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(54) **DISCHARGE OUTLET FOR DOUBLE WALL CONTAINMENT TANK ASSEMBLY**

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Related U.S. Patent Documents

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Filed: **Mar. 6, 2000**

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B65D 87/00 (2006.01)

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(58) **Field of Classification Search** 220/661, 220/567.2, 4.12, 567.3, 565
See application file for complete search history.

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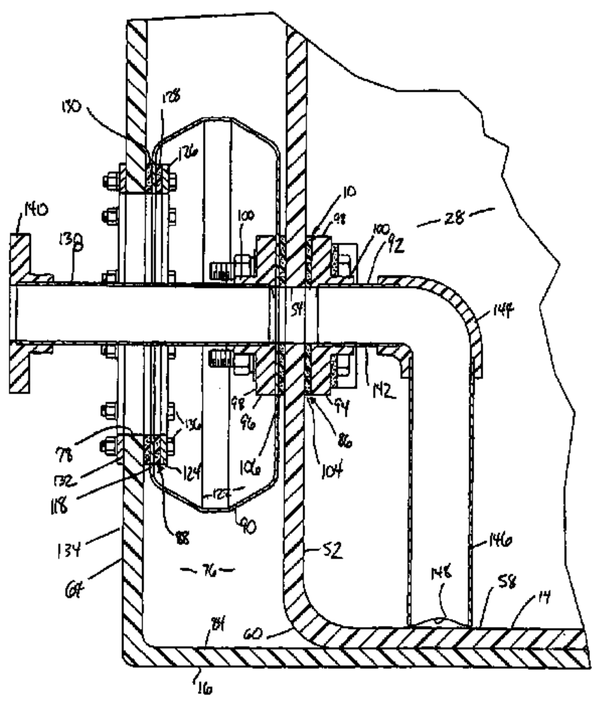
(57) **ABSTRACT**

A discharge outlet is provided for attachment to a double wall containment tank assembly having an inner tank and an outer containment vessel. The discharge outlet includes a conduit fluidically connected to the fluid receiving chamber of the inner tank and extending exteriorly of the outer containment vessel, a flexible annular sealing member positioned between the inner tank and the outer containment vessel, and couplers for attaching the sealing member to the inner tank and the outer vessel in surrounding relationship to the conduit. The containment area between the two tanks which is designed fro containing spills from the inner tank is thereby fluidically isolated form the access opening through which the conduit passes.

36 Claims, 3 Drawing Sheets



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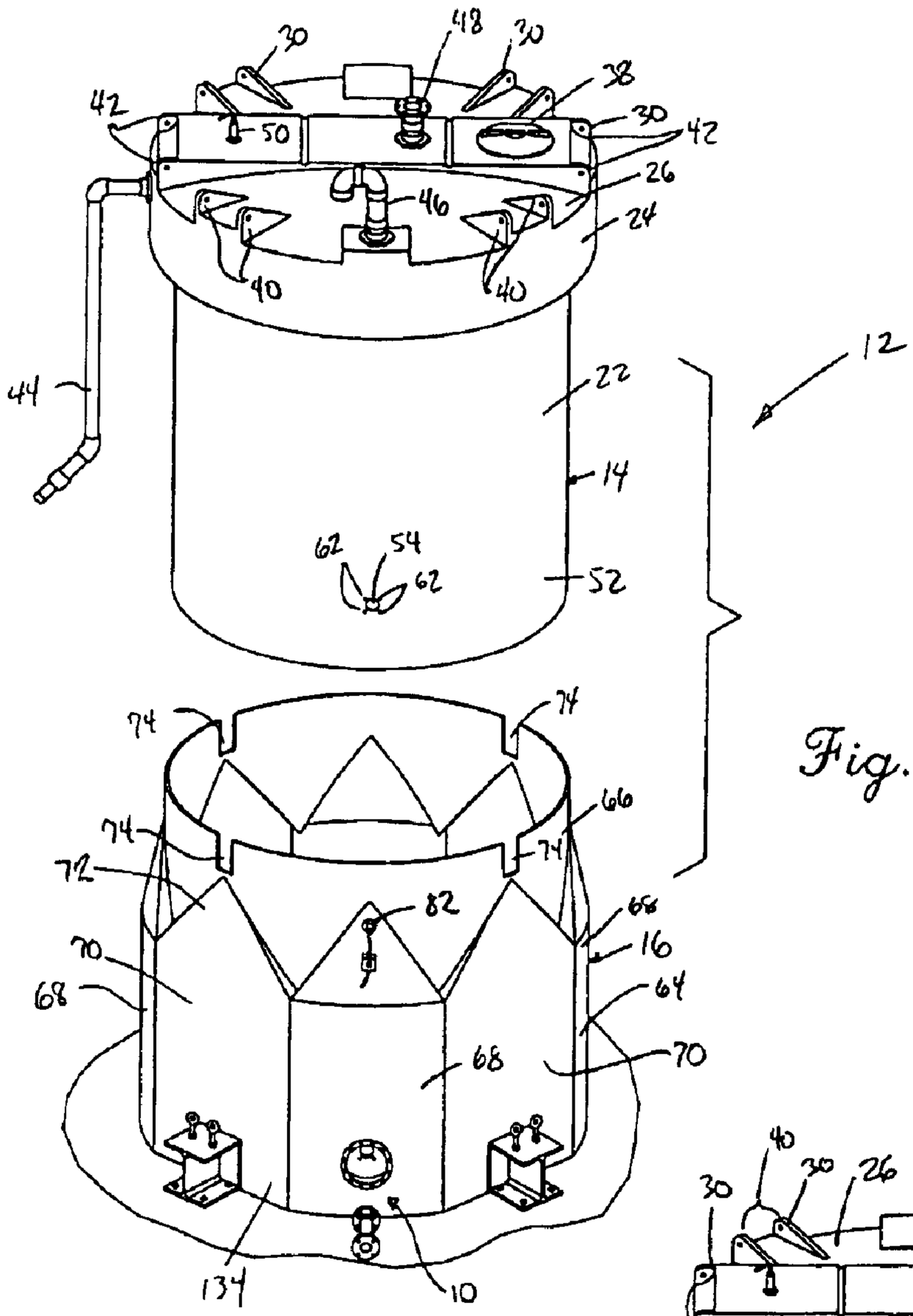
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Fig. 1.

