

Aug. 23, 1938.

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2,127,735

CARBURETOR

Filed Sept. 17, 1934

3 Sheets-Sheet 1

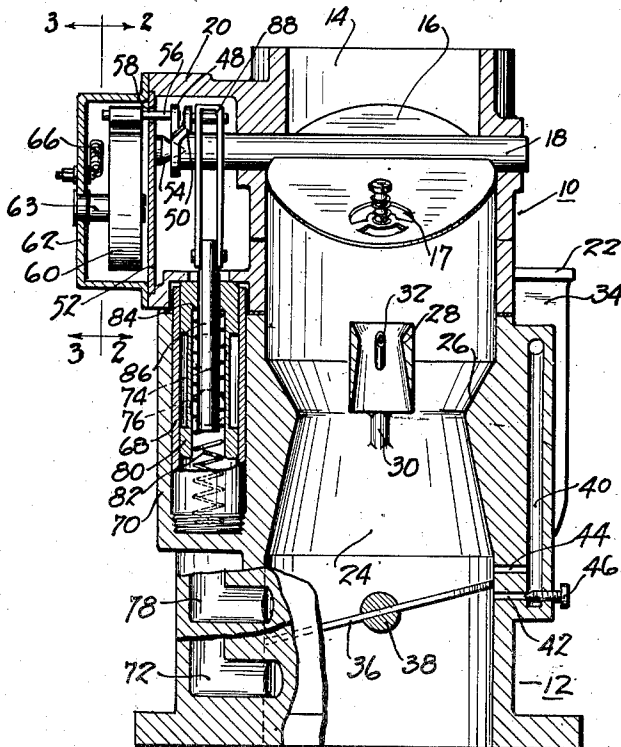


Fig. 1

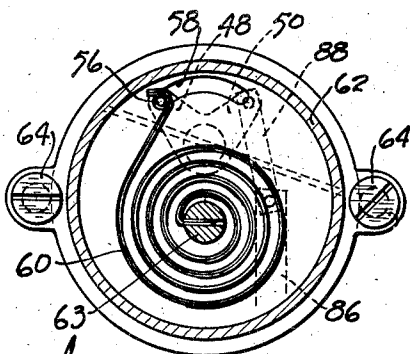


Fig. 2

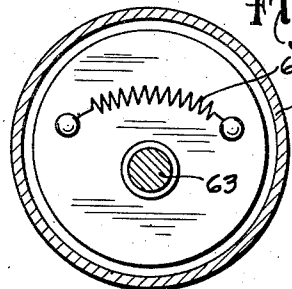


Fig. 3

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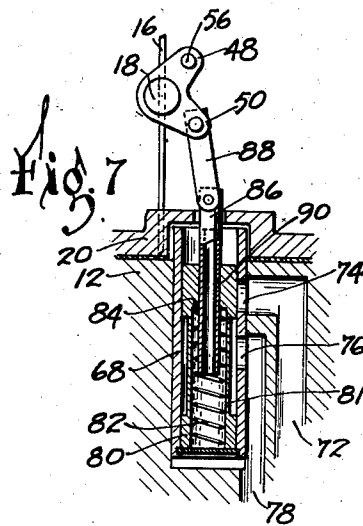
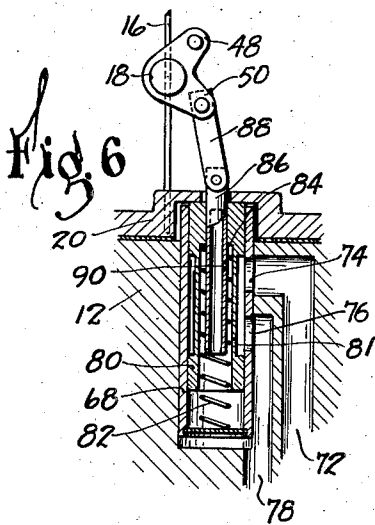
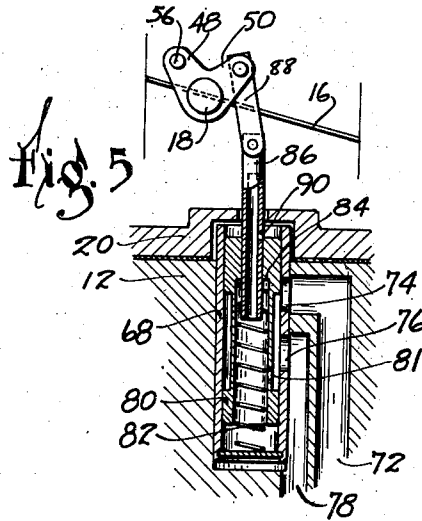
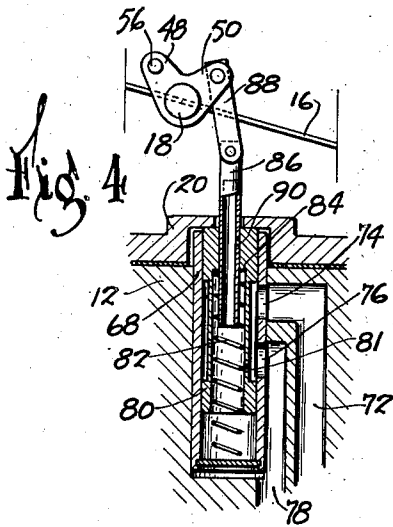
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3 Sheets-Sheet 2



