

Aug. 9, 1949.

J. H. WIGGINS

2,478,731

GAS HOLDER

Filed Sept. 28, 1944

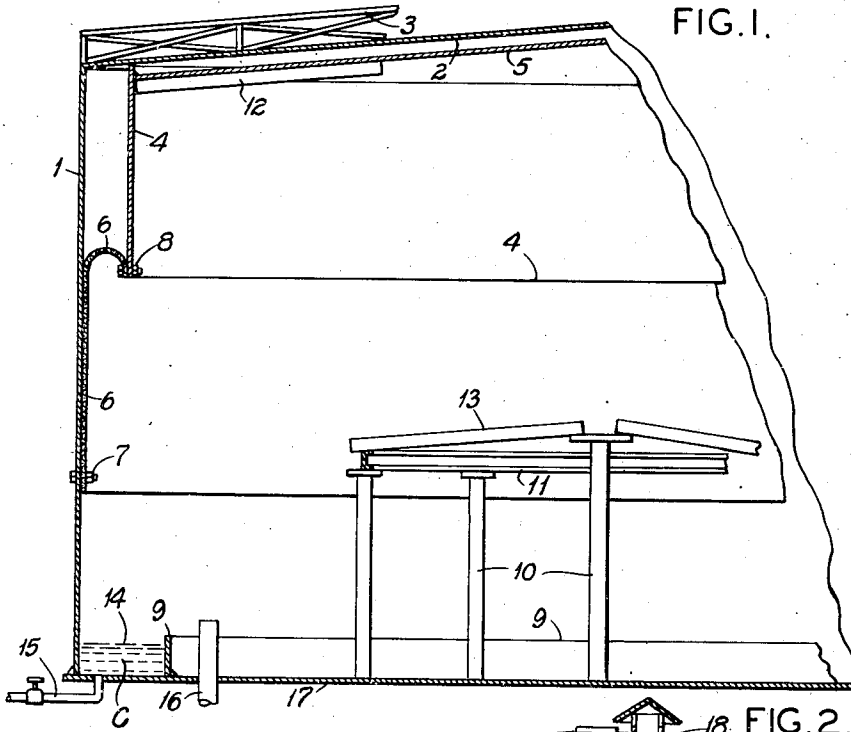


FIG. 1.

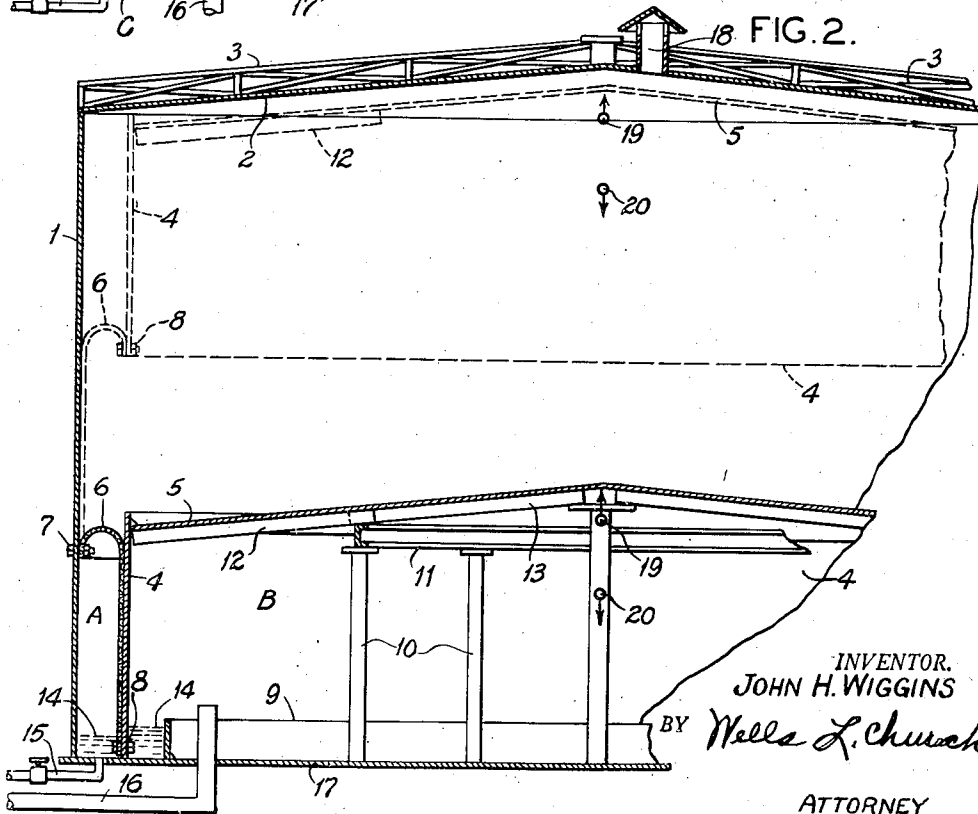


FIG. 2.

