

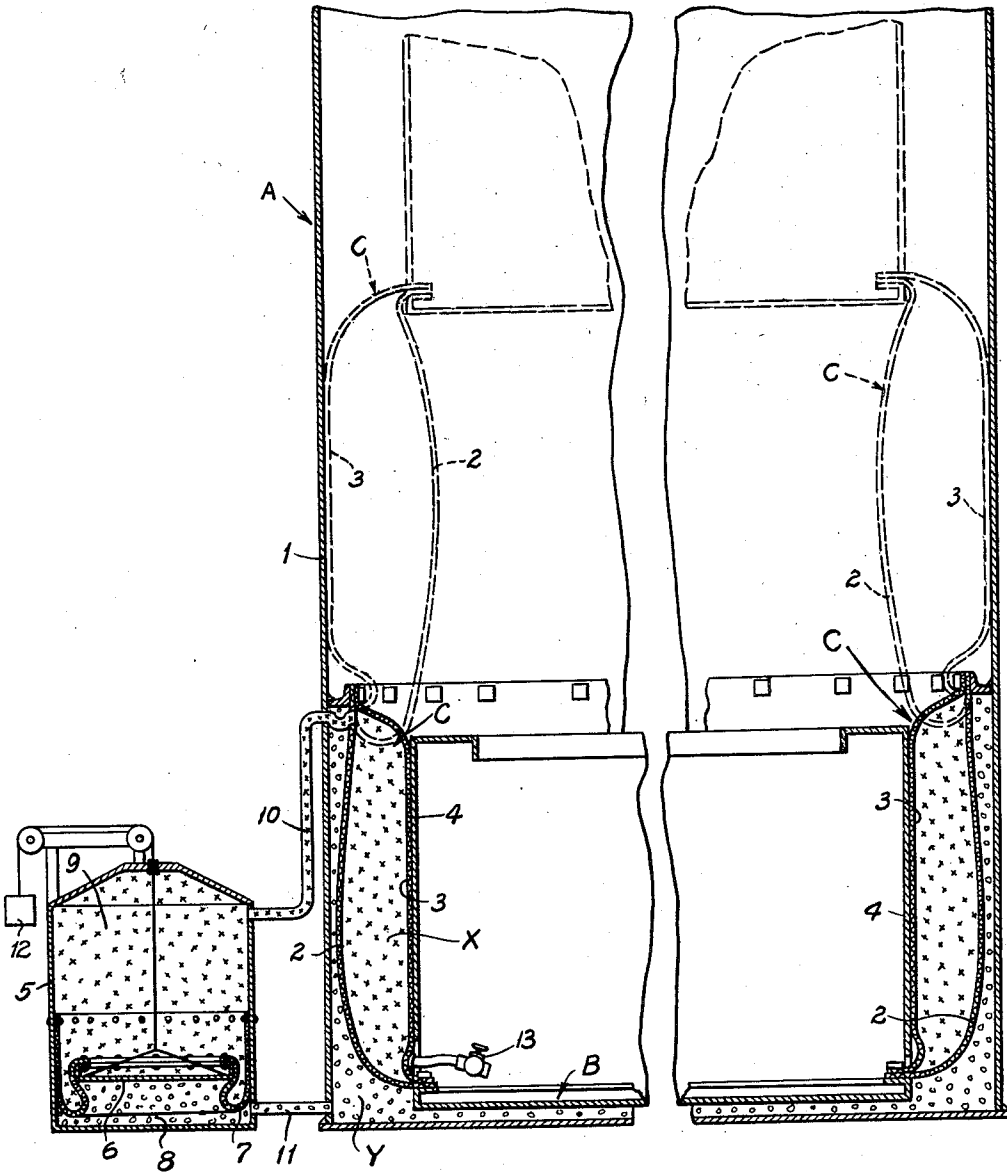
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DRY SEAL, PISTON-TYPE GAS HOLDER

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DRY SEAL PISTON-TYPE GAS HOLDER

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6 Claims. (Cl. 48—178)

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This invention relates to piston-type gas holders of the kind in which the annular space between the piston and the container side wall is closed or bridged by a "dry seal" consisting of a flexible, curtain-like sealing means attached to said wall and piston and proportioned so as to provide for the rise and fall of the piston. In conventional gas holders of the general type or kind above referred to the "dry seal" between the piston and the container side wall is constructed in whole or in part from fabric or some other suitable flexible material treated so as to render it gas-tight, and notwithstanding the fact that no expense is spared in the construction of such "dry seals," there is always the possibility of gases leaking through the same and combining with the air in the space above the piston to form an explosive mixture which creates a fire hazard.

