June 26, 1973 S. P. JONES 3,741,737

GAS CARBURETOR

Filed May 6, 1971 3 Sheets-Sheet 1

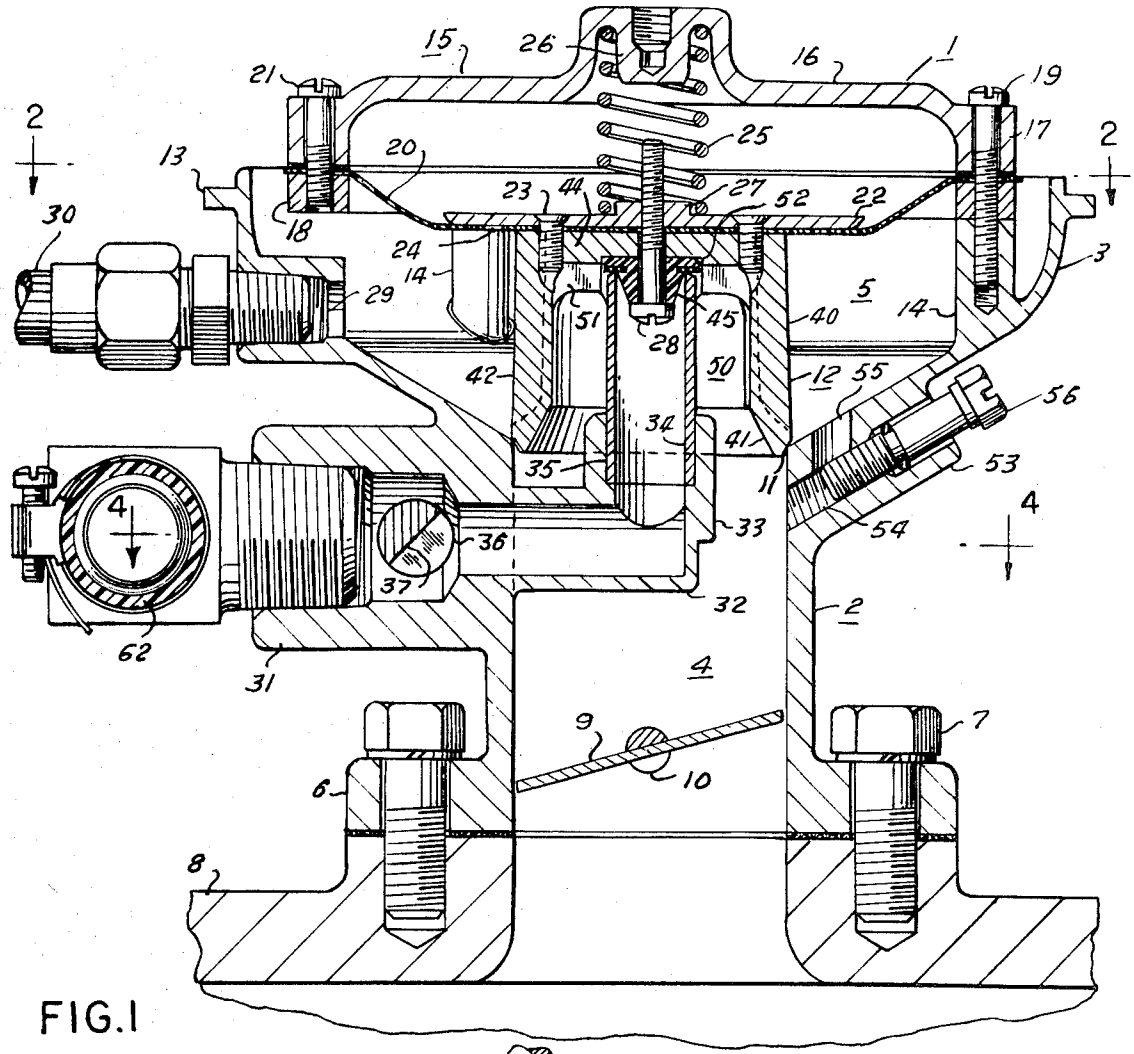


FIG.1

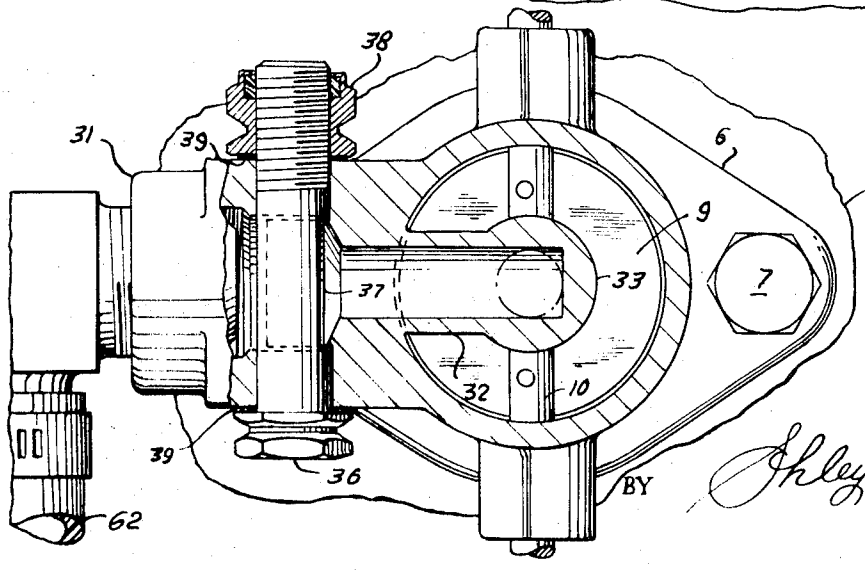


