March 4, 1941. A. J. ROOT 2,233,677

AIR AND GAS MIXER

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Fig. 1.

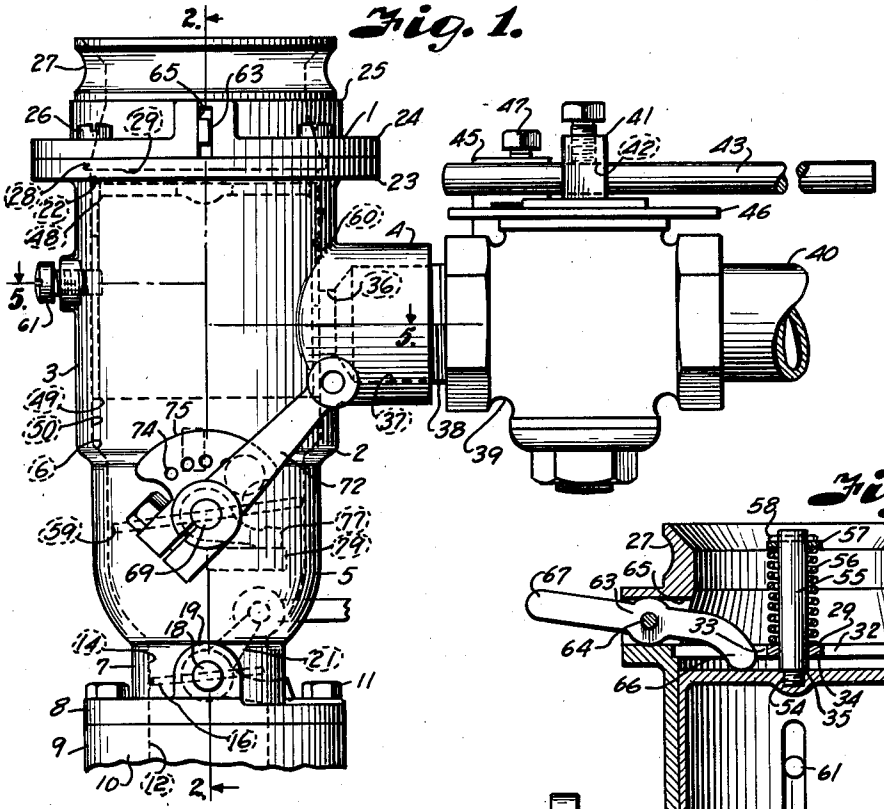


Fig. 2.

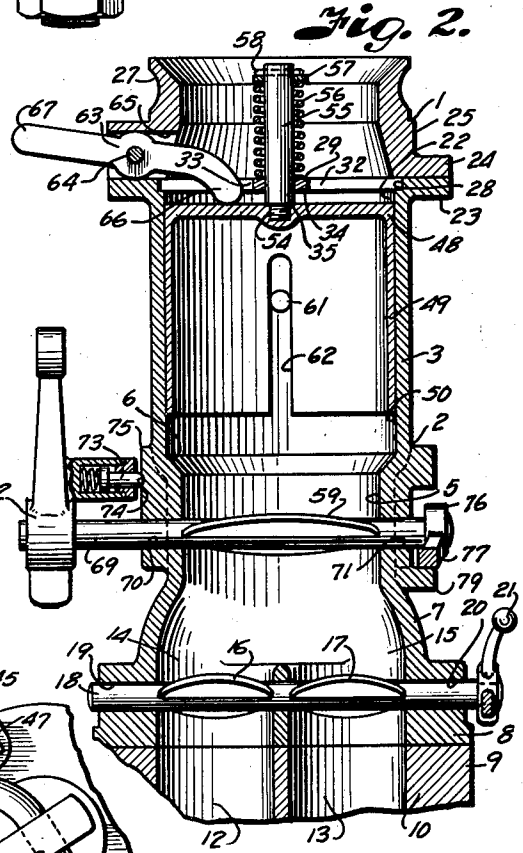


Fig. 4.

