

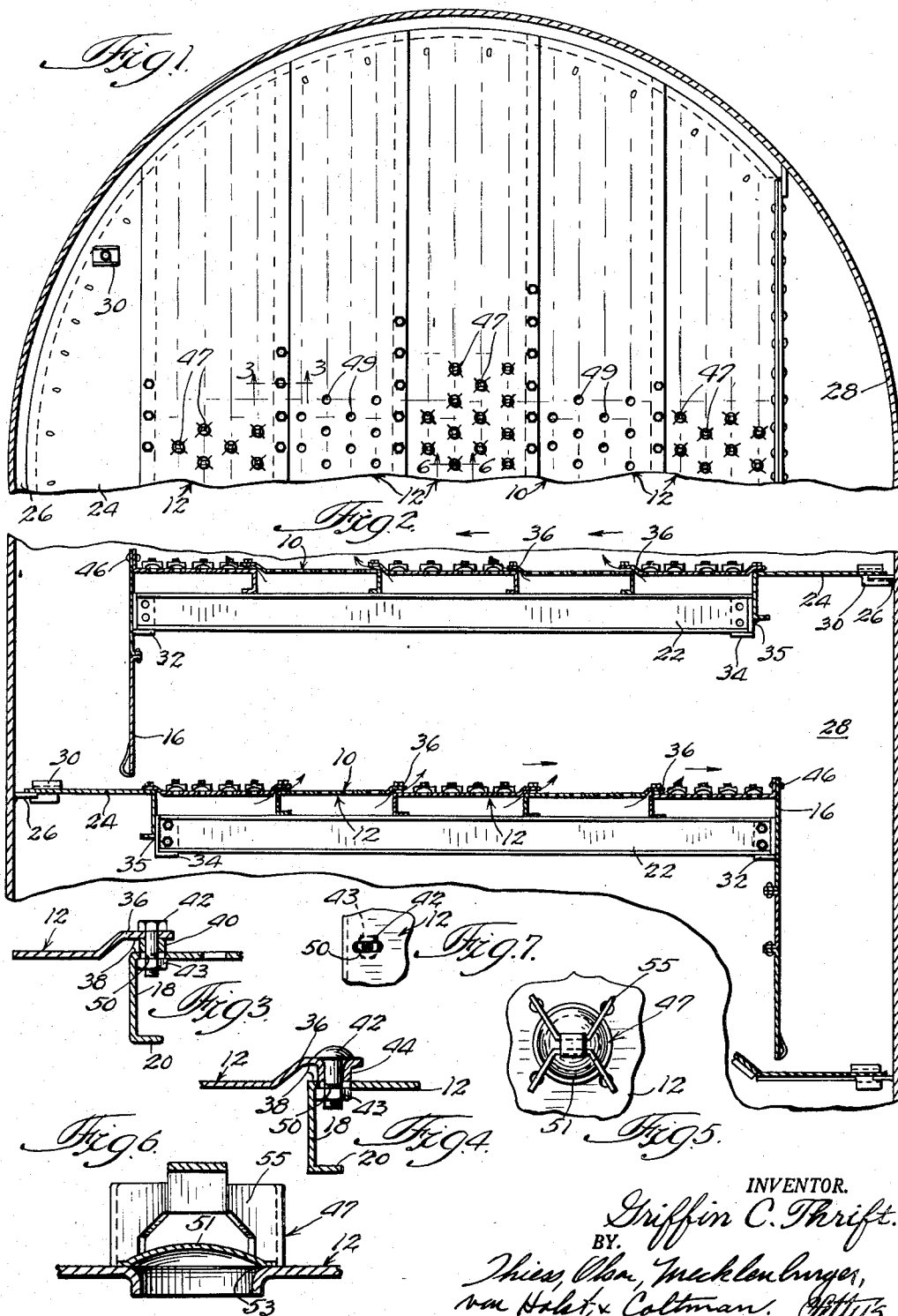
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SECTIONAL DECK CONSTRUCTION HAVING SPACED OVERLAPS

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SECTIONAL DECK CONSTRUCTION HAVING SPACED OVERLAPS

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1 Claim. (Cl. 261-114)

This invention relates to an improved apparatus for contacting a light fluid phase with a heavy fluid phase. More particularly, this invention pertains to a sectional deck construction for a contact apparatus having spaced-apart, overlapping deck sections, or trays, defining slots which assist the movement of a fluid across the deck surface.

