Oct. 27, 1936. W. F. SEELIG ET AL 2,059,044

BUBBLE TRAY AND METHOD OF ASSEMBLING SAME

Filed Oct. 3, 1932 2 Sheets-Sheet 1

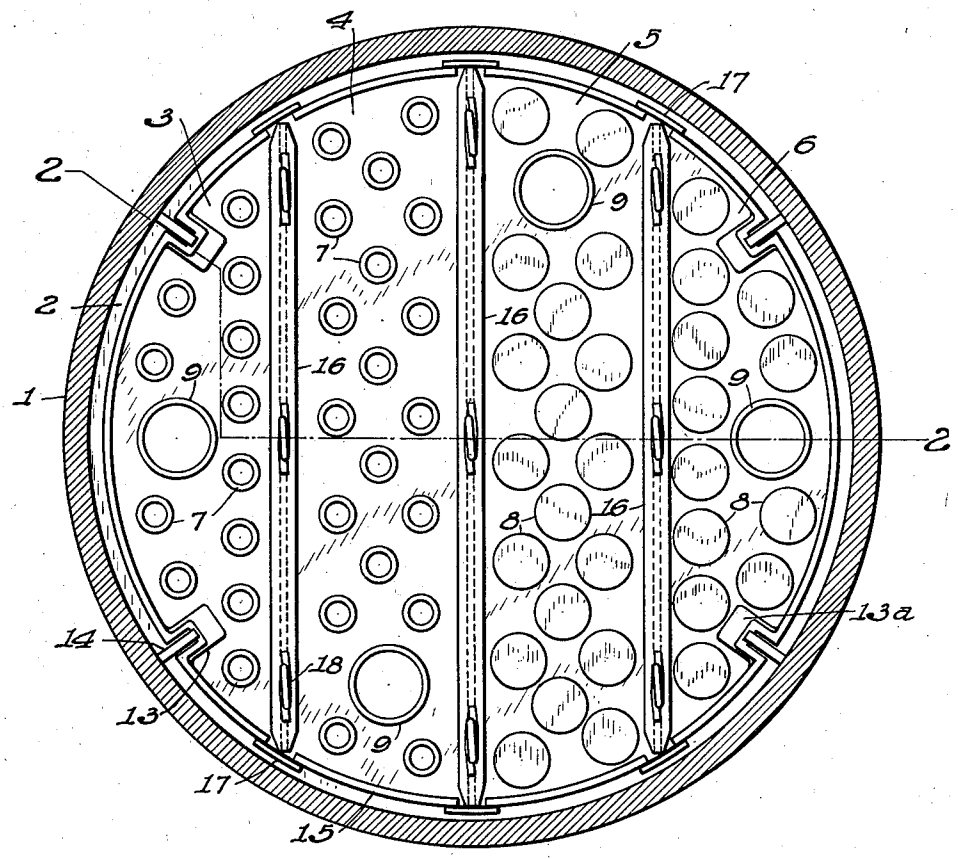


Fig. 1

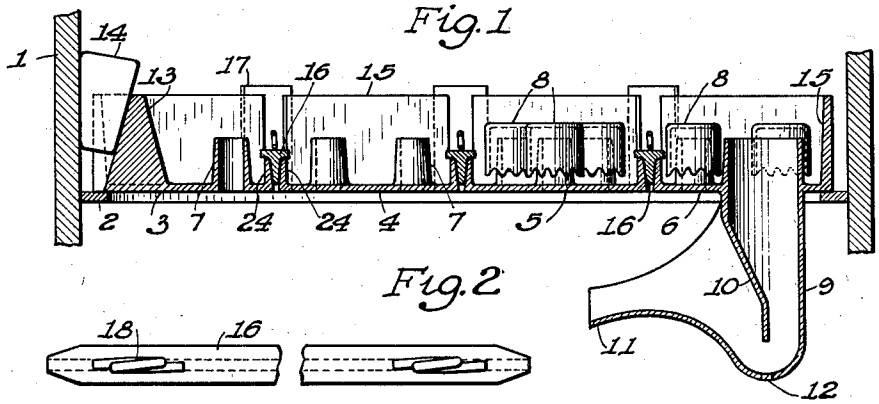


Fig. 2

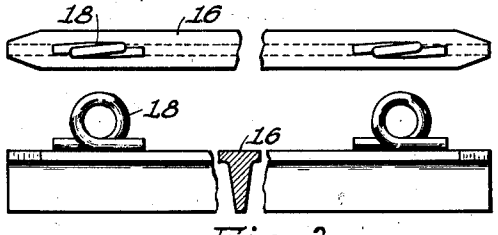


Fig. 3

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BUBBLE TRAY AND METHOD OF ASSEMBLING SAME

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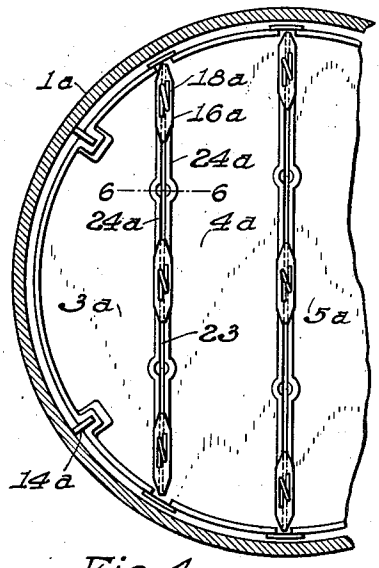


