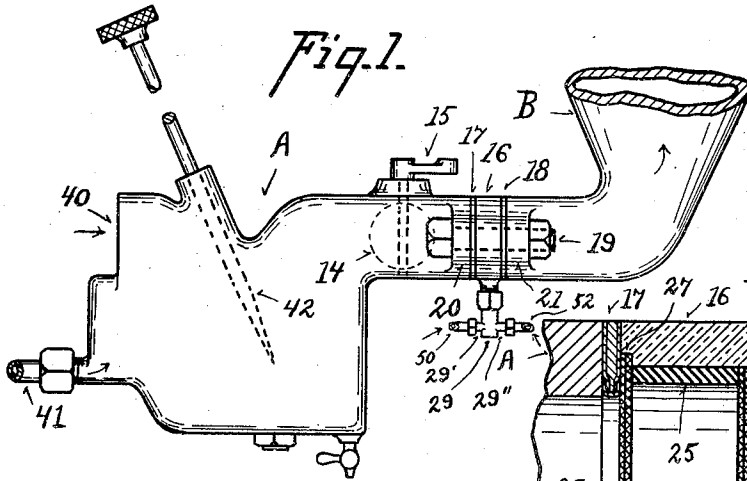
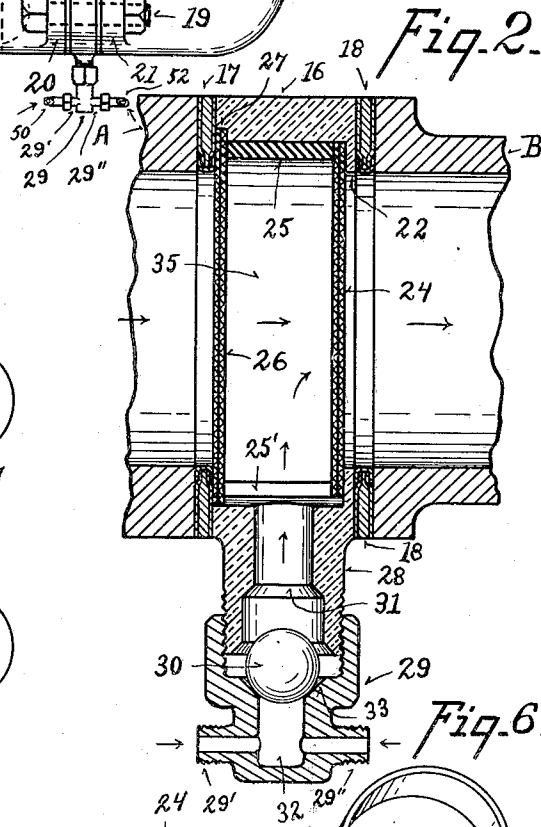
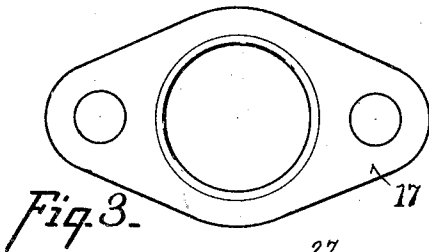
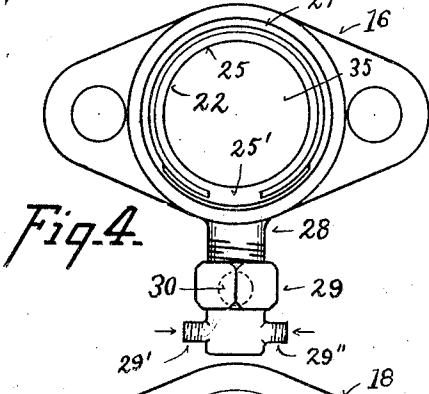
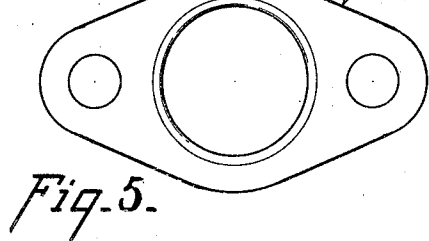
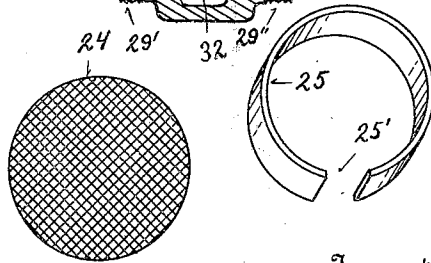


Jan. 9, 1923.