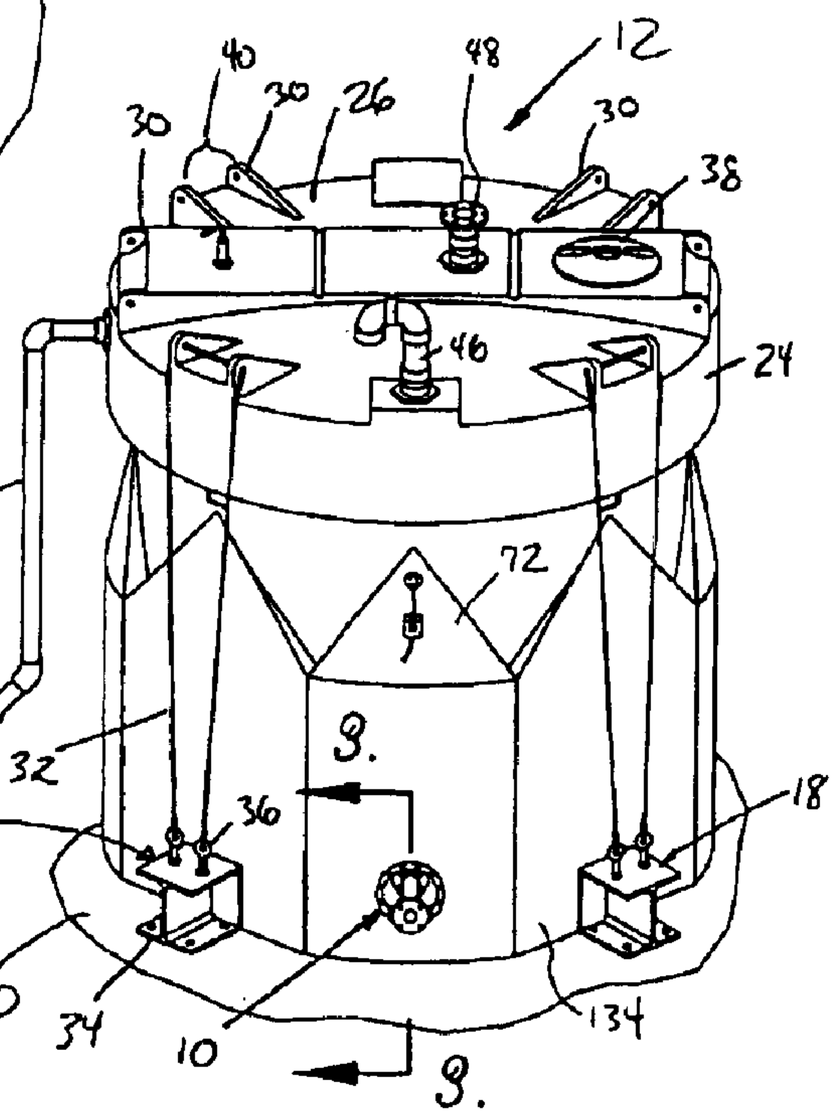
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Fig. 2.

