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LIQUID FUEL FEED DEVICES FOR INTERNAL COMBUSTION ENGINES

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Fig. 1.

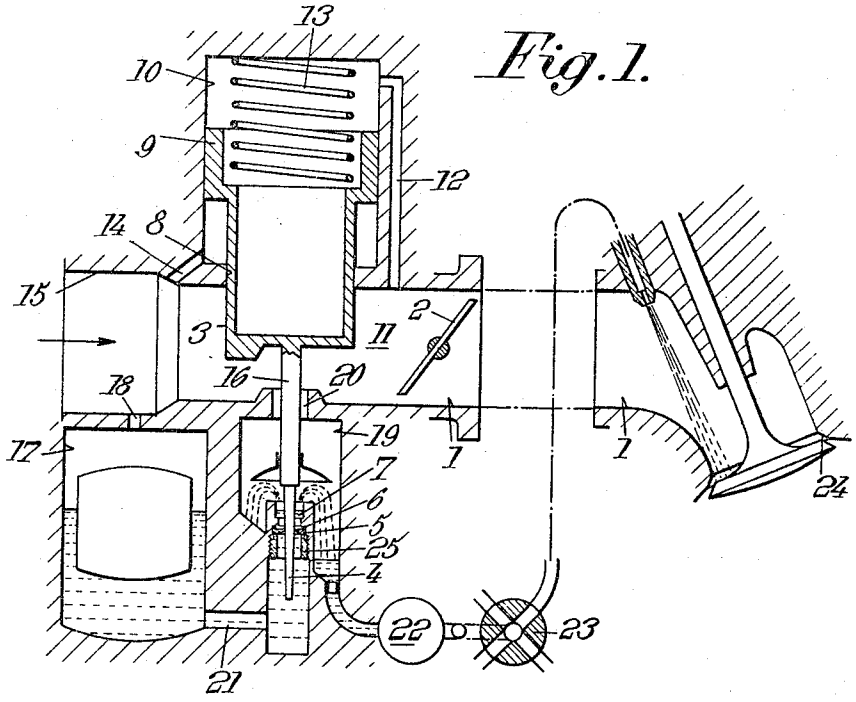


Fig. 2.

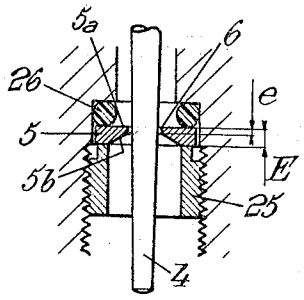


Fig. 3.

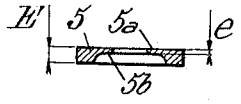
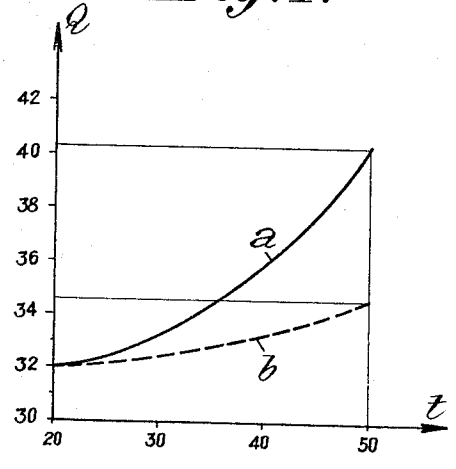


Fig. 4.



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LIQUID FUEL FEED DEVICES FOR INTERNAL COMBUSTION ENGINES

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1 Claim. (Cl. 261—37)

The present invention relates to liquid fuel feed devices for internal combustion engines, including a needle limiting, inside a central hole provided in a diaphragm, an annular orifice the cross section of which varies in accordance with the relative position of the needle and of the diaphragm, thus adjusting the flow rate of the fuel flowing through this orifice under the effect of a differential pressure. The invention is more especially, but not exclusively, concerned with fuel feed devices of this kind which comprise, in their induction pipe, an auxiliary throttle valve, disposed upstream of the main throttle valve actuated by the driver, said auxiliary throttle valve being mechanically connected with said needle, the above mentioned annular orifice being subjected, on the upstream side thereof, practically to the atmospheric pressure, and, on the downstream side thereof, to the pressure existing in the space between said two throttle valves, the whole being such that the auxiliary throttle valve opens the more, and produces an increase of the cross section of flow through said annular orifice the greater, as the flow rate through the induction pipe is higher, and vice versa.

