Aug. 20, 1963 W. S. GEARHART ET AL 3,101,101

SYSTEM AND MECHANISM FOR DISPENSING FLUIDS

Filed July 31, 1961 2 Sheets-Sheet 1

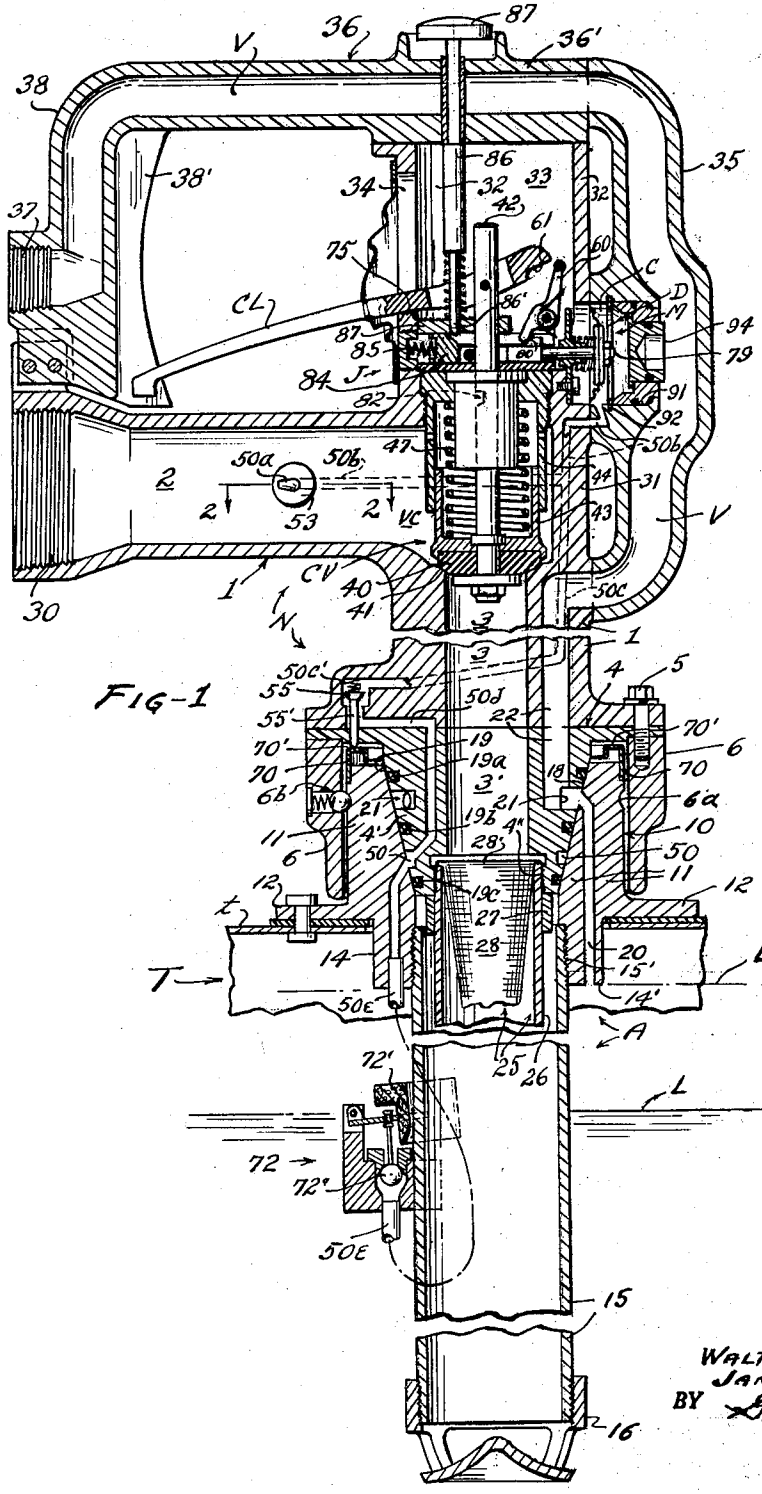


FIG-1

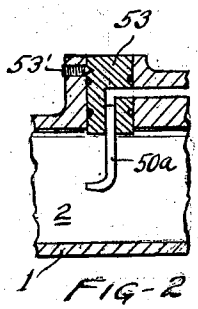


FIG-2

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SYSTEM AND MECHANISM FOR DISPENSING FLUIDS

Filed July 31, 1961 2 Sheets-Sheet 2

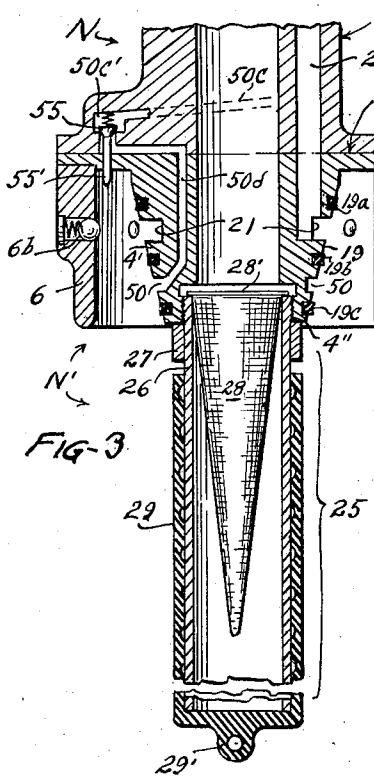


FIG-3

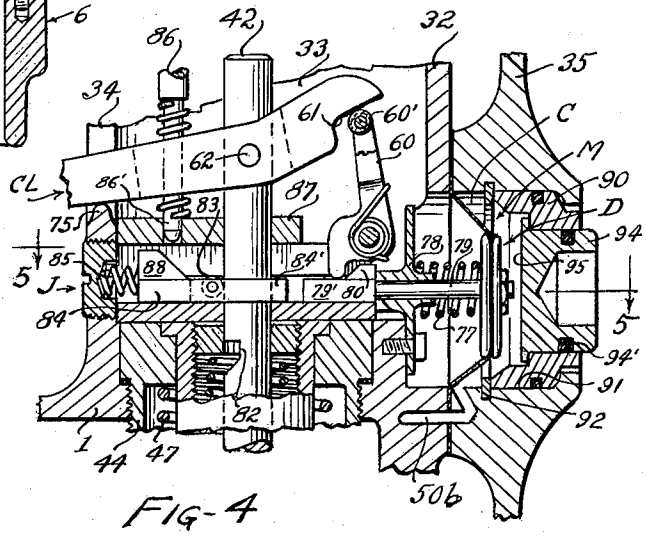


FIG-4

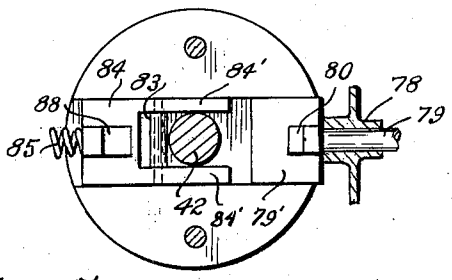


FIG-5

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Patented Aug. 20, 1963

3,101,101
SYSTEM AND MECHANISM FOR DISPENSING FLUIDS

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7 Claims. (Cl. 141—207)

This invention relates to an improved liquid dispensing system and mechanism or unit by the use of which for example highly volatile liquids such as fuel for internal combustion engines can be very quickly and safely transferred as from a distribution or main supply tank into the fuel tanks of various motor vehicles. Such system and mechanism designed for closed pressure operation (explained presently) are disclosed by our application Serial No. 123,385 filed July 6, 1961 entitled, Closed Pressure System for Dispensing Fluids.