1,441,209

R. R. BOLLMAN.
FUEL SUPPLY APPARATUS FOR INTERNAL COMBUSTION ENGINES.
FILED OCT. 3, 1919.

2 SHEETS-SHEET 1



Inventor

Fig. 7. Inventor
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By C. W. Miles.

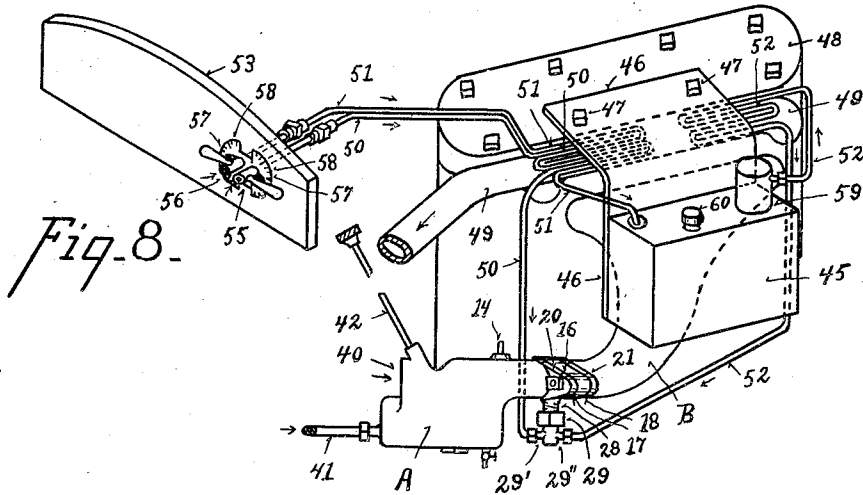
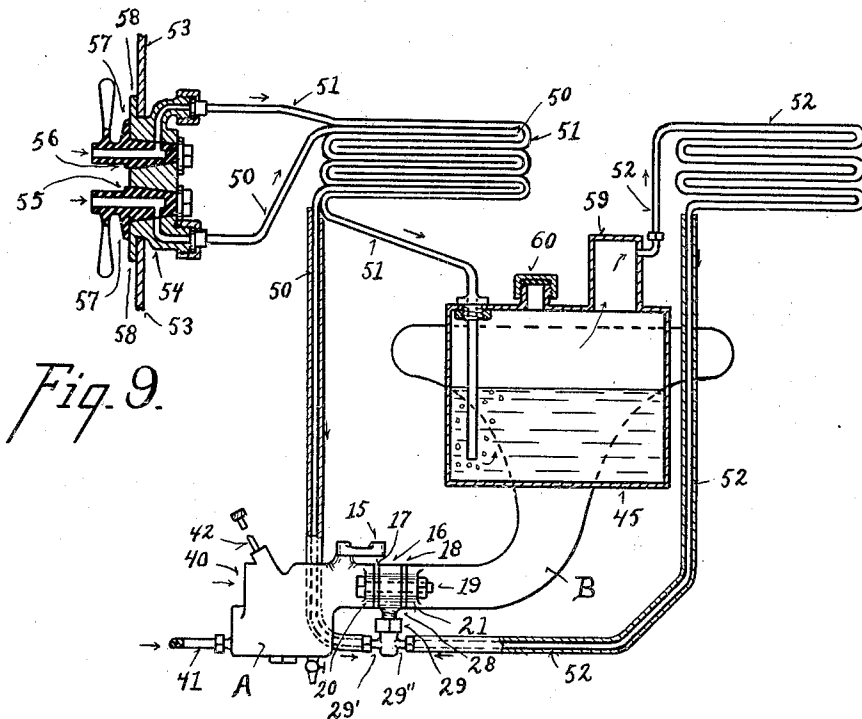
Attorney

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FILED OCT. 3, 1919.