INVENTOR.
JOHN H. WIGGINS

BY Wells L. Church

ATTORNEY

UNITED STATES PATENT OFFICE

2,478,731

GAS HOLDER

John H. Wiggins, Chicago, Ill.

Application September 28, 1944, Serial No. 556,228

4 Claims. (Cl. 48-178)

1

This invention relates to gas holders of the type in which the seal between the stationary side wall of the gas chamber and the piston or vertically movable member that constitutes one of the horizontally disposed walls of the gas chamber, is formed by a flexible, curtain like element, attached at one of its edges to said side wall and attached at its other edge to said piston.

Conventional gas holders of the general type mentioned, are of such construction that when the gas chamber is under no pressure or a vacuum, gravity causes the sealing element or flexible curtain to assume such a position or condition that when the gas chamber is subsequently placed under pressure, the sealing element will wrinkle or bend sharply on itself in such a manner that it is subjected to destructive strains which cause the sealing element to rupture long before the normal life of the flexible material of which it is constructed.

Another objectionable characteristic of conventional gas holders of the general type mentioned, is that relative expensive and cumbersome mechanisms or structures are employed to maintain the piston in a level position and hold it centered with relation to the side wall of the gas chamber.

One object of my present invention is to prolong the life of the flexible, curtain like sealing element of a gas holder, by preventing said sealing element from wrinkling, creasing, or bending sharply on itself during the normal functioning of the piston of the gas holder. To this end I have devised a gas holder which is of such design or construction that when the gas chamber is under no pressure or even under a vacuum, the flexible sealing element will be subjected to a pressure that maintains it in approximately its normal position and effectively prevents said element from kinking, wrinkling, folding or assuming such a shape or condition as to produce creases in same.

Another object of my invention is to provide a gas holder whose piston or vertically movable member, is self levelling, self centering and also effectively protected from the weather and from wind loads. Other objects and desirable features of my invention will be hereinafter pointed out.

Figure 1 of the drawings is a fragmentary, vertical transverse sectional view, of a gas holder constructed in accordance with my present invention, showing the piston at the end of its upward stroke; and

Figure 2 is a similar view, with the piston

2

shown in solid lines at the end of its downward stroke, and in broken lines at the end of its upward stroke.

In the drawings the reference character 1 designates the vertical side wall of a tank provided with a weather roof 2 of any preferred construction, the roof herein shown being equipped on its top side with a plurality of spaced, radially disposed trusses 3. At the center of the roof there is an air vent 18. A vertically movable piston 5 that is arranged inside of said tank constitutes the top wall of the gas chamber of the gas holder, and on its underside it is provided with inwardly radially disposed rafters 12, and at the peripheral edge of said piston there is a depending skirt or side wall portion 4 that is spaced away from the side wall 1 of the tank. The space between the tank side wall and the skirt of the piston is sealed by a flexible curtain like sealing element 6 which is attached at its outer edge to the tank side wall at the point 7 and attached at its inner edge to the lower edge portion of the skirt 4 of the piston as designated by the reference character 8. The sealing element 6 is of annular form in general outline and is of such depth that in all positions of the piston, when it rises and falls due to variation in the internal pressure of the gas chamber, there will be a portion of said sealing element that assumes the shape of an upwardly disposed loop that is positioned in the annular space between the skirt of the piston and the side wall of the tank. Thus when the piston 5 is at the end of its upward stroke as shown in Figure 1, the major area of the sealing element 6 will lie snugly against the tank side wall, and the portion of said sealing element immediately adjacent the skirt portion 4 of the piston will assume the shape of an upwardly disposed loop, positioned between the depending skirt 4 of the piston and the side wall 1 of the tank, the sealing element being maintained in the above described position or condition by the pressure of the gases in the gas chamber. During the downward stroke of the piston, the sealing element 6 is progressively stripped off the inner face of the tank side wall, and applied progressively to the outer face of the skirt portion of the piston, with the result that when the piston reaches the end of its downward stroke as shown in full lines in Figure 2, the portion of the sealing element 6 immediately adjacent the point of connection 7 of the sealing element with the tank side wall, will assume the form of an upwardly disposed loop, positioned between the tank side wall and the skirt portion

3

4 of the piston. In other words the sealing element 6 has sufficient fullness to permit it to, in effect, double during the rise and fall of the piston 5 in the normal operation of the gas holder, and the internal pressure of the gas chamber causes the "full" portion or excess portion of the sealing element to assume the form of an upwardly disposed loop whose radius of curvature is great enough to prevent the sealing element from creasing or bending sharply on itself.

