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Lawrence

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[54] **CARBURETORS**

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[52] **U.S. Cl.** .... **261/44 R,** 261/56

[51] **Int. Cl.** **F02m 9/04**

[58] **Field of Search** .... 261/44 R, 56, 50 A

[56] **References Cited**

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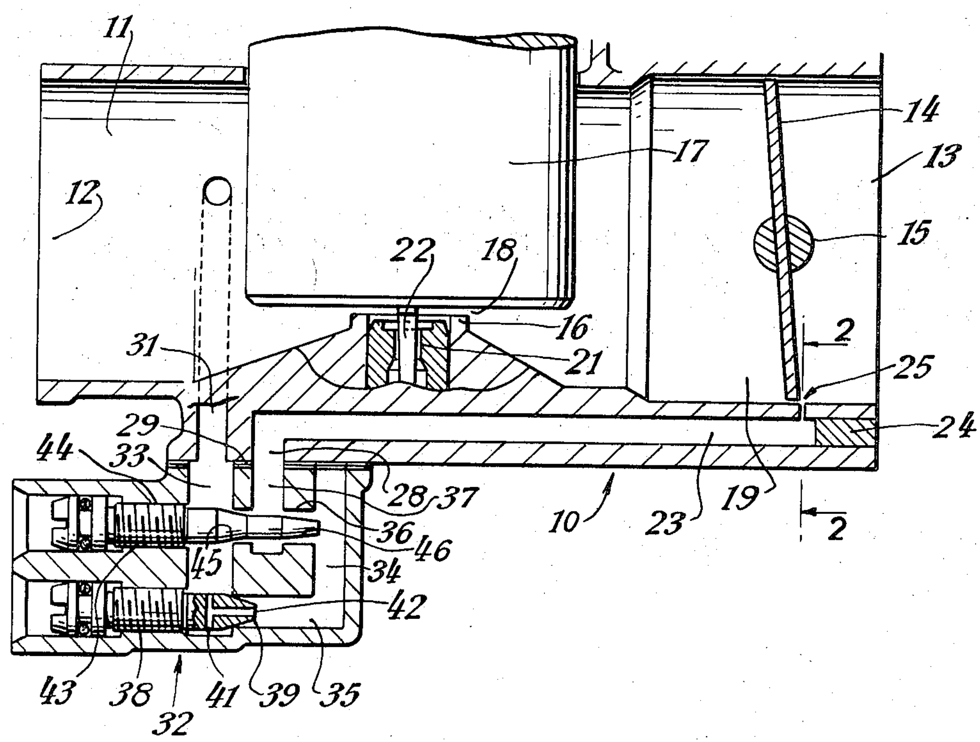
[57] **ABSTRACT**

A carburetor of the constant depression type having a butterfly throttle valve is provided with an auxiliary passage for supplying air directly to the induction passage downstream of the throttle valve when the said throttle valve is in the idling position, opening of the throttle valve beyond the idling position causing the air supply through the auxiliary passage to a position downstream of the throttle valve to cease either due to the edge of the throttle valve moving across the auxiliary passage opening or to the said auxiliary passage being closed.

