United States Patent

[11] 3,586,069

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[21] Appl. No. 821,366
[22] Filed May 2, 1969
[45] Patented June 22, 1971
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[54] **AUTOMATIC DISPENSING NOZZLE**
5 Claims, 9 Drawing Figs.

[52] U.S. Cl. **141/102,** 141/128, 141/206
[51] Int. Cl. **B65b 3/24,** B67d 5/28, B67d 5/372
[50] Field of Search .... 141/102, 126, 128, 192—229

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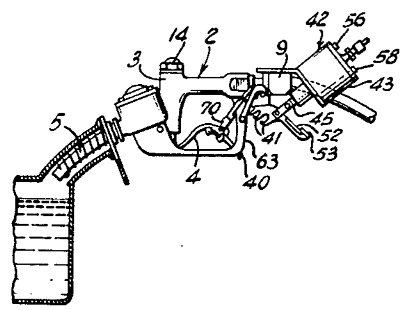
ABSTRACT: An automatic dispensing nozzle having means, in addition to the conventional vacuum responsive means for closing the main valve to reinstitute flow thru the nozzle at a relatively slow, predetermined rate suitable for carrying out the final or "topping-off" operation. With subsequent rise of fluid around the nozzle spout the resulting vacuum signal finally shuts off the operation. There is a predetermined time delay following initial closure of the main valve and prior to reinstitution of flow, sufficient to permit initial subsidence of fluid from about the spout of the nozzle.



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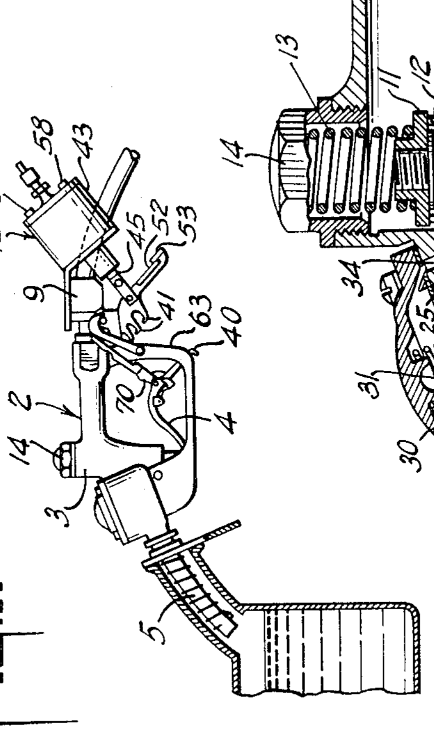

Fig.1.

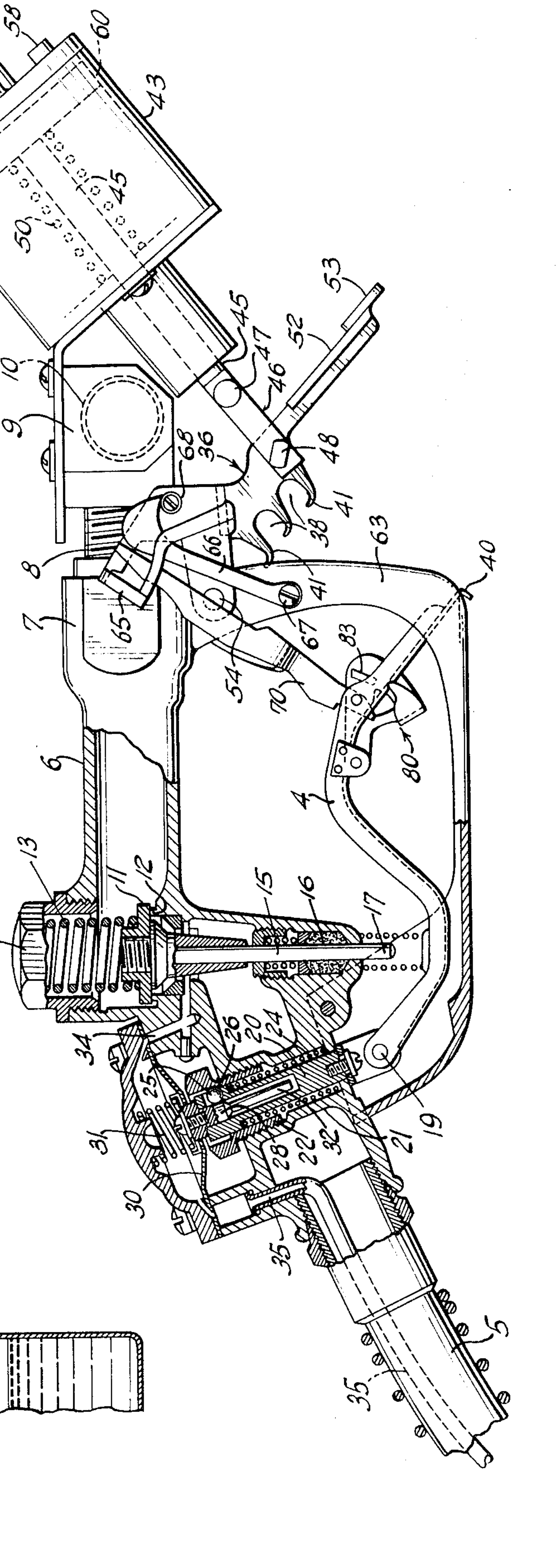

Fig.2.

