

Nov. 15, 1966

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3,285,585

CARBURETTING DEVICES FOR INTERNAL COMBUSTION ENGINES

Filed Dec. 29, 1964

3 Sheets-Sheet 1

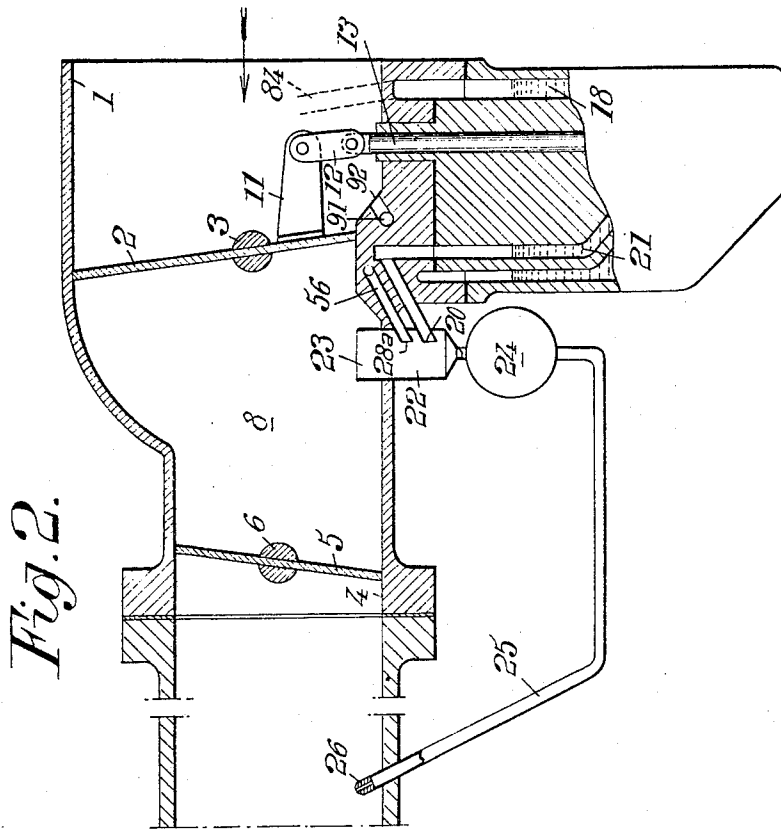


Fig. 2.

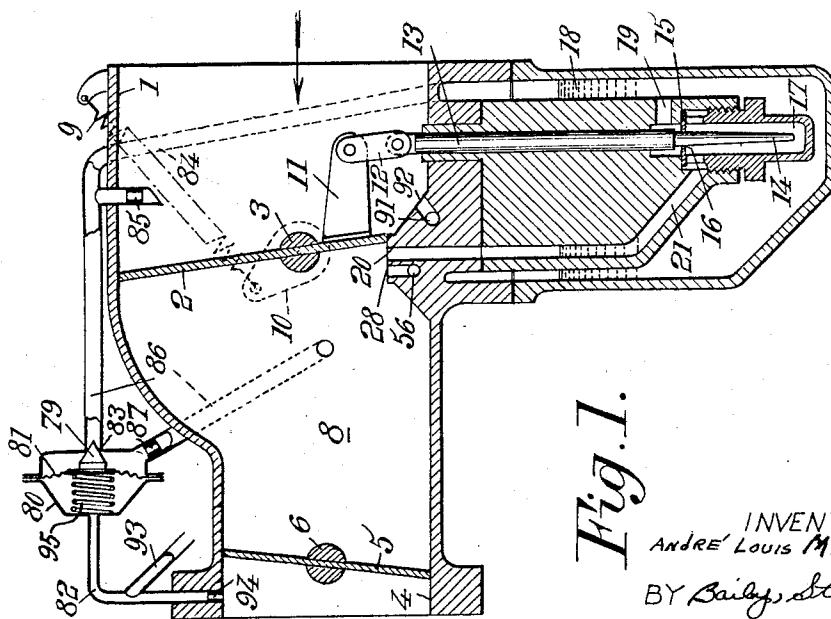


Fig. 1.

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Fig. 5.

