March 6, 1951 E. D. RAPISARDA 2,544,614

SEALING FASTENER FOR THE FLOOR PLATES OF THE TRAY OF A BUBBLE TOWER

Filed June 29, 1949 3 Sheets-Sheet 1

Fig. 1.

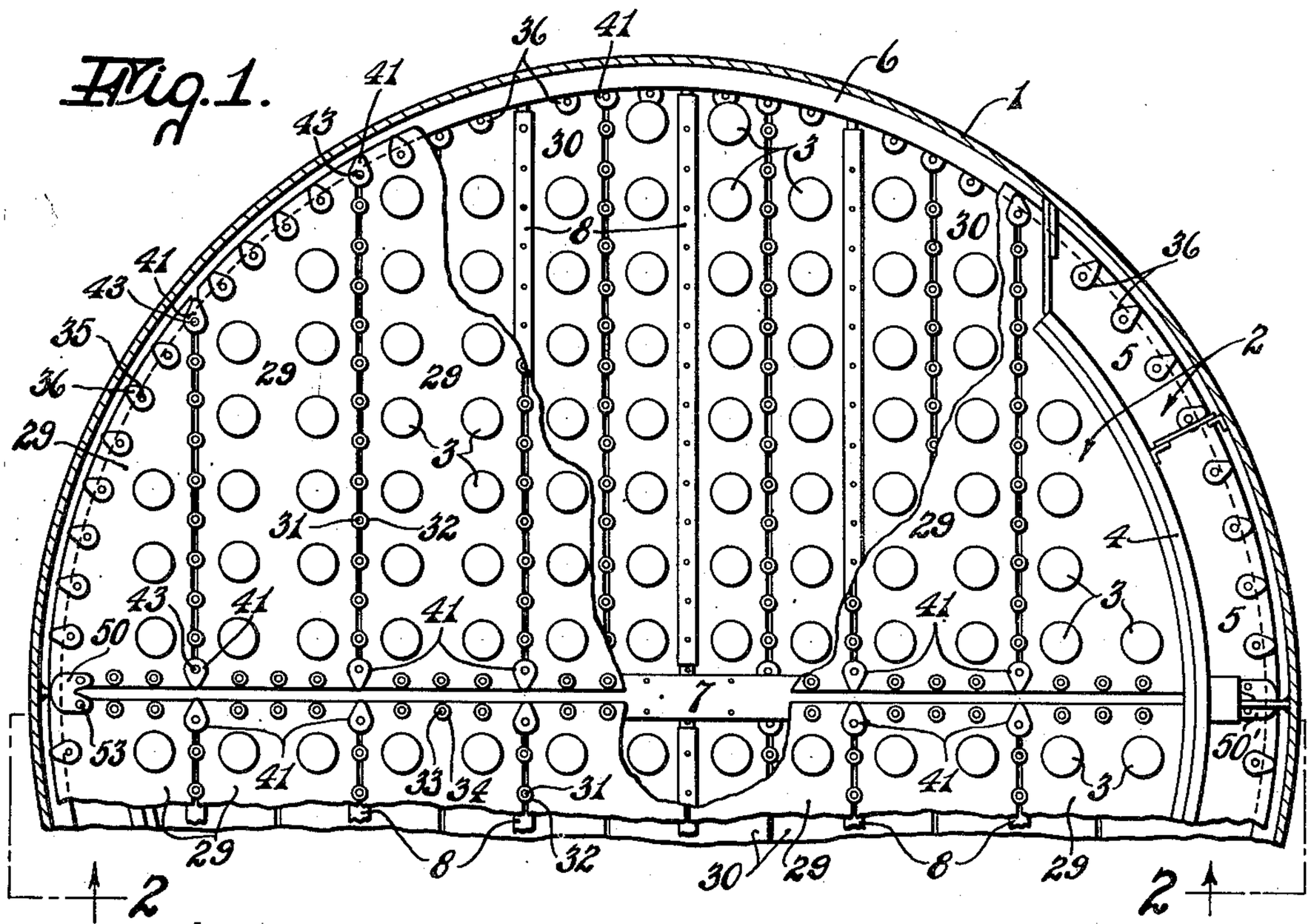

Fig. 2.

