

March 19, 1963

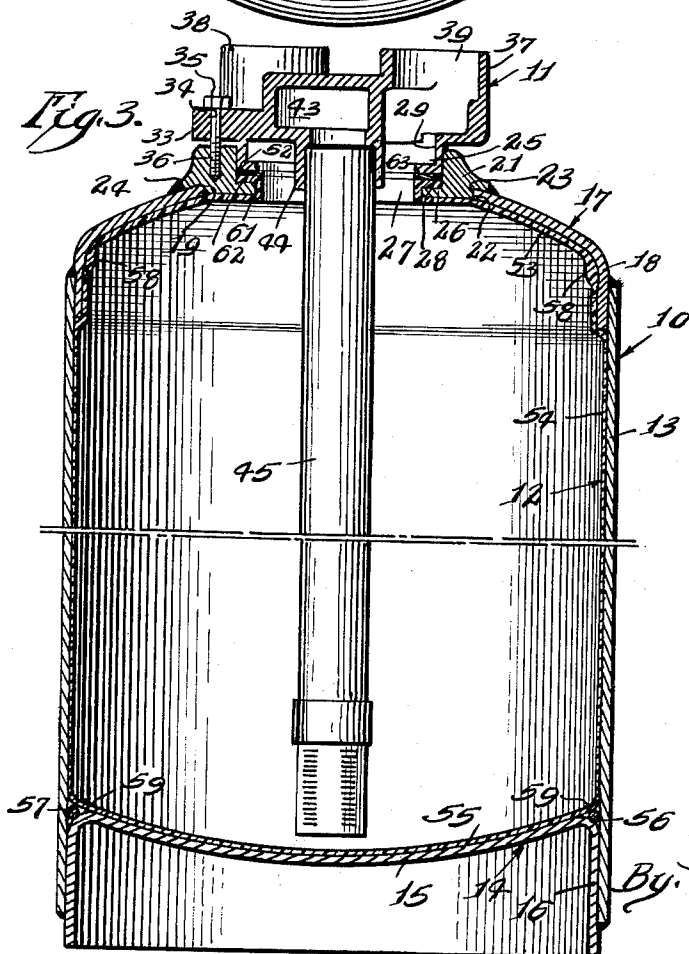
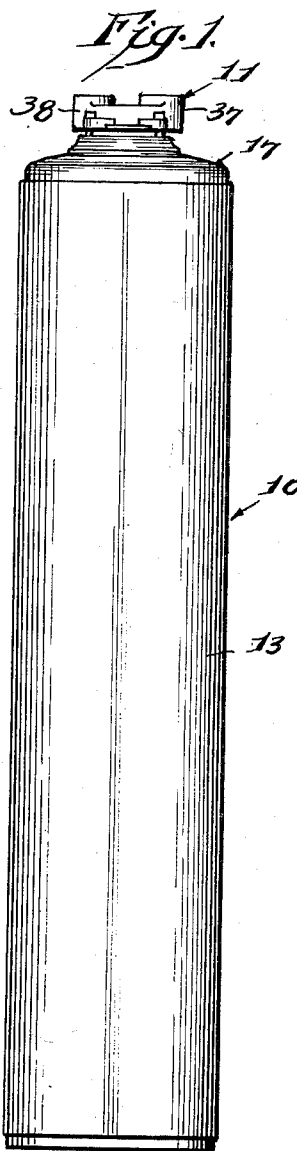
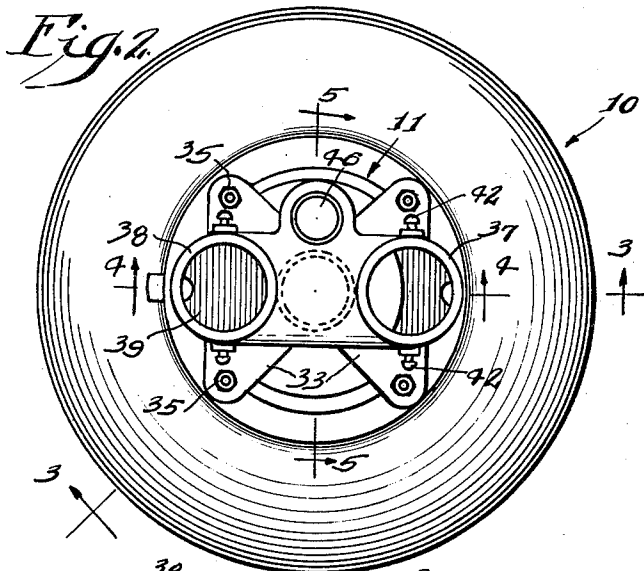
R. E. SCHULZE ET AL

