

[54] **EXPANSION SEAL DEVICE**
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 [51] Int. Cl.....F22b 37/36
 [58] Field of Search122/6 A, 235 A, 235 G, 494

[57] **ABSTRACT**

An expansion seal device for sealingly connecting two members which move relative to each other in response to temperature changes in their vicinity, wherein a heat absorption and expansion plate is fixed to one of the members and a flexible sheet connects the plate to the other member, with the plate and the sheet adapted to accommodate the relative movement.

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14 Claims, 7 Drawing Figures

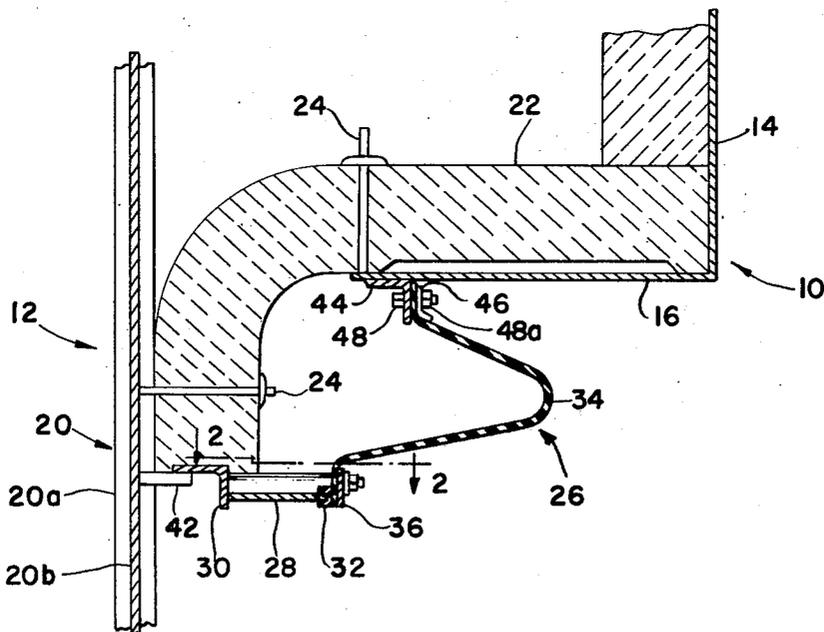


FIG. 1.