Fig. 4

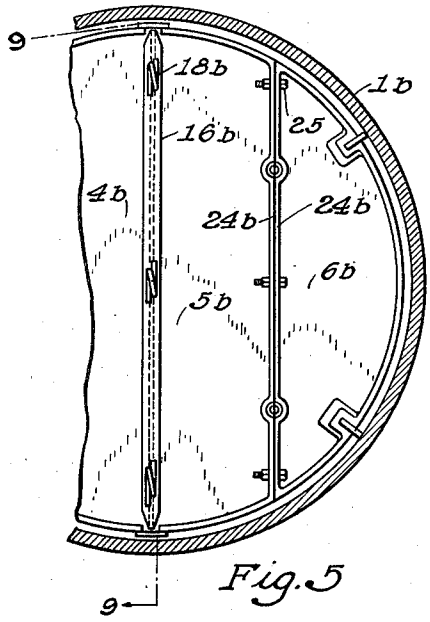


Fig. 5

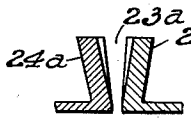


Fig. 6

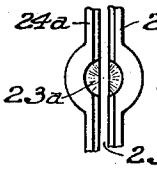


Fig. 7

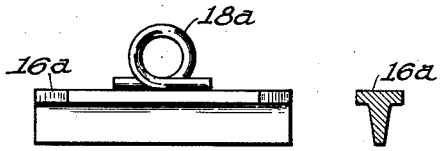


Fig. 8

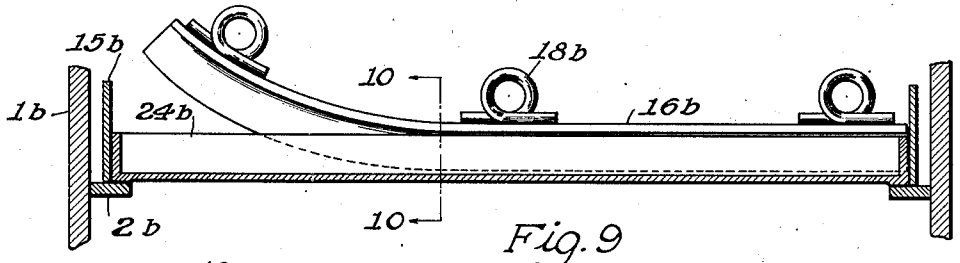


Fig. 9

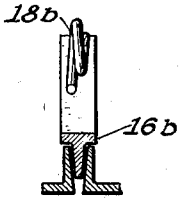


Fig. 10

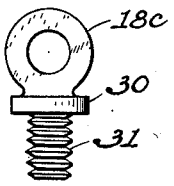


Fig. 11

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Patented Oct. 27, 1936

2,059,044

UNITED STATES PATENT OFFICE

2,059,044

BUBBLE TRAY AND METHOD OF ASSEMBLING SAME

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Application October 3, 1932, Serial No. 635,994

17 Claims. (Cl. 261—114)

This invention relates to bubble towers and more particularly to the bubble trays in said towers.

In the fractionation and rectification of liquids, more especially in the petroleum industry, the use of bubble towers has become increasingly more widespread. Some of the bubble towers used in the industry are of considerable size, towers having an interior diameter of 16 feet or more, being fairly common. While the use of castings and cast trays lends itself readily to the construction of bubble trays and bubble plates, the use of a tray having a diameter of 16 feet or more to a certain extent precludes the use of trays made from a single casting. This is because of the great weight of a single casting of such size and the practical difficulty of installation and removal for cleaning. Consequently, the use of trays made up of sections bolted or permanently fastened together has become widespread. Also in pressure still bubble towers, it is necessary to introduce the trays thru a relatively small manhole to preserve the strength of the tower walls. Trays made from such sections are more readily assembled and cleaned than trays made from a single casting.

Nevertheless, the cleaning of a sectional tray presents considerable difficulty. Immediately after the sections of a bubble plate or tray have been bolted together to form a complete tray the disassembling of the tray presents no great difficulty, but when the tray has been in use in the fractionation of various petroleum mixtures, some of which are quite corrosive and others of which are prone to deposit considerable coke upon various portions of the tower and trays, the disassembling of a tray for cleaning presents quite a problem. In the first place, the vertical distances between trays seldom exceeds 3–4 ft. and while this space is sufficient to permit men to enter into the space between trays, it is not sufficient to permit men to work to the best of their abilities. Thus, in the confined space between trays, it has been found to be exceedingly difficult to remove the bolts and to separate the sections of the tray because both bolts and trays are more or less corroded and sealed together by tarry matters.

