Oct. 17, 1967 R. W. SUTTON 3,347,536

CARBURETOR

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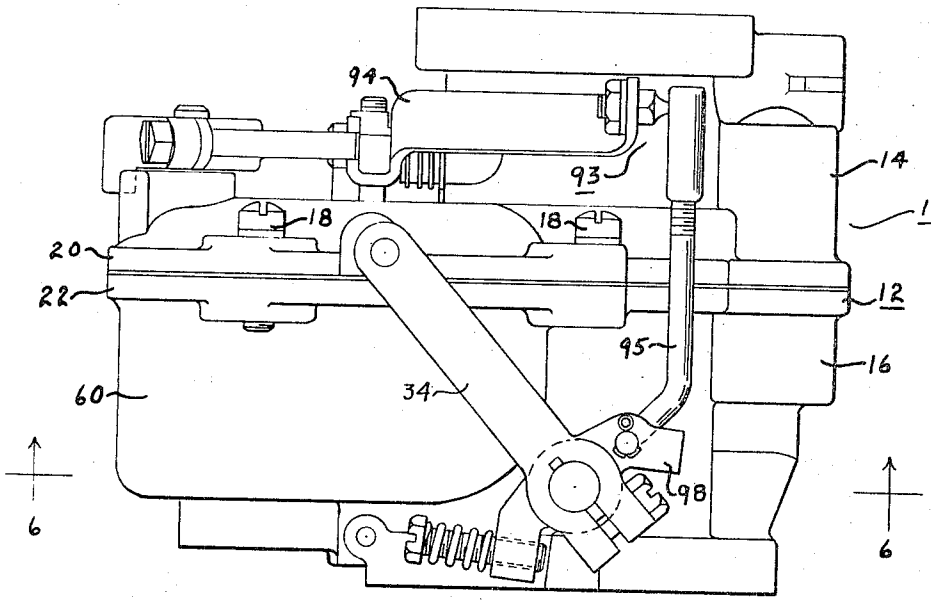