3,081,905

WATER CONDITIONING TANK AND LINER THEREFOR

Filed April 7, 1960

2 Sheets-Sheet 1



Inventors.
Robert E. Schulze.
Donald J. Dickel.

By: Wilson & Gifford
Attorneys.

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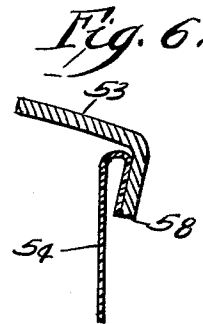
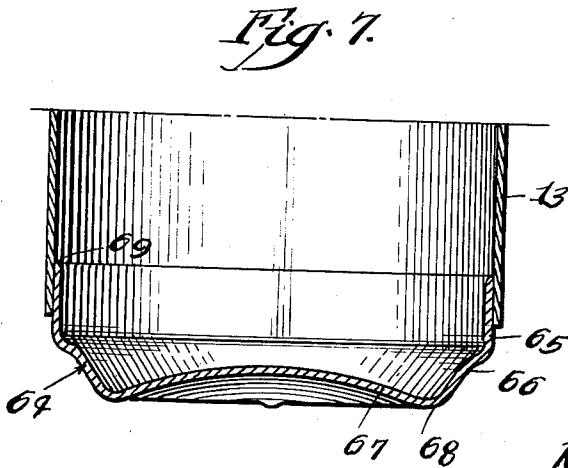
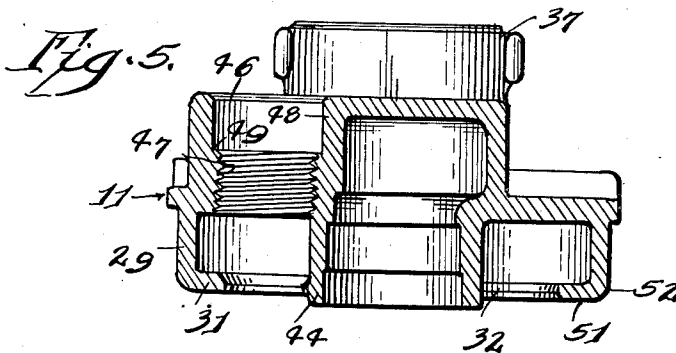
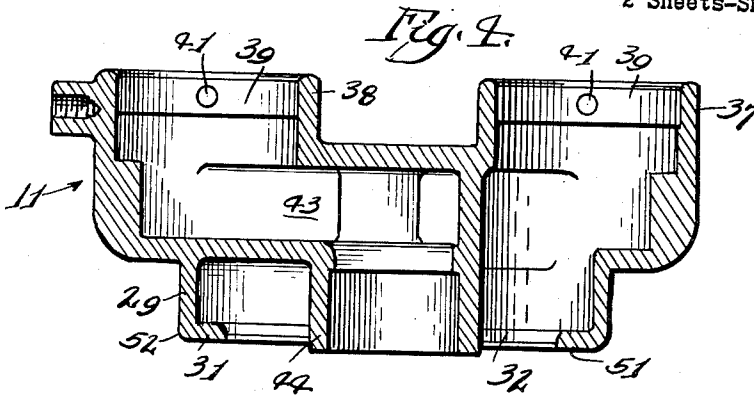
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WATER CONDITIONING TANK AND LINER THEREFOR

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2 Sheets-Sheet 2



Inventors.
Robert E. Schulze.
Donald J. Dicktel.

By. Wilson & Seppert
Attorneys.

