July 31, 1945. P. LAMBERT ET AL 2,380,852

FRACTIONATING PLATE CONSTRUCTION

Filed June 22, 1942

Fig. 1.

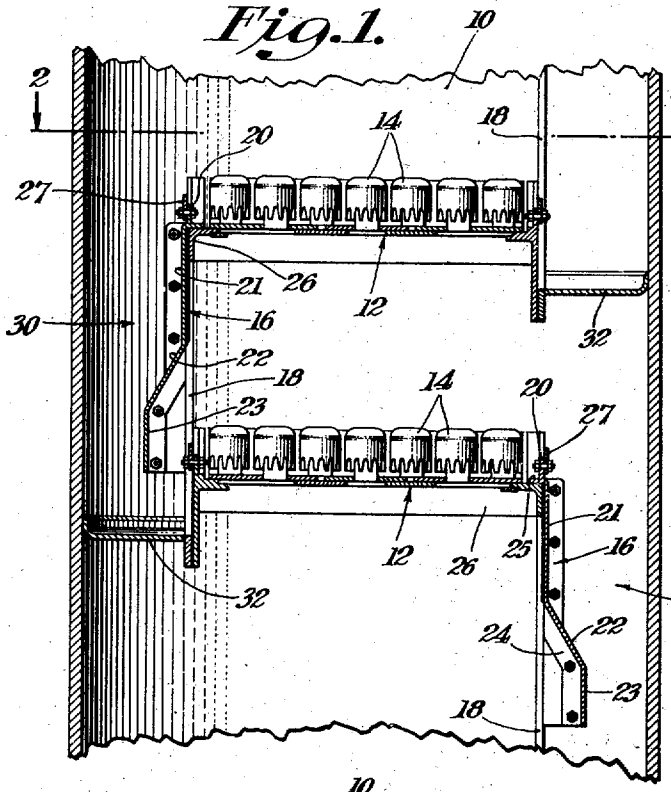


Fig. 3.

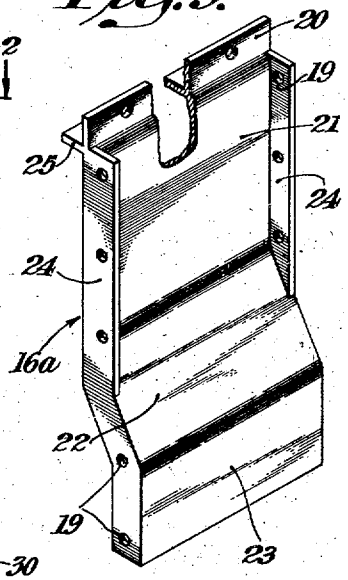


Fig. 4.

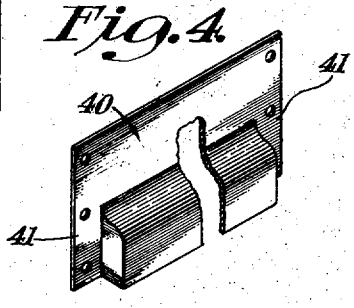


Fig. 2.