High flow rate or range of fuel feeding or the term "high flow" as used herein signify flow on the order of 100 gallons per minute (g.p.m.), more or less; and "low flow" or low flow range will be taken to mean from zero to for instance 20 g.p.m. or whatever under practical environmental circumstances would or could be considered safe for filling open fuel tanks or drums. "Universal" as applied to the fuel dispensing mechanism hereof means apparatus usable interchangeably for high flow closed pressure fueling operation and low flow open vent fueling operating. Closed pressure (dispensing or refueling operations) means that the dispensing nozzle of the system during high flow rate fuel feeding operation is sealed to a receiving neck or filler adapter of the tank or container to be filled, and has suitable provision safely to carry to or toward an appropriate disposal point or region vapor displaced from the tank or container by the incoming fuel. Disposal of vapor is preferably accomplished by conduction thereof partly through the nozzle unit to the main supply tank.

The present improvement, indicating one object of the invention, provides certain new features relating to a closed pressure fueling system or mechanism but principally renders a nozzle unit designed for use effectually in closed pressure high flow rate fueling operations usable with complete safety (i.e., without requiring precautionary measures or conversion adjustments or settings by or for the operator) to dispense the fuel at low flow rates into completely open containers or so called "open-vented" fuel tanks of vehicles (as of conventional automobiles). In the absence of automatically operating, built-in safeguarding means (provided hereby) such as will prevent use of the nozzle unit for high flow dispensing of fuel into (e.g.) small capacity open vented tanks or drums, the unit would manifestly, for numerous well understood reasons, be too hazardous to associated persons and property to permit its practical use.

Other objects involve provision of a fueling system and apparatus operable optionally for open vent type and closed pressure type filling and having improved means reliably preventing a fuel dispensing nozzle thereof from operating to deliver fuel until but permitting delivery when the nozzle is in proper mechanical relationship to the container or tank to be charged; a simplified and quickly operable detent means for retaining a nozzle component demountably on a filler adapter component of the system; a nozzle unit having an effectual means for progressively venting vapor from the fuel-receiving tank therethrough to any desired safe disposition point or region; an emergency or secondary shutdown device operated as a function of predetermined rise in pressure in a vented-vapor-conveying passage of the nozzle communicating with the tank or container, through its filling opening, and other

novel positive and above-atmospheric pressure-operated safety shutdown features as will be explained.

Another object is to provide, in a fuel dispensing system and apparatus arranged for use interchangeably for closed pressure, high flow operations and low flow, open vent type filling operations, an improved fluid-motor-operated valve trip or shutdown mechanism responsive to a suitable signal or condition requiring shutdown, wherein the motor operating force is supplied by the positive pressure of incoming fuel in a region upstream from the main or control valve as distinguished from the conventional vacuum responsive shutdown systems which, in practice, are limited to small signal and operating pressure forces. As illustrated herewith the motor operating force is supplied as a total pressure function, e.g., static pressure plus velocity head on part of incoming fuel.

Objects of the present invention not indicated by the above discussion will be brought out in the following description of a preferred form of unit apparatus assembly as shown in the drawings. The essential characteristics are summarized in the claims.

In the drawings FIG. 1 is a fragmentary, partly schematic central sectional assembly view of a nozzle unit N and adapter unit A, constituting the dispensing constitutents or components of a closed pressure refueling apparatus F for application to or use upon a vehicle fuel tank T.

FIG. 2 is a fragmentary sectional view as indicated at 2—2 on FIG. 1, showing a positive pressure pickup device of the preferred primary shutdown control circuit hereof.

FIG. 3 is a fragmentary sectional view partially duplicating and partially complementing FIG. 1 in showing the outlet or discharge portion N′ of the nozzle unit N as arranged solely for open vent type fuel dispensing.

FIG. 4 is an enlarged fragmentary detail view of a latching and tripping mechanism J of the main or control valve CV of FIG. 1.

FIG. 5 is a sectional detail plan view taken approximately as indicated at 5—5 in FIG. 4. FIGS. 4 and 5 are double scale (e.g., life size) in relation to other views.

