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WATERLESS GAS HOLDER

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INVENTOR.

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This invention relates to storage reservoirs or holders for gas, or volatile liquids and is particularly directed to improvements in the vertically translatable piston within the reservoir as a movable top closure thereof. The gas of the reservoir is confined in the space between the piston and the closed base of the holder. This piston, by its weight, maintains the gas under pressure and is vertically translatable in order to accommodate for change in the gas supply contained within the reservoir. This type of gas holder is commercially referred to as a waterless gas holder or dry gas meter.

Pistons for waterless gas holders are known in which the weights for increasing the pressure of the stored gas are placed in a central container which is located below the piston deck so that there is a counteracting moment when the piston is tipping which serves to move the piston back to its original or horizontal position. This construction is imperfect, because it is difficult to provide enough place for ballast for high pressure, and, therefore, with less ballast for low or medium pressure, the counteracting moment against tilting is not strong enough to move the piston into its normal horizontal position. Furthermore, this construction is complicated and expensive.

Tilting of the piston of a waterless type gas holder, within the holder itself, causes unusual structural strains, gives rise to a higher frictional force counteractive against vertical translation of the piston, and makes positive gas sealing difficult.

It is the concept of this invention to provide a construction for a piston for a gas holder of the type described, which piston has a mass center of gravity substantially below the center of buoyancy thereof whereby a substantially, counteracting moment is set up as the piston tends to tip within the holder. In this manner the piston is stabilized at horizontal position.

The improvement of this invention is that the piston deck is constructed on the lower edge of the piston shell. A platform is placed on the outside of the lower edge of the shell. This platform can be built as a cup for holding ballast. Another advantage of this invention is the building of an annular service space for the seal, which can be made by the use of an elastic seal ring pressed against the holder shell, or in other suitable manner.

It is therefore an object of this invention to provide a horizontally stabilized piston, constructed in such manner that ballast, for increasing gas pressure, may be conveniently added thereto without disruption of stability against tilting, having a service deck from which the piston seal, in cooperation with the wall of the gas holder, may be serviced and maintained in a convenient manner, in the whole structure of which the mass center of gravity is below the center of buoyancy thereof.

It is a further object of the present invention to provide an improved piston construction wherein the strains occurring when there is a tendency for the piston to tip are sustained by the framework of the piston rather than by the piston walls, and wherein the piston, particularly the roof or crown thereof, can be constructed of light materials since there are no stresses transferred from the guide rollers to the piston walls.

It is a further object to provide a piston of this structure wherein the framework supporting the sealing means and the guide rollers is disposed in such relation to the crown or roof of the piston that the center of gravity is lowered to a much greater extent than possible heretofore, in other words, well below the center of buoyancy.

Other objects and further advantages will be more fully apparent from the drawing, in which:

Figure 1 is a diagrammatic cross sectional view through a gas holder showing the piston disposed therein.

Figure 2 is an enlarged fragmentary view illustrating the service space and platform or walk afforded by the present invention for access to the piston seal, and detailing the seal of the piston in cooperation with the gas holder wall.

Figure 3 is a sectional diagrammatic view of a piston construction modified from the form shown in Figures 1 and 2, which is suitable for the reception of ballast below and in conjunction with the service walk.

Referring to the drawing, a gas holder, preferably having a substantially smooth interior surface free from irregularities and distortion, is generally indicated at 6. Disposed within the gas holder is a vertically translatable piston generally of inverted cup shape, indicated at 6. The top or deck of the piston is indicated at 7 and the cylindrical shell or skirt at 8. The piston may be said to include a dome-shaped crown including a rim.

The diametric width of the piston is substantially smaller than the diametric width of the holder to provide space for the sealing mechanism and to provide an annular sealing mechanism service-way between the holder and piston.
may be noted that the construction disclosed herein is suitable for cylindrical or polygonal types of gas holders.

The wall of the piston 6 is circumferentially strengthened by a rigidly annexed girth iron 5, upon which later is disposed the lateral rim providing a walkway or annular service platform 16 supported at spaced intervals by condilever or bracket plates 11 rigidly annexed to the piston.

The circumferential framework which carries the rollers and the sealing means constitutes a space within which the operator may move for servicing the seal and the guide rollers of the piston. The skirt of the piston shell and the rim extending laterally from the lower edge of the skirt enclose this space, and the rim forms a walkway for the operator.

Radially spaced about and embracing the skirt of the piston 6 and mounted for support on the service walkway 10 are a plurality of guide rollers and seal mechanism support frames, each comprising an inner vertical column 12, an outer vertical column 13, a top crosswise or beam 14, lateral braces or struts 15 and 16, and an intermediate frame crosswise or beam 17. Each outer vertical column 13 is braced from the service deck 1 by a buttress or gusset plate 18, the upper extremity of which also serves as a gusset plate for supporting the lower extremity of the lateral brace 15. The inner and outer columns 12 and 13 respectively are secured in position by angle irons 19 and 20.

