United States Patent [19]

Mick

[11] **3,841,281**

[45] **Oct. 15, 1974**

[54] **CARBURETOR**

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[73] Assignee: **General Motors Corporation,** Detroit, Mich.

[22] Filed: **Mar. 21, 1973**

[21] Appl. No.: **343,563**

[52] **U.S. Cl.** ..... **123/97 B,** 123/DIG. 11, 261/50 A, 261/44 R

[51] **Int. Cl.** **F02m 7/12,** F02d 9/00

[58] **Field of Search** ..... 123/97 B, DIG. 11, 124 B; 261/DIG. 19, 50 A, 44 R

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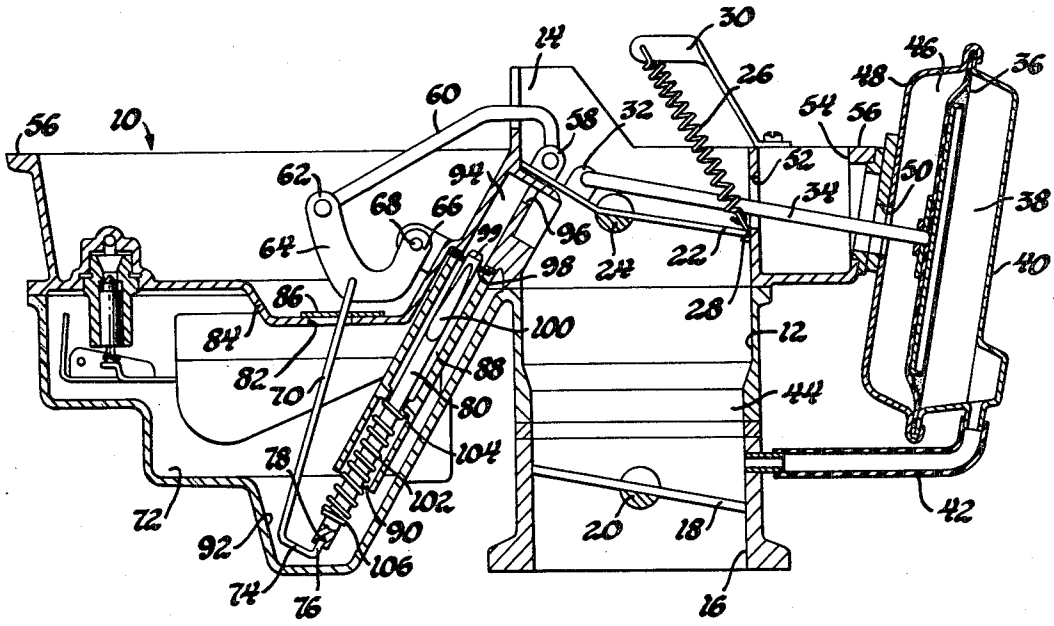
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Primary Examiner—Manuel A. Antonakas
Attorney, Agent, or Firm—C. K. Veenstra

[57] **ABSTRACT**

In an air valve carburetor, an air bleed passage opens into the region of the mixture conduit intermediate the air valve and the throttle and an air bypass passage extends to the mixture conduit below the throttle from the region of the mixture conduit intermediate the air valve and the throttle. A solenoid energized in accordance with engine operating conditions governs the application of pressure signals to a diaphragm which operates valves in each passage to provide anti-dieseling and deceleration control.