FIG. 1 shows the combined unit or general assembly F comprising, on the one hand, nozzle body member 1 including a main inlet passage 2 leading to the valve chamber VC and a main outlet passage 3 leading downwardly from the valve chamber partly through a separate generally conical body section or outlet fitting 4 tightly secured to the body section 1 and whose main bore is marked for identification 3′. Around the body section or fitting 4 and peripherally spaced outwardly from the conical nose portion 4′ is a tubular nozzle-piloting skirt or sleeve section 6. The outlet portion of body 1, section 4 thereof and the sleeve 6, are secured rigidly together in coaxial relationship as by series of screws 5, one being shown. The screws pass, for example, through flange portions of the parts 1 and 4 into threaded openings of the mounting sleeve 6. For convenience, i.e., reference purposes only, the assembly F will be described as though its principal components extend vertically in use. Also, for convenience, valve mechanisms will usually or sometimes be identified by reference only to their movable (e.g., plug) portions (as against plug, port and seat assemblies).

The adapter assembly A, secured as will be evident, to the top wall *t* of tank T comprises as shown a head or neck member 10 of generally tubular and flanged construction, having a rigid top wall portion 11, flange portion 12 and vapor vent skirt portion 14 which latter extends a short distance downwardly inside the tank or beyond the top wall *t* thereof. The adapter assembly A is completed principally by an appropriately selected length standpipe or filler tube 15 connected as by screw threads 15′ inside the vapor vent skirt portion 14. Thus the tube 15 discharges fuel received from the nozzle unit

N deeply into the tank or near the bottom, preferably through a splitter or splash deflector 16 of known or suitable form to minimize frothing during rapid rate or high flow filling of the tank.

The peripheral interior of the thick wall upper tubular portion 11 of the adapter section 10 is frusto conical as at 18, i.e., approximately complementary to the external frusto conical surface 19 of the nose portion 4' of the nozzle unit. A fairly large plurality of generally vertical passages 20, one shown, intersect the lower surface 14' of the skirt 14 and the internal frusto conical surface 18 of adapter member 10; and the passages, via a peripheral collector groove 21 around the nose portion 4', connect an axial passage 22 formed principally in body section 1 with an unrestricted vapor vent passage V formed in or continued through various components of the nozzle unit N as will be described later.

As shown by comparison of FIGS. 1 and 3 the nose portion 4' of outlets fitting 4 carries, as at internal screw threads 4'', a filler tube or spout and filter screen assembly 25, (partially shown in FIG. 1), comprising a tube 26 open at both ends, a manipulating sleeve 27 rigid with the tube 26 and a filter screen 28 supported as by a circular flange portion 28' of the screen resting on the top of the tube 26. The spout assembly 25 prior to use of the system to fill a tank or container includes a guard cap 29 (FIG. 3) of suitable construction shown with an eyelet portion 29' at its lower end for attachment to the nozzle unit N as by a suitable chain or cable not shown.

The main body section 1 of the nozzle unit N, as shown in FIG. 1, has an enlarged internally threaded portion 30 somewhat larger than the main portion of the inlet passage 2 and which (though not illustrated) receives a suitable fitting for connection to a fuel supply hose. At the inner end of the inlet passage 2 and around the control valve mechanism a vertical tubular wall portion 31 forms the principal portion of the valve chamber VC and is continued upwardly as at 32 to provide a generally cylindrical space 33 above the valve chamber intersected by a vertically extended slot or window 34. Circular space 33 contains portions of the nozzle control valve mechanism including means to prevent opening of the control valve CV more than a limited predetermined amount when the nozzle unit is dissociated from the adapter unit A or in case the nozzle unit is improperly placed upon the adapter assembly in preparation for closed pressure fueling operations or is lifted out of properly placed position during closed pressure fueling.

A portion of the vent passage V adjacent to the vertical passage 22 of the main body is contained in a hollow casting 35 having a generally U-shaped contour as exhibited in FIG. 1, being secured to the main body 1 by appropriate means for continuing the vent passage V to and through a combined cap and handle or carrier section 36 detachably secured to body 1 and section 35. A cap portion 36' of member 36 closes the top of circular space 33 in the tubular portion 32 and leads to a threaded portion 37 in a tubular portion 38 of the handle section 36 which includes a channel-like guide 38' (partially shown) for a control lever CL described later.

