

July 16, 1957

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2,799,425

RECEPTACLE FOR VOLATILE LIQUIDS

Filed July 24, 1951

2 Sheets-Sheet 1

FIG. 1

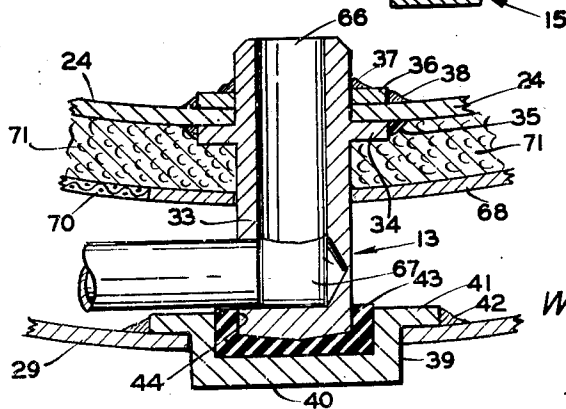
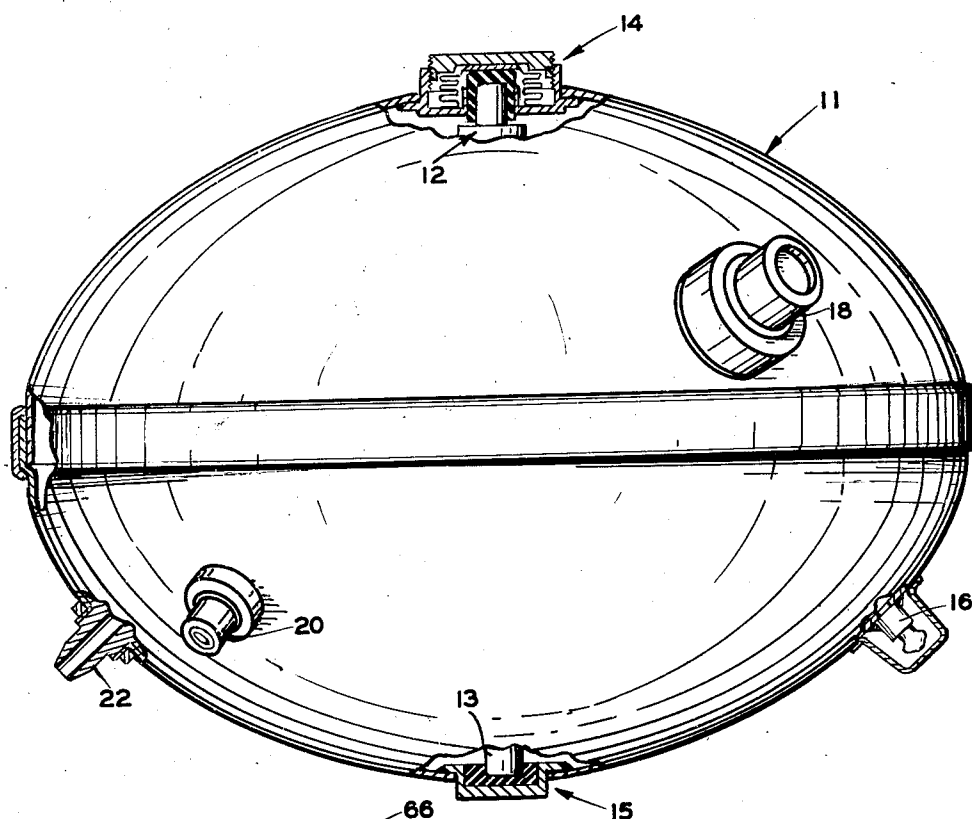


