United States Patent

[11] **3,586,070**

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[21] Appl. No. **826,313**
[22] Filed **May 21, 1969**
[45] Patented **June 22, 1971**

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[54] **AUTOMATIC DISPENSING NOZZLE**
7 Claims, 2 Drawing Figs.

[52] U.S. Cl. 141/128, 141/225
[51] Int. Cl. B65b 3/26
[50] Field of Search ..... 222/52, 53, 152, 74; 141/102, 126, 128, 198, 202, 210, 211, 214, 215, 225—6; 222/52, 53, 152, 74

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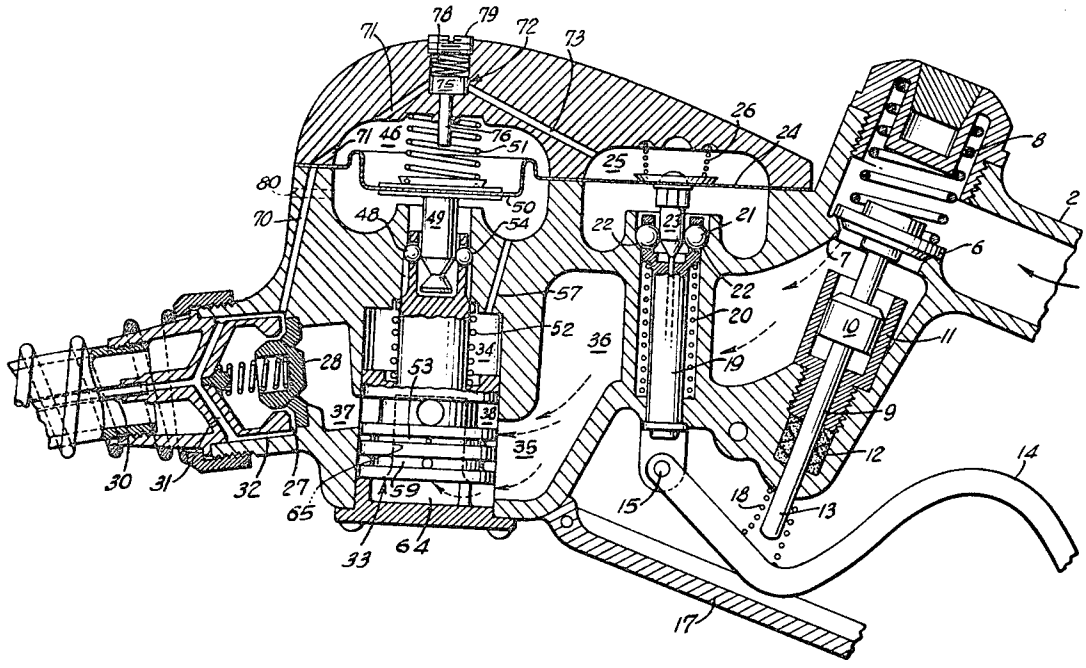
ABSTRACT: A liquid dispensing nozzle in which a vacuum signal set up by the rise of liquid about the nozzle controls closure of both the main valve and of a supplemental valve which is actuated to automatically effect the "topping-off" operation at a relatively restricted rate of feed. The present invention provides a separate vacuum signal transfer valve which so controls the vacuum signal as first to actuate the supplemental valve to effect the "topping-off" operation and thereafter, on completion of the "topping-off" operation, to effect closure of the main valve.