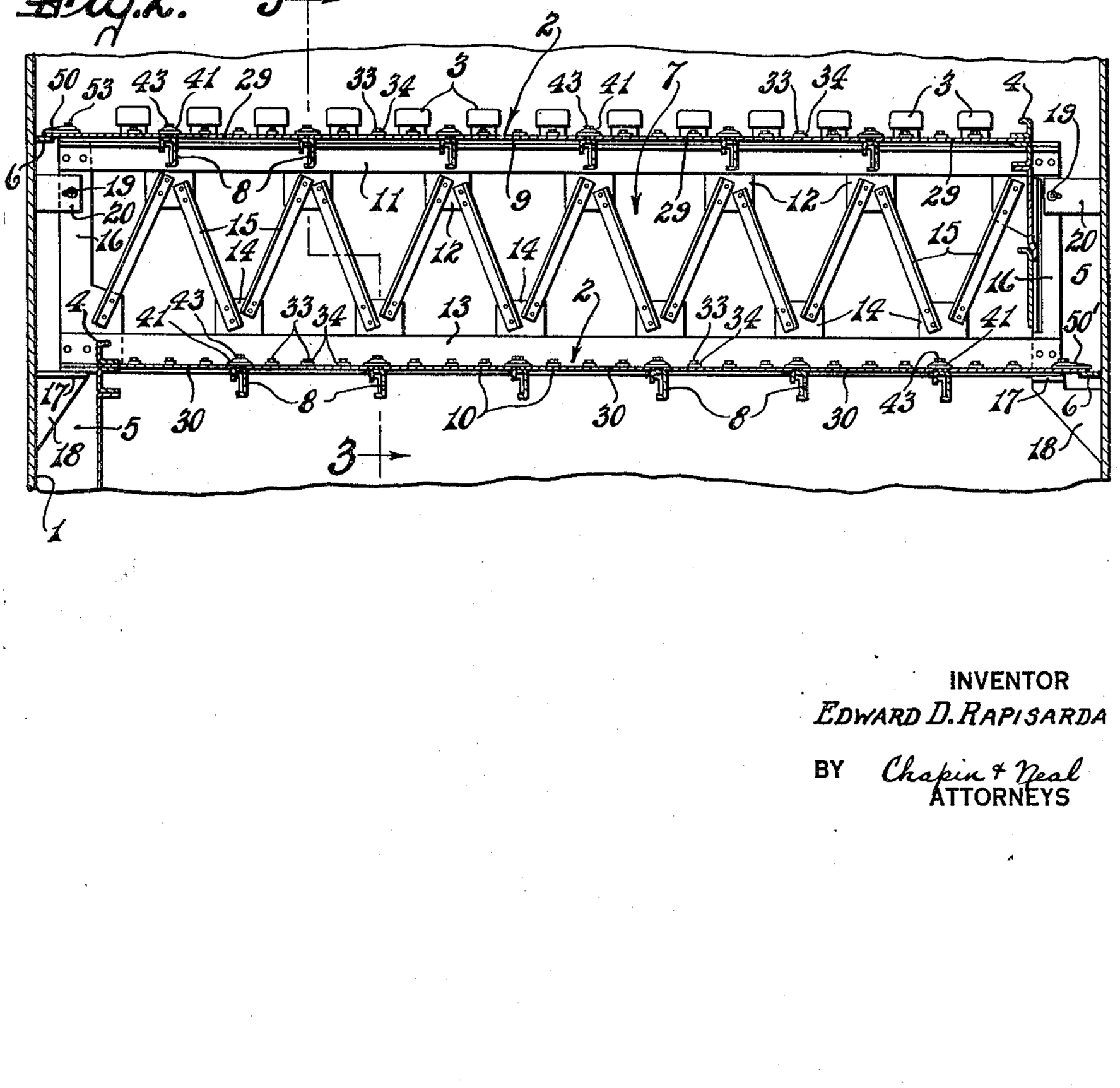

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Fig. 4.

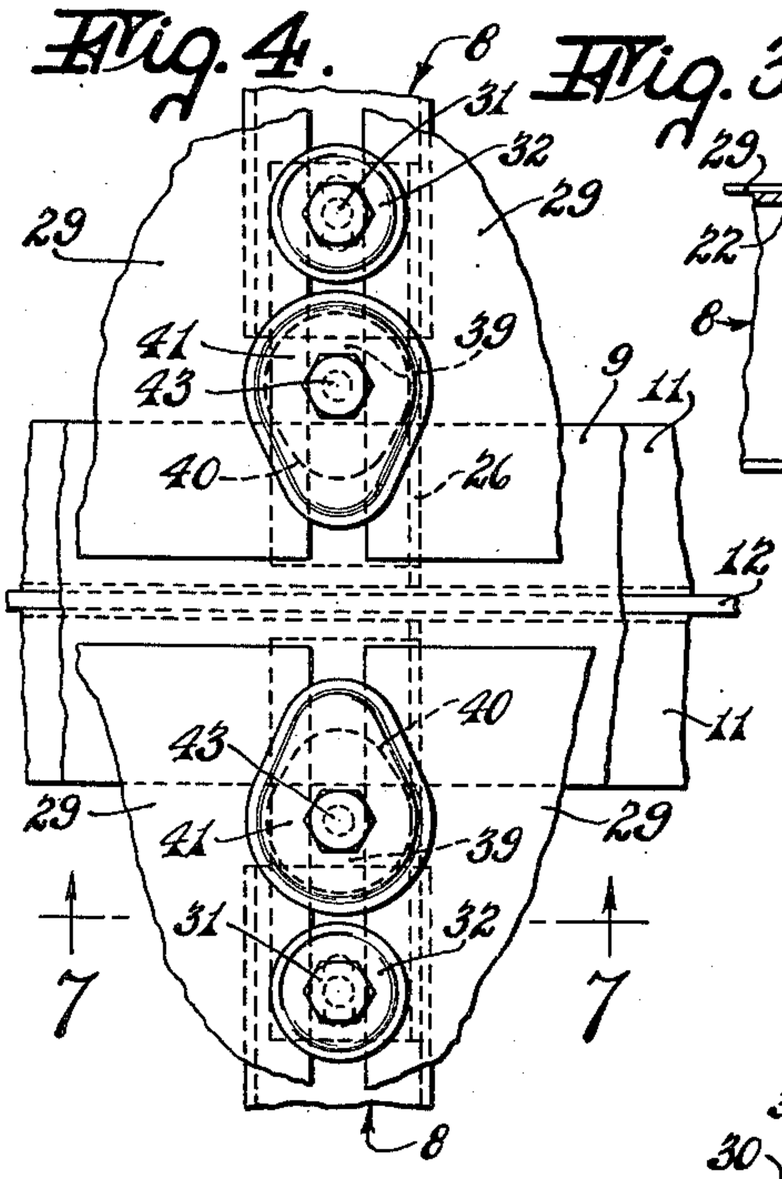

Fig. 3.