3 Claims, 5 Drawing Figures



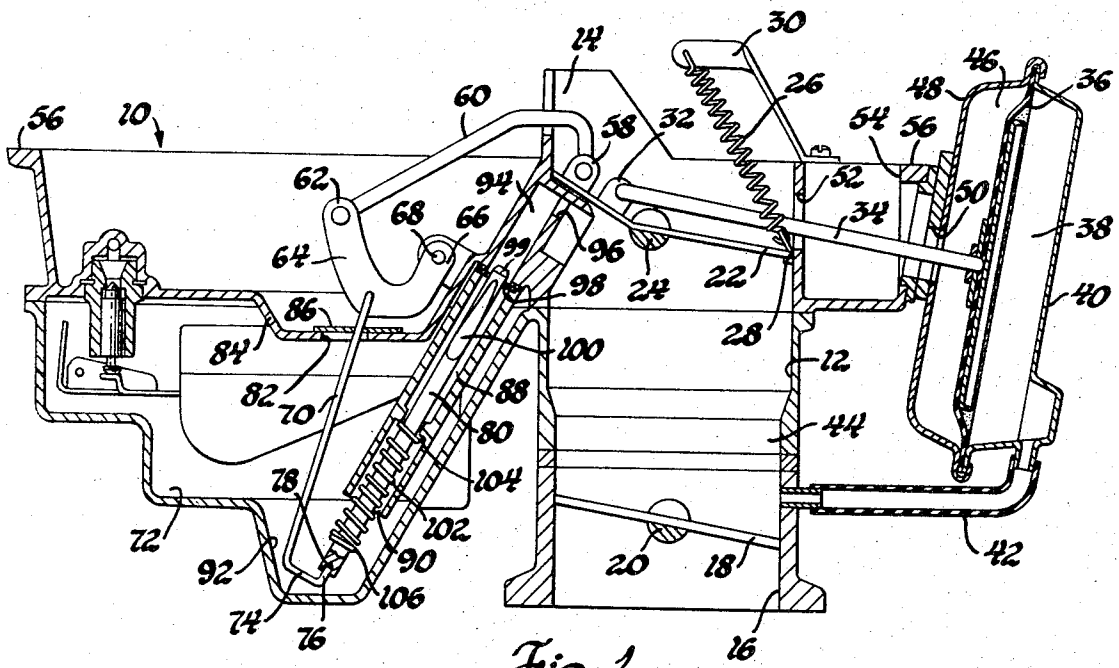


Fig. 1

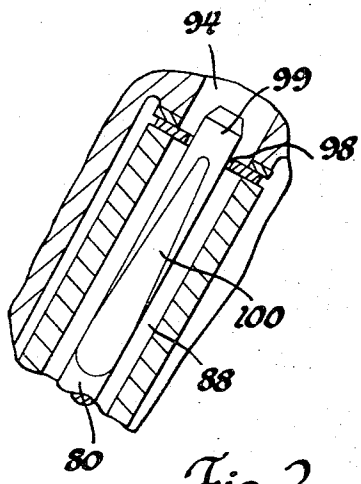


Fig. 2

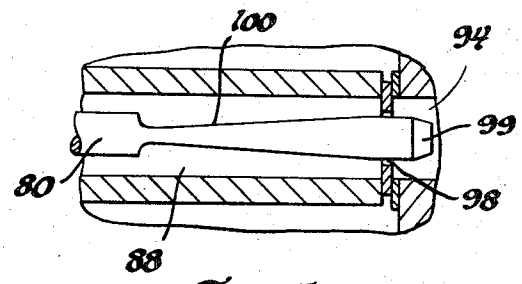


Fig. 3

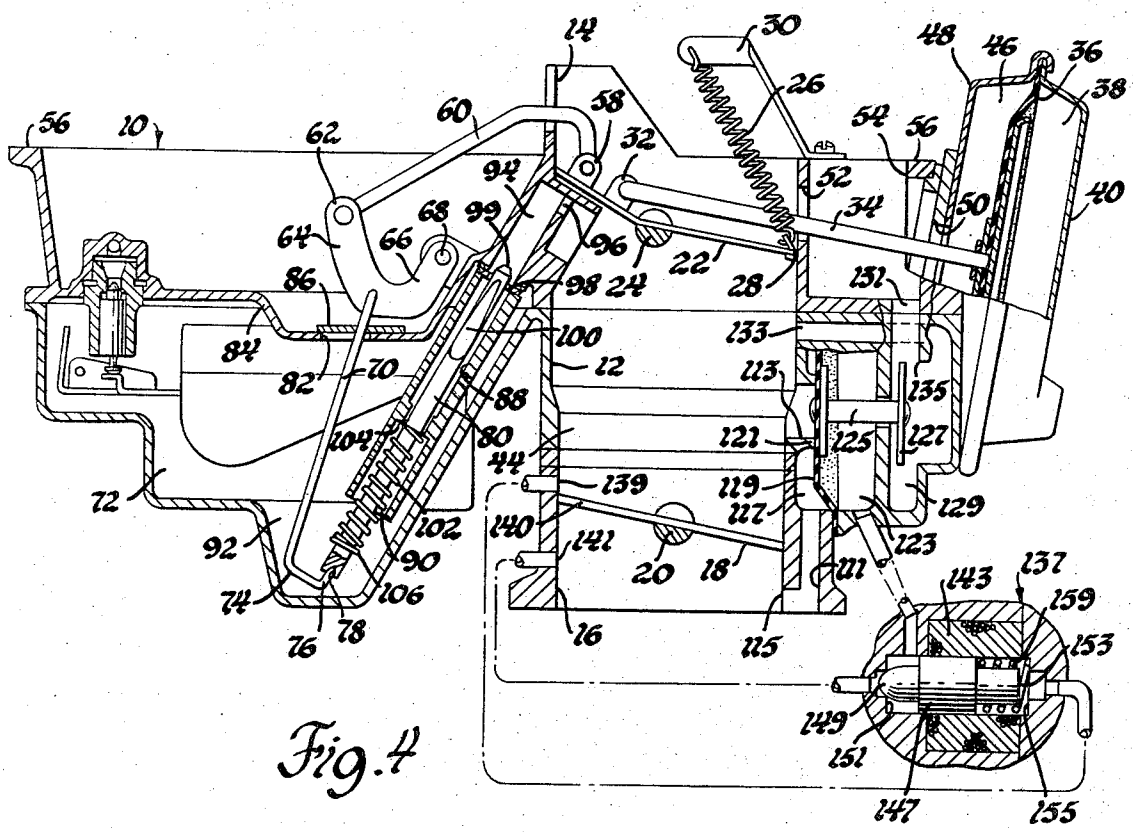

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Fig. 4

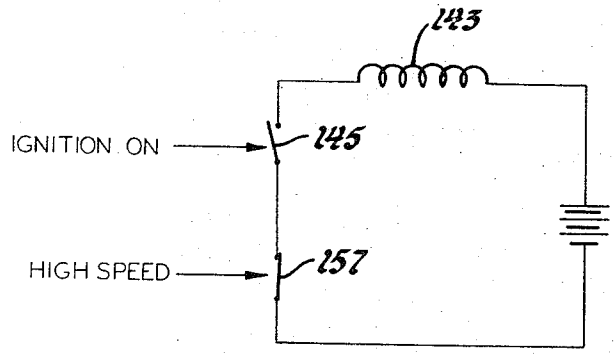

143
IGNITION ON
145
HIGH SPEED
157

Fig. 5

CARBURETOR

This invention relates to internal combustion engine carburetors.

In recent years, it has become common practice to reduce air flow through the carburetor below idle air flow rates when shutting off the ignition to prevent dieseling or afterrun of the engine. In one well recognized embodiment, an idle air passage bypasses the throttle and a solenoid valve closes the bypass passage when the ignition is shut off.

The carburetor disclosed herein is provided with such an idle air bypass passage, and a novel valve structure closes the bypass passage when the ignition is shut off. The novel valve structure includes a diaphragm valve subjected on one side to the pressure in the bypass passage and on the other side to pressures alternatively higher and lower than the bypass passage pressure. During engine operation, a solenoid is energized to apply the lower pressure to the other side of the diaphragm which results in opening of the valve. When the ignition is shut off, the solenoid is deenergized and the higher pressure is applied to the other side of the diaphragm which results in closing of the valve. Use of the solenoid to control only the pressure signals rather than to directly position the valve in the bypass passage permits use of a much smaller, less expensive, solenoid.

It also has been suggested that, during deceleration or coasting at high speeds, provision should be made to reduce the fuel flow — and in some instances the air flow — otherwise provided by the carburetion system.

The carburetor shown herein is of the well-known air valve type which includes an air valve controlled to maintain a substantially constant subatmospheric pressure in a region of the mixture conduit and a metering rod linked to the air valve to control fuel delivery into that region. A novel air bleed passage and valve are controlled to increase the subatmospheric pressure in said region during high speed deceleration and coasting to thereby reduce fuel delivery into the region. Simultaneously, the aforementioned bypass passage is closed to reduce air flow to the engine.

The details as well as other objects and advantages of this invention are set forth in the remainder of the specification and are shown in the drawings in which:

FIG. **1** is a sectional elevational view of the carburetor showing the basic metering linkage;

FIGS. **2** and **3** are enlarged views of the metering rod showing the configuration of the tapered portion;

FIG. **4** is a view similar to FIG. **1** further showing the anti-dieseling and deceleration controls; and

FIG. **5** is a schematic diagram of a circuit for operating the solenoid shown in FIG. **4**.

