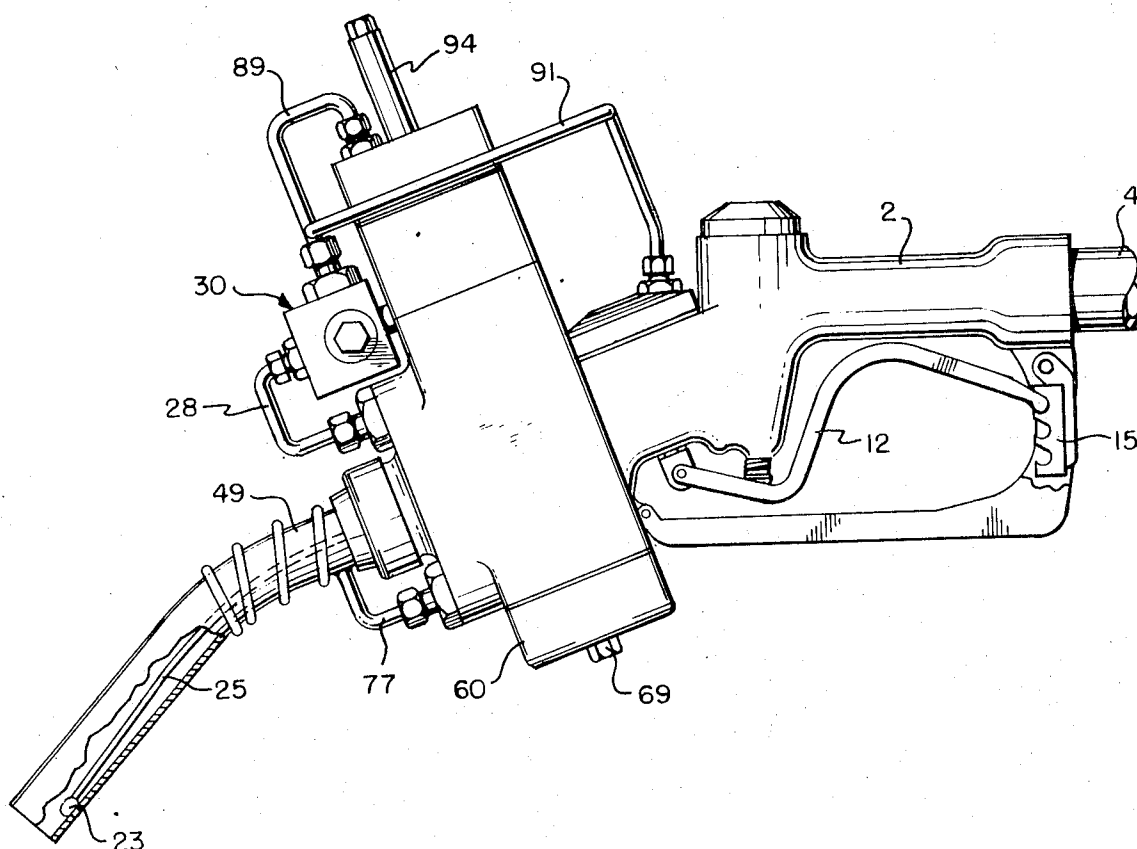


Mayer

[45] Nov. 27, 1973



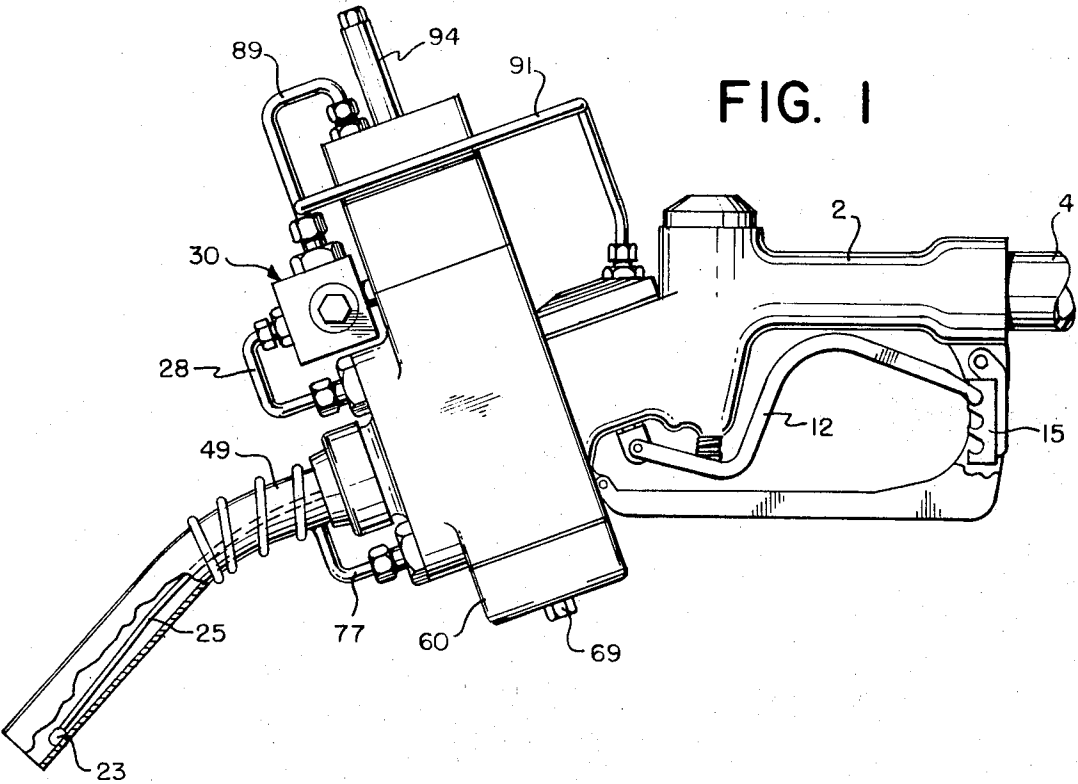


FIG. 2

