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[54] **CARBURETOR WITH FUEL SHUT-OFF MEANS HAVING A FUEL-AIR RATIO ADJUSTMENT MECHANISM**

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[58] **Field of Search** ....123/97 B, 119 D, 119 DB; 261/DIG. 19

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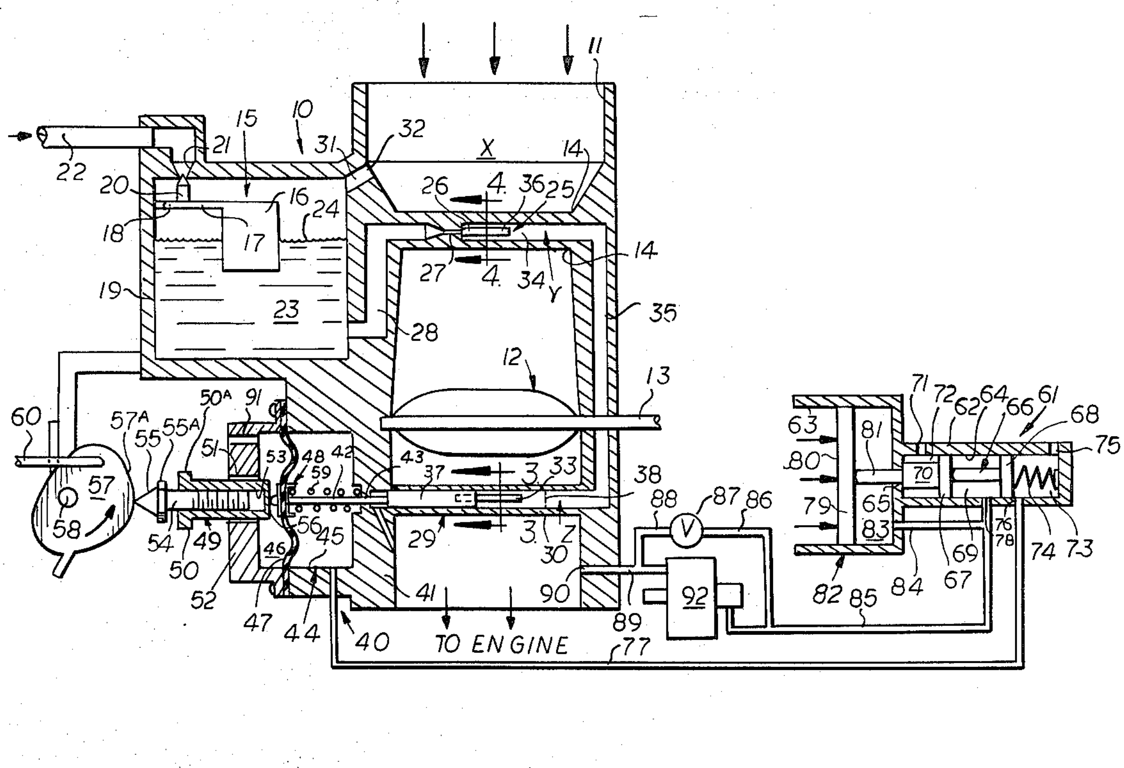
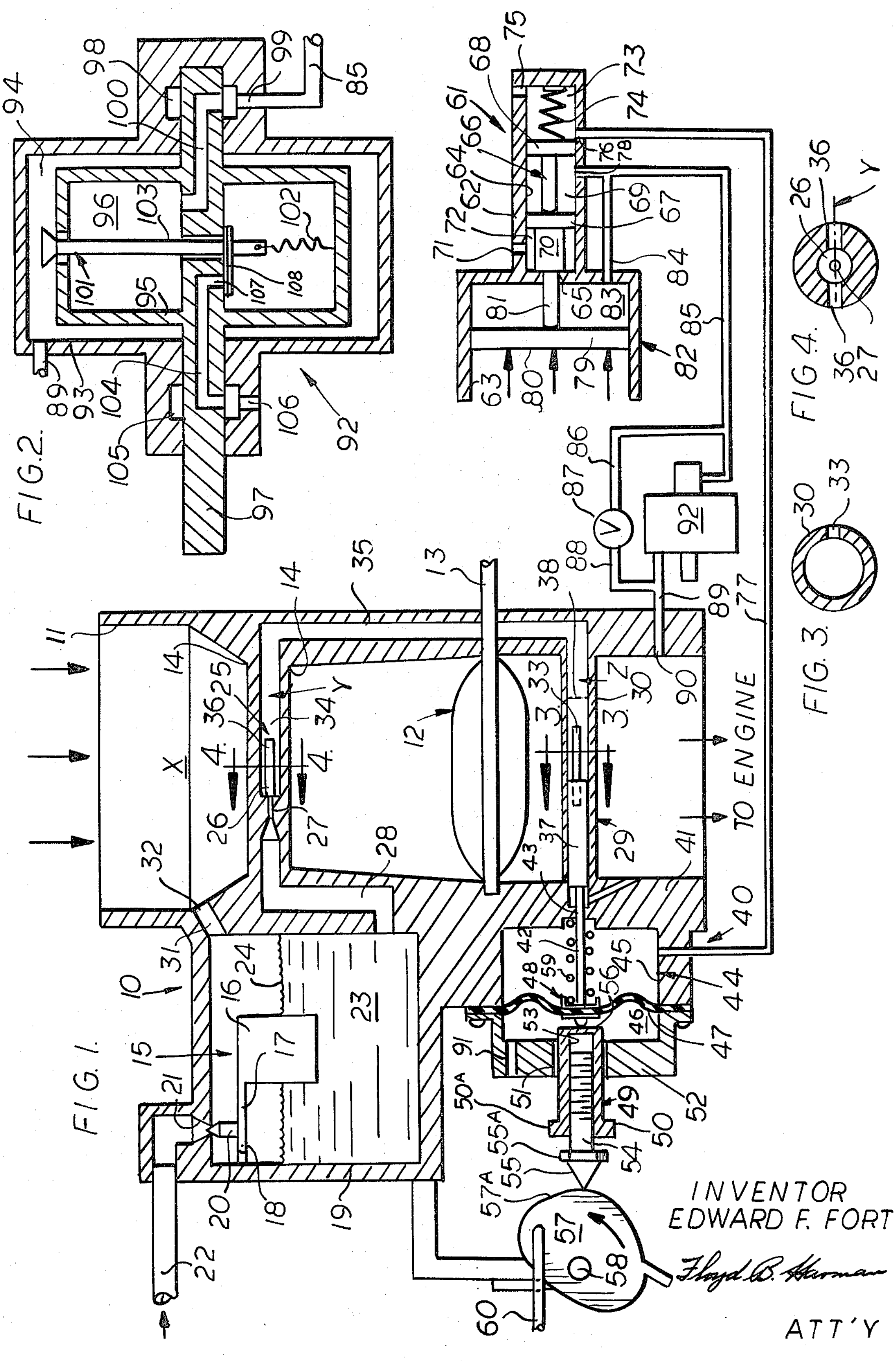
[57] **ABSTRACT**

