Aug. 15, 1967 D. EISINGA, JR 3,335,898

SEALED WALL MOUNTING FOR LIQUID CONTAINER IMMERSION ELEMENT

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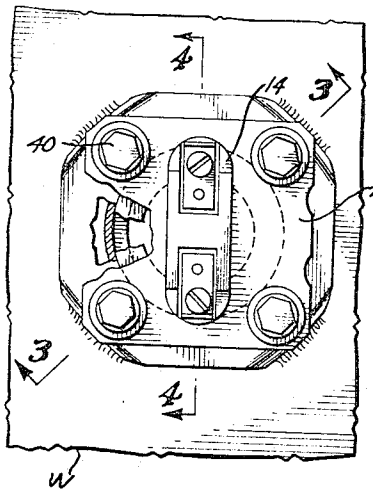
Fig. 2.



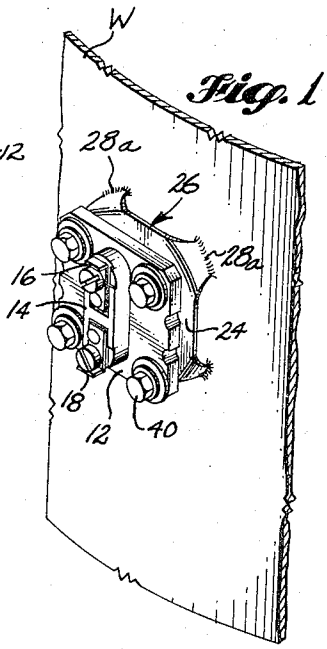


Fig. 1.

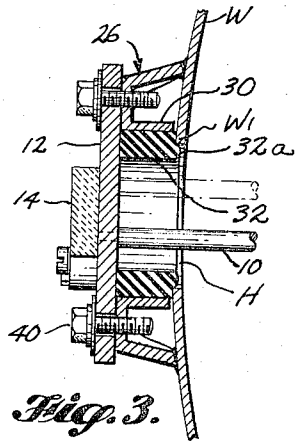


Fig. 3.

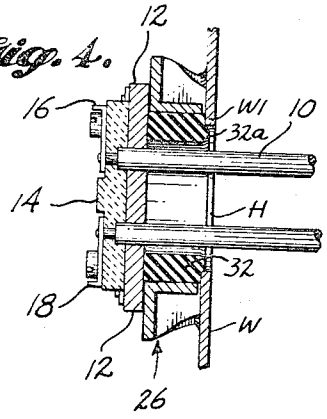


Fig. 4.

Fig. 5.

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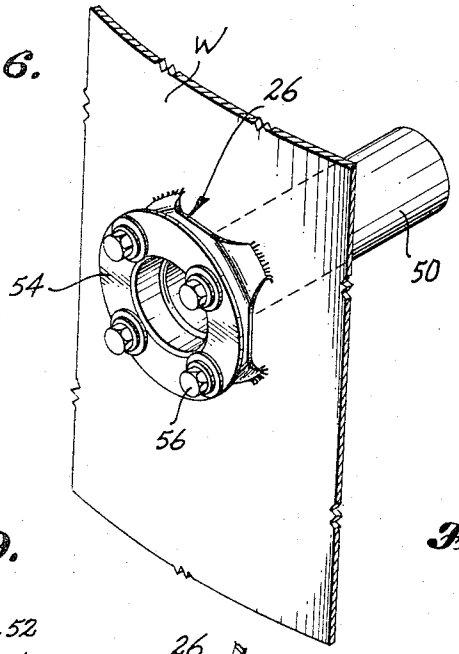
Fig. 6.



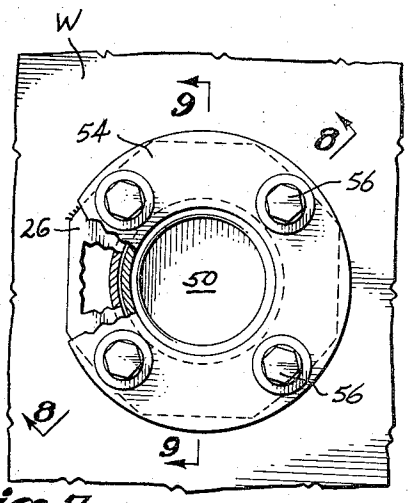
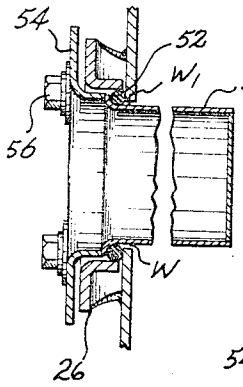


Fig. 7.

