May 8, 1928.

1,669,070

I. T. SWARTZ ET AL

CARBURETOR

Filed May 5, 1925

2 Sheets-Sheet 1

Fig. 1.

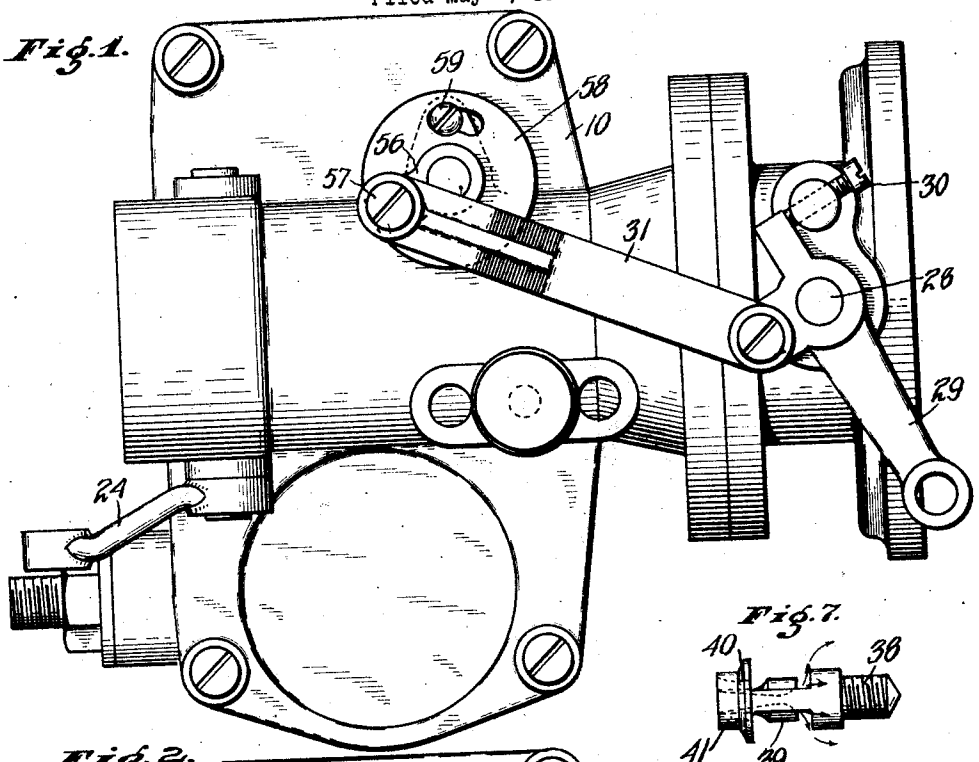
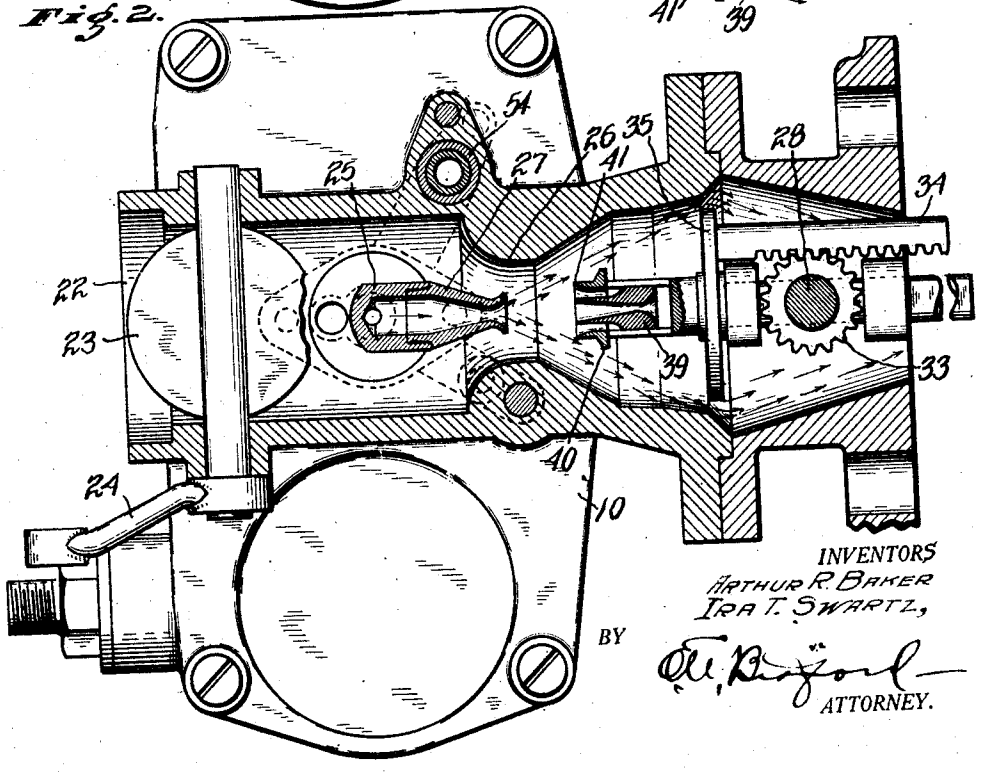


