June 11, 1940. S. P. JONES 2,203,961

GAS MIXER

Filed Aug. 23, 1937 3 Sheets-Sheet 1

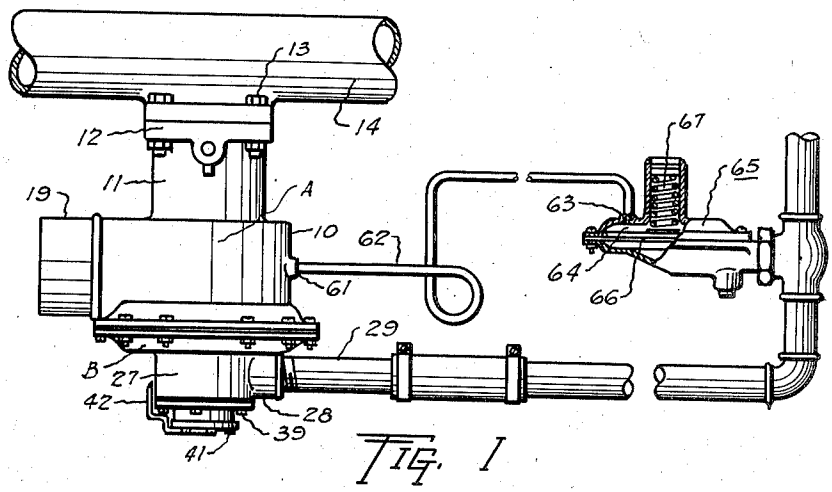


FIG. 1

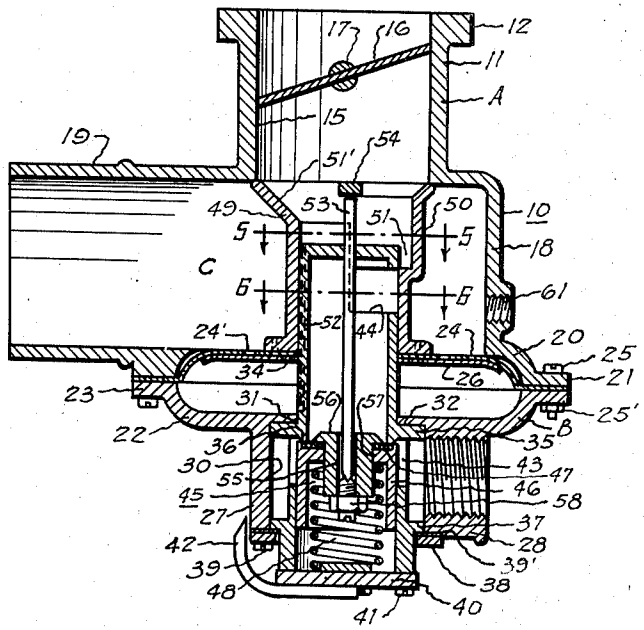


FIG. 2

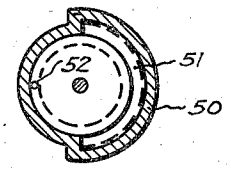


FIG. 5

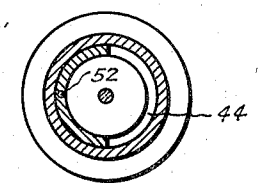


FIG. 6

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June 11, 1940. S. P. JONES 2,203,961

GAS MIXER

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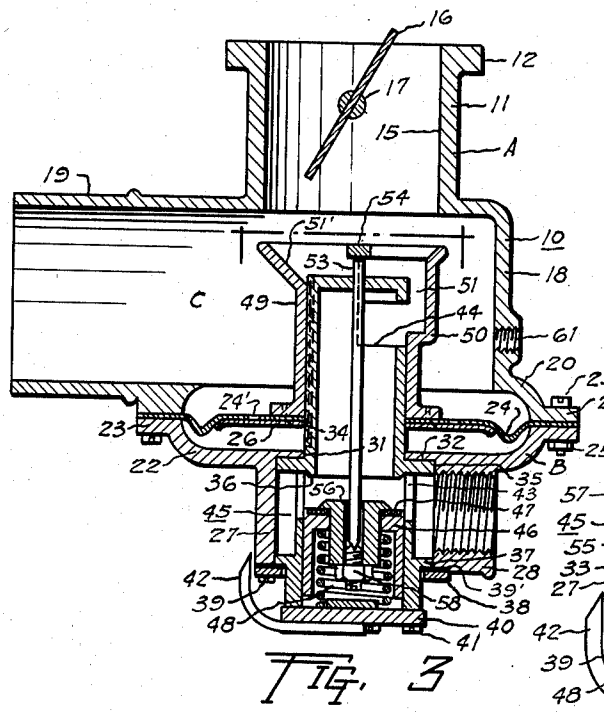


