May 9, 1944. A. M. FAIRLIE 2,348,208

FILLING MATERIAL FOR REACTION SPACES

Filed Jan. 13, 1941

Fig. 1.

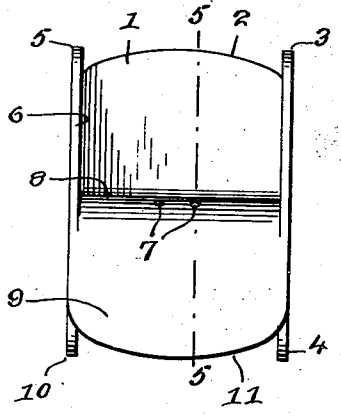


Fig. 2.

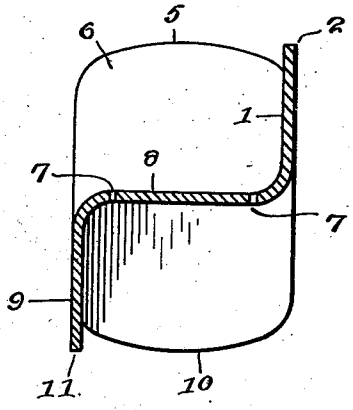
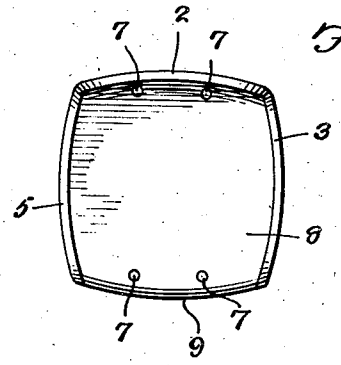


Fig. 3.



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FILLING MATERIAL FOR REACTION SPACES

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8 Claims. (Cl. 261—95)

This invention relates to forms of packing or filling material designed for use in chemical towers, gas-washing towers, chambers or other enclosed spaces wherein chemical reactions or washing, absorption, cooling, heating, drying, humidifying or mixing gases or liquids or operations of a similar character, may take place. Such packing bodies are also used in enclosed spaces for the concentration of liquids, for nitrating or denitrating liquids or gases, for purifying or otherwise conditioning air, and for many other purposes.

One object of this invention is to produce a form of packing material possessing greater surface area per unit of space occupied than the forms of packing bodies hitherto known.

Another object is to provide a form of packing unit having unusually large surface area per cubic foot of packed space in combination with a minimum resistance to gas flow, as packed in the enclosed space.

A third object is to make available a form of packing which, for its most effective use, does not require to be stacked in the enclosed space by hand (for example in courses or in rows), but which is also very effective when dropped into the space to be packed at random, without risk of breakage, thus saving the labor of placing by hand.

A fourth object is to produce a form of packing possessing all of the foregoing advantages, and at the same time capable of being manufactured cheaply and in large quantities with existing types of molding machinery.

This invention comprises a packing unit designed in a shape resembling the shape of an armchair which, upon being inverted, presents to view a duplicate armchair of a shape similar to that seen when the unit was in the original position. Owing to this peculiarity, this unit has been called "the invertible armchair."

The accompanying drawing illustrates several modifications of the packing unit of this invention. It is manifestly not practicable to show in the drawing all conceivable modifications in the design details disclosed herein, and the scope of this is not limited to the details of the designs shown. In the several figures of the drawing, like parts are indicated by like characters.

Figure 1 is a front view of a filling unit which has the shape of an invertible armchair having a web 8, joining and integrally connected with two similar side plates 3 and 5, midway of their height. An upwardly extending back or apron 2 is formed, extending approximately at right angles to the back part of the web 8, this extending upwardly to about the level of the tops of the side plates 3 and 5. A similar apron 9 extends downwardly from the front of the web, to about the level of the bottoms 4 and 10 of the side plates 3 and 5. At suitable points, e. g., at the front and back of the web 8, perforations 7 are preferably made, to allow accumulated liquid to drain or flow downwardly. These parts, 8, 3, 5, 4, 10, 2 and 9, can be termed (when considering the device as an invertible armchair shape), respectively the seat, the two arms, and two legs (supports), the back and the apron. When inverted, these become respectively the seat, the two legs, two arms, and apron and the back, of the armchair shape.

Figure 2 is a central vertical section of the device of Figure 1, on line 5—5, looking from the right.

Figure 3 is a plan view of the device of Figures 1 and 2, showing the side plates, back and apron curved (or bowed).

In the figures, the characters, respectively, indicate parts of an invertible armchair as follows:

1 indicates front surface of back of armchair.

2 indicates top edge of back.

3 indicates top edge of the side plate or arm at the right of the figure.

4 indicates bottom edge of the side plate or arm at the right of Fig. 1 extended downwardly to represent a support or leg for the armchair as shown, which support becomes an arm of the armchair when inverted. Here the upper part of the side plate may be considered the arm and the lower part of the side plate may be considered as the support.

5 indicates top edge of the side plate or arm at left of Figure 1.

