Aug. 20, 1963 W. S. GEARHART ET AL 3,101,102

CLOSED PRESSURE SYSTEM DISPENSING FLUIDS

Filed July 6, 1961 2 Sheets-Sheet 1

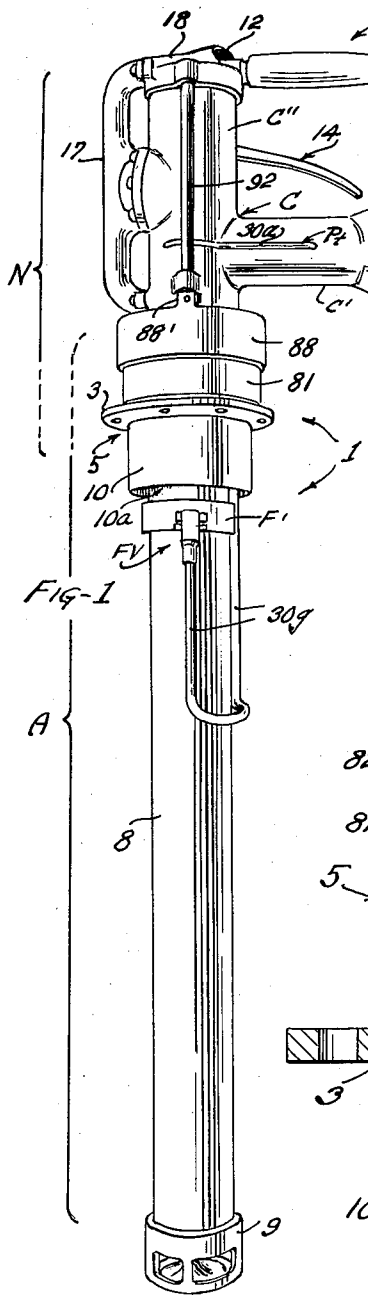


FIG-1

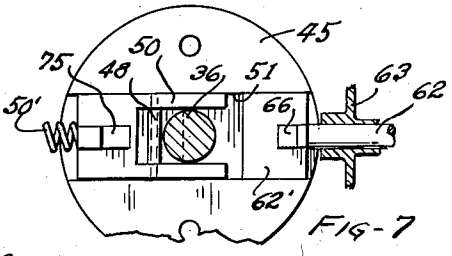


FIG-7

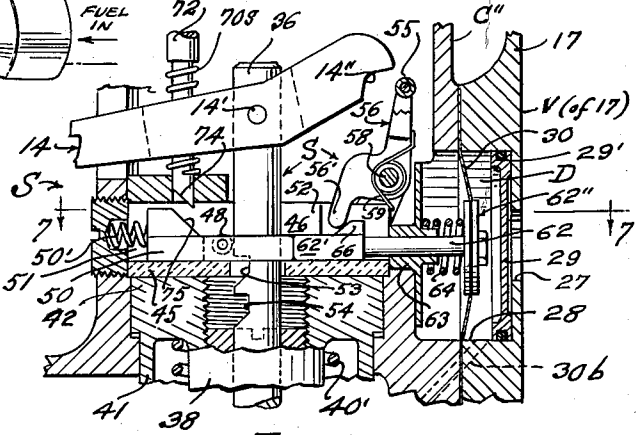


FIG-6

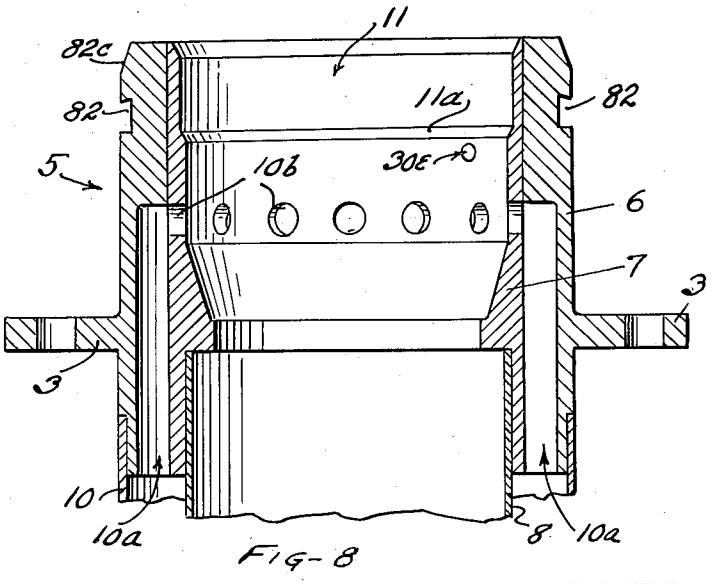


FIG-8

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CLOSED PRESSURE SYSTEM DISPENSING FLUIDS

Filed July 6, 1961 2 Sheets-Sheet 2

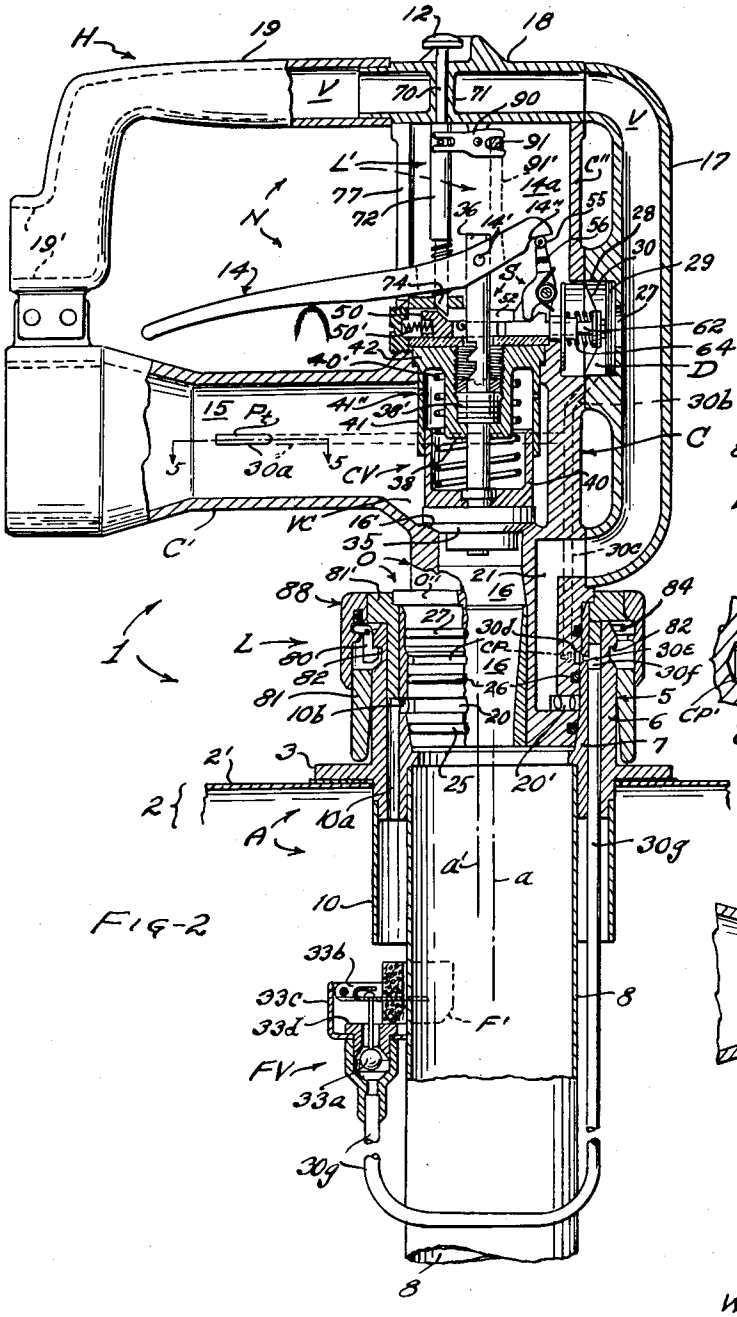


FIG-2

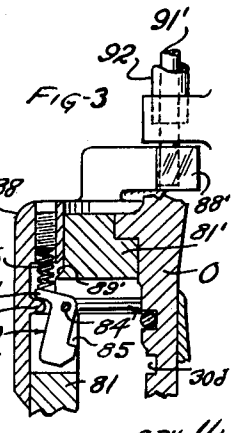


FIG-3

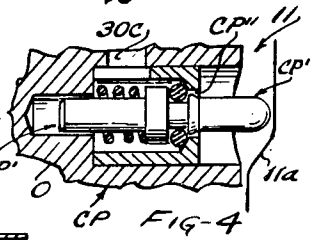


FIG-4

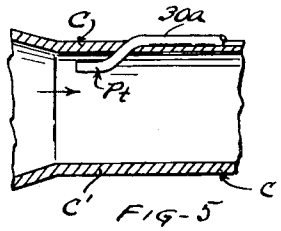


FIG-5

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United States Patent Office 3,101,102 Patented Aug. 20, 1963

3,101,102
CLOSED PRESSURE SYSTEM FOR DISPENSING FLUIDS

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Filed July 6, 1961, Ser. No. 123,385
15 Claims. (Cl. 141—209)

This invention relates principally to an improved liquid dispensing system and mechanism assembly adapted especially for safely filling or charging containers such as the fuel tanks of military and other vehicles with liquid (especially high volatile) fuels and at selectable rates of flow over an appropriately large range.

The invention provides significant improvements in a manually initiated and thereafter automatically controlled liquid dispensing nozzle and cooperating (e.g., tank adapter) equipment, designed especially for closed pressure high rate recharging of vehicle fuel tanks, an object being to enable economization in filling time while providing means for effecting rapid and reliable shutdown control of flow through the nozzle in response to one or more conditions such as are certain to obtain when the receiving container or tank has been adequately filled or when the filling operation should cease or be modified for other critically important reasons.

