Nov. 28, 1967 J. D. LEWIS ET AL 3,354,905

FLUID DISTRIBUTOR

Filed March 31, 1965

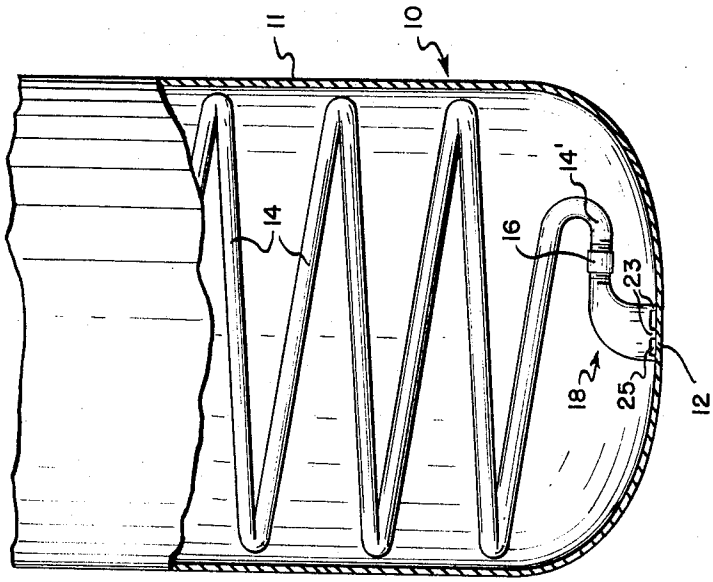

FIG. 1

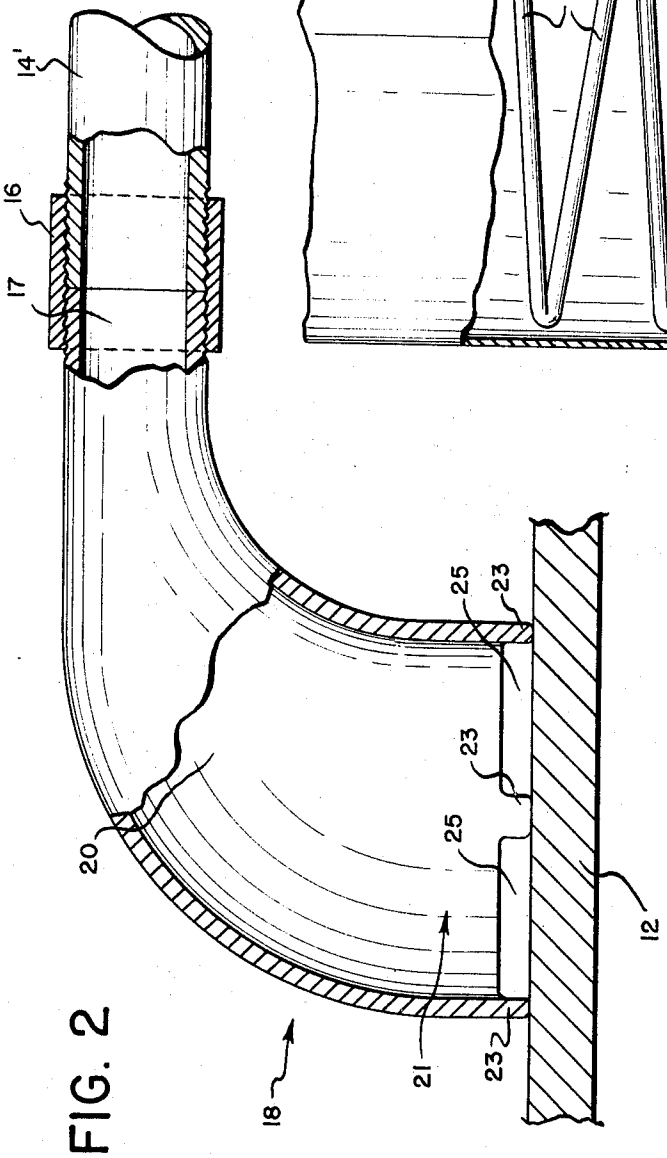

FIG. 2

INVENTORS
JOHN D. LEWIS
MORGAN C. SZE
BY HAROLD B. KOHN
Pennie, Edmonds, Morton, Taylor & Adams
ATTORNEYS

United States Patent Office 3,354,905
Patented Nov. 28, 1967

3,354,905

FLUID DISTRIBUTOR

John D. Lewis, Berkeley Heights, N.J., and Morgan C. Sze, Garden City, and Harold B. Kohn, Yonkers, N.Y., assignors to Vehoc Corporation, a corporation of Delaware

Filed Mar. 31, 1965, Ser. No. 444,302
1 Claim. (Cl. 137—590)

ABSTRACT OF THE DISCLOSURE

A fluid distributor for use on the open end of a conduit for conveying chilled pressurized fluid into and out of a bottle adjacent the bottom thereof, the fluid distributor including a neck attached to the conduit and a mouth facing downwardly towards the bottom of the bottle with lugs about its periphery for defining apertures between the mouth and the bottom of the bottle of greater total flow capacity than the open end of the conduit.

