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PROCESS OF AND APPARATUS FOR DEGASIFYING LIQUIDS AND WASHING GASES

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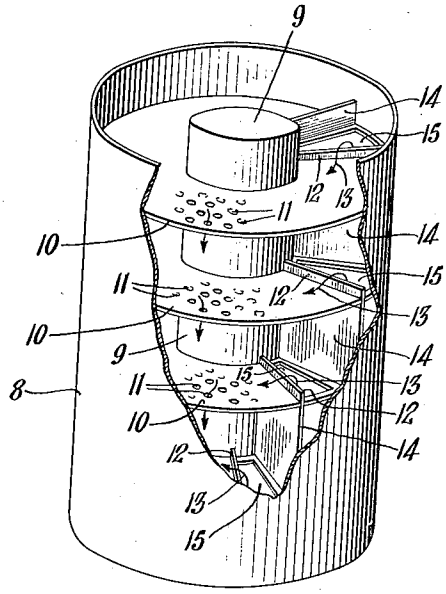


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## PROCESS OF AND APPARATUS FOR DEGASIFYING LIQUIDS AND WASHING GASES

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5 Claims. (Cl. 261—113)

This invention relates to a process of and apparatus for degasifying liquids and for washing gases.

Gas washing as well as the degasification of liquids is generally carried out by permitting the liquid to flow over individual trays in a wash column against the flow of the gas, whereby gas and liquid are brought into intimate contact and attain a state of substantial equilibrium with one another. When faced by this problem, which is very similar to rectification, it appears obviously advisable to utilize those apparatus arrangements which have been proven successful in the field of rectification.

In so far as this relates to columns with simple insets or filler bodies, it is possible to utilize such apparatus as washers or degasification towers without major construction alterations. However, in attempting to utilize particularly efficient rectification trays, such as circular or annular trays, for washing gases with liquids, for example, difficulties have been encountered, chiefly due to the fact that in gas washing appreciably more liquid is employed compared to the gas volume throughput than is employed in rectification. The same conditions exist in the degasification of liquids by counter-currently conducted gas.

If, however, a circular tray column of the known type is operated with a large volume of liquid, the pressure drop especially through the individual trays rises very appreciably because the high liquid throughput results in very large liquid cross-sections and correspondingly high liquid levels. Such high liquid levels however cannot be reduced by increasing the velocity of flow because, due to the continuous changes in direction undergone by the liquid, the centrifugal force at too high a velocity would cause an unequal distribution of the liquid over the tray.

Due to the large pressure drop through the individual trays, it is naturally impossible to construct wash columns of this type with a greater number of trays. However, according to the invention, it is still possible to apply to gas washing the circular tray principle used with great success in rectification, namely, the maintenance of a concentration-gradient within each individual tray. It has been found that the above mentioned difficulties can be eliminated by interchanging the paths followed by the liquid or gas in the known circular tray. According to the invention thereto, the preferably finely divided liquid flows vertically downwards through perforations of the trays while the gas is conducted in cross-current thereto in a circular path over the individual trays.

The formation of a concentration-gradient within each tray, which improves the efficiency of the column in the known manner, is favored by the fact that the flow of the gas over the individual trays is effected always in the same way for example, always clockwise or always counter-clockwise in a substantially helical path.

Thus a principle object of the invention is to provide a method and apparatus for effecting efficient gas and liquid contact providing the advantages of annular rectifying trays for gas washing and for degasification of liquids. The above and other objects of the invention will become evident from the following description in connection with the accompanying drawing which is a perspective view of a portion of an exemplary washing tower with a part broken away to illustrate the internal arrangement.

An operating example of the process according to the invention will be described with the aid of the illustration. The drawing shows a section including four trays of the newly developed wash column with a portion of the shell 8 broken away. The trays consist of perforated plates 10 provided with narrow holes or slits 11, said plates being inserted between the outer cylindrical casing 8 and an inner axially disposed displacement or filler body 9 and supporting a radial separating wall or partition 14 which entirely closes off each circular chamber at a point adjacent a gas passage 15 through the tray to the next higher tray. Each wall 14 extends through and above the next higher tray sufficiently to form a barrier or dam 12 so that the liquid is dammed up on the tray and forced to flow down through the holes or slits 11 in the tray. The separating walls 14 are so staggered on consecutive trays 10 that gas can flow through the remaining sector or opening 15 in the tray between walls 14 and barriers 12. The dammed up height of liquid on each perforated plate is thereby dependent upon the volume of liquid throughput. Nevertheless, it is possible for the liquid throughput to fluctuate extensively without disturbing the functioning of the column due to the fact that the volume flowing downward through the holes 11 of each perforated plate increases with the growing hydrostatic pressure of the liquid volume on the tray. The liquid trickles through the holes or slits 11 in the perforated plate in a finely divided state to the next tray, whereby it passes through