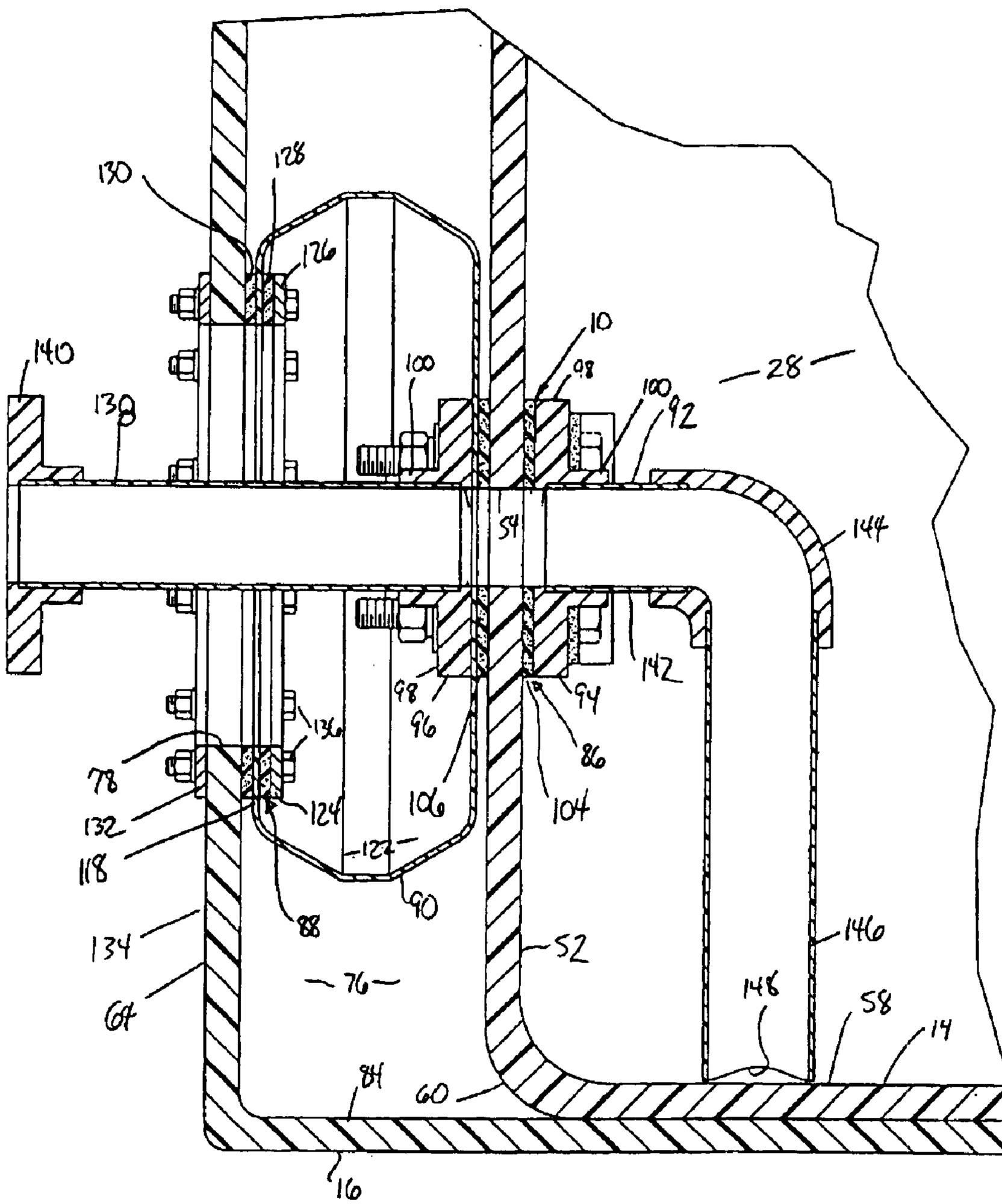
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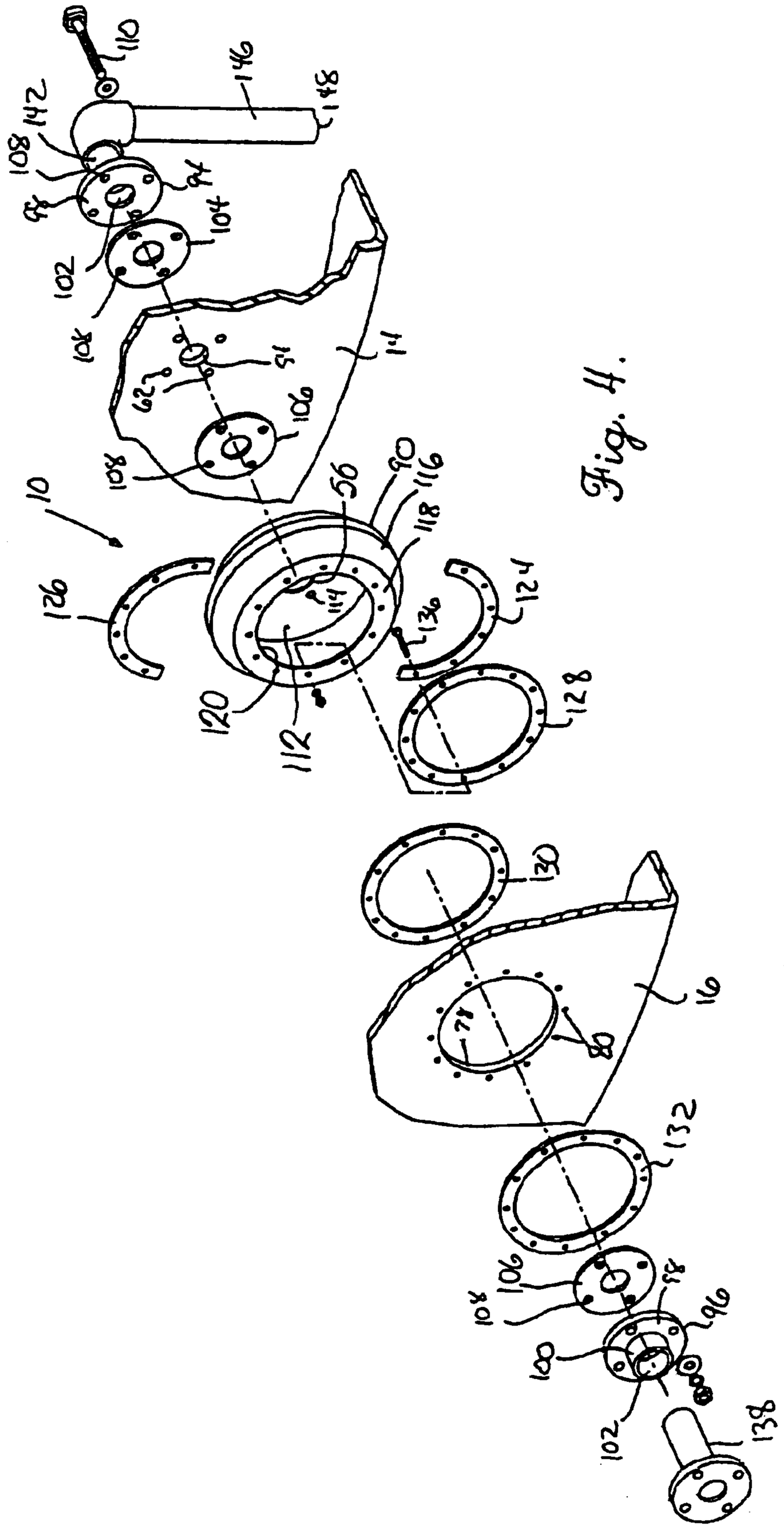
Fig. 3.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126
124
136
120
112
128
120
19
78
80
132
106
84
101
96
100
102
138

