

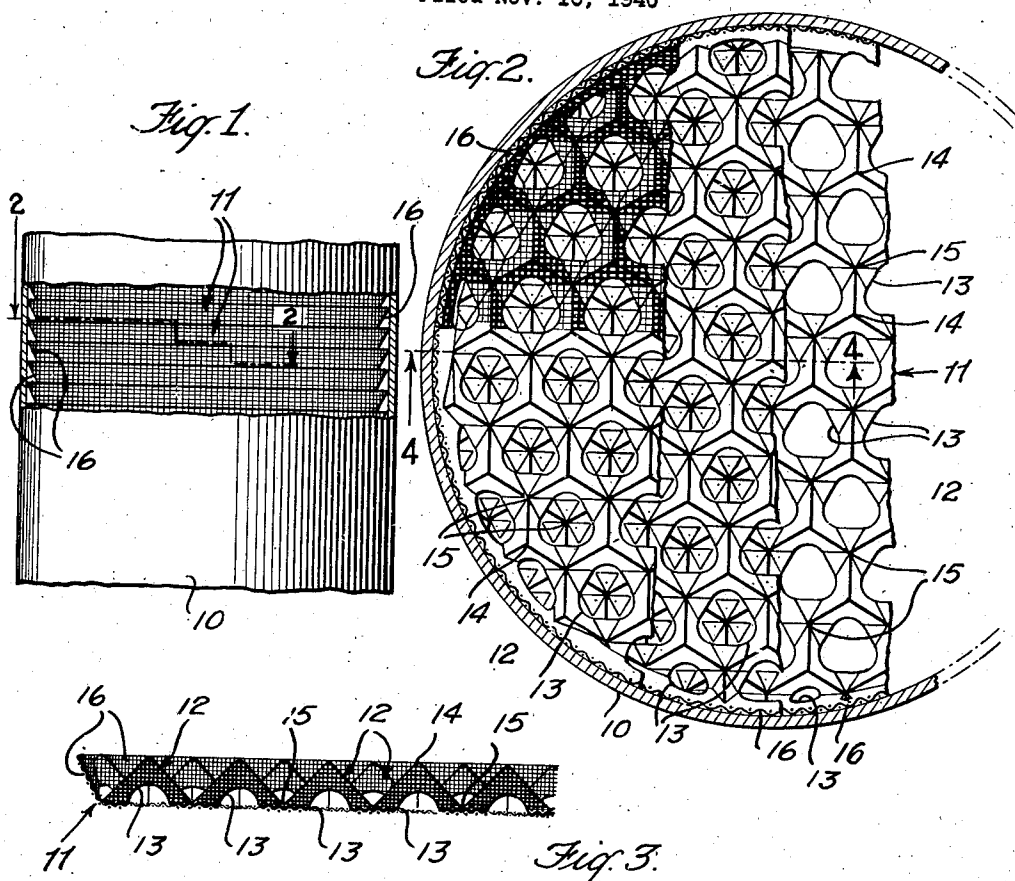
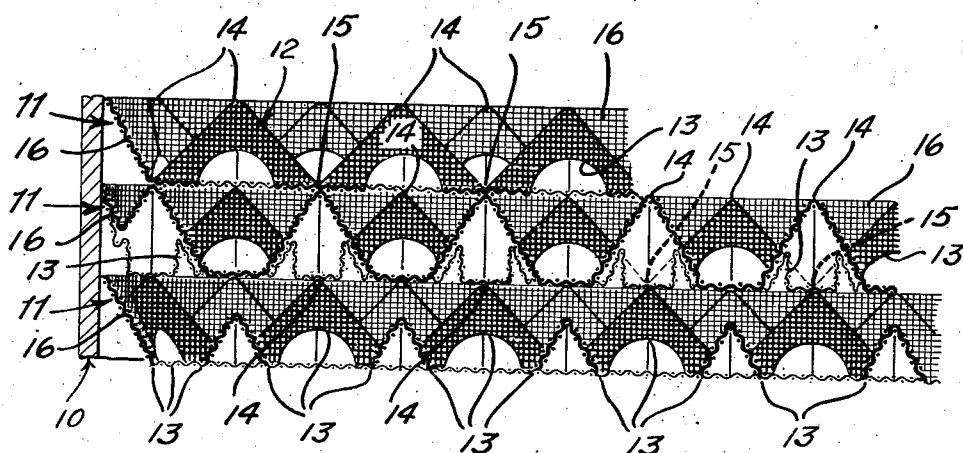
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VAPOR AND LIQUID CONTACT APPARATUS AND PACKING THEREFOR

