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Gural et al.

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[54] **CARBURETOR**

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

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[52] **U.S. Cl.** ..... **261/39 A**; 261/50 A

[51] **Int. Cl.** **F02m 7/22**

[58] **Field of Search** ..... 261/39 A, 50 A

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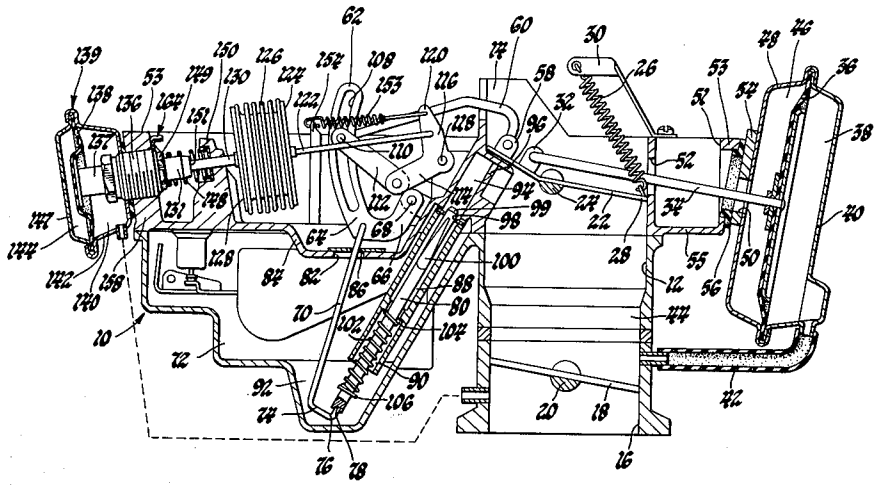
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[57] **ABSTRACT**

In an air valve carburetor, a reciprocable plunger controls the linkage between the air valve and the metering rod to vary the air-fuel ratio. The plunger is positioned by a vacuum unit, and its limits of travel are controlled by stops which are accessible for adjustment only by removing the vacuum unit.