The object of the present invention is to provide a fuel feed device of the above mentioned kind which is better adapted to meet the requirements of practice than those known up to now, and in particular which reduces the influence of variations of temperature of the fuel upon the flow rate thereof through said annular orifice.

The invention consists, chiefly, in giving the edge of the central hole provided in the diaphragm a thickness at most equal to 0.5 mm., whereas the remainder of the diaphragm is of a thickness sufficient to give the whole the desired rigidity in the direction of displacement of the needle.

Preferred embodiments of the present invention will be hereinafter described with reference to the appended drawings, given merely by way of example, and in which:

FIG. 1 is a diagrammatic vertical section of a fuel feed device provided with fuel metering means including a diaphragm made according to the present invention;

FIG. 2 shows, on an enlarged scale, the fuel metering means of FIG. 1;

FIG. 3 shows a modification;

FIG. 4 shows curves illustrating the advantages of the invention.

The fuel feed device to which the invention is applied may be of the type described in the British Patent No. 949,666, in the name of Société Industrielle de Brevets et d'Etudes S.I.B.E., filed on April 24, 1962, for "Carburetting Apparatus," and in the British Patent No. 993,825, in the name of Société Industrielle de Brevets et d'Etudes S.I.B.E., filed on December 23, 1963, for "Improvements in Carburetting Devices for Internal Combustion Engines."

Such a device comprises, in an induction pipe 1, upstream of a main throttle valve 2 operated by the driver (through suitable link means, not shown by the drawings), an auxiliary throttle valve 3 adapted to open automatically and gradually as the flow rate of air through said induction pipe 1 (in the direction of the arrow of FIG. 1) increases. To auxiliary throttle valve 3 there is operatively connected a fuel metering valve or needle 4 the cross section of which varies along its length. This needle 4 limits, in the central hole of a diaphragm 5, an annular fuel passage 6, so that the cross section of said annular passage 6 varies according to the longitudinal position of needle 4. Fuel flows toward induction pipe 1 through a channel 7 extending downstream of annular passage 6 and where the pressure is substantially the same as that existing in the portion 11 of induction pipe 1 located between throttle valves 2 and 3.

In the embodiment illustrated by FIG. 1, auxiliary throttle valve 3 is a cylindrical element of a diameter at least equal to that of induction pipe 1 and which extends through a bore 8 provided in the wall of said pipe 1. Auxiliary throttle valve 3 is rigid with a piston 9 of a diameter greater than that of said valve 3 and slidable in a cylinder 10. Piston 9 is urged toward the outside of induction pipe 1 by the suction existing in the portion 11 of induction pipe 1, this suction being transmitted through conduit 12. Piston 9 is urged in the opposed direction by a spring 13. The annular space limited in cylinder 10 by auxiliary throttle valve 3 and the edge of piston 9 communicates, through a conduit 14 with the air intake 15 of induction pipe 1.

It should be well understood that piston 9, slidable in cylinder 10, might be replaced by a diaphragm, a bellows, or any other equivalent member capable of moving auxiliary throttle valve 3 axially under the effect of the suction existing in the portion 11 of induction pipe 1. Likewise, the whole of sliding member 3 and piston 9 might be replaced by an eccentrically mounted flap valve located in induction pipe 1 and urged in the opening direction by the air stream flowing through said induction pipe, resilient return means opposing the opening of said flap valve.

In the embodiment shown by the drawing, needle 4 is rigidly connected to auxiliary throttle valve 3 through a rod 16.

Annular passage 6 is located, in the fuel circuit between, on the one hand, a constant level chamber 17 communicating through a hole 18 with air intake 15 and, on the other hand, a chamber 19 communicating, through a hole 20, with the portion 11 of induction pipe 1 located between throttle valves 2 and 3. Advantageously, as shown, rod 16 extends through said hole 20. Annular passage 6 communicates with constant level chamber 17 through a conduit 21.

The fuel metered through passage 6 is taken up by a pump 22 which delivers it, through a distributing valve 23, to induction pipe 1 near the suction orifice 24 of the corresponding engine cylinder.

As shown by FIG. 2, diaphragm 5 is advantageously held between an annular screw 25 and a ring 26 of rubber or a similar material.

In order to give diaphragm 5 a sufficient mechanical resistance to the pressure exerted by hollow screw 25 and to possible frictions of needle 4 when diaphragm 5 is being centered, the whole of this diaphragm is given a relatively great thickness, for instance of the order of 1.5 mm. and even more. As for the hole provided in diaphragm 5 its diameter averages 2–3 mm.