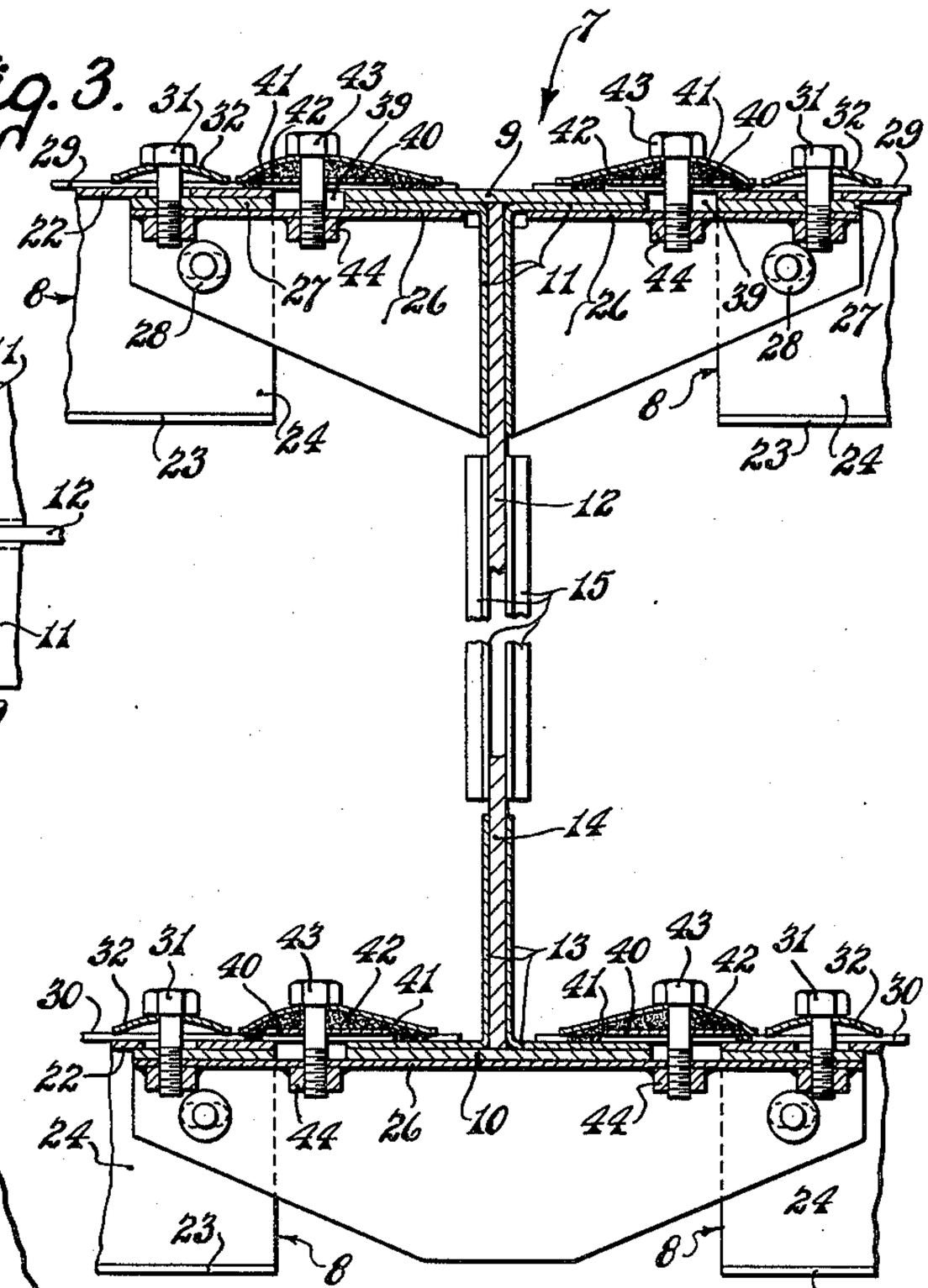

Fig. 5.

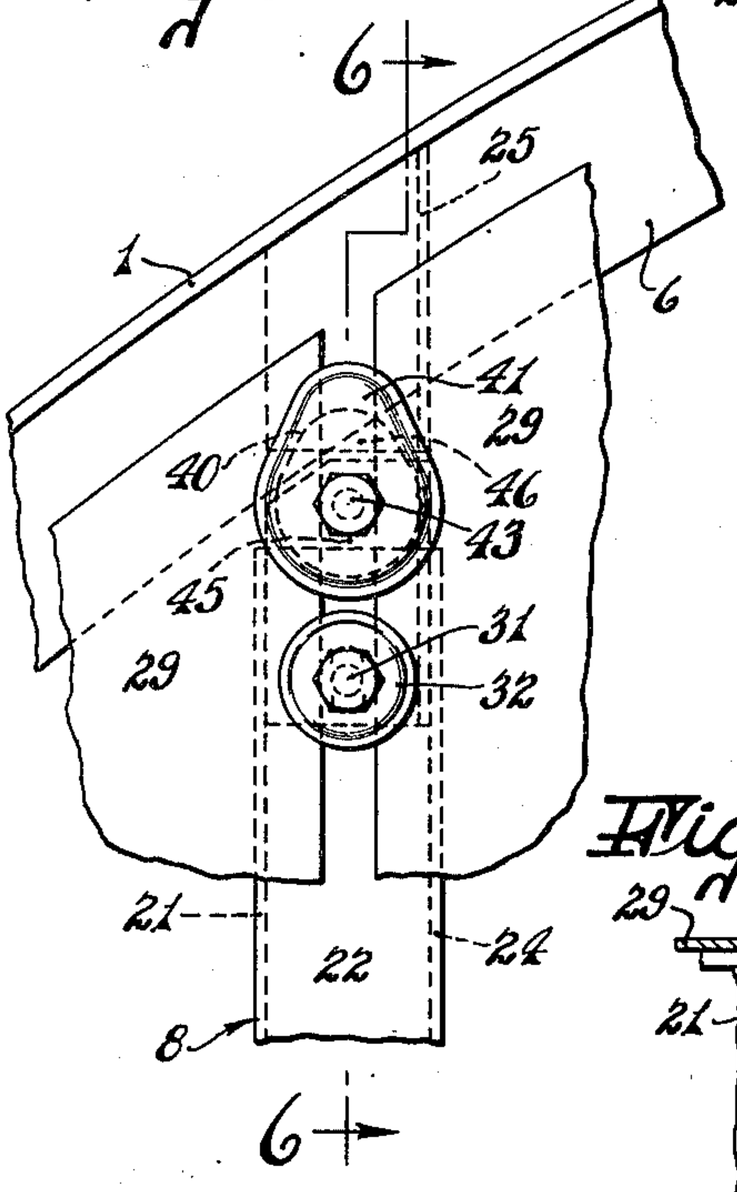

Fig. 6.