Fig. 4

DISCHARGE OUTLET FOR DOUBLE WALL CONTAINMENT TANK ASSEMBLY

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention concerns a discharge outlet for use with a double wall tank assembly used for storing and dispensing large quantities of liquid. More particularly, it is concerned with a sealing boot for the discharge outlet which enables the liquid to be dispensed through openings in the side walls of the inner tank and outer vessel of the double wall tank assembly.

2. Description of the Prior Art

Storage of liquid in bulk is well known, and has evolved in importance due to environmental concerns over the escape of chemicals. In the past, it was common to store chemicals underground in large tanks where gravity was used to fill the vessels and the contents were periodically pumped for use. However, the problems associated with leading underground storage tanks has increased the usage of above ground storage tanks. Typically, one or more above-ground vessels have been placed in a "tank farm" where a concrete pad and berm help to contain and capture any problem. Rainwater received in the containment area must be monitored and treated if leakage is detected. This has proven very expensive, as the rainwater represents a large volume of liquid even though the leakage is isolated.

As a result, storage containers have been developed which include a double walled construction. Examples of containment tanks utilizing such construction are shown in U.S. Pat. Nos. 5,287,986 to Frost and U.S. Pat. No. 5,333,752 to Harding, Jr. While the double walled construction therein is an improvement over single walled tanks, they require filling and discharge to be accomplished from atop the tanks. This requires extra energy to be expended in pumping the liquid. The need to prevent leakage from a double walled containment tank assembly has thus not heretofore permitted effective discharge openings through the sidewalls of the component inner and outer tanks. Thus, there has developed a need for a containment tank assembly which is capable of use in a variety of environments, minimizes, leakage, and has reduced energy demands.

