Feb. 14, 1933. A. M. BABITCH 1,897,292

AIRDOME TYPE PULSATOR FOR FUEL PUMPS

Filed Sept. 20, 1929

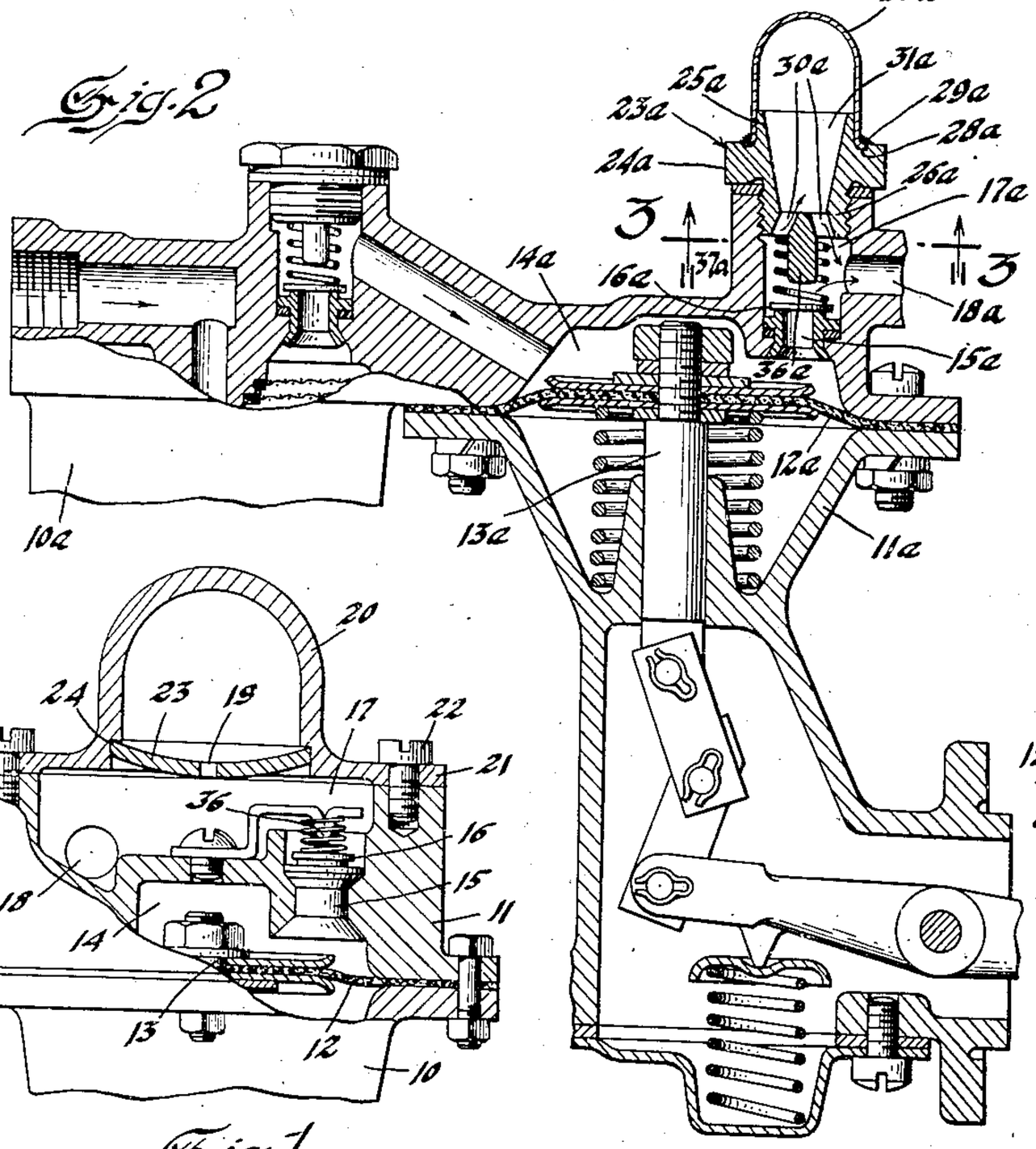


Fig. 2

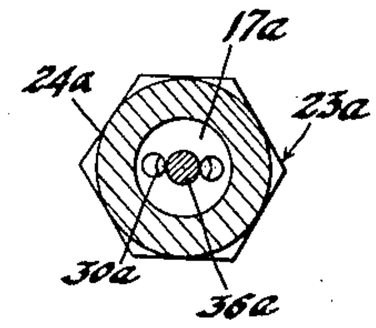
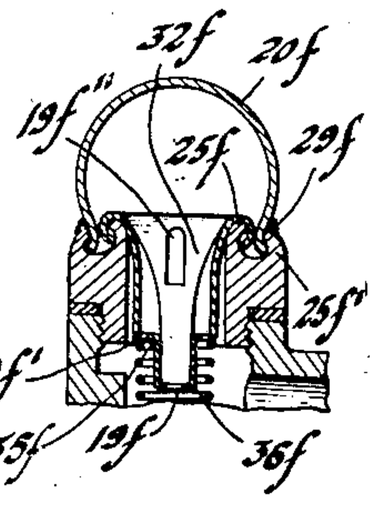