FIG. 4

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2 Sheets-Sheet 2

FIG. 2

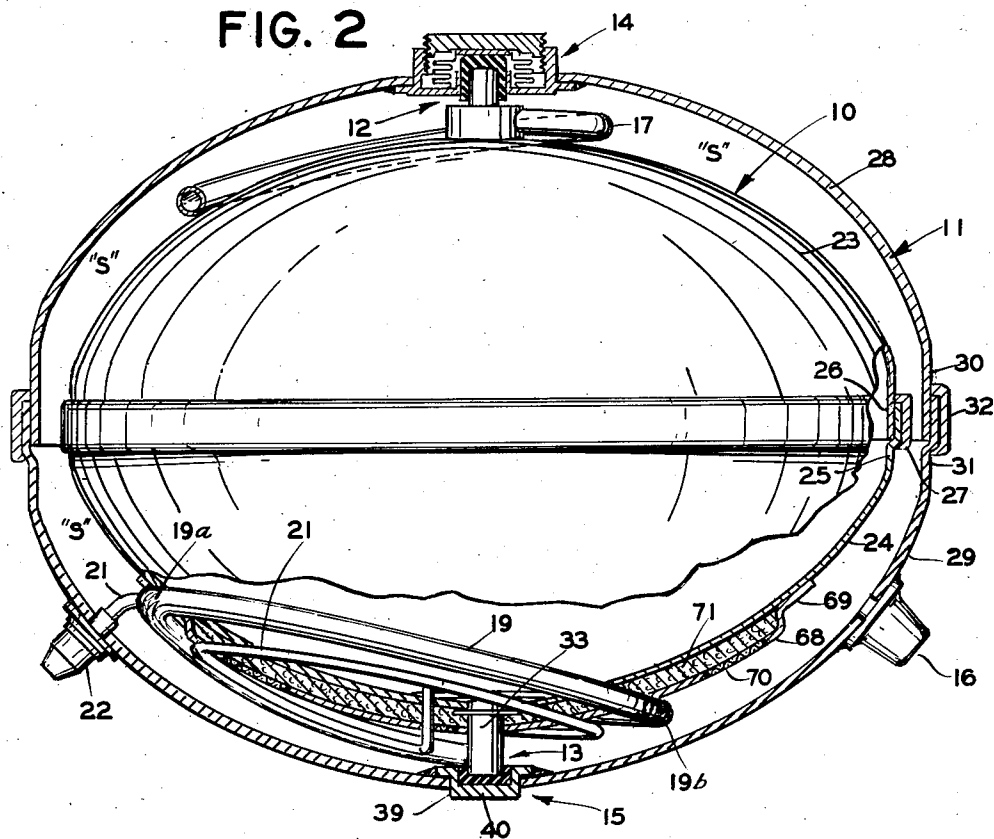
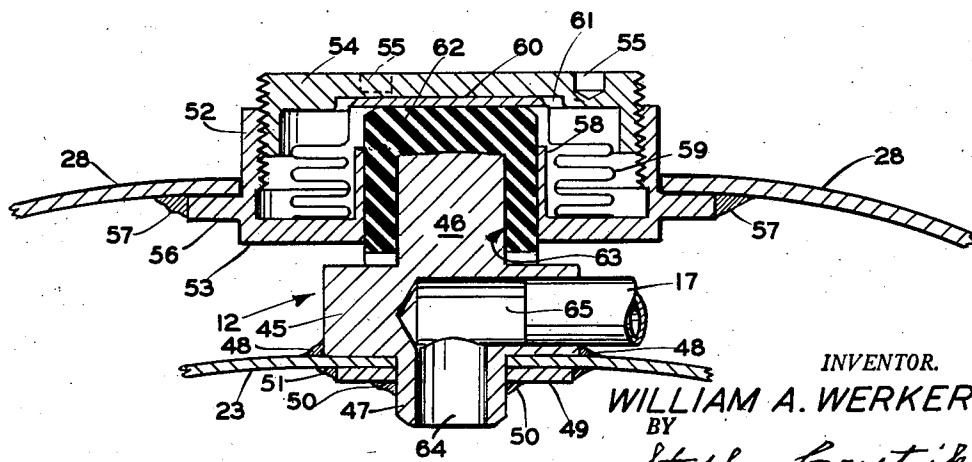


FIG. 3



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RECEPTACLE FOR VOLATILE LIQUIDS

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7 Claims. (Cl. 220—14)

This invention relates generally to receptacles for liquids and more particularly has to do with insulated receptacles for volatile liquids such as liquid oxygen, air or other liquified gases.

In the design and construction of receptacles for volatile liquids, it is desirable to prevent insofar as is possible, the transfer of heat between the ambient atmosphere, or surrounding structure, and the volatile liquid. To that end, receptacles of this type usually comprise a container that is designed and constructed to hold the desired quantity of fluid and to be supported and enclosed within an outer shell.

The container and shell are dimensioned so as to provide a space between their adjacent surfaces. To prevent heat transfer, this space is usually filled with a suitable insulating material such as cork, or the air is evacuated from the space to provide an insulating vacuum between the shell and container. It is to the latter form of insulated receptacles that the instant invention is particularly directed.

It is manifest that in instances where an insulating material such as cork is utilized, there is little or no problem in supporting the container within the shell since the insulating material itself is capable of performing this function. When, however, the space is evacuated so as to provide for vacuum insulation of the container, many problems are posed in mounting the container within the shell. For example, if the receptacle is to be utilized under conditions subjecting it to vibration, the mounting or supporting means must not only support the container out of contact with the shell, but in addition thereto must also have sufficient resiliency to prevent damage to the container due to vibration. In this connection it must also be noted that to insure a vacuum of a relatively high order, the resilient material utilized in the mounting means must have low vapor pressure characteristics to prevent "out-gassing" or the passage of gases contained in the material into the evacuated space to thereby lower or reduce the effectiveness thereof.

Moreover, since it is highly desirable to have the container firmly mounted within the shell, it is apparent that close manufacturing tolerances are required in fabricating the mounting means for supporting the container of receptacles of this type.

Another problem posed in the usual construction of vacuum insulated receptacles is the prevention of heat or thermal conduction through the filling and draining means of the receptacle. In the past, it has been common practice to provide a long, relatively narrow neck for the receptacle through which the volatile liquid could pass in filling or draining the receptacle. Thus, by providing a long conduit or neck made of a low heat conducting material, heat conduction through the neck to the volatile liquid was kept to a reasonable minimum. It is manifest, however, that in instances where the receptacle is to be used under conditions where storage space is at a premium, for example, in aircraft, the use of a long-necked

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receptacle is undesirable in that it occupies too much space.

The instant invention, therefore, contemplates a novel receptacle for volatile liquids in which the foregoing difficulties of design and construction heretofore experienced are greatly reduced, if not entirely eliminated.

Among other objects the present invention contemplates a novel vacuum insulated receptacle embodying means whereby the container may be resiliently supported within the shell to the end that the container will be relatively unaffected by vibration.

Another object of the instant invention is the provision of adjustable mounting means for the container of a vacuum insulated receptacle whereby the necessity for close manufacturing tolerances in the fabrication of the mounting means is eliminated.

A further object contemplated herein is the provision of a vacuum insulated receptacle wherein the filling and draining means are situated, or positioned, within the outer shell to the end that the receptacle occupies a minimum space and heat conduction through the filling and draining means to the volatile liquid is materially reduced, if not entirely eliminated.

The above and other objects and advantages of the present invention will appear more fully hereinafter from a consideration of the following description taken together with the accompanying drawings wherein one embodiment of the invention is shown by way of example. It is understood, however, that the drawings are for the purposes of illustration only and are not to be construed as defining or limiting the scope of the instant invention.

In the drawings, wherein like reference characters designate like parts throughout the several views:

Fig. 1 is a front view, partially in section of the novel receptacle constituting the subject matter of the present invention;

Fig. 2 is a longitudinal section, partially in elevation, of Fig. 1;

Fig. 3 is an enlarged section through the upper mounting assembly; and

Fig. 4 is a similar section through the lower mounting assembly.

As shown in Figs. 1 and 2 of the accompanying drawings, the novel receptacle for volatile liquids contemplated herein comprises, in general, an oblate spherical container 10 designed to hold the desired volume of liquid, and an outer shell 11, similar in form, adapted to receive and completely enclose container 10. As will hereinafter be more fully set forth, to resiliently mount container 10 within shell 11 and to provide a space S between the adjacent walls thereof, upper and lower stud members 12 and 13, respectively, mounted on container 10 at the opposite end of the minor axis thereof, are received within upper and lower support assemblies 14 and 15, respectively, similarly mounted on shell 11. The air within space S is evacuated through a fitting 16 mounted on shell 11 to provide for the vacuum insulation of container 10. An upper conduit 17, connected between upper stud member 12 and a fitting 18 carried by shell 11, provides means whereby container 10 may be vented, while a lower conduit 19 connected between lower stud member 13 and a fitting 20 mounted on shell 11 serves as a means whereby liquid may be introduced into or drawn from container 10. It is manifest, that when the receptacle is in use, suitable valve means are provided to control flow through fittings 18 and 20. A conduit 21 connecting the interior of container 10 to a fitting 22 on shell 11 affords means whereby the receptacle may be connected to a liquid contents gauge of the type shown and described in copending application Serial No. 189,768, filed October 12, 1950, in the name

of William A. Werker and assigned to the assignee of the present application.

More particularly, container 10 comprises two hollow oblate hemispheres 23 and 24, respectively, that are joined together at the peripheral portions thereof. To insure a strong joint, the peripheral portion of hemisphere 24 is provided with a joggle as at 25 that is adapted to receive and snugly engage the peripheral portion 26 of hemisphere 23. The lap joint thus formed is secured by a suitable bonding agent 27, such as a solder. Other suitable fastening means such as welding or riveting may be used, the only requisite being that the joint have sufficient strength to withstand the pressure developed internally of container 10 by the volatile liquid; and further, the joint must absolutely be fluid tight and leak-proof.

Shell 11 is constructed in a manner similar to container 10 and comprises two hollow oblate hemispheres 28 and 29 that are joined at the peripheral portions 30 and 31, respectively, by solder 32, or other suitable bonding means.

As hereinbefore set forth, container 10 is provided with upper and lower stud members 12 and 13, positioned at the opposite ends of the minor axis thereof, that are adapted to be resiliently supported in upper and lower support assemblies 14 and 15 similarly situated on shell 11.

As shown more particularly in Fig. 4, lower stud member 13 comprises a cylindrical body 33 having a peripheral mounting flange 34 adjacent one end thereof. To mount stud 13 to container 10, lower hemisphere 24 is centrally apertured and stud 13 is positioned therein so as to have flange 34 engage the outer surface of hemisphere 24. Suitable fastening means such as solder 35 secures stud 13 in position on hemisphere 24. To insure the firm attachment of stud 13 to container 10, a washer 36 engaging stud 13 and the inner surface of hemisphere 24 is soldered as at 37 and 38 to stud 13 and hemisphere 24, respectively. It is to be noted that solder 35 is applied so as to prevent any leakage from container 10 through the aperture formed therein to receive stud 13.

The lower, or fixed support assembly 15 carried by hemisphere 29 of shell 11 comprises a cylindrical member 39 closed at one end thereof by an end wall 40 and having mounting flange 41 at the opposite end thereof. Hemisphere 29 is centrally apertured and member 39 is positioned so as to have the flange 41 thereof engage the inner surface of hemisphere 29. Solder 42 sealingly secures flange 41 to hemisphere 29.

To provide for the resilient and insulated support of stud 13 in member 39, a resilient liner 43 formed of a suitable plastic material, such as polytrifluorochloroethylene, and adapted to be seated in member 39, is provided with a cylindrical recess 44 that snugly engages the lower end portion of cylindrical body 33. It is noted that the plastic material utilized in the fabrication of liner 43 must have insulating and resilient characteristics as well as low vapor characteristics. A plastic material such as polytrifluorochloroethylene procurable from M. W. Kellogg Company under the name of Kel F has been found to be satisfactory.

As shown in Fig. 3, upper stud member 12 comprises a cylindrical member or body 45 having colinear upper and lower extensions 46 and 47, respectively. To mount stud 12 on container 10, upper hemisphere 23 is centrally apertured and stud 12 is positioned so as to have the lower extension 47 thereof extend through the aperture and the lower surface of member 45 engage the outer surface of hemisphere 23 where it is sealingly secured to hemisphere 23 by solder 48. A washer 49 engaging lower section 47 of stud 12 and the inner surface of hemisphere 23 is soldered as at 50 and 51 to the stud 12 and hemisphere 23, respectively, to insure the firm attachment of stud 12 to container 10.

Upper support assembly 14, which forms the adjustable

element of the novel mounting means contemplated herein, comprises a cylindrical element or body 52 partially closed at one end thereof by an end wall 53, and internally threaded at the opposite end thereof to receive an externally threaded plug 54. Tool openings 55 are provided in plug 54 to permit the rotation thereof in element 52 and to thereby move plug 54 relative to element 52. Support assembly 14 is positioned so as to have the cylindrical element 52 thereof extend through the central aperture formed in hemisphere 28 and to have a peripheral flange 56 formed on element 52 adjacent end wall 53 engage the inner surface of hemisphere 28 where it is sealingly attached thereto by solder 57. Element 52 is further provided with an inner sleeve 58 that is formed integral with end wall 53 and extends therefrom in the direction of the open end of element 52. Sleeve 58 is coaxial with and of lesser length than element 52.

Sealing means are provided to prevent leakage between the ambient atmosphere and evacuated space S through plug 54 and sleeve 58. The sealing means comprises a bellows 59 closed at one end by an end plate 60 and sealingly attached at the other end thereof to end wall 53. Bellows 59 encloses sleeve 58 and is of sufficient length to engage the end plate 60 thereof with a recess 61 formed in the lower portion of plug 54.

To provide a resilient and insulating support within upper support assembly 14 for stud 12, a plastic liner 62 formed of polytrifluorochloroethylene is slidably mounted in sleeve 58 and is provided with a cylindrical recess 63 adapted to snugly receive the upper extension 46 of stud 12.

Due to the foregoing construction and arrangement of parts, it will be manifest to one skilled on the art, that when stud 13 is positioned within stationary support assembly 15 and stud 12 within adjustable support assembly 14, plug 54 may be rotated to thereby clamp studs 12 and 13 between plug 54 and end wall 40 of support assembly 15. By rotating plug 54 so as to move it inwardly of element 52, the clamping pressure is increased until the container 10 is firmly supported within shell 11. Since liners 43 and 62 are fabricated from a material having resilient and insulating characteristics, it is apparent that due to the foregoing mounting, container 10 will be relatively unaffected by vibration and a minimum of heat transfer will occur through the mounting means.

As hereinbefore set forth, means are provided to vent container 10. To that end, upper stud 12 is provided with intercommunicating vertical and horizontal bores 64 and 65, respectively. Vertical bore 64 communicates at the open end thereof with the interior of container 10, while the open end of horizontal bore 65 is connected to one end of vent conduit 17. Vent conduit 17 is connected at the other end thereof to fitting 18 carried by shell 11. Thus, a vent passage from the interior of container 10 to the exterior of shell 11 is provided through bores 64 and 65, conduit 17 and vent fitting 18.

As shown in Fig. 2, conduit 17 is in the form of a relatively flat helix that is coiled about the upper portion of hemisphere 23 and positioned within the evacuated space S. Moreover, conduit 17 is fabricated from a material having a low coefficient of thermal conductivity. It is apparent, that due to this construction and arrangement, a minimum of heat is conducted from fitting 18 through conduit 17 to container 10.

Filling and draining means are also provided for container 10 and to that end lower stud 13 is provided with intercommunicating vertical and horizontal bores 66 and 67, respectively (Figure 4). Vertical bore 66 communicates with the interior of container 10 and conduit 19 is connected to horizontal bore 67. The other end of conduit 19 is connected to fitting 20 carried by shell 11. Thus, filling and draining passageway means are provided comprising bores 66 and 67, conduit 19 and fitting 20.

Conduit 19 is fabricated from a material having a low coefficient of thermal conductivity and, like vent con-

duit 17, is in the form of a relatively flat helix. Moreover, conduit 19 is coiled about the lower portions of hemisphere 29 and positioned within evacuated space S. Thus, due to the relatively long length of conduit 19, its low heat conduction characteristics, and further, since conduit 19 is positioned within evacuated space S, it is manifest that heat transfer by conduction from fitting 20 to the volatile liquid within container 10 is kept to a minimum.

It is also to be noted that the helix formed by conduit 19 is not centrally disposed relatively to the bottom of hemisphere 29 but is disposed to one side thereof. Thus, as shown in Fig. 2, the diametrically opposed portions 19a and 19b of conduit 19 are at different elevations with respect to the bottom of container 10. Due to this arrangement, it will be apparent to one skilled in the art, that conduit 19 also serves as a liquid trap for container 10.

To provide means whereby any vapor present in space S after the air has been evacuated therefrom through fitting 16 may be adsorbed, a disk-like element 68 having an outstanding peripheral flange 69 and screened openings 70 formed therein, is mounted by flange 69 to the bottom or lower portion of hemisphere 29. The space between the adjacent walls of disk-like element 68 and hemisphere 24 is filled with a suitable adsorbing agent 71 such as cocoanut charcoal. Thus, any vapor remaining in space S after its evacuation, is adsorbed by cocoanut charcoal 71 through openings 70 provided in disk-like element 68.

From the foregoing description of the construction and arrangement of the novel receptacle contemplated herein, it will be apparent to one skilled in the art, that the various objects of the instant invention have been accomplished.

While the container 10 and shell 11 have been shown and described as being on the form of oblate spheres, it is understood that the instant invention is not limited to any particular form or dimensions of the aforementioned elements.

Moreover, other changes and modifications of the elements of the novel receptacle contemplated herein may be made by those skilled in the art without departing from the scope of the instant invention.

I claim:

1. A receptacle for volatile liquids comprising a container for said liquid, a shell enclosing said container with the adjacent walls of said container and shell in spaced relationship, means whereby the air between said container and shell may be evacuated to provide for vacuum insulation of said container, a pair of opposed fixed stud members carried exteriorly of said container, a fixed support assembly carried by said shell and including a liner having resilient and low thermal conduction characteristics engaging one of said stud members, an adjustable support assembly carried by said shell and including a liner having resilient and low thermal conduction characteristics slidably mounted in said adjustable support assembly and engaging the other of said stud members, said adjustable support assembly including a movable member operable to move in the direction of said fixed support assembly to axially move said liner whereby said stud members are clamped between said fixed and adjustable support assemblies to resilient support and thermally insulate said container within said shell, a vent fitting carried by said shell, a passageway formed in the stud member engaged with said adjustable support assembly and communicating at one end with the space between said container and shell and at the other end thereof with the interior of said container, a vent conduit disposed in the space between said container and shell and connected between said one end of said passageway and said vent fitting, a passage formed in the second stud member engaged with said fixed support assembly and communicating at one end with the space between said container and shell and at the other end thereof with the interior of said container, a filling and draining fitting carried by

said shell, and a conduit disposed in the space between said container and shell and connected between said one end of said passageway and said filling and draining fitting.

2. A receptacle for volatile liquids comprising a container formed of two hollow oblate hemispheres sealingly joined at the peripheral portions thereof, stud members carried by said container at the opposite ends of the minor axis thereof, a shell formed of two hollow oblate hemispheres sealingly joined at the peripheral portions thereof, said container and shell being dimensioned to provide a space between the adjacent walls thereof when the former is positioned within the latter, a fitting carried by said shell for evacuating said space to thereby provide for vacuum insulation of said container, a stationary support assembly carried by said shell at one end of the minor axis thereof and including a resilient and insulating liner receiving one of said stud members carried by said container, an adjustable support assembly carried by said shell at the opposite end of the minor axis thereof, said adjustable support member including a sleeve, a resilient and insulating liner slidably mounted in said sleeve and receiving the other of said stud members carried by said container, and movable means operative to axially move said liner and clamp said stud members between said stationary and adjustable support assemblies, and means for communicating the interior of said container with the exterior of said shell, including a passageway formed in one of said studs communicating at one of its ends with the space between the container and shell and its other end with the interior of said container, a fitting carried by said shell, and a conduit disposed in the space between the container and shell and connecting said one end of said passageway to said fitting.

3. A receptacle for volatile liquids comprising an oblate spherical container for said liquid, stud members carried by said container at the opposite ends of the minor axis thereof, a shell enclosing said container and dimensioned to provide a space between adjacent walls of said container and shell, support assemblies including liners having resilient and thermal insulating characteristics carried by said shell and receiving said stud members, at least one of said support members including an axially adjustable portion bearing axially against the associated stud member and exerting adjustable axial clamping pressure on the latter stud member and the container, a fitting carried by said shell whereby the air in the space between said container and shell may be evacuated, and means disposed in the space between the container and shell for communicating the interior of said container to the exterior of said shell.

4. A receptacle for volatile liquids comprising a container for said liquid, a shell enclosing said container, stud members fixed to said container, and support assemblies fixed to said shell for cooperative engagement with said stud members, at least one of said support assemblies including an axially adjustable portion bearing axially against the associated stud member and clamping the stud members axially between the support assemblies by said axial adjustment said support assemblies including a liner having resilient and thermal insulating characteristics and engaging said stud members whereby said container is resiliently supported and thermally insulated within said shell.

5. In a vacuum insulated receptacle for volatile fluids including a container for said liquid, a shell enclosing said container in spaced relationship thereto, and having the space between said container and shell evacuated to provide for the vacuum insulation of said container, the combination with said container and shell of means for resiliently supporting and thermally insulating said container within said shell comprising a first stud having a flange adjacent one end thereof, said flange being sealingly attached to said container at one end of the axis thereof, a fixed support assembly having a peripheral

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flange sealingly secured to said shell, a liner in said fixed support assembly having a recess to receive said first stud, a second stud including a cylindrical body sealingly fastened to said container at the other end of the axis thereof, an adjustable support assembly including a cylindrical element having a flange sealingly secured to said shell, a plug movably mounted in the one end of said element, an end wall partially closing the other end of said element, a sleeve integral with said end wall and extending partially in the direction of said plug, a bellows having an open end sealingly secured to said end wall and a closed end engageable with said plug, said bellows enclosing said sleeve, a liner slidably mounted in said sleeve and engageable with the closed end of said bellows, said plug being operable upon the inward movement thereof relative to said element to clamp said first and second studs within said fixed and adjustable support assemblies, and said liners being formed from a material having resilient and low thermal conduction characteristics.

6. In a vacuum insulated receptacle for volatile fluids including a container for said liquid, a shell enclosing said container in spaced relationship thereto and having the space between said container and shell evacuated to provide for the vacuum insulation of said container, the combination with said container and shell of means for resiliently supporting and thermally insulating said container with said shell comprising opposed stud members mounted to and projecting exteriorly of said container, a fixed support assembly mounted to said shell and including a resilient and thermal insulating member for cooperative engagement with one of said stud members, and an adjustable support assembly mounted to said shell including a resilient and thermal insulating member for cooperative engagement with the other of said stud members, said adjustable support assembly embodying means

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for exerting an axial clamping pressure on said stud members whereby said container is supported within said shell as aforesaid.

7. In a vacuum insulated receptacle for volatile fluids of the type including a container having fixed opposed stud members resiliently engaged in support assemblies carried by said shell whereby said container is supported within said shell and in spaced relationship thereto, and wherein the space between said container and shell is evacuated to provide for the vacuum insulation of said container, the combination with said container and shell of means for communicating the interior of said container with the exterior of said shell comprising a passageway formed in one of said stud members and communicating with the interior of said container, a fitting mounted on said shell, and a hollow fluid conduit connecting said fitting to the passageway in said stud member, said conduit being fabricated in the form of a relatively flat helix and from a material having a low coefficient of thermal conductivity, and positioned in the evacuated space between said container and shell.

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