Oct. 19, 1943. E. L. McCARTHY 2,332,243

MANWAY SYSTEM FOR MULTIPLE PLATE COLUMNS

Filed April 27, 1942

Fig. 1.

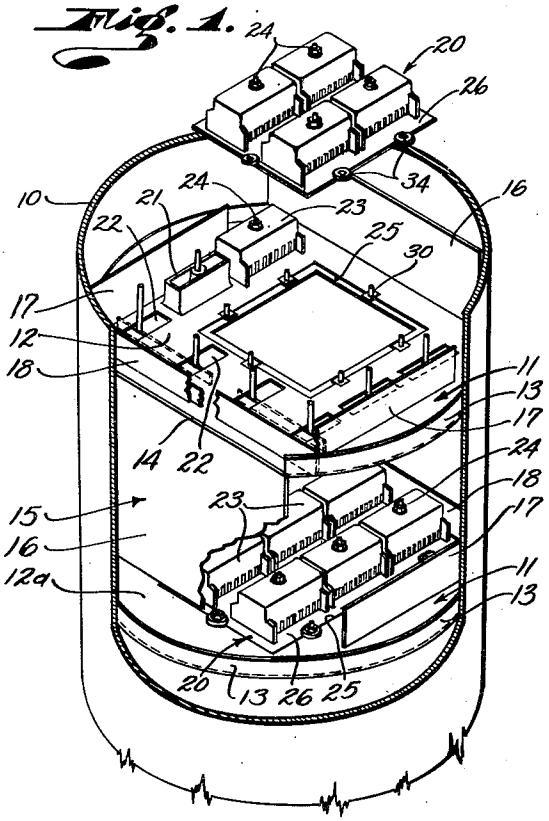
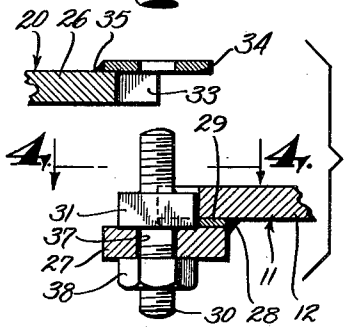


Fig. 3.



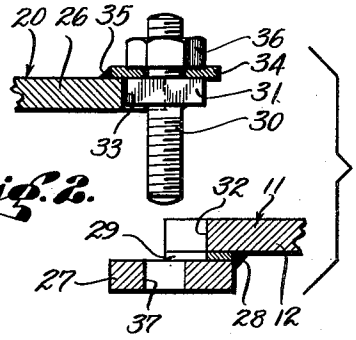


Fig. 2.

Fig. 5.

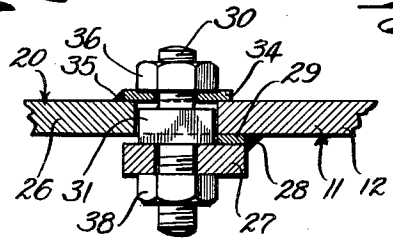
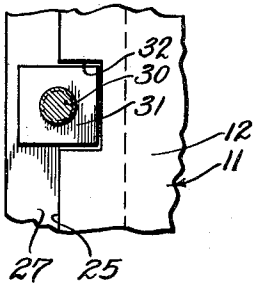


Fig. 4.



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MANWAY SYSTEM FOR MULTIPLE-PLATE COLUMNS

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4 Claims. (Cl. 261—114)

This invention has to do generally with multiple tray columns of the type used for liquid-vapor fractionation, distillation, absorption, and like purposes, and relates particularly to improvements in cover mountings for tray-contained man-ways whereby the interior of the column may be made more conveniently accessible for cleaning or inspection of any or all of the individual trays.

Columns of the type to which the invention is generally applicable, comprise a vertically extended shell, frequently of considerable height, containing a series of apertured trays over which and in downward sequence, liquid flows in intimate contact with vapor or gas passing upwardly through the trays. As illustrative, the invention is herein shown and described with reference to bubble cap tray columns, with the understanding however that the present man-way control system is applicable generally to multiple tray columns regardless of the specific form and type of tray used.

