

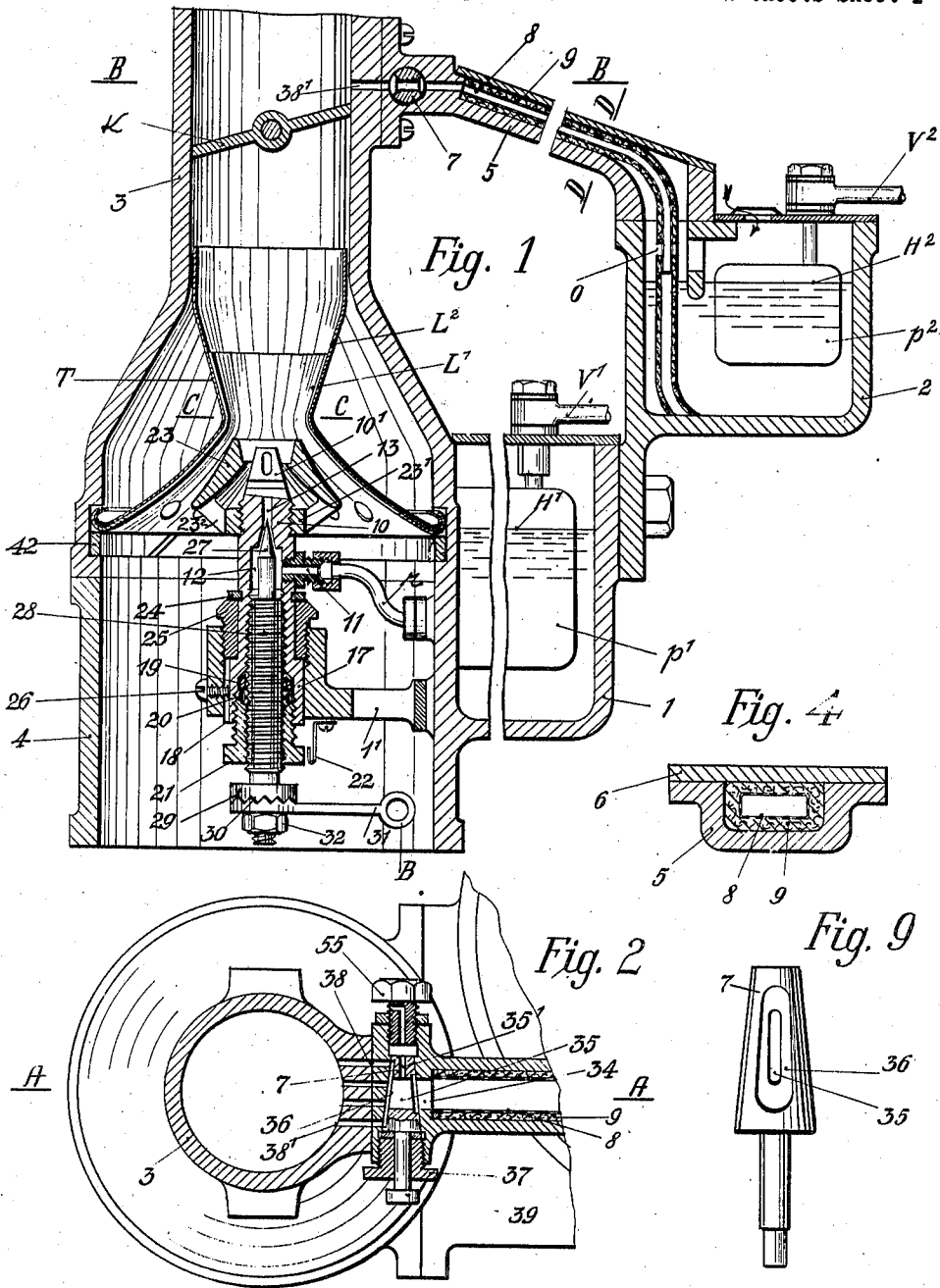
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CARBURETOR

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CARBURETOR

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This invention relates to a carburetor for liquid fuels of any kind, particularly for heavy oils in which the atomization of the fuel, the supplying of the main air and the mixing of the latter with the atomized mixture are accomplished separately.

