May 13, 1930. E. W. EVANS 1,758,897

APPARATUS FOR SUPPLYING ANTIKNOCK LIQUIDS

Filed Oct. 31, 1925 2 Sheets-Sheet 1

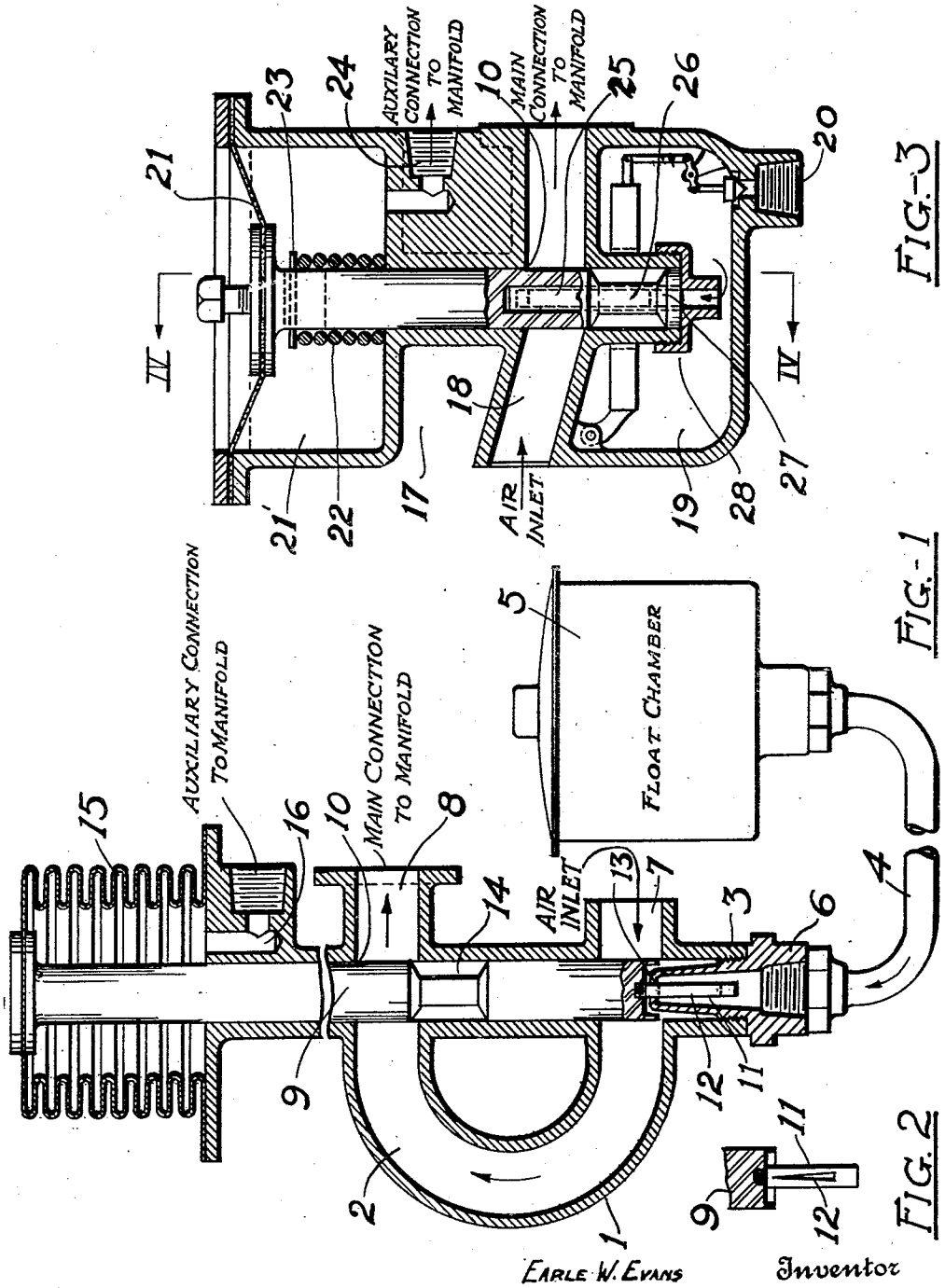


FIG. 3

FIG. 1

FIG. 2

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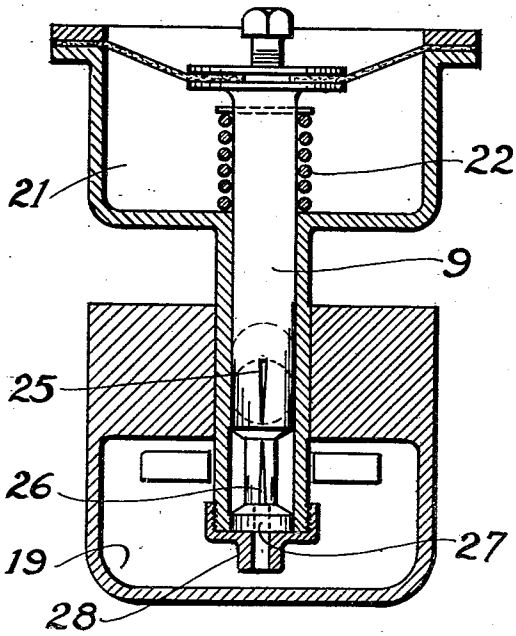


