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M. C. BROWN ET AL
THERMOSTATIC CHOKE SYSTEM

2,675,792

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2 Sheets-Sheet 1

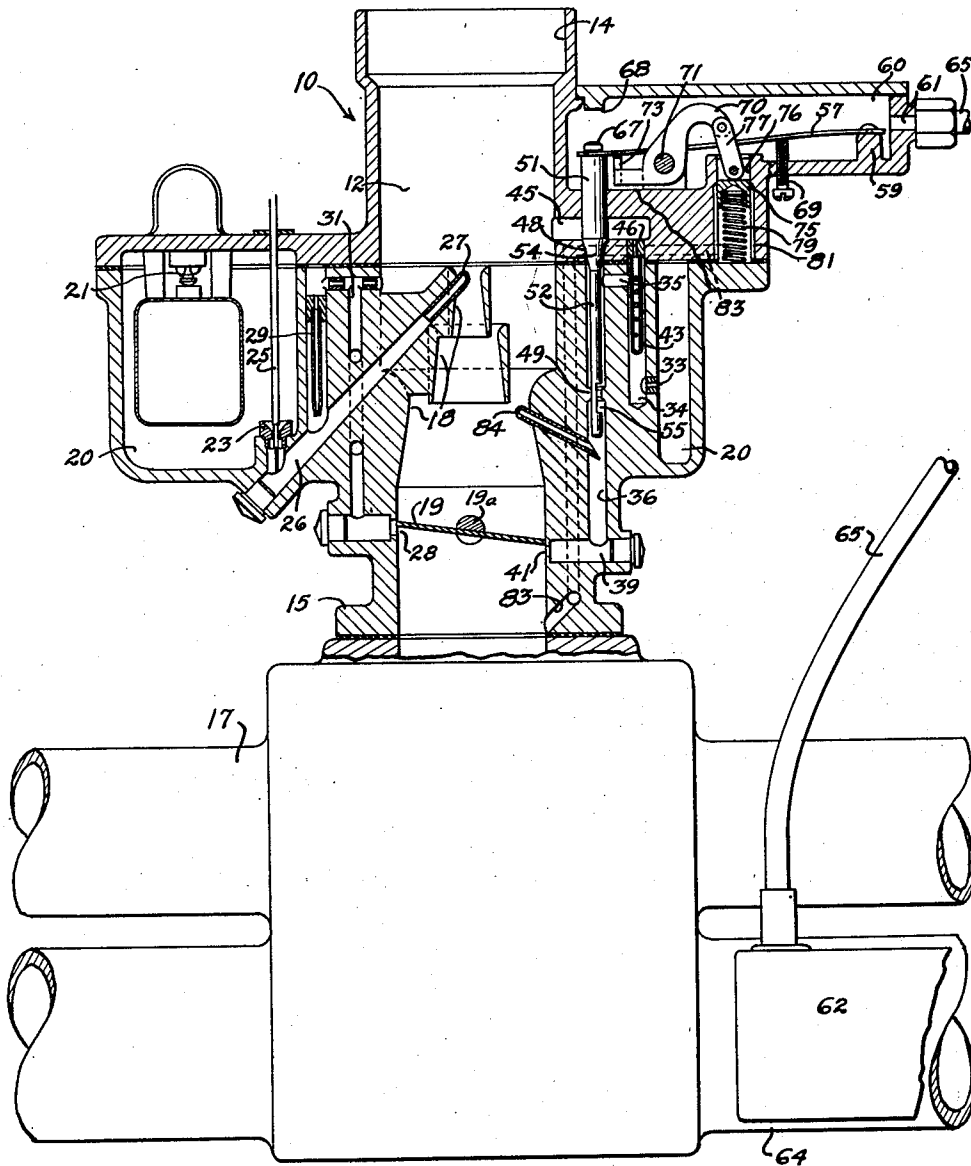


FIG. 1.