FIG.4

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GAS CARBURETOR

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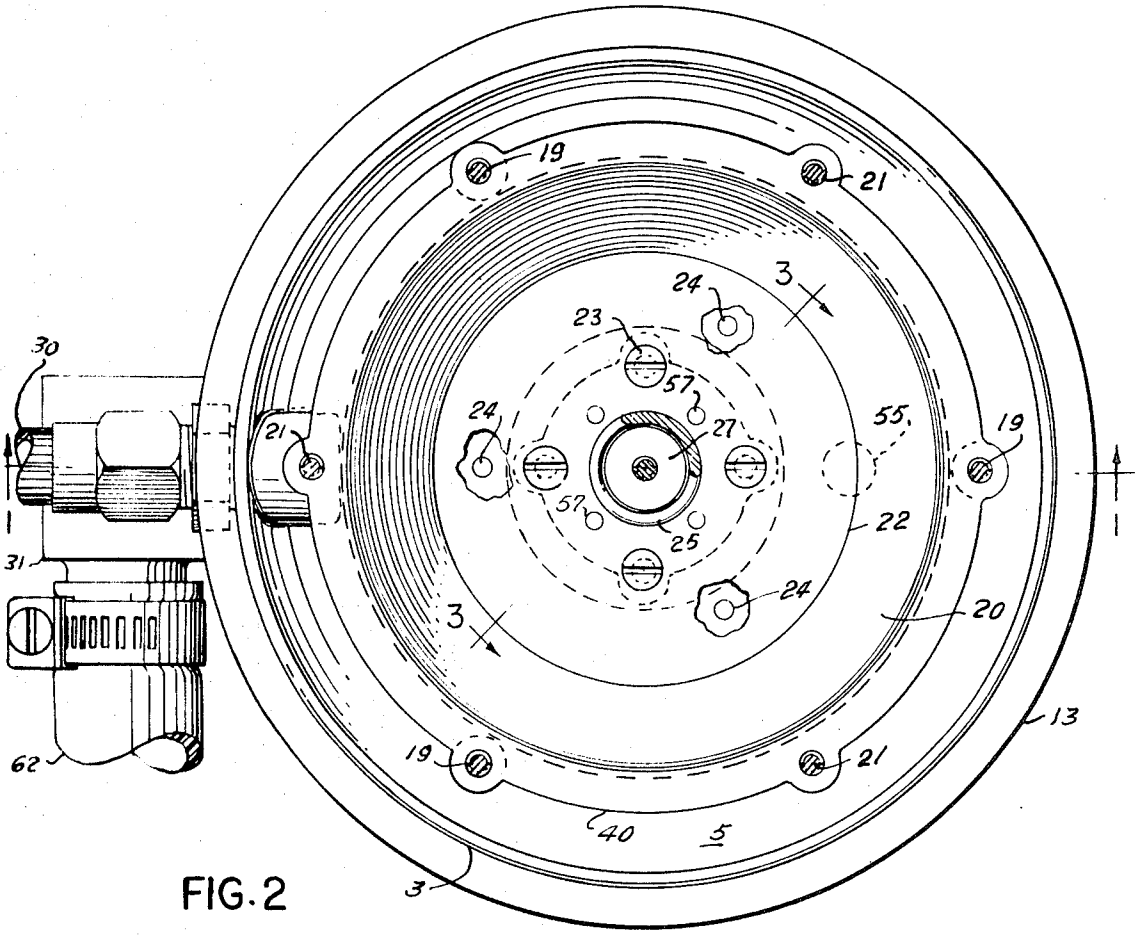