Fig. 7.

Fig. 2.



INVENTORS
ARTHUR R. BAKER
IRA T. SWARTZ,

BY

ATTORNEY.

May 8, 1928. 1,669,070

I. T. SWARTZ ET AL

CARBURETOR

Filed May 5, 1925 2 Sheets-Sheet 2

Fig. 6.

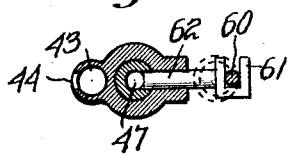


Fig. 3.

Fig. 4.

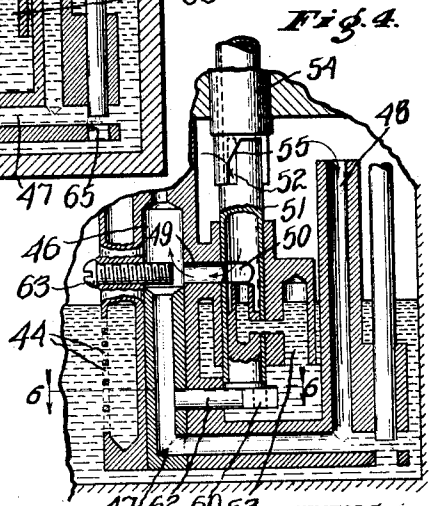
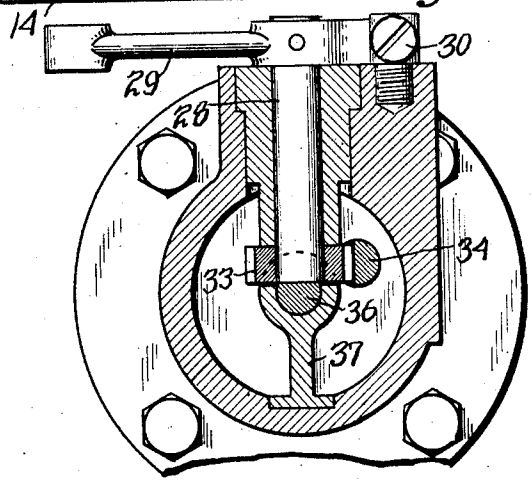


Fig. 5.



INVENTORS
ARTHUR R. BAKER
IRA T. SWARTZ,

BY

ATTORNEY.

Patented May 8, 1928. 1,669,070

UNITED STATES PATENT OFFICE.

IRA T. SWARTZ AND ARTHUR R. BAKER, OF INDIANAPOLIS, INDIANA; SAID BAKER ASSIGNOR TO SAID SWARTZ.

CARBURETOR.

Application filed May 5, 1925. Serial No. 28,215.

Our invention relates to a carburetor intended primarily for use in motor vehicles and it is an object of the invention to provide a device of this character which shall cause the driven vehicle to pick up speed very uniformly and rapidly due to the varying tapers of the throttle opening.

Another object of the invention is to provide a carburetor combining in improved fashion features of submerged blast operation with a spray nozzle.

