April 18, 1944. S. P. JONES 2,346,762

GAS CARBURETING APPARATUS

Filed Aug. 25, 1941 2 Sheets-Sheet 1

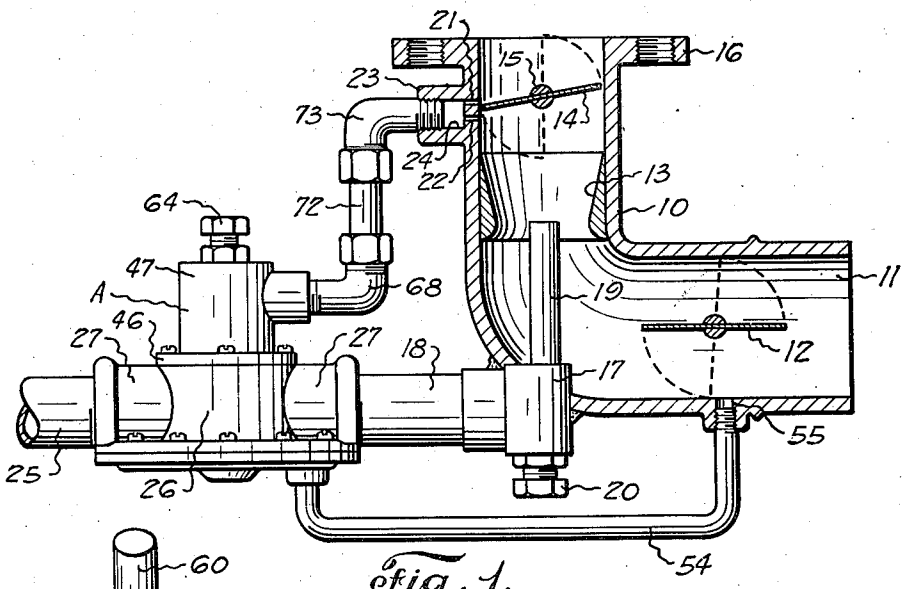


Fig. 1.

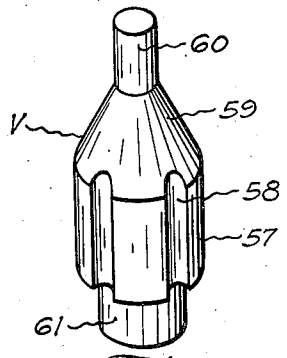


Fig. 4.

Fig. 2.

Inventor
Sam P. Jones

By Jack A. Ackley

Attorney

April 18, 1944. S. P. JONES 2,346,762

GAS CARBURETING APPARATUS

Filed Aug. 25, 1941 2 Sheets-Sheet 2

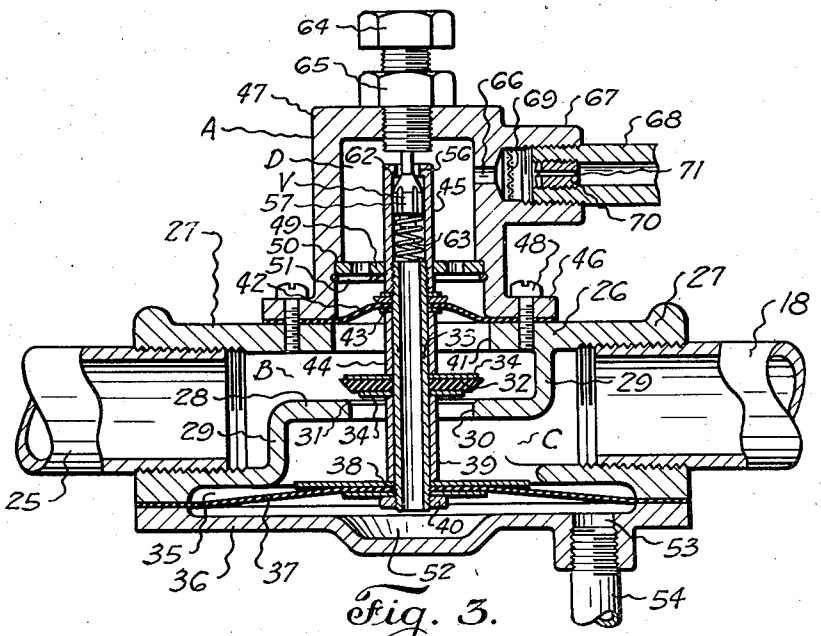


Fig. 3.

