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TANK FOR LIFT TYPE GAS HOLDERS

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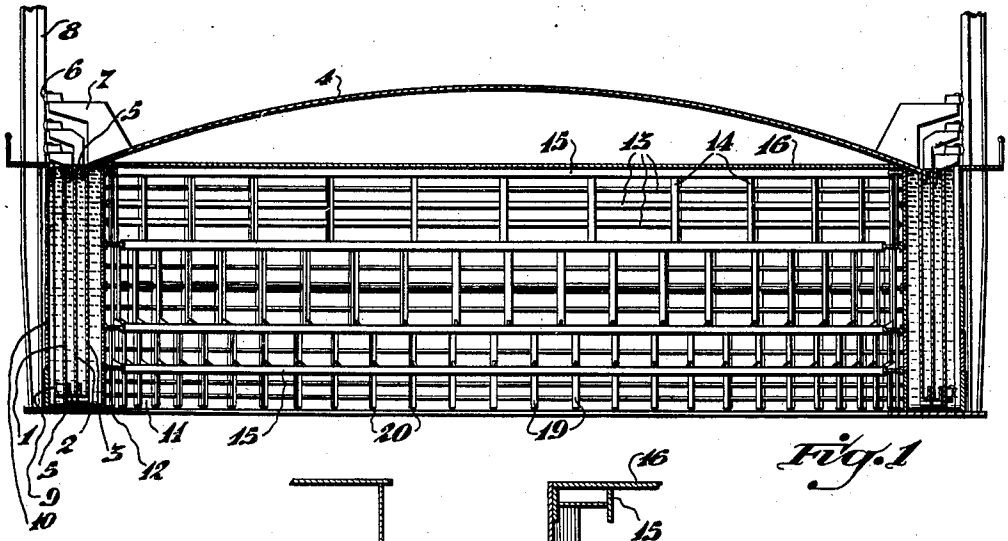


Fig. 1

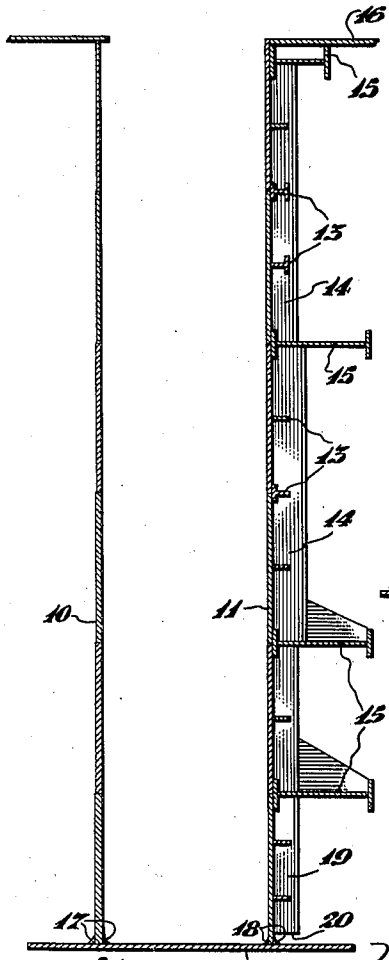


Fig. 2

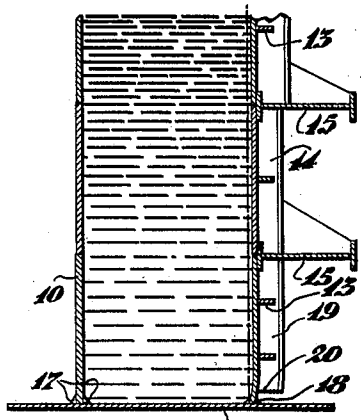


Fig. 3

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TANK FOR LIFT TYPE GAS HOLDERS

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2 Claims. (Cl. 48—179)

This invention relates to gas holders and is particularly directed to improvements in the construction of the tanks utilized for receiving the lifts of wet type gas holders. Generally speaking, these gas holders consist of a series of sections or lifts which are mounted telescopically in a tank of water and include interlocking water seals which are adapted to seal the holder when it is inflated.

