

[54] **TWO-STAGE CARBURETOR WITH
IMPROVED IDLE AIR FUEL MIXTURE
DISTRIBUTION**

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[58] Field of Search 261/23 A, 63, 41 D

[56] **References Cited**

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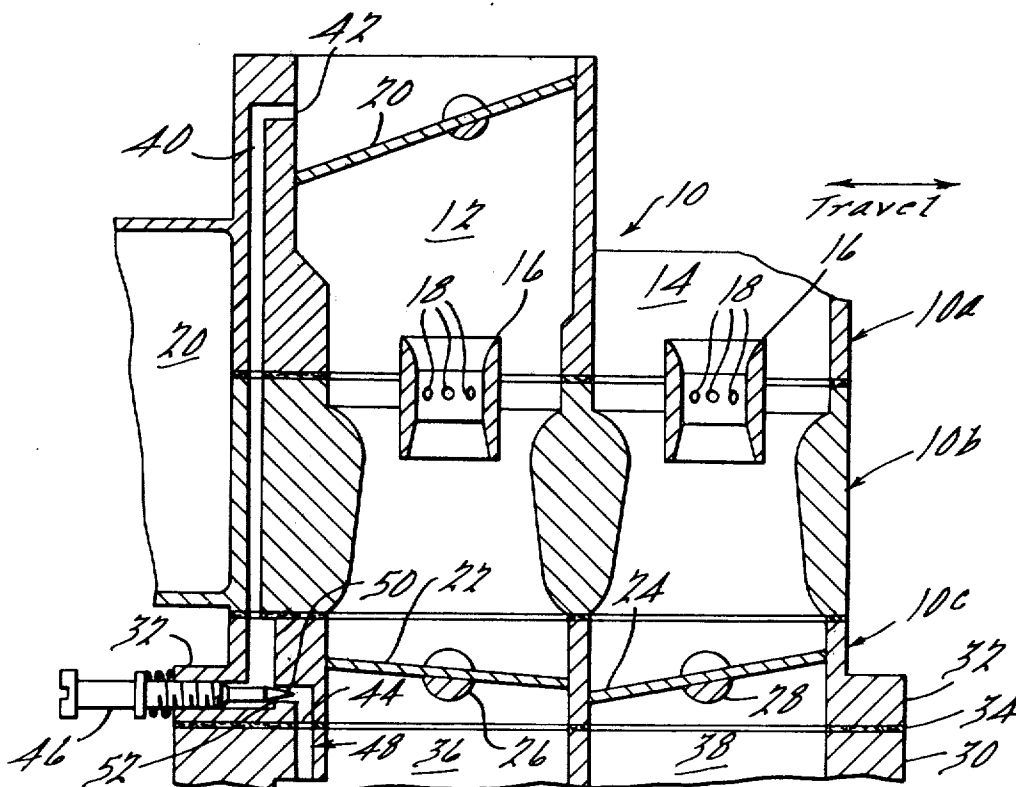
