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BELL CAP ARRANGEMENT

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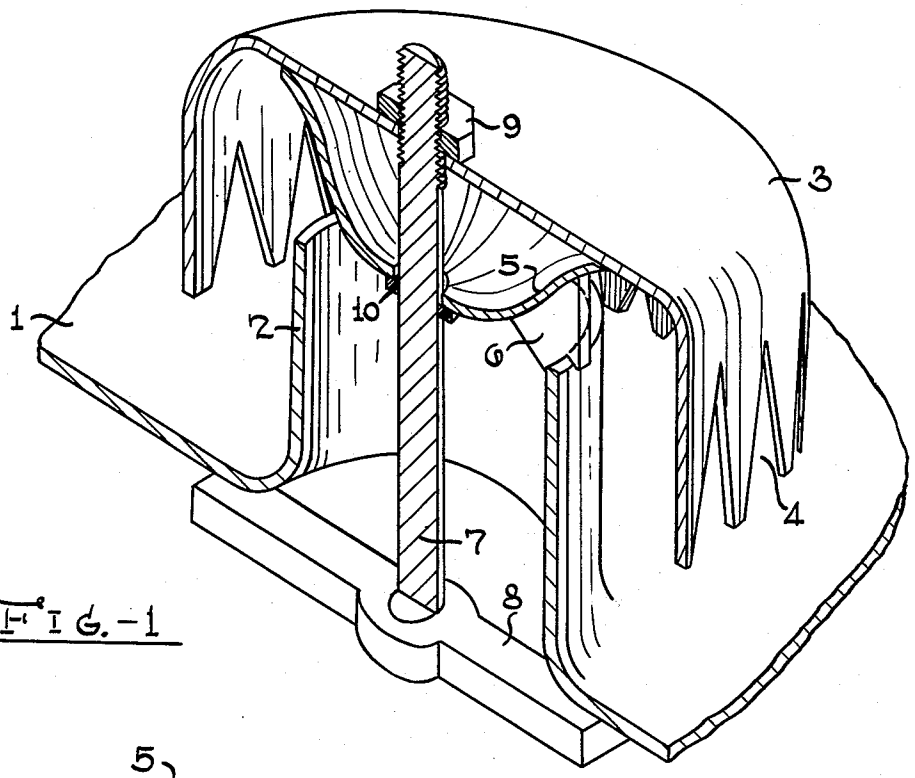
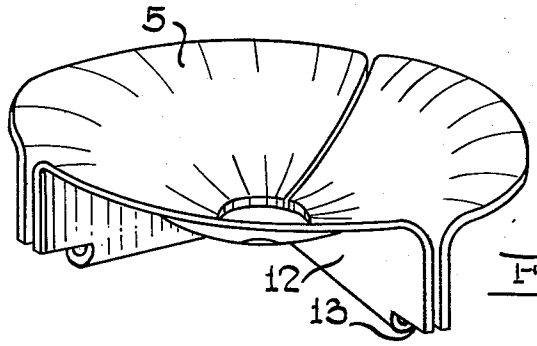
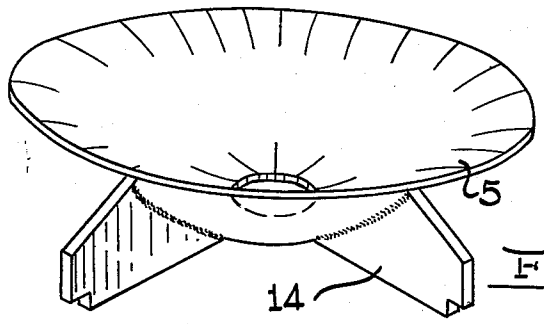


FIG. - 1



FOLDED AND CUPPED

FIG. - 2



CUPPED AND WELDED

FIG. - 3

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BELL CAP ARRANGEMENT

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4 Claims. (Cl. 261—114)

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This invention concerns a novel and improved form of bell cap of the nature used in distillation towers. The invention particularly concerns use of a cup-shaped deflector insert beneath a bell cap member to provide a streamlined vapor passage over the chimney with which the bell cap is employed. The deflector insert is adapted for utilization with conventional types of bell cap constructions, permitting conversion to an improved streamlined flow type of bell cap arrangement.

For many years a desirable form of contacting apparatus has been a tower arrangement in which perforated plates provided with bubble cap members are employed. Such towers are particularly employed in distillation operations involving the contacting of vapors and liquids. The bell type bubble caps are employed to permit the upflow of vapors through the perforated plates referred to, while preventing the downflow of liquid through the bubble cap members. The bubble caps, therefore, provide the function of permitting vapor to pass from a lower plate member through an upper member and through the liquid maintained on the upper plate phase to secure successive vapor liquid contacting.

