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AUXILIARY MEANS FOR FUEL PUMPS

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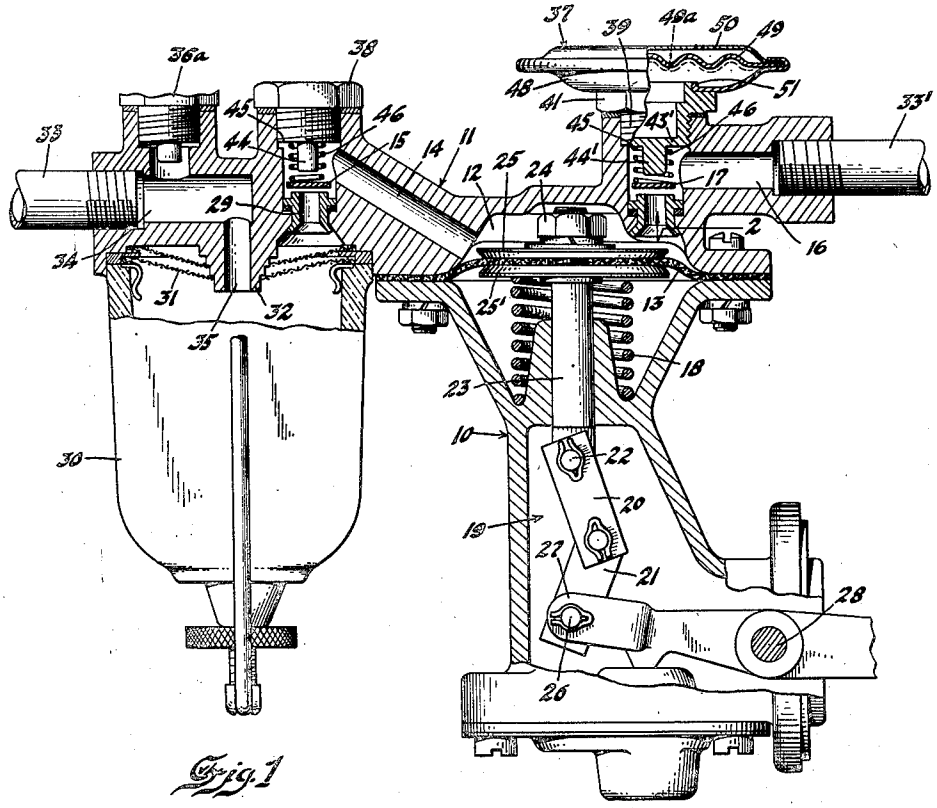


Fig. 1

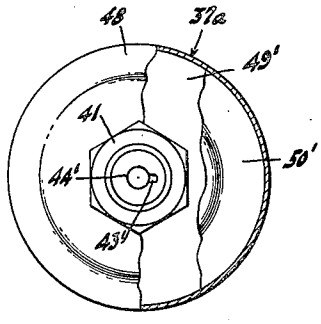


Fig. 2

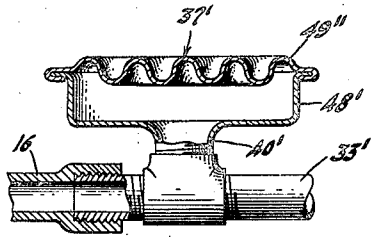


Fig. 3

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AUXILIARY MEANS FOR FUEL PUMPS

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10 Claims. (Cl. 103—224)

This invention relates to fuel pumps; and it is referred to as an auxiliary means for fuel pumps for the reason that, although it comprises certain fluid-advancing parts and also certain flow-maintaining parts which may respectively be capable of separate or alternative uses, specific constructions herein described have been devised and correlated with particular reference to an improvement in the efficiency of continuous-feed fuel delivery systems for use upon motor vehicles.