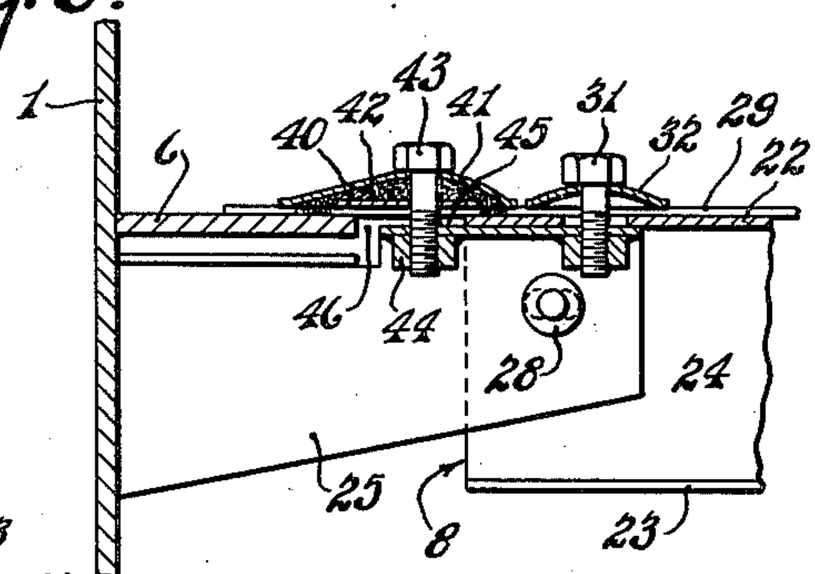

Fig. 7.

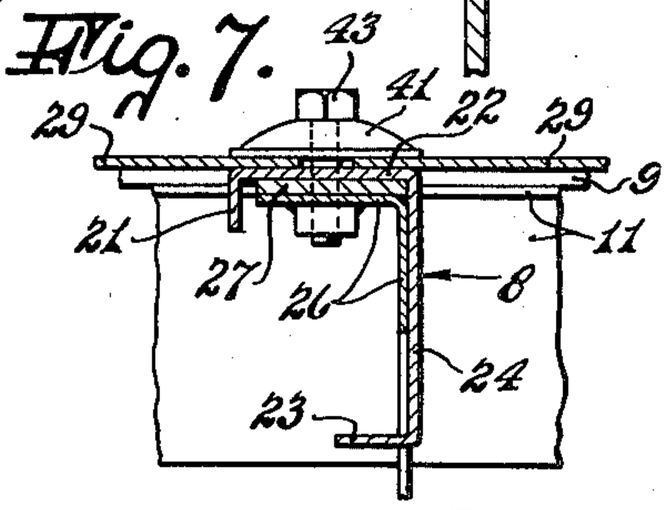

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Fig. 8.

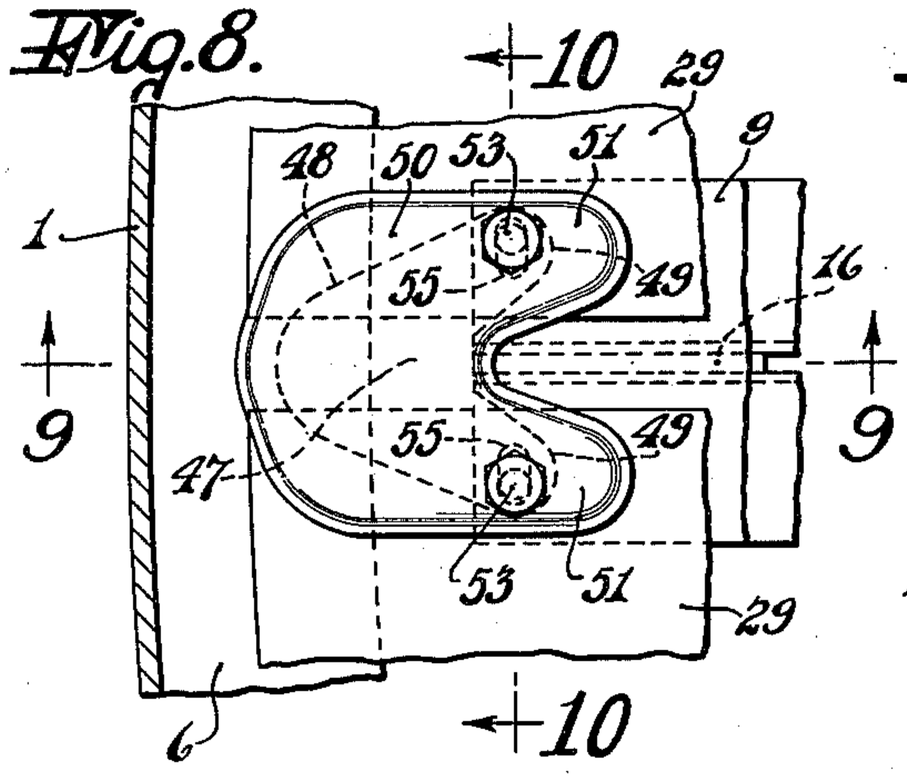


Fig. 9.

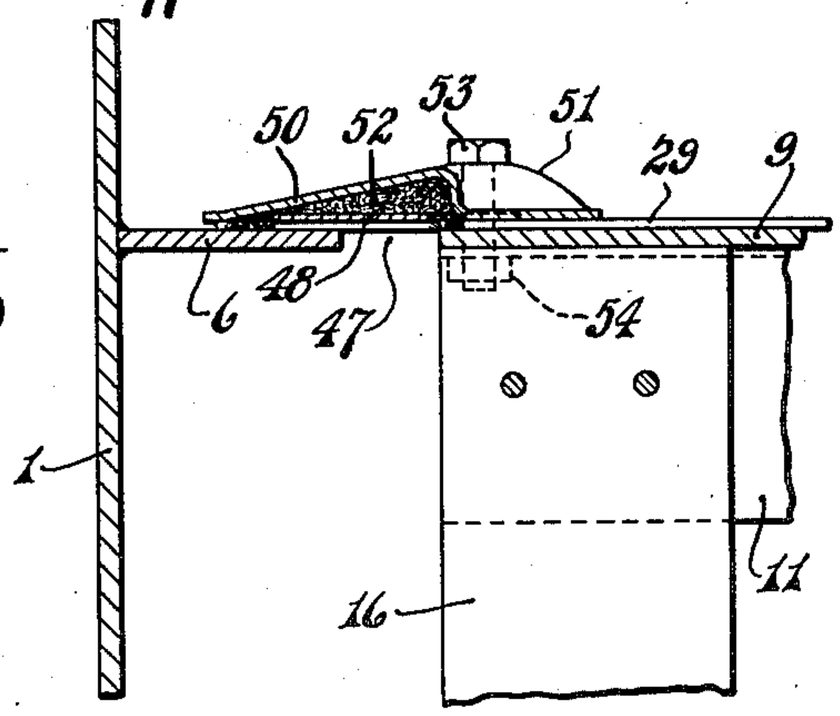


Fig. 11.

