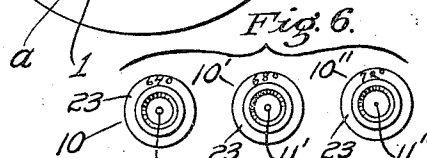
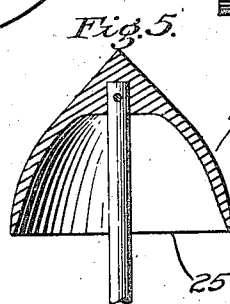
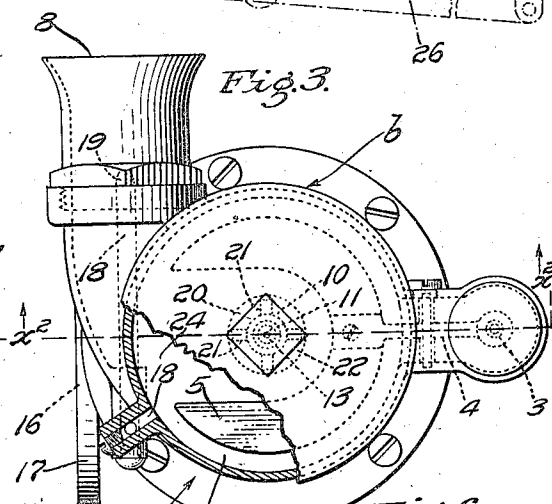
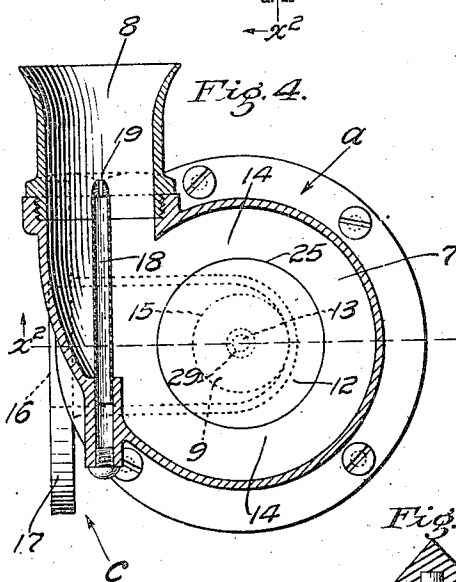
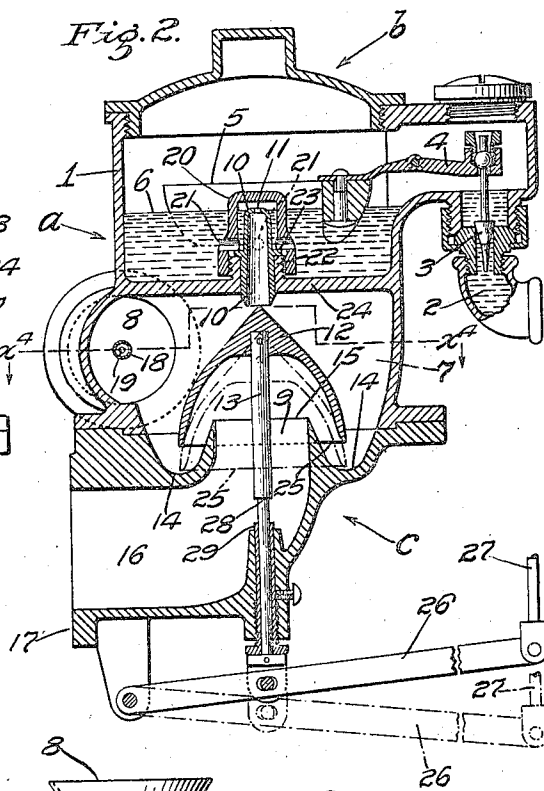
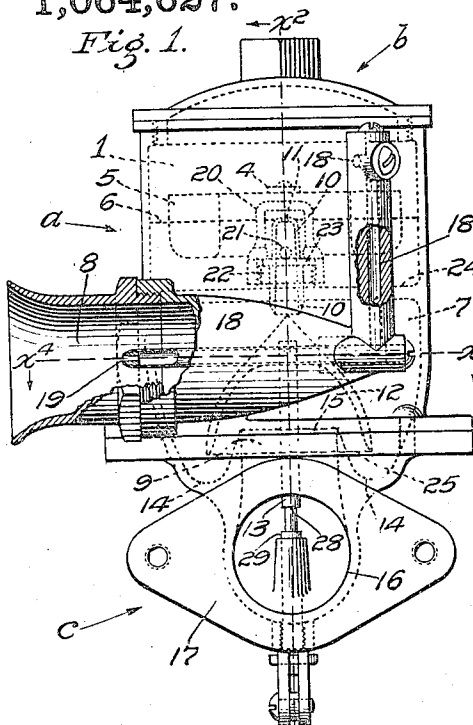


