Jan. 2, 1951 C. M. ORR ET AL 2,536,077

VENT FOR FLOATING ROOF TANKS

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Fig. 1.

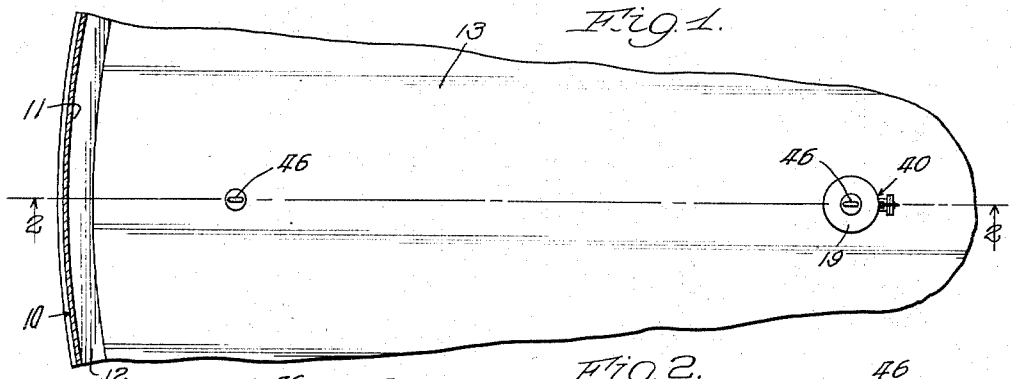


Fig. 2.

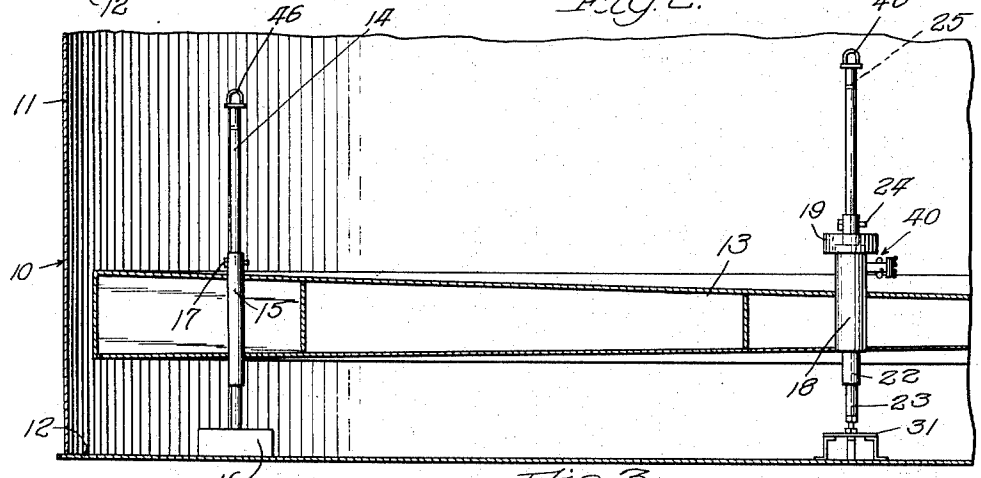
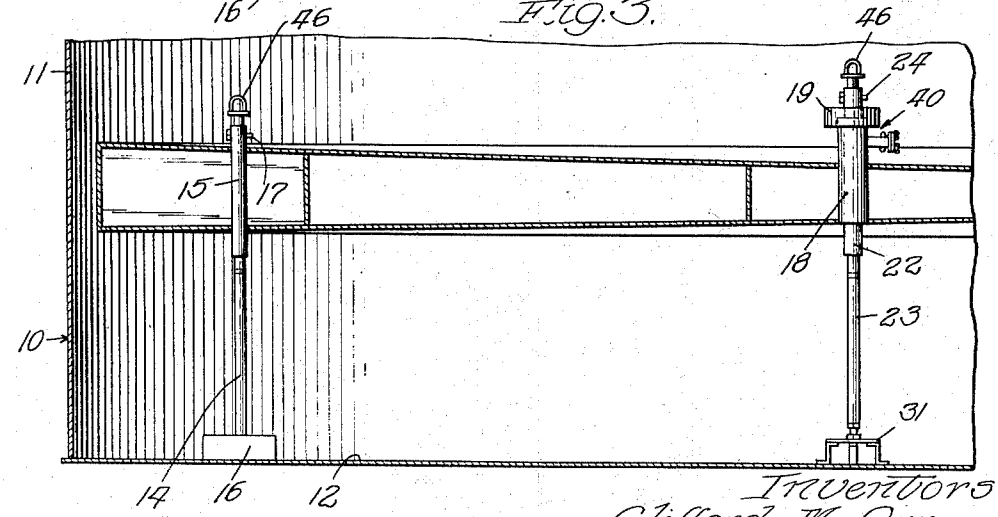


Fig. 3.