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Filed Sept. 17, 1934

3 Sheets-Sheet 3

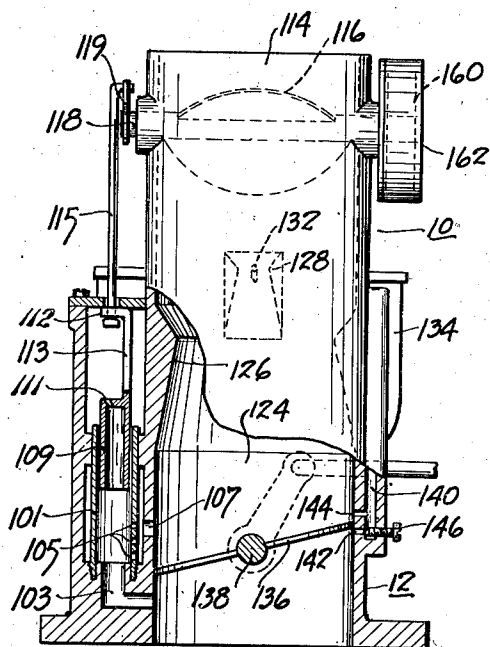


Fig. 8

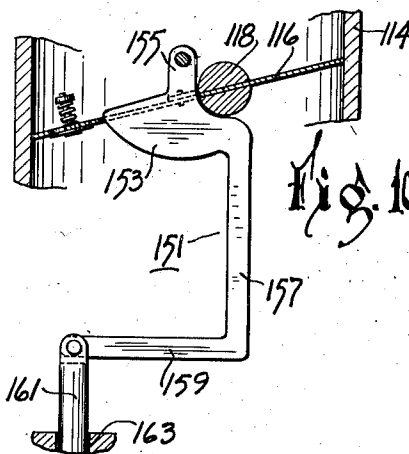


Fig. 10

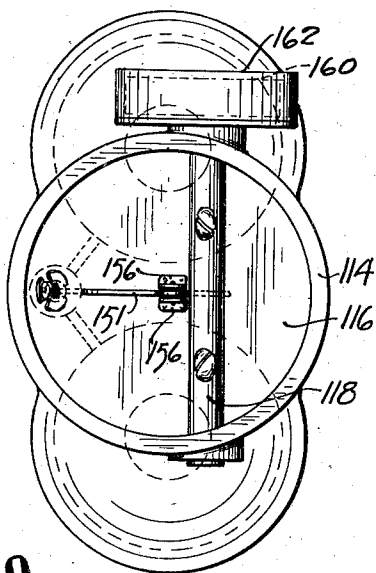


Fig. 9

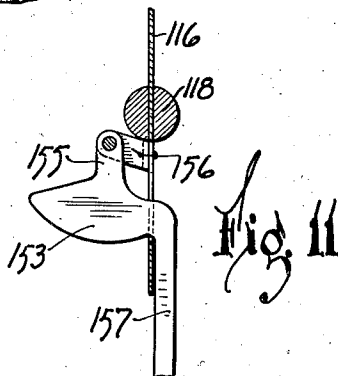


Fig. 11

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UNITED STATES PATENT OFFICE

2,127,735

CARBURETOR

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Application September 17, 1934, Serial No. 744,328