It is well recognized in the art of dephlegmation and distillation that intimate mixture between the light and heavy fluid phases, usually a gas and a liquid, is essential if efficient separation is to be effected. However, in addition to intimate contact, it is also desirable that the intermingling of the gases and liquids be carried out in a rapid manner. It is of further importance that the apparatus in which the dephlegmation or distillation operation is carried out be flexible and adapted to efficiently operate under varying rates of flow.

It is an object of this invention to provide an apparatus for contacting liquids and gases in which efficient liquid-gas admixture is assured by means of a novel deck construction.

It is a further object of this invention to disclose a contact apparatus which is highly flexible and able to efficiently handle rates of flow varying over a wide range.

A still further object of this invention is the provision of a sectional deck construction which may be incorporated in a contact apparatus whereby the possibility of hydraulic gradients existing across the deck surface is eliminated even under exceptionally high rates of flow.

It is another object of this invention to provide a tray construction which reduces pressure drop across a deck to a minimum.

The above and other objects will become more apparent from the following description, detailed drawing, and appended claim.

In one embodiment of the invention a sectional deck construction for use in a rectification column which may, for example, be employed in the separation of hydrocarbons is provided. Each of the deck sections, or trays, has its longitudinal axis disposed transverse to the normal flow of liquid across the deck. The longitudinal edge portion of at least one tray or deck section, is offset so as to overlap an underlying edge portion of a juxtaposed tray; all tray surfaces are substantially coplanar. The offset edge portion is disposed toward the fluid outlet and may have its upper surface disposed parallel to the remainder of the deck surface so as to define a longitudinal slot, with the underlying tray edge portion, disposed transverse to the flow of fluid thereacross. Spacers mounted on bolts or other spacer means may be used to maintain the overlying tray edges in spaced-apart relationship. Thus, in the normal course of apparatus operation, rising vapors from beneath the sectional deck emerge through the slots and function as jets which assist in moving the liquid body across the tray surfaces. Each of the trays may be covered with check valves or perforations, or each section may utilize

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both perforations and check valves to increase the flexibility of operation.

For a more complete understanding of this invention, reference should now be had to the drawings, wherein

Figure 1 is a fragmentary top plan view of a sectional deck construction embodying the invention;

Fig. 2 is a fragmentary transverse sectional view of two superposed sectional decks;

Fig. 3 is an enlarged fragmentary sectional view taken on line 3-3 of Fig. 1;

Fig. 4 is an enlarged fragmentary detailed view of two overlapping trays utilizing a modified form of spacing means;

Fig. 5 is a fragmentary top plan view of a check valve used on alternate trays;

Fig. 6 is an enlarged sectional view taken on line 6-6 of Fig. 1; and

Fig. 7 is a fragmentary top plan view, partly in section, illustrating a portion of an underlying tray edge.

Referring now to the drawings and, more particularly, to Fig. 1, a plan view of a sectional deck 10 employed in a dephlegmation or rectification column is illustrated. The deck is composed of a plurality of discrete trays 12 disposed transversely to the normal flow of liquid thereacross. As will be noted from Fig. 2, the trays 12 are substantially coplanar and define a substantially horizontal surface.

