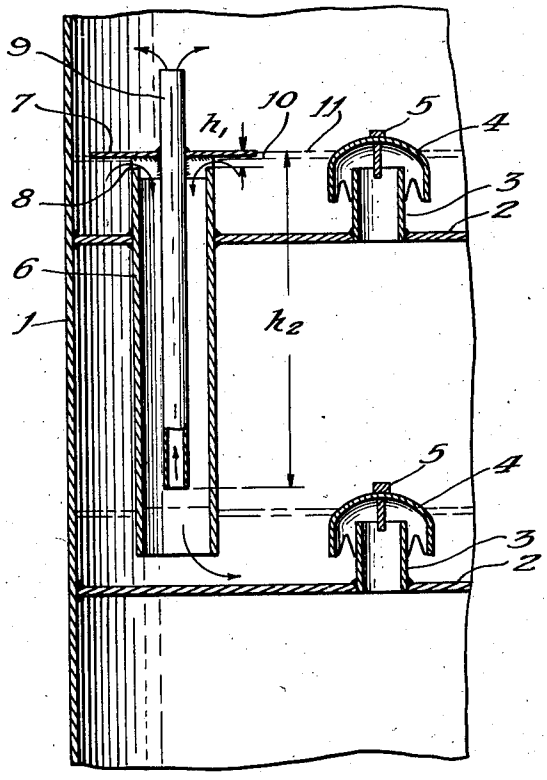
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DOWNSPOUT FOR BUBBLE TRAYS

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DOWNSPOUT FOR BUBBLE TRAYS

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4 Claims. (Cl. 261—114)

This application is a continuation-in-part of application Serial No. 510,284, filed November 15, 1943.

This invention relates to an improved form of downspout for bubble trays and the like. More specifically it is concerned with a means for increasing the capacity of given sized downspouts by a novel arrangement of apparatus.

The conventional downspout used in fractionating columns and the like employing bubble trays is merely an open-ended conduit extending through the deck of the tray and adapted to carry liquid from a point above the tray to a point below the tray. In conventional apparatus these downspouts when designed to adequately accommodate the downward moving liquid in the column occupy a considerable portion of the tray area. The tray area unoccupied by downspouts is generally provided with a plurality of risers and bubble caps by means of which contact between gases and liquids is accomplished. It is therefore, obvious that as much of the bubble tray area as can be provided with bubble caps is desirable in order to utilize to the utmost the full capacity of the fractionating column.

The present invention by providing a means for increasing the capacity of downspouts provides a more efficient contacting means because a higher proportion of the bubble tray area is actually employable for contacting the liquid and gaseous materials.

In some cases where fractionating columns have been erected following conventional design, it has been found that the downspouts are inadequate to convey the normal flow of liquid down the column. This results in flooding of the columns and consequently very unbalanced operation.

The present invention may be advantageously adapted to these particular situations to overcome the difficulties due to flooding of the columns.

Briefly the present invention comprises in combination with a bubble tray downspout, a closure means at the upper end of said downspout, said downspout being provided with at least one inlet port at the normal liquid level carried on the bubble tray, and an open-ended conduit extending from a point above said closure means through the latter to a point within said downspout a spaced distance above the lower end thereof.

In order to more adequately illustrate the features and advantages of the present invention reference is made to the accompanying diagrammatic drawing which shows a sectional elevational view of a portion of a bubble tower in which the features of the invention are embodied.

In the drawing, 1 denotes the outer shell of the bubble tower within which are disposed at vertically spaced intervals bubble trays 2. The bubble trays are provided with a plurality of risers 3 each of which is surmounted by a bubble cap 4 which is held in place by means of hold down bar 5, or by any other conventional means.

Member 6 is an elongated conduit which forms the main portion of the downspout and is supported by welding or other suitable means from bubble tray 2. Conduit 6 extends from a point immediately below the normal liquid level to be maintained on the tray, through the tray to a point above the next lowermost tray but below the normal liquid level to be maintained thereon. At the upper end of conduit 6 is positioned a closure means comprising plate 7 and supporting webs 8. Centrally disposed within conduit 6 and extending from a point spaced from the lower end of conduit 6 through plate 7 to a point above the latter is an open-ended conduit 9. The function of this latter conduit will be hereinafter described.

In operation the downspout will function as follows:

When the liquid level is at the position indicated by broken line 10 the head of liquid above the upper end of conduit 6 which acts as a weir is equal to h_1. This head of liquid will cause a particular quantity of material to flow into the annular space between conduits 6 and 9 in the downspout. However, the downspout is so designed that the quantity of liquid flowing due to head h_1 is less than the normal downward flow of liquid through the columns. It is, therefore, apparent that the liquid level on the tray will tend to increase until it reaches the level indicated by broken line 11. When this occurs the ports provided between the upper end of conduit 6 and plate 7 are completely covered with liquid preventing the passage of any gases into the annular space in the downspout. When this occurs, the entire annular space fills with liquid and immediately the effective head on the liquid on the tray becomes equivalent to h_2. This increase in effective head will greatly increase the flow of liquid from the tray into the downspout and rapidly bring the level down to the level indicated by broken line 10. As the column continues in operation the liquid level will fluctuate between the two levels indicated by broken lines 10 and 11. Entrained gases or vapors in the liquid flowing through the downspout are separated therefrom in the section below conduit 9 and pass up-

wardly therethrough to enter the vapor space above the liquid level on the tray.

In order that the full effective head, h_2, be applied to induce flow of liquid through the downcomer 6 when the liquid level is in position 11, it is necessary that any gases or vapors remaining in the downcomer be swept from it. This in turn necessitates the condition that the rate of liquid flow down the downcomer relative to its cross section must be such that the liquid will fill the downcomer. While the exact dimensions necessary to bring about this condition depend to some extent on the details of the design of the downcomer, it is generally true that the liquid velocity will be sufficient to fill the downcomer if the cross sectional area of the portion confined between conduits 6 and 9 is equal to, or less than, the area of the opening between the downcomer 6 and the plate through which the liquid flows.

I claim as my invention:

1. In combination with a bubble tray downspout, a closure means at the upper end of said downspout, said downspout being provided with at least one inlet port at the normal liquid level carried on the bubble tray and an open-ended conduit extending from a point above said closure means through the latter to a point within said downspout a spaced distance above the lower end thereof.

2. In combination with a bubble tray downspout, a closure means at the upper end of said downspout, said closure means being spaced from the upper end of said downspout to form an inlet port therewith at the normal liquid level carried on the bubble tray, and an open-ended conduit extending from a point above said closure means through the latter to a point within said downspout a spaced distance above the lower end thereof.

3. In combination with a bubble tray downspout, a flat plate positioned a spaced distance above the upper end of said downspout and an open-ended conduit extending from a point above said plate through the latter to a point within said downspout a spaced distance from the lower end thereof.

4. The device defined in claim 2 further characterized in that the cross sectional area of that portion of the downspout confined between said downspout and said conduit is not greater than the area of said inlet port.

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