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CARBURETOR AIR BLEED

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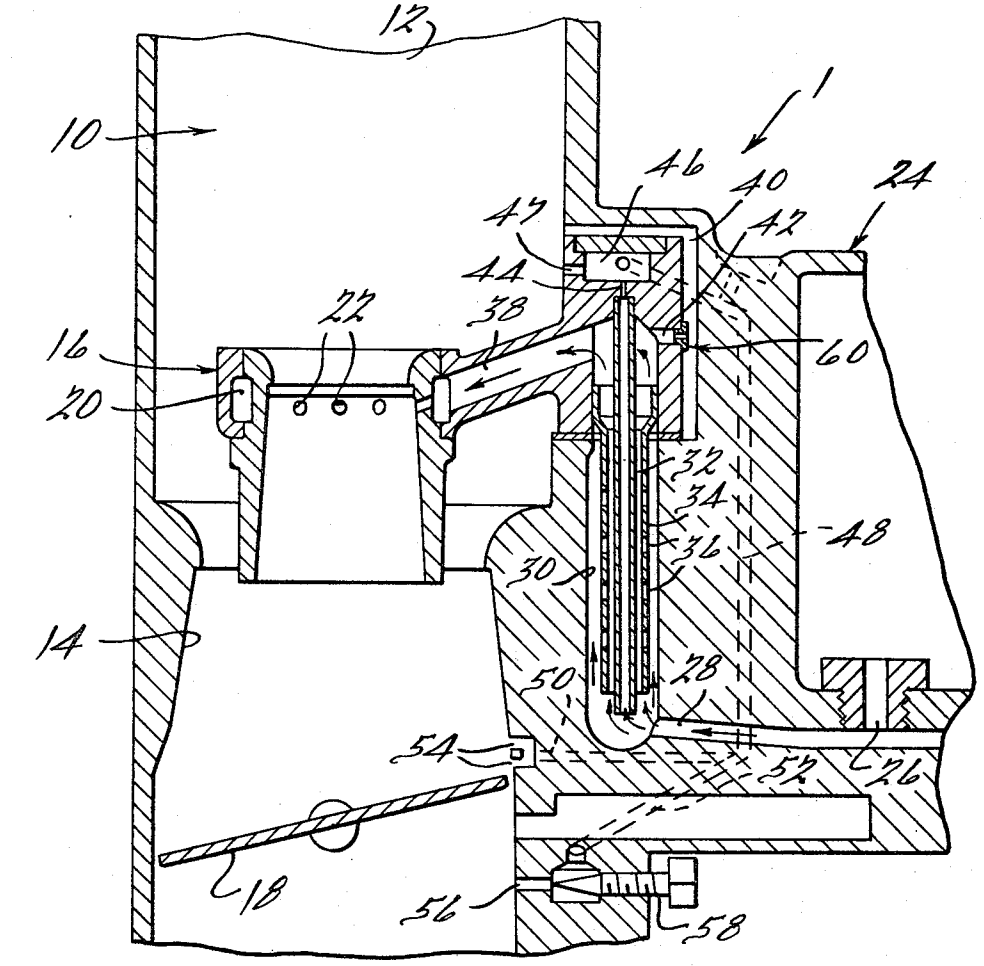


Fig. 1.

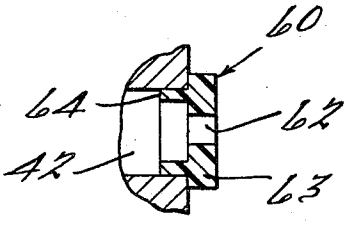


Fig. 2.

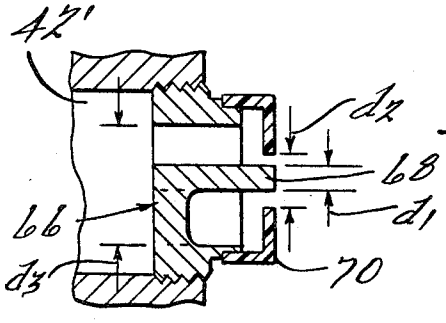


Fig. 3.

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CARBURETOR AIR BLEED

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ABSTRACT OF THE DISCLOSURE

A carburetor air bleed passage containing an orificed plug of a thermally sensitive material that varies the size of the orifice, and, therefore, the air flow, as a function of the change in air density, to thereby maintain an essentially constant air/fuel ratio.

This invention relates, in general, to a charge forming device such as an automotive type carburetor. More particularly, it relates to a variable area air bleed for the main fuel system of such a charge forming device, and one that automatically maintains essentially a constant air/fuel ratio regardless of changes in ambient air temperature.