Fig. 9.



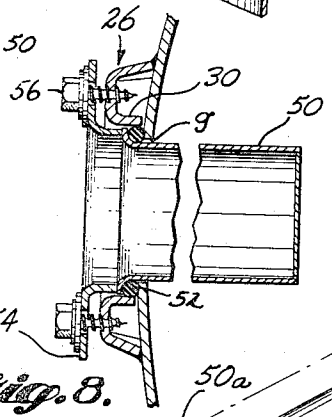


Fig. 8.

Fig. 10.

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United States Patent Office 3,335,898 Patented Aug. 15, 1967

3,335,898

SEALED WALL MOUNTING FOR LIQUID CONTAINER IMMERSION ELEMENT

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Filed Nov. 6, 1964, Ser. No. 409,403
5 Claims. (Cl. 220—46)

ABSTRACT OF THE DISCLOSURE

Sealed wall mountings for liquid container immersion elements are described. A mounting bracket secured to the wall has a tubular section maintained in non-sealed relation to the wall and disposed around a hole in the wall which accommodates the immersion element. Details of an elastic seal disposed about the hole within the tubular section of the bracket, as well as cover means including or carrying the immersion element, together with associated seal compressing means are shown and described.

This invention relates to an improved sealed wall mounting for liquid container immersion elements, particularly for immersion heater elements used in electric water heaters. The invention is herein illustratively described by reference to the presently preferred embodiment thereof; however, it will be recognized that certain modifications and changes therein with respect to details may be made without departing from the essential features involved.

In addition to the objective of simplicity and low cost in manufacture, installation and replacement of the immersion units of this invention, a main purpose hereof is to achieve a durable and reliable liquid-tight seal at the juncture between the wall of the tank and the cover or equivalent portion of the immersion element or unit, which seal is effective despite variations in temperature and, particularly, in pressure within the tank. It is a specific and related purpose hereof to devise a simple and effective seal in which an increase of pressure within the tank so reacts against the elastic body of the immersion element seal as to substantially increase the contact pressure between the elastic seal and the cooperating bearing surfaces engaged by it.

A related object of this invention is to devise a sealed wall mounting of the described type wherein manufacturing tolerances need not be critically determined and wherein machined surfaces are not required, on the contrary, simple and inexpensive stampings and castings may be used with complete effectiveness, and without any necessity for establishing a permanent liquid-tight connection of any part to the tank wall. Easy removability and replaceability of immersion elements, with full reusability of the seal and other components are also permitted by this invention.

As herein disclosed the invention comprises the combination of a mounting bracket rigidly secured to the container wall as by welding in non liquid-sealed relationship, and having thereon a tubular member the interior of which is spaced slightly outward in a radial sense from and surrounds the hole in the tank wall which accommodates the immersion element. An elastic seal ring seats against the rim of the wall aperture and is slidably fitted within the tubular member. Cover means including or carrying the immersion element which is to project through the seal ring and the aligned hole in the tank has a bearing surface which is brought into contact with the seal ring in order to compress the ring agains the tank wall. Preferably the interior of the seal ring is smaller than the hole so that the rim of the hole

forms a reentrant groove in the seal ring to enhance the seal as the seal ring is compressed. Under compression from securement of the cover means to the mounting bracket, the seal ring tends to expand laterally. However, such expansion in the radially outward sense is resisted by the surrounding confinement of the bracket's tubular member, and thus directs maximum contact pressure against the tank and cover means surfaces at which a liquid seal is desired. Moreover, liquid pressure within the container reacting outwardly against the interior wall of the seal ring further serves to increase this sealing contact pressure at the ends of the seal ring because the tubular member prevents transverse expansion of the ring. Consequently, an increase of liquid pressure in the tank serves not to lessen or jeopardize the liquid seal but actually to enhance the leakage resistance of the seal.

These and other features, objects and advantages of the invention will become fully evident from the following description thereof by reference to the accompanying drawings.

FIGURE 1 is an isometric view of a tank wall section in which is mounted according to this invention an electric heating immersion element of a type commonly in use.

FIGURE 2 is an end view of the installed immersion heater with parts broken away to show certain details.

FIGURE 3 is a transverse sectional view taken on line 3—3 in FIGURE 2.

FIGURE 4 is a transverse sectional view taken on line 4—4 in FIGURE 2.

FIGURE 5 is an exploded isometric view with the parts shown in FIGURE 1 now depicted in disassembled relationship.