The main object of my invention is to overcome or minimize the above mentioned inherent defect of conventional dry seal, piston-type gas holders. To this end I have devised a gas holder, which, in its simplest form, is composed of a container that constitutes a stationary portion of the gas storage chamber of the apparatus, a piston in said container which is adapted to move relatively to the container so as to increase or decrease the volume of the storage chamber, and a sealing means for the piston, formed by a flexible, bag-like structure inflated with inert gas, bridging the space between the container and the piston and attached to said parts. The particular shape of said gas-inflated, flexible, bag-like structure, or the way in which it is made, are immaterial, so far as my broad idea is concerned, so long as it is of such design or construction that it comprises at least two flexible, gas-tight wall portions or sealing elements, arranged in spaced or opposed relation and attached to the container and the piston, so as to bridge the space or joint between the same, one of said wall portions, which, for convenience, I will refer to as the "inner seal," being presented to the gases in the storage chamber of the apparatus; and the other wall portion, referred to for convenience, as the "outer seal," being presented to the atmosphere, and a body of inert gas confined by and interposed between said wall portions or sealing elements so as to prevent gases in the storage chamber that may leak through a defect or imperfection in the inner seal from becoming mixed with a body of air that exists in a space adjacent to or at one side of the piston. While the above described gas-inflated, multiple seal between the piston and the container constitutes the basic feature of my present

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invention, another novel feature of my invention consists in combining such a gas-inflated, multiple piston-sealing device with a means that is adapted to be operated, either manually or automatically, for maintaining the inert gas in said piston sealing device at a certain approximate pressure.

The figure of the drawings is a fragmentary, vertical transverse-sectional view of a dry seal, piston-type gas holder constructed in accordance with my invention.

Referring to said figure, A designates a container, provided with a vertical side wall 1 of cylindrical form, and B designates a vertically-movable, piston in said container that constitutes the top wall of the gas storage chamber of a gas holder, the peripheral edge of said piston being spaced away a considerable distance from the side wall 1 of the container. The means used to seal the space or joint between the piston and the container side wall consists of a flexible, gas-inflated, multiple wall device C of substantially tubular form in general outline, attached to an intermediate portion of the container side wall and to the periphery of the piston and bridging the gap or space between said parts. It preferably is composed of two flexible, gas-impervious, annular wall portions 2 and 3, joined together at their edges so as to form a tubular envelope or bag-like structure, which confines a body of inert gas X that holds said envelope in a distended condition. For convenience, I will refer to the wall portion 2 of said envelope or flexible, bag-like structure that is presented to the gases Y in the storage chamber of the apparatus, as the "inner seal," and I will refer to the other wall portion 3 of said bag-like structure that is presented to the atmosphere, as the "outer seal." During the cycle of operations of the piston, the gases Y in the storage chamber of the apparatus exert pressure on the above mentioned inflated envelope or bag-like piston sealing device C, in a direction to press one or the other wall portions or sealing elements 2 or 3 of said device into snug engagement, either with an annular back-stop member 4 rigidly attached to the piston and projecting upwardly from the peripheral edge of same, or with the portion of the container side wall 1, located above the point where said inflated piston-sealing device C is attached to the container side wall, said back-stop member and container side wall portion co-acting with each other to absorb pressure exerted on the piston sealing device C by the gases in the storage chamber of the apparatus. Thus, as shown

in full lines in the drawing, when the piston B is at the end of its downward stroke, the sealing element 3 of the inflated piston sealing device C snugly engages the back-stop member 4 on the piston, and during the upward stroke of the piston, said device C shifts into such a position that the sealing element 3 of same will be in snug engagement with the upper portion of the container side wall by the time the piston reaches the end of the upward stroke, as shown in broken lines in the drawing. At all times, i. e., when the piston is in its lowermost position, uppermost position and intermediate position, the sealing element 2 of the inflated piston-sealing device C is maintained in spaced relation with the sealing element 3 by the inert gas X interposed between and confined by said sealing elements 2 and 3, thereby effectively preventing an explosive mixture from accumulating in the air space above the piston B of the gas holder, inasmuch as the joint between the piston, and the container side wall 1 is closed by a device C, that comprises two tubular-shaped sealing elements 2 and 3 arranged in telescoped relation and maintained in a distended condition by a body of inert gas X, interposed between and confined by said sealing elements.