Conventional carburetor constructions of the induction type generally have a fixed area main air bleed to effect a mixture of air with the fuel as it is being drawn into the induction channel of the carburetor. Such a construction, however, fails to compensate for changes in density of the bleed air with changes in the ambient air temperature. This is particularly noticeable during engine idle speed operation. For example, if the main air bleed is calibrated for a predetermined flow at normal engine operating temperatures, the change in density of the air with changes in the air temperature will affect the air/fuel ratio of the mixture. This will cause and enrichment of the flow during hot conditions.

The invention obviates the above disadvantages by providing a thermally sensitive air bleed that automatically varies in cross-sectional area as a function of changes in air temperature to maintain essentially a constant fuel/air ratio for a given engine speed.

The invention accomplishes the above, in one embodiment, by the insertion of an orificed plug of thermally sensitive material in the main air bleed passage, the plug material having a high coefficient of expansion. In another embodiment, the passage contains a tubular plug of a material having a low coefficient of expansion, such as brass, for example, the plug having a central rod-like portion projecting through a circular opening in a cap of a material having a high coefficient of expansion.

Therefore, it is an object of the invention to provide a variable area air bleed for a charge forming device that maintains the air/fuel ratio essentially constant regardless of changes in ambient air temperature.

Other objects, features and advantages of the invention will become apparent upon reference to the succeeding detailed description thereof, and to the drawings illustrating the preferred embodiments thereof, wherein;

FIGURE 1 illustrates, schematically, a cross-sectional view of a portion of a charge forming device embodying the invention;

FIGURE 2 is an enlarged view of a detail of FIGURE 1; and,

FIGURE 3 is a modified version of the air bleed of FIGURE 2.

FIGURE 1 shows a portion 1 of a down-draft type carburetor. It has the usual induction passage 10 having an air inlet 12 that would be connected to a source of air at atmospheric pressure, in a known manner. The body portion of the induction passage contains a primary venturi section 14, a secondary venturi 16, and a rotatably

mounted throttle valve 18. The secondary venturi 16, which is positioned adjacent the low pressure section of main venturi 14, has an annular fuel/air annulus 20 from which fuel is drawn into induction passage 10 through spaced discharge ports or nozzles 22.

Fuel is supplied to secondary venturi 16 through a main fuel system assembly that includes a fuel bowl 24. Fuel flows from the bowl through a calibrated main jet 26, through a transverse passage 28 into a main fuel well 30. The fuel well contains an idle speed fuel supply tube 32 concentrically surrounded by an emulsion or main fuel flow supply tube 34. Tube 34 has a plurality of air/fuel mixing holes 36, for a purpose to be described later. Tube 34 opens at its upper end into a main transfer passage 38 that is connected to secondary venturi annular channel 20.

The main fuel flow nozzle assembly is spaced at its upper end from the carburetor housing, as shown, to provide an air passage 40 communicating with induction passage 10. A restricted transverse passage 42 connects the air in passage 40 to main fuel well 30 and transfer passage 38. Passage 42 constitutes the air bleed for the main fuel system. It is of a size to admit sufficient air to mix with and foam the fuel in emulsion tube 34, to provide a desired air/fuel ratio to the mixture, and to aid in fuel atomization, in a known manner.

Idle speed fuel tube 32 is connected at its upper end by a restriction or idle speed jet 44 to a chamber 46. The chamber at one side communicates with the air in induction passage 10 through a restriction 47, and, at the other side, with the end of a conduit 48. The idle speed air/fuel mixture drawn upwardly through tube 32 into chamber 46 passes through conduit 48 into branch conduits 50, 52 opening into induction passage 10. Passage 50 ends in two ports 54 located above the closed position of throttle valve 18, while passage 52 has a single port 56 located at all times below the throttle valve. Flow through passage 52 and port 56 is controlled by an idle mixture screw 58.

In operation, during engine idle speed conditions, throttle valve 18 is in the essentially closed position shown. The resultant low air flow through induction passage 10 is insufficient to provide a large enough pressure differential between the air acting on top of the fuel in bowl 24 and the air passing through the secondary venturi 16 to draw fuel through the main fuel tube 34 into the secondary venturi. However, the high vacuum below throttle valve 18 is sufficient, acting through port 56 and idle speed fuel channel 48 on chamber 46, to depress the pressure in chamber 46 sufficiently to allow air to bleed through restriction 47 and mix with fuel drawn through idle fuel tube 32 so that the engine is maintained at its idle speed.

When the throttle valve 18 is rotated counterclockwise for an increase in engine speed, the increased air flow through the secondary and primary venturis 16 and 14 now creates sufficient pressure drop in transfer passage 38 and fuel well 30 to begin drawing fuel through emulsion tube 34 into the upper portion of the main well. Simultaneously, the decreased pressure in main well 30 permits air flow through main air bleed 42 down into the emulsion tube air/fuel mixing holes 36 where it mixes with the fuel and establishes an emulsified mixture of a desired air/fuel ratio. The emulsified fuel then flows through transfer passage 38 into the secondary venturi through openings 22.