Because the time consumed in cleaning an inactive tower is time lost with regard to the effective operation of the tower and because the time spent by laborers in cleaning the tower is a tangible cost, it has frequently been found necessary to smash one or more sections of a tray in order to permit the ready removal and cleaning of the other sections of the tray. This breakage, of course, is a direct loss and requires the replacement of the destroyed section by a new section. Nevertheless, operators in the oil industry have figured that the loss thus incurred was less than the loss incurred by an attempt at removal of all the sections of the tray in complete form.

Our invention has for one of its objects a method of installation of trays and a construction whereby trays may be installed in such a fashion that the sections may readily be removed without necessitating breakage of one or more of the sections. A further object of our invention is the speedy removal of the sections in order that the trays may be disassembled and cleaned with a minimum loss of time. Other objects will be apparent as our description proceeds.

For a clearer understanding of our invention reference may be had to the accompanying drawings in which Fig. 1 shows a plan view of one type of our improved sectional bubble tray; Fig. 2 shows a vertical section of said tray taken along the lines 2—2; Fig. 3 shows a detailed plan side and cross-sectional view of one type of wedge-shaped spacing element employed in our invention; Fig. 4 shows a plan view of a modified type of assembly of sectional bubble tray; Fig. 5 shows a different modification of an improved type of sectional bubble tray; Fig. 6 shows a cross section of an inverted conical wedge pocket taken along lines 4—4; Fig. 7 shows a plan of said wedge pocket; Fig. 8 shows a detailed drawing of the wedge-shaped spacing elements, as shown in less detail in Fig. 4; Fig. 9 shows a diagrammatic side view of the wedge-shaped spacing element shown in less detail in Fig. 5; Fig. 10 shows a sectional view of a partially removed wedge-shaped spacing element as it would appear from a section taken along the lines 10—10; Fig. 11 shows a modification of an eye-element which may be employed in lieu of the welded eye element shown elsewhere.

