March 6, 1951 H. SCHNEEBELI 2,544,111

CARBURETOR

Filed Oct. 1 , 1946. 2 Sheets-Sheet 1

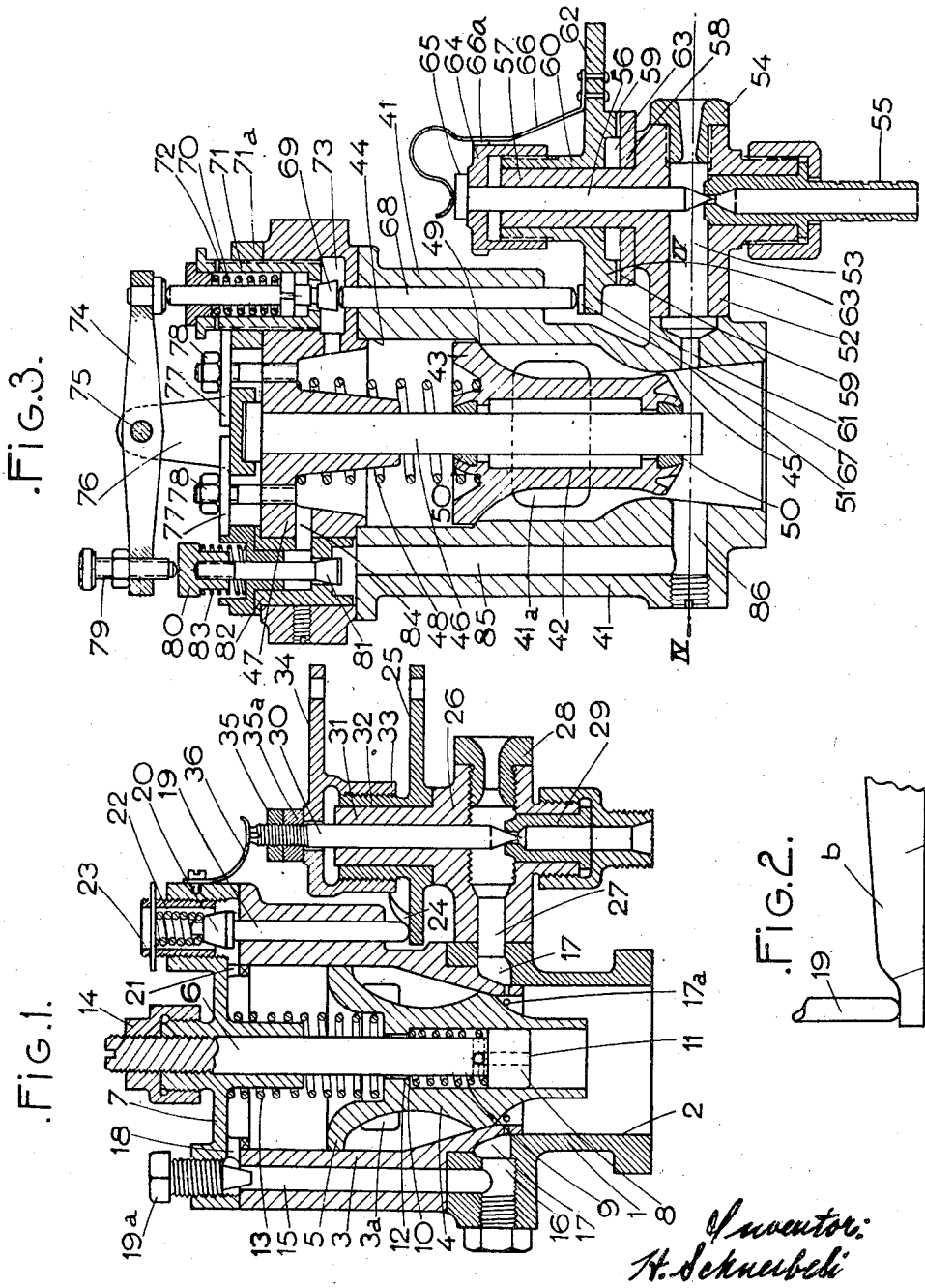

FIG.3.

FIG.1.