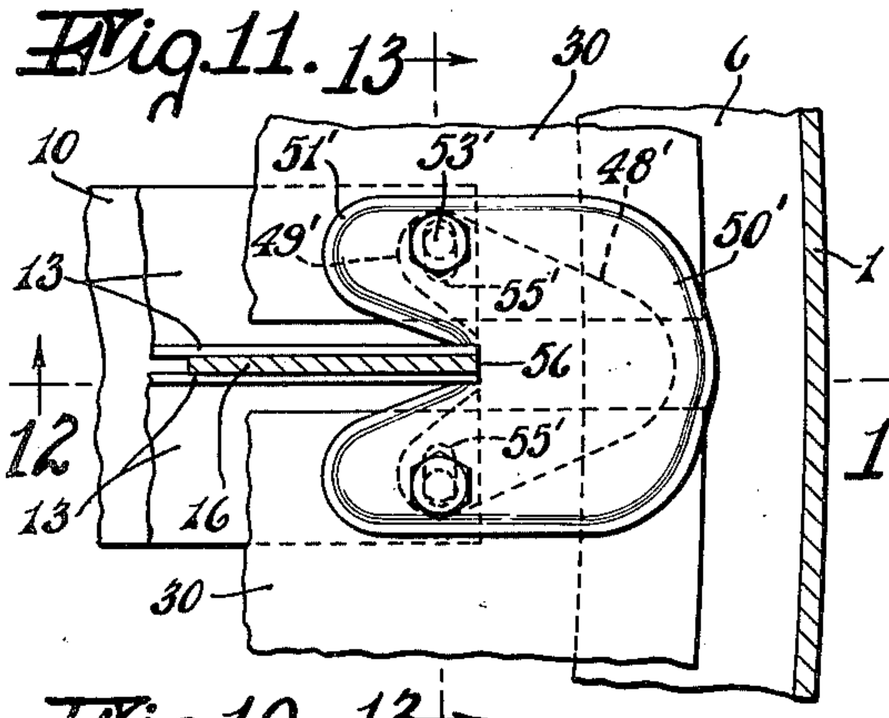


Fig. 12.

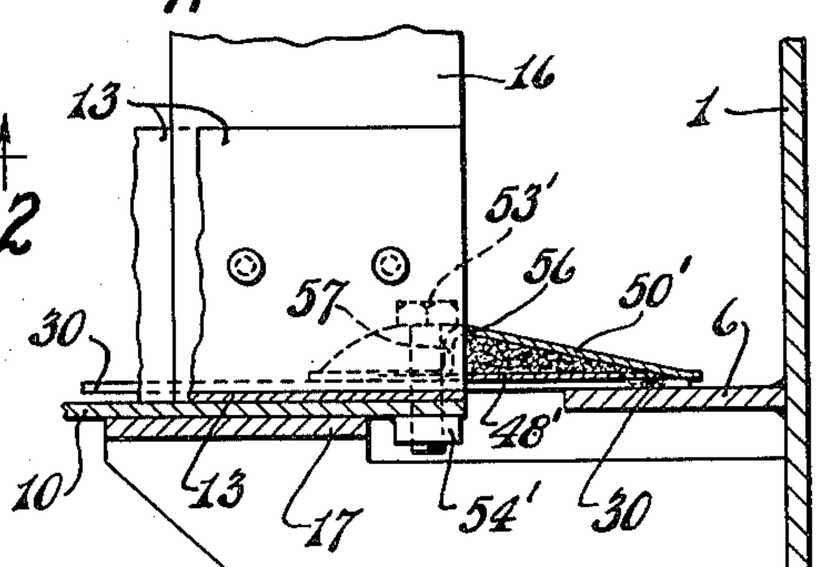


Fig. 10.