FIG. 1

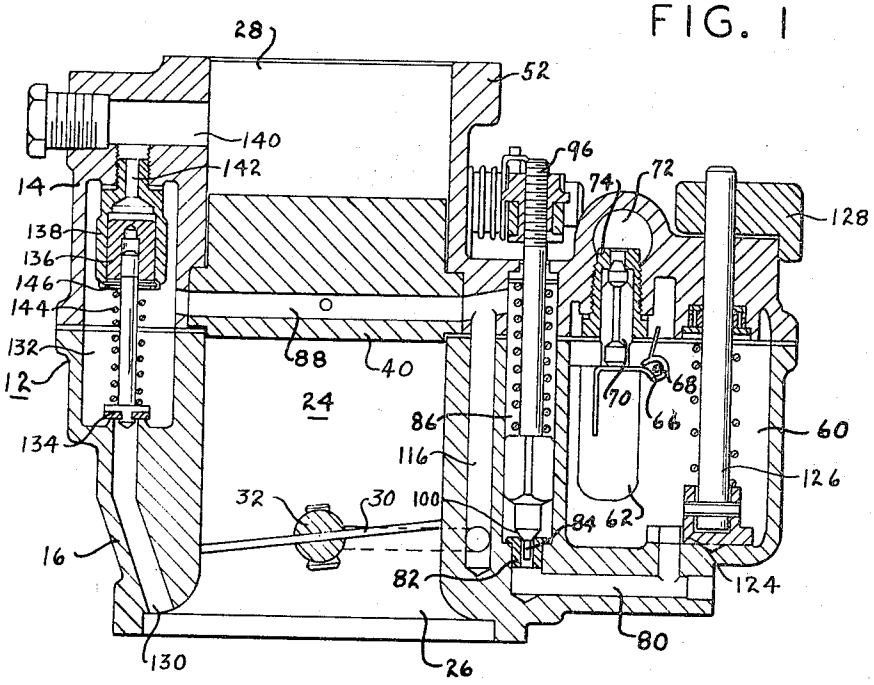


FIG. 3

INVENTOR.
ROBERT W. SUTTON
BY
James L. O'Brien
ATTORNEY

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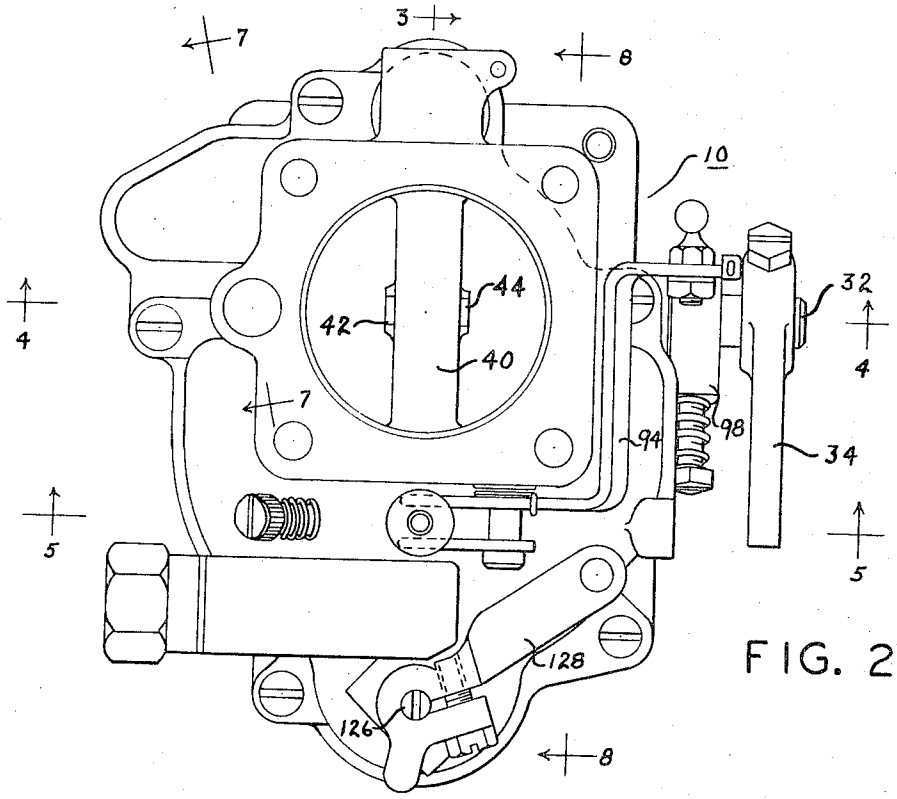