6 indicates inside surface or arm at left of Figure 1.

7 indicates holes in the web or seat for drainage of liquid.

8 indicates horizontal web or seat.

9 indicates surface of apron below the outer (or front) edge of the web or seat.

10 indicates bottom edge of side plate at the left of the figure extended downwardly to represent a parallel support for the armchair as shown, which becomes an arm of the armchair disclosed when the body is inverted.

11 indicates bottom edge of apron 9.

There may be provided, ridges or ribs, to increase surface area and to stiffen and strengthen the unit. These are optional.

Referring to Figure 1, which is the preferred form of packing unit having the shape of an

invertible armchair. This device as shown may be inverted (turned upside down), the top edge 2 of the back 1 then becoming the bottom edge of the apron, while the bottom edge 11 of the apron becomes, in the inverted position, the top edge of the back. To all appearances the general shape of the armchair disclosed is the same, with seat, back, two arms, two supports or legs, and an apron, whether the unit is looked at in the normal or the inverted position. In fact if, as is easily possible, the upper and lower halves of the unit be made symmetrical about a given center line taken as an axis, it might be difficult to distinguish between the normal and the inverted positions of the unit. Symmetry about an axis, however, is not essential. The arms shown in Figure 1 are obviously higher, in relation to the back than those of a conventional armchair used as a seat. This is for the sake of additional surface area; but the tops of the arms could of course be made lower, if one desired to reproduce the arms of a conventional armchair, rather than a more efficient packing unit. In this invention, an arm is not merely a rail resting on two supports, as in the case of some types of conventional armchair, but, for the sake of more surface area, is a continuous vertical sheet, which may be flat-sided, extending upward from the seat 8 to an elevation virtually as high as the top edge 2 of the back, as well as downward (to form a leg or support) from the seat 8 to a point substantially as low as the bottom edge 11 of the apron 9. The downward extensions of the arms below the seat may be regarded as the parallel supports of the unit, serving as legs, and they also serve to form the arms of the device when in the inverted position. As is explained below, these arms are not necessarily flat-sided; on the contrary they or the back or the apron or the seat may be corrugated, or ribbed or studded with knobs or other protuberances, on either or both sides, to further increase the surface area. This also prevents two adjacent units from contacting closely one with the other, which would reduce or nullify the effectiveness of surfaces which through contact directly with surfaces of a neighboring unit are no longer exposed to contact with liquid or gas. The top and bottom edges of the back, arms and apron of this unit are shown curved, but of course they could be made straight and with even greater efficiency as regards surface area. Holes 7 may be formed at the back and front of the seat, to permit liquid to drain out when the seat is tilted backward. The front edge of the seat 8 merges into the top part of the apron 9, preferably with curved surface rather than as a sharp corner. The back or arms or apron or supports of this device may be curvilinear in cross section, instead of straight, if preferred. Instead of the apron shown in Figure 1, this unit may have an extension of the back 1 downward below the seat, similar to the downward extensions of the arms 3 and 5, and the invertible armchair thus produced would be but a modification of Figure 1. Such downward extension of the back would constitute a cross support in the position shown in Figure 1, which would become the back of the armchair brought to view when the unit is inverted.

In all of these modifications of the invertible armchair type of packing unit, as well as in other modifications embodying alterations in detail not shown, the body is so designed as to simulate an armchair, when placed in what may be arbitrarily assumed as the normal position, and also an armchair of generally similar shape (though not necessarily exactly symmetrical or of identical dimensions or proportions) when turned upside down (inverted). In Figures 1 and 2, the back, arms, supports, seat and apron are shown with flat surfaces, but in practice the surfaces may be corrugated, grooved, curved or crimped, as desired, to increase surface area, strengthen the unit, or keep surfaces of adjacent units separate from one another, without departing from this invention. Ridges or ribs for stiffening or for increasing surface area may be provided, having suitable shapes and in any desired number, the ribs may be applied to the arms or downward extensions thereof, or to the apron, back or seat, and on either side of any of them, or knobs, studs or other protuberances may be substituted for the ribs or ridges as means for increasing surface area or for keeping surfaces of adjacent units apart or spaced away from each other, without departing from this invention.

The form of packing unit herein described, in any of its modifications or sizes, is preferably dumped into a tower or other packed space at random, thus avoiding the labor expense involved in stacking by hand in courses or rows, and it is designed to avoid the nesting of adjacent units within one another. The preferred modification shown in the drawing presents a maximum of surface area per unit as well as per cubic foot of packed volume, combined with a maximum of free volume and free cross sectional area as packed in an enclosed space. The modification shown in Figure 1, especially when the surfaces are corrugated, curved or crimped, effects the purposes of packing an enclosed space (namely, to delay the progress of gas and liquid therethrough in order to prolong the period of contact therein, in combination with a minimum of resistance to gas flow and a maximum of surface area) better than any of the forms of packing hitherto known.

Another advantage of the invertible armchair type of packing unit is that it can be manufactured in large quantities and cheaply by types of machinery already in use, merely by changing the form of dies or molds in a manner to shape the product shown herein.