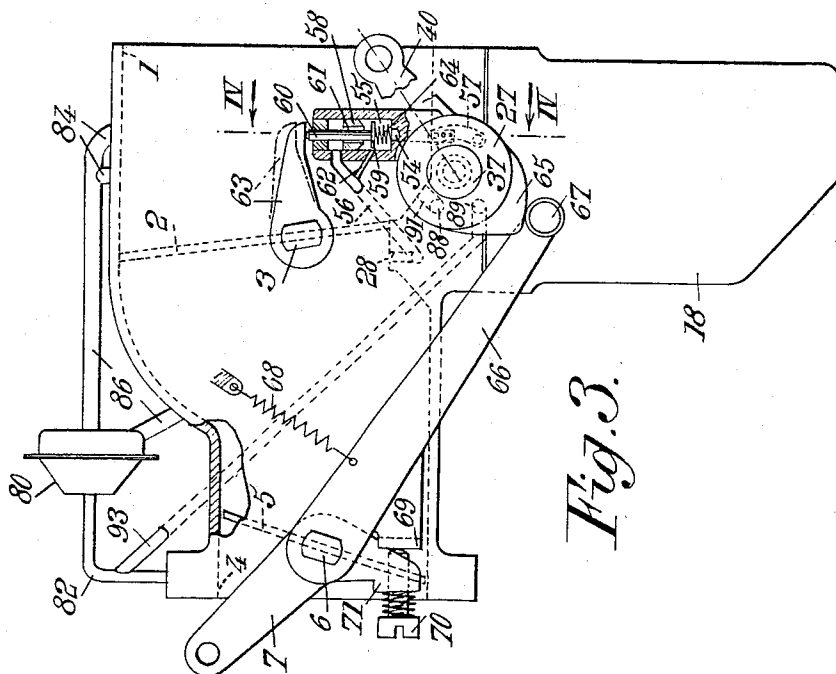
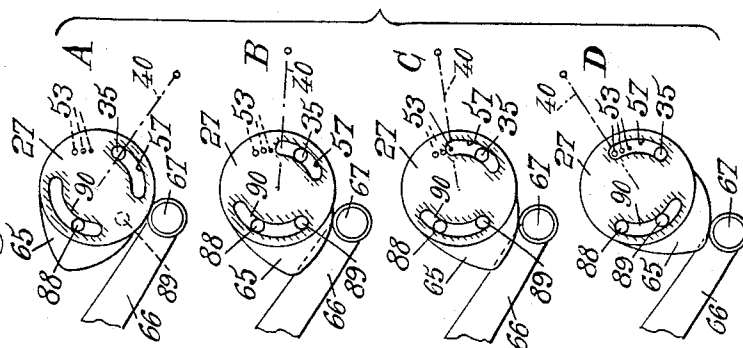


Fig. 3.

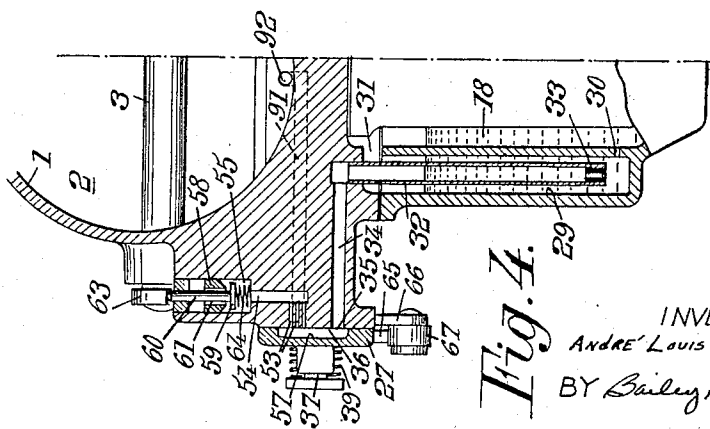


Fig. 4.

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Fig. 6.

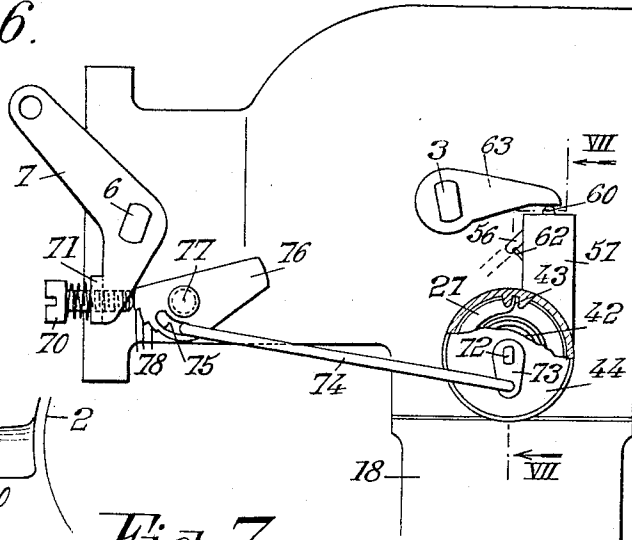


Fig. 7.

