

April 25, 1939.

M. C. P. THIEULIN

2,156,132

CARBURETOR

Original Filed March 12, 1935

3 Sheets-Sheet 1

Fig. 1.

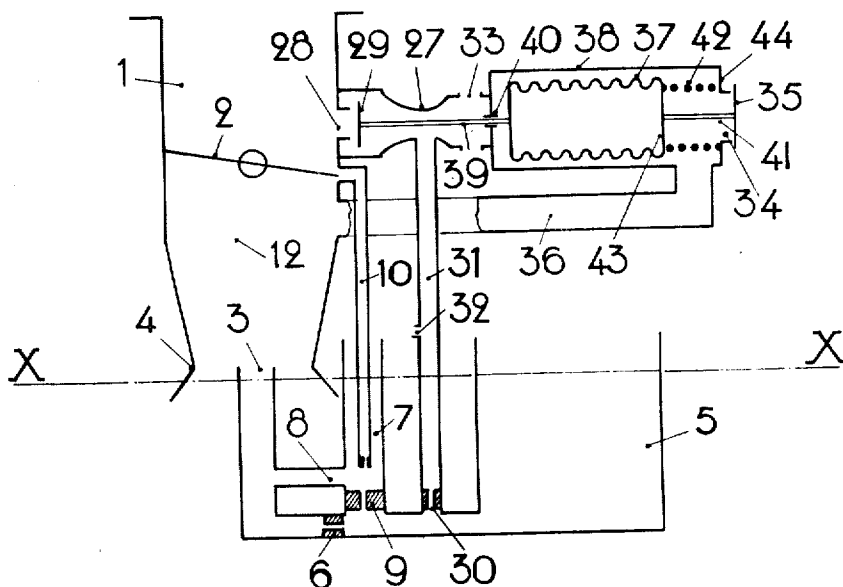
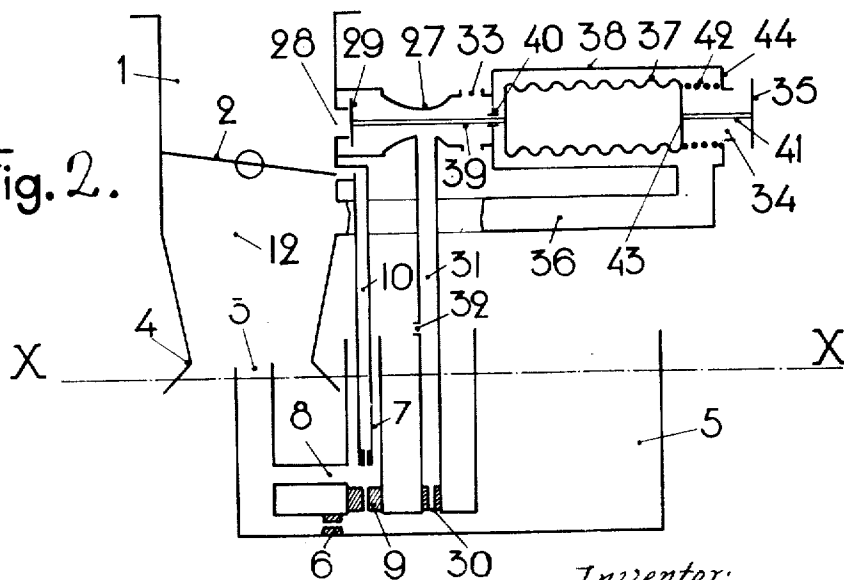


Fig. 2.