FIG.-4

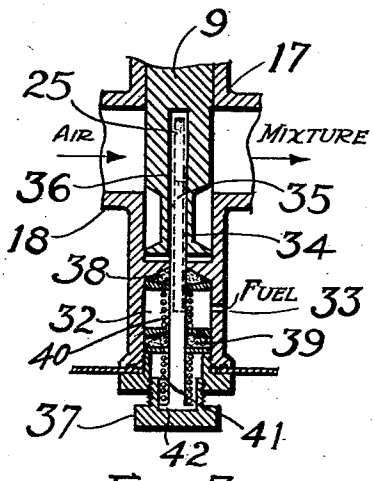


FIG.-7



FIG.-5

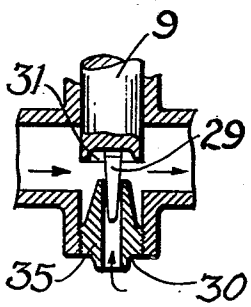


FIG.-6

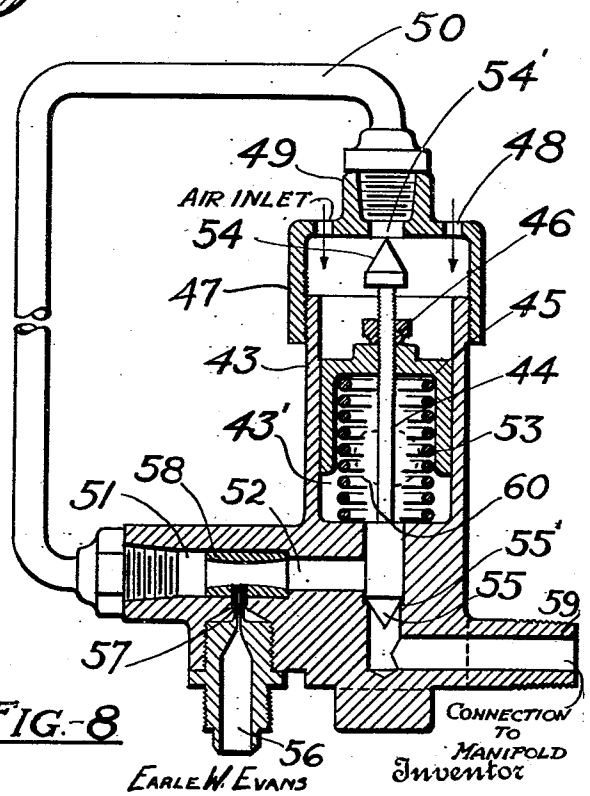


FIG.-8

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UNITED STATES PATENT OFFICE

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APPARATUS FOR SUPPLYING ANTIKNOCK LIQUIDS

Application filed October 31, 1925. Serial No. 65,959.

This invention relates to improvements in apparatus for supplying an anti-knock or anti-detonation substance to internal-combustion engines. The invention will be fully understood from the following description, taken in connection with the accompanying drawing, in which

Fig. 1 is a vertical section through one form of the device;

Fig. 2 is a detail part-sectional view, showing the variable jet used in the device of Fig. 1;

Fig. 3 is a vertical section through a modified form of the invention;

Fig. 4 is a vertical section on line IV—IV of Fig. 3, looking in the direction of the arrows;

Fig. 5 is an elevation of the sliding valve stem of Figs. 3 and 4;

Fig. 6 is a fragmentary vertical section through an alternative form of jet;

Fig. 7 is a partial vertical section through a device similar to that of Figs. 3 and 4 but having means for adjusting the fuel jet; and

Fig. 8 is a vertical section through another modified form of the device of my invention.

