling plan may often amount to several pounds of vacuum per square inch. Among the several advantages arising from this mode of control are, first, the removal of the obstruction caused by the ordinary posterior throttle, which latter has a tendency to separate the imperfectly vaporized fuel particles from the air; secondly, the removal from the surface of these particles, immediately on their issuance from the jet-nozzle, of a portion of the atmospheric pressure proportionate to the choking effect of valve 15, whereby their instant vaporization is promoted; thirdly, the largely increased difference between float-chamber and mixing-chamber pressures which is made available for use in propelling the fuel whenever desired; and fourthly, the possibility of introducing the air-supply to the mixing-chamber from any source and at any desired pressure without disturbing the fuel and air ratio.

I am aware that it has been proposed to control the primary air-inlet of a carbureter by means of a valve or "shutter" which may be arbitrarily adjusted and is sometimes interconnected with a posterior throttle-valve, and also to connect the air-space of the float-chamber through a duct with a point in the air-passage adjacent to the fuel-jet nozzle, but such prior devices have been, so far as I am aware, mere carbureting expedients designed to control the ratio of fuel to air, and I do not claim the exclusive use of such devices unless so combined with a fuel-reservoir pressure-controller as to afford the described mode of anterior throttle governing, or unless, without regard to the mode of governing, the mixer is provided with the described automatic devices or their equivalents for obtaining constancy or controllability in the mixture of the liquid and gaseous ingredients.

I claim—

1. A gas and liquid mixer comprising a mixing chamber having a liquid-spray jet-nozzle, a source of liquid-supply connected with said nozzle, a conical valve-seat surrounding a gaseous-fluid inlet to said chamber and adapted to direct a convergent liquid-atomizing gaseous current upon the immediate efflux from said nozzle, a valve predisposed to close against said seat in the direction of flow therethrough, and a septum attached to the valve and subject in the direction of valve-closure to the gaseous pressure in said mixing-chamber, and in the opposite direction to the gaseous pressure anterior to the valve.

2. A carbureter comprising a mixing chamber having an atmospheric air inlet and a spray-nozzle, a chamber for supplying fuel to the nozzle, means for maintaining a constant level in said fuel-chamber, an air-passage between said chambers for communicating the mixing-chamber vacuum to the surface of the fuel in the fuel-chamber, an atmospheric air-inlet to said fuel-chamber, and independently-adjustable valves for regulating the size of said vacuum air-passage and said air-inlet.

3. A suction carbureter comprising a mixing chamber having air and fuel inlets and a mixture outlet, a liquid-fuel chamber supplying said fuel inlet and having a constant-level device, said fuel-chamber having its upper space in communication with the mixture-outlet, and mechanism controlled automatically by the vacuum in the mixture-outlet for varying the fuel-feeding pressure in said upper space.

4. A carbureter comprising a mixing-chamber having a primary-air inlet, a fuel inlet and a mixture outlet, a fuel-reservoir connected with said fuel inlet, means for carrying a secondary air-current through said fuel reservoir to the mixing-chamber, and means for concurrently varying the primary-air inlet and the air pressure in the fuel reservoir.

5. An aspirating carbureter comprising a mixing-chamber having a primary-air inlet, a fuel inlet and a mixture outlet, a fuel-reservoir in connection with the fuel inlet, means for carrying a secondary air-current through said fuel-reservoir to the mixing-chamber, and connected valves for simultaneously varying the primary and secondary air flows.

6. A carbureter comprising a mixing chamber having an air-inlet and a fuel-inlet, a liquid-fuel chamber connected with said fuel-inlet, a passage connecting the mixing chamber with the air-space above the fuel in the fuel chamber, an air inlet to said fuel chamber, and means controlled by the pressure in the mixing-chamber for automatically varying the size of said connecting passage.

7. A carbureter comprising a mixing chamber having a main air-inlet and a fuel-inlet, a liquid-fuel chamber connecting with said fuel-inlet and having a constant-level device and an air inlet, a passage for communicating the mixing-chamber vacuum to the space above the fuel in said fuel-chamber, and a valve governing said vacuum passage and controlled differentially by the pressures in said chambers.