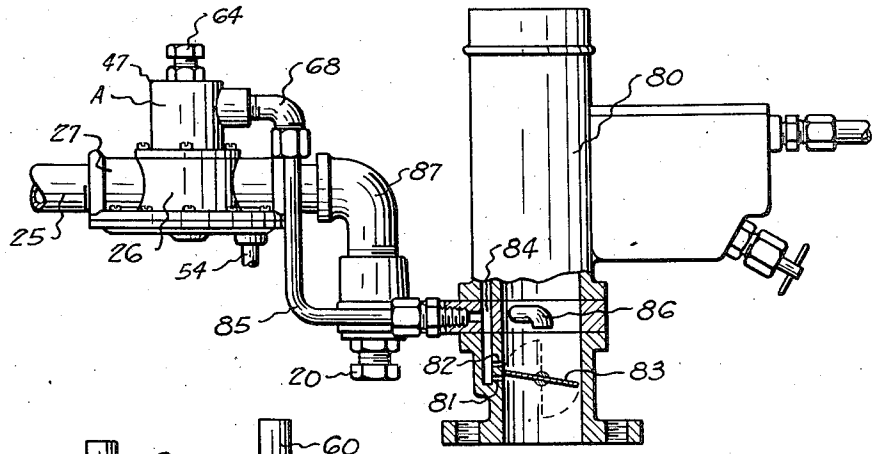


Fig. 7.

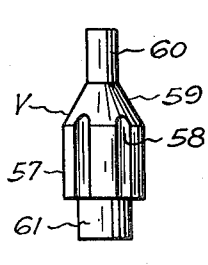


Fig. 5.

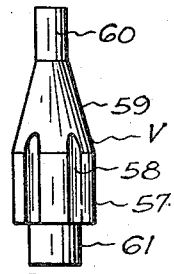


Fig. 6.

Inventor
Sam P. Jones

By Jack A. Ackley

Attorney

Patented Apr. 18, 1944

2,346,762

UNITED STATES PATENT OFFICE

2,346,762

GAS CARBURETING APPARATUS

Sam P. Jones, Dallas, Tex.

Application August 25, 1941, Serial No. 408,178

12 Claims. (Cl. 48—180)

This invention relates to new and useful improvements in gas carbureting apparatus.

One object of the invention is to provide an improved fuel control device which is particularly adapted for use with internal combustion engines and which will efficiently and accurately control the flow of fuel to said engine under all operating conditions.

An important object of the invention is to provide an improved fuel control device for an internal combustion engine which is operating on a gaseous rather than a liquid fuel, said device having means for efficiently controlling the gas supply at idling and during the range immediately above idling, whereby maximum efficiency and engine operation is obtained.

A particular object of the invention is to provide an improved fuel control device which is actuated by the engine suction and which has means for accurately controlling the movement of the main fuel valve, whereby said valve may be opened to any desired or predetermined position to accurately control the volume of fuel passing to the engine under all operating conditions.

Another object of the invention is to provide a fuel control device, of the character described, wherein the main fuel valve is actuated by a vacuum responsive element which is exposed to the engine suction, said device also including an auxiliary control means for the main valve, which auxiliary control means is operative only during idling and the range immediately following idling, during which period the vacuum responsive control element is not extremely sensitive due to the throttle valve being substantially closed; the provision of the auxiliary control means permitting an accurate and sensitive control of the gas supply for idling and also for the period immediately following idling, whereby engine efficiency is increased.

Still another object of the invention is to provide a device, of the character described, wherein a vacuum responsive member which is connected to the main fuel valve is disposed within a chamber which communicates with the engine, together with means for accurately maintaining a predetermined vacuum within said chamber, whereby the position of the main fuel valve may be controlled; the device also being readily adjustable to suit various operating conditions.