In localities where the bearing capacity of the soil is low, where the water supply is limited, or where there is extreme cold causing freezing of the water, it has been found expedient to substantially decrease the volume of water used by providing an annular tank instead of a vat-type tank. In this instance, the lifts are submerged in water in the annular channel constituted by double walls and the interior of the tank on the inside of the inner wall is an open space. Tanks of this double wall type have been used in the past.

It has been an object of the present inventor to provide an improved double wall tank of stronger construction, the walls of which will not buckle or distort or cause shifting of the base or floor of the tank and opening of the seams of the plates and the connection of the walls and base due to the hydrostatic pressure. It will be apparent to those skilled in the art that these improvements may be included in other tanks and similar structures without departing from the invention.

Although the desired decrease in the total weight of water is attained by the double walls, the head of water and the resulting hydrostatic pressure is not changed. For example, the volume of water in a single-walled tank 150 feet in diameter and 36 feet deep can be reduced considerably by utilizing an inner tank 136 feet in diameter. The annular chamber, therefore, would be only 7 feet wide, but the hydrostatic pressure on the walls from the head of water 36 feet deep would remain the same as with the larger volume. The hydrostatic pressure resulting from 36 feet of water is considerable and special precaution must be taken in constructing the walls constituting the annular tank.

In a large tank of this type when a load is placed on it, the structural materials are strained and either stretch or compress according to the nature of the load applied. Under a load, the respective stretching and compression in the materials constituting a double-walled tank the size of the above example is appreciable. The hydrostatic pressure on the outer wall tends to expand it outwardly radially; that is, toward bursting; whereas, the hydrostatic pressure on the inner wall tends to compress it inwardly radially; that is, toward collapse. The bottom plates are joined to the two walls of the annular channel; and even though the bottom plates rest flatly on the foundation provided for the tank and so are not affected by the weight of water on them, they are put under great tension because of the pressure on the walls. In other words, the water above the bottom plates exerts a direct force against the walls which is transmitted indirectly into the bottom plates.

In some instances, if the inner wall were stiffened and fastened rigidly to the bottom plates in such a manner that a large percentage of the load was transmitted to the bottom plates, the inner wall upon being compressed under the load would pull the bottom plates inwardly and cause the unstiffened outer shell to buckle and pull inwardly at the bottom. On a large tank this might be as much as two inches which is enough to bind the guide rollers of the outer lift section, or cause the outer tank wall to be shifted on the foundation, or to open many of the seams. If the outer wall is stiffened sufficiently against buckling, expense and other factors enter.

It has therefore been a further object of the present inventor to provide a double wall tank which is so constructed that the loads on the walls, for the greater part, are not transmitted into the bottom plates. The design is such that each section between girders is capable of resisting the thrust or hydrostatic compression within that area.

In fulfilling this objective, the present inventor has provided a simple bendable joint between the inner wall and the bottom plates so that the inner wall can compress without drawing the bottom plates inwardly with it. By not welding any of the vertical stiffeners directly to the bottom, and simply welding the wall to the bottom in order to obtain a water-tight joint, the joint between the bottom and wall remains much more flexible. Due to the fact that that this joint is "hinged" or flexible, a greater portion of the hydrostatic pressure is transmitted to the first girder.

Another objective has been to provide a stiffened inner wall for tanks of this type which is of improved construction and an improved outer wall which is unstiffened but constructed to withstand great loads.

Other objectives and advantages will be ap-

parent from the following description of the drawing in which:

Figure 1 is a diagrammatic sectional view of a telescopic lift, wet-type gas holder embodying the present invention.

Figure 2 is a sectional view of the annular channel constituted by the two walls and bottom plates.

Figure 3 is a fragmentary sectional view similar to Figure 2 exaggerating the bendable joint for illustration purposes.

