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APPARATUS FOR INTRODUCTION OF ANTIKNOCK FUEL MIXTURE

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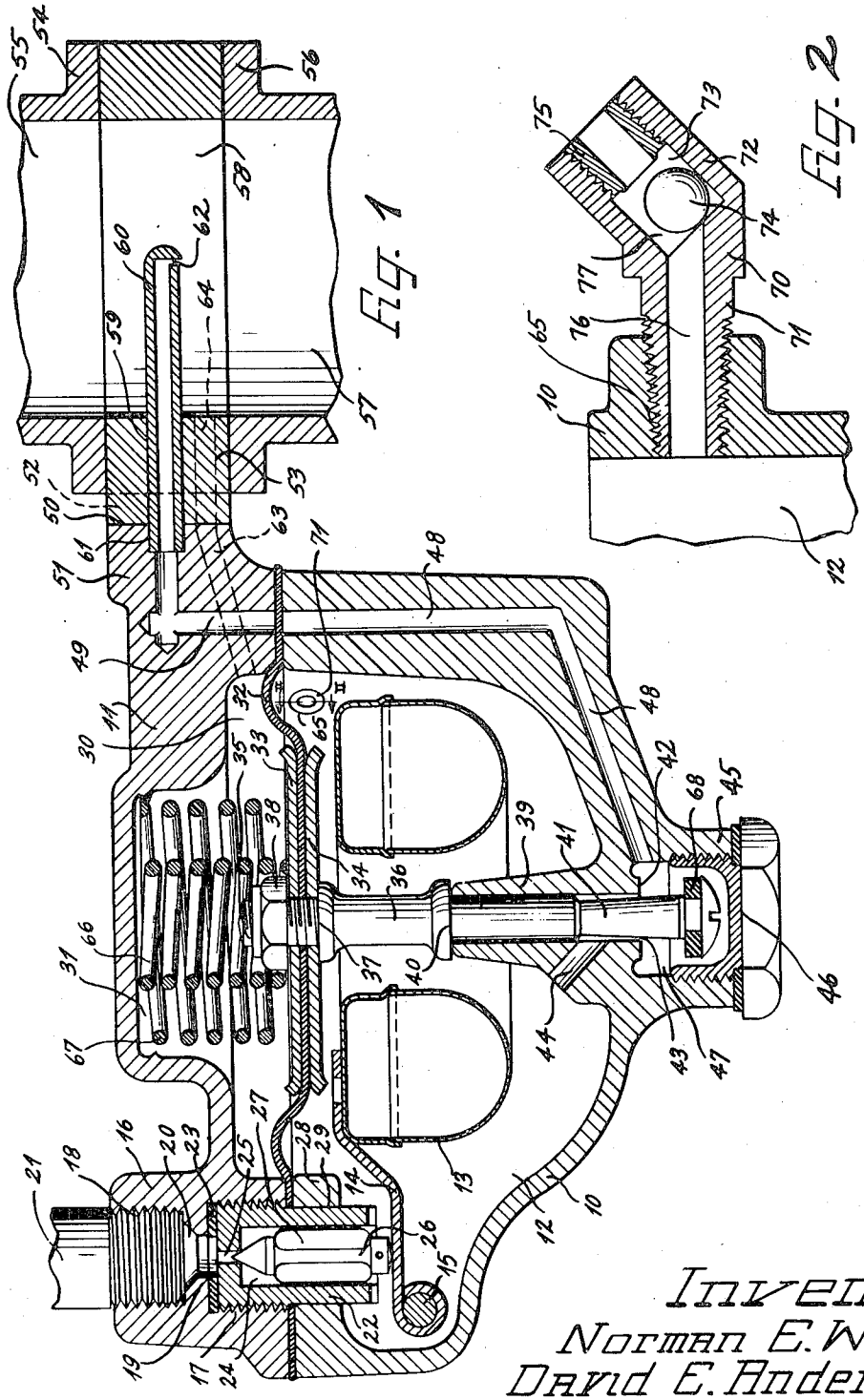


Fig. 1

Fig. 2

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APPARATUS FOR INTRODUCTION OF ANTI-KNOCK FUEL MIXTURE

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4 Claims. (Cl. 261—69)

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This invention relates to apparatus to be associated with carburetors of internal-combustion engines for introducing supplemental fluid such as alcohol and water, for mixture with the power fuel to eliminate detonation or knocking of the engine and to increase engine operation efficiency.