SUMMARY OF THE INVENTION

These objects have largely been met through the discharge outlet and sealing boot of the present invention. That is to say, the present invention effectively seals openings provided in the sidewalls of a containment tank assembly having an inner tank and an outer vessel. Moreover, the discharge outlet includes a sealing boot which captures liquid which might leak into the containment area between the inner tank and outer vessel. Advantageously, the sealing boot is flexible and thus accommodates relative movement between the inner tank and outer vessel, such as may be encountered by expansion of the inner tank during filling and external forces applied to the outer vessel.

The discharge outlet of the present invention broadly includes an inner tank flange assembly, an outer vessel flange assembly, and a sealing boot interconnecting the two flange assemblies, piping or conduit is preferably provided

which extends from the inner flange assembly exteriorly of the outer vessel for attachment of a valve, piping or the like to effect the transfer of liquid from the tank. The sealing boot is preferably of a flexible material and is provided in the shape of a tire, whereby liquid leaking may be readily visually detected and repair of the inner tank assembly may be effected without deterioration of the containment capabilities of the double wall tank assembly. The piping of the discharge outlet, which is positioned relatively near the bottom of the side of the double wall tank assembly, may be further provided with additional piping interiorly of the inner tank and include a pipe opening near the bottom wall of the inner tank, thereby facilitating removal of most of the liquid within the inner tank when it is desired to be emptied.

These and other advantages of the discharge outlet of the present invention will be readily appreciated by those skilled in the art with reference to the drawings and the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a exploded view of a double wall containment tank assembly, showing the opening in the outer vessel for receiving the discharge outlet positioned relatively low on the side thereof;

FIG. **2** is a perspective view of the double wall containment tank assembly shown in FIG. **1** with the inner tank nested in the outer vessel and showing anchor assemblies for holding the double wall containment tank assembly against movement relative to the supporting surface;

FIG. **3** is an enlarged, vertical sectional view taken through line **3**—**3** of FIG. **2** showing the discharge outlet mounted on the double wall containment tank assembly; and

FIG. **4** is an exploded view of the discharge outlet hereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, a discharge outlet **10** in accordance with the present invention is provided for mounting as part of a double wall containment tank assembly **12** used for bulk storage of liquids. The double wall containment tank assembly **12** includes an inner tank **14**, an outer vessel **16**, and a plurality of anchor assemblies **18** for securing the tank assembly **12** to a pad or other supporting surface **20**. The details of the structure of the tank assembly **12** are further described in my U.S. Patent Application entitled Containment Tank Assembly filed contemporaneously herewith as application Ser. No. 09/519,323 filed Mar. 6, 2000, the disclosure of which is incorporated herein by reference.

In greater detail, the inner tank **14** includes a lower section **22**, an upper section **24** which extends radially outwardly of lower section **22** and is connected thereto by a lip presenting a trough, and a roof **26** which acts as a cover to define a liquid-receiving chamber **28** therewithin. The lip includes a plurality of circumferentially spaced chutes to permit drainage from the trough back into the interior of the lower section **22**. A plurality of upstanding lugs **30** project upwardly from the roof **26** for the attachment of cables **32** of anchor assemblies **18** thereto. The anchor assemblies **18** also include anchors **34** which are bolted into the supporting surface **20** (such as a concrete pad) and connected to the cables **32** by eyebolts **36**. A manhole cover **38** is interfitted into a manhole in the roof **26** to permit access into the chamber **28**. The lugs **30** provide pairs of tie-down flanges **40** and lifting flanges **42**, each provided with holes for the

passage of cables **32** therethrough. An opening through the side of the upper section **24** permits the attachment of fill pipe **44** thereto. In addition, the roof **26** receives vent **46**, filler inlet **48**, and level indicator **50** thereon, the latter including a probe for determining the amount of the liquid in the chamber **28**. The lower section **22** includes a substantially cylindrical sidewall **52** and a bottom wall **58** which are joined at the lower perimeter **60** of the sidewall **52**. A port **54** is provided in the cylindrical sidewall proximate to the lower perimeter **60**, with four surrounding circumferentially spaced bolt holes **62** provided through the side wall **52**.

The outer vessel **16** includes a multifaceted lower wall portion **64** and a substantially cylindrical upper wall portion **66**. The lower wall portion **64** includes a plurality of alternating arcuate sections **68** and chord sections **70**. The lower wall portion **64** tapers inwardly in transition area **72** to cylindrical wall portion **66**, which lies closely adjacent the cylindrical sidewall **52** when the inner tank **14** is nested in the outer tank **16**. The upper wall portion **66** has an upper margin provided with a plurality of notches **74** for receiving the chutes of the inner tank **14** therein. The arcuate sections **68** are spaced from the cylindrical sidewall **52** of the inner tank **14** to define therebetween a containment area **76**. An access opening **78** is provided in one of the arcuate sections **68** for receipt of the discharge outlet **10** therein, with a plurality of surrounding, circumferentially spaced holes **80** for the receipt of the bolts therethrough. A leak detection system **82** may be mounted in the lower wall portion **64** and include a probe extending downwardly into the containment area **76** to detect the presence of liquid therein. The base wall **84** connects to the lower wall portion **64** and receives the bottom wall **58** of the inner tank **14** thereon. Both the inner tank **14** and the outer vessel **16** are rotationally molded of synthetic resin, such as high density linear polyethylene or cross-linked, high density polyethylene.