Pressure-controlled variable-stroke reciprocating pumps comprising diaphragms being now extensively used in the automatic advancement of gasoline or the like, up to a predetermined pressure, from supply tanks secured at various levels, it is a special object of this invention to provide simple, inexpensive and reliable means whereby an intermittent, pulsating advance of fuel past the valves of such pumps shall result in a comparatively continuous movement thereof through feed pipes and/or delivery pipes or passages connected with said fuel pumps.

Considerable energy having heretofore been wasted in the repeated starting and stopping of liquid fuel, as the same advances through passages communicating with pump chambers, it is an object of this invention, preferably providing valves with suitable springs and avoiding the use of so-called "air domes" or "pressure heads" (found to suffer loss of efficiency by reason of an absorption of air into fuel) to provide resilient means, preferably in the form of durable but replaceable "pulsator" units, for maintaining flow. These units may have bodies suitable for use as valve plugs; they may be used mainly for (1) the advancement of pumped fuel through a feed pipe, even during the expulsion stroke of a fuel pump, and/or for (2) the advancement of the pumped fuel through a delivery pipe, even during the intake movement of a pump piston, diaphragm, or other reciprocatory element; and, in preferred embodiments of this invention, assuming the mentioned pump to comprise a flexible diaphragm, any associated replaceable unit or units, serving as an auxiliary means, may also comprise a flexible diaphragm,—the former or pumping diaphragm being preferably formed of fabric and the latter being preferably metallic, suitably proportioned in relation thereto, and constituting or being associated with a resilient wall.

Other objects of this invention, which may incidentally aid promptly to close an outlet valve and may also tend to assure an instantaneous delivery of fuel upon the opening of a needle valve when an engine is to be started, may be best appreciated from the following description of preferred and alternative embodiments thereof, taken in connection with the appended claims and the accompanying drawing,—showing units, of valve plug type, which notably enhance efficiency.

Figure 1 is a general view, showing one advantageous type of fuel pump as equipped with one or more auxiliary means embodied in replaceable units which comprise bodies suitable for use as valve plugs,—some of the illustrated parts being shown in elevation and others in substantially median vertical section.

Figure 2 is a separate bottom plan view of one advantageous type of unit,—this view being taken substantially as indicated by arrow 2 of Figure 1, but suggesting alternative details.

Figure 3 is a view, partly in vertical section, showing an alternative type of auxiliary means,—such as may be permanently associated with the feed pipes or the delivery pipes of a fuel pump.

Referring first to conventional parts shown in Figure 1, it is to be noted that various forms of the novel auxiliary means upon which protection is herein sought may be separately or conjointly used,—either directly on or in proximity to fuel pumps of various types. A main pump casting 10 is shown as cooperating with a closure plate or casting 11, and one of these castings may comprise a pump chamber 12 whose volume is variable by the reciprocation of a diaphragm 13. Details of pump construction being comparatively immaterial to the present invention, it should nevertheless be noted that, a diagonally-extending inlet passage 14 being shown as controlled by a valve 15, and an outlet or fuel delivery passage 16 being shown as controlled by a similar valve 17, the illustrated means for reciprocating diaphragm 13 comprise a spring 18, operative to effect an expulsion of fuel from the chamber 12 past valve 17, such expulsion being conditioned upon a pressure differential between chamber 12 and passage 16.

Any desired means, such as a lost-motion linkage 19, effective under tension but ineffective under compression, may be employed to impart an intake movement to the diaphragm 13, or its equivalent; but it should be understood that, although the illustrated links 20 and 21 are respectively pivoted at 22 to a slidable element 23 (carrying a nut 24, for the retention of plates 25 and 25', by which the diaphragm 13 is secured) and at 26 to a lever 27 (movable upon a pivot 28

by any suitable means, not shown) the mechanical details of pump construction last referred to are of subordinate importance.