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3,081,905

WATER CONDITIONING TANK AND LINER
THEREFOR

Robert E. Schulze, Deerfield, and Donald J. Dicktel,
Mount Prospect, Ill., assignors to Culligan, Inc., North-
brook, Ill., a corporation of Delaware
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5 Claims. (Cl. 220—63)

The present invention relates to a novel water conditioning tank and more particularly to a novel tank which will accommodate various manifold arrangements and automatic directional valves and to a novel liner to be used in this tank for the prevention of corrosion to the metal utilized in the walls and ends of the tank.

Water conditioning tanks have been constructed of steel or cast or wrought iron for many years because of the economy involved in using these readily available materials. Since the tanks are constantly in contact with water, corrosion of the tanks has been an ever-present problem. Further, various factors accelerate the corrosion of the metal used, such as the presence of dissolved oxygen in the water, the acidic nature of some water supplies, free carbon dioxide and the presence of certain bacteria.

Further difficulties arose due to lack of uniformity of the composition of the metal and due to inclusions, such as mill scale. These factors gave rise to an electrochemical effect by the production of anodic and cathodic areas in the metal. These areas accelerated corrosion in small areas, and a tank would develop small holes although up to 99% of the tank was in good condition.

One attempt to solve this problem was a zinc galvanize. The base metal was coated with zinc by dipping or electroplating. However, where there were impurities in the zinc, cathodic and anodic areas occurred resulting in the disappearance of the zinc and exposure of the iron or steel. As the small areas of exposure increased, the zinc afforded little corrosion protection.

Tanks of alloy metals having low corrosion rates were tried, but the alloys were expensive and such tanks were not commercially economical. Using the alloy as a coating on iron or steel was also attempted, but wherever the alloy was porous, corrosion would occur more rapidly due to the electrochemical reaction between the alloy and the iron or steel.

A more recent attempt at a solution of this serious problem was the utilization of a coating of a resinous, asphaltic or thermoplastic material. These coatings required most careful application to obtain a uniform coating, and for an interior of a tank, inspection of the coating or testing of the coating was extremely difficult. Also asphaltic and thermoplastic coatings had a tendency to crack due to variations in temperature and sometimes melted at high temperatures. These coatings were essentially insulators and any imperfections in the coating resulted in an intensified corrosion. Vitreous coatings were also attempted but were found to be too fragile in use and again intensified corrosion would result at any imperfections.

The present invention relates to the use of a removable liner which is inserted in a water conditioning tank and to the construction of the water conditioning tank. The liner is in the form of a bag having an open flanged top which fits within the water softener tank. The tank has a relatively large central opening and an adapter head which has the sealing surface urged against the flanged top of the liner to seal the tank and adapter together. The adapter head has openings for fittings which connect to water lines or to automatic directional valve units that are combined with or used on the tank.

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An important object of the present invention is the provision of a novel liner, preferably made from plastic, to be used in a water conditioning tank. The liner is easily removed from the tank and can be readily inspected both before installation and during use to determine whether there are any imperfections or weakened areas in the liner walls which would result in corrosion of the tank. The liner is formed of a molded plastic top or head piece and a side wall and a bottom or base portion, the top or head piece being somewhat heavier or of greater thickness than the side wall and bottom. This molded top results in an umbrella effect for most effectively supporting the side wall suspended therefrom during insertion of the liner into the tank, whereby the side wall and base portion can be constructed of relatively thin rolled sheet plastic or extruded tubing of minimum thickness.

Another important object of the present invention is the provision of a novel construction of a water conditioning tank for receiving the tank liner. This tank has a cylindrical body with a top and bottom welded or rigidly affixed thereto. A relatively large central opening is formed in the top of the tank and an adapter head fits into this opening and is secured to the tank by means of four bolts passing through spaced ears or projections on the adapter head and received in tapped openings in the top of the tank. This adapter head is provided with the inlet and outlet openings for the tank and a depending flange for effecting sealing when urged against the liner to seal the head and tank together.