A wide variety of bubble cap arrangements may be employed to secure the general objectives indicated. In general, however, a typical bubble cap assembly comprises a chimney element extending above each of the perforations of the plates employed. An inverted cup-shaped bubble cap is positioned over this chimney element so as to provide a dependent skirt portion extending below the upper termination of the chimney. Suitable holding arrangements are employed to fix the bubble cap at a specified distance above the chimney in this manner. The skirt of the bubble cap member is slotted or notched along its lower periphery to permit vapors rising upwardly through the chimney to pass outwardly through the slots into the liquid maintained on the plate.

The principal problem in connection with the provision of improved forms of bubble cap elements is concerned with practical limitations of use. For example, it is important that the construction employed be such as to permit convenient removal or servicing of the bubble cap arrangement. A practical difficulty which has been observed is the tendency for carbonaceous or coke-like deposits to form on the threaded holding elements generally employed, so as to complicate or prevent removal of the bubble cap. One of the objects of this invention is to provide a bubble cap arrangement which by its nature will avoid this difficulty caused by deposition of

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carbonaceous deposits on the holding means employed.

It is now generally appreciated that improved tower performance may be obtained by streamlining the flow of vapor upwardly through a chimney in the bubble cap arrangement. A desirable streamlined passage for upflowing vapors may be provided by forming the lower inside surface of the bell cap member in a cup-shaped configuration. This will provide a deflecting surface for upflowing vapors, tending to direct the vapors outwardly over the upper edge of the chimney with a minimum of turbulence. Provision for streamlining vapor flow through a bubble cap, therefore, has the effect of decreasing the vapor pressure drop across the bubble cap arrangement. It is a further object of this invention to provide an improved form of bubble cap arrangement which simply and effectively provides the desired streamlined passage through the bubble cap.

In its simplest form the present invention comprises a deflector insert having a general conical shape. This deflector is to be positioned centrally beneath a bell cap so as to provide deflecting surfaces for the vapor which are inclined upwardly and outwardly toward the chimney element. The deflector can well be designed to include standoff lugs adapted to rest directly on the chimney element. By passing a hold-down bolt through the bell cap and through the deflector to be anchored to the plate on which the bell cap is positioned, the entire arrangement will be held in a fixed position. The invention is of such a nature as to particularly permit modification of existing bubble cap arrangements to incorporate the streamlined vapor flow employed.

The accompanying drawings fully illustrate the present invention:

Figure 1 of the drawings illustrates the integral bubble cap arrangement of this invention in a cross-sectional perspective view;

Figure 2 is a perspective view of one form of deflector element which may be employed in the apparatus of Figure 1, and finally

Figure 3 is a perspective view of an alternative form of deflector insert embodying this invention.

Referring now to Figure 1, the nature and principle of this invention may be understood. A fragmental view of a perforated plate equipped with bell type bubble caps is illustrated. The portion of the plate shown is designated by numeral 1. A chimney element which can simply comprise a cylindrical sleeve 2 is fixed to plate 1 over a perforation cut in the plate. The chimney

element may, if desired, be cast or formed as an integral portion of the plate in the manner particularly illustrated. A bell cap member 3 is fixed above the chimney element and essentially comprises an inverted cup-shaped member. The bell cap is constructed to have a substantially greater diameter than the chimney so that the dependent skirt of the bell cap can extend below the upper edge of the chimney while being displaced from the chimney. A large number of perforations 4 are cut in the lower edge of the bell cap. These perforations may simply consist of elongated slots, but are preferably triangular in configuration, as shown. The slots are cut so as to extend upwardly from the edge of the bell cap to an elevation substantially that of the uppermost part of the chimney element 2.

In accordance with this invention a deflector element 5 is centrally positioned beneath the lower side of the bubble cap 3. As will be seen, deflector 5 is maintained in a clamped relation with the bell cap 3. A number of vertical bracket lug members 6 may be fixed to the deflector 5 adapted to seat on the chimney element 2. For example, three radially disposed bracket lug members 6 may be employed. It is the function of these members to space the deflector 5 and the bell cap 3 with relation to the chimney 2. In this connection, the bracket members are preferably shaped to center the bell cap arrangement as well as to space the bell cap above the chimney. For this purpose each of the bracket members 6 will be notched in the manner illustrated so as to maintain a fixed locked position when the bell cap arrangement is assembled.

A suitable hold-down arrangement is employed to force the bell cap 3 downwardly against deflector 5 which in turn is forced against the top of the chimney 2. For example, a hold-down bolt 7 may be employed. One end of bolt 7 may be fixed in or threaded in a bar member 8 of sufficient length to extend across the perforation of the plate. The other end of the bolt 7 may be threaded to accommodate a nut 9 which may be tightened to fix the entire bubble cap arrangement in a clamped position.

