United States Patent

[11] 3,586,071

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[21] Appl. No. 821,364
[22] Filed May 2, 1969
[45] Patented June 22, 1971

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New York, N.Y.

[54] AUTOMATIC DISPENSING NOZZLE
9 Claims, 7 Drawing Figs.

[52] U.S. Cl. 141/28, 137/386, 141/214
[51] Int. Cl. B67d 5/373
[50] Field of Search ..... 141/40, 41, 46, 128, 198, 206—229; 137/386, 389

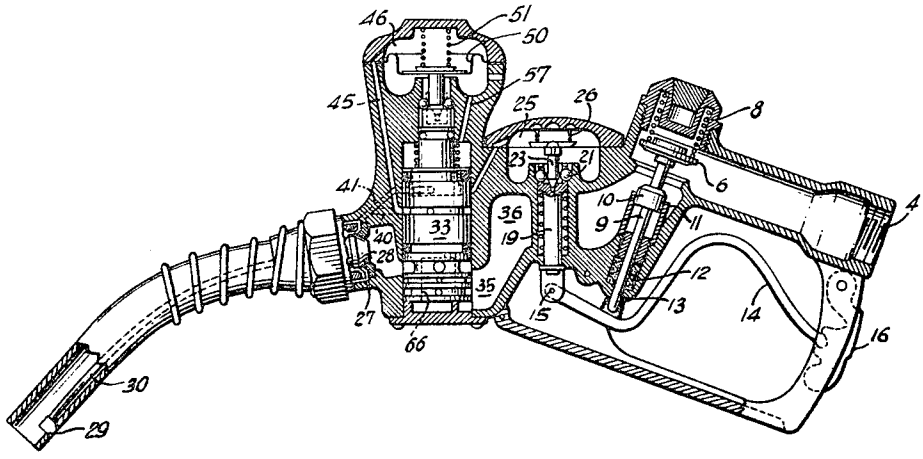
[56] References Cited

UNITED STATES PATENTS

2,678,658	5/1954	Rittenhouse	141/128 X
2,948,307	8/1960	Rittenhouse et al.	141/128 X
3,254,683	6/1966	Jennings et al.	141/128

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Assistant Examiner—Edward J. Earls
Attorneys—K. E. Kavanagh, Thomas H. Whaley and L. H. Phelps, Jr.

ABSTRACT: An automatic tank filling nozzle involving a device responsive to the surge of fluid about the end of the nozzle for closing the main valve, having, in addition thereto, a flow-regulating valve normally in full-flow position but which is caused by the initial surge of fluid about the nozzle, to move to a secondary valve position where fluid flow is restricted to a relatively low rate suitable for "topping." In the second or relatively restricted flow position of the flow-regulating valve the final rise of fluid about the nozzle acts to close off the main control valve.



