June 10, 1941. W. A. HARGISS 2,244,947

NOZZLE TUBE

Filed Dec. 4, 1939

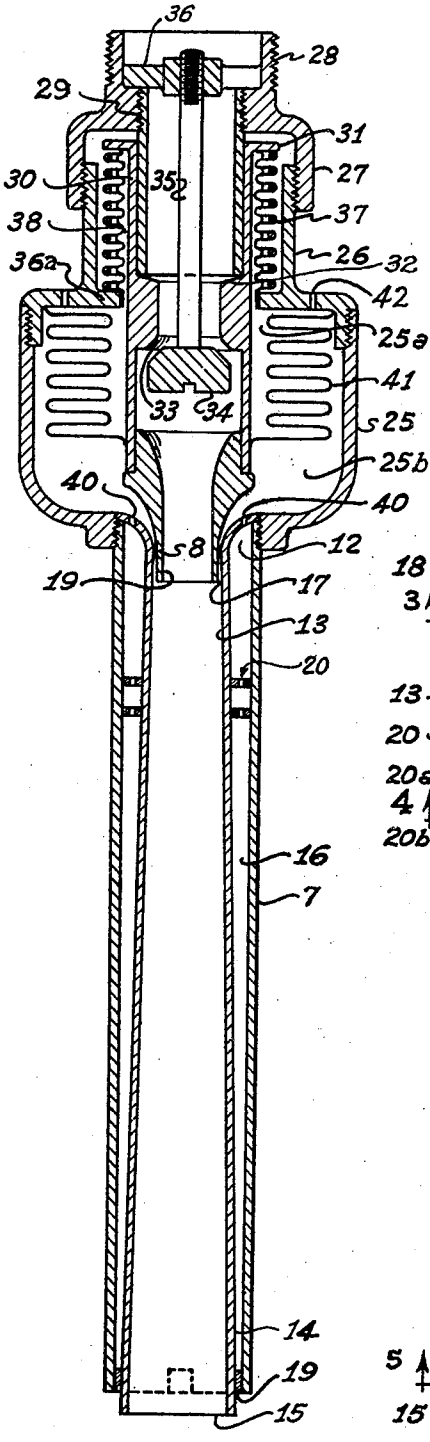


FIG. 6

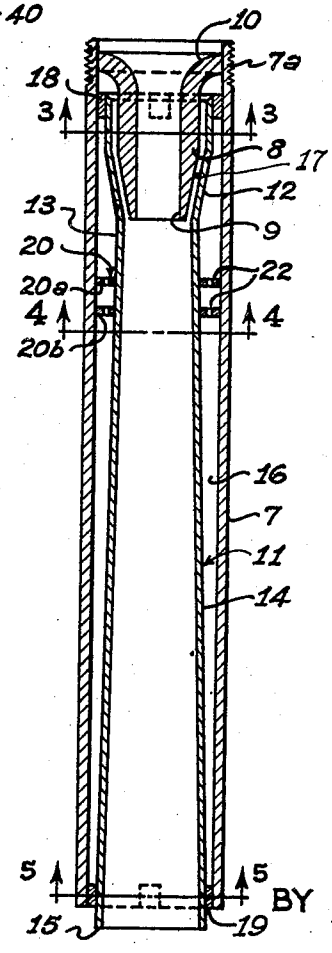


FIG. 2

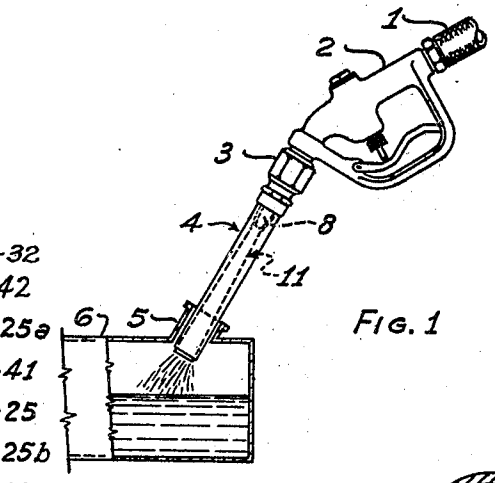


FIG. 1

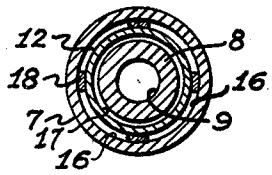


FIG. 3

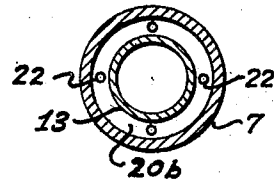


FIG. 4

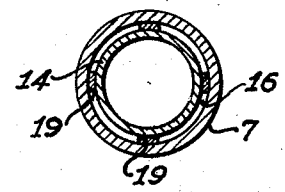


FIG. 5

INVENTOR
W. A. HARGISS
BY
R. Werlin
ATTORNEY

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NOZZLE TUBE

William A. Hargiss, Tulsa, Okla.

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7 Claims. (Cl. 226—66)

This invention relates to liquid discharge nozzles and particularly to nozzle tubes of the type ordinarily attached at the end of gasoline dispensing hose for insertion into the supply tanks of an automobile, or the like.

In filling automobile tanks or the like from a dispensing hose equipped with the more conventional form of nozzle tubes, the operator ordinarily has no positive way of knowing when the tank becomes full, since the interior of the tank is invisible. Unless, therefore, great care is exercised, generally by greatly reducing the rate of flow of gasoline into the tank, and thereby greatly increasing the filling time, the tank may overflow, causing waste and producing a fire hazard due to the spilled fuel. Also, since the filler tubes of most automobile tanks are not straight but are curved in various ways to conform with the framework and construction of the vehicle, and since modern gasoline dispensing pumps are operated to discharge fuel into the tanks at the rate of about 15 gallons per minute, the filler tubes will often overflow, even though the tank is not full, and result in wastage of fuel as well as in the hazard of fire and explosion resulting from the spilled fuel. This overflow of the filler tubes is due in part to the restrictions in the flow of entering fluid because of the bends or curves in the filler tubes and in part to the exiting air being displaced from the tank by the entering fluid. Since the space between the walls of the filler tubes and the inserted nozzle tube is comparatively confined, the exiting air discharges through this space at a relatively high velocity and tends to block the entrance of the liquid into the tank and to mechanically carry out of the filler tube some of the entering fluid.