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Fig. 4.

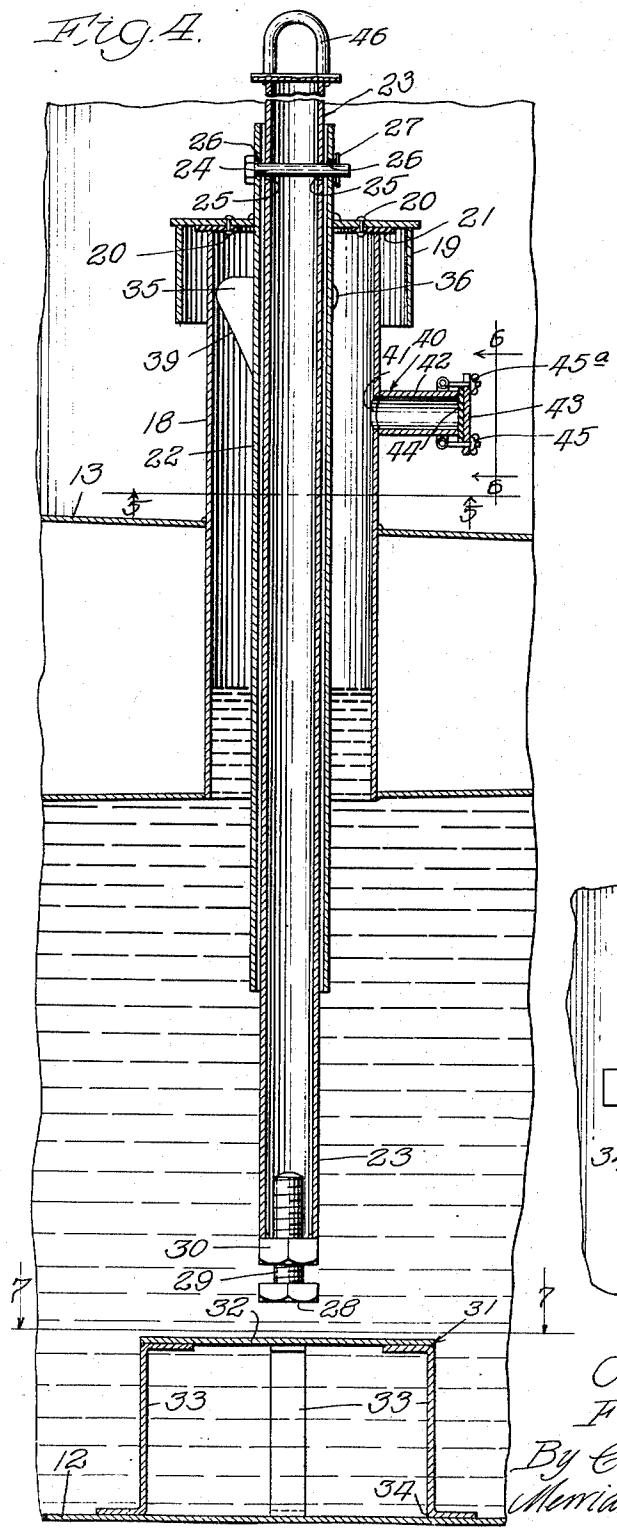


Fig. 5.

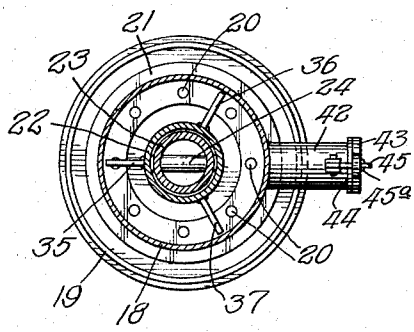


Fig. 6.