FIG.2.

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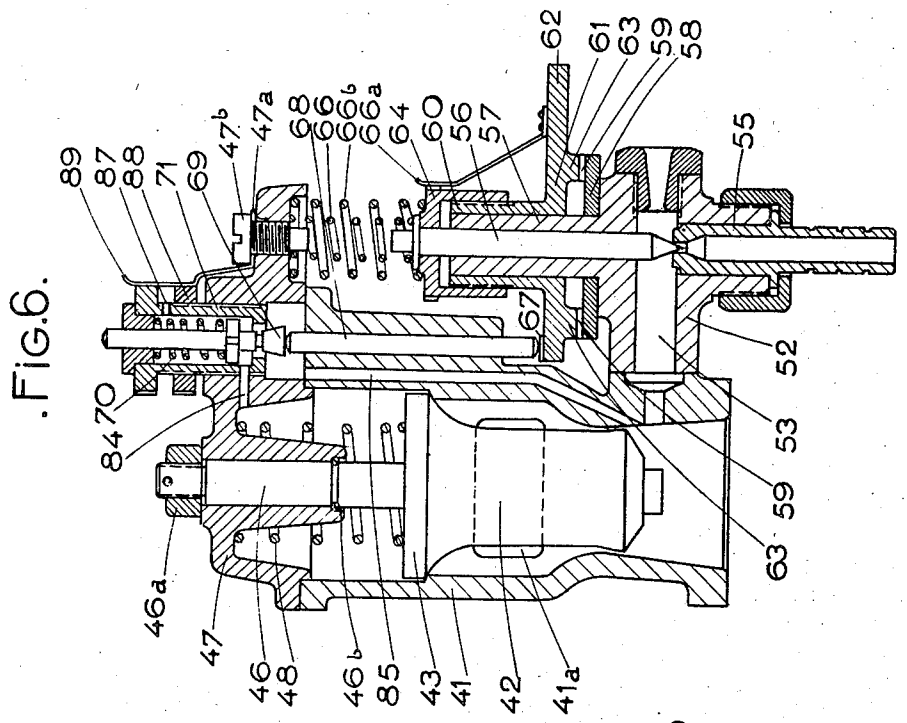

Fig.6.

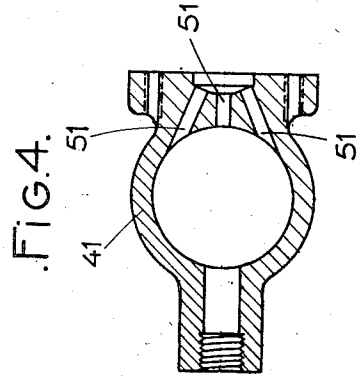

Fig.4.

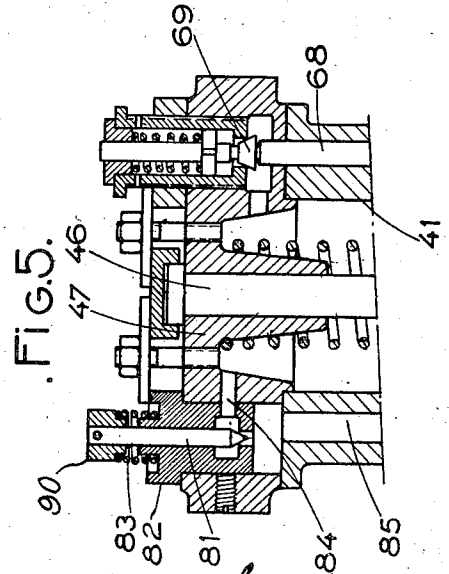

Fig.5.

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CARBURETOR

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2 Claims. (Cl. 261—44)

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The present invention relates to carburetors for internal combustion engines, and more especially to carburetors of the kind including on the one hand injecting means for supplying gaseous or liquid fuel emulsified in primary air and on the other hand secondary air inlet means controlled by throttling means automatically operated in response to variations of the suction of the induction pipe leading to the engine.

The essential object of my invention is to provide a carburetor of this type which is better adapted to meet the requirements of practice than those used up to the present time.

Other objects of my invention will appear from the following detailed description of some specific embodiments of the invention.