It is, therefore, a general object of this invention to provide improved forms of nozzle tubes which will obviate and eliminate to a great extent the aforementioned and other difficulties inherent in the use of more conventional forms of nozzle tubes.

A principal object of this invention is to provide an improved form of nozzle tube for use with gasoline dispensing hose which will continuously advise the operator of the rising level of liquid in the tank receiving same and which will promptly warn him when a pre-determined level is reached in the tank.

Another important object is to provide a modified form of nozzle tube which is adapted to automatically control the rate of flow of liquid through the nozzle tube in accordance with the filling conditions in the receiving tank.

More specific objects are to provide a nozzle tube having an internal return passageway for air and gas displaced from the fluid receiving tank and a Venturi arrangement for producing a vacuum in said return passageway; to provide means in said passageway which is operative by the return of flow of air therethrough to produce an audible signal indicating the progress in filling the receiving tank with liquid and warning when it is full; and to provide a diaphragm operated flow valve for controlling the liquid discharging through said nozzle tube by the vacuum produced in said passageway.

These and other objects of this invention will be readily apparent from the following detailed description and the accompanying drawing which illustrates two useful embodiments of this invention.

In the drawing:

Fig. 1 is a view showing the nozzle tube of this invention inserted in operative position in the filler tube of a liquid receiving tank.

Fig. 2 is a longitudinal section through a nozzle tube constructed in accordance with one modification of this invention.