2 SHEETS-SHEET 2



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UNITED STATES PATENT OFFICE.

ROLAND R. BOLLMAN, OF CINCINNATI, OHIO, ASSIGNOR TO CHARLES F. HAGAN, OF BRISTOL, VIRGINIA.

FUEL-SUPPLY APPARATUS FOR INTERNAL-COMBUSTION ENGINES.

Application filed October 3, 1919. Serial No. 328,325.

To all whom it may concern:

Be it known that I, ROLAND R. BOLLMAN, citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Fuel-Supply Apparatus for Internal-Combustion Engines, of which the following is a specification.

My invention relates to improvements in fuel regulating apparatus for internal combustion engines. One of its objects is to provide improved means to supply preheated air to be introduced between the carburetter and the engine to secure a more perfect mixture and complete vaporization. Another object is to provide a supply of preheated air and preheated water vapor to be introduced between the carburetter and engine. Another object is to provide in combination with a supply of air, preferably preheated, and a supply of water vapor, preferably preheated, means controllable by the operator whereby air only, or any desired mixture of air and water vapor may be introduced with the fuel into the engine, preferably between the carburetter and the engine. Another object is to provide means to automatically regulate and introduce air or air and water vapor, preferably between the carburetter and the engine. Another object is to provide improved means to provide a supply of preheated air and preheated water vapor to be introduced with the fuel to the engine. Another object is to provide improved means to automatically regulate the air supply. Another object is to provide improved means in connection with the introduction of air or water vapor to intercept unvolatilized fuel, and to effect its volatilization. Another object is to provide improved means to introduce said means conveniently into existing mechanisms. My invention also comprises certain details of form, combination, and arrangement, all of which will be fully set forth in the description of the accompanying drawings, in which:

Fig. 1 is a side elevation of a carburetter and part of a manifold of an internal combustion engine with a portion of my improved apparatus applied thereto.

Fig. 2 is an enlarged central vertical section through a portion of the apparatus of Fig. 1.

Fig. 3 is a plan of one of the packing washers detached.

Fig. 4 is a plan view of the air or water vapor admitting and fuel vaporizing member detached.

Fig. 5 is a plan of another packing washer detached.

Fig. 6 is a perspective view of a spacing ring detached.

Fig. 7 is a plan of one of the wire screen disks detached.

Fig. 8 is a perspective view of an engine with my improved apparatus applied thereto.

Fig. 9 is a diagram partly in section of the apparatus of Fig. 8.

The accompanying drawings illustrate the preferred embodiment of my invention, in which A represents a carburetter for an internal combustion engine, and B represents a manifold therefor. A butterfly valve 14 is preferably interposed in the passage leading from the carburetter to the manifold and said valve may be manually actuated to open, close, or partially close said valve through a crank arm 15, and a rod not shown connected thereto. Interposed between the carburetter and manifold is an annular member 16, with a packing ring or washer 17 on one side and a packing ring or washer 18 on the other side, said members 16, 17, and 18 being clamped in position with reference to the carburetter and manifold by means of two bolts 19 passing through perforations in said members 16, 17, and 18 at opposite sides thereof, and through correspondingly perforated ears 20 and 21 on the carburetter and manifold, said ears 20 and 21 being those ordinarily employed to secure the manifold directly to the carburetter, thus providing for readily introducing the members 16, 17, and 18, by separating the carburetter from the manifold a sufficient distance to permit the introduction of said members between the carburetter and manifold.

The member 16 is counter-bored from one side so as to leave an inwardly directed flange 22 at one face thereof. One or more wire screen disks 24, preferably two at each side are seated against the flange 22, and a spacing ring 25. The spacing ring is illustrated with a gap 25' between its adjacent ends, but it may be a continuous ring with a perforation in place of the gap 25' to serve

the purpose of admitting the air or water vapor to the interior of member 16. The second pair of wire screen disks 26 are seated in a shallow recess 27 in the opposite face of member 16 and bear firmly against the edge of the ring 25. Said screen disks 26 are held in place by the packing ring 17 against accidental displacement. The member 16 is provided with a downwardly directed tubular projection 28, preferably formed integrally therewith and externally threaded to receive and engage a cap 29 provided with threaded tubular projections 29' and 29'' to which conduits may be coupled to supply respectively air and mixed air and water vapor. Internally the projection 28 is counter-bored to form a cage for a ball valve 30, which valve is preferably but not necessarily employed. The counter-boring of the projection 28 also provides for forming a valve seat 31 above the ball valve. The cap 29 forms the lower portion of the valve cage for the valve 30, and is provided with a main port 32 to which the bores of the projections 29' and 29'' lead, and a valve seat 33 on which the ball valve 30 normally rests and seats.