The two threaded connections 30 and 37 shown at the left in FIG. 1 provide for parallel disposition of flexible tubes (not shown) such as the well known siamese type construction as described in our prior application, particularly if air or fumes from the tank or container T are to be conveyed to the fuel supply source.

The control valve or valve assembly CV has a plug member 40 preferably of yieldable material shown in FIG. 1 as closed against a generally conical seat 41 defining part of the bottom of the valve chamber VC. As in our prior application the plug 40 is supported on a valve stem and head assembly which includes a stem member 42 and a dash pot piston 43 cooperating with a dash pot cylinder 44 and containing a seal assembly (not shown) around the stem member very much as in our previous application. A loading spring 47 acts oppositely against the dash pot members 43 and 44 normally to maintain the valve plug 40 closed against the seat 41.

As in our previous application the present refueling apparatus F comprising the detachably associable nozzle unit N and adapter unit A contains passages constituting two open fluid circuits, respectively of and for primary and secondary shutdown mechanisms. The passages constituting each of the circuits are formed in part in the nozzle unit N and in part in the adapter unit A. Two pairs of sealing rings, preferably quad rings for long wear and maintenance of mounted position, isolate the passages from each other at the juncture or mating portions of the two units.

The pair of seal rings 19*a* and 19*b* as will be evident from comparison of FIGS. 1 and 3 isolate the vapor vent passages 20 and 22 from signal transmitting fuel transfer groove 50 around the nozzle body nose portion 4' below which is a similar seal ring 19*c*. The illustrated fairly wide angle of convergence or taper of the mating frusto conical surfaces of the nozzle and adapter minimizes sliding of the seal rings against the associated adapter surfaces during mounting and dismounting of the nozzle unit in respect to the adapter head portion 11. When the mating nozzle and adapter components are in their relationship illustrated in FIG. 1 those components can for example be detachably secured together by a spring loaded ball detent means which as shown includes a peripheral groove 6*a* around the tubular head portions 11 of the adapter and a plurality of spring loaded detent balls 6*b* in the mounting sleeve 6, one ball and spring unit of several detent assemblies being shown.

In common with our previous application the present system includes a positive pressure pickup (Pitot) tube 50*a* FIGS. 1 and 2 preferably having its upstream-directed inlet centrally of the nozzle body inlet passage 2 or at an inlet passage region of low turbulence. The Pitot tube 50*a* is shown as supported on an easily replaceable cartridge type mounting 53 secured to the body 1 as by a set screw 53' as shown in FIG. 2. The effective positive pressure fluid pickup inlet (in tube 50*a*) leads through a channel 50*b* FIG. 1 to a fluid motor M comprising a pressure chamber C FIGS. 1 and 4 defined in part by a flexible diaphragm and connected motor output assembly D described later.

The branch 50*c* of the positive pressure pickup passage portion 50*b* leads to a conditioner valve chamber 50*c'*, shown schematically and about 160° out of actual position counterclockwise if the nozzle unit is viewed from above it, as occupying the base or flange supporting portion of the main body 1. The outlet port of the conditioner valve chamber 50*c'* (see FIG. 3) is normally closed by a spring loaded poppet type valve 55 having a stem 55' in a suitable guide bore on the nozzle unit. The axis of operation of the conditioner valve stem 55' is shown generally parallel to that of the outlet passage 3,3' of the nozzle unit main body hence to the working axis of the control valve CV. During open vent type fuel feeding operations and whenever static supply pressure of fuel is established in the main valve body inlet 2 around the closed control valve CV (assuming no flow can occur in branch passage 50*c* for any reason) the diaphragm of motor M is exposed approximately to supply pressure in the chamber C through the passage 50*b*. Such pressure moves the motor output assembly D to the left or as shown in FIG. 1.