11 Claims, 6 Drawing Figures



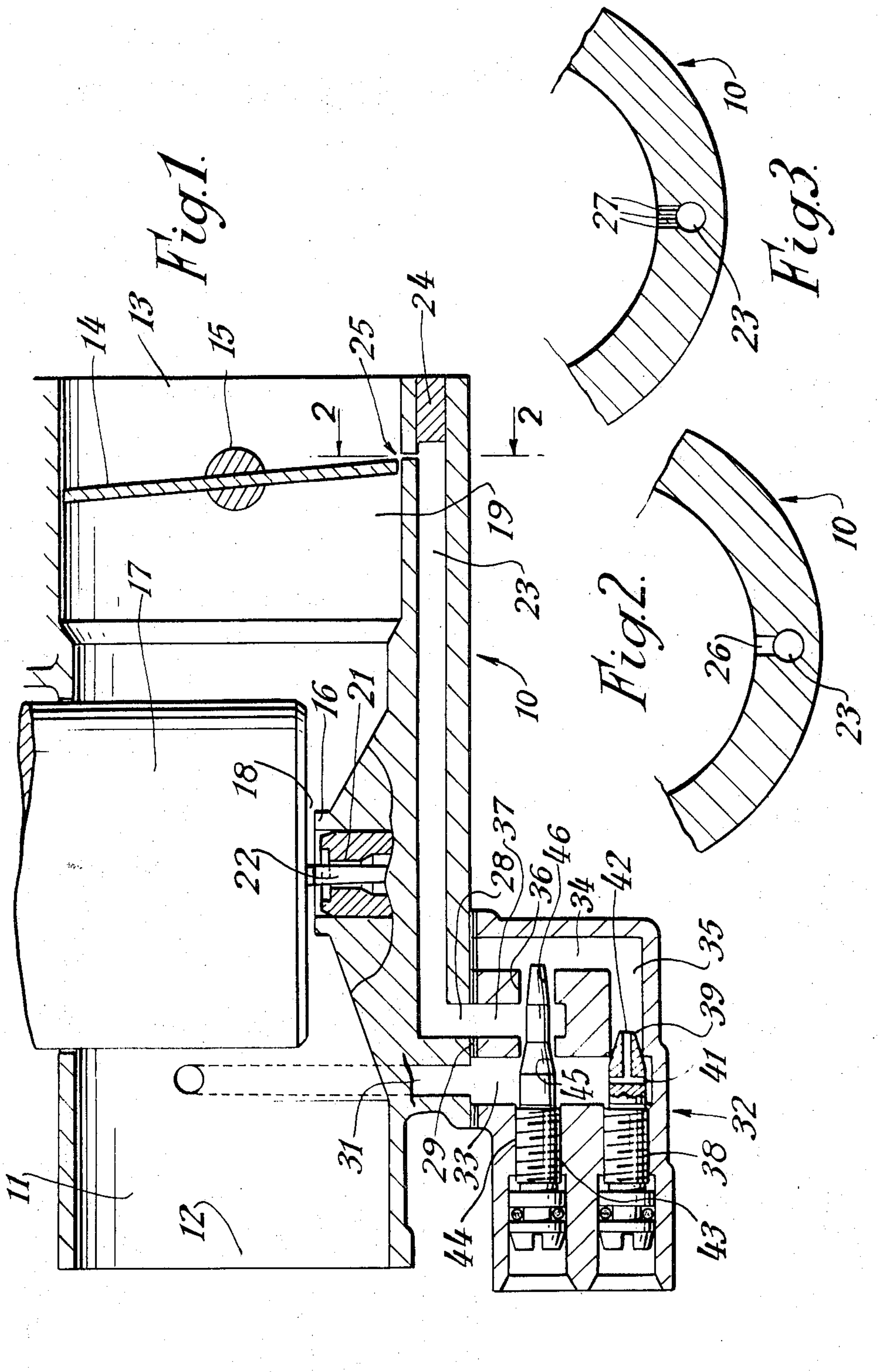


Fig.1.
Fig.2.
Fig.3.