FIG. 2

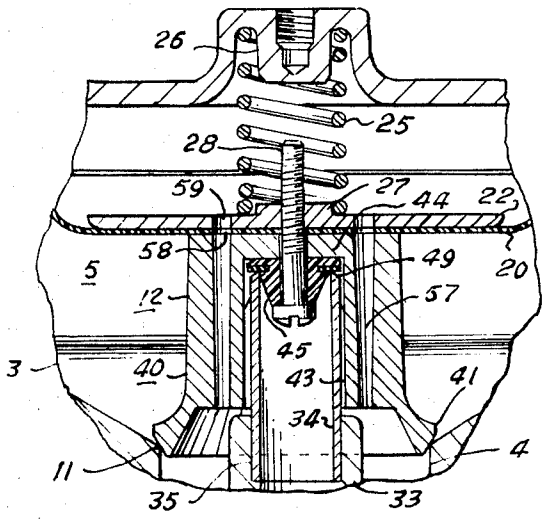


FIG. 3

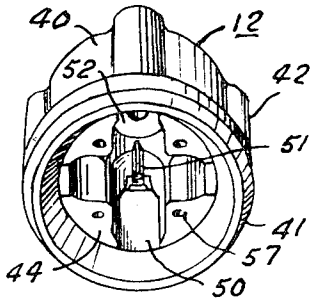


FIG. 5

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GAS CARBURETOR

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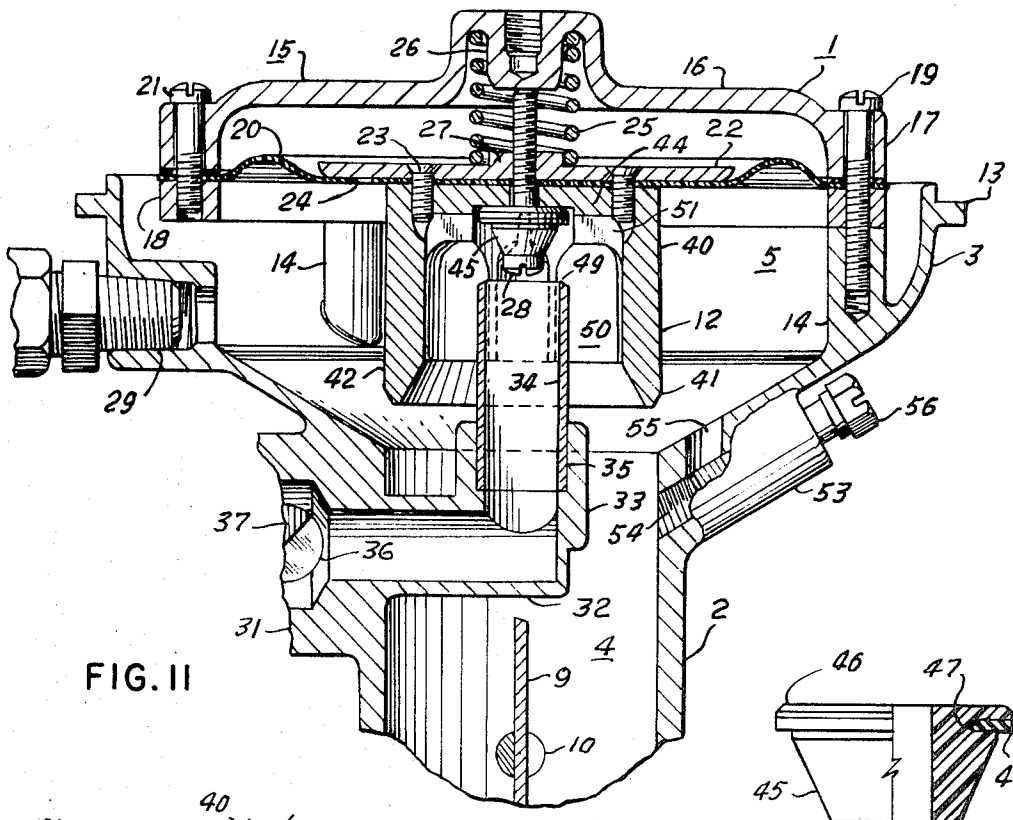


FIG. 11

FIG. 10

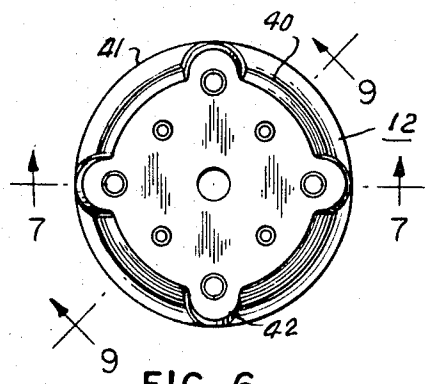


FIG. 6

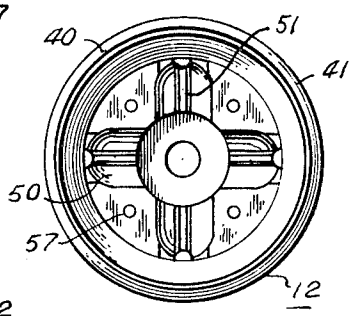


FIG. 8

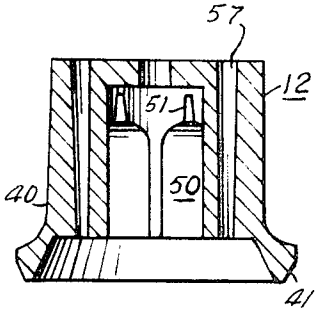


FIG. 9

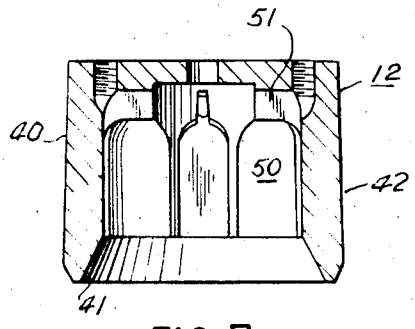


FIG. 7

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United States Patent Office 3,741,737 Patented June 26, 1973

3,741,737

GAS CARBURETOR

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Filed May 6, 1971, Ser. No. 140,688
Int. Cl. F02m 7/18, 9/12
U.S. Cl. 48—180 C 9 Claims

ABSTRACT OF THE DISCLOSURE

A carburetor for mixing air with natural or liquefied petroleum gas comprising a housing having air and gas inlets and a common outlet, fixed means within the housing having an opening through which gas may flow into said housing from the gas inlet, movable means surrounding the fixed means and arranged to coact with its opening to control the flow of gas as well as control the flow of air through said housing, pressure responsive means connected to the movable means with one side exposed to atmosphere and its opposite side of the suction of an internal combustion engine whereby said movable means is actuated by said suction, said movable means having a plurality of separate passages for conducting gas from the opening of said fixed means in separate streams, and means aligned with the passages for impingement by the gas streams to disperse said streams so as to more thoroughly mix the air and gas.