2 Claims, 4 Drawing Figures



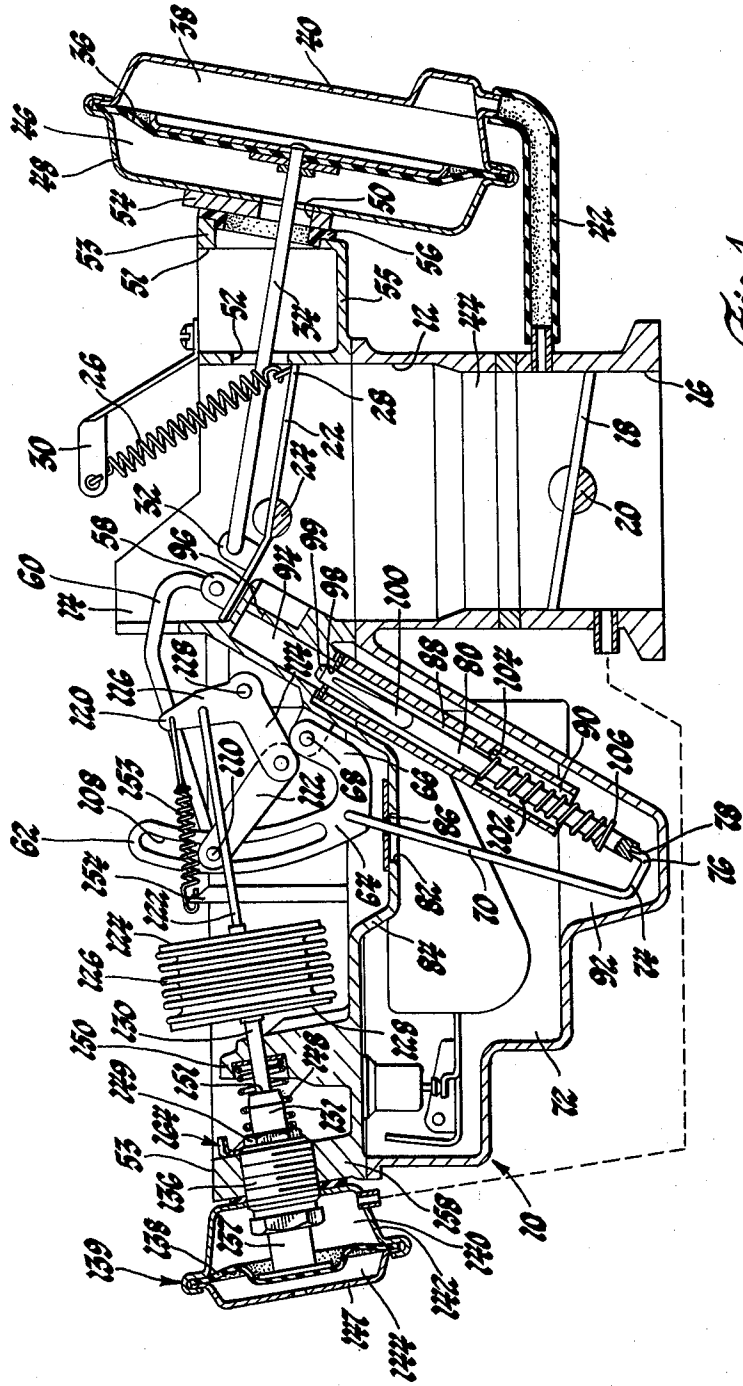


Fig. 1

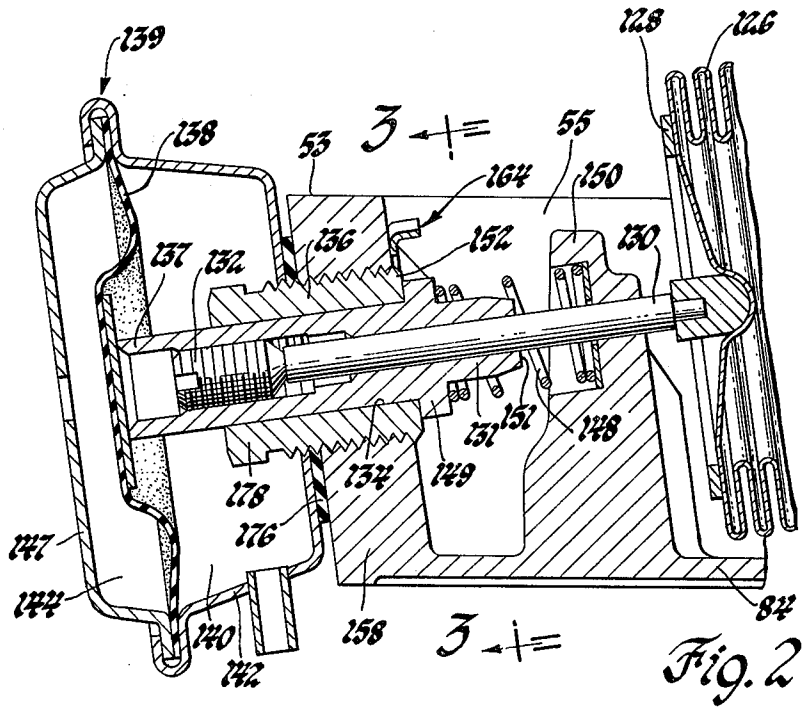


Fig. 2

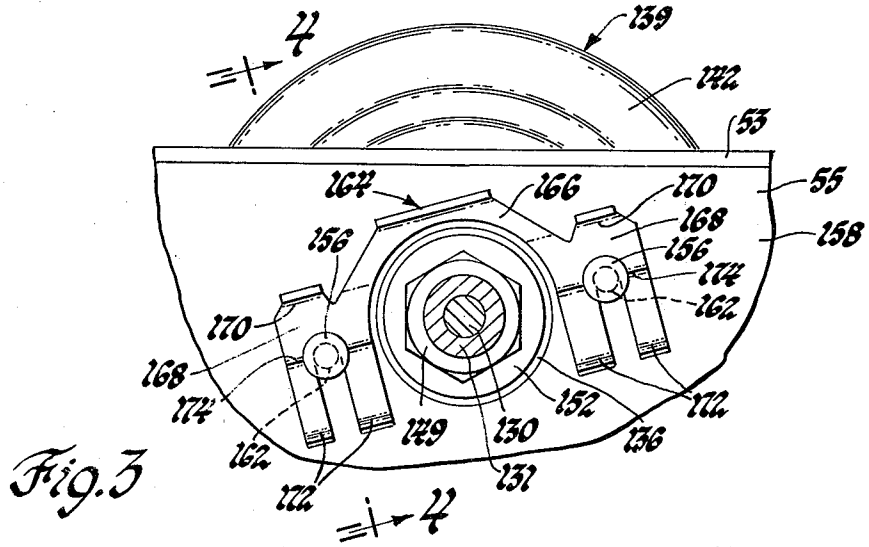


Fig. 3

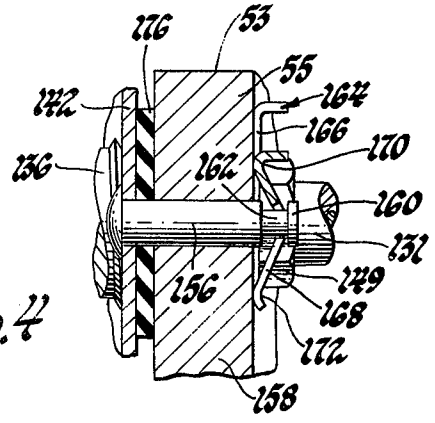


Fig. 4

CARBURETOR

This invention relates to a carburetor for an internal combustion engine and more particularly to such a carburetor having a novel mechanism for adjusting the air-fuel ratio delivered to the engine.

Carburetors are conventionally provided with a manifold vacuum responsive device which limits fuel flow during high vacuum conditions to provide a lean air-fuel mixture for economy operation and which permits increased fuel flow during low vacuum conditions to provide an enriched air-fuel mixture for power operation. In some instances, adjustable stops have been proposed for variably limiting travel of the vacuum responsive device and thereby adjusting the economy and power mixture ratios.

This invention provides a carburetor having a novel mixture ratio adjustment mechanism which variably limits travel of a reciprocable plunger operated by a vacuum unit. In this mechanism, economy and power mixture ratio adjustments are disposed concentrically for compactness and adaptability to computer controlled adjusting mechanisms. Further, the adjustments are accessible only by removing the vacuum unit to inhibit tampering by unqualified personnel. With this invention, therefore, carburetor mixture ratios may be accurately set at the factory and secured against tampering and yet may be easily adjusted by qualified personnel if necessary.

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

FIG. 1 is a sectional elevational view of an air valve carburetor embodying the novel adjustment mechanism;

FIG. 2 is a view of a portion of FIG. 1 enlarged to show details of the mixture ratio adjustments;

FIG. 3 is a view, taken in the direction indicated by line 3—3 of FIG. 2, showing a clip for retaining the vacuum unit, and

FIG. 4 is a sectional view, taken along line 4—4 of FIG. 3, further illustrating the vacuum unit retaining pins and clip.