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VAPOR AND LIQUID CONTACT APPARATUS
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9 Claims. (Cl. 261—95)

This invention relates to vapor and liquid contact apparatus, more particularly to packing for fractionating columns and the like, and especially to packing of capillary material.

As used herein and in the claims, the expression "capillary material" means a material having a plurality of spaced openings of such size that they will seal completely with the liquid being treated. Woven wire of any suitable metal or alloy is a satisfactory capillary material provided the mesh openings are small enough to seal with the liquid under treatment. The capillary material may be made of other suitable materials, such as fabric, asbestos, glass, slag wool, plastics or similar substances. Materials not sufficiently rigid in themselves require structural support to sustain the packing.

The invention provides a packing of capillary material which is so constructed and arranged that the liquid under treatment will remain on the packing in its flow downwardly through the column and will not reach the wall of the column and continue down the column wall and thereby short circuit the packing to the detriment of the efficiency of the column.

The invention will be understood from the following description when considered in connection with the accompanying drawing forming a part thereof, and in which:

Fig. 1 is a vertical sectional view of part of a fractionating column having packing of capillary material arranged in accordance with the invention;

Fig. 2 is a transverse sectional view on an enlarged scale, taken on irregular line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view of one of the component discs or sheets of the packing, and

Fig. 4 is a sectional view taken on line 4—4 of Fig. 2.

Like characters of reference refer to the same parts throughout the several views.

Referring to the drawing, reference character 10 designates the shell of a fractionating column having a plurality of discs or layers 11 of capillary material in the form of metal wire gauze having mesh openings which seal with the liquid under treatment. It will be understood that the vapor to be fractionated is introduced into the lower part of the column 10 below the packing 11 and that liquid, as reflux or otherwise, is introduced into the upper part of the column above the packing and flows downwardly through the column from disc to disc counter-current to and in contact with the vapor flowing upwardly through the column.

In the form shown, each disc 11 is shaped or formed to provide a plurality of rows of pyramids 12, with the pyramids in adjacent rows being disposed in staggered relationship, and a plurality of vapor openings 13, each at the base portion of three adjacent pyramids. The pyramids and vapor openings are substantially regularly disposed on each disc. The vapor openings 13 are larger than the mesh openings of the metal gauze and are of sufficient size so as not to seal with the liquid under treatment. Preferably all the discs are alike with respect to the pattern, or arrangement, of pyramids and openings, and in assembling them into a packing, the discs are disposed so that the apices 14 of the pyramids 12 of each disc are in vertical alignment and in contact with the points of junction 15 of each group of three adjacent pyramids on the disc next above. This is accomplished by starting the packing with one disc, placing a second disc upon the first disc in such position that the pattern is at an angle of 120° to the pattern of the first disc and with the points of junction 15 of the second disc in engagement with the apices 14 of the pyramids of the first disc, placing a third disc upon the second disc with its pattern at an angle of 120° to the pattern of the second disc with the points of junction 15 of the third disc in engagement with the apices 14 of the pyramids of the second disc, placing a fourth disc upon the third disc with its pattern in vertical alignment with the pattern of the first disc and with the points of junction of the fourth disc in engagement with the apices of the pyramids of the third disc, and so on in the same order and manner until the packing is completed. With the packing arranged in this manner, the vapor openings in every third disc only are in vertical alignment, and each vapor opening is disposed immediately below and in alignment with the apex of a pyramid, and is immediately above and in alignment with a point of junction 15 of three adjacent pyramids. A plurality of substantially cubical cells thus are formed throughout the packing, with each cell having a vapor inlet opening at its base and three spaced outlet openings, one in each of the three adjacent sides forming the upper portion of the cell. Each cell thus is fed with vapor from each of three similar cells immediately below each cell. The layers are secured together by any suitable means, preferably by welding the apices of the pyramids to the junction points of groups of three adjacent pyramids. To prevent the down flowing liquid from reaching the wall of the column and thereafter flow-

