Jan. 3, 1939. J. L. ALLEN 2,142,231

BOILING CAP PLATE FOR FRACTIONATING COLUMNS

Filed Dec. 18, 1936

Fig. 1.

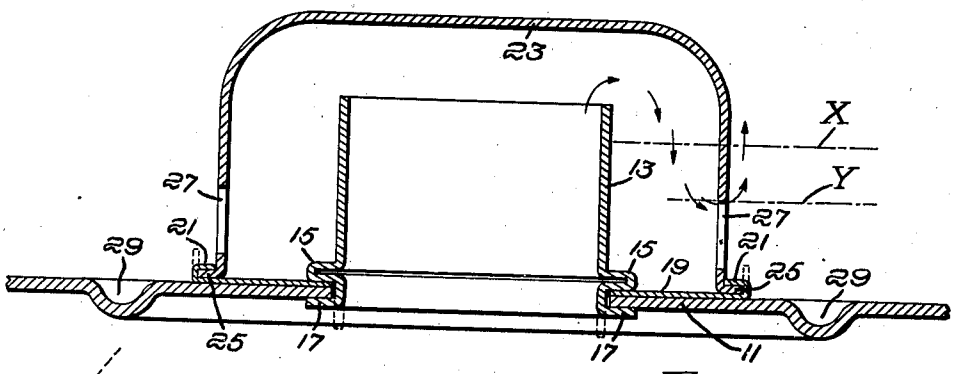


Fig. 2.

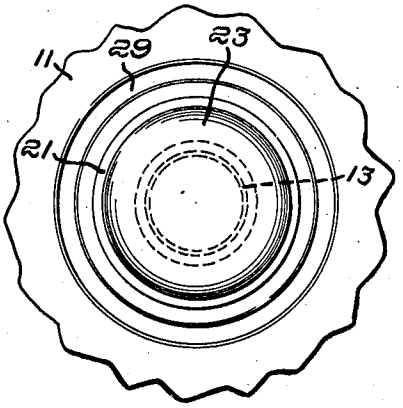


Fig. 5.

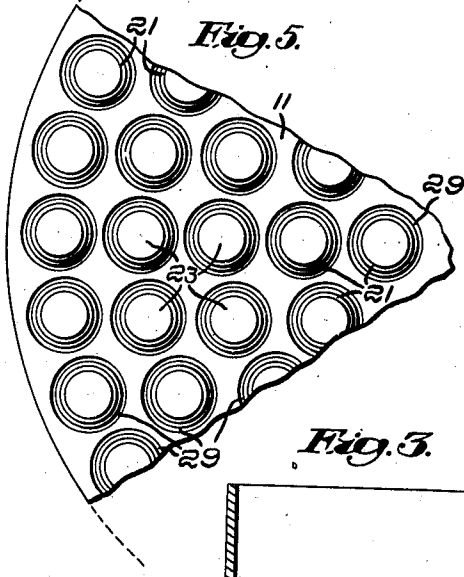


Fig. 3.

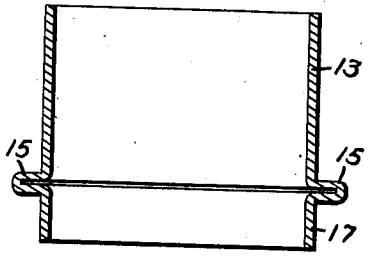


Fig. 4.

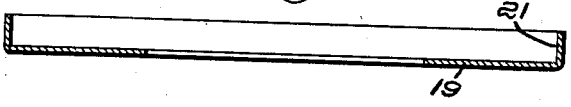
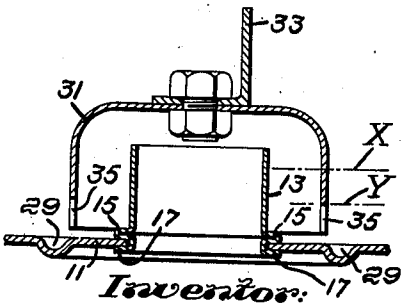


Fig. 6.



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BOILING CAP PLATE FOR FRACTIONATING COLUMNS

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Application December 18, 1936, Serial No. 116,512

2 Claims. (Cl. 261—114)

This invention relates to boiling cap plates for fractionating columns, being concerned more particularly with an improved construction of such a plate by simple methods which render it effective for its designed purpose. Boiling cap plates, which form horizontal liquid carrying subdivisions for the successive chambers of a fractionating column, are provided each with a plurality of chimneys or short standpipes distributed in closely spaced relation over the entire area of the plate. These serve as passages for the vapor from one chamber to the next upper chamber. A covering hood or cap about but spaced from the mouth of the chimney and presenting a vapor passage or passages below the liquid level compels the vapor emerging from the chimney to pass down and thence to bubble up through the liquid before escaping to the next adjacent chamber above. The liquid to be fractionated is supplied to the uppermost chamber of the column and overflows into succeeding chambers below through passages in each plate protected by a weir which maintains a fixed liquid level over the entire plate.

