Nov. 5, 1968 L. C. CREITH 3,409,165

FLOATING DECK

Original Filed Oct. 29, 1964 2 Sheets-Sheet 1

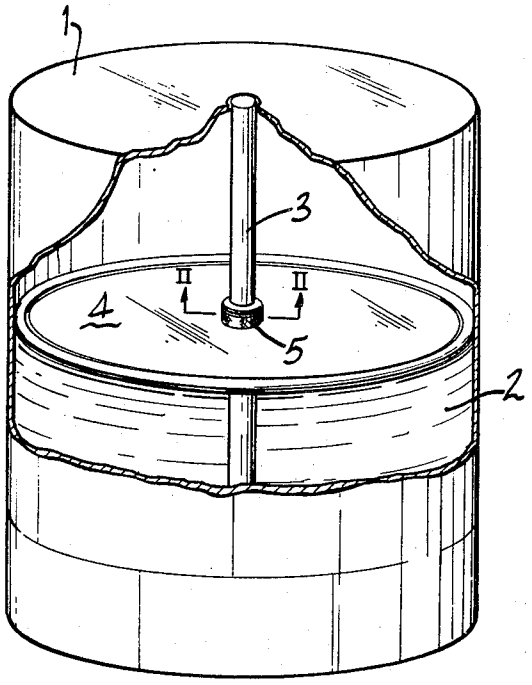

FIG - 1

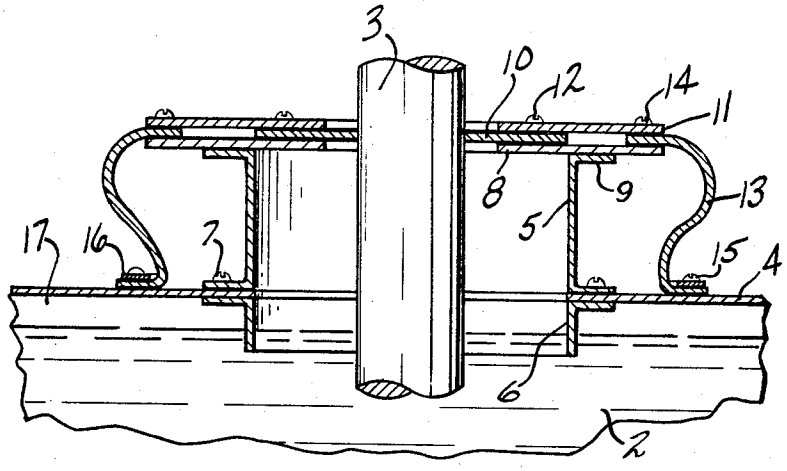

FIG - 2

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FLOATING DECK

Original Filed Oct. 29, 1964 2 Sheets-Sheet 2

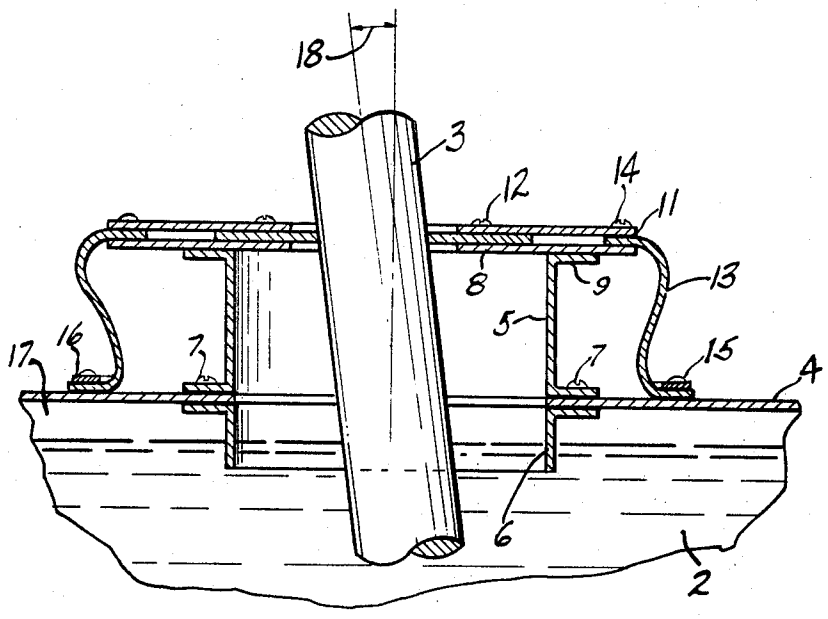

FIG-3

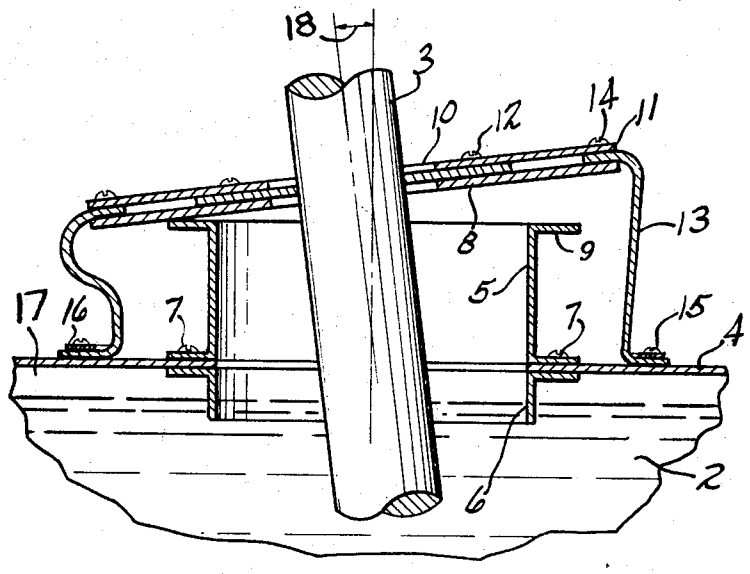

FIG-4

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FLOATING DECK

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Continuation of application Ser. No. 407,372, Oct. 29, 1964. This application Apr. 3, 1967, Ser. No. 628,162
15 Claims. (Cl. 220—26)

ABSTRACT OF THE DISCLOSURE

A floating deck is provided having an opening therein. One sleeve member projects from the lower side of the deck at the opening and a second sleeve member projects upwardly from the deck at the opening. A diaphragm having one or more supporting rings rests upon the upper portion of the upper sleeve to allow for the passage of a vertical pole through the opening.

This application is a continuation of application, Ser. No. 407,372, filed Oct. 29, 1964.

This invention relates to a floating deck for use within a liquid storage tank, and more particularly to a novel seal for a pole passing therethrough.

Floating decks of many types and forms have been proposed and used in tanks designed for the storage of various liquids. Such decks float horizontally on the surface of the liquid in the tank and move downwardly with the surface as the liquid is removed from the tank. Thus, protection is afforded for any liquid which is affected by the presence of air. For example, evaporation of such liquids as petroleum distillate and crude petroleum is materially reduced, thus resulting in a reduction in the risk of fire and explosion, as well as in a substantial cost saving due to the decreased evaporation losses. Merely exemplary of such a floating deck is that described in detail in U.S. Patent 3,104,775, issued Sept. 24, 1963, to Champagnat.