FIG. 3

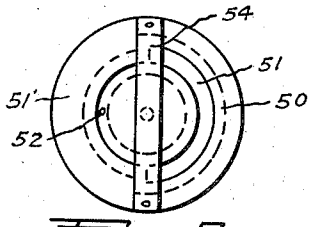


FIG. 7

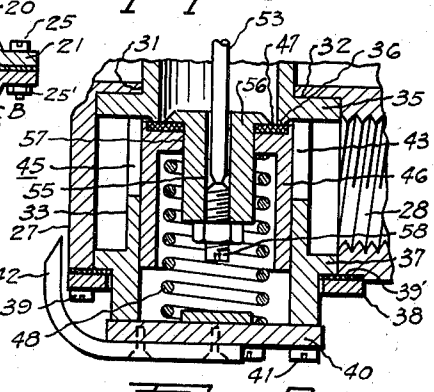


FIG. 8

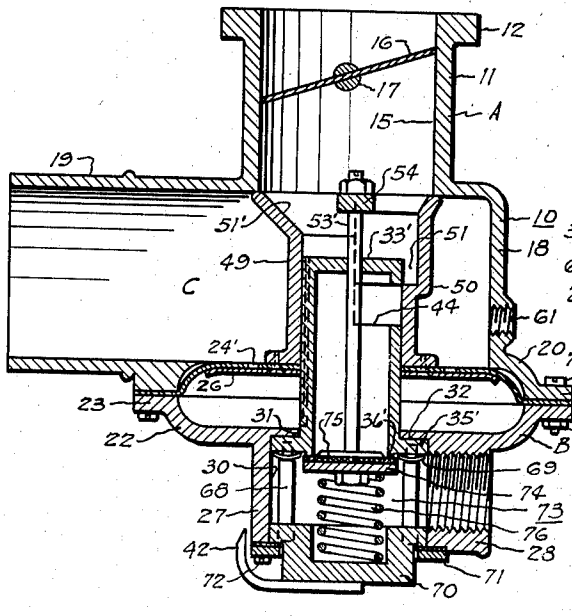


FIG. 9

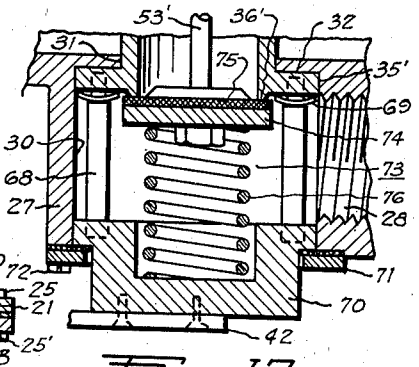


FIG. 12

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GAS MIXER

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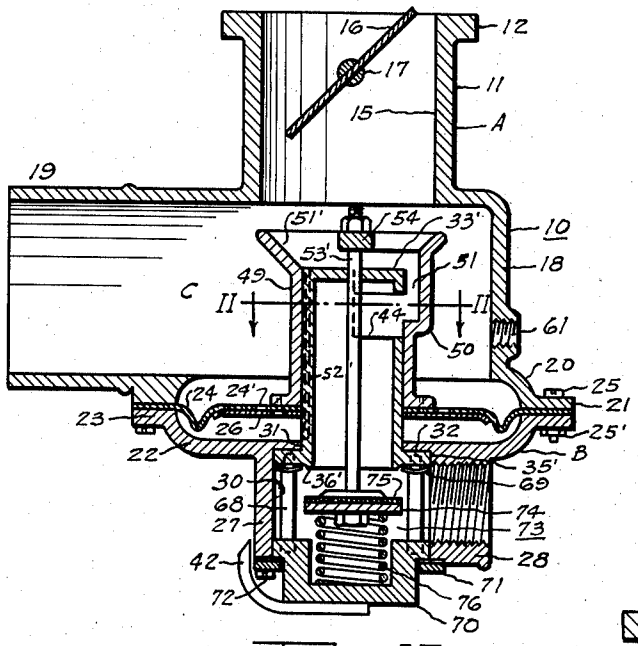