15 Claims. (Cl. 261—39)

This invention relates to carburetors and more particularly to means for proportioning the amount of air admitted to the cylinders of an internal combustion engine, in accordance with manifold suction and engine temperature.

Internal combustion engines using liquid fuel are ordinarily equipped with carburetors which proportion the fuel to air ratio under various operating conditions. This is generally done by means of a choke valve, operably positioned in the air inlet passage of the carburetor, so that the amount of air admitted under various operating conditions may be decreased by actuating the choke valve to partially close the air inlet passage. It is known in this art to actuate the choke valve manually; that is, by means of a manually operable connection designed to close the choke valve, while the choke valve is returned to its open position by resilient or gravity actuated means upon release of the manually operable means.

It is, however, desirable to automatically vary the richness of the mixture supplied to the engine in accordance with the variations in temperature of the engine, and the speed of the engine.

Temperature responsive means, such as a bi-metallic thermostatic element, operably connected to the choke valve may be employed herein to control the position of the choke valve in accordance with the temperature of the engine.

It is also desirable to control the position of the choke valve in accordance with the vacuum obtaining in the intake manifold. For this purpose applicant employs novel differential fluid pressure actuated means communicating with the main carbureting passage on either side of the throttle valve, and operably connected with the choke valve in such a manner as to modify the action of the thermostat.

As will be pointed out in more detail later, applicant's novel differential fluid pressure actuated means comprises a member operable to restrict the flow of air bypassing the throttle valve when high suction is exerted in the manifold, and operable to permit an increasing quantity of air to bypass the throttle valve as the vacuum is destroyed.

An object of the present invention is therefore to provide an automatic choke mechanism, operable by the engine variables, manifold suction and engine temperature, whereby the most desirable and economical combustible mixture will be supplied by the carburetor under all operating conditions of the engine.

Another object of the invention is to provide a built-in automatic choke mechanism, which will accurately and quickly proportion the quantity of air admitted to the engine, so as to produce the most satisfactory operation of the engine during starting and warming up operations.

A still further object of the invention is to provide means, operable upon a decrease in the manifold vacuum and/or other variables, to increase the quantity of air bypassing the throttle valve to prevent the engine from stalling.

Another object of the invention resides in the provision of means for increasing the charge of combustible mixture supplied to the engine, when it is operating at a temperature below its normal operating temperature.

A still further object of the invention is the incorporation of an automatic choke, fast idle mechanism, and non-stalling device entirely enclosed in the body of the carburetor, so as to be less susceptible to maladjustments in service, and to provide a simple mechanism having a minimum of moving parts for controlling the combustible mixture supplied to the engine.

Another object of the invention is to provide a novel choke actuating mechanism entirely enclosed within the body of the carburetor.

Other objects and advantages of this invention will be apparent from the following detailed description, together with the illustrative embodiments thereof in the accompanying drawings, submitted for purposes of illustration only, and not intended to define the scope of the invention, reference being had for that purpose to the subjoined claims.