In a carburetor construction for metering liquid fuel for delivery downstream of the throttle valve to a spark-ignition engine, means are provided for remotely controlling the fuel-to-air ratio including a rapidly operative mechanism for shutting off the fuel source during periods when the engine or vehicle is decelerating toward a predetermined minimum speed value.

12 Claims, 4 Drawing Figures





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CARBURETOR WITH FUEL SHUT-OFF MEANS HAVING A FUEL-AIR RATIO ADJUSTMENT MECHANISM

BACKGROUND OF THE INVENTION

This invention relates to a liquid fuel metering system for a spark-ignition internal combustion engine. More in particular this invention relates to a carburetor construction employing a fluidic device for metering liquid fuel for delivery through nozzle means positioned downstream of the throttle control valve wherein the system singularly is capable of supplying fuel to the engine at a substantially constant fuel-air ratio under normal operating conditions for all loads imposed upon the engine and yet permit the engine to idle under the same system. However, this invention is principally directed to altering, in a favorable direction, the fuel-air ratio delivered when the engine is under abnormal operating conditions and is an improvement upon the carburetor construction described in copending application Ser. No. 806,645 filed on Mar. 12, 1969, now U.S. Pat. No. 3,544,082 and assigned to the same assignee herein, reference there to being had.

A striking advantage of the present invention is that when a vehicle is decelerating with the engine under closed or nearly closed throttle condition, the fuel supply to the engine is completely shut-off but provision is made for smooth restart automatically without attention of the operator. Thus hydrocarbons and products of fuel combustion discharged into the atmosphere during such decelerating periods attendant thereto are eliminated with a corresponding fuel consumption improvement in efficiency. Further, since combustion during decelerating periods is eliminated the engine functions in a manner similar to an air pump which may effectively be utilized in assisting the braking of the vehicle. This is an important feature because there is a considerable difference between the braking drag of an engine wherein the fuel supply is cut-off as compared with the braking drag of an engine wherein fuel is fed to the engine at idling rate for in the latter case there is combustion taking place thus obviously providing some power which appreciably subtracts from the engine's braking drag.

SUMMARY OF THE INVENTION

An important object of the present invention is to provide a fuel shut-off mechanism in a carburetor which is effective during periods when the associated engine or vehicle is decelerating or when such engine is utilized as a brake upon its load.

Another object of the invention is to provide a fuel shut-off mechanism according to the preceding object wherein the device functions to cut off all fuel supply to the engine automatically when the absolute pressure differential between atmospheric pressure and the pressure downstream of the throttle valve exceeds a predetermined limit.