FIG. 10

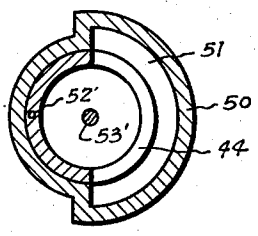


FIG. 11

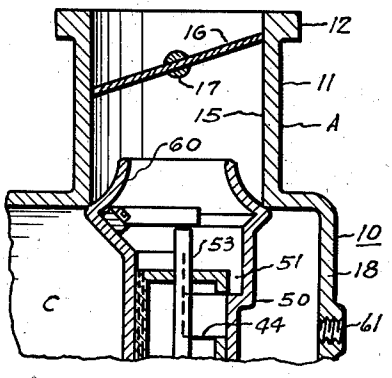


FIG. 13

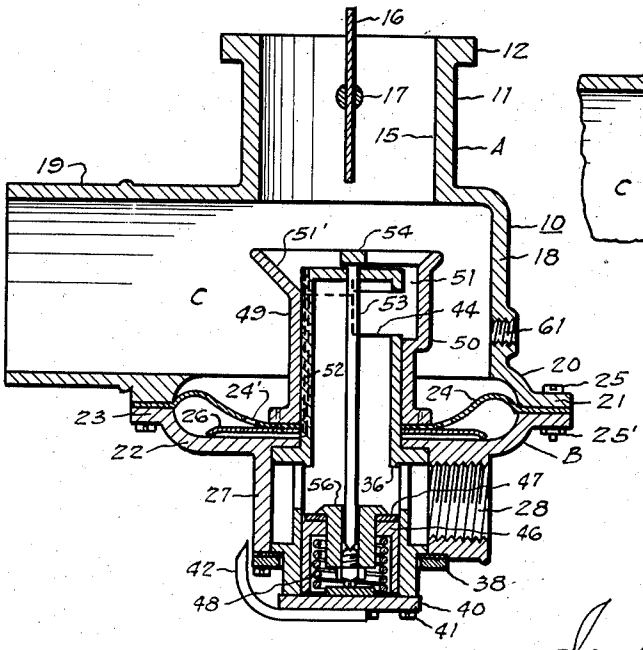


FIG. 4

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Patented June 11, 1940 2,203,961

UNITED STATES PATENT OFFICE

2,203,961

GAS MIXER

Sam P. Jones, Dallas, Tex.

Application August 23, 1937, Serial No. 160,405

13 Claims. (Cl. 48—180)

This invention relates to new and useful improvements in gas mixers.

One object of the invention is to provide an improved gas mixer for gas engines which is operated by the suction of the engine, whereby the gas and air are correctly proportioned and controlled by said engine suction to maintain the operating efficiency of the engine under all loads and conditions.

An important object of the invention is to provide an improved gas mixer wherein the means for controlling the flow of gas into the engine is located out of the path of the incoming air, whereby said air does not contact the same and any dirt, or other extraneous matter in said air cannot accumulate or adhere to said control means to impair its efficient operation.

Another object of the invention is to provide an improved gas mixer wherein the gas is controlled by a movable member which is adapted to engage a flexible or soft seat, whereby a positive cut-off of the gas is obtained.

A further object of the invention is to provide an improved gas mixer having a stationary tubular post or member through which the gas flows, with a sleeve slidable on said post for controlling the air entering the engine and also for controlling the air passing from the interior of said post, said sleeve being actuated or moved by the suction of the engine, whereby both the gas and air supply are controlled by said engine suction.

Still another object of the invention is to provide an improved gas mixer having a movable sleeve member which not only controls the admission of air and meters the flow of gas entering the engine, but also controls the opening and closing of a positive cut-off valve for said gas; the member having a diaphragm connected thereto which diaphragm is exposed to the engine suction, whereby an increased area for the suction to act upon is provided, thereby resulting in actuation of the mixer regardless of the speed of the engine.

A still further object of the invention is to provide an improved gas mixer having a control member slidable on a stationary member for controlling the admission of gas and air to the engine and so constructed that the contacting surfaces between the surface is not depended upon to cut off the flow of gas when the mixer is inactive, whereby a slight clearance between the members may be provided to assure operation or sliding of the movable member.

A particular object of the invention is to provide a gas mixer which has means for connecting its air chamber with the regulator controlling the flow of gas to its gas chamber, whereby any change in the volume of air entering the mixer results in a proportionate change in the incoming gas.

Another object of the invention is to provide a gas mixer employing a diaphragm exposed to the engine suction, with means for preventing rupturing of or injury to said diaphragm in the event that the engine brackfires.

A 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, in which an example of the invention is shown, and wherein:

Figure 1 is an elevation of a gas mixer, constructed in accordance with the invention, and connected to the intake manifold of an engine, as well as to an ordinary gas regulator,

Figure 2 is a transverse, vertical sectional view with the mixer in a cut-off position,

Figure 3 is a similar view, with the mixer admitting gas and air to the engine,

Figure 4 is a view, similar to Figure 3, showing the position of the parts in the event that the engine backfires,

Figure 5 is a horizontal, cross-sectional view, taken on the line 5—5 of Figure 2,

Figure 6 is a horizontal, cross-sectional view, taken on the line 6—6 of Figure 2,

Figure 7 is a horizontal, cross-sectional view, taken on the line 7—7 of Figure 3,

Figure 8 is an enlarged, vertical, sectional view of the gas cut-off valve,

Figure 9 is a view similar to Figure 2 showing a modified form of gas valve construction, with said valve in a closed position,

Figure 10 is a similar view with the valve in an open position,

Figure 11 is a horizontal, cross-sectional view taken on the line 11—11 of Figure 10,

Figure 12 is an enlarged view showing the construction of the modified form of valve, and

Figure 13 is an enlarged view of a modified form of sleeve which controls the admission of air to the engine.

In the drawings, the numeral 10 designates a casing or housing, which has a general cylindrical shape in cross-section and which is constructed of an upper section A and a lower section B. The upper section includes an upwardly extending neck 11 having an external, annular flange

12 made integral therewith and this flange is arranged to be fastened by bolts 13 to the usual intake manifold 14 of an internal combustion engine (not shown). The neck is formed with a vertical bore 15 and the usual throttle valve 16 is mounted within said bore on a transversely extending shaft 17. Obviously, by swinging the valve 16 the passage of gas and air through the bore 15 into the manifold 14 may be readily controlled.