Other objects of the invention are to provide a more nearly perfect mixture of liquid fuel and air and finer atomization of the spray while avoiding stratification. This results in more flexible operation and better engine performance with diminished waste of fuel. In addition to the rapid acceleration above referred to the performance of the motor vehicle is improved in that it is started easily, gets away quickly and has a remarkable "pull" at low speeds with wide open throttle which affords exceptional hill climbing ability. By reason of the improved fuel mixture in the carburetor the explosions in the engine are more uniform, the vibration is reduced and the running of the engine is very smooth.

It is a well established fact that internal combustion engines are much more difficult to operate efficiently at low speeds, and the demand on carburetors at these speeds of 10 miles and under is one of the most difficult problems in carburetion.

This condition is due to the fact that fuel mixtures at low speeds must be richer. The reduced air flow at closed throttle positions makes separate idling devices imperative, and the synchronizing of the two separate fuel supplies thus demanded, (main and idling) difficult and extravagant. One of the important objects of our invention therefore is to provide improved means in a carburetor for regulating the supply of fuel at low speeds.

It is a well known fact that carburetors do not deliver to the engine a perfect mixture of air and gasoline, as a gas, also that the mixture is full of drops or globules of gasoline; one reason being that the auxiliary air is not properly mixed with the stream of atomized liquid and air, at and beyond the point, where the current of auxiliary joins the main or primary stream of air, carrying misted gasoline in suspension. Another reason is that stratification occurs in the carburetor and intake manifold of the engine to a very great extent. It is well known that gases of even slightly different specific gravities are very prone to stratification and that it is a difficult matter to produce a fairly uniform mixture of two gases of somewhat different specific gravities.

The specific gravity of gasoline vapor is much greater than that of air, and the specific gravity of air with liquid gasoline in suspension is higher than that of gasoline vapor. Ordinarily the auxiliary air passes into the engine intake at the side of the primary current of air with misted gasoline in mechanical suspension and without proper mixture with such primary current. The condition existing in the ordinary carburetor is therefor particularly such as favors stratification, as against thorough mixture, and this tendency to stratification is further enhanced by the ordinary butterfly or throttle valve, which is commonly so placed as to favor passage of the auxiliary air along one side of the butterfly valve, and to favor the passage of the principal portion of the primary air current with gasoline in suspension, along the other side of the valve. It seems that this stratification tends to persist all the way to the engine cylinders and is the cause, or at least an important cause, of imperfect combustion and uneven firing in the cylinders of a multi-cylinder engine.

Referring to the accompanying drawings which are made a part hereof and on which similar reference characters indicate similar parts,

Figure 1 is a plan of our improved device,

Figure 2, a horizontal section substantially on line 2—2 of Fig. 3, with the float chamber disposed at right angles for purpose of illustration.

Figure 3, a vertical central section of Fig. 1.

Figure 4, a fragment of Fig. 2 showing certain parts in a different position,

Figure 5, a section on line 5—5 of Fig. 3,

Figure 6, a section on line 6—6 of Fig. 4, and

Figure 7, a detail of an idling device shown in Figs. 2 and 3.

In the drawings reference character 10 indicates the outer casing of the carburetor which is provided with a fuel chamber 11 containing float 12. The float controls the position of a needle valve 13 by means of which the fuel inlet 14 is opened and closed in well-known manner. The float has a stem comprising a hollow section 15 containing a spring 16 engaging at its upper end another section 17 having a pin and slot connection at 18 with the lower section to limit their relative movement. Levers 19 have weights at their outer ends and engage at their inner ends in a groove at the upper end of section 17, these levers being pivoted at 20 upon downward extensions from a plate 21 forming the upper wall of this part of the fuel chamber. This arrangement provides means for maintaining a fixed fuel level in the chamber, the spring 16 allowing a slight resiliency between the valve and the float and serving to prevent the valve from raising and lowering on its seat and so admitting the fuel to the chamber unnecessarily so as to raise the level above the normal. The reduction of pressure in the float chamber due to suction from the engine causes the float to raise slightly and force the valve 13 more tightly on its seat until this reduction of pressure is overcome by the ingress of more air whereupon the float rebounds or slightly lowers to its normal position without admitting excess fuel into the float chamber. Because our nozzle is placed relatively high above the fuel level and also because of the lifting action of the air on the fuel in the passages, it is not necessary to maintain an absolutely accurate fuel level, wherefore we are able to do away with all float valve adjustment.

