COLUMNS FOR CONTACTING LIQUIDS WITH GASES OR VAPOURS

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This invention relates to columns for contacting liquids with gases or vapours, comprising a cylindrical shell arranged with vertical axis and divided into a series of superposed chambers by perforated plates arranged horizontally one above the other in spaced relation. Columns of this general character are well known for handling liquids in counterflow to gases or vapours and are employed in the chemical industry, in particular for the washing of gases and for the distillation of liquids as petroleum, alcohol and the like.

More specifically the invention relates to columns of the stated kind in which the plates are formed in known manner so that in operation each of them carries a quantity of liquid up to a restricted depth, into and through which liquid gases or vapours rising from the underlying compartment penetrate through the plate perforations. Obviously it is necessary to maintain a pressure gradient over each plate, by which the liquid carried on the plate is supported; and it is therefore necessary to prevent the ascending gases or vapours from flowing around the edge of the plate, for which reason such edge is sealed, by an asbestos packing ring or the like, with respect to the wall of the shell.

An object of the invention is to simplify and improve the connection or joint between the edges of the plates and the wall of the shell.

According to the invention the edges of the plates are sealed against the wall of the shell by annular elements consisting entirely of metal which encircle the plates and bear elastically against the wall of the shell with a certain degree of pressure, the open expansion slots of these elements being narrower than the individual perforations in the plates. Preferably said open expansion slots are arranged below the level of the perforations in the pertaining plate in such manner that a somewhat higher column of liquid extends over them than over the above-mentioned perforations; this measure reliably prevents the pressure difference or gradient necessary for proper operation of the plate from escaping through the expansion slots. It is, of course, not permissible to situate the expansion slots so low that the liquid carried on the plate is able to escape through them; in practice, it is sufficient to make such difference in level between about 2% and 10% of the depth of liquid over the plate, usually restricted by an overflow.

By the means of the present invention the use of packing means hitherto necessary for sealing is eliminated and contamination of the column and its contents by crumbling particles of such packing material is avoided; moreover, the removal and replacement of the plates for periodic cleaning of the column is considerably facilitated and cheapened.

The invention will be clearly understood from the following description aided by the accompanying drawings which show two embodiments by way of example.

Fig. 1 is a partial sectional elevation of a cylindrical column with a sealing ring according to the invention. Fig. 2 is a sectional elevation on a larger scale of the sealing region. Fig. 3 is a plan view of the turnbuckle or tightening means of the sealing ring. Fig. 4 is a perspective view of the ends of the ring forming the expansion slot. Fig. 5 is a sectional elevation of a modified form of construction of the sealing ring and plate edge.

In accordance with Fig. 1, the cylindrical shell 1, the axis of which is indicated by the lines x—x', contains fitted plates 2 and 2a provided with a number of capped openings or perforations 3 and 3a for the ascending gases or vapours. The liquid flows on to the plate 2 peripherally through the pipe 4, covers the plate up to the level indicated by a—b and then flows down through the central overflow pipe 5 on to the plate 2a, which becomes covered with the liquid to the level c—d. From the plate 2a, the liquid flows peripherally through the central pipe 4a to the next subjacent plate (not shown) and so on. The pipes 4 and 4a are immersed below the levels a—b and c—d; they each, therefore, form a liquid seal through which the gases or vapours ascending from the surface of the liquid, cannot pass. These latter, consequently, flow in the direction of the dotted arrows A through the openings 3 and 3a from below, into the liquid on the plates 2, 2a.