the gas flowing substantially helically in the direction of the arrows 13. One sector of the perforated plate has an opening 15 which is provided with the aforementioned dam or barrier 12 which prevents the liquid from running down through the opening 15. The path of the gas is limited by the partition 14 in such a way that the gas is guided in a circle and in a clockwise direction over each perforated tray and after flowing around the chamber above one tray, it enters into the next higher chamber through the opening 15 cut in the next higher perforated plate and flows through said higher chamber in the same circular direction. By conducting the gas and liquid in cross-section fashion, and causing the liquid to pass through successive revolutions of the gas, an intimate contact between liquid and vapor is attained.

According to a further thought of the invention, a number of radial partitions may be provided on the perforated plates, the height of such partitions being so measured that they prevent an intermixing of the liquid on the perforated plate in a peripheral direction, but do not limit the flow of the gas. Such partitions confine the flow of liquid to a vertically downward direction. Through this arrangement it is possible to attain the formation of a concentration gradient within the liquid located upon a tray and thereby improve the efficiency of the column.

The process is particularly suitable for carrying out gas washing under pressure, whereby appreciable savings in material are possible due to the reduced dimensions of the column because of the much greater liquid and gas contact efficiency.

A further advantage of the new process consists therein that the number of wash trays required is very low; furthermore, the pressure drop between the ends of the column is incomparably smaller than with the heretofore known forms of constructions.

What is claimed is:

1. A process for degasifying a liquid or for washing gas with a liquid which comprises feeding the liquid into the upper portion of a washing column; conducting the gas upwardly through said column in a succession of substantially annular paths and always in the same direction of revolution; causing all the liquid fed to the column to flow vertically downward through the column across said succession of paths and in substantially parallel finely divided streams whereby the movement of all liquid in the column is transversely across the paths of gas flow; and effecting substantially uniform distribution of said liquid streams throughout each of said substantially annular paths.

2. Apparatus for effecting contact between a liquid and a gas which comprises an outer casing; an inner axial member; a series of annular perforated trays forming annular chambers with said outer casing and said member; a partition extending across each annular chamber and joining consecutive trays; said partitions being disposed in staggered relation to each other; each tray being provided with a gas passage opening therethrough, each such gas passage opening being adjacent to and on the same corresponding side of the respective partition across the chamber above the tray having such opening; and at least one dam extending across each annular tray for maintaining a desired maximum depth of liquid on each tray.

3. Apparatus as claimed in claim 2 in which each of said perforated annular trays is provided with a series of peripherally spaced radial barrier walls of a height sufficient to prevent substantial intermixing of the liquid on the tray but of insufficient height to substantially interfere with the flow of the gas.

4. Apparatus for effecting contact between a liquid and a gas which comprises an outer casing; an inner axial member; a series of annular perforated trays forming annular chambers with said outer casing and said inner member; a partition extending across each annular chamber and joining consecutive trays; each of said partitions being offset with respect to each next lower partition by approximately the same displacement and in the same direction around the column, each of said partitions extending above the tray next above it for a distance sufficient to form a dam, each of said trays having a gas passage therethrough located between the dam formed by the next lower partition and the partition next above said tray, and the height of each dam being sufficient to retain liquid on the corresponding tray to a desired maximum height and cause such liquid to flow downwardly through the perforations in such tray.

5. Apparatus for effecting contact between a liquid and a gas which comprises a washing column having therein contact means including a series of annular perforated trays, constructed and arranged for conducting a gas upwardly through said column in a succession of substantially annular paths between such trays and always in the same direction of revolution; an inlet for supplying a gas at the lower portion of said column; an inlet for supplying a liquid at the upper portion of said column; and dams on said trays arranged to confine the flow of all of said liquid solely through said perforations and vertically downward through said column in substantially parallel finely divided streams across said successive paths so that the movement of all the liquid through the column is transversely across the paths of gas flow.

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