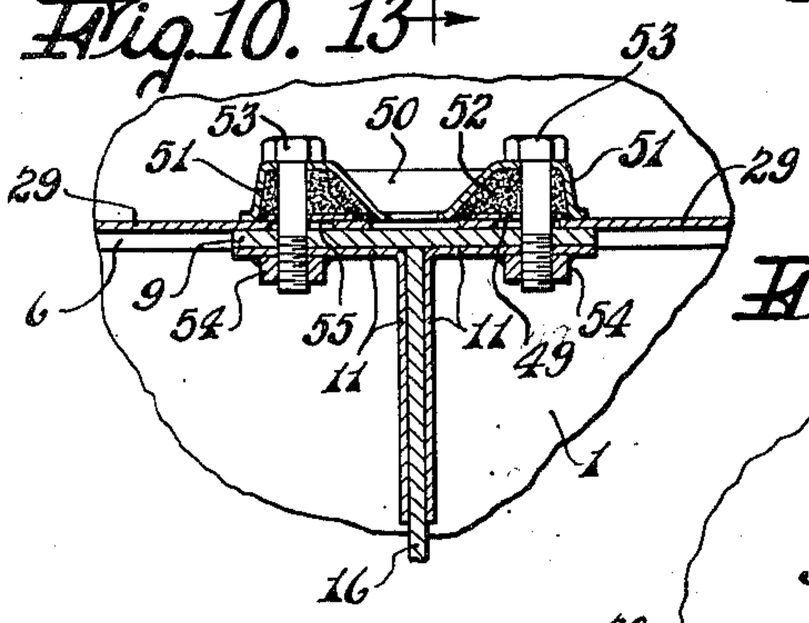
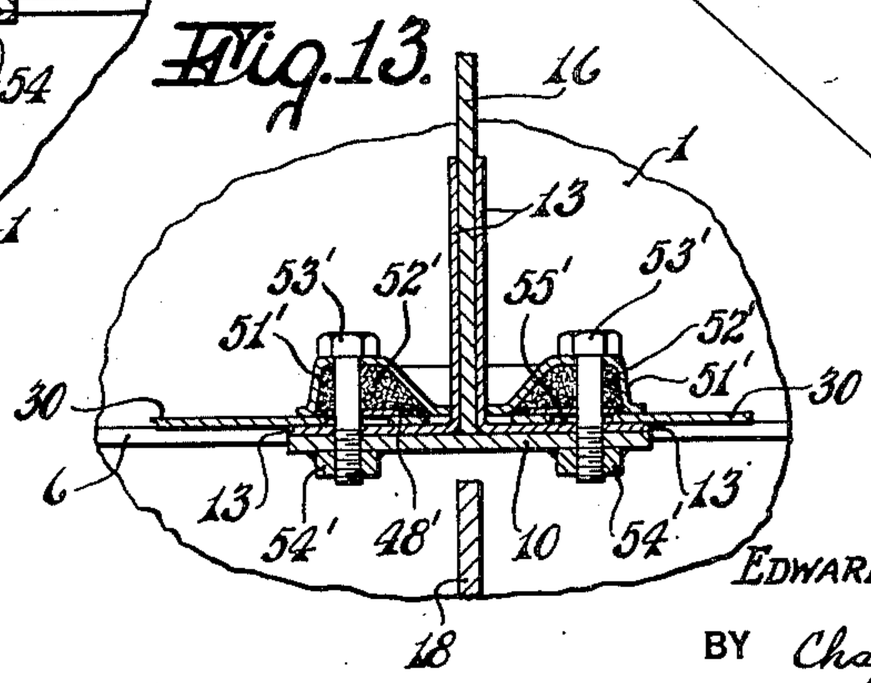


Fig. 13.



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Patented Mar. 6, 1951

2,544,614

UNITED STATES PATENT OFFICE

2,544,614

SEALING FASTENER FOR THE FLOOR PLATES OF THE TRAY OF A BUBBLE TOWER

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Application June 29, 1949, Serial No. 102,010

4 Claims. (Cl. 189—35)

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This invention relates to an improvement in the tray construction of a bubble tower and, more particularly, to a fastener for overlapping the adjacent margins of two metallic floor plates of the tray and holding the plates to the underlying metallic floor supports in a leak tight manner.

The invention is particularly useful where there is a hole or a deep pocket between the adjacent edges of two floor plates. For example, an end of one floor support lies in proximity to a side of another floor support but the two do not abut because space must be left between them for expansion. One of these two supports will be supported, as by an angle iron and bolt and slot connections, from the other support or, in some cases, from the wall of the bubble tower in a manner so as to be free to expand and contract. This angle iron may underlie the gap between the two floor supports but its top will lie considerably below the top faces of the floor supports on which the floor plates rest, thereby forming a deep pocket. In some cases, there may be a hole instead of a pocket. The floor supports are sometimes trusses, or beams or an annular ring fastened to the inner peripheral wall of the bubble tower. The invention provides a means for covering a pocket or hole, such as described, in leak-proof fashion and at the same time fastening the floor plates to their supports in a manner such as to enable expansion and contraction of the plates.

The invention has for its object to provide a fastener for the purpose described, having a sealing member of thin pressed metal with marginal edges to engage the floor plates and elsewhere arched upwardly into crowned formation, forming a recess to receive packing material, and a packing retainer consisting of a thin flat plate to lie wholly within the recess in the sealing member, overlap the margins of two floor plates and span the gap between them, and a bolt extending through the member and plate and the underlying floor support for drawing the member and support together to compress the packing between the member and thin plate and force it around all edges of the thin plate and also to yieldingly hold the floor plates to their supports in a manner to enable expansion and contraction thereof.

The invention will be disclosed with reference to the several illustrative examples in the accompanying drawings, in which,

Fig. 1 is a fragmentary top plan view of a bubble tower showing a bubble tray construction

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embodying the floor plate fasteners of this invention;

Fig. 2 is a fragmentary sectional elevational view taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary cross sectional view of the central truss and the connections of the upper and lower floor beams and floor plates thereto, such view being taken on the line 3—3 of Fig. 2 and drawn to a larger scale;

Fig. 4 is a top plan view of the construction shown in Fig. 3;

Fig. 5 is a fragmentary top plan showing the sealing fastener construction used where the floor plates span the gap between the floor beam and the annular ring on the shell of the tower;

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is a cross sectional view taken on the line 7—7 of Fig. 4;

Fig. 8 is a top plan view of a sealing fastener for the floor plates, used where they span the gap between the upper end of the central truss and the ring on the shell of the tower;

Figs. 9 and 10 are sectional views taken on the lines 9—9 and 10—10 respectively, of Fig. 8;

Fig. 11 is a top plan view of the sealing fastener for two floor plates used where they span the gap between the lower end of the truss and a ring on the shell of the tower; and

Figs. 12 and 13 are sectional views taken on the lines 12—12 and 13—13, respectively, of Fig. 11.

Referring to these drawings; a portion of a bubble tower is shown in Fig. 2 as an upstanding cylindrical shell 1, having a plurality of trays 2 located at different levels. Each tray is provided with the usual bubble caps 3. Gases rise through the bubble caps and are directed through liquid contained in the tray to a level determined by a dam 4, all in the usual manner. The liquid overflowing each dam 4 passes through a downcomer 5 to the tray below. Only two trays have been shown but in practice there would be many more. The invention is not concerned with the functioning of the bubble tower in fractionating hydrocarbon liquids but rather with a special fastening and sealing means for the floor plates of a bubble tray. Therefore, the two trays shown will suffice to illustrate the application of the invention.

All parts of each tray are preferably constructed of some suitable non-corrosive metal, such as stainless steel for example.