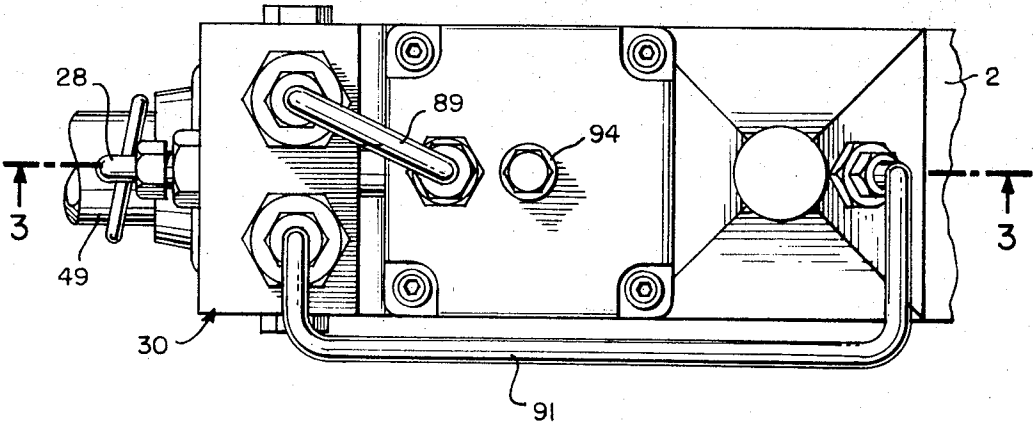


FIG. 3

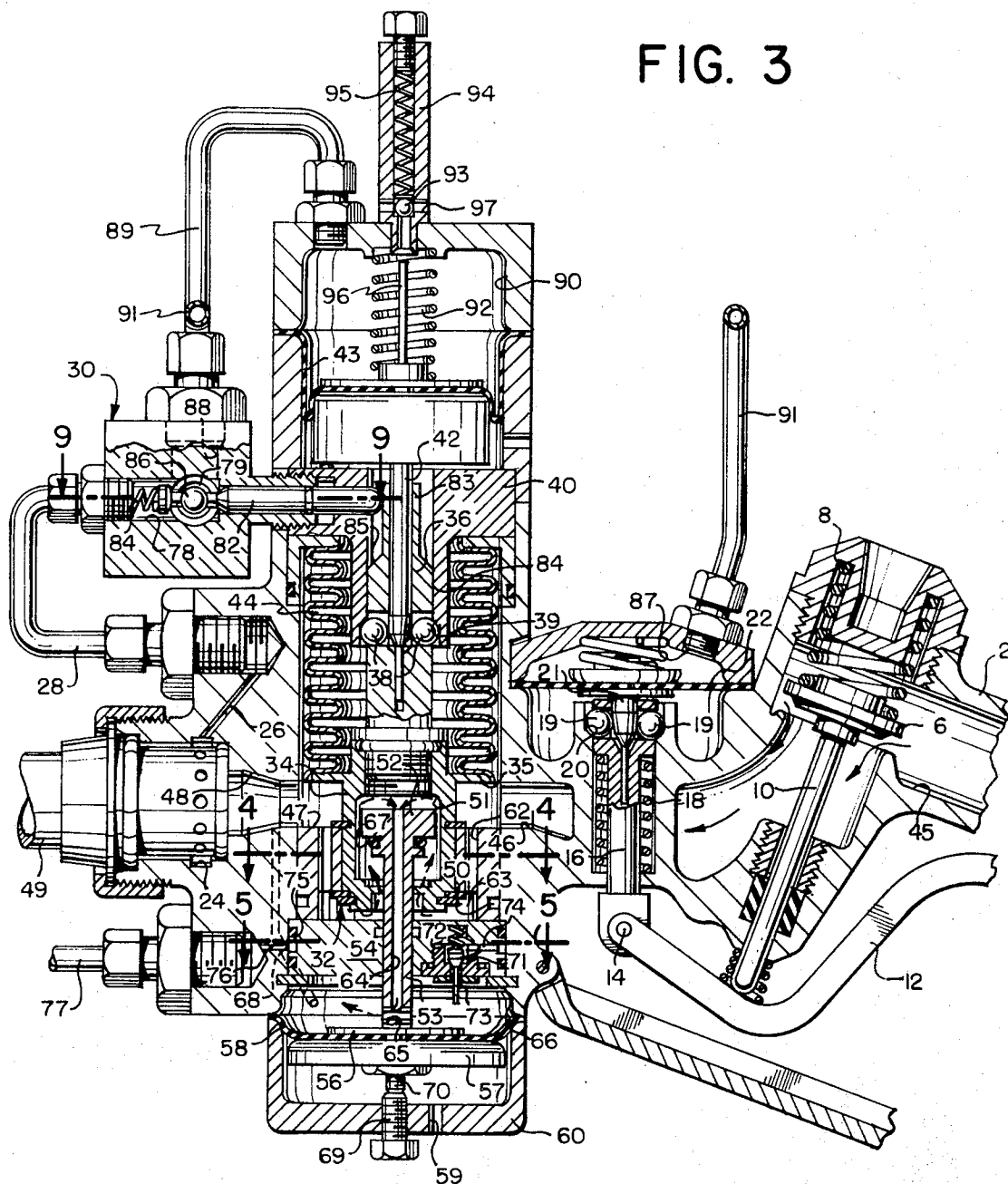


FIG. 4

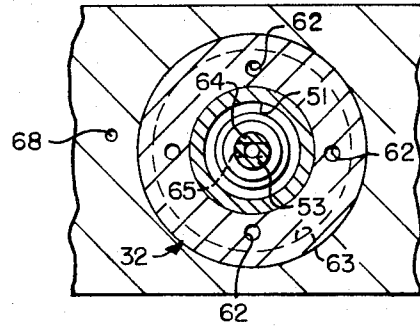


FIG. 6

