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TOWER PACKING

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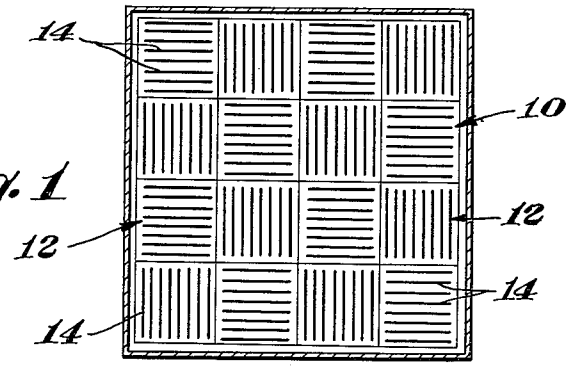


Fig. 1

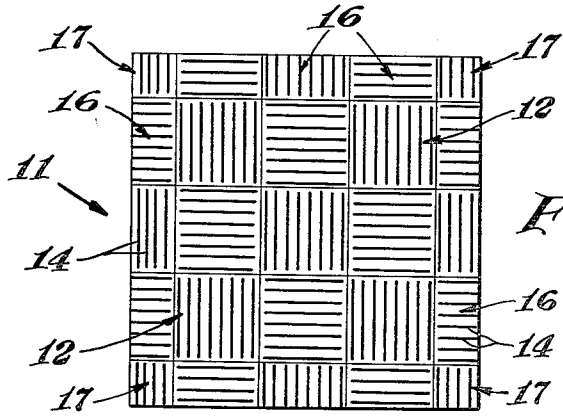


Fig. 2

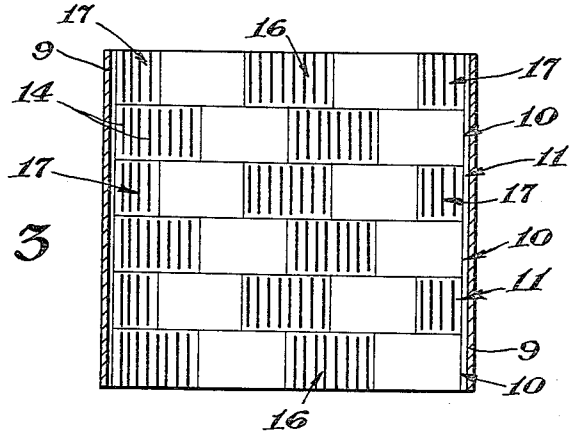


Fig. 3

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TOWER PACKING

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This invention relates to sheet assembly and apparatus for the distribution of flowing liquid through a plurality of thin films. More particularly, it relates to a method of assembling a tower packing for extended surface elements for gas liquid contacts and the product prepared thereby.

Many cooling towers, and towers for biological oxidation, employ assemblies of sheets positioned generally in parallel relationship. Frequently, such sheets are prepared from plastics, such as polystyrene and polyethylene and are assembled into a generally rectangular group or bundle. A plurality of such bundles are placed within a tower to provide additional surface to facilitate the contact of a flowing liquid film with air or other gas passing through the tower.

A typical sheet assembly which may be employed in the practice of the invention is shown in U.S. Letters Patent No. 2,793,017. In the packing of a typical tower, bundles of parallel sheet elements are placed in the tower, the sheets maintained generally parallel and oriented in a substantially vertical plane, as further bundles are added to complete the lower layer, the parallel relationship of the individual sheets in the bundle assemblies is maintained. Similar layers of bundles are stacked vertically in matching relationship. This arrangement results in a cubic packing. By cubic packing is meant that the centers of the sheet bundles lie in planes vertically and horizontally at right angles to each other and are disposed in relation to adjacent bundles as the corners of a cube or right parallelepiped.

Bundles of sheets fabricated from plastic materials and particularly the thermoplastics, such as polystyrene, polyethylene, and polyvinyl chloride, exhibit limited structural strength, and the depth of packing permitted between support platforms in a tower is dependent on the initial edgewise resistance of the individual rectangular bundles to deform along any one of the three principal axes. Generally, deformation of the bundles takes place along a horizontal axis parallel to the sheets forming a bundle. Failure of the bundle often occurs where there is a tendency for solids to build up on the tower packing in operation. This action is particularly prevalent in biological oxidation process wherein a slime forms on the surface of the individual sheets frequently causing a relatively large increase in the load which must be supported by the sheet bundles, particularly by the sheet bundles disposed toward the lower portion of the tower.

It is an object of the invention to provide a method of stacking in a tower generally rectangular bundles of generally parallel elements which would provide packing having improved resistance to deformation under load.

It is a further object to provide a method of packing such bundles which would result in a smaller side thrust load being applied to the tower walls.

It is still a further object to provide a method of packing a tower with generally rectangular bundles of substantially parallel sheets or lamina which would reduce the shear stress between adjacent sheets in said bundle.

It is another object of the invention to provide a tower packing assembly of improved rigidity.

