July 4, 1950 D. E. ANDERSON 2,513,774

SUPPLEMENTARY FEED DEVICE FOR INTERNAL-COMBUSTION ENGINES

Filed June 20, 1946 2 Sheets-Sheet 1

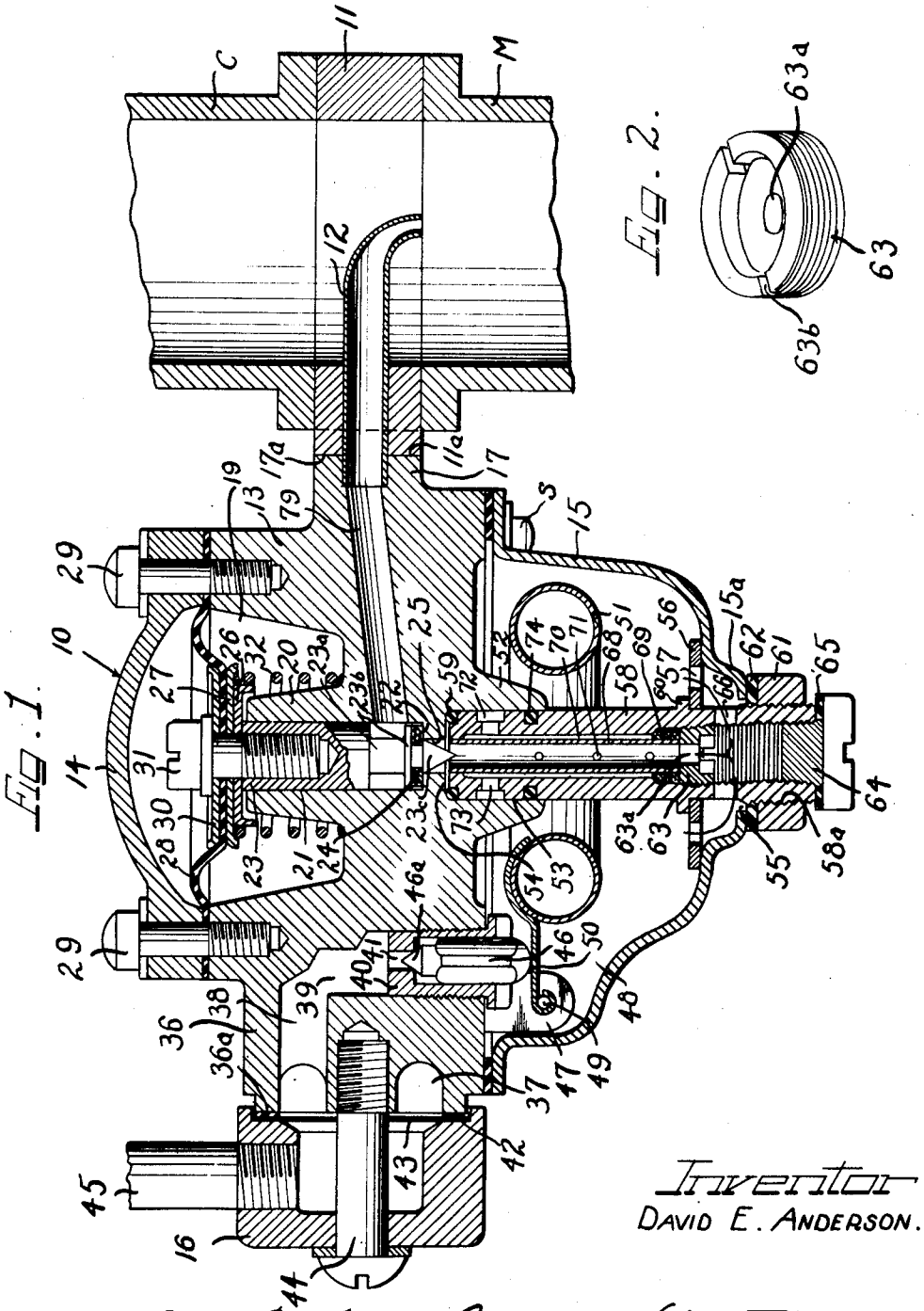


Fig. 1.

Fig. 2.

Inventor
DAVID E. ANDERSON.

by Pennie Davis Marvin & Edmonds Attys.