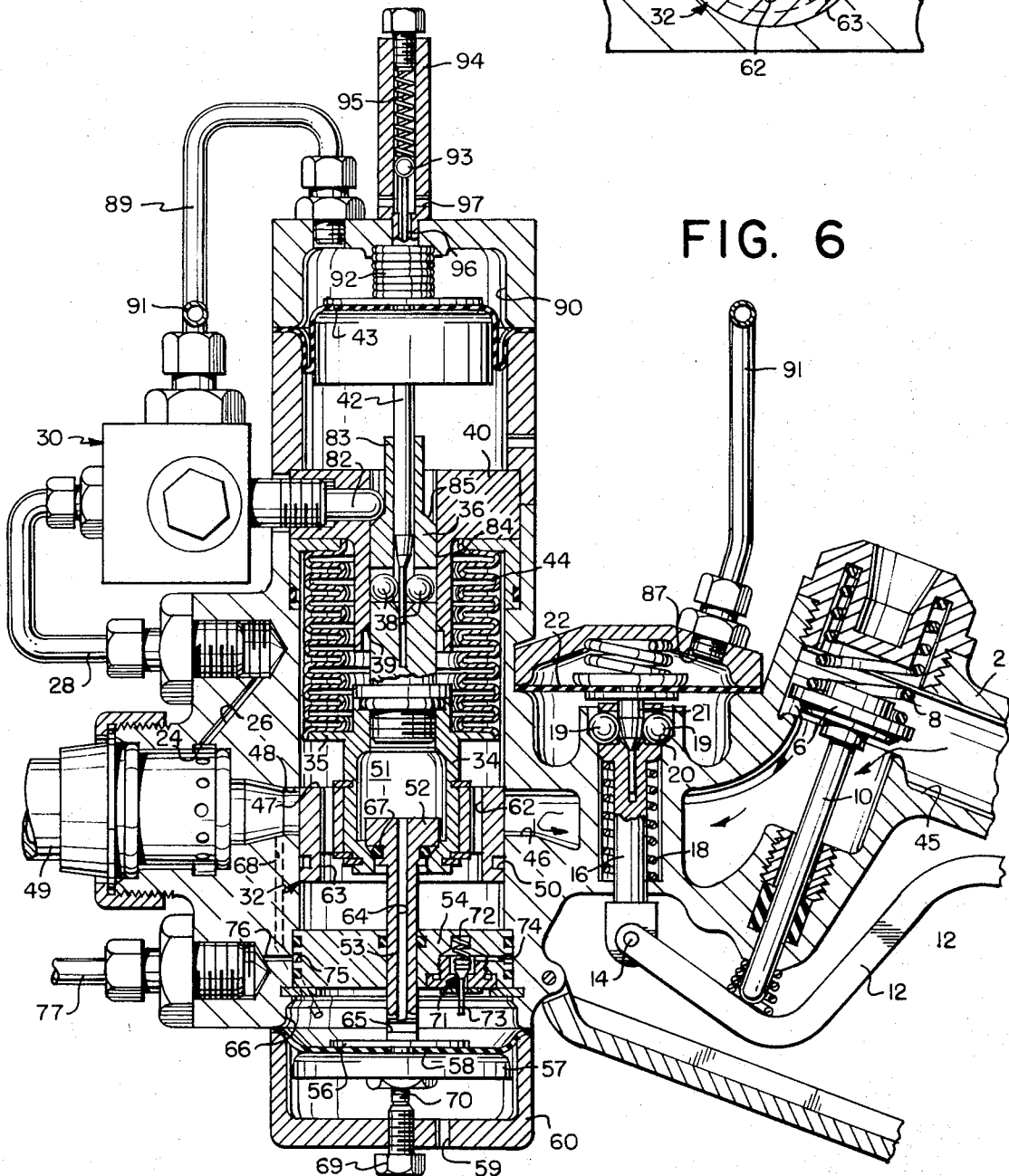


FIG. 5

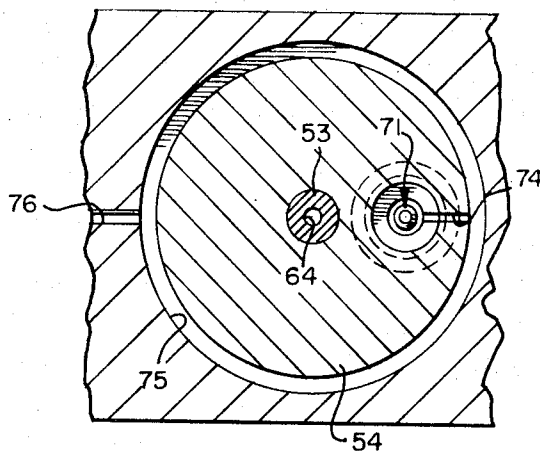
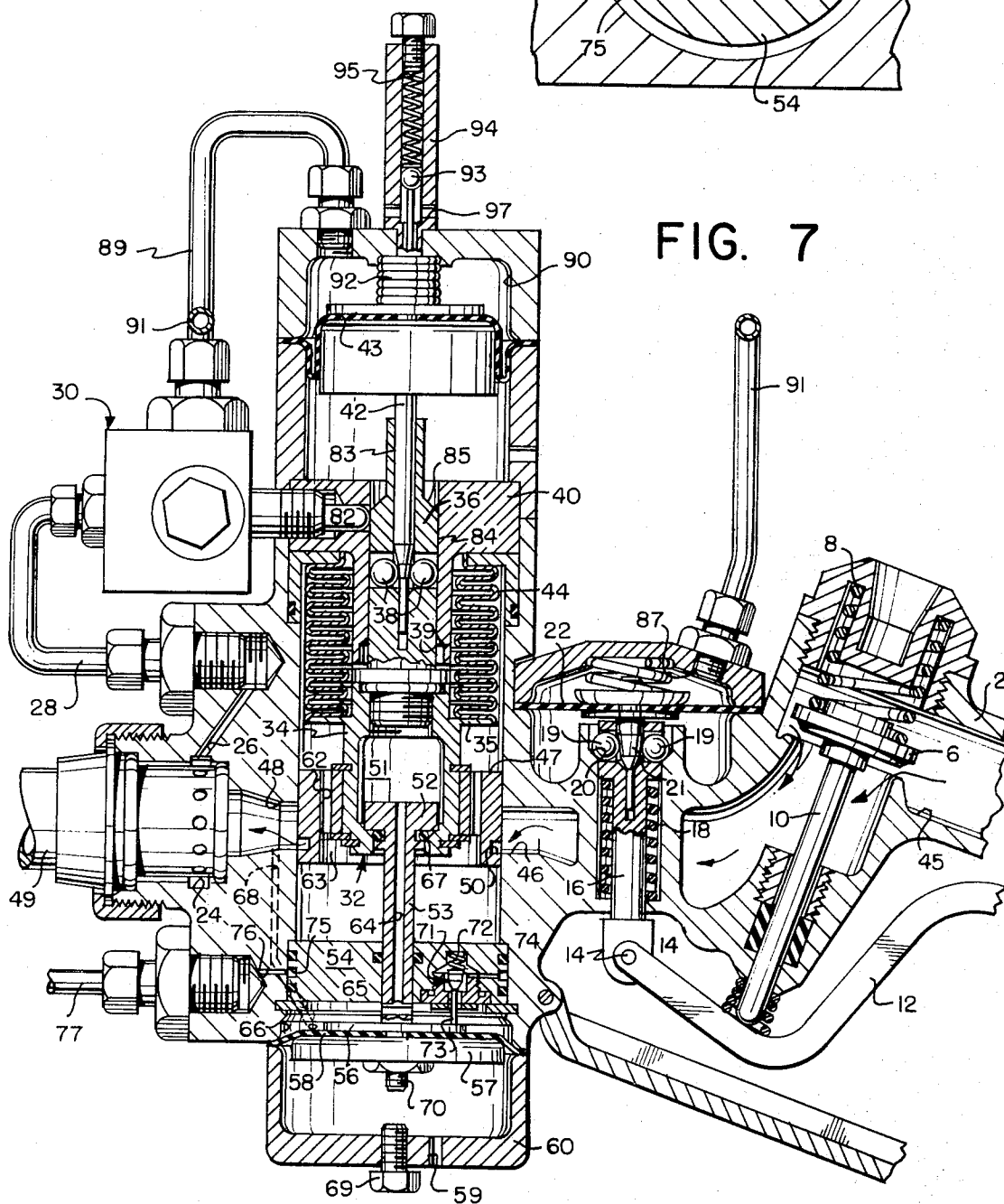