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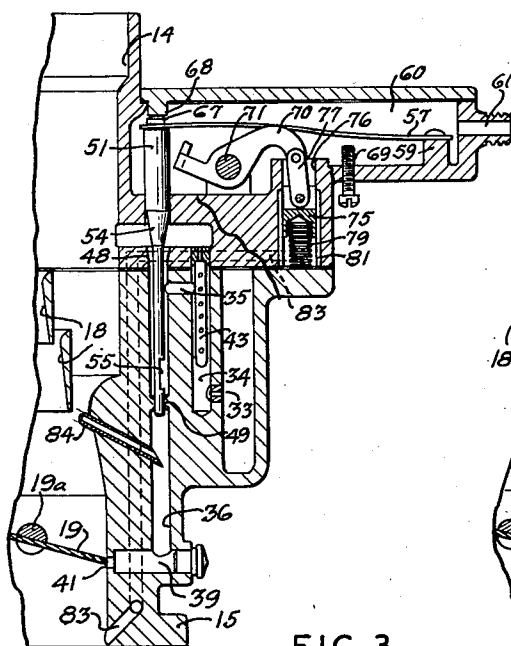


FIG. 3.

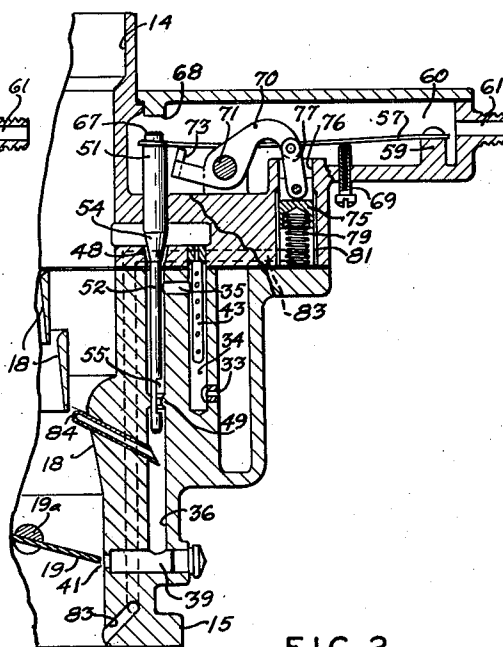


FIG. 2.

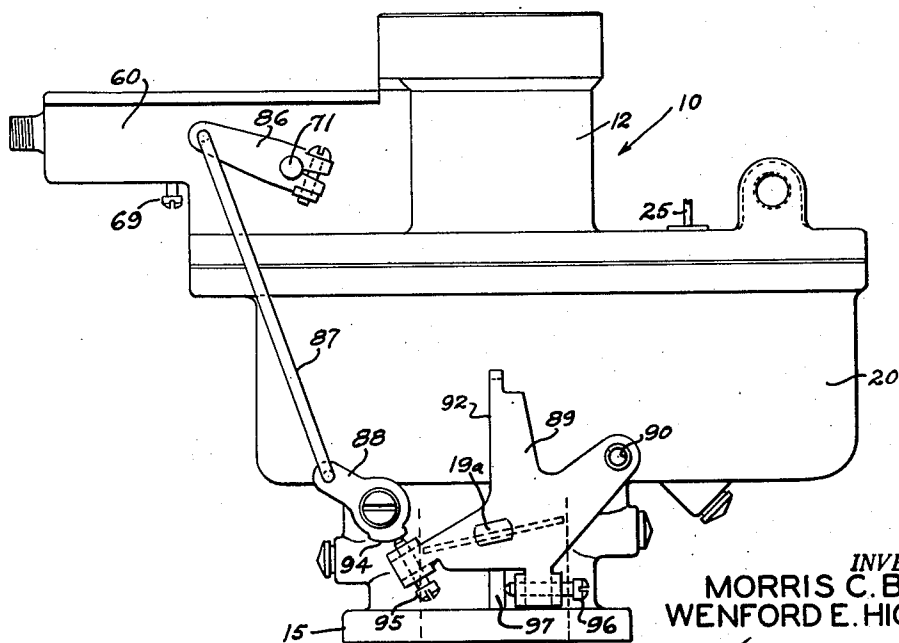


FIG. 4.