An object of the invention is the provision of a carburetor in which the fuel is very finely atomized, in which the rate of atomization is adjustable depending upon the kind of the fuel, and in which the fuel thus atomized may be mixed uniformly and free of eddies with the main air being also adjustable as to its quantity.

A further object of the invention is the provision of a carburetor adapted to furnish a correct ratio of the mixture of air and fuel for any condition of operation (load condition) of the motor and for any kind of fuel.

The essence of the invention consists in an auxiliary air funnel being arranged coaxially with the fuel nozzle and having its inner surface so shaped, that the ring space formed between the fuel nozzle and the inner surface of the auxiliary air funnel decreases in the direction of the air flow to a substantially ring-shaped slot located near the discharge openings of the fuel nozzle, and permitting only such quantity of air to pass as is necessary for the atomization of the fuel, the size of the slot being adjustable by an axial adjustment of the auxiliary air funnel with respect to the fuel nozzle. The invention furthermore consists in means for adjusting and fixing the fuel nozzle together with the auxiliary air funnel in the direction of the main air funnel wherein the latter, consisting of elastic members, is expandible and contractible, and is arranged coaxially with the fuel nozzle and the auxiliary air funnel, and the outer surface of the auxiliary air funnel being so shaped, that between this surface and the inner surface of the main air funnel, a gradually tapering ring space is formed through which the main air flows to the motor with gradually increasing speed.

The invention furthermore consists in a capillary body arranged in the top of the fuel nozzle in front of the discharge openings of this nozzle, and consisting of elastic material, which capillary body divides the fuel column flowing through the center bore of the nozzle into small columns which, when leaving the fuel nozzle, are severed into finest particles by the atomizing air coming from the slot between the fuel nozzle and the auxiliary air funnel, and are uniformly mixed therewith.

The atomized fuel comes together with the

main air flowing through the ring space between the auxiliary air funnel and the main air funnel, and is furthermore divided by the main air due to its energy of flow, and intimately mixed therewith.

The invention furthermore consists in a main air funnel comprising elastic members connected at their ends to form at least two hollow bodies or jackets lying close to each other and consisting of elastic material. By suitably choosing the materials, such an expansion or contraction of the main air funnel by the prevailing motor vacuum may be accomplished under any condition of operation of the motor, that the quantity of the main air flowing through the main air funnel, is adequate to the quantity of fuel discharged from the fuel nozzle so that the correct ratio of the mixture of air and fuel may be obtained under any condition of operation.

For the starting and the idling of the motor, a mixture of a light fuel with air may be used which may be created in a separate carburetor device.

Further objects, advantages and details will be apparent from the following description and the drawings illustrating embodiments of my invention.

In the drawings are

Fig. 1 a vertical section along line A-A of Fig. 2 of a carburetor as per the invention with the fuel nozzle and the air funnel.

Fig. 2 a top view, partly in section along line B-B of Fig. 1 showing the organ for regulating the light fuel.

Fig. 3 a horizontal cross section along line C-C of Fig. 1 on a larger scale, showing the main air funnel, (at the left hand side the smallest, and at the right hand side an enlarged passage).

Fig. 4 a cross section along line D-D of Fig. 1, showing the wick arrangement.

Fig. 5 an axial cross section of the top of the fuel nozzle illustrated in Fig. 1, on a larger scale.

Fig. 6 an elevation of the top of the fuel nozzle.

Fig. 7 a longitudinal section of the top of another fuel nozzle with the auxiliary air funnel, the form of the inside surface of the main air funnel being only indicated.

Fig. 8 an elevation of the fuel nozzle as per Fig. 7 on a larger scale.

Fig. 9 an elevation of the fuel cone of the regulating organ shown in Fig. 1, and of its groove on a larger scale.

Fig. 10 a side view of another carburetor with an adjustable float chamber for heavy fuel on a smaller scale, and

Fig. 11 a side view of another carburetor in

which only one kind of fuel is used, and which has only one float chamber.

