

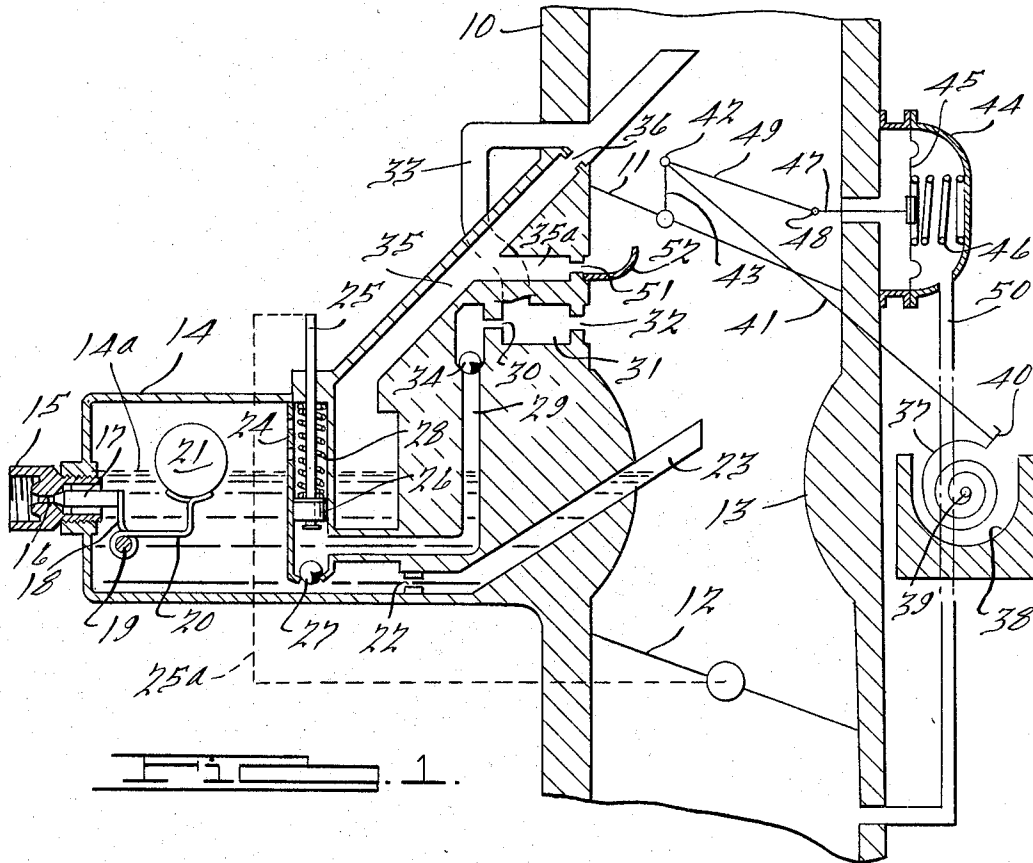
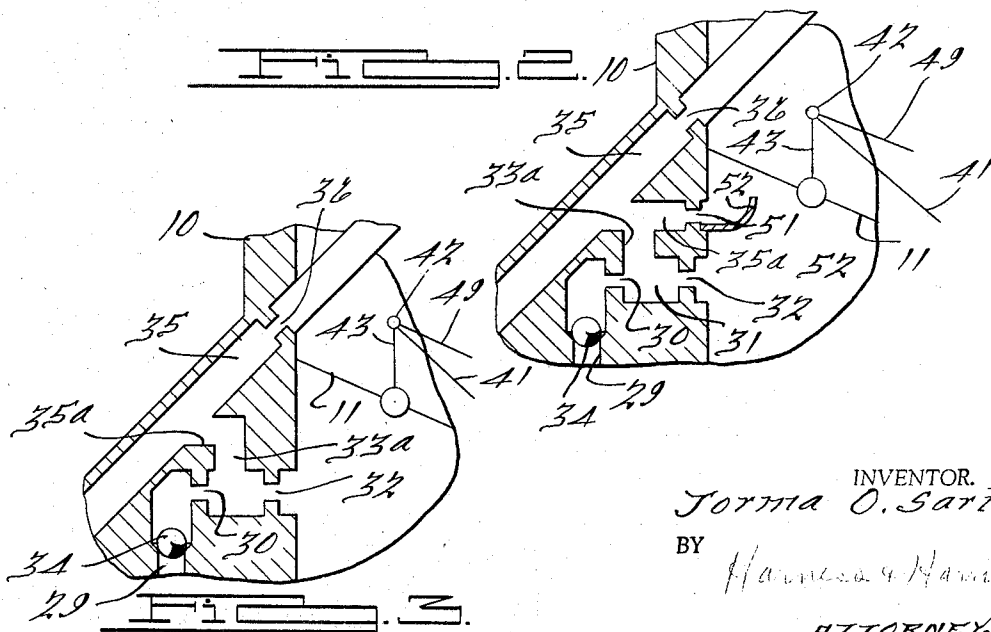
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BACK BLEED CHOKE MIXTURE CONTROL