The above construction, except for the details of air bleed 42, is known. Further details of the construction and operation of the carburetor, therefore, are not given since they are known and are believed to be unnecessary for an understanding of the invention.

Turning now to the invention, as best seen in FIGURE 2, air bleed passage 42 contains a thermally sensitive plug

60 provided with an orifice 62 of a calibrated cross-sectional area. The plug has a main body portion 62 and an annular flange 64 providing an interference fit with the walls of passage 42. The plug is made of a material having a high coefficient of expansion; that is, say twenty times, for example, the coefficient of expansion of the material of which the housing walls defining passage 42 are made. Therefore, as the temperature of the air passing through the plug increases, the plug main body portion 63 expands to increase proportionately the cross-sectional area of orifice 62.

Since the density of air varies inversely with a change in temperature, it will be clear that it is necessary to increase the air flow as the temperature of the air increases so that essentially the same density will exist regardless of the temperature change. The enlargement of the air bleed as the temperature of the air increases does this. Of course, increasing the cross-sectional area of the plug orifice causes a decay in the vacuum acting on the fuel in main well 30; however, this is negligible in view of the over-all effect of the vacuum and air flow in the main induction passage 10. For example, the manifold vacuum at idle is strong enough, say 15" Hg, for exampe, that the increased area of the bleed has only a minimum effect on the decrease in fuel flow. Therefore, for all intents and purposes, the changes in the size of orifice 62 with changes in air temperature will always be such that the air/fuel ratio of the mixture in the transfer passage 38 remains essentially constant for a given engine speed.

FIGURE 3 shows a modified form of thermostatically controlled air bleed that is more sensitive to temperature change than the circular hole orifice shown in FIGURE 2. More specifically, the main air bleed passage 42 is fitted with a tubular plug 66 of a material such as brass, for example, having a predetermined bore diameter d_3. It is provided with a centrally located rod-like member 68 of a diameter d_1 that is suitably supported from the bore wall, as shown. Secured over the top of the plug is a cup shaped cap 70 of a material such as plastic, for example, that has a central aperture or hole of a diameter d_2. The walls defining the aperture of the cap are radially spaced from brass rod 68 to define a tubular orifice of predetermined size. In this instance, the annular area

$$(d_2^2-d_1^2)\frac{\pi}{4}$$

is more sensitive to temperature change than a circular hole, as the plastic cap has a much higher coefficient of expansion than the brass rod. Also, since d_3 is larger than d_2 when it is fully expanded under maximum temperature, d_3 does not affect the air bleed principle described previously.

From the above, therefore, it will be seen that the invention provides a main air bleed for an induction type charge forming device that automatically varies in cross-sectional area as a function of the change in temperature of the air passing through the bleed to automatically compensate for changes in density of the air with changes in temperature. It will be seen, therefore, that the invention automatically maintains an essentially constant air/fuel ratio of the mixture in the main fuel supply system.

While the invention has been described and shown in its preferred embodiments, it will be clear to those skilled in the arts to which the invention pertains that many changes and modifications may be made thereto without departing from the scope of the invention. For example, the inclusion of a thermally responsive orificed plug has been shown only in connection with the main air bleed. It will be clear, however, that it could be used equally as well in each of the other air bleeds in a system of this type, without departing from the scope of the invention.

What is claimed is:

1. A charge forming device having an air induction passage, fuel discharge means secured in said passage to discharge fuel therein, a source of fuel, conduit means connecting said source and said discharge means, and air bleed means connected to said conduit means to mix a controlled amount of air with said fuel in said conduit means, said air bleed means comprising, an air passage having an inlet communicating with a source of air at ambient temperature and having a discharge opening into said conduit means, said inlet having mounted therein orificed flow restricting means, said latter means including thermally sensitive expandable-contractable material having a substantially higher coefficient of expansion than the walls of said passage and defining at least a portion of the orifice of said means, said material being responsive to changes from a predetermined level of the temperature of the air flowing through said orifice to automatically expand or contract the said material and thereby the area of said orifice passage to control the air/fuel ratio of the fluid in said conduit means.

2. A charge forming device as in claim 1, said flow restricting means comprising an orificed plug composed of said material and removably insertable into said inlet.

3. A charge forming device as in claim 1, said material comprising a cap member secured over said inlet and having a control aperture for the flow of air therethrough.

4. A charge forming device as in claim 3, said passage having a projection extending into and radially spaced from the walls of said cap defining said aperture, said cap and projection having different coefficients of expansion to vary the radial space therebetween upon changes in temperature of the ambient air flowing through said aperture.

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