A further object of the invention is to provide an improved fuel control device, which may be applied to the usual gas mixer of an internal combustion engine or which may be combined with the ordinary gasoline carburetor to convert said carburetor into a gas mixer; the device being so constructed that closure of the main valve is assured when operation of the engine is halted regardless of whether or not the auxiliary control means should become inoperative, whereby danger of gas leakage past said valve or a substantial gas leakage past other parts of the device, is obviated.

The construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, as an example of the invention is shown, and wherein:

Figure 1 is a view, partly in elevation and partly in section, and illustrating a fuel control device, constructed in accordance with the invention, applied to the gas mixer of an internal combustion engine,

Figure 2 is an enlarged, transverse, vertical, sectional view of the fuel control device, with the main valve in a closed or seated position,

Figure 3 is a view similar to Figure 2, with the main valve in a raised or open position,

Figure 4 is an isometric view of the air inlet valve,

Figure 5 is an elevation of the air inlet valve,

Figure 6 is a view similar to Figure 5, showing a modified form of air inlet valve, and

Figure 7 is a view, partly in elevation and partly in section, and showing the fuel control device combined with the usual gasoline carburetor and converting said carburetor into a gas mixing device.

In the drawings, the numeral 10 designates the body or housing of a gas mixer which is adapted to be connected to the inlet manifold of an internal combustion engine (not shown). The body or housing is shown in the form of an elbow and the lateral or horizontal portion of the housing is open to provide an air inlet 11. The usual choke valve 12 is mounted adjacent the air inlet in the usual manner. A Venturi sleeve 13 is mounted within the vertical portion of the housing 10 and the butterfly throttle valve 14 is mounted above the Venturi sleeve on a rotatable shaft 15. The upper portion of the housing is formed with an outwardly directed annular flange 16, whereby said housing may be readily connected to the intake manifold of the engine.

A T coupling 17 is mounted in the lower portion of the housing, being welded or otherwise suitably secured thereto. The lateral leg of the

coupling has a gas inlet pipe 18 connected thereto, whereby gas from a suitable source may be supplied to the coupling. From the coupling, the gas flows upwardly through an inlet tube 19, and this tube has its upper end terminating within the lower portion of the throat formed by the Venturi sleeve 13. A suitable valve (not shown) is mounted within the coupling 17, and its position is controlled by an adjusting screw 20, which extends outwardly from the lower end of the coupling, and by adjusting the screw 20, the volume of gas flowing upwardly through the inlet tube 19 may be accurately controlled.

The mixer which is shown in Figure 1 is of standard construction, and the engine suction is depended upon to draw air through the housing from the inlet 11 and also to draw gas upwardly through the inlet tube 19. The gas and air admixes and flows through the manifold to the engine.

Adjacent the throttle valve 14, the housing 10 is provided with a pair of orifices 21 and 22, and these orifices are spaced one above the other. A collar 23 which is preferably integral with the wall of the housing surrounds the orifices 21 and 22, whereby the bore 24 of said collar communicates with the interior of the housing 10 through said orifices, as is clearly shown in Figure 1. When the engine is idling, the throttle valve 14 is in the position shown in Figure 1, that is, the valve is disposed between the upper orifice 21 and the lower orifice 22. In such position, the engine vacuum is acting only through the orifice 21. As the throttle valve 14 is rotated, so as to increase the fuel supply to the engine, the movement of the valve exposes the lower orifice to the engine suction. Thus, during idling, only the upper orifice 21 is exposed to the engine suction, or the vacuum, but immediately upon movement of the valve 14, both orifices are exposed to this vacuum.

For controlling the flow of fuel to the housing 10 and thereby control the gas-air ratio, the improved fuel control device A is connected to the gas line 18 which leads to the coupling 17 and then to the gas inlet tube 19. The opposite side of the device A has connection with a gas supply line 25. The device A includes a cylindrical body 26 which has diametrically opposed collars 27 preferably formed integral therewith, and each collar is internally screw threaded, whereby the pipes 18 and 25 may be connected with the body. A transverse web 28 is located centrally within the body 26 (Figures 2 and 3) and is secured to the body by vertically extending supports 29 which are preferably integral with said body. The web 28 serves to divide the interior of the body into an upper chamber B and a lower chamber C, the upper chamber communicating with the gas supply pipe 25 and the lower chamber C communicating with the gas line 18 which leads to the mixer. The web is formed with a central or axial opening 30 which establishes communication between the chambers B and C, and obviously, a flow of gas from the supply pipe 25, into the chamber B, then through the opening 30, chamber C and pipe 18, may occur.