In the drawings, wherein similar reference characters refer to similar parts throughout the several views:

Figure 1 is a longitudinal sectional view of a carburetor equipped with a device of the present invention;

Figure 2 is a sectional view taken on the line 2—2 of Figure 1, looking in the direction of the arrows;

Figure 3 is a sectional view taken on the line 3—3 of Figure 1, looking in the direction of the arrows;

Figure 4 is a diagrammatic view of a portion of the device disclosed in Figure 1, showing the relative position of the parts preparatory to cranking the engine when it is cold;

Figure 5 is a view similar to Figure 4 showing the relative position of the parts when the engine is running and is cold;

Figure 6 is a view similar to Figure 4 showing

the relative position of the parts preparatory to cranking the engine when it is hot;

Figure 7 is a view similar to Figure 4 showing the relative position of the parts when the engine is running and is hot;

Figure 8 is a longitudinal view, partly in section, of a modified form of the invention;

Figure 9 is a plan view of a further modification, wherein a double-barreled carburetor is equipped with a device of the present invention;

Figure 10 is a longitudinal sectional view showing one position of the choke actuating mechanism shown in Figure 9; and

Figure 11 is a view showing another position of the choke actuating mechanism shown in Figure 10.

Referring more particularly to Figure 1, there is shown for illustration, a carburetor having an upper or air horn section 10 and a lower or throttle body section 12.

The air horn section 10 comprises an air inlet passage 14, in which a choke valve 16, preferably of the unbalanced type and provided with a spring-pressed poppet relief valve 17, is pivotally mounted on a shaft 18 journaled in the walls of the air inlet passage 14. A boss or housing 20 formed on one side of the air inlet passage 14, and receiving one end of the choke shaft 18, houses a portion of the choke valve actuating mechanism, to be more particularly described hereinafter. The air horn section 10 is provided with a flange 22 forming a float chamber cover.

The lower or throttle body section 12 comprises a main carbureting passage 24, fitted with a secondary venturi 26. A primary venturi 28 is suspended in the main carbureting passage 24, and supported therein by a fin 30, in such a position that it discharges at the most restricted section of the secondary venturi 26. A main fuel discharge nozzle 32 projects through the fin 30 and discharges at the most restricted section of the primary venturi 28. A conventional fuel reservoir 34 supplies fuel to the main fuel discharge nozzle 32 under a constant head.

The main carbureting passage 24 receives a mixture of air and fuel, and discharges said mixture to the intake manifold (not shown), under the pumping action of the pistons reciprocating within the cylinders of the engine. The flow of the combustible mixture through the main carbureting passage 24 is normally controlled, in the usual manner, by a throttle valve 36 mounted on a throttle shaft 38, journaled in the walls of the throttle body section 12. Fuel for idling purposes is supplied in the known manner from the fuel reservoir 34, through a duct 40 terminating in a port 42 immediately posterior to the throttle valve 36 when in closed position. Air for idling purposes is supplied through a port 44, immediately anterior to the throttle and communicating with the port 42. An idling adjustment screw 46 is provided to adjustably restrict the port 42 to increase or decrease the idling speed of the engine.

Applicant's novel choke valve actuating mechanism comprises a bell crank having arms 48 and 50, fixed to the choke shaft 18 and enclosed in the housing 20. The housing 20 is closed by a plate 52, which carries a choke shaft bearing 54, to support one end of the choke shaft 18. The arm 48 is provided with a pin 56 projecting through a semicircular shaped slot 58 in the plate 52, and positioned to be actuated by one end of a bimetallic thermostat 60. The other

end of the thermostat 60 is fixed to a stud 63, enclosed in a casing 62, adjustably clamped to the housing 20 by a plurality of screws 64. For purposes of illustration the thermostat is shown as heated by an electric coil 66 positioned within the casing 62. It is understood, however, that the thermostat may be heated by other means such as those disclosed in my copending applications Serial No. 718,633, filed April 2, 1934, and Serial No. 744,329, filed September 17, 1934.

A cylinder 68 fixed in the air horn section 10 and communicating with the interior of the housing 20, is received within an enlarged bore formed in a longitudinal boss 70 in the throttle body section 12. A passageway 72, in the lower end of boss 70, communicates with the main carbureting passage 24 posterior to the throttle valve 36. A port 74 in the walls of the cylinder 68 serves to interconnect the interior of the cylinder 68 with the passageway 72.

A second port 76 in the walls of the cylinder 68 connects with a passageway 78, which communicates with the main carbureting passage 24 anterior to the throttle valve 36.