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1

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BACK BLEED CHOKE MIXTURE CONTROL

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This invention relates to improvements in a carburetor for an internal combustion engine and in particular to means for improving the cold starting characteristics of such a carburetor to prevent flooding of the engine with raw fuel.

In a customary carburetor construction, a choke valve is provided in the air intake passage upstream of the throttle valve to regulate the inlet air flow. Means responsive to engine manifold pressure and temperature are usually provided to regulate the extent of choke opening while the engine is idling or operating under low loads during the warm-up period. However, conventional thermostatic means responsive to decreasing temperature for urging the choke valve toward its closed position against the comparatively strong air pressure forces acting on the choke valve during engine operation, urge the choke valve to its closed position with too much force during conditions of engine cranking or starting when the prevailing air pressure forces are comparatively weak. In consequence the fuel-air mixture during cold cranking is too rich for efficient starting and the engine is frequently flooded.

An important object of the present invention is to provide improved and simple means effective during engine cranking for decreasing the fuel pressure differential across the metering jet or nozzle that supplies fuel to the conventional carburetor induction passage or conduit, such that the customary thermostatically controlled choke valve can remain closed during cranking without causing engine flooding.

Another and more specific object is to provide a carburetor with a conventional float controlled fuel bowl vented to the atmosphere, and a fuel-air induction passage containing a throttle valve and a thermostatically controlled choke valve upstream of the throttle valve. A restricted fuel jet connects the fuel bowl with the induction passage at an intermediate location between the choke and throttle valves to discharge metered fuel thereto at a rate determined by the pressure differential between the bowl vented to atmosphere and the induction passage at said intermediate location. The bowl vent to atmosphere is restricted and this restricted vent is arranged in parallelism with a second restricted bypass vent for the fuel bowl to the induction passage at said intermediate location.

By suitably determining the size of the two vent restrictions, the pressure differential between the fuel bowl and said intermediate location can likewise be determined to prevent the discharge of excess fuel into the induction passage during cranking prior to self sustaining operation of the engine and while the choke valve is closed and the air flow through the induction passage is small. The fuel jet discharges into the induction passage at the region of a venturi restriction therein. Thus when the engine is operating and the air flow through the induction passage and venturi restriction increases to sustain the engine operation, the resulting low pressure at the venturi restriction will cause fuel to be discharged into the induction passage as has been customary heretofore.

2

Another object is to provide such a carburetor wherein a fuel acceleration pump is connected with the fuel bowl to pump fuel through a restricted fuel outlet into a chamber vented to atmosphere through the first named restricted bowl vent. Said second restricted bypass vent is aligned with the first restricted fuel outlet and opens from the chamber into the induction passage, whereby fuel is discharged from the first outlet and through the bypass vent into the induction passage upon operation of the acceleration fuel pump. Thus the means for preventing over enrichment of the fuel-air ratio during engine cranking is part of the acceleration fuel supply system and can be provided with a minimum of alteration of the conventional carburetor structure.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

FIGURE 1 is a schematic sectional view through a carburetor embodying the present invention.

FIGURES 2 and 3 are fragmentary views similar to FIGURE 1, showing modifications of the invention.

It is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to the drawings, a particular embodiment of the present invention is illustrated by way of example in a carburetor for an automobile internal combustion engine. The carburetor includes a main fuel-air induction conduit or passage 10 open at its upper end to receive combustion supporting air and discharging at its lower end to the customary engine inlet manifold. A butterfly type choke valve 11 is pivotally mounted off-center within the duct 10 so as to be free to swing clockwise to an open position under the pressure of air flowing downwardly in the conduit 10. Spaced downstream of the choke valve 11 is a throttle valve 12 under the control of the operator, as for example by means of a foot pedal operated throttle linkage. An intermediate portion of the conduit 10 between the valves 11 and 12 contains the customary venturi 13 for actuating the main fuel supply as described below.

