April 15, 1941. D. EISINGA 2,238,102

TANK

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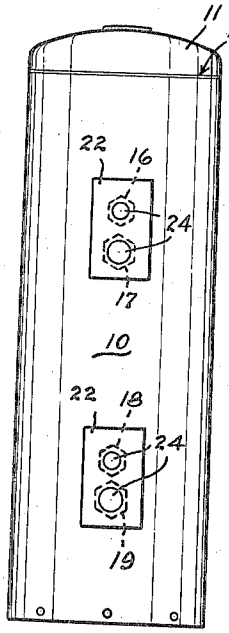

Fig. 1

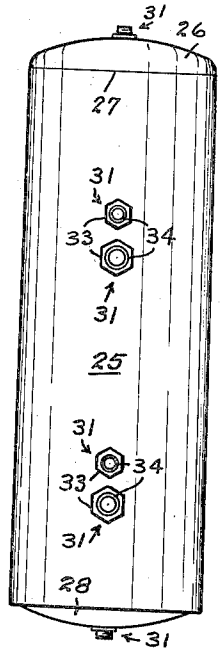

Fig. 2

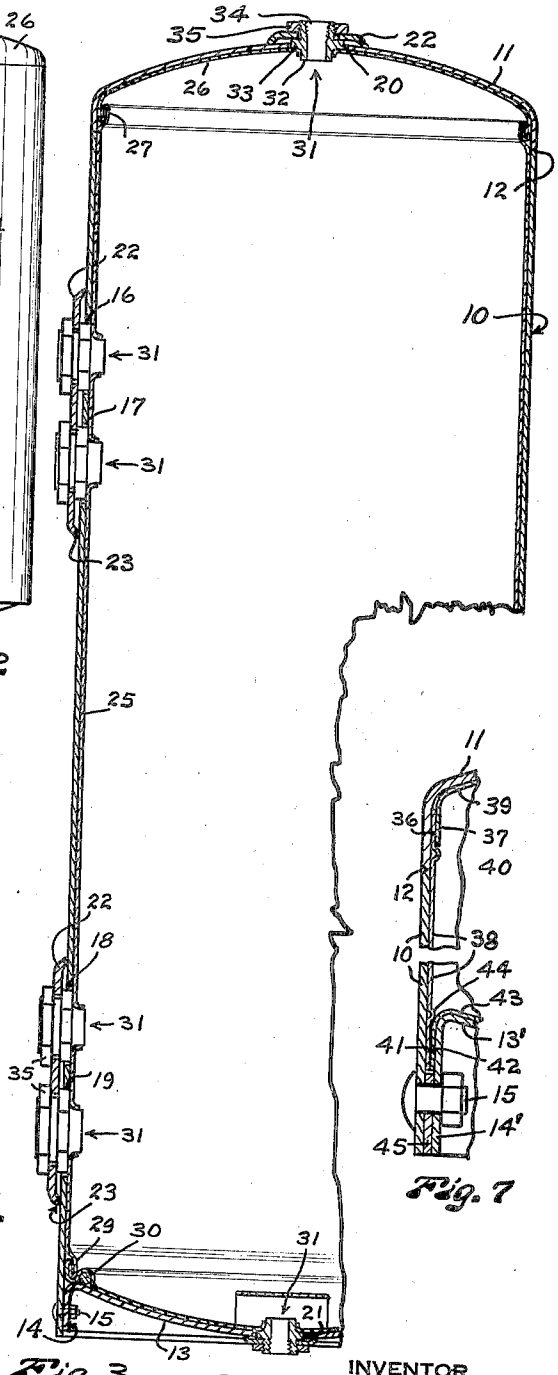

Fig. 3

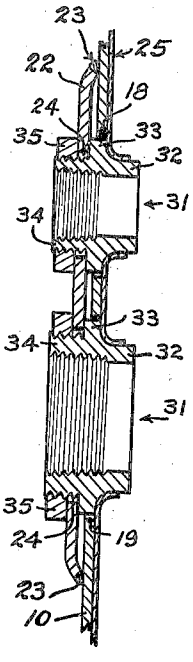

Fig. 4

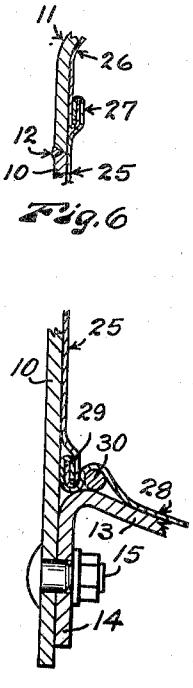

Fig. 6

Fig. 5

Fig. 7

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TANK

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2 Claims. (Cl. 220—63)

This invention relates to a tank for the reception of liquid under pressure and the primary object of this invention is to provide a tank having an outer shell of strong material and an inner liquid tight lining of non-corrosive material.