Below the neck 11, the upper section A is enlarged as shown at 18 to form an air chamber C and a collar 19 which is preferably made integral with said section extends radially therefrom. The chamber C is open to atmosphere whereby air may enter the same and flow upwardly through the face of the neck to the manifold. If desired, a suitable air cleaner (not shown) may be mounted on the collar 19. The upper half of a diaphragm case 20 is formed integral with the lower end of the section A and is provided with an outwardly directed annular flange 21.

The lower half of the diaphragm case 22 having an external annular flange 23, is formed at the upper end of the section B of the housing. A flexible diaphragm 24 has its peripheral edge portion clamped between the flanges 21 and 23, which flanges are secured together by bolts 25 and nuts 25'. The central portion of the diaphragm is suitably reinforced in the usual manner by a metallic plate 26.

A cylindrical skirt 27 depends from the lower half 22 of the diaphragm case and has an internally screw-threaded collar 28 extending radially therefrom. The collar receives one end of a gas inlet pipe or conductor 29 whereby gas is conducted into the bore 30 of the skirt. The bottom of the diaphragm case 20 has a circular opening 31 therein, which opening is in axial alinement with the bore of the skirt and the diameter of said opening is less than the diameter of the bore, so as to form an internal annular shoulder 32 at the upper end of the bore. A tubular guide post or member 33 is located within the skirt and has its upper end extending through the opening 31 in the bottom of the diaphragm case and also through an opening 34 in the diaphragm, whereby its upper end projects into the air chamber C. The top of the post is closed and terminates some distance below the neck 11 at the upper end of the section A.

An external flange 35 is provided on the post and abuts the internal flange 32 at the upper end of the bore 30 of the skirt 27. Below the flange the post or member is slightly enlarged to form an internal valve seat 36 within the post. The diameter of this enlarged portion of said post is less than the diameter of the bore 30 to permit gas entering the bore from the inlet pipe 29 to flow into the annular space between the exterior of the post and the bore 30. In alinement with the lower end of the skirt, the post or member 33 is provided with a second external flange 37 having substantially the same diameter as the bore and this flange is disposed within said bore, and rests upon a retaining ring 38 which is fastened to the lower edge of the skirt 27 by bolts 39. A suitable packing gasket 39' is interposed between the ring and skirt to prevent leakage of the gas from the bore of the skirt. The distance between the flanges 35 and 37 is such that when the ring is engaging the latter flange, the flange 35 is held in engagement with the shoulder 32. This engagement is sufficient to prevent leakage of gas past the shoulder 32 but yet permits a rotation of the post or member 33 with relation to the skirt 27 and diaphragm 24.

The extreme lower end of the post 33 or that portion below the flange 37, depends beyond the retaining ring 38 and is closed by a plate 40 which is secured thereto by bolts 41. An indicating arm 42 is fastened to the plate and is curved upwardly so that its upper end extends contiguous to the exterior of the skirt 27 at its lower end. The skirt may have graduations or other markings thereon and when the post 33 is rotated within the housing, the arm 42 indicates its position therein, as will be explained.

From the foregoing, it will be seen that the gas may enter the bore 30 of the skirt 27 and may flow into the annular space between the bore and the lower end of the post. For permitting this gas to flow into and upwardly through the post or member 33, said post is formed with a plurality of radial ports 43 which are located immediately below the flange 35 and internal valve seat 36. The gas which passes through these ports flows upwardly through the post 33 and escapes therefrom through an arcuate slot or opening 44 at the upper portion of said post. The slot 44 preferably extends halfway around the post, as is clearly shown in Figure 6, and the gas passing through slot may flow upwardly through the neck 11 at the upper end of the section A and then into the intake manifold 14.

For controlling the flow of gas through the ports 43 and upwardly through the tubular post 33, a valve assembly 45 is mounted within the lower end of the bore of said post below the valve seat 36. This valve assembly includes a valve member or piston 46 which has a sliding fit within the bore of said post and a flexible ring 47 is secured to the top of said piston. A coiled spring 48 is confined within the bore between the underside of the piston and the closure plate 40 and exerts its pressure to constantly urge the piston upwardly so as to hold the flexible ring 47 in engagement with the seat 36. The valve ring is constructed of rubber or other suitable material and obviously, when engaged with the seat 36, is distorted to some extent, whereby the seat is embedded therein to prevent any leakage of gas thereby.

Movement of the valve member off its seat must be accomplished against tension of the spring 48 and for opening said valve member to permit gas to enter the tubular post 33, a sleeve 49 surrounds the upper end of the post and is slidable thereon. This sleeve has its lower end flanged and suitably secured to the upper side of the diaphragm 24. The upper portion of the sleeve is offset or enlarged at one side as shown at 50 in Figures 2, 3 and 5 and this enlarged portion extends around substantially one half of the sleeve to form an arcuate passage 51 therein. The upper end of the sleeve is flared outwardly at 51' and is adapted to engage the top of the chamber C adjacent and surrounding the bore 15 of the neck 11. When the diaphragm 24 is in a normal position, the sleeve 49 is raised with its upper end closing the bore of the neck 11 whereby air from the chamber C cannot pass the manifold. At this time, the passage 51 formed within the upper portion of the sleeve is above the arcuate slot in the post 33 and said slot is closed by the sleeve.