FIGURE 6 is an isometric view of a tank wall section and modified immersion element assembly in which the invention is incorporated.

FIGURE 7 is a front view of the immersion element thus mounted and with parts broken away to show certain details.

FIGURE 8 is a transverse sectional view taken on line 8—8 of FIGURE 7.

FIGURE 9 is a transverse sectional view taken on line 9—9 in FIGURE 7.

FIGURE 10 is an exploded isometric view with the parts shown in FIGURE 6 now depicted in disassembled relationship.

Referring to FIGURES 1 to 5, inclusive, container wall W is shown fragmentally as being of cylindrical form and has a cut hole H through which electric immersion element heater 10 may be inserted. Heater 10 is of conventional form, in this case being carried by a cover plate 12 supporting on its exterior face an elongated dielectric terminal board 14. Electric terminals 16 and 18 mounted on board 14 are suitably connected electrically to the heater resistance wire within the metallic cover of the heater element 10 as shown. Mounting holes 20 formed in the four corners of the cover plate 12 come into registry with threaded mounting holes 22 formed in the annular, planar flange portion 24 of the mounting bracket 26. Four legs 28 turned at right angles to the flange 24 are welded to the tank exterior at 28a (FIGURE 1) with the mounting bracket aligned with the tank hole H as depicted. The mounting bracket further comprises a tubular portion 30, the projecting inner end of which approaches but need not physically contact the tank wall (FIGURE 3). The inside diameter of tubular portion 30 exceeds the diameter of hole H and the tubular portion surrounds the hole so as to provide a narrow ledge W1 of tank wall within the encirclement of the tubular member 30.

An elastic seal ring 32 seats against the ledge W1

as shown, being slidably fitted within the tubular member 30. The internal diameter of seal ring 30 is preferably smaller than the diameter of hole H and its outside diameter is preferably slightly smaller than the inside diameter of tubular member 30. The length of the seal ring 32 initially, that is before compression, exceeds the effective length of tubular member 30 sufficiently that the seal ring is compressed to a material degree in the process of securing the cover plate 12 in position on the mounting bracket 26.

Securement of the cover plate and closing of the connection is accomplished by the screws 40 which pass through the holes 20 in the cover plate and thread into the threaded holes 22 in the mounting bracket. As these screws are tightened pressure of the inside bearing face of the cover plate 12 is brought against the outer end of seal ring 32, compressing the latter against the ledge W1. While the desired degree of compression of the seal ring may be achieved without necessarily driving the cover plate 12 into physical contact with the flange 24 of mounting bracket 26 it is nevertheless desirable to so design the length of seal ring 32 that virtual contact between the plate 12 and mounting bracket occurs when the desired degree of compression of the seal ring is achieved, as an indication of proper tightening of the screws 40.

It will be observed that tightening of the screws 40 firmly secures the immersion heater element and associated components in and upon the tank wall and also establishes a liquid-tight seal at the juncture. Such seal is effectuated by the elastic seal ring 32. As the elastic ring is compressed axially it tends to expand radially, but such expansion is prevented by the confinement of the tubular member 30 and in being thus confined the seal ring exerts concentrated pressure against the bearing surfaces contacted by the end faces of the seal ring. This is accompanied by some inward bulging of the inner end face of the seal ring past the edge of the rim of hole H, as indicated at 32*a*, and thus causes the corner of the hole rim to bite into the elastic material of the seal ring to enhance the seal. Of particular significance is the effect of increased pressure within the tank. Should water pressure rise within the tank, such pressure reacts primarily on the major exposed inside face of the seal ring tending to expand it radially outwardly. Because of the confining effect of the tubular member 30 the seal ring cannot expand radially, hence such pressure exerted hydraulically on the seal ring is manifested in terms of increased endwise pressure of the seal ring against the opposing inside face of the cover 12 and the rim or shoulder W1 surrounding the hole H in the tank wall. In effect, therefore, the leakage resistance of the seal is a direct function of water pressure against which it must resist.

It will be evident, furthermore, that the parts comprising the immersion element assembly need not be of precision manufacture with respect to tolerances or the use of accurately machined surfaces in order to effectuate a reliable seal. For example, the bracket 20 is customarily a stamping which may be quickly and easily welded by production methods to the tank wall without precisional control in its ultimate positional relationship with the exterior surface of the tank wall. Moreover, there is no need for a sealed connection between the bracket 30 and the tank wall. Likewise, the inside face or bearing surface afforded by the cover plate 12 can be a cast surface inasmuch as the elastic flow of the seal ring 32 will accommodate irregularities and still provide an effective seal. The accommodation afforded by flow of the elastic material allows for the fact that the shoulder surface W1 against which the seal ring makes contact is not a planar surface, yet the seal ring 32 is conveniently and inexpensively manufactured with cylindrical inner and outer walls and parallel, planar end faces.