The juncture of the piston top 1 and the side wall 8 may be reinforced, if desired, by a corner strengthening ring annexed to the framing to carry the stresses thereof. The framing at the upper extremity may be annexed to this ring or directly to the piston wall 1. It is preferable that a gusset plate 22 of substantial strength be provided at the juncture of the inner column 12, the upper or inner extremity of the inwardly extending lateral strut 15, and the upper crosswise beam 14, since tilting of the frame will focus the forces incident thereto substantially at this locality.

Each frame is cross braced to each adjacent frame. At a level near the service deck 19 a horizontal support beam 22 connects the outer columns 13 to tie the frames together into a rigid frame-work lattice. A similar set of frame crosswise beams (not shown) are provided at the upper extremities between the outer vertical columns 13. Rotatable guide rollers 23, engaging against the wall of the gas holder, journaling on the frame at the level of the lower crosswise 22, through bearing brackets 24 mounted on the outer vertical columns 13. Upper rotatorily mounted guide rollers 25, engaging the wall of the gas holder, are mounted by means of brackets 26 on the frame at a level near the upper extremities of the columns 13. The brackets 24 and 25 are secured directly to the outer columns 13. If the radial frame spacing is substantial, the brackets may be mounted directly on the lower and upper horizontal frame beams 22.

The piston sealing mechanism is hung on the frame near the lower extremity thereof, whereby the mass center of gravity of the entire structural system is kept at a low level with respect to the piston height. A support arm 27 is mounted on each outer vertical column 13 and carries a channel iron bracket 28 disposed generally circumferentially relative to the holder. A flexible hanger strip 29 is secured to the bracket 28 and carries the piston sealing mechanism, generally indicated at 30. This sealing mechanism includes sets of superimposed packing rings 31, 32, and a spacing ring 33 between the sets. An elastic, dilatate, sealing ring 33 is secured to the hanger strips 29 and has a continuous circumferential skirt 32 secured to the service deck by sealing brackets 32.

The packing rings 31 are held in lubricated sealing contact against the inner wall of the gas holder or reservoir. The dilatable ring, which is on the inside of the unit adjacent the packing rings, is acted upon by pressure means for dilation of the unit.

The dilatable ring includes a plurality of inwardly disposed vertical flutes 34 at spaced intervals around the circumference thereof. Pressure plates 34, disposed against the ring intermediate the flutes, are urged outwardly by means of translatable cable links 35 pivotally engaged with swinging levers 36. These levers are pivoted at their upper ends on a channel 37 annexed to the outer columns 13 and carry the counter-weighted pressure levers 38. The levers 38 continuously maintain pressure contact of the sealing rings against the wall of the holder.

It will, of course, be understood that the piston sealing mechanism, herein disclosed, is not critical in connection with the invention inasmuch as any suitable piston sealing arrangement may be used.

Figure 3, diagrammatically disclosing the structural elements suitable for the manufacture of a piston of the type described, discloses an annular receptacle or tank 39 located below the service walkway 10, encircling the piston wall 8, in which tank, ballast, such as sand, water, rock, or other suitable material may be disposed for the purpose of increasing the weight of the piston, and thus increasing the pressure of the gas maintained within the reservoir. This construction is particularly suitable inasmuch as it provides an area for conveniently locating ballast: at a level on the piston whereby the mass center of gravity of the same is maintained in the same relative position or even lowered.

The pistons, heretofore known in the art, afford a location for ballast only on top of the dome or deck 7, in which event the piston so constructed is rendered even less stable against tilting.

A stairway 40 is provided within the framing for access between the piston top or dome and the walk. Likewise a stairway 41 provides access to the upper guide rollers for convenient service and maintenance thereof.

In Figures 1 and 3 the mass centers of gravity of the piston are represented by the dots 43 and 43 respectively, while the centers of gravity due to gas pressure acting on the piston dome or deck are represented by the dots 44 and 44 respectively. These representations show that there is a great distance between the centers of gravity, so that there will be a large counteractive moment against tipping of the piston.

The load which occurs on the guide rollers when the piston is tipping is, sustained by the framing of the piston. Therefore the piston itself can be very lightly constructed as there will be substantially no stress from the rollers transferred to the piston, and likewise the gas pressure acting thereon is equally distributed.

Having described my invention, I claim:

1. A translatable piston for a waterless type gas holder comprising, a circumferential frame...
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work in the form of a ring adapted to be disposed within the gas holder, said framework carrying rollers around its top and bottom in contact with the holder wall, a sealing means carried by the framework and engaging the wall of the holder, and a piston structure supported by said framework consisting of a crown supported solely around its circumferential margin substantially at the top of the framework, a skirt depending from the crown and lining the inside of the framework, and a rim extended laterally from the lower edge of the skirt around the bottom of the framework, said framework being of sufficient rigidity in and of itself to resist the strains transmitted from the rollers, independently of the crown, the skirt and the rim.

2. A translatable piston for a waterless type gas holder comprising, a crown, a cylindrical side wall, a lateral rim extending peripherally from the lower edge of the side wall, a supporting and bracing framework for said piston, said side wall and rim attached to said supporting framework, said supporting framework disposed substantially within the height of the side wall and including guide rollers around its top and bottom engaging the holder wall, and a sealing means engaging the holder wall, said frame having sufficient stiffness, independently of the crown, the side and the rim for resisting tilting strains and thereby stabilizing the piston.

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