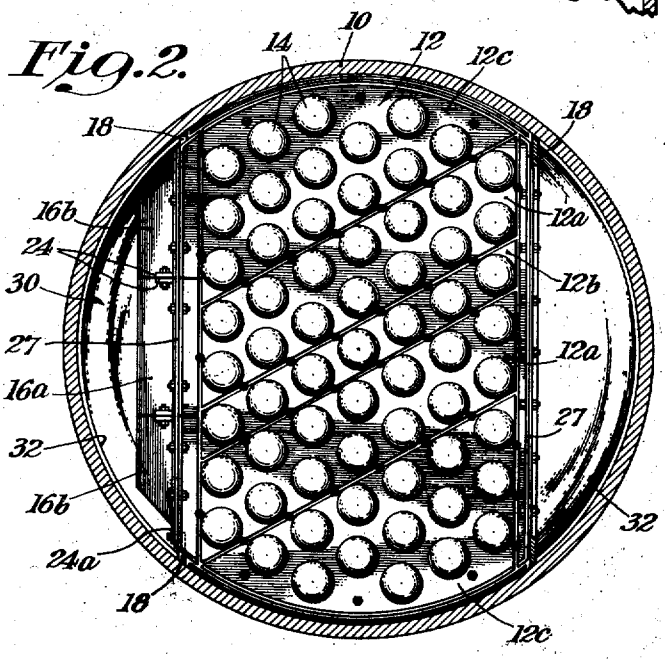
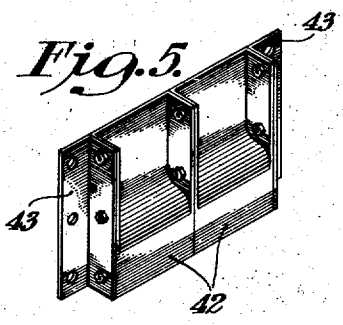


Fig. 5.



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FRACTIONATING PLATE CONSTRUCTION

Pierre Lambert, New Rochelle, Ralph H. Riemenschneider, Pleasantville, and John A. Gibb, Northport, N. Y., assignors to The Lummus Company, New York, N. Y., a corporation of Delaware

Application June 22, 1942, Serial No. 447,948

4 Claims. (Cl. 261—114)

This invention relates to a fractionation apparatus and more especially to an apron type downpipe for discharging liquid from a bubble deck in a distillation column.

The principal object of this invention is to provide a simplified construction of bubble plate downcomer for distillation columns, down which the liquid can flow wthout eddies or surge and with a smoothness such that foam will not form and the vapors will be released.

A further object of the invention is to provide an improved form of bubble plate construction for a distillation column in which a downpipe apron is provided in lieu of the conventional downcomer pipes to reduce pressure drop between plates and to provide adequate liquid flow area.

A still further object of the invention is to provide a series of standard forms of apron downpipe units for large distillation columns in which similar units can be used on substantially all sizes of columns.

Further objects and advantages of the invention will appear from the following description of a preferred form of embodiment thereof taken in connection with the attached drawing illustrative thereof, and in which:

Fig. 1 is a substantially vertical section through a fractionating column showing the location of adjacent bubble plates and the arrangement of the downpipe apron;

Fig. 2 is a horizontal section taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is a perspective view of the downpipe shown in Fig. 1, and

Figs. 4 and 5 are perspective views of modified forms of apron downpipes.

In accordance with the preferred form of embodiment of the invention, the column or tower 10 is a typical fractionating column and is provided with a series of transverse bubble trays 12 having a series of bubble caps 14, through which the ascending vapors pass, such trays being adapted to carry a body of liquid extending above the bottoms of the caps as the vapor seal. While the bubble trays 12 may be of any desired type, we particularly prefer to use and have shown a form of construction in which the bubble cap tray is formed in polygonal sections generally indicated at 12a, 12b, and 12c, such sections being readily formed by casting and being adapted to support the necessary bubble caps. This construction is of particular benefit with large trays where it is impractical to cast the entire tray in one piece. This is described more particularly in the copending application of John A. Gibb, Serial Number 404,796, filed July 31, 1941.

With a construction of this type, it is necessary to provide for the continued movement of the liquid downwards through the column as the vapors pass through the bubble caps on each deck, and for this purpose, we prefer to use an apron form of downpipe generally indicated at 16, which is adapted to be sealed to the upper part of the deck 12 and to the vertical sides of the column. For the side seals, due to the special construction of our apron downpipe, we are able to use vertical strips 18, which are suitably welded to the column as shown in Fig. 2, such strips extending laterally inward. They are suitably provided with bolt holes, to which the sides of the downflow apron 16 can be attached by suitable bolts extending through the bolt holes 19.

