July 15, 1958 C. C. WARD 2,843,161

TANK FILLING NOZZLE

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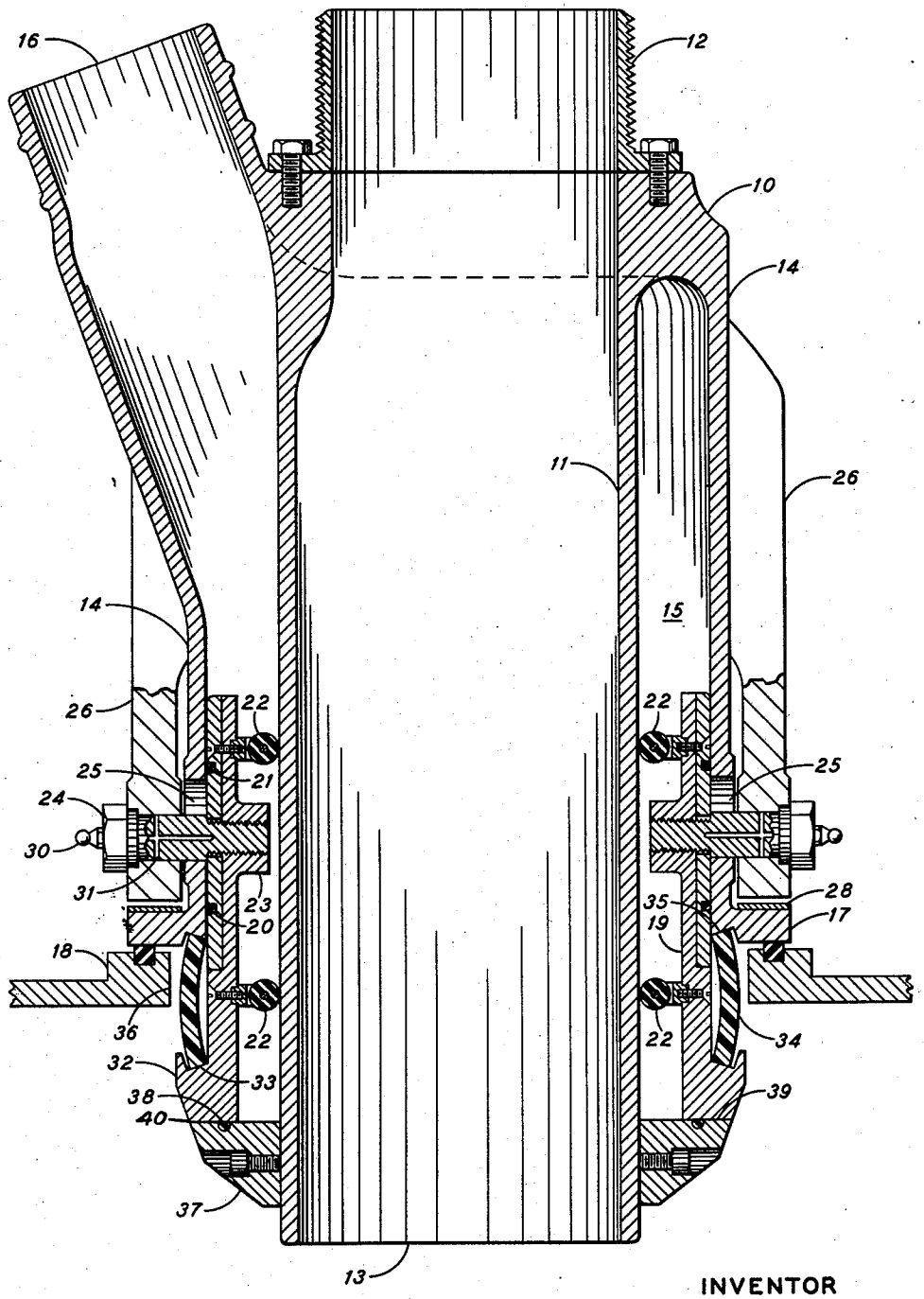