In the diagrammatic sectional view, Figure 1, a typical wet-type gas holder is shown including three lifts. The holder is shown in the deflated position with the lifts positioned telescopically one inside the other. Generally speaking, the lower lift is the outermost in this position and is indicated at 1. The second lift is between the other two and is indicated at 2. The upper lift is the innermost, being indicated at 3. The upper lift is provided with a dome-shaped crown or roof 4. Conventional interlocking water seals, indicated at 5, are provided to seal the lifts when the holder is inflated.

The lifts are guided at their upper ends by rollers 6 mounted on hangers 7 which are secured to the top of each respective lift. The rollers 6 ride on tracks on the inner faces of standards or column 8 (two only are shown here) of the guide frame. At the lower ends, the lifts are guided by rollers 9 which roll, in each instance, on the inner face of the next outermost lift; the rollers 9 on the outermost lift 1 being guided on tracks on the inner face of the outer wall 10 of the water tank in which the lifts are mounted.

Inside the innermost lift an inner tank wall 11 is provided. This inner wall 11 and the outer wall 10 are joined by bottom plates 12 and constitute an annular tank which is filled with water to provide a seal for the lifts.

The outer wall 10 is built up, in the instance shown, of six rings. Each ring is constituted by a plurality of equally thick, arcuate shell plates which preferably are butt-welded. The respective rings are made increasingly heavy from the top to the bottom of the wall, and preferably, each ring is butt-welded to the ring above and below it.

The bottom of the annular channel is made up of the plates 12 which are butt- or lap-welded to each other.

The inner wall, in the instance shown, is also made up of six rings comprised of shell plates which are butt-welded. The six rings of the inner wall may be equally thick from top to bottom and the respective rings, butt-welded together. The inner wall is stiffened by a plurality of horizontal, circular beams 13, a plurality of vertical stiffeners 14 and a series of large horizontal girders 15 designed as rings.

The circular girders 15 are fastened to the inside of the inner wall preferably by a continuous weld. In the instance shown in Figure 2, four circular girders are utilized; one at the top of the wall, one approximately one-third of the way down the wall, one at two-thirds of the way down the wall, and one between the last-mentioned girder and the bottom of the wall. The vertical stiffeners 14 and the horizontal, circular beams 13 are welded to the wall between the circular girders 15. Preferably, the ends of the vertical stiffeners are butt-welded to the respective top and bottom sides of the circular girders.

The area within the inner wall may be closed off by a roof 16 which is sealed and secured to the inner wall around the top edge thereof. Appropriate supporting columns have not been shown here for the roof 16 or the dome 4 since their construction is well known in the art. The roof 16 may be dome-shaped depending on the system of bracing utilized.

The bottom plates are fastened to the bottom of the outer wall by a continuous seal weld indicated at 17. The wall rests on top of the plates, and the seal weld is made on both sides of the wall in order to provide a strong joint.

The bottom of the inner wall is similarly welded to the bottom plates; that is, a continuous seal weld 18 on both sides of the wall. But at this point, the inner wall is unstiffened because the vertical stiffeners, indicated at 19, which are secured to the lower portion of the inner wall, stop short of the bottom of the wall, as at 20.

This unstiffened portion and the continuous seal weld 18 provide a bendable joint which is adapted to yield when the inner wall is compressed under a load and thus, relieve the tension on the bottom plates. That is to say, there will be no tendency to displace or bend the base plates.

There are two factors to be considered in determining the strength of materials used in the outer wall 10. First, the outer wall is subjected to radial pressure at every point on its circumference. This pressure is equal at every point on any one horizontal circumference. Therefore, the only stress arises from the internal pressure which is tending to increase the circumference of the ring. This is a tearing or bursting stress; that is, pure tension.