FIG. 7



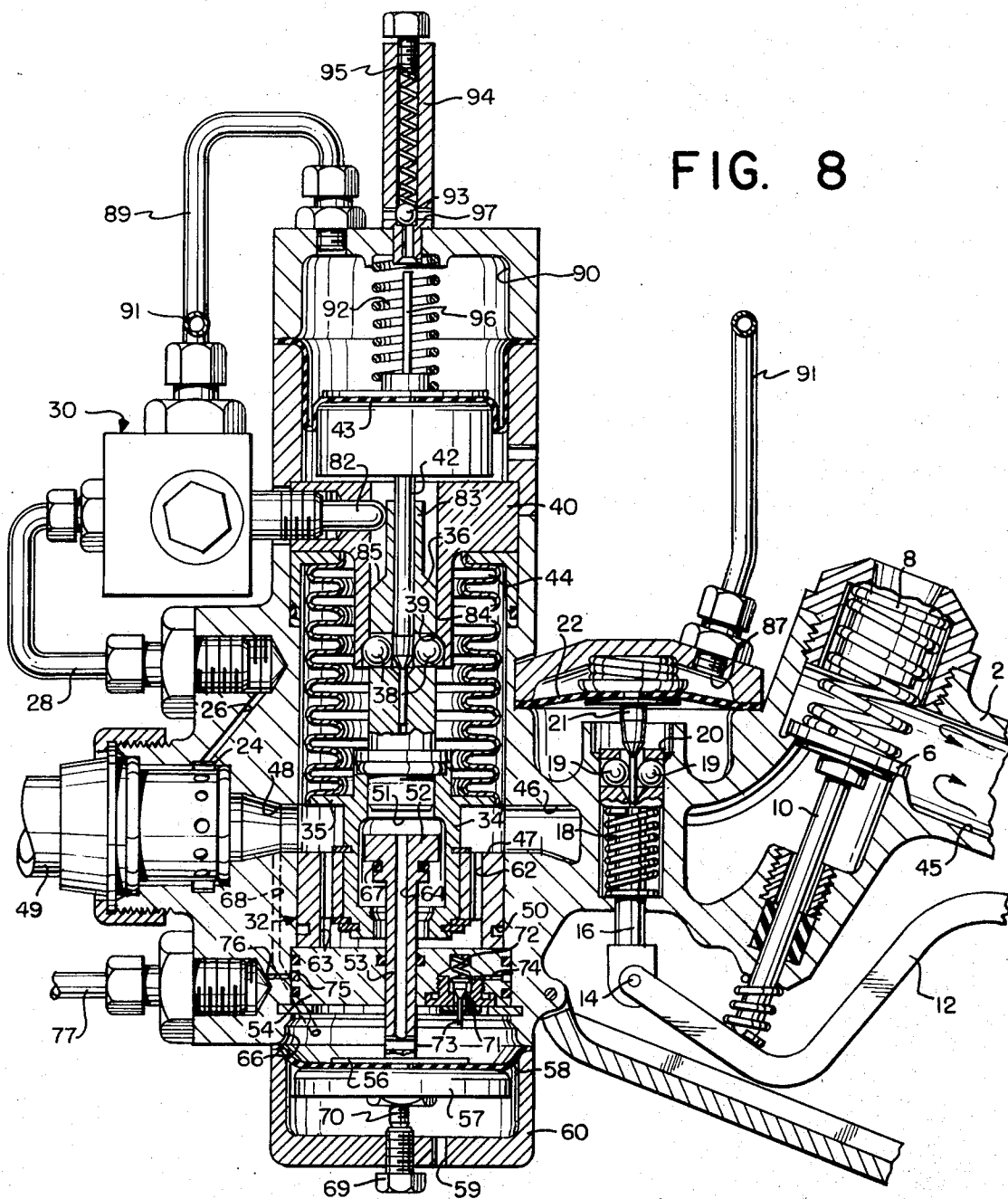


FIG. 8

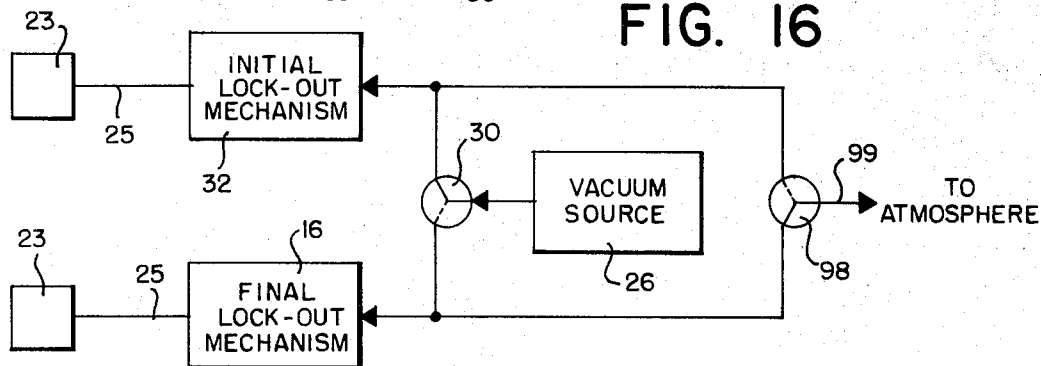


FIG. 16

FIG. 9

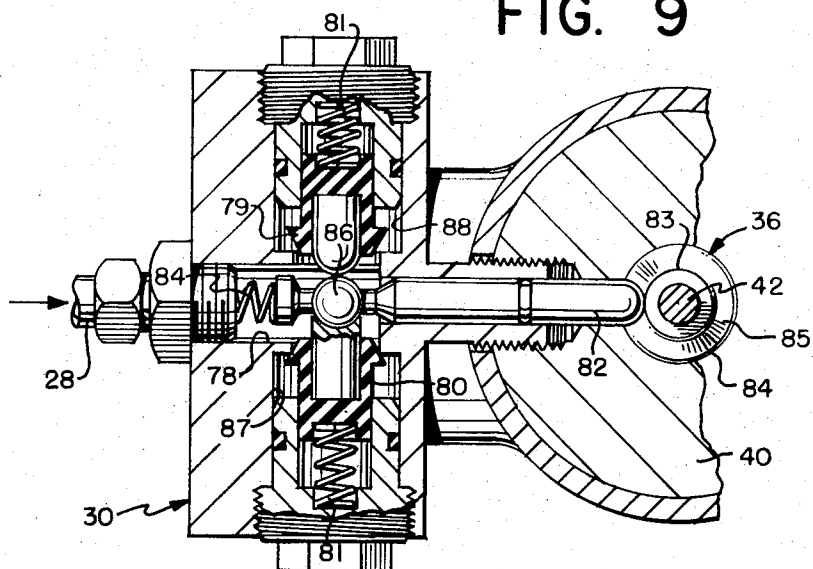


FIG. 10

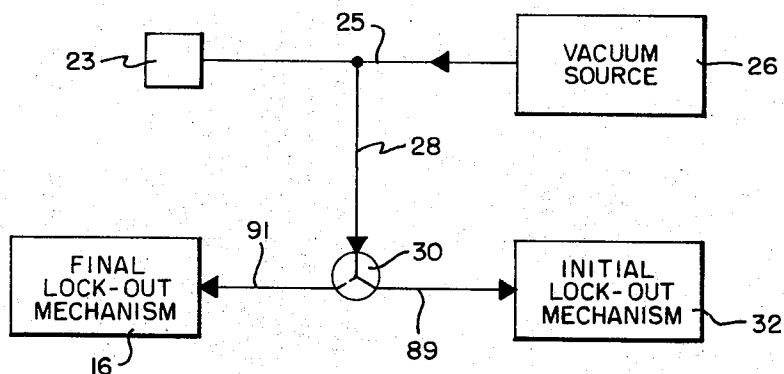
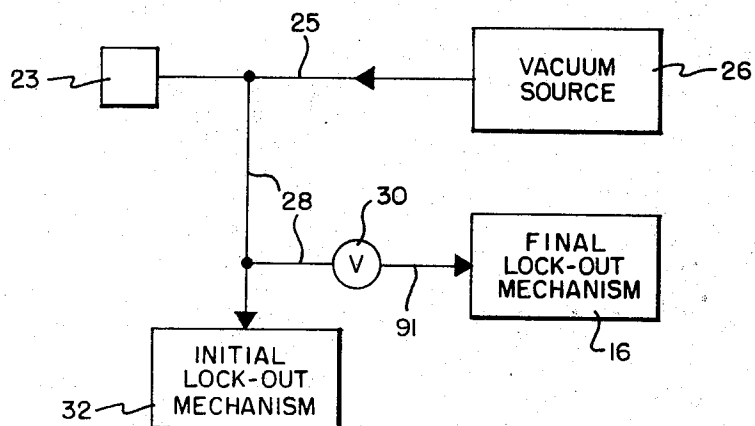


FIG. 11



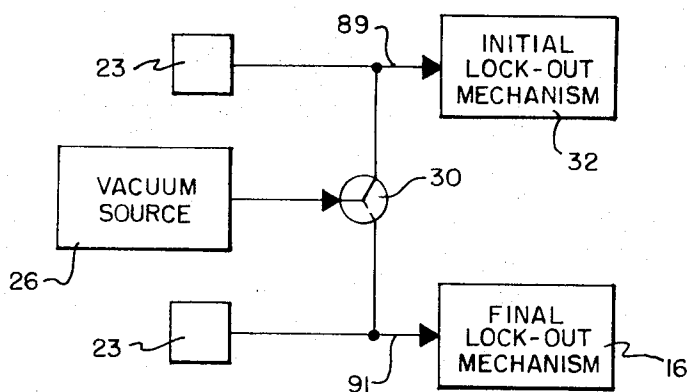


FIG. 12

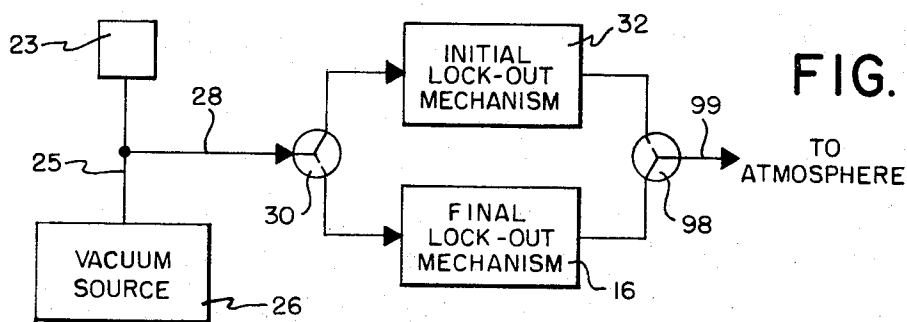


FIG. 13

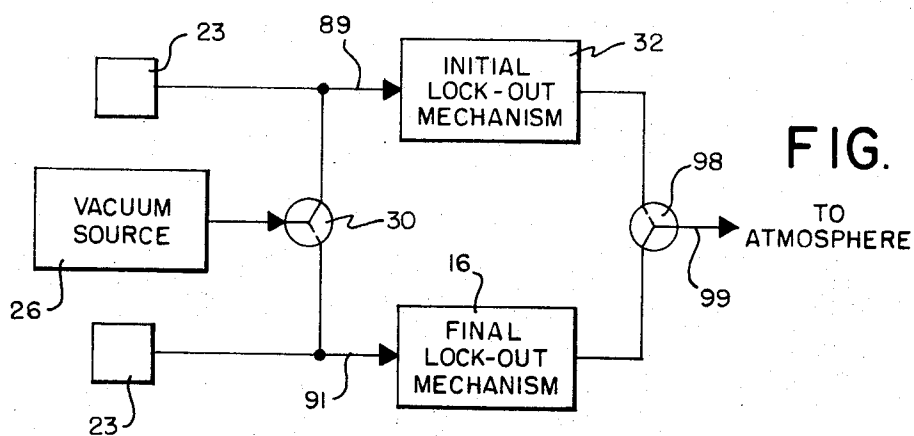


FIG. 14

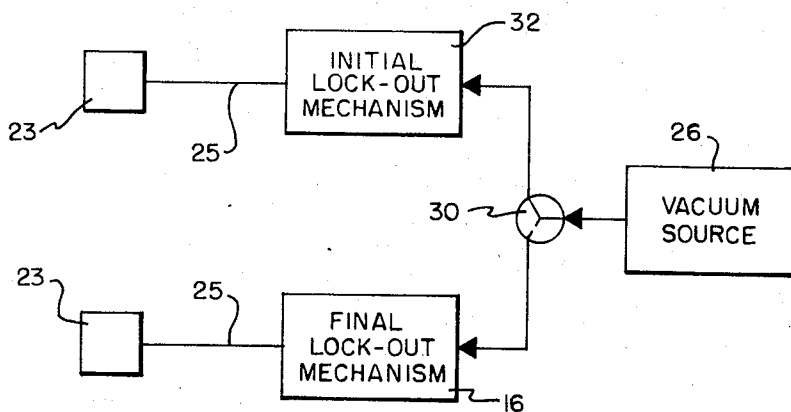


FIG. 15

AUTOMATIC FUEL DISPENSING NOZZLE

The present invention relates to an automatic dispensing nozzle and more particularly to such a nozzle automated to the extent of controlling both the filling and topping-off operations normally encountered in filling vehicle fuel tanks, followed by shut-off of the nozzle when topping-off is completed.

The present application involves a development and improvement in the type of nozzle described in U.S. Pat. No. 3,586,071, as well as the related applications mentioned therein.

In the aforesaid U.S. patent means is provided for automatically terminating the flow of fuel thru a fuel dispensing nozzle in response to the initial surge of fuel in the filler pipe of a gasoline tank, pursuant, for example, to a vacuum signal produced by such surge. This is essentially followed by a predetermined time delay which enables the surge of fuel to subside within the filler pipe, which is followed, in turn, by a resumption of fuel feed at a substantially lower feed rate until the fuel level rises to a predetermined position in the filler pipe, at which time the entire operation is terminated.