Figs. 3, 4 and 5 are cross-sections taken along lines 3—3, 4—4, and 5—5 respectively, of Fig. 2, and

Fig. 6 is a longitudinal sectional view of another modification of this invention which includes automatic means for controlling the flow of liquid through the nozzle tube.

Referring to the drawing, Fig. 1 shows the end of a tube 1, such as the conventional gasoline pump dispensing hose, to which is connected a conventional form of manually operated discharge control valve 2, to the discharge end of which there is connected by means of a union 3 one of the nozzle tubes constructed in accordance with this invention, the details of which will be described more fully hereinafter. The nozzle tube 4 is shown inserted through the usual filler tube 5 of the ordinary automobile fuel tank 6.

The details of nozzle tube 4 are shown in Figs. 2, 3, 4 and 5 and comprise an elongated tubular jacket 7 constructed preferably of metal and provided at its inlet end with external threads 7a for ready attachment to union 3. Mounted interiorly of the inlet end of jacket 7 is a nozzle member 8 having an axial passageway 9 and provided about its inlet end with an outwardly turned annular flange 10 which is rigidly connected to the bore wall of jacket 7 to form a fluid-tight joint therewith. Nozzle member 8 is of generally tubular shape which tapers toward its

discharge end and is of substantially lesser exterior diameter than the bore of jacket 7. Extending axially through jacket 7 is a Venturi tube designated generally by the numeral 11, and consisting of the usual enlarged inlet portion 12, throat 13 and diffuser tube 14 which is of gradually enlarging diameter toward its discharge end which protrudes slightly from the discharge end of jacket 7 forming a tip portion 15. The external diameter of Venturi tube 11 is generally smaller throughout its length than the internal diameter of jacket 7 thereby forming a generally annular passageway 16 therebetween. The inlet portion 12 of the Venturi tube surrounds nozzle member 8 and its internal diameter is somewhat greater than the external diameter of nozzle member 8, thereby providing an annular passageway 17 between these members. The free end of inlet portion 12 terminates forwardly of flange 10 and is rigidly connected to the inner wall of jacket 7 by a plurality of radially arranged spacers 18. The free area between the spacers permit open communication between passageways 16 and 17. Another group of spacing members 19 are similarly arranged between the discharge ends of jacket 7 and diffuser tube 14, to maintain a relatively uniform spacing therebetween and permit open communication with the end of passageway 16. An annulus, designated 20, and consisting of a pair of spaced ring members 20*a* and 20*b* surround throat 13 of the Venturi tube and extend transversely across passageway 16 to the inner wall of jacket 7. The ring members 20*a* and 20*b* have fluid tight connection with the outer wall of throat 13 and the inner wall of jacket 7. Each of rings 20*a* and 20*b* have a plurality of registering orifices 22 which are circumferentially arranged therein. The annulus 20 constitutes a signal member which by its form produces an audible whistling sound when air or gaseous fluid flows through the orifices 22. This form of whistle is of a common type familiar to persons generally.

The nozzle tube, above described, operates in the following manner to accomplish the previously mentioned objects of this invention:

As indicated in Fig. 1, the nozzle tube, attached to the end of the dispensing hose is inserted in the filler tube 5 of the liquid receiving tank 6, and the flow of liquid to the tank is begun by opening valve 2 in the usual manner. The liquid flowing through nozzle member 8 and thence through Venturi tube 11 creates a vacuum in passageways 17 and 16 which acts to draw a portion of the air and vapors being displaced from tank 6 by the entering liquid through passageway 16 toward passageway 17 and thence into the throat 13 of the Venturi tube, where it is returned to the tank with the entering fluid. The flow of air and vapors through passageway 16 must necessarily pass through orifices 22 and, by virtue of the construction of annulus 20, will produce a whistling sound which will be clearly audible to the operator. As long as this sound is heard by the operator he knows that the level of liquid in the tank has not yet reached the tip of the nozzle tube, for as soon as the level of liquid rises sufficiently to submerge the tip of the nozzle tube and the end of passageway 16 the flow of air and vapors into passageway 16 will be cut off and the whistling will cease immediately, thus instantly warning the operator that the tank is full to the level to which the nozzle tube has been inserted.