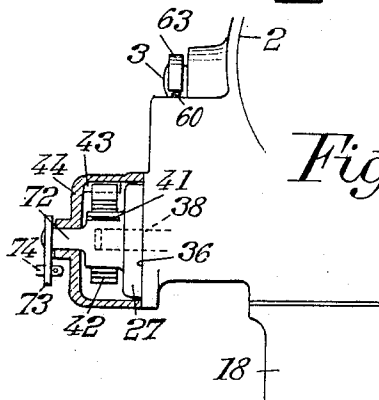


Fig. 8.

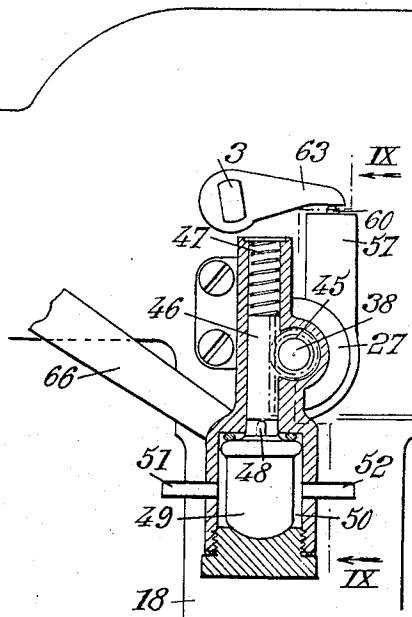
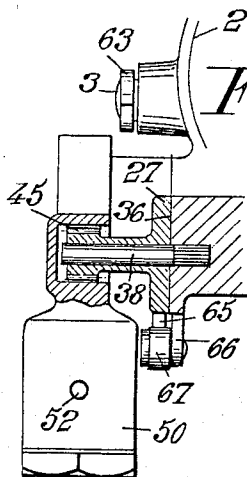


Fig. 9.



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CARBURETTING DEVICES FOR INTERNAL COMBUSTION ENGINES

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5 Claims. (Cl. 261—39)

The present invention relates to carburetting devices for internal combustion engines comprising, in their intake pipe, upstream of the main throttle valve actuated by the driver, an auxiliary throttle valve which opens automatically and gradually as the flow rate of the air passing through said pipe increases and which controls a metering member serving to adjust the flow rate of the fuel which, under the effect of the suction existing between the two throttle valves, is sucked in and admitted into the intake pipe at a point located downstream of said auxiliary throttle valve, in such manner that the cross section of the air passage controlled by said auxiliary throttle valve and the cross section of the fuel passage controlled by said metering member are substantially proportional to each other.

The object of the present invention is to provide a device of this kind such that the fuel percentage and the volume of the air and fuel mixture that it supplies are adapted to all working conditions of the engine, and in particular to the starting and running from cold of the engine.

For this purpose, according to the present invention, such a carburetting device comprises: a distributing element capable, when the internal combustion engine is started and running from cold, of opening a supplementary fuel feed pipe opening into a space where there is the same reduced pressure as between the two throttle valves and said auxiliary throttle valve is adapted to control means capable of locally reducing the cross section of said supplementary pipe (and therefore of reducing the fuel flow rate through said pipe), as soon as said auxiliary throttle valve is opened beyond the position corresponding to the internal combustion engine being driven by its starting motor.

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

FIG. 1 is a vertical longitudinal section of a carburettor to which the invention is to be applied.

FIG. 2 is a view, similar to FIG. 1, relating to another type of carburettor.

FIG. 3 is an elevational view, with parts in section, of a carburetting device made according to a first embodiment of the invention.

FIG. 4 is a transverse sectional view on the line IV—IV of FIG. 3.

FIG. 5 shows at A, B, C and D the positions successively occupied by the distributing element of FIG. 3, as the engine is cooling down, the position of FIG. 5D being the same as that of FIG. 3.

FIG. 6 is an elevational view of a carburetting device made according to a second embodiment of the invention.