Fig. 3

Fig. 1

Fig. 9



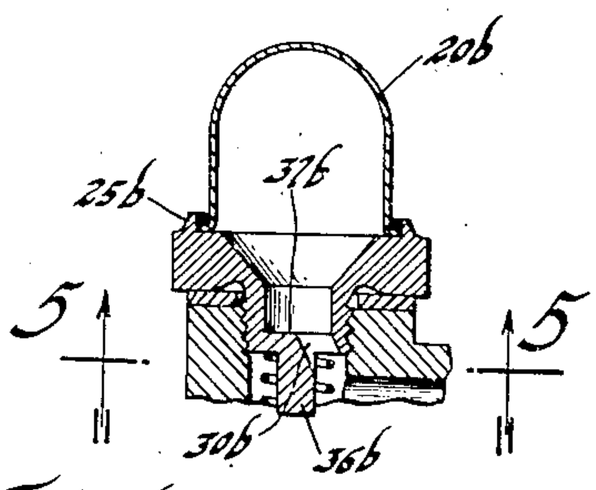


Fig. 4

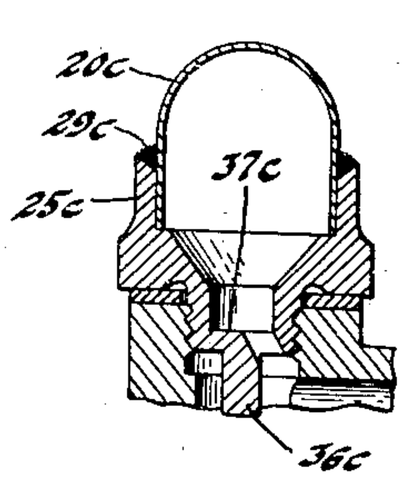


Fig. 6

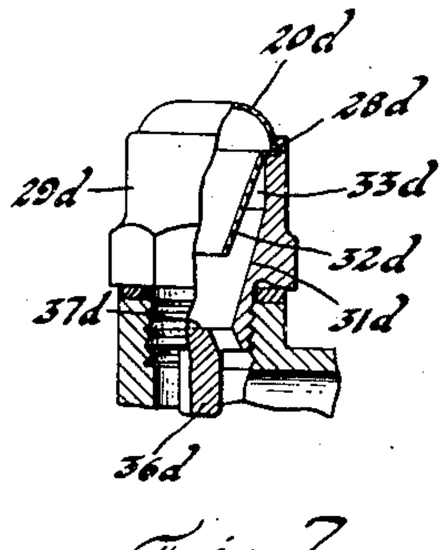


Fig. 7

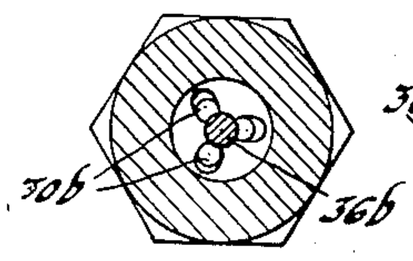


Fig. 5

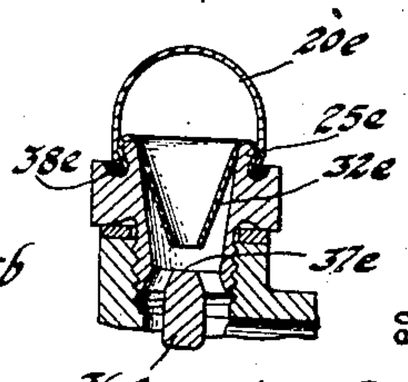


Fig. 8

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UNITED STATES PATENT OFFICE

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AIRDOME TYPE PULSATOR FOR FUEL PUMPS

Application filed September 20, 1929. Serial No. 393,974.