Still another object of the invention is to provide a fuel shut-off mechanism according to the preceding objects wherein the device is precluded from functioning to cut off fuel supply to the engine when the vehicle speed is below a predetermined value.

Yet a further object of the invention is to provide a fuel shut-off mechanism according to the preceding objects wherein the device is externally adjustable for controlling the fuel-to-air ratio delivered to the engine during normal and abnormal engine operating conditions.

Still a further object of the invention is to provide a fuel shut-off mechanism according to the immediate preceding object wherein the device is remotely adjustable for controlling the fuel-air ratio delivered to the engine during normal and abnormal engine operating conditions.

These and other desirable objects inherent in and encompassed by the invention will become more apparent from the ensuing description of a preferred embodiment, the appended claims and the annexed drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side view center section taken through the central portion of a carburetor construction showing the arrangement of the fuel shut-off mechanism of the present invention;

FIG. 2 is a center sectional view, partly broken away, illustrating a rotational speed actuated valve which may optionally be included as a component of the fuel shut-off device of FIG. 1;

FIG. 3 is a slightly enlarged sectional view taken on line 3—3 of FIG. 1 showing a detail of the fuel discharge member component of the present invention; and

FIG. 4 is a slightly enlarged sectional view taken on line 4—4 of FIG. 1 illustrating a detail of the fluidic device employed in the carburetor construction of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 of the drawing the fluidic fuel metering system or carburetor utilized as an environment for the present invention is indicated generally by the numeral **10**. The carburetor **10** includes an air-flow conduit **11** having its upper end in communication with the atmosphere, usually through a conventional air filter (not shown), and its lower end in communication with the cylinders through an intake manifold, of an internal combustion engine (not shown). Air flowing through the conduit **11** is controlled by a conventional throttle valve generally indicated at **12** which is varied by a rotational movement of the throttle valve shaft **13** in a conventional manner.

The conduit **11** includes a restriction or venturi portion **14** which reduces the static pressure of air flowing therethrough to create control signal pressures related to the rate of air flow through the conduit **11** which will be discussed herein more in detail.

The carburetor **10** is provided with a conventional fuel float bowl or float chamber indicated generally at **15**. The chamber **15** includes a float **16** connected to an arm **17** pivotally connected at **18** to a side wall **19** of the carburetor **10**. The arm **17** is provided with a valve element **20** in cooperative alignment with valve seat **21** in a conventional manner. A source of liquid fuel under pressure above atmospheric is connected to pipe **22** whereby liquid fuel is admitted into the float chamber **15** via conduit **22** and valve **20,21** until the amount of fuel **23** in the float chamber **15** reaches a predetermined fuel level **24** as indicated in the drawing. The upper portion of the float chamber **15** communicates with the upper portion of the inlet air-flow conduit **11** through passage **31** having a port **32** opening into the conduit **11** as shown in FIG. **1**.

The carburetor **10** is provided with a fluidic device generally indicated at **25** which includes an interaction zone **26** having a restriction or inlet nozzle **27**, as shown in FIGS. **1** and **4**, in communication with the float chamber **15** through fuel passage **28**. Thus liquid fuel from the float chamber **15** may enter the interaction zone **26** through passage **28** and inlet port or nozzle **27**.

The carburetor **10** is provided with a liquid fuel discharge member indicated generally at **29** extending into the air-flow conduit **11** and positioned below the throttle valve **12**. The discharge member **29** comprises a tubular element **30** having at least one slit or elongated orifice **33** preferably disposed at right angle with reference to the inlet air-flow conduit **11** as shown in FIGS. **1** and **3**. The discharge member **29** communicates with interaction zone **26** of the fluidic device **25** through outlet port **34** and outlet passage **35**. Thus liquid fuel from the float chamber **15** is diverted by the nozzle **27** through the interaction zone **26** into port **34** and thereafter conducted to the discharge orifice **33** through outlet passage **35** and discharge member **29**.

It will be noted that the float chamber **15** is positioned with respect to the fluidic device **25** whereby the fuel level **24** is maintained at or just slightly below the horizontal plane of the nozzle **27**. If the fuel level **24** is above the nozzle **27** liquid fuel from the float chamber **15** will drain into the air-flow conduit

11 during periods when the engine is not operating which would result in loss of fuel and may affect the ability of the engine to start easily. On the other hand, the fuel level 24 should not be substantially below the horizontal plane of nozzle 27 because it would then require an unnecessarily higher pressure difference to cause the liquid fuel to flow through the nozzle 27.

In the drawing it will be observed that the interaction zone 26 of the fluidic device 25 communicates with air-flow conduit 11 through the signal port openings 36 disposed preferably at right angle with respect to the inlet air-flow conduit as indicated in FIGS. 1 and 4. The distance between the nozzle 27 and the signal port opening 36 ideally should be zero. However, practically the distance between the nozzle 27 and pressure signal port opening may be as much as about one-half the total wetted perimeter of the port opening 36. For example a distance of about one-sixteenth inch provides very satisfactory operation. As indicated in FIG. 1, the signal port opening 36 may conveniently be in the form of a slit or elongated aperture which communicates the interaction zone 26 of the fluidic device 25 with the venturi portion 14 of the inlet air-flow conduit 11.