Adjacent the conduit 10 is a fuel bowl 14 having an inlet 15 suitably connected with a source of pressurized fuel, as for example a conventional fuel pump. An annular inlet valve seat 16 is provided in the inlet 15 and cooperates with an axially reciprocal valve plunger 17 connected by means of an arm 18 with one end of a dog leg lever 20. The connection between the arm 18 and leg 20 comprises a pivotal element 19 mounted within bowl 14. The other end of leg 20 is secured to a float 21, whereby raising or lowering of the fuel level 14a will cause a counter-clockwise or clockwise swinging respectively of the assembly 18, 20 about pivot 19 and corresponding closing or opening of the inlet 15 at the valve seat 16 so as to maintain a substantial constant fuel level within the bowl 14.

Fuel is conducted through a metering orifice 22 and a main fuel nozzle 23 into the region of the venturi restriction 13 located in the intermediate portion of passage 10 between the valves 11 and 12. An acceleration pump

3

cylinder 24 is mounted within bowl 14 and contains a plunger 25 secured at its lower end to a piston 26 reciprocal vertically in cylinder 24. The lower end of cylinder 24 opens into bowl 14 below the level 14a to receive fuel upon upward movement of piston 26 and is suitably closed by a one-way spherical check valve 27 when piston 26 moves downward, as urged by operating spring 28. An acceleration fuel conduit 29 communicates with cylinder 24 at a location between piston 26 and check valve 27 and discharges through restricted outlet 30 into a small chamber 31. A second and larger restriction 32 aligned with restriction 30 opens into the afore-said intermediate region of passage 10 at a location slightly above venturi restriction 13. Thus upon downward movement of piston 26 under the influence of spring 28, pressurized fuel is discharged in a stream through the aligned restrictions 30 and 32 into passage 10.

Plunger 25 may be operably connected with a throttle control linkage 25a so as to raise piston 26 against the force of spring 28 each time the throttle is returned to the closed position shown. Upon operation of the throttle linkage to open valve 12, plunger 25 is released to be moved downwardly by spring 28 to effect the discharge of additional fuel required for acceleration. In order to prevent an undesirable discharge of acceleration fuel when piston 26 is not being actuated in a pumping stroke, chamber 31 is vented to atmosphere via duct 33. A spherical one-way check valve 34 located near the upper end of conduit 29 serves to enable rightward fuel flow through restriction 30 during a pumping operation of piston 26 and to prevent return flow of fluid in conduit 29 to the bowl 14 when the acceleration pump is not in operation. The structure and operation of valves 11, 12 and 17, the acceleration pump 24, 26, and the throttle linkage 25a connecting plunger 25 with valve 12 may be conventional and are accordingly not described in further detail.

Atmospheric air pressure is applied to the fuel in bowl 14 via vent 35, which in the present instance opens into passage 10 above choke valve 11 through restriction 36. During operation of the engine, air flowing downwardly in passage 10 develops a lower static pressure at the region of the venturi 13 so as to effect a pressure differential between the fuel in bowl 14 and the discharge end of nozzle 23, thereby to cause the discharge of fuel into passage 10 at a rate which is a direct function of the rate of air flow through passage 10.

In order to bias choke valve 11 toward its closed position during cold operation of the engine so as to enrich the fuel-air mixture, a bimetallic thermostatic spring 37 is contained within a pocket 38 located in a portion of the engine structure responsive to the engine temperature. One end of spring 37 is fixed at 39, the free end of spring 37 being secured at 40 to the lower end of a connecting link 41. The upper end of link 41 is pivotally connected at 42 to a crankarm 43, which in turn is secured to valve 11 adjacent its pivotal mounting. Thus during warm-up operation of the engine, spring 37 yieldingly urges valve 11 toward its closed position with a force inversely related to the engine temperature. In consequence, the static air pressure in the intermediate portion of passage 10 between valves 11 and 12 will be reduced for any given rate of air flow as the engine operating temperature is reduced. An enriched air-fuel mixture will result.

Control of choke valve 11 in accordance with the manifold pressure downstream of throttle valve 12 is accomplished by means of pressure chamber 44 partitioned into a low pressure part and a high pressure part by means of a flexible diaphragm 45. A spring 46 within the low pressure part of chamber 44 urges diaphragm 45 leftward against the pressure in the high pressure portion thereof. A plunger 47 secured centrally to diaphragm 45 extends leftward through an opening in the sidewall of passage 10 at a location upstream of valve 11 and is pivotally connected at 48 to one end of a connecting link

4

49, the other end of link 49 being pivotally connected at 42 to the swinging end of crankarm 43.