A closed sheet metal container 45 is attached to and supported by a plate or housing member 46, which in turn is connected by bolts 47 to the head 48 of the engine, said plate 46 extending across the top of the exhaust manifold 49 so as to form a hood or shield over a portion of said exhaust manifold and exclude drafts of cold air. To the inner or under face of the plate or shield 46 are attached three heating coils 50, 51, and 52, so as to occupy positions in close contact with said exhaust manifold and to be heated thereby while protected from drafts of cold air by the plate 46. Upon the dash-board 53 of an automobile for instance, or in a position conveniently adjacent to the engine is mounted a valve casing 54 in which are two independently adjustable regulating cocks 55 and 56, each provided with a pointer 57 movable over an index plate 58 to accurately indicate the position of the cock, and to enable the cock to be set or reset at any desired position. Atmospheric air is supplied through the cock 55 to the coil or tube 50, where the air is heated and then conducted to the inlet 29' of the cap 29, the unheated lower portion of said coil or conduit 50 being insulated externally to insure the air reaching the cap 29 in heated condition. The cock 55 provides for independently regulating or entirely cutting off the supply of air through the conduit 50.

The cock 56 is independently regulated to supply atmospheric air through the coil or conduit 51, where the air is preheated and then conducted into the container 45 and below the surface of a body of water in

said container. The heated air bubbling up through the water in the container 45 serves to heat said body of water, which also receives a certain amount of heat from the engine and exhaust manifold, so that considerable water vapor is given off from the water in said container and carried away by the current of air passing through said container 45 from the coil 51 to the coil 52. The mixed air and water vapor in its passage through the conduit 52 is further heated or superheated so as to enter the cap 29 through the port 29'' as a heated gas or vapor, and in condition to assist in vaporizing any unvaporized fuel it may come in contact with, and to readily and completely mix with the fuel vapor on its way to the engine. The lower portion of the conduit 52 is externally insulated to avoid chilling or cooling of the air and vapor current passing therein to the cap 29. The cocks 55 and 56 may be independently manually adjusted to supply heated air only, or any desired proportion of heated air and water vapor to the cap 29 to be introduced and mixed with the fuel, and also provide by means of the pointers and index plates for resetting the respective cocks at any predetermined positions best suited for the operating conditions which may be encountered, and which are subject to frequent changes, such as changes of temperature and moisture contents in the external atmosphere. The container 45 has a screw cap 60 through which the water supply of said container may be renewed from time to time, and a dome 59 to insure a supply of water vapor free from water to the conduit 52.

In operation air is admitted at 40 to the carburetter, and liquid fuel is admitted to the carburetter at 41, and its flow to the air channel or conduit is regulated by a needle valve 42. The mixed air and fuel, partly as a vapor, and partly as a mist, passes on through the valve 14 toward the manifold. Any mist or unvaporized fuel in attempting to pass through the wire screens 24 and 26, which are preferably but not necessarily employed, tends to deposit upon the surfaces of said wire as a thin film of liquid fuel exposing a large surface to the air, and thus being more readily converted to a vapor. Also upon being brought into contact or mixture with the heated air or mixed air and water vapor, whether the wire screens are employed or not, such mist is heated and converted to a true vapor. The formation of a mist instead of a vapor at the carburetter is promoted by a higher suction or vacuum therein particularly in cool weather. The admission of the air, particularly when preheated air or mixed air and water vapor is employed, through the cap 29 into the chamber 35 of member 16 tends to convert any fuel which has reached the chamber 35

in a misty state into a true vapor. Air or mixed air and water vapor admitted at this point, and under the conditions of its regulation and admission also tends to secure
 5 complete combustion of the fuel in the engine, and consequently fuel economy, and to avoid the formation or deposit of carbon in the engine cylinders.