The discharge outlet **10** includes an inner coupler assembly **86**, an coupler flange assembly **88**, sealing boot **90**, and piping **92**. The inner coupler assembly includes interior flange **94** and intermediate flange **96** which each include a ring **98** and a neck **100**, each flange **94** and **96** having a central opening **102** to permit the flow of liquid therethrough. Annular gaskets **104** and **106** abut the cylindrical sidewall **52** in sealing relationship thereto. The rings **98** and gaskets **104** and **106** each include apertures **108** aligned in registry with the bolt holes **62** in the cylindrical sidewall **52** for the receipt of bolts **110** therethrough. The bolts **110** are secured by suitable nuts and washers.

The sealing boot **90** is located in the containment area **76** and preferably rotationally molded of synthetic resin such as either high density linear or low density polyethylene for flexibility. The sealing boot **90** is provided in the shape of a tire, including a flat inner wall **112** provided with surrounding, circumferentially spaced apertures **114** for the receipt of bolts **110** therethrough, and a central hole **56** for alignment in registry with the port **54** and the central opening **102** of the neck **100**. An circumferentially extending cup-shaped protrusion **116** extends radially outwardly from the flat inner wall **112**, with flat outer wall **118** extending radially inwardly therefrom in spaced, opposed relationship to flat inner wall **112**. The flat outer wall **118** includes an inner margin **120** having a transverse dimension **[**D**]** which is substantially the same as that of the access opening **78** and **[**smaller**]** *larger* than the diameter of the central hole **56** of the flat inner wall **112**. The sealing boot **90** thus defines an annular, circumferentially extending channel **122** which permits flexing of the boot **90** and captures liquid leaking past the inner coupler assembly.

The outer coupler assembly **88** has an inner flange provided as semi-annular inner flange plate halves **124** and **126** positioned within the channel **122**, annular gaskets **128** and **130** sandwiching the flat outer wall **118** therebetween, and outer flange plate **132** for engagement against the exterior **134** of the outer vessel. The inner flange plate halves **124** and **126** and the outer flange plate **132** are preferably stainless steel or other corrosion resistant metal. The flat outer wall **118**, inner plate halves **124** and **126**, gaskets **128** and **130**, and outer flange plate include holes which are positioned in registry with the holes **80** in the outer vessel **16** for receipt of bolts **136** therethrough. The bolts **136** are secured in place by suitable nuts and washers as shown in FIGS. **3** and **4**. The gaskets **104** and **106** and also **128** and **130** are preferably elastomeric, and provided of a chemically resistant natural or synthetic rubber material.

The piping **92** is preferably of a chemical resistant synthetic resin material such as polyvinyl chloride and provides a conduit for the passage of liquid in the chamber **28** out of the containment tank assembly **12**. The piping **12** includes a discharge tube **138** having an inner end which is preferably chemically welded to the neck **100** of the intermediate flange **96** and an outer end which receives a connection flange **140** for the attachment of further piping or a discharge valve to control the flow of liquid from the chamber **76**. An inner tube **142** extends into the chamber **76** and has one end which is preferably chemically welded to the neck **100** of interior flange **94** and another end which receives thereon elbow **144**. The elbow **144** is oriented downwardly and a pickup pipe **146** is connected at one end thereto, the pickup pipe **146** having an open, lower end **148** adjacent the bottom wall for providing an intake into the pipeline **92** for the discharge of liquid therethrough.

In use, the sealing boot **90** and the access opening **78** of the outer vessel are trimmed to fit with the flange plate halves **124**, **126** and outer flange plate **132**. The flange plate halves **124**, **126** are placed in the channel **122** with the gaskets positioned as shown in FIG. **3** and the bolts **136** are inserted and tightened. The inner tank **14** is lowered into the outer vessel **14** in nesting relationship with the chutes received in the inner notches and the port **54** aligned with the access opening **78**. The inner tank **14** is then preloaded, and the port **54** is trimmed to receive the inner flange assembly **86**. The inner tube **142**, elbow **144** and pickup pipe **146** are installed into the inner flange assembly **86** mounted on the cylindrical sidewall **52** to permit liquid to flow through the central opening **102**. The discharge tube **138** with connection flange **140** is then chemically welded to the neck **100** of intermediate flange **96**, and a control valve such as a ball valve or further piping is attached to the connection flange to permit filling of the chamber **28**.