The relative dimensions and the sizes of this device may be whatever is desired for the particular purpose in hand. For most purposes it will be satisfactory to have the overall length, breadth and height, for any size of unit, the same; although any two or all three of the dimensions may be different, in the same unit. The range of sizes may extend from 2 millimeters or even less to 20 centimeters or even more, for any dimension. For most purposes the range of sizes will be from 6 millimeters to 16 centimeters, for length, breadth and height.

The invertible armchair type of packing unit may be made of clay, shale, porcelain or other ceramic material, or of glass, steel, cast or wrought iron, silica, silicon-iron or other iron or steel alloy, or any other suitable metal or metallic alloy, or of carbon or sulfur or mixtures of sulfur with sand, coke, etc., or of any other material suitable for the purpose involved. Obviously, the material selected should be such as withstands the action of the gases and liquids to be contacted.

The type of packing unit herein described may be manufactured in pairs, or in clusters or groups, two or more invertible armchairs being manufactured as a unit, and such dual or plural invertible

armchairs come within the scope of this invention.

I claim:

1. A filling body for reaction spaces consisting of a pair of side plates, spaced from each other, and a substantially flat web spanning the space between said side plates and integrally connected therewith, said side plates both being substantially perpendicular to said web, one of said side plates having at least one portion projecting from the web in one direction and the other of said side plates having at least one portion projecting from the web in the opposite direction and substantially to the same extent as the first mentioned portion, said body also carrying aprons attached to the front and rear edges of said web, and both of said aprons extending substantially perpendicular to said web.

2. A filling body for reaction spaces consisting of a pair of substantially parallel substantially vertical side plates of about equal dimensions, said side plates being spaced from each other, and a web spanning the space between said side plates and integrally connected therewith, said side plates being substantially perpendicular to the web, each of said side plates projecting equally in both directions from the web, said side plates being curved.

3. A filling body for reaction spaces consisting of a pair of substantially parallel spaced side plates, and a substantially flat web spanning the space between said side plates and integrally connected therewith, said side plates being substantially perpendicular to said web, one of said side plates having at least one portion projecting from the web in one direction and the other of said side plates having at least one portion projecting from the web in the opposite direction and substantially to the same extent as the first mentioned portion, said web having back and front edge portions extending between the said parallel side plates attached respectively to a back and an apron extending in opposite directions and substantially at right angles to the web.

4. A filling body for reaction spaces consisting of a pair of substantially parallel spaced side plates of about equal dimensions, and a substantially flat web spanning the space between said side plates and integrally connected therewith, said side plates being substantially perpendicular to the web, each side plate projecting about equally in both directions from the web, said web having back and front edge portions extending between the said parallel back and front plates, said back and front edge portions being attached respectively to a back and an apron extending in opposite directions from said web and substantially at right angles to the web.

5. A filling body for reaction spaces consisting of a pair of substantially vertical substantially parallel spaced side plates of about equal dimensions, a substantially flat web spanning the space between said side plates and integrally connected therewith, said side plates being substantially perpendicular to the web, each side plate projecting about equally in both directions from the web, and a rib being provided on at least one of said parts and integral therewith, said web being provided with a perforation to allow drainage.

6. A filling body for reaction spaces having a pair of substantially vertical side plates, spaced apart from each other and substantially parallel to each other, a web spanning the space between said side plates, a part of which web is substantially flat and horizontal, the front and rear edges of which are respectively curved downwardly and upwardly, said flat part being substantially perpendicular to said side plates, and being integrally connected therewith at about midway of their height, and front and back plates integrally connected to the front and back edges respectively of said web, said front and back plates being approximately perpendicular to the plane of said flat part of said web and also being approximately perpendicular to said vertical side plates, one of these front and back plates extending upwardly and the other extending downwardly from the flat portion of said web, one at least of said parts having a rib on its outer surface.

7. A filling body for reaction spaces consisting of a pair of substantially vertical side plates spaced from each other and of about equal dimensions, and substantially parallel to each other, a web a central portion of which is substantially flat, spanning the space between said side plates and integrally connected therewith, said side plates being substantially perpendicular to the web, each side plate projecting about equally in both directions from said web, and a plurality of plate-like projections attached to said web and integral therewith, which extend upwardly and downwardly respectively from the back and front edges of said web, said structure being perforated to allow collecting liquid to drain out, a part at least of the exterior of said body presenting a convex surface.

8. A filling body for reaction spaces having a pair of substantially vertical side plates, spaced apart from each other and substantially parallel to each other, a web spanning the space between said side plates, a central part of which web is substantially flat and the front and rear edges of which are respectively curved downwardly and upwardly, said flat part of said web being substantially horizontal and substantially perpendicular to said side plates, and being integrally connected therewith about midway of their height, and front and back pieces integrally connected to the curved front and back edges respectively of said web, and one of these pieces extending upwardly and the other extending downwardly from said web, said structure being provided with at least one perforation permitting liquid collected in said body to drain out.

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