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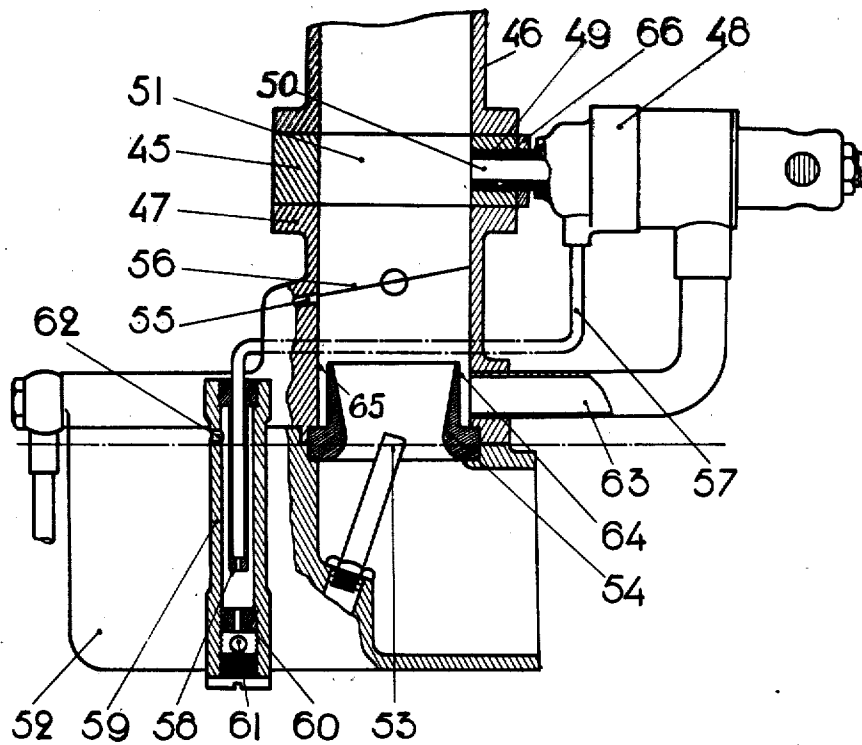
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Fig. 3.



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Fig. 4

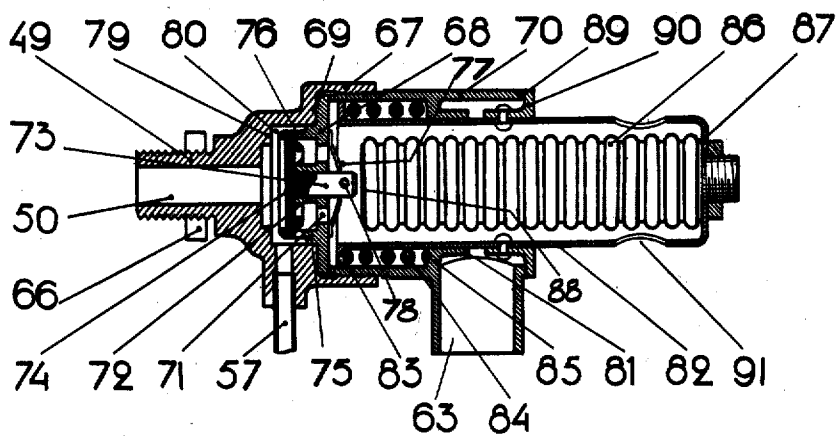
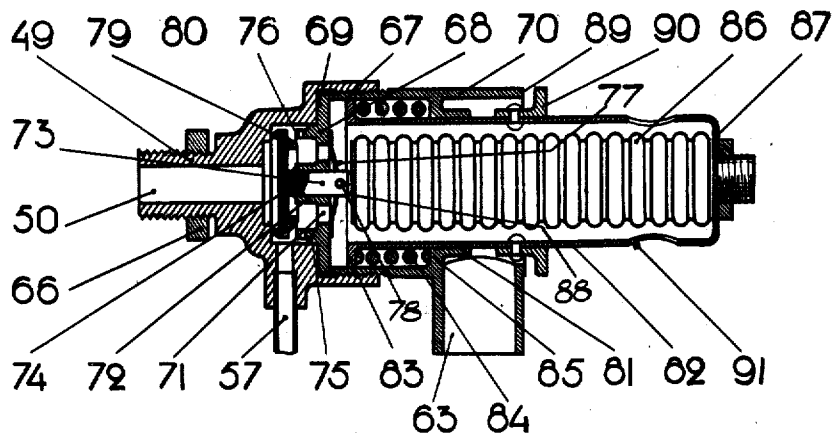


Fig. 5.



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UNITED STATES PATENT OFFICE

2,156,132

CARBURETOR

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Application March 12, 1935, Serial No. 10,721.
 Renewed August 9, 1937. In Belgium March
 16, 1934

11 Claims. (Cl. 261—39)

The present invention relates to carburetors for internal combustion engines.