The type of device called for in the aforesaid patent U.S. Pat. No. 3,586,071 has a main control valve in the fuel line of the nozzle, which preferably follows the conventional poppet type of valve presently in use. This is actuated thru a valve stem via a manual lever pivoted upon a lockout plunger, and ordinarily held in open position by a latch.

In addition, a flow-regulating valve, preferably in the form of an axially moveable spool or spindle is interposed transversely of the main flow line or conduit of the dispensing nozzle and ordinarily held in full-flow position by a lockout mechanism similar to that which controls the conventional lockout plunger.

For example, an annular channel about the spool or spindle in alignment with the aforesaid flow conduit permits full flow. A vacuum signal created in conventional manner by the initial surge of fuel in the filler pipe of the tank acts upon the aforesaid lockout mechanism so that the spool is axially moved, preferably by the fluid pressure of the conduit, into a secondary position, where a second annular conduit on the spool, of considerably restricted cross-section, sharply restricts the flow.

The axial movement or shift of the spool or spindle of the auxiliary valve, as it may be called, from its first or full flow to its second or restricted flow position also actuates associated valve means to control the vacuum signal.

As a result of this the second or succeeding vacuum signal is directed to the lockout plunger of the main poppet valve so that the vacuum signal which results from the topping-off operation, releases the lockout plunger and closes the main poppet valve.

Reference is made specifically to the aforementioned patent as well as to all of the other patents and applications mentioned therein for the structure and operation upon which the present invention forms an improvement.

In accordance with the present invention the automatic dispensing nozzle heretofore referred to is improved and modified in a number of ways. First problems associated with the axial movement of the spool or spindle valve are alleviated by sealing the valve by means of a bellows which, in addition to the sealing

function, assures sufficient pressured differential to effect a fluid pressure activation of the spool to its secondary position and also imposes sufficient inherent resiliency to return the spool to initial operating position.

Furthermore, the present invention provides adjustable dash-pot means for imposing a time delay between full flow position of the flow control valve and its topping-off or restricted flow position. This is extremely important since if a delay of at least in the order of 1-4 seconds is not provided between these two steps, the initial surge of liquid will not clear itself out of the filler pipe prior to topping-off.

Furthermore, the present invention provides novel and efficient valve means for transmitting the vacuum signal to the respective lockout mechanisms and also for venting the mechanisms thereafter.

In order to facilitate an understanding of the present invention, reference is specifically made to the figures of the attached drawing wherein one preferred embodiment of the invention is described in specific detail, on the basis of which the many modifications contemplated can be more readily visualized.

In the figures of the drawing:

FIG. 1 is a side elevation of a nozzle embodying the present invention with portions broken away to expose the interior construction.

FIG. 2 is a plan view of the central portion of the nozzle taken approximately from above FIG. 1.

FIG. 3 is a sectional elevation taken on the line 3-3 of FIG. 2 with the parts in initial operating position.

FIG. 4 is a detailed transverse section taken on the line 4-4 of FIG. 3.

FIG. 5 is a detailed sectional view taken on the line 5-5 of FIG. 3.

FIG. 6 is a view exactly as in FIG. 3 showing an intermediate stage of the flow control valve between full open position and restricted position.

FIG. 7 is identical with FIGS. 3 & 6 with the flow control valve in topping-off or restricted flow position.

FIG. 8 is identical with FIGS. 3, 6 & 7 showing the parts just subsequent to the final vacuum signal when the topping-off operation has been concluded and the dispensing operation concluded.

FIG. 9 is a section taken on line 9-9 of FIG. 3 to show a general construction of the signal transfer valve.

FIG. 10 is a flow diagram representing the vacuum signal transmission system of the foregoing figure.

FIGS. 11, 12, 13, 14, 15 & 16 are corresponding flow diagrams of alternate systems.

The automatic dispensing nozzle in FIG. 1 comprises a cast housing with a handle portion 2 receiving a supply hose as at 4 and provided internally with a poppet valve 6 as in FIG. 3, normally seated by spring 8 and opened by tappet rod 10, the lower end of which is actuated by lever 12. The lever 12 is manually moveable about fulcrum 14 which is, in turn, mounted on a conventional lockout plunger 16 which is released by a vacuum signal to close poppet valve 6.

The other end of lever 12, as shown in FIG. 1, may be latched in valve-open position by latch 15, pivoted to a guard handle as shown. The lockout plunger 16 is ordinarily urged to the position shown in FIG. 3 by spring 18 and locked therein by a plurality of balls 19 which reside in radial openings or passageways in the plunger 16 so that they engage shoulders 20 on the surrounding housing, being held in this position by a tapered pin 21. Pin 21 is, in turn, fixed to diaphragm 22

so that a vacuum signal applied to the upper surface thereof, in conventional manner, retracts the pin, permitting balls 19 to fall free of shoulder 20 so that the entire plunger 16 is projected downwardly by the influence of the relatively powerful spring 8, as in FIG. 8,

In the conventional arrangement the actuating system signal is generated by the venturi effect of an annular orifice inside manifold 24 which is normally associated with the outlet check valve (not shown in detail in the present drawings). Vacuum, however, is normally vented, namely, prevented from building up, by vent 23, best shown in FIG. 1 which communicates with manifold 24 via conduit 25.

Hence a vacuum signal can only build up by closure of vent 23, as, for example, by a surge of liquid thereabout. At such time the vacuum signal is, in the present embodiment, transmitted via bore or passageway 26 (FIG. 3) and conduit 28 to valve 30 to be hereinafter described in greater detail.

Referring now more specifically to the secondary or flow control valve, this, as shown in FIGS. 3, 6, 7 & 8, takes the form of a generally cylindrical chamber within the casting occupied by a piston, spool or spindle 32 which moves axially therein. The spool has a central columnar portion 34 terminating in outwardly projecting annular flange 35 which is rigidly connected with a centrally located lockout column 36, best shown in FIG. 8.

The lockout column 36 functions identically as described in connection with the lockout plunger 16 which forms the base for the fulcrum 14 of the main flow control lever 12. Hence the piston or spool valve 32 with its attached portions 34-36 is ordinarily locked in the position shown by balls 38, held against fixed shoulder 39 of the housing 40 by lockout pin 42.

Pin 42, as previously described in connection with pin 21, is attached to diaphragm 43 so that it will be drawn upwardly in response to a vacuum signal to release the lockout mechanism and permit the entire cylinder 32 to move. The leakage of fuel from about the spool 32 is positively prevented by an annular, accordion-bellows diaphragm 44.

With more specific reference to FIG. 3, the main conduit 45 of the dispensing nozzle passes thru the poppet valve 6 and about the lockout plunger mechanism to a port 46 which communicates with a relatively large annular channel 47 in the spool 32. This, in turn, communicates with port 48 on the other side of the cylinder housing, which leads to the outlet or discharge spout 49 of the dispensing nozzle as shown in FIGS. 3 & 1. Annular channel 47 is to be contrasted with comparatively narrow channel 50 shown in FIGS. 3, 6, 7 and 8 and hereinafter described more in detail.