In the absence of any means to maintain the sealing element 6 in the position above mentioned when the gas chamber becomes empty or when a minus pressure is created in the gas chamber, gravity would cause the "full" or excess portion of the sealing element 6 to drop or fall downwardly. Then if pressure were subsequently created in the gas chamber, the sealing element 6 would be pressed against the skirt 4 of the piston at a much lower position, with the result that bad wrinkles would form in the sealing element. Such wrinkles, due to pressure, would cause the sealing element to bend sharply on itself and cause the sealing element to rupture early in its life. In addition the radius of curvature of the "full" portion of the sealing element (due to its having fallen downwardly) would be much greater than the normal radius of curvature of the "full" portion of the sealing element, with the result that the tension in this area of the sealing element would be increased to such an extent as to shorten the life of the sealing element. In order to overcome the conditions just described and hence prolong the life or period of usefulness of the sealing element 6, I have constructed the gas holder in such a manner that the "full" or excess portion of the sealing element 6 is always subjected to a pressure that maintains it in the form of an upwardly disposed loop, even if the gas chamber is under no pressure or is under a partial vacuum.

In the preferred form of my invention herein illustrated the desirable result just mentioned is attained by constructing the gas holder in such a manner that sufficient pressure will be trapped or created in the space between the sealing element 6 and the tank side wall as the piston 5 nears the end of its downward stroke, to maintain the "full" portion of the sealing element in the form of an upwardly disposed loop, even though the space bounded by the piston 5, the skirt 4 of the piston and the bottom 17 of the tank, is under no pressure or is subjected to a partial vacuum. One convenient and inexpensive construction that may be employed, consists of an annular trough C located on the bottom 17 of the tank at the tank side wall, and containing a body of liquid 14 in which the lower edge portion of the skirt 4 of the piston is submerged when the piston is at the end of its downward stroke as shown in full lines in Figure 2. Said trough C may be about two to three feet deep and it may be formed by the lower end portion of the side wall 1 of the tank and a vertically disposed, annular dam 9 that is arranged in spaced relation to the tank side wall and welded to the bottom 17 of the tank. Preferably said trough is filled with oil 14 or some other suitable non-freezing sealing liquid, and the trough is equipped with a valve controlled drain 15. The pipe 16 through which gases are admitted to the gas chamber, projects upwardly through the tank bottom at a point inside of the dam 9.

During the downward stroke of the piston, when

4

the skirt of the piston first touches the sealing liquid 14 in the trough C, the pressure in the two zones designated by the reference characters A and B in Figure 2 are the same, but as the skirt of the piston descends further into the sealing liquid, the pressure in zone A is slightly increased due to the fact that the volume of said zone A decreases slightly as the piston moves downwardly. The result is that the pressure trapped in or created in the space between the tank side wall and the skirt 4 of the piston (zone A), will maintain the portion of the sealing element 6 immediately adjacent the point 7 of attachment of the sealing element to the tank side wall, in the form of an upwardly disposed loop, thereby eliminating the possibility of the said portion of the sealing element dropping downwardly due to its own weight, and assuming a position or condition which subsequently will result in wrinkles or creases forming in said sealing element. Even though a slight vacuum, for example 1" to 2" of water, is created in the zone B, the liquid seal 14 between zones A and B, will hold the pressure in zone A so long as the lower edge portion of the skirt of the piston remains submerged in the sealing liquid. One advantage of the construction above described, is that the skirt 4 of the piston can travel down through the sealing liquid 14 to the bottom of the trough, thus enabling the gas holder to be completely emptied to zero pressure, with the exception of the very small volume of the space or zone A, between the tank side wall and the sealing element 6 when the piston is in its lowermost position. From the foregoing it will be seen that in my improved gas holder, the flexible, curtain like sealing element 6 is always held under a pressure to maintain it in its best operating shape and to prevent it from falling down, or moving from its operating position or shape, even though there is no pressure in the gas chamber or even if the gas chamber is under a partial vacuum. In accordance with standard practise, proper pressure and vacuum valves are provided for the gas space of the holder, the vacuum valve being so arranged that it provides relief only for the zone B. In order to provide a large factor of safety the vacuum relief valve is designed so as to operate at about 1" of water.