Referring first to Figs. 1 and 2, reference numeral 1 denotes a casing comprising a passageway 2 and a nipple 3 for introducing a supply of anti-knock liquid through pipe 4 from a float chamber 5. The float chamber may be of any approved form. An injector nozzle 6 is connected to the pipe 4 and projects upwardly through the nipple 3 into the passageway 2 adjacent its inlet 7. The outlet 8 of the passageway 2 is in communication with the intake manifold of the engine (not shown). A valve stem 9, adapted to reciprocate in a cylindrical opening 10 in the casing 1, carries a terminal jet member 11, in which an elongated tapering or triangular slot 12 is formed. The jet member 11 extends through an orifice 13 in the nozzle 6. In accordance with the position of the valve stem 9 a greater or less area of the triangular slot 12 is exposed to the air current passing through the passageway 2. A correspondingly varying amount of anti-knock liquid is supplied to the passageway and thence to the intake manifold.

The valve stem 9 has a constriction 14 which operates as a valve and controls the flow through the passageway 2, in accordance with the position of the stem. As will be understood, the members 11 and 14 effect the simultaneous regulation of air and anti-knock liquid.

Fluid-pressure differentials formed in the operation of the engine are utilized to regulate the position of the valve stem 9. For this purpose a spring bellows 15, an expansible diaphragm, or other suitable pressure-responsive device, is arranged beneath the upper end of the valve stem 9. The interior of the bellows 15 is connected to the intake manifold of the engine through the passageway 16. When the device is installed between the throttle valve and the engine, and the throttle valve is closed, or nearly closed, the suction in the intake manifold is high and atmospheric pressure forces the bellows 15 downward, causing the constricted portion 14 to pass below the passageway 2 and the jet member 11 to enter the nozzle 6 completely. Under such conditions of engine operation no anti-knock liquid is necessary and none can be supplied through the device. When the throttle is opened the suction in the manifold falls and the bellows 15 expands, moving the constriction 14 and the jet member 11 upward into operative position for the supply of anti-knock liquid and air.

It is generally desirable so to adjust the spring bellows and the valve and jet members that when the throttle is wide open the constriction 14 shall be fully exposed in the passageway 2, and the jet member 11 shall permit the flow of the maximum amount of anti-knock liquid. It will be understood that for various intermediate throttle positions there

will be a corresponding regulation of the flow of air and liquid. The mixture of air and liquid passes to the engine cylinders, together with the main fuel supply from the carburetor.

An important feature of my invention is the simultaneous regulation of the amounts of anti-knock liquid and air by means of fluid-pressure differentials formed in the engine operation. In this way I am able conveniently to provide the proper amount of air for combustion of the anti-knock liquid, so that its fuel value is obtained as well as its anti-knock value. In addition I avoid the difficulty of having too rich a mixture, which is met when the supply of anti-knock fuel is added to the main fuel mixture without addition of a properly adjusted additional volume of air. The invention is particularly adapted for use with those anti-knock liquids that are supplied in relatively large volume and have a material fuel value, such as alcohol-benzol mixtures and the like. The devices described herein may, however, be used advantageously with any anti-knock liquid or substance that can be satisfactorily supplied through a jet or equivalent means.

In the form of the invention shown in Figs. 3, 4, and 5, a casing 17 contains a passageway 18 open to the air at one end and connected to the intake manifold at the other end. The casing contains a float chamber 19 supplied with anti-knock liquid through connection 20. Like the device of Fig. 1, that of Figs. 3, 4, and 5 contains a valve stem 9 having a constriction 14 adapted to regulate flow through the passageway 18, and the position of the valve stem is controlled by a pressure-responsive member. In this form of the invention I utilize a diaphragm 21, or the like, of leather, flexible metal, or other suitable material. The diaphragm 21 closes an upper chamber 21′ and is secured to the valve stem 9. A spring 22 encircles the valve stem and presses upon a collar 23 mounted on the stem 9. The pressure prevailing in the intake manifold is communicated to the diaphragm chamber 21′ through a connection 24. The response of the device to the pressure prevailing in the manifold is similar to that previously described. Air and anti-knock fuel are automatically supplied in corresponding proportions.

The liquid supply jet of Figs. 3, 4, and 5 comprises two reversely arranged triangular slots 25 and 26, formed respectively in the wall of the tubular opening 10 receiving the valve stem 9 and in the constricted portion of that stem. In the various adjusted positions of the stem, more or less of the area of the slots coincides and the flow of anti-knock liquid is correspondingly increased or diminished. The anti-knock liquid passes up to the jet through the opening 27 in the lower portion of the valve stem 9. A perforated retaining cap 28 supports the valve stem.