The upper portion of the wall of the opening 30 is beveled to form a valve seat 31 which is arranged to be engaged by a resilient or elastic valve element 32 and manifestly, the valve element controls the flow of gas through the opening 30. The elastic valve element 32 is mounted on a tubular stem 33 and is suitably reinforced by reinforcing plates 34. The lower end of the stem 33 extends downwardly from the body 26 into an enlarged chamber 35 which is formed integral with the lower portion of the body. The chamber 35 is closed by a diaphragm case 36 which is bolted or otherwise secured to the lower end of the body. A flexible diaphragm 37 extends across the diaphragm chamber 35 and has its outer peripheral portion clamped between the diaphragm case 36 and the body 26. The diaphragm is provided with an axial opening 38 through which the lower end of the tubular valve stem 33 extends. A spacer sleeve 39 surrounds the tubular stem and is located between the valve element 32 and the diaphragm, as is clearly shown in Figure 2, and a retaining nut 40 which is threaded onto the extreme lower end of the stem, clamps the diaphragm against the spacer sleeve 39. Manifestly, with this construction, any movement of the diaphragm 37 will result in a movement of the tubular stem 33, with a resultant movement of the valve element 32. The diaphragm 37 is exposed to the suction of the engine through the gas inlet tube 19, coupling 17, gas line 18, and chamber C, and obviously the vacuum will act upon the diaphragm to effect a movement of the valve element 32 relative to its seat 31.

The upper end of the body 26 is formed with an opening 41, and the upper end of the tubular valve stem 33 extends upwardly through this opening (Figures 2 and 3). An upper diaphragm 42 spans the opening 41 and has an axial hole 43 through which the stem 33 extends. The central portion of the diaphragm 42 is secured to the stem, being clamped between the upper end of a spacer sleeve 44 which surrounds the tubular stem between the valve element 32 and said diaphragm, and a tubular sleeve 45 which is threaded onto the extreme upper end of the valve stem. The outer peripheral portion of the diaphragm 42 is clamped between the top of the body 26 and an annular flange 46 which is formed on the lower end of a hollow head or cap member 47. This flange is secured to the body by suitable bolts 48 or other fastening means. The bore of the head or cap member 47 is substantially of the same diameter as the opening 41, and the interior of the head forms a chamber D. With this arrangement, the upper diaphragm 42, which is of a smaller size than the lower diaphragm 37, is also attached to the tubular valve stem 33, and movement of the diaphragm 42 will result in a movement of said stem and a resultant movement of the main valve element 32.

As explained, the sleeve 45 is threaded onto the upper end of the valve stem 33 and is movable therewith. For guiding the movement of the sleeve 45 within the chamber D, a perforated guide plate 49 is mounted within the chamber, said plate abutting an internal shoulder 50 and being retained in place by a snap ring 51. The interior or bore of the sleeve 45 communicates with the bore of the tubular valve stem 33 and the bore of said valve stem communicates with the space 52 below the diaphragm 37. The diaphragm case 36 is provided with a vent or air inlet opening 53, and this opening may communicate directly with atmosphere, but as illustrated is connected through an air line 54 with an opening 55 provided in the housing 10 of the mixer, said opening 55 being located adjacent the air inlet 11 of said housing. In this manner, the air within the diaphragm case below the diaphragm 37 is of substantially the same pressure as the air entering the mixer 10. With

this arrangement, it will be obvious that air may flow upwardly through the tubular valve stem 33 and into the sleeve 45 and then through an axial opening 56 which is provided in the top of said sleeve into the chamber D.