FIG. 7 is a transverse section on the line VII—VII of FIG. 6.

FIG. 8 is an elevational view, with parts in section, of a carburetting device made according to a third embodiment of the invention; and

FIG. 9 is a transverse sectional view on the line IX—IX of FIG. 8.

The carburetting devices of FIGS. 1 and 2 both include

an air intake 1 provided with an air filter (not shown) and in which is provided an auxiliary throttle valve 2 eccentrically mounted on an axis 3. The air intake is followed, in the direction of flow of air diagrammatically illustrated by the arrow, by an intake pipe 4 in which is disposed a main throttle valve 5 adapted to be actuated by the driver. This valve 5 consists of a shutter fixed on an axis 6 which carries a lever 7 (FIGS. 3 and 6) operable from a distance through means that are not visible on the drawings and comprising a spring urging the main throttle valve 5 toward its closed position. Throttle valves 2 and 5 limit, between them, a chamber 8.

Under the effect of the suction of the internal combustion engine, air flowing in the direction of the arrows, auxiliary throttle valve 2 tends to open due to the fact that it is eccentric with respect to its pivot axis 3. The opening effort to which valve 2 is thus subjected is balanced by a spring 9 acting upon a lever 10 rigid with axis 3. Thus there exists a position of equilibrium of throttle valve for all conditions of running (and suction) of the engine, this suction being transmitted to chamber 8 when the main throttle valve 5 is open. Of course the auxiliary throttle valve might be of a different specific construction, consisting, for instance, of a slide valve movable transversely to air intake 1, or a valve slidable in the direction of the axis of said air intake 1 so as to move toward or away from a seat, this slide valve being in all cases balanced by a spring.

The auxiliary throttle valve 2 controls, through a lever 11 and a connecting rod 12, a sliding rod 13 which passes through the wall of the air intake 1, or of pipe 4, said rod 13 carrying at its lower end a needle 14. This needle is movable inside a fixed diaphragm 15, and its cross section is variable along its length, whereby the cross section of the annular passage 16 existing between diaphragm 15 and needle 14 depends upon the longitudinal position of rod 13 and, consequently, upon the angular position of auxiliary throttle valve 2 about its pivot axis.

Diaphragm 15 is disposed in a chamber 17 which communicates, on one side of the diaphragm, with a constant level chamber 18, through a channel 19, and, on the other side, with an orifice 20, through a conduit 21.

According to the embodiment of FIG. 1, orifice 20 opens into chamber 8, preferably, as shown, immediately downstream of the auxiliary throttle valve 2. The fuel metered by annular passage 16 therefore flows directly into intake pipe 4 through orifice 20 under the effect of the suction existing in chamber 8 and it is caused to flow toward the engine after passing along the main throttle valve 5.

According to the embodiment of FIG. 2, orifice 20 opens into a chamber 22 which is connected through a large orifice 23 to chamber 8, so as to be subjected to the same suction as that existing in said chamber 8. The bottom of chamber 22 is connected to the suction of a pump 24 the delivery of which communicates with a pipe 25 opening, through at least one injection nozzle 26, into the intake pipe downstream of the main throttle valve 5. The fuel metered by annular passage 16 and sucked into chamber 22 mixes, in said chamber, with the air coming from orifice 23 and the mixture thus formed is delivered by pump 24 through nozzle 26.

Concerning now the system for starting the engine and running it from cold, according to the present invention, there is provided a distributing element 27 (FIGS. 3 to 9) capable, when the engine is to be started and run from cold, of opening supplementary fuel feed conduit means leading into a space where there is the same suction as in chamber 8 between the two throttle valves 2 and 5, through an orifice 28 (FIGS. 1 and 3) or 28a (FIG. 2) and the auxiliary throttle valve 2 controls means capable

of locally reducing the cross section area of said supplementary fuel feed conduit means (and consequently of reducing the rate of flow in said conduit means) as soon as said auxiliary throttle valve 2 has been opened beyond the position thereof corresponding to the internal combustion engine being driven by the starting motor.

