April 5, 1932. F. O. BALL ET AL 1,852,638

CARBURATION

Filed Jan. 29, 1930

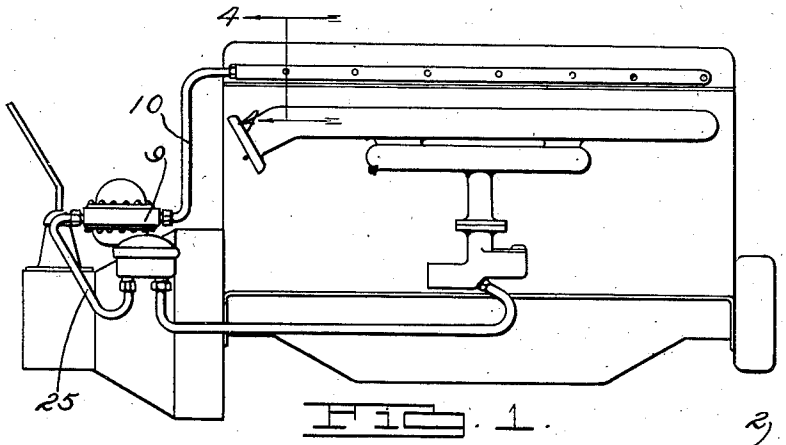

Fig. 1.

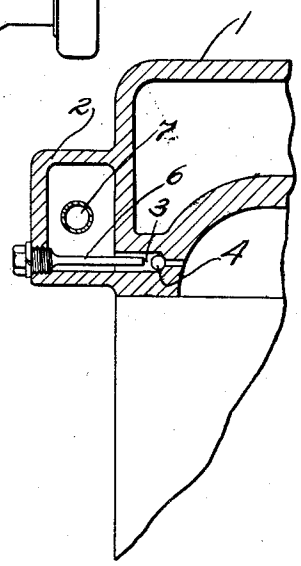

Fig. 4.

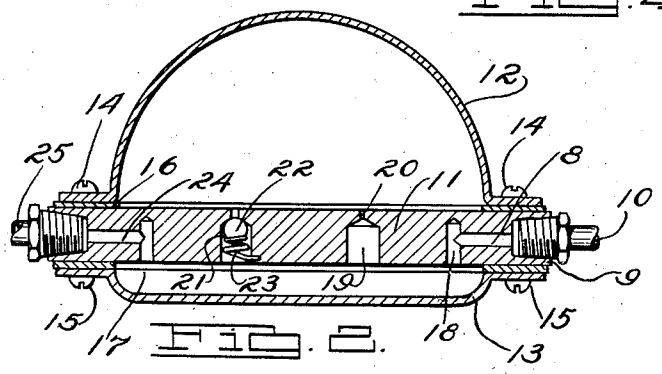

Fig. 2.

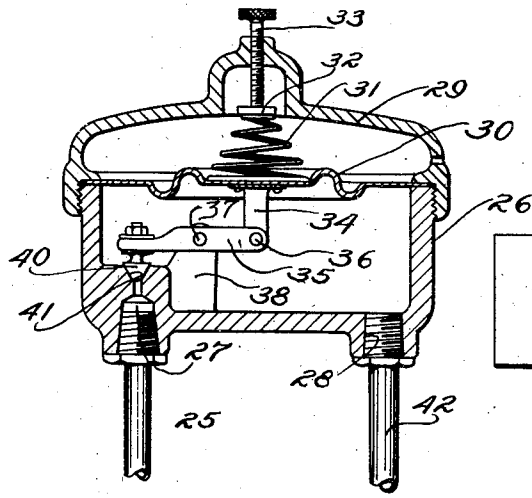

Fig. 3.

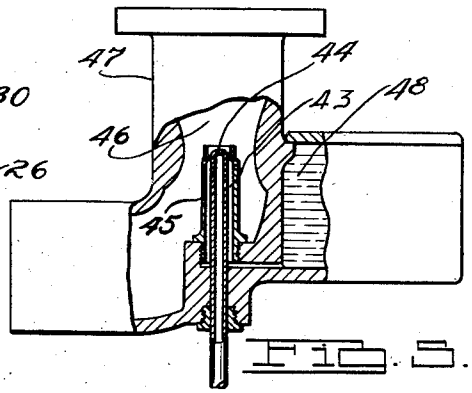

Fig. 5.

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Patented Apr. 5, 1932

1,852,638

UNITED STATES PATENT OFFICE

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CARBURATION

Application filed January 29, 1930. Serial No. 424,373.

The main objects of this invention are to provide improved apparatus for feeding fuel to the mixing chamber of a carburetor; to provide improved apparatus of this kind which is operable by the cylinder pressure of an internal combustion engine; to provide improved means for supplying a current of gases to a carburetor under a predetermined pressure; to provide means in apparatus of this kind for supplying a constant flow of gases from an internal combustion engine to a carburetor thereof during variable operation of said engine.