The supports for the floor of each tray include a flat ring 6 suitable fastened, as by weld-

ing, to the interior wall of shell 1 and extending around its periphery except for that portion occupied by the downcomer 5; a central truss, designated generally as 7, and extending diametrically across the shell and supported at its ends therefrom; and two sets of parallel beams 8, one set on each side of truss 6, and each set extending from a side of truss 7 toward ring 6 and the peripheral wall of shell 1 and suitably supported from such wall. As shown herein, one tray is supported from the top of truss 7 and another is supported from the bottom of the truss but in the same general manner.

The truss, as shown, includes upper and lower flat plates 9 and 10, respectively. Fixed to the bottom of upper plate 9 are the horizontal legs of a pair of angle irons 11 and fixed to and between the vertical legs of these angle irons at spaced intervals are a series of gusset plates 12. The horizontal legs of a similar pair of angle irons 13 are similarly fixed to the top of lower plate 10 and between the vertical legs of these angle irons at spaced intervals are a series of gusset plates 14. The gusset plates 12 are staggered with respect to the gusset plates 14 and they are interconnected by diagonal angle irons 15. At the ends of the truss are vertical plates 16 which interconnect the angle irons 11 and 13. The upper end of each plate fits between and is secured to the angle irons 11 and the lower end of each plate fits between and is secured to the angle irons 13. The ends of truss 7 rest on seats 17, braced by gussets 18, both welded to the shell 1. Above these seats, the vertical members 16 are fastened by bolts 19 to plates 20, which in turn are welded to shell 1, these bolts as indicated passing through horizontal slots in plates 20 to enable longitudinal expansion and contraction of the truss.

Each floor support 8, as shown, is of modified angle iron section with a short vertical web 21 downturned from one edge of its upper horizontal leg 22 and a short horizontal web 23 outturned from the lower edge of the vertical leg 24. The ends of each support 8 are supported by angle irons 25 and 26 respectively secured, as by welding, to the shell 1 and to the angle irons 11 or 13, as the case may be, of truss 7. The inner end of the horizontal leg 22 of support 8 rests on a shim 27 on top of the horizontal leg of angle iron 26 and the vertical leg 24 of the support at its inner end abuts the vertical leg of angle iron 26. The outer end of the horizontal leg 22 of support 8 rests on the horizontal leg of angle iron 25 and its vertical leg abuts the vertical leg of angle iron 25. Bolts 28 passing through holes in the vertical leg 24 and through horizontal slots in the vertical legs of the angle irons 25 or 26, as the case may be, secure the supports 8 in a manner to permit longitudinal expansion and contraction thereof.

The upper faces of the floor supports for the upper tray, that is ring 6, supports 8 and plate 9, are at the same level and support the floor plates 29 of the upper tray. Similarly, the upper faces of the floor supports for the lower tray, that is ring 6, supports 8 and the horizontal legs of angle irons 13 of truss 7, are at the same level and support the floor plates 30 of the lower tray. These plates 29 (Fig. 1), except the two at the extreme left, have parallel side edges and rest along their sides on top of the horizontal legs 22 of a pair of supports 8. The inner ends of plates 29 rest on top of the plate 9 of truss 7 and along their outer ends on top of the ring 6. The two

end plates have a curved edge connecting a straight side and a straight end edge and such curved edge rests on ring 6 while the side and end edges respectively rest on the leg 22 of a support 8 and on plate 9 of truss 7. The parallel side edges of two adjacent plates 29 are spaced apart and receive between them bolts 31 which through clamps 32 draw the plates against the supports 8. Each plate 29 along its inner end edge is secured by bolts 33 which act through clamps 34 to hold the plates frictionally to plate 10. The curved edges are held to ring 6 by bolts 35 and clamps 36. The lower plates 30 are similarly held in place.

The fasteners, thus far described, may be of any suitable type. They may, for example, be of the type disclosed in my co-pending application Serial No. 76,675, filed February 16, 1949. However the special sealing fasteners of this invention are needed at the corners of the various floor plates 29 and 30. These special fasteners may be of the type shown in Figs. 3, 4, 5 and 6 for all corners of the floor plates 29 and 30 except those between the ends of the two end plates adjacent one end of truss 7. Here, a fastener such as shown in Figs. 8, 9 and 10 is required for the upper end plates 29 and one such as shown in Figs. 11, 12 and 13 for the lower end plates 30.

Referring to Fig. 3, it will be seen that the inner end of the floor support 8 is spaced from the side of the plate 9 of truss 7. The horizontal web of angle iron 26 bridges the gap between such end and side but nevertheless there is left a deep pocket 39 which also extends laterally in opposite directions (Fig. 4) beneath the floor plates 29. A thin plate 40, having a bolt hole therethrough, is provided to cover the pocket 39. This plate is wide enough to overlap the adjacent edges of the two floor plates, which rest on support 8, and is longer than the gap. A crowned member 41, with a bolt hole therein, overlies plate 40. This member 41, as shown, is roughly oval shape, as viewed in plan, and has a narrow endless marginal flat rim to engage the floor plates and elsewhere is arched upwardly in crown form to provide a recess to receive packing 42. A bolt 43 passes through the holes in member 41, cover 40 and the horizontal leg of angle iron 26 and threads into a nut 44, welded to said leg, whereby the marginal rim of member 41 may be drawn against the floor plates 29 to yieldingly hold them in place on support 8 and also to compress the packing 42. The plate 40 prevents the packing from being forced into the pocket 39. This plate 40 is smaller than the base of the recess in member 41 and the packing is pressed into the space between its outer margin and the inner margin of member 41 and pressed against the edges of member 40 and also into the space between the floor plates 29 on each side of gap 39. A leak-tight seal is thus provided.

In Fig. 6, the connection of the floor support 8 to the shell 1 is shown. Here there is a pocket 45 above the horizontal leg of angle iron 25 and between the floor plates 29 and also a hole 46. The same fastener is used here, the plate 40 covering pocket 45 and hole 46 and the bolt 43 and nut 44 serving to draw the crowned sealing member 41 against the floor plates 29 and compress the packing 42 to make a leak-tight joint.