It is known that the fuel mixture delivered to an engine by its carburetor may contain a lower percentage of fuel as the temperature rises, without detriment to the proper operation of the engine, and especially without reducing its power or its capacity of acceleration. This modification of the percentage of fuel in the mixture in accordance with the temperature is even desirable because if the adjustment of a carburetor is such that the power and the acceleration characteristics of the engine are satisfactory at low temperatures, the mixture supplied to the engine by the carburetor thus adjusted is richer than necessary when the temperature is high and the consumption of fuel by the engine is unnecessarily high at high temperatures. Two temperatures influence the working of an engine, to wit: the temperature of the engine itself, and the temperature of the external air. As a matter of fact, many aircraft carburetors are provided with a correction device adapted to be controlled by the pilot and which permits of increasing or decreasing the richness of the mixture fed to the engine as desired by the pilot. This kind of correcting device, the principle of which is perfectly sound, possesses, for practical purposes, some disadvantages. It requires, from the pilot, a correct reckoning of the correction to be made as a function of the temperature, and it occurs often that the pilot, being not thoroughly familiar with the engine, brings the correcting device into a position that does not correspond to good conditions of working of the engine, so that the latter does not work in a satisfactory manner.

The object of the present invention is to provide a device for automatically regulating the richness of the fuel mixture in accordance with the temperature.

A further object of the present invention is to combine an automatic regulating device of this kind with a starting device which is also automatic, and which is intended to feed the engine, in a known manner, with a rich mixture so as to facilitate the starting of the engine from cold when the atmospheric temperature is low.

A carburetor fitted with a regulating device according to the present invention comprises an additional air inlet controlled by a valve which is itself controlled by a thermostatic element, in such manner that the valve opens and thus increases the amount of air admitted through said air inlet when the temperature to which the thermostatic element is subjected rises. In the

present specification, the term "thermostatic element" means an element which is deformed when the temperature varies and the deformations of which serve to actuate the regulating organ that it is desired to control.

When the carburetor comprises, in combination, a device for automatically regulating the richness of the mixture and an automatic starting device, a single thermostatic element controls both the air inlet valve of the automatic regulating device, and a valve controlling the discharge of mixture from the starting device, that is to say the communication between the mixing chamber of the starting device and the mixture pipe of the carburetor. The connection between the thermostatic element and these two valves is such that, when the temperature rises, the thermostatic element successively operates the valve controlling the discharge of mixture from the starting device and the air inlet valve of the regulating device. As the valve controlling the discharge of mixture from the starting device is initially open, the thermostatic element first causes said valve to close, the air inlet valve of the regulating device remaining stationary as long as this discharge valve is not closed, and it is only after this discharge valve has been closed that the thermostatic element causes the air inlet valve of the regulating device to open.

Other features of the present invention will result from the following detailed description of specific embodiments thereof.

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

Fig. 1 and Fig. 2 diagrammatically show, in longitudinal section, a carburetor provided with a regulating device and with a starting device, both controlled by the same thermostatic element. In Fig. 1 the parts are shown in the position they occupy when the engine is cold and in Fig. 2 they are shown in the position they occupy when the engine is warm;

Fig. 3 diagrammatically shows, in elevation and partly in section, a preferred embodiment of a carburetor including in combination a starting device and a regulating device both controlled by thermostatic means;

Figs. 4 and 5 diagrammatically show, in longitudinal section, the combined arrangement of regulating means and starting means on the carburetor of Fig. 3.

The carburetor shown in Figs. 1 and 2 is provided with a starting device including a mixing

chamber 27. This mixing chamber 27 communicates with the mixture pipe 1 of the carburetor, behind throttle valve 2, through a mixture outlet 28 controlled by a valve 29. The mixing chamber 27 of the starting device is fed with fuel from float chamber 5 through a calibrated jet 30 and a conduit 31. This conduit 31 is provided with an emulsifying air inlet hole 32 located slightly above the level X—X of fuel. The mixing chamber 27 is fed with air through air inlet orifices 33 of sufficient section.

The regulating or correcting device includes an additional air inlet 34 controlled by a valve 35 and communicating through a conduit 36 with the mixing chamber 12 of the carburetor.

Valves 29 and 35 are both controlled by a floating thermostat 37 filled with a liquid, a gas, or a vapour. This thermostat 37 is disposed in a casing 38. Valve 29 is connected to thermostat 37 through a rod 39 passing through guiding means 40 carried by the end of casing 38. Valve 35 is connected to thermostat 37 through a rod 41. The guiding means 40 and the additional air inlet 34 are disposed at opposite ends of casing 38, respectively. A spring 42, compressed between the end 43 of thermostat 37 and the end 44 of casing 38, tends to keep valve 35 applied against its seat.

