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J. E. KNAPP

FUEL REGULATING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed May 19, 1923

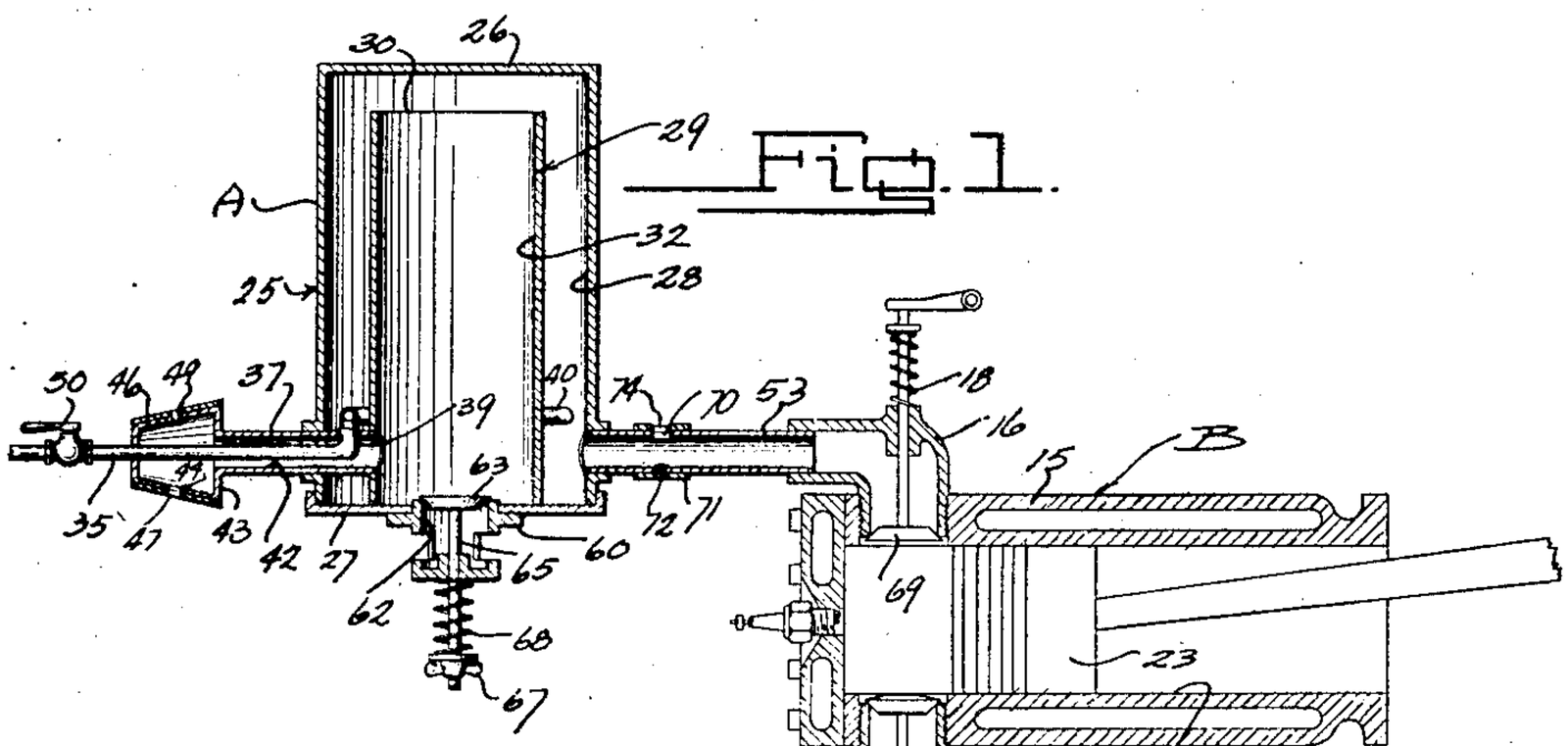


Fig. 1.