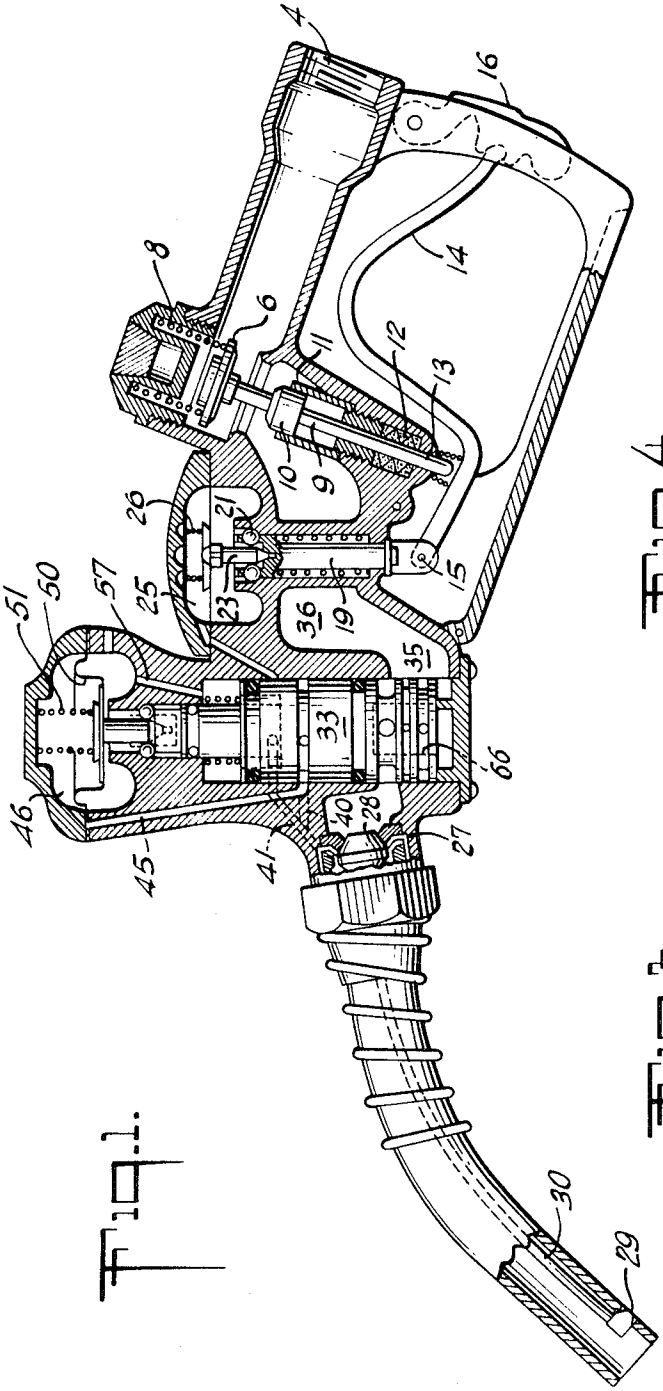


Fig. 1.

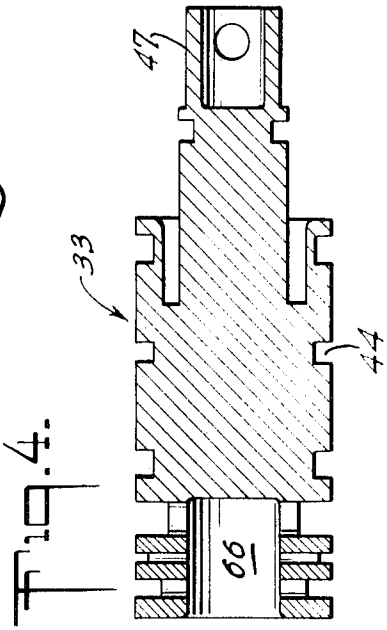


Fig. 4.

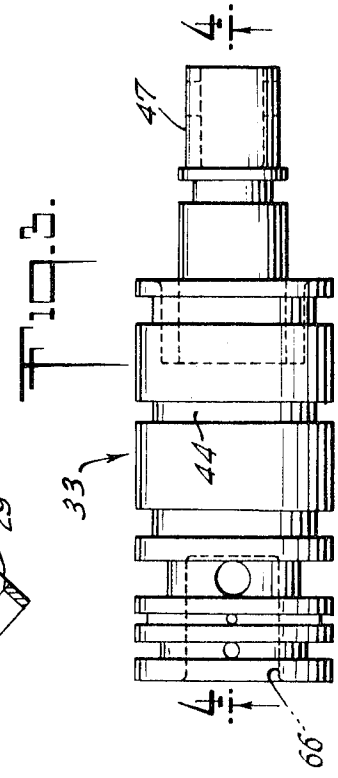


Fig. 5.