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THERMOSTATIC CHOKE SYSTEM

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7 Claims. (Cl. 123—119)

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This invention relates to carburetors for internal combustion engines and consists particularly in novel automatic means for the initial starting of a cold engine.

In conventional carburetors, the rich fuel mixture required for cold starts is provided by choking the air intake of the carburetor, the choking being accomplished by a thermostatically controlled valve in the intake conduit. The conventional choke valve is arranged to be moved towards open position responsive to pressure differentials in the intake conduit, assisted by suction in the intake manifold, manifold suction acting upon the thermostatic mechanism by means of a vacuum piston. Heated air from a manifold stove is generally drawn into the choke control mechanism by the same suction which actuates the piston, the cylinder being slotted to permit the passage of the heated air past the piston. It is evident that in the conventional construction there are only three points which may be calibrated, namely, the thermostat, the piston, and the slots in the cylinder walls. The thermostat required for the conventional thermostatic choke control device is moreover a relatively expensive and carefully calibrated helical thermostat.

It is an object of this invention to provide improved starting and warm-up means for internal combustion engine carburetors.

It is a further object to provide a relatively simple and inexpensive substitute for the relatively expensive and complex automatic choke.

It is a still further object to provide means associated with the first-named means for sufficiently enriching the fuel mixture for acceleration during the warm-up period.

It is an additional object to provide a substitute for the present automatic choke device capable of more accurate calibration than the present construction.

We achieve these and other objects by incorporating in a conventional carburetor having the conventional low and high speed fuel systems, an auxiliary fuel supply system consisting of a series of calibrated passageways connecting the constant level fuel chamber to the mixture conduit immediately posterior to the throttle valve. The auxiliary system includes a thermostatically controlled air bleed valve and a thermostatically controlled fuel valve, arranged so that when the engine is cold the air bleed valve remains closed and the fuel valve open, thereby permitting the free passage of fuel through the system and into the mixture conduit. Means responsive to manifold suction are also provided for opening the air bleed valve and closing the fuel valve whereby the flow of fuel through the auxiliary system may be varied in response to changes in manifold suction. The auxiliary fuel system has a second

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outlet at the throat of the venturi so that when the throttle is opened for acceleration, with resultant decrease of depression at the outlet port posterior to the throttle valve, the relatively high depression at the Venturi throat will draw sufficient fuel through the second discharge outlet for acceleration. In operation when the engine is cranked while cold the air bleed valve remains closed and the fuel valve open, thereby permitting cranking suction at the port posterior to the throttle valve to draw a fuel mixture into the mixture conduit. As the engine begins to fire, increased manifold suction partially opens the air bleed valve, thereby introducing additional air into the system and reducing the richness of the fuel mixture discharged into the intake conduit. If, during this period, the throttle is opened for acceleration, fuel will be discharged at the outlet in the Venturi throat thereby enriching the mixture in the intake conduit sufficiently for acceleration. As the engine warms up the thermostatic control device moves the air bleed valve to its maximum open position and closes the fuel valve in the auxiliary system, thereby preventing further flow of fuel through the system. This fuel system may be calibrated at the thermostat, the piston, the cylinder slots, the piston spring, the orifice leading from the fuel chamber to the system, the passages comprising the system, the air vent, the air bleed valve, and the fuel valve.

Referring to the drawings:

Fig. 1 is a cross-sectional view through a carburetor incorporating our invention, mounted on the intake manifold of an internal combustion engine.

Fig. 2 is a fragmentary vertical section view showing the auxiliary fuel system during warm-up, but after the engine has begun to fire.

Fig. 3 is a fragmentary vertical section view showing the auxiliary fuel system with the engine warmed up.

Fig. 4 is an elevation view of the carburetor showing the fast idle and unloader linkage.