This device works in the following manner:

When the engine is cold and the external temperature is low, thermostat 37 is contracted and the various parts occupy the position shown in Fig. 1. The valve 35 of the regulating or correcting device is opened, while the valve 29 of the starting device is open. When the pilot starts the engine, the starting device supplies the engine with a rich mixture consisting of air delivered through air inlets 33 and of fuel delivered through jet 30. This mixture, which is formed in mixing chamber 27, is delivered to the mixture pipe 1 of the carburetor through fuel mixture outlet 28 and is added to the main mixture supplied by the main carburetor. The additional air conduit 36 is inoperative since valve 35 is closed.

When the temperature rises, thermostat 37 dilates and gradually closes valve 29. Therefore the starting device delivers to the mixture pipe 1 of the carburetor a smaller and smaller amount of supplementary rich mixture. When the temperature is sufficient for causing thermostat 37 to fully close valve 29, the starting device is wholly inoperative.

If the temperature further rises, due to heating of the engine, thermostat 37 dilates more and more. It then bears against the seat of valve 29, through rod 39, and the end 43 of thermostat 37 pushes valve 35 into the open position, against the action of spring 42. Said valve 35 thus opens and conduit 36 feeds to the mixing chamber of the carburetor additional air which reduces the percentage of fuel in the final mixture fed by the carburetor to the engine. The various parts now occupy the position shown in Fig. 2. It should be noted that the opening of the valve of the regulating or correcting device takes place only after the closing of the valve controlling the mixture outlet of the starting device.

In the embodiment of Fig. 3, an intermediate collar 45 is interposed between a flange on the intake pipe 46 of the engine and the flange 47 of the carburetor. The combined regulating and starting device 48 is fixed on the intermediate collar 45 by means of the threaded end 49 through which extends the outlet conduit 50 of the starting device. The device is fixed in position by means of lock-nut 56. Conduit 50 opens

into the central bore 51 of intermediate collar 45 which establishes a communication between the mixture outlet of the main carburetor and the engine intake pipe 46. In the main carburetor, a float chamber 52 feeds fuel through known means, not shown in the drawings, to fuel outlet 53, which opens into choke tube 54. An idling system, not shown in the drawings, feeds a fuel mixture to the idling mixture outlet 55, which opens into pipe 1 close to the edge of throttle 56, when the latter is in the closed position.

The starting device is fed with fuel through conduit 57, the end of which is provided with a calibrated hole 58 immersed in a vertical tube 59 carried by the float chamber. This tube 59 is fed with fuel through an immersed jet 60 connected with the float chamber through a conduit 61. Tube 59 is fed with air at its upper part through orifice 62.

The additional air supplied by the correcting or regulating device is delivered to the carburetor through conduit 63. This conduit 63 opens into an annular space 64 provided between the outer wall of choke tube 54 and the inner wall 65 of the mixing chamber of the carburetor. Owing to this arrangement, the additional air is regularly distributed around the main mixture of air and fuel issuing from choke tube 54, which ensures the homogeneity of the final mixture.

The details of the combined regulating and starting device 48 are shown in Figs. 4 and 5. The body 67 of this device includes the threaded end part 49 which serves to fix it in the intermediate collar 45, and through which is provided the mixture outlet conduit 50 of the starting device. This body 67 is further adapted to receive the end of the fuel feed conduit 57. A seat 68 is tightly held between a shoulder 69 of body 67 and the threaded end of a shell 70. This seat 68 is provided with holes 71, which constitute the air inlet orifices of the starting device. It is further provided, in its central part, with a cylindrical guiding sleeve 72, in which is slidably mounted a rod 73 carrying a valve 74. This seat 68 is further provided, in its peripheral part, with a cylindrical extension 75 provided with calibrated holes 76. A spring 77, interposed between seat 68 and a pin 78 extending through rod 73, tends to keep valve 74 applied against the end of cylindrical part 75 (Fig. 4). When valve 74 is moved against the action of spring 77, it may be seated against a shoulder 79 of body, which constitutes the seat of said valve, so as to stop mixture outlet 50 (Fig. 5). The annular space 80, existing between valve 74 and body 67, constitutes the mixing chamber of the starting device.