FIG. 1

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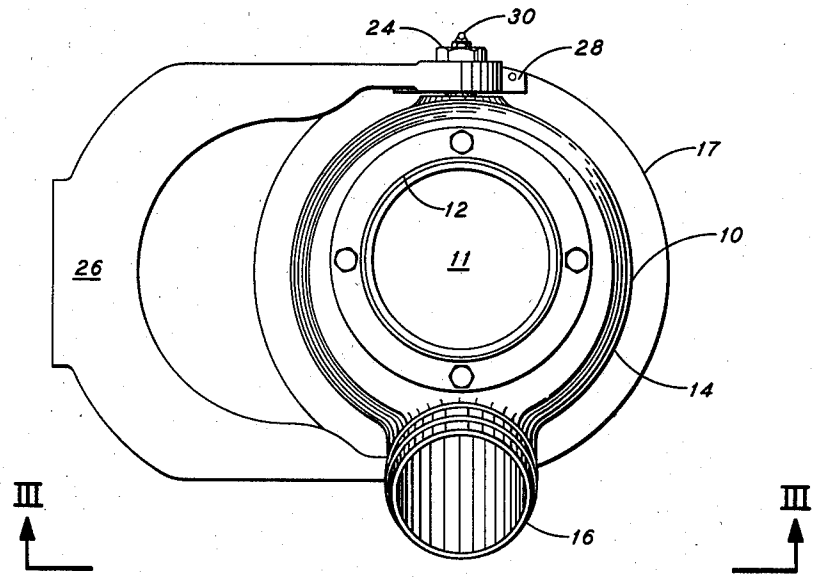


FIG. 2

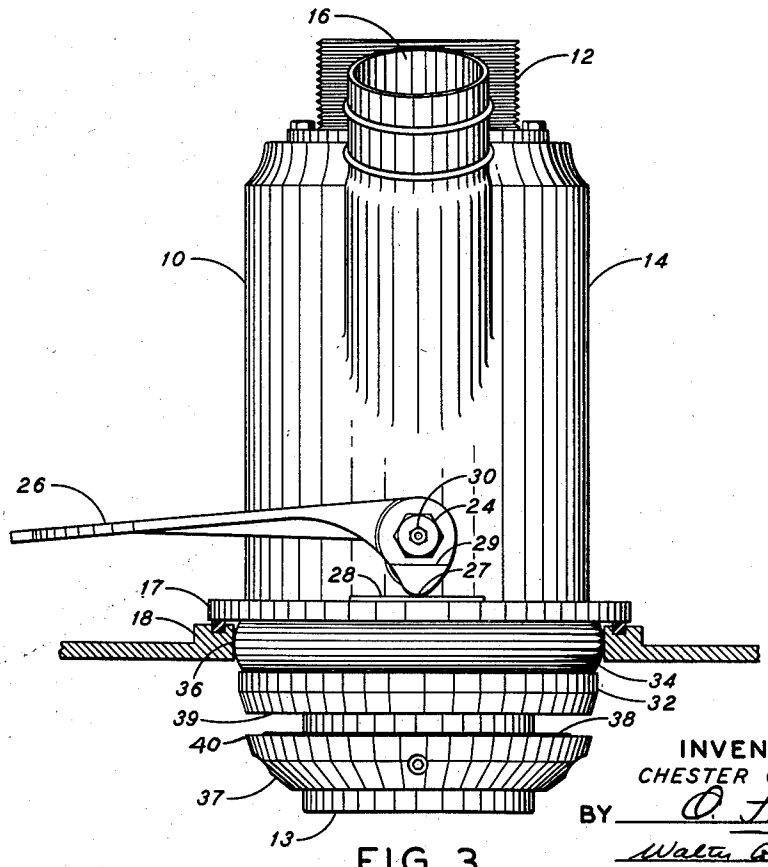


FIG. 3

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TANK FILLING NOZZLE

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Application August 15, 1955, Serial No. 528,451

7 Claims. (Cl. 141—290)

This invention relates to a nozzle for introducing volatile liquids such as gasoline or other low-boiling hydrocarbons into a tank at the same time that the displaced vapors in the tank are withdrawn through the same inlet opening into a separate passage in the nozzle, and particularly refers to an improved arrangement for sealing the space between the nozzle body and the tank shell and for controlling the admission of air and displaced vapor into the withdrawal passage.

In the loading of volatile liquids and specifically hydrocarbons into tank trucks, tank cars and the like, it has been customary to release to the atmosphere the saturated vapor-air mixture in the tank that is displaced by the incoming liquid. The amount of valuable hydrocarbons so lost increases with atmospheric temperature and with the volatility of the liquid. In addition, it has been indicated that release of such vapors into the atmosphere may, under certain conditions, lead to a photochemical reaction that produces irritants generally known as "smog." Accordingly, it has been proposed to recover the heretofore displaced air-vapor contents of an empty tank while it is being filled with volatile liquid. An example of a process for such a recovery system is described and claimed in the copending application of R. F. Hartman et al., Serial No. 484,962, filed January 31, 1955, entitled, "Method for the Recovery of Hydrocarbon Vapors," and assigned to the common assignee herewith, which issued October 9, 1956, as Patent 2,765,872. In general, that recovery system includes a fuel storage tank with a suitable pump, pipeline, and nozzle for filling the tank truck, tank car, or the like, and a vacuum-actuated vapor withdrawal system that removes and processes the displaced vapor by compression and absorption in a suitable liquid, from which the fuel is ultimately recovered in liquid form and returned to the storage tank. The air-vapor mixture is collected from the tank being filled by a collapsible fitting that is inserted in a vent in the vessel and which, when expanded, forms a seal with the wall of the vent opening, according to that disclosure.