An important object of the invention is to produce a simple, economically manufactured unitary apparatus which may be readily mounted between the engine carburetor and intake manifold for the introduction of the supplementary fluid.

Another object is to provide apparatus which will function efficiently at all times for the delivery of a predetermined flow rate of the supplementary fluid in accordance with the varying operating conditions of the engine to eliminate knocking where it is otherwise likely to occur.

Still another object is to provide apparatus from which the delivery of the supplementary fluid is automatically jointly controlled by spring means and the manifold vacuum.

Another object is to provide apparatus in which a diaphragm connected with a flow control valve for the fluid is subjected to manifold vacuum for movement for control of the valve against the opposition of a spring assembly for the proper rate of fuel delivery during various operation conditions of the engine in order that supplementary fluid will be delivered only when required and in proper amounts.

A further object of the invention is to provide a discharge accelerating valve structure functioning normally to maintain atmospheric pressure between the diaphragm and the fluid in a supply chamber but which, upon depression of the accelerator pedal for acceleration of the engine, will momentarily shut off the air flow for subjection of the diaphragm to pressure by the spring assembly for exertion of pressure against the fluid for introduction of an instantaneous charge of supplementary fuel into the engine intake manifold and a consequent suppression of detonation before it has a chance to set in.

The above and other objects and features of the invention will become apparent from the following detail specification in connection with the drawing, on which drawing

Figure 1 is a vertical cross section of the apparatus and its mounting in service position; and

Figure 2 is an enlarged section on plane II—II of Figure 1.

The apparatus shown comprises a body structure 10 and a cover structure 11, each of these structures being in the form of a simple casting

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of non-corrosive metal, such as brass. The body part is in the form of a cup to form a supply chamber 12 for the supplemental fluid, such as water and alcohol mixture, and to house the float 13 which is fulcrumed by its arm 14 on a pin 15 supported by the body at one side thereof. At one side of the cover 11 is a boss 16 having at its inner end the threaded bore 17 and at its outer end the threaded bore 18. The two bores are separated by the internal annular flange 19 through which extends the passageway 20. The threaded bore 18 forms the inlet for receiving a pipe 21 or other conductor for delivering supplementary fuel from a tank (not shown) to the float chamber 12.

A cylindrical valve housing 22 threads into the bore 17 to abut the sealing washer 23 resting against the flange 19. Extending into the housing 22 from the lower end thereof is the bore forming a valve chamber 24, a port 25 connecting the valve chamber with the passage 20 for flow of fluid from the pipe 21 into the valve chamber. Within the valve chamber is a needle valve 26 for cooperation with the port 25 to control the inflow, the valve having the wings 27 thereon for guiding its movement in the valve chamber and between which the fluid flows to the float chamber. A wall 28 extends inwardly on the body 10 at the upper edge thereof and has the passageway 29 through which the lower end of the valve housing projects when the body and cover are assembled. The valve rests with its lower end on the float arm 14 adjacent to the fulcrum pin 15 for operation of the valve by the float to control the opening and closing of the valve in accordance with the level of the fluid in the float chamber.

In the underside of the cover 11 is the large cylindrical recess 30 forming a diaphragm chamber and above this recess is a smaller diameter recess providing a spring chamber 31. Between the valve chamber and the float chamber is interposed a diaphragm 32 which may be extended to engage between the body and cover to form a gasket therebetween when the body and cover are secured together. The float 13 is of the annular or doughnut type and is concentric with the diaphragm and the chambers 30 and 31. The diaphragm is received between upper and lower plates 33 and 34, the diaphragm and the plates having a passageway therethrough for the threaded end 35 of a valve stem 36 for clamping of the diaphragm and plates between the shoulder 37 on the stem and a nut 38.