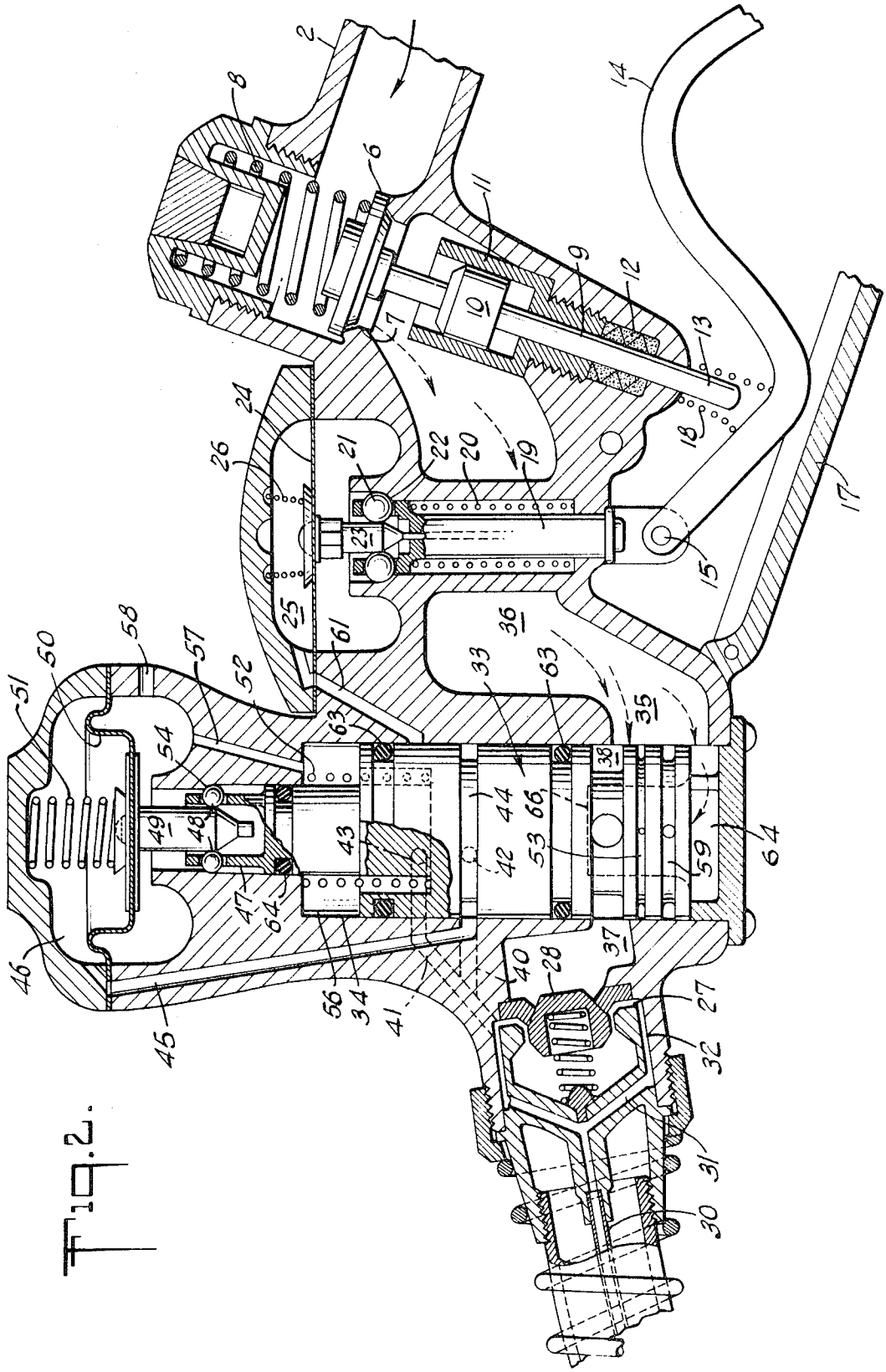


Fig. 2.

Fig. 5.

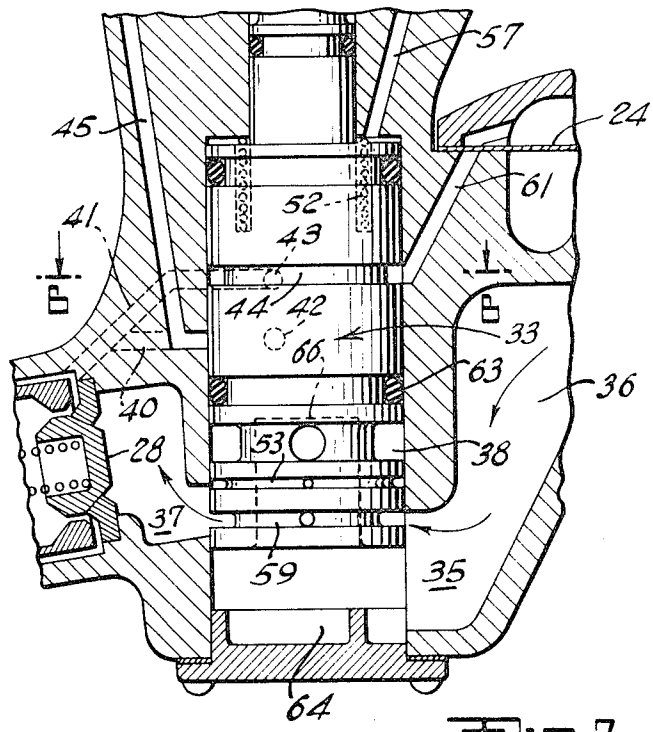


Fig. 6.

