This invention relates to an overflow device for liquid storage tanks, and has for one of its objects to provide an overflow device which, by such design or construction that it effectively prevents a tank from being accidentally filled with liquid to a point which is higher or above the designed maximum liquid level of the tank, thereby preventing injury or damage to parts of the tank roof or side wall, as hereinafter explained.

Another object is to provide an overflow device for tanks used to store inflammable liquid, that effectively prevents excess liquid from spilling out of the tank during the operation of filling the same and forming a pool of inflammable material around the tank that creates a fire hazard. Other objects and desirable features of my invention will hereinafter be pointed out.

Sometimes in the operation of filling a liquid storage tank, the tank is filled with liquid to a point which is above the designed maximum height or level for the liquid in the tank. In the case of a tank provided with a floating roof, the roof is liable to rise to such a height or level that the sealing structure at the peripheral edge of the roof will accidentally hook over the top edge of the tank side wall and be torn away from the roof when the roof subsequently descends, due to a drop in the level of the liquid on which the roof floats.

In floating roof tanks of the kind used to store oil, it has been the custom to form overflow slots in the tank side wall just below the top edge of said wall, but such overflow slots have proved to be inefficient and objectionable for numerous reasons, such as:

(a) The overflow oil that runs down the outside face of the tank side wall destroys the paint or other external coating on said wall, and if the overflow is excessive, a pool of oil collects on the ground around said wall and creates a dangerous fire hazard, which, in many instances, has become ignited and made it impossible to cut off the flow of oil being pumped into a storage tank;

(b) The high pumping rates of approximately 10,000 bbls. per hour, that are now common practice, require the overflow slots to be of such area and located at such a point in the tank side wall, that the maximum storage capacity of the tank is greatly diminished; and

(c) The overflow slots in the tank side wall are located at such a level, that they are apt to be closed or obstructed by the peripheral sealing structure on the roof, thus interfering with or cutting off the escape of the excess oil from the tank and rendering said overflow slots useless or inefficient.

My improved overflow device overcomes or eliminates the above mentioned objectionable characteristics of a floating roof tank equipped with an overflow consisting simply of slots in the upper edge portion of the tank side wall.

Briefly described, my improved overflow device consists of or comprises a closed housing or casing mounted on the exterior of the upper edge portion of the tank side wall and connected to same by a liquid and gas-tight joint, a weir or dam arranged horizontally on the interior of said housing with its top edge disposed in spaced relation with the housing so as to form an overflow slot for liquid in excess of the quantity of liquid the tank is designed to hold, an opening in the tank side wall for permitting liquid in the tank to pass into said housing, disposed at a point or level lower than the level of the above mentioned overflow slot formed by the top edge of said weir and an opposed portion of the said housing, and an ejection pipe leading from the lower end of said housing. Preferably, the lower discharge end of said ejection pipe terminates at a point beyond or outside of a fire wall built on the ground around the tank, so that overflow liquid from the tank cannot form a pool of inflammable liquid that surrounds the tank in close proximity to the tank side wall.

Figure 1 of the drawings is a fragmentary, vertical transverse sectional view of a floating roof tank equipped with an overflow device embodying my invention;

Figure 2 is a fragmentary side elevational view of said tank; and

Figure 3 is an enlarged, vertical sectional view, illustrating the principle of operation of my improved overflow device.

In Figure 1 of the drawings, the reference character A designates the side wall of a floating roof tank, B designates the floating roof which is supported by the liquid in the tank and adapted to move upwardly and downwardly in the tank as the level of the liquid varies, and C designates as an entirety the sealing mechanism on the periphery of the roof, that is used to close the annular space between the roof and the tank side wall, said sealing mechanism being carried by the roof and arranged in sliding engagement with the tank side wall.

My improved overflow device comprises or is composed of the following elements, to wit: A gas-tight housing D attached to the outer face of the tank side wall, and preferably made of such form that it tapers from its upper to its lower end, as shown in Figure 2, a weir or dam E arranged transversely of said housing in spaced relation with the top wall F of said housing so as to form a horizontal overflow slot x, a liquid inlet for said housing D, formed by a slot y in the tank side wall arranged horizontally at a level or point below the previously mentioned overflow slot x formed by the top edge of the weir E, so as to permit excess liquid to pass from the tank into the housing D, and an ejection pipe F leading from the lower end of the housing D and supported by any suitable kind of brace or supporting structure G on the tank side wall.