For controlling the flow of air from the valve stem and sleeve 45 into the chamber D, a valve member V is slidably mounted within said sleeve 45. This member is clearly shown in Figure 4 and includes a cylindrical body 57 having vertical grooves or channels 58 in its outer surface. The lower end of the body is provided with a depending stud 61, while the upper portion of said body is tapered or reduced to form a conical surface 59 and an upstanding pin 60 extends upwardly from this surface. The tapered surface 59 of the valve element is adapted to co-act with a valve seat 62 which is formed at the lower portion of the opening 56; manifestly, as the valve member V moves relative to its valve seat 62, the volume of air flowing through the opening 56 and into the chamber D is accurately controlled. The amount of movement which the valve must undergo relative to its valve seat to admit a predetermined volume of air is dependent upon the angle or inclination of the taper 59. The valve member is constantly urged toward a raised position within the housing or sleeve 45 by a coiled spring 63 which is confined between the lower end of the valve member and the upper end of the tubular valve sleeve 33 as is clearly shown in Figures 2 and 3.

For effecting an opening of the valve member V, upon an upward movement of the tubular valve stem 33 and the sleeve 45 which is secured thereto, a set screw 64 is threaded into the upper end of the head or cap member 47. A lock nut 65 is threaded onto the screw below the head thereof and is adapted to lock said screw in various adjusted positions. The extreme lower end of the screw 64 extends into the chamber D above the upstanding pin 60 of the valve member V, and is adapted to co-act therewith. It will be apparent that when the tubular valve stem 33 and the various parts secured thereto move upwardly, the tubular sleeve 45, as well as the valve member V mounted therein, will also move upwardly. Such upward movement will cause the upstanding pin 60 on the valve member V to strike the lower end of the set screw 64, and any continued upward movement of the valve assembly will result in an unseating of the valve member V, whereby air may flow into the chamber D. Manifestly, the distance between the lower end of the set screw and the pin 60, when the sleeve 45 is in a lowered position, will determine the distance which the sleeve must travel before the valve V is opened and by adjusting the screw, this distance may be readily varied. After the valve V is unseated, the taper or inclination of the conical surface 59 of the valve member V will control the volume of air which enters the chamber D upon a predetermined continued movement of the sleeve 45 and its associate parts, and by varying this taper, the volume of air entering said chamber upon predetermined travel of the sleeve 45 may be accurately controlled.

The hollow head or cap member is provided with a port or opening 66 which communicates with the chamber D. A collar 67 which is integral with the head or member 47, surrounds the opening and has the outer end of its bore internally screw threaded to receive an elbow 68. A screen 69 is mounted adjacent the opening or port 66, being located within the inner end of the bore of the collar 67. A nipple 70 is threaded into the inner end of the elbow and is provided with a reduced orifice 71 which is of a predetermined size and area, whereby flow into the elbow 68 from the chamber D may be controlled. By varying the size of the orifice 71 in the nipple, the volume of flow at this point may be controlled. The elbow 68 is connected by a line 72 to another elbow 73, the latter being threaded into the collar 23 which surrounds the orifices 21 and 22 in the body 10 of the mixer. In this manner, a communication is established between the chamber D of the device A and the inlet manifold of the engine, whereby the chamber D is exposed to the vacuum of the engine.

In the operation of the device, when the engine to which said device is applied is not operating, the parts are, of course, in the position shown in Figure 2. In such position, the main fuel valve 32 is engaging its seat to shut off the flow of gas to the engine; also at this time the valve member V is held in its seated position by the coil spring 63 and the upstanding pin 60 on said valve member is spaced from the set screw 64. When the engine is started and is operating at an idling speed, the throttle valve 14 is in the position shown in Figure 1, that is, said valve is disposed between the orifices 21 and 22 in the body of the housing 10. At this time, the engine vacuum is acting through the orifice 21, through the connections 73, 72 and 68, upon the upper diaphragm 42 within the lower end of the chamber D. The orifice 71 which is located within the inner end of the connection 68 controls the volume of air which is drawn from the chamber D by the vacuum of the engine The suction acting upon the upper diaphragm 42 is sufficient to lift said diaphragm and to lift the fuel valve 32, valve stem 33 and sleeve 45 attached to said diaphragm, whereby said fuel valve 32 is lifted from its seat 31 to permit a flow of gas from the supply line 25 to the gas mixer and then to the engine.