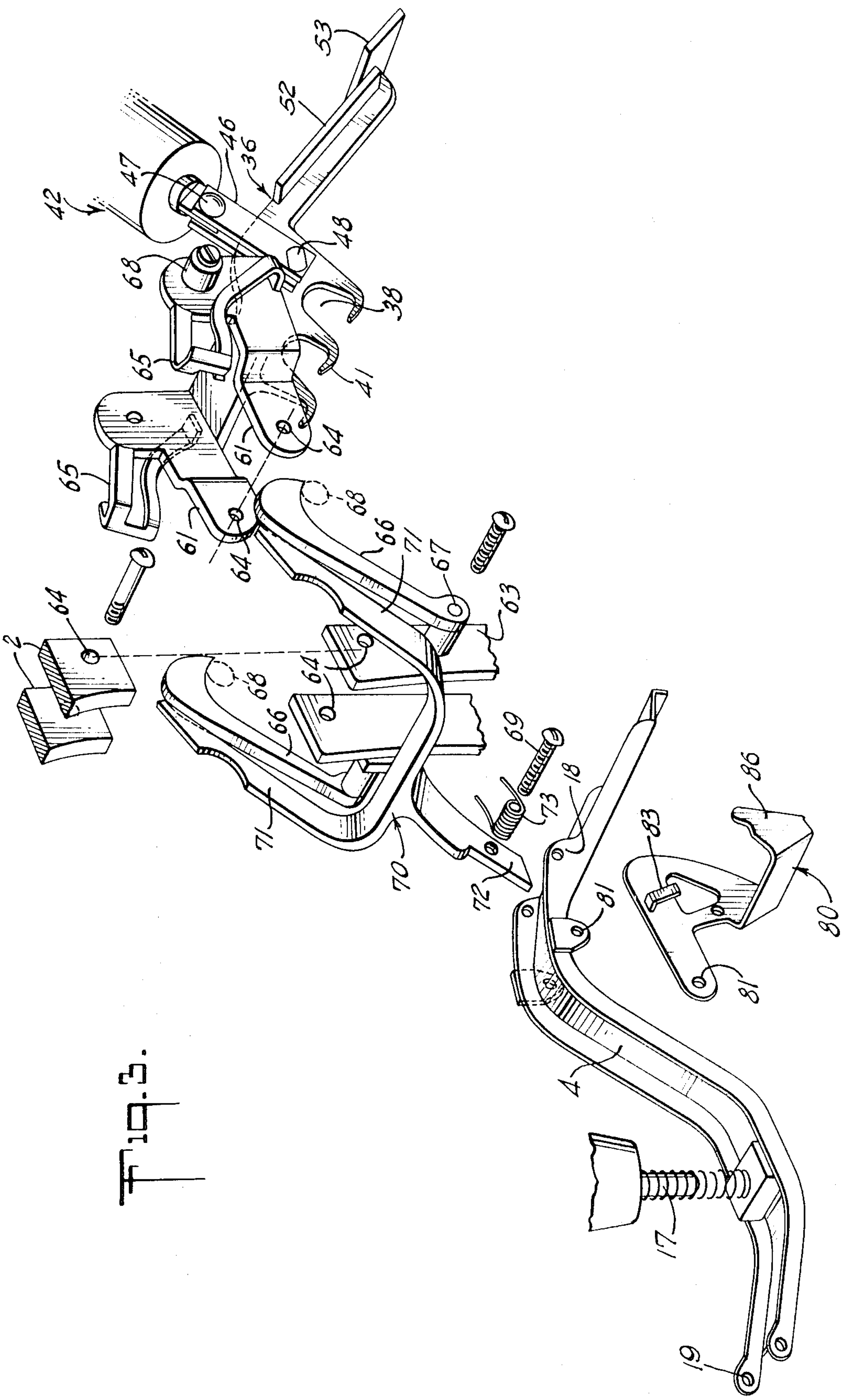
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Fig. 3.