For normal operation of the internal combustion engine served by the carburetor 10 the aggregate cross-sectional area of the orifice 33 in the discharge member 29 is important and should preferably be from one-half to three times the cross-sectional area of the nozzle 27. However, as will be apparent later herein, the present invention includes means for adjusting the magnitude of the cross-sectional opening of orifice 33 not only to obtain the optimum size for normal engine operation but also for abnormal engine operating conditions such as, for example, starting a cold engine and subsequent operation thereof until normal engine temperature is reached.

Referring again to the drawing it will be noted that in the inlet air-flow conduit 11 there are three principal signal pressure regions indicated at X, Y, and Z. The rate of metering of fuel 23 from the float chamber 15 through the fluidic device 25 is a function directly related to the composite or integrated effect of the three absolute pressure magnitudes existing in regions X, Y, and Z during any predetermined operating condition of the engine. The absolute pressure at region X has been found to be slightly below atmospheric pressure and varies only slightly under all engine operating conditions at any given elevation with reference to sea level. The absolute pressure in region Y at the venturi portion 14 of the air-flow conduit 11 reaches its lowest value when the throttle 12 is at its maximum open position (i.e. maximum throttle engine operation) and rises progressively to a maximum value somewhat below the absolute pressure value in region X when the throttle 12 is nearly closed (i.e. operation of the engine at idling condition). The range of absolute pressure values in region Z has the widest variation. During operation of the engine at idling condition the absolute pressure value in region Z is very low, that is to say a pressure value of much lower magnitude than that found in regions X or Y under any engine operating condition. On the other hand, when the throttle 12 is at its wide open position (i.e. engine operating at full load) the absolute pressure value in region Z will be slightly greater than the corresponding pressure value in region Y.

In operation, from the above, it will be apparent that under all engine operating conditions the absolute pressure value in region X will always be greater than at either region Y or region Z. Therefore the air pressure in the float chamber 15 will drive the liquid fuel 23 through the nozzle 27. The nozzle 27 is so positioned that the liquid fuel emanating therefrom is directed toward the outlet port 34 and if the fluidic device is properly arranged all fuel delivered into the conduit 11 will preferably be through the orifice 33 of the discharge member 29 during any engine operating condition. Otherwise at wide open throttle or near wide open throttle engine operating condition some fuel may enter the air-flow conduit 11 through the port opening 36. From this it will be apparent that in general operation no fuel is discharged through port openings 36 but, to the contrary some air may enter these ports 36 and mix with the fuel directed through the outlet passage 35.

The foregoing describes a carburetor construction providing a suitable environment for the invention, now to be explained in detail wherein means are provided for remotely controlling the air-fuel ratio including a rapidly operative mechanism for shutting off the fuel source during periods when the engine speed is decelerating under reduced throttle toward a predetermined speed value. The invention may therefore be considered to be an air-fuel ratio control mechanism capable of regulating the cross-sectional area of the fuel discharge orifice 33 from maximum open position to closed position, as may be desired, with means for automatically closing the fuel discharge orifice 33 when the engine or vehicle is decelerating toward a predetermined minimum speed value or, alternatively, during periods when the engine is being driven by the momentum of its load at a speed above its predetermined minimum speed value such as that which occurs when a vehicle is moving downhill.

Referring to FIG. 1 it will be seen that the spray bar 30 of the fuel discharge member 29 is a tubular structure having one end in communication with the outlet passage 35. Disposed in slidable relation within the spray bar 30 is a movable plunger 37 which is capable of being moved rightwardly in FIG. 1 to an extreme position, indicated by the dotted line 38, which closes communication of the outlet passage 35 with the discharge orifice 33 and leftwardly to an extreme position where the entire discharge orifice 33 is in open communication with outlet passage 35. Thus, it will be apparent that movement of the plunger 37 correspondingly regulates the flow of fuel from the outlet passage 35 into the inlet air-flow conduit 11 through the variable size opening of the discharge orifice 33 thereby correspondingly regulating the air-fuel ratio delivered to the engine. Means for controlling the position of the plunger 37 in respect of the discharge orifice 33 will now be described.