However, it has become evident that many tanks for which such floating decks are desirable are provided with one or more vertical poles on the interior of the tank. Accordingly, some provision must be made for those portions of the floating deck through which such poles pass; evaporation losses near such deck portions must be held to a minimum to maintain the desired advantages of a floating deck. In addition, any seal used at such an area must provide for possible misalignment of the vertical poles. That is, such poles are often not precisely perpendicular to the tank floor; hence, the seals must be so designed as not to bind the horizontal deck as it ascends or descends along the poles.

According to this invention there is provided a diaphragm which sealingly engages the pole or column passing through the floating deck. Such diaphragm is spaced above the surface of the liquid to be protected by means of a cylindrical section surrounding the pole or column, for reasons to become evident. A shroud surrounds the metal cylindrical section connecting the diaphragm to the floating deck, and a lower ring penetrates the liquid below the floating deck, thereby preventing further vapor escapages.

It is therefore an object of the present invention to provide a seal for a floating deck employed in tanks having vertical poles.

It is a further object of the present invention to provide such a seal which will not impede the motion of the deck as it travels along a pole which may be slightly misaligned.

Further objects will become apparent to those skilled in the art as a description proceeds of a specific embodiment illustrated in the attached drawings which form a part hereof and wherein:

FIGURE 1 is a fragmentary perspective view of a storage tank embodying the instant invention;

FIGURE 2 is a cross-section of the instant device along the line II—II of FIGURE 1;

FIGURE 3 is a view similar to FIGURE 2 showing the device on a pole which is misaligned;

FIGURE 4 is a view similar to FIGURE 3 showing another possible position of the device on a misaligned pole.