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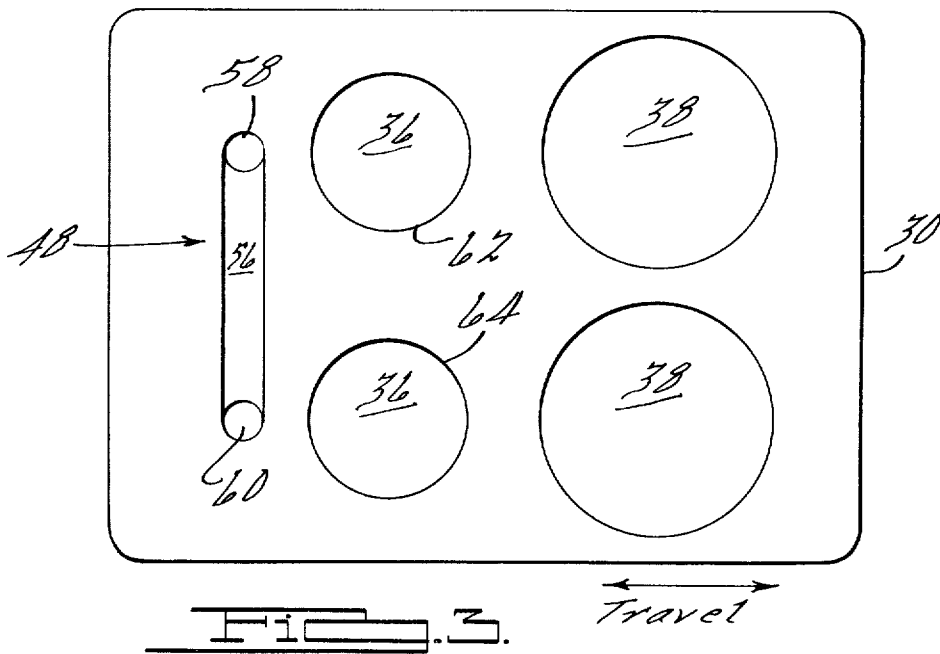
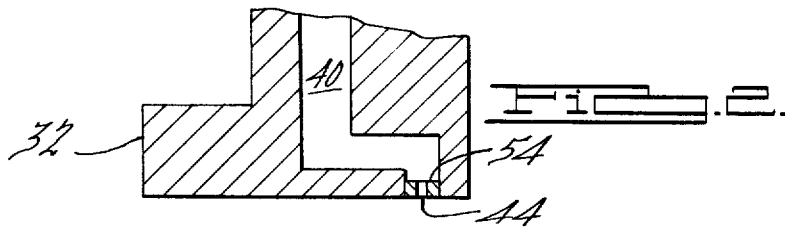
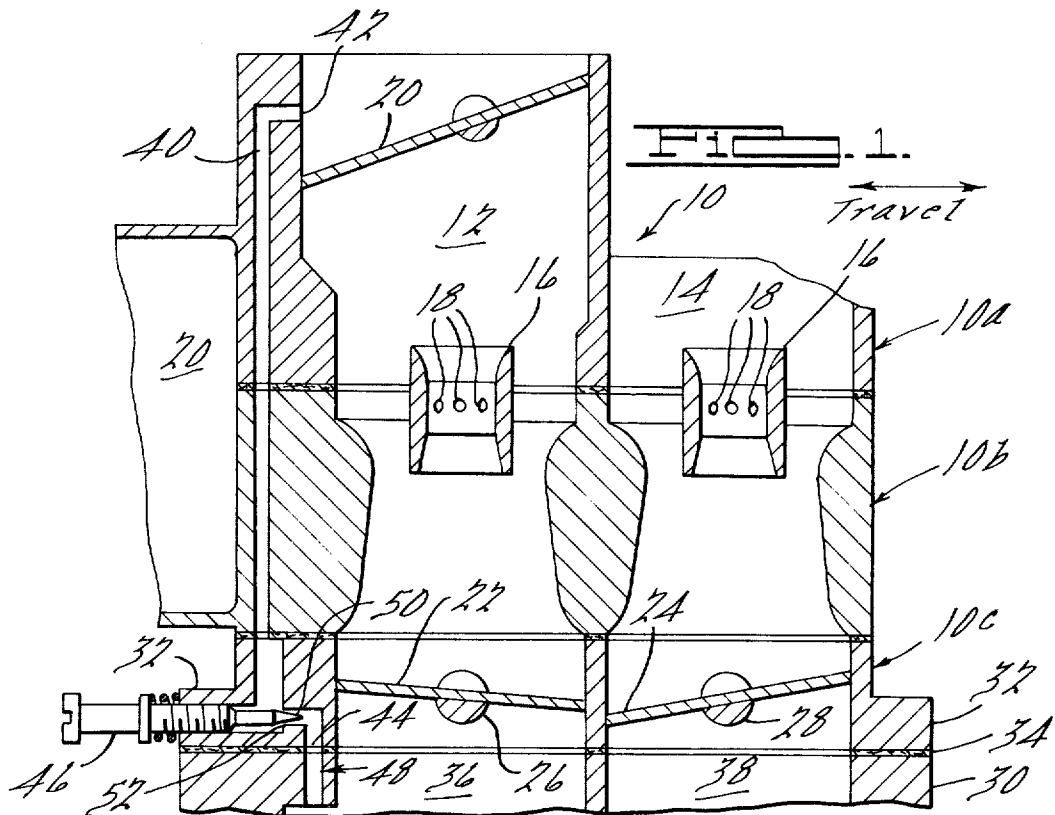
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[57] **ABSTRACT**