The present invention further comprehends a plastic liner provided with a molded top having a unique flange at its upper open end. The liner is so constructed as to closely conform to the interior of the tank extending with its neck or open end upwardly through the central opening and terminating in a radially outwardly extending flange. When the liner is assembled in the tank its flange is located between the sealing surface or shoulder of the tank defining the central opening and the sealing surface of the depending flange on the adapter head. This molded top and flange assembly eliminates all wrinkles and distortion which would otherwise occur due to stretching of the plastic material.

A further object of the present invention is the provision of an additional gasket ring to enhance the seal between the adapter head, the plastic liner and the tank. The provision of this gasket ring precludes any leakage which might occur if the plastic liner has a tendency for cold-flow under pressure.

The present invention also comprehends a novel seam assembly at the seams between the molded top piece, the side wall and the bottom piece or base of the liner. The provision of these seams eliminates stresses which otherwise would occur in the liner and, in the present novel manner of assembly, when pressure is exerted from the inside of the liner, such pressure enhances the sealing effect at the seams.

The present invention also comprehends a novel construction of the adapter head for the tank, such that the bolts used to attach the head onto the tank do not pass through the flange of the liner or the sealing gasket. Thus the sealing function of the liner and gasket is not weakened or adversely affected.

Further objects are to provide a construction of maximum simplicity, efficiency, economy and ease of assembly and operation, and such further objects, advantages and capabilities as will later more fully appear and are inherently possessed thereby.

In the drawings:

FIGURE 1 is a front elevational view of the novel water conditioning tank and adapter head of the present invention.

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FIG. 2 is an enlarged top plan view of the tank more fully showing the adapter head and its connections and manner of assembly.

FIG. 3 is a fragmentary vertical cross-sectional view of the tank and adapter head assembly taken on the line 3—3 of FIG. 2 and showing the novel plastic liner assembled in the tank.

FIG. 4 is an enlarged horizontal cross-sectional view of the tank adapter head taken on the line 4—4 of FIG. 2.

FIG. 5 is an enlarged vertical cross-sectional view of the tank adapter head taken on the line 5—5 of FIG. 2.

FIG. 6 is an enlarged fragmentary cross-sectional view of a heat seal between two portions, such as the molded top and the attached side wall, of the plastic liner when in the assembled tank.

FIG. 7 is a fragmentary cross-sectional view of the bottom of an alternate form of water conditioning tank.

Referring more particularly to the disclosure in the drawings in which is shown illustrative embodiments of the present invention, FIGS. 1, 2 and 3 disclose a water conditioning tank 10 having an adapter head 11 and a plastic liner 12 conforming to the interior of the tank. The tank consists of a tubular shell or side wall 13 fabricated from sheet steel or other metal suitable for the purpose, a bottom member or base 14 having a dished circular part 15 and a depending side wall or supporting skirt 16. The head or top member 17 is bowed and provided with a depending annular part 18. Both the head and bottom members are press or force fitted into the shell 13 and welded or rigidly affixed thereto.

The head 17 of the tank 10 has a central access opening 19 allowing access to the interior of the tank. A tank spud or ring adapter 21 is conformably received in the opening 19 with its shoulder 22 received in and contacting the inner peripheral edge 23 of the opening 19. This spud is welded or affixed to the tank along the overlapping edge 24. The spud 21 has a central opening 25 with an inwardly extending lip 26 forming a smaller access opening 27 communicating with the interior of the tank 10, the lip also forming a sealing surface 28 which cooperates with the adapter head 11 in a manner as hereinafter explained. The invention also contemplates a tank having a central opening in both the head 17 and the bottom member 14 with a similar closure for each opening.

The tank adapter head 11 is a metal casting having an annular base 29 terminating in an inturned lip 31. The lip defines an annular opening 32 communicating with the interior of the tank 10. Above the circular base 29 and extending outwardly beyond the base are spaced anchoring ears 33, each with an opening 34 adjacent its outer end receiving a bolt 35 to detachably secure the adapter head 11 to the tank body 10. Threaded or tapped openings 36 in the spud 21 receive the threaded ends of the bolts 35.