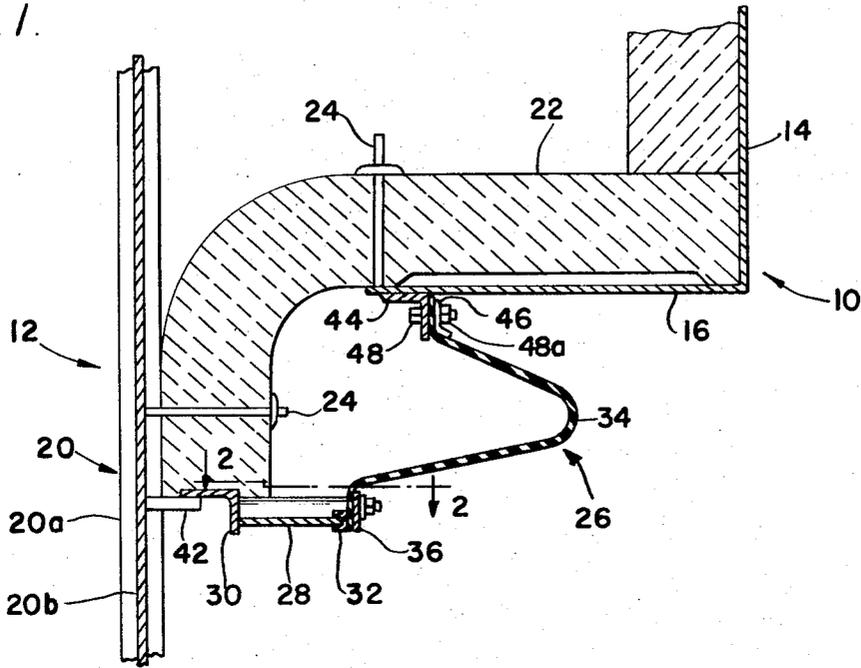
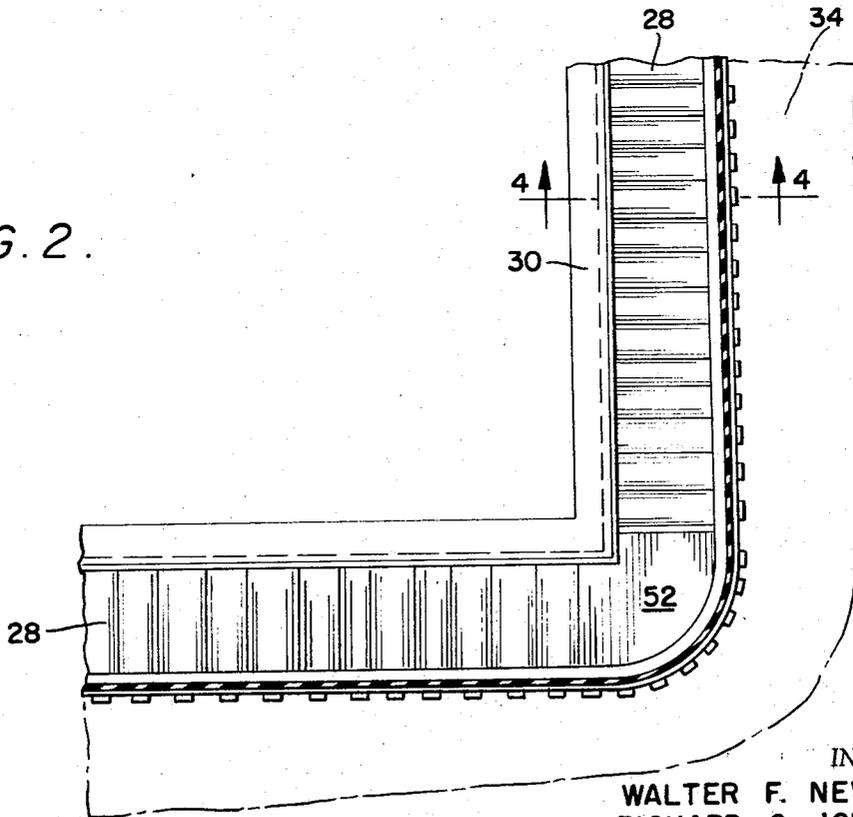


FIG. 2.



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FIG. 3.