Because of its relatively high vapor pressure characteristics, gasoline, unlike other liquids, when discharged from a tube, such as Venturi tube 11, will tend to expand radially. For this reason, tip 15 is provided in order that the radial expansion will take place somewhat in front of and spaced from the end of passageway 16, otherwise liquid leaving the end of Venturi tube 11 would be immediately sucked back into passageway 16 by the vacuum created therein. Due to the expansion of the gasoline, air and vapors flowing back from the tank and through filler tube 5 will necessarily pass through the expanding mist of liquid and will tend to blow some liquid out of the tank. By means of the described arrangement of tip 15, the air and vapors carrying only the liquid mist will be drawn, in part at least, into passageway 16 by the action of the vacuum therein and will be recirculated to the tank with the main stream of liquid, thus eliminating or reducing greatly the losses of liquid ordinarily carried out of the filler tube by the displaced air and vapors.

Instead of constructing jacket 7 and Venturi tube 11 of rigid metal, these members may be constructed of flexible metal or other substances so as to allow bending of the nozzle tube to conform with the entrance angles or shapes of the various filler tubes into which the nozzle tubes are to be inserted. For example, jacket 7 may be constructed of any of the conventional forms of flexible metal tubing, the joints of which should be air tight, however, while Venturi tube 11, or at least diffuser tube 14, may be constructed of "thiokol" or "neoprene" or any other flexible composition which is insoluble in the gasoline or other liquid passing through the nozzle tube. The spacers 19 will maintain passageway 16 open while permitting some degree of relative longitudinal movement between the ends of jacket 7 and diffuser tube 14 resulting from the flexing of the nozzle tube.

Fig. 6 illustrates a modified form of the nozzle tube of this invention which includes additional elements operative by the vacuum created in passageway 16 by Venturi tube 11 to automatically control the rate of flow of liquid through the nozzle tube. In this modification the inlet end of jacket 7 is connected to an enlarged chamber 25 which has a reduced neck portion 26 which is threadedly connected to a collar member 27, which is, in turn provided with a reduced inlet portion 28 having external threads for attachment to union 3. The bore of collar member 27, inwardly of the end thereof, is reduced somewhat in diameter and internally threaded to receive a tubular sleeve 29, which extends through reduced neck portion 26. Nozzle member 8 is provided with an elongated tubular shank 30 which is slidingly mounted on the outer surface of sleeve 29 and is provided with an outwardly extending annular flange 31. An annular shoulder 32 is positioned internally of shank 30 at a position therein intermediate the ends of the shank and its lower face is provided with a ground seat 33 which cooperates with a disk valve 34 axially positioned in the bore of shank 30 and affixed to a stem 35 which is fixedly attached to the center of a spider 36 which is rigidly mounted in the bore of the reduced portion 28 of collar member 27. Reduced portion 26 of the chamber 25 is provided at its inner end with an inwardly extending annular shoulder 36*a*, the bore of which is of sufficient diameter to allow free longitudinal movement therethrough of shank 30. A coil spring 37 surrounds

the portion of shank 30 which extends between shoulders 31 and 30a and normally tends to hold these members apart. A flexible bellows 38 also surrounds the portion of shank 30 between shoulders 31 and 30a and is positioned inside the coils of spring 37. The ends of bellows 38 has fluid tight connection between the adjacent faces of shoulders 31 and 30a so as to prevent leakage of any fluid along the exterior of shank 30. This bellows arrangement is a conventional form of fluid tight flexible connection which is commonly used in many mechanical constructions. By this arrangement it will be evident that as nozzle member 8 and shank 30 move longitudinally on sleeve 29 toward the discharge end of the nozzle tube, seat 33 will cooperate with valve 34 to close the axial passageway through the nozzle member against the compression of coil spring 37, while movement in the opposite direction, aided by expansion of spring 37, will open the passageway.