With the larger columns, it is desirable to build the downflow apron in sections, which are as near standard as possible, so that the minimum pattern expense is involved, and for this purpose, we may provide standard inside and standard outside units as shown at 16a and 16b in Fig. 2.

A typical inside downflow apron unit is particularly shown at 16a in Fig. 3, such unit being provided with an upstanding weir supporting portion 20, an upper apron section 21, a central offset section 22, and a lower apron section 23, the offset amount being sufficient to clear the subjacent tray to provide the maximum amount of bubble caps thereon.

It will be noted that the inside apron downpipe unit 16a also is provided with the laterally projecting side flange portions 24, by which it is made liquid-tight to an adjacent portion, and it is also provided with a supporting flange 25 which rests on the bubble cap support channel 26 as shown in Fig. 1. The weir supporting flange 20 is provided for carrying the weir plate 27, which may be of a desired height to provide the necessary liquid level on the deck.

The outside downpipe sections 16b adjacent to the section 16a are preferably identical except that the vertical flange portions 24a on the left-hand and right-hand outer edges, respectively, project from the plane of the apron rather than at right angles to engage the vertical plate 18, by which they are sealed liquid-tight to the column.

The resulting construction provides a liquid downflow section generally indicated at 30 in the column which, at the upper part of the plate, is of the maximum desired cross-section so that there is a relatively low velocity of the liquid, and there can be the desired release of the vapors

carried thereby. As the liquid passes downward in the section 30, it ultimately engages the offset apron portion 22, but at this point the vapors have been released and the mimimum cross-section at the apron portion 23 is sufficient for the amount of liquid carried.

It is to be noted that a transverse baffle 32 is provided below the edge of the respective downpipes for the purpose of establishing the necessary liquid trap to seal the vapor path.

The construction is particularly of an advantage, in that a tight connection is readily made between the vertical edges of the apron downpipe and the tower on the sides, and between the apron downpipe and the bubble cap along the supporting edge. The construction is readily made of standard size units which are readily used in different size towers, it being necessary with small variations only to change the size of the vertical sealing strips 18.

With some size constructions, it may be sufficient to eliminate the inside sections 16*a*, or it may be appropriate with larger units to include a plurality of the intermediate sections 16*a* as well as the outer sections 16*b* to form the apron downpipe.

It is also possible with this construction to provide the optimum cross-sectional arrangement to meet the conditions of gas entrained in the liquid. Usually it is found preferable to provide a cross-sectional area defined by the lower portion of the downpipe, which is approximately one-half of that defined by the upper portion of the downpipe, for at the lower section the vapor bubbles entrapped in the overflowing liquid are completely free if the velocity of the liquid has been sufficiently low to permit this action.

Modified forms of construction are shown in Figs. 4 and 5, it being noted that in Fig. 4 the apron downpipe 40 is a single unit construction which would be adaptable for small columns and, therefore, is provided with marginal flanges 41, which are directly attachable to the vertical sealing strips 18.

In Fig. 5 the unit sections 42 are similar to those shown in Fig. 3, it being noted that two or more sections may be secured together and attached to the sealing strips 18 by suitable vertical angles 43.

In each case, substantially vertical sealing portions exist on the outermost edges of the apron downpipe so that the seal with the inner wall of the tower is accomplished by engagement with a similar vertical strip. This makes it possible to form the apron downpipe sections externally of the column and have them fit tight when assembled even though they have a downwardly and outwardly extending section to reduce the flow area.

While we have shown and described preferred forms of embodiment of our invention, we are aware that modifications may be made thereto, and we, therefore, desire a broad interpretation of our invention within the scope and spirit of the description herein and of the claims appended hereinafter.