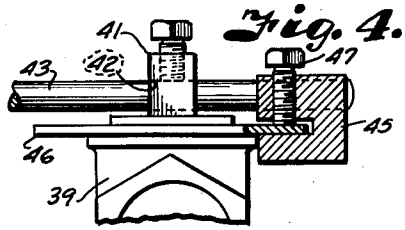
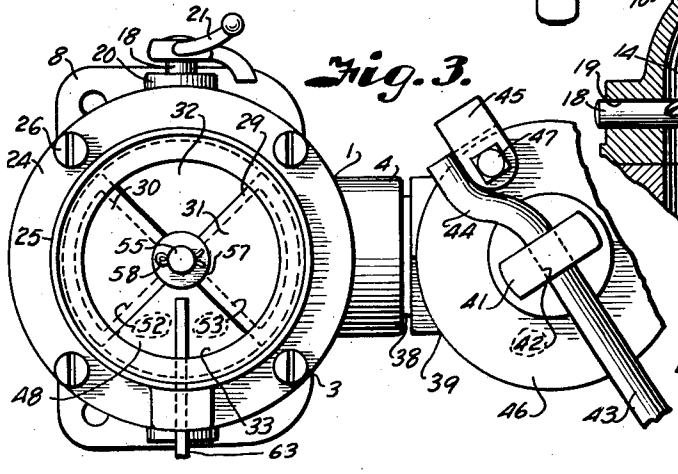


Fig. 3.



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Fig. 5.

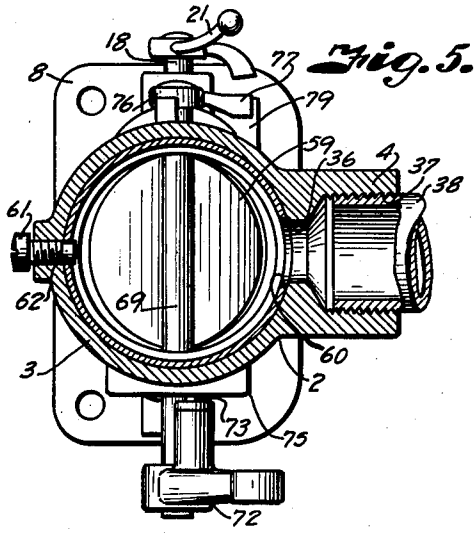


Fig. 6.

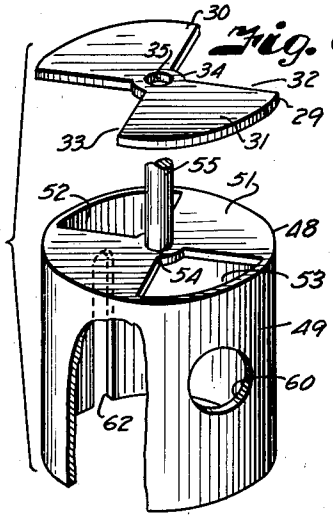


Fig. 7.

