June 17, 1952 J. H. WIGGINS 2,600,717

DRY SEAL PRESSURE TYPE GASHOLDER

Filed July 8, 1947

FIG. 1.

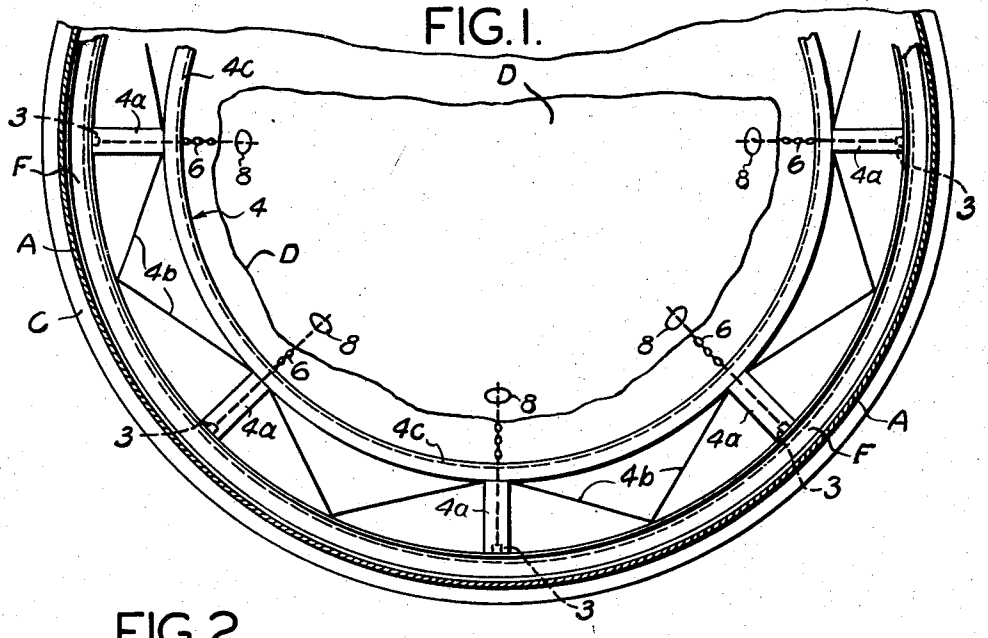
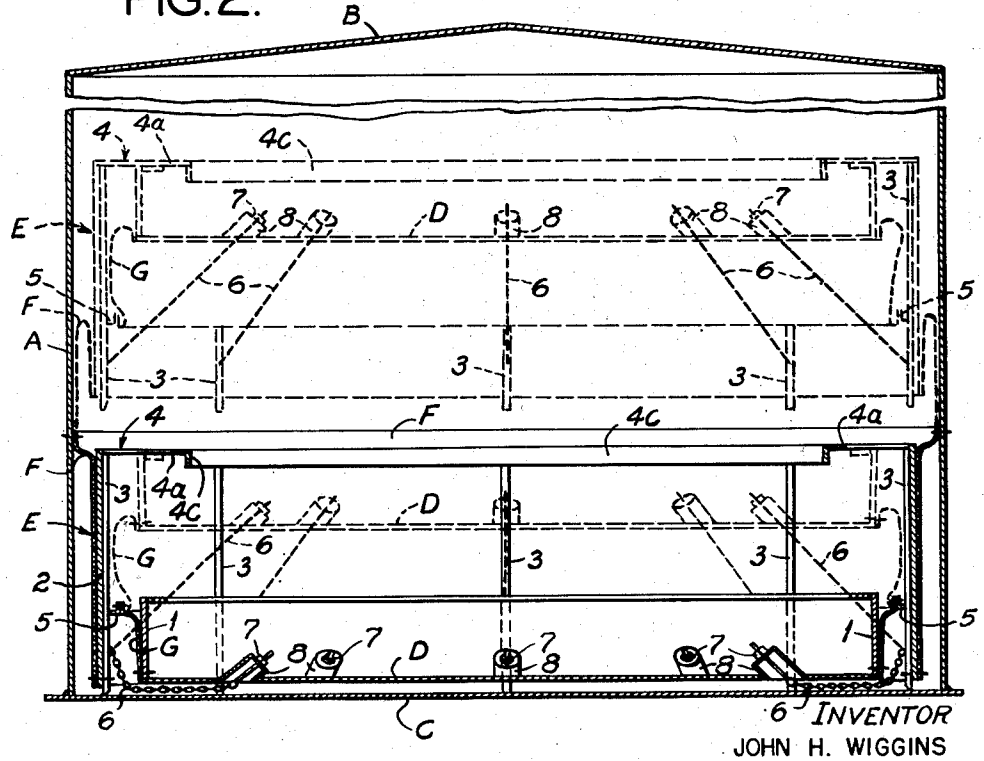


FIG. 2.