A hollow spool-shaped valve member 80, having a small vent 81 in the lower part of the section of reduced outer diameter, is slidably mounted within the cylinder 68 and is yieldingly urged toward the upper end of the cylinder by a light coiled spring 82. The spring 82 engages a section of the valve of reduced internal diameter 84. A hollow plunger 86, slidable within the spool-shaped valve 80, is operably connected to the arm 50 by a linkage 88. The hollow plunger 86 is provided with a small vent 90 designed to be obstructed by the section of reduced internal diameter 84 of the valve member 80.

The operation of this device is as follows: When the engine is cold, the thermostat 60 will have rotated in the counterclockwise direction, as viewed in Figure 2, thereby rotating the arm 48 in the counterclockwise direction, to close the choke valve 16, and rotating the arm 50 to lift the plunger 86. This position of the parts is shown in Figures 1, 2 and 4, in which it will be noted that the spool-shaped valve 80 is urged to the upper end of the cylinder 68 by the spring 82.

When the engine is cranked, the choke valve 16 being held in the closed position by the thermostat 60, a relatively high suction is exerted on the fuel discharge nozzle 32, to draw a quantity of fuel therefrom. The fuel mixes with air admitted through the relief valve 17, positioned in the choke valve 16, to produce a combustible mixture in the main carbureting passage 24, anterior to the throttle valve 36. Since the spool-shaped valve 80 is in the upper end of the cylinder 68, free communication is established between the passages 78 and 72. The combustible mixture is therefore drawn up the passageway 78 into the cylinder 68, downwardly in the cylinder 68 (between the walls of the cylinder and the section of reduced outer diameter of the spool-shaped valve member 80) to the passageway 72, from which it is discharged into the carbureting passage, posterior to the throttle valve 36, and drawn into the cylinders of the engine (not shown).

When the engine begins running on its own power an increased suction is exerted on the passageway 72, so that air is withdrawn from the interior of the spool valve member 80 and the lower portion of the cylinder 68 through the vent 81. The spool valve 80 is thereupon urged

downwardly in the cylinder so that its upper section partially closes the passageway 72, and a decreased quantity of combustible mixture bypasses the throttle valve 36. During this period of operation a combustible mixture is supplied through the idling passages 44 and 42, so that the additional charge supplied through the passageway 72 will produce a fast idle, to prevent the engine from stalling while it is cold.

When the spool-shaped valve member 80 moves downwardly in the cylinder 68 to the position shown in Figure 5, the vent 90 in the plunger 86 becomes exposed above the top of the valve member 80. Since the vents 81 and 90 are of substantially the same size, the partial vacuum existing within the spool-shaped valve member 80 and the lower portion of the cylinder 68 is destroyed. The valve member 80 will then be held temporarily in equilibrium.

As the engine continues to run, the thermostat 60 will become heated, and tend to coil more tightly upon itself, thereby decreasing the force urging the choke valve 16 toward the closed position. As the air entering the air inlet passage 14 strikes against the unequal areas of the choke valve 16 on either side of the choke shaft 18, it will tend to rotate the valve 16 to open it. As the choke valve 16 is gradually opened, the crank arm 50 is rotated in the clockwise direction as viewed in Figure 5, so that the plunger 86 is moved downwardly in the valve member 80. The vent 90 is then closed by the section of reduced internal diameter 84 of the valve member 80, and air is withdrawn from the interior of the valve member 80, whereupon it will be moved downwardly in the cylinder 68, to reduce the quantity of combustible mixture supplied to the engine through the passageway 72. This process is repeated until the engine is running at normal operating temperature, at which time the choke valve 16 will be completely open as shown in Figure 7. The vent 90 in the plunger 86 is then closed by the section of reduced internal diameter 84 of the valve member 80, and the valve member 80 is drawn downwardly to the bottom of the cylinder 68 by the suction exerted through the passageway 72 and the vent 81. It will be noted that in this position the enlarged upper portion of the valve member 80 closes off the passageway 78 so that no communication is established between the passageways 72 and 78.