FIG. 2

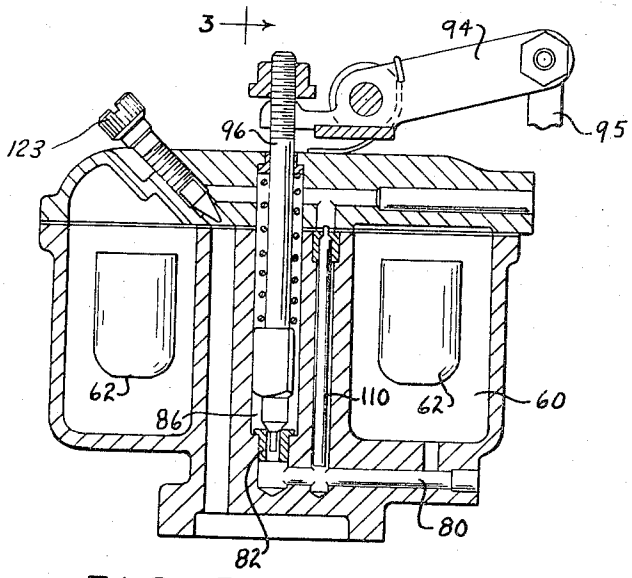


FIG. 5

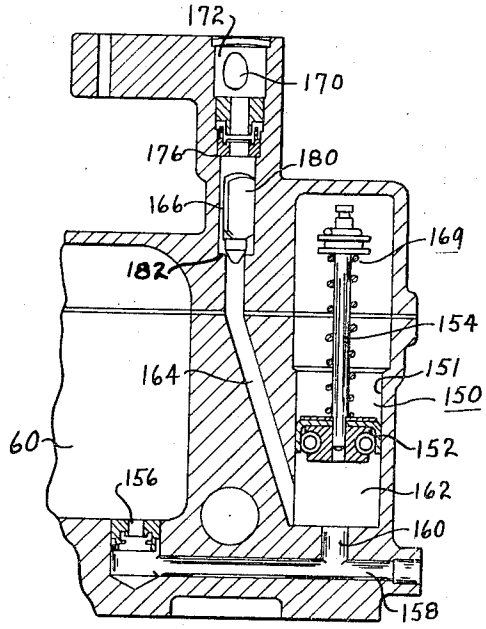
INVENTOR.
ROBERT W. SUTTON
BY
James L. O'Brien
ATTORNEY

Oct. 17, 1967 R. W. SUTTON 3,347,536

CARBURETOR

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FIG. 7



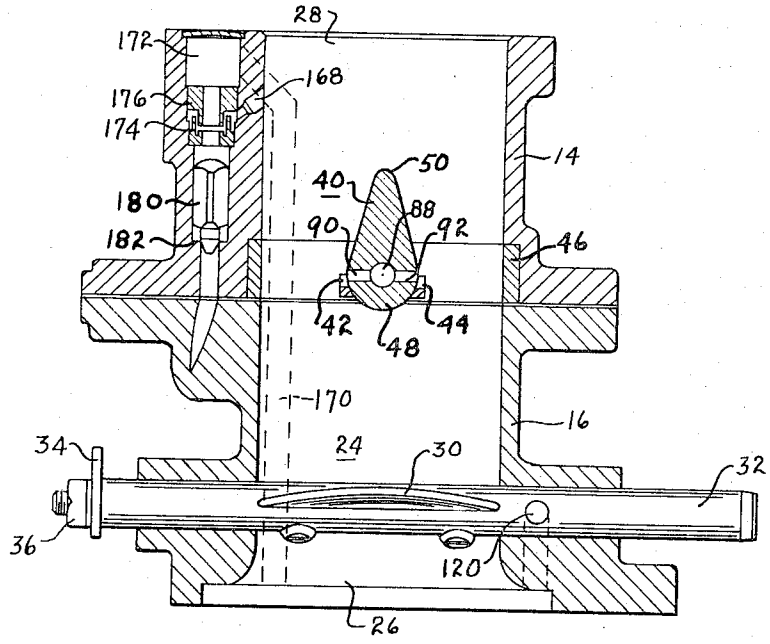


FIG. 4

INVENTOR.
ROBERT W. SUTTON
BY
James L. O'Brien
ATTORNEY

Oct. 17, 1967 R. W. SUTTON 3,347,536

CARBURETOR

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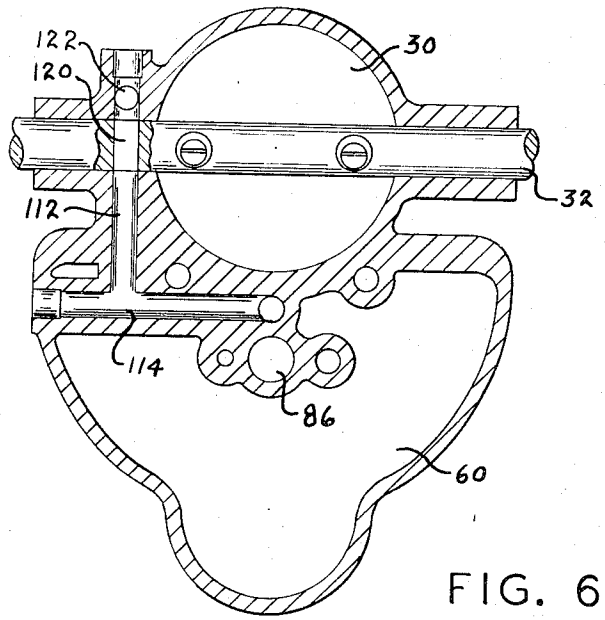