This invention comprehends broadly an improved form of nozzle which will provide a unitary connection to the tank filling opening to admit the liquid through one passageway, with an expansible and contractible seal to prevent loss of vapor between the nozzle body and the wall of the inlet opening, together with a vapor withdrawal passage and a valve therefor to prevent undesired admission of air while the nozzle is not actively in use, and is characterized by means interconnecting the valve and the expansion seal arrangement so that they invariably function in a predetermined manner and with a minimum of attention and manipulation by the operator.

It is an object of this invention to provide an improved tank filling nozzle that will prevent the escape to the atmosphere of vapors displaced from the tank by the incoming liquid.

Another object is to provide for a unitary nozzle including connections for both liquid introducing and vapor withdrawal conduits, which may be flexible hoses, and a

valve means for preventing undesired air introduction into the vapor withdrawal conduit, for example, when the nozzle is not engaged with or sealed into the filling opening of a tank truck or tank car.

Another object is to provide an improved nozzle construction in which a valve such as that just described is positively interconnected with an expansible sleeve or other sealing means to prevent air or vapor leakage between the nozzle body and the filling opening of a tank.

Another object is to provide a tank filling nozzle in which a single actuating means is provided for both the vapor withdrawal control valve and the tank-engaging seal, and in which the actuating means will also indicate to the operator the position of these elements.

These and other objects and advantages of the invention will be further apparent from the following description of a preferred embodiment, taken in connection with the attached drawings, which form a part of this specification.

In the drawings, Figure 1 is a longitudinal sectional view of a nozzle in its unsealed position in a tank filling inlet, and with the vapor withdrawal passage valve closed, so that the actuating means therefor is in released position.

Figure 2 is a plan view of the nozzle of Figure 1, but with the actuating means in closed or locked position.

Figure 3 is a side elevational view on line III—III of Figure 2, showing the actuating means in position to expand the seal and to retain the vapor-admission valve in open position.

Referring to the drawings, and particularly to Figure 1, reference numeral **10** designates generally a substantially cylindrical nozzle body having an axial bore **11** for the introduction of liquid such as gasoline or the like. This may be supplied through a threaded inlet **12** to which is secured the usual flexible hose or conduit (not shown) leading from a convenient source of filling liquid under pressure. The means forming bore **11** is a cylindrical tube **13**, around which is an outer shell **14**, the latter spaced from tube **13** to form an annular passage **15** having at its upper end a vapor withdrawing connection **16**. A suitable conduit or flexible hose (not shown) leads from connection **16** to a vapor withdrawal vacuum system, such as that of the copending application of R. F. Hartman et al., referred to above, and which includes a vacuum pump to maintain a negative pressure which is transmitted through the connecting conduit to annular passage **15** to withdraw displaced air-vapor mixtures from the tank being filled, as will be explained below.

The lower end of outer shell **14** is flanged outwardly as at **17** so that the nozzle body **10** may rest upon the upper rim of a tank filling opening **18**, with the lower end of tube **13** extending into the tank. Inside of shell **14** there is positioned an axially movable sleeve **19**, desirably provided with sealing means such as O-rings **20** and **21** retained in appropriate circumferential grooves. To facilitate axial movement of sleeve **19** in shell **14**, a plurality of circumferentially and longitudinally spaced guide rollers **22** may be positioned to bear on the outer surface of tube **13**.

On diametrically opposite sides of sleeve **19** are bosses **23** into which are threaded a pair of studs **24** which project radially outwardly through longitudially extending slots **25** in shell **14**. These slots permit a limited axial movement of sleeve **19** inside of shell **14** and are sealed by the cooperation of O-rings **20** and **21** with the inner face of shell **14**. A bifurcated actuating lever generally designated **26** is pivotally mounted on studs **24**, and is provided with cams **27** (Figure 3) which bear against the top of flange **17** when the lever is moved to the position shown in that figure and move sleeve **19** upwardly with respect to outer shell **14** and nozzle body **10**. Desirably, but not necessarily, the upper face of flange

17 is provided with wear plates 28 of stainless steel or other hard material, and the working faces of cams 27 are tipped as at 29 with similar material, particularly if the nozzle 10 and lever 26 are of soft metal, such as aluminum or bronze. Appropriate lubricant fittings 30 and communicating passages 31 may be carried by studs 24 to reduce friction and prevent wear at that point.