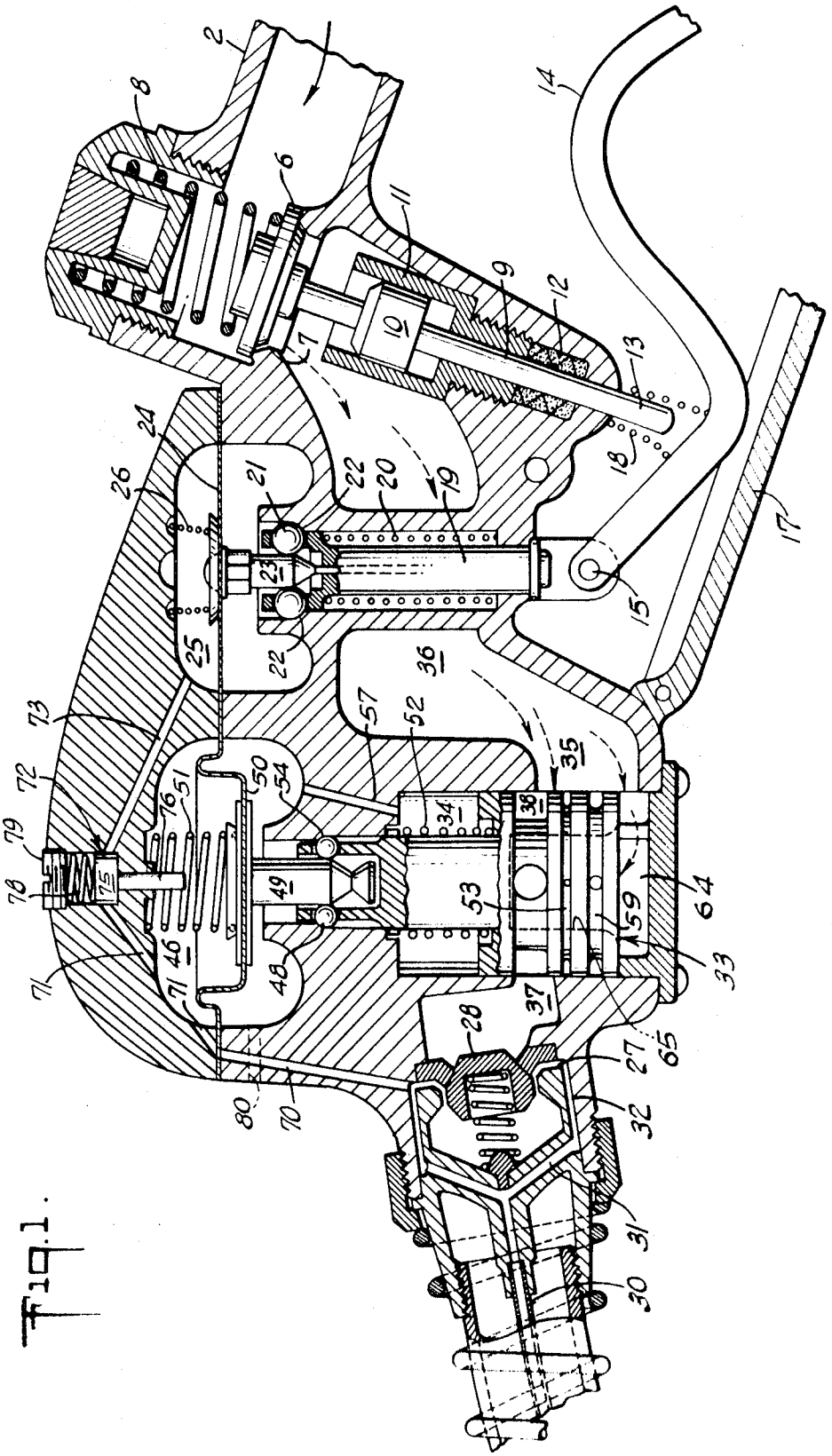
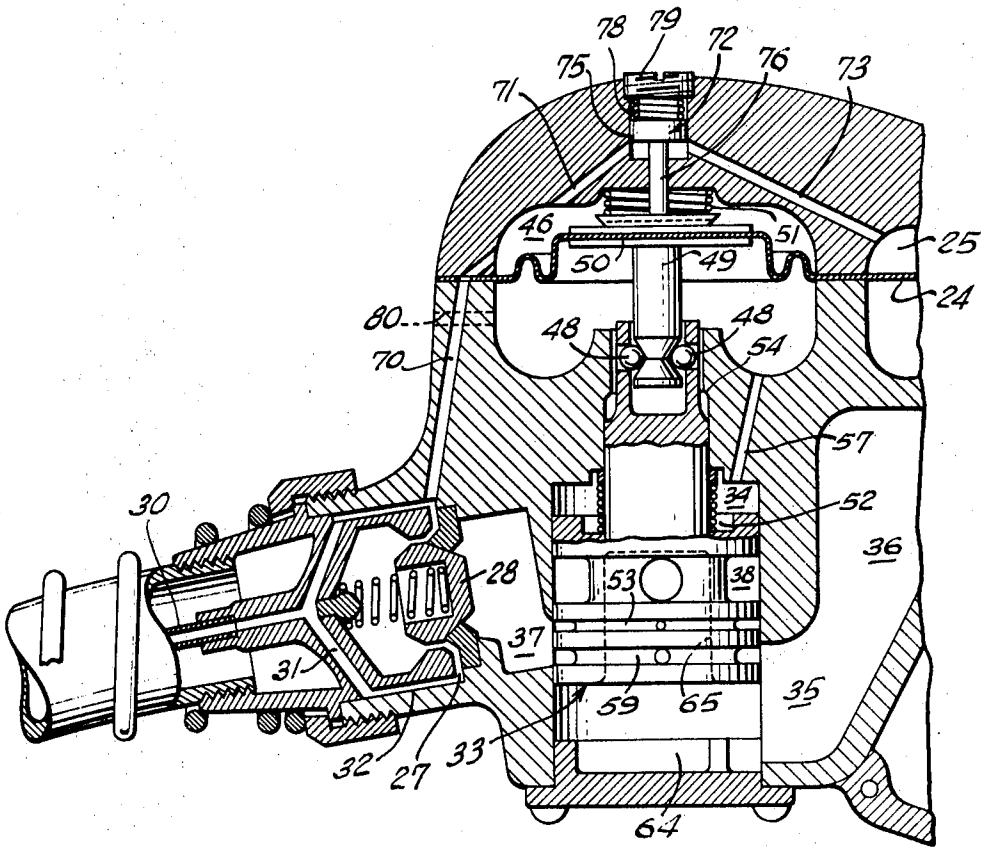