As will be more clearly seen in Fig. 3, each of the trays 12 is formed integral with a depending foot portion 18 having a flange portion 20 disposed normal thereto. The latter flange portion, as is more apparent in Fig. 2, may be bolted, welded or otherwise suitably affixed to supporting beam members 22, which underlie the plurality of trays comprising each deck and which are transversely disposed thereto. As will be further noted from Figs. 1 and 2, a deck portion 24 is suitably supported by a peripheral support ring 26 by means of a clamp member 30 at one peripheral edge portion, and welded at 35 or otherwise suitably affixed at an opposed edge portion to a support beam 34 disposed transverse to beam 22. The support ring 26 is welded or otherwise suitably affixed to the inner periphery of the coulumn wall 28. The oppositely disposed end limits of each support beam 22 are bolted or otherwise suitably affixed to cross beams 32 and 34 which may be clamped or otherwise suitably affixed at either end limit to the support ring 26.

Referring once again to Fig. 3, it will be noted that an end portion 36 of each tray 12 is offset in an upward direction so as to overlap the adjacent underlying edge portion of a juxtaposed tray 12. It will also be noted from Fig. 2 that the offset edge portions 36 of the trays 12 are disposed toward the fluid exits or downcomers 16 of the decks 10. The top surface of the offset portion 36 of each tray 12 is preferably disposed parallel to the remaining surface area of the trays so as to define with the underlying tray a slot 38 (more clearly shown in Figs. 3 and 4), across the deck which is disposed transverse to the flow of liquid thereacross.

It is apparent that in the normal course of operation vapors rising from the lower portion of the column will emerge through slots 38 defined by the overlapping edge portions of the trays and accelerate the velocity of the liquid flowing across the deck surface. To maintain the edge portions of adjacent trays in spaced-apart relationship, spacer means 40 (see Fig. 3) comprising washer members of predetermined heights (the height of the washers defines the desired opening of slots 38) may be maintained between the undersurface of the offset edge portion 36 of a tray and the upper surface of an underlying tray 12. In order to maintain the spacer 40 properly disposed between the oppositely disposed tray portions,

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a bolt member 42 is provided which traverses the two tray portions, engages nut member 43, and thus fixedly positions the spacer or washer 40. It is also apparent from Fig. 2 that the weight of the overlapping tray portion is borne by the adjacent underlying tray and transmitted by the foot portion 18 thereof to the underlying support beam 22. It is obvious, of course, that the number of support beams 22 disposed across the column and underlying the trays is dependent upon the column diameter.

In an alternate method of maintaining the overlapping portion of a tray 12 in spaced-apart relation with an underlying tray portion, the tray construction illustrated in Fig. 4 may be utilized. A spacer means equivalent to the washer 40 illustrated in Fig. 3 may comprise depending lip 44 formed integral with the offset edge portion of the tray, as a result of a punching operation performed at predetermined intervals along the offset edge. The depending peripheral lip 44, defining the aperture traversing the edge portion, maintains the overlying edge portion 36 and the underlying tray portion of the adjacent tray 12 in fixed spaced-apart relationship. The underlying portion of a juxtaposed tray 12 may be apertured to enable a bolt member to traverse the apertures defined by the depending lip 44 and the underlying tray 12 and, thus, fix the two trays in substantially immovable relationship.

As will be noted more clearly from Fig. 1, each of the trays 12 has positioned thereon a plurality of check valves 47 or perforations 49. It may be desirable in some instances to position both perforations and check valves on the same tray. The alternate check valve and perforation disposition on adjacent trays provides for efficiency of column operation over an exceedingly large range of flow conditions. It is thus apparent that the flexibility allowed by such a construction greatly exceeds that of the ordinary column construction.

It is well known in the rectification art that at high liquid rates hydraulic gradients exist across a deck surface. At normal liquid rates of flow, the liquid being processed tends to pile up upon converging to the deck weir, such as weirs 46 illustrated in Fig. 2. It is apparent that the slots 38 disposed across the tower at regular intervals and which emit vapors from below, which move at relatively high rates of speed, will assist or aid in accelerating the flow of fluid across the deck from the inlet to the exit. Utilizing such flow rate "boosters," higher capacities are available in the column and more uniform distribution of the rising vapors in the down-flowing liquids is assured.