The center opening cut in the deflector 5 to accommodate the hold-down bolt 7 is preferably such as to permit a forced fit of the bolt within this opening. It is practical to accomplish this so as to substantially provide a fluid-tight seal at this point. Alternatively, if desired, a simple form of packing member, or grommet may be employed to prevent passage of vapor upwardly along bolt 7 past the deflector.

In its simplest form the deflector 5 may consist of a conical member providing an inclined surface extending upwardly from the central position of the chimney toward the outer periphery of the bell cap. Somewhat improved streamlined flow will be obtained, however, by particularly shaping deflector 5 to have the curved cup shape illustrated. This shape further minimizes turbulence caused by deflection of vapor from the chimney into the bell cap.

A particular feature of the arrangement described is the fact that the bell cap construction is devoid of any hollow or cup-shaped recesses in which liquid can deposit. Thus the upper portion of bell cap 3 may, as illustrated, constitute a horizontal plate surface. While liquid may condense on the surface during distillation operations, liquid will freely flow downwardly over the edges of the bell cap. Consequently, the threads of bolt 9 can not be plugged by deposition of carbonaceous deposits caused by hold-up of hydrocarbon liquids on the bell cap. This obviously can be furthered, if desired, by somewhat curving the upper surface of the bell cap to facilitate drainage of liquid from the top of the bell cap.

It is apparent that any desired type of standoff arrangement may be employed to perform the function of the bracket 6. For example, if desired, a collar element 10 may be provided on bolt 7 against which the lower portion of deflector 5 may bear. The bracket 6 may in this case be simplified or dispensed with. Tightening of nut 9 will permit fixed clamping of the element in the general manner described. In this case, if desired, a spider or other centralizing spacer may be employed within the chimney 2.

Again the bracket member 6 may be modified or replaced by simple standoff rods which are preferably notched to fit over the upper edge of the chimney tube. These standoff rods being fixed to the deflector 5 will permit clamping of the entire arrangement on tightening of nut 9 in the same manner as that described.

The deflector element 5 may be formed in any desired manner. Thus, if desired, the deflector may be cast or pressed to provide the configuration illustrated. Two particular methods of fabrication are illustrated in Figures 2 and 3. In Figure 2 illustrating the deflector 5, the deflector is essentially formed from a circular sheet of metal. This sheet is pressed to form the cup shape illustrated, at the same time causing folding of the metal at three or more radial portions of the deflector. This will result in the provision of downwardly dependent rib or bracket elements 12. By cutting a notch 13 near the edge of each of these bracket elements, the deflector will be complete and ready for insertion in a bubble cap arrangement in the manner described.

In Figure 3, the deflector 5 is formed by cold pressing or otherwise shaping the circular metal blank employed. The operation is conducted to form this blank into the cup-shaped configuration illustrated. Bracket members 14 may then be welded to the lower side of the cup-shaped deflector to provide the complete deflector element. It is apparent that these or other techniques may be employed to suitably form a deflector for use in this invention.

As brought out, therefore, this invention concerns a novel and desirable form of bubble cap arrangement in which a deflector element is positioned over a bubble cap chimney beneath a bell cap member. The deflector element has a generally conical shape to provide an upwardly and outwardly flaring surface for the direction of vapors upwardly through the chimney and outwardly toward the periphery of the bell cap. In its preferred form the invention concerns the use of this deflector element in combination with a bell cap having a substantially plane surface. The combination of the deflector with a bell cap of this nature permits the desired streamlined direction of vapors referred to without permitting the possibility for hold-up of liquid above the bell cap. It will be observed in this connection that the deflector of this invention is ideally qualified for the conversion of standard bubble cap arrangements to the streamlined type of arrangement. Thus bell caps of the nature referred to are commonly employed at the present time. Inclusion of the deflector element described in conventional bubble cap arrangements may therefore simply be made to provide the benefits of this invention.

What is claimed is:

1. In a bubble cap arrangement comprising a perforated plate, a chimney element surmounting said plate over each of the perforations, and a bell cap member spaced above the chimney, the improvement which comprises: a deflector element adapted to be placed within the bell cap over the said chimney, said deflector being characterized by an inclined surface directed upwardly toward the periphery of the bell cap, standoff elements fixed to the underside of said deflector adapted to seat on said chimney, and means to clamp said bell cap to said deflector and said chimney, whereby said deflector spaces and positions said bell cap with respect to the chimney.

2. The apparatus defined by claim 1 in which the said deflector element has a generally conical configuration.

3. The apparatus defined by claim 1 in which the said deflector element is cup-shaped.

4. An article of manufacture comprising a deflector element for use in bubble cap trays comprising a cup-shaped plate member having a central opening, at least three bracket elements fixed to the lower portion of the said cup-shaped member extending radially from the center of the member, said bracket elements including notched portions adjacent their ends.

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