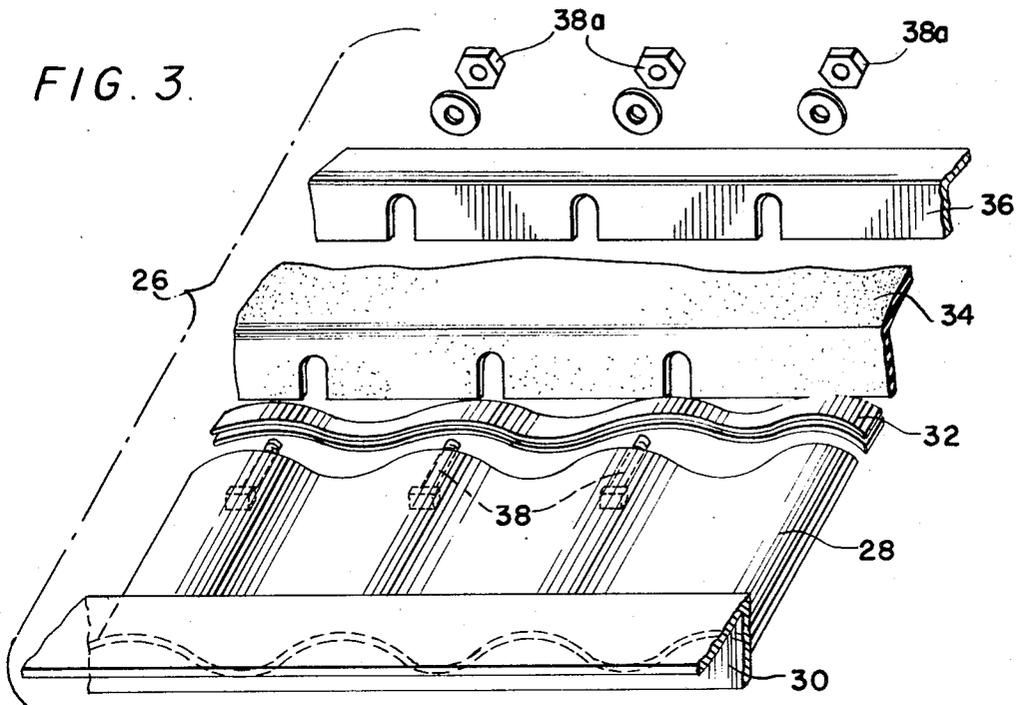


FIG. 5.

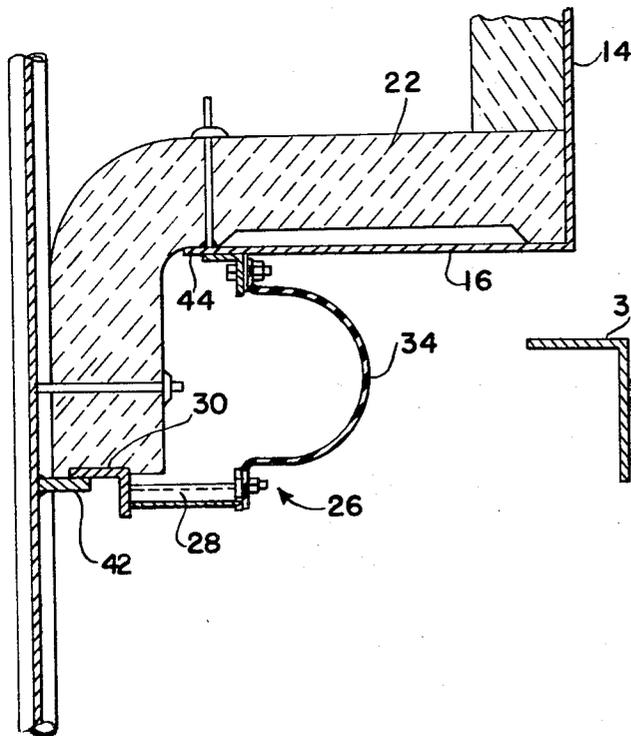
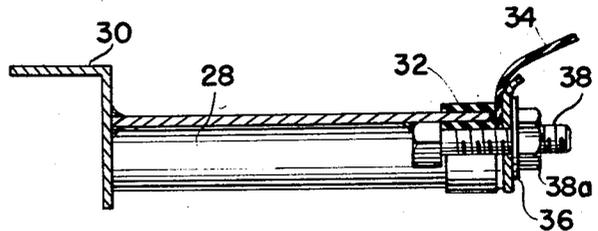


FIG. 4.



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FIG. 7.

