

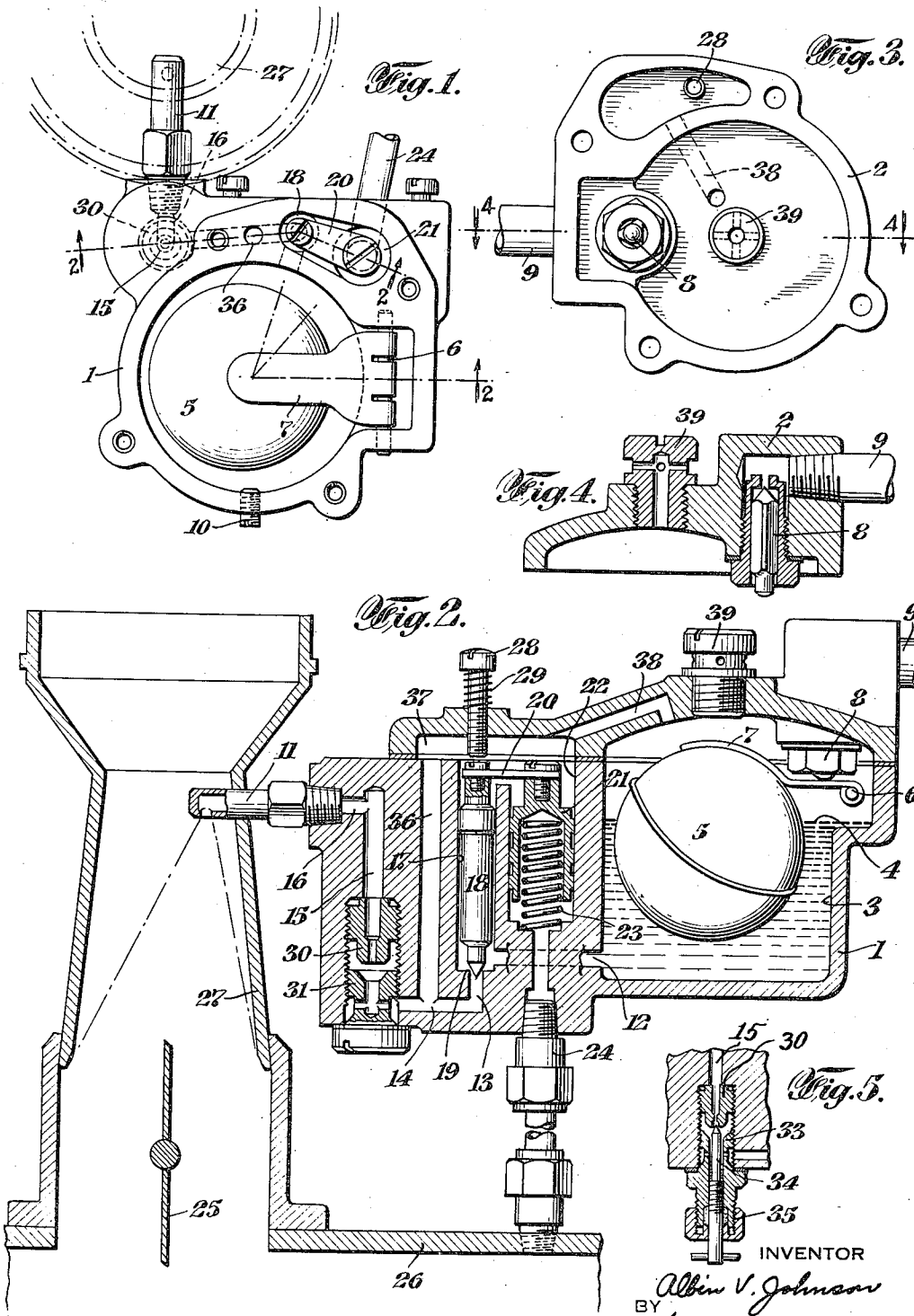
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AUXILIARY FUEL FEEDING DEVICE FOR INTERNAL COMBUSTION ENGINES

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AUXILIARY FUEL FEEDING DEVICE FOR
INTERNAL COMBUSTION ENGINES

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1 Claim. (Cl. 261-69)

This invention relates to auxiliary or supplementary fuel feeding devices, such devices for example as are intended for feeding liquid anti-knock agents or detonation suppressers in conjunction with and separately from base or primary fuel. These so-called auxiliary fuels may contribute added B. t. u. value to the primary fuel in addition to acting as anti-knock agents or may be devoid of any B. t. u. value and merely act as anti-knock agents.