The air-fuel ratio control mechanism of this invention includes an actuator device generally indicated at 40, which may be integral with the carburetor 10 as shown in FIG. 1 or constructed as a separate component suitably secured, as by screws, to the casing 41. The plunger 37 includes a stem 42 which passes through a hole 43 in the casing 41 and projects into a room 44 of the actuator device 40. The room 44 is divided into a chamber 45 and a compartment 46 hermetically sealed from each other by a flexible diaphragm 47. The stem 42 extends through the diaphragm 47, by conventional clamping seal indicated at 48, and abuts a bushing assembly indicated at 49. The bushing assembly 49 comprises a bushing 50 journaled for slidable movement through bore 51 in the wall 52 of the actuator device 40 as may be evident from FIG. 1. The bushing 50 is provided with a cylindrical recess 53 having internal threads therein. Threadedly fit within the recess 53 is a pin 54 having a head 55 forming a cam follower. The leftward end of the bushing 50 may be formed into a hexagonal head 50*a* suitable for wrench-engaging means. Likewise the head 55 of the pin 54 may be provided with a hexagonal-shaped portion 55*a* also suitable for wrench-engaging means. Thus it will be apparent that by relative rotational movement between the pin 54 and bushing 50 the distance between the abutment 56 of the bushing 50 relative to the cam follower 55 is adjustable. Suitable locknuts or other conventional means (not shown) may be employed to lock the pin 54 from rotational movement with reference to the bushing 50.

A convenient means for engaging the cam follower 55 for adjustably moving the bushing assembly 49 and its abutment 56 may comprise a cam 57 mounted for rotational movement on a shaft 58. A compression spring 59 anchored on the casing 41 and seated on the clamping seal 48 urges the plunger 37 and bushing assembly 49 leftwardly as viewed in FIG. 1 so that the cam follower 55 is urged against the cam lobe 57*a*. The cam 57 is moved rotatively about the axis of its shaft 58 either by applying sufficient torque to the shaft 58 or by appropriate movement remotely of lever 60 connected to the cam 57. Thus it will be apparent that by proper selection of the curvature of cam lobe **57***a* the position of the plunger **37** with reference to the elongated orifice **33** varies correspondingly the size of the opening **33** for discharging fuel into the inlet air-flow conduit. From this it will be apparent that the air-fuel ratio may be selectively altered such as for starting and operating a cold engine or changing the air-fuel ratio corresponding to variations in atmospheric pressure such as that which occurs by reason of changes in altitude.

From the foregoing it will be seen that the bushing assembly **49** and its associated cam **57** provides an operative adjustable stop means for limiting the leftward movement of the plunger **37** as viewed in FIG. **1** and thereby controlling the size of the discharge orifice. It will be obvious to those skilled in the art that an ordinary bolt threadedly fit into bore **51** could be substituted for the bushing assembly **49** and cam **57** thereby providing a stationary abutment **56** thus fixing the maximum size of the discharge orifice **33**.

Means will now be described for energizing the actuator device **40** wherein the plunger **37** is moved rightwardly to its extreme position wherein the discharge orifice **33** is closed and thus no fuel is discharged into the inlet air-flow conduit **11** from the outlet passage **35**. Broadly speaking, this entails communicating the inlet air-flow conduit **11** at signal pressure region Z (downstream of the throttle valve **12**) with chamber **45** during periods of engine operation when fuel cut-off is desired.

The actuator device **40** may be operated by means such as a pressure sensing valve indicated generally at **61** in FIG. **1**. The valve means **61** may comprise a valve housing **62** having axially aligned bores **63**, **64** and **65** as shown in FIG. **1**. Disposed in the bore **64** for axial movement therein is a valve spool indicated generally at **66**. Valve spool **66** is provided with lands **67**, **68** forming a circumferential groove **69** therebetween. Extending leftwardly from the land **67** the valve spool **66** is provided with a shoulder **70** which serves to limit the leftward movement of the spool **66**. Vent **71** in the valve housing **62** is provided to vent the formed compartment **72**.

Disposed in compartment **73** formed in bore **64** rightwardly of land **68** is a compression spring **74** which urges the valve spool **66** leftwardly to abut the shoulder **70** against the valve housing **62** as is evident from FIG. **1**. Vent **75** in the valve housing **62** is provided to vent the compartment **73**. Port **76** communicates with chamber **45** of actuator device **40** through pipe **77**. Port **78** in the valve housing **62** is positioned for continuous communication with circumferential groove **69** irrespective of the axial position of the valve spool **66** in the bore **64**.

In order to actuate axial movement of the valve spool **66** against the urging of spring **74**, the valve means **61** includes a cylinder indicated at **82**. Disposed within the bore **63** of cylinder **82** in slidable relation is a piston **79** having the face **80** thereof exposed to the atmosphere as shown in FIG. **1**. Piston **79** includes a piston rod **81** slidably disposed in the bore **65** which rod may be, but not necessarily, integral with shoulder **70** of the valve spool **66**. The piston **79** in the bore **63** of the housing **62** forms a cylinder cavity **83** communicatively connected to port **78** through pipes **84** and **85**. Pipe **85** communicates with signal pressure region Z of carburetor **10** through pipe **86**, shut-off valve (in open position) **87**, pipes **88** and **89** and port **90** positioned in casing **41** downstream of the throttle valve **12**.