The closure plate or casting 11, carrying an inserted seat 29 for the mentioned valve 15, is shown as supporting also a sight cup or filter cup 30, provided with an annular filtering element 31 through which extends an inlet nipple 32,—the construction here referred to being such that fuel advancing through a fuel feed pipe 33, which may be connected with any fuel tank, or the like, not shown, may be admitted through passages such as shown at 34 and 35, into 30, to advance therefrom through the filter or filters 31 and past the mentioned intake valve 15.

Coming now to a novel "pulsator" 37, shown as associated with the mentioned outlet passage 16, this replaceable unit 37 is shown as comprising (like an adjacent plug 38) a threaded plug 39 having a non-circular body 41, suitable to be engaged by a wrench, and an extension, terminating in a shoulder 45 and adapted to retain a light and calibrated valve closing spring 46.

In the unit 37, the spring-retaining extension 44' is shown as extending below a diagonal duct 43'; and the hexagonal body 41 is shown as carrying an expansible assembly comprising an upwardly concave part 48, which may be comparatively rigid, to which is secured a generally flat and perforate but preferably annularly corrugated disc 49,—an upper and complemental concave part 50 being optionally associated therewith. The parts 48, 49 and 50 may advantageously be formed of comparatively thin sheet metal and either rebent or so soldered together as to form a lenticular resiliently expansible member,—an inner edge of the part 48 being shown as inwardly turned and secured to an upwardly extending boss 51 upon the body 41. A non-threaded part of this body, whether merely knurled or regularly polygonal is hereinafter referred to as "non-circular" in that it is in some way adapted to be gripped during such manipulation as is appropriate to its use as a valve plug.

In operation, assuming auxiliary units to be used as shown in Figure 1, so long as the pressure differential between the pump chamber 12 and outlet passage 16 remains such as to permit the valve 17 to open during expulsion strokes of any reciprocatory pumping element (such as, for example, the diaphragm 13) it will be seen that separate portions of the fuel advancing past valve 17 will be delivered respectively into the passage provided by delivery pipe 33' and into the auxiliary unit 37, or its equivalent; and that, as soon as the valve 17 closes, at the beginning of a downward or intake movement of the reciprocatory pumping element, this closing movement being accelerated by a pressure exerted by or through the corrugated disc or other diaphragm 49, said pressure becomes effective to maintain an advance of pumped fuel through the pipe 33' during the intake stroke of the pump. The illustrated proportions assure efficiency.

An increase of about 50% in efficiency being obtainable at about 2000 R. P. M. by the use of one of our pulsators in connection with a Babitch pump, only a considerably less increase in efficiency can ordinarily be obtained by the use of a similar unit near an inlet valve; but any auxiliary unit positioned in advance of a pump intake valve, in the general manner of the unit which is incompletely shown at 36*a*, Figure 1, may be substantially like the described unit, or it may resemble the alternative type of lenticular unit 37*a* shown in Figure 2,—each of said units comprising a body adapted to serve incidentally as a valve plug.

When any lenticular unit is so placed that its interior is in constant communication with an intake or feed line, the diaphragm part 49 (or 49') thereof (assuming this to be a resilient wall and the part 50 or 50', if employed, to be either perforated or imperforate and to be either rigid or resilient) may be moved inward, during each intake stroke, beyond such a normal or intermediate position of rest as is suggested by the dotted line 49*a*, Figure 1, thereafter moving to or toward the "full line". position during intervals wherein the intake valve is closed,—during expulsion strokes of the pump.

That is to say, in case the diaphragm is a resilient wall, the downwardly concave part 50 may be perforated or so constructed or secured as to preclude its use in a protected-air vesicle. If, on the other hand, an upper or outer concave part (whether or not corrugated in the manner suggested in 50' in Figure 2) is so constructed and used as to confine air, whether the unit is employed in a feed line or in a delivery line or in constant communication with a pump chamber, a mere fabric diaphragm 49', or the like, if suitably prepared and adapted to respond to variations in pressure, may be relied upon to protect confined air against absorption into the pumped fuel,—thus affording, in a single unit, the advantages of an air vesicle whose air is protected and the advantages of resilient walls.