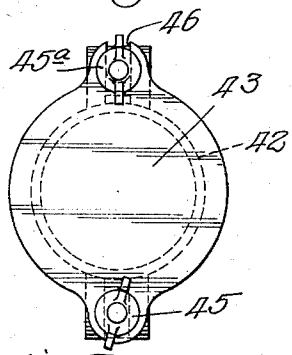
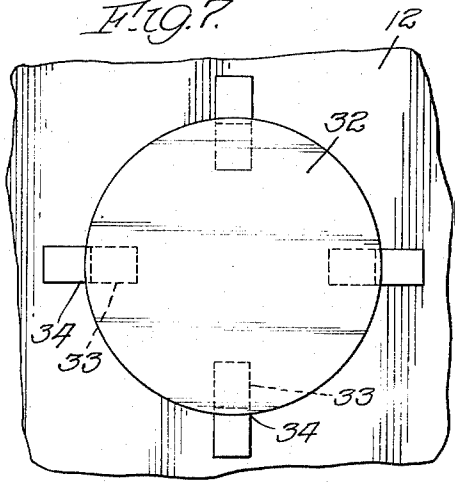


Fig. 7.



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VENT FOR FLOATING ROOF TANKS

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Application October 17, 1946, Serial No. 703,732

5 Claims. (Cl. 220—44)

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This invention relates to a vent, and more particularly to a vent for a floating roof tank.

Volatile liquids are often stored in tanks having a roof floating upon the surface of the liquid stored therein, adapted to rise and fall with the liquid level within the tank. Such floating roofs are generally provided with some sort of supporting means to maintain the roof a predetermined distance above the bottom of the tank even though all or substantially all of the liquid is drained from the tank.

Difficulty has been experienced when reintroducing liquid to a floating roof tank from which the liquid has been previously withdrawn, in that no means is provided for the air within the tank between the bottom and the roof to escape as liquid is being introduced. This has resulted in a large air bubble forming under the roof. Difficulty has also been experienced in draining such a tank completely, as means must be provided for allowing air to enter the space between the roof and the tank after the roof has reached its lowest position in order to permit the liquid to escape.

We have invented, and are herein disclosing and claiming, a vent for a floating roof tank which is automatically opened when the roof falls to a predetermined height above the bottom of the tank thereby permitting air to enter the space below the roof as further liquid is drained, and permitting air to escape from said space when liquid is introduced into the tank.

The invention will be described as embodied in the illustration shown in the accompanying drawings in which

Fig. 1 is a top elevation of a portion of a liquid storage tank and a floating roof;

Fig. 2 is a vertical section along lines 2—2 of Fig. 1;

Fig. 3 is a vertical section along lines 2—2 of Fig. 1 with a roof at a higher position above the bottom of the tank;

Fig. 4 is a vertical section through a portion of the floating roof showing our vent;

Fig. 5 is a horizontal section along lines 5—5 of Fig. 4;

Fig. 6 is a plan view along lines 6—6 of Fig. 4; and,

Fig. 7 is a top elevation along lines 7—7 of Fig. 4.

Referring to the drawings, a portion of a cylindrical tank 10 is shown, having side walls 11 and a bottom 12. A floating roof 13 of usual construction is adapted to float upon the surface of the liquid contained within the tank. It is

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customary in such installations to provide sealing means between the edge of the floating roof and the tank to prevent loss of vapor from that space; however, such sealing means form no part of this invention and hence are not shown in the drawings. A plurality of supporting posts 14 are provided about the roof being received into the pipe-like members 15 extending through the roof and adapted to rest upon the bottom of the tank or upon pedestals 16 attached to the bottom. It is customary to connect the support 14 to the pipe 15 by adjustable means, such as a bolt 17, in order that the height above the bottom may be varied as required. For example, the bolt might be positioned as shown in Fig. 2 or as shown in Fig. 3. The pedestals 16 are not necessary and the supports may rest directly upon the bottom of the tank.

The vent comprises a cylinder 18 formed in the roof 13 and extending therethrough. Sealing the upper portion of the cylinder is a sealing member, being in the embodiment shown, in the form of an inverted cup 19. We prefer to construct the sealing member of metal and attach thereto, such as by means of rivets 20, a resilient sealing member 21. Welded to the cup 19 is a pipe-like member 22 extending downwardly through the cylinder 18. An actuating element 23 is connected to the member 21 by means of a bolt 24. In the embodiment shown, the actuating element is in the form of a hollow rod having a plurality of holes 25 formed therein, which holes match a hole 26 formed in the pipe-like member 22. The bolt 24 is secured in position by a cotter pin 27 or other means, and the bolt may be withdrawn and reinserted through the holes 26, the member 22 and another of the holes 25 in the member 23 to vary the relative position of the hollow rod 23. This latter adjustment is further aided by a bolt 29 threading into a nut 30 attached to the bottom of the member 23. Positioned on the bottom 12 of the tank is a pedestal 31 comprising a flat, circular plate 32 attached to angle irons 33 which are in turn attached to the bottom of the tank at 34 as shown. As stated before, the pedestals may be dispensed with, if desired, and the term "bottom" used throughout this application should be taken to mean either the bottom of the tank or the top of a pedestal, or the like, attached to the bottom, as the case may be.