The low pressure side of chamber 44 is connected by means of duct 50 to passage 10 at a location downstream of throttle valve 12. Thus during cranking of the engine during a cold condition, thermostatic spring 37 will maintain choke valve 11 substantially closed to obtain a desired fuel enrichment for the cold starting condition. As soon as the engine begins to idle at a self sustaining condition of operation, the low pressure downstream of throttle valve 12 will cause rightward movement of diaphragm 45 and partial opening of choke valve 11 against the tension of thermostatic spring 11, thereby to obtain an optimum fuel-air ratio for the engine temperature involved.

The air pressure forces acting on the choke valve 11 during operation of the engine at idle or load conditions are very great in comparison to these same forces during initial cranking of the engine to start the same. It has been found that any thermostatic spring 37 sufficiently strong to resist opening of the choke blade 11 during cold operation of the engine, exerts too great a choke closing force during cold engine cranking. In consequence the fuel enrichment during cold cranking frequently causes engine flooding. In order to reduce the pressure differential between the air pressures on the fuel in the bowl 14 and at the discharge end of nozzle 23 during engine cranking, a bypass duct 35a is provided to connect vent duct 35 with induction passage 10 at a location downstream of choke valve 11 via a second restricted or bypass vent 51.

By suitably determining the sizes of the restrictions 36 and 51, the air pressure on the fuel in bowl 14 can be reduced below atmospheric pressure so as to reduce the effective pressure differential between the fuel pressures on the fuel in the bowl 14 and at the discharge end of nozzle 23. Thus an optimum fuel-air ratio for starting or cranking conditions is readily obtained.

During engine idling or operation of the engine under load conditions, when choke valve 11 is at least partially open in accordance with the cooperating efforts of thermostatic spring 37 and pressure actuated diaphragm 45, the pressure within passage 10 at the region of restriction 51 will rise and will act in parallelism with restriction 36 to maintain nearly atmospheric pressure within bowl 14. To this end a scoop 52 may be provided in cooperation with vent 51 so as to convert a portion of the dynamic pressure of the air flowing downwardly in passage 10 to a static pressure in duct 35 and bowl 14.

It is to be noted that restriction 36 is required in the present instance only in cooperation with restriction 51. During self sustained engine operation, the two restrictions 36 and 51 alone might result in sub-atmospheric pressure within bowl 14. In order to compensate for the sub-atmospheric pressure within bowl 14, fuel metering restriction 22 will be enlarged slightly in comparison to the size of the restriction 22 that would otherwise be required if restriction 51 were completely closed, as in conventional carburetors. By virtue of scoop 52, the sub-atmospheric pressure in bowl 14 can be substantially eliminated and a conventional carburetor can be modified by employing restrictions 36 and 51 without altering the size of fuel metering restriction 22.

FIGURE 2 shows a modification of the present invention wherein duct 33 is eliminated and is replaced by a duct 33a directly connecting chamber 31 and branch conduit 35a. In other respects, the structure and operation in FIGURE 2 is the same as described above in regard to FIGURE 1, so that corresponding parts are numbered the same in both views.

The structure of FIGURE 3 is similar to FIGURE 2 except that the restriction 51 is completely closed. In this construction, the acceleration fuel orifice 32 performs the dual functions of an acceleration fuel orifice and a bypass vent, such as the restriction 51 in FIGURE 2.

5

In other respects the structure and operation in FIGURE 3 is the same as in FIGURE 2, so that corresponding parts are numbered the same in both views.

I claim:

1. In a fuel charging system for an internal combustion engine, an air intake passage, a butterfly type choke valve pivotally mounted off-center in said passage to be urged from its closed position in response to the air flow in said passage, a throttle valve operably mounted in said passage downstream of said choke valve, a fuel bowl, means for maintaining a predetermined fuel level in said bowl, a venturi restriction in an intermediate portion of said passage between said valves, a fuel metering duct connecting said bowl with said intermediate portion of said passage to discharge metered fuel thereinto, means for maintaining a predetermined pressure relationship in said intermediate portion with respect to temperature when said engine is idling or operating under load comprising thermostatic means responsive to an engine operating temperature for urging said choke valve toward its closed position with increasing force as said temperature decreases, means for predetermining the pressure differential between the fuel pressure in said bowl and at said discharge end of said fuel metering duct when said choke valve is closed during cranking of said engine including duct means in communication with said fuel bowl and having first and second restricted portions venting said bowl respectively to the atmosphere and to said intermediate portion of said passage, an air chamber comprising part of said duct means and having said second restricted portion opening therefrom into said passage, an acceleration fuel pump operatively connected with said bowl to receive fuel therefrom and having a restricted outlet opening into said chamber in alignment with said second restricted portion for discharging fuel thereinto upon operation of said pump, said chamber being in communication with the atmosphere through said first restricted portion.