The underside of the diaphragm 24 is exposed to the suction of the engine through a vertical

passage 52 which extends downwardly through the wall of the post or member 33 and when the engine is started, the suction acts upon the cross-sectional area of the diaphragm to move the same downwardly (Figure 3). Downward movement of the diaphragm slides the sleeve 49 downwardly whereby its upper end thereof moves away from the top of the chamber C to permit the air therein to enter the manifold 14. At the same time the passage 51 formed by the offset 50 in the sleeve uncovers a portion of the arcuate slot 44 in the post, the particular portion which is uncovered being dependent upon the movement of the sleeve.

As the air is admitted to the manifold and the slot 44 is uncovered, the valve member or piston 46 must be moved downwardly to admit gas to the tubular post so that gas may flow through the slot 44 to the manifold 14. For this purpose, a vertical rod 53 extends axially through the post 33 and has its upper end projecting into the sleeve 49. This upper end is adapted to be engaged by a bar 54 which extends transversely within the sleeve and manifestly, downward movement of the sleeve will move said rod downwardly. The lower end of the rod extends into the axial bore 55 of a flanged head 56. The head is mounted within an axial opening 57 in the valve member 46 and ring 47 and has its flange overlying said ring. The lower end of the bore of the head is closed by a screw 58 and the pointed lower end of the rod 53 engages said screw. When the rod is moved downwardly the valve member or piston 46 is moved downwardly under tension of the coiled spring 48 whereby the flexible ring 47 is disengaged from the valve seat 36.

It is noted that the point of contact between the sleeve 49 and the rod 53 is some distance above the diaphragm which is the element exerting the force; also the point of contact between said rod and the valve member 46 is below the point at which the spring 48 engages the member and therefore, the side pull on the rod when the diaphragm is depressed, is negligible. This eliminates any tendency of the sleeve to bind on the post as it is moved in a vertical or straight line, thereby preventing excessive wear on the sleeve and post.

In operation, when the engine to which the gas mixer is attached is started, the partial vacuum created in the intake manifold 14 will act against the underside of the diaphragm 24 through the port or passage 52 in the post 33. The vacuum will, of course, act on the cross-sectional area of the sleeve 49 but since the effective area of the diaphragm is much greater than the exposed cross-sectional area of said sleeve, the diaphragm and sleeve will move downwardly to move the upper end of said sleeve away from the bore 15 of the neck 11. When this occurs, the air entering the air chamber C may pass upwardly into the manifold 14. At the same time that the sleeve 49 moves downwardly to admit air to the manifold 14, the chamber 51 which is formed by the enlarged portion 50 of the sleeve 49 is moved downwardly with relation to the arcuate slot or opening 44 in the tubular post or member 33, whereby a portion of this slot or opening is uncovered. This establishes a communication between the interior of the post or member 33 and the bore 15 of the neck 11 as well as the manifold 14.

The downward movement of the sleeve which admits air to the engine manifold and uncovers a portion of the slot 44 also imparts a downward movement to the valve member 45 through the medium of the vertical rod 53. The rod is moved downwardly by the engagement of the transverse bar 54 with its upper end and since its lower end engages the screw 58 within the head 56 of the valve member, it will be manifest that the valve member is moved off of the seat 36, as is clearly shown in Figure 3. When this occurs, the gas from the inlet pipe 29 may flow through the radial ports 43 in the lower end of the member 33 after which it may enter the interior of said member. The gas from the interior of the member may then flow outwardly through the slot or opening 44, upwardly through the neck 11 and into the manifold 14 of the engine. The mixing of the air and gas takes place within the bore 15 of the neck 11 and also within the intake manifold 14 prior to its passage to the cylinders of said engine. It is pointed out that there is no restriction of the gas flow at the valve member 45 for obviously when the member moves off the seat 36 the gas may flow into the post 33 from any direction around said seat. However, in escaping from the member 33, the gas must pass through the arcuate slot 44 which extends only half way around said post. The area which is uncovered at the seat 36 is twice as great as the cross-sectional area of the slot 44 and therefore the restriction or control of the gas entering the manifold 14 is accomplished at the opening 44 and not at the valve member 45.

The amount of gas which escapes from the slot can be readily controlled by adjusting the member 33 to register more or less of the slot 44 with the passage 51 in the sleeve. This adjustment is accomplished by rotating the member 33 with relation to the sleeve and the mounting of said member is such that the frictional engagement of its flanges 35 and 37 with the shoulder 32 and ring 38 is sufficient to hold said member in its adjusted positions. The position of the slot with relation to the passage is indicated by the indicator arm 42 which is outside of the skirt 27.