The diaphragm motor M operates through suitable means essentially as shown in our previous application to move a fulcrum establishing lever 60 out of range of an associated end surface portion 61 of the control valve lever CL shown as pivoted at 62 to the valve stem 42. Under the motor pressure condition just above mentioned (i.e., fulcrum establishing lever 60 as in FIG. 1) full range upward movement of the control lever CL from its illus-

trated position to a position in which the lever will abut for example the handhold portion 36 of the nozzle unit N will be ineffective to open the control valve CV. However low flow control rate opening of the control valve is made possible by provision of a secondary fulcrum for the control valve lever as will be described later.

During the closed pressure fueling operations as primarily represented by FIG. 1 the conditioner valve chamber 50c' is maintained in constant communication with fluid passage portion 50d formed in or between the nose portions of the nozzle and leading to the transfer groove 50 described above. The stem 55' of the conditioner valve plug is suitably guided for movement generally parallel to the longitudinal axis of the nozzle outlet or discharge passages 3 and 3' and when the nose portion 4' of the nozzle is in its FIG. 1—illustrated position in the adapter head 10 of the valve stem 55' makes contact with and is lifted by continuously annular or uninterrupted surfaces of the adapter assembly such as may be formed for example as at 70' on a mounting ring 70 for a two-way-vented closure cap (not shown) and which is suitably locked in protecting or generally covering relationship to the adapter throat after completion of the closed pressure filling operation. With the illustrated sealing arrangement including the conditioner valve and associated operating means for it as described the nozzle unit N can be applied to the adapter head or neck 10 in any relatively turned position of the nozzle and adapter units (through 360 degrees) about the axis of the adapter head or neck portion 10.

With the conditioner valve 55 open as in FIG. 1 the positive pressure passages 50c and 50d are in communication and passage 50d, via the peripheral groove 50 of nose portion 4', leads to a tube 50e of a tank-fuel-level-responsive valve mechanism 72 supported as on the filler tube 15 and having a float 72' whose mass, while the tank is being filled, holds a spherical plug 72'' off its seat at the outlet of tube 50e and, when the fuel level L, FIG. 1, has attained the illustrated position, causes the plug to close the tube 50e as illustrated. That causes the control valve latch mechanism to be tripped as will be explained.

In the operation of the control valve CV and its latching mechanism as shown in FIGS. 1, 4 and 5 as for low flow open vent type filling it will be assumed first that the conditioner valve plug 55 is seated to close passage 50d from communication with the branch passage 50c of body 1, or as shown in FIG. 3, thus assuring substantial positive pressure of fuel in motor chamber C as is accomplished in FIG. 1 by the closed condition of float valve 72. The operator or attendant can now open the control valve CV manually a small amount, for example to establish a maximum of a .100 inch gap between the plug 40 and seat 41 by swinging the free end of the control valve lever CL downwardly or in a counterclockwise direction about a second fulcrum shown as established by a rounded formation 75 FIGS. 1 and 4 of the main body 1 at the lower end of the lever-receiving slot 34. Such opening movement of the control lever may be limited by any suitable stop such for example as a set screw (not shown) on or engaging the free end portion of the control lever which is more or less concealed by the channel-defining walls of the guide 38' or so as not to encourage unauthorized change of preset adjustment.

Assuming the spout cap 29 FIG. 3 has been removed and that the spout 26 is inserted into an open container, the attendant cannot possibly increase the flow rate of the nozzle unit N beyond a predetermined safe limit.

For closed pressure operation (in common with the disclosure of our earlier application), assume (*a*) that the nozzle unit N is properly mounted on the adapter assembly A as in FIG. 1 so that the plug 55 of the conditioner valve CV is open and (*b*) that the tank level responsive or float valve 72 is open. There will then be negligible pressure in the diaphragm motor chamber C. Thereby a spring 77 reacting at one end on a guide bushing 78 for a latch releasing rod 79 and at its opposite end on the diaphragm assembly D will hold a cam 80 on the latch releasing rod 79 out of operating contact with the fulcrum-establishing lever 60. As shown in FIG. 4, a roller 60' on the lever 60 is in position pivotally to support the associated end of the control lever CL as a fulcrum and allow the control valve stem 42 to be lifted for high flow fuel feeding operation. As best shown in FIG. 4 the valve stem 42 has a notch 82 engageable as by a roller 83 mounted on a slidable latch block 84 which is spring loaded as at 85 for movement of the roller 83 into latching engagement with the notch 82.