ing down the column wall, the peripheral portion of each disc, in the form shown, is turned upwardly to provide a vertically inclined lip 16, preferably having substantially the same height as the pyramids 12 and substantially the same inclination to the horizontal as the sides of the pyramids. The upper edge of the lip 16 is in contact with the inner wall of the column 10, or it may be in engagement with a lining, or packing enclosing device, within the column.

In operation, the vapor introduced into the column below the packing, flows into the openings 13 in the lowermost disc 11 and into the cells of which these openings form the inlets, and after flowing in contact with the liquid on the walls of these cells, the vapor divides and flows out the three outlet openings of each cell into the cells immediately above these outlet openings, along with vapor from the two other cells adjoining each outlet opening. In this manner, each vapor stream entering the lowermost cells is divided into three streams flowing from these cells, and each of the divided streams in flowing into the cells next above, combines and mixes with two divided streams from adjacent cells, after which this combination is divided into three streams in flowing from the said cells next above, and so on through the packing with repeated divisions, combinations and mixings. The liquid in flowing downwardly through the packing, divides at each apex of each pyramid into three streams, one flowing down each side of each pyramid, each of these divided streams flows toward the two junction points adjacent the lower ends of each side of a pyramid, and there combines with liquid flowing down the sides of the two adjacent pyramids adjacent the junction point, the combined streams flow through the mesh at the junction points to the apices of the pyramids below the junction points and again divides and flows down the sides of the pyramids. Due to the inclination of the sides of the pyramids, there is a tendency for the liquid to flow toward the wall of the column, but the use of the upturned lips prevents the liquid from reaching the column wall because the liquid will not flow up the inclined lips and in flowing from the lips it is caused to flow away from the wall and onto the pyramids below and to be redistributed on the packing. In this manner, substantially uniform distribution of the liquid on the packing is obtained and maintained regardless of the height of the packing.

Although the invention has been disclosed in association with a particular form of packing, it will be understood that the upturned lip may be employed with other forms of packing of capillary material whether or not of the cellular type disclosed. In other words, the upturned lip at the periphery of the packing will prevent the liquid flowing downwardly through the packing from reaching the column wall and short circuiting the remainder of the packing, thereby seriously interfering with the efficiency of the packing and the column, and can be employed with any and all forms of capillary material packing, regardless of whether or not the vapor and liquid are divided and combined as in the form of packing disclosed.

The expression "vapor" as used herein and in the claims includes "gas" within its scope.

Inasmuch as changes may be made in the form of the packing disclosed and the material of which the packing is made without departing from the principles of the invention, it will be

understood that the invention is not to be limited excepting by the scope of the appended claims.

What is claimed is:

1. Packing for vapor and liquid contact apparatus comprising capillary material having mesh openings which seal with liquid under treatment, said material being arranged to provide contact of vapor with a thin film of liquid and adapted to be positioned in a column, the capillary material having a lip at its periphery inclined upwardly and outwardly of said material toward the wall of the column.

2. Packing for vapor and liquid contact apparatus comprising superposed sheets of capillary material having mesh openings which seal with liquid under treatment, said material being adapted to be positioned in a column, each sheet having a pattern of integral raised portions forming with adjacent sheets a multiplicity of interconnected cells and perforations larger than the mesh openings of the material to provide vapor passages to and from each cell, at least some of said sheets having a peripheral portion inclined upwardly and outwardly of the sheet toward the wall of the column.