The weight of the ball valve 30 when employed is sufficient to keep the port 32 closed until a predetermined state of suction or vacuum has been reached within the manifold and chamber 35, whereupon the valve 30 is lifted from its lower seat 33 and admits
 10 air or mixed air and water vapor to the chamber 35 to mix with the fuel therein, and to assist in vaporizing any unvaporized fuel which may exit as globules or films upon the wire screens or interior of member 16.
 20 The body of water in the container 45 also serves to prevent air or water vapor being drawn through conduit 52 until a certain degree of suction is exerted upon the manifold. For medium vacuum or suction, the ball
 25 valve 30 is lifted from its lower seat 33 and does not reach or seat upon its upper seat 31, and hence admits air or mixed air and water vapor to the chamber 35, but when the vacuum or suction is increased further, the valve
 30 30 is lifted sufficiently to engage its seat 31, and thereby cut off the air and water vapor supply to chamber 35 through the cap 29, and in this manner provides for the introduction of a rich fuel mixture to the manifold. Thus in starting the engine for instance, there is not sufficient suction or vacuum to lift valve 30 from its seat 33, and a mixture rich in fuel suitable to start the engine is furnished. Under ordinary running conditions the valve 30 automatically regulates and admits air or mixed air and water vapor to provide a vaporous mixture not too rich in fuel, and suited to an economical operation of the engine
 40 with complete combustion, while the cocks provide for regulation of the proportion of water vapor until by sound and other indications, or previous experience, a close approximation to perfect combustion
 50 in the engine is attained. For hill climbing and heavy duty, the valve 30 automatically seats upon its upper seat 31 to provide a rich fuel mixture capable of delivering more power at a temporary loss of economy in operation. When the valve 30 is omitted the
 55 cocks 55 and 56 may be employed to cut off all air and vapor supply through the cap 29.

The supply of air and mixed air and water vapor, particularly under the conditions of heat and control as above set forth effects an important fuel economy by securing a more uniform and perfect fuel mixture and regulation, and combustion thereof, thereby enabling a greater average distance to be traveled with a fixed quantity of fuel.

It also results in arresting and preventing the formation and accumulation of deposits of carbon in the cylinders, and thereby effects several important economies in time, wear, and expense.

I am also enabled to readily and conveniently introduce my improved mixing apparatus into existing mechanisms, or to remove it therefrom, thus providing for its extensive use on automobiles and other mechanisms heretofore manufactured and in operation.

The apparatus herein illustrated and described is capable of considerable modification without departing from the principle of my invention.

What I claim is:

1. A fuel supply apparatus for internal combustion engines comprising, a carburetter, a main fuel conduit leading from the carburetter to the engine, a container provided with water to furnish water vapor to mix with the fuel, an air supply conduit having a heated section and with its exit terminating beneath the surface of the water in said container to supply heated air in contact with said water, and a conduit leading from said container above the water level to said main fuel supply conduit and having a heated section, to supply preheated mixed air and water vapor to said main fuel conduit.

2. A fuel supply apparatus for internal combustion engines comprising a carburetter, a main fuel conduit leading from the carburetter to the engine, a container provided with a water supply to furnish water vapor to mix with the fuel, an air supply conduit having a heated section connected to said water container to supply preheated air to said container, and an air supply conduit leading from said water container to said main fuel supply conduit and having a heated section, to supply preheated mixed air and water vapor from said water container to said main fuel conduit.

3. A fuel supply apparatus for internal combustion engines comprising, a carburetter, a main fuel supply conduit leading from said carburetter to the engine, a container provided with a water supply to furnish water vapor to mix with the fuel, an air supply conduit having a heated section and connected to said water container to supply preheated air to said container, a cock manually operable to regulate the air supply to said water container, and an air supply conduit leading from said water container to said main fuel conduit and having a heated section, to supply a regulated amount of preheated mixed air and water vapor from said water container to said main fuel conduit.