The valve stem 36 extends down through the

center of the float into the upper portion of the passage through an annular guide flange 39 projecting upwardly from the bottom of the body 10, the downward movement of the stem being limited by the engagement of the shoulder 40 thereon with the upper end of the guide flange. Secured at its upper end to the lower end of the stem, as by threading, is the metering valve 41 of comparatively slender frusto-conical or tapering shape for cooperation with the seat 42 surrounding the lower end of the guide flange passage to define an annular port or orifice 43 whose area varies as the valve is moved with the diaphragm. A flow passageway 44 extends through the flange 39 for flow of fluid from the float chamber into the lower end of the flange passage for outflow through the orifice 43.

Depending from the bottom of the body 10 is a boss 45 threaded to receive a hollow plug 46 which, with the upper end of the bore provides a chamber 47 into which fluid flows from the float chamber through the orifice 43. A passageway 48 extends from the chamber 47 through the body 10 along the bottom and one side thereof for communication with the passageway 49 in the cover 11, which passageway 49 terminates in the outer vertical face 50 of a flange 51 on the cover. The flange 51 is secured, as by screws, to the flange 52 on a supporting plate or block 53 which extends horizontally to be interposed between and secured to the lower flanges 54 of a carburetor 55 and the flange 56 at the inlet of the engine intake manifold 57, the plate 53 having the passage 58 therethrough through which the carburetor mixture flows to the manifold. On its flange side the plate 53 has the radial bore 59 therethrough into which is inserted the nozzle 60 whose outer end seats in the recess 61 at the end of the passageway 49, the nozzle outlet opening 62 being directed downwardly in the axial line of the passage 58. The nozzle is preferably of the spray type so that the fluid withdrawn therefrom by the manifold vacuum will be delivered in spray form for mixture with the power fuel delivered by the carburetor.

A flow passageway 63 in the cover 11 extends from the diaphragm chamber 30 to the face 50 of the flange 51 to communicate with the passageway 64 in the plate 53 leading to the plate passage 58, and through these passageways the intake manifold vacuum is communicated to the diaphragm chamber. An air inlet opening 65 is provided on the body 10 for maintaining the float chamber above the level of the fluid therein at atmospheric pressure. The diaphragm is thus subjected on its underside to atmospheric pressure and on its upper side to the vacuum pressure in the diaphragm chamber.

Interposed between the diaphragm plate 33 and the upper wall of the spring chamber 31 is the inner or primary helical spring 66, and surrounding this spring is the outer or secondary helical spring 67 which is secured to be suspended from the top wall of the spring chamber to terminate normally a distance above the diaphragm. The inner spring functions to alone resist upward movement of the diaphragm by vacuum pressure during a predetermined range of lower vacuum pressure, while both springs will resist the vacuum movement of the diaphragm during predetermined higher range of vacuum pressure.

The drawing shows the position which the various parts assume when the engine is not running and there is no vacuum, the float valve being in closed position with maximum fluid level in the float chamber, and the inner spring 66 holding the diaphragm down with its stem 36 against the end of the guide flange 39 with the valve 41 in position for maximum opening of the orifice 43. When the engine is now started, and runs at comparatively low speed, such as idling speed, and the vacuum is sufficient to raise the diaphragm against the resistance of the primary spring 66, the valve 41 is moved in orifice closing direction. As the engine throttle setting is increased for the delivery of more power and the intake manifold vacuum decreases, the diaphragm will be moved by the spring 66 for movement of the valve 41 to increase the area of the orifice 43 with corresponding increase in the rate of delivery of supplementary fuel. During the initial movement of the valve 41 which may be, say 30% of its total travel in orifice reducing direction, only the primary or initial spring 66 is engaged by the diaphragm. When the engine is operating the manifold vacuum is variable, and the rate of flow and delivery of the supplementary fluid is dependent upon manifold vacuum, the spring rate of the spring assembly, and the area of the orifice controlled by the valve 41. The initial spring 66 is therefore dimensioned and applied so that when acting alone to resist the vacuum pull on the diaphragm it will cooperate with the vacuum and the orifice area for increasing flow of fluid under increasing vacuum pull on the nozzle but with diminishing rate of increase as the orifice area is decreased against the resistance of the spring. The secondary spring 67 comes into play after the initial movement of the diaphragm and valve against the initial spring 66 and then, for the final movement of the diaphragm and valve, both springs function to increase the spring rate for decreasing of the delivery of supplementary fuel at the desired rate, and finally at a predetermined point, a sealing washer 68 on the lower end of the valve is brought into engagement by the valve with the seat 43 to close the orifice 43 to entirely shut off the flow of fluid from the float chamber to the nozzle. Thus, the cooperation of the springs with the vacuum pull on the diaphragm results in positioning of the metering valve relative to the outlet orifice so that a predetermined flow rate of supplementary fluid is obtained for efficient operation of the engine without knocking where knocking would otherwise occur. During the various flow rates of the supplementary fuel, the float 13 will control the fluid inlet valve 26 for maintaining a fairly constant fluid level in the float chamber.