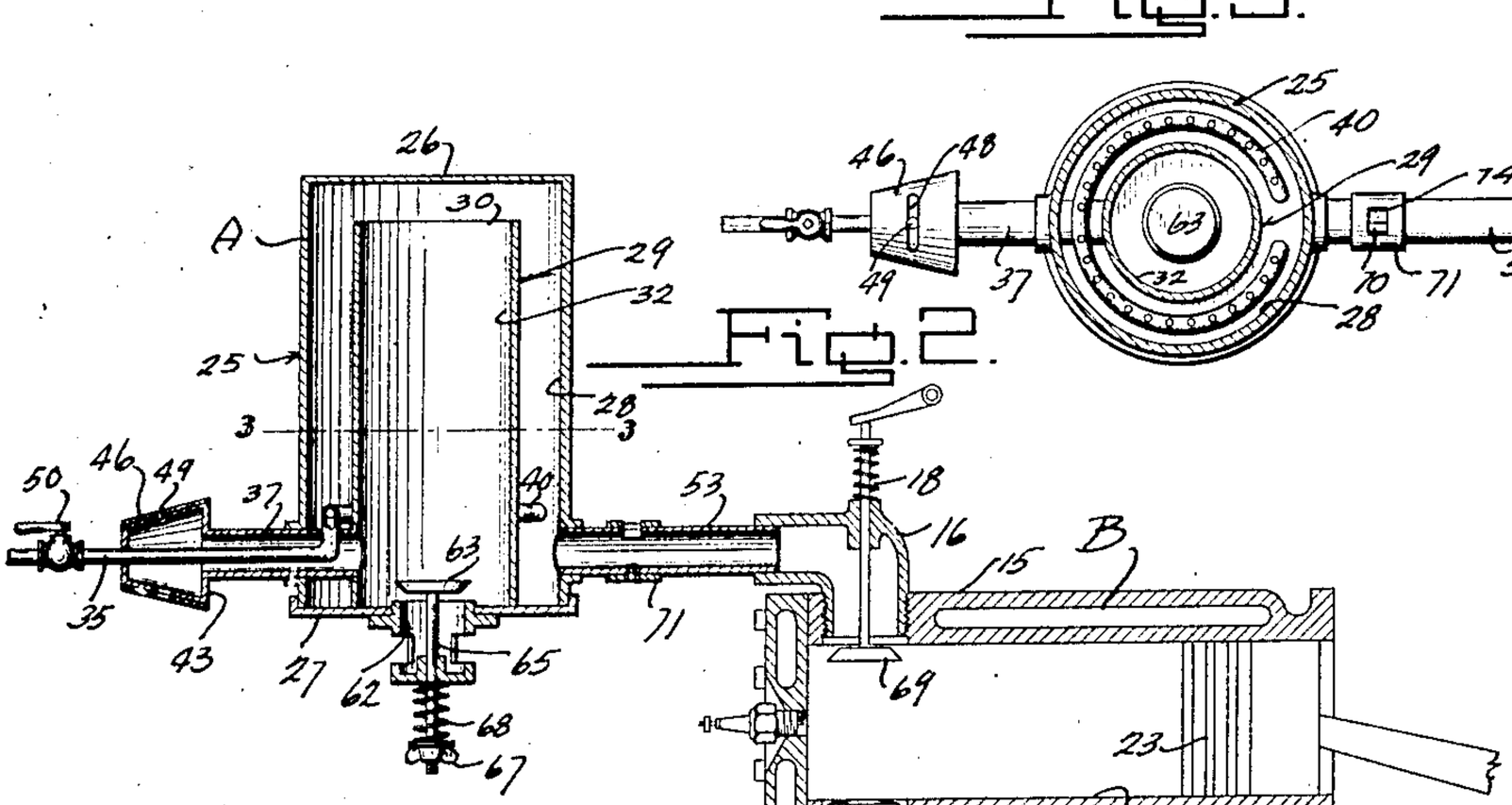
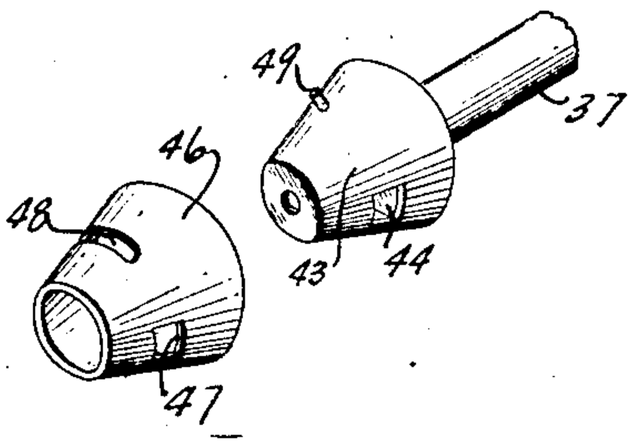


Fig. 3.