If the flow rate Q of the fuel (in cubic centimeters per minute for instance) is plotted as a function of the temperature t of the fuel, it is found that, with a diaphragm of such a thickness, for a given pressure difference, flow rate Q varies in the manner indicated by the solid line curve a of FIG. 4. As a matter of fact said flow rate varies to a substantial degree when the temperature varies. With a fuel consisting of ordinary gasoline, the flow rate may increase by about 26% when the temperature of the fuel passes from 20° C. to 50° C. It has been found that this undesirable variation of the flow rate is due chiefly to variations of both the viscosity and the density of the fuel.

According to the present invention, in order to obviate this drawback, the central portion of diaphragm **5** is given a thickness *e* at most equal to 0.5 mm. whereas the remainder of the diaphragm (or at least the peripheral portion thereof held between screw **25** and ring **26**) is made of a thickness E sufficient for giving the whole of this diaphragm the desired rigidity in the direction of displacement of needle **4**. This thickness is generally at least equal to 1.5 mm. The central hole of the diaphragm is of a diameter of the same order of magnitude as that of the usual diaphragms.

As shown by FIGS. 2 and 3, diaphragm **5**, which is generally metallic, is shaped so that one of its transverse faces **5***a* is flat whereas its other transverse face comprises a gradual connecting surface **5***b* between the central edge of reduced thickness *e* and the peripheral portion of thickness E. The joining surface **5***b* may either by frusto-conical as shown by FIG. 2, or have a curvilinear generatrix as shown by FIG. 3.

With a diaphragm of the type illustrated by FIGS. 2 and 3, it is found that the flow rate of fuel Q, measured in the same manner as above stated, corresponds to the dotted line curve *b* of FIG. 4. Instead of a variation of 26% (case of an ordinary diaphragm), which is hardly acceptable for practical purposes, there is a variation of flow rate of about 8% which, on the contrary, may be considered as very satisfactory. This improvement may be explained by the fact that the fuel viscosity and density variation phenomenons, which are considerably influenced by the temperature, act, at the level of passage **6**, on a much shorter length than in the case of the usual diaphragm, thus consequently reducing the influence of the temperature of the fuel on the flow rate thereof.

However, due to the fact that diaphragm **5** has a relatively great thickness E in its peripheral portion, it has a sufficient resistance to deformation and, consequently is no more liable than usual diaphragms to risks of misadjustment.

In a general manner, while the above description discloses what is deemed to be practical and efficient embodiments of the present invention, said invention is not limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the invention as comprehended within the scope of the appended claim.

What I claim is:

An improved internal combustion engine carburettor including a liquid fuel circuit, means for circulating a liquid fuel through said circuit, said fuel circuit including

a straight portion, a straight needle of a cross section varying along its length movable in said fuel circuit straight portion along the axis thereof, and a ring-shaped diaphragm carried by said fuel circuit straight portion transversely thereto and provided with a central hole surrounding said needle so as to define therewith an annular passage to control the rate of fuel flow through said circuit, wherein the improvement comprises;

the particular shape of said diaphragm the central hole of which is cylindrical, the edge of said diaphragm about said hole having a thickness of at most 0.5 mm., the remainder of said diaphragm being of a greater thickness to ensure the rigidity thereof, and

releasable means for holding said diaphragm fixed with respect to said fuel circuit straight portion, said diaphragm being of smaller diameter than said circuit portion so as to be adjustable transversely with respect to said circuit straight portion when said means are released, whereby, said means having been released, said diaphragm can be adjusted into position coaxial with said needle by moving the needle into contact with the hole of said diaphragm, after which the diaphragm is secured in fixed position with respect to said circuit straight portion by tightening said releasable means, the means for holding said diaphragm including, on one side of said diaphragm, a ring of a resilient material housed against a shoulder on said circuit straight portion and, on the other side of said diaphragm, an annular screw screwed in a screw-threaded wall of said circuit straight portion and bearing against said diaphragm, said ring of resilient material being sufficiently compressible to resiliently hold said diaphragm against said annular screw over a short range of axial movement of said screw.

References Cited

UNITED STATES PATENTS

2,443,464	6/1948	Leibing et al.	261—50
3,198,498	8/1965	Mennesson	261—50 X
3,210,055	10/1965	Kingsley	260—50
3,249,346	5/1966	Bickhaus et al.	261—50

FOREIGN PATENTS

620,840	5/1961	Canada.
958,915	5/1964	Great Britain.

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