With more particular reference to the drawings, reference number 1 represents the walls of a bubble tower. 2 represents an annular horizontal flange connected to the walls of the tower and adapted to furnish supporting means for the bubble tray assembly. 3 and 6 represent segmental outer sections of the bubble tray and 4 and 5 represent inner sections of the bubble tray. Each of the sections 3, 4, 5 and 6 is supplied with vapor risers 7 and bubble caps 8. Each of the sections, moreover, is supplied with a liquid downcomer 9 which may be of any desired type but which we have shown more particularly in Fig. 2 as being of the gooseneck variety having an inwardly and downwardly directed web 10 for somewhat constricting the area of the column of liquid near the bottom portion of the downcomer; the downcomer also being provided with an extended lip 11 and, if desired, an orifice 12, the function of which is to permit a constant flow of a small volume of liquid to avoid the accumulation of coke or tar at the lower extremity of

the downcomer. It will be apparent that any desired type of downcomer may be employed and that any desired number of downcomers may be supplied on each section of the bubble tray. It will also be understood that one or more of the downcomers 9, as shown in Fig. 1 of the drawings, may be capped with a capping element (not shown) in order that a lesser number of downcomers may be utilized on a given tray. It will also be understood that any desired type of vapor riser and bubble cap may be employed since neither the type of vapor riser, bubble cap nor liquid downcomer form any essential part of our invention.

At a plurality of desired points around the periphery of the bubble tray the sections of the tray may be provided with wedge slots 13*a* formed by vertical flange or web 13, the outer surfaces of which are downwardly inclined from the vertical to afford a seat for the wedge elements 14. It is apparent that both the wedge pockets and wedge elements are of diminishing size from top to bottom. Elsewhere around the periphery of the sections of the bubble tray the tray is provided with an upturned flange 15 which functions as a retaining wall for the liquid to be maintained on the tray. Disposed between adjacent edges of contiguous sections of the tray are wedge-shaped spacing elements 16 which, in the modification in Fig. 1, are disposed to cover the entire space between adjacent sections of the tray. To permit the ready insertion of these spacing elements we have found it desirable to break the continuity of the retaining wall 15 and to provide auxiliary backing plates 17, as shown in Figs. 1 and 2.

The wedge-shaped spacing elements 16 are provided with one or more eye rings 18 which may be suitably welded as shown in Fig. 3 of the drawings. It will be apparent from Fig. 2 that the wedge-shaped spacing elements 16 are adapted to be inserted between the upturned flanges 24 on adjacent edges of contiguous sections of the tray. It is also apparent that the wedge-shaped elements being in general T-shaped in cross section and having the leg thereof wider at the top than at the bottom, function effectively in filling the space between adjacent flanges 24, the surface of which is inclined so as to form a notch which is wider at the top than at the bottom.

Fig. 4 illustrates a modified type of construction in which relatively short wedge elements 16*a* are inserted at a plurality of places between adjacent sections of the tray. The interstices 23 between the several wedge-shaped elements may be filled by any suitable calking or packing, such as asbestos rope. This modification also permits the use of inverted conical wedge pockets 23*a* into which any suitable tool may be inserted for assisting in the separation of the said sections.

A further modification of our invention is illustrated in Fig. 5 which shows the possibility of employing a single wedge-shaped spacing member 16*b* while bolting the remaining adjacent sections of the trays in the prior art fashion.

A further modification of our construction is shown in Fig. 9 in which the wedge-shaped spacing member 16*b* may be of relatively soft steel which may be removed from between adjacent sections by lifting and peeling back the element, as shown in Fig. 9. It is, of course, obvious that the eye members on the various types of wedge-shaped spacing elements may be welded or the alternative type shown in Fig. 11 may be screwed into tapped and threaded holes in the spacing elements.