A two-stage carburetor having improved cylinder-to-cylinder idle air/fuel mixture distribution is disclosed. The carburetor includes a controlled air leakage which is provided on one side of the idle air/fuel mixture source to balance the leakage of air around the throttle valve in the secondary bore which is located on the opposite side of the idle air/fuel mixture source. Bleed air may be controlled by use of a fixed restriction, sized to approximate the mean secondary throttle air leakage under normal engine operating conditions or it may be provided with an adjustable bleed, calibrated to equal the air leakage around the secondary throttle blade.

6 Claims, 3 Drawing Figures





TWO-STAGE CARBURETOR WITH IMPROVED IDLE AIR FUEL MIXTURE DISTRIBUTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is concerned with two-stage carburetors for internal combustion engines and particularly for such carburetors as are called on to provide an air/fuel mixture to an internal combustion engine which operates over a very wide range of air/fuel mixture flow rates, for example, as in an automobile. More particularly, the present invention is related to that portion of the above noted field which is concerned with the provision of substantially uniform idle air/fuel mixtures to the combustion cylinders of an internal combustion engine.

2. Description of the Prior Art

Prior art two-stage carburetors which are used to provide air/fuel mixtures for automotive internal combustion engines typically provide an idle air/fuel mixture to the primary bore or bores of the carburetor at a point which is downstream from the throttle mechanism. This is ordinarily provided by arranging one or more orifices in the wall of the primary bore which orifices are operative to sense throttle position and to respond to a condition of nearly closed throttle to discharge an air/fuel mixture below, or down stream of, the throttle blade. For single stage carburetors, this method of idle air fuel delivery has been most satisfactory. This method has also been satisfactory from an operational standpoint for carburetors having more than a single stage. However, for such multi-stage carburetors, the distribution of the idle air/fuel mixture thus provided has been found to vary greatly between cylinders located at one end of the engine and cylinders located at the opposite end of the engine. This maldistribution may range from, for example, an air/fuel ratio of about 18 to 1 in one cylinder and about 14 to 1 at the oppositely positioned cylinder.

It has been determined that the cause of this maldistribution occurs, at least in great part, as a result of air leaking past or around the throttle mechanism used to control air flow through the secondary bore or bores. Under idle conditions, the throttle mechanism or plate valve located in the secondary bore or bores of a multi-stage carburetor is biased toward a closed position. However, conventional manufacturing and assembly tolerances cause the throttle mechanism in the secondary bores of a multi-stage carburetor to achieve the fully closed position in only a relatively small number of carburetors. This results from the fact that the diameter of the bores may vary slightly so that there is not a complete closure fit between the throttle mechanism and the bore. Additionally, a plurality of throttle blades situated on a single shaft may not be coplanar so that one throttle blade reaches the closed position in advance of closure of the other bore of the secondary stage. Either or both of these conditions will permit a relatively small amount of air to flow into the intake manifold of the associated engine through the secondary bore or bores when the associated engine is operated at idle. In a typical carburetor, such leakage is seldom greater than about 15 percent of the air flowing into the intake manifold through the primary bore or bores. Under idle conditions such flow rates may be, in a carburetor for a V-8 type engine of about 400CID for example, 13 cubic feet per minute as compared with

1½ cubic feet per minute. However, as small and insignificant as this may appear, the resulting maldistribution, which may reach for example four air/fuel ratios, results in the exhaust gases produced by that engine containing an unduly high proportion of exhaust pollutants, principally CO when set for acceptable idle quality. It is, therefore, a general object of the present invention to provide a carburetor mechanism which does not result in significant maldistribution of the idle air/fuel mixture. A further problem resulting from maldistribution resides in the fact that for large distribution variations the engine idle quality deteriorates greatly. It is therefore a further object of the present invention to provide a carburetor which provides improved idle quality while also providing decreased exhaust emissions at idle.

Various correction methods have been proposed to cure this particular problem. For example, it has been proposed to positively seal the secondary throttle blade as for example by use of gaskets and other positive sealing mechanisms. Alternatively, it has been proposed that the idle air/fuel mixture be introduced into the manifold through both the primary and the secondary stages of a two stage carburetor. However, such corrections involve additional cost and/or increased complexity of the carburetor to which they are applied. It is therefore a further object of the present invention to provide a carburetor having improved idle air/fuel mixture distribution in which the improvement is obtained without incurring substantial cost penalties. It is a more particular object of the present invention to provide such a carburetor in which the improvement is obtained without increasing the complexity of the idle air/fuel mixture delivery or preparation mechanism.