Referring now to Fig. 1, numeral 10 indicates a down-draft carburetor having a mixture conduit 12, the upper portion of which is opened as at 14 to permit the admission of air, the lower outlet portion being flanged as at 15 for attachment to the intake manifold 17 of an internal combustion engine. Mediate its end portions, mixture conduit 12 is provided with conventional stacked venturis 18. The outlet of mixture conduit is controlled by throttle valve 19 mounted on rotatable shaft 19a. The carburetor is provided with a conventional constant level fuel chamber 20 into which fuel is admitted by float controlled needle valve 21. A metering orifice 23 regulated by stepped metering pin 25 is provided to meter the fuel supplied via passage 26 to main

nozzle 27 responsive to normal engine requirements. Fuel for idling is transmitted to the idle port 28 via metering orifice 23, passage 26, restricted tube 29, and passage 31.

The auxiliary fuel system consists of a restricted metering orifice 33 communicating with the float chamber, a vertical passage 34, short horizontal passage 35, vertical passage 36, cavity 39, and outlet port 41 communicating with the mixture conduit immediately posterior to the throttle valve. For introducing air into the fuel in the auxiliary fuel system, a perforated air vent tube 43 is mounted in passage 34 and has its upper end connected to an air shaft 45 by means of a horizontal orifice 46. Shaft 45 freely communicates at one end with the air intake portion 14 of mixture conduit 12.

Since it is desirable that the auxiliary fuel system provides the greatest amount of fuel when the engine is cold, and decreasing amounts as engine temperature increases, a thermostatically controlled air bleed valve and fuel valve are included in the auxiliary fuel system. The upper end of passage 36 communicates with air shaft 45 and is slightly tapered as at 48 to form the air bleed valve seat. Passage 36 is also formed with a restriction as at 49, which serves as the fuel valve seat. The air and fuel valves are provided with a pin-type closure member 51 consisting of an elongated cylindrical stem portion 52 substantially equal in diameter to restriction 49, and having a tapered shoulder portion 54 adapted to sealingly engage the tapered end portion of passage 36. Stem portion 52 is formed with a flat-bottomed notch 55 (in registry with restriction 49 when shoulder 54 is seated) to permit the passage of fuel through restriction 49 when tapered shoulder 54 is seated in the upper end of passage 36. For actuating closure member 54 a flat bi-metal thermostat 57 is provided. It is secured at one end to a post 59 within hot air chamber 60. Chamber 60 is formed with an air inlet opening 61 which is connected to a stove 62 on exhaust manifold 64 by means of heat tube 65. At its free end thermostat 57 normally engages the upper end of closure member 51, so that when engine temperature is low it will urge closure member 51 downwardly thereby closing the air bleed valve and opening the fuel valve. The thermostat is slotted to receive the headed upper end 67 of closure member 51 so that upward movement of the free end of the thermostat will elevate closure member 51 thereby opening the air bleed valve and moving the fuel valve towards closed position. Upward movement of closure member 51 is limited by stop 68. A movable abutment in the form of a screw 69 is provided for adjusting thermostat 57. Since the rich fuel mixture required for starting is not required after the engine has begun to fire, means responsive to manifold suction is provided for opening the air bleed valve and for moving the fuel valve towards closed position. The suction responsive means consists of a lever 70 mounted on rotatable shaft 71 and having a portion 73 adapted to engage the underside of thermostat 57, a suction actuated piston 75 slidably mounted in cylinder 76, a link 77 connecting piston 75 with lever 70, and a spring 79 biasing piston 75 upwardly in the cylinder. Cylinder 76 communicates at its upper end with hot air chamber 60 and is formed with a plurality of vertical slots 81. The cylinder is connected at its lower end by means of suction passage 83 with the mixture conduit posterior to the throttle, so that after the engine begins to fire, suction in the intake

manifold will draw piston 75 downwardly thereby rotating lever 70 clockwise so as to elevate closure member 51, thus opening the air bleed valve at 48 and moving the fuel valve at 49 towards its closed position. At the same time suction draws heated air from the stove 62 through tube 65, hot air chamber 60 past piston 75 via slots 81, and into the intake conduit thereby causing the thermostat 57 to be surrounded by air at engine temperature.