The discharge outlet **10** thus effectively permits the inner tank **14** to be emptied of liquid through gravity rather than pumping, because the integrity of the containment area **76** is preserved by the sealing boot **90**. The boot **90** is sufficiently flexible to permit limited relative movement between the inner tank **14** and the outer vessel **16** due to seismic events, wind forces or thermal expansion. If liquid begins to leak from the inner tank **14** through the inner flange assembly **86**, the leakage is nonetheless contained within the channel **122** and can be readily visually observed. Other leaking from the inner tank **14** is confined to the containment area **76** between the inner tank **14** and outer vessel **16**, such that even if the leakage rises above the access opening **78** in the side of the outer vessel **16**, it does not escape.

Although preferred forms of the invention have been described above, it is to be recognized that such disclosure

is by way of illustration only, and should not be utilized in a limiting sense in interpreting the scope of the present invention. Obvious modifications to the exemplary embodiments, as hereinabove set forth, could be readily made by those skilled in the art without departing from the spirit of the present invention.

The inventor hereby states his intent to rely on the doctrine of equivalents to determine and assess the reasonably fair scope of his invention as pertains to any apparatus not materially departing from but outside the literal scope of the invention as set out in the following claims.

What is claimed is:

1. A discharge outlet for a double walled containment tank having an inner tank having a chamber for receiving liquid therein and a port for the passage of liquid therethrough, and an outer containment vessel having an access opening aligned with the port, the inner tank and the outer containment vessel defining a containment area therebetween, said discharge outlet comprising:

a conduit fluidically coupled to the inner tank;

a flexible, annular sealing member positioned between the inner tank and the outer containment vessel in substantial alignment with the port and the access opening in surrounding relationship to said conduit, *said sealing member presenting a pair of opposed holes, one of said holes being of substantially greater diameter than the other of said holes*;

a first coupler for connecting said sealing member to the inner tank around the port; and

a second coupler for connecting said sealing member to the outer containment vessel around the access opening and thereby fluidically isolating the containment area from the access opening.

2. A discharge outlet as set forth in claim **1**, wherein said sealing member includes a circumferentially extending cup-shaped protrusion.

3. A discharge outlet as set forth in claim **2**, wherein said sealing member is a flexible synthetic resin material.

4. A discharge outlet as set forth in claim **3**, wherein said sealing member includes a substantially flat inner wall extending radially inwardly from said protrusion and having **[**a central**]** *said smaller diameter* hole therein for permitting the passage of liquid therethrough.

5. A discharge outlet as set forth in claim **4**, wherein said first coupler includes an inner flange positioned in the chamber and an outer flange positioned in the containment area for receiving a wall of the inner tank therebetween, each of said inner flange and **[**intermediate**]** *outer* flange*s* having a central opening for the passage of liquid therethrough.

6. A discharge outlet as set forth in claim **5**, wherein said conduit includes a discharge tube fluidically connected to said intermediate flange and having a length sufficient to extend exteriorly of the outer vessel.

7. A discharge outlet as set forth in claim **6**, wherein said conduit includes an inner tube fluidically connected to said inner flange.

8. A discharge outlet as set forth in claim **3**, wherein said sealing member includes a substantially flat outer wall extending radially inwardly from said protrusion and having an inner margin.

9. A discharge outlet as set forth in claim **8**, wherein said inner margin is spaced outwardly from said conduit.

10. A discharge outlet as set forth in claim **3**, wherein said second coupler includes an inner flange plate **[**positioned in said channel**]**.

11. A discharge outlet as set forth in claim **10**, wherein said inner flange is provided as two semi-annular flange plate halves.

12. A discharge outlet as set forth in claim **11**, wherein said second coupler includes an outer flange plate **[**and positioned relatively exteriorly of said flat outer wall**]**.

13. A double walled containment tank assembly comprising:

an inner tank having a chamber for receiving liquid therein and a port for the passage of liquid therethrough;

an outer containment vessel having an access opening aligned with the port, the inner tank and the outer containment vessel defining a containment area therebetween; and

a discharge outlet, said discharge outlet including:

a conduit fluidically coupled to said inner tank;

a flexible, annular sealing member positioned between said inner tank and said outer containment vessel in substantial alignment with said port and said access opening in surrounding relationship to said conduit, *said sealing member presenting a pair of opposed holes, one of said holes being of substantially greater diameter than the other of said holes*;

a first coupler for connecting said sealing member to said inner tank around said port; and

a second coupler for connecting said sealing member to said outer containment vessel around said access opening and thereby fluidically isolating said containment area from said access opening.

14. A containment tank as set forth in claim **13**, wherein said sealing member includes a circumferentially extending cup-shaped protrusion.