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 secured to 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 the 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, 51** and **52.** (The air cleaner seats on a rim **53** disposed about the upper portion of carburetor **10.**) Cover member **48** is welded to a bracket **54** which is secured to the air horn **55,** and a grommet **56** is disposed between bracket **54** and air horn **55.**

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 fuel bowl cover portion **84** of air horn **55.** 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.** 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 a 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 that the thickness of metering rod **88** increases from the end of surfaces **100** 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.

A slot **108** is formed in the end **62** of lever **64.** Link **60** is connected to lever **64** by having one end **110** disposed in slot **108.** A link **112** extends from the end **110** of link **60** to arm **114** of a supplementary lever **116** pivoted at **118.** The opposite arm **120** of lever **116** is con-

nected by a link 122 to one end 124 of an aneroid or bellows 126. As shown in enlarged detail in FIG. 2, the opposite end 128 of aneroid 126 is connected to a reciprocable plunger 130 slidingly received in a ferrule 131 and abutting a threaded economy adjusting screw 132 carried ferrule 131. (In some embodiments, plunger 130 and screw 132 may be integral.) Ferrule 131 is guided in the bore 134 of an adjustable power stop 136 and has a tail 137 engaging a diaphragm 138 of a vacuum unit 139.

A chamber 140 defined between the right side of diaphragm 138 and a cover member 142 is subjected to the manifold vacuum in mixture outlet 16 downstream of throttle 18, while a chamber 144 defined between the left side of diaphragm 138 and a cover member 147 is subjected to atmospheric pressure. The resulting rightward bias on diaphragm 138 is resisted by a spring 148 disposed between the head 149 of ferrule 131 and an economy stop 150.