The air which is entering the manifold 14 from the chamber C contacts only the upper end or outer surface of the control sleeve 49. This air does not have to pass over the contacting surface between the sleeve and the stationary post 33 and therefore there is no danger of any dirt or grit which may be present in the air impairing the efficiency of the movable parts. This is an important feature of the invention as obviously the inner surface of the sleeve is kept clean at all times since there is substantially no dirt present in the incoming gas.

The suction of the engine at all times controls the amount of gas and air entering said engine and if the same is accelerated, the suction is proportionately increased, whereby the sleeve is moved downwardly a greater distance to uncover more of the arcuate slot 44 and permit a greater amount of air to enter the manifold 14. This increased downward movement of the sleeve 49 moves the upper end of said sleeve further away from the neck 11, whereby more air may enter said manifold. It is noted that the air chamber C extends completely around the sleeve 49, whereby said air may enter the neck 11 circumferentially. If desired, the upper end of the sleeve 49 may be curved inwardly as shown at 60 in Figure 13. This curved upper end of the sleeve may extend into the bore 15 of the neck whereby the air entering said bore is directed toward the center thereof to assure its complete admixture

with the gas passing upwardly through the sleeve from the interior of the post or member 33.

When the engine is stopped, the suction or partial vacuum created in the manifold 14 is cut off and the spring 48 below the valve member 46 immediately returns said member to its seat 36. At the same time the upper end of the sleeve 49 is seated against the lower end of the neck 11 by means of the rod 53 engaging the bar 54. The engagement of the sleeve with the lower end of the neck immediately cuts off the air entering said neck. The flexible ring 47 at the upper end of the valve member strikes the seat 36 and being flexible, it will be seen that said seat embeds itself within the ring, whereby a gas-tight seal is had at this point. Thus the gas and the air passing to the manifold 14 are shut off upon the upward movement of the valve member and sleeve. The parts remain in this position until the engine is again started.

To prevent rupturing or otherwise injuring the diaphragm 24 in the event that the engine backfires, said diaphragm is formed with a plurality of openings 24' which are disposed adjacent the lower end of the sleeve 49. Normally these openings overlie the metallic reinforcing plate 26 and so long as the diaphragm is moved more or less gradually, said openings engage and are covered by said plate. If the engine backfires, the sleeve and diaphragm would be suddenly and quickly moved downwardly to the position shown in Figure 4. This sudden movement of the diaphragm would cause the diaphragm to leave the metallic plate 26, whereby the openings 24' are uncovered. When so uncovered any gas or air which is trapped beneath said diaphragm may escape outwardly through these openings. Therefore a sudden downward movement of the diaphragm would not rupture the same as the openings provide a relief for the escape of any gas or air which may be trapped therebeneath.

The upper section A of the housing is provided with a port 61 which communicates with the interior of the air chamber C. This port is internally screw-threaded so as to receive a connection or conductor 62. The other end of the conductor 62 (Figure 1) is connected to the vent 63 of the diaphragm chamber 64 of a gas regulator 65. The inlet pipe 29 is also connected to the gas regulator 65 in the usual manner and the gas flowing into the bore 30 of the skirt 27 is controlled by said regulator. The pressure of the air within the chamber C is thus directed against the usual diaphragm 66 within the regulator and is added to the spring 67 to resist movement of the diaphragm. The spring 67 is adjusted so as to properly control the gas flowing through the conductor 29 into the skirt 27. So long as the volume of air entering the chamber C is maintained, the volume of gas entering the skirt 27 is regulated so that a proper amount of gas and air is passing to the manifold 14. However, in the event that the volume of air within the chamber C should undergo a change for any reason whatsoever, such as if the air cleaner becomes dirty or clogged and prevents sufficient air passing into the chamber, then a resultant change in air pressure within the diaphragm chamber 64 will occur. This change in pressure within the chamber 64 will cause a change in the regulation of the gas flow passing through the conductor 29 and therefore the amount of gas entering the skirt 27 will immediately be cut down in proportion to the change within the chamber C. It is pointed out that this hook-up of the gas mixer with the usual regulator is entirely optional and if it is not desired to use said regulator, the opening 61 in the housing 10 may be plugged.

In Figures 9 to 12 a slightly modified form of the invention is shown. In this form, the tubular post or sleeve 33 is eliminated and a post 33' is substituted therefor. The upper portion of the post 33' is similar in construction to the post 33 but said post 33' terminates at a valve seat 36' which is disposed at the same point as the valve seat 36. A flange 35' surrounds the valve seat 36' and a plurality of vertical pins 68 have their upper ends engaged in the flange 35'. The pins are shouldered and have spring washers 69 confined between the shoulder thereon and the underside of the flange 35'. The lower ends of the pins 68 are confined within a cap or closure 70 which is inserted in the lower end of the skirt 27 of the housing. The cap is flanged and is held within the skirt by a retaining ring 71 secured thereto by bolts 72. The cap or closure 70 has the indicating arm 42 fastened to its underside.