On the float chamber 1 for heavy fuel, the float chamber 2 for light fuel, for instance gasoline, is mounted, for instance by means of screws. The inlet of the gasoline supplied from the tank (not shown) through pipe v^2 is controlled by means of the float device p^2 with a needle of wellknown construction, the latter not being shown. A chamber 5 is fastened with one of its ends on top of chamber 2. Its other end forms the casing for the control member 7, and is tightly screwed to chamber 3 of throttle k . In chamber 5 a flat tube 8, for instance of the shape illustrated in Fig. 4, is provided, consisting of wire net work, perforated sheet metal, or the like. Tube 8 is enclosed over its entire length by a wick 9 of any suitable make which dips into the gasoline of chamber 2 with a sufficiently long portion.

Tube 8 reaches with one end into the air space of float chamber 2. Openings o are provided in the wick at this end and allow air to enter into the interior of the tube. The other end of tube 8 opens into the aperture 34 leading to cone 7 of the control member. The cross section of aperture 34 equals that of tube 8.

Cone 7 has a longitudinal hole 35 so formed, that it still remains in connection with aperture 34 when cone 7 is turned a certain angle. Hole 35 opens into an especially formed recess of cone 7 (see Fig. 9). Auxiliary air can flow through bore 35 in cone 7. The quantity of this auxiliary air may be adjusted by means of a wellknown screw valve which is screwed into the casing in a manner that it is adjustable, and may be kept in its adjusted position.

Cone 7 has a prolongation of smaller diameter to which lever 39 is fastened which may be controlled from the driver's seat also while the motor is running. A stuffing box 37 with nut and gasket of wellknown construction prevents "wrong air" from entering the interior of the cone casing.

Interiorly, regarding the longitudinal extension of recess 36, a certain number of small bores are arranged in the flange of the chamber 5, said flange being fastened to the throttle chamber 3. Bores 38 correspond to the calibrated bores 38' provided in chamber 3.

By means of control member 7, the quantity and partly also the quality of the mixture of gasoline and air is adjustable, and by means of the screw valve the quality of the mixture is adjustable.

In the top of fuel nozzle 10 a body 45 in cushion form is arranged made of a capillary material, for instance of sponge, animal hair, very fine steel wool or the like. In the embodiment of Figs. 1 and 5, this body is held by means of the screw cap 10¹ provided with large openings 49 and a central bore 48. The position of this cap in relation to the nozzle body 10 is determined by the thickness of gasket 10².

The heavy fuel enters the space 12 of the nozzle from the float chamber 1 through the tube r of yielding material and through opening 11. From space 12 it flows through a fine bore 13 to the capillary body 45. The flow of the fuel to the top of the nozzle may be controlled and closed by means of needle 27 at the mouth of bore 13. Needle 27 is screwed into the nozzle by means of the threads 28. A downward outflow of the fuel is prevented by a stuffing box consisting of a ring 19, a gasket 20, and a nut 21 the position of which is secured by means of the member 22.

On the lower end of needle 27 a disc 29 is fastened

the lower surface of which is provided with fine radial teeth 30. These teeth are engaged by similarly formed teeth of lever 31 which is pressed against disc 29 by means of nut 32 and may be operated at B by means of a well known Bowden cable.

Nozzle 10 with its cylindrical portion 17 of larger diameter is mounted in the bracket 1¹ fastened to chamber 1. A nut 25 is screwed into this bracket and abuts on the one side against the recessed front surface of the enlarged portion 17 of nozzle 10, and on the other side against the bipartite ring 24 inserted in a ring groove of the nozzle and secured by well known means against falling out. The point of the screw 26 screwed into bracket 1¹ reaches into the longitudinal groove 18 of the lower enlarged portion 17 of the nozzle. By turning nut 25 nozzle 10 may be adjusted with relation to its height and is prevented from turning by screw 26. The moving of the nozzle is made possible by the yieldingness of the inlet tube r . The adjustment of needle 27 controlling the fuel inlet remains unaffected if the Bowden cable is suitably arranged. The needle 27 will at first be adjusted to a corresponding cross section of flow at the mouth of the bore 13 while lever 31 is taken off. The adjustment of the needle may be changed by means of the Bowden cable even while the motor is running in order to obtain a more saturated mixture.