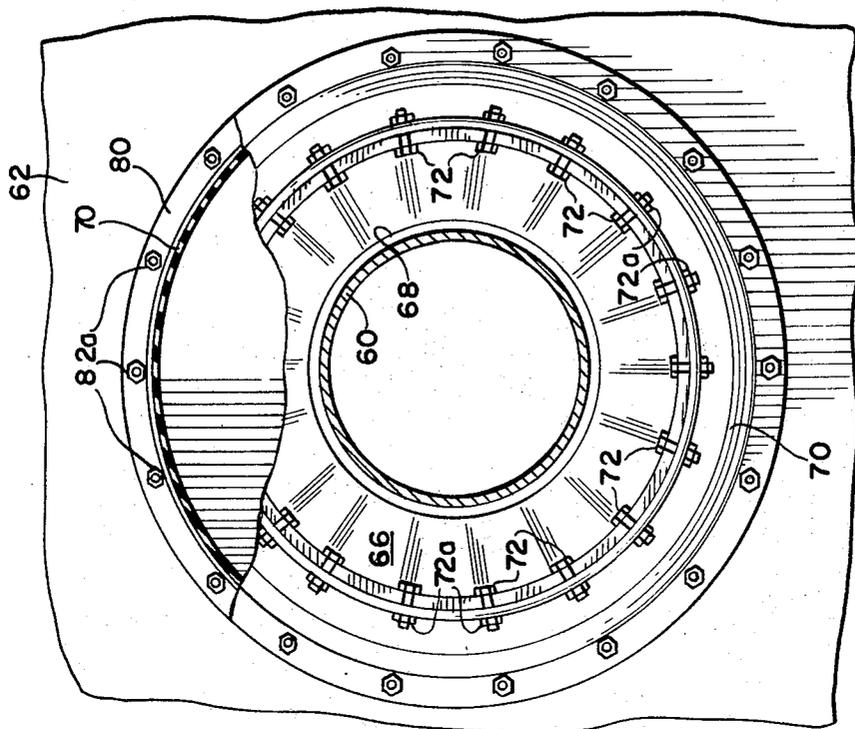
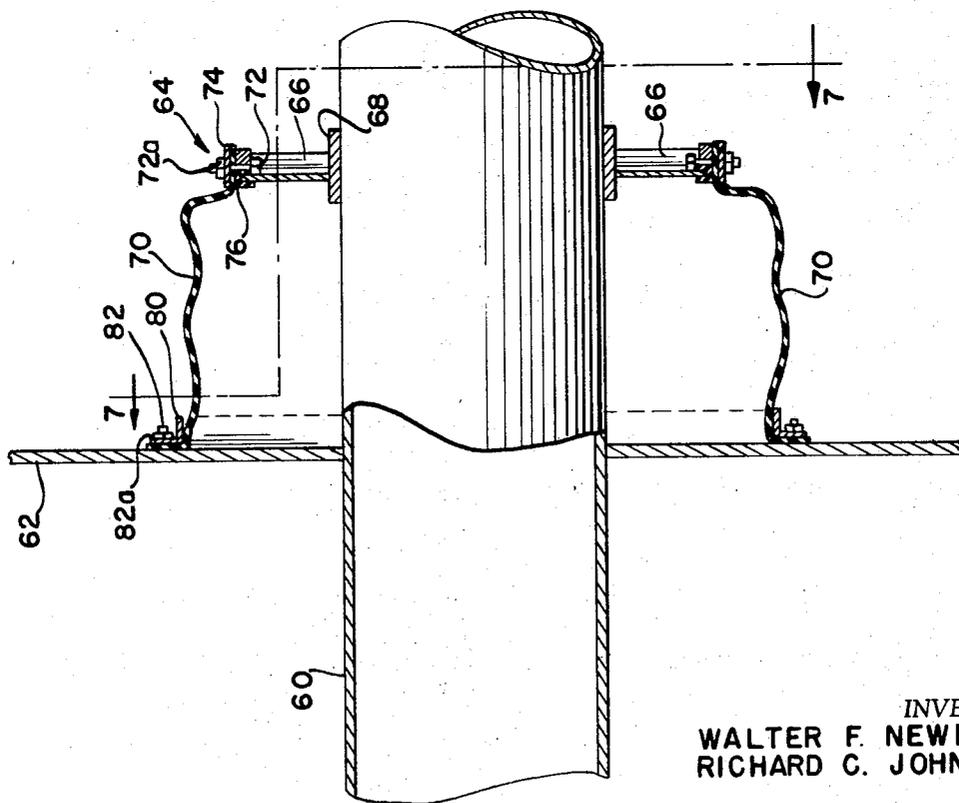


FIG. 6.



