March 28, 1939. J. J. TOKHEIM 2,152,422

SAFETY DEVICE FOR VOLATILE LIQUID STORAGE TANKS

Filed Jan. 25, 1937

Fig. 1.

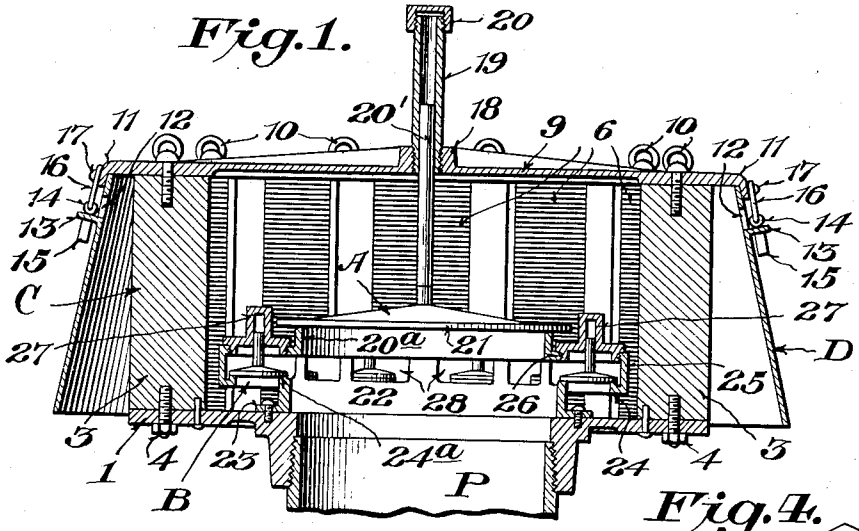


Fig. 4.

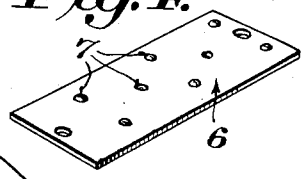


Fig. 2.

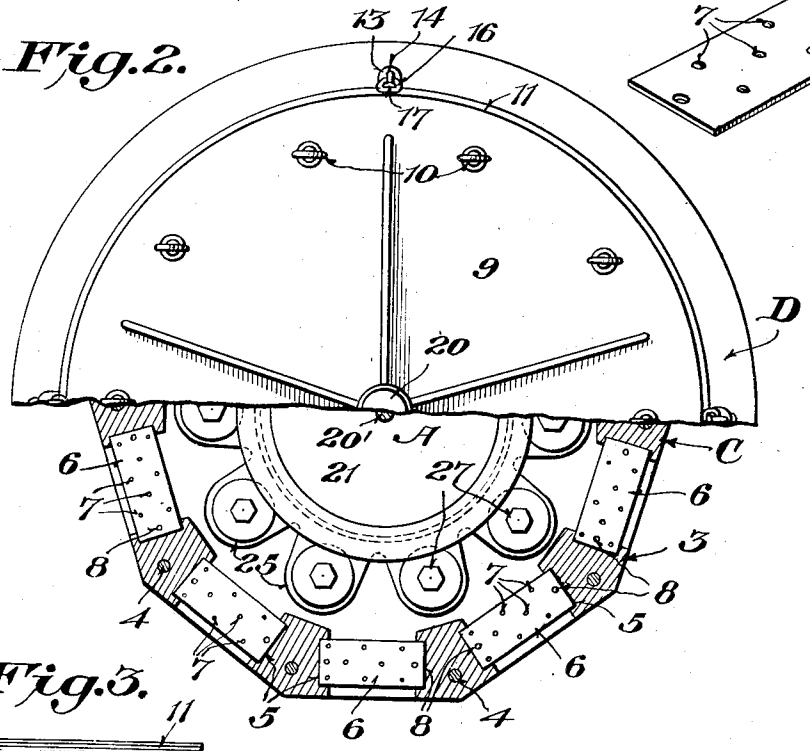
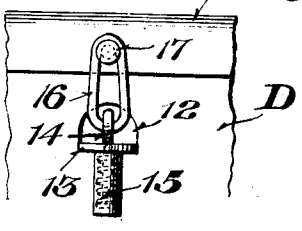


Fig. 3.



Inventor.

John J. Tokheim,

By D. T. Woodhead

Attorney

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SAFETY DEVICE FOR VOLATILE LIQUID STORAGE TANKS

John J. Tokheim, Cedar Rapids, Iowa

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6 Claims. (Cl. 220—44)

This invention relates to a safety device for volatile liquid storage tanks.

Storage tanks for gasoline and the like must be provided with adequate venting means not only to take care of the expansion of air or vapor above the fluid level therein, but also to permit the ingress of air when the liquid fuel is withdrawn from the tank to prevent the formation of a vacuum which would tend to collapse the tank. Moreover, such vents must be so constructed as to provide adequate protection against fire, dust, sand, rain, snow and ice.