When the engine is running under full torque load with wide open throttle and full power fuel delivery, and the vacuum is low and the metering valve exposes substantially full orifice area, the fluid level in the float chamber may vary slightly from its normal or static level, due to outflow of supplemental fluid for engine requirements. As the engine power requirement is reduced, and the intake manifold vacuum correspondingly increases, the diaphragm, under control of the vacuum and the spring rate of the spring assembly, will be moved for movement of the metering valve for reduction of orifice area for corresponding outflow of supplementary fuel, and during the various conditions of operation of the engine until it comes to rest, the metering valve will be operated for the predetermined flow rate.

In the air passage 65 a special nozzle discharge accelerating valve is inserted, as best shown on Figure 2. This valve comprises a body 70 having a threaded stem 71 for engagement in the opening 65, a cylindrical extension 72 on the outside of the body being inclined upwardly. This extension has a bore which, at its lower end, provides a valve chamber 73 for a ball valve 74, a seat 75 for the valve being adjustably secured in the outer end of the bore as by threading thereinto. A bore 76 extends through the body 70 and stem 71 for connecting the valve chamber with the float chamber below the diaphragm and above the fluid level.

The ball valve and its seat are of nonmetallic material which will resist corrosion by the supplementary fluid, and the valve material has a density greater than that of the fluid so that under normal conditions, any fluid which might find its way into the valve chamber will not seat the valve to shut off atmospheric flow. The diameter of the ball valve is less than the diameter of the valve chamber so that normally the valve will roll down the inclined bottom of the valve chamber for exposure of the restricted passageway 77 through which the space between the diaphragm and the fluid is normally maintained at atmospheric pressure. When the throttle is now depressed for acceleration, and the intake manifold vacuum is suddenly correspondingly reduced, the spring assembly above the diaphragm will follow up and move the diaphragm and the valve down for correspondingly increasing the area of the orifice 43. This downward movement of the diaphragm will also displace a quantity of air thus raising the pressure between the diaphragm and the fluid above atmospheric pressure, and this pressure, by reason of the restricted passageway 77, will be exerted against the ball valve to force it against the seat 75 to shut off further outflow of air, and the raised pressure, acting against the fluid, will force fluid out of the supply chamber through the increased area orifice and out through the flow channels into the spray nozzle, the net result being an instantaneous charge of supplementary fluid and a consequent sppression of detonation before it has a chance to set in. The seat 75 for the ball valve is adjustable for the desired control and timing of the operation of the vent valve.

We have thus produced a simple, economically manufactured unitary apparatus which will efficiently function to deliver supplementary fluid at the proper rate during the various conditions of operation of an engine for increasing the efficiency of operation thereof and eliminating knocking when knocking would otherwise occur. We do not, however, desire to be limited to the exact construction, arrangement and operation shown and described, as changes and modifications may be made without departing from the scope of the invention as defined in the appended claims.