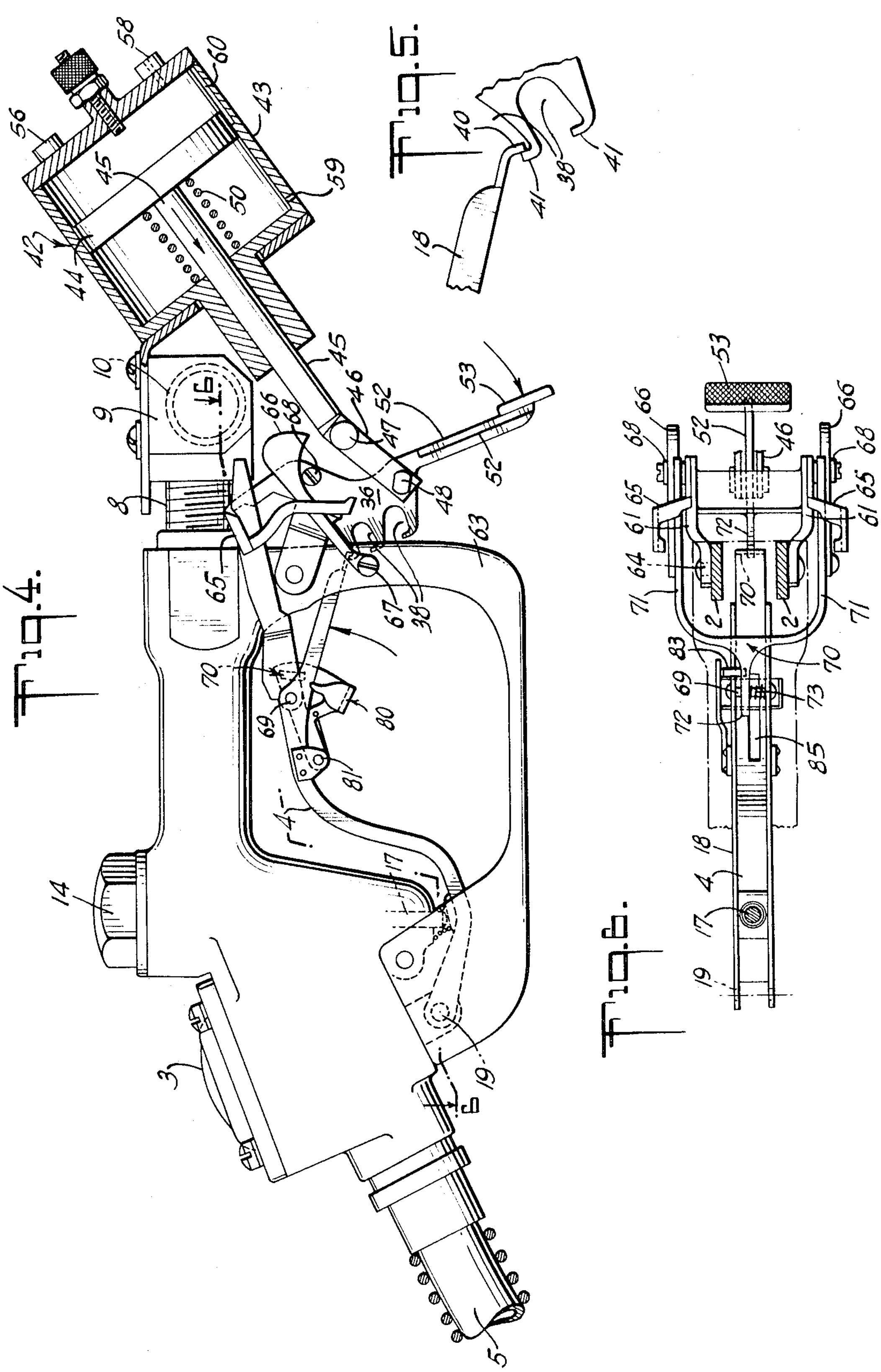
Fig.4.
Fig.5.
Fig.6.