In order to provide a sufficiently rich fuel mixture for acceleration during the warm-up period, the accelerating nozzle 84 is positioned at the throat of the main venturi and communicates directly with passage 36 posterior to restriction 49. The inner end of the nozzle may be cut back, as shown, to form a scoop within passage 36. As the throttle valve is opened, with a consequent drop in suction at port 41 and increase in suction at the Venturi throat, the additional fuel required for acceleration will be drawn through nozzle 84 into the mixture conduit.

The auxiliary fuel system is provided with means for unloading the engine. Shaft 71 of lever 70 has at its outer end an arm 86 which is connected by a link 87 to rotatably mounted arm 88. Throttle shaft 19a is provided at its outer end with a throttle operating arm 89. Arm 89 has at its end an opening 90 to receive an operative connection with the accelerator pedal, a projecting portion 92 having a lip at its outer end for engaging the upper edge of rotatable arm 88 so that when the throttle is moved to fully open position the lip will engage arm 88 thereby rotating arm 88 downwardly and also causing arm 86 and lever 70 to be similarly rotated. Thus lip 73 of lever 70 urges the free end of thermostat 57 upwardly thereby opening the air bleed valve 48 and closing the fuel valve 49 of the auxiliary fuel system so as to unload the motor. Arm 88 is provided with a conventional fast idle cam portion 94, adapted to engage idle adjustment screw 95 on the throttle operating arm when the engine is cold. Throttle operating arm 89 is also provided with a conventional adjusting screw 96 adapted to abut against boss 97 on the mixture conduit wall structure.

Operation of the carburetor incorporating our invention is as follows: With the engine cold, closure member 51 is urged to its lowermost position by thermostat 57 thereby closing the air bleed valve at 48, as shown in Fig. 1. If the motor is flooded the operator depresses the accelerator pedal to the floor in the usual manner, thus fully opening the throttle valve and simultaneously, through arm 88, link 87, and arm 86, fully opening the air bleed valve and closing the fuel valve in the auxiliary system. Operation of the starter then draws sufficient air into the engine to clear it. As the engine is cranked the idle system functions in its normal manner and fuel is drawn from the float chamber through metering valve 23 and associated passageways through idle port 28 into the mixture conduit. At the same time cranking suction draws fuel from the float chamber through orifice 33, passage 34, where it is mixed with air at air vent tube 43, passage 35, valve 49, and port 41 into the mixture conduit. As the engine begins to fire, the increased manifold suction draws piston 75 downwardly thus moving lever 70 clockwise so as to elevate the free end of thermostat 57 as shown in Fig. 2. This causes closure member 51 to be moved upwardly thereby opening the air bleed valve at 48. Thus additional air is

introduced into the auxiliary system, causing a reduction in the vacuum therein, and a consequent reduction in the volume of fuel which passes through valve 49 and into the mixture conduit via port 41. If the throttle is opened for acceleration, the onrush of air through the mixture conduit past shaft 45 causes a slight depression in air bleed 46 and air vent 43 so that the pressure differential between fuel chamber 20 and passage 34 lifts the fuel in passage 34, and starts its flow through passages 35 and 36 even though depression in the mixture conduit be very low. Simultaneously the reduction in depression at idle port 28 and auxiliary fuel port 41 causes the flow of fuel through these ports to be reduced in volume while the increase in suction at the venturis causes the discharge of fuel from main nozzle 27 and accelerating nozzle 34. When the engine reaches normal operating temperature, thermostat 57 elevates closure member 51 until it reaches stop 63, thereby opening air bleed valve 43 and closing fuel valve 49 as shown in Fig. 3. Thus at normal operating temperature no fuel passes through the auxiliary fuel system.

This invention may be modified as will occur to one skilled in the art and exclusive use is contemplated of all modifications and embodiments as come within the scope of the appended claims.