SUMMARY OF THE INVENTION

A novel carburetor for an internal combustion engine having an intake manifold which comprises a housing adapted to be connected to the intake manifold and having separate air and gas inlets and a common outlet. A passage in the housing, in constant communication with the manifold, connects the inlets to the outlet and has fixed conductor means, such as an elbow, therein leading from the gas inlet. Valve means movably mounted in the passage controls the flow of gas thereinto through the conductor means and controls communication of said passage with the air inlet. A diaphragm or other pressure responsive means is mounted in the housing with one side exposed to atmosphere and its opposite side to the manifold so as to be actuated by the suction or subatmospheric pressure of the engine. The valve means is provided with a plurality of separate internal passages for conducting gas from the conductor means to the housing passage so as to ensure distribution of the gas into a plurality of separate streams, and means is provided in said housing in alignment with the separate passages of said valve means for impingement by the gas streams to further distribute the flow of gas. The impingement means may include at least a part of the conductor means leading from the gas inlet, the transversely extending shaft of a throttle valve pivotally mounted in the housing passage and/or a transverse stream of air admitted to said passage from atmosphere.

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

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a transverse vertical sectional view, taken on the line 1—1 of FIG. 2, of a gas carburetor constructed in accordance with the invention and mounted on the intake manifold of an internal combustion engine,

FIG. 2 is a horizontal cross-sectional view taken on the line 2—2 of FIG. 1,

FIG. 3 is a transverse vertical sectional view taken on the line 3—3 of FIG. 2,

FIG. 4 is a horizontal cross-sectional view taken on the line 4—4 of FIG. 1,

FIG. 5 is a perspective view of the valve member,

FIG. 6 is a top plan view of the valve member,

FIG. 7 is a transverse vertical sectional view taken on the line 7—7 of FIG. 6,

FIG. 8 is a bottom plan view of the valve member,

FIG. 9 is a transverse vertical sectional view taken on the line 9—9 of FIG. 6,

FIG. 10 is an elevational view, partly in section, of the valve element, and

FIG. 11 is a transverse vertical sectional view of the carburetor in fully open position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawings, the numeral 1 designates the generally cylindrical housing or body of a natural or liquefied petroleum gas (LPG) mixing valve or carburetor embodying the principles of the invention having a tubular lower portion or neck 2 of reduced diameter and an enlarged upper portion or bowl 3 forming a complementary air chamber 5 adapted to communicate with the coaxial bore or throat 4 of the neck. A suitable flange 6 projects radially from the lower end of the neck 2 for fastening by bolts 7 to the usual intake manifold 8 of an internal combustion engine, and a conventional throttle valve 9 in the form of a circular plate is pivotally mounted within the bore 4 of said neck on a shaft 10 extending diametrically of said bore for controlling the flow of gas and air into said manifold. The bowl-shaped air chamber 5 is open to the atmosphere and the upper end of the neck bore opens directly into the bottom thereof, the juncture therebetween functioning as an upwardly-facing seat 11 for coacting with a valve member 12 which will be described hereinafter. Preferably, an annular radial flange 13 circumscribes the upper end portion of the bowl 3 for supporting engagement by the complementary flange or portion (not shown) of the usual air cleaner.