INVENTOR
JOHN H. WIGGINS
BY Wells L. Church
ATTORNEY

Patented June 17, 1952

2,600,717

UNITED STATES PATENT OFFICE

2,600,717

DRY SEAL PRESSURE TYPE GASHOLDER

John H. Wiggins, Chicago, Ill.

Application July 8, 1947, Serial No. 759,579

5 Claims. (Cl. 48—178)

1

This invention relates to piston type gas holders of the type that comprise a "dry seal" formed by a flexible, curtain-like means attached to the container side wall and to the peripheral edge of the piston, and a reinforcing and backing structure for said flexible piston sealing means that comprises a tubular or annular backing member mounted between the piston and the container side wall in concentric or telescoped relation with the piston, and adapted to move vertically relatively to the piston during the cycle of operations of the apparatus.

In gas holders of the kind referred to the gases or other medium stored in the apparatus exerts such a terrific pressure on the above mentioned tubular backing member, that there is a tendency for said backing member to go out of round, or lose its truly circular or tubular form. My invention has for its main object to provide a mechanism of novel construction, that effectively prevents the above-mentioned vertically-shiftable backing member from flexing out of its truly tubular or circular form, due to the pressure exerted on said member by the gases or other medium stored in the apparatus, the main advantage of my improved mechanism being that it is of such design or construction that it does not require considerable clearance space between the piston and the vertically-movable, annular backing member with which it is associated.

Briefly described, my improved mechanism consists of a collapsible structure attached to the piston and to one end of said vertically-movable backing member, so as to function as a stay that resists strains or pressures tending to cause one end of said backing member to go out of round when said backing member is disposed in a certain relationship with the piston, and when said backing member and piston are disposed in a different relationship, said stay will automatically assume a collapsed condition, in which it takes up no space between the backing member and the piston, or a part attached to the top side of the piston. I have herein illustrated my improved mechanism as being used for retaining the shape and preventing deformation of the lower end portion of the previously mentioned vertically-shiftable backing member, but I wish it to be understood that my improved mechanism can be associated with either end portion of said backing member. Also I wish it to be understood that so far as my present invention is concerned, the particular construction of the flexible piston sealing means is immaterial, and it is immaterial whether or not the piston is provided on its top side with a rigid backing member that co-acts with the previously mentioned vertically-shiftable backing member to assist in backing up and reinforcing the flexible, curtain-like sealing means for the piston.

2

Figure 1 of the drawings is a fragmentary top plan view of a dry seal, pressure-type gas holder constructed in accordance with my invention, the roof of the container of the apparatus being omitted and the piston being broken away so as to more clearly illustrate the flexible or collapsible stays which prevent the lower end portion of the vertically-shiftable backing member from going out of round; and

Figure 2 is a vertical, transverse-sectional view of the apparatus illustrated in Figure 1, said figure showing in solid lines the relative positions of the vertically-shiftable backing member and the backing member on the piston when the piston is in its lowermost position, and showing in broken lines the relative positions of two backing members at the moment the piston picks up the vertically-shiftable backing member and also when the piston has nearly reached the end of its upward stroke.

In the drawings, the reference character A designates the side wall of the container of the apparatus, B designates the roof of the container, C designates the bottom of the container, D designates the vertically-movable piston of the apparatus which forms one wall of the gas storage space or chamber, and E designates a tubular or annular member, hereinafter referred to as a vertically-shiftable backing member, that is arranged between the piston and the side wall of the container. The space between said piston and side wall is sealed by a flexible, curtain-like structure of gas-tight fabric, which is herein illustrated as being composed of two sealing elements F and G of annular form in general outline. The element F is attached to the side wall A of the container and to the lower end portion of the vertically-shiftable backing member E, and is so proportioned that when the piston is in its lowermost position, shown in solid lines in Figure 2, said sealing element F will be disposed in parallel relation with the outer surface 2 of the backing member E, i. e., on that side or face of the backing member E which is presented to the side wall A of the container. The other sealing element G of the piston sealing means is attached at its outer edge to the inner side of the backing member E at a point above the bottom edge of said member, and the inner edge of