The lower end of sleeve 19, in this example, is somewhat enlarged in diameter as at 32, and is circumferentially grooved at 33 to accommodate an annular resilient sealing ring 34, desirably of neoprene or other solvent-resisting flexible material, the upper edge of which is received in a corresponding circumferential groove 35 in the lower face of flange 17 on shell 14. Thus, when lever 26 is moved from the vertical position illustrated in Figure 1 to the horizontal position shown in Figures 2 and 3, cams 27 will move sleeve 19 upwardly with respect to shell 14 and compress sealing ring 34, enlarging its diameter until it forms a vapor-tight joint with the inner face 36 of tank filling opening 18.

To provide a valve means for the annular vapor withdrawal passage 15, the lower end of nozzle tube 13 is fitted with a circumferential ring or abutment 37, in the upper face of which is an O-ring 38 adapted to seal against the flat end face 39 of movable sleeve 19. When the sealing ring 34 is expanded to close the annulus between sleeve 19 and the inner face 36 of the tank inlet opening 18, the upward motion of sleeve 19 in the valve body 10 which causes that expansion will open the valve means just described, which is generally designated 40, and will permit withdrawal of the vapor-air mixture from the tank as liquid enters the latter through the nozzle bore 11. In Figure 1, valve 40 is illustrated in the closed position, while in Figure 3, the cooperating parts 37, 38, and 39 are shown spaced apart to release vapor to passage 15 and outlet 16.

In conclusion, it will be apparent from the foregoing description of the construction and operation of this exemplary nozzle that it includes separate passages for liquid introduction into a tank and for vapor withdrawal therefrom, with means interconnecting a valve in the last-identified passage with an expansible sealing member surrounding the nozzle body, the means, in this example, including an actuating and position-indicating lever and the associated axially movable sleeve in the nozzle body. In one position the lever relaxes the sealing means and closes the vapor-withdrawal passage so that the nozzle may be removed from a tank filling opening or inserted therein without permitting air to enter the vapor-withdrawal passage. When the nozzle is in place in the tank filling opening, actuation of the lever opens the vapor-withdrawal passage and at the same time closes and seals the annulus between the nozzle body and the tank filling opening to prevent loss or escape of vapors therefrom.

Although only a single embodiment of this invention is illustrated and described, it is apparent that numerous changes could be made without departing therefrom, and it is understood that all such modifications as come within the scope of the appended claims are intended to be embraced thereby.

I claim:

1. In a fuel tank filling nozzle having a passage for liquid fuel and a separate vapor withdrawal passage, radially expansible means carried by said nozzle for sealing it to a tank filling opening, valve means for said vapor withdrawal passage, and a single actuating means movable with respect to said nozzle and interconnecting said sealing means and said valve so that when said sealing means is contracted said valve is closed and when said sealing means is expanded said valve is opened.

2. A nozzle according to claim 1, in which the inlet of said vapor withdrawal passage is concentric with and surrounds said nozzle, and said valve means comprises an abutment carried by said nozzle adapted to be contacted by said actuating means.

3. A nozzle according to claim 1, in which said actuating means comprises a sleeve carrying said expansible means, and is slidably mounted with respect to said nozzle.

4. A nozzle according to claim 3, with the addition of means adapted to be actuated from outside of said tank to move said sleeve relatively to said nozzle body.

5. In a fuel tank filling nozzle having separate passages for discharging liquid fuel into a tank and for withdrawing vapor therefrom, a generally cylindrical body terminating in a discharge nozzle having a concentric abutment, a movable sleeve surrounding said nozzle above said abutment and communicating with said vapor withdrawal passage, the lower end of said sleeve cooperating with said abutment to form a valve, resilient means carried by said sleeve, and means for moving said sleeve to open said valve and to expand said resilient means to engage the filling opening of a tank.

6. A fuel tank nozzle according to claim 5, in which said last-named means comprises cam means connected to the sleeve and engaging the body for moving the former relatively to the latter.

7. A fuel tank filling nozzle body adapted to be sealed to a tank inlet, comprising means forming a central liquid discharge nozzle, a vapor withdrawal passage surrounding said nozzle, a movable sleeve surrounding said nozzle and spaced therefrom to form an annular passage communicating with said vapor withdrawal passage, an abutment on said nozzle cooperating with an end of said sleeve for opening and closing said passage, annular resilient means retained between the outside of said nozzle body and said sleeve, and a lever-actuated cam carried by said sleeve outside of said vapor withdrawal passage and engaging said nozzle body so constructed and arranged that said resilient means is expanded to sealing engagement with said tank inlet when said sleeve and said nozzle body are moved relatively to each other by said cam to open said passage.

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