O. H. ENSIGN.
VAPORIZER.
APPLICATION FILED JAN. 5, 1912.

Patented June 10, 1913.

1,064,627.



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UNITED STATES PATENT OFFICE.

ORVILLE H. ENSIGN, OF LOS ANGELES, CALIFORNIA.

VAPORIZER.

1,064,627.

Specification of Letters Patent. Patented June 10, 1913.

Application filed January 5, 1912. Serial No. 669,672.

To all whom it may concern:

Be it known that I, ORVILLE HIRAM ENSIGN, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Vaporizer, of which the following is a specification.

An object of this invention is to provide means whereby a mixture of air and liquids can be made and maintained in constant proportion with absolute precision with varying quantities of air.

The invention may be carried out in various ways and is applicable for many uses but will be readily understood from a description thereof as applied in the form of a carbureter for gasolene engines.

An object of this invention is to provide means whereby a predetermined mixture of air and liquid fuel will be maintained automatically without mechanical adjustment of parts regardless of varying air temperatures and altitudes for any given fuel; also to make provision whereby the carbureter may be easily changed as required to operate with different kinds of fuel, to supply a determined mixture with no experimentation on the part of the operator.

Another object is to obtain a perfectly even distribution of the liquid fuel in the form of vapor in case of the lighter hydrocarbon liquids or in the form of an infinitely divided spray in the case of the heavier hydrocarbon liquids, throughout the whole mass of the air issuing from the vaporizer, and this is accomplished by means of first producing a rapidly rotating vortex of the onflowing air surrounding the ongoing liquid fuel and then reversing the flow of the mixture upon itself so as to practically turn inside out and thus mix the current of liquid and air and break up all stratification which may still remain in the mixture.

This invention is a broadly novel departure from the usual method of approximating constant mixture of air and gasolene in carbureters; which is to provide an air inlet, the orifice of which remains fixed, and a valved auxiliary air inlet the valve of which is controlled by a spring or series of springs for regulating the auxiliary air supply which is variable and increases with the load. This auxiliary air supply with the adjustable liquid fuel valve requires delicate and skillful adjustment by actual trial to obtain desired results. The reasons for this

are manifold. For instance: to obtain combinations of air passages, and gasolene supply means which are practical to make, a tortuous air passage is provided; and such air passage offers a variable frictional resistance to the inflowing air which is not at all proportional to the quantity of air delivered at various loads. This resistance gives the necessary resulting vacuum or partial vacuum which is utilized to suck in from a supply that is subject to atmospheric pressure, the gasolene which flows into the stream of air. The lack of proportional relations between such resistance and the quantity of air supplied makes the auxiliary air inlet with its delicate adjustment necessary. In a carbureter constructed in accordance with this invention the air inlet is so designed that it has a definite coefficient of entrance, and from the nozzle where this entrance occurs, to the point where the gasolene is allowed to come in contact with the inflowing air, there is practically no resistance, and hence it becomes practicable to pick up by the well-known Pitot tube device the velocity and pressure head only of the inflowing air through the air nozzle thus eliminating the effect of eddy currents and other disturbances at the entrance of the nozzle and applying that pressure to force the liquid through the supply nozzle. The result is practically constant proportion between the gasolene and air.