4. A fuel supply apparatus for internal combustion engines comprising, a carburetter, a main fuel supply conduit leading from said carburetter to the engine, a con-

5 tainer provided with a water supply to fur-
 nish water vapor to mix with the fuel, an
 air supply conduit having a heated section
 and connected to said water container to
 10 supply preheated air to said container, an
 air supply conduit leading from said water
 container to said main fuel conduit and
 having a heated section to supply preheated
 mixed air and water vapor from said con-
 15 tainer to said main fuel conduit, an inde-
 pendent air supply conduit having a heated
 section to supply preheated air unmixed
 with water vapor to said main fuel conduit,
 and independently manually operable cocks
 20 to predetermine the amount of air supplied
 through said respective air conduits.

5. A fuel supply apparatus for internal
 combustion engines comprising, a carbu-
 retter, a main fuel supply conduit leading
 20 from said carburetter to the engine, a con-
 tainer provided with a water supply to fur-
 nish water vapor to mix with the fuel, an
 air supply conduit having a heated section
 and connected to said water container to
 25 supply preheated air to said container, an
 air supply conduit leading from said water
 container to said main fuel conduit and
 having a heated section to supply preheated
 mixed air and water vapor from said con-
 30 tainer to said main fuel conduit, an inde-
 pendent air supply conduit having a heated
 section to supply preheated air unmixed
 with water vapor to said main fuel conduit,
 an automatically actuated valve to prevent
 35 the introduction of air or water vapor to
 said main fuel conduit except under prede-
 termined suction conditions, and independ-
 ently manually operable cocks to predeter-
 mine the amount of air supplied through
 40 said respective air conduits.

6. In combination with an internal com-
 bustion engine, a carburetter, and a main
 fuel supply conduit from the carburetter to
 the engine, a supply apparatus comprising
 45 a housing member detachably connected to
 the engine and forming a housing over a
 portion of the engine exhaust manifold, a
 water container to supply water vapor to
 mix with the fuel mounted upon said hous-
 50 ing, an air supply conduit leading to said
 container having a section carried by said
 housing in position to be heated from said
 exhaust manifold and protected by said
 housing from cool air currents, and an air
 55 conduit having a section carried by said
 housing in position to be heated from said

exhaust manifold and protected by said
 housing from cool air currents to conduct
 preheated mixed air and water vapor from
 said container to said main fuel conduit. 60

7. In combination with an internal com-
 bustion engine, a carburetter, and a main
 fuel supply conduit from the carburetter to
 the engine, a supply apparatus comprising a
 housing member detachably connected to 65
 the engine and forming a housing over a
 portion of the engine for air heating con-
 duits, a water container to supply water
 vapor to mix with the fuel mounted upon
 said housing, an air supply conduit leading 70
 to said container having a section carried by
 and protected by said housing and in posi-
 tion to be heated from said engine, an air
 supply conduit having a section carried by
 and protected by said housing and in posi- 75
 tion to be heated from said engine to supply
 preheated mixed air and water vapor from
 said container to said main fuel conduit, and
 an independent air supply conduit having
 a section carried by and protected by said 80
 housing and in position to be heated from
 said engine to supply preheated air to said
 main fuel supply conduit.

8. In combination with an internal com-
 bustion engine, a carburetter, and a main 85
 fuel supply conduit from the carburetter to
 the engine, a supply apparatus comprising a
 housing member detachably connected to
 the engine and forming a housing over a 90
 portion of the engine for air heating con-
 duits, a water container to supply water
 vapor to mix with the fuel mounted upon
 said housing, an air supply conduit leading
 to said container having a section carried by
 and protected by said housing and in posi- 95
 tion to be heated from said engine, an air
 supply conduit having a section carried by
 and protected by said housing and in posi-
 tion to be heated from said engine to sup-
 ply preheated mixed air and water vapor 100
 from said container to said main fuel con-
 duct, an independent air supply conduit hav-
 ing a section carried by and protected by
 said housing and in position to be heated
 from said engine to supply preheated air to 105
 said main fuel supply conduit, and means to
 control the preheated air supply and the
 preheated mixed air and water vapor supply
 to said main fuel conduit.

In testimony whereof I have affixed my 110
 signature.

ROLAND R. BOLLMAN.