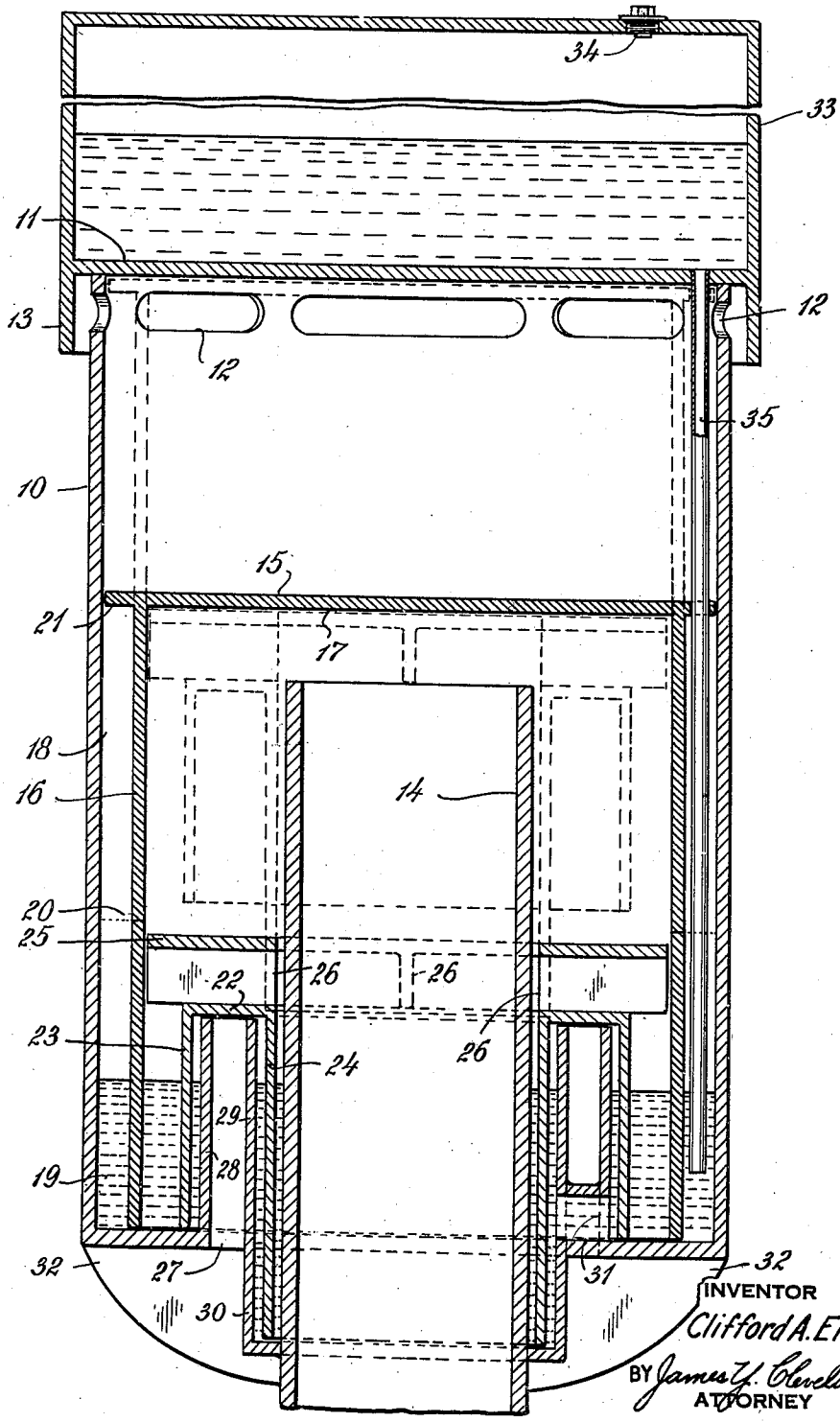
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TANK VENT VALVE

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TANK VENT VALVE

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2 Claims. (Cl. 137—53)

This invention is concerned with relief valves for the release of differential pressures existing between the vapor space above volatile liquids stored in vapor tight tankage and the surrounding atmosphere.