15. A containment tank as set forth in claim **14**, wherein said sealing member is a flexible synthetic resin material.

16. A containment tank as set forth in claim **15**, wherein said sealing member includes a substantially flat inner wall extending radially inwardly from said protrusion and having **[**a central**]** *said smaller diameter* hole therein for permitting the passage of liquid therethrough.

17. A containment tank as set forth in claim **16**, wherein said first coupler includes an inner flange positioned in said chamber and an outer flange positioned in the containment area for receiving a wall of said inner tank therebetween, each of said inner flange and **[**intermediate**]** *outer* flange*s* having a central opening for the passage of liquid therethrough.

18. A containment tank as set forth in claim **17**, wherein said conduit includes a discharge tube fluidically connected to said intermediate flange and having a length sufficient to extend exteriorly of said outer vessel.

19. A containment tank as set forth in claim **18**, wherein said conduit includes an inner tube fluidically connected to said inner flange and extending into said chamber adjacent a bottom wall of said inner tank.

20. A containment tank as set forth in claim **15**, wherein said sealing member includes a substantially flat outer wall extending radially inwardly from said protrusion and having an inner margin, said outer wall being positioned proximate said outer vessel.

21. A containment tank as set forth in claim **20**, wherein said inner margin is spaced outwardly from said conduit.

22. A containment tank as set forth in claim **15**, wherein said second coupler includes an inner flange plate **[**positioned in said channel**]**.

23. A containment tank as set forth in claim **22**, wherein said inner flange is provided as two semi-annular flange plate halves.

24. A containment tank as set forth in claim **23**, wherein said second coupler includes an outer flange plate **[**and

positioned relatively exteriorly of said flat outer wall and proximate said outer vessel].

25. A discharge outlet for a double walled containment tank having an inner tank provided with a chamber for receiving liquid therein and having a side wall provided with a port therein for passage of liquid therethrough, and an outer containment vessel having a wall portion provided with an access opening having a predetermined area and positioned generally across from the port in the side wall of the inner tank, the inner tank and the outer containment vessel defining a containment area therebetween, said discharge outlet comprising:

a conduit coupled to the port in the side wall of the inner tank for fluidic communication of the conduit with the inner tank;

said conduit extending through the access opening in the outer containment vessel;

a flexible annular boot member positioned in surrounding relationship to the conduit and having opposed annular end portions, each of said annular end portions defining a hole, one of said holes having a diameter greater than the diameter of the other of said holes;

a first coupler sealingly coupling the end portion of the boot member having said larger diameter hole to the outer containment vessel around the access opening therein; and

a second coupler sealingly coupling the end portion of the boot member having said smaller diameter hole adjacent to the conduit in spaced relationship from the first coupler,

the area of said access opening being greater than the cross-sectional area of that part of the conduit extending through said access opening,

whereby said boot member prevents leakage of liquid from the double walled containment tank that may collect in the containment area.

26. A discharge outlet as set forth in claim 25, wherein the boot member is sufficiently flexible to permit limited relative movement between the inner tank and the outer containment vessel.

27. A discharge outlet as set forth in claim 25, wherein said first coupler is annular and spaced radially outwardly of said conduit to permit limited relative movement between the conduit and the containment vessel.

28. A discharge outlet as set forth in claim 25, wherein said other opposed annular end portion of the boot member is sealingly coupled to the conduit adjacent the port in the side wall of the inner tank.

29. A discharge outlet as set forth in claim 25, wherein said second coupler sealingly couples said other end portion to said inner tank.

30. A discharge outlet as set forth in claim 25, wherein said boot member includes a circumferentially extending cup-shaped protrusion.

31. A discharge outlet as set forth in claim 30, wherein said cup-shaped protrusion has a maximum cross-sectional area greater than the area of the access opening.

32. A discharge outlet as set forth in claim 25, wherein said boot member is of a flexible synthetic resin material.

33. A discharge outlet as set forth in claim 25, said boot member having first and second outer end portions, wherein said first outer end portion of the boot member has a unitary first annular wall, a first annular gasket between the side wall portion of the outer containment vessel and the first annular wall of the boot member to prevent leakage of fluid from the containment area of the tank through said access opening of the containment vessel.

34. A discharge outlet as set forth in claim 33, wherein said second end portion of the boot member has a unitary second annular wall and a second annular gasket surrounding the conduit and sealingly engaging the second annular wall of the boot member to prevent leakage of fluid from the containment area between the inner tank and the containment vessel.

35. A discharge outlet as set forth in claim 25, said annular boot being located within said containment area.

36. A discharge outlet as set forth in claim 25, said inner tank having a base, an upright sidewall, and an upper end, said outer containment vessel having a base, an upright sidewall opposed to said inner tank sidewall, and an upper end, said discharge outlet located closer to said inner tank and containment vessel bases than said inner containment and containment vessel upper ends.

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