Preferred embodiments of my invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is an axial sectional view of a first embodiment of a carburetor made according to the present invention;

Fig. 2 is a detail view on a larger scale corresponding to Fig. 1;

Fig. 3 is an axial sectional view of a second embodiment of my invention;

Fig. 4 is a cross section on the line IV—IV of Fig. 3;

Fig. 5 is a partial sectional view of a modification of the embodiment of Fig. 3;

Fig. 6 is an axial sectional view of a third embodiment of my invention.

In the embodiment of Fig. 1, the apparatus is mounted on a base piece 1 which forms a pipe 2 one end of which is connected with the engine intake. To the other end of piece 1 is fitted the lower edge of a casing 3 provided with secondary air inlet ports 3a. This casing forms a seat for the secondary air throttle valve 4. Casing 3 further forms a cylinder for a piston 5 integral with throttle valve 4. Piece 4—5 is guided by an axial rod 6 carried by a cover 7 which closes casing 3 at the top thereof. The free end of rod 6 forms a cylindrical head 8 slidable in an axial bore provided in valve 4. A spring 9 is interposed between this head 8 and a shoulder 10 of piece 4—5, said spring being wound around rod 6. Passages 11 provided in rod 6 and its head 8 connect the housing of spring 9 with the engine induction pipe. This housing communicates, on the other hand, with the space between piston 5 and cover 7 due to a clearance 12 between rod 6 and piece 4—5. Another spring 13 wound around rod 6, is interposed between cover 7 and piece 4—5 and acts in opposition to spring 9,

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Rod 6 is screwed in cover 7 and extends therethrough. It carries, on the outside of said cover, a cap-shaped nut 14 which is also screwed on a central projection or boss of cover 7. This arrangement is intended to permit adjusting the strength of spring 9 by longitudinally displacing rod 6 and setting said rod in the desired position.

Cover 7 extends above lateral projections of casing 3. One of these projections is provided with a longitudinal conduit 15 in communication, at the bottom end thereof, with a radial conduit 16 of base piece 1. Conduit 16 opens into an annular chamber 17 which surrounds the seat of valve 4. At a short distance below this seat, casing 3 is provided with a plurality of small holes 17a which connect chamber 17 with induction pipe coupling 2. On the other hand, at the top end thereof, conduit 15 communicates, through a radial conduit 18 provided in cover 7, with the space between said cover and piston 5. A needle valve 19a mounted in this cover permits varying the section of the by-pass communication thus formed.

The other lateral projection of body or casing 3 is provided with a longitudinal bore in which is slidably mounted the stem 19 of a valve 20. This valve cooperates with a box which communicates, through a conduit 21 provided in cover 7, with the space between said cover and piston 5. Valve 20 is subjected to the action of a spring 22. Its stroke can be adjusted by screwing or unscrewing the seat 23 thereof. The other end of rod or stem 19 projects to the outside. It is in permanent contact with an inclined surface or cam 24 carried by one of the operating levers 25 of the injector means.

Said injector means include a body 26 fixed to base piece 1 and provided with a lateral conduit 27 adapted to fit in line with a radial conduit of said piece 1 opening into annular chamber 17. An air inlet tubular piece 28 diametrally opposed to conduit 27, serves for the inflow of fuel emulsifying air. Fuel is fed through an axial jet 29 controlled by a needle valve 30. This needle valve is slidable in a sleeve 31 in body 26. On this sleeve 31 is coaxially mounted another sleeve 32, integral with lever 25 and provided with external screw threads. A cap-shaped nut 33 is engaged on this threaded part, a second operating lever 34 being made integral with said nut. The stem of needle valve 30 extends freely through the top of cap 33. It is provided, on the outside of this cap, with a nut 35 and a lock nut 35a and subjected to the action of a spring 36 which applies said nut against the top of cap 33.

Lever 25 is connected with the throttle pedal whereas lever 34 is connected with a handle or lever located within reach of the driver's hand, for instance on the steering wheel.

The first of these levers, to wit 25, serves to control the rate of feed of fuel to the carburetor according to the effort required from the engine. The other lever, to wit 34, is an independent controlling means. It allows opening or closing the fuel feed without modifying the adjustment obtained through lever 25.