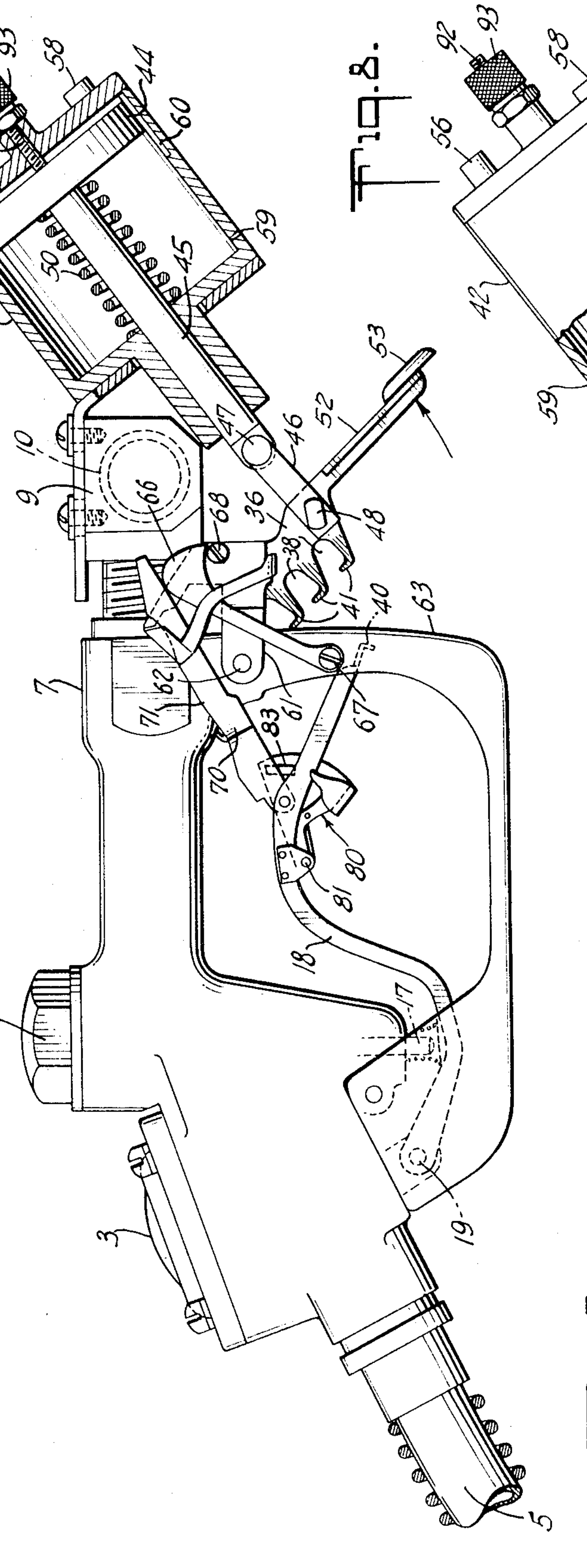

Fig. 7.

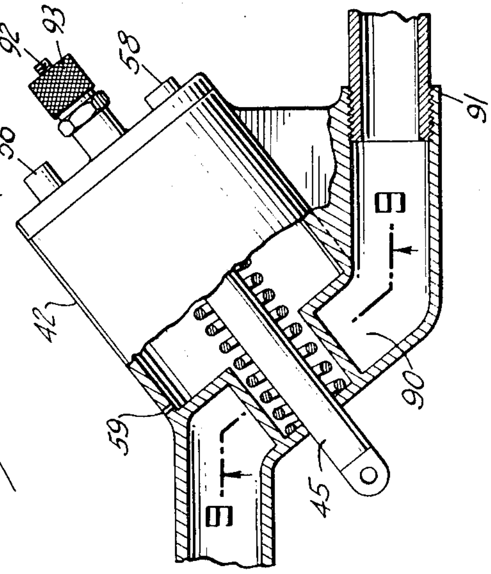

Fig. 8.

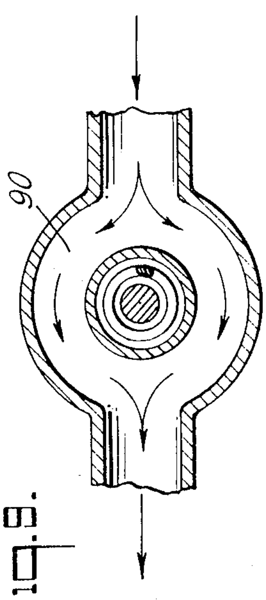

Fig. 9.

AUTOMATIC DISPENSING NOZZLE

The present invention relates to an automatic fuel dispensing nozzle and particularly a nozzle automated to the extent of effecting both filling and topping operations normally required for properly filling vehicle fuel tanks.

The typical fuel tank filling operation requires a flow of fuel at rates sufficient to enable reasonably prompt servicing without blowback. At rates of flow which do not require undesirably long filling times, approach to completion of the filling operation typically produces a back surge in the filler pipe. For example, within 1 or 2 gallons of completion a sudden tendency to constriction at the lower end of the filler pipe caused by the rising liquid induces this characteristic back surge. In order to respond to this, the conventional dispensing nozzle is provided with a level sensor near the end of the spout, which, under the influence of the back surge, promptly actuates means to shut off the main valve of the nozzle and thus to terminate the operation.

After the shutoff the back surge subsides readily and when this has occurred, the tank will still accept what is usually a substantial additional quantity of fuel at a lower feed rate. This is referred to as "topping off," a practice which, however, requires care and, because in the absence of care, it may entail spillage, can be onerous to an employee.

The present invention concerns the provision of a nozzle effective to carry out the initial filling operation to the point of back surge, followed by restriction of flow at this point for a predetermined time sufficient to enable subsidence of the back surge, and then by automatic initiation of flow at a relatively low-flow, restricted, topping rate, followed again by automatic final cutoff during the final rise of fluid in the filler pipe as topping off is completed.

More specifically, the fuel dispensing nozzle, in accordance with the present invention, is based upon an improvement of the conventional nozzle which comprises a main control valve cooperating with a latching device by which the main control valve is held in open position, but with an automatic shutoff device responsive to the initial back-surge of fuel in the filler pipe to release and shut off said valve.