Tanks for the storage of liquid under pressure must be made of strong material to safely withstand the pressure of the liquid, and for use with liquids, such as water; which tend to corrode or oxidize some metals, it is very desirable that the interior of the tank be made of a non-corrosive metal.

Because of the requirement for strength it has been common practice to use ferrous metal, as sheet steel, in the construction of hot water storage tanks. This metal, even though it is well galvanized, is subject to corrosion or rusting, when used as a water tank, with the result that an accumulation of rusted or oxidized iron is found in the tank after a short period of use and the tank will rust out and leak within a few years. To overcome this objection these tanks have been made of special alloys such as stainless steel, Monel metal and the like but this has proved to be expensive and there is a demand for a tank which will not oxidize and rust out and which is cheaper in cost of construction than a tank made of these alloys.

It is an object of this invention to provide a tank which is internally non-corrosive, which has the strength of a steel tank, and which is substantially less expensive in cost of manufacture than a similar tank of the non-corrosive steel alloys now on the market.

Another object of this invention is to provide a tank in which the outer shell of the tank is made of steel and provides the strength element and the inner liner is made of copper which is insertable into and removable from the outer shell and which is sufficiently soft and pliable to be expanded by internal pressure against the outer shell.

Another object is to provide a tank comprising an outer supporting shell of metal of high tensile strength, said shell being of circular cross section and having a slight taper, the larger end of said shell being arranged to be left open and unobstructed initially and to be closed by a separate end member after a separately constructed slightly tapered liquid tight liner receptacle of soft non-corrosive readily deformable metal has been installed within said shell, the slight taper of the shell and liner facilitating insertion and removal of the liner and leaving the end of the shell initially open making it possible to treat the inside of the shell, such as by galvanizing, to render it rust resistant and separately constructing the liner making it possible to thoroughly test the liner for leaks before it is installed in the shell.

Another object is to provide a tank embodying a steel casing or shell and an insertable and removable liner, said liner having fittings secured thereto, which fittings project beyond the circumference thereof and said liner being sufficiently soft and ductile so that a section of the liner containing a fitting may be bent inwardly to allow the fitting to be passed into the outer shell whereby pressure within the liner will press said bent section of the liner together with the fitting outwardly to position the fitting within an opening in the shell where said fitting will rest and be secured in such a manner as to relieve the liner of undesirable strain.

Another object is to provide efficient means for supporting the liner adjacent an end seam thereof so that said liner is relieved of undesirable strain at the location of such seam.

Other and more specific objects will be apparent from the following description taken in connection with the accompanying drawing.

In the drawing

Fig. 1 is an elevation of an outer shell member constructed in accordance with this invention.

Fig. 2 is an elevation of an inner liner member adapted for use in the shell shown in Fig. 1.

Fig. 3 is a longitudinal medial section on a larger scale showing the shell and liner member assembled, parts being broken away.

Fig. 4 is a fragmentary sectional view on a still larger scale showing the doubling plates and parts associated therewith.

Fig. 5 is a fragmentary sectional view, on a larger scale than Fig. 3, showing the seam at the bottom end of the liner and the means for protecting said seam against damage by internal pressure.

Fig. 6 is a fragmentary sectional view showing a seam adjacent the top of the liner.

Fig. 7 is a fragmentary sectional view showing an alternative method of forming the seams at the top and bottom of the liner.

Like reference numerals designate like parts throughout the several views.

The drawing shows a tank comprising a shell 10 which is of generally cylindrical shape except that it is of slightly smaller diameter at the upper end than at the lower end. In a tank approximately four feet long and fourteen inches in diameter I find it satisfactory if the shell 10 is

approximately one fourth inch smaller in diameter at the top portion than at the bottom portion.