In the present embodiment of our invention the mixing chamber is somewhat elongated as shown in the drawings and is open at one end, as indicated at 22, for admission of air which is preferably heated by the exhaust of the engine or in some other manner. A choke valve 23, here shown as being of the butterfly type, is provided at this end of the chamber for reducing the supply of air as in starting the engine. The upper end of submerged air vent tube 43 is open to atmospheric pressure, said tube extending beyond choke valve 23 and when the choke is closed the suction of the engine is relieved through this tube thereby taking a richer mixture of fuel into the engine.

A rockarm 24 on the pivot of the valve is operated from the dashboard of the car in the usual manner. A nozzle 25 is shown as located concentrically of the mixing chamber which is narrowed adjacent the opening of the nozzle to provide a venturi indicated at 26. In the present embodiment of the invention the nozzle is shown as having a removable end piece 27 (Fig. 2) screwed into the body of the nozzle, said end piece being flared or bell-shaped at its other end and terminating in a thin practically knife-edged rim adjacent the smallest part of the venturi. The outside shape of the nozzle, and the relative position of the nozzle in relation to the Venutri neck, permit a suction to be created directly in front of the bell of the nozzle, which suction is transmitted to the passages behind the nozzle and is the reason why air passes down through the submerged air vent tube 43, (i. e. to relieve this suction). The rear part of the nozzle just beyond the right angle bend is enlarged to reduce momentarily the velocity of the fuel and give a larger surface for the liquid fuel in the mixture to adhere to, thus exposing a larger surface to the incoming heated air around the nozzle from the exhaust manifold. It acts as an expansion chamber for the fuel that is heated in its passage from the preliminary mixing chamber.

A throttle-actuating rockshaft 28 is mounted to move about a vertical axis on the forward extension of the mixing chamber, said rockshaft having secured thereto at its upper end an arm 29, for connection to control levers of an automobile in usual manner. Another arm abuts against an adjustable screw 30 to limit the movement of the rockshaft and the throttle and a third arm is connected to a link 31 by a screw 32 for a purpose hereinafter described. At its lower end the rockshaft has secured thereto a pinion 33 meshing with a rack 34 secured at its forward end to a throttle disk 35 fixed to the forward end of a rod 36 sliding in a bearing on a block 37 in the mixing chamber for movement axially of said chamber, this disk taking the place of the butterfly throttle in general use.

The disk is held in place on the rod by a threaded extension 38 (Fig. 7) engaging a threaded opening in the end of the rod and said extension is secured to or preferably formed integral with an idling collar 40. An auxiliary nozzle 39 is fastened to the extension 38 and idling collar 40. The auxiliary nozzle 39 has a longitudinal opening aligning with the passage in the nozzle 25 but of a smaller diameter, said auxiliary nozzle being flared at its forward end and at its rear end being shaped to fit inside the part 27 in a manner to provide a tapering extension of the narrowest part of the passage through the removable end piece 27. The auxiliary nozzle also carries the concentric annulus or idling collar 40 as above stated comprising a cylindrical portion with

a radially extending flange and a rearward flared opening 41. The taper of said flared opening is such as to enable it to fit closely about the rim of the removable end piece 27 of the main nozzle and its radial flange constricts to a considerable extent the space between said rim and the inner wall of the venturi, thus increasing the velocity of the air stream.

The location of the disk 35 and the auxiliary nozzle with its associated parts is such that when the throttle is brought into idling position relative to the venturi, as indicated in Figure 3, the flared part of the idling collar engages the rim at the end of the main nozzle as above described. The annular space between the throttle and the venturi is now very small while at the same time the space between the venturi and the main nozzle has been greatly decreased and the operative narrowest part of the fuel channel has been reduced and brought relatively near the throttle whereby the amount of air passing through the mixing chamber is greatly decreased. The velocity of the air current is however, increased due to the narrower passages about the idling collar and the throttle.

