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SAFETY AND VACUUM VALVE STRUCTURE FOR TANKS

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Fig. 1.

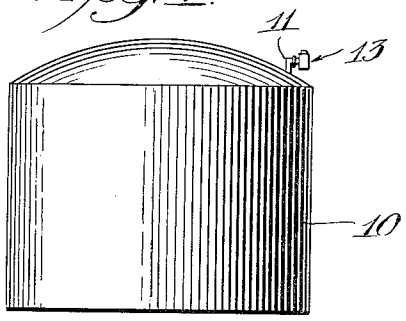
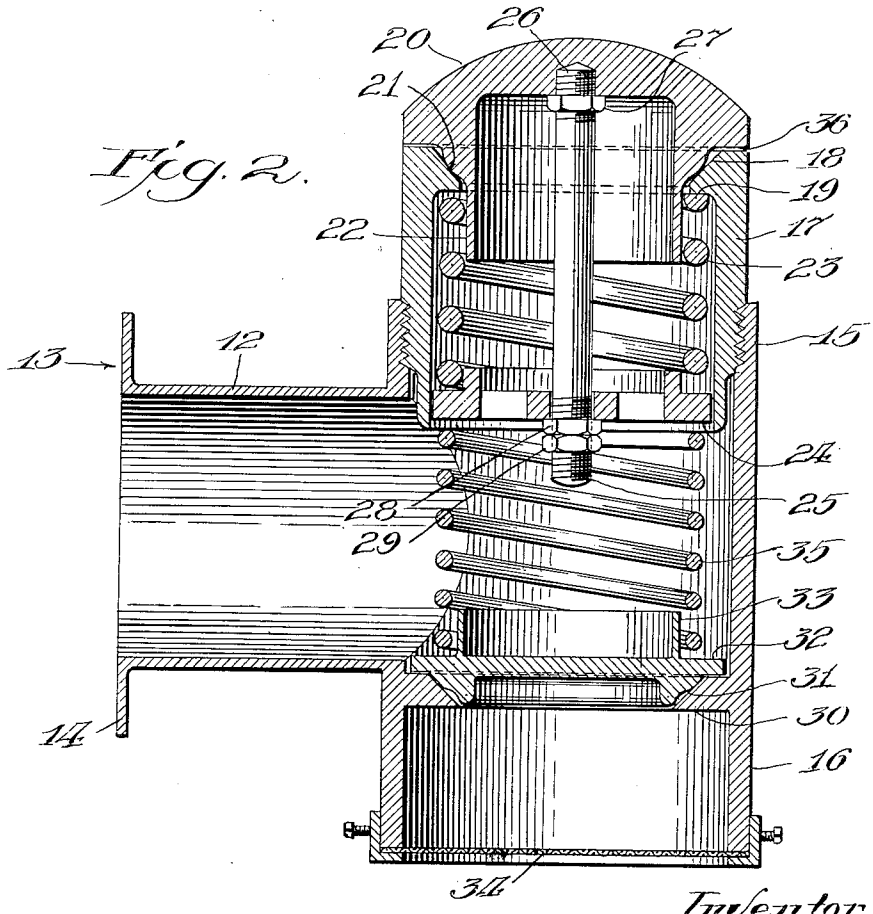


Fig. 2.



Inventor,
George W. King.
By Rector, Hibben, Davis & Macauley
Attys

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SAFETY AND VACUUM VALVE STRUCTURE FOR TANKS

George W. King, Coffeyville, Kans., assignor of two-twelfths to Lee T. Englund, two-twelfths to John E. Mahan, both of Coffeyville, Kans., and seven-twelfths to Roy T. Osborn, New York, N. Y.

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9 Claims. (Cl. 277—21)

My invention relates to a combination safety and vacuum valve structure for tanks, more particularly those intended for storage purposes, which embodies several operating advantages over those now in common use.

One object of my invention is to devise a valve structure of the character indicated which is compactly arranged and adapted for easy attachment to storage tanks for the purpose of relieving any accumulated pressure that may be built up within the tank when the latter is being filled, or for whatever cause, and also to relieve the vacuum which is created when the liquid in the tank is being withdrawn.

A further object is to provide a valve structure as above set forth in which the valves are spring-actuated and so positioned with respect to each other than a common backing member may be used for the two kinds of springs, thereby providing a highly compact structure and one that may be assembled easily and manufactured at a relatively low cost.

A further object is to devise a combination valve structure which incorporates a unit housing that carries both the safety and vacuum valves, so that the device may be assembled in units at remote localities and applied directly to storage tanks.

A further object is to devise a combination valve structure including a safety valve which is arranged to inhibit an accumulation of ice, snow, frost, dirt, cinders and foreign matter in general that might otherwise affect the free movement of the valve, and which is also designed to prevent the entrance of water through the valve into the tank.