It is desirable at this time that the main valve element 32 be maintained in a predetermined open position to supply exactly the right amount of gas to the engine for efficient idling. It might be noted that since the throttle valve 14 is substantially closed at this time, the action of the engine suction upon the main or lower diaphragm 37 is not sufficient to provide a sensitive control of the valve element 32 through this lower diaphragm. Therefore, under idling conditions, the vacuum acts upon the upper or smaller diaphragm 42 to lift the valve from its seat and thereby supply gas for idling purposes.

In order to lift the valve 32 to a proper position and maintain the valve in such position, the air control valve V comes into operation. Upon the initial lifting of the valve assembly due to the action of the suction upon the diaphragm 42, the sleeve 45, as well as the valve element V, are lifted. This lifting continues until the upstanding pin 60 on the valve element strikes the lower end of the adjusting screw 64, and when this occurs, further upward movement of the valve member V is prevented. However, the valve assembly, including the sleeve 45, continues to move upwardly so as to move the seat 62 away from the inclined surface 59 of th valve member V. When this happens, air is permitted to enter the chamber D past the valve element V, the volume of air being controlled by the taper 59 of said valve element. As soon as the valve

member V has moved to a position permitting air to flow into the chamber D as fast as air is withdrawn from the chamber through the orifice 71, further movement of the diaphragm 42 and the main valve 32 is halted. When this condition occurs within the chamber D, the vacuum within said chamber is maintained constant, with the result that the valve 32 will be suspended in a predetermined open position, whereby a predetermined flow of gas to the engine occurs. So long as the engine is idling and the throttle valve 14 is not moved from the position shown in Figure 1, the main fuel valve 32 remains in such position.

From the foregoing, it is obvious that the adjustment of the set screw 64 controls the distance which the fuel valve 32 is raised because lifting of the fuel valve continues until the air valve V strikes the set screw and opens to admit air to the chamber D. Therefore, by adjusting the screw, the point to which the fuel valve is opened may be controlled. The taper or inclination of the conical surface 59 of the valve member V is also a factor in determining the position at which the main valve 32 is maintained. By increasing the angle of this surface, that is, by making the same steeper, as shown in Figure 6, a greater movement of the sleeve 45, after opening of the valve V, must occur before sufficient air is flowing into the chamber D and thus, the main valve will be moved to a higher position before its movement is halted. Similarly, by reducing the angle, the upward movement of the main valve 32 may be halted in a lower position. However, under idling conditions, the taper 59 is only a minor factor, the main control of the valve position being in accordance with the adjustment of the screw 64. The arrangement provides a very accurate control of the amount of gas which flows to the engine under idling conditions.

As above stated, so long as the throttle valve 14 remains in the position shown in Figure 1, the main control valve 32 will be maintained in a predetermined position to permit a predetermined volume of gas to flow to the engine. When the throttle valve is opened to accelerate the engine, the initial movement of said valve will expose the lower orifice 22 to the engine suction, whereby the vacuum acting upon the diaphragm 42 within the chamber D will be immediately increased. This increased vacuum will result in an additional volume of air being withdrawn from the chamber D, whereby the diaphragm 42 will be lifted an additional amount. This additional upward movement of the diaphragm and the main valve 32 which is attached thereto will continue only until an increased volume of air will be admitted into the chamber D because of the increased relative movement between the seat 62 and the inclined surface 59 of the valve member V. As soon as the volume of air passing the valve V is sufficient to equal the air being withdrawn by the increased vacuum, further upward movement of the diaphragm and of the main valve 32 is halted. It is pointed out that it is during this period that the taper 59 of the valve V is the controlling factor as to the further upward travel or movement of the main fuel valve 32 and by varying this taper, this travel may be varied.

Thus, upon initial opening of the throttle 14, the fuel valve 32 is automatically opened to supply gas to the engine for idling, the position of the valve being controlled by the adjustment of the set screw; upon further opening of the throttle, the valve 32 is opened further, the additional opening being controlled by the taper of the surface 59. Continued opening of the throttle valve permits the vacuum to act directly upon the lower or main diaphragm 37, and from this point on, the position of the main valve 32 is controlled solely from the lower diaphragm. Thus, it becomes obvious that the upper diaphragm 42, together with the air control valve V, functions only during idling and in the range immediately above idling. It is at this time that the main diaphragm 37 is not sufficiently sensitive to provide for an accurate control of the main fuel valve 32.