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EXPANSION SEAL DEVICE

BACKGROUND OF THE INVENTION

This invention relates to an expansion seal device, and, more particularly, to such a device for sealingly connecting two members which move relative to each other in response to temperature changes.

In a modern large boiler or vapor generator, pipes and/or other conduits which join several of the boiler sections often project upwardly over the top of the boiler. To prevent heat losses, the conduits are often covered by means of a penthouse which extends over the top of the boiler. In such an arrangement the interior of the penthouse is often pressurized to prevent leakage of the corrosive gases which are generated by the boiler into the interior of the penthouse. Due to the fact that the boiler expands more than the penthouse during operation, it is often difficult to permit this relative movement while preventing leakage.

The problem is further complicated by the fact that in large boiler installations both the penthouse and the boiler are generally hung from structural supports by members which are heated by the heat conducted from the associated boiler and penthouse. Since the members which connect the boiler walls to the structural supports and the tubular walls will be heated to a higher temperature than the temperature of the members which connect the penthouse to the supports, the boiler wall will expand downwardly more than the penthouse during operation. Thus, in addition to the boiler expanding circumferentially more than the penthouse during heating, the boiler expands downwardly to a greater extent than the penthouse for the above reasons, therefore necessitating an even more sophisticated seal between the boiler and the penthouse.

SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide a device for connecting two members which move relative to each other in response to temperature changes while providing a seal between the members.

Toward the fulfillment of this object, the expansion seal device of the present invention comprises a heat absorption and expansion plate fixed to one of the above-mentioned members and a flexible sheet connecting the plate to the other member, the plate and the sheet being adapted to accommodate relative movement between the members.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference is now made to the accompanying drawings for a better understanding of the nature and objects of the present invention. The drawings illustrate the best mode presently contemplated for carrying out the objects of the invention and are not to be construed as restrictions or limitations on its scope.

In the drawings:

FIG. 1 is a partial, vertical sectional view taken along two adjacent walls of a typical boiler-penthouse installation and showing the expansion seal device of the present invention;

FIG. 2 is a horizontal sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is an exploded perspective view of the expansion seal device of the present invention;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 2;

FIG. 5 is a view similar to FIG. 1, but showing the boiler wall in an expanded condition.

FIG. 6 is a partial vertical sectional view of a steam pipe shown mounted relative to a boiler wall; and

FIG. 7 is a sectional view taken along the line 7—7 of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 of the drawings, the reference numeral 10 refers to a portion of a penthouse having a vertical wall 14 connected to a horizontal floor 16. The penthouse 10 is designed to cover a boiler shown in general by the reference numeral 12 and having a vertical wall 20 formed in a conventional manner by connecting a plurality of tubes 20a by a webbing 20b. Although not completely shown in the drawings, the penthouse 10 extends over the top of the boiler 12 and around all four vertical walls thereof in a conventional manner, with the inner edge of the horizontal floor 16 of the penthouse being spaced from the boiler wall 20 as shown in FIG. 1. An insulating material 22 lines the inner wall 14 and the floor 16 of the penthouse 10, extends to the outer surface of the boiler wall 20, and is secured thereto by means of fasteners 24.

The expansion seal device of the present invention is shown in general by the reference numeral 26 and is better shown with reference to FIG. 3. Specifically, the device comprises a corrugated plate 28 having one side welded to an angle iron seal bar 30. A generally V-shaped rubber strip 32 extends over the opposite edge of the plate 28 and a closure bar 36 presses a side edge portion of a flexible sheet 34 against the strip 32. The closure bar 36 is attached to the corrugated plate 28 by means of a plurality of bolts 38 which receive nuts 38a, the bolts being welded to the underside of the plate 28 and extending through elongated slots formed in the flexible sheet 34 and the closure bar 36.

Referring again to FIG. 1, the angle seal bar 30 is welded to a flange 42 projecting from the outer surface of the boiler wall 20 and the other side edge portion of the flexible sheet 34 is clamped between an angle iron 44 and a clamping plate 46. The angle iron 44 is welded, or otherwise attached, to the bottom surface of the floor 16 of the penthouse 10, and a series of bolts 48 extend through the angle iron 44, the sheet 34, and the plate 46, with each bolt receiving a nut 48a.