These and further objects of my invention will be set forth in the following specification, reference being had to the accompanying drawing, and the novel means by which said objects are effectuated will be definitely pointed out in the claims.

In the drawing:

Figure 1 is an elevation showing a conventional type of storage tank with my improved valve structure in position thereon.

Fig. 2 is an enlarged sectional elevation of the valve structure proper.

The present invention will be described as applied to a storage tank, more particularly one intended for the holding of volatile, inflammable vapors and liquids, although it will be understood that no restrictive interpretation is to be placed upon the particular character of the tank, either as to the nature of the material which it is intended to hold, nor as to its stationary type. The invention is also entirely adaptable for tank cars, or under other operative conditions requiring the diversity of action of which the present device is capable.

Referring to the drawing, the numeral 10 designates a storage tank having a pipe 11 projecting upwardly from the dome thereof. Secured to said pipe is an arm 12 provided on a T-shaped housing 13. The arm or branch 12 may be flanged as at 14, if desired, in order to facilitate its attachment to the pipe 11, although other forms of attachment may be adopted, such as the direct attachment of the branch 12 to the side of the tank 10. The housing 13 also comprises an upwardly extending branch 15 and a downwardly extending branch 16, both of said branches being in substantial alignment and in communication with the branch 12.

Preferably the upper end of the branch 15 is internally threaded to receive the lower end of a cylindrical valve casing 17 which is provided at its upper end with a frusto-conical valve seat 18. Beneath the valve seat 18, the casing 17 is provided with an internal shoulder 19 for a purpose presently explained. A valve 20 is mounted on the casing 17 and is provided with a valve face 21 having a convex profile which is intended to cooperate with the valve seat 18 to close the opening into the interior of the housing 13. Preferably, the top of the valve 20 is dome-shaped, as shown in Fig. 2, and below the valve face 21, the valve 20 may embody a depending, annular apron 22 which serves to guide the valve 20 during its vertical movements.

The valve 20 is yieldingly held in engagement with the seat 18 by means of a helical spring 23 whose upper end abuts against the shoulder 19, with its lower end abutting against a follower 24 which slides freely within the casing 17. In order to maintain the follower in abutting relation to the spring 23, a stud 25 passes freely through the follower and at its upper end is threaded as at 26 in the valve 20, a lock nut 27 serving to maintain the threaded engagement of the stud 24 with said valve. Beneath the follower 24, an adjusting nut 28 and a lock nut 29 are threaded on the stud 24, whereby any desired tension may be set up in the spring 23 in order to establish the pressure at which the valve 20 will rise and relieve the internal pressure within the tank.

The branch 16 is internally provided with an annular shoulder 30 which is preferably disposed adjacent the lower side of the branch 12 and which incorporates a valve seat 31. Engaging

with said valve seat is a disk valve 32 having on its upper side an annular wall 33 for a purpose presently explained. Beneath the shoulder 30, a screen 34 may be bridged across the opening into the branch 16 in order to prevent any movement of dust or foreign particles in general into the tank, when the valve 32 is lifted from its seat by the vacuum within the tank 10. The lower end of a helical spring 35 rests on the upper surface of the valve 32 in encircling relation to the annular wall 33 and the upper end of said spring preferably terminates just short of contact with the underside of the follower 24. Accordingly, the valve 32 is unhindered in its initial, raising movement from the valve seat 31, except for its own weight, and is therefore rendered more sensitive in operation. However, when the valve 32 raises to a certain point, the spring 35 undergoes compression and interposes a constantly increasing resistance to the further movement of the valve and also assists in returning the latter to its seat. During these movements, the contact of the spring 35 with the wall 33 is substantially of a guiding nature. The spring 35 may contact with the follower 24.

The operation of the safety valve portion of the structure is precisely the same as that of safety valves now in standard use, that is, the valve 20 opens and closes in response to pressure conditions obtaining within the tank 10 and depending upon the setting of the spring 23. Its particular advantages over the present practice resides in the fact that, in the first place, the casing 17 and the valve 20 present substantially a smooth, external surface, since both these parts have the same diameter and are placed in close juxtaposition to each other. This relation of the indicated parts effectually prevents accumulation of any foreign material in the region of the valve seat, for the surfaces of these parts operate to deflect any particles, whether of a liquid or of a solid nature, away from the valve structure. When the valve 20 is closed, as shown in Fig. 2, the abutting faces of said valve and the casing 17 are separated by an extremely narrow, annular opening 36 whose width is insufficient to permit the passage therethrough of particles having a size that would interfere with the normal operation of the valve, as well as preventing the accumulation and building up of snow, frost and ice formations within the opening.