Referring first to FIG. **1**, the carburetor **10** has a mixture conduit **12** including an air inlet **14** and a mixture outlet **16** which discharges to the engine. A throttle **18** is disposed in mixture outlet **16** in the usual manner on a throttle shaft **20**.

An air valve **22** is disposed in air inlet **14** on an air valve shaft **24**. A spring **26** is hooked over the downstream edge **28** of air valve **22** and extends to a bracket **30** to bias air valve **22** to the position shown.

A tang **32** reaches upwardly from air valve **22** and is connected by a link **34** to a diaphragm **36**. A chamber **38**, formed between the right side of diaphragm **36** and a cover member **40**, is connected by a tube **42** to a region **44** of mixture conduit **12** defined between air valve **22** and throttle **18**.

A chamber **46**, defined between the left side of diaphragm **36** and a cover member **48**, is subjected to substantially atmospheric pressure, present in air inlet **14** and in the air cleaner (not shown), through openings such as **50**, **52** and **54**. (The air cleaner seats on a rim **56** disposed about the upper portion of carburetor **10**.)

In operation, chamber **38** is subjected to the subatmospheric pressure created in region **44** as throttle **18** is opened, and diaphragm **36** acts through link **34** to pull air valve **22** clockwise to an open position. Spring **26** is effective to balance the opening force of diaphragm **36**, thereby creating a substantially constant subatmospheric pressure in region **44**. By thus establishing a generally constant pressure drop across air valve **22**, the area about air valve **22** and thus the rotative position of air valve **22** is determined by and is a measure of the rate of air flow through mixture conduit **12**.

A tab **58** extends upwardly from air valve **22** and is connected through a link **60** to one end **62** of a lever **64**. The opposite end **66** of lever **64** is pivoted about a pin **68**. Intermediate ends **62** and **66**, a hanger **70** extends from lever **64** into the carburetor fuel bowl **72**. The lower end **74** of hanger **70** has a hook **76** which is received in a recess **78** formed in a metering rod **80**.

It may be noted that hanger **70** extends through an opening **82** in the cover **84** for fuel bowl **72**. Opening **82** is closed by a slider **86** which shifts horizontally during movement of hanger **70**.

Metering rod **80** is disposed in a fuel passage **88** having its lower end **90** disposed to receive fuel from a well **92** formed in the bottom of fuel bowl **72**. The upper end **94** of fuel passage **88** has an opening **96** through which fuel is discharged into region **44** of mixture conduit **12**. It will be appreciated, therefore, that the fuel in fuel bowl **72** is subjected to a substantially constant metering head — from the substantially atmospheric pressure in the upper portion of the fuel bowl to the generally constant pressure in region **44**.

A metering jet or orifice **98** is disposed in fuel passage **88** around the tip **99** of metering rod **80**. As best shown in FIGS. **2** and **3**, metering rod **80** has flat tapered surfaces **100** on opposite sides which, upon reciprocation of metering rod **80** in jet **98**, varies the area available for fuel flow through jet **98**.

In operation, as air valve **22** opens by clockwise rotation, link **60** rotates lever **64** in a clockwise direction. Lever **64** then lifts hanger **70** to move metering rod **80** generally upwardly and rightwardly in fuel passage **88**. Thus as air valve **22** is opened to increase the area available for air flow through air inlet **14**, metering rod **80** is shifted to increase the area available for fuel flow through metering orifice **98**. By this means, a substantially constant air-fuel ratio may be maintained — the precise proportion being controlled by the geometry of tapered surfaces **100** and of the linkage between air valve **22** and metering rod **80**.

A spring **102** extends from an annular ledge **104** formed in fuel passage **88** to the lower end **106** of metering rod **80** to take up any slack in the linkage and to load metering rod **80** against jet **98**.

It may be noted from FIG. **3** that the thickness of metering rod **80** increases from the end of surfaces **100** most closely adjacent passage inlet **90** to tip **99**. Tip **99**

is therefore enlarged and assists in discharging fuel from fuel passage **88** as air valve **22** and metering rod **80** are moved to increase air and fuel flow. This offsets the greater inertia of the fuel which otherwise could create a mixture temporarily leaner than desired.