July 4, 1950 D. E. ANDERSON 2,513,774

SUPPLEMENTARY FEED DEVICE FOR INTERNAL-COMBUSTION ENGINES

Filed June 20, 1946 2 Sheets-Sheet 2

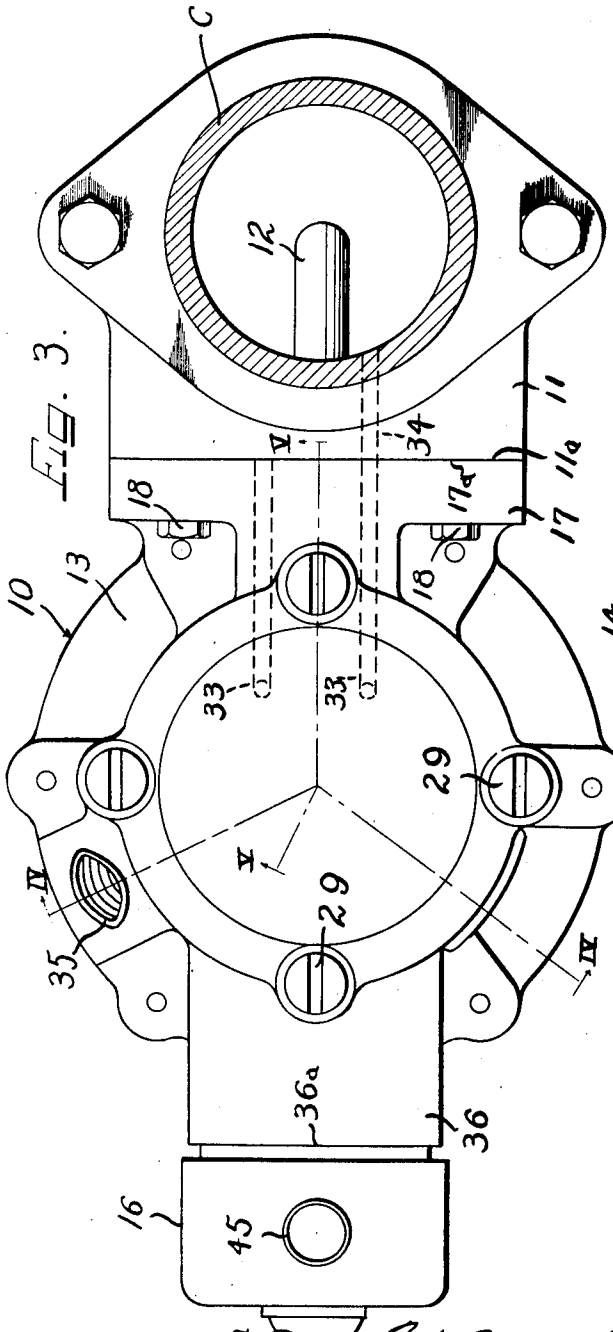


Fig. 3.

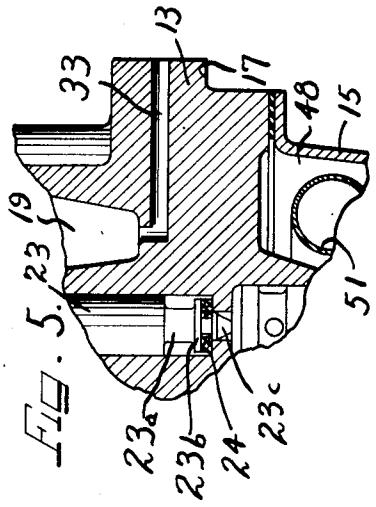


Fig. 5.

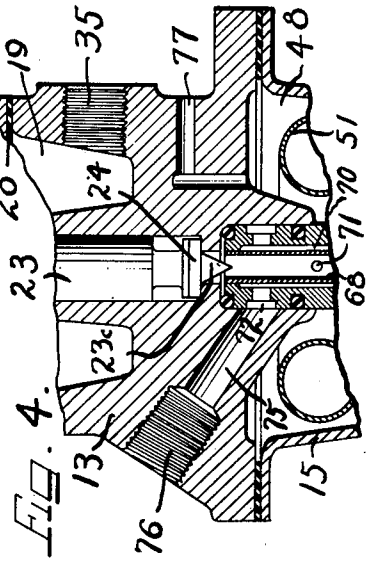


Fig. 4.

Inventor
DAVID E. ANDERSON.

by Thos. Brown of Charles W. Hills Attys.