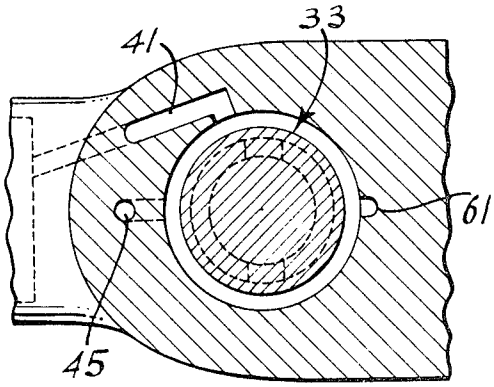
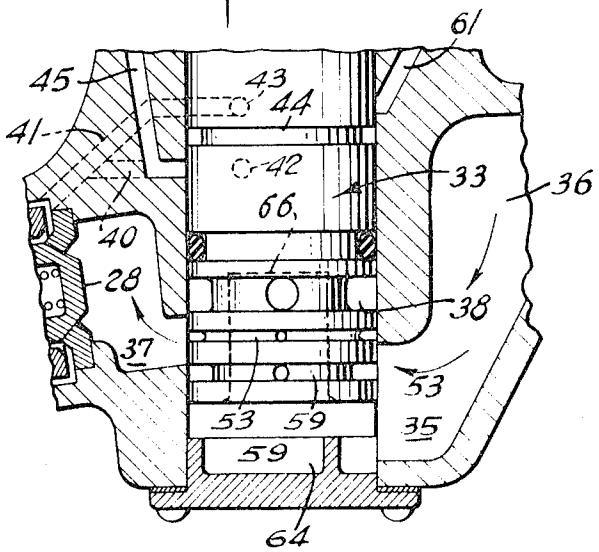


Fig. 7.



AUTOMATIC DISPENSING NOZZLE

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

As explained in our copending U.S. Pat. Application, Ser. No. 821,366 filed March 2, 1969 the typical fuel tank filling operation requires a flow of fuel sufficient in volume to enable reasonably prompt service without blowback. Typically however, as filling reaches, for example, with 1 or 2 gallons of completion, a sudden constriction in the internal space produces a characteristic back-surge in the filler pipe which, with the conventional type of dispensing nozzle, actuates means to shut off the main valve of the nozzle and thus terminate the flow.

After the initial surge referred to above has subsided the tank will still accept an additional quantity of fuel at a lower feed rate. This step is referred to as "topping-off," a practice which may be onerous to an employee and, in the absence of good lighting, may entail spillage.

The present invention concerns a provision of a nozzle effective to conduct this complete series of operations automatically.

More specifically the invention contemplates an automatic shutoff nozzle with a main control valve which is also provided with a flow-regulating valve, in the main conduit, responsive to the initial back surge of fuel in the filler pipe, for actuation from an open-flow position to a flow-restricting position, thru an intermediate flow-interrupting position. By open-flow position is meant a position of minimal flow restriction, permitting flow thru the nozzle at an appropriate predetermined filling rate.

In the flow-restricting position the valve restricts or regulates flow to a somewhat lesser, predetermined "topping rate," at which back surging in the filler pipe does not occur.

Furthermore, the surge responsive mechanism is also controlled by the flow-regulating valve so that the initial surge of fuel in the filler pipe triggers actuation of the regulating valve; whereas the ultimate or final rise of fuel in the filler pipe at the termination of the "topping operation" effects control or triggers actuation of the main fuel valve to cut off all flow and effect final termination of the filling operation.

Ordinarily the surge responsive actuation of the several controls is effected as a result of a suction created, as is well known, by the flow of fuel and normally relieved or vented near the end of the nozzle but permitted to build up sharply when the relief or venting means is covered with an aforementioned surge of fuel.

By the adoption of this means therefore the flow-regulating valve, in its normal open-flow or full-flow position directs the suctions impulse exclusively for its own actuation. In its flow-restricting position, the aforementioned valve, on the other hand, directs the actuating change in pressure, namely the suction impulse, to the final control of the main flow valve.