As also more fully described in our prior application the latch yoke 84 can at any time (overridingly) be released or tripped manually independently of the existence or non-existence of pressure in the motor chamber C. For manual release an upwardly spring biased stem or rod 86 connected to an externally exposed manual release button 87 FIG. 1 has its lower end portion 86' guided in a bearing block or yoke guide cap 87 and is thereby positioned for engagement with a cam 88 on the latch yoke 84 to withdraw the roller 83 from the notch 82 and permit the control valve to be closed by its loading spring 47. The latch member 84 has a pair of yoke arms 84' (FIG. 5) straddling the control valve stem 42 for abutment by a head portion 79' of the motor-connected rod 79 whereby when substantial pressure occurs in the diaphragm chamber C, and the control lever CL is disabled for high flow control operation, the same fulcrum disestablishing operation of the diaphragm motor output assembly D described earlier will disengage the roller 83 from the notch 82 or in other words will trip the latch 84 and initiate closing of the control valve.

As best shown in FIG. 4 the rightward wall of the diaphragm chamber C is formed in part by an annular plug 90 which constitutes a piston cylinder sealed around a bore 91 in the vent conduit section 35 and maintained in fixed position as by snap ring 92 in said section. The annular-cylinder-constituting plug 90 slidably guides a piston 94 exposed in the vapor vent passage V and having an end face 95 in close proximity to the adjacent end of the diaphragm-connected stem 79 when the diaphragm assembly D is as far to the right as it will go and when the piston 94 is in the FIG. 4-illustrated stopped position. Piston 94 preferably has a quad ring seal 94'. If for any of the reasons explained more fully in our prior application, (e.g., plugging of the vent passage V or the vapor disposal hose connected to it or the occurrence of dangerously high pressure to the tank T or emission of liquid fuel therefrom to the vapor-vent-passage-exposed portion of the piston 94) said piston 94 then acts as a secondary or emergency shutdown-operated motor to cause tripping movement of the latch yoke 84, hence closing of the control valve CV, assuming of course that the control valve has been latched in its high-flow-rate-determining position.

In case the fuel-level-responsive or float valve 72 fails to function and the fuel level in the tank T rises upwardly beyond the illustrated position L FIG. 1 (as to L') air will then be trapped in the top of the tank by the vent skirt portion 14 of the adapter head, and (assuming the malfunctioning of the float valve persists) fuel will enter the vent passage V and rise in pressure thereof will move the piston 94.

We claim:

1. A liquid dispensing nozzle unit comprising a body formed with an inlet passage and an outlet passage, said passages intercommunicating via a valve chamber, a self closing valve movable in the valve chamber between a closed position and at least two open positions, a manually operable control lever pivotally connected to the valve, and two fulcrum members for the lever, one of the fulcrum members being movable into and out of a position enabling it to contact with and establish a pivotal support for the lever, spring means connected to said one ful-

crum member for biasing it into fulcrum-establishing position, means connected to said one fulcrum member and operating thereon as a function of admission of liquid under a predetermined pressure to the inlet passage to move it out of said position and render the lever inoperable to open the valve, the other fulcrum member being arranged to enable only a predetermined limited maximum opening movement of the valve.

2. A liquid dispensing nozzle unit comprising a body formed with an inlet passage and an outlet passage, said passages intercommunicating via a valve chamber, a self closing valve movable in the valve chamber between a closed position and two open positions, one enabling low flow and the other high flow of liquid through the body, a manually operable control lever operatingly connected to the valve, a fulcrum member for the lever fixed to the body and arranged to allow low-flow-enabling movement of the valve by swinging movement of the lever about the fulcrum member, another fulcrum member for the lever movable on the body from a neutral position relative to the lever to an active position relative thereto for allowing movement of the valve by the lever to high-flow-enabling position, and means connected to the movable fulcrum and operating as a function of admission of liquid under a predetermined pressure to the inlet passage to move the fulcrum to its neutral position.