An object of the invention is to provide a carbureter with a separate mixing chamber so arranged that in the process of throttling the engine for various loads, the agitation of the mixture of liquid fuel and air will be intensified as the engine is throttled for smaller loads; thus assuring a perfectly mixed combination of fuel and air.

I have discovered that the difficulties heretofore obtaining with regard to producing a satisfactory mixture of liquid fuel and air is that the air pressure depended upon for supplying the liquid fuel is not properly correlated with the air pressure at the place where the mixture occurs and that the whole difficulty may be removed by simply applying to the liquid to force it through the supply nozzle an air pressure corresponding to the air pressure which creates the velocity of the inflowing air known technically as velocity head.

In carrying out this invention I employ a Pitot tube which picks up the velocity

head and applies the same to the supply chamber, so that the surface of the liquid in said chamber will be acted upon by such velocity head in addition to the pressure head which is alike in the supply chamber and the mixing chamber so that the pressure across the supply orifice will become for all practical purposes so close to the true velocity head of the inflowing air where it enters the mixing chamber, that in actual practice the amount of the liquid fuel forced through the orifice of the supply nozzle will always bear the proper relation to the air entering the mixing chamber so that all that is necessary to be determined is the relative sizes of the two orifices.

I regard this invention as pioneer in that this newly invented carbureter is constructed in accordance with the principle just stated.

Another feature of this invention is the provision of means whereby a thin conical sheet of liquid fuel is subjected to the action of a whirling air current and is thereby taken up and is thoroughly mixed with the air by rotation and reversal of direction given to the current.

A further feature of this invention relates to the construction and arrangement whereby the liquid fuel is mainly fed to the mixing chamber by the force of gravity, instead of being sucked upward; the suction of the engine being depended upon, in this case, only to slightly raise the level of the liquid in the supply chamber so that the liquid may just flow over the tip of the nozzle and then down through the nozzle to the center of a vortex. The dropping air pressure at the center of the vortex adds greatly to the suction causing the liquid to flow into the mixing chamber.

The accompanying drawings illustrate the invention.

Figure 1 is a broken elevation of a carbureter constructed in accordance with this invention. Fig. 2 is a mid-sectional elevation from line x^2 , Figs. 1, 3 and 4. Fig. 3 is a plan of the carbureter broken to show the Pitot tube where it opens into the supply chamber. Fig. 4 is a plan section from line x^4 , Figs. 1 and 2. Fig. 5 is a sectional detail elevation of the combined conical distributor and throttle. Fig. 6 is an end view of a set of interchangeable supply nozzles for use with different qualities of fuel.

Arrows on the section lines indicate the direction of sight.

The liquid supply chamber 1 may be of any desired form and the means to supply liquid to said chamber may be of the usual form comprising a supply pipe 2, supply valve 3, valve lever 4 and valve float 5 arranged to maintain a practically constant liquid level 6 in the chamber 1.

Below the liquid supply chamber 1 is ar-

anged a circular mixing chamber 7 provided with an air inlet 8, in the form of a contracted vein, and mixture outlet 9.

Means in the form of a detachable supply nozzle 10 having a minute orifice 11 in its tip just above the liquid level 6 communicates with the mixing chamber to conduct liquid from the supply chamber to the mixing chamber.

Below the nozzle 10 there is provided a hollow conical distributor 12 that may be made vertically movable by means of the throttle stem 13 toward and from a floor of the mixing chamber and surrounding a mixture outlet nozzle 15 communicating with a passage 16 leading through the connection 17 by which the carbureter is connected with the engine.

The chamber 7 with tangential-inlet 8, central downwardly opening outlet 9 and the distributor 12 arranged therein constitutes a snail-shell type mixer to cause the air to take up the fuel that is admitted above the distributor, thus presenting a large surface film of the fuel to the air passing around the distributor thereby causing the fuel to be intimately and homogeneously associated throughout the whole mass of the air.

It is important that the fuel nozzle 10 be provided with a large bore the top of which is formed as a very thin plate having a perforation 11 of minimized length comparatively widely separated from the walls of the bore, so that siphoning of the fuel when it is once started to flow at the nozzle is prevented.