FIG. 6

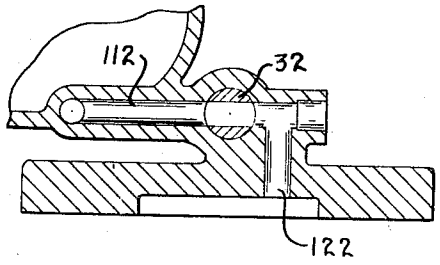


FIG. 8

INVENTOR.
ROBERT W. SUTTON
BY
James L. O'Brien
ATTORNEY

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CARBURETOR

Robert W. Sutton, Grosse Pointe Farms, Mich., assignor to The Bendix Corporation, a corporation of Delaware

Filed Aug. 5, 1966, Ser. No. 570,499
7 Claims. (Cl. 261—34)

ABSTRACT OF THE DISCLOSURE

A float type carburetor for an internal combustion engine having a throttle and an airfoil bar disposed in the induction passage posterior to the throttle, and a main fuel conduit connecting the main fuel bowl with the fuel passage in the airfoil bar. A metering jet is disposed in the main fuel conduit and a valve controlled by the movement of the throttle varies the flow through the passage in accordance with throttle position and air flow in the induction passage.

In the conventional float type carburetors for aircraft, the throttle is on the manifold side of the main fuel jet and in the operation of these carburetors, under certain conditions, severe icing occurs on or at the throttle, occasionally sufficient to kill the engine while the craft is in flight. Various attempts have been made to overcome this condition by placing the main fuel discharged jet on the engine side of the throttle to eliminate the effect of the icing phenomenon, which is most prevalent in humid, moderately low temperature conditions, and while the engine is operating at idling or part throttle. Under these conditions, the moist air is cooled rapidly at the throttle by the vaporization of the fuel on or near the throttle, and by the expansion of the air and fuel mixture resulting from the relatively high drop in pressure across the throttle. Various attempts have been made in the past to overcome the foregoing conditions by placing the main fuel discharge jet on the engine side of the throttle, thus eliminating the cooling effect of the fuel on the throttle. However, these attempts have generally been unsuccessful, in that the effect of the high mainifold vacuum on the engine side of the throttle while the throttle is in closed or part throttle position, prevents or interferes with proper metering of the fuel with a conventional venturi, and has required the use of one or more relatively complicated metering valves in the main jet system to regulate the fuel flow in accordance with air flow rather than manifold vacuum. Further, the air flowing in the induction passage past the partly opening throttle has been deflected to one side of the passage and hence has interfered with proper metering and distribution of the fuel with the use of the conventional venturi and main fuel nozzle. It is therefore one of the principal objects of the present invention to provide a float type anterior throttle carburetor which is free of idle freeze and other carburetor icing conditions, yet which effectively meters the fuel in accordance with air flow without adverse interference of manifold vacuum on the metering characteristics of the carburetor.

Another object of the invention is to provide an anterior throttle carburetor of the foregoing type in which an airfoil is used for sensing the air flow at the main discharge jet and for obtaining effective distribution of fuel in the air, and which will deliver the proper amount of fuel on the engine side of the throttle throughout the entire operating range of the engines.

Still another object is to provide an anterior throttle carburetor having the main and idle jets and accelerating pump discharge nozzle on the engine side of the throttle, in which optimum atomization and distribution of the fuel is obtained under all operating conditions and which is compact, relatively low in height and easily installed and serviced.