This invention relates to simple and advantageous means, relying upon the elasticity of a confined body of air or vapors and upon a novel self-replenishment effect, for augmenting the delivery of a liquid fuel from a diaphragm pump, or the like; and all forms of this invention may involve (1) the use of a bubble-receiving and air-confining dome element provided with means for securing the same above an outlet valve from the fuel pump, (2) the use of a bubble-collecting chamber, or the like, between said valve and said dome, and (3) the use of means providing a "throat" between said chamber and said dome,—the aggregate cross-sectional area of openings which provide this throat being preferably about one-eighth of the cross-sectional area of the dome.

In pending application Ser. No. 254,490, filed February 15, 1928, there is contained a disclosure of an early embodiment of the present invention; and Fig. 1 of the present drawing is reproduced from the mentioned application; but more recent and efficient and inexpensive embodiments of said invention are also herein disclosed. Each of the latter preferably include a threaded body element which may serve as a valve plug and which is formed separate from an air-dome element but secured in air-tight relationship thereto,—said body element, or a partition or subsidiary element, providing the mentioned throat; and said throat preferably provides a plurality of openings so formed and positioned as to favor a rise of bubbles therethrough from a bubble-collecting chamber above an outlet valve, for a self-replenishment of the "air" in said dome.

Functionally, the pulsators herein described and claimed resemble the diaphragm pulsator or so-called "auxiliary means" described and claimed in patent application 288,755, filed June 17, 1928; and, like the diaphragm pulsators referred to, the air-dome pulsators to whose protection the present application is directed preferably include means for the retention of a valve spring within or below a body which includes a non-circular portion, suitable for engagement by a wrench.

Other objects of the present invention may be best appreciated from the following descriptions of alternative embodiments thereof, taken in connection with the appended claim and the accompanying drawing.

Fig. 1 is, for the most part, a vertical sectional view, only a small portion of a fuel pump, with the invention applied thereto, being shown.

Fig. 2 is a view taken similarly to Fig. 1, but including additional parts and showing a more recent embodiment of the invention.

Fig. 3 is a horizontal sectional view, taken substantially as indicated by the line 3—3 of Fig. 2.

Fig. 4 is a vertical sectional view, corresponding to the upper right hand portion of Fig. 2, but showing an alternative form.

Fig. 5 is a horizontal sectional view taken substantially as indicated by the line 5—5 of Fig. 4.

Figs. 6–9 are views similar to Figs. 4, but showing additional alternative forms.

Referring first to Fig. 1, this view being taken from Fig. 4 of the mentioned application Ser. No. 254,490, pump body elements 10 and 11 are shown as cooperating in the retention. of a pump diaphragm 12, manipulable by a diaphragm stem 13 in a manner that is now well known; and the upper body element 11 is shown as providing not only a pump chamber 14 and an outlet passage 15, controlled by a valve 16, but an additional bubble-collecting chamber 17. This chamber communicates with a delivery opening 18 and also, by way of a throat 19, with an air chamber provided by a so-called cap or dome element 20. This is shown as integral with a body which merges into a flange 21, retained by screws 22, and as positioned above the valve 16 in such manner that bubbles of air or hydrocarbon vapors that may pass into or form within the chamber 17 can advance through the throat 19 into said air chamber.

In practice, it has now been found advantageous to employ throat openings somewhat different from that shown at 19, and unnecessary to give the partitioning element 23 (whether or not this latter is secured, in somewhat the manner of a "Welsh" plug, in an an-

nular channel 24) any downward convexity. Considerations of utility and economy are accordingly favorable to the use of the one or another of the alternative forms which will now be successively described.

In Figs. 2 and 3, pump body elements 10*a* and 11*a* are shown as retaining a diaphragm 12*a*, reciprocable by guided stem 13*a*; a pump chamber 14*a* is shown as provided with an outlet passage 15*a*, controlled by a valve 16*a*. Thereabove, a bubble-collecting chamber 17*a* is shown as communicating with both an outlet opening 18*a* and a throat provided by a so-called valve-plug body 23*a*. This body includes a non-circular or wrench-receiving portion 24*a*, having an upwardly extending flange 25*a*, and a downwardly extending threaded portion 26*a*; an air-confining dome element 20*a* is shown as snugly fitting over the flange 25*a*, and as including a lateral flange which is seated in an annular channel 28*a*, wherein it may be additionally secured by soldering, as at 29*a*. To permit rise of bubbles from the chamber 17*a* into the air chamber provided by the dome element 20*a*, a plurality of vertical or upwardly-inclined passages 30*a*, two being here shown, may communicate with a single upwardly expanding passage 31*a*; and it is found to be important that the passages 30*a* be of sufficient size, and sufficiently vertical, to favor the mentioned rise of bubbles,—the horizontal diameter thereof being preferably not less than that shown. For reasons that are not yet entirely clear, a total cross-sectional area, in the passages 30*a*, amounting to approximately one-eighth of the inside horizontal sectional area of the dome 20*a* is found to give more satisfactory results than are obtainable by either a much smaller or a much greater ratio than that mentioned.