Reference is now made to the FIGURES of the attached drawing wherein the invention is illustrated in terms of one detailed and specific embodiment thereof; this embodiment being based upon a modification and reconstruction of the form of specific automatic dispensing nozzle shown in U.S. Pat. No. 3,085,600, which patent is referred to for a more detailed description and understanding of such of the parts of the present nozzle as correspond thereto.

In the FIGURES of the drawing,

FIG. 1 is a side elevation of the nozzle with the major parts broken away to expose the interior in section,

FIG. 2 is a more detailed, enlarged vertical section thereof,

FIG. 3 is a side elevation of the regulating valve spool,

FIG. 4 is a transverse sectional view thereof,

FIG. 5 is a detailed sectional elevation showing the flow regulating valve in flow-restricting position,

FIG. 6 is a sectional view on the line 6–6 of FIG. 5,

FIG. 7 is a detailed sectional elevation showing the regulating valve in the flow-interrupting position.

The automatic dispensing nozzle shown in FIGS. 1 & 2 comprises a cast housing with a rearwardly extending portion 2, arranged to receive a hose coupling (not shown) as at 4. The main valve at the forward end of this extension comprises valve tappet 6 held against seat 7 by spring 8. A valve tappet rod 9, comprising piston 10 cooperating with dashpot cylinder 11, extends downwardly thru a packing gland 12 and then outwardly thru the housing to provide a valve actuating extension 13.

Valve operating lever 14, pivoted or fulcrumed as at 15 to a lockout plunger 19, to be hereinafter more fully described is movable in a counterclockwise direction to engage the lower end of rod 13 and raise the valve 6 from its seat 7 against the spring 8 (as shown in FIG. 1).

The free end of the lever 14 may be latched in valve-open position by engagement with latch 16. When not engaged, latch is pivoted outwardly in retracted position by a spring member not shown. A guard 17 surrounds the lever 14 which is normally urged to lower position by a relatively light spring 18.

The lockout fulcrum involves a conventional construction, as in the aforementioned Patent, comprising a plunger 19, normally urged into its uppermost position as shown in FIG. 2 by a relatively light spring 20 and locked in that position by a plurality, for example 3, plunger balls 21, each arranged to move transversely in the plunger thru lateral or radial openings therein. In their radially outermost positions as shown in FIG. 2 the balls 21 engage a shoulder 22 on the casting which "locks" the plunger against downward motion. The balls are retained in this position by cylinder or plunger 23 which is attached to and depends from a diaphragm 24, extending across a chamber 25 formed in the housing just above lockout plunger 19. Spring 26 in the chamber above the diaphragm urges the diaphragm and accordingly the cylinder or plunger 23 into the locking position shown so that the balls 21 cannot move radially inwardly.

As is known, the pivot or fulcrum accordingly remains fixedly oriented until upward flexure of the diaphragm as by application of a substantial surge of vacuum in the chamber 25 retracts the piston or plunger from between the balls 21 enabling them to collapse inwardly. Thereupon the plunger is "unlocked" and promptly driven downwardly by major spring 8, closing the valve 6.

The actuating vacuum in accordance with the present embodiment is derived from the Venturi effect of an annular orifice 27 formed about the seat of check valve 28 and normally with the Venturi by passageways 30, 31 and 32, better shown in FIG. 2.

Accordingly, as previously intimated, in the conventional system, the surge of fuel in the filler pipe blocks vent 29 creating a vacuum in chamber 25 to terminate the flow of fuel.

However, in accordance with the present invention the initial surge of vacuum is used to terminate the normal full-flow of fuel and, after a predetermined period of cessation or substantial cessation of flow, to reestablish flow at a restricted or "topping" rate.

To this end the present illustrated embodiment is provided with a regulating valve comprising a spool or spindle identified generally by the reference numeral 33. This, as is shown, is received within mating cylinder 34 in the casting. The cylinder is, in turn, provided with main fuel flow inlet portion 35, communicating with passageway 36 which receives the fuel flowing from main valve 6. An outlet port 37 on the other side of the cylinder 34, in turn, communicates directly with the aforementioned check valve 28.

In the lower or "full-flow" position of the valve as shown in FIGS. 1 and 2, port 35 communicates with port 37 thru annular groove or channel 38 in the spool or piston 33. At the same time the vacuum means, previously mentioned, is connected via interconnecting passageways 40 and 41 with axially spaced ports on the cylinder 34 as indicated respectively by dotted

lines 42 and 43. In the position shown in FIGS. 1 and 2 port 42 is in alignment with a spindle groove or annular channel 44. At the same time the channel 44 is also in alignment with the extremity of passageway or conduit 45 which communicates with diaphragm chamber 46 in the casting above the valve.