As in the previously described modification, the discharge end of nozzle member 8 extends into the inlet portion 12 of the Venturi tube providing passageway 17 therebetween, while the inlet end of inlet portion 12 is rigidly connected with the bore wall of jacket 7 so as to provide ports 40 for communication between passageways 16 and 17. Whistle member 20 may also be positioned in passageway 16 as above. In the present arrangement this communication extends through the hollow interior of chamber 25. A flexible partition member 41 extends generally transversely across the interior of chamber 25 and has fluid tight connection between the outer wall of shank 30 and the inner wall of chamber 25 thereby dividing the chamber into upper and lower sections 25a and 25b, respectively. Vents 42 extend through the wall of section 25a to provide open communication between this section of chamber 25 and the atmosphere.

The operations of the modified form of nozzle tube is as follows: Liquid is discharged from hose 1 into and through the nozzle tube in the usual manner by opening valve 2. As the liquid discharges through the Venturi tube a slight vacuum is created in passageways 16 and 17 and section 25b of chamber 25 and causes flow of air and vapors into and through passageway 16 toward passageway 17, and produces the audible signal in member 20 just as in the previously described modification. So long as this flow of air and vapors is relatively dry, the flow thereof through passageway 16 will be relatively free and unrestricted and the vacuum produced by the venturi action will be very small, and will be insufficient to flex partition member 41, since coil spring 37 will ordinarily be designed to resist movement of the nozzle member 8 under low vacuum conditions. When, however, sufficient splashing of liquid entering the filler tubes occurs to cause substantial entrainment of liquid in the air and vapors entering passageway 16, this liquid will tend to restrict the free area of the passageway, and the resulting restriction will tend to sharply increase the vacuum created in the passageway and consequently in chamber section 25b. This increase in vacuum, which may be as great as seven inches of mercury, will overcome the strength of spring 37 and cause a forward flexing of partition member 41 which will draw nozzle member 8 and shank 30 forwardly, bringing seat 33 toward valve 34 and thereby acting to close the valve. Depending upon the vacuum thus created, the valve will be partially or fully closed and will thereby act to check the flow of liquid through the nozzle tube and reduce the filling rate to such an extent as to eliminate splashing and allow the liquid to enter the tank quietly. Immediately, the splashing is eliminated, the vacuum is reduced and the valve opens again to allow a greater rate of flow of liquid. Of course when the tank has been filled to a level sufficient to submerge the end of the nozzle tube, vacuum thereupon created in passageway 16 will be at a maximum and sufficient to completely close the valve in the nozzle member 8, thereby completely cutting off the flow of liquid to the tank. In view of this arrangement permitting control of flow and complete cutting-off of the flow when the tank is filled, whistle member 20 may be dispensed with entirely although it is often desirable even in this modification to furnish an audible signal of the filling progress. It will be evident, therefore, that by the modified form of this invention, the flow of liquid through the nozzle tube is automatically controlled in conformity with the filling conditions, and the objectionable effects of ordinary practice are substantially obviated or eliminated. In this modification, also, the jacket and Venturi tube members of the nozzle tube may be constructed of flexible materials.

It will be apparent that numerous modifications and alterations may be made in the size, form and details of construction of the nozzle tubes herein described without departing from the scope of the appended claims.

What I claim and desire to secure by Letters Patent is:

1. A nozzle tube comprising, an elongated tubular jacket, a Venturi tube extending longitudinally through said jacket and concentrically arranged therein to provide a substantially annular passageway between the jacket and tube which is open at one end, means providing communication between the opposite end of said passageway and the inlet end of said Venturi tube, a tubular nozzle member extending into the inlet end of said Venturi tube and having fluid tight engagement with the bore of said jacket rearwardly of said opposite end of said passageway, and signal means positioned in said passageway and responsive to the flow of gaseous fluid therethrough to emit an audible signal.