In FIGURE 1 there is illustrated a conventional storage tank **1** having stored therein a liquid **2**. At **3** there is illustrated a vertical column or pole; only one such column or pole is illustrated, but it is to be understood that any number of such vertical elements may be provided in the tank according to design need. Situated in the tank is a floating deck **4**, of any of the known types. As is now known in the art, deck **4** will descend with the surface of the liquid **2** as quantities of liquid are removed. Apertures must, of course, be provided in the deck **4** through which the pole **3** may pass, and according to this invention there is provided in the floating deck **4** at the area of the pole **3** a seal of the present invention identified generally as **5**.

The seal is shown in detail in FIGURE 2, which is a cross-section taken along the line II—II shown in FIGURE 1. Situated around the aperture in the deck **4** through which the pole **3** passes is a first cylindrical sleeve **5** which may be of metal, and a second cylindrical sleeve **6**, which may be of metal or some other material essentially impervious to the stored product and to the passage of vapors. Sleeves **5** and **6** are joined to the deck **4** as at **7** in any suitable manner, as for example, by rivets. As can be seen, sleeve **6** penetrates the surface of the liquid and thus seals off the space within the instant device from the surrounding space between the surface of the liquid **2** and the underside of the deck **4**. This space, identified generally by **17** may contain vapors, but by virtue of sleeve **6**, such vapors are prevented from escaping through the instant seal device.

Atop the sleeve member **5**, as on a flange **9** thereof, rests a pair of annular rings **8** and **11** between which is clamped a diaphragm **10** of a pliable, essentially impervious coated fabric or other resilient natural or synthetic material. The diaphragm **10** is apertured centrally thereof in a configuration to sealingly engage the pole **3**, and is securely held between the rings **8** and **11** by suitable fasteners **12** having a low projection on the underside of ring **8**, for reasons to become evident. Secured between the annular rings **8** and **11** is one end of a substantially cylindrical shroud **13**, secured by similar suitable fastening means **14**. As shown, the shroud **13** surrounds the sleeve **5**, and is attached at its opposite end to deck **4** as by fasteners **15**. To ensure a more positive seal, an annular ring **16** may be provided at the connection of shroud **13** to deck **4**, if so desired.

Thus, it will be evident from the above description that the diaphragm **10** and its supporting rings **8** and **11** are free to move horizontally with respect to the sleeve **5** should the pole **3** be slightly misaligned, for example as shown in FIGURE 3 or to tip so as to be at an angle to the plane of flange **9**, for example as shown in FIGURE 4. The misalignment of pole **3**, as represented by the angle **18**, depicted in FIGURE 3 and FIGURE 4 is exaggerated for sake of clarity.

The shroud **13**, which is of a flexible construction such as an impervious coated fabric, is of a sufficient length to allow for the sliding or tipping of the diaphragm **10** and rings **8** and **11**. As noted previously, the fasteners **12** and **14** have low projection on the underside so as not to impede the motion of rings **8** and **11** across flange **9**. While allowing for free movement of the diaphragm **10**, the shroud **13** also serves to prevent

any loss of vapor from between the flange **9** and ring **8** when these elements may become separated. Thus, as deck **4** moves downwardly, the diaphragm **10** and supporting rings **8** and **11** may become spaced from the flange **9** or such a space may result from the tipping depicted in FIGURE 4; however, the presence of shroud **13** prevents any loss of vapor through this space to the space above the deck **4** and also serves to pull the diaphragm **10** and supporting rings **8** and **11** down as the deck moves downward.

By the structure above described, it is evident that important advantages are obtained. But for the instant device, an area around the pole **3** would be open to the air above the deck **4** and hence the undesired evaporation could take place in such an area. In the instant device, however, the diaphragm **10** sealingly engages the pole **3** and prevents such evaporation. It is to be noted that while the pole **3** is shown as being cylindrical, the pole may have any desired configuration and the diaphragm would be accordingly apertured to match this configuration. By virtue of the cylindrical member **5**, the diaphragm **10** is spaced above the surface of the liquid **2**, thus allowing for free movement of the diaphragm **10** substantially unimpeded by deck **4**, ensuring that shroud **13** is not trapped between the diaphragm **10** and any stationary member on the deck, and preventing direct liquid losses through the diaphragm.

Although this invention has been described with reference to a particular embodiment, various changes will be apparent to those skilled in the art, and the invention is therefore not to be limited to such embodiment except as set forth in the claims.