Therefore the suction effect caused by the initial surge in the filler pipe is applied to diaphragm chamber 46.

Port 43 aligned with the conduit 61 controlling the fulcrum lockout plunger (as will hereinafter appear) is at this time blanked.

It is preferred in the present invention to "lockout" the piston or spindle 33 in full-flow position in the same manner as previously described in connection with the lockout fulcrum of the main valve control lever previously described.

To this end spool 33 is provided with an axial extension 47 which carries a series of locking balls 48 (FIG. 2) held outwardly by central pin or plunger 49 attached to diaphragm 50 and normally urged downwardly into locking position by spring 51.

The spindle or spool 33 is normally held in its lower or "full-flow" position by spring 52. Hence the plunger or pin 49 accordingly holds the balls 48 against shoulders 54 in the casting so that the valve spool is locked in full-flow position against upward movement. When however, a surge of vacuum reaches the chamber 46 above diaphragm 50, via conduit 45, as when the vent 29 in the nozzle spout is closed by a surge of liquid, plunger 49 is sharply withdrawn permitting the balls to fall inwardly against the taper of the pin 49 and releasing the valve for upward movement.

With the main valve 6 open and line pressure acting on the bottom of spindle 33, a force sufficient to shift the unlocked spindle against spring 52 moves the spindle toward its upper or restricted flow position illustrated more or less diagrammatically in FIG. 5.

It is particularly important to note that in approaching this second or restricted flow position the valve remains in what is essentially a nonflow condition for a period of time sufficient to permit the initial surge of fuel to settle back within the fill pipe. This condition, as illustrated, more or less diagrammatically in FIG. 7, involves the blanking off of vacuum ports 42 and 43 and essential blanking off of outlet port 37, except for a relatively insignificant flow thru annular groove 53 which is provided simply to facilitate downward movement of the spool 33 during a subsequent operation as will be hereinafter more fully described. By insignificant or negligible flow is therefore meant the degree of flow to accomplish this purpose without materially affecting, in any way, tank filling or the creating of a suction or vacuum in any appreciable respect.

In order to realize the aforementioned predetermined time period of relative flow quiescence between valve settings, the present invention contemplates construction and arrangement of the spool and cylinder, such that space 56, provided in the cylinder above the spool, forms a dashpot which is vented via a conduit 57 into the space below the diaphragm 50 and thence to atmosphere by duct 58. Accordingly it is preferred to so size duct 57 as to restrict the flow of air to a rate sufficient to restrain the upward movement of the spindle for some predetermined time, say 1 to 2 seconds.

It will be apparent from the foregoing that other arrangements may be provided to effect delayed action of the valve from "full-flow" to "restricted-flow" position, as for example, providing passageway 57 with a valve which permits free flow of air in a downward direction but limits flow to some predetermined rate of restriction in the other direction.

Referring now to the valve spool in its upper position as shown in FIG. 5, it will be apparent that the flow of fuel now passes from port 35 to port 37 by way of annular groove or channel 59, quite substantially restricted as compared with the full-flow channel 38.

At this time the ports forming the terminal of ducts 40 and 45 are blanked against the wall of the spindle, whereas annular channel or groove 44 is now in alignment with port 43 of duct 41, and at the same time is also in alignment with the port formed by the terminus of duct 61 leading to the previously mentioned chamber 25 of the fulcrum lockout mechanism previously described. Accordingly, therefore, any subsequent surge of vacuum caused by restriction of orifice 29 is not longer applied to diaphragm 50 of the flow-regulating valve but, on the contrary, is direct by conduit 41, port 43, groove 44 and duct 61 to the upper portion of the diaphragm 24 to unlock the fulcrum-locking mechanism, so that the fulcrum is driven downwardly by the force of relatively powerful valve spring 8. This releases latch 16 which flies outwardly concluding the entire operation.

The valve spool 33 of the flow-regulating valve is provided with suitable O-ring seals 63. Its lower portion, as indicated, is provided with a hollow bore 66 (FIG. 4) having communicating passages, as indicated, with each of the annular grooves. As a result the grooves are always in communication with the open lower portion of the cylinder 64, which, when main valve 6 is in open position, is subject to the line pressure of the fluid. Also, this assures vital fluid communication with inlet port even tho a specific groove may be blocked off from port 35.