Separate feeding of such liquids is well understood to those skilled in the art and numerous devices have been proposed for such separate feeding. Some of the devices heretofore proposed have been too complicated, both from the standpoint of manufacturing and installing, as well as servicing. Others are unitary with the carburetor for the primary fuel, and require material alteration in the engine structure. Still others are uneconomical in the use of the auxiliary fuel. In this connection it is pointed out that in the use of certain auxiliary fuels which have a combined anti-knock and B. t. u. value (such as alcohol or a mixture of alcohol and water), the fuel cost is not justified when reckoned solely on the B. t. u. basis but only when its additional anti-knock property is required for optimum engine operation—and this last operative condition occurs at only relatively narrow ranges and time intervals.

An object of the invention is to provide a device of the character described which is a unitary structure separate from the primary fuel carburetor but adapted for conjoint use therewith and capable of ready installation.

Another object is to provide a simple and dependable device which is adapted to be easily adjusted or adapted to engines of varying characteristics.

The invention consists in the novel features, arrangements, and combination of parts embodied by way of example in the apparatus hereinafter described as illustrating the present preferred form of the invention, and the invention will be more particularly pointed out in the appended claim.

Further objects and advantages of the invention will more fully appear from the following description taken in connection with the accompanying drawing, which shows by way of example, the preferred embodiment of the invention.

In the drawing:

Fig. 1 is a plan view of the device with the cover removed;

Fig. 2 is a development section taken substan-

tially along the line 2-2-2 of Fig. 1 to better show the relationship of the feeding unit, including body and cover, with the associated parts of the engine;

Fig. 3 is a bottom view of the cover;

Fig. 4 is a cross section of the cover taken on the line 4-4 of Fig. 3; and

Fig. 5 is a fragmentary view showing a modification of the low speed nozzle illustrated in Fig. 2.

Before giving a detailed description of the invention as embodied in the drawing, a general description will first be given.

Different makes of cars and trucks have different knock characteristics. That is, the detonation usually increases with the engine speed up to a certain point, and then diminishes and disappears. This peak knock varies with different engines; and accordingly in using a supplementary or auxiliary fuel to suppress detonation it is economical to use only the amount required for this purpose at the various engine speeds and throttle openings peculiar to the characteristics of the particular engine.

The vacuum or suction in the engine intake, on the engine side of the throttle, varies inversely as the engine speed and throttle opening, i. e., at higher engine speed and reduced throttle opening, the vacuum is greater than at a lower engine speed and wider throttle opening. Accordingly, it is useful to utilize the intake suction of the engine as a means of controlling the feed of the auxiliary fuel. The prior art has utilized the intake suction of an engine as a means of shutting off or turning on a flow of auxiliary fuel, but the balance of control necessary in regulating the auxiliary fuel consumed by the engine was not maintained in a manner to produce economy. I have solved this problem by utilizing the suction of the respectively opposite sides of the engine throttle and by a special arrangement of feed jets and atmospheric vent. In general, I effect the desired balance of control as follows: A float chamber, or other suitable constant level fuel chamber, supplies the fuel to a primary jet which is opened or closed in accordance with the intake suction from the engine side of the throttle. The size of the primary jet when fully opened is adjustable so as to provide for a maximum flow capacity through said jet. From the primary jet the fuel passes to a secondary jet through which it is drawn by suction imposed on the auxiliary fuel discharge nozzle which is positioned in the carburetor mixing chamber, and the size of this jet is predeter-