The shell 10 is provided with a fixedly secured top end portion 11, preferably of concavo-convex shape, as shown. Preferably this top end portion 11 is welded to the shell 10 along the annular line 12 so as to leave an even and unbroken surface free from bumps and shoulders in the inside of the shell 10. At the bottom end the shell 10 is provided with a removable concavo-convex end member 13. The end member 13 has an annular marginal flange portion 14 projecting from the convex side thereof. The end member 13 is positioned in the shell 10 with the concave side inwardly and the annular flange portion 14 is positioned within the lower end portion of the tank. Bolts 15 removably secure said end member 13 to the shell 10. Making the end member 13 and the inner liner removable makes it possible to thoroughly galvanize or otherwise rust proof the interior of the shell 10 and cover member 11.

The shell 10 is provided at suitable locations with holes 16, 17, 18 and 19 to accommodate fittings, hereinafter described and the top portion 11 and bottom portion 13 are centrally provided with similar openings 20 and 21 respectively. The holes 16 to 21 inclusive are of non-circular shape and preferably are hexagonal, as shown.

The holes 16—17 and the holes 18—19 are illustrated as positioned in pairs with the two holes of each pair close together. This provides for two connections with the tank adjacent each other, which, for instance, may be used for an electric heater and a thermostat respectively.

A doubling plate 22 is positioned over each hole or pair of holes and the marginal portion of each doubling plate 22 is secured to the shell or cover member or bottom, preferably by welding, as indicated by 23. The doubling plates 22 are provided with circular holes 24 positioned in registration with the holes 16 to 21 for purposes hereinafter explained.

The inner receptacle or liner of non-corrosive metal comprises a substantially cylindrical portion 25 having a concavo-convex top portion 26 connected therewith by a seam or joint 27 and having a bottom portion 28 connected therewith by a seam 29. An annular bead member 30, of wire or any other suitable material is provided on the bottom portion 28 just inside of the seam 29 to partially fill a groove which is left just inside of said seam and prevent injury to the seam due to internal pressure within the liner member.

A plurality of pipe fitting members 31 extend through the side walls and top and bottom portions 26 and 28 respectively of the non-corrosive liner in positions corresponding to the positions of the holes 16 to 21 in the outer shell. Each of these pipe fitting members 31 comprises an inner cylindrical portion 32 to which the non-corrosive metal is soldered or welded or otherwise secured in such a manner as to provide a leak tight connection and a hexagonal portion 33 positioned outside of the non-corrosive liner and an externally and internally threaded portion 34 projecting beyond the hexagonal portion 33.

The non-corrosive liner has a slight taper corresponding to the slight taper of the outer shell in which it is to be used so that it may be more easily inserted into and removed from the outer shell.

One metal which has been found satisfactory for use in constructing the liner is copper. If desired this copper may be plated with tin on the inside. Obviously other soft non-corrosive metals may be used for this purpose.

The outer shell and the liner are constructed separately. This makes it possible to rust proof the inside of the outer shell, as by galvanizing, and to test the liner for leaks before these two parts are assembled. In assembling the tank the liner is inserted into the outer shell through the open bottom of said shell and the bottom member 13 is applied to said outer shell. Before inserting the liner, the side portions of the liner which carry the pipe fitting members 31 are pressed and bent inwardly far enough so that the pipe fitting members 31 will not catch on the shell. When the liner is inserted it is positioned so that these pipe fitting members 31 are in exact registration with the hexagonal openings 16, 17, 18 and 19 of the outer shell. After the liner has been inserted and carefully positioned and the bottom member 13 secured to the outer shell, all openings are plugged and fluid under pressure is admitted into the inner liner. This will expand all portions of the liner out against the supporting shell and will press the pipe fitting members 31 outwardly until the hexagonal portions 33 of said pipe fitting members are positioned within the hexagonal openings 16 to 21 inclusive. Also the outer sides of the hexagonal members 33 will rest against the doubling plates 22 and prevent strain on the inner shell and the threaded portions 34 of the pipe fitting members will project through the cylindrical openings 24 in the doubling plates 22 so that nuts 35 may be threaded thereon. The pipe fitting members 31 are thus held against rotation by the walls of the hexagonal openings 16—19 and are firmly secured to the doubling plates 22 and the inner shell is relieved of substantially all strain at this location.

The seams 27 and 29 will usually be soldered to insure against leakage and the walls of the liner parts may also be soldered to the pipe fitting members 31.

For the purpose of convenience in this description I have referred to one end of this tank as a top end and the other end as a bottom end but it will be understood that this tank may be, and in some instances of use is, reversed end for end.