The body of inert gas X confined between the opposed wall portions or sealing elements 2 and 3 of the piston sealing device C, is maintained under a certain approximate pressure, preferably a pressure equal to or greater than the pressure of the gases in the gas storage chamber of the apparatus. This can be effected either by manually varying the pressure of the inert gas space between the sealing elements 2 and 3 at rather wide intervals of time, say, for example, once a week, or by automatically varying the pressure of said inert gas space as the internal pressure of the gas storage space of the apparatus varies. I also prefer to provide means for enabling the inert gas space of the piston sealing device C to be purged at intervals in the event the inert gas X between the sealing elements 2 and 3 becomes excessively contaminated by permeation of gas Y through the inner sealing element 2. In the embodiment of my invention herein illustrated, a piston-type, auxiliary gas holder is used to automatically control the pressure of the body of inert gas X in the multiple seal, piston sealing device C. Said auxiliary gas holder is herein illustrated as comprising a container 5, a vertically-movable piston 6 in said container, and a flexible, curtain-like seal 7 attached to the piston and to the side wall of the container 5 so as to divide the interior of the container into a pressure chamber 8 below the piston and an inert gas chamber 9 above the piston that contains a supply of inert gas. A conduit 10 leads from the said inert gas chamber 9 to the inert gas space between the two sealing elements 2 and 3 of the piston sealing device C, and a conduit 11 leads from the pressure chamber 8 of the auxiliary gas holder to the lower end of the container A in which the piston B operates, said conduits 10 and 11 being wide open at all times. Preferably, the piston 6 of the auxiliary gas holder is equipped with a counterbalancing mechanism comprising a weight 12. If the load of said weight just balances the piston 6, plus the piston seal 7, then the pressure of the inert gas space between the sealing elements 2 and 3 of the piston sealing device C of the main gas holder will vary from 0" to about 8" H₂O above the pressure of the gases stored in the gas storage chamber of the main

gas holder, formed by the container A, piston B and inflated piston sealing device C. The initial pressure of the inert gas space of said piston sealing device can be varied by varying the weight of the counterbalancing weight 12 of the auxiliary holder. The piston sealing device C is preferably provided with a manually-operated purging valve 13 that is adapted to be opened at relatively long intervals, say, for example, from three months to nine months, so as to permit inert gas in the space between the sealing elements 2 and 3 of the piston sealing device C that has become contaminated by leakage of gas Y through the sealing element 2, to be replaced or replenished by fresh inert gas from the supply in the inert gas chamber 9 of the auxiliary holder.

In the apparatus above described, if the pressure in the gas storage chamber of the main gas holder increases, then the pressure in the inert gas chamber 9 of the auxiliary holder is immediately increased, and hence, the pressure of the inert gas between the sealing elements 2 and 3 of the piston sealing device C of the main holder is increased. There may be some permeation of gas Y through the sealing element 2 into the inert gas space of the sealing device C, but this is very slow, and accordingly, it is only at widely spaced intervals that it is necessary to purge the inert gas space of the device C by opening the valve 13. In a multiple seal, gas-inflated piston-sealing device of the kind above described, the outer sealing element 3 takes substantially all of the pressure of the gas in the gas storage chamber of the main holder, and the inner sealing element 2 merely hangs of its own weight and may take a little excess pressure of the inert gas X up to, say, $\frac{3}{8}$ " H₂O. This will cause sealing element 2 to hang substantially like a curtain with a portion of same curved slightly, as shown in the drawing.

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

1. A gas holder, comprising a container having a vertical side wall that forms a stationary portion of the storage chamber of the apparatus, a vertically-movable piston in said container that forms a movable wall of said storage chamber, a sealing device for said piston composed of a pair of substantially cylindrical flexible elements arranged in opposed relation with their outer edges attached to the container side wall and their inner edges attached to the piston, and a body of inert gas interposed between and confined by the opposed flexible elements.

2. A gas holder of the kind described in claim 1, provided with a means rendered operative by the movement of the piston of said container for automatically maintaining the inert gas between the opposed flexible elements of said piston sealing device at a pressure equal to or greater than the pressure of the gases in the storage chamber of the apparatus.

3. A gas holder of the kind described in claim 1, provided with a purging valve for the inert gas space between the opposed flexible elements of said piston sealing device, and means for enabling the inert gas in said space to be maintained at a certain approximate pressure.

4. An apparatus of the kind described in claim 1, provided with an inert gas supply reservoir connected by a conduit with the inert gas space between the opposed flexible elements of said piston sealing device and means for causing the pressure of the inert gas in said supply reservoir

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to vary automatically as the pressure in the gas storage chamber of the apparatus varies.

5. The combination of a main gas holder, comprising a gas storage chamber whose top wall is formed by a piston that reciprocates vertically in a container having a side wall which surrounds and is arranged in spaced relation with the peripheral edge of said piston, a sealing means for said piston formed by two substantially tubular-spaced, telescoped, flexible sealing elements attached at their opposite ends to said stationary side wall and to said piston, respectively, and maintained in spaced relation with each other by a body of inert gas confined by said sealing elements, an auxiliary piston-type gas holder provided with a pressure chamber and a dry gas chamber located above said pressure chamber, a gas conduit that establishes communication at all times between the dry gas chamber of the auxiliary holder and the space between the two flexible elements of the piston sealing means of the main holder, and a gas conduit that estab-

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lishes communication at all times between the gas storage chamber of the main holder and the pressure chamber of the auxiliary holder.

6. An apparatus of the kind described in claim 5, in which the piston of the main holder is provided on its top side with an upwardly-projecting, annular abutment member that co-acts with the container side wall of the main holder to absorb pressure exerted on the flexible elements of said piston sealing means by the gases in the gas storage chamber of the main holder.

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