The apparatus embodying our present invention is particularly adapted to actuate fuel injectors of the type shown in our copending application, Serial No. 410,581, filed Nov. 29, 1929.

An illustrative embodiment of this invention is shown in the accompanying drawings, in which:

Fig. 1 is a side elevation of an internal combustion engine embodying our invention.

Fig. 2 is a central vertical section of a storage device.

Fig. 3 is a central vertical section of a pressure regulator.

Fig. 4 is a fragmentary vertical section taken on line 4—4 of Fig. 1.

Fig. 5 is a side elevation of a carburetor, partly in section.

In the form shown, the improved fuel injecting apparatus comprises a receiving housing which communicates with each of the cylinders of an internal combustion engine. The receiving housing is connected with an injector through a storage device and pressure regulator. The storage device accumulates a reserve supply of gases during high speed engine operation and releases the gases when the speed of the engine is decreased and the pressure regulator maintains a substantially uniform gas pressure at the nozzle.

In the illustration shown, the cylinder head 1 of an engine has a longitudinally extending tubular housing 2 on one side which communicates with each cylinder of the engine through passages 3. Confined in each passage 3 is a ball valve 4 which allows some of the gases to escape from the cylinder when the gases above the piston thereof are under pressure and prevents communication between the interior of the housing 2 and the cylinders during the suction strokes of the piston. The balls 4 are secured against displacement by plugs which are threaded in apertures in the side of the housing 2. The plugs comprise pins 6 which extend into the passages 3.

An outlet 7 in the end of the tubular housing 2 is connected with an inlet 8 of a storage device 9 by a tube 10. The storage device includes an intermediate partition 11, an upper dome 12 and a lower wall 13. The dome 12 and wall 13 are rigidly secured to the partition 11 by screws 14 and 15 respectively. Gaskets 16 and 17 are provided on the respectively opposite sides of the partition 11 between the dome 12 and the wall 13 for forming air-tight seals between these members. The inlet 8 extends centrally into the partition 11 and communicates with a port 18 which directs the incoming cylinder gases into the space between the bottom wall 13 and the lower side of the partition. A passage 19 extending through the partition 11 and having a restricted portion 20 communicating with the interior of the dome 12, allows some of the gases to enter the dome.

The partition 11 is provided with a second passage 21 in which a ball valve 22 is confined. The valve 22 is normally held in closed position by a spring 23 until the pressure in the dome is sufficient to open the valve against the action of the spring 23 and the gas pressure in the space below the partition. An outlet passage 24 formed in the partition communicates with a tube 25 which in turn communicates with the pressure controlling apparatus shown in Fig. 3.

The pressure regulator comprises a casing 26 having inlet and outlet apertures 27 and 28 respectively, and a detachable cover 29. Mounted between the adjacent edges of the detachable cover 29 and the casing 26 is a diaphragm 30 comprising resilient material. This diaphragm is normally urged downwardly at its center by a spring 31 bearing between the diaphragm and the head 32 of an adjustable bolt 33 which is threaded in the top of the cover. The tension of the spring 31 may be predetermined by the adjustable bolt 33.

Mounted on the lower side of the diaphragm 30 is a support 34 on which a lever 35 is pivoted at 36. The lever 35 is pivoted, intermediate its end, at 37 on a flange 38 of the casing. Mounted on the free end of the lever 35 is a valve 40 which engages a valve seat 41 formed on the wall of the inlet passage 27. The diaphragm 30 controls the admission of gases to the interior of the casing so as to maintain a predetermined pressure therein.

Communicating with the outlet 28 of the pressure regulating apparatus is a tube 42 which is connected with an injector 43 having a restricted discharge opening 44 at its end. The injector 43 extends axially of a nozzle 45 which is mounted in the mixing chamber 46 of a carburetor 47. The injector 43 is substantially smaller in diameter than the diameter of the nozzle 45 and the space between these two members communicates with the interior of a fuel reservoir 48.

In operation, each explosion stroke of the piston discharges a portion of the gases into the tubular member 2 from which they are supplied to the storage device 9. When the engine is operated at a comparatively high speed, some of the gases under pressure in the cylinder pass through the restricted passage 20 of the partition 11 and accumulate in the dome 12. The remaining portion of the gases which enter the storage device pass between the partition 11 and the bottom wall 13 and are discharged, through the outlet 24 and tube 25, into the inlet of the pressure regulating device. When the speed of operation of the engine is decreased, the pressure in the tubular housing 2 is reduced and the gas accumulated in the dome 12 opens the valve 22 and passes through the passage 21 to the space below the partition. In this manner, the flow of gas to the pressure regulating apparatus is maintained substantially constant during variable operation of the engine.