An air passage 18 open at a small orifice 19 to the inflowing air in the air inlet 8 and communicating with the supply chamber 1 above the liquid level 6 picks up the velocity head of the inflowing air and applies static air pressure to the liquid contained in the supply chamber 1.

The gasoline nozzle 10 is covered by a cap 20 closed to the air space of the chamber 1 and open through ports 21 below the liquid level to admit the liquid supply to the orifice 11 of the gasoline nozzle which is normally just above the liquid level 6. Said cap is detachable being screwed upon a threaded boss 22, and engages a flange 23 of the supply nozzle to hold said nozzle in place.

The two chambers are preferably made of three castings *a*, *b* and *c*, the central casting having a partition forming the floor of the supply chamber, and the top 24 of the mixing chamber. The middle casting *a* is threaded at top to receive the cover formed by the casting *b*; and the lower portion is flanged to receive the floor and outlet portion of the mixing chamber that is formed by the casting *c*.

The gasoline nozzle projects down from

the top 24 of the mixing chamber just above the apex of the conical distributor 12, which distributor terminates at its base in an annular edge 25 adapted to approach closely to the mixing chamber floor 14 when the distributor is fully depressed as it may be by the throttle lever 26 operated through the connecting rod 27 which may lead to the seat of the driver. In order to avoid accidental complete stoppage of the flow of fuel to the engine by a sudden closure of the throttle, a shoulder 28 is provided on the throttle stem 13 of the distributor 12 to seat on the top of the guide that is adjustable through the bottom of the mixture outlet so as to stop the distributor at any point desired thus to regulate the minimum passage for the mixture and to avoid entirely cutting off the flow of mixture, so that the engine may be slowed down to minimum speed without any danger of stopping.

The air inlet 8 is in tangential relation to the mixing chamber 7 and the mixture outlet is in co-axial relation to said chamber, so that the mixing chamber constitutes a vortex chamber through which the air will pass with a rotary motion generating a high rate of rotation amounting to 5,000 revolutions, more or less, per minute depending upon the engine load, the number of revolutions being greater when the load is greater because of the greater volume of air, and hence higher velocity is created through the inlet thereby causing the vortex.

The throttle stem 13 is held in axial relation by the guide 29 projecting up into the passage 16; and as the conical distributor 12 is raised and lowered from and toward the floor 14 thereby increasing or decreasing the area of the passage between its lower edge and the floor, the agitation of the mixture passing between the lower edge and the floor is maintained at an approximately constant value for all loads. That is to say, the volume of mixture passing at a large load with the throttle wide open would have a certain velocity through this space between the throttle and the floor and as the throttle is closed and the power of the engine thereby reduced, the contraction of this passage will tend to maintain a high velocity through this passage and hence maintain a normal value of the passage as a mixing device.

The supply chamber is closed to atmospheric air except through the Pitot tube which has its inlet orifice 19 opening toward the incoming air in the narrowest portion of air inlet nozzle.

It may readily be seen that the relation between the area of the orifice 11 of the liquid supply nozzle 10 and the smallest area of the air inlet opening 8 should vary with the different kinds of fuel used.

The removal of the cover 6 of the supply chamber 1 gives access for ready removal of

the cap 20 releasing the supply nozzle 10 so that one of the other nozzles 10' or 10'' which have different sized orifices 11' or 11'' and are stamped to indicate the gravity of liquid for which they should be used may be substituted therefor, thus giving to the user or operator absolute precision in meeting the conditions imposed by various fuels which may be practical to use. That is to say the several nozzles may be constructed and tested for the various gravities of standard liquid fuels so that no adjustment will be required in the field excepting the change of liquid supply nozzles if a change of fuel is made.

One great advantage of this invention is that once the relations between the area of the orifice 11 of the gasoline nozzle 10 and the inlet 8 for gasoline or other liquid fuel of any definite gravity has been determined innumerable carbureters of this same size can be manufactured and guaranteed to work with absolute precision without adjustment or skilled attendance in connection with any engine installation. And any size of carbureter can be made with absolute precision and its operation after a practical manner can be definitely foreseen and guaranteed without adjustment by the purchaser.