Referring now to FIG. **4**, a passage **111** has an inlet **113** opening from region **44** and an outlet **115** opening into mixture outlet **16** downstream of throttle **18.** Passage **111** includes a chamber **117** closed by a diaphragm **119.** Diaphragm **119** also forms a valve member which cooperates with a valve seat **121** formed in passage **111** adjacent inlet **113.**

The opposite side of diaphragm **119** encloses a chamber **123.** A valve stem **125** extends through chamber **123** to a valve member **127** disposed in an air bleed passage **129.** Bleed passage **129** extends from an inlet **131** exposed to the substantially atmospheric pressure upstream of air valve **22** to an outlet **133** opening into region **44.** Bleed passage **129** includes a valve seat **135** receiving valve member **127.**

It will be noted that the left side of diaphragm **119** is exposed to an effective pressure intermediate the substantially constant slightly subatmospheric pressure in region **44** and the manifold vacuum in mixture outlet **16** below throttle **18.** When the right side of diaphragm **119** is exposed to a higher pressure, diaphragm **119** assumes the position shown — closing bypass passage **111** and opening bleed passage **129.** When the right side of diaphragm **119** is exposed to a lower pressure, diaphragm **119** moves rightwardly — opening bypass passage **111** and closing bleed passage **129.**

A solenoid valve unit **137** alternatively connects chamber **123** to the pressure at a port **139** disposed adjacent and traversed by the upstream edge **140** of throttle **18** and to the manifold vacuum at a port **141** disposed downstream of throttle **18.**

The winding **143** of solenoid valve unit **137** is energized through a switch **145** of (FIG. **5**) when the ignition is turned on. The solenoid plunger **147** is then pulled rightwardly, unseating the plunger valve tip **149** from a valve seat **151** to apply manifold vacuum from port **141** to chamber **123** and, if desired, seating the right end **153** of plunger **147** against a seat **155** to prevent application of pressure from port **139** to chamber **123.** Thus during all low speed operating conditions, the lower pressure of manifold vacuum will cause rightward movement of diaphragm **119** — moving diaphragm **119** away from seat **121** to open bypass passage **111** and engaging valve member **127** with seat **135** to close bleed passage **129.**

When engine or vehicle speed exceeds a certain level, a switch **157** (FIG. **5**) opens to deenergize solenoid winding **143.** Solenoid plunger **147** then moves leftwardly, under the bias of a spring **159,** to engage valve tip **149** with seat **151** and disengage right end **153** from seat **155.** Chamber **123** is then subjected to the pressure at port **139.**

During open throttle operation, the pressure at port **139** is subjstantially the same as that at port **141.** Thus during open throttle operation at either high or low speeds, chamber **123** is subjected to manifold vacuum and, as described above, bypass passage **111** is opened and bleed passage **129** is closed.

When the throttle is closed during high speed operation, as during initial deceleration and during coasting, chamber **123** is subjected to the only slightly subatmospheric pressure in region **44.** Since this is higher than the pressure in bypass passage **111,** diaphragm **119** moves leftwardly — engaging valve seat **121** to close bypass passage **111** and disengaging valve member **127** from valve seat **135** to open bleed passage **129.**

Two effects occur upon this event: First, air flow through bleed passage **129** into region **44** increases the pressure in region **44,** resulting in reduced fuel flow through fuel passage **88** into region **44.** Second, air flow through bypass passage **111** is blocked, resulting in reduced air flow to the engine and increased pressure in region **44** which further reduces fuel flow into region **44.**

When throttle **18** is again opened, or when the speed drops below a selected level and switch **157** again closes to energize solenoid winding **143,** chamber **123** is again subjected to manifold vacuum and normal fuel and air flow is restored.

When the engine ignition is turned off, switch **145** is opened to deenergize solenoid winding **143.** Spring **159** then biases plunger valve tip **149** into engagement with valve seat **151** and chamber **123** is subjected to the pressure at port **139.** Closing of throttle **18,** as is customary when shutting off the ignition, applies the only slightly subatmospheric pressure of region **44** to chamber **123,** forcing diaphragm **119** leftwardly to the position shown. The engagement of diaphragm **119** with valve seat **121** blocks air flow through bypass passage **111,** thus reducing air flow and fuel flow to the engine to prevent dieseling or afterrun.