As shown clearly in Figure 3, the dam or weir E is so proportioned and arranged that it extends outwardly and upwardly from the bottom edge of the slot y in the tank side wall, and terminates at a point in relatively close proximity to the top wall F or top portion I of the housing D, so as to form a horizontally disposed overflow slot x of relatively small vertical height or depth as shown in Figure 3, but which is of relatively great length and preferably extends across the entire width of the housing D as shown in Figure 2. Said overflow slot x may have a cross sectional area much greater than the cross sectional area of the ejection pipe F. The upper end portion of the housing D may have a width of from two to four feet, and the overflow slot x, formed by the top edge of the weir E and an opposed portion of said housing, may have a depth of from one inch to one and a half inches. The vertical height or depth of the weir E may be from four inch to eight inches, and the housing D is mounted as high as possible on the side wall of the tank.

During the operation of pumping the liquid into the tank, the bottom edge of the side wall shoe C rises above the bottom edge of the slot y as the liquid surface in the tank rises above the bottom edge of the slot x. Therefore liquid starts to flow very slowly from the tank through the ejection pipe F. By the time the bottom edge
of the shoe has uncovered, say three fourths of the area of slot y, liquid is flowing downward through pipe F to uncover the siphonic action has nearly reached its peak. Now as the liquid surface in the tank starts to drop, the bottom edge of the side wall shoe descends below the top edge of slot y, thereby diminishing the flow of liquid through eduction pipe F, and when the flow of liquid through said pipe F is thus cut down the siphon is broken at the lower end of said pipe by air flowing upwardly through said pipe against the liquid stream until said air enters the housing D and breaks the siphon. If the slot y is 4 3/4 inches wide area of said slot is 24 square inches which is just about the internal area of a 6 inch diameter pipe, and with a slot y of such dimensions the flow of liquid through the eduction pipe F would be cut down about 50% when the bottom edge of the side wall shoe descends approximately 3/4 of an inch below the top edge of slot y. In my improved structure the side wall shoe is never subjected to a force of pressure that will wreck it or interfere with its operation due to the relatively small area of the shoe (about 12 square inches or one half of the area of the slot y) that is pulled against the tank side wall until the suction is broken as above described. If the suction is as much as 100% per square inch, the force pushing the shoe against the side wall is only 10×12 or 120# total, which is not enough to interfere with the operation of the shoe. But suppose that the suction were applied to the entire height of the dam E and the side wall shoe had to take the place of the port of the tank side wall which is between the top edge of slot y and the bottom edge of slot y, say, for example 6 inches. Then the suction would be applied to an area of 6”×48” or 288 square inches which would cause the shoe to be pressed against the tank side wall by a pressure of 10×288 or 2880# which would wreck the side wall shoe.

I prefer to build a circular fire wall H on the ground in widely spaced relation with the tank side wall, and mount the eduction pipe F in such a way that it discharges excess liquid at a point sufficiently remote from the tank to eliminate the possibility of overflow liquid forming a pool of inflammable material that completely surrounds the tank, and which, if ignited, might make it impossible for the operative in charge of the tank to turn off the valve through which liquid is admitted to the tank.

Briefly stated, my improved overflow device has the following desirable characteristics:

(a) It uses atmospheric pressure to force excess liquid over the top edge of a weir, by setting up a siphon in an eduction pipe leading from the top edge portion of the tank side wall;

(b) It discharges overflow liquid at a point remote from the tank; and

(c) It prevents paint or the like on the exterior of the tank side wall from being marred by overflow liquid.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The combination of a tank designed to hold an approximately predetermined amount of liquid, a vertically movable roof that floats on the liquid in the tank and rises and falls as the level of the liquid in the tank varies, a sealing shoe carried by the roof and arranged in sliding engagement with the tank side wall, a discharge opening in the tank side wall arranged in the path of travel of said sealing shoe, for permitting excess liquid to escape from the tank when the upwardly moving roof approaches the designed maximum liquid level of the tank, a closed housing on the exterior of the tank side wall arranged to receive excess liquid that escapes from the tank through the said discharge opening in the tank side wall, an eduction pipe leading from the lower end portion of said housing, and a weir housing disposed so that excess liquid entering said housing from the tank must rise in said housing and spill over the top edge of said weir before escaping from the housing through said eduction pipe.

2. A structure of the kind described in claim 1, in which the top edge of said weir is located at a level higher than the level of the discharge opening in the tank side wall through which the excess liquid escapes from the tank into said housing.

3. A structure of the kind described in claim 1, in which the top edge of said weir is located at a level higher than the level of the discharge opening in the tank side wall through which the excess liquid escapes from the tank into said housing.

4. The combination of a tank designed to hold an approximately predetermined amount of liquid, a vertically movable roof adapted to float on the liquid in the tank, an annular sealing shoe carried by the roof and arranged in sliding engagement with the tank side wall, and an overflow mechanism for excess liquid that is pumped into the tank during the operation of filling the same, comprising a closed housing communicating with the interior of the tank through a horizontally disposed overflow slot of relatively small vertical height and of relatively great length, located at a level higher than the level of the discharge opening in the tank side wall through which excess liquid escapes from the tank into said housing.

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