The upper portion of the adapter head 11 is so constructed not only to accommodate the inlet and outlet connections for a replaceable water conditioning unit, but also the automatic directional valve assemblies utilized in a fully automatic permanent-type water conditioning unit. This structure includes an inlet fitting 37 and an outlet fitting 38 with each fitting having a cylindrical opening 39 within which will fit a slip connector or a conduit from an automatic valve assembly. Threaded openings 41 are placed on opposite sides of each fitting and below the top of the fitting to accommodate set screws 42 to hold the connectors or conduits in operative position in the adapter head.

The outlet fitting 38 communicates with a horizontal passage 43 which extends inward to the center of the adapter head 11 and terminates in a downwardly opening port in a cylindrical fitting 44 communicating with an outlet manifold 45 secured thereto. The opening 39 in the inlet fitting 37 communicates with the annular opening 32 surrounding the fitting 44. A third fitting 46

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is located between the inlet and outlet fittings, but rearwardly thereof so as not to interfere with the fitting 44 and the passage 43. This fitting (FIG. 5) includes a threaded opening 47 communicating with the annular opening 32 and a smooth cylindrical opening 48 above the threaded portion 47 and separated by a shoulder or chamfer 49. If only the inlet and outlet fittings 37 and 38 are used, a threaded plug can be used to close the fitting 46. If an automatic valve with a separate eductor unit is used, the eductor would be disposed at the fitting 46.

The under surface 51 of the inwardly extending lip 31 provides a complementary sealing surface to the surface 28 of the spud 21. The corner 52 of the adapter is rounded or chamfered to provide a slight clearance in case there is any deformation or flow of the plastic liner 12 between the adapter head 11 and the spud 21.

The plastic liner 12 is composed of three pieces of plastic material, the molded top member 53, the depending cylindrical side wall 54 and the bottom member 55. The plastic used for the liner must be non-toxic since the water conditioning units treat water for human consumption and usage and the plastic must not impart any odor or taste to the water. Although there are many suitable plastics and rubber components, the plastic used is preferably a non-toxic polyvinyl chloride. The top member 53 of the liner is molded to a shape closely conforming to the configuration of the top of the tank, such as by injection or compression molding. The bottom member 55 is formed from a thin rolled sheet of the plastic, and the cylindrical side wall 54 can be formed from a rolled sheet or an extruded tube of the plastic. These members are sealed together.

The top member of the liner is approximately three times thicker than the side wall or the bottom. As an illustrative example, the top is 0.040" thick and the side wall and bottom are 0.015" thick; but this is not intended as limiting the invention, for the thickness may also depend on the stiffness of the particular material used in the liner. For example, the top may be thicker near the flanged opening and thin out toward the heat seal 58, providing the material has sufficient inherent stiffness and supporting strength to assure the desired umbrella effect. Suspending the liner 12 by the top member 53, the depending side wall 54 and the bottom 55 are supported in umbrella fashion by the thicker top member. The dimensions of the liner are kept very close to the internal dimensions of the tank to prevent distortion such as wrinkling or stretching of the liner. In this way, the side wall 54 and bottom 55 of the liner are formed of a plastic sheet of a minimum thickness. Furthermore, all crevices in the internal tank wall are filled by galvanizing or caulking material before the liner is inserted.

At the juncture of the tank side wall 13 and the bottom or base member 14, there is an annular crevice or depression 56 as shown in FIG. 3 of the drawings.

Rather than caulking or galvanizing this crevice, a hoop or ring 57 of plastic material is placed in and substantially fills this crevice 56. The hoop prevents stretching or wrinkling of the liner 12 at the bottom of the tank. The hoop 57 may be a wire encased within a circle of plastic tubing with the butt ends of the tube sealed together.

The three plastic pieces of the liner 12 are joined together in the manner shown by similar heat sealed seams 58 and 59. To form these seams the edges of adjacent components of the liner are arranged in parallel relation and a band approximately $\frac{1}{8}$ " to $\frac{3}{16}$ " from the free edges is heat sealed by any well known means. Then when the liner is placed in the tank 10, each seam 58 or 59 is folded back against the side or bottom of the liner as shown in FIG. 6. Pressure acting from within the liner against the seam tends to hold the seam together, thereby enhancing the heat seal.