For the designed effective operation of a fractionating column, the chimneys at their points of attachment to the plate present a strictly liquid-tight joint. A critical condition is the depth of the liquid through which the vapor passes, first down inside of and then up outside of the hood. This should be, as nearly as possible, the same for each boiling cap over the entire area of the plate. This depth is fixed by the distance the vapor passages in the hood are submerged below the liquid level. The maintenance of the same vapor pressure within all the boiling caps on each plate is another important condition. This is adversely affected by displacement of the tops of the chimneys with relation to the walls of the hood in different boiling caps on the same plate.

The common method of constructing the plate, with its assembled boiling caps, is first to punch out a multiplicity of openings in the plate designed to carry the chimneys, and then attach the chimneys thereto, after which the hoods are placed in position, either by being attached directly to the plate or by suspension on a suitable support above the chimneys. Both the punching operation and the attachment of the chimneys to the plate tend to set up buckling stresses in the plate which more or less distort it and throw it out of a true plane, so that when assembled with its boiling caps either the liquid depth through which the vapor passes or the vapor pressure within the hood varies with different boiling caps on the same plate.

One effective method of securing chimneys to the plate to provide the required liquid-tight joint may be had by providing a shoulder or flange on the chimney which rests on the marginal edges of the aperture against the upper side of the plate when the chimney is loosely installed therein, and providing furthermore a short skirt on the chimney protruding below the plate. This skirt may then be rolled or crimped over against the under marginal edges of the plate aperture to form a flange and the plate edges squeezed under heavy pressure between the flange thus provided and the chimney shoulder.

This crimping and squeezing action, however, in particular serves to set up stresses in the metal of the plate in and adjacent the area pressed between the flanges on each chimney, which stresses tend to distort and buckle the plate, throwing it out of a true plane. This effect becomes cumulative with the attachment of successive chimneys.

I have found that, by forming corrugations or indentations in portions of the metal of the plate lying between successive chimneys on the plate, buckling strains set up in the boiling cap plate in the course of its construction may be neutralized and the otherwise buckled plate, which would interfere with maintaining the desired conditions referred to when the chimneys are assembled thereon, may be caused to assume such a flat condition that the relationship of each chimney to its hood and of each hood to the liquid level remains uniform.

The invention will be best understood by reference to the following description when taken in connection with the accompanying illustration, while the scope will be more particularly pointed out in the appended claims.

In the drawing:—

Fig. 1 is a cross-sectional elevation of a single boiling cap where the hood is fastened directly to the plate, the adjacent portion of the boiling cap plate with one of the corrugations formed therein being also shown;

Fig. 2 is a plan view of the same on a somewhat smaller scale;

Fig. 3 is a sectional elevation of the chimney before installation on the plate;

Fig. 4 is a sectional elevation of the annular collar employed to hold the hood in place, shown before its installation on the plate;

Fig. 5 in a plan view of a portion of a boiling

cap plate showing the manner in which the boiling caps are distributed thereover; and

Fig. 6 is a sectional elevation, similar to Fig. 1, but showing, on a smaller scale, a boiling cap where the hood is suspended above the chimney.

Referring to the drawing and to the illustrative embodiment of the invention shown in Figs. 1 to 5 inclusive, the metallic boiling cap plate 11, which is usually circular in formation, has formed in it a multiplicity of press-punched, closely-adjacent apertures distributed over its entire area, one for each chimney to be installed. Each chimney 13 is formed from a metallic tubular member (Fig. 3) of an outside diameter fitting the aperture in the plate and having a shoulder 15 formed near its lower end in any suitable manner, as by folding out its walls thereat. Beyond the shoulder is a short skirt or extension 17.

The chimney in this form is placed on the upper side of the plate 11, with its skirt 17 protruding through the aperture (as shown in dotted lines in Fig. 1) and the shoulder 15 resting on the top of an annular sheet metal plate 19, which latter has an inside diameter the same as that of the plate aperture and is provided with an upstanding peripheral rim 21 (Fig. 4 and dotted lines in Fig. 1).

The plate is placed in a press having dies adapted to bend the protruding skirt 17 from the dotted line to the full line position shown in Fig. 1 and over against the lower marginal walls of the plate aperture. As each chimney is installed on the plate 11, heavy pressure is applied, causing the dies to nip and squeeze such walls between the bent over skirt and the portion of the annular plate 19 abutting against the shoulder 15.