In order to feed said supplementary conduit means with fuel, fuel may be collected from a well 29 (FIG. 4) communicating with the constant level chamber 18 through a calibrated orifice 30 located below the level of the fuel in said chamber 18. Well 29 is vented at its upper part through an orifice 31 opening into the upper portion of chamber 18. In well 29 there is provided a tube 32 dipping into the fuel and provided at its lower end with at least one calibrated orifice 33. The upper end of tube 32 communicates with a channel 34 leading to an orifice 35 opening in a flat wall 36. Distributing element 27 is pivotable about a fixed pin 37 (FIGS. 3 and 4) or 38 (FIGS. 7 to 9) secured to the body of the device and it is applied against flat wall 36, for instance by a spring 39 (FIG. 4).

Distributing element 27 is actuated either by the driver, for instance by means of a lever 40 (FIGS. 3 and 5), or automatically in accordance with the temperature of an element of the internal combustion engine (FIGS. 6 to 9). According to the construction of FIGS. 6 and 7 distributing element 27 is provided with a slot 41 into which is inserted the inner end of a spiral wound bimetallic strip 42. The outer end of this strip 42 is inserted in a notch 43 provided in a lid 44 of adjustable position, this lid covering distributing element 27 and bimetallic strip 42. This last mentioned strip is heated by an element the temperature of which varies in the same manner as that of the internal combustion engine (for instance the cooling water or the lubricating oil of the engine, air heated by the exhaust gases, or an electrical resistor energized at the same time as the ignition circuit of the engine). According to the embodiment of FIGS. 8 and 9, distributing element 27 is rigid with a pinion 45 meshing with a rack 46. This rack is held by a spring 47 in contact with the rod 48 of a cap 49 filled with wax capable of expanding under the effect of heat, this cap being fixed inside a chamber 50 heated by an element of the type above mentioned. If this element is fluid (water, oil, air), it enters chamber 50 through a channel 51 and leaves it through a channel 52.

In flat wall 36 there is provided a plurality of calibrated orifices 53 (FIGS. 3 to 5) which are located along a circular arc having its center on pin 37 (or 38) and which communicate with a channel 54 (FIG. 3) leading to a chamber 55. This chamber 55 communicates with an outlet channel 56 which opens either through orifice 28 (FIGS. 1 and 3) into chamber 8, or through orifice 28a into chamber 22 (FIG. 2). Distributing element 27 is provided with an arcuate slot 57 which is adapted either to connect orifice 35 with one or several of the orifices 53 of channel 54 or to separate channels 34 and 54 from one another, according to the angular position of the distributing element.

It will be understood that the supplementary fuel feed conduit means above referred to consist of channels 34, 54 and 56 and that said means may be more or less opened by distributing element 27. The means for locally reducing the cross section of said supplementary fuel feed conduit means consist, as shown by FIGS. 3 and 4, of a check valve seat 58 located in chamber 55 and a check valve 59 carried by a rod 60, which extends through seat 58 while leaving a free annular passage 61. A channel 62 of small cross section permanently connects the upstream side and the downstream side of check valve 58. In order to have said means controlled by the auxiliary throttle valve 2, a rod 60 extends, in a practical manner, through the upper wall of chamber 55, the projecting portion of this rod 60 is disposed at the end of a lever 63 fixed on the axis 3 of

said auxiliary throttle valve 2. Said rod 60 is urged by a spring 64 toward the position where it projects to the maximum degree to the outside of chamber 55 and annular passage 61 is closed by check valve 59.

Advantageously, as shown, distributing element 27 controls the usual abutment determining the minimum degree of opening of the main throttle valve 5 in such manner that this minimum degree of opening is greater when said supplementary fuel feed conduit means 34, 54, 56 is opened than when it is closed.

For this purpose, according to the embodiment of FIGS. 3 to 5 (manual control of the distributing element through lever 40) and according to the embodiment of FIGS. 8 and 9 (automatic control of the distributing element), distributing element 27 carries a cam 65 and there is mounted, freely rotatable on the axis 6 of the main throttle valve 5, a lever 66 the end of which carries a roller 67 and which is urged by a spring 68 in the direction that maintains rollers 67 against cam 65, this direction being also that of the closing of main throttle valve 5. Lever 66 further carries an abutment 69 adapted to cooperate with an adjustment screw 70 carried by an extended portion 71 of lever 7. Cam 65 is such that abutment 69 is moved more and more in the direction of opening of throttle valve 5 as distributing element 27 is more and more opened.