As shown in FIG. 2, a flat plate 52 is provided for the corners of the seal device 26 and is welded to the ends of the corrugated plates 28, so that the seal device extends around the entire outer periphery of the boiler penthouse assembly.

Each plate 28 is constructed of steel or a similar material to apply a rigidity to the seal device, with the corrugations acting to present a relatively large heat absorption area for the heat from the boiler, thus reducing the temperature gradient between the boiler wall 20 and the flexible sheet 34. The corrugations also accommodate expansion of the plate 28 in a direction perpendicular to the longitudinal axes of the corrugations in response to expansion of the boiler and heating of the plate by the boiler. The strip 32 can be made of silicone rubber which, in addition to adding to the in-

tegrity of the seal, acts as an insulating cushion for the sheet 34.

The width of the flexible sheet 34 is elongated in order to form a bellows to accommodate any relative movement between the boiler 12 and the penthouse 14 which occurs in a direction parallel to the longitudinal axes of the corrugations of plate 28. The sheet 34 can be of a rubber material such as viton and has a 5-mil teflon coating on the pressurized surface thereof to resist abrasions and corrosion. In addition the teflon coating will melt at the relatively high temperatures encountered and flow into any pin holes which may form through the flexible sheet 34 to seal same.

It is noted that the bolts 38 as well as the elongated slots in the flexible sheet 34 and the steel closure bar 36 are all disposed on the non-pressurized surface of the device.

The seal device of FIGS. 6 and 7 is adapted to seal a steam pipe 60 relative to a boiler wall 62 or the like, and yet accommodate movement of the pipe relative to the wall in response to expansion of the pipe as a result of the passage of hot steam therethrough.

The seal device is shown in general by the reference numeral 64 and comprises a corrugated plate 66 which is welded, or otherwise attached, to a circular ring 68 which, in turn, is welded, or otherwise attached, to the outer surface of the pipe 60. A flexible sheet 70 has one edge portion clamped to the corrugated plate 66 by means of a series of bolts 72 welded to the non-pressurized side of the plate, and extending through slots (not shown) provided in the flexible sheet 70 and the closure bar 74. The bolts 72 receive nuts 72a to achieve the clamping. A rubber strip 76 extends around the outer edge of the plate 66 to insulate and cushion the flexible sheet 70. The plate 66, the flexible sheet 70, the closure bar 74, and the rubber strips 76 can all be constructed identical to the corresponding components of the previous embodiment.

The other edge portion of the flexible sheet 70 is attached to the boiler wall 62 by means of an angle iron seal bar 80 fastened to the boiler wall by means of a bolt 82 and a nut 82a.

In operation of the sealing device of the embodiment of FIGS. 1 and 5, as well as the embodiment of FIGS. 6 and 7, the heated seal bar 30 and the seal ring 68 expand as a result of the boiler wall expanding, and due to the heat from the boiler 10. The expansion, in a direction perpendicular to the longitudinal axes of the corrugations of the respective plates 28 and 66, is accommodated by the corrugations functioning as bellows. Expansion in a direction perpendicular to this latter direction is accommodated by the flexible sheets 34 and 70 functioning in a similar manner. As an example of this, reference is made to the relative positions of the penthouse 10 and the boiler 12 as shown in FIG. 1 as compared to FIG. 5, in the first embodiment.

As stated above, the corrugated plates 28 and 66 also aid in heat absorption, thereby reducing the temperature of their respective flexible sheets relative to the boiler wall 20 and the pipe 60, respectively.

It is understood that several variations can be made in the above without departing from the scope of the invention. For example, the device can be used in environments other than those described above. Also, fastening means other than the bolts 38 and 72 can be

utilized. These and other variations of the specific construction and arrangement of the device disclosed above can be made by those skilled in the art without departing from the invention as defined in the appended claims.