We claim:

1. A carburetor having a mixture conduit, a constant level fuel chamber, a main fuel system, an idling system, and an auxiliary fuel system connecting said fuel chamber and said mixture conduit, and an air bleed valve and a fuel valve controlling said auxiliary system, said valves being respectively openable and closable responsive to engine temperature and manifold depression above a predetermined value whereby the passage of fuel through said auxiliary system may be regulated in accordance with engine requirements.

2. A carburetor having a mixture conduit, a constant level fuel chamber, a throttle valve in said mixture conduit, a main fuel system, an idling system, and an auxiliary fuel system communicating with said constant level chamber below the fuel level therein and with said mixture conduit posterior to said throttle valve, and an air bleed valve and a fuel valve controlling said auxiliary fuel system, said valves being respectively openable and closable responsive to increases in engine temperature and manifold depression above a predetermined value whereby the passage of fuel through said auxiliary system may be regulated in accordance with engine requirements.

3. A carburetor having a mixture conduit, said mixture conduit having an air intake portion, a venturi, and a throttle valve controlling the outlet, a constant level fuel chamber, a main fuel system, an idling system, and an auxiliary fuel system communicating with said constant level chamber below the fuel level therein and with said mixing conduit posterior to the throttle valve and adjacent the throat of said venturi, and an air bleed valve and a fuel valve controlling said auxiliary system whereby the passage of fuel through said auxiliary system may be regulated in accordance with engine requirements.

4. A carburetor having a mixture conduit, said mixture conduit having an air intake portion, a venturi, and a throttle valve controlling the outlet, a constant level fuel chamber, a main fuel supply system, an idling system, and an auxiliary

fuel system communicating with said constant level chamber below the fuel level therein and with said mixing conduit posterior to the throttle valve and adjacent the throat of said venturi, an air bleed valve and a fuel valve in said auxiliary system, a common closure member for said valves whereby the passage of fuel through said auxiliary system may be regulated in accordance with engine requirements.

5. A carburetor having a mixture conduit, said mixture conduit having an air intake portion, a venturi, and a throttle valve controlling the outlet, a constant level fuel chamber, a main fuel supply system, an idling system, and an auxiliary fuel system communicating with said constant level chamber below the fuel level therein and with said mixing conduit posterior to the throttle valve and adjacent the throat of said venturi, an air bleed valve and a fuel valve in said auxiliary system, a common closure member for said valves, and a thermostat for moving said closure member between open and closed positions, whereby the passage of fuel through said auxiliary system may be regulated in accordance with engine requirements.

6. A carburetor having a mixture conduit, said mixture conduit having an air intake portion, a venturi, and a throttle valve controlling the outlet, a constant level fuel chamber, a main fuel supply system, an idling system, an auxiliary fuel system communicating with said constant level chamber below the fuel level therein and with said mixing conduit posterior to the throttle valve and adjacent the throat of said venturi, an air bleed valve and a fuel valve in said auxiliary system, a common closure member for said valves, a thermostat for moving said closure member between open and closed positions, and means responsive to suction in the intake conduit for moving said closure member whereby the passage of fuel through said auxiliary system may be regulated in accordance with engine requirements.

7. A carburetor having a mixture conduit, said mixture conduit having an air intake portion, a venturi, and a throttle valve controlling the outlet, a constant level fuel chamber, a main fuel supply system, an idling system, an auxiliary fuel system communicating with said fuel chamber below the fuel level therein and with said mixing conduit posterior to the throttle valve, said auxiliary system including passageways, a restricted metering orifice, air vent means, an air bleed valve and a fuel valve in said passageways, a common closure member for said valves, a thermostat arranged to open said air bleed valve and close said fuel valve when engine temperature increases to a predetermined value, means responsive to suction in the intake conduit posterior to said throttle valve, an operative connection between said suction responsive means and said closure member arranged to open said air bleed valve and close said fuel valve responsive to increases in manifold suction above a predetermined value whereby the flow of fuel through said auxiliary system may be regulated in accordance with engine requirements.

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