According to the embodiment of FIGS. 6 and 7 (automatic control through the spiral wound bimetallic strip 22), distributing element 27 is rigid with a spindle 72 which carries a lever 73 located on the outer side of lid 44. To this lever 73 there is hinged, at one of its ends, a rod 74 the other end of which is engaged in a slot 75 provided in a cam 76, this cam being freely rotatable about a pin 77. Cam 76 is provided with steps 78 acting as abutments for screw 70, which is identical to that of FIG. 3. Steps 78 are at different respective distances from pin 77 so that the rotation of cam 76 in the clockwise direction (direction corresponding to the heating of strip 42) enables screw 70 to move toward pin 77 and, consequently permits throttle valve 5 to close more and more.

The device above described works as follows:

For very low temperatures of the internal combustion engine, distributing element 27 is in the position D of FIG. 5, either due to the action of the driver or automatically. The slot 57 of distributing element 27 connects the orifice 35 of channel 34 with the three orifices 53 of channel 54, which ensures a maximum cross section of flow of fuel through supplementary conduit means 34, 54, 56. For higher and higher temperatures of the internal combustion engine, distributing element 27 passes successively through the positions shown at C, B and A of FIG. 5. The slot 57 of distributing element 27 thus connects the orifice 35 of channel 34 to the orifices 53 of channel 54 (position intermediate between those illustrated at 5D and 5C), then to a single orifice 53 (position C), and finally seals off orifice 35 (positions B and A). This gradually reduces, finally to zero, the cross section through which fuel can flow in supplementary conduit means 34, 54, 56 as the temperature of the internal combustion engine is increasing.

When the engine is being driven by the starting motor throttle valve 2 is closed, due to the small flow rate through air intake 1, and lever 63 occupies the position illustrated in solid lines in FIG. 3. Check valve 59 is therefore opened and supplementary conduit means 34, 54, 56 supply the maximum flow rate of fuel that corresponds to the position of distributing element 27, that is to say to the temperature of the engine, under the effect of the suction to which is subjected orifice 28 (FIGS. 1 and 3) or 28a (FIG. 2).

Then, as soon as the engine is running by itself, auxiliary throttle valve 2 opens to an angle corresponding to some degrees and lever 63 comes to occupy the dot-and-dash lines in FIG. 3. Check valve 59 closes annular passage 61 under the action of spring 64 and channel

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62 constitutes the only path for the flow of fuel through conduit means 34, 54, 56. The flow rate through said conduit means is therefore reduced to the value just corresponding to the running of the engine, but it remains adapted to the temperature conditions thereof, owing to distributing element 27. As soon as the engine is warm, only the fuel metered by needle 14 (FIG. 1) is admitted to the engine.

At the same time as it determines the optimum flow rate of fuel for starting the engine and running it from cold, in combination with check valve 59, distributing element 27 determines the flow rate of the air stream flowing past the main throttle valve 5.

According to the embodiment of FIGS. 3 to 5 and to that of FIGS. 8 and 9, the muscular force applied by the driver on lever 40 or the force exerted by spring 47 on rack 46, against that developed by cap 49, is sufficient to overcome the resistance opposed to the opening of the main throttle valve 5 by the spring of the remote control means connected with lever 7. It will therefore be understood that to any position of distributing element 27 there corresponds automatically a degree of minimum opening of the main throttle valve 5, due to the connection through cam 65 and lever 66. In other words, as the engine is heating up, cam 65 and lever 66 successively occupy the positions shown at D, C, B and A in FIG. 5, which corresponds to a smaller and smaller minimum opening of the main throttle valve 5. Inversely, as the engine is cooling down after it has been stopped, cam 65 and lever 66 successively occupy the positions A, B, C and D of FIG. 5 which corresponds to a greater and greater minimum opening of the main throttle valve 5.

According to the embodiment of FIGS. 6 and 7, the force exerted by bimetallic strip 42, contrary to the preceding cases, is insufficient to overcome the resistance opposed to the opening of the main throttle valve 5 by the spring of the remote control means acting upon lever 7. When the internal combustion engine has cooled down, it suffices for the driver to act upon said remote control means to move screw 70 away from the steps 78 of cam 76 and to release said cam. The bimetallic strip 42, which is then cold, can then rotate cam 76 in an anti-clockwise direction (with respect to FIG. 6) and said cam then comes into the position shown by said FIG. 6 at the same time as distributing element 27 comes into the position indicated at C or D in FIG. 5. The main throttle valve 5 is therefore slightly opened with respect to the minimum degree of opening corresponding to the engine being warm and this owing to the difference between the respective distances of steps 78 from pin 77. The starting from cold device is then in action as in the case of FIGS. 3 to 5 and in that of FIGS. 8 and 9. Subsequently, it is the heating of strip 42 which, as in the preceding cases, causes distributing element 27 to pivot gradually with respect to wall 36 so as gradually to close supplementary conduit means 34, 54, 56 and to cause the main throttle valve 5 to return to its normal idling position.