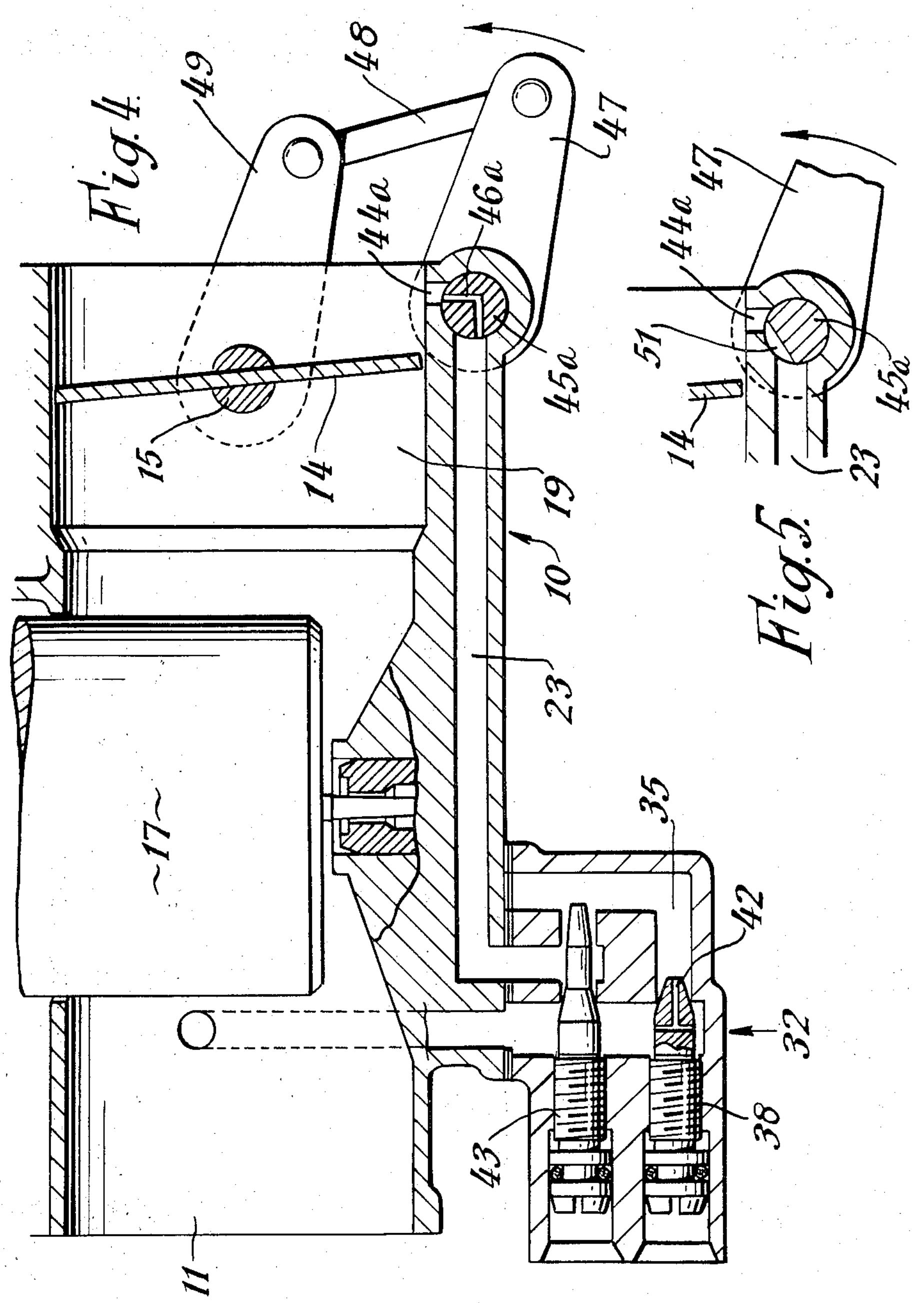

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Fig. 4

Fig. 5

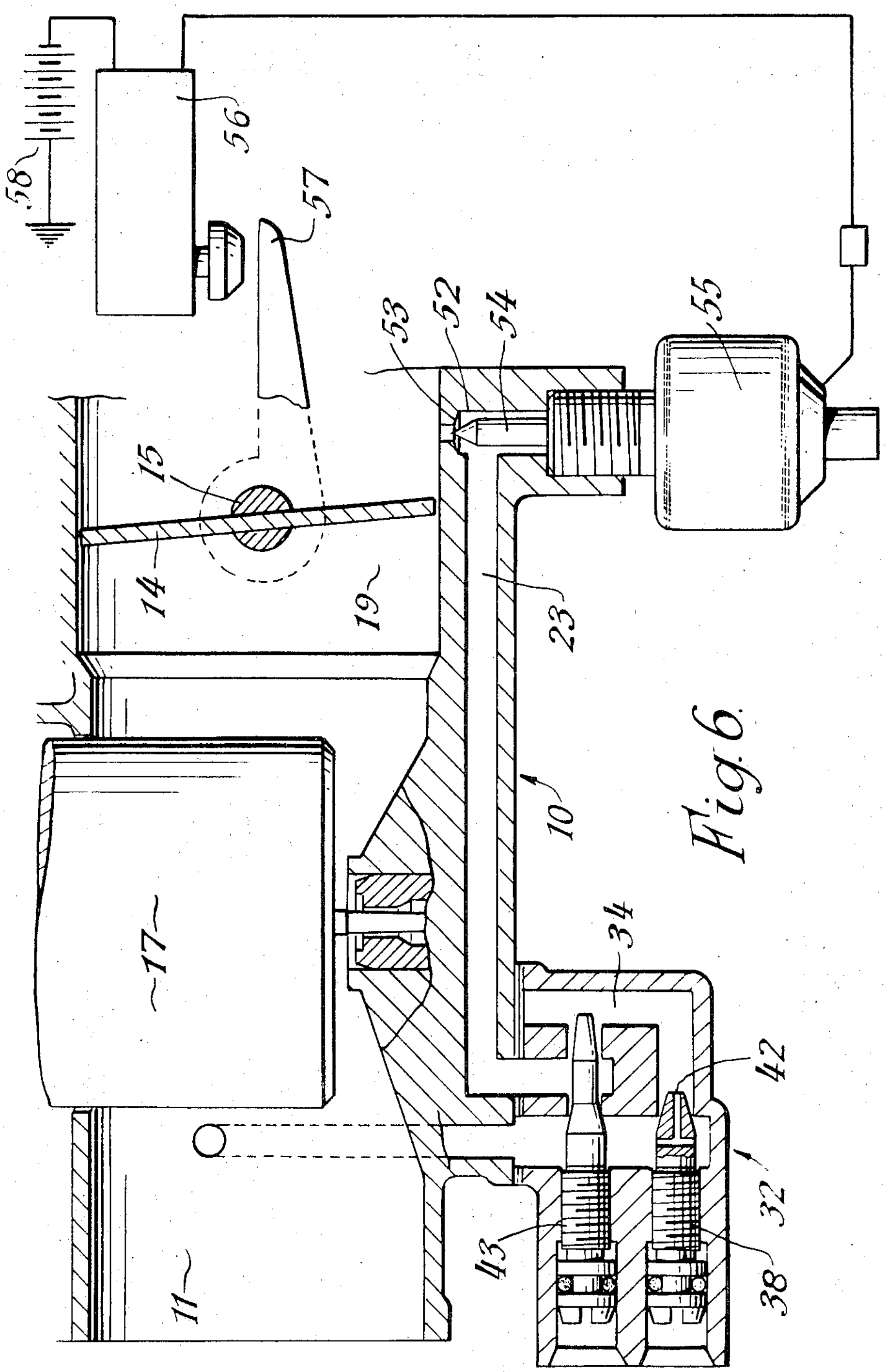

Fig. 6

CARBURETORS

This invention relates to carburetors for internal combustion engines, and, more specifically, to carburetors of the so-called constant depression type, in which there is provided in the induction passage of the carburetor, upstream of the throttle valve, an air valve which is controlled automatically in response to any tendency for the depression in the part of the induction passage, between the throttle valve and the air valve, which part is hereinafter called the mixing chamber, to change, so as to maintain the depression in the said mixing chamber substantially constant.

Fuel is supplied to the induction passage of such carburetors through an orifice leading into a throat the area of which is defined by the position of the air valve, the area of the orifice itself being varied by movement of a profiled needle extending through the said orifice and moving to increase the said area as the throat area is increased by movement of the air valve.

It has been found with such carburetors that it is a distinct advantage to be able to modify the fuel/air mixture metered for idling purposes to achieve close control of the toxic CO content of the exhaust gases emitted during the idling mode. Further it is required to enable this adjustment to be made without interfering with the metering characteristics established over the rest of the carburetor flow range.