When manifold vacuum increases to a point indicative of a need for a lean or economy air-fuel ratio, diaphragm 138 forces ferrule 131 and plunger 130 rightwardly until the nose 151 of ferrule 131 engages stop 150. This forces aneroid 126 and link 122 rightwardly resulting in clockwise rotation of lever 116. Lever 116 then lifts link 112 to raise the end 110 of link 60 in slot 108 and increase the lever arm defined between link end 110 and pivot pin 68. This reduces the travel of metering rod 80 through metering jet 98 for equivalent opening movement of air valve 22 to provide a lean air-fuel mixture.

When throttle 18 is opened and manifold vacuum drops to a point indicative of the need for an enriched or power air-fuel ratio, spring 148 moves ferrule 131 leftwardly until head 149 engages the face 152 of stop 136. Link 130 is thus freed for leftward movement and a spring 153, entending between end 120 of supplementary lever 116 and a support 154, moves supplementary lever 116 counterclockwise to move link 122, aneroid 126 and plunger 130 leftwardly. Simultaneously, lever 116 pulls link 112 downwardly to lower the end 110 of link 60 in slot 108, thereby resulting in a shorter lever arm defined between link end 110 and pivot pin 68. This increases the travel of metering rod 80 through metering jet 98 for equivalent opening movement of air valve 22 to provide an enriched air-fuel mixture.

Upon a decrease in ambient air pressure or an increase in ambient air temperature, both indicative of a reduction in air density and consequently a reduction in the mass rate of air flow through air inlet 114 for equivalent volume air flow, aneroid 126 expands forcing link 122 rightwardly and causing clockwise rotation of lever 116. Lever 116 moves link 112 to raise the end 110 of link 60 in slot 108 and increase the lever arm defined between link end 110 and pivot pin 68. The increased lever arm reduces the travel of metering rod 80 in metering jet 98 for equivalent movement of air valve 22 to prevent air-fuel mixture enrichment caused by a reduction in air density.

Upon an increase in ambient air pressure or a decrease in ambient air temperature, both indicative of an increase in air density, aneroid 126 contracts. Spring 153 then causes counterclockwise rotation of supplementary lever 116 which pulls link 112 to move link end 110 downwardly in slot 108 and shorten the lever arm defined between end 110 and pivot pin 68. The shortened lever arm increases the travel of metering rod 80 in jet 98 for equivalent movement of air valve 22 to prevent leaning of the air-fuel mixture due to an increase in air density.

As shown in FIGS. 3 and 4, cover member 142 carriers a pair of retaining pins 156 which extend through the wall 158 of carburetor 10. The inner ends 160 of pins 156 have annular grooves 162 which receive a retaining clip 164.

Clip 164 has a central portion 166 which spans ferrule 131 and stop 136 and a pair of bifurcated ends 168 which receive pins 156. As viewed in FIG. 3, each end 168 is bent concavely along lines 170 and 172 and convexly along line 174. When installed, the convexly bent portions 174 of clip 164 bear against the inner ends of 160 of pins 156 while the concavely bent portions 170 and 172 bear against wall 158. This retains vacuum motor 139 on air horn 55 and snugly secures a gasket 176 between cover member 142 and wall 158 to prevent air from leaking into chamber 140. If desired, gasket 176 may include a boot surrounding the head 178 of stop 136 and the tail 137 of ferrule 131. Alternatively, a seal may surround ferrule 131 within stop 136.

It will be noted that adjusting screw 132 and adjustable stop 136 are disposed to inhibit tampering by unqualified personnel. If adjustment of the power or economy mixture ratio is required, retaining clip 164 is pulled upwardly to free retaining pins 156 and vacuum unit 139 is pulled outwardly to expose screw 132 and stop 136.

To adjust the economy air-fuel ratio, a screwdriver is inserted in ferrule 131 to engage adjusting screw 132 and sufficient axial force applied to overcome the bias of spring 148 and engage nose 151 with stop 150. Screw 132 is then turned to move plunger 130 rightwardly against the bias of spring 153 for a leaner economy air-fuel mixture or leftwardly for a richer economy air-fuel mixture. Head 149 of ferrule 131 is adapted for retention by a wrench to permit turning of screw 132 within ferrule 131.

To adjust the power air-fuel ratio, head 149 of ferrule 131 is permitted to engage power stop 136. Stop head 178 is then engaged and turned by a wrench to move ferrule 131 and plunger 130 rightwardly against the bias of spring 153 for a leaner power air-fuel mixture or leftwardly for a richer power air-fuel ratio.