Figure 6 shows the relative position of the parts when the engine has been running at normal operating temperature and has been stopped. It will be noted that the choke valve 16 is in the full open position; that the plunger 86 is extended into the valve member 80, and that the valve member 80 is held in the upper position by the spring 82. In this position, communication is established between the passageways 72 and 78 so that a combustible mixture will be bypassed beyond the throttle valve 36 to assist in starting the engine. As soon as the engine has started running on its own power, the interior of valve member 80 and the lower portion of the cylinder 68 will be evacuated and the valve member 80 will be urged downwardly against the force of the spring 82.

It will be observed that this device operates as an anti-stall device. If the engine slows down below normal idling speed, when the throttle valve 36 is in the closed position, the suction exerted in the passageway 72 and transmitted to the interior of the valve member 80, through the vent 81 is partially destroyed, whereupon

the spring 82 will force the valve member 80 upwardly in the cylinder 68. Communication is then established between the passageways 72 and 78, whereupon an additional quantity of combustible mixture is supplied posterior to the throttle valve 36, which will prevent the engine from stalling. As soon as the engine begins running again at normal idling speed, air will be withdrawn from the interior of the valve member 80, and it will again move to the bottom of cylinder 68, as shown in Figure 7, to cut off the excess charge of combustible mixture bypassing the throttle valve 36.

The modification disclosed in Figure 8 is similar in principle to the embodiment disclosed in Figure 1. To avoid repetition the corresponding parts have been given the same numerals with the addition of 100.

The vacuum actuated piston mechanism is different in many respects from the embodiment of Figure 1. A cylinder 101 is provided with an outlet 103, communicating with the main carbureting passage 124, posterior to the throttle valve 136. The cylinder 101 is also provided with a plurality of apertures 105 communicating with the main carbureting passage 124, anterior to the throttle valve 136, through a port 107. A hollow piston 109 having a small vent 111 in the end thereof is slidably mounted in the cylinder 101 and actuated by a link 113. The link 113 is connected by an overrunning connection 112 to another link 115 connected to the choke valve shaft 118 by an arm 119. By reason of the overrunning connection 112, force can be transmitted in only one direction, that is, the piston 109 can exert force on the choke valve 116 tending to open it, but the choke valve cannot force the piston 109 downwardly.

The operation of this device is substantially similar to the operation of the embodiment illustrated in Figure 1. When the engine is cold, the choke valve 116 is urged to the closed position by the thermostat 160, and the piston 109 is lifted to the position shown in Figure 8 by the links 113 and 115. In this position of the piston 109, a bypass is established around the throttle valve 136 through the port 107, apertures 105, and the outlet 103. A combustible mixture is thus bypassed around the throttle to assist in starting the engine.

When the engine has started and warms up, the force of the thermostat 160, urging the choke valve 116 toward closed position, is decreased. The force of the air entering the air inlet 114 urges the unbalanced valve 116 toward open position. As the choke valve opens, the piston 109 is drawn by suction downward in the cylinder 101, and progressively closes the apertures 105 so that a decreasing quantity of combustible mixture is allowed to bypass the throttle valve. It thus appears that as the engine progressively warms up, the amount of mixture permitted to bypass the throttle is progressively decreased, giving a slower idling speed, and when the engine is running at normal operating temperature the piston 109 rests upon the bottom of the cylinder 101 to completely close the outlet 103. When the piston 109 closes the outlet 103, all of the mixture for idling purposes is supplied through the idling passages 142 and 144. The vent 111 operates to assist in the smooth operation of the device by preventing the sudden increase of suction in the piston 109 which would otherwise occur as the piston approached its lowermost position.

Figures 9, 10 and 11 show a modification wherein this invention is applied to a double-barrelled carburetor having a single air inlet passage.

The cylinder 163 and piston 161 controlling the 5 bypass around the throttle valve are positioned in the throttle body section, and communicate with each barrel of the carburetor, posterior and anterior to the throttle valve.