At one upper end of truss 7, the arrangement shown in Figs. 8, 9 and 10 is used. Here, there is a large hole 47 between the adjacent edges of the floor plates 29 and between one end of the truss 7 and ring 6. A packing retaining

plate 48 wide enough and long enough to cover this hole 47 is used and this plate has two ears 49, resting on top of plate 9, one on each side of its longitudinal center line and each having a bolt hole therethrough. A sealing member 50 of somewhat similar shape but larger is placed over the plate 48 and has two ears 51 therein each with a bolt hole therein. The member 50 has a marginal flat rim to engage the floor plates 29 and elsewhere is arched upwardly to form a recess to receive packing 52. The member 50 is drawn against the floor plates 29 by bolts 53 and nuts 54, which are welded to the horizontal legs of angle irons 11. Each bolt passes through the registering holes in ears 49 and 51, through a slot 55 in a floor plate 29, through a hole in plate 9 and the underlying angle iron 11 and threads into its nut 54, whereby the plates 29 may be drawn against plate 9 and the packing 52 compressed against plate 48 and around its edges to provide a leak-tight joint.

For use at one lower end of truss 7 for fastening the floor plates 30 to the horizontal legs of angle irons 13 a fastener, similar to that last described, is used except that it is centrally slotted to straddle the adjacent vertical part of the truss, which part is composed of plate 14 and the vertical legs of the two angle irons 13. Parts of this fastener, which correspond with that last described, have been given the same reference numerals with the addition of a prime. When the member 48' is slotted as described and as shown in Figs. 11 and 12, the vertical wall 56 will abut the end of the composite vertical member of truss 7 and the two faces 57 will abut the outer vertical faces of angle irons 13. The packing 52' in member 48', when compressed by tightening of bolts 53', will seal the joint between these faces 56 and 57 and the adjacent parts described.

All the forms of the invention described utilize a crowned sealing member having a flat, marginal rim for engaging the floor plates and, within the recess bounded by said rim, packing material, which is retained by a thin plate at the base of the recess and adapted to cover a hole or pocket between two floor supports and provide a leak-tight joint between the floor plates above the hole or pocket.

What is claimed is:

1. In a tray floor construction for a bubble tower, a pair of floor supports located with an end of one in proximity to a side of the other with a space therebetween, a pair of thin metal floor plates resting on said supports, each plate having a marginal side portion resting on one support with two adjacent sides in spaced parallel relation and a marginal end portion resting on the other support, a thin flat plate overlying said space and overlapping the side portions of said floor plates, a crowned sealing member having a marginal flat rim to rest on said floor plates and surround the flat plate in spaced relation, said member elsewhere being arched upwardly away from said rim forming a recess within the crowned portion of said member and above said thin plate, packing in said recess, and a bolt passing through the crowned part of said member, the packing, said thin plate and through the first-named floor support for drawing the rim of said member against the floor plates and compressing the packing, forcing it against said thin plate and around its edges, to provide a leak tight closure above said space.

2. In a floor construction for a bubble tower, a pair of floor supports located with one end of one in proximity to a side of the other with a gap between such end and side, the first-named support having a flat top member and a central vertical web beneath it, a pair of floor plates each having a marginal side portion resting on said member with the two adjacent side edges in spaced parallel relation, said plates bridging said space and having ends resting on the second-named floor support, a thin flat plate overlapping the marginal side portions of the floor plates where they span said gap and covering the top of the latter, said thin plate having two ears both resting on said member one on each side of said web, a crowned sealing member having ears and having a marginal flat rim to rest on the floor plates and surround said thin plate and its ears, said member elsewhere being arched upwardly away from said rim into crowned formation forming a recess within the crowned portion of said sealing member and above the thin plate, packing in said recess, and bolts one for each ear on said sealing member and extending through such ears and through the ears on the thin plate and through said first-named member one on each side of said web for drawing said rim against said plates and compressing the packing and forcing it against said thin plate and around its edges to provide a leak tight closure above said gap.

3. In a floor construction for a bubble tower, a pair of floor supports located with one end of one in proximity to a side of the other with a gap between such end and side, the first-named support having a flat bottom member and a web rising vertically from it between the sides thereof, a pair of floor plates, each having a marginal side portion resting on said member one on each side of said web, said plates bridging said space and having ends resting on the second-named floor support, a thin flat plate overlapping the marginal side portions of the floor plates where they span said gap and covering the top of the latter, said thin plate having two ears both resting on said member one on each side of said web, a crowned sealing member having ears and having a marginal flat rim to rest on the floor plates and surround said thin plate and its ears, said sealing member elsewhere being arched upwardly away from said rim into crowned formation forming a recess within the crowned portion of said sealing member and above the thin plate, packing in said recess, and bolts one for each ear on said member and extending through such ears and through the ears on the thin plate and through said first-named members for drawing said rim against said floor plates and compressing the packing on each side of said web, forcing it against said thin plate and around the edges thereof to provide a leak tight closure above said gap.

4. In a floor construction for a bubble tower, a pair of floor supports located with one end of one in proximity to a side of the other with a gap between such end and side, the first-named support having a flat bottom member and a web rising vertically from it between the sides thereof, a pair of floor plates each having a marginal side portion resting on said member one on each side of said web, said floor plates bridging said space and having ends resting on the second-named floor support, a thin flat plate overlapping the marginal side portions of the floor plates

where they span said gap and covering the top of the latter, said thin plate having two ears both resting on said member one on each side of said web, a crowned sealing member having ears and having a marginal flat rim to rest on the floor plates and surround said thin plate and its ears, said member elsewhere being arched upwardly away from said rim into crowned formation forming a recess within the crowned portion of said member and above the thin plate, said sealing plate being slotted between its ears to straddle said vertical web, packing in said

recess, and bolts one for each ear on said member and extending through such ears and through the ears on the thin plate and through said first-named member for drawing said rim against said floor plates compressing the packing and forcing it against said thin plate and around the edges thereof to provide a leak tight closure above said gap.

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No references cited.