We claim:

1. A device for sealingly connecting a first member which is exposed to elevated temperatures to a second member, said device comprising a plate having one side edge portion attached to said first member, said plate being corrugated in order to accommodate expansion of said first member in one plane as a result of said elevated temperatures and to provide a relatively large absorption surface for heat resulting from said elevated temperatures, a flexible sheet sealingly connecting said plate to said second member, said sheet having one side edge portion fixed relative to the other side edge portion of said plate and forming a bellows to accommodate movement of said first member in said plane as a result of said expansion, and resilient cushion means extending over said other side edge portion of said plate for engagement by said sheet, said cushion means adapted to insulate said sheet from said plate.

2. The device of claim 1 further comprising a closure bar pressing said sheet to said other side edge portion of said plate, and means to fasten said bar to said plate.

3. The device of claim 1 further comprising means formed on at least one surface of said sheet and responsive to a predetermined elevated temperature for melting and filling holes in said sheet.

4. A device for sealingly connecting a first member which is exposed to elevated temperatures to a second member, said device comprising a plate having one side edge portion attached to said first member, said plate being corrugated in order to accommodate expansion of said first member in one plane as a result of said elevated temperatures and to provide a relatively large absorption surface for heat resulting from said elevated temperatures, a flexible sheet sealingly connecting said plate to said second member, said sheet having one side edge portion fixed relative to the other side edge portion of said plate and forming a bellows to accommodate movement of said first member in said plane as a result of said expansion, a closure bar pressing said sheet to said other side edge portion of said plate, and means to fasten said bar to said plate.

5. The device of claim 4 further comprising means formed on at least one surface of said sheet and responsive to a predetermined elevated temperature for melting and filling holes in said sheet.

6. A device for sealingly connecting a first member which is exposed to elevated temperatures in its vicinity to a second member, said device comprising a plate having one side edge portion attached to said first member, said plate being corrugated in order to accommodate expansion of said first member in one plane as a result of said elevated temperatures and to provide a relatively large absorption surface for heat resulting from said elevated temperatures, a flexible sheet sealingly connecting said plate to said second member, said sheet having one side edge portion fixed relative to the other side edge portion of said plate and forming a bellows to accommodate movement of said first member in said plane as a result of said expansion, and means formed on at least one surface of said sheet

and responsive to a predetermined elevated temperature for melting and filling holes in said sheet.

7. A device for sealingly connecting a first member which is exposed to elevated temperatures to a second member, said device comprising a continuous plate extending around the outer periphery of said first member and fixed thereto, said plate being formed to provide a relatively large absorption surface for heat resulting from said elevated temperatures and being adapted to accommodate expansion of said first member in at least two directions as a result of said elevated temperatures, and means for sealingly connecting said plate to said second member in a manner to accommodate the movement of said first member relative to said second member as a result of said expansion.

8. The device of claim 7 wherein said plate is corrugated in order to form said absorption surface and to accommodate said expansion, said corrugation extending perpendicular to the particular wall of said first member with which they are associated.

9. The device of claim 7 wherein said plate is rigid and further comprising an insulating material supported by said plate against said outer periphery of said first member.

10. The device of claim 7 wherein said second member is spaced from said plate and wherein said means is in the form of a flexible sheet extending from said plate to said cover and forming a bellows to accommodate said movement of said first member.

11. The device of claim 10 wherein the inner side edge portions of said plate are attached to said first member and wherein said sheet has one side edge portion fixed relative to the other side edge portions of said plate, and another side edge portion fixed to said second member.

12. The device of claim 11 further comprising a resilient cushion means extending over said other side edge portions of said plate for engagement by said sheet, said cushion means adapted to insulate said sheet from said plate.

13. The device of claim 11 further comprising a closure bar pressing said sheet to said other side edge portions of said plate, and means to fasten said bar to said plate.

14. The device of claim 10 further comprising means formed on at least one surface of said sheet and responsive to a predetermined elevated temperature for melting and filling holes in said sheet.

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