Further objects and advantages of the invention will become apparent from the following description and accompanying drawings, wherein:

FIGURE 1 is a side elevational view of the present carburetor;

FIGURE 2 is a top plan view of the carburetor shown in FIGURE 1;

FIGURE 3 is a vertical cross sectional view of the carburetor shown in FIGURES 1 and 2, the section being taken on line 3—3 of FIGURE 2;

FIGURE 4 is a vertical cross sectional view taken on a line at right angles to the view shown in FIGURE 3, the section being taken on line 4—4 of FIGURE 2;

FIGURE 5 is a vertical cross sectional view of the carburetor taken on line 5—5 of FIGURE 2;

FIGURE 6 is a horizontal cross sectional view taken on line 6—6 of FIGURE 1;

FIGURE 7 is a fragmentary cross sectional view taken on line 7—7 of FIGURE 2; and

FIGURE 8 is a fragmentary cross sectional view taken on line 8—8 of FIGURE 2.

Referring more specifically to the drawings, numeral 10 designates generally the present carburetor, consisting of a body 12, with upper and lower sections 14 and 16, the two sections being secured together by a plurality of screws 18 extending through outwardly extending flanges 20 and 22 on the periphery of the two sections. The two sections contain an induction passage 24, having an air inlet 26 and a fuel mixture outlet 28, the carburetor shown being an up-draft carburetor. The present carburetor is designed primarily for light aircraft, but may be adapted for automotive use, and the primary novel combination, hereinafter described, may be embodied in other types of carburetors, including down-draft and horizontal-draft carburetor induction passages.

A throttle 30 is mounted in the induction passage near the inlet thereof and the shaft is journalled in the side walls of lower section 16 and is operated by a linkage (not shown) connected to throttle lever 34 secured to one end of throttle shaft 32 by a nut 36 threaded onto the end of the shaft. The shaft forms a part of a valve structure which regulates the air flow to the fuel jets, as will be more fully described hereinafter.

Mounted in the induction passage on the engine side of the throttle valve is an airfoil bar 40 containing the main fuel discharge jets 42 and 44 on opposite sides thereof and being held in place in the induction passage by a ring-like support member 46, seated in the wall of upper section 14. The bar extends diametrically across the induction passage and has an enlarged portion 48 on the air inlet side tapering to a relatively small or thin portion 50 on the outlet side. The carburetor is connected to an intake manifold by bolts extending through a flange 52 around the upper edge of section 14 and discharges fuel-air mixture upwardly into the manifold. The air passing through the carburetor from inlet 26 and past throttle valve 30 and airfoil bar 40 is mixed with fuel from the two jets and the mixture is thence discharged through outlet 28 into the intake manifold for delivery to the engine cylinders.

The present carburetor is the float type, having a fuel chamber 60 in which is disposed a float 62 connected by a lever 66 pivoted on a pin 68 and contacting a fuel inlet valve 70 for controlling the flow of fuel from passage 72 through valve sleeve 74 to chamber 60. Passage 72 is connected by a fuel line to a fuel tank (not shown). The main discharge jets 42 and 44 are connected with the fuel chamber by passage 80, metering orifice 82 controlled by

mechanically operated metering valve **84**, and passages **86** and **88**, the latter passage being connected to jets **42** and **44** by transverse passages **90** and **92**, respectively, in airfoil bar **40**. The mechanical metering valve **84** is controlled by the operation of the throttle **30** through a linkage **93** consisting of levers **94** and **95** connected at one end to stem **96** of the valve and at the other end to a lever **98** mounted on and secured to throttle shaft **32**, lever **98** being operated along with the throttle valve by lever **34**. As the throttle valve is opened, lever **94** lifts stem **96** and valve **84** to regulate the fuel flowing from the fuel chamber **60** through passage **80** to passages **86** and **88** to the discharge jets in bar **40**. When the throttle valve is closed, the enlarged portion **100** seats on the jet **82** and closes the orifice and prevents fuel from flowing to the engine under the influence of the high vacuum created upon the closing of the throttle while the engine is running.