As previously intimated, as soon as the main valve 6 has closed and flow terminated, the line pressure in passage 36, of course, drops and spring 52 takes over to return the valve spool 33 back to its original position, shown in FIGS. 1 & 2. Inasmuch as the spool 33, as it moves downwardly, displaces fluid, it is obviously necessary that such fluid pass thru check valve 28. Therefore, it will be apparent that the bleeder groove 53 and the associated holes or passages into central bore 66 enable the displaced fluid to pass thru port 37 to the check valve 28 without being trapped below the spool 33. In other words, the bleeder conduit or channel 53 permits the spool to move freely to its lower position, which it could not do without some means to relieve fluid trapped therebelow.

Accordingly the present invention supplements a conventional form of automatic nozzle with a flow-regulating valve which normally occupies a first, full-flow or open-flow position at which predetermined tank-filling rates of flow are permitted. Also, in this first full-flow position, the vacuum impulse responsive to the surge of liquid in the filler pipe is so directed as to actuate movement of the flow-regulating valve to a second or flow-restrictive position. In the second position of the valve, the flow is cut down and restricted to a relatively limited maximum rate, suitable for the so-called topping operation.

The topping rate for conventional automotive equipment may typically fall within the range of up to about 2 to 4 gallons per minute, whereas the rate of flow at the full-flow or open flow position of the regulating valve may typically vary from about 4 up to from 10 to 12 gallons per minute. These ranges may, of course, may in the future with changes in the design of the fuel tank of the typical motor vehicle as well as with variations in the nozzle. Therefore the exact flow rate may be of secondary significance as contrasted with a relatively high open-flow rate and relatively low topping rate.

Also, in the second position of the flow-regulating valve the vacuum impulse is now directed thru appropriate conduits to the main valve cutoff means, namely and specifically the diaphragm controlling release of the lockout fulcrum 15, which, inturn, cuts off the main valve.

Also provided is a predetermined time lag in the sequence of transition from the first to the second position of the flow-regulating valve, during which there is substantial cessation of flow, such that the surge of fuel liquid in the filler pipe of the tank being filled has an opportunity to subside just prior to topping off.

This is preferably accomplished by a dashpot arrangement associated with a flow-regulating valve which can be coordinated with axial movement of the spool in the cylinder.

Furthermore, actuation of the flow-regulating valve during the automatic filling operation is preferably effected by the action of the line-pressure of the fuel.

Normal seepage or leakage of gas from conduit 45 to port 40, even with communication "blanked" by the spindle,

serves to relieve the vacuum in chamber 46 so that pin 49 will return to cocking position as the spool drops back.

Many embodiments of the inventions will be apparent from the foregoing examples and disclosures within the scope of the following claims.

We claim:

1. In an automatic dispensing nozzle for supplying liquid fuel and the like to the filler pipe of a fuel tank, said nozzle having a supply conduit for said liquid terminating in a filler spout, a main control valve in said conduit, releasable means for holding said main control valve in open position, first vacuum responsive release means acting through said holding means for closing said main control valve, and means responsive to a surge of fluid about said spout for creating a vacuum impulse, the improvements which comprises

a flow-regulating valve in said conduit, said flow-regulating angle normally residing in a first, full-flow position permitting flow of said liquid at a predetermined relatively high filling rate,

second vacuum responsive means for shifting said flow-regulating valve to second flow restricting position wherein said liquid flow is limited to a predetermined low topping rate,

means in said first position of said flow-regulating valve directing a first vacuum impulse from said surge responsive means to said second vacuum responsive means for actuating said flow-regulating valve to said second, flow-restricting position,

and means in said second flow-restricting position of said flow-regulating valve, directing any subsequent vacuum impulse from said surge responsive means to actuate said main control valve releasing device, terminating the dispensing operation.

2. An automatic dispensing nozzle as defined in claim 1 comprising delaying means effecting a predetermined time lag between said first and second positions of said flow-regulating valve, such that flow of fluid is substantially terminated during such period to enable subsidence of surged fluid in the filler pipe.

3. An automatic dispensing nozzle as defined in claim 2 wherein said flow-regulating valve comprises an axially movable spool located within a cylinder, means for locking said spool in said first, full-flow position said second vacuum responsive means being responsive to such vacuum impulse to release said locking means.