I have deemed it only necessary to illustrate the device as applied in a carbureter for an internal combustion engine but it is to be understood that the operation is not changed by forcing the air into the air inlet nozzle by external pressure above atmospheric; the Pitot tube operating the same in each instance; and by detaching the carbureter from the engine and applying air pressure to the inlet, an inflammable vapor can be produced at the flange connection and may be utilized by any suitable means for any purpose desired. By thus connecting the air inlet with a source of air pressure, not shown, and supplying liquid chemicals to the supply chamber, the device may be used for horticultural spraying or as a disinfecting device.

In practical operation as a carbureter for a gasoline engine, not shown, the engine suction produced by the starting revolutions will cause air to flow through the carbureter. Such suction will reduce the pressure in the mixing chamber 7 thus causing air to flow into the air inlet nozzle 8 and to impinge upon the air in the orifice 19 in the tube 18 which opens toward the inlet end of the nozzle thereby producing in said tube and in the supply chamber 1, a pressure resulting from the momentum of the incoming air thus producing upon the surface of the liquid fuel 6, a static pressure determined by and proportional to the velocity and weight of the air flowing through the inlet 8. The difference between this pressure on the surface of the liquid 6 and the

reduced pressure in the mixing or carbureting vortex chamber 7 caused by the suction of the engine and the vertical action combines to force the liquid through the orifice 11 of the supply nozzle 10 and as liquids and gases follow the same law concerning the relation between pressure and velocity, hence the flow of gasoline through the circular orifice 11 will be proportional to the flow of the air through the circular inlet 8, because the pressure on the liquid is the same that sustains the air velocity thus producing a practically constant mixture for all quantities of air used within the range of a particular vaporizer. The gasoline is dropped or sprayed downward through the supply nozzle onto the apex of the conical distributor 12 and while flowing thence down over the surface of this distributor, is largely and perhaps entirely torn off by the centrifugal action of the air rotating in the mixing chamber 7. Whatever liquid may remain on the distributor 12 until it reaches the edge 25 will be torn from such edge in spray or vapor by the high velocity stream of air underneath the edge and by impingement of the currents of air from the opposite sides of the lower edge of the distributor 12 upon each other, and the reversal of direction through the outlet nozzle 15, and consequently a complete and final mixture and dissemination and distribution throughout all portions of the air supply is effected. The relative amount of mixing done by the centrifugal action and the high velocity around the lower edge of the distributor 12 is proportional to the load. That is to say, during a large load with the distributor lifted to its maximum height as a throttle, the larger portion of the mixing occurs on account of the high rate of rotation of the air around the distributor performing this function as a centrifugal mixer, and as the throttle is closed for smaller amounts of power on the engine the velocity or rate of rotation is less and the centrifugal mixing action is less and the tearing apart of the film of fuel which reaches the bottom edge of the distributor 12 is intensified by its close approach to the floor 14, thus making this lower edge an important part of the mixing device at light loads. I have found by experiment that as a result of this superior mixing action, an automobile engine can be operated at exceedingly slow speeds with perfect engine action and that a 30 horse power automobile engine can by application of the brake, be brought down to, and will readily run at a speed of five miles an hour on the high gear without danger of stopping and with an opening of the throttle only equivalent in area to a hole $\frac{1}{16}$ of an inch in diameter; and that with the brakes released the machine will speed up and run on a smooth

level road at a rate of twelve miles an hour without further opening the throttle; also that under all conditions of operation remarkable economy is secured.

The inlet orifice 19 of the Pitot tube 18 should be small and in actual practice, I find it desirable to make it $\frac{1}{16}$ inch in diameter. It is open toward the inlet end of the air inlet and consequently against the inflowing air so as to directly pick up the velocity of the inflowing air and convert the velocity head into static pressure on the surface of the liquid in the supply chamber.