It is to be noted that the central portion 34 of the spool valve 32 is provided with an internal chamber 51 which receives a follower 52 mounted on rod 53. The head 52 of the follower, being somewhat larger than the lower portion of the chamber 51, accordingly engages the lower wall of the chamber via O-ring 67, as the flow control valve is moved upwardly and, as will be hereinafter described, cooperates to provide a dash-pot function, introducing a predetermined time delay into the operation.

To this end, therefore, the rod 53 slides axially in a corresponding opening in lower wall 54 of the aforementioned cylinder or housing which receives the valve spool. An unnumbered O-ring is provided to seal the

rod. At its lower extremity the rod 53 is attached to washer 56 and piston 57 which, between them, grip diaphragm 58. The space below diaphragm 58, as shown, is open to atmospheric pressure via duct 59 in housing 60.

Now therefore, as shown in FIG. 3, with the main valve 6 open, flow of fuel proceeds as shown by the arrows, passing on thru spout 49. At the same time a secondary flow of fuel, as indicated by the dotted arrows, proceeds thru vertically extending passageways 62 in the cylinder 32 into space 63 beneath the cylinder. From thence the flow goes upwardly into the chamber 51 about the follower 52 and down thru a central passageway or bore 64 in the rod 53. Bore 64, extending along the axis of the rod 53, connects with transverse passageway or bore 65 at its lower end which, in turn, communicates with chamber 66 above the diaphragm 58. The flow continues back into the main stream via passageway 68 shown in dotted lines in FIG. 3.

Accordingly, the system is maintained full of fuel at all times.

Assuming now that the initial vacuum signal reaches the chamber above diaphragm 43, pin 42 is sharply retracted, dropping balls 38 inwardly and releasing the spool 32.

Line pressure of the main conduit then moves the spool upwardly toward the position where the relatively small annular passageway 50 is aligned with the main flow line as shown in FIG. 7. However, the follower 52, at approximately the axial spool position shown in FIG. 6, is engaged by the spool 32 and therefore tends to provide a predetermined drag thereon by virtue of its connection with the diaphragm 58 and associated parts.

More importantly, since the follower 52 makes sealing engagement with the piston by virtue of O-ring 67, communication is cut off between chamber 66 and chamber 63. Therefore, passageway 68 forms the only outlet to what is now dash-pot chamber 66.

As a result, fuel trapped in the chamber 66 leaves at a rate determined by the dimensions of passageway 68 which are restricted accordingly.

Also, the extent of the delay may be determined in some considerable measure by adjustment screw 69 which determines the initial or rest position of the diaphragm 58 by virtue of its contact with the stub end 70 of rod 53. This, accordingly, not only determines the initial volume of chamber 66 but the point at which the follower 52 will be contacted by the lower extremity of the spool 32 in its upward movement and hence the stroke of the follower.

To assure that the spool will ultimately move to its second position shown in FIG. 7, poppet valve 71 is provided, in the wall 54 forming the lower axial extremity of the flow control valve cylinder. Valve 71 is normally seated by spring 72 but opens, as shown in FIG. 7, when valve stem 73 is contacted by washer 56 of the dash-pot diaphragm 58.

As shown in FIG. 7, the poppet valve 71, in open position, establishes communication between dash-pot chamber 66 and a radial channel 74 which communicates with annular channel 75 formed in the surface of the lower wall 54 of the flow control valve cylinder. Annular channel 75, in turn, communicates with passageway 76 which leads into conduit 77. This conduit 77, in turn, and as more specifically shown in FIG. 1, discharging into the spout of the dispensing nozzle.

Accordingly therefore, near the end of its stroke, just before the spool position shown in FIG. 7, valve stem 73 is raised by washer 56 so that the residual fluid in chamber 66 is released thru valve 71 and conduit 77 into the discharge spout thereby relieving the dash-pot restriction on spool 32.

Referring now to the vacuum signal transmission system, pipeline or conduit 28, which, as previously described, receives the vacuum signal, communicates with central chamber 78 of valve 30 which, in turn, communicates with poppet valves 79 and 80 in either side thereof, as shown in FIG. 9. Each poppet valve is urged toward central position by means of springs 81, in which position they are closed against the housing as shown in the case of valve 80.

The position of the poppet valves is, however, determined by axially shiftable plunger 82, the location of which is determined by column 36, previously described.

Thus the central lockout column 36 of the spool valve 32, as shown in FIGS. 3, 6, 7 & 8, has a radially constricted portion 83 and a wide or full diameter portion 84. Plunger 82 is normally urged toward such surfaces by spring 84 within housing 30 as shown in FIG. 9.

Therefore, when the parts are in normal starting position as shown in FIGS. 3, 8 & 9, plunger 82 is seated against the narrow or restricted portion 83 of the column 36.

When, however, the spool valve 32 is in its secondary or restricted flow position, as shown in FIG. 7, the plunger or follower 82 has been caused to ride up the inclined surface 85 of the column and has been retracted by contact with the larger diameter portion 84 of the column.

This will have the effect of moving protruberance 86 on the plunger 82 to a position to the left of that shown in FIG. 9 wherein the poppet valve 79 is closed and the poppet valve 80 is opened.

In other words, with the plunger 82 as shown in FIG. 9, communication is established between conduit 28 and the chamber 88 of valve 79, whereas with the plunger 82 retracted to the left, the valve 79 will be closed and valve 80 is opened, effecting communication between pipe 28 and valve space 87.

As indicated in FIGS. 2 & 3, valve space 88 is in communication via pipe 89 with the chamber 90 above diaphragm 43. Hence the initial signal goes directly to the space 90 and actuates pin 42 and the associated lockout mechanism which releases spool 32.

On the other hand, pipe 91, as shown in FIGS. 1 & 2, communicates with the valve space 87 and also with the lockout plunger which controls main valve 6. Hence with the auxiliary or flow control valve 32 in secondary or restricted flow position, the signal is directed via pipe 91 to the main lockout mechanism and thus terminates the operation.

In other words, as shown in FIG. 3, the operator, having lifted and latched lever 12 has instituted full flow thru the main conduit 45 via the large annular channel in the spool 32. At this time plunger 82 resides against the inner or restricted portion 83 of the lockout column so that the initial vacuum signal is transmitted via lines 26 and 28 thru valve 79 and passageway 89 into chamber 90 where it releases the lockout mechanism which has, up to this time, locked the spool 32 of the flow control valve in its initial position. The released spool

32 proceeds upwardly under the influence of line pressure, contacting the follower 52 of the dash-pot and moving in timed relationship to the position where spindle 73 on poppet valve 71 is contacted by washer 56 on the dash-pot diaphragm 58, as in FIG. 7. This opens valve 71, releasing the back pressure in the dash-pot 66 and enabling the parts to move freely to the position shown in FIG. 7 so that the flow-restricting annular channel 50 is in line with the main conduit of the nozzle.