In assembling our improved tray we have found it advantageous to place the sections of the tray in such a manner as to rest upon the supporting flange 2 in normal and contiguous fashion. We thereupon insert between the flanges 24 of adjacent trays spacing elements 16 and tamp these spacing elements into place. We next calk any open space between the sections and the space between the wall of the tower and upturned flanges 15. A suitable calking material we have found to be asbestos rope. When the tray is thus assembled and calked we drive into position the peripheral wedges 14. When this has been accomplished the tray is firmly in place and ready to function as readily as though the prior practice of bolting the sections together had been employed.

When it is desired to unassemble the tray for cleaning or other purposes, the wedge-shaped spacing member between adjacent sections may readily be lifted by means of the eye member, thus providing a free space into which the adjacent sections may be moved. Even though stuck to the walls because of an accumulation of tar, the peripheries of the elements may be separated from the wall of the tower by means of further driving home the wedges 14. The sections of the tray are thus properly loosened and may be individually lifted out for cleaning or for any desired purpose.

This mode of assembly and removal we have found to be attended by the elimination of breakage of one or more of the sections in order to unseal the sections when coked together. We have also found that a considerable saving in time is effected with the employment of less needless labor and the consumption of less valuable time when the tower might otherwise be in operation. Thus we have found that in a tower having an internal diameter of 6 ft. and equipped with 12 trays a saving of time in removing the trays under our method is upwards of five hours. It will be apparent, therefore, that we have invented a novel construction and process of assembling bubble trays.

Since many modifications of our invention may be made without departing from the spirit of our invention we desire to be limited only as we have limited ourselves in the appended claims.

We claim:

1. In a bubble tower a bubble tray formed of a plurality of sections and means for assembling the sections in position to form a complete tray, said means comprising readily removable wedge elements interposed between contiguous edges of the sections.

2. In a bubble tower a bubble tray formed of a plurality of sections and means for assembling the sections in position to form a complete tray, said means comprising readily removable wedge elements interposed between contiguous edges of the sections, said wedge elements being provided with means to facilitate lifting of the elements when it is desired to unassemble the tray.

3. In a bubble tower a bubble tray formed of a plurality of sections and means for assembling the sections in position to form a complete tray, said means comprising readily removable wedge elements interposed between contiguous edges of the sections, said wedge elements being provided with eyes to facilitate lifting and removal of the

wedge elements when it is desired to unassemble the tray.

4. The combination such as is claimed in claim 1 in which the wedge element comprises a metallic strip T-shaped in cross section, the leg of the T being wedge-shaped.

5. The combination such as is claimed in claim 1 in which the wedge element comprises a metallic strip of sufficient length to cover the space between contiguous edges of adjacent sections, and T-shaped in cross section, the leg of said T being wedge-shaped in cross section.

6. The combination such as is claimed in claim 1 in which the wedge element comprises a metallic strip of sufficient length to cover the space between contiguous edges of adjacent sections, and T-shaped in cross section, the leg of said T being wedge-shaped in cross section, said metallic strip being provided with an eye to facilitate lifting the strip.

7. In a bubble tower a bubble tray formed of a plurality of sections and means for assembling the sections in position to form a complete tray, said means comprising readily removable wedge elements interposed between contiguous edges of at least two of the sections.

8. In a bubble tower an annular flange on the inner surface of the wall of the tower, a bubble tray adapted to rest on said annular flange, said tray being composed of a plurality of sections, each of said sections having a relatively high vertical flange at that edge which is adapted to be placed adjacent the tower wall and having a relatively lower vertical flange at that edge which is adapted to be placed next to the obverse edge of the adjacent section, the extreme face of said relatively lower vertical flange deviating slightly from the vertical to permit co-operation with a wedge-shaped element and with the obverse face of the flange on the adjacent section, a readily removable wedge-shaped spacing element adapted to be wedged between the relatively lower flanges of adjacent sections.