mined in accordance with the motor characteristics so that the amount of fuel which can be sucked therethrough is in proportion to the engine needs. Since the suction at this point in the carburetor increases with the engine speed, and since the peak knock occurs at an engine speed well below the maximum speed, the rate of feed of the auxiliary fuel would be uneconomical above the peak knock engine speed. I have prevented this uneconomical use of auxiliary fuel by placing a vent intermediate the two jets so as to prevent the suction from being imposed upon the primary jet, which is accordingly subjected only to gravity feed from the chamber; and by adjusting the maximum opening of the primary jet this flow may be limited to a maximum corresponding to any peak knock speed of the engine. By this means I am able to feed auxiliary fuel in increasing amounts in accordance with the suction in the carburetor mixing chamber up to the desired engine speed and then maintain a substantially constant maximum feed along a substantially straight line throughout the remaining range of engine speed; and the feed is commenced and stopped under control of the suction on the engine side of the throttle.

In the embodiment of the device illustrated in the drawing, 1 designates a body member and 2 a cover therefor. A fluid chamber 3 is provided therein and the fluid level in the body member, designated as 4, is maintained substantially constant as by means of a float 5 pivotally supported at 6 by a float lever 7 engageable with the valve stem of a feed valve designated in general as 8 and which may be of any suitable well-known form; the valve 8 being disposed in the cover 2 and being in connection with a suitable source of fluid supply through pipe 9. A fluid level plug 10 is preferably provided in the wall of chamber 3 to facilitate the correct setting of the float 5.

The fluid chamber 3 is adapted to supply, on demand, fluid (such as auxiliary fuel) to a discharge nozzle 11 through an interconnecting passage comprising a horizontal bore 12, a vertical bore 13, a horizontal bore 14, a vertical bore 15 and a horizontal bore 16 which is in communication with the bore of the externally extending nozzle 11. The flow of fluid through said passage is controlled in the manner now to be described.

A vertical bore 17 is disposed in axial alignment with the vertical portion 13 of the fluid passage and accommodates a needle valve member 18 vertically movable therein. The lower end of the needle 18 is provided with the usual point operatively disposed relative to a cooperating seat 19 provided at the upper end of the bore 13; the lower end of the needle being reduced in cross section at the junction of the bores 12 and 13 to provide an annular passage portion between the bores 12 and 13. The upper end of the needle 18 is connected by a link 20 with the upper end of a pneumatic piston 21 positioned in a cylindrical bore 22 formed in the body 1 and whose axis is substantially parallel to and spaced laterally from the axis of needle 18. The piston 21 is urged upwardly by means of a helical spring 23 disposed within a bore provided in said piston and seated on the lower cylindrical end. The cylinder is supplied with suction through a tube 24 in communication with the intake of an internal combustion engine on the engine side of the intake throttle valve 25, as by being in communication with the intake manifold of said engine designated as 26. The throttle valve 25 may be the throttle of the usual engine fuel carburetor designated as 27,

and the mixing throat of which is designated as 27', within which is positioned the auxiliary fluid discharge nozzle 11. From the foregoing it will be seen that the valve stem 18 is normally urged upwardly to open position by the spring 23, the open position being fixed by an adjustable stop provided by a screw 28 passing through the cover 2 and held in adjusted position by a helical spring 29. When the suction imposed on the piston 21 overcomes the force of the spring 23, the valve stem or needle 18 is moved downwardly and is seated on the valve seat 19 to close the control jet provided by this valve structure and herein termed the primary jet or high speed flow control jet.

A secondary or low speed control jet may be a fixed jet such as 30, which is disposed in the vertical portion 15 of the fluid passage. This jet is of such size as to control the flow of fluid in accordance with suction imposed on the nozzle 11 even when the high speed flow control jet is open, i. e., when the valve stem 18 is raised by the spring 23. The jet 30 is selected in accordance with the characteristics of the engine for which the feeder is intended, and in the present embodiment when the jet was selected for a Ford 1937 engine, the jet opening is .040 inch. A jet plug 31 closes the threaded bore into which the jet 30 is positioned and the plug 31 is provided with suitable axial and radial fluid passages in register with the passage 15 and 14. As is well understood by those skilled in the art, an adjustable jet of the screw needle valve type may be used so as to provide a universal device which may be adjusted for the desired engine. For example, the plug 31 may be replaced by a needle valve stem assembly illustrated in Fig. 5, where 33 designates a modified plug through which passes a needle 34 threadably engaged in the plug 33 for axial adjustment relative to the jet 30, against which the needle point is adapted to cooperatively seat, and the bore of the jet 30 will be increased (say to .055 inch diameter) to provide for the largest capacity desired. A suitable packing gland is provided in the usual manner and is adjusted by means of the nut 35.