When this last mentioned lever is in the position corresponding to idling of the engine, the stem 19 of valve 20 has its lower end located in a recess *a* (Fig. 2) of cam 24, so that valve 20 is wide open. It therefore permits air to enter from the outside into the space between cover 7 and piston 5 at a sufficient rate for preventing the formation of a vacuum in this space under the effect of the suction from the engine. Throttle valve 4 therefore remains on its seat and does not admit secondary air to the engine cylinders.

If, now, lever 25 is operated in the suitable direction, needle valve 30 is lifted from its seat through the intermediary of cap 33 and a greater amount of fuel is supplied through the fuel jet. At the same time, a sharp slope of cam 24 lifts the stem 19 of valve 20, which thus throttles the air inlet into the space between cover 7 and piston 5. The suction exerted by the engine can then act upon the top face of piston 5, which is moved upwardly, lifts throttle valve 4 from its seat and thus causes air to enter through ports 3*a* into pipe 2.

If lever 25 is further rotated in the same direction, the portion of cam 24 that is now acting upon the lower end of stem 19 is but little inclined. Valve 20 is therefore further closed but at a relatively slow rate. The suction in the space between cover 7 and piston 5 grows nearer and nearer to that existing in the engine. In the position of the parts corresponding to normal running conditions, this suction balances the resultant of the suction effect exerted on throttle 4 on the side of the engine and of the respective actions of springs 9 and 13 for a given lift of valve 4 from its seat. This lift is, on the other hand, interrelated with the degree of opening of the fuel jet.

In the embodiment of Figs. 3 and 4, casing 41 is in communication through its open base portion with the engine. It is provided with wide lateral air inlet ports 41*a*. It is fitted with a throttle 42 the upper part of which constitutes a piston 43 slidable with a certain play in a suitable housing 44. The lower end portion of this throttle is adapted to move without friction in the neck 45 of casing 41. This member 42—43 is guided by a rod 46 rigid with a cover 47 which closes box 41 at the top thereof. A spring 48 interposed between this cover and member 42—43 urges piston 43 toward its seat 49 constituted by a shoulder of the inner wall of casing 41. Member 42—43 is guided on its rod 46 by elements 50 which are not fluid-tight.

Below the lowest position of the bottom end of the throttle, I provide three transverse conduits 51 (Fig. 4) extending through the wall of casing 41. They converge into a single chamber opposite which is fixed the body 52 of the injector device. This body is provided with a passage 53 communicating with the outside through a calibrated orifice 54. A fuel jet 55, supplied with fuel through suitable fuel feed means, opens transversely into passage 53. The outlet of jet 55 into passage 53 is controlled by a needle valve 56. This needle valve is slidable in a sleeve 57 integral with body 52. On this sleeve is coaxially mounted a disc 58, resting on a flat portion of body 52 and held in fixed angular position on this body about the axis of sleeve 57. The upper face of disc 58 is provided with two inclined cam surfaces 59—59, symmetrically located with reference to the center of said disc. Sleeve 57 acts as a pivot for a coaxial sleeve 60, provided, at the base thereof with an annular flange 61, integral with an operating lever 62. Flange 61 is provided, on its under face, with projections 63 arranged to cooperate with cam surfaces 59. The top end of sleeve 60 is closed by a screwed cap 64, provided with a hole affording a free passage for needle valve 56. A flange 65 carried by this needle valve bears upon the upper face of the end of said cap 64. A spring 66, fixed to lever 62, carries a small block 66*a* engaged with a set of teeth provided along the upper edge of cap 64. This cap can thus be fixed in a given angular position about its axis while keeping the possibility of adjusting it so as to determine at will the degree of opening of needle valve 56 in the idling position. This same spring 66 is curved at the top so as to bear against the flange 65 of needle valve 56 and to urge said needle valve toward its seat.