In order to insure perfect working of a carbureter built in accordance with the principles of this invention the air inlet should be a perfectly-constructed smoothly bored nozzle and the Pitot tube 18 with its orifice 19 should project within the smooth straight portion of the bore of the inlet 8 in such manner that it may function properly in accordance with the principle of Pitot tubes and make a proper application of the true velocity and pressure head of the inflowing air upon the liquid fluid in the supply chamber, and thus by the combined effect of the reduction of pressure within the mixing chamber necessary to cause the air to flow in through the air inlet 8, and the actual pressure produced above the surface of the liquid 6 in the supply chamber 1 by the impingement of the inflowing air upon the contents of the orifice 19, create upon the liquid fuel at the nozzle orifice 11 the functional air pressure which is essential to a proper proportioning of the fuel with the air to form the best explosive mixture.

In order to obtain a perfect mixture, it is necessary to follow the above method: The increasing of the load upon the engine will produce a greater rarefaction of the air flowing through the carbureter, because it is necessary to create a lower pressure within the engine cylinder to cause such air to flow in under atmospheric impulse. Were atmospheric pressure allowed upon the surface of the liquid 6 in the supply chamber 1, the mixture would become richer and richer in fuel as the load increases on the engine, because the greater rarefaction would cause increase in flow of fuel.

This invention allows an air pressure upon the surface of the liquid 6 only in proportion to the velocity of the air supplied through the inlet 8 and this is done by conversion of such velocity into static pressure only corresponding to the pressure which creates that velocity and applies it to the liquid 6, and due to the rarefaction caused by such creation of velocity this pressure on the surface of the liquid 6 is proportional to the rarefaction produced in the mixing chamber and in this manner maintains a constant mixture.

The air inlet 8 is of a fixed cross-sectional area for any given size of engine as it is necessary, that such area does not change during the operation of the carbureter, otherwise the mixture would be changed. If a smaller air inlet were provided a reduced fuel nozzle would also be required, and vice versa.

I claim:—

1. A vaporizer comprising a liquid supply chamber, means to supply liquid to said chamber, a vortex mixing chamber provided with a tangential air inlet and an axial mixture outlet, means to conduct liquid from the supply chamber to the mixing chamber, and an air passage open toward the inflowing air in the air inlet and communicating with the supply chamber; said supply chamber being otherwise closed against atmospheric pressure.

2. A vaporizer comprising a liquid supply chamber, means to supply liquid to said chamber, a vortex mixing chamber provided with a tangential air inlet and an annular axial mixture outlet, means to conduct liquid from the supply chamber to the mixing chamber, and an air passage open toward the inflowing air in the air inlet and communicating with the supply chamber; said supply chamber being otherwise closed against atmospheric pressure.

3. In a vaporizer the combination with the mixing chamber floor and outlet nozzle, of a conical distributor having a lower edge to surround the outlet nozzle.

4. In a vaporizer the combination with the mixing chamber floor and outlet nozzle, of a conical distributor having a lower edge to surround the outlet nozzle, and means to move the distributor toward and from the nozzle.

5. A vaporizer comprising a liquid supply chamber; a vortex mixing chamber provided with a tangential air inlet; means to supply liquid through the bottom of the liquid supply chamber to the center of the vortex of air produced in the mixing chamber; and means provided for passing the mixture out of the center of the vortex through a mixture outlet.

6. A vaporizer comprising a liquid supply chamber, means to supply liquid to said chamber, a vortex mixing chamber provided with a tangential air inlet and an axial mixture outlet, means to conduct liquid from the supply chamber to the mixing chamber, and a Pitot tube open toward the inflowing air in the air inlet and communicating with the supply chamber; said supply chamber being otherwise closed against atmospheric pressure.

7. A vaporizer comprising a liquid supply chamber, means to supply liquid to said chamber, a vortex mixing chamber provided with a tangential air inlet and an annular

axial mixture outlet, means to conduct liquid from the supply chamber to the mixing chamber, and a Pitot tube open toward the inflowing air in the air inlet and communicating with the supply chamber; said supply chamber being otherwise closed against atmospheric pressure.

8. A vaporizer comprising a liquid supply chamber; a vortex mixing chamber provided with a tangential air inlet to such chamber; means to supply liquid through the bottom of the liquid supply chamber to the center of the vortex of air produced in the mixing chamber; and means provided for passing the mixture downward out of the center of the vortex through an axial mixture outlet.