With the device herein described, an accurate and efficient operation at idling and within the range immediately above idling, is had. The entire structure is simple and comprises a minimum number of parts. There are no small orifices which can affect the closing of the main valve 32 and therefore the device is extremely safe when applied to internal combustion engines within vehicles. In the event that the valve member V should stick and become inoperative, this would result only in poor engine idling and would not prevent the closing of the main valve 32 when the engine is halted. In the event that either of the diaphragms 37 or 42 should rupture, there would be substantially no loss of gas. Of course, if the uppermost diaphragm 42 should break, gas could flow upwardly and then escape through the restricted orifice 71 into the engine manifold. This opening is relatively small and any loss of gas therethrough would be substantially negligible. The device is extremely sensitive and can be adjusted to move the main valve 32 to any desired position relative to its seat 31 and to maintain that position at idling.

As shown in Figures 1 to 6, the improved device is applied to an ordinary gas mixer. However, it would be possible to combine the device with the usual gasoline carburetor and convert said carburetor into a device for supplying a gas-air mixture to the engine. In Figure 7, this combination is shown, wherein an ordinary gasoline carburetor 80 is provided with idling ports 81 and 82 which are located adjacent the throttle valve 83. The idling ports communicate with a vertical passage 84 which finally has its other end in communication with the bowl of the carburetor. In applying the present device, a conduit 85 connects the passage 84 with the head 47, and in this way the vacuum is applied to the upper diaphragm in idling and in the range immediately following idling. A gas inlet pipe or nozzle 86 is mounted within the bore of the carburetor immediately above the throttle valve 83, and this nozzle is connected by means of a suitable line 87 with the collar 27 of the body 26 of the device A. The operation of this form of the invention is exactly the same as that hereinbefore described. Of course it is obvious that the carburetor 80 would not be supplied with gasoline when combined with the device A.

What I claim and desire to secure by Letters Patent is:

1. A gas carbureting apparatus including, a gas mixer having an air inlet and a gas inlet and a combined air and gas outlet, said mixer also having a throttle valve disposed therein for controlling the flow therethrough, a body connected with the fuel inlet, a fuel valve within the body for controlling the flow of fuel to the fuel inlet of the gas mixer, a vacuum responsive member connected with the fuel valve and ex-

posed to the suction upstream of the throttle valve for actuating the fuel valve, and an auxiliary vacuum responsive element also connected with the fuel valve and exposed to the suction downstream of the throttle valve for actuating the fuel valve and assuring positive unseating thereof when the suction upstream of the throttle valve is relatively low.

2. A gas carbureting apparatus as set forth in claim 1, wherein the auxiliary vacuum responsive element is confined within a chamber formed in the body, with an air inlet communicating with said chamber, and valve means connected with the element and movable to an open position upon a predetermined movement of the element, whereby said valve means functions to control the opening movement of the main fuel valve.

3. A gas carbureting apparatus including, a carburetor having therein a suction passage with an air intake, a Venturi throat and a throttle valve and also having a fuel inlet delivering fuel at the Venturi throat, a body connected with the fuel inlet and having a fuel line extending thereto whereby fuel passes through the body and to the inlet of the carburetor, a main fuel valve within the body for controlling the flow of fuel to the carburetor, vacuum responsive means actuated by the suction adjacent the fuel inlet and connected with the main valve for actuating said valve in accordance with said suction, and an auxiliary vacuum responsive element separate from the vacuum responsive means and also connected with the main fuel valve, said element being exposed to the suction downstream of the throttle valve of the carburetor, whereby the main fuel valve is positively opened by the auxiliary element during those ranges of operation in which the suction at the fuel inlet of the carburetor is relatively low.

4. A gas carbureting apparatus including, a fuel supply line having one end thereof connected to a source of suction, a throttle valve in the supply line, a body connected in the supply line upstream of the throttle valve, a main fuel valve for controlling the flow through the body and line, suction-actuated means exposed to the suction in the fuel line between the throttle valve and body and connected to the fuel valve for controlling the position of said fuel valve, and auxiliary suction-actuated means also connected to the main fuel valve and exposed to the suction in the fuel supply line downstream of the throttle valve for controlling the position of the main fuel valve when the suction acting on the first mentioned suction-actuated means is insufficient to accurately control the main fuel valve.