Patented July 4, 1950 2,513,774

UNITED STATES PATENT OFFICE

2,513,774

SUPPLEMENTARY FEED DEVICE FOR INTERNAL-COMBUSTION ENGINES

David E. Anderson, Cleveland, Ohio, assignor to Thompson Products, Inc., Cleveland, Ohio, a corporation of Ohio

Application June 20, 1946, Serial No. 678,089

4 Claims. (Cl. 261—69)

1

This invention relates to simplified inexpensive apparatus for the accurate metering of supplementary fluids to the intake of an internal combustion engine in accordance with operating characteristics of the engine. Specifically the invention relates to an injector device for feeding controlled amounts of coolant or antiknock fluids to the main fuel intake of an internal combustion engine only at periods when the engine would otherwise be subject to detonation.

The feed devices of the present invention are simplified for mass production but at the same time operate very efficiently to maintain the accuracies of more expensive devices. While the feeding of detonation suppressing liquids to the fuel intakes of internal combustion engines is known, the heretofore known feed devices were not only expensively made but were deficient in many respects. Since engine detonation varies with the quality of main fuel being burned in the engine and only occurs during certain operating conditions of the engine as influenced by the throttle setting and degree of intake suction, it is desirable to feed just enough antidetonant material to the engine at just the right time to eliminate detonation. The metering of the antidetonant can be controlled by the intake suction but this control alone is not sufficient to account for variation in quality of fuel being burned in the engine. The present invention provides a replaceable fixed orifice arrangement that can be quickly changed upon changing in quality of fuel supplied to the engine. At the same time this replaceable feature does not increase the cost of the device.

Since most detonation suppressing liquids are immiscible with the main fuel, such as gasoline, burned by an engine, it is desirable to feed a spray or jet of the antidetonant into the atomized gasoline to insure a good intermingling of the two liquids. If the detonation suppressing liquid has a fuel value, the jet or spray should contain sufficient air to insure thorough combustion and utilization of this fuel value. The device of the present invention therefore includes a vent tube which supplies sufficient air to the antidetonant for feeding a spray or jet in metered quantities to the atomized gasoline supplied by the carburetor of the engine. This vent tube is closed by the vacuum controlled metering valve of the

2

device whenever antidetonant is not being delivered by the device. This arrangement prevents feeding of air to the main fuel during the inoperative periods of the feed device so that the carburetor setting for the main fuel will not be influenced and the carburetor can furnish the correct amount of air for thorough combustion of the main fuel.

The devices of this invention are equipped with a multi-part casing including a main casing body having an integral flange on one side thereof for easy attachment to a mounting block or flange unit that is inserted between the carburetor and intake manifold of an engine. This mounting flange of the main casing contains passageways for feeding the antidetonant spray or jet to the intake manifold as well as for venting the metering valve actuating diaphragm to the vacuum in the intake manifold. The main casing removably carries an inlet boss receiving antidetonant from a suitable supply source. A screen or filter is clamped between this boss and the main casing. An inexpensive stamped cup is secured on the bottom of the main casing and defines a float chamber receiving antidetonant from the inlet boss. This cup has an aperture in the bottom thereof receiving a tubular fitting therethrough. This tubular fitting carries the air vent tube and the replaceable jet orifice feeding the air vent tube. The metering valve for the device is slidably mounted in the main body of the casing and controls discharge out of the air vent tube into the passageway through the mounting flange. A cover or lid is secured on top of the main casing and the metering valve diaphragm is clamped between this cover and the main casing.

It is then an object of this invention to provide a device for supplying antidetonant material in proper metered quantities and at proper times to the fuel intake of an internal combustion engine.

A further object of this invention is to provide an inexpensive supplementary fuel injector for internal combustion engines simplified for mass production without sacrificing operating efficiency.

A still further object of the invention is to provide a supplementary feed injector for internal combustion engines which meters anti-

detonant material or the like to the fuel intake of the engine under the influence of intake manifold pressure and contains a replaceable orifice to provide an adjustment for different types of main fuels burned by the engine.

A still further object of the invention is to provide a supplemental fuel injector for the main fuel intake of an internal combustion engine which is conveniently supported on a flange member inserted between the carburetor and intake manifold of the engine and which supplies a jet of antidetonant admixed with air only when required by the engine.

A further object of the invention is to provide a supplemental fuel injector for attachment to the intake manifold of an internal combustion engine and having an air vent tube between a replaceable fixed jet and a metering valve for supplying a jet of antidetonant to the engine as controlled by the valve.