This invention relates to means for conveying fluid into and out of a bottle through a conduit extending downwardly into and opening at the bottom of the bottle and, more particularly, to a fluid distributor at the open lower end of the conduit through which the conduit communicates with the interior of the bottle.

In the transportation of compressed and refrigerated natural gas mixtures by ship, large elongated bottles vertically disposed in the hold of the ship are used to contain the fluid cargo. To load a bottle of this kind, a pressurized cushion gas is first introduced into the bottom of the bottle through an internal fluid conduit which extends downwardly through the top of the bottle to the bottom thereof. The hydrocarbon gas mixture is then introduced at constant pressure into the bottom of the bottle through this fluid conduit while the cushion gas is removed through another opening at the top of the bottle. At the unloading port, the cargo is removed at constant pressure from the bottom of the bottle through the internal fluid conduit by the introduction of a pressurized displacement gas at the top of the bottle. At least some of the displacement gas may be expanded out of the bottle after the fluid cargo has been unloaded.

It is very important to remove virtually all of the chilled cargo fluid by means of the displacement gas, or else when the latter is expanded out of the bottle any substantial residue of the chilled cargo fluid will flash off and drop to a very low temperature. This temperature may be well below the minimum safe chilling temperature for the wall of the bottle, and as a result the bottle could crack. The usual form of open ended internal conduit cannot be relied upon to remove the last inch or so of cargo fluid from the bottom of the bottle, and a residual pool of even that small size can cause serious over-chilling when it flashes off. Another factor of significance in the design of the internal fluid conveying conduit is that during loading it should direct the chilled cargo fluid into the cushion gas in a fashion which reduced admixture of the two to a minimum. This is achieved by creating the least possible amount of turbulence as the chilled cargo fluid is forced into the bottom of the bottle.

Broadly stated, the invention is concerned with means for conveying fluid into and out of a bottle wherein a conduit extends downwardly into the bottle and opens adjacent the bottom thereof. In particular, it provides a fluid distributor at the open end of the conduit comprising a neck portion attached to and communicating with the open end of the conduit. The distributor also includes a mouth communicating with the neck portion, and facing and spaced from the bottom of the bottle to define aperture means therewith of greater flow capacity than the open and of the conduit.

Because the mouth of the distributor faces downwardly toward the bottom of the bottle, the spacing between it and the bottom of the bottle can be made quite small. This spacing determines the height of the aperture through which the cargo fluid passes on its way into the conduit, which in turn is a measure of the depth of whatever residual cargo fluid will be left in the bottle. It is so small as to be negligible, and no significant over-chilling occurs from the flashing off of that remaining minor amount of cargo fluid.

Also, the aperture defined between the mouth of the distributor and the bottom of the bottle can be rather wide since the circumference of the mouth need not be limited to that of the neck of the distributor. Consequently, even though the aperture is very small in its vertical dimension, its considerable width permits it to define an area of appreciable size. The flow capacity through the aperture can therefore be greater than through the conduit, and fluid exiting from the conduit slows down as it passes through the distributor. This results in far less turbulence and cargo fluid directed out of the distributor does not tend to admix with the cushion gas.

A preferred embodiment of the invention is described hereinbelow with reference to the accompanying drawing, wherein:

FIG. 1 is a fragmentary elevation partly broken away of a bottle having an internal fluid conduit to which the distributor of the invention is attached;

FIG. 2 is an enlarged fragmentary elevation partly broken away of the distributor in operative position relative to the bottom of the bottle.

In FIG. 1, the lower end of a bottle **10** is shown which includes an elongated cylindrical body portion **11** and a rounded end portion or bottom **12**. When such a bottle is used to contain chilled or compressed natural gas mixtures on board ship, its bottom **12** is supported by a suitable structure so that the bottle is disposed vertically in the hold. An internal fluid conduit **14** extends downwardly through the top of the bottle of the bottom thereof. It is advantageous to configure the conduit **14** helically so that it can accommodate variations in dimension of the bottle produced by temperature changes. The lower end **14'** of the conduit **14** terminates adjacent the bottom **12** of the bottle at the center portion thereof.