In Fig. 7, I have shown an alternative form of construction for the annular seams at both ends of the inner liner. In this disclosure the joint shown at the top is in the form of a lap seam made by lapping the two ends 36 and 37 of a liner tube 38 and a top liner head 39 and soldering this lapped joint. Preferably an annular bead 40 is formed in one of these parts to serve as a stop against which the end of the other part may abut and as a dam for melted solder which is caused to flow into the space between the two parts to provide a leak proof joint. This lap joint lies flatly against the outer shell and is not damaged by internal pressure.

The seam shown at the bottom of the liner in Fig. 7, is also a lap seam formed between a straight projecting end 41 of the liner tube 38 and an outwardly bent end 42 of a liner head 43. The liner head 43 is spun to a correct shape to snugly fit a head 13' of the outer shell. An annular internally protruding bead 44 is formed in the liner tube 38 to serve as a stop for initially positioning the head 43 within the liner and as a dam for melted solder which is caused to flow into the space between the overlapped members 41 and 42 to provide a leak proof joint therebetween.

The head 13' has an outwardly extending flange 14' of sufficiently smaller diameter than the shell 10, to snugly receive the overlapped portions 41 and 42 of the liner therebetween. A spacer ring 45, of a thickness substantially equal to the thickness of the two overlapped portions 41 and 42, is provided between the flange 14' and the shell 10. The bolts 15 which secure the head 13 to the shell 10 preferably extend through suitable holes in the ring 45. The liner parts 38, 41, 42 and 43 all fit snugly against the supporting parts of the outer shell and are supported in such a manner that they will not be damaged by internal pressure.

Constructing the liquid tight liner receptacle as a separate unit independently of the outer supporting shell and leaving one end of the outer shell open until after the separate liner has been positioned in the shell makes it possible to galvanize or otherwise treat the inside of the shell to render the same rust resistant and also makes it possible to independently test the separate liner for leakage before it is installed in the outer shell. It is desirable to rust proof the inside of the outer shell, as its is always possible that some moisture may get into said shell and tend to rust it. It is also very desirable to test the independent inner liner unit for leaks before it is installed in the outer shell, because leaks are easily detected before installation but are difficult to detect after installation especially if they are small leaks.

The slight taper of the shell and the liner makes it possible to readily disassemble these two parts even after they have been in assembled relation for a long period of time. Before the liner can be withdrawn from the shell it is necessary to remove the end member 13 and to remove all of the nuts 35 and to press the pipe fitting members 31 which are positioned on the sides of the liner inwardly far enough to clear the shell thus allowing the liner to be withdrawn. Obviously end member 13 may be secured to the shell 10 by riveting or by welding and still be removable.

By constructing the tank as herein set forth I am able to provide a non-corrosive tank, which has ample strength to withstand heavy pressures and which is much cheaper to manufacture than tanks made of non-corrosive metals of high tensile strength now available.

The foregoing description and accompanying drawing clearly disclose a preferred embodiment of my invention but it will be understood that this disclosure is merly illustrative and that changes may be made within the scope and spirit of the following claims.

I claim:

1. A tank of the class described comprising an outer supporting shell of metal of high tensile strength, said shell having openings therein; doubling plates on the exterior of said shell at the locations of said openings, said doubling plates having openings in registration with the openings in said shell; a liquid tight liner receptacle of soft non-corrosive readily deformable material separable from said outer shell and insertable into and removable from said outer shell; and pipe fitting members carried by said liner and movable into and out of said shell along with said liner and having portions positioned to extend outwardly through said openings in said outer shell and other portions positioned to engage with said doubling plates whereby the thrust on said pipe fitting members will be borne by said doubling plates.

2. A tank of the class described, comprising an outer supporting shell of metal of high tensile strength, said shell having openings of non-circular shape therein; doubling plates secured to the exterior of said outer shell at the location of said openings, said doubling plates having openings of smaller size than the openings in said shell positioned in registration with the openings in said shell; a liquid tight liner receptacle of soft non-corrosive readily deformable metal separable from said outer shell insertable into and removable from said outer shell; and pipe fitting members connected with said liner; said pipe fitting members embodying non-circular portions positioned adjacent the walls of the liner and threaded portions of smaller size than the non-circular portions extending outwardly from the non-circular portions, said non-circular portions of said pipe fitting members being positioned within the non-circular holes in said outer shell whereby they are held against rotation, said non-circular portions resting against said doubling plates and said smaller threaded portions of said pipe fitting members extending through the holes in said doubling plates when said inner liner is properly positioned within said outer shell.

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