A further object is to provide, especially in a fuel dispensing system having a self-closing dispensing or control valve, a fluid-motor-operated 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.

In a closed pressure fuel filling system such as will enable rapid recharging of fuel tanks on military and other vehicles, failure of any primary automatic shutdown mechanism, (e.g., float-valve-operated, fuel-level-responsive) can be extremely hazardous to attendant personnel and associated fuel storage or receiving containers because the customary outward pressure relief valve equipment thereof would not be designed with sufficient liquid discharge capacity or area safely to accommodate the final stage of a high rate filling operation if subjected directly to rapidly rising pressure transmitted to the relief valve equipment via incompressible, i.e. liquid, fuel. A further object of the present invention is to provide, as an adjunct to a suitable automatic fuel nozzle control valve mechanism, an emergency pressure-operated control valve shutdown producing mechanism in the fuel dispensing nozzle unit and which operates independently of fuel level in the receiving tank or container when pressure in that tank or container reaches a critically or dangerously high point.

A further object is to provide a closed pressure fueling system including a nozzle unit and tank adapter unit detachably secured together by conveniently operable manually releasable latching means, the system including a primary automatic nozzle control valve shutoff mechanism, wherein the manual latch releasing means is connected to operate the control valve in a manner to override the automatic shutoff mechanism and being so arranged as to insure discontinuance of fuel feeding through the nozzle whenever the latching means is released and, concomitantly, to prevent fuel flow through the nozzle in case the nozzle and adapter units are not

properly mechanically connected to each other preparatory to any attempted fueling operation.