These objects, advantages, and other benefits may be obtained by positioning in a tower, a packing comprising a plurality of generally parallel-lamina, tower packing

bundles, said bundles arranged in layers, said bundles being positioned in horizontal layers in a square pattern; said bundles in each of said layers being arranged with the lamina of adjacent bundles substantially normal to each other; and said lamina lying in a substantially vertical plane.

Other advantages and objects of the present invention will become apparent in the following description and specification taken in connection with the accompanying drawing, wherein:

FIGURE 1 schematically represents a top view of one layer of bundles employed in a tower packing;

FIGURE 2 represents a top view of a layer arrangement wherein fractional bundles are employed; and

FIGURE 3 schematically represents the arrangement of several layers of bundles employed in a tower packing.

In FIGURE 1 there is schematically represented a top view of a layer of tower packing generally designated by the reference numeral 10 positioned within a tower 9 of rectangular cross section. The layer 10 is made up of a plurality of bundles 12, each of said bundles 12 comprising a plurality of adjacent sheets 14. The bundles 12 are arranged in such a manner that bundles adjacent to each other have their sheets 14 substantially normal to a plane parallel to the sheets 14 of all adjacent bundles.

FIGURE 2 illustrates a layer of tower packing generally indicated by the reference numeral 11. The layer 11 comprises a plurality of bundles 12 centrally located and surrounded by half bundles 16 and quarter bundles 17 disposed at the corners of the layer 11. Each of the bundles 12 and the fractional bundles 16 and 17 is oriented with the sheets or lamina 14 substantially normal to the sheets 14 in adjacent whole or fractional bundles.

In FIGURE 3 there is a schematic, cutaway representation of a tower 9 containing layers 10 of bundles alternating with layers 11 of bundles. The layers designated 11 differ only from the layers 10 in the fact that half bundles 16 are positioned at the sides and quarter bundles 17 at the corners. The half bundles 16 and quarter bundles 17 cause the centers of the bundles 12 to be disposed generally colinear with the corners of the upper and lower adjacent bundles.

In constructing a packed tower according to the method of the invention, bundles 12 of parallel elements 14 may be placed into the tower individually or in groups of two or more alternating the configuration in such a way that the ends of the elements 14 of a bundle support the sides of the two adjacent bundles from deformation in their physically weak direction. Thus, the initial layer of bundles provides a relatively rigid unit that has a substantially smaller tendency to deform than if a normal packing method were used wherein the sheets 14 in the bundles 12 are substantially parallel to each other.

The second layer is readily prepared by employing half bundles 16 at the ends of the full size bundles 12 employing sheet or lamina orientation similar to that of the first layer. Bundle 12 centers are displaced out of vertical alignment with the bundle centers of layer 10 and thus, positioned with the geometric centers over the center of one edge of the bundles in the layer below by employing half bundles at ends of rows.

Thus, half bundles 16 may be employed to offset the centers of the bundles 12 in one direction or quarter and half bundles 17 and 16 may be employed if the geometric center of the bundle is to be positioned over a point substantially common to four bundles in the lower layer.

The gain in physical strength employing the method of the invention is significant and is dependent upon the particular physical characteristics of the individual sheets 14 of the bundle elements 12; thus, in general the strength is dependent on, and proportional to, the stiffness of the

bundle elements in a direction generally parallel to the surface of the elements 14.

Towers of circular and other nonrectangular shapes may be packed in accordance with the invention by trimming the bundles positioned adjacent the tower walls or wall not in rectangular arrangement.

While the invention has been described with reference to particular embodiments, it is to be understood that more modifications thereof may be made without departing from its scope, particularly as defined in the hereto appended claims.

That which is claimed is:

1. In a method of packing a tower for the contact of a liquid with a gas employing as packing material a plurality of horizontal layers of generally rectangular tower packing bundles, said bundles being self-supporting, each of said layers being composed of a plurality of said bundles; said bundles consisting essentially of a plurality of generally parallel self-supporting thermoplastic lamina; the improvement which comprises: arranging said bundles in each of said layers in a square pattern, further arranging said bundles in each of said layers with the lamina of adjacent bundles substantially normal to each other and with said lamina lying in substantially vertical planes, and locating the centers of vertically adjacent bundles in a displaced position from a vertical line passing through said centers.

2. A method in accordance with claim 1, wherein the centers of vertically adjacent bundles are positioned vertically adjacent to the corners of a vertically adjacent bundle in an adjacent layer.

3. In a tower for the contact of a liquid with a gas employing as a packing material a plurality of horizontal layers of tower packing bundles, said bundles being self-supporting, each of said layers being composed of a plurality of said bundles, said bundles consisting essentially of a plurality of generally parallel thermoplastic lamina, said lamina lying in a substantially vertical plane, the improvement which comprises: the parallel lamina of each bundle being disposed substantially normal to the lamina of adjacent bundles, vertically adjacent bundles are displaced from a vertical line passing through the centers of the vertically adjacent bundles.

4. A tower in accordance with claim 3, wherein the centers of vertically adjacent bundles are disposed vertically adjacent to the corners of a vertically adjacent bundle in an adjacent layer.

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