Another embodiment of the fuel nozzle is illustrated in Figs. 7 and 8. The capillary body 45 is held in this case by means of dogs 44 formed by the provision of cross slots 49¹ and of the bore 48 in the top of the nozzle. Body 45 furthermore is pressed upward by the little tube 46 which is screwed into nozzle 10 and secured against automatic unscrewing by a check nut 47.

Tube 46 projects into the fuel space 12 of nozzle 10 and protrudes almost down to the bottom of this space. The lower mouth cross section of the longitudinal bore of tube 46 is adjustable by needle 27 described above. Instead of needle 27, however, a similar valve, may be arranged at any suitable other part of the fuel inlet pipe r leading to nozzle 10 as shown for instance in Fig. 10 where a needle valve device 27', 28' 31', and B' is provided in connection with the fuel pipe r' leading from the float chamber towards the nozzle system within chamber 3.

The highest point of space 12 of nozzle 10 is connected with the air space surrounding nozzle 10, mainly, however, with a ring space between the outer surface of the nozzle top and the inner surface of the auxiliary air funnel 23 by means of a bore or of a plurality of bores in order to allow air to enter and to escape.

The arrangement of space 12 offers a further advantage inasmuch as, at a sudden acceleration of the motor, a fuel storage is being kept in it to serve at the time when the fuel column in the inlet pipe leading to the nozzle becomes accelerated to the desired extent, in a manner that the motor may be accelerated without any disturbance.

The top of nozzle 10 is surrounded by the auxiliary air funnel 23 which is connected by means of narrow ribs 23² with a funnel hub 23¹ screwed on the nozzle 10. As apparent in Fig. 7, funnel 23 may be axially moved with relation to the nozzle top in a manner that the ring shaped cross section 52 for the air passage between the outside surface of nozzle 10 and the inner surface of funnel 23, may be adjusted. A check nut 51

secures the adjusted position of the funnel 23.

The outside surface of the funnel 23 reaching into the cross section of the passage through the Venturi shaped main air funnel T is so formed that the cross sections of the flow along this surface, that means between this surface and the inner surface of the main air funnel T uniformly decrease towards the end of funnel 23, for instance from cross section 53 to the cross section 53¹. The speed of the air sucked in by the motor and flowing in the direction of arrow S², will thus become uniformly increased.

The main air funnel T is so formed, that the cross section of the air flow is changeable according to the motor vacuum. An embodiment of this device is shown in Figs. 1 and 3. The funnel consists of two jackets 1¹ and 1² of elastic material, one arranged within the other, and both provided with longitudinal slots s. The slots s start from the upper end downward without, however, reaching to the lower end. They end in bores b so that the jackets are kept together at this place. The jackets are so placed respecting each other, that each jacket covers the longitudinal slots s and the bores b of the other jacket respectively. The lower ends of both jackets are connected with each other in any suitable manner for instance by beading, riveting and the like, and they are held for instance by means of a slotted spring ring 42 engaging a ring groove of chamber 3. The upper end of funnel T elastically contacts the bore of the throttle chamber 3.

If the vacuum in the motor suction pipe exceeds a certain amount, jackets 1¹ and 1² become stretched by the outside super pressure against their elastic effect whereby the jackets move away from the upper edge of the auxiliary air funnel 23 thus opening a cross section for the air corresponding to the vacuum in the suction pipe.

The main air funnel may be made also in any other suitable manner provided it is capable of automatically altering its shape and particularly its width in the desired manner in response to a change of the motor vacuum.

Different fuel levels will adjust themselves in nozzle 10 if different fuels but the same float p¹ are used. This may have the disadvantage that losses of fuel may occur through the dripping of fuel from the nozzle 10. In order to prevent this according to the invention the float chamber 1¹ is so arranged that it may be moved parallel to the longitudinal axis of nozzle 10 in a dove-tail groove of the carburetor chamber 3. It may be adjusted in a desired position according to a scale 56 to be seen from the outside. This is schematically shown in Fig. 10. In this case float chamber 2 for the light fuel is not connected with chamber 1.