Provision for man-ways through the trays is necessitated by the accumulation on the trays of dirt or sediment requiring removal from time to time, or by the desirability for having the trays accessible, without removing them from the column, for inspection and repair or replacement of parts. It is desirable and time-saving for workmen cleaning or inspecting the trays, to be able to reach them by working upwardly, or both upwardly and downwardly, through the man-ways. For example, where it is necessary to inspect only one or more of the lower trays, time and labor required to remove all the trays above, might be obviated were it possible to pass upwardly through the man-ways starting at the bottom of the column. Again, cleaning of all the trays might greatly be expedited were different workmen able to pass both downwardly and upwardly through the man-ways.

In accordance with the invention, the manway closures are attached to the trays by connections that may be released to permit removal of the closures, by manipulation at either the upper or under sides of the trays. Similarly, the connections may be made up or engaged at either side of the trays to secure the closures about the tray openings. Preferably, the closures are made in the form of covers overlying the openings so as to be removable at the top surfaces of the trays, and attached to the trays by threaded bolt connections releasable or engageable at either of the tray sides, as described in the foregoing.

For a more complete understanding of all the various features and objects of the invention, reference may be had to the accompanying drawing illustrative of the invention in one of its typical and preferred forms. In the drawing:

Fig. 1 is an isometric view showing a section of the column containing a pair of trays, a portion of the shell being broken away to expose the trays and certain of the parts, including vapor risers, bubble caps, and one of the man-way covers, being removed to show more clearly the construction;

Fig. 2 is a composite view showing parts of the cover attachment when the cover is removed from below the column tray;

Fig. 3 is a similar view showing the condition of the parts when the cover is removed from above the tray;

Fig. 4 is a fragmentary plan as viewed from line 4—4 of Fig. 3; and

Fig. 5 is a sectional view showing the completely made-up attachment.

Reference first may be had to Fig. 1 as showing a typical bubble tray column embodying the invention, it being understood of course that the specific form and details of the column proper are illustrative only and that the invention is equally applicable to other column and tray designs. The column comprises the usual shell 10 containing a vertical series of trays, generally indicated at 11, it being understood that the column may be of extended height and contain a considerable number of trays. Also it may be explained, without necessity for specific illustration, that man-ways may be provided at the top and bottom of the shell 10 to permit access into the shell above its uppermost tray and below its lowermost tray.

Each of the trays 11 comprises a horizontal plate 12, the rim 13 of which is applied to the shell 10 except at one side of the column where the plate edge terminates along a chordal line 14 to provide an overflow space permitting passage of liquid downwardly to the plate next below. Such overflow occurs through a down spout, generally indicated at 15, formed by the shell and a vertical plate 16 attached to the tray plate 12 and extending transversely to the wall of the shell. The bottom of plate 16 is spaced above the surface of the plate 12a below, so that the liquid overflowing through the down spout is permitted to flow across the plate onto which it is delivered, to a similar down spout located at the opposite side. The liquid flows across the trays between plates 17, and overflows weirs 18, the height of which may be predetermined or ad-

justed to maintain the desired depth of liquid on the trays.

Gas or vapor rising within the column is brought into intimate contact with the downflowing liquid by means of the tray-carried bubble cap assemblies, generally indicated at 20, each comprising a vapor neck or riser 21 placed over an opening 22 in the tray, and a cap 23 overlying the riser. The cap and riser assemblies are retained in position by bolt connections 24 with the plates extending up through the risers and the tops of the bubble caps. Each plate contains a man-way opening 25 normally closed by a cover 26 which may carry a bubble cap assembly, as illustrated by the elevated cover appearing in Fig. 1. As will be understood, by removal of the covers 26, access may be had to all locations within the column for cleaning or inspection of the trays.