Other objects involve provision of a closed pressure fueling system 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 (e.g., sealed and latched) to the container or tank to be charged; a rugged and dependable quickly operable means for latching a nozzle component to 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.

Other objects and novel features will become apparent from the following description of the preferred form as shown in the drawings. The essential characteristics are summarized in the claims.

In the drawings FIG. 1 is a perspective view of a filler nozzle unit N and an adapter unit A hereof in operating relationship to each other.

FIG. 2 is a fragmentary assembly view, principally in central longituidnal section, showing the two units of FIG. 1 as coupled together for closed pressure fuel dispensing and showing a top portion of a tank to be filled.

FIG. 3 is a fragmentary enlarged (actually full scale) view of a portion of a quick releasable latch mechanism in condition enabling detachment of the nozzle unit from the filler adapter assembly.

FIG. 4 is a greatly enlarged detail fragmentary central sectional view of a valve device which operates to assure proper operative association of the nozzle and adapter units before the nozzle can be operated.

FIG. 5 is a detail sectional view of a total pressure pickup portion of the shutdown control system.

FIG. 6 is an enlarged detail view corresponding to a portion of FIG. 2 showing the preferred control valve latching and trip mechanism.

FIG. 7 is a fragmentary detail plan view taken as indicated at 7—7 on FIG. 6.

FIG. 8 is a full scale fragmentary central sectional view of a filler adapter unit as shown in half scale in FIG. 2.

ILLUSTRATED MECHANISM

(*General*)

The present system and mechanism embodiment as shown in FIGS. 1 and 2 (nozzle and filler pipe assembly 1 comprising demountably interconnected nozzle or nozzle valve unit or assembly N and a tank-supported filling adapter unit or assembly A) appear as arranged for rapid rate, sealed or "closed-pressure" charging or refilling of military and other vehicle fuel tanks. The tank 2, represented in FIG. 2 only for reference purposes by the top wall portion 2' thereof, can be any container to be charged with fuel or other liquid apt to produce dangerous or undesirable vapor.

TANK ADAPTER

The tank adapter assembly A is sealingly mounted on the tank 2 as at a flange 3 of adapter unit 5 (hereinafter usually adapter) which unit, as best shown in FIG. 8, includes suitably integrated outer and inner sleeve components 6 and 7. Adapter assembly A further includes a suitable length stand pipe or filler tube 8 attached and

sealed to the inner sleeve component 7 and which discharges fuel received from the nozzle unit N deep into the tank or near its bottom, preferably through a splitter or diffuser unit 9 of already known construction to prevent or minimize frothing during the desirably rapid or high rate closed pressure charging of the tank. Axially short tube 10, secured and sealed to the outer adapter sleeve component 6, will be hereinafter referred to as a vent skirt because, as normally practiced, all air or vapor leaving the tank 2 during the fuel-filling operation must pass therethrough (no other vent).

The usual or conventional vapor-venting means for the tank, prior to performance of the fueling operation by the present subject equipment, is or would be supported on a cap device, not shown, covering the top opening or neck of the adapter 5 during normal operation of the vehicle. The preferred cap device is made as disclosed in a copending application of Michael M. Palm, Serial No.123,977 filed July 12, 1961, entitled, fuel tank cap.

A circular downwardly open space 10*a* (FIG. 8) between adapter parts 6 and 7 leads to a series of radial openings 10*b* through the inner adapter part 7 to form a substantially unrestricted, adapter-associated vent passage for connection with a communicating, similarly unrestricted vent passages V in the nozzle unit as will be described later.

NOZZLE OR CONTROL VALVE UNIT N

(*General*)

Nozzle or nozzle assembly N, as shown in FIGS. 1 and 2, comprises a main or control valve body or frame section C having a main tubular inlet passage portion C' (shown as though horizontal) and, integral therewith, a tubular portion C'' incorporating an outlet or nose portion O, (shown as though vertical). Nose portion O enters and is peripherally sealed, as will be explained, to the upwardly open interior space or throat surface portion 11 of the adapter 5 (FIG. 8) during the refueling operation.

The vertical outlet or nose portion O of the nozzle N (FIG. 2), upon being inserted into the throat 11 of adapted unit 5, or as shown by FIGS. 1 and 2, is mechanically retained therein by a readily releasable spring loaded latch mechanism L (FIGS. 2 and 3) operable manually for quick release and detachment (as at termination of the filling operation) by a push-button-connected release rod and lever linkage L' (FIG. 2). The push-button 12 of the linkage L' is located on a handhold portion H of the nozzle unit or assembly N above the fuel inlet portion C' and above a manual control valve operating lever 14 which occupies a generally rectangular region guarding the lever and projects into an upper generally closed cavity or chamber portion 14*a* (FIG. 2) of a vertical tubular formation C'' of the main housing section C.

The control valve lever 14 is arranged to enable manual opening of a self-closing, fuel metering or control valve assembly CV, FIG. 2, within a valve chamber VC formed in the lower part of the tubular formation C''.

The readily detachable coupling latch mechanism L; control valve mechanism CV, and the push-button operated linkage L' will be hereinafter more full described, but at this point it may be noted that when the manual release button 12 is depressed to cause tripping of the control valve CV to terminate fuel feeding a series of radially inwardly extending spring loaded latch pawls 80 of mechanism L, FIGS. 2 and 3, are caused to disengage a peripheral locking slot 82 (FIG. 8) with which the pawls have previously been engaged or suggested at the left in FIG. 2, one only of a circumferential series of latch pawls being shown.