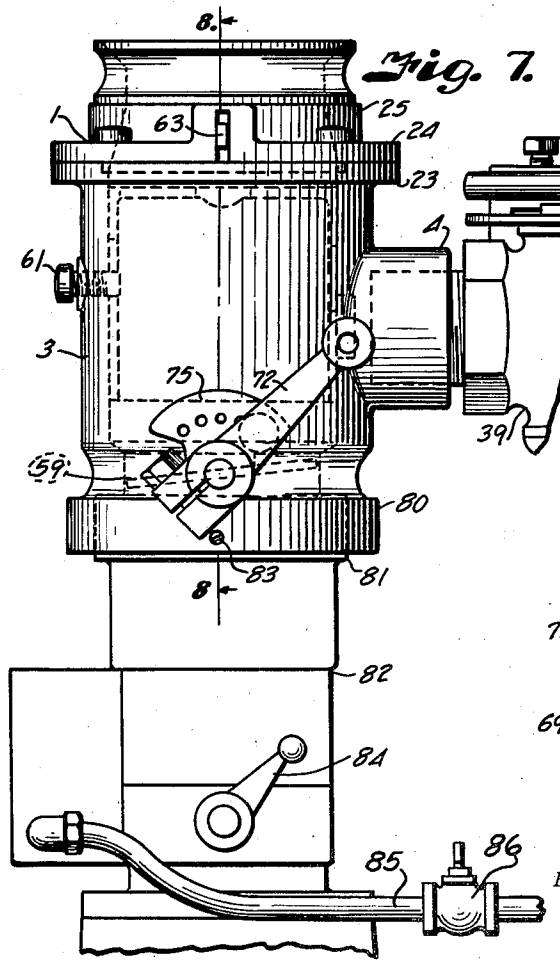
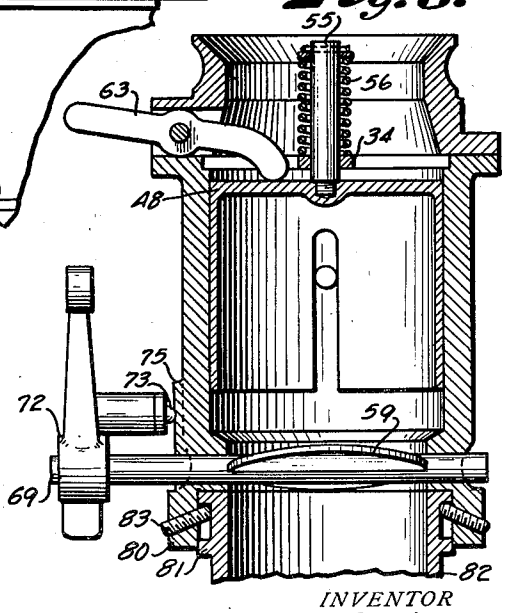


Fig. 8.



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AIR AND GAS MIXER

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Application August 30, 1939, Serial No. 292,647

4 Claims. (Cl. 48—180)

This invention relates to air and gas mixers, particularly those for use in connection with internal combustion engines, and has for its principal object to provide a device of this character arranged for maintaining an efficient air and gas mixture responsive to suction of the engine with which it is connected.

It is also an object of the invention to provide an air and gas mixer with a throttle valve acting independently of the usual governor actuated throttle valve, so that the engine is started under control of a manually-operated throttle and thereby avoid starting of the engine under wide open throttle conditions.

Other objects of the invention are to provide a gas mixer with a piston or sleeve-type valve having air inlet ports in the head thereof normally closed when the gas inlet port thereof is out of registry with the gas supply port; to provide a construction wherein a portion of gas is trapped within the mixer and which is immediately available upon restarting the engine; to provide an air and gas mixer with manual means for initially actuating the piston valve thereof; to provide an improved gas shut-off valve in cooperation with the mixer; to provide an air and gas mixer adapted for connection to the air intake of a conventional carburetor; to provide a combination mixer and carburetor using the carburetor throttle valve for controlling operation of the mixer; to provide a combination gasoline carburetor and air and gas mixer capable of selectively operating an engine on either gas or gasoline; and to provide an air and gas mixer which is of simple and inexpensive construction.

In accomplishing these and other objects of the invention, I have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a side elevational view of an air and gas mixer and its associated valve for controlling admission of gas thereto.

Fig. 2 is a vertical section through the mixer on the line 2—2 of Fig. 1, particularly illustrating the throttle valves and the piston type mixing valve for controlling admission of air and gas.

Fig. 3 is a plan view of the apparatus shown in Fig. 1.

Fig. 4 is a detail section through the adjustable stop on the gas shut-off valve.

Fig. 5 is a cross-section through the mixer on the line 5—5 of Fig. 1.

Fig. 6 is a detail perspective view of the piston type valve and valve plate for closing off admission of air into the mixer.

Fig. 7 is a side elevational view of the mixer as applied to the air inlet of a carburetor, thereby adapting the mixer to an engine designed for operation on liquid fuel.

Fig. 8 is a vertical section through the mixer on the line 8—8 of Fig. 7, particularly showing attachment of a mixer to the air inlet of the carburetor.

Referring more in detail to the drawings:

1 designates an air and gas mixer constructed in accordance with the present invention, and includes a casing 2 having a substantially cylindrical body portion 3 provided with a lateral gas inlet connection 4 and a lower throttle portion 5, of slightly smaller diameter than the cylindrical body portion 3 to provide an annular stop shoulder 6 therebetween. The portion 5 has a neck 7 provided with a flange 8 for connection with the inlet 9 of an engine manifold 10 by means of fastening devices, such as cap-screws 11.