As is well known, gasoline, crude petroleum, and similar volatile liquids or liquids containing volatile constituents are normally stored in tanks with vapor tight roofs capable of withstanding pressure and vacuum ranging from a fraction of an inch of water pressure to several inches of water pressure to avoid evaporation losses. At the same time, due to expansion and contraction of the contents of the vapor space due to temperature changes, and also to pumping in or removing liquid, it becomes necessary to provide for egress or ingress of considerable volumes of vapor or air. Tank vent valves are used to accomplish this purpose.

This invention has for its object the provision of a liquid sealed vent valve for this purpose which valve does not force passage of vented vapors or incoming air through the sealing liquid. It has also the object of providing such a valve capable of passing quickly from closed to full capacity position.

The construction of my novel valve will be understood by reference to the drawing attached hereto the figure of which shows a vertical section through the valve.

In the figure, 10 is the external shell of the valve, closed at the top by plate 11, and equipped near its upper end with ports 12 of sufficient area to vent the maximum outward gas flow which the valve is expected to handle. The cover plate 11 may be extended and flanged downwardly, as at 13 to protect the ports from ingress of rain, dirt, and the like. The valve is mounted upon and supported by a central pipe 14 which communicates with the vapor space of the tank to be protected. Within valve body 10 and around and over pipe 14 there is a valve member 15 composed of a skirt 16 and cover plate 17. This valve member is so constructed that its total weight, divided by the area of the underside of plate 17 which lies within the skirt 16, is that design pressure at which the tank must be vented. This pressure will normally be about 1 to 4 inches of water. The valve member 15 is so mounted that its skirt 16, which is spaced inwardly from wall 10, as at 18, dips into and is sealed by liquid 19. This liquid may be water, glycerine, mercury, or any of the liquids usually used for this purpose. I normally prefer water, and when it is desired that the valve be kept in service during freezing weather, brine. The submergence of the skirt 16 in liquid 19 is so calculated that any tank pressure less than sufficient to lift valve member 15 will not be bypassed under skirt 16. That is, as the pressure in the tank rises the sealing liquid rises within space 18, reaching a level 20 when the pressure reaches design relief pressure level. At that instant valve member 15 lifts, and the liquid drops away. The length of dip skirt 16 and the distance between the bottom of orifices 12 and the bottom of the valve body is such that when the dip skirt 16 leaves the sealing liquid, the outward flange 21 of valve body cover plate 17 is still below the bottom of ports 12, so that the liquid is permitted to drop away without any more blowing through the liquid than just enough to transmit tank pressure into passage 20. At this instant the pressure within the tank commences to act, not only upon the bottom area of plate 17 within skirt 16, but also upon the bottom area of the overhanging outward flange 21, giving a force substantially greater than just necessary to lift the valve member, and the valve rises to the position indicated by dotted lines, above orifices 12 and vents. As long as it is venting, the lifting pressure works upon both areas, and consequently the valve will not drop and close until the tank pressure is at a level below that at which the valve was opened. This gives a "snap" return, at a pressure at which no vented gas will pass through sealing liquid 19. By these means I have completely avoided any blowing through sealing liquid, while still retaining all of the very real advantages of a liquid seal.

A very similar provision is made for preventing existence of vacuum above a desired level within the tank. Within valve member 15 there is provided a vacuum relief valve composed of a plate 22, an outer skirt 23, and inner skirt 24, and a plate 25 supported above, fastened to and spaced from plate 22 by edge-mounted radial members 26. This structure is so proportioned that the entire weight of the member, divided by the area of the underside of plate 22 between skirts 23 and 24 is equal to the design vacuum venting pressure. Access of atmosphere to the underside of plate 22 is by annular port 27; formed in the valve body by ring plates 28 and 29. Since the vacuum vent pressure level is lower than the internal pressure vent pressure level, skirt 23 will be shorter than the skirt 16 of the pressure valve member 15, and when the vacuum vent valve assembly is lifted, it will be stopped by and within pressure vent valve 15 in the position shown by the dotted