When the pressure in the space below the diaphragm 30 of the casing 26 is less than the force of the spring, the diaphragm is bulged downwardly and the lever 35 is rotated in a clockwise direction so as to lift the valve 40 from its seat 41 for admitting the gases into the interior of the casing through the inlet 27. After the pressure in the casing has been built up to a predetermined intensity the diaphragm 30 is restored to its initial position and the valve 40 is again moved to a closed position, thereby preventing further admission of the gases into the casing until the pressure therein decreases again.

In this manner, a constant flow of gas under substantially uniform pressure is supplied to the injector 43 by the tube 42. The current of the gases is discharged through the restricted orifice 44 at the end of the injector forming a jet which feeds fuel from the nozzle 45 into the mixing chamber of the carburetor and thoroughly atomizes the fuel.

Although but one specific embodiment of this invention has herein been shown and described, it will be understood that various changes including the size, shape and arrangement of parts, may be made without departing from the spirit of our invention and it is not our intention to limit its scope other than by the terms of the appended claims.

We claim:

1. Fuel injecting apparatus for carburetor comprising a nozzle, an injector in said nozzle, and means communicating with said injector and with the combustion chamber of an engine for supplying gas to said injector and including apparatus for maintaining the pressure of the gas constant during varying operating speeds of said engine for supplying a current of gas to said injector under a predetermined pressure.

2. The combination with an internal combustion engine comprising a carburetor, of a fuel injector in said carburetor, a casing having an inlet communicating with the cylinders of said engine for receiving gases under pressure therefrom, a pressure valve in said inlet for controlling the admission of the gases under pressure to said casing, and a tube communicating with said casing for discharging said gas through said injector.

3. The combination with an internal combustion engine comprising a carburetor, of a fuel injector in said carburetor, a housing on the cylinder head of said engine communicating with the interiors of the cylinders thereof for accumulating gases under pressure, means communicating with said housing for storing some of said gases, and a pressure regulating valve having an inlet communicating with said storing means and an outlet communicating with said injector for supplying a current of gas to said injector under uniform pressure.

4. In an engine comprising a carburetor, fuel injecting apparatus for said carburetor comprising a nozzle, an injector in said nozzle, means communicating with the cylinders of said engine for storing gas at high speed operation thereof and releasing such gas when the cylinder pressure of said engine is below a predetermined intensity, and a check valve communicating with said storing mem-

ber and with said injector for discharging a current of gas from said nozzle under substantially uniform pressure.

5. The combination with an internal combustion engine comprising a carburetor, of a nozzle in said carburetor, means communicating with the combustion chamber of said engine for receiving gases under pressure therefrom comprising a casing, a partition in said casing forming a storage chamber, said partition being provided with a pair of passages communicating with said storage chamber, a check valve in one of said passages normally closing same, the other passage being restricted for directing the major portion of said gases through said casing and admitting some of the gas into the storage compartment when the pressure of said gases is high, and means communicating with said casing for supplying said gases to said nozzle, said valve being operable by the pressure in said storage compartment for discharging accumulated gas therefrom when the pressure of said gases is unable to supply sufficient gas to said nozzle.

6. The combination with an internal combustion engine comprising a carburetor, of a nozzle in said carburetor, means communicating with the combustion chamber of said engine for receiving gases therefrom comprising a casing having an inlet and an outlet, a valve in said inlet, a pressure sensitive diaphragm in said casing, valve actuating mechanism on one side of said diaphragm, adjustable means on the other side of said diaphragm for predetermining the pressure in said casing, and a tube communicating with said outlet for supplying the gases under pressure to said nozzle.

7. In an internal combustion engine having a fuel inlet, a pressure system communicating with the cylinders of said engine for feeding fuel to said inlet, and a storage device in said system accumulating a reserve supply of the gases from said cylinder during high speed operation of said engine and adapted to release said gases during low speed operation of said engine.

8. In an internal combustion engine having a fuel inlet, a pressure system communicating with the cylinders of said engine for feeding fuel to said inlet, a storage device in said system for retaining a reserve supply of the gases from said cylinders in readiness to feed fuel to said inlet when the pressure in said cylinders decreases at low speed engine operations, and a pressure regulator in said system for predetermining the pressure at the discharge end thereof.

9. In an engine including a carburetor, fuel injecting apparatus for said carburetor including a nozzle, an injector in said nozzle, and means communicating with said nozzle, and with the cylinder of said engine for storing gases at high speed operation thereof and releasing such gases when the cylinder pressure of said engine is below a predetermined intensity.

10. In an internal combustion engine having a fuel inlet, a pressure system communicating with the cylinders of said engine for feeding fuel to said inlet, and a storage device in said system for retaining a reserve supply of the gases from said cylinder in readiness to feed fuel to said inlet when the pressure in said cylinders decreases at low speed operation of said engine.

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