In addition to, and in combination with the foregoing, the present invention provides an automatically operating mechanism, triggered and initiated by the shutoff of said main control valve to reinstitute fuel flow thru the nozzle by controlled actuation of the main control valve at a reduced, low-flow or topping rate, after first, as previously indicated, introducing a time lag interval to enable subsidence of the initial back-surge of fuel. Upon subsequent rise of fluid in the filler pipe the fluid level sensor actuates the automatic shutoff to effect final shutoff of the main control valve.

The supplemental control mechanism which characterizes the present invention can be motivated by any suitable source of energy although it is preferred to do so either by mechanical energy available in the system or introduced by the operator. Energy may also, as will be apparent from the following, be derived from the line pressure of the fuel (supplied as it normally is from a source involving a driven pump).

Preferably however, the source of energy comprises a spring loaded device actuated by the operator in originally latching the main valve in operative position.

Conclusion of the automatic topping operation preferably concludes the expenditure of the imposed operating energy so that the operation remains dormant until the actuation to a completely new cycle by the operator.

Ordinarily surge-responsive actuation or control of the valve is effected as a result of suction induced, as is known, by the flow of fuel thru the nozzle. This suction is normally relieved by a vent, preferably located near the delivery end of the spout which forms the end of the nozzle. The suction or vacuum, however, builds up sharply when the sensor or venting means is covered as by the aforementioned surge of fuel. The suction impulse thus created effects termination or restriction of flow as previously indicated.

Reference is now made to the figures of the attached drawing wherein one detailed and specific embodiment of the present invention is shown by way of illustration. While, as previously, indicated, the invention constitutes an improvement upon various of the conventional constructions presently known or in use (indicated, for example, in U.S. Pat. No. 3,085,600, 3,276,486, 3,196,908 and 2,538,747) nevertheless it is important to note that the specific illustrative embodiment which follows is based upon modification and improvement of the U.S. Pat. No. 2,582,195. Furthermore, reference is made to the specific disclosure of this patent for details and understanding of such portions of the present nozzle as correspond thereto.

In the figures of the drawing:

FIG. 1 is an elevational view illustrating the present nozzle in operating position in the course of filling a vehicle fuel tank,

FIG. 2 is a more detailed elevation with the central portions thereof broken away to show the internal structure,

FIG. 3 is an exploded prospective view of the low-flow actuating mechanism for effecting a restricted opening of the main valve subsequently to completion of the initial filling operation,

FIG. 4 is a detailed elevation similar to FIG. 2 with the parts in position for initial full-flow of fuel thru the nozzle during the so-called first stage delivery wherein the main valve is opened at a high rate of flow,

FIG. 5 is a fragmentary detailed elevation showing engagement of the main valve control lever with the latch in first stage or full flow position,

FIG. 6 is a detailed sectional view taken on the line 6–6 of FIG. 4.

FIG. 7 is an elevational view as in FIG. 4 but showing the arrangement of parts after the termination of the first stage delivery and during the "topping" operation,

FIG. 8 is a detailed sectional view showing a modified arrangement of the present invention, and

FIG. 9 is a detailed sectional view taken on the line 9–9 of FIG. 8.

As shown in FIG. 1, the nozzle of the present invention comprises a body 2 of cast material with a main valve at 3 controlled by a suitable handle or lever 4 and terminating in spout 5 which is adapted to extend into the filler pipe of a vehicle fuel tank as indicated.

Insofar as it adopts the features of the conventional nozzle, the body 2, as better shown in FIG. 2, comprises a rearwardly extending portion 6 arranged to receive a hose coupling, not shown as at 7. In the present embodiment however the hose coupling receives a nipple 8 which is connected to a special "L" 9 provided with a laterally extending coupling 10 which projects on the rearward side and therefore is identified only by dotted lines in the drawing.

The valve located at the forward end of conduit 6 comprises a valve tappet 11, seated as at 12 by a relatively forceful spring 13 held in place by cap 14. This spring is required to store considerable energy, as will hereinafter appear, to control closure of said valve and other associated mechanisms as will hereinafter appear.

Valve rod or stem 15 projects downwardly thru packing means 16 and thence downwardly thru the housing or casting to provide extension 17. This, in turn, actuated by hand-operated lever 4, pivoted or fulcrumed as at 19 on lockout plunger 20, to be hereinafter more fully described. The hand lever is manually moved in a counterclockwise direction to engage the lower extremity of rod 17 and raise the valve 11 from its seat 12 against spring 13.

Referring to the lockout mechanism, fulcrum 19 is fixed by a clevis or yoke to the lower end of lockout plunger 20 which, in turn is slidably disposed in the cylinder or sleeve 21 of the casting and continuation sleeve 22 which is threaded therein-to. Plunger 20 is normally urged into its upper position shown in FIG. 2 by means of coil spring 24.