A vertical bore 36 is positioned intermediate the high speed flow control jet 18—19 and the low speed suction controlled jet 30 and is in communication at its lower end with the horizontal passage portion 14; while its upper end is in communication with a recess 37 provided in the cover 2 and which communicates with the float chamber 3 by means of a passage 38. The float chamber, and thereby the passage 38, recess 37 and bore 36 are vented to atmosphere by means of a vent plug 39 provided with passages for this purpose. The fluid level in bore 36 varies in accordance with flow through nozzle 30.

From the foregoing it will be understood that by selecting a spring 23 which will overcome the opposite force exerted on the piston 21 by a suction of the order of magnitude indicated, the valve stem 18 will be caused to move away from its seat 19. The spring is such as to open the valve at the desired degree of suction (which is usually 4"—5" Hg or less) such as at relatively low speed and open throttle positions; and to close the valve at increased suction, such as at partly closed throttle and increased speed. The maximum opening of the valve is set to provide a maximum gravity flow capacity equal to the capacity of the suction jet 30 at the engine speed desired (preferably corresponding to the peak knock engine speed). This arrangement not

only supplies auxiliary fuel when needed but prevents an excess of auxiliary fuel being fed to the engine at such times as the engine requires a limited supply thereof.

In the use of certain auxiliary fuels, such as a mixture of alcohol and water, it is not only wasteful to use excessive amounts of such auxiliary fuel but it is important that auxiliary fuel in excess of that which may be taken into the intake of the engine and consumed be not fed to the intake, since this will cause harmful crank case dilution. I have found that the present invention has very satisfactorily met all of these requirements and its arrangement is such as to prevent leakage of the auxiliary fuel into the system when the auxiliary fuel is not required. Furthermore, by the use of this invention the auxiliary fuel system may be installed in an automobile or truck with a minimum of work and the absence of rearrangement of the standard equipment of the automobile or truck.

Having thus described my invention with particularity with reference to the preferred embodiment of the same, and having referred to certain modifications thereof, it will be obvious to those skilled in the art after understanding my invention, that other changes and modifications may be made therein without departing from the spirit and scope of the invention, and I aim in the appended claim to cover such changes and modifications as are within the scope of the invention.

What I claim is:

In a device of the character described, the combination of a body portion and a cover therefor, a fluid chamber in said body, a horizontally dis-

posed discharge nozzle extending externally of said body adjacent the top of said body and adapted to be inserted within the zone of suction of an internal combustion engine carburetor, a fluid passage within said body and interconnecting said chamber and nozzle, said passage comprising horizontally and vertically disposed portions, a first metering jet in said vertically disposed fluid passage portion intermediate said discharge nozzle and said horizontally disposed passage portion constructed and arranged so as to vary the flow capacity in accordance with suction imposed through said nozzle, a second jet between said first jet and said chamber constructed and arranged so that the flow of fluid therethrough is under the pressure influence of gravity only, said first and second jets being substantially below the liquid level of said fluid chamber and being so constructed and arranged that the entire fluid flowing through said nozzle passes in series through said jets, an air vent passage formed jointly in said cover and said body and in communication with said fluid passage intermediate said jets, a vertically movable valve member positioned in a bore in said body for varying said jet opening, a pneumatically operable piston substantially parallel to said valve member positioned in a cylinder formed in said body and connected to said valve member for movement thereof, means for urging said piston upwardly against pneumatic operation and adjustable stop means carried by said cover for limiting the upward movement of said valve member and piston.

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