I claim:

1. A floating deck for use in liquid storage tanks having at least one vertical pole therein, comprising:

(a) a horizontal deck member adapted to float on the surface of the enclosed liquid and having an aperture therein to receive a substantially vertical pole passing therethrough,

(b) a sleeve member surrounding said aperture and joined to said deck member on the upper side thereof,

(c) a diaphragm supported by said sleeve member and having an aperture to sealingly receive said pole,

(d) a flexible shroud member encasing said sleeve member, and joining said diaphragm to said deck member,

whereby said diaphragm may move with respect to said deck member independently on said pole.

2. A floating deck for use in liquid storage tanks having at least one vertical pole therein, comprising:

(a) a horizontal deck member adapted to float on the surface of the enclosed liquid and having an aperture therein to receive a substantially vertical pole passing therethrough,

(b) a first sleeve member surrounding said aperture and joined to said deck member on the upper side thereof,

(c) a diaphragm supported by said first sleeve member and having an aperture to sealingly receive said pole,

(d) a flexible shroud member encasing said first sleeve member, and joining said diaphragm to said deck member,

(e) a second sleeve member joined to and projecting from the lower side of said deck member for penetration of the liquid surface therebelow, said second sleeve member surrounding said aperture,

whereby said diaphragm may move with respect to said deck member independently on said pole.

3. A floating deck according to claim **2** for use in liquid storage tanks having more than one vertical pole therein in which said horizontal deck member has an aperture to receive each vertical pole in said storage tank and in which the items B, C, D, and E in claim **2** are provided for each vertical pole and aperture in the horizontal deck.

4. A floating deck according to claim **2** in which said first sleeve is flanged at an upper portion to receive said diaphragm.

5. A floating deck according to claim **2** in which additional sealing means are provided to seal said shroud to said deck.

6. A floating deck according to claim **2** in which at least one supporting ring is affixed to said diaphragm.

7. A floating deck according to claim **6** in which supporting rings are affixed to both sides of said diaphragm.

8. A floating deck according to claim **7** in which said first sleeve is flanged at an upper portion to receive the lower supporting ring.

9. A floating deck according to claim **7** in which fasteners are used to secure said supporting rings to said diaphragm, said fasteners having a low projection on the underside of the lower supporting ring.

10. A floating deck for use in liquid storage tanks having at least one vertical pole therein, comprising:

(a) a horizontal deck member adapted to float on the surface of the enclosed liquid and having an aperture therein to receive a substantially vertical pole passing therethrough,

(b) a first sleeve member surrounding said aperture and joined to said deck member on the upper side thereof,

(c) a second sleeve member joined to and projecting from the lower side of said deck member for penetration of the liquid surface therebelow, said second sleeve member surrounding said aperture,

(d) a diaphragm supported by said first sleeve member and having an aperture to sealingly receive said pole,

(e) at least one supporting ring clampingly engaging said diaphragm and being concentric therewith,

whereby said diaphragm may move with respect to said deck member independently on said pole.

11. A floating deck according to claim **10** for use in liquid storage tanks having more than one vertical pole therein in which said horizontal deck member has an aperture to receive each vertical pole and in which items (b), (c), (d) and (e) in claim **10** are provided for each vertical pole and aperture in the horizontal deck.

12. A floating deck according to claim **10** in which said first sleeve has a radially, outwardly directed flange at its upper portion upon which an area adjacent the periphery of said diaphragm and supporting ring rests.

13. A floating deck for use in liquid storage tanks having at least one vertical pole therein, comprising:

(a) a horizontal deck member adapted to float on the surface of the enclosed liquid and having an aperture therein to receive a substantially vertical pole passing therethrough,

(b) a first sleeve member surrounding said aperture and joined to said deck member on the upper side thereof,

(c) a second sleeve member joined to and projecting from the lower side of said deck member for penetration of the liquid surface therebelow, said second sleeve member surrounding said aperture,

(d) a diaphragm supported by said first sleeve member and having an aperture to sealingly receive said pole,

(e) supporting rings clampingly engaging said diaphragm on the upper and lower surfaces of said diaphragm, said rings being concentric with said diaphragm,

whereby said diaphragm may move with respect to said deck member independently on said pole.

14. A floating deck according to claim **13** in which said first sleeve has a radially, outwardly directed flange

at its upper portion upon which an area adjacent the periphery of said lower supporting ring rests.

15. A floating deck according to claim **14** in which fasteners having a low projection on the underside of the lower supporting ring are used to secure said supporting rings to said diaphragm.

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