In Figs. 4 and 5, three upwardly convergent passages or ducts 30*b* are shown as admitting bubbles to an air chamber within the dome element 20*b*; and said dome element is shown as interfitting in an upstanding exterior flange 25*b*, no interior flange being provided.

In Fig. 6, a more rugged external flange 25*c* is shown as receiving and directly engaged by a dome element 20*c*, cylindrical in its lower part, in a manner favorable to a liberal and easy use of solder at 29*c*; and in Fig. 7, a still higher flange 29*d* is interiorly provided, near the upper end thereof, with a special channel 28*d* adapted to receive, with or without solder or crimping effects, peripheral portions of not only a dome element 20*d* but a special subsidiary throat element 32*d*. This latter, if provided, may be formed, like the mentioned dome elements, of thin sheet metal, and it may be so spaced from a conical throat surface 31*d* as to permit some entrapping of air in an intervening space 33*d*.

A similar effect may be obtained by the use of the form shown in Fig. 8,—in which an ample groove 38*e* is shown as provided externally of the flange 25*e*, to receive edge portions of both a dome element 20*e* and a subsidiary throat element 32*e*; and Fig. 9 will be seen to suggest not only enclosure of edges of a dome element 20*f* and a throat element 32*f* between successively and oppositely deformed flanges 25*f* and 25*f'* (solder being optionally employed, as at 29*f*) but also the use of a lower end portion or downward prolongation of the throat element 32*f* (having any suitable upwardly convergent or other apertures 19*f*, 19*f'* and/or 19*f''* and/or lugs 35*f* formed therein) to provide a spring-retainer 36*f*,—corresponding in function to the spring-retaining fingers 36, 36*a*, etc. of Figs. 1–8 inclusive.

Several reference characters additional to those mentioned have been applied to Figs. 4–9 inc. consistently with the usage in preceding figures; but the application of arrows to Fig. 2 should not be understood to indicate any continuous or unidirectional flow of liquid through any of the mentioned domes. A vitally important discovery relied on in the present invention is the fact that by suitably positioning and proportioning air domes of the described types (the word "air" being herein used as inclusive of vapors), assuming bubble-collection chambers and throat passages to be provided as described, a self-replenishing effect may be obtained,—such as to provide an air cushion which serves for a pulsating effect in maintaining the onward flow of the pumped fuel, during intervals wherein the valves 16, 16*a*, etc. are closed. When the exposure to absorption is too great, any confined "air" has been found to disappear into the fuel; when "throat" passages are two small or unfavorably disposed, bubbles which may form from previously absorbed or entrained air (and/or as a result of variations in pressure, in velocity and/or in temperature) may be carried, without segregation, onward through outlets 18, 18*a*, etc., into the delivery line, but self-replenishment is nevertheless now found to be reliably obtainable by proper design along the lines indicated.

Within limits any desired plurality of convergently inclined or other openings 19, 19*f*, etc. may be provided in a suitable transverse partition element; and this element may be formed either, as in Fig. 1, by a separate flat or convex or concave plate 23; or by a fixed horizontal element such as the partitions 37*a* . . . 37*e*,—shown as carrying the mentioned spring-retaining fingers 36*a* . . . 36*e*; or by a downwardly-extending throat element such as 32*d*, 32*e*, or 32*f*; but it is not considered desirable entirely to eliminate said partitioning element; and the use of a plurality of apertures 19, 19*f*, etc. is deemed advantageous as permitting ascent of bubbles through

one or more openings and a corresponding simultaneous descent of liquid through another opening or openings.

Although the foregoing description has included reference to several alternative embodiments of the present invention, it should be understood not only that various features of said invention may be independently employed but also that numerous modifications, additional to those herein proposed, might easily be devised,—all within the scope of the present invention.

This application is a continuation in part of my application for fuel pump, Serial No. 254,490, filed February 15, 1928.

I claim:

In a fuel pump pulsator of the air-dome type: a pulsator body element; and a bubble-receiving dome element secured thereto, one of said elements having connected therewith a throat element which is so positioned and proportioned as to admit bubbles into said dome element,—the cross-sectional area within the throat of said throat element and that within said dome element being in substantially the ratio of 1 to 8.

In testimony whereof I affix my signature.

ABRAHAM M. BABITCH.