Normally plunger 20 is fixed in this upper position by a suitable locking mechanism comprising a plurality of balls 25, (in the present case 3), nested in circumferentially spaced radial openings in the plunger and held against annular shoulders 26 on the interior of sleeve 22 by latch pin 28. Inasmuch as shoulder 26 faces upwardly, the plunger is locked positively against downward movement so long as the balls remain in the position shown.

The pin 28, which retains the balls in position, is secured to the underside of the diaphragm 30 which is held in position shown in FIG. 2 by spring 31. The pin moreover is provided at its lower end with a tapered portion, including a depending stem 32.

Thus, if the pin is raised by diaphragm 30 to a point where the reduced diameter of the stem or taper permits the balls to fall inwardly, the plunger may move freely downwardly.

This downward movement is effected sharply by energy of spring 13. Thus when the hand lever 4 has been actuated upwardly to shift the valve stem and accordingly the valve tappet 11 to full-flow, open position it is held in this position, as will hereinafter appear, by a suitable latching means. Obviously with the lever latched in the position shown more clearly in FIG. 4 and the valve in full-open position, when the lockout plunger is released, the predominant force of the relatively strong coil spring 13 snaps it downwardly, closing the valve 11.

As previously intimated, the diaphragm 30 is actuated upwardly by a suction or vacuum impulse in the chamber thereabove. The suction is induced in conduit 34 by the Venturi effect of liquid flowing thru the main valve, but which is normally vented to atmosphere via the chamber above the diaphragm 30 and conduit 35 extending therefrom, which extends to a small aperture, vent or sensor, not shown, near the lower extremity of the spout 5.

Manifestly, when the vent is closed by a rise of fluid in the fill pipe of the tank, atmospheric venting ceases, resulting in a sudden vacuum buildup in the chamber above the diaphragm 30.

A pivoted latch for holding the hand lever 4 in open valve position is indicated generally by reference number 36 in FIGS. 2, 3, 4 and 7. FIG. 4 shows how the hand lever may be shifted upwardly about fulcrum 19 so that the end of lever 4 engages one of the notches 38 of the latch. For reasons which will hereinafter more fully appear, the end of lever 4 is, as shown specifically in FIG. 5, provided with a lip or folded-over portion as at 40 to engage with the reversely hooked extremities 41 of the notches on the latch 36.

Accordingly therefore with the main valve in open position as in FIG. 4, the hooked ends 40 and 41 of the hand lever and the latch respectively are held together against a force tending to urge the latch away from the lever.

This force is imposed by means of a spring loaded dashpot 42 mounted on "L" 9 and comprising a cylinder 43 and an internal piston 44 connected to piston rod 45 which, in turn, is connected by link 46 and pivots 47 and 48 to the latch 36.

The piston is urged forcibly into the position shown in FIGS. 2 and 7 by a relatively strong helical spring 50.

Conversely the spring 50 must be loaded or compressed to shift the latch 36 into hand lever engaging position, as shown in FIG. 4. Therefore the latch 36 is advantageously provided with an elongated extension or lever 52 terminating in a hand engaging portion 53, all of which rotates about pivot 54. This enables the operator, after introducing the nozzle into fuel tank shown in FIG. 1, to lift hand lever 4 to the position shown in FIG. 4, and with his free hand force hand lever 52 clockwise about pivot 54 until the hooklike extremity 41 on one of the notches engages the hooked end 40 of the lever 4 as in FIG. 4. This also brings piston 44 to the position shown in FIG. 4 with spring 50 compressed. This is accomplished almost exclusively against spring pressure and friction inasmuch as the numeral 56 represents a check valve which permits air to be drawn freely into cylinder 43. The other side of the piston is always vented by aperture 61.

Numeral 58 represents a restricted orifice which meters the outflow of air from the cylinder at a slow rate and this provides a dashpot effect as the piston moves outwardly.

In other words, piston 44 moves to the left against only loading of spring 50 whereas the piston, on its return stroke, must force the air above it out thru restricted orifice 58, effecting a time delay which permits the fill pipe of the tank to clear itself of the surging fuel.

Attention moreover is directed to the axially extending groove 60 in the wall of cylinder 43, terminating at some predetermined point above the innermost position of the piston 44. This, by venting the air around the piston and thru orifice 59, permits prompt actuation of the spring pressed piston thru the latter part of its stroke and after the initial time delay has been effected.

With reference to topping operation, attention is directed particularly to the exploded perspective view of FIG. 3 wherein pivoted latch member 36 comprises bifurcated flanges 61 which embrace and are pivoted at 64 to the casting or body of the nozzle where it is joined to hand lever guard member 63. The side flanges of the bifurcated pivoted latch member are also provided with cagelike guide extensions 65 for bracing and guiding a topping lift and associated mechanism as follows:

Cam members 66, each pivoted as at 67 on opposite sides of the handle guard 63, ride respectively on rollers 68, one on either side of the pivoted latch member. The two cams, in turn, support a bifurcated lifter 70, pivotally attached to the flange 18 of valve operating hand lever 4 as at 69. The bifurcations 71 of the lifter necessarily ride on cams 66, as shown in FIGS. 2, 3 and 7 during the "topping operation."