This type of seal is advantageous in that an internal

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seam would tend to peel under pressure. Further, there is less shear stress occurring under pressure than with a lap seal. Also, folding the seam against the liner enhances the sealing effect when pressure is exerted on the liner 12.

As previously stated, the top member 53 of the liner 12 is molded to closely conform to the internal configuration of the head 17 of the tank 10. This member has a cylindrical wall 61 which fits within the lip 26 of the tank spud 21 and terminates in a radially outwardly extending flange 62 which rests on the sealing surface 28 of the lip 26. This flange 62 aids in sealing the tank 10 and its adapter head 11. However, it has been found that under pressure, some plastics have a tendency for cold flow or deformation which might result in the loss of a proper seal. To prevent this, a rubber gasket or resilient sealing ring 63 is placed over the flange 62 of the liner. This gasket is in direct contact with the sealing surface 51 of the adapter head 11.

Thus both the flange 62 and the gasket ring 63 are sandwiched between the sealing surfaces 28 and 51 of the spud 21 and the adapter head 11 respectively. It should be noted that the bolts 35 do not pass through either the flange 62 or the gasket ring 63.

In FIG. 7, an alternate form of water conditioning tank is shown. The top of the tank is identical with that shown in FIGS. 1 to 3. However, as the bottom member 64 does not form an annular crevice at the juncture with the tank shell 13, the hoop 57 shown in FIG. 3 is not required. This bottom member 64 has a cylindrical side wall 65, an inwardly and downwardly inclined or reduced wall 66 and an upwardly bowed bottom plate 67. The upward bowing presents a circular ridge 68 on which the tank 10 is supported. The top edge 69 of the side wall 65 is chamfered to present a fairly smooth surface at the junction of the bottom 64 and the shell 13 and which smooth surface allows the use of a liner of minimum thickness.

To assemble the unit, the liner 12 is suspended by the top portion 53 when inserted into the central opening in the tank 10 through the spud 21. The umbrella effect created by the thicker top portion 53 of the liner supports the side wall for easier insertion into the tank. Once the liner is in place with the flange 62 resting on the lip 26, water is placed in the tank while air is allowed to bleed out from between the tank 10 and the liner 12. When the tank is full, the ring gasket 63 is placed on the liner flange 62 and the adapter head 11 is inserted and bolted in place. Then the water conditioning material may be inserted in the tank. Obviously, air under pressure can be used instead of water to inflate the liner and discharge air from between the tank and the liner, and to cause the liner to closely conform to the interior of the tank. Other methods of insuring a proper fit of the liner 12 in the tank 10 include the insertion of a small vent tube between the liner and the tank at the top flange with the application of a vacuum to the tube, or a vacuum may be applied through a bolt hole 36 in the spud 21 extended to communicate with the interior of the tank. The liner 12 can be tested for air or liquid leaks prior to insertion in the tank, and can be removed at any time during service after emptying the tank for further testing.

Thus, it can be seen that the present invention comprehends a new and novel water conditioning tank and a plastic liner therefor which will protect the tank from corrosion which would occur during service of the tank. While there is shown a preferred embodiment, it is understood that the same is susceptible of modification and change, and comprehends such equivalents as are inherent in the disclosure and claims.

Having thus disclosed the invention, we claim:

1. A metallic tank and a liner therefor including a tank having a hollow cylindrical body with a base and a top having a large central opening, a tank spud attached

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to the top of the tank and having a depending cylindrical projection fitting within said central opening in the top of the tank, the bottom surface of said projection forming an extension of the smooth interior surface of the top of the tank, said tank spud having a central opening, an inwardly extending lip at the lower end of the central opening forming an access opening with said lip defining a first sealing surface, a flexible removable liner conforming to and covering the interior surface of the tank and having a molded top portion with an outwardly extending flange covering the sealing surface on the lip of the spud, and a tank adapter head having a body portion and a depending cylindrical projection conformably received within the opening in the tank spud, said body portion including a pair of upwardly extending fittings, a central fitting depending from said head into the tank and adapted to be connected to an outlet manifold, one of said upwardly extending fittings communicating with said central depending fitting through a lateral passage, the remaining upwardly extending fitting communicating with an annular opening surrounding said central depending fitting and defined by said inwardly extending lip, and the lower surface of the depending cylindrical projection on said head forming a second sealing surface having sealing contact with and resting on the flange of the liner.