The carburetor as per the invention operates in the following manner:

The gasoline rises up through wick 9 which is dipped into it and permanently saturated due to the wellknown wick effect. If the cone 7 has the position shown in Figs. 1 and 2 at the starting of the motor, then the motor sucks in air which flows through pipe 8, apertures 34 and 35 and through the bores 38 and 38¹. While passing along the interior surface of pipe 8, the air takes along gasoline from the gasoline saturated wick in such a manner that a corresponding starting mixture will be formed. The amount of the mixture streaming into the motor may be regulated by adjusting cone 7, the longitudinal groove 36

of which is so shaped, that one bore 38 after the other will be throttled and closed at the turning of the cone, whereby the idling number of revolutions of the motor become regulated. By a corresponding dimensioning of pipe 8,—several pipes arranged in any suitable manner with respect to each other may be used also,—and by the choice of a suitable wick, the necessary quantity of mixture for the starting and idling is secured. During the idling the throttle is closed, and separates consequently the motor suction pipe entirely from the chamber of the main fuel nozzle.

The starting mixture may be made richer or poorer by screwing screw valve 55 in or out, respectively.

When the motor is sufficiently warmed up during the idling, that a condensation of the heavy fuel may not occur any more so easily, and if the throttle is then opened a little, air from the nozzle space flows into the suction pipe whereby the air current passing along the apertures 38¹, causes an increased suction of a saturated mixture of light fuel and air due to its energy of flow. Consequently, the number of revolutions of the motor becomes increased. Due to the inflowing air, however, the mixture ratio of the light mixture comes closer to normal whereby a further increase of the number of revolutions takes place which in turn increases the vacuum at the nozzle 10 so much, that the heavy fuel begins to atomize, while the light fuel carburetor is still operating. In the course of the further opening of the throttle, the throttle edge moves, more and more away from the wall of the chamber 3 whereby the effect of the energy of flow of the mixture current coming from the space of the nozzle 10, decreases again. The change from the operation with light fuel to that with heavy fuel consequently takes place automatically without intermission or disturbance.

By the vacuum at the throttle 10, fuel is sucked in through the bore 13 respectively the little tube 46, and flows through the body 45 whereby the fuel is divided in as many partial columns as the body has capillaries. The fuel particles pass through the nozzle openings 48 and 49¹ or 49 into the air current coming from the slot 52 whereby it is furthermore divided and thoroughly mixed with this air.

Since the size of the capillary may be made correspondingly small, (by compressing body 45 of yielding material with the help of the little tube 46 and the cap 10¹ respectively) a rate of atomization of the fuel will be obtained to a hitherto unknown extent.

By moving the auxiliary air funnel 23 towards the top of nozzle 10 the size of slot 52 and hence the amount and the speed of the atomizing air may be adjusted whereby best atomization of a fuel of any kind is obtained.

By axially moving nozzle 10 and funnel 23 together, the size of the cross section 53¹ and thus the quantity of main air flowing into the motor may be adjusted. Due to the uniform contraction of the cross sections 53 and 53¹, the air flow is free of eddies. The energy of flow of the air flowing out at 53¹, causes a thorough mixture of the same with the saturated atomizing mixture coming from the top of the nozzle.

The adjustment of the auxiliary air funnel 23 as regards to nozzle 10 and of this group as to funnel T is very simple since the motor directly responds with a change of its number of revolutions to a change of position of the funnel 23 and nozzle 10 in a manner that the number of

revolutions decreases if the mixture is too rich or too poor. The number of revolutions of the motor which is easily ascertained, therefore indicates the best adjustment of the respective position of the nozzle and the funnel.

The adjustment of the fuel level depending upon the kind of the fuel by means of the adjustment of the float chamber as described is also very simple.

Consequently the carburetor may be adjusted for any fuel in a very short time and without any difficulty and for any construction of motor.