5. A gas carbureting apparatus adapted to be connected in a fuel supply line which line has one end connected to a source of suction, said apparatus including, a body, a main fuel valve for controlling the flow through said body and line, means exposed to the source of suction and connected with the fuel valve for controlling the initial opening movement of the main valve, and a suction-actuated member also connected to the main valve and exposed to the source of suction for controlling the position of the main valve subsequent to the movement of the valve beyond a predetermined point.

6. A gas carbureting apparatus including, a fuel supply line having a source of suction connected to one end thereof, a throttle valve in said line, a body in said line, a suction operated main fuel valve within the body for controlling the flow of fuel therethrough, said body having a chamber which communicates with the suction in the line downstream of the throttle valve, whereby a vacuum is created within said chamber, a pressure responsive element within said chamber and connected with the valve, whereby the vacuum within said chamber acts upon said element to lift the valve, an air inlet leading to said chamber, a valve means for controlling the admission of air into the chamber to maintain a predetermined vacuum in said chamber and thereby maintain the main fuel valve in a predetermined position, and means connecting the pressure responsive element with the air valve means, whereby the latter is controlled by the movement of said pressure responsive element.

7. A gas carbureting apparatus including, a gas mixer connected with a source of suction and provided with a throttle valve and also having a gas supply line leading thereto, a body connected in said line, a main fuel valve within the body for controlling the flow of gas through the line to the mixer, a vacuum responsive element connected with the valve and exposed to the suction upstream of the throttle valve of the mixer to control movement of the valve, communication between the source of suction and the element being through the mixer and through the throttle valve thereof, and auxiliary vacuum actuated means connected to the main fuel valve and exposed to the suction downstream of the throttle valve of the mixer for controlling the position of the main fuel valve when the suction upstream of the throttle falls below a predetermined point.

8. A gas carbureting apparatus including, a gas mixer connected with a source of suction and provided with a throttle valve and also having a gas supply line leading thereto, a body connected in said line, a main fuel valve within the body for controlling the flow of gas through the line to the mixer, a vacuum responsive element connected with the valve and exposed to the suction upstream of the throttle valve in the mixer to control movement of the valve, communication between the source of suction and the element being through the mixer and through the throttle valve thereof, said body having a chamber therein, a vaccum responsive member within said chamber and connected with the main fuel valve, and means for establishing communication between the chamber and the suction in the line downstream of the throttle valve of the fuel mixer, whereby said suction acts upon the member to impart movement to the gas valve when the throttle is substantially closed.

9. A gas carbureting apparatus as set forth in claim 8, with means for establishing additional communication between the source of suction and the chamber upon initial increased opening of the throttle valve to increase the opening of the main fuel valve.

10. A gas carbureting apparatus as set forth in claim 8, with means for maintaining a substantially constant predetermined vacuum within the chamber to maintain the main fuel valve in a predetermined open position.

11. A gas carbureting apparatus including, a gas mixer connected with a source of suction and provided with a throttle valve and also having a gas supply line leading thereto, a body connected in said line, a main fuel valve within the body for controlling the flow of gas through the line to the mixer, a vacuum responsive element connected with the valve and exposed to the suction upstream of the throttle valve in the

mixer to control movement of the valve, communication between the source of suction and the element being through the mixer and through the throttle valve thereof, said body having a chamber therein, a vacuum responsive member within said chamber and connected with the main fuel valve, means for establishing communication between the chamber and the suction in the line downstream of the throttle valve of the gas mixer, whereby said suction acts upon the member to impart movement to the fuel valve when the throttle is substantially closed, means for maintaining a substantially constant predetermined vacuum within the chamber to maintain the main fuel valve in a predetermined open position, and means for adjusting the last named means to accurately limit the amount of movement of the main fuel valve.

12. A gas carbureting apparatus as set forth in claim 11, wherein the means for maintaining the constant vacuum is an air inlet leading to the chamber, and an air valve means for controlling the flow of air through said inlet.

SAM P. JONES.