The upper face of the annular flange 61 of sleeve 60 is provided with another cam surface 67 intended to cooperate with push-piece 68 guided in a vertical housing of body 41. Push piece 68 is intended to act upon a valve 69 subjected to the action of a spring 70 and located in a valve casing 71 screwed in the cover 47 of body 41. The function of valve 69 is to control the feed of air from the outside into the space between piston 43 and cover 47, this air being supplied through orifices 72 provided in the wall of casing 71 and a conduit 73 provided in cover 47. The initial degree of aperture of valve 69 can be adjusted by screwing or unscrewing valve casing 71. After adjustment, this valve casing 71 is fixed in position by means of a lock nut 71*a*. Valve 69 is carried by a stem which projects outwardly from valve casing 71 and which is adapted to act as a push-piece on a rocker lever 74, pivoted at 75 on a support 76. This support is carried by the top end of guiding rod 46, against which it is fixed by means of two locking plates 77 secured through nuts 78.

At the end thereof opposed to push-piece 68, rocker lever 74 cooperates with a screw 79 the base of which is adapted to bear against the top face of a cap 80, screwed on the end of the stem of a valve 81. This valve 81 is housed in a valve casing 82 fitted in casing 47. Valve 81 is provided with a return spring 83 for urging it toward its seat. It controls the communication between the space between piston 43 and cover 47 and the suction of the engine, this communication taking place through a radial conduit 84 provided in cover 47, vertical conduit 85 and transverse conduit 86, both provided in casing 41, and the central bore of said casing, below throttle 42.

This carburetor device works in the following manner:

When the engine is idling, needle valve 56 permits a minimum amount of fuel to be fed through the injector device. On the other hand, secondary air flows in, at a very low rate, through the leak existing between the lower portion of the throttle and the inner wall of the neck 45 of the central bore of casing 41.

Throttle 43 cannot lift, since air inlet valve 69 is wide open, thus preventing the suction from the engine from exerting a lifting action on piston 43 through conduits 85, 86 and 84. However, in case of necessity, screw 79 might be adjusted in such manner as to have valve 81 more or less open for these conditions of operation.

When lever 62 is operated in such manner as to lift needle valve 56 away from its seat, valve 69 tends simultaneously to be lifted through the intermediate of push-piece 68 and accordingly to close the air inlet to the rear face of piston 43. Consequently an increasing suction tends to act on this rear face. Throttle 42 is therefore gradually lifted, thus clearing the secondary air intake to the engine. At the same time as valve 69 closes, valve 81 is opening wider and wider under the action of rocker lever 74 and the vacuum created by the suction from the engine is transmitted to the space at the rear of piston 43 through the direct way constituted by passages 84, 85 and 86, so that the lift of throttle 42 is accentuated by the action of the above mentioned valves.

In the modification illustrated by Fig. 5, there is no connection between valve 69 and valve 81. This last mentioned valve is intended in this case to work automatically. In place of opening towards the suction of the motor as in the preceeding modification it opens in the opposite direction, As shown it comprises a center punch 81, guided longitudinally in a perforation of the valve box 82 and provided exteriorly of the valve box with a head 90. A spring 83 which is interposed between the head 90 and the valve box 82 tends to raise the center punch 81.

When the motor is stopped the valve 81 is thus raised to a maximum. When the motor idles the valve 81 is on the contrary applied against its seat by the effect of atmospheric pressure, the depression then created by the motor in its suction conduit being at a maximum. For the other speeds of the motor the raising of the valve 81 is more or less large according to the value of the depression in the suction conduit of the motor and this depression becomes more or less sensitive consequently in the space located in back of the piston 45 through the conduits 84—85.

In the embodiment illustrated by Fig. 6, I make use, for controlling the secondary air intake, of a throttle 42 similar to that of Fig. 3, this throttle being integral with a piston 43 and being mounted slidable on a central guiding rod 46 inside body 41. Rod 46 projects beyond the upper face of cover 47. Its upper end is provided with a tightening nut 46*a*, screwed thereon, which applies in an annular recess of a central tubular inward projection of cover 47 a split ring 46*b*, partly housed in a circular groove of rod 46.

A spring 48 urges throttle 42 toward its seat, against which it is applied through its piston portion 43. The lower end of throttle 42 is dimensioned to pass freely through the neck formed by the central passage of body 41. Ports such as 41*a* are provided in the wall of body 41 for the inflow of secondary air. Fuel emulsified with primary air is fed through a conduit 53 provided in the body 52 of the fuel injection device.