A specific object of the invention is to provide a detonation suppressor unit arranged to meter an aerated jet of antidetonant to the engine in accordance with the vacuum in the intake manifold of the engine and arranged to seal both the air feed and the antidetonant feed from the engine whenever intake vacuum increases beyond a predetermined point.

Other and further objects of the invention will be apparent to those skilled in the art from the following detailed description of the annexed sheets of drawings which, by way of a preferred example only, illustrates one embodiment of the invention.

On the drawings:

Figure 1 is a vertical cross sectional view of a supplementary feed device according to this invention mounted on a mounting block or flange unit interposed between the carburetor and the intake manifold of an internal combustion engine.

Figure 2 is an isometric view of a replaceable fixed orifice unit for the device of Fig. 1.

Figure 3 is a top plan view, with parts in horizontal cross section, of the assembly of Fig. 1.

Figure 4 is a fragmentary vertical cross sectional view taken substantially along the broken line IV—IV of Fig. 3.

Figure 5 is a fragmentary vertical cross sectional view, taken slbstantially along the broken line V—V of Fig. 3.

As shown on the drawings:

The device 10 of this invention shown in Figs. 1 and 2 is mounted on a flange unit or mounting block 11 interposed between the discharge outlet of a carburetor C and the inlet of an engine intake manifold M. The flange unit or mounting block 11 has a flat mounting face 11*a* positioned laterally of the carburetor and intake manifold as shown in Fig. 3. A Venturi nozzle 12 is carried by the flange or block 11 and projects downstream in the unit 11 so that suction in the intake manifold M will draw fluid through the tube. The tube projects beyond the flat face 11*a* of the block 11 as shown in Fig. 1.

The device 10 includes a main body casing 13, a top cover 14, a stamped metal bottom cup casing 15 and an inlet boss casing 16. The main body 13 has a mounting flange 17 extending laterally from one side thereof and having a flat face 17*a* mating with the face 11*a* of the mounting block 11. Bolts 18 connect the flange 17 to the mounting block.

A well 19 is formed in the top of the body 13 and has a central upstanding boss 20 therein. A cylindrical bore 21 extends inwardly from the top of the boss 20 into the body 13 to terminate at a flat shoulder 22 in spaced relation above the bottom face of the body.

A valve assembly is slidably mounted in the bore 21 and includes a rod 23 slidably engaging the bore and having a reduced end portion 23*a* with a flange or collar 23*b* and a pointed needle valve end 23*c*. A sealing washer 24 is interposed between the flange 23*b* and the large end of the pointed portion 23*c*. The washer 24 coacts with the shoulder 22. An orifice opening or bore 25 of lesser diameter than the bore 21 receives the pointed end 23*c*.

A washer 26 is seated on top of the rod 23 and receives a spring retainer 27 thereon. A flexible diaphragm 28 having its peripheral portion clamped between the body casing 13 and the cover 14 by means of bolts 29 extending through the cover and threaded into the body casing 13 has a portion overlying the central portion. A washer 30 overlies this central portion of the diaphragm 28 and a cap screw 31 is passed through the washer 30, the diaphragm 28, the retainer 27 and the washer 26 into threaded engagement in the rod 23. The screw 31 clamps the diaphragm between the retainer 27 and washer 30. A coiled spring 32 surrounds the boss or lug 20 and is compressed between the bottom wall of the well 19 and the retainer 27. The spring thereby acts on the assembly to lift the rod 23 out of the lug 20 thereby unseating the sealing washer 24.

As illustrated in Figs. 3 and 5, the main body casing 13 has bores 33 extending from the bottom of the well 19 through the mounting flange 17 for mating with at least one bore 34 through the mounting block 11. These bores provide a passageway venting the interior of the well 19 under the diaphragm 28 to vacuum existing in the intake manifold M. This vacuum tends to draw the diaphragm 28 into the well 19 for opposing the spring to seat the sealing washer 24 on the shoulder 22.

The casing 13 as shown in Figs. 3 and 4 also has a tap hole 35 normally colsed by a plug (not shown) communicating with the well 19. This tap hole can receive a fitting to connect the well with the intake manifold of an engine in the event that the arrangement shown in Figs. 3 and 5 is not convenient.