At least three internal tubular posts 14 upstand from the bowl adjacent its periphery for supporting a diaphragm case 15 by the external, peripheral, downwardly offset flange or rim 17 of its upper half or cover 16. The base or lower half of the diaphragm case 15 is formed by an annular plate or ring 18 complementary to the flange 17 and secured to the posts 14 by machine screws 19 extending through said flange and ring and screwthreaded in said posts. A circular flexible diaphragm or pressure-responsive element 20 has its peripheral portion clamped between the flange and ring by the screws 19 as well as by at least three machine screws 21, interposed between and of less length than said screws 19, extending through said flange and screwthreaded in said ring. The central portion of the diaphragm element 20 is reinforced by an overlying, circular, coaxial plate or disk 22, of less diameter than said diaphragm element, which may be secured to the latter as well as to the valve member 12 by a plurality, such as four, of suitable machine screws 23. For preventing rupturing of the diaphragm element in the event that the internal combustion engine (not shown) backfires and creates excessive pressure in the air chamber 5, a plurality of openings 24 is formed in said element outwardly of the screws 23. Normally, the reinforcing plate 22 overlies and closes the openings 24 to permit gradual flexure of the diaphragm element.

The diaphragm element 20 is constantly urged downwardly or inwardly by an overlying helical spring 25 interposed between said member and the cover 16 of the diaphragm case 15 and having its ends confined on a boss 26 depending axially from said case cover and a boss or spring follower 27 upstanding axially from the reinforcing plate. An upright machine screw 28 secures the valve member 12 coaxially to the plate 22 by having its upper end screwthreaded through said plate and its boss 27.

Except for the areas occupied by the valve member and the ring **18**, the entire underside of the diaphragm element is exposed to the air chamber **5**. Optionally and as shown and described in my Pat. No. 2,203,961 page 4, column 1, lines 42–74, a screwthreaded port **29** may be provided in the wall of the bowl **3** for communication with the air chamber and engagement by a line or conductor **30** which extends from the air vent of a regulator (not shown) for controlling the pressure of the gas supplied to the carburetor. With this connection, any change of the volume of air within the chamber **5** results in a corresponding alteration of the air pressure within the regulator and an adjustment of the volume of gas supplied.

An internally screwthreaded collar or nipple **31** is integral with and projects radially from the upper end portion of the neck **4** for connection with a conductor **62** extending from the pressure regulator or other suitable source of natural or liquefied petroleum gas. The inner end of the collar **31** communicates with an integral elbow **32**, of reduced or much less diameter, which extends radially inward to the center of the bore **4** of the neck **2** and has its inner arm or branch **33**, or relatively short length, upstanding coaxially of said bore into the lower end of the air chamber **5**. For receiving and supporting a short cylindrical tube or nipple **34** which is adapted to coat with the valve member **12**, a counterbore **35** extends throughout the major portion of the upright arm **33** of the elbow **32** and the inner or lower end portion of the nipple has a press fit therein. It is most desirable to control the volume of gas admitted to the carburetor in accordance with the demands of the internal combustion engine and this may be accomplished by means of an adjustable load screw **36**, of approximately the same diameter as the bore of the elbow **32**, extending diametrically across the inner end portion of the collar in close proximity to the outer end of said elbow bore. The portion of the load adjusting screw **36** within the bore of the collar **31** has approximately one-half thereof cut away to provide a semicylindrical section **37**. A nut **38** is screwthreaded on the free end of the screw (FIG. 4) for holding it in adjusted positions and, preferably, both the nut and the head of said screw are provided with gaskets **39** to prevent leakage of gas.

As best shown in FIGS. 3 and 11, the valve member includes a generally cylindrical body **40** having a flared hood or skirt **41** at its lower end for mating engagement with the seat **11** formed by the juncture of the neck bore **4** and air chamber **5** so as to function as a valve. Longitudinal bosses or ribs **42** may be formed on the exterior of the body **40** (FIGS. 1, 5–7 and 11) for accommodating the inner or lower ends of the machine screws **23** as well as reinforcing the skirt **41**. The valve body (FIGS. 3 and 9) has a coaxial cylindrical bore **43**, of slightly greater diameter than the nipple **34**, extending outwardly or upwardly from its open inner or lower end and having its outer or upper end closed by a transverse end wall **44** (FIGS. 1 and 11) formed by the circular outer or upper end portion of said body, whereby the major portion of the latter is substantially annular in cross-section. A substantially frusto-conical valve element **45**, of plastic or other suitable material, is confined upon the inner or lower end of the machine screw **28** which projects outwardly or upwardly through the end wall **44** as well as the diaphragm element **20** and its reinforcing plate **22**. As best shown at **46** in FIG. 10, the upper end of the valve element **45** is slightly enlarged in diameter to provide an annular flange or lip which is adapted to overlie the outer or upper end of the nipple **34**. Immediately below or inwardly of the flange **46**, an annular radial groove or recess **47** is formed in the valve element for confining an elastic seating ring **48** in coaction with said flange. Preferably, the outer or upper end of the nipple is bevelled outwardly to provide a sharp-edged seat (FIG. 11) for sealing engagement with the ring **48**.