Instead of the valve member 45, a valve member 73 is provided and includes a metallic disk 74 having a flexible disk 75 on its upper surface. A vertical rod 53' extends through the disks 74 and 75 and has its upper end bolted to the transverse bar 54 of the sleeve 49, whereby said sleeve is connected to the valve member 73. A coiled spring 76 is confined between the underside of the disk 74 and the closure 70 to urge the valve upwardly against the seat 36'. The operation of this form is exactly the same as the first form hereinbefore described.

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

1. A gas mixer for an internal combustion engine having an intake manifold including, a housing adapted to be connected to said intake manifold of the engine and having a gas inlet and an air inlet, the housing also having a gas passage leading from the gas inlet and having a port establishing communication between the passage and the manifold, said housing also having a fuel opening which communicates with the manifold, pressure responsive means within the housing exposed to the engine suction and actuated thereby, movable means within the housing secured to the pressure responsive means movable with relation to the air outlet for controlling the admission of air to the manifold and also for co-acting with the port leading from the gas passage for controlling the gas flowing from the passage to said manifold, whereby the gas and air flowing to the manifold is proportioned by said means, a valve seat within the gas passage between the gas inlet and the port which establishes communication between the passage and manifold, a valve adapted to engage the seat and having a flexible seating surface whereby a positive gas cut off is had when said valve is seated, and means for connecting said valve to the movable means so that said valve is operated thereby.

2. A gas mixer for an internal combustion engine having an intake manifold including, a housing adapted to be connected to said intake manifold of the engine and having a gas inlet and an air inlet, a tubular member within the housing having a gas inlet at its lower end communicating with the gas inlet in the housing and an outlet port in its upper portion so that gas may flow into the manifold from said member, the housing also having a fuel opening which com-

municates with the manifold, a sleeve slidable on said member for closing the outlet port therein to cut off the gas to the manifold, said sleeve also being movable relative to the full opening for controlling the admission of air to the manifold, and a pressure responsive element connected to the sleeve and to the housing and exposed to the suction of the engine for moving said sleeve to proportion the admission of air and gas to the manifold.

3. A gas mixer for an internal combustion engine having an intake manifold including, a housing adapted to be connected to said intake manifold of the engine and having a gas inlet and an air inlet, a tubular member within the housing having a gas inlet at its lower end and an outlet slot in its upper portion so that gas may flow into the manifold from said member, the housing also having a fuel opening which communicates with the manifold, a sleeve slidable on said member for closing the outlet slot therein to cut off the gas to the manifold, said sleeve also being movable relative to the fuel opening for controlling the admission of air to the manifold, a pressure responsive element connected to the sleeve and to the housing and exposed to the suction of the engine for moving said sleeve to proportion the admission of air and gas to the manifold, and a positive cut off valve within the tubular member between the gas inlet and the outlet slot and connected with the sleeve for controlling the admission of gas to the member.

4. A gas mixer for an internal combustion engine having an intake manifold including, a housing adapted to be connected to the intake manifold of the engine and having a gas inlet and an air inlet, a tubular member within the housing having a gas inlet at its lower end and an outlet port in its upper portion so that gas may flow into the manifold from said member, said housing also having a fuel opening which communicates with the manifold, a sleeve slidable on said member for closing the outlet port therein to cut off the gas to the manifold, said sleeve also being movable relative to the fuel opening for controlling the admission of air to the manifold, a pressure responsive element mounted within the housing and connected to the sleeve and exposed to the suction of the engine for moving said sleeve to proportion the admission of air and gas to the manifold, a valve seat within the member and located between the gas inlet and the outlet opening, and a valve having a flexible seating surface arranged to engage the seat for controlling the flow of gas into the member.

5. A gas mixer for an internal combustion engine having an intake manifold including, a housing having a gas inlet and an air chamber therein and adapted to be connected to the manifold of an engine, a tubular member rotatably confined within the housing and having a gas inlet in its lower end communicating with the gas inlet of the housing whereby gas may flow into the member, said member having an arcuate outlet slot in its upper portion to permit gas to escape therefrom to the manifold, the housing also having an opening which communicates with the manifold, a sleeve slidable on the member and having its upper end movable relative to the opening for controlling the admission of air from the air chamber to the manifold, said sleeve having an arcuate passage therein adapted to register with the arcuate outlet slot to uncover the same to permit the gas to flow to the manifold, and a diaphragm mounted within the housing and connected to the sleeve and exposed to the engine suction to move said sleeve to admit the air and gas to the manifold in predetermined proportions.

6. A gas mixer for an internal combustion engine having an intake manifold including, a housing having a gas inlet and an air chamber therein and adapted to be connected to the manifold of an engine, a tubular member rotatably confined within the housing and having a gas inlet in its lower end communicating with the gas inlet of the housing whereby gas may flow into the member, said member having an arcuate outlet slot in its upper portion to permit gas to escape therefrom to the manifold, the housing also having an opening which communicates with the manifold, a sleeve slidable on the member and having its upper end movable relative to the opening for controlling the admission of air from the air chamber to the manifold, said sleeve having an arcuate passage therein adapted to register with the arcuate outlet slot to uncover the same to permit the gas to flow to the manifold, a diaphragm mounted within the housing and connected to the sleeve and exposed to the engine suction to move said sleeve to admit the air and gas to the manifold in predetermined proportions, and means for preventing rupturing said diaphragm in the event that the engine backfires.