Each of the described auxiliary units being provided with a threaded body adapted to serve as a valve plug, Figure 3 shows a simplified auxiliary unit 37', this unit comprising a concave part 48' and a corrugated disc 49'' which are secured together by a re-bending of the edge of the latter part and are secured to pipe 33' by means of a tubular connection 40'.

Preferred and alternative constructions and uses of plug-including auxiliary units being emphasized above, it should be understood that such units may be used upon either side of either or both of ordinary or special pump valves, as the latter are provided in fuel pumps, or the like; that units connected or interposed somewhat as is shown in Figure 3 may be used either separately or in conjunction with plug-including units; and that all of the described units possess in common the advantage over so-called "air domes", or the like, that they avoid contact between the pumped oil and confined air (which results in an absorption of the air and a consequent diminution in or complete loss of efficiency). All of the described units moreover have the advantage that, employing a resilient-walled expansible member, they are capable of exerting a useful effect, when placed near the intake valve connected with the feed pipe, or an expulsion effect when placed near the outlet valve of the fuel pump, or both effects alternately when placed by both said valves.

Without implying any limitation in this regard, it may be suggested that the pump-connected units (Figures 1–2, inclusive) and the interposed units (Figure 3) when employed, may best be placed in close proximity to a pump, rather than near a tank or carburetor.

Assuming the corrugated disc 49 of the unit 37 to be forced at the end of an expulsion stroke of the reciprocatory element 13, upwardly to substantially that full-line position in which it is

shown in Figure 1, the contraction of the unit 37 may be due largely or entirely to the resiliency of the parts 48, 49 and/or 50; but it has been noted that, in case the downwardly concave part 50, serving as a guard element, is imperforate, the last-mentioned part may serve also to confine air above the diaphragm part 49. Relying in slight degree, or not at all, upon the resiliency of the oppositely concave parts 48 and 50, it therefore becomes possible to substitute an imperforate diaphragm of any desired character (as, a fabric diaphragm) for the corrugated plate 49, relying upon the elasticity of any air confined between the parts 49 and 50 to produce, or to contribute to, the desired expulsive effect and to maintain an outward flow through the pipe 33' during periods when the valve 17 is closed. The suggested confinement of air is entirely optional.

As a mater of fact, the use of a unit comprising corrugated disc 49, proportioned and secured between oppositely disposed sheet-metal elements in substantially the illustrated manner, has been found to increase the efficiency of a fuel pump of the described type by more than fifty per cent; and, although any desired number of like or unlike units may be employed in a single system, somewhat as shown, there may ordinarily be no necessity or special advantage in the employment of more than one of the described units in connection with a single fuel pump,—as, the unit 37.

The size of the duct through which the fuel may surge to and from the described units, as well as the flexibility and dimensions of the described parts, may be of some practical importance to maximum efficiency; but all of the described forms have been found operative; and substantially the illustrated dimensions of the unit 37 have been found remarkably efficient, as employed in connection with a diaphragm pump of the type shown.

It is an important advantage of the units herein shown that these units (being externally used upon or near pumps) may be conveniently applied, in replacement of ordinary valve plugs, upon installations not originally equipped therewith,—the term "valve plug" being herein applied to a threaded closure element which is removable without disconnection of pipes and whose removal permits access to, and direct replacement of, a valve normally retained thereby.

Various alternative types of auxiliary means for fuel pumps having been described in detail, it will be understood that a number of additional forms might easily be devised by workers skilled in this art, without the slightest departure from the spirit and scope of this invention, as the same is indicated above and in the following claims.

We claim:

1. For use in conjunction with a fuel pump which is provided with an inlet valve and an outlet valve, one of said valves being accessible through an opening adapted to receive a valve plug: a valve plug which is provided with a variable-volume lenticular container for the pumped fuel; said plug being provided with a threaded portion, a non-circular portion above said threaded portion, and with a spring-retaining extension below said threaded portion.