For distributing the downward flow of the gas around the nipple **34** with a minimum obstruction of such flow, the bore **43** of the valve body **40** has a plurality (such as four) equally-spaced channels or passages **50** extending longitudinally throughout its length from the skirt **41** to the outer or upper end wall **44** of said body. Manifestly, the passages **50** are in constant communication with the bore **4** of the neck **2**. It is most desirable and highly beneficial for the passages to be in vertical alignment with the end portions of the shaft **10** of the throttle valve **9**, the lower or outer arm or branch of the elbow **32** and the stream of air discharged into the neck bore **4** from the air chamber **5** through ports **54** and **55** (FIGS. 1 and 11). Accordingly, the passages **50** are equally spaced and the downstreams of gas therefrom are broken up and spread by impinging against the shaft end portions, the elbow and the idling air stream. At the inner or upper end of each passage, a relatively small coextensive groove or channel **51** may extend radially to the coaxial bore of the valve body so as to establish communication between the passages and the bore of the nipple **34** during initial opening and final closing movement of the valve element **45**. If desired, this coaxial bore may be of greater depth than the passages **50** so as to extend thereabove and provide in the end wall of the valve body **40** a recess or socket **52** for complementary engagement with the flange **46** of the valve element for centering the latter. Of course, such centering is assisted by the frusto-conical contour of the valve element **45**.

In order to ensure sufficient air for idling of the internal combustion engine, a semicylindrical boss **53** is provided on the underside of the bowl **3** and has a screwthreaded bore **54** communicating with the inner or upper portion of the bore **4** of the neck **2**. Also, the bore **54** communicates with the air chamber **5** through a suitable upright port **55** and has an adjusting screw **56** threaded therein. Manifestly the force of the spring **25** must be overcome to permit unseating of the valve member **12** and valve element **45** as well as maintenance thereof in an opened position during operation of the engine. For accomplishing this purpose, a plurality (such as four) of equally spaced orifices **57** (FIGS. 3, 5, 6 and 9) is formed in the end wall **44** of the valve member and communicates with aligned ports **58** and **59** in the diaphragm element **20** and its reinforcing plate **22**, respectively, whereby the outer or upper side of said element is constantly exposed to the pressure within the neck bore.

OPERATION

Upon starting of the engine, a suction or partial vacuum is created in the bore **4** of the neck **2** and is exerted against the outer or upper side of the diaphragm element. Although the underside of the valve member is also exposed to this subatmospheric pressure, the greater area of the element **20** permits the pressure of the air within the chamber **5** to overcome the force of the spring **25** and thereby flex said element upwardly (FIG. 11) so as to unseat the valve member **12** and its valve element **45**. When this occurs, the gas within the nipple **34** flows over the seat **49** and downwardly around said nipple through the passages **50** of the valve body **40** into the neck of the carburetor and the air within the chamber is drawn past the seat **11** into said neck for mixing with said gas. Due to the alignment of the end portions of the throttle shaft **10**, the elbow **32** and the air stream or jet of the idling port **45** with the gas streams emitted by the passages, the resultant impingement causes amplified distribution or dispersement of the gas and more thorough admixture with the air. Of course, the air and gas mixture flows outwardly or downwardly from the bore **4** of the neck **2** into the manifold **8** of the engine wherein further mixing takes place.