As shown in Figs. 1 and 3 the main body casing 13 has a laterally extending boss portion 36 on the side thereof opposite the mounting flange 17. This boss has a flat side face 36*a* with an annular groove 37 therein. The top portion of the groove has a horizontal bore 38 extending therefrom into the casing to a vertical bore 39 opening through the bottom face of the casing. A valve housing plug 40 is threaded into the bore 39 and has an orifice 41 therein providing an outlet for the bore.

The flat face 36*a* of the boss receives a gasket 42 thereagainst and a flat screen 43 is bottomed on this gasket ring and is clamped between the inlet fitting 16 and the end face 36*a* by a screw 44 extending through the fitting 16 and threaded into the casing. This single screw 44 sealingly attaches the inlet fitting 16 to the casing 13 and at the same time sealingly clamps the filter screen 43 in position. An inlet tube 45 from a source (not shown) of antidetonant supplies the interior of the fitting with antidetonant liquid and this liquid is filtered through the screen 43 into the groove 37 from which it flows through the bores 38 and 39 to the inlet orifice 41. The filter 43 is readily removed for cleaning and replacement by release of the screw 44 from the casing. The

groove 37 provides a relatively large collection area for the filtered antidetonant and any fine material that does pass through the screen 43 will be collected in the bottom of the groove which acts as a sump. The groove can be cleaned with the filter.

The valve housing 40 slidably supports a valve member 46 with a pointed needle-like end 46a controlling flow through the orifice 41. A bracket 47 depends from the bottom of the casing 13 into the interior of the chamber 48 provided by the cup casing 15. This bracket carries a pin 49 on which is pivoted an arm 50 secured to an annular float 51. The arm 50 engages the bottom of the valve member 46 to cause the valve to rise and fall with the float 51 thereby controlling the inlet orifice 41 in accordance with the level of liquid in the float chamber 48.

The main casing 13 has a lug 52 depending from the bottom face thereof into the central portion of the float chamber 48. A bore 53 extends upwardly through this lug 52 into the casing 13 in axially aligned relation with the bore 21. The bore 53 terminates at a shoulder 54 beneath the shoulder 22. The orifice passage 25 connects the bore 21 with the bore 53.

The cup casing 15 is secured to the main casing by screws such as S and has a sump defining portion 15a with an aperture 55 through the bottom thereof. A mounting plate 56 rests on the bottom of the cup casing 15 around the mouth of the sump and overlies the sump. Perforations 57 are provided in the plate.

A tubular fitting 58 projects into the bore 53 and an O ring sealing washer 59 is interposed between the end of the fitting and the shoulder 54. The fitting 58 projects through the plate 56 and aperture 55 and has a collar or flange 60 supported on the plate 56. The lower end portion 58a of the fitting 58 is exteriorly threaded and receives a nut 61 in threaded engagement thereon. The nut thrusts through a sealing washer 62 against the bottom of the sump 15a to draw the fitting tightly against the supporting plate 56 thereby clamping the fitting in position.

The interior of the lower end portion 58a of the fitting 58 is also threaded and receives an orifice member 63 in threaded engagement. This orifice member 63 as shown in Fig. 2 has external threads therearound engaging the internal threads of the fitting 58 and defines a fixed orifice hole 63a in the axial center of its end face. Screw driver slots 63b are provided in the member so that it can readily be inserted and removed from the tube 58 through the open bottom of the tube without disrupting the tube mounting. A closure plug 64 is threaded into the bottom end of the tubular fitting 58 and a sealing washer 65 on the plug seals the bottom of the tubular fitting.

Ports 66 are provided in the tubular fitting 58 communicating with the sump beneath the apertured mounting plate 56. Fluid in the float chamber 48 thus flows by gravity through the ports 66 and through the orifice 63a as shown by the arrows in Fig. 1.

An air tube 68 fits freely in the fitting 58 and is bottomed on the orifice member 63. Packing material 69 surrounds the lower end of the tube and is compressed into sealed engagement between the tube and fitting when the orifice member 63 is threaded home. The upper end of the tube 68 has snug fitting engagement with a reduced neck portion of the tubular member 58. A passageway 70 is thereby provided around the tube 68 intermediate the ends of the tube. Ports

71 are formed through the tube 68 at spaced levels below the fluid level maintained in the float bowl. These ports 71 join the passageway 70 with the interior of the tube. The fitting 58 has an annular groove 72 therearound within the bore 53 and ports 73 extend radially inward from this groove into communication with the passageway 70. A second O ring seal 74 is seated in a groove around the fitting 58 to sealingly engage the bore 53 beneath the groove 72. The O rings 59 and 74 cooperate to prevent leakage along the fitting from the groove 72.