As the valve and the carbureting chamber, in which the valve functions, are circular, and as the valve always maintains the same axial alinement, the space between the walls of the carbureting chamber and the throttle valve will be uniform at any part around the valve, so that a clear passage way at all throttle openings is provided which prevents stratification in the fuel stream. The walls in the carbureting chamber are tapered and the degree of the taper determines the volume of the fuel mixture at any throttle opening, hence the control of the speeds at any predetermined opening of the throttle. The globules of fuel shoot out of the spray nozzle bombarding the disk and are broken up, while the air takes the shortest path and picks up the broken globules at the disk edge, thus the throttle disk tends to further break up the gasoline globules on their way to the intake manifold and to further mix the fuel stream.

Because our fuel mixtures at idling or higher speeds all come through the main spraying nozzle there is no hesitation or rich or lean spot when the idling flow begins and the main fuel flow ceases or vice versa. This hesitation is noticeable in most carburetors. This is why our carburetor responds instantly to the different fuel demands without hesitation and cannot be "loaded". The neck of the nozzle at 42 is relatively thin and is exposed to the heat of the air entering at 22. This helps to expand the air and vaporize the fuel passing said neck. Just behind the nozzle there is a branch passage 43 leading in from the atmosphere. Air is led through this passage down below the liquid level where it enters the fuel chamber through one or more of a plurality of ports 44 of varying size, the smallest being nearest the surface of the liquid fuel and the ports increasing in size toward the bottom of the chamber. In the operation of the engine the air will be drawn through the tube 43 with a force increasing with the increasing speed of the engine so as to enter through an increasing number of ports thus providing carbureted or hydrocarbon-saturated air for use as hereinafter described in accordance with the demands of the engine. At very slow speeds or when idling the suction of the engine may be insufficient to draw the needed air through any of the ports 44 below the fuel level, and at such times, the throttle being nearly closed, air must enter the fuel chamber substantially at atmospheric pressure for which purpose I have provided a port at 45 above the normal fuel level. This port also serves to relieve the air pressure when filling the float chamber. Since the air entering the passage 43 is heated it will also warm the lower part of the nozzle 25 and adjoining parts to some extent which also aids in the operation of the carburetor by heating to some extent the fuel stream passing to the spraying nozzle.

Underneath the nozzle there is a chamber 46 hereinafter referred to as a preliminary mixing chamber, said chamber communicating directly with the passage 46' through the nozzle. The main fuel passage 47 enters the preliminary mixing chamber from beneath said passage being here shown as extending vertically upward from a horizontal branch opening out of the fuel chamber. A vertical passage 48 connects at its lower end with a horizontal passage 47 which is provided with a port 65 for the admission of liquid fuel which is carried with the carbureted air along passage 47 to the passage leading to the preliminary mixing chamber. This passage 48 is the main passage for carbureted air from the upper part of the fuel chamber, which air has been carbureted by its passage through the fuel by way of ports 44.

An auxiliary fuel passage at 49 leads into the preliminary mixing chamber from a point above the normal fuel level, this passage being here shown as formed partly in a casting in which is formed the passage 48 and part of the passage 47. At its outer end the passage 49 opens into orifice 50 in a tube 51 having a port 52 near the top of the fuel chamber. The suction in tube 51 causes the fuel to rise and meet the air through orifice 50, and mix with it. The

opening or closing of orifice 52 controls the amount of fuel lifted through orifice 50. The main fuel passage is provided with a plunger valve 62 adapted to close with the throttle for slow motor speed (see Fig. 3), and the suction of the motor in the carburetor is so increased as to cause a spray of fuel to be injected into the port 50 by the air entering through the orifice 52 to provide a mixture for operating the motor at slow speed. The air port 52 is varied in size by means of an auxiliary air valve in the form of a sleeve 54 supported above the fuel chamber and provided with a cut-away part having a diagonal face at 55 which when the tube 51 is rotated gradually closes the orifice 52. It will be noted that there is constant communication between the chamber in the tube 51 and the port 50 and a similar opening is provided for forming communication between the tube 51 and the substantially vertically disposed elongated passage 53 which has its open lower end terminating below the normal level of the fuel in the fuel chamber. The tube 51 is rotated by means of a rockarm 56 secured to the upper end thereof pivotally attached to the link 31 by a screw 57. An annular flange 58 at the upper end of the sleeve 54 serves for adjustment of the sleeve by means of a screw 59 passing through a slot in the flange into a fixed part of the carburetor. At its lower end the tube 51 carries an eccentric pin 60 engaging a yoke 61 (Fig. 6) on said plunger valve 62 by means of which the main fuel passage 47 is opened or closed, so as to cut off the main supply of fuel when idling. When the plunger valve cuts off the main fuel passage this passage fills with liquid fuel and so acts as an accelerating well offering a supply of fuel immediately available for rapid acceleration. The unusual size of all the passages is necessary on account of the emulsified condition of the fuel. A baffle 63 enters the preliminary mixing chamber opposite the passage 49 and encounters the fuel stream entering from the tube 51 and serves to break up the globules or droplets of fuel and assist in making the charge uniform.