In the arrangement just described it will be seen that when the throttle valve **12** is open to a degree such as that which occurs when the engine is driving a load, the absolute pressure value (i.e. a vacuum) in the cavity **83** of the pressure sensitive valve means **61** will be substantially equal to the absolute pressure value of the signal pressure region Z but the pressure differential then existing between cavity **83** and the atmosphere will be insufficient to move the piston **79** against the urging of the spring **74**. Thus the valve spool **66** of the valve means **61** will remain in the position shown in FIG. **1** and the chamber **45** of the actuator device **40** is in communication with the atmosphere through pipe **77**, port **76**, compartment **73** and vent **75**. Under such operating condition the position of the plunger **37** with reference to the discharge orifice **33** remains under control through manual (or otherwise) operation of the cam **57**.

When the throttle valve **12** is substantially closed, and the engine speed is near that which occurs when the engine is permitted to idle under a no-load idling condition, the absolute pressure in the signal pressure region Z communicated to the cavity **83** of the valve means **61** reaches a relatively low value. However, this value is still such that atmospheric pressure on the face **80** of the piston **79** will be insufficient to move the piston **79** such that the land **68** of the valve spool **66** will move toward port **76**. Thus when the engine idles normally the chamber **45** of the actuator device **40** is not yet in communication with signal pressure region Z and therefore the position of the plunger **37** with reference to the discharge orifice **33** remains under control through operation of the cam **57**. From this it will be apparent that the size of the piston **79** and the characteristics of the spring **74** should be chosen such that the absolute pressure value in the signal pressure region Z during normal engine idling is barely high enough so that the valve spool **66** will not move sufficiently to communicate port **76** with circumferential groove **69**.

When the speed of the engine is elevated under no-load or low load and the throttle **12** is moved into idling position the absolute pressure in the pressure region Z drops to values below the above described normal values because the engine is being driven principally by its own momentum or kinetic energy until its speed reduces or approaches idling speed. A similar drop in the absolute pressure in the pressure region Z occurs also when the throttle **12** is moved substantially to idle position during periods when the engine is being driven by the kinetic energy of its load such as that which occurs when an engine driven vehicle is moving downhill while in gear. Under either of these conditions the resulting absolute pressure value in the pressure region Z being lower than the value obtained under normal engine idling or power producing conditions creates a differential pressure between cavity **83** and the atmosphere so that the piston **79** moves the valve spool **66** rightwardly such that port **78** communicates with port **76** through circumferential groove **69** thereby communicating the pressure existing in pressure region Z with chamber **45** of the actuator device **40**. The drop in pressure within the chamber **45** permits atmospheric pressure in compartment **46** through vent **91** to overcome spring **59** and drive rightwardly the flexible diaphragm **47**, clamping seal assembly **48**, stem **42** and plunger **37** to the dotted line **38** thereby closing the discharge orifice **33**. Thus all fuel flow is shut off and therefore fuel delivery to the engine is terminated, i.e. zero fuel-air ratio. Under such conditions at least three distinct advantages occur. First, since no fuel is delivered to the engine there can be no combustion and thus the engine functions entirely as a pump. The engine may thus function much more efficiently as a speed retarder than when combustion is permitted to take place if idling air-fuel ratio mixture is delivered to the engine. Second, there is obviously an improved fuel economy. Third, the shutting off of the fuel flow during such periods of operation serves to minimize unwanted engine emissions into the atmosphere.

During periods when the fuel is shut off as above described any air which may have entered into the outlet passage **35** through the apertures **36** will rise thus leaving a column of liquid fuel in the passage **35** which is immediately available for restarting engine combustion. Engine restart commences automatically when the engine speed reduces to some preset value above idling speed at which time the absolute pressure in the signal pressure region Z rises to the restart pressure value. When the pressure in the signal pressure region Z rises to the restart pressure value then the spring **74** of the pressure sensitive valve means overcomes the atmospheric pressure acting on the piston **79** permitting the chamber **45** to re-establish communication with the atmosphere through pipe **77**, port **76**, compartment **73** and vent **75**. Thus the spring **59** moves the plunger **37** with its associated stem **42** and clamping seal assembly **48** back into abutting relation with abutment **56** of the bushing assembly **49** as shown in FIG. **1**. When this occurs the column of liquid fuel (free of air bubbles) in the outlet passage **35** is available for immediate discharge into the inlet air-flow conduit **11** through the fuel discharge orifice **33**. Since the column of liquid fuel in the passage **35** is at that time temporarily free of air bubbles the initial rate of fuel flow through discharge orifice results in a temporarily enriched air-fuel ratio delivered by the carburetor **10** to the engine.