said sealing element G is attached to the lower end portion of a vertically-disposed rim on the piston which constitutes a rigid, annular backing member I that co-acts with the vertically-shiftable backing member E, to cause the piston sealing means formed by the elements F and G to assume a certain approximate shape or form during the rise and fall of the piston and also prevent said elements F and G from being subjected to destructive strains from the gases stored in the apparatus. As shown in the drawings, the height or depth of the backing member I on the piston is approximately one-third the height or depth of the vertically-shiftable backing member E, and the piston sealing element G is so proportioned that when the piston is at the end of its downward stroke, as shown in full lines in Figure 1, the gases in the storage chamber of the apparatus press the major portion of the area of said sealing element G snugly against the backing member I on the piston. At such times the gases in the storage chamber press the major portion of the area of the sealing element F snugly against the outside of the vertically-shiftable backing member E. During the first portion of the upward movement of the piston, the backing member E remains at rest, thus causing the gases on the underside of the piston and in the space between the backing members E and I to progressively strip the short sealing element G off the backing member I and force said sealing element snugly against the inner side of the backing member E, as shown in broken lines in the lower part of Figure 2. This first portion of the upward movement of the piston effects a change in the relative positions of the co-acting backing members E and I, and when the piston reaches such a point that the backing member I on the piston is in the zone of the upper end portion of the backing member E, said member E starts to move with the piston and continues its upward movement, at the same speed as the piston during the remainder of the upward stroke of the piston, thereby causing the relatively long or deep sealing element F to be stripped off the outer side of the backing member E and forced snugly against the side wall A of the container by the pressure which the gases in the storage chamber exert on said sealing element F, the above described operation being illustrated by the broken lines in the upper portion of Figure 2 which indicate the relative positions of the two piston sealing elements F and G, and of the two backing members E and I when the piston has nearly reached the end of its upward stroke. In the apparatus herein illustrated the means that is employed to cause the backing member E to start to move upwardly with the piston, as above described, consists of an annular compression member or girder at the upper end of the backing member E which overhangs or projects inwardly over the member I on the piston. Said compression member or girder is designated as an entirety by the reference character 4 and is herein illustrated as being composed of horizontally-disposed struts 4^a projecting inwardly from a flange at the top edge of the vertically-shiftable backing member E, an annular-shaped stiffener 4^c attached to the inner ends of said struts, and cross braces or angularly-disposed braces 4^b combined with said flange, said stiffener and struts in such a way as to produce a structure that will impart sufficient rigidity to the upper end portion of the backing member E to enable the same to successfully withstand pressures and strains tending to cause said upper end portion to go out of round or assume a form other than a perfectly true circle.

The particular design or construction of the above mentioned compression member or girder is immaterial, and as it overhangs the piston or the backing member I on the piston, there is no limitation as to its width and no problem is involved in making it strong enough and large enough to successfully resist compressive forces and tension strains that tend to make the upper end portion of the backing member E go out of round. However, a different problem is involved with the lower end portion of the backing member E, due to the relatively slight clearance space between the backing members E and I, and due to the fact that the member I reciprocates inside of the shiftable backing member E during upward and downward movement of the piston. Accordingly, instead of relying on a rigid girder or similar structure on the interior of the vertically-shiftable backing member E to hold the lower end portion of said member rigid and in the form of a true circle, I join the lower end portion of the backing member E to the piston by means of a flexible, collapsible or articulated structure, arranged so that when the lower end portion of the backing member E is held in a true circle by friction of the posts 3, due to the weight of the member E on the bottom C, said structure will not interfere with the telescoping action of the members E and I, but when the lower end portion of member E is off the bottom C and subjected to pressures and strains tending to make it go out of round, said flexible or collapsible structure will effectively resist or counteract such pressures and strains and hold the lower end portion of member E rigid and in a truly circular or tubular form. In the preferred form of my invention herein shown, the above mentioned flexible, collapsible or articulated structure is composed of a plurality of radially-disposed chains or cables 6 attached at one end in spaced relation to the lower end portion of the backing member E and having their opposite ends attached to the piston D at points some distance inwardly from the peripheral edge of the piston, said chains being of such length that when the backing member I on the piston picks up vertically-shiftable backing member E, the chains 6 become taut, and hence, will act as radially-disposed tension members or stays that effectively resist any tendency of the lower end portion of the member E to go out of round, due to the pressure exerted on same by the gases in the gas space of the apparatus, and when the backing member I subsequently moves into the zone of the lower end portion of the backing member E, the chains 6 become slack, and hence, do not interfere with the vertical movement of one backing member relatively to the other. Preferably, vertically-disposed posts 3 are attached to the inner side of the backing member E, and a horizontally-disposed, relatively narrow, circular compression member 5 is attached to the inner side of said backing member adjacent the bottom edge of same, so as to reinforce and strengthen said member and impart stiffness and rigidity to same. The chains 6 are attached to the lower end portions of the posts 3 and lead inwardly from same under the peripheral edge of the piston, to fastening devices such as bolts 7 which are adjustably mounted in angularly-disposed housings 8 in the pis-