9. A vaporizer comprising a liquid supply chamber; means to supply liquid to said chamber; an annular circular snail-shell type mixer provided with a tangential air inlet and an annular circular outlet in the center under the inner circular wall of the mixing chamber; means to supply liquid to the inner circular wall of the mixing chamber, as a distributor; a Pitot tube open toward the inflowing air in the air inlet and communicating with the liquid supply chamber above the surface of the liquid; said supply chamber being otherwise closed to the atmosphere.

10. A carbureter comprising a liquid supply chamber; a mixing chamber below said supply chamber; means consisting of a detachable nozzle projecting upward from the bottom of the liquid supply chamber held in place by a threaded cap; means to maintain constant level of liquid in the supply chamber slightly under the top of the said nozzle; said cap constituting means to exclude the air contained in the liquid supply chamber from said nozzle and to allow the liquid to run over the nozzle; means to supply functional air pressure to cause the liquid to run over and pass down through the nozzle consisting of a Pitot tube combined with the air inlet and open toward the inflowing air in the air inlet and communicating with the liquid supply chamber above the surface of the liquid.

11. A carbureter comprising a liquid supply chamber; a vortex carbureting chamber located below said supply chamber and provided with a tangential air inlet and an axial mixture outlet at the bottom; means to maintain a supply of liquid at a fixed level in the supply chamber; a supply nozzle having an orifice slightly above the liquid level in the supply chamber and being open to the liquid in the supply chamber and to the air in the carbureting chamber; and means to seal said orifice against the air in the supply chamber.

12. A carbureter comprising a liquid supply chamber; a vortex carbureting chamber located below said supply chamber and

provided with a tangential air inlet and with an axial mixture outlet; means to maintain a supply of liquid at a fixed level in the supply chamber; a supply nozzle having an orifice slightly above the liquid level in the supply chamber; said orifice communicating between the supply chamber and the carbureting chamber and being open to the liquid in the supply chamber and to the air in the carbureting chamber; and means to seal said orifice against the air in the supply chamber, said air inlet being in the form of a contracted vein opening into the carbureting chamber and said mixture outlet leading from the bottom of said chamber.

13. A carbureter comprising a liquid supply chamber; a vortex carbureting chamber located below said supply chamber and provided with a tangential air inlet and with an axial mixture outlet; means to maintain a supply of liquid at a fixed level in the supply chamber; a supply nozzle having an orifice slightly above the liquid level in the supply chamber; said orifice communicating between the supply chamber and the mixing chamber and being open to the liquid in the supply chamber and to the air in the carbureting chamber; means to seal said orifice against the air in the supply chamber; and a Pitot tube communicating between the air inlet and the air space of the supply chamber; said space being otherwise closed to atmospheric pressure.

14. A carbureter comprising a liquid supply chamber; a vortex carbureting chamber located below said supply chamber and provided with a tangential air inlet and with an axial mixture outlet; means to maintain a supply of liquid at a fixed level in the supply chamber; a supply nozzle having an orifice slightly above the liquid level in the supply chamber; said orifice communicating between the supply chamber and the carbureting chamber and being open to the liquid in the supply chamber and to the air in the carbureting chamber; means to seal said orifice against the air in the supply chamber; and a Pitot tube communicating between the air inlet and the air space of the supply chamber; said space being otherwise closed to atmospheric pressure; said air inlet being in the form of a contracted vein opening into the carbureting chamber and said mixture outlet leading from the bottom of said chamber.

15. The means substantially set forth for vaporizing liquids and mixing the same with air which comprises means for containing an air body, means for producing a low pressure zone centrally of one side of such air body; means for supplying air tangentially to said body and thereby inducing a helical rotating air current and a

second low pressure zone on the opposite side of the air body from the inducing zone; and means for supplying vaporizable liquid to the induced low pressure zone.