A fuel inlet passage 15 of the body portion C', connected to a supply hose such as diagrammatically indicated at 15'' in FIG. 1, contains the valve chamber VC,

which communicates with a vertical outlet passage 16, FIG. 2, in the nose or outlet or discharge portion O of the nozzle. The longitudinal axis *a'* of fuel outlet or discharge passage 16, which as shown in FIG. 2 leads downwardly from a conventionally tapered valve seat 16' to a downwardly somewhat convergent choke portion 16'' of the passage, is eccentric to the axis *a* of the nose portion O for the sake of accommodating a substantially unrestricted vapor vent passage portion 21 described below. The choke portion 16'' of the discharge passage 16 may be formed in an inserted sleeve as shown or otherwise and the amount of restriction is selected in relation to the effective high flow valve area to provide a desired back pressure such that the total pressure pickup signal system to be described shall function with negligible lag.

SIGNAL PRESSURE CIRCUITS

(*General*)

The present fuel dispensing assembly (detachably associable nozzle unit N and adapter unit A) contains passages constituting two open circuits, respectively for primary and secondary shutdown signal transmitting fluid, the passages of each circuit being formed partly in the nozzle unit N and partly in the adapter unit A. Two pairs of sealing rings (e.g. O-rings), —each pair having a sealing ring in common with other pair as illustrated in FIG. 2—, are operative during the fueling cycle to isolate the necessary fluid transfer areas of the nozzle unit N and the adapter unit A axially of the nose portion O of unit N. For convenience the nozzle body portions, sealing rings and passages which are involved in the secondary shutdown fluid circuit will be described first, or ahead of the primary shutdown circuit passages and associated parts.

VAPOR VENT SYSTEM PASSAGES ETC.

Tubular nozzle body sections 17, 18 and 19, FIGS. 1 and 2, suitably and rigidly connected to the main body section C, communicate serially with passages or passage portions 20, 20' and 21 in the nose portion O of the nozzle N to form part of the vapor vent passage V of adequate vapor discharge capacity in the nozzle. Passage 20 is defined in part by an external peripheral groove (indicated 20, FIG. 2) around a circular surface of the nozzle nose portion O and which, in the operating or fuel feeding position of the nozzle N, cooperates with one pair of circular elastic seals 25 and 26, FIG. 2 (shown as O-rings), to connect the radial passages 10*b*, FIG. 8, of the adapter 5 with the nozzle vent passage portions 20, 20' and 21, FIG. 2. Thus, during the fueling operation, vapor as received from the tank through the vent skirt 10 is conveyed freely or without substantial restriction to and through the various serially connected portions of the vent passage V of the nozzle N to the terminal opening 19', FIG. 2, of the handhold section 19. The vented vapor can at this point be exhausted into the atmosphere, as through a suitable fire stop or spark arrester, not shown; or the vapor can be carried, as through a small flexible tube 19'', FIG. 1, parallel to filler tube 15'' (as by a siamese or other dual hose construction) to any other desired region. It has been suggested that the vapor vented from the tank to be filled can be transferred to the main supply tank.

Double U-shaped (e.g., W-style or form) vapor-vent housing section 17, between its ends, as shown in FIGS. 2 and 6, contains a lateral (shown horizontal) bore 27 leading to a counterbore 28 which, in cooperation with a rigid O-ring-equipped, disc-like slidable piston assembly 29 and a flexible diaphragm 30 between housing section 17 and the main section C constitutes a generally closed expansible chamber D hereinafter usually referred to as the diaphragm chamber. During the fueling operation, (control valve CV open) fuel at the total pressure pickup

Pitot tube apparatus P_t (FIGS. 2 and 5) having its inlet disposed beyond a convergent tubular portion of passage **15** upstream from the control valve CV (and as part of the primary shutdown fluid circuit system described later) is arranged to be diverted, in part, to the diaphragm chamber D and in part to signal effecting valves in series as will be described.

The diaphragm **30** is connected for actuation of a control valve tripping mechanism assembly S, FIGS. 2, 6 and 7, whose components are located principally in the tubular chamber **14***a* above the control valve CV.

Linkage of mechanism S, connected with the diaphragm **30**, is also arranged to be actuated (through operation of piston **29**) in response to the occurrence of abnormally high (usually liquid) pressure (emergency signal) in the vent passage V for causing shutdown. The performance of both shutdown mechanisms will be recapitulated or summarized herein under a heading: "Operation."

POSITIVE PRESSURE SIGNAL SYSTEM (PASSAGES ETC.)

The pressure pickup tube **30***a*, FIGS. 2 and 5, communicates with the diaphragm chamber D through an associated branch portion **30***b*; and a connected passage portion **30***c* (FIG. 2) leads to a peripheral groove **30***d* around the nozzle portion O above the peripheral vapor-venting groove **20** and lying between the transfer-area-dividing O-ring **26** and another O-ring **27** thereabove. The series of O-rings and associated peripheral surfaces are of increasing diameter upwardly as will be apparent.

When the nozzle N is detached from the adapter assembly A the vertical passage **30***c* is closed at the region adjacent the peripheral groove **30***d* by operation of a spring loaded conditioner valve CP (for conditioning pressure) shown in large scale in FIG. 4. The plug assembly CP′ thereof (FIG. 4), normally closing the port CP″, can be opened by a frusto-conical camming surface **11***a* on the inner adapter part or member **7**. When the nose portion O of the nozzle has been inserted into operating position in the adapter the valve CP must be opened. The discharge port CP″ of conditioner valve mechanism CP, as best shown in FIG. 8, communicates through the peripheral groove **30***d* of nozzle portion O with a radial hole **30***e* in the inner adapter part **7** leading to a circumferentially isolated space **30***f* (right FIG. 2 only) which is in continuous communication with a U-shaped tube **30***g* connected to discharge total pressure pickup fluid to a float valve FV so long as the float thereof, identified F′, is in its open portion as illustrated in FIG. 2, being closed only when the fuel being supplied to the tank **2** reaches the desired level.