Fig. 1.

Fig. 2.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AUTOMATIC DISPENSING NOZZLE

The present invention relates to an automatic fuel dispensing nozzle and more particularly to such a nozzle which automatically controls both the initial filling and topping operations normally encountered in filling of vehicle fuel tanks.

Because it specifically involves an improvement upon the invention described and claimed in copending application Ser. No. 821,364 filed on May 2, 1969 in the names of Eugene W. Vest and Dean C. McGahey (D071,258), reference is made to that application for all descriptive details of the invention disclosed therein which are supplemented by the present invention.

As pointed out in the aforesaid copending application, to dispense liquid fuel into a vehicle, tank at reasonably expeditious rates of, for example, 6 to 20 gallons per minute typically causes back surge of fuel within the filler pipe, just before the fuel tank has been completely filled, at which time the currently conventional vacuum signal actuated shutoff means closes the main valve. This permits "topping off" at a considerably reduced rate of flow, with the result that up to one or two additional gallons can be added, without filling the tank beyond its design capacity.

The aforesaid copending application describes a tank filling nozzle having a conventional automatic main valve which cuts off in response to the presence of a liquid around the tip of the spout which is supplemented by an added improvement involving a flow-regulating valve which, in its normal or primary position, permits full-flow of fuel thru the nozzle. This flow-regulating valve is, however, preferentially actuated in response to the initial surge of fluid in the filler pipe so as to move into a secondary position where a suitable topping rate prevails, and where, also, any subsequent surge or rise of fluid in the filler pipe, thereafter, is effective to close off the main valve.

With the present invention the auxiliary or flow-regulating valve is likewise adapted to limit the flow of the liquid fuel as between a normal unlimited or full-flow rate selected for expeditious filling, and a relatively low or restricted "topping-off" rate. These two valve positions are also spaced or separated by an appreciable and predetermined time delay, as is fully detailed in the aforesaid copending application, in order to permit subsidence of the level of fuel in the fill pipe.

The function of respectively and selectively controlling the flow-regulating valve and the main valve in response to a rise or surge of fluid in the fill pipe is, in accordance with the present invention, controlled by separate means which may take several forms but basically comprises a transfer valve actuated by the aforesaid flow-regulating valve.

The advantages of the present invention are a simplification and substantial reduction in size of the flow-regulating valve and of its associated parts which, in turn, contribute to an overall simplification of the nozzle, decreased frictional resistance and a considerable reduction in weight and bulk.

Referring now to the figures of the drawing which illustrate one embodiment of the principles of the present invention,

FIG. 1 represents a detailed sectional elevation of the central portion of the dispensing nozzle involving the present invention as specifically applied to the embodiment of the aforesaid copending application.

FIG. 2 is a view, as FIG. 1 but showing the parts in relatively low-flow position during the topping operation.

Again it must be emphasized that the structure and details of the dispensing nozzle, apart from the specific improvement disclosed herein claimed, are fully and completely shown and described in the aforesaid application (D071,258), to which reference is made for such details.