An additional benefit in preventing dieseling also may be realized by disengagement of valve member **127** from valve seat **135.** The resulting air flow through bleed passage **129** increases the pressure in region **44,** resulting in reduced fuel flow through fuel passage **88.**

It will be appreciated, of course, that the advantages of controlling air flow through bypass passage **111** in the above-described manner and of providing bleed passage **129** and its associated controls may be utilized individually.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. For use with an internal combustion engine, a carburetor comprising a mixture conduit having an air inlet and a mixture outlet, a throttle disposed in said mixture outlet for controlling flow therethrough, an air valve disposed in said air inlet, means controlling said air valve to maintain a substantially constant subatmospheric pressure in said mixture conduit between said air valve and said throttle, a fuel bowl, a fuel passage receiving fuel from said fuel bowl and discharging fuel into said mixture conduit between said air valve and said throttle, an air bleed passage for discharging air at substantially atmospheric pressure into said mixture conduit between said air valve and said throttle, a valve seat formed in said bleed passage, a valve unit engageable with said valve seat to restrict air flow through said bleed pasage, and valve operating means for causing said valve unit to engage said valve seat during open throttle operation and during closed throttle operation at speed below a selected level and for moving said valve unit away from said valve seat during closed throttle operation at speeds above said selected level to thereby permit air to bleed into said mixture conduit between said air valve and said throttle to increase the pressure therein, whereby fuel flow to said mixture

conduit is minimized during closed throttle operation at speeds above said selected level.

2. For use with an internal combustion engine having an ignition system energized when engine operation is desired and deenergized when engine operation is not desired, a carburetor comprising a mixture conduit having an air inlet and a mixture outlet, a throttle disposed in said outlet and rotatable betwen open and closed positions for controlling flow therethrough, an air valve disposed in said inlet, means controlling said air valve to maintain substantially constant subatmospheric pressure in the region of said mixture conduit between said air valve and said throttle, a fuel bowl, a fuel passage receiving fuel from said fuel bowl and discharging fuel into said mixture conduit region, an air bleed passage for discharging air at substantially atmospheric pressure into said mixture conduit region, an air bypass passage extending from said region to said mixture conduit downstream of said throttle, valve means for alternatively restricting air flow through said bleed and bypass passages, a diaphragm positioning said valve means, one side of said diaphragm being subjected to the pressure in said bypass passage, the opposite side of said diaphragm being subjected alternatively to the pressure at a first port in said mixture conduit disposed downstream of said throttle and to the pressure at a second port in said mixture conduit disposed adjacent the upstream edge of said throttle when said throttle is in said closed position and traversed by the upstream edge of said throttle as said throttle is rotated from said closed position, and valve means for subjecting said opposite side of said diaphragm to the pressure at said second port when the ignition system is energized and the engine is running at speeds above a selected value and for subjecting said opposite side of said diaphragm to the pressure at said first port at other times, whereby when said ignition system is deenergized and said throttle is rotated to said closed position said diaphragm will position said valve means to restrict air flow through said bypass passage and to permit unrestricted air flow through said bleed passage and thereby reduce air and fuel flow sufficiently to prevent afterrunning of the engine, whereby when the engine is running at speeds above said selected valve and said throttle is rotated to said closed position said diaphragm will position said valve means to restrict air flow through said bypass passage and to permit unrestricted air flow through said bleed passage and thereby reduce air and fuel flow during engine deceleration, and whereby at other times said diaphragm will position said valve means to restrict air flow through said bleed passage and to permit unrestricted flow through said bypass passage.

3. For use with an internal combustion engine having an ignition system energized when engine operation is desired and deenergized when engine operation is not desired, a carburetor comprising an air induction passage, a throttle disposed in said induction passage for controlling air flow therethrough, an air bypass passage extending from a location in said induction passage upstream of said throttle to a location in said induction passage downstream of said throttle, a valve seat formed in said bypass passage, a diaphragm valve unit engageable with said valve seat to restrict air flow through said bypass passage, said diaphragm valve unit including a diaphragm member having one side subjected to the pressure in said bypass passage and the opposite side alternatively subjected to pressures higher and lower than the pressure in said bypass passage, and means for subjecting said opposite side of said diaphragm to such lower pressure when said ignition system is energized whereby said diaphragm valve member is biased away from said valve seat to permit unrestricted air flow through said bypass passage and for subjecting said opposite side of said diaphragm to such higher pressure when said ignition system is deenergized whereby said diaphragm valve member is biased into engagement with said valve seat to restrict air flow through said bypass passage and thereby reduce the tendency toward afterrunning of the engine.

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