ton D, the nuts of the bolts 7 being located in an accessible position on the top side of the piston. In the operation of assembling and adjusting the co-operating parts of the apparatus, the nuts of the bolts are adjusted so that the tension members 6 will be taut by the time the piston has moved upwardly high enough to engage the annular compression member 4 at the upper end of the backing member E and cause said member E to be picked up by the piston during the upward stroke of the piston.

When the piston D is in its lowermost position, shown in full lines in Figure 2, the vertically-shiftable backing member E is standing at rest on the bottom C of the container, the backing member 1 on the piston is located in the zone of the lower end portion of the backing member E, and the tension members or stays 6 are in a collapsed or inactive condition. At this time the lower end portion of the backing member E is under neither compression nor tension, since the pressure of the gas balances on both sides of said lower end portion. In addition, the posts 3 are standing on the tank bottom C and friction holds them in round. During the upward movement of the piston the tension members 6 straighten out, as shown in broken lines in Figure 2, and by the time the backing member 1 on the piston has engaged the overhanging compression member 4 on the shiftable backing member E, thus causing said member E to start to move upwardly with the piston, the tension members 6 are taut and in an operative condition to perform the function of stays which tie the lower end portion of the member E to the piston and effectively hold the lower end of said backing member in a perfectly circular or cylindrical form. So long as the member E is supported by the piston and moves with the piston, the stays 6 remain in an active or operative condition, but as soon as the member E comes to rest during the downward stroke of the piston, the stays 6 become slack or inactive and remain in this condition until the backing member E is again picked up by the piston during the succeeding upward stroke of the piston. Thus, at the moment the posts 3 are landed on the bottom C as the piston D descends, the lower ends of these posts are in a true circle, being held so by the stays 6. As the piston moves downwardly from this landing point, the lower ends of the posts 3 are held in a true circle, due to the friction on the bottom C from the weight of the backing member E.

Having thus described my invention, what I

claim as new and desire to secure by Letters Patent is:

1. A fluid storage apparatus, comprising a container having a side wall, a vertically-movable piston in said container, an annular backing member disposed in the space between the piston and the container side wall and movable relative to both, a flexible sealing member attached to the backing member and to the container side wall, a second flexible sealing member attached to the backing member and to the piston, a reinforcing member attached to one end of said backing member so as to preserve the annular shape of the end portion of said backing member to which said reinforcing member is attached, and a plurality of collapsible stays attached to the piston and to the other end portion of said backing member, said stays being adapted to distend into a condition in which they prevent the end portion of said backing member to which they are attached from going out of round.

2. An apparatus of the kind described in claim 1, in which said reinforcing member consists of a girder that projects inwardly from said backing member in overlapping relation with the piston.

3. An apparatus of the kind described in claim 1, in which said reinforcing member is attached to the upper end portion of the backing member and said stays are attached to the lower end portion of the backing member.

4. An apparatus of the kind described in claim 1, in which said stays are disposed radially with respect to the piston and are non-stretchable when said stays are functioning and are in a completely unfolded condition.

5. An apparatus of the kind described in claim 1, which also includes adjusting devices for said stays, disposed so as to be accessible from the top side of the piston.

JOHN H. WIGGINS.

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