Fig. 2.

Fig. 4.



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FUEL-REGULATING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

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To all whom it may concern:

Be it known that I, JOHN E. KNAPP, a citizen of the United States, residing at Clarion, in the connty of Clarion and State of Pennsylvania, have invented certain new and useful Improvements in Fuel-Regulating Devices for Internal-Combustion Engines, of which the following is a specification.

This invention relates to improvements in carburetors.

The primary object of this invention is the provision of a device for effectively controlling the use of manufactured or natural gas as a fuel for internal combustion engines, whereby quantities of the fuel may be supplied to the cylinders of an internal combustion engine in correct quantity according to the capacity of the engine cylinders and the operation of the engine.

A further object of the invention is the provision of a relatively simple and compact device for the effective control of manufactured and natural gas, whereby the same may be made practical for use as a fuel for internal combustion engines, in that correct quantities of the fuel may be delivered to the internal combustion engine cylinders without the necessity of placing the fuel under excessive pressure in order to supply the amount required for a fast working engine.

A further object of this invention is the provision of a device for effectively supplying fuel to an internal combustion engine to prevent the formation of a vacuum in the fuel line thereof incident to engine suction.

Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawing, forming a part of this specification, and wherein similar reference characters designate corresponding parts throughout the several views:

Figure 1 is a cross sectional view taken through the improved device, showing the same as used in connection with an internal combustion engine whose piston is about to make an intake stroke.

Figure 2 is a view substantially similar to Figure 1, showing the cooperating details of the improved device as positioned when the engine piston has about reached the end of an intake stroke.

Figure 3 is a cross sectional view taken substantially on the line 3—3 of Figure 2.

Figure 4 is a perspective view of details of a valve mechanism used in connection with this invention.

In the drawing, wherein for the purpose of illustration is shown the preferred embodiment of this invention, the letter A may generally designate the improved device, which is adapted for use in connection with the internal combustion engine B, whereby fuel in proper quantity and quality may be delivered to the cylinders of said engine for combustion.

Referring to the internal combustion engine B, the same may be of any type, either of the two or four cycle system of operation, and may include the jacket or block 15, having intake and exhaust manifolds 16 and 17 respectively connected thereto, and in connection with which manifolds suitable poppet or control valves 18 and 19 respectively may be provided for the inlet and exhaust of fuel and exploded gases with respect to the cylinder chamber 22 of the engine B. Any approved piston mechanism 23 may be employed in connection with each cylinder of the engine B.

Referring to the device A, the same preferably is constructed of galvanized sheet material, cast iron, aluminum, or any other suitable material including a cylindrical shaped housing 25, which may include a top wall 26, and a detachable bottom wall 27, and which provides a compartment 28 enclosed therein. A cylindrical shaped container 29, entirely open at the upper end 30 thereof, rests upon the bottom 27 of the housing 25. This container 29 provides a pocket or compartment 32 therein of a capacity or volume which is substantially equal to the effective fuel volume of a cylinder chamber 22 of the internal combustion engine with which the improved device A is to be connected. The container 29 is preferably of uniform diameter throughout the length thereof and is of considerably less diameter than the diameter of the housing 25, so that the same is annularly spaced from the housing 25, as disclosed in the compartment 28 of the housing 25. At its upper end 30, the container is open and spaced from the top wall 26 of the housing 25, so that fuel vapors or the like, passing through the compartment 28 may readily enter the

open top of the container 29 for flow into the container compartment 32, as will be subsequently described.