The form of the invention illustrated is adapted for connection with a manifold having passages 12 and 13 leading to separate lines of cylinders in a multi-cylinder engine (not shown), and therefore the neck 7 has diverging branches 14 and 15 leading to the respective passages 12 and 13. The branches 14 and 15 are provided with throttle valves 16 and 17 fixed to a common shaft 18 extending diametrically thereacross and having its ends journalled in bearings 19 and 20 formed as an integral part of the flange 8.

The shaft 18 is usually controlled by a governor (not shown) and actuated responsive to speed of the engine, the governor being connected with a lever arm 21 fixed to the outer end of the shaft as in conventional practice. In ordinary installations the governor is so arranged that when the engine is idle the throttle valves 16 and 17 are wide open, and when the engine is started the valves are automatically moved toward closed position in accordance with the setting of the governor, whereby the engine is caused to maintain a constantly uniform maximum speed.

The cylindrical body portion 3 is provided at the top thereof with an opening 22, encircled by a flange 23 upon which the flange 24 of a collar 25 is retained by cap-screws 26. The collar 25 has an externally grooved neck portion 27 for attaching an air cleaner or the like (not shown). Formed in the upper face of the flange 23 is an inset shoulder or seat 28, mounting a valve plate 29 that is clamped therein by the flange 24. The plate 29 includes oppositely disposed sector-shaped segments 30 and 31 forming sector-shaped air inlet openings 32 and 33 therebetween. The

segments 30 and 31 are interconnected by an integral collar 34, having a bearing opening 35 therein for a purpose later described.

With the structure thus far described it is obvious that air may be drawn through the collar 25 and through the sector-shaped openings or ports 32 and 33, into the cylindrical body 3 for mixture with gas that is admitted through a port 36 located in the side of the casing, as best shown in Fig. 5.

The connection 4 has an internally threaded socket 37, in which is threaded a nipple 38 to connect the outlet of a shut-off valve 39. The inlet of the valve is connected by a pipe 40 with a suitable source of gas supply (not shown). The valve 39 may be of conventional construction, but the stem 41 thereof projects through the top of the casing and is provided with an opening 42 through which an actuating lever or rod 43 is extended. The end 44 of the lever terminates in an offset adapted to engage an adjustable stop 45. The stop 45 is in the form of a C-clamp as shown in Fig. 4, and is clamped in a selected position about the periphery of a laterally projecting plate 46 attached to the top of the valve housing, best shown in Fig. 4, the C-clamp being secured to the plate by a set-screw 47. It is apparent that the effective opening of the valve may be maintained constant by selectively positioning the stop 45 on the plate 46 so that the valve may be accurately set to supply a required amount of gas to the mixer.

Slidable within the cylindrical body 3 is a piston type valve 48, including a skirt portion 49 movable in sliding contact with the inner face 50 of the casing, and a head 51 that is provided with sector-shaped openings 52 and 53 therein registering with the sector-shaped segments 30 and 31 of the valve plate previously described.

Fixed within a concentric opening 54 in the center of the head is a stem 55, slidable through the bearing opening 35, and which carries a coil spring 56 sleeved thereover, having one end bearing against the collar 34 and its opposite end against a washer 57 retained on the upper end of the stem by a cotter pin 58, as shown in Fig. 2. The skirt portion of the valve is open at the lower end and in direct communication with the throttle valve 59 in the portion 5 of the casing. The skirt portion of the valve has a gas inlet port 60 extending therethrough and which is located in upward offset relation with the gas inlet port 36 when the head of the valve is engaging the valve plate 29. The piston-like valve is retained from rotation within the cylindrical portion of the casing by a set-screw 61, threaded in the side of the casing and having its end projecting through a vertical slot 62 in the skirt of the valve as shown in Figs. 2 and 5.

The spring 56 is so adjusted that the openings 52 and 53 of the head are normally closed by the sector-shaped segments 30 and 31 of the valve plate, and the port 60 is out of registry with the gas inlet opening so that when the engine is idle the gas and air inlet ports are closed.