It is noted that the air which enters the manifold contacts only the exterior of the valve member and does not flow over the nipple **34** or its seat **49**. Therefore, there

is no danger of impairment of efficiency by any dirt or girt which may be in the air. The suction of the engine at all times controls the amount of air and gas entering the manifold and, upon acceleration of said engine, said suction increases proportionately and moves the valve member **12** and its element **45** upwardly a greater distance away from the seats **11** and **49**, respectively, whereby more air and gas may enter said manifold. Since the air chamber **5** completely encircles the valve member, the air enters the neck of the carburetor circumferentially.

When the engine is stopped, the suction or partial vacuum in the manifold **8** ceases and the force of the spring **25** immediately seats the valve member and its valve element to stop the flow of air and gas into the neck **2**. Due to the sharp edge of the seat **49** at the upper end of the nipple **34**, said seat tends to embed itself in the elastic seating ring **48** and provide a gas tight seal.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. A carburetor for an internal combustion engine having an intake manifold including

a housing adapted to be connected to the intake manifold and having separate air and gas inlets and a common outlet,

a passage in the housing establishing communication between the inlets and outlet,

fixed means within the passage leading from the gas inlet and having an opening through which gas may flow into said passage,

moveable means within said housing concentrically surrounding the fixed means and adapted to coact with its opening to control the flow of gas to said passage as well as control communication of the latter with the air inlet,

pressure responsive means within said housing connected to the moveable means with one side exposed to atmosphere and its opposite side to the suction of the engine whereby said movable means is actuated by said suction,

said moveable means having a plurality of separate internal passages for conducting gas from the opening of said fixed means to said housing passage so as to ensure distribution of the gas into a plurality of streams,

and means in the latter passage aligned with the separate passages of said movable means for impingement by the gas streams to disperse the same, said opening of said fixed means extending longitudinally of said housing passage and having its egress end directed toward the pressure responsive means, so as to discharge gas against the latter means in opposed relation to the flow through said housing passage.

2. A carburetor as defined in claim **1** wherein

the impingement means includes at least a part of the fixed means leading from the gas inlet.

3. A carburetor as defined in claim **2** including

throttle means pivotally mounted in the housing passage downstream of the fixed means for controlling flow to the outlet and having rotatable supporting means extending transversely of said passage so as to form a part of the impingement means.

4. A carburetor as defined in claim **2** wherein

the housing has means establishing communication between its passage and atmosphere to admit air to said passage and to direct the admitted air in a stream transversely of said passage so as to ensure sufficient air during idling of the engine,

the transverse stream of admitted air forming a part of the impingement means.

5. A carburetor as defined in claim **4** including

throttle means pivotally mounted in the housing passage downstream of the fixed means for controlling flow to the outlet and having rotatable supporting means extending transversely of said passage so as to form a part of the impingement means.

6. A carburetor as defined in claim **1** wherein

the housing has means establishing communication between its passage and atmosphere to admit air to said passage and to direct the admitted air in a stream transversely of said passage so as to ensure sufficient air during idling of the engine,

the transverse stream of admitted air forming a part of the impingement means.

7. A carburetor as defined in claim **1** including

throttle means pivotally mounted in the housing passage downstream of the fixed means for controlling flow to the outlet and having rotatable supporting means extending transversely of said passage so as to form a part of the impingement means.

8. A carburetor as defined in claim **7** wherein

the housing has means establishing communication between its passage and atmosphere to admit air to said passage and to direct the admitted air in a stream transversely of said passage so as to ensure sufficient air during idling of the engine,

the transverse stream of admitted air forming a part of the impingement means.

9. A carburetor as defined in claim **1** wherein

a portion of the fixed means extends transversely of the passage of the housing in alignment with at least one of the separate passages of the movable means and forms a part of the impingment means,

said fixed means having a portion thereof and its opening extending axially of said housing passage for coaction with the surrounding movable means.

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U.S. Cl. X.R.

48—180 P; 123—119 DB