If desired optionally the actuator device **40** may be rendered inoperative to shut off the fuel flow when the vehicle speed is below a predetermined minimum speed by simply interposing a vehicle speed sensitive valve mechanism, indicated generally at **92** in FIGS. **1** and **2**, communicatively connected to pipes **85** and **89** and either closing valve **87** or eliminating valve **87** and associated pipes **86** and **88**. The speed sensitive valve **92** merely communicates pipe **85** with pipe **89** during periods when the speed of the vehicle exceeds a predetermined value thus rendering the actuator device **40** operative and, to the contrary, renders the actuator device **40** inoperative when the vehicle speed is at or below the aforesaid predetermined value. One form of speed sensitive valve mechanism is illustrated in FIG. **2** which will now be described.

In FIG. **2** the mechanism **92** comprises a stationary hollow housing **93** forming a first compartment **94** communicatively connected to signal pressure region Z of the carburetor **10** through pipe **89**. Disposed within the compartment **94** in journaled relation is a hollow rotor **95** forming a second compartment **96** therewithin. The rotor **95** is provided with an externally protruding shaft **97** suitably connected in driven relation with the vehicle such as from the speedometer cable. The housing **93** is provided with an internal circumferential groove **98** communicatively connected to pipe **85** through port **99**. Disposed within the shaft **97** is a passage **100** continuously communicating circumferential groove **98** with the second compartment **96**. Positioned at the periphery of the rotor **95** is a poppet valve assembly indicated generally at **101**. As shown in FIG. **2** the poppet valve **101** is in open position which occurs when the rotor **95** is rotating above a predetermined speed value thereby communicating the first compartment **94** with the second compartment **96** in which case the pipe **85** is in communication with the pipe **89**. Thus the condition exists where the valve means **61** and actuator device **40** is rendered operative as previously described. If the rotational speed of the rotor **95** decreases to a predetermined value then the tension spring **102** will overcome the centrifugal force of the valve body **103** and thus the valve assembly **101** will close. When the valve assembly **101** closes communication between pipe **89** and pipe **85** is terminated. In this condition the valve means **61** is rendered inoperative and the actuator device **40** cannot function to close the discharge orifice **33** in response to the absolute pressure existing in the signal pressure region Z. In order to prevent the possibility of having the chamber **45** under sub-atmospheric pressure when the poppet valve assembly **101** closes a means for automatically venting the chamber **45** to the atmosphere under such condition will now be described.

Disposed within the shaft **97** is a second passage **104** which is in continuous communication with a circumferential groove **105** positioned in the stationary housing **93** as shown in FIG. **2**. The circumferential groove **105** is in communication with the atmosphere through the port **106**. The second passage **104** also communicates with the second compartment **96** through port **107**. The valve body **103** is provided with a valve element **108** positioned such that when the poppet valve assembly **101** is in open position the valve element **108** closes the port **107** thereby precluding communication between the second compartment **96** and the atmosphere when the rotational speed of the valve mechanism **92** is above a predetermined minimum rotational speed value. Under such condition the actuator device **40** is operatively connected to function as hereinbefore described. However, when the speed of the vehicle is below a predetermined value, the poppet valve assembly **101** closes thus terminating communication between pipes **85** and **89** and at the same time opens the valve element **108** thereby venting the second compartment **96** with the atmosphere through port **107**, second passage **104** and port **106**. In the latter condition the chamber **45** is also vented to the atmosphere because the cylinder cavity **83** is thereby vented to the atmosphere and the pressure sensitive valve means **61** will move to the position shown in FIG. **1** which communicates the pipe **77** with the atmosphere through vent **75**. Thus when the speed of the vehicle is below a predetermined value set by the speed sensitive valve mechanism **92** the actuator device **40** is deactivated in which condition fuel is supplied to the engine in an air-fuel ratio consistent with the position of the cam **57**.

Although the invention has been described in considerable detail with particular reference to certain proposed embodiments thereof, variations and modifications may be effected within the spirit and scope of the invention as described hereinabove and as defined in the appended claims.

What is claimed is:

1. For a spark-ignition internal combustion engine carburetor having an air-fuel conduit and a throttle valve positioned therein, a fuel-to-air ratio regulating means, comprising,

a. a fuel discharge member including an elongated, generally tubular bar extending normally with respect to the longitudinal axis of said air-fuel conduit and having fuel discharge orifice means formed therethrough disposed downstream of said throttle valve providing communication between the interior of said tubular bar and said conduit downstream of said throttle valve, substantially all of the liquid fuel required by the engine to said conduit being introduced through said discharge orifice means;

b. a movable element associated with said tubular bar and cooperable with said fuel discharge orifice means, the effective cross sectional area of said orifice means being directly dependent upon the position of said movable element with respect to said tubular bar and continually varying in accordance with movement of the movable element with respect to said tubular bar, said movable element being movable between a closed position wherein communication between the interior of said tubular bar and said conduit is precluded and fully open position wherein a pre-established effective cross sectional area of said discharge orifice means affords maximum communication for the flow of liquid fuel between the interior of said tubular bar and said conduit;

c. biasing means yieldably urging said movable element in one direction toward its fully open position;

d. stop means operatively engageable with said movable element to limit movement of said movable element in said one direction and thereby establish the fully open position of said movable element; and

e. actuating means for moving said movable element toward its fully closed position against the resilient action of said biasing means, said actuating means being responsive to the absolute pressure value in said conduit downstream of said throttle valve and being effective to rapidly move said movable element to its closed position and to maintain such closed position when said absolute pressure value in said conduit downstream of said throttle valve is below a predetermined value, said biasing means being effective to rapidly move said movable element in said one direction and into operative engagement with said stop means when the absolute pressure value in said conduit downstream of said throttle valve rises to a value at least equal to said predetermined value.