The idle system consists of an idle tube **110** connected at its lower end to passage **80** and at its upper end to passage **88**, and delivers fuel from the fuel bowl to jets **42** and **44** while the throttle is in substantially closed position. One source of air for mixing with the idle fuel is supplied through passages **112**, **114** and **116**, the latter passage being connected to passage **88** delivering air for mixing with the idle fuel in passage **88** to form a fuel-air emulsion which is discharged through jets **42** and **44**. The air to the idle system in passages **112**, **114** and **116** is controlled by a valve **120** disposed in and forming a part of the throttle shaft, and passage **122**, which is subjected to impact air, as seen in FIGURE 8, connects the valve and hence passage **112** and passage **88** with the air inlet pressure. The air flow to the idle system may be regulated manually by adjustable valve **123**. In order to prevent flow of fuel through the idle system when the engine is turned off but rotating, an idle shut-off is provided, consisting of a valve **124** controlled by stem **126** and lever **128**.

While the throttle is in partly closed position with the engine operating, a relatively high vacuum is normally present in the induction passage around airfoil bar **40**, and this vacuum is transmitted through the jets **42** and **44** into passage **88**. During this time, the idle or main jet fuel is mixed with additional air from impact air passage **130**, passing through chamber **132** into the airfoil bar, where it is mixed with either the idle or main jet fuel in passage **88** at or near passages **90** and **92** before being discharged through jets **42** and **44**. A valve **134** controls the flow of air through passage **130** and chamber **132**, the valve being controlled by a vacuum responsive piston **136** in cylinder **138**. The cylinder is connected to the induction passage by passages **140** and **142**, and a spring **144** reacting between a collar **146** on cylinder **138** and valve **134** urges the valve to closed position. The vacuum piston **136** holds the valve open in opposition to spring **144** when the throttle valve is in closed or partly closed position and the vacuum in the induction passage on the engine side of the valve is relatively high. When the throttle valve is moved to full throttle or nearly full throttle position, and vacuum in the induction passage is relatively low, and hence is insufficient to retain valve **134** open. This decreases the flow of air to the main discharge jets, and hence increases the richness of the mixture of the fuel delivered to the induction passage, performing, in effect, the function of an economizer or power enrichment system.

An accelerating pump generally indicated by numeral **150** delivers fuel to the induction passage in outlet **28** when the throttle valve is moved toward open position. The pump consists of a cylinder **151**, a piston **152**, and a stem **154**, the stem being connected to the throttle valve by suitable linkage (not shown). As the piston is urged upwardly as the throttle is closed, fuel is drawn from fuel chamber **60** through valve **156** and passages **158** and **160** into cylinder **162** beneath the piston. As the piston

is moved downwardly upon the opening of the throttle, the fuel is discharged through passage **164** and valve **166** to discharge nozzle **168**. A spring-loaded, lost-motion connection, indicated by numeral **169**, permits rapid and normal operation without interference from the pump. In order to break the manifold vacuum effect upon the accelerating pump, the upper end of passage **164** is connected to the carburetor inlet **26** by a passage **170** and chamber **172**, and in order to prevent fuel from being ejected through this passage when the accelerating pump is operated, a check valve **174** is placed in chamber **172**. The check valve includes a plate **176** which seats on both its upper and lower sides, i.e., seats on the upper seat when the accelerating pump is discharging to prevent the outflow of fuel through the inlet air passage, and seats on the lower seat to permit air to bleed into the induction passage when the accelerating pump is not operating. An additional valve **180** seats on valve seat **182** to close passage **164** when the piston **152** is moving upwardly, as viewed in FIGURE 7, to draw the fuel from chamber **60** into cylinder **162**.

In the operation of the present carburetor, after the engine has been started and is operating with throttle valve **30** closed, fuel is supplied from the fuel bowl through passage **80**, idle tube **110**, passage **88** and fuel nozzles **42** and **44**. Impact air from entrance **26** is supplied to the idle system through passages **122**, **112** and **116**, and this air is controlled by the valve **120** in the throttle shaft. Additional impact air from the air inlet is supplied through passage **130** and chamber **132**, when valve **134** is held open by the high manifold vacuum transmitted to cylinder **138**. As the throttle is opened, the main metering jet **82** is opened by the lifting of valve **84** from its seat, and the fuel is thereafter controlled by metering valve **84** in response to variations in throttle position. Fuel passes through jet **82** into passages **86** and **88** and is discharged through jets **42** and **44**. While the manifold vacuum is relatively high during part throttle operation, the valve **134** is held in open position and the air is supplied through passage **130** and chamber **132** to passage **88** and is mixed with the fuel therein before it is discharged by the two jets. As the throttle is opened further or the engine placed under additional load, the manifod vacuum decreases, permitting valve **134** to close, thus increasing the richness of the mixture discharged by the main discharge jets **42** and **44**.