Shell 70 is provided with a cylindrical guiding surface 81, in which is slidably mounted a sleeve 82. This sleeve 82 is provided at one end with a flange 83. A spring 84, stronger than spring 77, interposed between said flange 83 and a shoulder 85 on shell 70, tends to push flange 83 toward seat 68. At the opposite end, sleeve 82 is provided with orifices 91. A thermostat 86, which is filled with a liquid, a gas, or a vapour, is fixed to the end 87 of sleeve 82, and when it expands, due to a rise of the temperature, its end 88 comes into contact with the end of the rod 73 that carries valve 74 and pushes said valve against its seat 79, against the action of spring 77.

At its end opposed to seat 68, shell 70 is open and forms a circular seat 89 adapted to cooperate with a valve 90 rigidly carried by sleeve 82.

The additional air conduit 63 is fixed to shell 76. Valve 90 tends to be applied against its seat 89 by the action of spring 84, which applied against the flange 83 of said sleeve 82.

This device works in the following manner:

When the engine is cold and the external temperature is low, the various parts of the device occupy the position shown in Fig. 4. Thermostat 86 is contracted. Spring 84 keeps valve 90 in the closed position, so that no additional air can be fed through conduit 63. Spring 77 keeps valve 74 applied against the end of cylindrical part 75. There is a certain clearance between the end of valve rod 73 and the end of thermostat 86. When the engine is started, the throttle valve 56 of the carburetor being closed, the mixing chamber 80 of the starting device is fed with air only through orifices 76 of small section, which themselves communicate with the atmosphere through holes 71 provided in seat 68 and through ports 91 provided in sleeve 82. Valve 74 permits free communication between mixture outlet conduit 50 and the fuel inlet conduit 57. A considerable suction is then transmitted 25 through conduit 57 and calibrated orifice 58 to tube 59. Conduit 57 feeds the mixing chamber of the starting device, 80, with a considerable amount of fuel emulsified by air admitted into tube 59 through calibrated orifice 62. On the 30 contrary, this mixing chamber 80 receives but a small amount of air through orifices 76, which are of small section. Therefore the starting device supplies the engine with a very rich mixture which is particularly well adapted to permit the 35 starting of the engine from cold. If the pilot opens throttle valve 56 so as to use the engine, the very rich mixture fed by the starting device is added to the normal mixture delivered by the main carburetor, and facilitates the running of 40 the engine which is still cold.

As the engine grows warmer, thermostat 86 expands gradually more and more. Its end 88 comes into contact with the end of rod 73, and gradually pushes valve 74, which is rigid with 45 said rod, toward the left hand side, against the action of spring 77. Valve 74 is thus moved away from the end of cylindrical part 75 and thus increases the amount of air admitted into the mixing chamber 80 of the starting device. At 50 the same time, valve 74 is moved nearer and nearer to its seat 79, thus reducing the section of flow for the mixture issuing from chamber 80 and fed to the engine through mixture outlet 50. This produces a reduction of the suction created 55 in chamber 80 and a reduction of the richness of the mixture supplied by the starting device. At the same time, the amount of mixture that is fed by the starting device decreases and it becomes zero when valve 74 is brought into contact with its seat 79. The starting device is thus 60 gradually brought out of action when the engine grows warmer and warmer.

As the temperature further rises (Fig. 5), the end 88 of the expansible thermostat 86 comes to 65 bear against the end of the rod 73 of valve 74, which is itself applied against its seat 79. The opposite end of thermostat 86 pushes the end 87 of sleeve 82 to the right, against the action of spring 84 under the effect of a further expansion thermostat 86, valve 90, which is rigid with said 70 sleeve 82, opens, and additional air is fed to conduit 63 through the space between the end 89 of piece 78 and valve 90. This additional air is fed into the annular space 64 surrounding the choke 75 tube of the main carburetor and reduces the per-

centage of fuel in the fuel mixture fed to the engine by the carburetor. Valve 90 is the more widely open as the temperature is higher. Therefore the amount of additional air delivered by the correcting or regulating device increases simultaneously with the temperature, so that the mixture fed to the engine by the carburetor becomes poorer in fuel as the temperature rises. 5

When the engine is started, if the external temperature is not very low, valve 74 may be already in an intermediate position between the 10 end of cylindrical part 75 and shoulder 79. Therefore the richness and the amount of the mixture fed to the engine by the starting device vary with the conditions of temperature in which 15 the engine is placed and with the requirements of said engine.