2. A nozzle tube comprising, an elongated tubular jacket, a tubular nozzle member mounted in one end of said jacket, said nozzle member having a laterally extending annular flange about its inlet end which has fluid tight connection with the inner wall of said jacket and a tip portion of reduced diameter extending axially into said jacket, a Venturi tube mounted axially within said jacket, said Venturi tube having its inlet end surrounding said tip portion and in radially spaced relation thereto and terminating forwardly of said annular flange, the discharge end of said Venturi tube extending beyond the opposite end of said jacket, said Venturi tube being of generally smaller diameter than said jacket to thereby provide a generally annular passageway between the jacket and the Venturi tube, and signal means mounted in said passageway and responsive to the flow of gaseous fluid through said passageway to emit an audible signal.

3. A nozzle tube comprising, an elongated tubular jacket, a Venturi tube extending longitudinally through said jacket and arranged therein to provide a longitudinal passageway between the jacket and tube open at one end and communi-

cating at the opposite end with the inlet to said Venturi tube, a hollow chamber arranged in the inlet end of said jacket and in communication with said passageway and the inlet to said Venturi tube, a tubular nozzle member extending through said chamber and longitudinally movable relative to the inlet of said Venturi tube, a valve in said chamber operative by the longitudinal movement of said nozzle member to control the flow of liquid therethrough, and means responsive to vacuum created in said chamber by the flow of liquid through said Venturi tube to produce said longitudinal movement of said nozzle member.

4. A nozzle tube comprising, an elongated tubular jacket, a Venturi tube extending longitudinally through said jacket and concentrically arranged therein to provide a substantially annular passageway between the jacket and tube, a tubular nozzle member mounted in said jacket and longitudinally movable relative to the inlet end of said Venturi tube, a valve operative by the longitudinal movement of said nozzle member to control the flow of liquid therethrough, and means responsive to vacuum created in said passageway by the flow of liquid through said Venturi tube to produce said longitudinal movement of said nozzle member.

5. A nozzle tube comprising, an elongated tubular jacket, a Venturi tube extending longitudinally through said jacket and concentrically arranged therein to provide a substantially annular passageway between the jacket and tube which is open to the atmosphere at one end, an enlarged chamber which is connected to the opposite end of said jacket, and communicating with the bore of said Venturi tube, means providing communication between the opposite end of said passageway and the interior of said chamber, a tubular nozzle member extending axially through said chamber into the inlet end of said Venturi tube and movable axially relative thereto, a valve in the bore of said nozzle member, adapted to be opened and closed by axial movement thereof, and means positioned in said chamber and connected to said nozzle member and responsive to vacuum conditions in said chamber to produce said axial movement of said nozzle member.

6. A nozzle tube comprising, an elongated tubular jacket, a Venturi tube extending longitudinally through said jacket and concentrically arranged therein to provide a substantially annular passageway between the jacket and tube which is open to the atmosphere at one end, an enlarged chamber connected to the opposite end of said jacket and communicating with the bore of said Venturi tube, means providing communication between the opposite end of said passageway and the interior of said chamber, a tubular nozzle member extending axially through said chamber into the inlet end of said Venturi tube and movable axially relative thereto, a valve in the bore of said nozzle member adapted to be opened and closed by axial movement thereof, and a fluid tight flexible partition member extending across said chamber and connected to said nozzle member, said partition member being responsive to vacuum conditions in said chamber to produce said axial movement of said nozzle member.

7. A nozzle tube according to claim 3 wherein a signal means is mounted in said passageway, said signal means being responsive to the flow of gaseous fluid through said passageway influenced by said vacuum to emit an audible signal.

WILLIAM A. HARGISS.