A valve for the main liquid fuel passage or main fuel stream 47 is provided by means of a screw 64 having a flat end for entering the port 65. At its upper end a head 66 is provided for turning the screw which is mounted by means of a fine thread in another screw 67, the screw 64 being adjusted to provide carbureting adjustment under running conditions, i. e., when the engine is hot. The second screw has a relatively coarse thread for temporary adjustment from the dash as for priming the engine for easy starting and for running until the engine gets hot, and a limit is provided by a screw or other means whereby the screw 67 always returns to the same position when moved back and forth by the connection 68 from the dash, which limit may of course be adjustable.

In the operation of our device a main stream of air, which is preferably heated, will enter at 22 and pass to the mixing chamber and a minor stream will pass into the tube 43. The minor stream may pass from the tube into the fuel chamber through the opening 45 and as the speed of the engine increases it will pass also through one or more of the ports 44 for which purpose it forces the fuel out of the way in the tube and rises through the fuel in the chamber. It will be remembered that the fuel level in the chamber is maintained accurately by reason of the spring pressed valve 13 which permits entrance of fuel to the chamber only when positively lifted by the movement of the levers 19 raising the lower section 15 positively through the connection of the pins with the upper section 17.

Air passing into the fuel chamber is carbureted or saturated to a greater or less degree with the more volatile constituents of the liquid fuel in the chamber. This air is admitted directly into the sleeve 54 which forms an inlet for air into the main fuel passage 47 when the valve 62 is opened. The flow through the passage 47 is metered by the flat end of the screw 64 and the main fuel stream consisting at the lower speeds of liquid fuel mixed with bubbles of carbureted air and at the higher speeds an emulsified fuel due to the increased air velocity, flows into the preliminary mixing chamber where it strikes against the underside of the baffle 63 and is thus further broken up.

An auxiliary fuel stream enters the preliminary mixing chamber at right angles to the main fuel stream and is directed against the flat end of the screw 63 which forms a baffle for the auxiliary fuel stream also. The auxiliary fuel stream consists of carbureted air controlled by the auxiliary air valve and the current of air passes over the fuel in the passage 53 where it takes up a certain amount of additional fuel due to the suction created at this point. The auxiliary current consisting principally of air in a saturated state mixes with the spray in the preliminary mixing chamber and the mingled product passes up into the nozzle 25 where it is exposed first to the heat passing through the thin neck 42 and then to the heat in the walls of the enlarged chamber in the nozzle. At this point any unvaporized fuel will be thrown against the upper and rear walls of the chamber in the nozzle due to the bend in the current and will be sprayed out in a thin film so as to be fully exposed to the

heat at this point. From this chamber the mixture passes through the flared nozzle to be further mingled with the air passing through the venturi in well-known manner.

When the throttle approaches closed position, as shown in Fig. 3, a relatively small amount of air will pass through ports 44 and in fact when at atmospheric pressure air will pass only through port 45. As the valve 62 closes, the flow through the main fuel passage is cut off and the fuel in said passage serves as an accelerating well when the throttle is again opened. As the throttle is closed the auxiliary air supply through port 52 to the preliminary mixing chamber is also diminished but the suction is increased whereby a spraying action takes place at the junction of the passage 53 with the air passage. The fuel after leaving the preliminary mixing chamber passes up, as above described, but the auxiliary nozzle is now in the position indicated in Figure 3, as are also the idling collar and the throttle so that the fuel follows the path indicated by the arrows and is again very thoroughly volatilized.