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 20 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 25 of the appended claims.

What I claim is:

1. A carburetor for an internal combustion engine which comprises, in combination, a carburetor body forming a mixing chamber, means for 30 feeding fuel into said chamber, a main air inlet for said chamber, an additional air inlet, a valve for controlling said additional air inlet, a starting device including a mixing chamber for forming a rich mixture of fuel with air, and a passage for 35 leading said rich mixture from said last mentioned chamber to the engine, a valve for controlling said passage, and thermostatic means for controlling both of said valves so as to leave the last mentioned valve open when the temperature 40 of said thermostatic means is low and gradually close it when said temperature rises and to move said first mentioned valve in the opening direction thereof when the temperature of said thermostatic means exceeds a predetermined value 45 and is rising, and in the closing direction when said temperature drops toward said predetermined value.

2. A carburetor for an internal combustion engine which comprises, in combination, a carburetor body forming a mixing chamber, means for 50 feeding fuel into said chamber, a main air inlet for said chamber, an additional air inlet adapted to reduce the percentage of fuel in the mixture fed by said carburetor to said engine, a valve for 55 controlling said additional air inlet, a starting device for forming a rich mixture of fuel with air, a passage for leading the rich mixture from said starting device to the engine, a valve for controlling said passage, said last mentioned valve 60 being normally open at low temperature, a thermostat filled with a fluid, means for connecting one end of said thermostat with the second mentioned valve so as to cause said last mentioned 65 valve to close gradually when said thermostat expands under the effect of a rise of temperature, means for connecting the opposite end of said thermostat to the first mentioned valve, so as to cause said first mentioned valve to open when 70 said thermostat expands to a sufficient degree, and elastic means for yieldingly opposing the opening of said first mentioned valve.

3. A carburetor according to claim 2 in which 75 said valves are positioned parallelly with each other and are adapted to open both in the same

direction, the means for connecting one end of the thermostat with the second mentioned valve including a rod rigid with said valve and against which said end of the thermostat comes into contact after a given expansion of the thermostat, and the means for connecting the other end of the thermostat with the first mentioned valve being rigid connecting means.

4. A carburetor according to claim 1 including a throttle in said mixing chamber in which said additional air inlet opens into said mixing chamber ahead of said throttle.

5. In a carburetor for an internal combustion engine comprising an induction passage and fuel and air inlets for supplying mixture to the engine for normal operation; auxiliary fuel supply means arranged to discharge into the induction passage, an auxiliary air inlet arranged to discharge into the induction passage, independently operative valves controlling said auxiliary fuel supply means and said auxiliary air inlet, and a floating thermostat connected to the valves and arranged to successively close one of said valves and open the other as the temperature rises.

6. In a carburetor, a mixture control device comprising a floating thermostat having one end movable in a predetermined direction upon rise in temperature and the other end movable and biased in the same direction, a valve member connected to said one end and arranged to close upon movement of said one end in said direction, a second valve member connected to the other end and arranged to close upon movement of said other end in the same direction, and fuel and air inlets controlled by said valve members for influencing the richness of the mixture generated by the carburetor.

7. A carburetor as defined in claim 6, wherein one of said valve members is associated with a fixed valve seat which acts as an abutment against which the thermostat reacts in actuating the other valve member.

8. A carburetor as defined in claim 6, wherein one of said valve members is associated with a valve seat which, when in contact with its valve member, acts as an abutment against which the thermostat reacts in operating the other valve member, and the other valve member is associ-

ated with a valve seat which, when in contact with its valve member, acts as a stop to limit movement of the thermostat due to said bias.

9. A carburetor having a main induction passage, a mixture control device comprising a floating thermostat having one portion movable in a predetermined direction upon rise in temperature, means biasing another portion of the thermostat in the same direction, auxiliary fuel and air passages connected to the induction passage and designed to influence the fuel-air ratio of the mixture generated by the carburetor, and valve members connected to said portions of the thermostat for controlling said auxiliary passages.

10. A carburetor for an internal combustion engine having an induction passage, comprising in combination a main air inlet, an additional air inlet, and an auxiliary starting device including a mixing chamber, a mixture passage connecting said mixing chamber and said induction passage, a floating expansible thermostat, a valve member connected to said thermostat and arranged to close said mixture passage upon expansion of the thermostat, and a second valve member connected to said thermostat and arranged to open said air inlet upon expansion of the thermostat, said thermostat being biased in a direction to tend to close said mixture passage.