The lower extremity or arm 72 of the lifting lever normally abuts the upper surface of the hand lever 4, therefore operating to lift the hand lever upwardly as bifurcations 71 are elevated, as shown in FIG. 7.

The operation of this lifter is more clearly shown in the fragmentary plan view of FIG. 6, supplemented by FIGS. 3 and 7 wherein it is seen that the lower end of arm 72 of the lifter normally seats against the transverse upper face of the manual valve lever 4, being urged to this position by spring 73 on pivot pin 69.

Therefore, as shown in FIG. 7, the lever 4 is, by the action of the lifter 70 on cams 66 which, in turn contact rollers 68, lifted upwardly carrying with it manual valve control lever 4 to a predetermined, relatively low-flow or topping position of the main nozzle control valve 11. In this position therefore a restricted flow of fuel proceeds at a rate of, for example, 1 to 3 gallons per minute, insufficient to permit any back surge of fuel in the filler pipe.

Of course, the positioning of the cams 66 with respect to the rollers 68 and the lifter 70 determines the extent to which the main valve is opened.

However, so that lever 4 can be returned to off position, namely where the main flow valve is completely shutoff (and where the fulcrum plunger can reset), means is provided to permit the lifter 70, when necessary, to pivot freely about pivot 69. This comprises a finger-operated lever or detent 80, likewise pivoted to the manually controlled main valve lever 4 as at 81. The detent or lever 80 normally resides in the lowermost position as shown in FIGS. 2, 4 and 7 by virtue of gravity or else a coil spring, not shown. When however the lever 4 is embraced by the operator, his hand moves the fingerpiece 80 counterclockwise about pivot 81 until it is brought upwardly into contact with the lower face of lever 4.

In shifting the lever 80 it is to be particularly noted that a cam surface or projection 83 on its inner face contacts the lifter 70, sliding it axially on pivot 69 as shown in FIG. 6, so that the lower extremity of the lifter arm 72 is now opposite slot 85 in the lever 4. In this position the lifter is thus free to pivot about 69 and therefore the hand lever 4 can be lowered to the position shown in FIG. 2 without interference. Once set in full-flow position as in FIG. 4, the spring 73 takes over so that thence forth the hand lever raises with the lifter as though they were integral.

It is to be noted that the cam surface 83 is offset so as to extend over the side portion of lever 4 and is inclined to impinge the lifter 70 as lever 80 rotates so as to shift the lifter laterally as viewed in FIG. 6 into position opposite slot 85. Flange 86 on the other side of the fingerpiece 80 moves upwardly on the other side of the lever 4 to form an opposed reaction piece which supports the shifting force of cam 83.

Referring now to the operation of the present nozzle, the device is inserted into a fuel tank as shown in FIG. 1, at which time the operator lifts the lever 4 to a suitable full-flow position determined by the opening of valve 11. At the same time he engages the lever 52 forcing it to the left, as viewed in FIG. 2, against spring 50 and until the hooked extremity 40 of lever 4 engages the opposed hooked ends of 41 of one of the recesses 38 in latch 36.

With the valve 11 now in full-flow position (as for example 5—10 gallons per minutes rate of flow), as shown in FIG. 4, filling proceeds promptly until the end of the nozzle is immersed by the sudden back surge of fuel in the tank which closes off the vented conduit 35 thereby permitting the Venturi at the extremity of conduit 34 to build a sudden vacuum in conduits 34 and 35 as well as the intermediate chamber or space above the diaphragm 30.

With the surge of vacuum, diaphragm 30 moves upwardly, retracting spring 31 and withdrawing pin 28 from between the locking balls 25, which thus collapse effecting immediate release of the fulcrum plunger 20. Since the valve spring 13 is stronger and more powerful than, for example, the lockout plunger spring 24 it, via valve stem 17, violently urges the manual valve lever 4 downwardly from the position shown in FIG. 4. But since the latched or right-hand extremity cannot move, it is the lockout plunger 24 and the fulcrum 19 which snap downwardly until main valve 11 is completely closed.

The violent action of spring 13 also effects a downward jolt causing a percussive effect in the lever 4 which invariably dislodges its top 40 from the engaging hook 41 of the latch.

Therefore with the latch now released, the spring loaded dashpot takes over, forcing piston 44 to the right. This takes place slowly at first, due to the pressure of the air trapped by the piston as it is released slowly thru the metering orifice 58. As previously indicated, this occupies a time period of from 1 to 2 or more seconds to permit subsidence of the fuel surge in the fill pipe.