The main jet being disposed in the airfoil bar **40** on the engine side of the throttle produces effective distribution and atomization of the fuel in the air flowing through the induction passage. The relationship of the bar to the throttle position, both in distance and in angle, avoids any icing and maldistribution of the air in the induction passage around the main discharge jets. During acceleration, the pump **150** is operated by mechanical linkage with the throttle, thereby discharging fuel through passage **164** and valves **180** and **176**, and thence through jet **168** into the induction passage near outlet **28** of the carburetor. When the accelerating pump is not in operation, a small amount of air is bled into the induction passage through impact air passage **170** and valve **174**, thus effectively preventing the manifold vacuum from influencing the operation of the accelerating pump either during acceleration or at any other time during the operation of the engine.

When the throttle valve is moved toward closed position, the manifold vacuum transmitted to the induction passage increases, again opening valve **134** for admitting air into passage **88**. Simultaneously therewith, throttle control valve **120** is opened, further supplying additional air for the idle fuel. The transverse relationship of the throttle shaft to the position of the airfoil bar **40**, and hence to the pivot point of the throttle to the axis of the airfoil bar, produces an effective distribution of air flow around both discharge jets **42** and **44**, in all part throttle and wide open throttle positions.

While only the preferred embodiment of the present invention has been described in detail herein, various changes and modifications may be made without departing from the scope of the invention.

I claim:

1. In a carburetor having a fuel bowl and an induction passage with an air inlet and a mixture outlet: a throttle in said induction passage, an airfoil bar disposed in said induction passage posterior to said throttle and having a fuel passage in one end and an air passage in the other end and a discharge jet on each side near the center of the bar connected to said fuel and air passages, a main fuel conduit connecting said bowl with said fuel passage, a metering jet in said conduit, a valve for controlling the fuel flow through said metering jet, a linkage connecting said valve with said throttle for regulating the flow of fuel in accordance with throttle position, a passage for impact air connecting the passage in said bar with the induction passage on the air intake side of the throttle, and a valve responsive to manifold vacuum in said impact air passage for closing said air passage when the throttle is in substantially wide open position.

2. A carburetor as defined in claim 1, in which said throttle is mounted on a throttle shaft pivoted in the wall of the carburetor, and the axis of said airfoil bar is disposed in transverse relationship to the axis of said throttle shaft.

3. A carburetor as defined in claim 2, in which said airfoil bar is spaced sufficiently far from said throttle to obtain substantially uniform distribution of air around and along the airfoil bar.

4. A carburetor as defined in claim 1, in which an idle fuel conduit communicates with the main fuel passage anterior and posterior to said metering jet, and a passage is connected to said fuel passage for supplying impact air for forming a mixture with the idle fuel.

5. A carburetor as defined in claim 4, in which a valve is disposed in said impact air passage and is controlled by

the movement of the throttle valve to open said passage to the flow of said impact air when said throttle valve is moved to closed position.

6. A carburetor as defined in claim 1, in which is included an accelerating pump system, said system having a pump, passages connecting the pump to the fuel bowl and to the induction passage on the posterior side on said throttle, a passage for impact air connected to the last mentioned passage, and a valve for closing said impact air passage when said pump is operating and for admitting air into the induction passage when said pump is inoperative.

7. A carburetor as defined in claim 1, in which is incorporated an accelerating pump system having passages connecting the pump to the fuel bowl and to the induction passage on the posterior side of said throttle, a passage for impact air connected to the last mentioned passage, and a valve for closing said impact air passage when said pump is operating and for admitting air into the induction passage when said pump is inoperative.

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HARRY B. THORNTON, *Primary Examiner.*

TIM R. MILES, *Examiner.*