Ball type plug **33***a* of the float valve mechanism FV is freely swingably suspended via its stem from a suitable float-connected lever **33***b* pivotally carried by a mounting frame **33***c* attached to the standpipe **8**. Frame **33***c* carries a two part fitting **33***d* coupled to the U-shaped tube **30***g*. The fitting **33***d* has a downwardly facing valve designed to be sealed by the plug **33***a* in response to the plug being lifted by the float F to terminate the refueling operation. Thereby the stream of fuel being ejected from the tube **30***g* against the plug **33***a* is in a direction to aid the float in retaining the plug on its seat, once the float valve port has been closed.

CONTROL VALVE MECHANISM AND OPERATING LINKAGE

The plug **35** of the main or control valve CV, FIG. 2, and its manually operated stem **36** are supported for movement along the axis *a′* of the conical valve seat **16′** and contiguous discharge passage **16**, principally by relatively telescoping dash-pot-constituting, piston and cylinder members **40** and **41** of generally well known form mounted in the valve chamber VC on said axis. A head portion **42** of the cylinder member **41** is suitably fixed and sealed in a bore and counterbore of main body section C

or so as to close the bottom of the chamber **14***a* which is formed in the tubular body portion C″ above the valve chamber. An inner tubular portion **38** of cylinder member **41** forms a guide for the stem **36** and contains suitable sealing packing **38′** around the stem. A loading spring **40′** between the piston and cylinder members **40** and **41** normally holds the plug **35** on its seat **16′**. Openings **41′** in the outer or sleeve portion of the cylinder **41** are proportioned to enable desirable retardation or regulation of closing of the control valve CV incident to automatic valve tripping operation to prevent shock or hydraulic hammer.

To enable manual operation of the valve stem **36** to lift it, as necessary initially to open the control valve and start the filling cycle, the lever **14**, at a yoke or loop portion of it, is pivotally secured to the stem by a pin **14′**. A conditionally acting fulcrum (pin **55**) for the control valve lever will be described later.

VALVE TRIPPING ETC. MECHANISM S

The control valve mechanism includes a valve-tripping and lever-fulcrum-control-positioning mechanism generally indicated S in FIGS. 2 and 6. The principal components of tripping mechanism S are suitably supported and guided between two generally circular or disc like mounting bracket members **45** and **46** above and/or attached to dashpot cylinder **41**. The special section shading of member **45** is intended to indicate low friction material such as "Teflon," (trademark). In the closed position of valve plug **35** a roller **48** carried by parallel arms of a valve latch yoke **50**, supported in suitable guideways **51** and **52** in the mounting members **45** and **46**, is held by a spring **50′** in contact with the valve stem **36** above a low flow notch **53** in the valve stem. Therebelow the stem has a high flow notch **54**.

If the valve stem is lifted by the valve control lever **15** appropriate distances, the roller **48** and latch yoke **50** will thereby hold the control valve CV open under action of the latching spring **50′**. The term "low flow" as applied to the flow notch **53** is only applicable to closed pressure refueling; since the rate of feeding when the notch **53** is engaged is around 55 g.p.m., or more than twice the maximum rate for open-vented, tank-filling operations as in filling stations. Engagement of the high flow notch **54** by the roller **48** will at least double the rate of fuel flow into the tank (e.g., 120 g.p.m.).

As will be evident from FIGS. 2 and 6, opening of the control valve by manipulation of the control valve lever **14** depends upon the position of the fulcrum-establishing roller **55** shown as carried by a lever **56** pivoted to the mounting bracket member **46** as on a pin **58** and which has a biasing torsion spring **59** tending to move the lever **56** counterclockwise as shown in FIGS. 2 and 6. The roller **55**, in the position of its supporting lever **56** shown in FIG. 2, can abut a notch **14″** of the valve control lever and allow the valve stem **36** to be lifted by operation of said lever.

As best shown in FIG. 6, a valve trip rod **62** slidable in a fixed supporting bracket or bushing **63** for a trip-rod-biasing spring **64** has a head portion **62′** movable in the guideways of the mounting members **45** and **46**. The valve trip rod is suitably secured to the flexible diaphragm **30** by a nut and washer assembly **62″** as evident from FIGS. 2 and 6; and the biasing spring **64** acting through the nut and washer assembly **62″** of the diaphragm assembly tends to move the valve trip rod **62** to the right until it abuts the emergency shutdown piston **29** (position of parts shown in FIG. 2).

Assuming a condition of negligible pressure in the diaphragm chamber D, such will allow the spring **64** to withdraw a cam portion **66** of the valve trip rod **62** away from a depending tail portion **56′** of the fulcrum supporting lever **56** so that said lever will be swung by its spring **59** into the illustrated valve-control-lever-fulcrum-establishing position thereof shown in FIG. 2, thus enabling a

fuel-feeding operation to be initiated manually. On the other hand if a predetermined amount of pressure sufficient to overcome the biasing force of the spring 64 exists in the diaphragm chamber D, such will prevent or terminate the fueling operation. Such termination, as will be reviewed later under "OPERATION" occurs in event either the float valve FV FIG. 2 or the conditioner valve CP FIG. 4, in series with the float valve, becomes closed. FIG. 6 shows the head 62' of the valve trip rod 62 in position to abut the parallel arms of the valve latch yoke 50 to enable leftward movement of said yoke to its illustrated position. Such abutment and resultant release of the valve stem 36 by the latch roller 48 occur when there is such predetermined substantial pressure in the diaphragm chamber D at a time when the valve latch yoke 50 has been retaining the valve stem 36 in either raised, flow-establishing, position. In other words pressure in chamber D on the diaphragm sufficient to overcome the force of the valve trip rod biasing spring 64 will release or trip the control valve latch mechanism S and allow the control valve CV to close.