3. A liquid dispensing nozzle unit comprising a body formed with an inlet passage and an outlet passage, said passages intercommunicating via a valve chamber, a self closing valve movable in the valve chamber between a closed position and two open positions respectively allowing low flow and high flow of liquid through the body, a manually operable control lever pivotally connected intermediately of its ends to the valve, a fulcrum member for the lever fixed to the body for allowing low-flow-enabling opening movement of the valve by the lever, another fulcrum for the lever movably supported on the body for allowing high-flow-enabling movement of the valve by the lever, and means operating as a function of admission of liquid under a predetermined pressure to the inlet passage and connected to move said other fulcrum to a position to render the lever incapable of opening the valve.

4. A liquid dispensing nozzle unit comprising a body formed with an inlet passage and an outlet passage, said passages intercommunicating via a valve chamber, a self closing valve movable in the valve chamber between a closed position and two open positions, one a maximum low flow position and the other a high flow position, a manually operable control lever pivotally connected intermediately of its ends to the valve, means operable as a function of admission of liquid under a predetermined pressure to the inlet passage and while the valve is closed to render the lever inoperable to open the valve farther than said maximum low flow position, the lever being movable in opposite directions about the pivotal connection from a zero-flow-establishing position in order to move the valve to respective low flow and high flow positions.

5. A liquid dispensing nozzle unit comprising a body formed with an inlet passage and an outlet passage, said passages intercommunicating via a valve chamber, a self closing valve movable in the valve chamber between a closed position and at least two open positions, a manually operable control lever pivotally connected between its ends to the valve, two fulcrum members disposed at opposite sides of said pivotal connection along the lever, fluid pressure responsive means connected to one fulcrum member and operating thereon as a function of admission of liquid under a predetermined pressure to the inlet passage to move said one fulcrum member out of range of the lever thereby to render it incapable of opening the valve, the other fulcrum being operatively associated with the lever so as to enable only a predetermined limited angular movement of the lever in a direction to open the valve.

6. In combination with a filling nozzle unit of the type described having a nose portion of circular cross section, a tank adapter having a receiving throat portion operatingly mating the nose portion of the nozzle, a control valve on the nozzle manually operable to low flow enabling and high flow enabling open positions and having automatically operating latching means to hold the valve in high flow enabling open position, a fluid motor operatingly connected to the latching means to trip it, a supply source of pressure fluid for the motor, a passage connecting said source and a pressure chamber of the motor, a branch passage communicating the motor with a peripheral groove around the nose portion and having an outlet leading through the adapter unit to a fuel-level-responsive normally open signal valve, and a conditioner valve plug movable in said branch passage in a direction generally parallel to the movement of the control valve, said conditioner valve being spring loaded to a closed position so as to shut off the branch passage when the nozzle unit and adapter unit are separated or the nozzle unit is being used for low flow operation, the interior of the adapter having a releasing surface exposed axially of its throat for operation to open the conditioner valve when the nose portion of the nozzle enters the adapter throat to a predetermined position.

7. A fuel dispensing nozzle unit comprising a body formed with an inlet passage and an outlet passage, said passages intercommunicating via a valve chamber, a self closing valve movable in the valve chamber between a closed position and two open positions, one enabling low flow and the other high flow of fuel through the body, manual control means operatingly connected to the valve, to open it to its two positions, a tubular discharge nose portion of the body being arranged selectively to cooperate sealingly with a mating adapter portion of a receiving container during high flow operation of the nozzle unit and non-sealingly with a container for low flow operation, a fuel supply pressure operated safety system for disabling the manual control means when the nose portion cooperates non-sealingly with a receiving container, said safety system comprising a fuel pressure pickup in the inlet passage, a fluid motor connected to the pickup and arranged to render the manual control means inoperable to open the valve to high flow position, and a normally closed conditioner valve adapted to be opened by cooperation of the nose portion and such adapter whereby to spill fuel en route from the pickup to the motor.

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