It will be obvious to those skilled in the art that various changes may be made in our device without departing from the spirit of the invention and therefore we do not limit ourselves to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

Having thus fully described our said invention, what we claim as new and desire to secure by Letters Patent, is:

1. A carburetor having a mixing chamber, a fuel chamber, a nozzle in the mixing chamber, means for admitting air to the fuel chamber below normal fuel level to cause air to pass into the fuel and to become carbureted, a main fuel passage leading to said nozzle, a passage for the carbureted air from the fuel chamber merging with the first-named passage, and means for spraying fuel into such carbureted air in the second passage, substantially as set forth.

2. A carburetor as in claim 1, with valve means for closing the main passage without interfering with said spraying means, substantially as set forth.

3. A carburetor as in claim 1, with valve means for closing the main passage and varying the admission of air to the second passage without interfering with said spraying means, substantially as set forth.

4. A carburetor having a mixing chamber, a fuel chamber, a nozzle in the mixing chamber, means for admitting air to the fuel chamber below normal fuel level to cause air to pass into the fuel and to become carbureted, a preliminary mixing chamber communicating with said nozzle, a passage for fuel from the bottom of the fuel chamber to said preliminary mixing chamber, and a passage for air leading to said preliminary mixing chamber from a point in the fuel chamber above normal fuel level, substantially as set forth.

5. A carburetor comprising a mixing chamber, a fuel chamber, a nozzle in the mixing chamber, means for admitting air to the fuel chamber, a main fuel passage leading to said nozzle, a passage communicating with the upper portion of the fuel chamber and said main fuel passage for spraying carbureted fuel thereinto, and valve means for simultaneously closing the main passage and for varying the admission of carbureted fuel to the second passage, substantially as set forth.

6. A carburetor having a fuel chamber, a mixing chamber, an air passage leading into the fuel chamber below the normal fuel level to cause air to pass into the fuel and to become carbureted, a nozzle in said mixing chamber, an outlet passage leading from the fuel chamber into the nozzle, a fuel supply passage communicating with the outlet passage from a point below the fuel level, a carbureted air passage above the normal fuel level forming communication with said outlet passage, and interconnected means for controlling said fuel supply and said carbureted air passages, substantially as set forth.

7. A carburetor having a fuel chamber, a mixing chamber, an air passage leading into the fuel chamber below the normal fuel level to cause air to pass into the fuel and to become carbureted, a nozzle in said mixing chamber, an outlet passage leading from the fuel chamber into the nozzle, a fuel supply passage communicating with the outlet passage from a point below the fuel level, a carbureted air passage above the normal fuel level forming communication with said outlet passage, interconnected means for controlling said fuel supply and said carbureted air passages, and means projecting into said outlet passage and forming a baffle for fuel discharged against the same, substantially as set forth.

8. A carburetor having a fuel chamber, a mixing chamber, a passage for the admission of heated air to the mixing chamber, an air passage leading into the fuel chamber, a plurality of vertically spaced ports opening out of said air passage below the normal fuel level to cause air to pass into the fuel and to become carbureted, a nozzle in said mixing chamber, an outlet passage from the fuel chamber to the nozzle, a fuel supply passage communicating with said outlet passage from a point below the fuel level, and a carbureted air passage above the normal fuel level forming communication with said outlet passage, substantially as set forth.

9. A carburetor having a fuel chamber, a mixing chamber, a passage for the admission of heated air to the mixing chamber, an

air passage leading into the fuel chamber, a plurality of vertically spaced ports opening out of said air passage below the normal fuel level to cause air to pass into the fuel and to become carbureted, a port in said air passage above the normal fuel level, a nozzle in said mixing chamber, an outlet passage from the fuel chamber to the nozzle, a fuel supply passage communicating with said outlet passage from a point below the fuel level, and a carbureted air passage above the normal fuel level forming communication with said outlet passage, substantially as set forth.

In witness whereof, we have hereunto set our hands at Indianapolis, Indiana, this 25th day of April, A. D. nineteen hundred and twenty-five.

IRA T. SWARTZ.
ARTHUR R. BAKER.