MANUAL (OVERRIDING) SHUTDOWN

The stem 70 of the manual control or release button 12 FIGS. 1 and 2 extends through a non-vapor-flow-obstructing guide portion 71 in the vent section 18 of the body and has a normal-position-establishing, enlarged diameter portion 72 the lower reduced diameter terminal of which has a conical or bevel face 74 thereon in position to make control-valve-tripping contact with a cam surface 75 on the valve latch yoke 50. Tripping occurs when the stem 70 of the button 12 is depressed against the force of a return spring 70*s* at a time when the control valve stem 36 is being supported solely by the latch yoke roller 48 in engagement with one of the notches 53 or 54 of the valve stem. The slot 77, FIG. 2, in the tubular casing portion C'' through which the control valve lever 14 extends can be closed, to protect the trip etc. mechanism S, by a flexible boot (not shown) or an equivalent dirt-excluding arrangement around the lever.

NOZZLE AND ADAPTER COUPLING LATCH ASSEMBLY L

As previously mentioned, the manual-control-button operated linkage L' FIG. 2 under the vent cap section 18 is connected to release the latching mechanism L between the nozzle portion O and the adapter 5 (FIGS. 2 and 3) at completion of the fuel refilling operation cycle. The mechanism L, as shown, includes a plurality of evenly circumferentially spaced latch pawls 80 (one shown) which occupy respective radial guide spaces 85 (see FIG. 3) in an outer sleeve portion or guide skirt 81 around the nozzle portion O and rigid therewith. The skirt 81 has an annular head portion 81' secured to a narrow flange O'' of nose portion O, and has an upwardly converging inner surface portion serving to align the latch pawls 80 with a beveled camming surface 82*c* (cf. FIG. 8) on the top of the adapter 5 for self-locking engagement of the latch pawls 80 in the peripheral groove 82 of the adapter during application of the nozzle unit thereto.

The working spaces for the latch pawls 80 are only slightly wider than the latch pawls circumferentially of the head portion of the skirt 81; and all of the latch pawls are pivotally carried on a single free floating wire ring 84. The latch pawls 80, as shown, are bell cranks having radially outwardly extending arms 80' supported by the pivot ring 84 in contact with an inwardly extending annular rib 87 of a releasing sleeve 88 which carries loading springs 86 bearing downwardly on the respective arms 80'. Releasing sleeve 88 slides vertically on the guide skirt 81, and its latch-pawl-releasing rib 87 is shown in FIG. 2 in a lowered or normal position as against a suitable stop shoulder 89' (FIG. 3) of the head portion of the guide skirt. For latch releasing operation as a function of manual shutdown operation for example, the slidable ring 88 has a pair of radially inwardly extending lugs 88' thereon (one shown in FIG. 3) connected to vertical leg portions 91' of an inverted U-shaped or bail-like lifter device 91. The leg portions 91' (one partially shown in FIG. 3) extend through guide tubes 92 (one shown in FIG. 1) from a lever 90, FIG. 2, pivoted on the under side of the vent cap section 18 and connected with the enlarged diameter portion 72 of the release manual button stem 70. Thereby downward pressure on the release button 12 (e.g. in tripping the control valve CV as described earlier) simultaneously operates the latch connected sleeve 88 as necessary in order to release the nozzle unit N from the adapter assembly A.

OPERATION

(Summary)

Assuming the attendant or operator in charge of the refueling operation has connected the filler hose 15'' to a supply tank and has started the delivery pump thereof; has adjusted its regulator for operation of the pump to deliver fuel to the nozzle N at a desirable rate to be delivered to the receiving tank 2 through the nozzle control valve CV, and that the nozzle portion O has been properly seated in the neck 11 of the adapter 5 (thus opening conditioner valve CP of the primary shutdown signal control system), the biasing spring 64 of the flexible diaphragm will then have thrust the valve trip rod 62 to its FIG. 2-illustrated position, so that the fulcrum roller 55 will be in position to support the fulcrum end of the control valve lever to enable the operator to lift the handle end of the lever and open the control valve. The roller 48 of the valve latch yoke 50, FIGS. 6 and 7, will thereby be moved by spring 50' so as to hold the control valve 36 in its selected raised position (in flow notch 53 or 54). The control valve lever can now, optionally, be released by the operator; and flow at the selected rate will continue to take place automatically. Meanwhile air and vapor from the top of the tank 2 will be vented freely through nozzle N as received from the interior of vent skirt 10 provided the vent hose 19'' and passages leading thereto are not restricted.

When the fuel supplied to the tank reaches and lifts the float F of the primary shutdown signal producing means FV, sealing the float-valve-connected tube 30*g*, the continuing supply of fuel through the P_t system 30*a*—30*g* will build up pressure in the diaphragm chamber D. The increased pressure in the chamber D forces the flexible diaphragm 30 and connected trip rod 62 toward the left sufficiently to move the valve latch yoke 50 and its roller 48 out of the engaged flow-rate-selecting notch in the control valve stem 36. That causes shutdown of the control valve CV by operation of the valve loading spring 40', completing the normal filling cycle.

The operator then removes the nose portion O of the nozzle from the adapter 5 and replaces the earlier mentioned adapter cap (not shown).

If for any reason any portion of the linkage on the float valve mechanism FV fails or jams and fuel therefore continues to be supplied to the tank 2 after sealing of the lower end of the vent skirt 10, fuel will be forced through the vapor vent passages 10*a*, 10*b* and 21 to the main vent passage V of the various nozzle body sections. Meanwhile a sealed body of compressible fluid (air or vapor) accumulates in the air dome around the vent skirt 10 to protect the tank from being suddenly subjected to impact by incompressible fluid, as could occur in the absence of such vent skirt.