We claim:

1. In a fractionating tower, an apron downpipe construction including a pair of vertical supporting strips spaced around and projecting inwardly from the inner wall of the tower and rigid therewith; an apron body comprising a panel formed of a plurality of sections in edgewise opposition in succession horizontally across the apron and having angular flanges along their opposed edges, each of said sections extending the full depth of the apron body and said body having an upper margin projecting above an edge of a bubble deck to comprise a weir structure, a horizontal supporting flange overlapping the margin of said deck edge, side margins overlapping the said supporting strips, and a portion between said side margins belled toward the adjacent wall of the tower to afford space for a subjacent bubble deck and cap assembly adjacent the lower margin of the apron body; releasable fastening means securing said apron sections together through the said angular flanges thereof; and releasable fastening means securing the apron body, through said side margins thereof, to the said supporting strips.

2. In a fractionating tower, an apron downpipe construction including a pair of vertical supporting strips spaced around and projecting inwardly from the inner wall of the tower and rigid therewith; and an apron body extending downwardly from an edge of a bubble deck and comprising a panel formed of a plurality of sections in edgewise opposition in succession across the apron and having angular flanges along their opposed edges of the sections, each of said sections extending the full depth of the apron and said body having side margins overlapping and secured to the said supporting strips, and a portion between said side margins belled toward the adjacent wall of the tower to afford space for a subjacent bubble deck and cap assembly adjacent the lower margin of the apron body.

3. In a fractionating tower having an upper bubble deck and a lower bubble deck, an apron downpipe construction including a pair of vertical supporting strips spaced around and projecting inwardly from the inner wall of the tower and rigid therewith; an apron body extending downwardly from an edge of said upper deck toward the level of said lower deck and comprising a panel formed of a plurality of plate-like sections in edgewise opposition in succession horizontally across the apron and having angular flanges along their opposed edges and abutting in succession across the apron body, each of said sections extending the full depth of the apron body, and said body having vertically straight side margins overlapping and secured to said supporting strips, and a lower portion between said side margins belled toward the adjacent wall of the tower for clearance from the lower bubble deck and cap assembly; and series of releasable fastening elements respectively securing said side margins to said strips and said abutting flanges to each other, the upper portions of said abutting flanges, located above said belled portion, projecting outwardly toward the wall of the tower for access to the upper fastening elements of the flanges through the space between the apron body and the tower wall, and the lower portions of the flanges, along said belled portion, projecting inwardly for access to the lower fastening elements through the space between the decks.

4. In a fractionating tower having an upper bubble deck and a lower bubble deck, an apron downpipe construction including a pair of vertical supporting strips spaced around and projecting inwardly from the inner wall of the tower and rigid therewith; an apron body extending downwardly from an edge of said upper deck toward the level of said lower deck and comprising a panel formed of a plurality of plate-like sections in edgewise opposition in succession hori-

zontally across the apron and formed with angular flanges along their opposed edges and abutting in succession across the apron body, each of said sections extending the full depth of the apron body and being integrally formed along its upper end with a supporting flange to overlap the adjacent deck margin and with an upper margin projecting above said supporting flange to form a weir construction, said body having side margins overlapping and secured to said supporting strips, and a lower portion between said side margins belled toward the adjacent wall of the tower for clearance from the lower bubble deck and cap assembly; and series of releasable fastening elements respectively securing said side margins to said strips and said abutting flanges to each other, the upper portions of said abutting flanges, located above said belled portion, projecting outwardly toward the wall of the tower for access to the upper fastening elements of the flanges through the space between the apron body and the tower wall, and the lower portions of the flanges, along said belled portion, projecting inwardly for access to the lower fastening elements through the space between the decks.

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CERTIFICATE OF CORRECTION.

Patent No. 2,380,852. July 31, 1945.

PIERRE LAMBERT, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 25, claim 2, strike out the syllable "op-" and insert instead --opposed edges secured together to form a rigid body"; line 28, same claim, strike out "posed edges secured together to form a rigid body"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of November, A. D. 1945.

Leslie Frazer

(Seal) First Assistant Commissioner of Patents.

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