After the attachment of the chimneys as described, the hoods are fastened in place. Each hood comprises a dome like top 23 resting on a flanged foot 25 and having sides which are provided with a series of slot-like bubbling openings 27 immediately above the foot but terminating well below the level of the chimney top and below the level of the liquid maintained on the plate. The flange foot on the hood 25 fits between the upright rim 21 and the plate 19, and when placed thereon the rim is bent over the flange 25, from the dotted line to the full line position shown in Fig. 1, and the aligned parts of the rim 21, flange 25, plate 19 and plate 11 are squeezed together under heavy pressure between suitable dies.

The liquid level designed to be maintained by the weir (not shown) is indicated by the dotted line X in Fig. 1, so that the vapor discharged from the chimney escapes, as indicated by arrows, through the bubbling openings 27 and thence to a chimney of the next upper compartment, passing downward through a depth of liquid represented by the spacing between the dotted lines X and Y, the latter indicating the level of the tops of the bubbling openings.

To offset the distortion of the plate 11 heretofore referred to, there is formed one or more indentations in the walls of the plate between adjacent boiling caps, herein in the form of corrugations or grooves. Herein (Figs. 1 and 2) there is shown surrounding each boiling cap a continuous corrugation 29 circular in form and concentric with the chimney and forming a shallow groove in the upper face of the plate 11. These corrugations may be formed in the plate at any suitable stage in the construction of the boiling cap plate, but, in the case of the embodiment illustrated in Fig. 1, for simplicity in manufacture they may be readily formed in the plate simultaneously with the attachment of the hood, in the same press and by the same set of dies as are employed for the purpose of crimping the rim 21 of the annular plate over the flange 25 of the hood.

Such corrugations may be otherwise than continuous and otherwise than circular in form, but the shape illustrated and described lends itself to ease and simplicity in the process of manufacture. These corrugations may be pressed into the boiling cap plate to form a groove on either the upper or lower side of the plate.

In Fig. 5 there is shown a modified form of boiling cap. The chimney 13 is attached to the plate 11 in the same manner as heretofore described, the annular plate 19, however, being omitted. The hood or cap 31, instead of being fastened to the plate 11, is herein suspended from above by suitable supports, such as the angle iron 33, which also acts to support a number of other hoods over the same plate and may be attached to the plate or to the walls of the column. In this case the bubbling slots 35 are formed in the lower marginal rim of the hood, the flange 25 (Fig. 1) being omitted and the rim being spaced from the top of the boiling cap plate 11.

The corrugation 29 is formed in the plate 11 concentric with, and herein somewhat closer to, the chimney 13 than in the case of the construction shown in Fig. 1. While the corrugations may be formed in the plate at any suitable stage in the manufacture of the plate, they may be readily formed simultaneously with the attachment of the chimney, in the same press and by the same set of dies as are employed for crimping the skirt 17 of the chimney over the edges of the plate aperture.

Features of the method employed in the manufacture of the boiling cap plate herein described are separately claimed in my co-pending divisional application, Serial No. 143,304, filed May 18, 1937.

While there is herein shown and described for the purposes of illustration one specific embodiment of the invention and there have been described in detail the steps by which the boiling cap plate is constructed, it is to be understood that such description is illustrative only and that wide variations may be made both in the method of attaching the chimneys, the hoods, and in the form and shape of the corrugations, all without departing from the spirit of the invention.

I claim:

1. A boiling cap plate for a fractionating column having attached thereto and distributed in closely spaced relation over its area a plurality of boiling caps comprising each a chimney mounted over an aperture in the plate, having its walls overlapped and pressed against the underside of the plate, an annular plate mounted on the boiling cap plate and surrounding the aperture, said chimney having its walls also overlapping and pressed against the top of the annular plate, a hood surmounting the chimney having a flanged edge resting on the annular plate, the edges of the latter being overlapped and pressed against the flanged edge of the hood to secure the latter to the boiling cap plate, and means to neutralize buckling strains in the boiling cap plate induced by the pressing together of the latter and the attached parts comprising a corrugation between each adjacent hood.

2. A boiling cap plate for a fractionating column having attached thereto and distributed in

closely spaced relation over its area a plurality of boiling caps comprising each a chimney mounted over an aperture in the plate, having its walls overlapped and pressed against the underside of the plate, an annular plate mounted on the boiling cap plate and surrounding the aperture, said chimney having its walls also overlapping and pressed against the top of the annular plate, and a hood surmounting the chimney having a flanged edge resting on the annular plate, the edges of the latter being overlapped and pressed against the flanged edge of the hood to secure the latter to the boiling cap plate.

JOHN L. ALLEN.