The spring 23 is initially set to permit the opening of the valve 20 at some predetermined pressure in order to relieve a pressure that would otherwise accumulate within the tank 10, this condition ordinarily obtaining when the tank is being filled, or it might also arise by reason of temperature changes. The spring 35 and the valve 32, on the other hand, are mutually related to permit an opening of the valve 32 when a predetermined vacuum condition obtains within the tank 10, such as when the tank is being pumped dry, or when the material in general is being withdrawn therefrom. The spring 23 is, of course, the heavier spring and is subjected to greater tension. The provision of having a common backing member 24 for both sets of springs enables a highly compact structure to be evolved for the purpose stated, since both kinds of valves may be arranged within a single housing that may be directly attached to the storage tank as a unitary structure.

While I have shown one set of elements and combinations thereof for effectuating my improved safety and vacuum valve structure, it will be understood that the same is intended for purpose of illustration only and in no wise to restrict my device to the exact forms and structures shown, for many changes may be made therein without departing from the spirit of my invention.

I claim:

1. A safety and vacuum valve structure for tanks comprising a housing having a pair of substantially aligned branches, a safety valve and a vacuum valve positioned in said branches, respectively, a spring for maintaining said safety valve in closed position up to a predetermined pressure, a follower member engaging one end of said spring, a second spring interposed between said vacuum valve and member and adapted to have backing engagement with said member, and means of communication for connecting said pair of branches with the tank.

2. A safety and vacuum valve structure for tanks comprising a housing having a pair of substantially aligned branches, a safety valve and a vacuum valve positioned in said branches, respectively, a spring for maintaining said safety valve in closed position up to a predetermined pressure, a follower member engaging one end of said spring, a second spring guidably contacting said vacuum valve and adapted to have backing engagement with said follower member, and means of communication for connecting said pair of branches with the tank.

3. A safety and vacuum valve structure for tanks comprising a housing having a pair of substantially aligned branches, a safety valve and a vacuum valve positioned in said branches, respectively, a spring for maintaining said safety valve in closed position up to a predetermined pressure, a follower member engaging one end of said spring, a second spring interposed between said vacuum valve and member and adapted to have backing engagement with said member, said second spring having a free height less than the distance between said vacuum valve in the closed position and said follower member, and means of communication for connecting said pair of branches with the tank.

4. A safety and vacuum valve structure for tanks comprising a housing having a pair of substantially aligned branches, a safety valve and a vacuum valve positioned in said branches, respectively, a spring for maintaining said safety valve in closed position up to a predetermined pressure, a follower member engaging one end of said spring, a second spring interposed between said vacuum valve and member and adapted to have backing engagement with said member, said first spring being stronger than said second spring whereby said member is unaffected by a movement of said vacuum valve, and a third branch communicating with said pair of branches and with the tank.

5. A safety and vacuum valve structure for tanks comprising a housing having a pair of substantially aligned branches, a safety valve and a vacuum valve positioned in said branches, respectively, a spring for maintaining said safety valve in closed position up to a predetermined pressure, a follower member engaging one end of said spring, a second spring seated at one end on said vacuum valve and adapted to have backing engagement at the opposite end with said member, said vacuum valve having a guide portion projecting from one side thereof and receivable within said second spring, and means of communication connecting said pair of branches with the tank.

6. A safety and vacuum valve structure for tanks comprising a housing having a pair of branches, a safety valve and a vacuum valve positioned in said branches, respectively, a spring for maintaining said safety valve in closed position up to a predetermined pressure, a follower member engaging one end of said spring, yieldable means interposed between said vacuum valve and member and adapted to have backing engagement with said member, and means of communication for connecting said branches with the tank.

7. A safety and vacuum valve structure for tanks comprising a housing having a pair of branches, a safety valve and a vacuum valve positioned in said branches, respectively, a spring for maintaining said safety valve in closed position up to a predetermined pressure, a follower member engaging one end of said spring, yieldable means interposed between said vacuum valve and member and adapted to have backing engagement with said member, the disposition of said yieldable means being such that said vacuum valve is unhindered thereby during the initial stages of its opening movement, and means of communication connecting said branches with the tank.

8. A safety and vacuum valve structure for tanks comprising a housing having a pair of substantially aligned branches, a safety valve and a vacuum valve positioned in said branches, respectively, a stem fixed at one end to said safety valve, a follower member freely movable on and supported by the opposite end of said stem, a spring interposed between said member and housing to maintain said safety valve in closed position up to a predetermined pressure, a second spring interposed between said vacuum valve and member and adapted to have backing engagement with said member, and means of communication connecting said branches with the tank.

9. A safety and vacuum valve structure for tanks comprising a housing having a pair of branches, a safety valve and a vacuum valve positioned in said branches, respectively, a spring for maintaining said safety valve in closed position up to a predetermined pressure, a follower member engaging one end of said spring, a second spring interposed between said vacuum valve and member and adapted to have backing engagement with said member, said first spring being stronger than said second spring whereby said member is unaffected by a movement of said vacuum valve, and means of communication connecting said branches with the tank.

GEORGE W. KING.