We claim as our invention:

1. A fluid feed device comprising a casing having a float chamber and a spring chamber, a diaphragm separating said chambers, a fluid inlet and a fluid outlet for said float chamber, a float in said float chamber, a valve actuated by said float coacting with said inlet to regulate feed of fluid to the float chamber, a metering valve actuated by said diaphragm and coacting with said outlet to regulate flow of fluid out of the float chamber, spring means in said spring chamber acting on said diaphragm and arranged to resist closing movement of the metering valve with a varying degree of resistance to provide one rate of resistance for initial closing movements of the valve and a higher rate of resistance for closing movements of the valve beyond said initial movements, means for connecting the spring chamber to a source of vacuum to act on the diaphragm for closing the metering valve against the action of said spring means, means venting said float chamber to the atmosphere, a normally open check valve in said venting means arranged to seal the vent whenever a quick drop in vacuum in said source permits a sudden shifting of said diaphragm by said spring means causing a decrease in size of said float chamber whereby fluid in said float chamber will be placed under pressure and ejected through the outlet which is opened by the spring action on said metering valve.

2. A feed device comprising casing means defining a fluids chamber and a spring chamber, a diaphragm separating said chambers, an inlet and an outlet for said fluids chamber, a metering valve actuated by said diaphragm and having a tapered surface coacting with the said outlet to vary the effective orifice size in the outlet, spring means in said spring chamber acting on said diaphragm to urge the metering valve in a direction for increasing the orifice size in said outlet, a passageway arranged for connecting said spring chamber with an intake manifold of an engine, means defining a passageway connecting said outlet with said intake manifold, said engine evacuating said manifold and said vacuum acting on the diaphragm in opposition to the spring means for moving the metering valve toward outlet closing position and for drawing fluid from the fluids chamber through said outlet and passageway into said manifold, means venting the fluids chamber to the atmosphere, and a valve member in said vent means arranged to close the vent upon rapid egress of fluid from the fluids chamber whereby gradual fluctuation in vacuum in said intake manifold will effect shifting of the metering valve and diaphragm while said air vent allows the fluids chamber to breathe and whereby sudden increase in manifold pressure will cause said spring means to suddenly shift the diaphragm to decrease the size of the fluids chamber thereby causing a sudden egress of fluid through the vent to close the valve therein and pressure the fluid for squirting through the outlet and passageway into the manifold.

3. A fluids feed device comprising a casing having a float chamber and a spring chamber, a diaphragm separating said chambers, an inlet and an outlet for said float chamber, a float in said float chamber, a valve actuated by said float coacting with said inlet to regulate feed of anti-detonant fluid to the float chamber, a metering valve actuated by said diaphragm and coacting with said outlet to regulate flow of anti-detonant out of the float chamber, a first compression spring in said spring chamber acting on said diaphragm to urge the metering valve for opening said outlet, a second compression spring in said spring chamber engageable with said diaphragm to aid the first spring only after the first spring is partially compressed by closing movements of the metering valve whereby initial closing movements of the metering valve are resisted by one spring load and further closing movements beyond said initial movements of the metering valve are resisted by two spring loads,

means for connecting the spring chamber to a variable source of vacuum for acting on the diaphragm to close the metering valve in opposition to the action of said springs, means venting said float chamber to the atmosphere, and a normally open check valve in said venting means arranged to seal the vent whenever a quick drop in vacuum in said source permits a sudden drop of said diaphragm by the spring load thereon for pressuring anti-detonant in the float chamber through said outlet.

4. Apparatus for feeding supplementary fluid to an internal combustion engine which comprises a casing having a float chamber and a spring chamber, a diaphragm separating said chambers, a fluid inlet and a fluid outlet for said float chamber, a float in said float chamber, a valve actuated by said float coacting with said inlet to regulate feed of fluid to the float chamber, a metering valve actuated by said diaphragm coacting with said outlet to regulate flow of fluid out of said float chamber, spring means in said spring chamber acting on said diaphragm to urge the metering valve toward open position, means for connecting said spring chamber to the intake manifold of an engine, means for connecting said outlet of the float chamber to said engine to feed supplementary fluid thereto, an atmospheric vent in the upper portion of said float

chamber, a valve in said vent arranged to normally open the vent, and said spring means in said spring chamber being effective to rapidly depress said diaphragm into the float chamber whenever vacuum in the spring chamber rapidly drops and said valve means being arranged to close said vent upon rapid egress of fluid through the vent caused by said depression of the diaphragm whereby fluid in said float chamber is pressured and rapidly squirted through said outlet.

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