A fuel inlet pipe or conduit 35 is preferably provided, which enters the housing 25 through a tube 37 to be subsequently referred to, and which fuel pipe or conduit 35 is vertically offset, as at 39, to extend from the tube 37 directly into the housing compartment 28, and at the lower end of the compartment 28 provides the segmental exit conduit portion 40 disposed in a horizontal plane in the lower end of the compartment 28, and which is perforated so that fuel may flow therefrom into said housing compartment 28 exteriorly of the container 29. It is preferred that manufactured or natural gas be used as fuel under only normal flowing pressure so that the same may arise within the compartment 28 and enter the container compartment 32 through the top 30 thereof. The tube 37 above referred to, is arranged upon a horizontal axis, and provides a passageway 42, which communicates with the container compartment 32 at the lower end thereof. This tube 37 passes radially exterior of the housing 25 and at its outer end is preferably provided with a frusto-conical head 43 which may provide one or more openings 44 therein. A frusto-conical shell 46 is preferably provided for oscillatory attachment exteriorly upon the frusto-conical end 43 of the pipe or tube 37, and being provided with ports 47 therein, adapted for cooperation with the ports or openings 44 of the head 43 to provide a valve action whereby the compartment 32 of container 29 may have atmospheric communication. To limit the amplitude of oscillation of the control shell or valve member 46 upon the frusto-conical head 43, a slot 48 is preferably circumferentially provided in the shell 46, into which a stop pin 49 of the head 43 projects.

The provision of the tube 37 is for the escape of air from the container compartment 32, as the fuel enters the upper end of the compartment to displace said air. By means of the valve which the shell operating upon the head 43 provides, it is possible to regulate the ease with which the air may be expelled by the displacing action of fuel entering the container 29. It is preferred to provide a fuel control valve 50 of any approved type, in the fuel line 35, just outwardly of the frusto-conical valve of the air tube 37.

As used in connection with the intake manifold 16 of the internal combustion engine B, the housing 25 is preferably provided with a fuel exit tube 53, one end of which communicates with the lower end of the housing compartment 28 and the other end of which may be arranged in the intake manifold 16 whereby the housing compartment 28 at its lower end is in communication with the intake manifold 16 to permit flow of fuel into the cylinder chamber 22.

In order to permit the volume of fuel which may be in the container compartment 32 to be readily displaced therefrom incident to the suction action of the intake stroke of the engine piston, it is preferred to provide an air inlet valve in the lower end of the housing 25, by means of which air may directly enter the lower end of the container compartment 32. This valve means may include a spider 60 connected upon the bottom 27 of the housing 25, and providing a valve port or passageway 62 through which air may flow into the lower end of the container compartment 32. A valve head 63 is preferably provided for the port 62, being mounted upon a stem 65 reciprocably carried by the spider 60 on the same axis as the container 29. The lower end of the stem 65 may be screw threaded, and to provide for the ease or difficulty of lifting the valve head 63 from its seat over the port 62, it is preferred to provide a clamping nut 67 upon the screw threaded end of the stem 65, intermediate which, and the spider 60, a spiral spring 68 is positioned, which may be adjusted as to compression by means of the nut 67, so that the valve 63 may be seated in the port 62 with varying force. It is preferred that the valve head 63 be of substantially the same dimension as the valve head 69 of the intake valve 18, so that a quantity of air or other medium may enter the compartment 32 in sufficient amount to equal the volume of fuel which is displaced from the container compartment 32 by the suction action of the engine piston.

In order that the fuel which passes from the tube 53 into the intake manifold may have the proper consistency for explosive purposes, it is preferred to provide for the entrance of air therewith. This may be effected by providing a port 70 in the tube 53, and about which tube 53 and over the port 70 therein, a valve sleeve 71 may be provided, being connected to the tube 53 by means of a pin 72 operating within a slot in said sleeve 71 so that an opening 74 in said sleeve may be selectively aligned with the port 70 to permit any desired amount of air to be mixed with the fuel for intake.