Since the vent passage V and connected bore of the vapor disposal tube 19'' FIG. 1 (if such is used) are designed with only sufficient average cross sectional or transverse passage area for conveyance of vapor from the tank 2 at a safe rate (i.e., unlikely to generate dangerous static electrical potential) pressure of the fuel (as in the vent section 17 containing the piston cylinder entrance bore 27) will rise very rapidly, quickly forcing the emergency or secondary shutdown piston 29, via the diaphragm

assembly 62'' abutted thereby, to apply thrust to the valve trip rod 62 and the latch yoke 50, causing control valve shutdown essentially in the manner already described.

The same secondary or emergency shutdown operation, but performed as a function of vapor pressure (as against buildup of liquid fuel pressure in the vent passage V) will occur if the flexible hose 19'' becomes blocked (e.g., collapsed or plugged) during the fueling operation, or if for any other reason excessively high or dangerous pressure, prior to filling of the tank to the float valve level, occurs in the receiving tank or container.

Since the emergency shutdown piston unit 29, through a suitable O-ring 29' thereon or equivalent means transversely seals the outer end of the diaphragm chamber D, rupture of the diaphragm 30 of the primary shutdown system would have no effect on operation of the secondary or emergency shutdown mechanism, which therefore will effect emergency shutdown in the event, e.g., diaphragm failure or leakage in any portion of the P_t system prevents operation of the primary shutdown mechanism.

We claim:

1. A liquid dispensing system comprising, a nozzle having inlet and outlet passages joined through a valve chamber, a self closing control valve in the chamber, manually operable means connected and arranged for opening the control valve, a spring loaded latch mechanism acting to hold the control valve in an open position, a fluid motor having a pressure chamber and displacement member movable therein and operatingly arranged to trip the latch mechanism, means forming a motor-operating liquid passage having an inlet communicating with a space within the nozzle inlet passage containing incoming liquid to be dispensed and lying upstream from the control valve and an outlet connected to the motor pressure chamber, a branch outlet passage connected to enable diversion and spilling of liquid which would otherwise become effective in the motor pressure chamber, a normally open valve in the branch passage, and signal means connected to close the normally open valve and thereby cause operating movement of said displacement member to trip the latch mechanism.

2. The liquid dispensing system according to claim 1 wherein the manually operable means is a control lever pivoted to a valve plug stem portion of the control valve and having a movable pivot member which is spring biased into a fulcrum-establishing position in respect to the lever to allow the lever to be operated to open the control valve, and being moved into a fulcrum-disestablishing position to disable the lever by a predetermined rise in pressure in the motor pressure chamber.

3. The liquid dispensing system according to claim 1 wherein the manually operable means functions to move a stem portion of a valve plug of the control valve in a suitable guide along the longitudinal axis of the stem, the latch mechanism includes a latch yoke and means guiding the yoke for rectilinear movement transversely of said axis arm portions of the yoke embracing the stem and carrying an antifriction roller for latching engagement with one or more notches in the stem, the displacement member of the fluid motor including a latch trip portion thereof movable independently of the latch yoke, but in the same direction as it moves, for trip-effecting abutment therewith.

4. The liquid dispensing system according to claim 1 wherein an additional manually operable means is connected for operation on the latch mechanism to trip it at any time regardless of pressure or absence thereof existing in the motor pressure chamber at such time.

5. Closed pressure liquid dispensing mechanism comprising a filler adapter for a tank or closed container, a nozzle unit having inlet and outlet passage containing portions communicating through a valve chamber, a self closing control valve in the chamber, manually operable means connected and arranged for opening the control valve, a spring loaded latch mechanism acting on the control valve to hold it in an open position, a fluid pressure operated motor having a pressure chamber and a displacement member movable therein and operatingly connected to trip the latch mechanism and permit the control valve to close, means in the nozzle unit forming a motor-operating fluid passage operative to deliver above atmospheric pressure output to the fluid motor, a branch passage connected to the operating pressure passage to form an alternate potential outlet for fluid therefrom, the outlet passage portion of the nozzle unit comprising a nose element adapted sealingly to enter the filler adapter, a self closing conditioner valve in the nose element communicating with the branch passage, means on the filler adapter connected to operate to open the conditioner valve when the nose element occupies the filler adapter in proper liquid dispensing position, a normally open signal-producing valve on the filler adapter operable into closed position as a function of attainment of a predetermined liquid level in the tank or container, and a passage in the filler adapter having an inlet end connected to the branch passage via the conditioner valve and an outlet end connected to discharge fluid through the signal producing valve.

6. The dispensing mechanism according to claim 5 wherein said means in the nozzle unit which supplies said motor with operating fluid is located upstream from the control valve whereby to supply pressure as a function of static plus velocity head on part of incoming liquid.

7. In a closed pressure filling system for a tank or container, a nozzle unit having an inlet, a manually opened, normally closed control valve and a nose portion constituting an outlet, a filler adapter unit on or for installation in such tank or container and having a neck portion adapted for peripherally sealed mating relationship to the nose portion during filling operations, spring biased latching means for the control valve connected to act thereon to hold it in an open position, a fluid operated motor on the nozzle unit connected to trip the valve latching means, a source of positive primary shutdown pressure fluid in the nozzle unit and passage means therein connecting said source to the motor, said passage means including a branch connected between the source and motor to a continuation passage segment in the filler adapter unit when the nozzle and filler adapter units are in mating, liquid dispensing, relationship, liquid-level-responsive valve means arranged to block flow through the continuation passage segment to actuate the motor, vapor venting passage means on the adapter unit and nozzle unit comprising respective open circuit passage segments in the nozzle and adapter units respectively and serially connected when the nose portion of the nozzle unit and the adapter unit are in mating relationship, and a fluid pressure motor device in the nozzle unit exposed to pressure in its venting passage segment and connected to operate the valve latch tripping means.