2. A metallic tank and a liner therefor including a tank having a hollow cylindrical body with a base and a top having a large central opening, a tank spud secured to the top of the tank and having a depending cylindrical projection closely conforming to and depending into said central opening in the top of the tank, the bottom surface of said projection forming an extension of the smooth interior surface of the top of the tank, said tank spud having a central opening, an inwardly extending lip defining the lower portion of the central opening and forming an access opening with said lip defining a first substantially horizontal sealing surface, a flexible removable liner closely conforming to and covering the interior surface of the tank and having a molded top portion provided with an outwardly extending flange defining an annular channel conformably receiving said lip and covering the sealing surface on the lip of the spud, an annular resilient sealing gasket positioned upon the flange of the liner, and a tank adapter head having a body portion and a depending cylindrical projection fitting within the opening in the tank spud, the lower surface of said last mentioned projection forming a second substantially horizontal sealing surface bearing upon said resilient sealing gasket for tight sealing contact, said tank spud having threaded openings located beyond the periphery of the flange of said liner, said adapter head having a plurality of outwardly extending ears, each ear having an opening adjacent its outer end aligned with one of the threaded openings in said spud, and bolts received in said aligned openings to fasten the adapter head to the tank spud and effect sealing contact therebetween.

3. A metallic tank and liner therefor as set forth in claim 2, in which the base of the tank is permanently secured to said tank body and has a dished portion and a depending side wall forming an annular crevice with the encompassing side wall of the tank, and a hoop of plastic tubing placed in and conforming to said crevice to provide a smooth surface for said liner.

4. A metallic tank and plastic liner combination, comprising a cylindrical tank having a bottom supporting member and a head having a central opening defined by an inwardly extending lip, a tank adapter head secured to the tank and having a cylindrical projection fitting within said opening and cooperating with said lip to form parallel clamping and sealing surfaces, a flexible removable plastic liner fitting within said tank and conforming to the interior surface of the tank, said liner including a top portion, a depending cylindrical side wall portion and a bottom portion all heat sealed together in areas at their adjoining edges, said heat sealed areas being

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folded over against the wall of the liner such that internal pressure within said liner enhances the effectiveness of the seals, the top portion of the liner being thicker than the depending liner and having a cylindrical neck defining an opening into the liner with the neck terminating in a radially extending flange defining an externally opening channel receiving said lip, said neck and flange encompassing the inwardly extending lip on the tank with said flange being sandwiched between said parallel clamping and sealing surfaces, the head of the tank having threaded openings located beyond the periphery of the flange of said liner, said adapter head having a plurality of outwardly extending ears, each ear having an opening therein aligned with said threaded openings, and bolts received in said aligned openings to fasten the adapter head to the tank and effect sealing contact therebetween.

5. A metallic tank and plastic liner combination, comprising a cylindrical tank having a bottom supporting member and a head having a central opening defined by an inwardly extending lip, a tank adapter head secured to the tank and having a cylindrical projection fitting within said opening and cooperating with said lip to form parallel clamping and sealing surfaces, a flexible removable plastic liner fitting within said tank and conforming to the interior surface of the tank, said liner having a molded top portion and a depending cylindrical side wall portion and a bottom portion heat sealed together, the top portion having a cylindrical neck defining an opening into the liner with the neck terminating in a radially extending flange defining an externally opening

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channel receiving said lip, said neck and flange encompassing the inwardly extending lip on the tank with said flange being sandwiched between said parallel clamping and sealing surfaces, the head of the tank having threaded openings located beyond the periphery of the flange of said liner, said adapter head having a plurality of outwardly extending ears, each ear having an opening therein aligned with said threaded openings, and bolts received in said aligned openings to fasten the adapter head to the tank and effect sealing contact therebetween, one of said threaded openings extending through the head of the tank for access to the space between the tank and the liner.

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