Accordingly, the present invention has primarily in a view combined pressure and vacuum valve device and a fire protecting cage therefor. In that connection, the invention contemplates a structure including a single pressure or blow off valve surrounded by a multiplicity of vacuum valves, all of said valves being housed within a novel cage which permits of free access to the atmosphere so that the valves may reliably function under normal conditions of use, and, on the other hand, will be amply protected in the case of fire to prevent failure of the valves and also to prevent ignition of the contents of the tank.

A further object of the invention is to provide a novel weather-shield which in normal use adequately protects the valves from water, or snow and ice, and which, in case of fire, will drop out of position to compel flame propagation on the outside of the cage.

With the above and other objects in view which will more readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination and arrangements of parts hereinafter more fully described, illustrated and claimed.

A preferred and practical embodiment of the invention is shown in the accompanying drawing, in which:

Figure 1 is a vertical sectional view illustrating the invention.

Figure 2 is a top plan view, partly in section of the construction shown in Figure 1.

Figure 3 is a detail perspective view of a portion of the weather shield and cover showing the fusible link connecting the same.

Figure 4 is a detail perspective view of one of the flame arresting plates.

Similar references designate corresponding parts throughout the several figures of the drawing.

According to the embodiment of the invention shown in the drawing, the same includes in its organization a vapor condensation compelling and pressure relief or blow off valve A surrounded by an annular series of vacuum valves B, all housed within a valve cage designated generally as C and surrounded by a weather-shield D.

The cage C comprises a base 1 having a central internally threaded nipple 2 for mounting the entire device on a vent pipe P connected with the storage tang in the usual manner. The base 1 is provided at its outer periphery with a plurality of posts 3 which may be secured thereto by suitable fastenings 4. These posts are channeled or grooved at opposite sides to form guideways for receiving the opposite ends of the metal flame arresting plates 6. These plates are provided with integral offset spacing projections so that when they are arranged in stacked formation in the opposed channels 5 of adjacent posts, they provide intervening air passages for establishing communication between the valves A and B and the atmosphere. The plates in each stack may be conveniently held together by the fastenings 8. The top of the posts 3 support a cover plate 9 which is preferably secured to the posts by the fastenings 10 having winged heads to facilitate their placing and removal.

The outer edge of the cover plate 9 is preferably flanged downwardly as indicated at 11 to provide an annular recess for receiving the upper end of the frusto-conical weather shield D. The body of the shield is provided with a plurality of slots or openings 12 formed by striking out an ear 13. This ear is perforated to receive the shank of an eyebolt 14 said shank being tensioned by a coil spring contained within a housing 15. The eye 14 receives a fusible link or loop 16 which engages the fastening 17 on flange 11. This arrangement locates the fusible link 16 at the hole or slot 12, and the spring tensioned eyebolt 14 holds the weather-shield D firmly in place. In the event of fire, any flame propagated at the outer side of the plates 6 will pass through the openings 12 and quickly melt the links 16 thereby permitting the shield to drop. Ordinarily, however, the shield remains in the position shown in Figure 1 to prevent water entering the valve cage, or to prevent the formation of ice on the plates which would obstruct the free passage of air. The cover 9 is provided with a central boss 18 which is interiorally threaded to receive a tubular valve stem guide 19. The upper end of the tubular guide is fitted with a removable cap 20. As will be observed from the drawing, the guide 19 receives the stem

20' of the pressure relief valve A to guide it in its movement.

The pressure relief valve A is of substantially the same diameter as the pipe P so as to permit of full efficiency under service conditions. The body of the valve A fits within the collar 20a of the valve supporting casting which is common to both the pressure valve A and vacuum valves B as will presently appear. The body of the valve is provided with an annular flange which overlies the upper edge of the collar 20a so that the valve will tightly seat on the collar.

The valve casting which supports the pressure valve A and vacuum valves B, and which also includes the collar 20a previously referred to is designated generally as 22. This casting is provided with the base flange 23 which is secured to the base 1 about the opening formed by the threaded nipple 2 and is also provided with an intermediate horizontal wall 24 provided with ports or openings surrounded by the seats 24a for the vacuum valves B. This wall 24 is connected by a vertical web 25 with another or top horizontal wall 26 which is provided with openings for receiving the vacuum valve guide members 27.

The wall 26 carries the collar 20a previously referred to, and the portion of the casting below the collar 20a is provided with a series of openings 28 for establishing communication between the pipe P and the vacuum valves B which rest on the seats 24a formed in the wall 24. The ports about which seats 24a are formed communicate with the atmosphere through the space between the plates 6. The vacuum valve guiding members 27 are threaded into the top horizontal wall 26 of the valve casting, and by receiving the stems of the valves B serve to guide them in their opening and closing movements.

From the foregoing it will be apparent that the present construction provides a safety device performing the essential functions of (1) permitting air or vapor pressure in the tank to escape when the pressure exceeds the weight or load on the valve while on the other hand normally holding the vapors in the tank so that they may be condensed, thus preventing ordinary vapor losses; (2) when liquid is withdrawn from the tank the vacuum valves will function to admit air to displace the fluid withdrawn and prevent warping of the tank; (3) provide a flame arrestor screen which normally functions to prevent dust, soot, sand, etc., from entering the valve chambers and obstructing the proper closure of the pressure and vacuum valves. Further, in case escaping vapors through pressure valve and flame arrester cage ignite, the flame arrester stops the flame from entering the valve chamber, preventing consequent damage to valves or finally igniting the gases within the tank, causing tank explosion; (4) provides a weather shield with fusible link fasteners, normally functions to protect flame arrester and valves against rain, snow and sleet, and in case of fire at flame arrester to automatically drop down to protect the tank roof from becoming too hot, by permitting flame to spread outwardly instead of downward.