As best shown in Fig. 4, the groove 72 registers with a bore 75 in the main body 13 and this bore 75 extends to a threaded well 76 that can receive a tube for venting the bore to the air filter for the engine carburetor or to any other source of ambient air.

The interior of the tube 68 is thus vented to the atmosphere through the ports 71, passageway 70, ports 73, grooves 72 and bore 75.

As also shown in Fig. 4 the main body casting 13 has bores 77 therein venting the float chamber 48 to the atmosphere.

As shown in Fig. 1 a bore 79 extends through the flange portion 17 and main body 13 to register with the bottom end or inner end of the bore 21. This bore 79 receives the outer end of the Venturi nozzle 12 therein and provides a passageway for feeding antidetonant to the nozzle 12.

Operation

Antidetonant such as a 50% mixture of water and alcohol is fed by gravity or by a pump through the tube 45 to the inlet fitting 16. The liquid is filtered through the screen 43 and flows through the bores 38 and 39 to the inlet orifice 41 through which it is admitted under the influence of the valve 46 to the float chamber 48. The float 51 maintains a predetermined level of antidetonant in the float chamber 48. The antidetonant in the float chamber 48 flows through the apertures 57 in the plate 56 and through the ports 66 in the fitting 58 to the orifice 63a of the replaceable orifice unit 63. The liquid then rises into the tube 68 and passageway 70 to the same level as exists in the float chamber 48. This condition obtains when the engine is stopped and in such event the spring 32 is effective to lift the rod 23 to unseat the sealing washer 24 and to move the pointed metering valve 23c out of the orifice 25. The upper end of the tube 68 is thereupon in full communication with the bore 79 and nozzle 12.

During the cranking operation for starting the engine not enough vacuum is created to lift antidetonant from the float chamber into the engine and then as soon as the engine starts sufficient vacuum is created in the intake manifold to depress the diaphragm and close the valve. Therefore no antidetonant is fed during part throttle operation of the engine.

When the engine throttle is from ¾ to full open position the intake vacuum is lowered sufficiently to allow the spring to open the valve. As soon as the valve is opened an encircled mixture of antidetonat from the tube 68 and passageway 70 is fed to the engine. After this liquid has been exhausted from the passageway and tube, a normal mixture of liquid and air is fed.

In the wide open position of the metering valve, antidetonant and air will be drawn into

the intake manifold at a rate determined by the orifice 63a and the size and position of ports 71. If low grade main fuels are being used for feeding the engine the orifice 63a should be relatively large. If high grade main fuels are being used the orifice 63a can be smaller. The orifice member 63 is therefore readily replaceable to compensate for variations in the quality of main fuel being fed to the engine.

Since air as well as liquid fuel is drawn into the tube 68, the tube breaks up the liquid into an aerated jet which is fed to the intake manifold and easily mixes with the aerated gasoline. The air in the aerated jet of antidetonant is sufficient for thorough combustion of the antidetonant.

As vacuum builds up in the intake manifold the diaphragm 28, vented to the intake vacuum through the passageways 33 and 34 is drawn into the well 19 to compress the spring 32 and move the metering valve toward closed position. The needle valve end 23c will thereupon become effective to meter controlled amounts of the jet into the nozzle 12. When vacuum in the intake manifold increases sufficiently to cause the diaphragm 28 to move the sealing washer 24 against the shoulder 22, feed of the aerated antidetonant jet is stopped and the intake manifold is sealed against feed of either air or antidetonant material from the device 10. The sealing of the air feed supply through the device 10 eliminates heretofore encountered difficulties of interference with carburetor setting during those periods when antidetonant was not being fed.

The feed device 10 of this invention therefore functions to supply first an enriched aerated jet of antidetonant to the engine followed immediately by a leaner aerated jet due to the emptying of the air tube 68 and the exposing of more air holes 71 and next followed by a controlled metering of the leaner jet. Finally, when the detonating point of operation of the engine has been passed the vacuum in the engine is sufficient to close off automatically the feed of both antidetonant and air to the intake manifold from the device 10.