The invention is more particularly concerned with the man-way cover mountings or attachments to the trays, as specifically shown in Figs. 2 to 5. Each of the covers 26 is shown to be square or rectangular in shape and to be received within a correspondingly shaped opening 25 in the tray. The plate is vertically supported on a frame 27 welded to the underside of the tray, as at 28, with predetermined spacing therefrom as provided by a filler section 29. The threaded connection between the cover and the tray comprises a bolt 30 having intermediate its ends a square upset 31 adapted to be received within notches 32 and 33 in the opposed edges of the tray and cover, respectively. When the connection is fully made up, as shown in Fig. 5, the upper portion of the bolt 30 extends through a washer 34 welded at 35 to the top surface of the cover about the notch 33. Nut 36 thus secures the cover to the tray from above, washer 34 being considered a portion of the cover. The lower portion of the bolt is dropped through an opening 37 in the frame 27 opposite notch 32. Nut 38 on the lower end of the bolt secures the cover to the tray from below, the frame 27 being considered a part of the tray.

In the operation of assembling and securing the man-way connections from below the tray, see particularly Fig. 2, the bolt 30 is inserted upwardly through the washer 34 with the bolt turned to a position such that the square upset 31 fits into the notch 33 in the man-way cover. Nut 36 is then turned on the bolt to a position of tight engagement against washer 34, causing the upset 31 to be brought tightly up against the bottom surface of the washer. After all the bolts are similarly applied to the cover, the latter may be lowered from below the tray into seating position on the frame 27. The bottom nut 38 then is applied to the bolt and tightened against the undersurface of the frame piece. As will be understood, the confinement of the upset 31 within notches 32 and 33 prevents rotation of the bolt.

The connections may be assembled and the cover applied from above, by first inserting the bolt down through the hole in the frame 27, with the upset 31 received within the plate recess, and threading the nut 38 upwardly against the bottom surface of the frame, all as shown in Fig. 3. The cover then may be placed down about the upper end of the bolt and nut 36 finally applied to complete the joint, as shown in Fig. 5.

The man-way cover may be removed from below the tray by taking off nuts 38 and lifting out the studs with the cover, as illustrated by Fig. 2. In removing the cover from above, nuts 36 are taken off the bolts and the cover raised to slide the washers 34 over the studs being left bolted to the frame 27. Placement of the upsets 31 within the cover and tray recesses prevents rotation of the bolts whether the cover be removed from below or above the tray.

In Fig. 1 it will be observed that the specific openings 25 and plates 26 shown, are rectangular in shape, and that the width of each plate (across the bubble caps) is substantially less than its length (longitudinally of the bubble caps). Consequently, it is apparent that the plate openings 25 can pass the removed covers and their attached bubble caps and vapor necks, by up-ending the plate assemblies and passing them through the openings with the short dimensions of the covers extending within the long dimensions of the plates. In this manner the cover assemblies may be removed from or put into the column without disturbing the plates.

I claim:

1. In a column of the character described, a vertical series of plates each having a man-way formed by an opening in the plate, covers placed over said openings, bubble caps and vapor necks carried by said plates and covers, and connections rigidly attaching said covers to the plates, said connections being releasable from either the top or bottom sides of the plates to permit removal of the covers from said openings.

2. In a column of the character described, a plate having a man-way formed by an opening in the plate, a closure for the opening and having its top surface disposed substantially in the plane of the top surface of the plate, bubble caps and vapor necks carried by said plate and closure, and connecting means rigidly attaching said closure to the plate, said connecting means being releasable from either the top or bottom sides of the plate to permit removal of the closure from said opening.

3. A column plate assembly of the character described, comprising a horizontally extending plate, a man-way closure covering a correspondingly shaped opening in the plate and having its top surface in substantially the plane of the top surface of the plate, bubble caps and vapor necks carried by said plate and cover, and means accessible between said bubble caps connecting said closure to the plate, said connecting means being releasable from either the top or bottom sides of the plate to permit removal of the cover from said opening.

4. A column plate assembly of the character described, comprising a horizontally extending plate, a rectangular man-way closure covering a correspondingly shaped opening in the plate and having its top surface in substantially the plane of the top surface of the plate, bubble caps and vapor necks carried by said plate and cover, and means accessible between said bubble caps connecting said closure to the plate, said connecting means being releasable from either the top or bottom sides of the plate to permit removal of the cover from said opening, the plate opening being sufficiently large to pass the removed closure and the vapor necks and bubble caps carried thereby.

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