However as the piston 44 passes slot 60, air is released from ahead of the piston so that its action is now rapid, drawing the latch to the position shown in FIG. 7. In this position the lifting fork or lever 70, being now rigid with lever 4, rides up on cam 66 which, in turn is urged upwardly by roller 68 (the pivot spring 74 having meanwhile shifted the lever 70 to the position shown in FIG. 6), where, as pointed out above, lever 4 and the lifter 70, are, in effect, a single rigid member. Meanwhile the lockout plunger has been promptly returned to its locked out position shown in FIG. 2 by spring 24, at which spring 31 has urged pin 28 downwardly to set the balls 25 in lockout position.

Therefore the effect of raising cams 66 and the outer ends of lever 70 is to cause the lever 4 to be raised about the reset fulcrum 19 until it again impinges the end of valve stem 17 and opens the valve to a predetermined extent sufficient to permit the aforesaid relatively low-flow or topping rate.

The reinitiated flow continues until fuel again rises in the fill pipe of the tank, again causing a vacuum surge above the diaphragm 30 with release of the lockout plunger and final closure of the main valve, dropping fulcrum and causing the nozzle to finally shut off.

The present invention therefore provides a fuel dispensing nozzle in which not only is the flow of fuel automatically terminable in response to initial surge of fluid in the fuel pipe but thereafter means comes into effect to establish a predetermined relatively low rate of flow thru the nozzle, followed by a second and final termination of flow in response to the rise of liquid in the fill pipe of the tank.

Moreover the present invention contemplates effecting the several flows by means of a single main flow valve responsive to a single flow sensing means in the fill pipe of the tank.

Yet further, the present invention contemplates the actuation of the valve to low flow or topping flow position as the result of original latching of the valve in full flow position.

Yet more specifically it contemplates the introduction of the energy required to actuate the low flow means as a result of actuating the latch of the main valve in full flow position.

FIGS. 8 and 9 indicate a modification of the inlet portion of the nozzle to make the inlet conduit and coupling integral with the remainder of the casting.

The conduit, which passes thru rearward extension 6, commences with annular channel 90 and coupling section 91. The central area within the annular channel 90 therefore provides a region for the reception of spring loaded dashpot 42 which, however, in this embodiment is integral therewith as shown.

Also it is to be observed that the dashpot 42, in both embodiments, is provided with threaded stop member 92 forming a limit-stop for piston 44 and provided in turn with a knurled locknut 93. This, of course, determines the outermost position of piston 44 and indirectly, the extent of opening of the main valve during the topping operation.

Many other modifications of the present invention will be apparent from the foregoing description, and example is limited by the present claims and the patentable equivalents thereof.

We claim:

1. In an automatic dispensing nozzle for supplying liquid fuel and the like to the filler pipe of a fuel tank wherein said nozzle is provided with a supply conduit for said liquid terminating in a filler spout, a main control valve in said conduit for controlling the flow of liquid fuel thru said nozzle, releasable means for latching said main control valve in full-open position and release means for closing said main control valve in response to rise of fluid about the spout, said last named means being, in turn, responsive to a vacuum impulse and involving means for creating a vacuum impulse in response to the rise of liquid fuel about said spout as in the filler pipe of a fuel tank, the improvement which comprises

- means responsive to the initial closure of said main control valve, automatically to reopen said main control valve to a substantially reduced point of valve opening effective to permit a relatively low flow rate of said liquid fuel,
- said release means for closing said main control valve being also responsive to the second vacuum impulse created by the rise of fluid about said spout in a fuel tank filler pipe for effecting final shutoff of said main control valve.

2. An automatic dispensing nozzle as defined in claim 1, including means to effect delayed action of said automatic valve reopening means for a predetermined period of time effective to permit the subsidence of fluid surge in a filler pipe and the resetting of said main valve release means.

3. An automatic dispensing nozzle as defined in claim 1 wherein said means for reopening said main control valve to a substantially reduced point of valve opening is energized by latching of said main valve in full open position.

4. An automatic dispensing nozzle as defined in claim 1 wherein said means for reopening said main control valve to a substantially reduced point of valve opening is energized by a spring loaded dashpot,

- means for loading said spring actuated dashpot by latching said main valve in full open position,
- means effecting a predetermined time delay in the operation of said spring loaded dashpot to permit subsidence of initial surge of liquid from about the spout of said dispensing nozzle and resetting of said main control valve release means prior to reopening of said valve to low flow position.

5. An automatic dispensing nozzle as defined in claim 1, wherein said means to automatically reopen said main control valve to the low flow rate of liquid comprises

a. a pivoted latch means for latching said main valve in full open position,
b. spring pressed means connected with said latching means to urge said latching means to retracted position, said spring-pressed means being energy loaded by actuation of said latch to valve latching position, and
c. means associated with said pivoted latching member in retracted position to open said valve to low flow position.