2. A fuel-to-air ratio regulating means as set forth in claim **1**, wherein said discharge orifice means is partially defined by an elongated slit formed through the wall of said tubular bar, the longitudinal axis of said slit being substantially parallel to the longitudinal axis of said tubular bar, and said movable element includes a plunger mounted within said tubular bar for sliding movement along the longitudinal axis of said tubular bar.

3. A fuel-to-air regulating means as set forth in claim **2**, wherein said actuating means includes an actuating device operatively connected to said plunger, and passageway means extending and providing communication between said conduit downstream of said throttle valve and said actuating device, and a speed responsive valve mechanism interposed in said passageway means, said valve mechanism being responsive to the rotational speed of the engine and being effective to disrupt communication between said conduit downstream of said throttle valve and said actuating device only when the rotational speed of the engine is at and below a predetermined rotational speed to thereby render the actuating means ineffective to move said movable element toward its fully closed position against the resilient action of said biasing means.

4. A fuel-to-air ratio regulating means as set forth in claim **3**, wherein said movable element includes an elongated stem having one end fixed to one end of said plunger, and said stop means includes an abutment disposed in the path of movement of said stem, the end of said stem opposite the end fixed to said plunger abutting said abutment when said movable element is in its fully open position and thereby limiting movement of said movable element in said one direction.

5. A fuel-to-air ratio regulating means as set forth in claim **1**, further including manually operable adjustment means for said stop means, said adjustment means being manually operable to selectively vary the preestablished effective cross sectional area of said discharge orifice means affording maximum communication for the flow of liquid fuel between the interior of said tubular bar and said conduit when said movable element is in its fully open position.

6. A fuel-to-air ratio regulating means as set forth in claim **5**, wherein said discharge orifice means is partially defined by an elongated slit formed through the wall of said tubular bar, the longitudinal axis of said slit being substantially parallel to the longitudinal axis of said tubular bar, said movable element includes a plunger mounted within said tubular bar for sliding movement along the longitudinal axis of said tubular bar.

7. A fuel-to-air ratio regulating means as set forth in claim **4**, further including manually operable adjustment means for said stop means, said adjustment means being operable to selectively vary the position of said abutment along the path of movement of said plunger with respect to said slit.

8. A fuel-to-air ratio regulating means as set forth in claim **7**, wherein said manually operable adjustment means includes a rotatable cam having a cam surface formed thereon, and a cam follower operatively engaging said cam surface and connected to said abutment for cojoint movement along an axis coincident with the movement axis of said plunger, said cam and cam follower being effective upon rotation of said cam to vary the position of said abutment along the path of movement of said plunger with respect to said slit.

9. A fuel-to-air ratio regulating means as set forth in claim **8**, further including remote control means for rotating said cam remotely of the carburetor.

10. A fuel-to-air ratio regulating means as set forth in claim **1**, further including a liquid fuel reservoir; passageway means extending between and providing fluid communication between said fuel reservoir and said tubular bar; and a fluidic device formed within a section of said passageway means between said fuel reservoir and said tubular bar, said fluidic device being responsive to the absolute pressure magnitudes existing in certain regions of said conduit spaced along the longitudinal axis thereof and being effective to control the fuel flow rate through said passageway means.

11. A fuel-to-air ratio regulating means as set forth in claim **10**, wherein said air-fuel conduit is formed with a reduced-diameter venturi portion upstream of said throttle valve and said fluidic device is disposed within said conduit at said venturi portion, said fluidic device including a wall section of said passageway means partially defining an interaction zone, said fluidic device including a restricted fuel inlet nozzle providing fluid communication between said fuel reservoir and said interaction zone, a signal pressure port for subjecting said interaction zone to the absolute pressure magnitude existing in said conduit at said venturi portion, and an outlet port; said fuel reservoir being subjected to the absolute pressure magnitude existing in said air-fuel conduit upstream of said venturi portion.

12. A fuel-to-air ratio regulating means as set forth in claim **11**, wherein said fluidic device is vertically spaced above said tubular bar, and said passageway means extending between said fluidic device and said tubular bar being capable of serving as means for storing fuel trapped when said movable element is moved to its closed position

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