2. For use in conjunction with a fuel pump which is provided with an inlet valve and an outlet valve, one of said valves being accessible through an opening adapted to receive a valve plug: a valve plug provided with a resilient-walled variable-volume auxiliary fuel container at its upper end, and with means for holding the upper end of a valve-closing spring in proper position at its lower end.

3. For use in conjunction with a fuel pump which is provided with an inlet valve and an outlet valve, one of said valves being accessible through an opening adapted to receive a valve plug: a valve plug provided with an inward extension having a duct communicating with a fuel passage of the pump, and with a resilient-walled container with which said duct communicates, said plug being provided with a non-circular portion above a threaded portion and with means for the retention of a valve-seating spring.

4. For use in conjunction with a fuel pump which is provided with an inlet valve and an outlet valve, one of said valves being accessible through an opening adapted to receive a valve plug: a valve plug which is provided with a variable-volume auxiliary container for the pumped fuel and with a duct leading from a fuel passage of the pump into said container,—said container comprising a corrugated disc part capable of resilient expansion and contraction from an intermediate position of rest and also a downwardly concave guard part formed of sheet metal.

5. For use in a fuel pump system, comprising a valve which is accessible through a valve plug opening: an advance-continuing unit which includes an auxiliary container and an attachment body constituting a valve plug,—said valve being provided with a spring and said attachment body being provided with a duct leading from a fuel passage of the pump into said container and with means including a reduced extension downwardly terminating in a shoulder for the retention of said spring.

6. In a fuel pumping organization: a fuel line provided with a valve adapted to open thereto in response to a pressure differential; means for intermittently forcing fuel past said valve; and resiliently-walled means for continuing the advance of said fuel upon the closing of said valve,—said last mentioned means comprising a pair of oppositely disposed disc-shaped concave parts, a diaphragm of disc-like form the periphery of which is held between the edges of said concave parts, and a threaded supporting and attaching member fastened to and extending from one of said concave parts.

7. In a fuel pump pulsator of the air-dome type: said pump having a pump body provided with a double-receiving chamber; an outlet and a spring-pressed outlet valve, a pulsator body element secured to said pump body; and a bubble-receiving dome secured to said element, said body element providing a throat which is proportioned favorably to a rise of bubbles therethrough and is provided with means for positioning the same above bubble-collecting chamber and in proximity to said outlet valve of the fuel pump; and one of said elements being provided with means for positioning a valve spring above said valve.

8. In a fuel pump, comprising parts forming a pump chamber, an outlet valve communicating with the pump chamber, there being an outlet opening beyond said valve, a bubble-collecting chamber between said valve and said opening, a hollow dome element and a throat-providing means communicating with said dome and chamber, said throat-providing means being positioned between the outlet opening and the dome, said dome being secured to one of said pump parts and having a projection, a spring positioned by said

projection and acting to seat said outlet valve.

9. In a fuel pump, comprising parts forming a pump chamber, an outlet valve communicating with the pump chamber, there being an outlet opening beyond said valve, a bubble-collecting chamber between said valve and said opening, a hollow dome element and a throat-providing means communicating with said dome and chamber, said throat-providing means being positioned between the outlet opening and the dome, said dome being secured to one of said parts and having a projection, said projection positioned to serve as a limiting stop for said valve.

10. For use in improving the efficiency of a fuel pump system, comprising a reciprocating pump element movable in a pump chamber, a fuel line and a valve between said chamber and said fuel line: a valve plug unit comprising an air vesicle, a corrugated metal disc in said plug unit forming a yielding wall for preventing direct contact between the air in said vesicle and the pumped fuel, there being a flow-restricting duct in said valve plug unit whereby the moving fuel may influence the movement of the metal disc.

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