It frequently occurs that the carburetting devices such as illustrated by FIGS. 1 and 2 include means for making leaner the air and fuel mixture that is supplied, in some conditions of operation of the engine, for instance under reduced loads, by reducing the pressure existing upstream of the metering member, or needle 14. As hereinafter explained, such means embody the risk of unduly modifying the flow rate of fuel through supplementary conduit means 34, 54, 56. In order to obviate this drawback, according to the present invention, distributing element 27 is adapted to bring out of action the above mentioned means for making the air and fuel mixture leaner as long as supplementary feed means 34, 54, 56 are kept open.

Said means for reducing the richness of the air and fuel mixture may be made as shown in section in FIG. 1 and in elevation in FIG. 3 but of course they may apply to devices of the type illustrated by FIG. 2. They com-

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prise a needle valve 79 carried by a diaphragm 81 forming the deformable wall of a chamber 80 to which is transmitted the suction existing downstream of the main throttle valve 5, which suction is transmitted through a conduit 82. When said suction is weak, needle valve 79 is applied against a seat 83 by a spring 95 and fuel chamber 18 is vented exclusively from air intake 1 through a conduit 84 provided with a calibrated orifice 85. On the contrary, when this suction is high, needle valve 79 is moved away from its seat 83 and conduit 84 is connected to chamber 8 through a conduit 86 provided with a calibrated orifice 87. Thus, for high loads of the engine, where needle valve 79 is applied against its seat 83, the pressure in constant level chamber 18 is the same as in the air intake, that is to say practically equal to the atmospheric pressure. On the contrary, when the loads are low and needle valve 79 is moved away from its seat 83, there is produced in constant level chamber 18 a suction which depends upon that existing in chamber 8 and which is determined by the respective cross sections of calibrated orifices 85 and 87, which reduces the flow rate through annular passage 16 as compared to the preceding case.

The suction produced in constant level chamber 18 by the opening of needle valve 79 obviously tends to oppose the flow through supplementary conduit means 34, 54, 56. This might be taken into account when adjusting the carburetting device but, if the suction in intake pipe 4 were reduced downstream of the main throttle valve 5 (high loads), there would be no suction in constant level chamber 18, which would have the drawback of immediately increasing the flow rate of fuel through supplementary conduit means 34, 54, 56.

In order to obviate this drawback, distributing element 27 is arranged in such manner that it prevents the suction collected through conduit 82 from acting upon the inside of chamber 80 as long as this distributing element 27 keeps the supplementary conduit means open.

For this purpose, wall 36 is provided with two orifices 88 and 89 cooperating with an arcuate slot 90 provided in the inner wall of distributing element 27 and, on the one hand, orifice 88 is connected to the air intake 1 through a conduit 91 opening into said air intake 1 through an orifice 92 upstream of auxiliary throttle valve 2 and, on the other hand, orifice 89 is connected through a conduit 93 with conduit 82, the latter being provided with a calibrated orifice 94 between pipe 4 and the branching of conduit 93.

Thus, as long as distributing element 27 opens supplementary conduit means 34, 54, 56 (positions C and D of FIG. 5) and possibly when it closes said supplementary conduit means but keeps the main throttle valve 5 slightly open (position B), its slot 90 connects conduit 82 with the air intake 1, which keeps needle valve 79 upon its seat 83 whatever be the suction existing downstream of the main throttle valve 5. Thus, as long as supplementary conduit means 34, 54, 56 are open, the flow rate therethrough is uninfluenced by pressure variations in constant level fuel chamber 18.

In a general manner, while the above description discloses what are deemed to be practical and efficient embodiments of the present invention, said invention is not limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the invention as comprehended within the scope of the appended claims.