As can be seen from an examination of Fig. 4, a further lowering of the roof 13 would cause the end 28 of the member 23 to strike the bottom of the tank (the bottom in this case being the

top of the pedestal 31). The member 23, being connected by bolt 24 to the pipe 22, prevents further vertical movement in a downward direction of the cup 19, and further lowering of the roof thereupon lowers the cylinder 18 below the cup, opening the space under the roof to the atmosphere. The roof may continue to drop until the supports 14 contact the bottom halting its movement. The liquid within the tank may be completely drained without danger of a vacuum forming beneath the roof as the cylinder 18 remains open to the atmosphere.

As liquid is reintroduced to the tank and rises therewithin, air may escape through the cylinder 18 and no pressure is built up beneath the roof. As the liquid reaches the bottom of the roof and continues to rise, it eventually will float the roof off the supports 14. Further upward movement of the roof will bring the upper portion of the cylinder 18 in contact with the seal 21, closing the vent and lifting the member 23 off the bottom.

In order to center the pipe 22 within the cylinder, tapered vanes 35, 36 and 37 are provided. These vanes are attached to the pipe 22 and are adapted to slidably contact the interior of the cylinder 18. The tapered portion 38 of the vanes is adapted to guide the pipe to the center of the cylinder as the roof rises. A manually operable vent 40 is also provided, comprising an opening 41 in the side of the cylinder 18 to which is attached a pipe 42 capped at the opposite end by a metal cap 43, and a resilient seal 44. Wing nuts 45 and 45*a* attached to bolts on the pipe 42 and fitting into slots 46 of the cap 43 permit the same to be opened manually.

Our vent serves not only to open communication between the atmosphere and the space beneath the roof while the roof is below a predetermined height within the tank, but also serves as a pressure vent. It can be seen that excessive pressures within the tank would lift the cup and open the vent. The amount of pressure necessary to open the vent will vary, of course, with the weight of the members 22 and 23 and the cup 19. Additional weights may be added to the structure to raise the pressure necessary to open the vent without interfering with the function thereof when the roof is below the predetermined height. The supporting posts and the member 23 are provided with a ring 46 to facilitate the placement of the bolts 17 and 24 in the various holes, as desired.

While we have shown and described our invention in its preferred embodiment, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

We claim:

1. In a floating roof tank having a roof adapted to float on liquid within the tank, a vent comprising: a substantially vertical cylinder formed in said roof and extending therethrough, an inverted cup sealing the upper end of said cylinder, a pipe connected to said cup and extending into said cylinder, an elongated element connected to said pipe and extending beneath the roof, said element being in contact with the bottom of the tank in all positions of the roof below a predetermined height to prevent vertical movement of said cup with vertical movement of the roof below said predetermined height whereby said cylinder is opened to the atmosphere at all pressures in the space beneath the roof in all positions of the roof below said predetermined height.

2. The vent of claim 1 including centering means attached to said pipe to guide said pipe to the center of said cylinder.

3. The vent of claim 1 including tapering centering means attached to said pipe adapted to guide said pipe to the center of said cylinder as the roof rises from below said predetermined height.

4. The vent of claim 1 in which said element is connectable to said pipe at a plurality of positions to vary said predetermined height.

5. In a floating roof tank having a roof adapted to float on liquid within the tank, a vent comprising: a substantially vertical cylinder formed in said roof and extending therethrough, an inverted cup sealing the upper end of said cylinder, a pipe connected to said cup extending into said cylinder, an element connected to said pipe adapted to be in contact with the bottom of the tank in all positions of the roof below a predetermined height to prevent vertical movement of said cup with vertical movement of the roof below said predetermined height whereby said cylinder is opened to the atmosphere at all pressures in the space beneath the roof in all positions of the roof below said predetermined height, said element being connectable to said pipe at a plurality of said positions to vary said predetermined height, and said element being provided with adjustable contacting means on its bottom end to precisely adjust said predetermined height.

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