7. A gas mixer for an internal combustion engine having an intake manifold including, a housing having a gas inlet and an air chamber therein and adapted to be connected to the manifold of an engine, said housing also having an opening which communicates with the manifold, a tubular member rotatably confined within the housing and having a gas inlet in its lower end communicating with the gas inlet in the housing whereby gas may flow into the member, said member having an arcuate outlet slot in its upper portion to permit gas to escape therefrom to the manifold, a gas inlet line connected to the gas inlet, a pressure regulator connected in said line, a sleeve slidable on the member and having its upper end movable relative to the opening in the housing for controlling the admission of air from the air chamber to the manifold, said sleeve having an arcuate passage therein adapted to register with the arcuate outlet slot to uncover the same to permit the gas to flow to the manifold, a diaphragm mounted within the housing and connected to the sleeve and exposed to the engine suction to move said sleeve to admit the air and gas to the manifold in predetermined proportions, and means for connecting the air chamber of the housing with the pressure regulator to maintain a proportional inflow of air to the chamber and gas to the gas inlet and tubular member.

8. A gas mixer adapted to be connected to an internal combustion engine including, a housing having gas and air inlets and also having a common outlet for the gas and air flowing through the housing, fixed means within the housing leading from the gas inlet and having a port through which the gas from the inlet may flow into the housing and to the outlet, movable means surrounding the fixed means and adapted to co-act with the port to admit gas into said housing, and a pressure responsive element within the housing and connected with said movable means, said element being exposed to the suction of the engine, whereby the movable means is actuated by said suction.

9. A gas mixer adapted to be connected to an internal combustion engine including, a housing having gas and air inlets and also having a common outlet for the gas and air flowing through the housing, fixed means within the housing leading from the gas inlet and having a port through which the gas from the inlet may flow into the housing and to the outlet, movable means surrounding the fixed means and adapted to co-act with the port to admit gas into said housing, said last named means also coacting with the outlet of the housing to control the air admitted to said outlet, and a pressure responsive element within the housing and connected with said movable means, said element being exposed to the suction of the engine, whereby the movable means is actuated by said suction.

10. A gas mixer adapted to be connected to an internal combustion engine including, a housing having gas and air inlets and also having a common outlet for the gas and air flowing through the housing, fixed means within the housing leading from the gas inlet and having a port through which the gas from the inlet may flow into the housing and to the oulet, movable means surrounding the fixed means and adapted to co-act with the port to admit gas into said housing, said last named means also co-acting with the outlet of the housing to control the air admitted to said outlet, and a positive cut-off for the gas actuated by said movable means.

11. A gas mixer for an internal combustion engine having a manifold, a housing having an outlet which is adapted to be connected to the intake manifold of the engine, said housing also having a gas inlet and an air inlet, a gas passage leading from the gas inlet and having its outlet end disposed within the housing, movable means surrounding the gas passage and adapted to co-act with the outlet end of said passage for controlling the admission of gas to the housing and to the outlet of said housing, said means also co-acting with the outlet of the housing for controlling the air flowing from the housing to the outlet whereby the gas and air flowing through the housing outlet and to the manifold is proportioned by the movable means, and a pressure responsive element within the housing and connected with said movable means, said element being exposed to the suction of the engine, whereby the movable means is actuated by said suction.

12. A gas mixer for an internal combustion engine having a manifold, a housing having an outlet which is adapted to be connected to the intake manifold of the engine, said housing also having a gas inlet and an air inlet, a gas passage leading from the gas inlet and having its outlet end disposed within the housing, movable means surrounding the gas passage and adapted to co-act with the outlet end of said passage for controlling the admission of gas to the housing and to the outlet of said housing, said means also co-acting with the outlet of the housing for controlling the air flowing from the housing to the outlet whereby the gas and air flowing through the housing outlet and to the manifold is proportioned by the movable means, and a valve for controlling the flow from the gas inlet to the gas passage directly connected and actuated by the movable means.

13. A gas mixer for an internal combustion engine having a manifold, a housing having an outlet which is adapted to be connected to the intake manifold of the engine, said housing also having a gas inlet and an air inlet, a gas passage leading from the gas inlet and having its outlet end disposed within the housing, movable means surrounding the gas passage and adapted to co-act with the outlet end of said passage for controlling the admission of gas to the housing and to the outlet of said housing, said means also co-acting with the outlet of the housing for controlling the air flowing from the housing to the outlet whereby the gas and air flowing through the housing outlet and to the manifold is proportioned by the movable means, a valve for controlling the flow from the gas inlet to the gas passage directly connected and actuated by the movable means, a pressure responsive element exposed to the engine suction and connected to the movable means for imparting movement thereto, and a spring for resisting the movement of the valve and movable means and acting against the engine suction, whereby a predetermined suction is necessary to impart movement to these parts.

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