In the embodiment shown in FIGURES 6 to 10, inclusive, the same type of mounting bracket 26 is mounted

on the tank wall W. In this example the heater element is not depicted in the drawings but it will be understood that such element will be housed within the sealed elongated thermally conductive cup 50 of a known form. The cup is closed against water leakage and its outer end is flanged outwardly as shown at 50*a*. Its outwardly and radially directed flange seats against an elastic O-ring 52 which, in turn, seats against the annular shoulder surface W1 at the edge of the rim of the hole W in the tank wall. A flanged collar 54 having apertures 54*a* serves as a clamping device. The tubular portion of this flange collar bears against the flange 50*a* as the securing screws 56 are tightened by threading them into the bracket 26, as shown (FIGURE 8). Thus, as the screws are tightened, pressure is transmitted to the flange 50*a* on the outer end of the cup 50 and this, in turn, compresses the O-ring surrounded by the bracket's tubular portion 30 confining the O-ring as in the previous example. The gap G surrounding the wall of the cup 50 within the hole H would permit leakage of water past the cup and out the hole in the tank wall, but the compressed O-ring engaging the opposing and cooperating surfaces seals against such leakage as in the previous example. Moreover, pressure of such water, should it increase, reacts against the O-ring in order to further the sealing contact pressure which it makes with the ledge W1 and the flange 50*a*.

These and other features, objects and advantages of the invention will be evident to those skilled in the art based on the foregoing description and accompanying drawings relating to the preferred embodiments.

I claim as my invention:

1. In combination with a liquid container having a wall with a hole therein for insertion of an immersion element, a mounting bracket rigidly secured to the container wall including a tubular member projecting transversely outwardly from the wall surrounding the hole, with the tubular member's interior being spaced slightly outwardly in a radial sense from the hole's edge, a liquid seal comprising an elastic ring substantially conformably fitted within said tubular member and seated against said wall surrounding the hole, cover means, including an immersion element in sealed relationship thereon projecting inwardly of the container freely through the ring and hole, said cover means having a bearing surface uniformly contacting the ring, and means for removably fastening the cover means to the bracket including means to tighten the fastening by advancing the bearing surface against the seal ring so as to compress the latter against the container wall, with lateral expansion of the ring in a radial outward sense resulting both from such compression and from liquid pressure in the container being directly prevented by the ring's abutment against the surrounding interior of the tubular member.

2. The combination defined in claim 1, wherein the bracket's tubular member at its inner end lies in unsealed substantial contact with the container wall and outwardly therefrom integrally joins a surrounding transversely projecting collar having outer extremities which are turned back toward the container wall and welded thereto, said screws being threaded into said collar, said fastening means being engageable with said collar.

3. The combination defined in claim 1, wherein the interior diameter of the liquid seal elastic ring before compression is smaller than the diameter of the container hole such that compression of the ring bulges an inner peripheral portion thereof partly into the container hole to engage the inside edge of the hole.

4. In combination with a liquid container having a wall with a hole therein for insertion of an immersion element, a mounting bracket rigidly secured to the container wall including a tubular member projecting transversely outwardly from the wall surrounding the hole, with the tubular member's interior being spaced slightly outwardly in a radial sense from the hole's edge, a liquid seal comprising an elastic O-ring substantially conformably

fitted within said tubular member and seated against said wall surrounding the hole, cover means comprising an elongated tubular cup with a sealed inner end projecting into the container freely through the ring and hole and having a peripherally flanged outer end the flange of which is seated against the O-ring, means including a clamp member bearing inwardly against the cup's flange, and screw means holding the clamp member to the bracket and for advancing the cup's flange against the O-ring so as to compress the latter against the container wall, with lateral expansion of the ring in a radial outward sense resulting both from such compression and from liquid pressure in the container being directly prevented by the ring's abutment against the surrounding interior of the tubular member.

5. The combination defined in claim 4, wherein the

bracket's tubular member at its inner end lies in unsealed substantial contact with the container wall and outwardly therefrom integrally joins a surrounding transversely projecting collar having outer extremities which are turned back toward the container wall and welded thereto, said screw means being threaded into said collar.

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