The orifice member 63 is readily replaced by mere removal of the plug 64 and unscrewing of the member out of the tubular fitting 58. The multi-casing parts of the device include inexpensive castings or forgings and stampings, the parts are readily assembled and replaced and the unit is adapted for inexpensive mass production while at the same time it is capable of accurate efficient operation.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. An auxiliary fluid feed device for the fuel intake of an internal combustion engine comprising a main casing body having a mounting flange on one side thereof, a block unit arranged to be inserted between the carburetor and intake manifold of an engine and having a laterally projecting mounting boss, means connecting the mounting flange of said casing to said boss, said main casing having a well in the top thereof with an upstanding central lug and a lug depending from the bottom face thereof, aligned top and bottom bores extending through said lugs

into spaced opposed relation in the body, said body having an orifice passageway connecting said bores, a valve assembly slidable in the top bore controlling flow through said orifice, a cup casing secured to the bottom face of the body and defining a float chamber, an upstanding tubular fitting projecting into said bottom bore of the main casing and extending through the bottom of the cup casing, said tubular fitting having a replaceable orifice member threaded therein and accessible for replacement from outside of the cup casing, an air tube in said tubular fitting, passageways venting the interior of the air tube to the atmosphere, an inlet in said main casing, a float controlled valve slidable in said main casing regulating flow from said inlet to the float chamber of said cup casing, the main casing having a passageway therethrough and through the flange thereof communicating with said intake manifold for connecting the top bore with the intake manifold, a cover on said main casing, a diaphragm interposed between said cover and said main casing for covering said well, means connecting the central portion of said diaphragm with said valve for co-movement, a spring acting on said valve to urge the same to open position, and a passageway in said main casing vented to vacuum in the intake manifold for evacuating the well to draw the diaphragm therein for closing said valve.

2. A supplementary feed device for internal combustion engines comprising a main casing body having a laterally extending mounting flange and upstanding lugs on the top and bottom faces thereof, top and bottom bores extending through said lugs in spaced opposed relation in the body of said casing, an orifice passageway connecting said bores, said main casing having a laterally extending passageway connecting the top bore through the mounting flange, a valve slidably mounted in the top bore, a tubular fitting seated in the bottom bore and projecting therefrom, a cup casing defining a float chamber around the tubular fitting and secured to the bottom of the main casing, means venting the interior of the tubular fitting to the atmosphere, a replaceable orifice in the bottom of said tubular fitting, said main casing having an inlet communicating with the float chamber, a valve for regulating flow through said inlet, a diaphragm bridging the top of the main casing and connected to the valve slidable in the top bore of the casing for comovement therewith, means for venting one side of the diaphragm to a source of suction for depressing the diaphragm to close the valve, and spring means acting on the valve to urge the valve toward open position whereby said device meters an aerated jet of fluid under the influence of vacuum in the intake of an internal combustion engine at rates determined by a replaceable orifice.

3. A supplementary fluid feed device for internal combustion engines comprising a casing having a bottom float chamber, a tubular fitting removably disposed in said casing and depending through the bottom of said float chamber and having an internally threaded lower end portion, a vent tube disposed in the bore of said tubular fitting and spaced from the inner walls thereof defining a vent chamber, an externally threaded orifice defining unit removably inserted in said tubular fitting against the lower end of said vent tube for retaining the same in place and sealingly closing the lower end of said vent chamber, a plug for closing the bottom end of said fitting,

and ports supplying antidetonant material from the float chamber to said orifice whereby said orifice is readily replaceable from outside of said casing without removal of additional operating parts.

4. A fluid feed device for the main fuel intake of an internal combustion engine which comprises a casing having a float chamber defining portion at the bottom thereof with a localized bottom sump having an aperture therethrough, a mounting plate resting on the bottom of said casing portion, a tubular fitting extending through said mounting plate, said sump and said aperture and having a shoulder bottomed on said plate, a nut threaded on the projecting portion of said fitting and bottomed on said casing portion, said tubular member having an internally threaded end, an orifice unit removably threaded in said end, a plug member closing the bottom end of said tubular unit, and said mounting plate and tubular unit having ports therethrough for feeding fluid from the chamber to said orifice unit, said orifice unit being replaceable by removal of said plug and unscrewing the unit from the bottom end of the tubular member.

DAVID E. ANDERSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,601,437	Gustafson et al.	Sept. 28, 1926
1,915,852	Ericson	June 27, 1933
1,990,702	Leibing	Feb. 12, 1935
2,186,480	Ensign	Jan. 9, 1940
2,321,211	Johnson	June 8, 1943
2,441,301	Waag et al.	May 11, 1948