Applicant's novel connection between the piston 161 and the choke valve 116 is contained 10 entirely within the air horn section. It comprises a link 151 of irregular shape and of streamlined section. A portion 153 of the link 151 is arcuate in shape and projects through a slot cut 15 in the face of the unbalanced choke valve 116. A projection 155 is pivotally engaged by a bracket 156 fixed to the upper face of the valve 116 near the choke shaft 118. The arcuate section 153 is designed to close the slot in the face of 20 the choke valve when in closed position, as shown in Figures 9 and 10.

The link 151 has a vertically extending section 157 and a horizontally extending section 159 25 designed to transmit force from the piston 161 to the choke valve 116 and vice versa. As shown in Figure 11, the vertical section 157 contacts a portion of the valve 116 to prevent it from rotating beyond the vertical or full open position.

The operation of this device is substantially 30 similar to the operation of the device illustrated in Figure 1, and therefore will not be discussed in detail.

While several illustrative embodiments of the invention have been illustrated and described in 35 detail, it is not intended that the invention shall be limited to those embodiments, nor otherwise, than by the terms of the following claims.

I claim:

1. In a carburetor, a throttle, a choke valve, 40 temperature responsive means influencing the position of the choke valve, and means including a cylinder, a hollow spool-shaped spring pressed plunger and a piston controlled in part by the position of the temperature responsive 45 means and in part by suction beyond the throttle for introducing a charge of combustible mixture beyond the throttle.

2. In a carburetor having a main carbureting 50 passage, a throttle valve, a pressure responsive choke valve, temperature responsive means influencing the position of the choke valve, and means including a cylinder communicating with the carbureting passage on either side of the 55 throttle valve and a pressure responsive temperature controlled piston slidably mounted in the cylinder for introducing fuel mixture beyond the throttle.

3. A carburetor having a main induction passage, a throttle and an unbalanced pressure responsive choke valve mounted therein, tempera- 60 ture responsive means urging the choke valve toward one extreme position when cold, and means including a cylinder and a hollow spring pressed piston jointly controlled by the position of the 65 choke valve and pressure in the induction passage posterior to the throttle valve for introducing a charge of combustible mixture into the induction passage posterior to the throttle valve.

4. In a carburetor having a main carbureting 70 passage, a throttle valve, an unbalanced choke valve, temperature responsive means operably connected to the choke valve, a fluid pressure differential actuated motor including a cylinder 75 connected to the main carbureting passage on either side of the throttle, a piston in said cylin-

der, and connecting means between the piston and the choke valve whereby said motor may influence the position of the choke valve and the choke valve may influence the position of the piston, said motor acting also to interconnect the 5 main carbureting passage on either side of the throttle valve when said choke valve is actuated by said temperature responsive means.

5. In a carburetor, a main induction passage, a choke valve, a throttle valve, thermostatic 10 means to actuate the choke valve, a fluid actuated motor including a cylinder communicating with the induction passage on either side of the throttle valve, a piston in said cylinder, and connecting means between a portion of said motor 15 and the thermostatic means whereby said motor modifies the action of said thermostatic means.

6. In a carburetor having a main carbureting passage, a throttle valve, an unbalanced choke 20 valve, temperature responsive means urging the choke valve closed when cold, a fluid motor including a cylinder communicating with the main carbureting passage on either side of the throttle valve, a hollow spool-shaped piston slidably 25 mounted within the cylinder, yielding means urging the piston to one extreme position, a vent in a portion of the piston operable to subject the interior of the piston and a portion of the cylinder to suction existing in the main carbureting passage posterior to the throttle valve, and 30 connecting means between the piston and the choke valve.

7. In a carburetor having a main carbureting passage, a throttle valve, an unbalanced choke 35 valve, temperature responsive means urging the choke valve closed when cold, a fluid motor including a cylinder communicating with the main carbureting passage on either side of the throttle valve, a hollow spool-shaped piston slidably 40 mounted within the cylinder, yielding means urging the piston to one extreme position, a vent in a portion of the piston operable to subject the interior of the piston and a portion of the cylinder to suction existing in the main carbureting passage posterior to the throttle valve, a hollow 45 plunger slidably within said piston, a vent in a portion of said plunger operable to destroy the vacuum within said piston and a portion of the cylinder under certain operating conditions, and 50 connecting means between the plunger and the choke valve.