What I claim is:

1. A carburetting device for an internal combustion engine which comprises, in combination:
 - an air intake pipe,
 - a main throttle valve in said pipe,
 - an auxiliary throttle valve in said pipe upstream of said main throttle valve, means to bias said auxiliary throttle valve towards a closed position, said aux-

iliary throttle valve being mounted to open automatically, in response to the flow of air through said intake pipe, gradually more and more as the air flow rate through said intake pipe increases,

a constant level fuel chamber,

normal fuel feed means for leading fuel from said constant level fuel chamber to said intake pipe downstream of said auxiliary throttle valve,

means operatively connected with said auxiliary throttle valve for metering the flow of fuel through said fuel feed means so that the cross section of flow afforded to air by said auxiliary throttle valve through said intake pipe and the cross section afforded to fuel through said fuel feed means remain substantially proportional to each other,

starting and cold running fuel feed conduit means for feeding supplementary fuel to said intake pipe, said last mentioned means opening into a space in communication with said intake pipe, where the pressure is the same as that in the portion of said intake pipe located between said two throttle valves,

a distributing member including a first valve means for opening said starting and cold running fuel feed conduit means,

and second valve means operatively connected with said auxiliary throttle valve for gradually throttling said starting and cold running fuel feed conduit means in response to the opening of said auxiliary throttle valve.

2. A carburetting device according to claim 1 further comprising:

abutment means for said main throttle valve for determining the position of minimum opening thereof, and

means operatively connected with said distributing member for adjusting said abutment means in response to the position of said distributing member so that said position of minimum opening of said main throttle valve is greater when said supplementary conduit means is opened than when it is closed.

3. A carburetting device according to claim 1, further comprising:

means for reducing the fuel proportion in the fuel and air mixture, and

means responsive to the opening of said distributing member for placing said fuel proportion reducing means out of action as long as said starting and cold running fuel feed conduit means is open.

4. A carburetting device for an internal combustion engine which comprises, in combination:

an air intake pipe,

a main throttle valve in said pipe,

an auxiliary throttle valve in said pipe upstream of said main throttle valve, means to bias said auxiliary throttle valve towards a closed position, said auxiliary throttle valve being mounted to open automatically, in response to the flow of air through said intake pipe, gradually more and more as the air flow rate through said intake pipe increases,

a constant level fuel chamber,

normal fuel feed means for leading fuel from said constant level fuel chamber to said intake pipe downstream of said auxiliary throttle valve,

means operatively connected with said auxiliary throttle valve for metering the flow of fuel through said fuel feed means so that the cross section of flow afforded to air by said auxiliary throttle valve through said intake pipe and the cross section afforded to fuel through said fuel feed means remain substantially proportional to each other,

starting and cold running fuel feed conduit means for feeding supplementary fuel to said intake pipe, said last mentioned means opening into the portion of said intake pipe located between said two throttle valves,

a distributing member including a first valve means for opening said starting and cold running fuel feed conduit less means,

and second valve means operatively connected with said auxiliary throttle valve for gradually throttling said starting and cold running fuel feed conduit means in response to the opening of said auxiliary throttle valve.

5. A carburetting device for an internal combustion engine which comprises, in combination:

an air intake pipe,

a main throttle valve in said pipe,

an auxiliary throttle valve in said pipe upstream of said main throttle valve, means to bias said auxiliary throttle valve towards a closed position, said auxiliary throttle valve being mounted to open automatically, in response to the flow of air through said intake pipe, gradually more and more as the air flow rate through said intake pipe increases,

a constant level fuel chamber,

normal fuel feed means for leading fuel from said constant level fuel chamber to said intake pipe downstream of said auxiliary throttle valve, said normal fuel feed means comprising a feed chamber in direct and unobstructed communication with the portion of said intake pipe located between said two throttle valves, a fuel pump having its inlet in communication with said feed chamber, a fuel nozzle opening into said intake pipe downstream of said main throttle valve, said fuel nozzle being in communication with the delivery of said fuel pump, and

means operatively connected with said auxiliary throttle valve for metering the flow of fuel from said constant level fuel chamber to said feed chamber so that the cross section of flow afforded to air by said auxiliary throttle valve through said intake pipe and the cross section afforded to fuel through said fuel feed means remain substantially proportional to each other,

starting and cold running fuel feed conduit means for feeding supplementary fuel to said intake pipe, said last mentioned means opening into said feed chamber,

a distributing member including a first valve means for opening said starting and cold running fuel feed conduit means,

and second valve means operatively connected with said auxiliary throttle valve for gradually throttling said starting and cold running fuel feed conduit means in response to the opening of said auxiliary throttle valve.

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