In accordance with the invention, and as shown in more detail in FIG. 2, the lower end **14'** of the conduit is threaded to receive a collar fitting **16**. The collar fitting **16** is in turn threaded to a neck portion **17** of a distributor **18** such that the neck portion **17** communicates with the open lower end **14'** of the conduit and extends substantially horizontally therefrom. The distributor **18** also includes a downwardly turned throat portion **20**, the diameter of which increases smoothly from the smaller diameter at the neck portion **17**. At the lower end of the downwardly turned throat portion **20** is a mouth **21** facing downwardly toward the bottom **12** of the bottle. Four equally spaced integral lugs **23** extend downwardly from the periphery of the mouth **21** to rest against the bottom **12** of the bottle. Adjoining pairs of these lugs **23** define apertures **25** between the mouth **21** and the bottom **12** of the bottle, and the total area of apertures **25** (and thus the total flow capacity thereof) is greater than the area (and flow capacity) at the open end **14'** of the conduit.

To load a hydrocarbon gas mixture into the bottle **10**, the bottle is first filled with a pressurized cushion gas. The hydrocarbon cargo fluid, in a state of moderate compression and refrigeration, is then introduced into the bottle **10** through the conduit **14** and the distributor **18** at the bottom of the bottle as the cushion gas is released at the

top of the bottle, so that the pressure of the cargo fluid remains substantially constant. Because the area of the apertures **25** is greater than the area at the open end **14'** of the conduit, the fluid cargo disperses into the bottom of the bottle thereof at a lesser flow rate through the apertures **25** than it would if introduced directly out of the end **14'** of the conduit. Because its flow rate is less, the fluid cargo directed through the distributor **18** creates less turbulence and does not tend to admix with the cushion gas to any significant extent. Adulteration of the fluid cargo is therefore reduced to an absolute minimum.

When the bottle **10** is to be unloaded of its fluid cargo, a pressurized displacement gas is directed into the top of the bottle so that the fluid cargo is forced through the distributor **18** and up the conduit **14** to be removed from the bottle. Even though the apertures **25** are of relatively large total area, they can be made quite low in height because the circumference of the mouth **21** of the distributor is appreciably greater than that of the neck portion **20**. Therefore, the mouth of the distributor **18** can be effectively located within an eighth of an inch or so of the bottom **12** of the bottle to collect and withdraw virtually all of the displaced fluid cargo at the end of the unloading cycle. For all practical purposes, none of the fluid cargo remains as a residual pool at the bottom of the bottle, and hence none can flash off to over-chill the wall of the bottle when the displacement gas is expanded and evacuated.

By this construction, the distributor **18** minimizes turbulence during loading of the fluid cargo and eliminates any remaining pool of the cargo after unloading which could expand and over-chill the bottle wall.

We claim:

In means for conveying chilled pressurized fluid into and out of a bottle wherein a conduit extends downwardly into the bottle and opens adjacent the bottom thereof, a fluid distributor at the open end of the conduit comprising:

(a) a neck portion attached to and communicating with the open end of the conduit,

(b) a mouth providing the only communication with the neck portion and facing downwardly toward the bottom of the bottle, and

(c) lugs extending downwardly from the periphery of the mouth and resting against the bottom of the bottle to define apertures between the mouth and the bottom of the bottle of greater total flow capacity than the open end of the conduit.

References Cited

UNITED STATES PATENTS

2,036,698	4/1936	Hill	220—3
2,193,466	3/1940	Raymond	137—590
2,934,831	5/1960	Tasker	137—590
3,250,420	5/1966	Kohn	220—3

FOREIGN PATENTS

1,205,295	8/1959	France.

M. CARY NELSON, *Primary Examiner.*

W. CLINE, *Assistant Examiner.*

Dedication

3,354,905.—*John D. Lewis*, Berkeley Heights, N.J., and *Morgan C. Sze*, Garden City, and *Harold B. Kohn*, Yonkers, N. Y. FLUID DISTRIBUTOR. Patent dated Nov. 28, 1967. Dedication filed Sept. 16, 1971, by the assignee, *Vehoc Corporation.*

Hereby dedicates to the Public the entire remaining term of said patent. [*Official Gazette December 28, 1971.*]