In general, the cast housing 2 of the nozzle encloses a conduit controlled by main valve 6, urged against seat 7 by spring 8 but capable of being opened by a lifting force applied to the extremity 13 of valve stem 9.

Hand lever 14, pivoted as at 15, can be elevated to lift stem 9 and accordingly valve 6 to open position and means shown in the copending application is provided to latch the lever temporarily in raised position.

Fulcrum 15 is mounted on latched plunger 19 which, in all ordinary conditions, is urged into its upper position as shown in the figures by a relatively light spring 20 and is locked in that position by a plurality of plunger or latching balls 21, each arranged in a lateral or radial opening in the upstanding walls of the plunger as shown.

Held in their radially outermost positions by cylinder or latch pin 23 the balls engage shoulder 22 on the casting which accordingly "locks" the plunger against downward motion and thus latches the fulcrum 15 in position with respect to the casting as shown.

Latch pin or cylinder 23 depends from diaphragm 24 in chamber 25 and is urged into locking position shown by a relatively light spiral spring 26.

Therefore in response to a surge of vacuum referred to as a vacuum signal, in chamber 25, diaphragm 24 flexes upwardly, retracting the cylinder 23 and permitting the balls to collapse inwardly, thereby unlocking or unlatching the plunger. Accordingly with the lever 14 holding valve 6 in open position (not shown) the major spring 8 takes control to drive the plunger 19, and accordingly the fulcrum 15, downwardly, immediately closing valve 6.

The source of the vacuum signal is the venturi effect created as fuel flows through the seat opening 27 of the check valve 28, the suction from which is normally relieved by a vent adjacent to the extremity of the spout, not shown, communicating with the venturi via radial passageways and conduits 30, 31 and annular passageway 32.

Blockage of the vent by surge or rise of fuel about the spout results in a sharp vacuum impulse or signal which may be directed to control the latched fulcrum as will hereinafter more fully appear.

Referring now to the flow-regulating valve exemplifying a feature of the present invention, this involves a spool or spindle 33, axially guided in a suitable cylindrical chamber 34 in the casting 2 which, in turn, is provided with fuel inlet port 35 for passageway 36 which is the central fuel conduit of the nozzle. Outlet 37 on the other side of cylinder 34, in turn, communicates directly with aforementioned check valve 28. In its normal lower or full-flow position shown in FIG. 1, the flow regulating valve effects communication between port 35 and port 37 via a relatively large annular groove or channel 38 in the spool or spindle 33.

It may be noted moreover that upper channel or groove 38, as well as intermediate groove 53 and lower groove 59, also communicate with inlet port 35 by means of radial passageways, respectively extending into a central bore in the spool, indicated in dotted lines by the numeral 65 which, in turn, is open at its lower end to recess or cavity 64 which communicates with port 35.

Like the fulcrum plunger 19, the flow-regulating valve is normally locked or latched in the position shown in FIG. 1 by means essentially identical with those described in connection with plunger 19. This involves a plurality of balls 48 held against shoulder 54 by plunger or latch pin 49. The pin or plunger 49 is, in turn, attached to diaphragm 50 (which can be a part of diaphragm 24) in chamber 46, and normally positioned by spring 51.

Hence a surge of vacuum through conduit 70 and 71 into chamber 46 will lift diaphragm 50 sharply, withdrawing pin 49 and permitting the balls 48 to fall inwardly into the converging ramp or taper at the lower end of pin 49.

With the valve spindle 33 "unlocked" and the main valve 6 open, line pressure is acting on the bottom of spindle 33, so that there is an upward force on the spindle sufficient to shift it against spring 52 into the upper or restricted-flow position illustrated in FIG. 2.

As described more specifically in the aforesaid copending application, it is important that approach of the spindle to its

secondary or restricted-flow position involves passage through a transition stage involving what is an essentially noflow condition, which occupies a predetermined period of time sufficient to permit the initial rise of fuel (causing a vacuum surge) to settle back in the fill pipe. As therein shown, conduit **57** may be restricted to effect a delayed pressure release requiring, for example, one or two seconds between the two extreme positions of spool **33**.

In any event, with the flow-regulating valve or spindle **33** in the position shown in FIG. **2** the fuel can no longer flow through the relatively large passageways afforded by annular groove **38** and its associated conduits but is now restricted to the relatively narrow groove **59** and its tributaries which are so proportioned as to limit the flow to a suitable "topping-off" rate as, for example, 1 or 2 gallons per minute.