11. In a carburetor for an internal combustion engine comprising an induction passage and fuel and air inlets for supplying mixture to the engine for normal operation; auxiliary fuel supply means arranged to discharge into the induction passage, an auxiliary air inlet arranged to discharge into the induction passage, a valve operative when moved in one direction to close said auxiliary fuel supply means, a second valve operative when moved in the same direction to close said auxiliary air inlet, means limiting the movement of each of said valves in said same direction, a temperature responsive connection between said valves operative to move the valves away from each other upon a rise in temperature, and means biasing said connection in said same direction.

MAURICE CLÉMENT
PHILIPPE THIEULIN.

CERTIFICATE OF CORRECTION.

Patent No. 2,156,132.

April 25, 1939.

MAURICE CLÉMENT PHILIPPE THIEULIN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 33, for the word "opened" read closed; page 3, first column, line 39, for "carubertor" read carburetor; line 70, before "thermostat" insert of; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of March, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

direction, the means for connecting one end of the thermostat with the second mentioned valve including a rod rigid with said valve and against which said end of the thermostat comes into contact after a given expansion of the thermostat, and the means for connecting the other end of the thermostat with the first mentioned valve being rigid connecting means.

4. A carburetor according to claim 1 including a throttle in said mixing chamber in which said additional air inlet opens into said mixing chamber ahead of said throttle.

5. In a carburetor for an internal combustion engine comprising an induction passage and fuel and air inlets for supplying mixture to the engine for normal operation; auxiliary fuel supply means arranged to discharge into the induction passage, an auxiliary air inlet arranged to discharge into the induction passage, independently operative valves controlling said auxiliary fuel supply means and said auxiliary air inlet, and a floating thermostat connected to the valves and arranged to successively close one of said valves and open the other as the temperature rises.

6. In a carburetor, a mixture control device comprising a floating thermostat having one end movable in a predetermined direction upon rise in temperature and the other end movable and biased in the same direction, a valve member connected to said one end and arranged to close upon movement of said one end in said direction, a second valve member connected to the other end and arranged to close upon movement of said other end in the same direction, and fuel and air inlets controlled by said valve members for influencing the richness of the mixture generated by the carburetor.

7. A carburetor as defined in claim 6, wherein one of said valve members is associated with a fixed valve seat which acts as an abutment against which the thermostat reacts in actuating the other valve member.

8. A carburetor as defined in claim 6, wherein one of said valve members is associated with a valve seat which, when in contact with its valve member, acts as an abutment against which the thermostat reacts in operating the other valve member, and the other valve member is associ-

ated with a valve seat which, when in contact with its valve member, acts as a stop to limit movement of the thermostat due to said bias.

9. A carburetor having a main induction passage, a mixture control device comprising a floating thermostat having one portion movable in a predetermined direction upon rise in temperature, means biasing another portion of the thermostat in the same direction, auxiliary fuel and air passages connected to the induction passage and designed to influence the fuel-air ratio of the mixture generated by the carburetor, and valve members connected to said portions of the thermostat for controlling said auxiliary passages.

10. A carburetor for an internal combustion engine having an induction passage, comprising in combination a main air inlet, an additional air inlet, and an auxiliary starting device including a mixing chamber, a mixture passage connecting said mixing chamber and said induction passage, a floating expansible thermostat, a valve member connected to said thermostat and arranged to close said mixture passage upon expansion of the thermostat, and a second valve member connected to said thermostat and arranged to open said air inlet upon expansion of the thermostat, said thermostat being biased in a direction to tend to close said mixture passage.

11. In a carburetor for an internal combustion engine comprising an induction passage and fuel and air inlets for supplying mixture to the engine for normal operation; auxiliary fuel supply means arranged to discharge into the induction passage, an auxiliary air inlet arranged to discharge into the induction passage, a valve operative when moved in one direction to close said auxiliary fuel supply means, a second valve operative when moved in the same direction to close said auxiliary air inlet, means limiting the movement of each of said valves in said same direction, a temperature responsive connection between said valves operative to move the valves away from each other upon a rise in temperature, and means biasing said connection in said same direction.

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