In other words, to prevent the drag imposed by the dash-pot from interfering with proper alignment of the spool in secondary position, the valve 71 comes into play, completely releasing the dash-pot restraint as the spool approaches the vicinity of the secondary position.

At this time signal valve plunger 82 has been retracted from the position shown in FIG. 9, such that the poppet valve 79 is closed and the valve 80 is open, closing communication with conduit 89 and opening communication between signal control pipe 28 and pipe 91 which leads to the main lockout plunger release mechanism.

Accordingly, the second vacuum signal, in response to the end of the topping-off operation, releases the lock-out plunger 16 in conventional manner, terminating the operation.

With the termination of flow, the parts of the lockout plunger of the main valve return to their normal, locked position in conventional manner.

The lockout mechanism of the flow adjustment valve 32 is similarly returned to normal position by virtue of the fact that the accordian bellows diaphragm 44 normally exerts a resilient, downward spring force due to its spring-like structure.

Also in the embodiment shown, lockout pin 42 is returned to operative position by spring 92.

Provision is made for releasing the vacuum in chamber 90 by means of ball valve 93 disposed in tubular column 94, and normally seated as shown in FIG. 3 by spring 95. Upstanding spindle or pin 96 upon diaphragm 43 at the upper end of its stroke lifts ball 93 off its seat, opening chamber 90 to the atmosphere via radial passages 97.

It may be noted that the signal transmission arrangement thus far described is diagrammatically represented in FIG. 10 (with the exception of ball valve 93), wherein the venturi source of the vacuum is represented as at 26 and the nozzle vent as at 23. The valve represented by the numeral 30 controls the flow in lines 89 and 91, as shown, to release the lockout mechanism which controls the spool 32 and the plunger 16, as described.

FIG. 11 represents diagrammatically a modified system wherein the chamber 90, controlling the flow valve lockout mechanism is continuously in communication with line 28, the valve 30 acting simply to effect communication with the main lockout plunger mechanism 16 when topping-off is concluded. This means that instead of a dual valve system as shown in FIG. 9, it is necessary to use only poppet valve 78.

This has the advantage of eliminating the vacuum release valve on chamber 90 since the vacuum surge exists in chamber 90 only during the period it is in effect, since clearance of the tip vent 23 also releases the vacuum in chamber 90.

FIG. 12 shows another system which eliminates the need for ball valve 93, namely wherein each of the

lockout controls 32 and 16 is connected to one or more tip vents, so that the vacuum signal is released when the tip is clear.

FIG. 13 shows a system similar to that in FIG. 10, wherein a dual valve control system is provided to handle venting. In other words, valve 98, identical in construction and arrangement as valve 30, and connected respectively to lockout units 32 and 16, communicates with diaphragm flow line 99. It likewise may be operated by axial movement of the central column of spool 32 and may be located, for example, advantageously at a position diametrically opposite to valve 30, so arranged that when mechanism 32 is subject to the incoming vacuum signal its communication with atmosphere is cut off, whereas the lockout plunger mechanism is in free communication with the atmosphere and vice versa.

The diagram of FIG. 14 shows an arrangement showing a combination of FIGS. 12 and 13 whereas FIG. 15 is essentially similar to 12 in operation. Likewise, FIG. 16 is essentially similar to FIG. 15 in operation.

I claim:

1. In an automatic nozzle for dispensing a liquid fuel, and including a body communicated with a fuel supply conduit which terminates at a filler spout (49), a main flow control valve (6), and a flow regulating valve (32), the latter being movable between a full flow position and a restricted flow position, first (87) and second (90) vacuum responsive release means connected to said main control valve (6) and said flow regulating valve (32) respectively, pressure sensing means (23) responsive to a surge of fluid about said filler spout (49) for creating a vacuum impulse, and signal valve means (30, 79, 80) communicated with said pressure sensing means (23) for directing an initial vacuum impulse to said second vacuum responsive release means (90) whereby to actuate flow regulating valve (32) to the flow restricting position, and for directing a subsequent vacuum impulse into said first vacuum responsive release means (87), whereby to close said main control valve (6);

the improvement in said nozzle which comprises dash pot means (66) operably connected to said flow regulating valve (32) whereby to delay movement of said valve (32) for a desired time period while the latter adjusts from the full flow, to the restricted flow position.

2. In a nozzle as defined in claim 1, wherein said dash pot means (66) includes a dash pot passage means (62, 63, 64) formed therein and communicated with said flow regulating valve (32), whereby to maintain fuel flow into said dash pot passage means when said flow regulating valve is in the full flow position.

3. In a nozzle as defined in claim 2, wherein said dash pot passage means (62, 63, 64) includes sealing means (67) therein, adapted to prevent fuel flow into said dash pot means (66) when said valve (32) commences movement toward the restricted flow position thereof.

4. In a nozzle as defined in claim 3, wherein said seal means (67) is carried on an elongated rod (53) and positioned in said dash pot passage means (62, 63, 64) to engage said flow regulating valve (32) and prevent flow of fuel through said passage means (62, 63, 64) when said valve (32) is urged toward the restricted flow position.

5. In a nozzle as defined in claim 2, wherein said dash pot passage means (62, 63, 64) is communicated with the upstream side of said valve (32) to receive fuel flow concurrently with the latter, only when said valve (32) is disposed in the full flow position.

6. In a nozzle as defined in claim 1, wherein said dash pot means includes a chamber (66) having a movable diaphragm (58) operably connected to said flow valve (32), said diaphragm (58) being displaceable in response to movement of said flow regulating valve (32) whereby to urge liquid fuel from said chamber (66), through a constricted passage to restrain movement of said valve (32) toward the restricted flow position.

7. In a nozzle as defined in claim 6, wherein said dash pot means (66) includes an elongated rod (53) operably connected at one end thereof to said flow regulating valve (32), and fixed at the other end to said diaphragm (58).

8. In a nozzle as defined in claim 1, wherein said dash pot means (66) includes; a chamber (66) defined by displaceable diaphragm (58) forming a wall thereof, and a constricted passage (68) communicating said chamber (66) with said filler spout (49).

9. In a nozzle as defined in claim 1, including relief valve means (71) communicated with said dash pot means (66), and being normally in a closed position to prevent liquid flow from said means (66), said valve (71) being actuable to an open position whereby to relieve pressure within said dash pot means (66) when said flow regulating valve (32) reaches the restricted flow position.

10. In a nozzle as defined in claim 1, wherein said signal valve means (30, 79, 80) includes; a plunger (82) operably connected at one end thereof with said valve means (79) and (80) respectively, and at the other end with said flow regulating valve (32), whereby to sequentially actuate said respective valves (79 and 80) in response to movement of said valve (32) between the full flow and the restricted flow positions thereof.

* * * * *