4. An automatic dispensing nozzle as defined in claim 3 wherein said spool is moved in said cylinder from first to second position by line pressure in the fuel conduit.

5. An automatic dispensing nozzle as defined in claim 1 comprising means for returning said flow-regulating valve to said first-named position at the termination of said dispensing operation.

6. In an automatic dispensing nozzle for supplying liquid fuel and the like to the filler pipe of a fuel tank, said nozzle having a supply conduit for said liquid terminating in a filler spout, a main control valve in said conduit, releasable means for holding said main control valve in open position, first vacuum responsive release means acting through said holding means for closing said main control valve, and means responsive to surge of fluid about said spout for creating a vacuum impulse; the improvement which comprises:

a vacuum responsive flow-regulating valve in said conduit and normally disposed in a first or full-flow valve position permitting said liquid to flow at a predetermined relatively high filling rate,

second vacuum responsive means for shifting said flow-regulating valve to second flow-regulating position wherein said liquid flow is limited to a predetermined low topping rate,

said flow-regulating valve in said first position, also directing a first vacuum impulse from said surge responsive means to the control of said second vacuum responsive means such that said flow-regulating valve is caused to move thereby from said first position to second position, wherein said flow-regulating valve restricts said liquid flow to said relatively low topping rate; said flow-regulating valve in second position, directing any subsequent vacuum impulse from said surge responsive means to said first vacuum responsive release means for closing said main control valve whereby a vacuum impulse during said topping step results in termination of the dispensing operation.

7. An automatic dispensing nozzle as defined in claim 6 wherein both said main valve and said flow-regulating valve are normally held in locked position and wherein said respective vacuum responsive means act in response to a surge of vacuum directed thereto to release said locking means.

8. An automatic dispensing nozzle as defined in claim 6 comprising time delay means effective to delay the actuation of said regulating valve from said first to said second position, a predetermined time lag effective to permit subsidence of surged fluid in said filler pipe.

9. In an automatic dispensing nozzle for supplying liquid fuel and the like to the filler pipe of a fuel tank, said nozzle having a supply conduit for said liquid terminating in a filler spout, a main control valve in said conduit, releasable means for holding said main control valve in open position, first vacuum responsive release mans acting through said holding means for closing said main control valve and means responsive to a surge of fluid about said spout for creating a vacuum impulse, the improvement which comprises

a vacuum responsive flow regulating valve in said conduit downstream of said main control valve,

said flow-regulating valve being normally disposed in first or full flow valve position permitting liquid flow at a predetermined relatively high filling rate,

second vacuum responsive release means releasable in response to a first vacuum impulse from said surge responsive means for locking said flow-regulating valve in said first position,

the line pressure in said conduit acting upon said flow-regulating valve to urge said valve to a second, flow restricting position,

means associated with said flow-regulating valve in said first position directing said vacuum impulse to the actuation of said second vacuum responsive release means to release said flow-regulating valve means, such that said flow-regulating valve is free to move from said first position to said second position,

said flow-regulating valve in second position limiting liquid flow in said conduit to a predetermined, restricted rate suitable for a topping step and

means associated with said flow-regulating valve in said second position for directing any subsequent vacuum impulse from said surge responsive means to said first vacuum responsive release means for closing said main valve whereby a vacuum impulse during said topping step results in termination of the dispensing operation.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,586,071 Dated June 22, 1971

Inventor(s) Dean C. McGahey and Eugene W. Vest

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the specification:
Col. 1, line 15, change "with" to --within--
Col. 2, line 50, the following words omitted after "normally" --relieved, by means of vent 29, shown in Fig. 1, communicating--
Col. 2, line 65, change "portion" to --port--
Col. 3, line 38, change "nonflow" to --no flow--
Col. 3, line 72, change "terminal" to --termini-
Col. 4, line 4, change "not" to --no--
Col. 4, line 6, change "direct" to --directed--
Col. 4, line 51, change "may" (second occasion) to --vary--
Col. 5, line 3, change "inventions" to --invention--

In the claims:
Col. 5, line 15, change "improvements" to --improvement--
Col. 5, line 17, change "angle" to --valve--
Col. 6, line 3, change "-regulating" to -- -restricting --
Col. 6, line 34, change "mans" to --means--

Signed and sealed this 18th day of January 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents