Sept. 29, 1970 W. SAMAGA 3,530,630

TANK ASSEMBLY FOR THE TRANSPORTATION OF LOW-TEMPERATURE FLUIDS

Filed April 12, 1968

FIG. 1

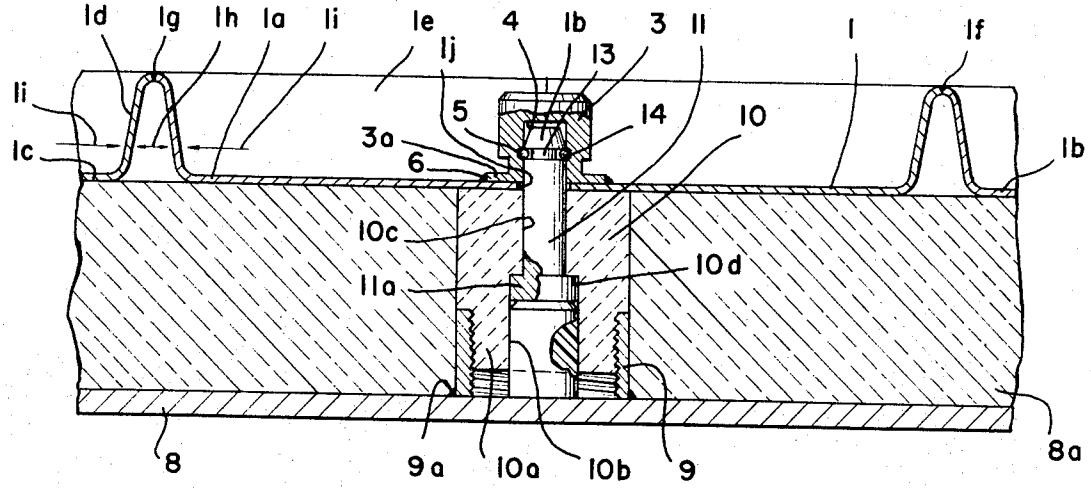


FIG. 2

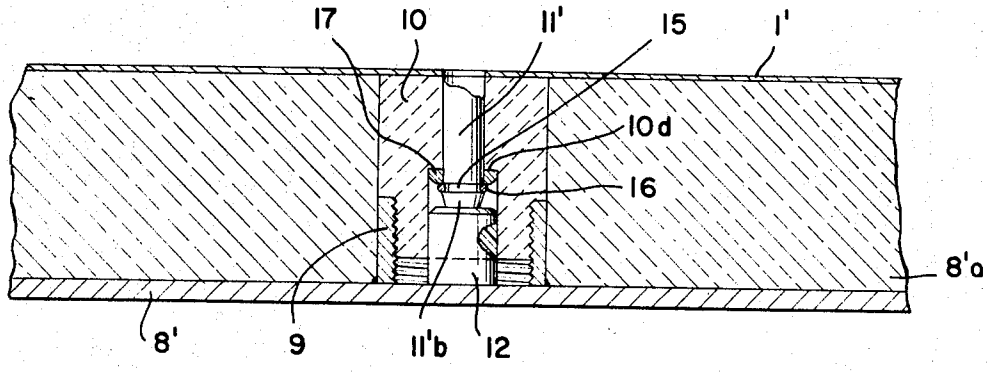
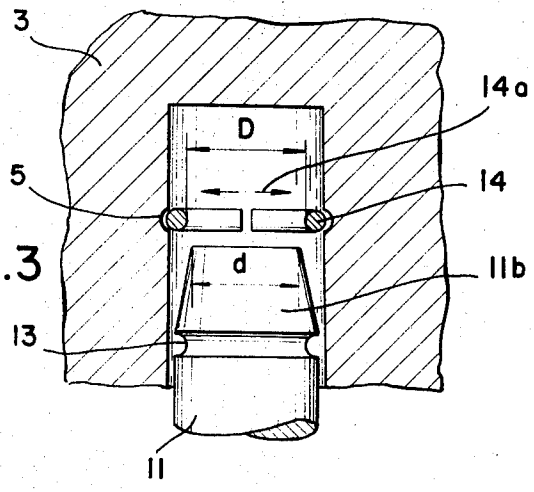


FIG. 3



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TANK ASSEMBLY FOR THE TRANSPORTATION OF LOW-TEMPERATURE FLUIDS

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U.S. Cl. 52—410 7 Claims

ABSTRACT OF THE DISCLOSURE

A receptacle assembly for the retention of low-temperature fluids, e.g. a tankship for the transportation of liquefied gases at low temperature, wherein a sheet-metal wall is affixed to a further wall with an intervening layer of thermal insulation with the aid of a cap mounted upon the sheet-metal wall and adapted to be thrust over a pin extending through the sheet-metal wall from an insulating post anchored to the other wall and to engage this pin via a spring ring received in a groove of the cap.

My present invention relates to containers for the transportation of low-temperature fluids and, more particularly, to tank or compartment in a seagoing vessel for the transportation of liquefied gases at low temperature.

In the commonly assigned copending application Ser. No. 664,066, filed Aug. 29, 1967 by myself, Hans Prögler, Hermann Ehms and Rudolf Eickemeyer, entitled "Tankship for Liquefied Gases" (now U.S. Pat. No. 3,459,148), there is disclosed a tankship for the transportation of liquefied gases (e.g. liquid hydrocarbons such as methane, ethane, and propane, or air-rectification products such as nitrogen, or ammonia) whose hull forms a hold containing a plurality of tanks thermally insulated from the hull and separated therefrom by a continuous sheet-metal skin. The skin, which may flex in response to temperature fluctuations, is composed of plates welded together in fluid-tight relationship along their peripheries at upstanding flanges so that the welded peripheries form expansion joints or folds accommodating expansion and contraction of the skin. Between the sheet-metal skin and the hull of the ship, there is provided a layer of insulation preferably of load-supporting of relatively incompressible character. In addition, the system of that application provides parallel arrays of shear-rail assemblies supporting the tank in load-transmitting relationship with the hull while thermally insulating the tank therefrom. The earlier application, Ser. No. 663,577, now abandoned, filed Aug. 28, 1967 by Rudolf Becker and also commonly assigned, describes an improvement in which insulating bolts attach the sheet metal outer wall of a double-wall assembly to the hull of the ship with an intervening layer of load-supporting insulation. As pointed out there, a further layer of insulation preferably of nonsupporting type may be interposed between the inner wall of the vessel and this intermediate sheet-metal layer. The bolt assembly described in that application comprises a bolt head welded sealingly to the sheet-metal layer and whose shank is threaded into a cylindrical post of thermally insulating material, the post being thermally anchored in a sleeve upstanding from and welded to the hull of the vessel.

It has been found that the individual mounting of the fixed point of an intermediate or inner sealed sheet metal skin for tankship and receptacle structures accommodated within the hull of a seagoing vessel, as proposed heretofore, is relatively complex and expensive when accomplished in the manner described above.

It is, therefore, the principal object of the present invention to provide an improved mounting assembly for hermetically sealed sheet metal walls spaced from the hull of a ship by a layer of load-supporting thermal insulation.

Another object of this invention is to provide a mounting assembly of the character described which is sealed against escape of the fluid and is thermally insulating but is less expensive and easier to use than earlier assemblies of this general type.

I have found that these objects can be attained in a particularly satisfactory and desirable manner by a snap-type junction between a supporting post and the sheet metal intermediate wall or skin by providing the sheet metal plates of the skin with throughgoing apertures at each of its fixed points and surmounting these apertures with caps whose interiors register with the apertures and are peripherally welded to the sheet metal at seams spacedly surrounding the apertures. The mounting assembly comprises an upstanding post of thermally insulating material, which may be threadedly received in a sleeve welded to the hull of the ship, the post being formed with an upstanding pin adapted to pass through the aperture of the sheet metal skin and to be received in the cap disposed thereabove. A spring ring is anchored in the cap and is designed to snap into a circumferential groove formed in the pin beyond a conical spreading head of the bolt whose small-diameter tip is receivable within the ring to expand the latter. Thus the inner diameter of the ring, in its relaxed condition, is less than the outer diameter of the spreading cone or tip at the upper end of the shank of the pin or both. The interior of the cap may be formed with an inwardly open circumferential groove receiving the ring and adapted to lock the ring and the pin against movement in the spread condition of the ring.

According to a more specific feature of the invention the cap is provided with an outwardly extending peripheral flange whose axial face lies flush with the corresponding surface of the sheet-metal skin and is peripherally welded thereto. The pin, according to the present invention, is anchored in an insulating post but need not be threaded into the latter. Thus, I provide a stepped bore in the insulating post with a smaller diameter portion registering with the aperture in the sheet-metal skin and a larger diameter portion disposed between the smaller diameter portion and the tankship hull or outer wall of a double-wall tank. The junction between the larger and smaller diameter portions of the bore forms a shoulder against which the pin is seated at its end remote from the frustoconical camming portion.

The remote end of the pin may be provided with a head or, in accordance with still another specific feature of this invention, a frustoconical tip symmetrical with

that head at the upper end of the pin and a corresponding groove in which a spring ring is anchored to retain a washer against the shoulder of the post.

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 represents a mounting assembly for a sheet-metal-intermediate skin of the type described in copending application Ser. No. 664,066;

FIG. 2 represents the improved assembly as applied to a double-wall tank (e.g. as described in application Ser. No. 663,577); and

FIG. 3 is a diagram of the snap-lock arrangement of this invention.

In FIG. 1, I show an assembly for a tankship for the transportation of liquefied gases at low temperature, e.g. with the aid of tanks disposed in the ship hull as described in application Ser. No. 664,066, wherein the intermediate sheet-metal skin **1** comprises a number of plates **1***a*, **1***b* and **1***c* having upturned peripheral edges **1***d*, **1***e* to form pans which are welded together at the outer edges of these flanges as represented at **1***f* and **1***g*; the skin **1** thus forms a continuous barrier to the passage of fluid. The flanges **1***d* and **1***e* define folds in this intermediate wall accommodating expansion and contraction of the plates **1***a*, **1***b*, **1***c*, etc., as represented by the arrows **1***h* and **1***i*. Between the sheet-metal skin **1** and the steel hull **8** of the ship, I provide a layer **8***a* of load-supporting thermal insulation, as described in application Ser. No. 664,066, to form a thermal barrier preventing heat loss from the tank compartment defined by the sheet-metal skin **1** to the wall **8** of the vessel.

A typical insulating material is Ferrozel (i.e. shear-resistant and compression-resistant Fiberglas-reinforced phenolic resin (see French Pat. 1,490,834).

To secure the sheet-metal skin in place, I provide an assembly which includes an upstanding internally threaded sleeve **9** which has a height equal only to a small fraction of the spacing of the skin **1** from the hull **8** and is welded to the latter along a seam **9***a*. A post **10** of load-supporting material of poor thermal conductivity (e.g. Ferrozel or a ceramic thermal insulator) has a threaded portion **10***a* screwed into the sleeve **9** so that the outer periphery of the post **10** is flush with the outer periphery of this sleeve. The post **10** is formed with a stepped bore whose large-diameter portion **10***b* joins the small-diameter portion **10***c* at a shoulder **10***d* serving to anchor the head **11***a* of a pin **11** extending upwardly through the small-diameter portion **10***c* and having a frustoconical end **11***b*.

The sheet-metal skin **1** is formed at each of its fixed points with an aperture **1***j* registering with the bore **10***b*, **10***c* and with the internal cavity **4** of a cap **3**.

At its lower end, the cap **3** is formed with an outwardly extending flange **3***a* lying flat against the sheet-metal skin **1** and being peripherally welded thereto at **6**. Within the interior **4** of the cap **3**, I have provided an inwardly open peripheral groove **5** which receives a spring ring **14** adapted to be wedged outwardly by the frustoconical upper end **11***b* of the bolt **11** as the cap **3** is thrust over this bolt. Behind the frustoconical tip **11***b*, the bolt or pin **11** is formed with an outwardly open circumferential groove **13** adapted to receive part of the ring **14** when the latter springs back after it has been wedged outwardly. To support the bolt **11**, I provide a backing block **12** of thermally insulating material which fills the large-diameter portion **10***b* of the bore of post **10** and is seated against the hull **8**.

As can be seen from FIG. 3, the frustoconical end **11***b* of the pin **11** has an outer diameter *d* which is less than the inner diameter D of the ring **14** in its relaxed position. After the cap **3** has been welded upon the plates **1***a*, **1***b*, etc., the plates may be placed with their apertures **1***g* over the pins **11** and set by relatively light taps upon the caps **3**. The taps drive the caps **3** over the frustoconical tips **11***b* of the bolts **11** until the rings **14**, which initially are spread in the direction of arrows **14***b*, spring back into the grooves **13**, thereby retaining the plates upon the pins. An extremely rapid rate of assembly is thus permitted.

In FIG. 2, I show a generally similar arrangement wherein, however, the sheet-metal layer may form an inner wall **1'** of a tank (see application Ser. No. 663,577), while the outer wall of this tank is represented at **8'**. The insulating layer **8***a'* can here be of the loose or fibrous type.

A cap is provided to retain the sheet-metal skin **1'** upon the bolt **11'** in the manner illustrated in FIGS. 1 and 3. In this embodiment, however, the lower end of the bolt **11'** is formed with a frustoconical tip **11***b'* behind which a circumferential groove **15** is formed. A split ring **16** is snapped into this groove and bears against a backing washer **17** to anchor the bolt **11'** against the shoulder **10***d* of the post **10** which otherwise has the configuration previously described. The cylindrical block **12** here supports the frustoconical end **11***b'* of the bolt.

The invention described and illustrated is believed to admit of many modifications within the ability of persons skilled in the art, all such modifications being considered within the spirit and scope of the appended claims.

I claim:

1. A mounting assembly for vessels and the like, comprising

a sheet-metal wall adapted to retain a low-temperature fluid and securable to another wall spaced therefrom with an intervening insulating layer;

a load-supporting post secured to said other wall and extending toward said sheet-metal wall, said post being composed of load-supporting thermal insulation,

a pin anchored in said post and extending there-beyond away from said other wall, said sheet-metal wall being provided with an aperture receiving said pin, said post being formed with a shoulder anchoring said pin against movement in the direction of said sheet-material wall

a cap sealingly anchored to said sheet-metal wall and having an interior registering with said aperture for receiving an end of said pin, said cap and said pin being formed with spring-ring means for locking said cap onto said pin upon insertion of said pin into said cap, said cap being formed with an inwardly open peripheral groove, said spring means including a resilient ring received in said groove, said end of said pin having a frustoconical configuration and being receivable in said ring to expand same, said pin being provided with an outwardly open circumferential groove behind the frustoconical configuration of said end to receive said ring upon its expansion by said end of said pin, said post being formed with a stepped bore having a large-diameter portion and a small-diameter portion extending from said shoulder toward said sheet-metal wall and registering with said aperture, said pin having another end spaced from said other wall; and

a thermally insulating block received in said large-diameter portion of said bore and seated against said other end of said pin and said other wall.

2. An assembly as defined in claim **1** wherein said cap is formed with an outwardly extending annular flange lying flat against said sheet-metal wall and being peripherally welded thereto.

3. An assembly as defined in claim **1** wherein said other end of said pin is formed with a head engaging said shoulder.

4. An assembly as defined in claim **1** wherein said other end of said pin is of frustoconical configuration and is formed with a circumferential groove, a spring ring receiving said groove at said other end, and a washer surrounding said pin and bearing upon said shoulder for

retaining said spring ring at said other end against movement in the direction of said sheet-metal wall.

5. An assembly as defined in claim 1, further comprising a sleeve welded to said other wall and receiving said post while extending toward said sheet-metal wall through a distance less than the thickness of said intervening layer.

6. An assembly as defined in claim 5 wherein said sleeve is internally threaded and threadedly receives said post, said post and said sleeve being flush with one another along their outer periphery.

7. An assembly as defined in claim 5 wherein said sheet-metal wall is formed with folds accommodating thermal expansion and contraction thereof.

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