In order to initially open the air and gas ports, for starting of the engine, the collar 25 carries a manually-operated lever 63 that is pivoted on a pin 64 extending transversely through a slot 65 in the collar. The inner end of the lever curves downwardly, as at 66, to engage the head of the piston-like valve, while the opposite end projects through the slot of the collar to form a handle 67 by which the lever may be manipulated to move the piston-like valve downwardly within its cylindrical chamber to uncover the ports 52 and 53 and to bring the gas inlet port 60 into partial registry with the gas inlet port 36. Gas and air are then being admitted to the interior of the piston-like valve to form a combustible mixture which is drawn through the intake manifold connections of the engine.

With the structure thus far described it is obvious that the engine would be started on wide open throttle, and to avoid this difficulty the portion 5 of the housing is provided with a throttle valve 59 which is normally closed and adapted to be gradually opened to control admission of the combustible mixture into the engine, until such a time that the governor-actuated valves are moved to throttling position for maintaining the engine at a constant speed. The valve 59 is of the butterfly type and is mounted on a shaft 69 extending transversely of the casing and having its ends journalled in bearings 70 and 71 formed in the walls thereof as shown in Fig. 2. The end of the shaft projecting through the bearing 70 carries an actuating lever 72, having a sping-pressed pawl 73 on the side thereof and which is adapted to engage in one of a series of notches 74 formed in a boss-like segment 75 on the side of the mixer casing, as shown in Fig. 2. The valve 59 may thus be retained at any one of a plurality of positions as governed by the notches 74. The opposite end of the shaft carries a stop lever 76 having an arm 77 engageable with a laterally projecting shoulder 79 on the side of the casing portion 5.

In assembling a mixer, the piston-like valve 48 is inserted through the open top of the casing, after which the valve plate 29 is applied and the collar 25 retained in clamping engagement therewith upon application of the cap-screws 26. The coil spring 56 is then sleeved over the stem of the valve to yieldingly retain the head of the valve in engagement with the valve plate. The valve is positioned so that the openings thereof are registered with the closure segments 30 and 31 of the valve plate and retained by application of the set-screw 61 so that the end thereof passes into the vertical guide slot 62. The mixer casing carrying the throttle valve 59 is then attached to the inlet connection of the manifold, after which the gas connection carrying the valve 39 is attached to the part 4 of the air and gas mixer.

When the engine is to be started, the manual lever 63 is operated to depress the piston-like valve against action of its spring, as shown in Fig. 2. Upon cranking of the engine, air is drawn through the collar, ports 32 and 33, ports 52 and 53, into the interior of the piston-like valve. Simultaneously gas is drawn through the partially registering ports 36 and 60 for mixture with the air. The mixture is then drawn into the intake passages 12 and 13 under control of the manually-actuated throttle valve 59.

When the engine gets under way, the suction created in the passageways 12 and 13 maintains the pistonlike valve in open position. As the engine gradually increases in speed, the suction increases so that the piston valve is moved toward full opening of the port 60 and the air inlet ports, thereby maintaining the air and gas mixture at proper ratio. As the engine speed is reduced and the suction becomes less, the spring 56 preponderates to move the piston-like valve toward closed position, thereby maintaining the proper gas and air ratio for the reduced engine speed. When the engine is stopped, the head of

the piston-like valve is drawn against the valve plate to shut off the air supply and at the same time the gas inlet port **60** is moved out of registry with the port **36** to trap an air and gas mixture within the mixer upon closure of the valve **59**. This air and gas mixture is immediately available upon restarting of the engine.

The form of mixer shown in Figs. 7 and 8 is identical to that illustrated in the preferred form, with the exception that the lower portion of the housing which carries the valve **59** is provided with an annular depending collar **80** engageable over the air inlet connection **81** of a conventional carburetor **82** and secured by set-screws **83**. In this instance the governor-actuated throttle valve, as indicated by the lever **84**, is the conventional throttle, and is a part of the carburetor. The carburetor is normally supplied with gasoline by a line **85** having a valve **86** therein so when it is desired to operate the engine on gas the valve **86** is closed and the combination carburetor and mixer operates in the identical manner as the air and gas mixer above described.