8. A closed pressure liquid fuel supplying system and apparatus, comprising a filling nozzle unit having a spring loaded control valve and latching means operative to hold the valve in an open position, a fuel-receiving tubular adapter unit for support on a tank or the like, said units having respective fuel-conveying passage segments in sealed communication via mating surface portions of the units during the filling operation, two normally open fluid circuits formed by additional respective primary and secondary fluid passage segments of the two units and which are serially connected as a function of bringing together the mating surfaces of the nozzle and adapter units, primary and secondary fluid motor mechanisms each mechanically connected to trip the latching means for shutdown of the filling operation, the primary and secondary passage segments of the nozzle being respectively fluid-connected to the motor mechanisms, means to supply liquid fuel under pressure enroute to the adapter unit via the nozzle to an associated pas-

sage segment of the primary circuit for operation of the primary fluid motor mechanism, vapor vent inlet means on the adapter unit operative to exhaust vapor from the tank to the secondary circuit passage segment of the nozzle unit, means on the adapter unit operative to seal the primary-circuit-connected passage segment of the adapter unit for latch tripping operation of the primary fluid motor mechanism as a function of filling of the tank to a desired level, the vapor vent inlet means of the adapter being operative to divert liquid fuel into the vapor passage segments of both units in the event of failure or malfunctioning of said primary signal producing means.

9. In a closed pressure liquid fueling system employing a filling nozzle unit having a spring loaded control valve and latching means connected to operate to hold the valve in an open position, the improvement comprising a fuel receiving tubular adapter unit on the tank arranged matingly to engage and seal against the nozzle unit in preparing the system for operation, a fluid motor on the nozzle unit operatingly coupled to the latching means to trip or release it, an operating pressure supply of fuel connected to said fluid motor and having an inlet exposed in the fuel path through the nozzle upstream from the control valve and a branch passage leading through the adapter unit, a normally open valve communicating with said branch passage, and tank-level-responsive means connected to close the last mentioned valve and cause latch releasing operation of the fluid motor.

10. In a closed pressure liquid fueling system employing a filling nozzle unit having a spring loaded control valve and latching means operative to hold the valve in an open position, the improvement comprising a fuel receiving tubular adapter unit on the tank arranged matingly to engage the nozzle unit in preparing the system for operation, a fluid motor on the nozzle unit coupled to the latching means to trip or release it, an operating pressure supply of fuel connected to said motor and having an inlet exposed in the path for fuel through the nozzle upstream from the control valve and a branch passage leading through the adapter unit to a tank-level-responsive, normally open valve to close that valve and cause latch releasing operation of the motor, a vent passage in the adapter unit sealed thereto and projecting below the top of the tank to trap a compressible body of fluid, as of air or vapor in the tank when or if the liquid fuel level rises above said normally open valve, serially connected vapor vent passages in the adapter unit and nozzle unit communicating with the interior of the vent passage, a fluid motor device exposed to pressure in the vent passage of the nozzle unit, said last mentioned motor device being operatingly connected to trip the control valve latching means as a function of predetermined pressure in the nozzle vent passage.

11. 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 open position and having automatically operating latching means to hold the valve open, 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 in said branch passage spring loaded to a closed position so as to shut off the branch passage when the nozzle unit and adapter unit are separated, the interior of the adapter having a releasing surface portion disposed for operation to open the conditioner valve when the nose portion of the nozzle unit enters the adapter throat to a predetermined position.

12. In a closed pressure fueling system and apparatus, a fuel dispensing nozzle unit having a spring loaded control valve and latching means operative to hold the valve open, a fuel-receiving tubular adapter unit for attachment to a tank, said units having complemental passage segments for fuel conveyance sealed around mating surface portions of the units during the fueling operation, spring loaded latching pawl on the nozzle unit movable into locking engagement with a peripheral shoulder extending around the adapter unit, an operating sleeve movable axially on the nozzle unit, operatingly connected to the latching pawl or pawls to release it, fluid pressure operated means adapted to release the control valve latching means to enable the control valve to be closed, manually actuated means operable on the control valve latching means to override the automatic control and cause fuel-supply shutdown, and a mechanical operating connection between the manually actuated means and the operating sleeve of the latching pawl and functioning to release it as a function of such manual shutdown operation.

13. A closed pressure fuel dispensing system wherein a fuel dispensing nozzle and a tank adapter to which the nozzle is detachably sealed during the fuel dispensing operation provide separate generally parallel unidirectional open circuits conducting, respectively, a large quantity of fuel for tank supply and a small quantity of fuel for nozzle shutdown operation, nozzle shutdown motor mechanism connected and arranged for operation by fluid in the small quantity circuit in case flow therethrough is interrupted, fuel-level-responsive means for automatically interrupting such flow, said nozzle and adapter cooperating to provide a normally unrestricted flow circuit for vapor displaced from the tank by incoming fuel and adapted to contain and conduct liquid fuel in event of overfilling of the tank, the vapor flow circuit being operatingly parallel to the fuel circuits but in the opposite direction, and nozzle shutdown motor mechanism operated by fluid pressure in the vapor flow circuit.

14. The system according to claim 13 including a manually opened fuel dispensing control valve having an automatically acting latching means to hold it open, and wherein the motor mechanisms operate essentially independently of each other on the latching means to trip or release it.

15. The system according to claim 14 wherein one motor mechanism includes a floating piston which is normally free from but is arranged to abut and move a push rod connected to a displacement member of the other motor mechanism, the push rod being arranged to trip the latching means.

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