Control and routing of the vacuum signal to effect the several steps contemplated by the present invention is accomplished via the passageways or conduits **70** and **71** in the casting **2** supplemented by transfer valve **72** which, in turn, controls conduit **73** leading to the chamber **25** which, in turn, controls the fulcrum lockout plunger **19**.

Transfer valve **72** involves a valve head or tappet **75** and stem **76** normally held in the position shown in FIG. **1** by coil spring **78** and retainer **79**. In this position the transfer valve **72** blocks communications between passageways **71** and **73** so that passageway **71**, which in effect passes through chamber **46**, communicates only with this particular chamber.

As a result, as long as the flow control valve is in its usual or lower full-flow position as shown in FIG. **1**, a vacuum signal set up in conduits **27** and **70** will be transmitted only to chamber **46**, but not to chamber **25**. Hence the first signal corresponding to he initial rise of liquid in the full pipe unlatches only the flow-regulating valve enabling spindle **33** to move to the secondary or relatively low-flow position shown in FIG. **2**.

It is to be specifically noted that in this latter or secondary position the upper face of the diaphragm **50** contacts pin or stem **76**, lifting the transfer valve **72** to the position where communication is effected between conduits **71** and **73**.

This accordingly places the chamber **25**, which controls the fulcrum lockout plunger, in communication with the vacuum signal. Therefore, the second vacuum signal, which follows in response to completion of the "topping-off" operation, is transmitted to chamber **25** to unlatch plunger **19**, lifting fulcrum **15** and dropping lever **14** so that main valve **6** finally closes off.

In operation therefore the operator lifts hand lever **14** to open valve **6**, preferably latching the hand lever in open position by means of a conventional latch. The fuel therefore flows at line pressure through conduit **36** port **35** and the spindle **33** at full flow rates, going thence through check valve **28** into the vehicle tank.

The initial rise of liquid in the filler pipe surrounds the vent, not shown, creating a vacuum surge which, as indicated, is communicated via conduits **70** and **71** to chamber **46**. This retracts latch pin **49**, unlocking spool valve **33** which, after a predetermined time delay, shifts into secondary or restricted-flow position shown in FIG. **2**. At this time a relatively limited stream of fuel proceeds to flow through passageway **59** and associated passageways at a preselected and predetermined "-topping-off" rate.

Also, as previously noted, in the secondary position, a disc that attaches latch pin **49** to diaphragm **50** lifts transfer means **72** against spring **78**, opening communication between conduits **71** and **73** to chamber **25**. As a result, the subsequent or secondary vacuum signal occasioned by the final rise of fluid around the tip of the nozzle spout reaches chamber **25** to unlatch fulcrum plunger **19** and finally shutoff valve **6**.

It may be noted that with the operation thus completed the parts return automatically to the normal or original position shown in FIG. **1**. That is to say, lever **14** by virtue of the jolt or impact of valve release, conventionally becomes unlatched and drops back into the position shown in FIG. **1**. This enables the spring **20** to return the lockout plunger to the position shown in FIG. **1** where the latching mechanism falls into the locked position. At the same time with line pressure relieved, spool valve **33** is returned to its initial position by spring **52** so that its latching mechanism is correspondingly engaged. This, in turn, results in release and accordingly, closure of the transfer valve **72**.

The present invention, therefore, has a number of advantages in respect to simplification of the unit and substantial decrease in its size and weight. For example, the spool valve **33** is materially shortened by the amount otherwise required to control the vacuum signal (as will be apparent from consideration of the aforesaid copending application, D071,258), this latter function being handled by a relatively compact and minute transfer or cutoff valve **72** which is shifted into open position by the spindle valve in its secondary position.

When the flow control spindle valve returns to its normal position the cutoff valve is likewise spring-returned to its closed position.

One particular advantage of shortening the spool valve is that the flow-regulator valve may be disposed within the casting without projecting thereabove thus simplifying the overall construction.

Another important advantage of the present invention involves elimination of one or more O-ring seals on the spool valve, with a substantial reduction in frictional resistance to actuation. Instead a stationary lip seal, preferably teflon coated, contacts the minor outside diameter of the spool valve and seals the dashpot chamber **34**. As noted more particularly in the aforesaid copending application, chamber **34** operates at pressure relieved via restricted passageway **57** into the chamber below diaphragm **50**, which is always vented to atmosphere. This therefore permits delayed action of the spool **33**.