Second, this internal pressure increases in direct proportion to the depth of the water and, therefore, the plates comprising the six rings from top to bottom are made increasingly heavy from one to six (Figure 2). The upper ring is made heavy enough to withstand the tension at the bottom of the upper ring; the second ring is made strong enough to withstand the tension at its lower edge, etc., so that the sixth ring is made strong enough to withstand the tension at the bottom of the tank. Therefore, on any horizontal circumference from top to bottom, the outer wall is strong enough to withstand the tension on that particular circumference. Thus, the outer wall when subjected to internal pressure will tend to round out and remain circular.

The inner wall 11, on the other hand, is subjected to a crushing pressure. If the same method of increasing the plates from the top to the bottom were used, the plates would have to be so thick that the structure would be impractical. The ring is therefore made of thin plates which are backed up with a framework. The vertical stiffeners 14 are used every few feet completely around the inside of the tank, and the large ring girders 15 are used to back up these vertical stiffeners. Any stress that is placed on the vertical stiffeners or the circular beams 13 is transmitted to one of the four ring girders 15. Thus, the stresses are localized; that is, taken in sections.

The necessary strength of the framework is largely dependent on the size of the tank and the head of water in the tank. The strength of materials necessary for a specific job will be known to those skilled in the art.

When water is put in the tank, the inner ring shrinks in diameter due to compression of the metal constituting the ring. If the bottom of

the inner tank were secured rigidly to the bottom plates, the compressive force would be carried into the bottom plates. This can be seen from a study of Figure 2. If the lower vertical stiffeners 19 were extended and fastened rigidly to the bottom plates, the whole inner wall as a unit from top to bottom would move in when the load is applied and the bottom plates would be pulled in with it. In this circumstance, the lower edge of the unstiffened outer wall would also be pulled inwardly and would buckle if the bottom plates did not split first. In any event, the joint between the bottom plates and the inner wall would be carrying most of the load on the inner wall.

The bottom plates are the most inaccessible in a structure of this type and therefore, it is most important that they never need repairing. So the less tension on them, the less chance there is for them to need repairing.

The present invention provides that the load on the inner wall be carried by the ring girders 15 and particularly, that the greater part of the load at the bottom of the inner wall be carried by the lower ring girder and not transmitted into the bottom plates. The bendable joint between the inner and the bottom plates which the inventor provides, accomplishes this. With the bendable joint at 20, the inner wall under a load assumes somewhat the position shown in Figure 3. The bend is exaggerated for illustration purposes, but it may be seen that with it, the greater part of the load on the lowermost section of the wall is transmitted into the large circular girder instead of into the bottom plates.

Having described my invention, I claim:

1. A liquid holding tank for receiving the lifts of a lift type holder, comprising a bottom, an outer wall and an inner wall secured to said bottom to form an annular chamber for holding the fluid sealing means, said outer wall composed of vertically arranged plate sections, said plate sections decreasing in thickness progressively from the bottom of the wall to the top, said inner wall consisting of plates of uniform thickness, circumferentially arranged girders fastened to the inside of the inner wall, additional vertical stiffening means associated with said circumferential girders and fastened to said inner wall and arranged so as to cause the inward pressure on the inner wall to be absorbed in sections centralized at the circumferential girders and said inner wall being attached to the bottom by welding and said vertical stiffening means extending only to a point removed from the bottom, the lowest portion of said inner wall being unstiffened and free to flex and prevent transmission of substantial stress to the bottom from hydrostatic pressure.

2. A liquid holding tank for receiving the lifts of a lift type holder, comprising a bottom, an outer wall and an inner wall secured to said bottom to form an annular chamber for holding the fluid sealing means, said inner wall consisting of plates, circumferentially arranged girders fastened to the inside of the inner wall, additional vertical stiffening means associated with said circumferential girders and fastened to said inner wall and arranged so as to cause the inward pressure on the inner wall to be absorbed in sections centralized at the circumferential girders and said inner wall being attached to the bottom by welding and said vertical stiffening means extending only to a point removed from the bottom, the lowest portion of said inner wall being unstiffened and free to flex and prevent transmission of substantial stress to the bottom from hydrostatic pressure.

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