SUMMARY OF THE PRESENT INVENTION

The present invention provides a multi-stage carburetor, for example a two-stage carburetor, with a controlled air leak or bleed which is located so that the primary bore or bores are positioned intermediate the controlled air leak or bleed and the secondary bore or bores. The controlled air leak or bleed is further provided with a restriction which may be fixed to establish a rate of air leakage which approximates the mean air leakage through the secondary bore or bores under normal engine idle operation. As an alternative, the present invention may include an adjustable bleed mechanism which may be set during carburetor calibration so that the air leakage through the controlled air bleed passage is exactly equal to the air leakage through the secondary bore or bores under all or substantially all engine idle operating conditions.

To further provide that engine idle air/fuel mixture distribution is optimized, the present invention contemplates the provision of a single controlled air bleed which communicates a source of filtered air through a suitable channel to the inlet of each primary induction passage. This channel may be, for example, centered about the center line of the carburetor and may have left and right excursions which are approximately equal.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a representative two-stage carburetor and intake manifold in a longitudinal cross section view showing both stages and illustrating the present invention.

FIG. 2 shows the presently preferred alternative air bleed mechanism for the present invention.

FIG. 3 illustrates a top elevational view of the primary and secondary induction passage inlets of a manifold according to FIG. 1 for an internal combustion engine.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein like numerals designate like structure throughout the various views, FIG. 1 illustrates a representative two-stage carburetor 10 incorporating the present invention. The carburetor 10 is comprised of air horn body portion 10a, main body portion 10b and throttle body portion 10c in assembled relation, separated by suitable gaskets. Carburetor 10 includes a primary induction passage 12 and a secondary induction passage 14 extending through each body portion. Each passage includes a centrally positioned boost venturi 16 having a plurality of fuel delivery ports or nozzles 18. Fuel is provided to the fuel reservoir 20, which has been partially broken away for purposes of clarity, through suitable passages, not shown.

Primary passage 12 includes choke means 20 in the form of a rotatable plate valve at the inlet (upper, relative to FIG. 1) end thereof. Air flow through both the primary and secondary induction passages 12, 14 is controlled by throttle valve means 22, 24, respectively. As in the normal practice, throttle valve means 22, 24 are comprised of plate valve members which are rotatable for positioning on a pair of shafts 26, 28, respectively. The rotary position of these shafts may be controlled by a suitable linkage mechanism from a remote control point as for example the passenger compartment of an automotive vehicle. Such controls and linkage mechanisms are well known and further description is therefore considered to be not necessary. The inlet end of both the primary and the secondary air passages is communicated to a typical air cleaner (not shown) while the outlet end of each passage communicates with an intake manifold 30. Carburetor 10 also includes means for removable securing the carburetor 10 to the manifold 30. This may be typically by means of mounting screws or bolts received within suitably prepared holes within the manifold and passing through holes in a mounting flange of the carburetor 32. In order to properly seal the carburetor 10 to the manifold 30 a sealing gasket 34 is typically provided. Manifold 30 includes primary and secondary induction passages 36, 38, respectively.

According to the present invention, carburetor 10 also includes controlled air by-pass passage means 40. This passage means is provided with an inlet port 42 which is situated upstream from, relative to the normal air flow direction, the choke mechanism 20. This assures an adequate supply of filtered air to the by-pass passage means 40. Passage means 40 is also provided with an outlet port 44 which is situated downstream from an air flow controlling needle valve means 46. Outlet port 44 communicates with the intake manifold 30 through a flow channel means 48.

According to one embodiment of the present invention, needle valve means 46 is adjusted to position metering needle 50 within needle valve seat 52 to provide an air flow through the by-pass passage 40 which is substantially equal to the amount of air flowing through

the secondary passage means 14 past throttle valve or valves 24 under engine idle conditions. That is to say, needle valve mechanism 46 is adjusted to provide an air bleed leakage area between metering needle 50 and needle valve seat 52 which is approximately equal to the air bleed leakage area between throttle plate 24 and the side walls of secondary air passage 14 when throttle valve 24 has been biased to its extreme closed position. A single by-pass passage means 40 would also suffice for a secondary stage having a plurality of secondary passages as is the normal practice.

Referring now to FIG. 2, the presently preferred embodiment of the controlled air by-pass control mechanism of FIG. 1 is shown. In this embodiment, the adjustable needle valve mechanism 46 has been replaced with a sized, fixed restriction or bleed 54. This restriction may be drilled or inserted during the carburetor calibration phase of manufacture and may have either a sized passage extending therethrough or an equivalent leakage rate in the case of a porous material. The effective leakage rate of restriction 54 will be selected to be substantially equal to the mean rate of leakage in the secondary stage or stages which may be determined during calibration testing and adjustment of the carburetor or by statistical sampling of representative carburetors.

Referring now to FIG. 3, the inlet ports for the primary and secondary induction passages in the manifold 30 are illustrated in a top view. As illustrated, this represents a typical manifold inlet for a four-venturi two-stage carburetor. For clarity, the carburetor mounting means have been omitted. As shown in this FIG. 3, flow channel means 48 is comprised of a cross flow channel portion 56 extending perpendicularly to the direction of travel and having a length in excess of the spacing between adjacent edges of the ports 58, 60 of primary induction passage means 36. With reference to FIGS. 1 and 3, it can be seen that flow channel means 48 also includes a pair of passages 62, 64 which communicate cross flow channel portion 56 with the primary induction passage means 36 forward of the riser bores. The flow channel means 48 is arranged to receive air flow through the controlled air by-pass passage 40, from the outlet port 44 thereof, and to communicate this air flow to each of the primary induction passages 36. This controlled bleed air flow, entering the primary induction passage means as it does on a side of the primary induction passages which is opposite to the position of the secondary induction passages with respect to the primary induction passages provides balancing or stabilizing air flow which compensates for air flow leakage through the secondary carburetor passage and thereby prevents maldistribution of air fuel mixture which may be caused by this air leakage.

For each of assembly and manufacturing convenience, the position of the air passage mechanism 40, its control means, either needle valve mechanism 46 or fixed restriction 54, may be situated where convenient in the carburetor provided that the outlet port 44 for this controlled air leakage passage network is situated on a side of the primary passages which is generally opposite to the location of the secondary passages which is generally opposite to the location of the secondary passages within the carburetor. Where convenient, cross flow channel 56 could also be formed within the throttle body portion 10c or passage mechanism 40 could be provided with an outlet port 44 in each of the

primary passages 12 of the carburetor. Additionally, cross-flow passage or channel 56 could be foreshortened and intercepting passages 62, 64 could be arranged to angularly interconnect the cross-flow channel 56 with the primary induction passage means 36.

I claim:

1. A two-stage carburetor for an internal combustion engine comprising in combination:

a housing;

at least one primary bore passage extending through said housing;

at least one secondary bore passage extending through said housing;

throttle valve means in each of said passages for controlling fluid flow through said passages;

linkage means connected to said throttle valve means for controlling the position of said throttle valve means in said passages whereby the rate of fluid flow may be controlled;

said linkage means including biasing means for biasing the secondary bore passage throttle means to a closed position and idle stop means defining at least one position of maximum closure of said primary bore passage whereby idle air/fuel mixture may be provided to the engine; and

means forming a bleed air passage through said housing in parallel with said primary and secondary passages and arranged to be spatially separated from the secondary passage by the primary passage whereby leakage air flowing past the secondary bore passage throttle means may be compensated and the idle air/fuel mixture distribution may be balanced.

2. The carburetor of claim 1 including restriction means in said bleed air passage operative to establish a predetermined air flow area in said bleed air passage whereby air flow through said bleed air passage may approximate air leakage around said secondary passage throttle valve means when in the closed position.

3. The carburetor of claim 2 wherein said restriction

means is a fixed restriction having an air flow rate substantially equal to the mean leakage air flow around the secondary bore throttle valve means when closed and when the associated engine is idling at normal operating temperature.

4. The carburetor of claim 2 wherein the opening of said bleed air passage upstream of the restriction is at a source of filtered air and the downstream opening is at the intake manifold of the associated engine.

5. The carburetor of claim 2 wherein said restriction means is an adjustable restriction calibrated to substantially equal the air leakage around the secondary bore throttle valve means when closed.

6. In an internal combustion engine fuel delivery system, the combination comprising:

a carburetor having a primary bore and a secondary bore;

a primary throttle plate positioned in said primary bore;

a secondary throttle plate positioned in said secondary bore;

linkage means connected to said primary throttle plate for operating said primary throttle plate;

means for biasing said secondary throttle plate to a closed position;

linkage means coupled to said primary throttle plate and to said secondary throttle plate for maintaining said secondary throttle plate in a closed position until said primary throttle plate has opened a predetermined amount; and a restricted air passage connected in parallel with said primary bore and said secondary bore, said restricted air passage being positioned on the opposite side of said primary bore from said secondary bore whereby distribution of the idle air/fuel mixture may be balanced and air leakage around the secondary throttle plate in the closed position may be compensated.

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