Needle valve 56, which controls the section of flow through fuel jet 55, is subjected to the action of a return spring 66 one end of which bears against a projection 47*a* of cover 47, said spring end being engaged about a screw 47*b*.

Needle valve 56 is operated by means of a

lever 62. This lever is integral with a disc 61, itself integral with a sleeve 60 pivotally mounted on a sleeve 57 integral with body 52. Sleeve 60 is covered with a screwed cap 64 against which bears the head of the needle valve. Cap 64 is provided on its upper edge with teeth with which can cooperate a small locking block carried by spring 66*a*. A spring 66*b* the upper end of which bears against the projection 47*a* of cover 47, urges cap 64 in the downward direction.

Disc 61 is provided, on its under face, with projections 63 adapted to cooperate with cam portions 59 symmetrically disposed with respect to the center of another disc 58 secured to body 52. On its upper face, disc 61 is provided with another cam portion 67 which is adapted to cooperate with the end of a push piece 68. The other end of this push piece is in contact with a valve 69 subjected to the action of a return spring 70.

A conduit 85 opens under this valve 69. This conduit 85, provided in the wall of body 41, opens, at its other end, into the central wall of said body 41, below throttle 42.

Valve 69 is housed in a valve casing 71 screwed in cover 47, in adjustable position. On the side of valve 69 opposed to the opening of conduit 85, this valve casing communicates, through a conduit 84, with the space provided in body 41 above the piston 43 of throttle valve 42.

A passage 87 provided in the wall of this valve casing 71 permits the inflow of air from the outside into this space above piston 43. Passage 87 may be controlled by means of a ring nut 88 screwed on valve casing 71 so as to permit of adjusting at will the section of flow through said passage. A spring 89 fixed to cover 47 is adapted to engage the toothed edges of parts 71 and 88 so as to permit bringing and holding them in the desired relative position.

Thus the section of flow through passage 87 remains constant once it has been adjusted by means of nut 88.

On the contrary, the communication of the space on the rear of piston 43 with the suction conduit of the engine through passages 84, 85 depends upon the degree of opening of valve 69, which degree of opening is itself determined in accordance with the position of the needle valve 56 which controls the fuel flow rate. The cam portions of disc 61 are so determined that valve 69 opens more and more as the section of flow through fuel jet 55 is being opened more and more by throttle valve 56.

Thus, as in the preceding embodiments, the inflow rate of the secondary air stream is automatically increased in response to increases of the fuel flow rate by upward displacements of throttle 42 produced by the suction of the engine acting more and more on the rear face of piston 43 integral with said throttle 42.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

What I claim is:

1. A carburetor for an internal combustion engine which comprises, in combination, an induction pipe to be connected with said engine,

throttle valve means for controlling the flow of secondary air from the atmosphere to said pipe, pneumatic means for controlling said throttle valve means, said pneumatic means including a variable volume chamber, a passage between said chamber and the atmosphere, a passage between said chamber and the portion of said induction pipe on the downstream side of said throttle valve means, means for controlling the feed of fuel to the portion of said induction pipe on the downstream side of said throttle valve means, means operatively connected with said fuel feed control means for controlling the flow section through the second of said passages, and manual control means for adjusting the flow section through the first of said passages.

2. A carburetor for an internal combustion engine which comprises, in combination, an induction pipe adapted to be connected with said engine, a hollow casing opening at one end into said pipe, a throttle valve in said end of said casing for controlling the communication between said casing and said pipe, the other end of said casing being closed and forming a cylinder, a piston rigid with said throttle valve adapted to cooperate with said cylinder, the wall of said casing between

said throttle valve and said piston being provided with at least one secondary air intake port, a passage between the closed end of said cylinder and the atmosphere, a passage between the closed end of said cylinder and said induction pipe, means for feeding fuel to said induction pipe, means for controlling the flow rate of fuel through said fuel feed means, means operatively connected with said fuel flow rate control means for controlling the flow section through the second of said passages and manual control means for adjusting the flow section through the first of said passages.

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