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

1. 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 for measuring air flow therethrough, a fuel passage entending to said mixture conduit for supplying fuel thereto, a metering orifice disposed in said fuel passage, a metering rod disposed in said metering orifice for controlling fuel flow therethrough, a lever positioning said metering rod, a link extending from said air valve to said lever for moving said lever and said metering rod to control fuel flow through said metering orifice in accordance with air flow through said air inlet, said lever having a slot receiving said link, and means for varying the position of said link in said slot to vary the travel of said metering rod in said orifice for selected movement of said air valve, said means including a reciprocable plunger connected to said link, a ferrule surrounding said plunger,

said plunger having an adjusting screw received in one end of said ferrule for varying the relative positions of said plunger and said ferrule, a wall, an adjustable stop supported in said wall and surrounding said ferrule, said ferrule having a head engageable with one end of said adjustable stop, spring means biasing said head into engagement with said end of said adjustable stop, stop means engageable with the opposite end of said ferrule for limiting travel of said ferrule away from said adjustable stop against the bias of said spring means, a diaphragm engaging said one end of said ferrule and cover means surrounding said one end of said ferrule and the opposite end of said ferrule for limiting travel of said ferrule away from said adjustable stop against the bias of said spring means, a diaphragm engaging said one end of said ferrule and cover means surrounding said one end of said ferrule and the opposite end of adjustable stop and defining a chamber enclosed by said diaphragm and subjected to the pressure in said mixture conduit downstream of said throttle, whereby when said pressure is below a selected level said diaphragm may displace said ferrule and said plunger against the bias of said spring means to engage said ferrule with said stop means and to move said link in said slot to provide an enriched air-fuel mixture, whereby when said pressure is above said selected level said spring means may displace said ferrule, said diaphragm and said plunger to engage said ferrule head with said adjustable stop and to move said link in said slot to provide a lean air-fuel mixture, and whereby said air-fuel mixtures may be adjusted by removing said cover means and said diaphragm to expose said one end of said ferrule and said opposite end of said adjustable stop, by adjusting the position of said adjusting screw relative to said ferrule, and by adjusting the position of said adjustable stop relative to said wall.

2. 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 for measuring air flow therethrough, a fuel passage extending to said mixture conduit for supplying fuel thereto, a metering orifice disposed in said fuel passage, a metering rod disposed in said metering orifice for controlling fuel flow therethrough, a lever positioning said metering rod, a link extending from said air valve to said lever for moving said lever and said metering rod to control fuel flow through said metering orifice in accordance with air flow through said air inlet, said lever having a slot receiving said link, and means for varying the position of said link in said slot to vary the travel of said metering rod in said orifice for selected movement of said air valve, said means including a reciprocable plunger connected to said link, a ferrule surrounding said plunger, said plunger having an adjusting screw received in one end of said ferrule for varying the relative positions of said plunger and said ferrule, a wall, an adjustable stop supported in said wall and surrounding said ferrule, said ferrule having a head engageable with one end of said adjustable stop, spring means biasing said head into engagement with said end of said adjustable stop, stop means engageable with the opposite end of said ferrule for limiting travel of said ferrule away from said adjustable stop against the bias of said spring means, a diaphragm engaging said one end of said ferrule, cover means surrounding said one end of said ferrule and the opposite end of said adjustable stop and defining a chamber enclosed by said diaphragm and subjected to the pressure in said mixture conduit downstream of said throttle, said cover means engaging one side of said wall and having a retaining pin extending through said wall, and a retaining clip disposed on the opposite side of said wall and engaging said retaining pin to secure said cover means to said wall, whereby when said pressure is below a selected level said diaphragm may displace said ferrule and said plunger against the bias of said spring means to engage said ferrule with said stop means and to move said link in said slot to provide an enriched air-fuel mixture, whereby when said pressure is above said selected level said spring means may displace said ferrule, said diaphragm and said plunger to engage said ferrule head with said adjustable stop to move said link in said slot to provide a lean air-fuel mixture, and whereby said air-fuel mixtures may be adjusted by removing said clip from said pin, by removing said cover means and said diaphragm to expose said one end of said ferrule and said opposite end of said adjustable stop, by adjusting the position of said adjusting screw relative to said ferrule, and by adjusting the position of said adjustable stop relative to said wall.

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