However, if it is desirable to operate the engine on gasoline the valve **86** may be opened and the valve **39** closed so the combination acts as a conventional carburetor thereby permitting the engine to operate on either gas or gasoline without changing the assembly.

From the foregoing it is obvious that I have provided an air and gas mixer which is of simple construction and well adapted for the efficient mixture of air and gas supplied to the intake manifold connections of an internal combustion engine.

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

1. An air and gas mixer for an internal combustion engine including, a casing having a substantially cylindrical wall provided with a gas inlet spaced from the ends thereof and having an end wall provided with an air inlet opening, a piston-like valve having a cylindrical skirt portion closely contacting the cylindrical wall of the casing to maintain said valve in coaxial relation therewith and having a head adapted to abut against the end wall of the casing to close said air inlet opening, the head of said piston-like valve having an opening offset from said air inlet opening for admitting air to the lower portion of the casing when the piston-like valve is moved from abutting relation with the end wall, said skirt portion of the piston-like valve having an opening registrable with the gas inlet when the piston-like valve is moved from closing relation with respect to said air inlet opening, means yieldingly retaining the piston-like valve in position to close said inlets, and means for moving the piston-like valve to open said inlets.

2. An air and gas mixer for an internal combustion engine including, a casing having a substantially cylindrical wall provided with a gas inlet spaced from the ends thereof and having an end wall provided with an air inlet opening, a piston-like valve having a cylindrical skirt portion closely contacting the cylindrical wall of the casing to maintain said valve in coaxial relation therewith and having a head adapted to abut against the end wall of the casing to close said air inlet opening, the head of said piston-like valve having an opening offset from said air inlet opening for admitting air to the lower portion of the casing when the piston-like valve is moved from abutting relation with the end wall, said skirt portion of the piston-like valve having an opening registrable with the gas inlet when the piston-like valve is moved from closing relation with respect to said air inlet opening, means yieldingly retaining the piston-like valve in position to close said inlets, means for moving the piston-like valve to open said inlets, and means for preventing rotation of the piston-like valve to maintain offset relation of the head opening with the air inlet opening and to maintain alignment of said skirt opening with the gas inlet.

3. An air and gas mixer for an internal combustion engine including, a casing having a substantially cylindrical wall provided with a gas inlet spaced from the ends thereof and having an end wall provided with an air inlet opening, a piston-like valve having a cylindrical skirt portion closely contacting the cylindrical wall of the casing to maintain said valve in coaxial relation therewith and having a head adapted to abut against the end wall of the casing to close said air inlet opening, the head of said piston-like valve having an opening offset from said air inlet opening for admitting air to the lower portion of the casing when the piston-like valve is moved from abutting relation with the end wall, said skirt portion of the piston-like valve having an opening registrable with the gas inlet when the piston-like valve is moved from closing relation with respect to said air inlet opening, a gas supply duct connected with the gas inlet, means yieldingly retaining said valve in position to close said inlets, means for moving the valve to open said inlets and a stop valve in said duct.

4. An air and gas mixer for an internal combustion engine including, a casing having a substantially cylindrical wall provided with a gas inlet spaced from the ends thereof and having an end wall provided with an air inlet opening and an axial guide opening, a piston-like valve having a cylindrical skirt portion closely contacting the cylindrical wall of the casing to maintain said valve in coaxial relation therewith and having a head adapted to abut against the end wall of the casing to close said air inlet opening, a stem fixed to the head of the piston-like valve in the axis thereof and movable through the axial guide opening to cooperate with said skirt portion to maintain said coaxial relation, a spring sleeved over the stem for normally retaining the head of the piston-like valve in abutting contact with said end wall to close said inlets, the head of said piston-like valve having an opening offset from said air inlet opening for admitting air to the lower portion of the casing when the piston-like valve is moved from abutting relation with the end wall, said skirt portion of the piston-like valve having an opening registrable with the gas inlet when the piston-like valve is moved from closing relation with respect to said air inlet opening, and a lever for moving the piston-like valve against action of said spring to open said inlets.

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