In breather vents it is important that all valve seats are provided with complete or perfect drainage, otherwise the escaping vapors when coming in contact with the atmosphere condense and form moisture in the valve chambers. Unless the valves are provided with complete drainage this moisture in cold weather freezes the valves fast to the valve seats. In warm weather the moisture dries and leaves a gummy substance on the valves and seats, glueing the valves to the seats. In either case prevents the valve from properly functioning. It will be noted from drawing Figs. 1 and 2 that the pressure valve seat 21, in casting 22 provides complete drainage both inside and out. The vacuum valves are provided with complete drainage on the outside between base casting 1, and valve seat bottom 24, and on the inside through vapor port 28, which opening is below valve seat 24a and drains directly into pipe P.

The interlocking breather valves, flame and dust arrester and weather-shield, insure unobstructed function and protection to storage tanks of volatile liquids.

It is further to be noted that the vacuum valves are made comparatively small in diameter. This to enable them to be light in weight and still retain the required strength to withstand the pressure applied by the pressure on the tank without warping and defeating their purpose. The light weight vacuum valves are especially important in storage of volatile liquid blends, as the light ends are drawn to the surface by vacuum, becoming vapors, and thus separating the blend and depreciating the value of the mixture.

The relatively large single pressure relief valve A adequately permits of adapting the device to a tank of a given size. For example, the diameter of the tank in feet, plus one fourth of the diameter is approximately the same as its area of the vent valve in square inches. Thus, if the tank is 40 feet in diameter, this formula shows that the index for computing the area of the valve is 50, that is 50 square inches. Therefore, since the area of an eight inch pipe is 50 square inches this size valve will meet all requirements. The total area of the vacuum valves is substantially equal to the area of the single pressure relief valve so that the valves are fully designed to compensate for movement of air or gas either in or out of the tank.

The foraminous valve cage, dust and sand screen flame arrester and its weather shield are essential to the proper functioning of all of the valves and the means which permits the shield to drop; in case of fire affords further protection to the tank as the flame will blaze outwardly and upwardly, in place of being forced down against the tank roof. Since the flame arrester and valve cage prevent fire propagation to the valve chamber, but burns entirely on the outside of plate stack 6. The valves function properly under fire and when the vapor pressure on the tank becomes less than the valve pressure, the valve closes and automatically the fire is extinguished for lack of fuel.

Without further description it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention and scope of the appended claims.

I claim:

1. A safety device for volatile liquid storage tanks including in combination, a casting having a central valve seat and a plurality of separate valve seats surrounding the central valve seat, said casting having passages for establishing communication between the last named valve seats and the space beneath the central valve seat, a pressure valve mounted on said central

valve seat, and vacuum valves on said separate valve seat.

2. In a safety device for volatile liquid storage tanks, the combination with a supporting vent pipe carried by the tank, of a pressure relief valve of substantially the same area as the pipe, and a plurality of vacuum valves of substantially the same total area as the pressure valve spaced radially from the axis of said pressure valve and arranged circumferentially there-about.

3. In a safety device for volatile liquid storage tanks, a casting mounted on the base member and having a central valve seat, and a plurality of separate valve seats in said casting surrounding and below the central valve seat, said casting having ports in the side thereof for establishing communication between the said separate valve seats and the space beneath the central valve seat, a pressure valve mounted on said central valve seat, and vacuum valves on said separate valve seats.

4. In a safety device for volatile liquid storage tanks, valve means comprising a casting having a central valve seat at the top portion thereof and having a laterally offset portion provided with a plurality of valve seats, said casting being provided between said laterally offset portion and the central valve seat with ports for establishing communication between the plurality of valve seats and the space beneath said central valve seat, a pressure responsive valve mounted on said central valve seat and a plurality of vacuum valves mounted on said separate valve seats.

5. In a safety device for volatile liquid storage tanks, a base member having an opening, pressure and vacuum valve means carried by said base above the opening therein, said means including a casting having a bottom portion adapted to rest on said base, an inner vertical wall provided with ports, a central valve seat formed above said inner wall, a pressure responsive valve for said valve seat, a laterally extending wall on the casting arranged substantially medially of the height of the latter and having a plurality of vacuum valve seats therein arranged opposite said ports in the vertical wall of the casting, and vacuum valves for said vacuum valve seats in the casting.

6. In a safety valve for volatile liquid storage tanks, a base having an opening and adapted to be fitted to the vent pipe of the storage tank; valve means arranged over said opening in the base and including a central pressure responsive valve and a plurality of vacuum valves, arranged circumferentially about the pressure responsive valve.

JOHN J. TOKHEIM.