If, with the carburetor according to the invention, the best adjustment for the atomization and for the correct mixture ratio of the main air and the atomizing mixture for any fuel has been made, a correct mixture ratio of air and fuel will be automatically obtained for all conditions of operation if the funnel T is used which expands and contracts depending upon the vacuum and hence upon the motor output, the material of which is so chosen that the air passage of the funnel T changes in a definite ratio to the vacuum. In this manner the most favorable conditions for an utmost of utilization of fuel are created by the carburetor according to the invention which considerably saves fuel and renders a higher motor output.

On account of the above mentioned excellent atomization of the fuel, the necessary preheating of the mixture in order to prevent a condensation will be much smaller than with the construction hitherto known, if not eliminated entirely. On account of the smaller heating of the mixture, the mixture weight sucked in by the motor, will be larger and consequently, the motor efficiency will be higher, or the lesser efficiency hitherto observed, will disappear.

The carburetor according to the invention may also be used for light fuel operation only, and this at a considerable saving of fuel and at a gain of a higher output. In this case, the float chambers 1 and 2 may be united to a single one as schematically illustrated in Fig. 11. The wick carburetor 8, 9 shown in dashed lines, leads the fuel mixture behind the throttle t and the idling will be adjusted by the cock 7 as described. The other parts are constructed as described.

The capillary body 45 may be shaped in a suitable manner, for instance ring-shaped etc. and the nozzle used together with it, may also be employed in motors with self ignition and with spraying of fuel under pressure. This nozzle may also be used for instance with oil furnaces.

I claim:—

1. In a carburetor the combination of an elastic main air funnel, adapted to alter its width under the influence of a motor vacuum, an auxiliary air funnel, a fuel discharge nozzle, a needle valve, said main air funnel, said auxiliary air funnel, said nozzle and said needle valve being arranged coaxially, said needle valve within said nozzle, said nozzle within said auxiliary air funnel and said auxiliary air funnel within said main air funnel, means for controlling the position of said needle valve within said nozzle for adjusting the passage of the fuel through said nozzle, means for adapting the position of said auxiliary air funnel in relation to said nozzle without interfering with the position of said needle valve in respect to said nozzle, and means for adjusting the position of said nozzle with said auxiliary air funnel in relation to the main air funnel.

2. In a carburetor the combination of an elas-

tic main air funnel adapted to alter its width under the influence of a motor vacuum, an auxiliary air funnel, a fuel discharge nozzle, said main funnel, said auxiliary air funnel and said nozzle being arranged co-axially with the auxiliary air funnel between the main air funnel and the nozzle, said main air funnel having a lower portion tapering towards the top, said auxiliary air funnel having a wall thicker near its top than near its lower end and said nozzle having a tapering top, whereby ring spaces gradually decreasing in width towards the narrowest portion of said main air funnel are formed, means for adjusting the position of said auxiliary air funnel as to its height with respect to said nozzle, and means for adjusting the position of said nozzle with said auxiliary air funnel as to its height with respect to the narrowest portion of said air funnel.

3. In a carburetor having a casing, a self-adjusting main air funnel of Venturi shape comprising two jackets of elastic material each jacket being provided with bores near its lower end and with longitudinal slots extending from the top of the jacket, and ending in said bores, said jackets being arranged close to and within one another, each slot of the one jacket being covered by a portion between two slots of the other one, said jackets being connected with each other at their lower ends, the lower end of the funnel being fixed within the carburetor casing and the upper end being free to slide therein, whereby the funnel is adapted to alter its width in response to a vacuum prevailing in the upper portion of the casing.