9. In a bubble tower an annular flange on the inner surface of the wall of the tower, a bubble tray adapted to rest on said annular flange, said tray being composed of a plurality of sections, each of said sections having a relatively high vertical flange at that edge which is adapted to be placed adjacent the tower wall and having a relatively lower vertical flange at that edge which is adapted to be placed next to the obverse edge of the adjacent section, the extreme face of said relatively lower vertical flange deviating slightly from the vertical to permit cooperation with a wedge-shaped spacing element and with the obverse face of the flange on the adjacent section, a readily removable wedge-shaped spacing element adapted to be wedged between the relatively lower flanges of adjacent sections, said wedge-shaped spacing element being provided with eye-members to facilitate ready lifting of the element when it is desired to disassemble the bubble tray.

10. In a bubble tower an annular flange on the inner surface of the wall of the tower, a bubble tray adapted to rest on said annular flange, said tray being composed of a plurality of sections, each of said sections having a relatively high vertical flange at that edge which is adapted to be placed adjacent the tower wall and having a relatively lower vertical flange at that edge which is adapted to be placed next to the obverse edge of the adjacent section, the extreme face of said relatively lower vertical flange deviating slightly from the vertical to permit cooperation with a wedge-shaped spacing element and with the obverse face of the flange on the adjacent section, a readily removable wedge-shaped spacing element adapted to be wedged between the relatively lower flanges of adjacent sections, said wedge-shaped spacing element being provided with eye-members to facilitate ready lifting of the element when it is desired to disassemble the bubble tray and other wedge elements adapted to be inserted between the wall of the tower and the relatively high vertical flanges of the tray sections.

11. In a fractionating tower, a tray provided with means for effecting gas and liquid contact thereon, said tray having an upwardly extending rim around the periphery thereof, means for supporting said tray in said tower and means for wedging the rim of the tray adjacent the wall of the tower, said means comprising wedge-shaped blocks placed at a plurality of points around the periphery of the tray.

12. In a bubble tower, a bubble tray having an upwardly extending rim around the periphery thereof, means for supporting said tray in said tower and means for wedging the rim of the tray firmly in place and adjacent the wall of the tower, said means comprising wedge-shaped blocks placed at a plurality of points around the periphery of the tray.

13. In a bubble tower, a bubble tray having an upwardly extending vertical flange around the periphery thereof, means for supporting said tray in said tower and means for wedging the said flange of the tray firmly in place and adjacent the inner wall of the tower, said means comprising wedge-shaped blocks placed at substantially equal distances apart and at a plurality of points around the periphery of the tray.

14. In a bubble tower, a bubble tray having an upwardly extending flange around the periphery thereof, an annular supporting ledge on the inner wall of the tower and means for wedging the said flange of the tray adjacent the inner wall of the tower and downwardly against the annular supporting ledge, said means comprising wedge-shaped blocks placed at a plurality of points around the periphery of the tray.

15. In a bubble tower, a bubble tray having an upwardly extending rim around the periphery of the tray, said rim at a plurality of points having inwardly and upwardly inclined faces which cooperate with the inner wall of the tower to form wedge-shaped recesses and wedge-shaped blocks adapted to be inserted into said recesses for holding the rim of the tray firmly adjacent the wall of the tower.

16. In a fractionating tower, a horizontal fractionating plate comprised of a plurality of contiguous sections the opposing faces of which deviate slightly from the vertical to form a wedge-shaped recess and a readily removable spacer member shaped to conform to said recess and adapted to be wedged between adjacent sections to facilitate dismembering said plate.

17. In a fractionating tower, a tray provided with means for effecting gas and liquid contact thereon, means for supporting said tray in said tower and means for wedging the rim of the tray adjacent the wall of the tower, said means comprising wedge-shaped blocks placed at a plurality of points around the periphery of the tray.

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