An alternative form of jet is illustrated in Fig. 6. This comprises a tapering pin 29 arranged to cooperate with a nozzle 30, which is connected to a supply of anti-knock liquid. In this construction, as in that of Figs. 3, 4, and 5, the lower portion of the valve stem 9 is the only means for regulating the amount of air supplied. When completely closed, the seat 31 fits over the mouth of the nozzle 30, and both air and liquid are shut off. In various intermediate positions of the jet more or less liquid and a corresponding amount of air will be admitted to the manifold. It will be understood that the valve stem 9 in all cases preferably is large enough to close the inlet passage, when the device is not delivering anti-knock liquid.

Fig. 7 illustrates means for adjusting the position of the liquid inlet, with resect to the pressure controlled regulating means. The casing 17, float chamber 19, and the tapered slot 25 may be like those shown in Fig. 3. Anti-knock fuel enters the chamber 32 through opening 33 and passes thence into a perforation 34 extending upwardly to the end of the rod 35 which enters an opening 36 in the lower part of a valve stem 9. The end of the rod lies adjacent to the slot 25. An adjusting nut 37, exterior to the casing 17, bears against the rod 35 for moving it upwardly. In order to prevent leakage. two packing glands 38 and 39 are provided about the rod 35. A spring 40 is interposed between these glands, and another spring 41 is arranged between the lower gland and the adjusting nut 37. The latter spring engages a collar 42 on the lower end of the rod 35 and tends to hold the rod against the adjusting nut.

The adjusting mechanism and liquid-supply means shown in Fig 7 may be advantageously used as a part of any of the forms of the invention described herein.

Adjustment may be readily made from the outside of the casing and an accurate regulation of the anti-knock liquid jet is secured.

Fig. 8 shows a modified form of the device, in which a casing 43 has a central chamber 43′ containing a valve stem 44, upon which is threadedly mounted a sleeve 45 and a locknut 46. The casing has threaded thereon a cap 47, with openings 48 for entry of air, and a nipple 49 connected to a conduit 50 leading to an anti-knock liquid injector 51 connected to the casing through conduit 52. A spring 53 is arranged within the sleeve 45 and tends to maintain the valve stem 44 in raised position. Two valves are mounted on the stem, one at each end. The upper valve 54 regulates entry of air into the conduit 50. The lower valve 55 regulates entry of anti-knock liquid from the injector 51, which in this form of the invention comprises a pipe 56 for supplying anti-knock liquid and a con-

stricted orifice 57 leading from the pipe 56 into a Venturi tube 58. Air and anti-knock liquid pass through a connection 59 to the intake manifold.

The pressure in the intake manifold is communicated to the chamber 43′ through a port 60 shown in dotted lines. As described above, the pressure differential between the intake manifold and the atmosphere determines the movement of the valve stem 44. The air and anti-knock liquid are simultaneously regulated. For example, when the throttle is closed and the reduction of pressure in the intake manifold high, the spring will be forced down by the pressure of the atmosphere so that the bottom valve 55 is closed, resting upon its seat 55′. When the throttle is opened and the pressure rises, the spring 53 will elevate the valve stem. At the same time air is permitted to pass through conduit 50, the amount of air being regulated by the position of the upper valve 54 with respect to the opening 54′. By adjusting the cap 47 the amount of air which will pass around the upper valve 54 in any given position may be readily regulated.

The forms of the invention described above are illustrative only of various modifications, and alternative arrangements may be made within the scope of the appended claims, in which it is my intention to claim all novelty inherent in the invention, as broadly as the prior art permits.

I claim:

1. An auxiliary apparatus to be used in addition to the carburetor for supplying anti-knock substances to an internal combustion engine, said apparatus comprising a casing, a passageway therethrough and adapted to be connected to the intake manifold of the engine, an inlet for air into said passageway, an inlet for anti-knock substance into said passageway, and a valve stem actuated automatically by fluid-pressure differentials formed in the operation of the engine and having valves adapted to control both said inlets.

2. Apparatus according to claim 1, in which the valve stem is connected to an expansible diaphragm and means are provided for communicating the pressure prevailing in the intake manifold to the diaphragm.

3. Apparatus according to claim 1, in which the inlet for anti-knock substance comprises a tapering slot adapted to cooperate with means for obstructing a greater or less area of the slot in accordance with the position of the valve stem.

4. An auxiliary apparatus to be used in addition to the carburetor for supplying anti-knock substances to an internal combustion engine, said apparatus comprising a casing, a passageway therethrough and adapted to be connected to the intake manifold of the engine, an inlet for air into said passageway, a valve stem carrying a valve adapted to control flow through said passageway, said stem having a slot, a device for supplying anti-knock liquid to said slot, said casing having a slot communicating with the passageway and adapted to cooperate with the slot in the valve stem, and means actuated automatically by fluid-pressure differentials formed in the operation of the engine for regulating the position of the valve stem.

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