The sealing of the plates, 2, 2a round their outer edges is performed by rings 6 and 6a, the form of which is more clearly shown in Fig. 2. Each ring is bent up from a profile bar of inverted F cross-section, the vertical limb 7 of which is pressed firmly against the shell wall 1 while the two horizontal circular limbs 8 and 9 lie respectively below and above the pertaining plate 2 or 2a. To enable the vertical limb 7 to be pressed firmly against the shell wall 1, the shell wall is a turnbuckle is provided (Fig. 3) between the ends of each ring 6 or 6a, the two lugs 10 and 11 of which turnbuckle are welded to the two ends of the ring and are pressed apart by two nuts 12, 13 on a screw spindle 14 in such manner that the ring is pressed radially against the shell wall 1. In order at the same time to obtain an as narrow as possible labyrinth expansion slot or passage, the lower horizontal limb 8 on the left-hand end of the sealing ring and the upper horizontal limb 9 on the right-hand end thereof, project as shown in Fig. 4 a few millimetres beyond the corresponding edge of the vertical limb 7 and thus enter into a corresponding recess of the other end. In order to penetrate through the expansion slot of the tightened ring, therefore, the ascending gases or vapours must pass under the plate 2 or 2a into the very narrow horizontal slit remaining between the lower horizontal limb 8 and the plate, which, of course, offers them a far higher flow resistance and is several millimetres lower under the level a—b than the admission openings or perforations 3 or 3a. In practice, consequently, the column works in exactly the same manner as a column with tight, asbestos packing rings, or the like.

To remove the plate 2 for example it is only necessary to release the turnbuckle 10—14, when the plate with its sealing ring 6 can be lifted out of the shell 1. To replace the plate is lowered from above to the required depth, then exactly adjusted with the turnbuckle fairly loose, and finally fixed in place by tightening the nuts, 12, 13.

In columns of smaller size each sealing ring may be a self-tightening sealing ring as shown in Fig. 5, consisting of a tightly-wound bare coil spring 15 the ends of which are joined to form a closed ring which is pressed from above into the space between the shell wall 1 and a downward-flanged rim 16 of the pertaining plate 2b. The very narrow expansion slots below the level of the admission openings of the plate 2b, formed between the
turns of the coil spring 15, offer a far higher resistance to the passage of ascending gases or vapours than the admission openings 3, so that in this case, also a sufficient seal is provided. It is recommended to fit individual plates sealed in this manner, with three feet 17 each, by means of which they are supported on the underlying plate. When assembling, the plates can then simply be stacked one on another, each being sealed, when fitted in place, by pushing the coil spring 15 into place. When dismantling, the plates are preferably withdrawn through the bottom of the shell, when the coil springs 15 will of their own accord be released.

Although only two forms or embodiments of the invention have been described, it will now be apparent that these can be modified, supplemented, or simplified in various details. For instance, the ring 6 or 6a may be made with only one horizontal limb 8 or 8a if the plate 2 or 2a is by any other means prevented from being lifted off its support, as by pulsations in the operation of the column; the coil spring 15 can itself be replaced by a flanged metal ring made elastic by radial slits and thus bearing elastically against the shell; it is even possible to flange down the edge of the plate itself, and silt it radially so that the elastic, closely spaced tongues thus formed, themselves act as sealing means. In this case, however, the plate itself must be made of suitably thin and elastic sheet metal and its central part then stiffened by ribs or the like.

What is claimed is:
1. In a bubble deck column, having a cylindrical container arranged with vertical axis and divided into superimposed chambers by at least one horizontally arranged circular bubble deck, a sealing means interposed between the periphery of the deck and the inner wall of the container, said means comprising an annular member having a vertical and at least one horizontal flange and being coaxially arranged within said cylindrical container, and a turn buckle on said means forcing the vertical flange of said annular member radially against the adjacent walls of said container, said horizontal flange supporting the periphery of said deck, said annular member comprising two parallel horizontal flanges, whereby said annular member has a cross-section in the shape of inverted F, the periphery of said deck being inserted into the space between the two horizontal flanges of said annular member.
2. In a bubble deck column, having a cylindrical container arranged with vertical axis and divided into superimposed chambers by at least one horizontally arranged circular bubble deck, a sealing means interposed between the periphery of the deck and the inner wall of the container, said means comprising an annular member having a vertical and at least one horizontal flange and being coaxially arranged within said cylindrical container, and a turn buckle on said means forcing the vertical flange of said annular member radially against the adjacent walls of said container, said horizontal flange supporting the periphery of said deck, said annular member being radially split, comprising two parallel horizontal flanges and having the form of an open ring having a cross-section of an inverted F, one of the two horizontal flanges of which fits below the deck and the other flange fits above the deck, and both flanges overlap at the radial split of said ring.

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