lines, at which time atmospheric air flowing in through passage 27 will flow freely through the space around the now elevated skirt 23, through the space between plates 22 and 25 in their elevated position, and through pipe 14 into the tank. Also, when the skirt 23 is lifted from the sealing liquid, plate 25 has not yet passed above the end of pipe 14, and at this instant, the inflowing air will exert lifting pressure against the underside of plate 25, which is a larger area than that of plate 22, thus giving the same "snap" action for opening and closing and the same avoidance of blowing through the liquid seal as in the pressure relief valve assembly. It is equally clear that the motion of this valve from full closed to full open position will be practically instantaneous, the sealing liquid around skirt 23 acting in the same manner as that described for that around skirt 16. To prevent blowby along pipe 14 on vacuum venting, skirt 24 is made longer than is skirt 23, and its seal well 30 is correspondingly deepened. To permit maintenance of liquid in this seal, one or more bridge passages for liquid across annular port 27 are provided, as at 31. To support the whole assembly with respect to pipe 14 and preserve its alignment, several brackets 32, usually three equally spaced brackets, are provided. An optional fature which is of real merit is utilized to maintain the seal liquid level over long periods without inspection, as follows: the cover plate 11 of the main valve body may be extended upwardly as at 33 to provide an auxiliary seal liquid container, closed by a plug 34. Downwardly into the valve, through plate 11, and extending into the sealing liquid to the plane of normal level of liquid attained in space 18 just before vacuum venting, there extends a pipe 35. Thus, when the seal liquid becomes depleted, as by leakage or evaporation, additional liquid will be fed in at these times, and the proper volume of liquid automatically maintained within the valve.

The whole assembly is simple in character, formed of flats and simple tubular shapes, and is most conveniently and cheaply assembled by welding. Since cover plate 11 is removable, complete and ready access may be had to the entire interior by removal of the moving valve members and complete cleaning or necessary maintenance is facilitated.

I claim:

1. In a tank vacuum relief valve of the kind described a casing having vertical side walls and top and bottom closures and a central pipe extending into the interior of the casing and adapted to communicate with the tank to be vented, within said casing a sealing liquid, within said casing and around said pipe a valve composed of a top plate, a secondary plate, spacing means between said top plate and said secondary plate, and a dip skirt, the top plate extending from wall to wall of said casing except for sufficient clearance to permit vertical movement and an orifice with similar clearance for passage of said central pipe, said secondary plate similarly clearing said central pipe and being of substantially less area than said top plate, said dip skirt depending from the outer edge of said secondary plate, means to admit atmospheric pressure to the underside of said secondary plate within said dip skirt, the area so exposed being sufficient to lift the valve when exposed to design vacuum relief pressure, the depth of the sealing liquid, the length of the dip skirt, the space between the two plates and the height of the central pipe being such that the dip skirt is pulled from the sealing liquid before the top plate passes above the end of the central pipe, at which moment the atmospheric pressure has access to the underside of the top plate to lift the valve to venting position and to prevent closing of the valve until the vacuum is reduced to a vacuum substantially below the design vacuum relief pressure.

2. In a combined pressure and vacuum relief valve for use upon storage tanks handing volatile liquids, a casing having substantially vertical walls, a top closure, a bottom closure, and a central pipe adapted to communicate with a tank to be vented, orifices in said casing near the top thereof, a sealing liquid in said casing, a gasometer type pressure relief valve within said casing, said pressure valve comprising a top plate and a dip skirt, said top plate extending from wall to wall of said casing except for clearance sufficient to permit vertical movement, said dip skirt being spaced away from the walls of said casing and defining a lift area upon the underside of said top plate sufficient for lifting the valve at design relief pressure, the submergence of the dip skirt and the location of the orifices in the casing being such that the valve must make substantial vertical travel after the dip skirt leaves the sealing liquid before the top plate clears the orifices and permits free venting, a vacuum valve comprising a top plate and a dip skirt within said pressure valve and surrounding said central pipe, means to admit atmospheric air into the space within the pressure valve at a point under the vacuum valve top plate and above the sealing liquid, the vacuum valve top plate extending from wall to wall within the pressure valve dip skirt which acts as a casing therefor except for cearance sufficient to permit vertical motion and having an orifice with similar clearance for the central pipe, the vacuum valve dip skirt being spaced away from the central pipe to permit access of design vacuum vent pressure to a limited lifting area sufficient to lift said valve so long as the vacuum valve is seated, the length of the vacuum valve dip skirt and the height of the point of access to the central pipe being so proportioned as to require additional travel after the vacuum valve dip skirt has left the sealing liquid before free venting is permitted.

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