If a tower is designed to operate at a normal liquid rate of flow, the overlapping tray arrangement, illustrated in either Fig. 3 or 4, or any other equivalent overlapping arrangement would be placed on the converging side of the tower; that is between the effluent weir and the deck center line. Thus, in Fig. 2, if the sectional deck constructions illustrated were to be employed in a column construction subject to only normal liquid rates of flow, the overlapping tray constructions would only be disposed to the right of the center line in the lower deck and to the left of the center line in the upper deck, as the booster or accelerating effect of the jetting, rising vapors through the slots 38 would be needed in these areas only.

However, if a column were to be subject to high liquid rates of flow and each deck would, thus of necessity, have a definite liquid gradient thereacross, the deck construction illustrated in Fig. 2 would be employed in its entirety, since the boosting effect of the vapors emerging through the slots 38 would be needed across the entire deck surface.

To add further to the flexibility of column operation, the check valve construction, such as is described in the Huggins and Thrift copending application Serial No. 505,568, filed May 11, 1955, now Patent No. 2,780,389, may be employed although other check valve constructions may be utilized. The latter valve 47 is illustrated in top plan in Fig. 5 and in section in Fig. 6. The valve

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comprises a concave-convex closure member 51 which is guided to its seat 53 formed integral with the deck surface by a four-posted closure member retaining means 55 which is affixed to the deck surface. The closure member 51 rises from its seat upon impingement on the undersurface thereof of the vaporous flow from beneath; the valve 47 is designed to be efficiently operable over a wide range of fluid flow.

By utilizing a check valve construction which is efficiently operable over an exceedingly wide range of fluid flow, by utilizing the deck sectional construction illustrated having alternate sections of perforations and check valves and by utilizing the booster slots 38 made possible by the tray construction illustrated, a contact apparatus is assured which will effect efficiency and flexibility of operation heretofore unattainable.

As illustrated in Fig. 7, tray apertures 50 traversed by the bolt members 42 or other securing means may be elongated in configuration to allow for expansion and contraction in the apparatus illustrated, during the normal course of operation, and thus allow compensational relative movement between trays. As is apparent from Fig. 2, the directions in which the slots 38 are disposed are reversed with each succeeding deck, because of the reversal of the fluid flow in the course of reversibly traversing each succeeding deck assembly during its downward descent.

It is obvious from the illustrated sectional deck construction that many modifications may be constructed which will still remain within the inventive spirit of the invention herein disclosed. The number of slots 38 disposed across any deck is variable and dependent upon the amount of assistance needed for the fluid flow across the deck surface. It should be noted that the trays are substantially coplanar so as to provide for unobstructed horizontal fluid flow resulting in low pressure drop and also a surface which consumes a minimum amount of tower height. Other equivalent means for sectional deck support and other equivalent spacer means for maintaining the overlapping tray edge portions in spaced-apart relationship may obviously be used to equal advantage. It is intended, therefore, that the invention provided be limited only by the scope of the appended claim.

What is claimed is:

In a contact apparatus adapted to separate a light fluid phase from a heavy fluid phase, a deck construction comprising a plurality of discrete coplanar trays disposed substantially transverse to the normal fluid flow across said deck and forming a substantially horizontal surface, a fluid inlet and outlet for said deck, at least one of said trays having an offset edge portion assuming an overlapping relationship with an adjacent tray edge whereby an elongated slot disposed toward said fluid exit is formed; at least some of said trays having fluid passageways disposed therethrough, and spacer means interposed between said tray overlapping edges comprising integral depending lip portions punched from said offset edge portions abutting against the underlying tray edge portion whereby a spaced relationship therebetween may be maintained.

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