Referring to the operation of this device, and bearing in mind that the primary purpose of the same is to permit the use of manufactured and natural gas under normal pressures so that the same may be supplied in volume sufficient to take care of the heat of the engine, the fuel enters the outer compartment 28 at the lower end thereof as above described and arises and passes into the compartment 32 at the upper end of container 29, displacing any air or other medium which may be in the

container compartment 32 by forcing the same outwardly from the lower end thereof thru the tube 37; the valve at the outer end of said tube 37, of course, being open. Upon the intake stroke of a piston in the internal combustion engine B, the suction incident thereto will draw fuel from the lower end of the housing compartment 28 through the tube or conduit 53. This fuel will necessarily have to pass rapidly into the cylinder chamber and not only withdraw the quantity of fuel from the compartment 28 about the container 29, but draws the supply of gas or fuel which may be in the container compartment 32 therefrom, and which gas of course flows into the compartment 28 until the end of the suction incident to the intake stroke. Were it not for the provision of the air valve in the lower end of the container compartment 32, a vacuum would be created in said compartment incident to displacement of the gas therefrom. However, as the valve seating spring 68 is of light construction, the valve seating tendency of the same is easily overcome by withdrawal of gas from the compartment 32 so that the valve rises to permit air to enter the lower end of the compartment 32 to take the place of the intake gas or fuel. At the end of the suction stroke, the valve head 63 of course seats itself, and the fuel or gas entering the compartment 28 through the line 35 will again flow into the upper end of the compartment 32, to displace the air or other medium therein, by forcing said air or other medium through the exit tube 37.

From the foregoing description of this invention it is apparent that a device has been provided, by means of which a body of fuel may be effectively regulated both as to quantity required for engine intake, and as the quality of the same.

Various changes in the shape, size and arrangement of parts may be made to the form of invention herein shown and described, without departing from the spirit of the invention or the scope of the claims.

I claim:

1. A device of the class described comprising a housing, a container in the housing open at its top, fuel inlet means in the housing to permit rise of fuel into the housing for flow into the container through the top opening, fuel outlet means in the housing, and valve means at the lower end of the container to permit entrance or exit of a medium as the volume of fuel in the container is decreased or increased.

2. A device of the class described comprising a housing, an open topped container disposed within said housing and providing compartments therein, fuel inlet means for the lower end of the housing compartment whereby fuel may rise upwardly within said compartment for flow into the container compartment through the open end of the container compartment, fuel exit means for the housing compartment, air inlet means for the lower end of the container compartment, an air outlet means for the lower end of the container compartment.

3. A device of the class described comprising a housing, a container disposed within said housing in spaced relation to the side walls thereof and providing an inner container compartment and outer housing compartment, said container compartment being open at one end thereof to communicate the compartments of the container and the housing, fuel inlet means for the compartment of the housing whereby fuel may flow into the housing compartment at the end thereof opposite to the intercommunicating ends of the compartments, air inlet and outlet means for the container compartment disposed therein remote from the end which communicates with the housing compartment, fuel outlet means for the housing compartment at the end thereof opposite to the communication of said compartments, and air inlet valve means in said last mentioned means to regulate the consistency of fuel passing therethrough.

4. In a carburetor device for internal combustion engines, the combination of a container having a fuel entrance and exit opening therein and a valve controlled air inlet to control entrance of air according to increase or decrease of the volume of fuel in the container, and an annular wall in said container terminating in spaced relation to the top thereof and dividing the container into inner and outer compartments the capacity of the inner compartment being substantially the same as the capacity of an engine cylinder into which the fuel flows, and an air outlet pipe extending from the lower end portion of the inner compartment and externally of said container whereby air in the inner compartment may be forced out of the inner compartment by fuel entering the inner compartment through the open upper end thereof.

5. Fuel regulating means for internal combustion engines comprising an enclosed housing, a conduit communicating at one end of the housing with the intake manifold of an engine to which the same is attached for flow of fuel from the housing into the intake manifold, means in said conduit for regulating the inlet of air thereto for admixture with the fuel pouring therethrough, a container supported in said housing and providing inner and outer compartments therein, the inner compartment being open at its upper end and communicating with the outer compartment at an end thereof remote from said conduit, means for inlet of fuel into the outer compartment about said container at an end of the housing adjacent

said conduit, means including a port and control valve therefor for inlet of air into the inner compartment at an end thereof opposite to the intercommunicating point of the inner and outer compartments, said port and valve head being substantially of the same size as the intake port and its control valve of the engine cylinder into which the fuel flows from said housing, and an air outlet conduit communicating with the inner compartment adjacent said air inlet port and valve.

JOHN E. KNAPP.