The present invention is obviously not limited to the specific structure, which is shown herein simply for purposes of illustration and exemplification. Thus, for example, means other than a vacuum signal (as for example an electrical signal) may be employed to control the various locking mechanisms. Likewise various other means appropriate to the particular type of control signal may be used to direct the signal to the appropriate control.

Delayed actuation of the flow-regulating valve or spindle described in the aforesaid copending application is, of course, an essential part of the present invention, and by the same token, a similar delay in the operation of the transfer valve means may be advisable to assure that the main control valve will not be prematurely closed during actuation of the flow-regulating valve. This can be accomplished as illustrated in FIG. **2**, with the balls **48** contacting the lower side of the tapered groove of plunger **49**, or by a roll pin horizontally attached to the upper end of the spool valve, sliding in a slot in the plunger **49**, or by balancing the force of spring **78** with respect to the forces acting upwardly on spool **33** to resist opening of the transfer means until a substantial force is applied against stem **76**.

The numeral **80** represents a vent leading to the chamber beneath the diaphragm **50**. A similar vent, not shown, is likewise provided for the chamber below the diaphragm **24**.

I claim:

1. In an automatic dispensing nozzle for supplying liquid fuel and the like to the filler pipe of a fuel tank, which comprises a supply conduit for said liquid and terminates in a filler spout adapted to be received by said filler pipe of said fuel tank, a main control valve in said conduit, releasable means for holding said main control valve in open position, means responsive to a signal caused by the rise of fluid about the filler spout of said nozzle for effecting the cutoff of said main control valve, and a flow-regulating valve in said conduit in series with said main control valve and normally residing in a primary position permitting full flow of said liquid and shiftable in response to such signal to a secondary flow-restricting position wherein said flow-regulating valve limits flow through said conduit to a predetermined relatively low topping rate, the improvement which comprises

signal transfer means normally biased to direct said signal exclusively to effect shifting of said flow-regulating valve from primary to secondary position,

said signal transfer means being actuated by movement of the flow-regulating valve into said secondary position to direct said signal to effect the cutoff of said main control valve.

2. A dispensing nozzle as called for in claim 1 wherein said signal comprises a vacuum impulse and said signal transfer means comprises a transfer valve in a signal conduit leading to said main control valve,

said signal transfer valve residing normally in closed position in which signal communication with said main control valve is cutoff,

and having means impinged by the flow regulating valve in secondary position, to shift said signal transfer valve into open position, in which open signal communication is maintained with said control valve.

3. In an automatic dispensing nozzle for supplying liquid fuel and the like to a fuel tank, which comprises a supply conduit for the liquid and terminates in a filler spout adapted to be received by the filler pipe of said fuel tank, a main control valve in said conduit, releasable means for holding said main control valve in open position, a fuel flow-regulating valve in said conduit normally residing in a primary position which permits full-flow of said liquid, and shiftable to a secondary flow-restricting position wherein said flow through said conduit is restricted to a predetermined, low, topping rate, the improvement which comprises

means creating a vacuum signal in response to the rise of fluid about the filler spout of said nozzle,

a signal transfer member normally biased to direct said signal exclusively to control the shift of said flow-regulating valve from said primary to said secondary position, said signal transfer member being actuated by movement of said flow-regulating valve into said secondary position to direct said vacuum signal to effect closure of said main control valve.

4. An automatic dispensing nozzle as defined in claim 3 comprising,

a vacuum signal conduit for controlling the shift of said flow-regulating valve to said second flow-restricting position,

an additional vacuum signal conduit for controlling closure of said main control valve,

said signal transfer member being located in said last named conduit.

5. An automatic dispensing nozzle as defined in claim 4 wherein said signal transfer member is normally biased to close said last named vacuum signal conduit

and has a portion contacted by said flow-regulating valve in its secondary position to open said vacuum signal conduit.

6. An automatic dispensing nozzle as called for in claim 3 wherein conduit means is provided to direct said vacuum signal to control said main control valve and said flow-regulating valve and wherein said signal transfer member comprises a signal cutoff valve located in said conduit means leading to the main control valve,

said signal cutoff valve normally biased to closed position, and

said signal cutoff valve being provided with actuating means contacted by said flow-regulating valve in secondary position to open said signal cutoff valve and thereby permit said vacuum signal to close the main control valve.

7. An automatic dispensing nozzle as defined in claim 6 wherein signal cutoff valve is provided with a stem which is actuated by the flow-regulating valve in its secondary position to open said signal cutoff valve.