To achieve this tuning facility it has been proposed to supply additional air directly to the induction manifold passage downstream of the carburetor throttle valve in some variable proportion with the effect that the position of the air valve and profiled needle is altered for a given air flow to the engine thus altering the effective size of the main metering orifice.

According to a previous proposal, the additional air was supplied to the mixing chamber, but the supply of additional air to the mixing chamber has been found to affect adversely both the quality of idling and the response of the carburetor to throttle movement in the range adjacent to the idling position.

It is an object of the present invention to provide an extra air supply arrangement which avoids or minimizes these disadvantages.

According to the present invention there is provided a carburetor of the constant depression type as herein defined and having a butterfly type throttle valve, wherein a further passage provided for supplying air directly to the induction passage at a position downstream of the throttle valve when the said throttle valve is in the idling position is so controlled by operation of the throttle valve that the supply of air through said further passage to the induction passage downstream of the throttle valve ceases when the said throttle valve has passed through a small range of movement in the opening direction from said idling position.

In one arrangement according to the invention, said further passage opens into the said induction passage at a position adjacent the edge of the throttle valve which moves away from the mixing chamber as the said throttle valve moves from its idling position, the said position of the passage opening being such that, when the throttle valve is in the idling position the said passage opening is on the downstream side of the throttle valve, the edge of the throttle valve passing across the said opening during a small range of movement from said idling position.

Preferably, the edge of the throttle valve is transferred from a position upstream of the passage opening to a position downstream thereof during an angular movement of the throttle valve such that the change in total air flow through the carburetor does not exceed one pound per minute.

The passage opening may be a circumferentially extending slot or a circumferentially extending row of holes so that, for a given area of the passage opening, the movement of the throttle valve edge necessary for said edge to pass across the passage opening is relatively small.

Preferably, the slot or series of holes has a length such that it subtends an angle of not more than 6° at the center of the induction passage.

In another arrangement according to the invention, said further passage is controlled by a normally open valve closed by operation of the throttle valve to move it from its idling position.

The normally open valve may be coupled mechanically to linkage means for operating the throttle valve or may be closed by a solenoid energized by operation of the throttle valve to move it from the idling position.

The normally open valve may be a rotary valve or a needle valve.

Adjustable flow controlling means may be provided in said further passage, and said means may comprise a fixed flow restricting device and a variable flow restricting device arranged in parallel.

Some embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. **1** is a partial longitudinal section of one form of carburetor embodying the invention;

FIG. **2** is a section on the line **2 — 2** of FIG. **1**;

FIG. **3** is a section similar to FIG. **2** but showing a modification;

FIG. **4** is a partial longitudinal section, similar to FIG. **1**, showing another embodiment of the invention;

FIG. **5** shows a detail modification of the embodiment shown in FIG. **4**; and

FIG. **6** is a partial longitudinal section, similar to FIG. **1**, showing another embodiment of the invention.

Referring to FIG. **1** of the drawings part of the body of a carburetor of the constant depression type is shown at **10**, the induction passage of the carburetor, which is shown at **11**, having its inlet end at **12** and its outlet end, which is adapted to be connected through an inlet manifold (not shown) to the inlet ports of an internal combustion engine, at **13**.

A butterfly type throttle valve **14** mounted in the induction passage **11** adjacent its outlet end **13** is carried by a pivot shaft **15** arranged to be rotated by an operator through a mechanical linkage (not shown) to open and close the said throttle valve.

Intermediate the ends of the induction passage **11** there is provided a bridge **16** and an air valve slide **17** movable transversely across the induction passage **11**. The air valve slide **17** co-operates with the bridge **16** to provide a variable throat at **18**, the slide **17** being controlled in the usual manner by differential air pressure acting, in a housing (not shown) on opposite sides of a piston or diaphragm connected to the slide, in such a way that depression in the part of the induction passage between the air valve slide **17** and the throttle valve **14**, hereinafter called the mixing chamber **19**, tends to cause movement of the slide away from the bridge and increase the area of the throat thereby maintaining the depression in the said mixing chamber **19** substantially constant.

A fuel supply orifice **21** opens into the bridge surface and is connected to a float chamber (not shown) containing fuel which is maintained at a constant level by a float-controlled valve, and a profiled needle **22**, carried by the air valve slide **17**, varies the effective area of the orifice **21** according to the position of the air valve.

The carburetor, as so far described, is conventional in construction and no further description of the parts referred to, or their operation, is deemed necessary.

A longitudinal passage **23** formed in the carburetor body **10**, and closed by a plug **24** at its end adjacent the outlet end **13** of the induction passage, is connected at **25** to the induction passage **11** at a position such that when the throttle valve is in the idling position, as shown in FIG. **1**, the connection is on the downstream side of the edge of the throttle valve **14** at the position, on a diameter of the throttle valve normal to its pivotal axis, where the said throttle valve moves away from the air valve during its opening movement, so that a very small opening movement of the throttle valve causes its edge to move across the connection and bring the latter to the upstream side of the said throttle valve. The connection at **25** may be a circumferentially extending slot **26** as shown in FIG. 2, or a circumferential row of holes **27** as shown in FIG. 3, the slot or row of holes preferably subtending an angle of not more than 6° at the axis of the induction passage.

The longitudinal passage **23**, at its end remote from the plug **24**, meets a transverse passage **28** opening into a flat external surface **29** on the body **10** into which also opens a passage **31** leading from the induction passage upstream of the air valve, and a flow restricting unit **32** is secured against the said flat external surface **29**. A first passage **33** in the unit **32** connects with the passage **31**, a second passage **34** in the unit **32**, parallel to the passage **33**, is closed at one end and connected at the other end by a passage **35** to the passage **33**, and a further passage **36** connecting the passages **33** and **34** is connected intermediate its ends by a passage **37** to the passage **28**.

A screw plug **38** mounted in a screw-threaded bore aligned with the passage **35** has a tapered end **39** seating in the passage **35** and is formed with intersecting bores **41, 42** providing a fixed flow restriction between the passages **33** and **34**, and a second screw plug **43**, mounted in a screw-threaded bore **44** aligned with the passage **36**, has tapered portions **45** and **46** cooperating respectively with the parts of the passage **36** on opposite sides of the passage **37** to provide a variable restriction of flow between the passages **34** and **37**. Thus the actual rate of flow of air through the passages **31, 23** can be approximately determined by selecting the area of the passages **41, 42** in the plug **38**, and can be slightly varied in either the increasing or the decreasing senses by moving the plug **43** in or out.

In the arrangement shown in FIG. **4** of the drawings, the passage **23**, instead of being a passage open at all times to the induction passage and traversed by the edge of the throttle valve **14** as the latter opens, has its opening to the induction passage spaced some distance downstream of the throttle valve, at **44*a***. A rotary valve plug **45*a***, having an L-shaped passage **46*a*** therein, is attached to an arm **47** connected by a link **48** to a throttle valve operating arm **49** connected to a throttle control linkage (not shown) the arrangement being such that, when the throttle valve **14** is in the idling position, as shown, the passage **46*a*** in the valve plug connects the passage **23** to the opening **44*a***, but a small opening movement of the throttle valve rotates the plug **45*a*** to bring the passage **46*a*** out of register with the passage **23** and opening **44*a***, thus shutting off the supply of air to the induction passage through the passage **23**.

FIG. **5** shows an arrangement similar to that of FIG. **4**, but in which the valve plug **45*a*** is formed with a slot **51** instead of a passage **46*a***.

In the arrangement shown in FIG. **6** of the drawings, the passage **23** leads into a passage **52** opening into the induction passage **11** downstream of the throttle valve **14**, the passage **52** being formed with a seating **53** for a needle valve **54** acted on by a solenoid **55** which, when energized, causes the needle valve to engage the seat. A normally open electric switch **56** is operated by an arm **57** fixed to the throttle valve spindle **15** so as to be closed when the throttle valve is moved slightly from the idling position, completing a circuit through the solenoid **55** and a battery **58** to energize the solenoid and so seat the needle valve **54**.

Apart from the provision of the valves to close the connection between the passages **23** and the induction passages **11** the arrangements shown in FIGS. **4, 5** and **6** are substantially identical with that shown in FIG. **1**.

Since, in all the embodiments of the invention described, the influence of the extra air supply is restricted to the idling condition and the condition close to idling, the said extra air supply does not interfere with the main metering characteristics of the carburetor.

The plug **43** of the flow restricting unit, or a further flow restricting device in the extra air supply passage, may be controlled by an aneroid capsule or other altitude sensing device to provide automatic fuel/air mixture compensation for changes of altitude at idling speeds.

The provision of an extra air supply passage according to the invention may obviate the need for other adjustments to control idling, such as adjustments of the relative positions of the fuel orifice and profiled needle for a given position of the air valve.

The air flow in the extra air supply passage may be used to provide a signal to operate a pneumatic ignition retarding capsule of known type.

I claim:

1. A carburetor comprising a body defining a first induction passage having an upstream end and a downstream end, a throttle valve of the pivoted flat type, including means for pivoting the same in said induction passage, said throttle valve having an idling position in which it is substantially closed, an air valve in said induction passage, said air valve cooperating with a wall of said induction passage to define a throat between said throttle valve and the upstream end of said induction passage, said throttle valve and said air valve defining between them a mixing chamber in said induction passage, means for supplying fuel to said throat, a second passage connected to said induction passage, said second passage being connected, at one end, only to the upstream end of said induction passage and upstream of said air valve and, at the other end, on the downstream side of said throttle valve when said throttle valve is in the idling position so that suction in said induction passage, when the throttle valve is in the idling position, creates air flow through said second passage, means including at least a part of said throttle valve responsive to the initial opening of said throttle valve from the idling position for eliminating the air flow creating suction in said second passage, and an adjustable flow controlling means provided in said second passage for controlling the flow of air, said adjustable flow controlling means including a fixed flow restricting device and a first variable flow restricting device in series with one another and in parallel with a second variable flow restricting device.

2. A carburetor according to claim **1** wherein the edge of said throttle valve is transferred from a position upstream of the other end of said second passage to a position downstream thereof during an angular movement of said throttle valve such that the change in total air flow through the carburetor does not exceed one pound per minute.

3. A carburetor according to claim **1** wherein the passage opening at said other end comprises a circumferentially extending slot.

4. A carburetor according to claim **1** wherein the passage opening at said other end comprises a circumferentially extending row of holes.

5. A carburetor according to claim **1** wherein said other end comprises an opening having a length such that it subtends an angle of not more than 6° at the center of the induction passage.

6. A carburetor as claimed in claim **1** in which said second passage opens into said induction passage at a position on a diameter of said throttle valve normal to the axis of said throttle valve where the edge of said throttle valve moves, as said valve opens, towards the downstream end of said induction passage, and in which said second passage is open to said induction passage at a position which is immediately downstream of said throttle valve edge when said throttle valve is in the idling position, said latter position comprising said eliminating means.

7. A carburetor as claimed in claim **1** in which said eliminating means comprises a shut-off valve provided in said second passage, operating means for opening and closing said shut-off valve, a control device connected to said throttle valve and means linking said throttle valve control device and said operating means, said control device causing said operating means to open said shut-off valve when said throttle valve is in the idling position and to close said shut-off valve during initial opening of said throttle valve from the idling position.

8. A carburetor according to claim **7** wherein said control device includes a throttle valve operating arm and said shut-off valve is coupled mechanically through said operating and linking means to said operating arm.

9. A carburetor according to claim **8**, wherein said shut off valve is a rotary valve.

10. A carburetor according to claim **7** wherein said operating means comprises a solenoid energized by movement of said throttle valve and said shut-off valve is electrically connected through said solenoid to said control device.

11. A carburetor according to claim **10**, wherein said shut off valve is a needle valve.

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