8. In a carburetor having a main carbureting passage, a throttle valve, a choke valve, thermostatic means operably connected to the choke valve, a cylinder formed integral with the main 55 carbureting passage, connecting means between the cylinder and the carbureting passage on either side of the throttle valve, a hollow spool-shaped piston slidably mounted within the cylinder, yielding means urging the piston to one 60 extreme position, a vent in a portion of the piston operable to subject the interior of the piston and a portion of the cylinder to the pressure existing in the main carbureting passage posterior to the throttle valve, a portion of said piston 65 being of reduced internal diameter, a hollow plunger slidably within said piston, a vent in a portion of the plunger designed to be closed under certain operating conditions by the portion of 70 said piston of reduced internal diameter, and connecting means between said plunger and said choke valve.

9. In a carburetor having a main carbureting passage, a throttle valve, a choke valve having a 75 spring pressed poppet relief valve, thermostatic

means operably connected to the choke valve, a motor including a cylinder formed integral with the main carbureting passage, connecting means between the cylinder and the carbureting passage on either side of the throttle valve, a hollow spool-shaped piston slidably mounted within the cylinder, yielding means urging the piston to one extreme position, a vent in a portion of the piston operable to subject the interior of the piston and a portion of the cylinder to the pressure existing in the main carbureting passage posterior to the throttle valve, a portion of said piston being of reduced internal diameter, a hollow plunger slidably within said piston, a vent in a portion of the plunger designed to be closed under certain operating conditions by the portion of said piston of reduced internal diameter, and connecting means between said plunger and said choke valve whereby the motor influences the position of the choke valve and the thermostatic means influences the position of the piston whereby a charge of combustible mixture is bypassed beyond the throttle valve until the choke valve approaches substantially full open position.

10. A carburetor having a main induction passage, a throttle and choke valve mounted therein, and means jointly controlled by the position of the choke valve and pressure in the induction passage posterior to the throttle valve for introducing a charge of combustible mixture into the induction passage posterior to the throttle valve.

11. In a carburetor, an induction passage, choke and throttle valves therein, a main fuel nozzle, a conduit bypassing the throttle valve, and a temperature actuated valve including a cylinder, a piston slidably in the cylinder yieldingly urged by suction posterior to the throttle valve toward the closed position controlling said conduit.

12. In a carburetor, an induction passage, choke and throttle valves therein, a main fuel

nozzle, a conduit bypassing the throttle valve, a bypass valve including a cylinder adjacent and parallel to the induction passage and a piston slidably in the cylinder yieldingly urged by suction posterior to the throttle valve toward the closed position controlling said conduit, and temperature responsive means operably connected to the choke valve and to the bypass valve for influencing the operation of the bypass valve.

13. In a carburetor, a choke valve, a throttle valve, a mixing chamber between said valves, means to supply fuel and air to the mixing chamber, a mixture bypass around the throttle valve, and valve means subjected to pressures beyond the throttle valve and operably connected to the choke valve to open the bypass when the choke valve approaches the substantially closed position and a predetermined pressure beyond the throttle valve is exerted on the bypass.

14. In a carburetor, an induction passage, a pressure responsive choke valve, temperature responsive means for controlling said choke valve, a throttle controlling the induction passage, a bypass for fuel mixture around the throttle, a plunger controlling the bypass and urged by suction posterior to the throttle toward a position where it closes the bypass, and an overrunning connection between the choke valve and the plunger.

15. In a carburetor, an induction passage, a pressure responsive choke valve, temperature responsive means for controlling the same, a throttle in said induction passage, a bypass for fuel mixture around the throttle, a plunger controlling the bypass and urged by suction posterior to the throttle toward a position where it closes the bypass, and a connection between the choke valve and plunger operative when the choke valve is closed to move the plunger to a position where it opens the bypass.

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