16. The means substantially set forth for vaporizing liquids and mixing the same with air which comprises means for containing an air body, means for producing a low pressure zone centrally of one side of such air body; means for supplying air tangentially to said body and thereby inducing a helical rotating air current and a second low pressure zone on the opposite side of the air body from the inducing zone; means for supplying vaporizable liquid to the induced low pressure zone; and means for turning the rotating current upon itself within the low pressure zone.

17. A carbureter comprising a liquid supply chamber; a vortex carbureting chamber located below said supply chamber and provided with a tangential air inlet and an axial mixture outlet at the bottom; means to maintain a supply of liquid at a fixed level in the supply chamber; a supply nozzle having an orifice slightly above the liquid level in the supply chamber and the carbureting chamber and being open to the liquid in the supply chamber and to the air in the carbureting chamber; a distributor for the liquid in the carbureting chamber; and means to seal said orifice against the air in the supply chamber.

18. A carbureter comprising a liquid supply chamber; a vortex carbureting chamber located below said supply chamber and provided with a tangential air inlet and with an axial mixture outlet; means to maintain a supply of liquid at a fixed level in the supply chamber; a supply nozzle having an orifice slightly above the liquid level in the supply chamber; said orifice communicating between the supply chamber and the carbureting chamber and being open to the liquid in the supply chamber and to the air in the carbureting chamber; a distributor for the liquid in the carbureting chamber; and means to seal said orifice against the air in the supply chamber, said air inlet being in the form of a contracted vein opening into the carbureting chamber and said mixture outlet leading from the bottom of said chamber.

19. A carbureter comprising a liquid supply chamber; a vortex carbureting chamber located below said supply chamber and provided with a tangential air inlet and with an axial mixture outlet; means to maintain a supply of liquid at a fixed level in the supply chamber; a supply nozzle having an orifice slightly above the liquid level in the supply chamber; said orifice communicating between the supply chamber and the carbureting chamber and being open to the liquid in the supply chamber and to the

air in the carbureting chamber; means to seal said orifice against the air in the supply chamber; a distributor for the liquid in the carbureting chamber; and a Pitot tube communicating between the air inlet and the air space of the supply chamber; said space being otherwise closed to atmospheric pressure.

20. A carbureter comprising a liquid supply chamber; a vortex carbureting chamber located below said supply chamber and provided with a tangential air inlet and with an axial mixture outlet; means to maintain a supply of liquid at a fixed level in the supply chamber; a supply nozzle having an orifice slightly above the liquid level in the supply chamber; said orifice communicating between the supply chamber and the carbureting chamber and being open to the liquid in the supply chamber and to the air in the carbureting chamber; means to seal said orifice against the air in the supply chamber; a distributor for the liquid in the carbureting chamber; and a Pitot tube communicating between the air inlet and the air space of the supply chamber; said space being otherwise closed to atmospheric pressure; said air inlet being in the form of a contracted vein opening into the carbureting chamber and said mixture outlet leading from the bottom of said chamber.

21. The means substantially set forth for carbureting liquids and mixing the same with air which comprises means for containing an air body, means for producing a low pressure zone centrally of one side of

such air body; means for supplying air tangentially to said body and thereby inducing a helical rotating air current and a second low pressure zone on the opposite side of the air body from the inducing zone; a distributor for the liquid in the containing means; and means for supplying vaporizable liquid to the induced low pressure zone.

22. The means substantially set forth for vaporizing liquids and mixing the same with air which comprises means for containing an air body, means for producing a low pressure zone centrally of one side of such air body; means for supplying air tangentially to said body and thereby inducing a helical rotating air current and a second low pressure zone on the opposite side of the air body from the inducing zone; means for supplying vaporizable liquid to the induced low pressure zone; a distributor for the liquid in the containing means; and means for turning the rotating current upon itself within the low pressure zone.

23. A carbureter comprising a snail shell-like carbureting chamber and air inlet provided at the bottom with a central outlet; and means to supply vaporizable liquid to the top of the chamber.

In testimony whereof, I have hereunto set my hand at Los Angeles California this 30th day of December, 1911.

ORVILLE H. ENSIGN.

In presence of—

JAMES R. TOWNSEND,
L. BELLE RICE.