Another desirable characteristic of the gas holder herein illustrated, is that the piston or vertically movable member 5, is maintained in concentric relation with the side wall 1 of the tank and held level, without the aid of guiding devices and a balancing mechanism such as are generally employed in gas holders of conventional construction inasmuch as the piston operates inside of a closed structure which comprises a roof 2 and a side wall 1 whose upper portion lies in the same horizontal plane as the skirt portion 4 of the piston when the piston is at the end of its upward stroke, the piston is effectively protected from the weather and from wind loads that might destroy the equilibrium of the piston and shift it sidewise. The piston 5 and its depending side wall portion 4, are so designed that the center of lift 19 of the piston structure is considerably above the center of gravity 20 of said structure, see Figure 2. Accordingly the piston will be automatically maintained in a level position or in other words is automatically self leveling. During the rise and fall of the piston, if one side of the skirt portion 4 should move closer to the tank side wall 1 than the side diametrically opposite, then on the narrow side, the sealing

5

element 6 climbs a little higher on the skirt portion 4 which increases the area of the sealing element pressing on that side of 4, whereas on the wide side, the sealing element 6 climbs down a little on skirt portion 4 which decreases the area of the sealing element pressing on 4. Since the pressure per square foot is the same for all the area of the sealing element 6, there results a greater net radial pressure toward the center of the tank on the narrow side, which would immediately push the skirt portion 4 back to center. This effectively prevents the skirt portion of the piston from ever getting "out of center" since there are no forces to throw it off center. The result is that the piston moves without friction and is automatically self centering. The piston 5 and the skirt 4 of the piston are joined together in a gas tight manner, and the bottom 17 and lower portion of the side wall 1 of the tank must be gas tight. The upper portion of the tank side wall, above the point 7 where the sealing element is attached to said wall, need not be gas tight and it is not essential that the roof 2 of the tank be gas tight. When the piston is at the end of its downward stroke, the weight of the top portion of the piston is sustained by a supporting structure, herein illustrated as comprising vertically disposed posts 10 that carry a circular girder 11 which supports radially disposed rafters 13.

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

1. A gas holder, comprising a vertically movable piston that constitutes the top wall of the gas chamber of the holder, a stationary side wall for said chamber, a depending skirt portion on the piston arranged in spaced relation with said stationary side wall, a flexible, curtain like sealing element attached to said side wall and skirt portion and arranged so that a portion of said sealing element is normally maintained in the form of an upwardly disposed loop by the pressure in the gas chamber and a liquid seal disposed so that as the piston approaches the end of its downward stroke, the skirt portion of the piston will dip into said seal and thus trap or create sufficient pressure in the looped portion of

6

the sealing element to maintain said looped portion in approximately its normal position.

2. A gas holder of the kind described in claim 1, in which the skirt portion of the piston is arranged inside of or is surrounded by the stationary side wall of the gas chamber when the piston is at the end of its downward stroke, and the sealing element is attached at one of its edges to the lower end of the skirt portion of the piston and attached at its other edge to said stationary wall at a point approximately coincident with the upper end of the piston when the piston is in its lowermost position.

3. A gas holder comprising a tank, a vertically movable piston in said tank provided with a depending skirt portion arranged in spaced relation with the side wall of the tank, a flexible, curtain like sealing element attached at one of its edges to the lower end of the skirt portion of the piston and attached at its other edge to the tank side wall, and a trough on the bottom of the tank, adjacent to the tank side wall, containing a sealing liquid in which the lower edge of the skirt portion of the piston submerges as the piston approaches the end of its downward stroke, whereby sufficient pressure will be trapped in or created in the space between the tank side wall and the skirt portion of the piston, to hold the flexible sealing element substantially taut and free from wrinkles or creases.

4. A gas holder of the kind described in claim 3, wherein the pipe through which gases are admitted to and exhausted from the gas chamber, extends upwardly through the bottom of the tank at a point between said trough and the center of the tank bottom.

JOHN H. WIGGINS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
633,427	Cooper	Sept. 19, 1899
2,142,225	Weichael et al.	Jan. 3, 1939
2,269,568	Wilken	Jan. 13, 1942