3. Packing for vapor and liquid contact apparatus comprising superposed sheets of capillary material having mesh openings which seal with liquid under treatment, said material being adapted to be positioned in a column, each sheet having pyramidal indentations arranged in rows, the pyramids in each row being staggered with respect to those in adjacent rows, and vapor passages arranged in rows, the passages in each row being staggered with respect to those in adjacent rows, the interconnecting wall portions of adjacent pyramids providing numerous contacts between adjacent sheets and forming cells in successive sections at different elevations for intimate intermingling of vapor entering said cells through said passages, at least some of said sheets having a peripheral portion inclined upwardly and outwardly of the sheet toward the wall of the column.

4. Packing for vapor and liquid contact apparatus comprising superposed sheets of capillary material having mesh openings which seal with liquid under treatment, said material being adapted to be positioned in a column, each sheet having pyramidal indentations arranged in rows, the pyramids in each row being staggered with respect to those in adjacent rows, and vapor passages arranged in rows, the passages in each row being staggered with respect to those in adjacent rows, the interconnecting wall portions of adjacent pyramids providing numerous contacts between adjacent sheets and forming cells in successive sections at different elevations for intimate intermingling of vapor entering said cells through said passages, at least some of said sheets having a peripheral portion inclined upwardly and outwardly of the sheets and of a height substantially equal to the height of the pyramids thereon and extending at substantially the same angle to the plane of the bottom of the sheet as the side wall of the pyramids thereon.

5. Vapor and liquid contact apparatus comprising a column and a packing therefor comprising capillary material having mesh openings which seal with liquid under treatment, said material being arranged to provide contact of vapor with a thin film of liquid, the capillary material having a plurality of spaced peripheral lips extending upwardly and outwardly of the packing and toward the wall of the column.

6. Vapor and liquid contact apparatus comprising a column and a packing therefor comprising superposed sheets of capillary material having mesh openings which seal with liquid under treatment, each sheet having a pattern of integral raised portions forming with adjacent sheets a multiplicity of interconnected cells and perforations larger than the mesh openings of the material to provide vapor passages to and from each cell, at least some of said sheets having a peripheral portion extending upwardly and outwardly of the sheets toward the wall of the column.

7. Vapor and liquid contact apparatus comprising a column and a packing therefor comprising superposed sheets of capillary material, each sheet having pyramidal indentations arranged in rows, the pyramids in each row being staggered with respect to those in adjacent rows, and vapor passages arranged in rows, the passages in each row being staggered with respect to those in adjacent rows, the interconnecting wall portions of adjacent pyramids providing numerous contacts between adjacent sheets and forming cells in successive sections at different elevations for intimate intermingling of vapor entering said cells through said passages, at least some of said sheets having a peripheral portion inclined upwardly and outwardly of the sheets and of a height substantially equal to the height of the pyramids thereon and extending at substantially the same angle to the plane of the bottom of the sheet as the side wall of the pyramids thereon and toward the wall of the column.

8. Packing for vapor and liquid contact apparatus comprising a plurality of superposed sheets of capillary material having mesh openings which seal with liquid under treatment, said material being adapted to be positioned in a column and arranged to provide contact of vapor with a thin film of liquid, at least some of said sheets having a lip at their periphery inclined upwardly and outwardly of the sheets and into contact with the wall of the column.

9. Vapor and liquid contact apparatus comprising a column and a packing therefor comprising superposed sheets of capillary material, the mesh openings of which seal with liquid under treatment, each sheet having pyramidal indentations arranged in rows, the pyramids in each row being staggered with respect to those in adjacent rows, and vapor passages arranged in rows, the passages in each row being staggered with respect to those in adjacent rows, the interconnecting wall portions of adjacent pyramids providing numerous contacts between adjacent sheets and forming cells in successive sections at different elevations for intimate intermingling of vapor entering said cells through said passages, at least some of said sheets having a peripheral portion of a height substantially equal to the height of the pyramids thereon and extending upwardly and outwardly of the sheets at substantially the same angle to the plane of the bottom of the sheet as the side wall of the pyramids thereon and into contact with the wall of the column.

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