4. A carburetor comprising a casing, a main air funnel of Venturi shape, and an auxiliary air funnel, said main air funnel consisting of two jackets of elastic material each jacket being provided with bores near its lower end and with longitudinal slots extending from the top of the jacket and ending in said bores, said jackets being arranged close to and within one another, each slot of the one jacket being covered by a portion between two slots of the other one, said jackets being connected with each other at their lower ends, the lower end of the main air funnel being fixed within the carburetor casing and the upper end being free to slide therein, said auxiliary air funnel being tapered towards its upper end and being arranged coaxially with said main air funnel and within its lower portion, and means for altering the position of said auxiliary air funnel as to its height in relation to said main air funnel whereby a ring space gradually decreasing in width towards the top is formed, which is changeable depending upon the adjustment of the auxiliary air funnel and upon the width of the main air funnel being changeable in response to a vacuum prevailing in the upper portion of the casing.

5. In a carburetor, the combination of an elastic main air funnel adapted to alter its width under the influence of a motor vacuum, an auxiliary air funnel, a fuel discharge nozzle, said main air funnel, said auxiliary air funnel and said nozzle arranged coaxially to each other with substantially ring-shaped spaces gradually decreasing towards the top, between said nozzle and said auxiliary air funnel and between said auxiliary and said main air funnel, said auxiliary air funnel having a hollow cone-shaped portion, an interiorly threaded hub and ribs connected with said cone-shaped portion and said hub, said nozzle having a cone-shaped top and an exteriorly threaded body portion there below,

said auxiliary air funnel being mounted with its threaded hub on said threaded nozzle body so as to be adjustable as to its height with respect to said nozzle, and means for adjusting said nozzle with said auxiliary air funnel as to its height in relation to said main air funnel.

6. A carburetor comprising a casing, a bracket in the interior of said casing, an adjustable main air funnel, a nozzle body mounted on said bracket in alignment with the axis of the main air funnel said nozzle body being provided with a central bore as a passage for fuel and having an upper threaded portion, a hollow top cap adapted to be threaded upon the upper portion of said nozzle body, said top cap being provided with a central aperture and with lateral apertures, a capillary elastic body within said cap so arranged as to be compressed depending upon the distance said cap is screwed down on said nozzle body, an auxiliary air funnel mounted on said nozzle body and being adjustable as to its height in relation thereto, means for adjusting the height of said nozzle body in relation to said bracket, and means for arresting said nozzle body in its adjusted position.

7. A carburetor as claimed in claim 6 in which the nozzle body is provided with a lateral passage communicating with said central passage, further comprising a flexible tube connected to said nozzle body for admitting fuel through the lateral passage to the central passage.

8. In a carburetor having a main air funnel, a fuel nozzle device comprising a bracket having an enlarged portion with a bore in axial alignment with said main air funnel, a nozzle body being inserted in the bore of said bracket and provided with a central bore as a fuel passage, means for adjustably altering the position of said nozzle body as to its height in relation to said bracket, means in connection with said bracket for ar-

resting the nozzle body in its adjusted position, an adjustable needle valve with a shaft within said nozzle body for closing its center bore, said valve shaft protruding from said nozzle body, means attached to said valve shaft for controlling said needle valve, a cap with discharge apertures on top of said nozzle body, a capillary body within said cap in the path of the fluid passing through the nozzle body to the discharge apertures of said cap, an auxiliary air funnel mounted on said nozzle body with its top near the discharge apertures of said nozzle cap, said auxiliary air funnel being so arranged as to leave, between said auxiliary air funnel and said nozzle cap, a substantially ring shaped space decreasing in width towards the top, means for adjusting the position of the auxiliary air funnel as to its height in relation to the nozzle cap, and means for admitting fuel to the interior of said nozzle body.

9. A carburetor comprising an elastic main air funnel adapted to alter its width in response to a motor vacuum, a discharge nozzle, being adjustable as to its height in relation to said main air funnel and being provided at its top portion with an adjustably compressible capillary body, an auxiliary air funnel, said auxiliary air funnel surrounding the top portion of said discharge nozzle and being in alignment with the axis of the main air funnel, said auxiliary air funnel being adjustable as to its height in relation to said nozzle, and said nozzle with said auxiliary air funnel being adjustable as to their height in relation to the narrowest portion of said main air funnel, a float chamber mounted at the side of said casing, means for adjusting the height of said float chamber in relation to the nozzle, and a flexible fuel conduit between said float chamber and said nozzle.

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