8. A gas and liquid mixer comprising a mixing-chamber, a liquid-chamber having liquid-discharge and gas-discharge outlets to said mixing-chamber and a gas-inlet, a valve controlling the gas-discharge outlet between said chambers, and a diaphragm subject on opposite sides to the pressures of said chambers and controlling said valve.

9. A gas and liquid mixer comprising a mixing-chamber having a gas-inlet, a liquid-

chamber having liquid-discharge and gas-discharge outlets to the mixing-chamber and an adjustable gas-inlet, and means controlled differentially by the pressures in said chambers for varying the gas-outlet.

10. A gas and liquid mixer comprising a mixing-chamber having a main gas-throttle and a liquid-inlet, an initial-pressure chamber antecedent to said mixing-chamber and communicating therewith past said gas-throttle, a liquid-chamber for supplying said liquid-inlet, means to establish a gaseous pressure in said liquid-chamber intermediate between the initial pressure and the mixing-chamber pressure, and means inter-connected with the throttle for varying the intermediate pressure.

11. A gas and liquid mixer comprising a terminal-pressure mixing-chamber, an antecedent initial-pressure gas-chamber, an automatic throttle-valve controlling the passage between said chambers, a liquid reservoir having its outlet in said mixing-chamber, means for applying gaseous pressure in said reservoir to force the liquid into the mixing-chamber, means to arbitrarily adjust the constriction afforded by the automatic throttle-valve, and means to vary the liquid-forcing gaseous pressure conformably therewith.

12. A gas and liquid mixer comprising a mixing-chamber, an antecedent gas-chamber, a liquid-chamber having a liquid-outlet to the mixing-chamber, an automatic throttle-valve between the mixing-chamber and the antecedent chamber controlled differentially by the pressures in the respective chambers, a passage between the liquid-chamber and the mixing-chamber, a discharge-valve controlling said passage and controlled differentially by the pressures in the said chambers, springs controlling said valves and acting with the pressure in the mixing-chamber, and means for reciprocally adjusting the tension of said springs.

13. A gas and liquid mixer comprising a mixing-chamber having a gas-entrance, a liquid-chamber having a liquid-outlet to the mixing-chamber, and a gas-outlet thereto for relieving the motive pressure on the liquid, a diaphragm having means for controlling the gas-entrance to the mixing-chamber and subject on opposite sides to the pressure in said chamber and the antecedent pressure, a second diaphragm having means for controlling the gas-entrance from the liquid-chamber to the mixing-chamber and subject on opposite sides to the pressures in the last-said chambers, springs acting on said diaphragms in aid of the pressure in the mixing-chamber, and means for simultaneously and reciprocally adjusting the tension of the respective springs.

14. A gas and liquid mixer comprising a mixing-chamber having inlet and outlet for the gas and inlet for the liquid, a throttle-valve controlling the gas-inlet and automatically controlled by the pressure in the mixing-chamber and the pressure antecedent thereto, means for establishing a gaseous motive pressure on the liquid for forcing it toward the mixing-chamber, and means for automatically controlling said motive pressure by the pressure in said mixing-chamber.

15. A suction carbureter comprising a mixing chamber having an air inlet, a throttle-valve controlling said inlet and having its opening varied automatically by the vacuum in said chamber, means for feeding liquid fuel to said chamber by the air pressure, and means mechanically controlled by the automatic movements of said throttle-valve for varying the force of the feeding pressure.

16. A gas and liquid mixer comprising a mixing-chamber having a liquid inlet, means to maintain a pool of liquid for supplying said inlet, means to establish a gaseous feeding pressure upon said pool, a valve controlling said pressure, a spring tending to close the valve, a throttle-valve controlling the pressure in said mixing-chamber, and means whereby the variable opening of said throttle valve varies the tension of said spring.

17. In a vapor carbureter operated by motor suction, the combination of a liquid-fuel reservoir, means for aspirating the fuel from said reservoir by the passage of the suction air-current, a throttle-valve controlling the air-current at a point anterior to the mixing point, means for maintaining a working preponderance of air-pressure in said fuel-reservoir at all degrees of mixing-chamber vacuum, and means for adjusting at will the amount of said pressure preponderance.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses, the 19th day of June 1906.

EDWARD P. NOYES.

Witnesses:

ARTHUR H. BROWN,

B. W. GLOVER.