2. In the combination according to claim 1, said restricted outlet affording a greater restriction to fluid flow than said second restricted portion.

3. In a fuel charging system for an internal combustion engine, an air intake passage, a butterfly type choke valve pivotally mounted off-center in said passage to be urged from its closed position in response to the air flow in said passage, a throttle valve operably mounted in said passage downstream of said choke valve, a fuel bowl, means for maintaining a predetermined fuel level in said bowl, a venturi restriction in an intermediate portion of said passage between said valves, a fuel metering duct connecting said bowl with said intermediate portion of said passage to discharge metered fuel thereinto, means for maintaining a predetermined pressure relationship in said intermediate portion with respect to temperature when said engine is idling or operating under load comprising thermostatic means responsive to an engine operating temperature for urging said choke valve toward its closed position with increasing force as said temperature decreases, means for predetermining the pressure differential between the fuel pressure in said bowl and at said discharge end of said fuel metering duct when said choke valve is closed during cranking of said engine including duct means in communication with said fuel bowl and having first and second restricted portions venting said bowl respectively to the atmosphere and to said intermediate portion of said passage, said second restricted portion of said duct means comprising two restrictions opening in parallelism into said passage at said intermediate portion thereof between said choke and throttle valves, an air chamber comprising part of said duct means and opening into said passage through one of said restrictions, an acceleration fuel pump operatively connected with said bowl to receive fuel therefrom and having a restricted outlet opening into said chamber in alignment with said one restriction to dis-

6

charge fuel thereinto upon operation of said pump, said chamber being in communication with the atmosphere through said first restricted portion.

4. In a fuel charging system for an internal combustion engine, an air intake passage, a butterfly type choke valve pivotally mounted off-center in said passage to be urged from its closed position in response to the air flow in said passage, a throttle valve operably mounted in said passage downstream of said choke valve, a fuel bowl, means for maintaining a predetermined fuel level in said bowl, duct means in communication with said fuel bowl and having a first restricted portion venting said bowl to the atmosphere, a venturi restriction in an intermediate portion of said passage between said valves, fuel metering nozzle means connecting said bowl with said intermediate portion of said passage at said venturi restriction to discharge metered fuel thereinto, means for maintaining a predetermined low pressure relationship in said intermediate portion with respect to temperature when said engine is idling or operating under load comprising thermostatic means responsive to an engine operating temperature for yielding urging said choke valve toward its closed position with increasing force as said temperature decreases, means for reducing the fuel pressure in said bowl and accordingly the fuel flow through said nozzle means to said passage during cranking of said engine under cold temperature conditions when said choke valve is held closed by said thermostatic means including a second restricted portion of said duct means in parallel with said first restricted portion and venting said bowl to said intermediate portion of said passage, and means for increasing the pressure at said discharge end of said fuel metering nozzle means to render said second restricted portion ineffectual and substantially prevent fuel flow through said nozzle means into said passage during engine idling comprising means responsive to the pressure in said passage downstream of said throttle valve during engine idling for urging said choke valve to an open position against the force of said thermostatic means.

5. In the combination according to claim 4, said duct means comprising a duct opening at one end into said bowl at a location above the level of the fuel therein and opening at its other end into said passage at a location upstream of said choke valve, said first restricted portion comprising a restriction in said duct adjacent the opening thereof into said passage, said second restricted portion comprising a branch duct having a restriction therein, said branch duct opening at one end into the first named duct adjacent the first named restriction and between the latter and said fuel level and opening at its other end into said passage at a location between said choke valve and throttle valve.

6. In the combination according to claim 4, an air chamber comprising part of said duct means and having said second restricted portion opening therefrom into said passage, an acceleration fuel pump operatively connected with said bowl to receive fuel therefrom and having a restricted outlet opening into said chamber in alignment with second restricted portion for discharging fuel thereinto upon operation of said pump, said chamber being in communication with the atmosphere through said first restricted portion.

7. In the combination according to claim 4, said second restricted portion of said duct means comprising two restrictions opening in parallelism into said passage at said intermediate portion thereof between said choke and throttle valves, an air chamber comprising part of said duct means and opening into said passage through one of said restrictions, an acceleration fuel pump operatively connected with said bowl to receive fuel therefrom and having a restricted outlet opening into said chamber in alignment with said one restriction to discharge fuel thereinto upon operation of said pump, said chamber being in

7

communication with the atmosphere through said first
restricted portion.

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5

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