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A. M. FAIRLIE

2,212,932

FILLING MATERIAL FOR REACTION SPACES

Filed Oct. 28, 1938

Fig. 1.

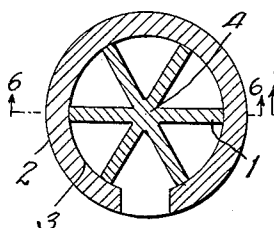


Fig. 2.

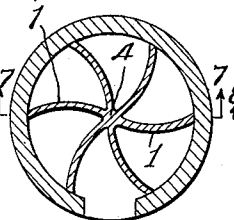


Fig. 3.

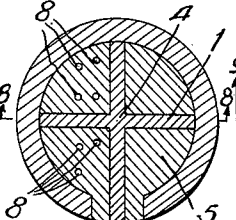


Fig. 4.

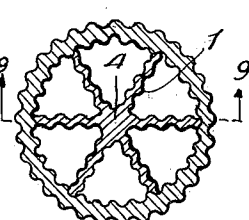


Fig. 6.

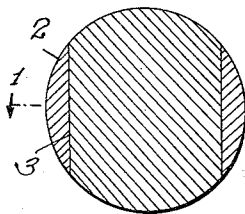


Fig. 7.

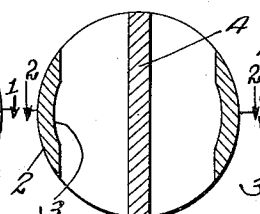


Fig. 8.

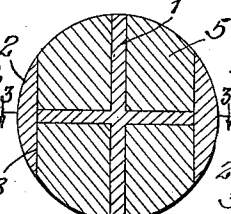


Fig. 9.

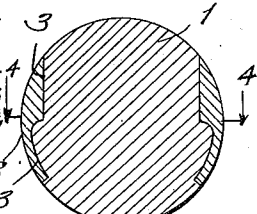


Fig. 5.

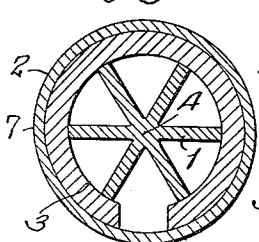


Fig. 11.

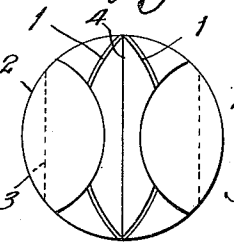


Fig. 12.

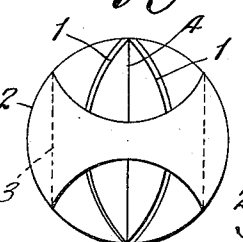


Fig. 13.

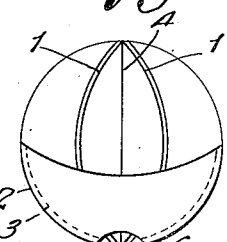


Fig. 10.

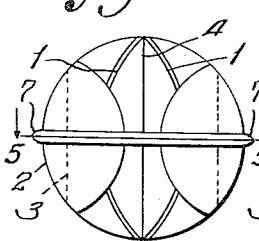


Fig. 14.

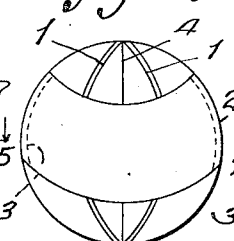


Fig. 15.

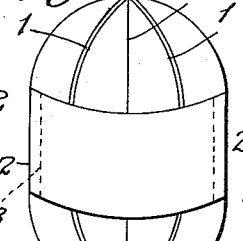
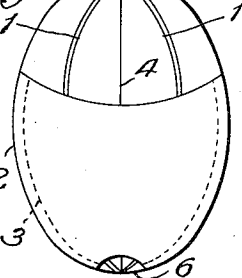


Fig. 16.



Inventor:

Andrew M. Fairlie

UNITED STATES PATENT OFFICE

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FILLING MATERIAL FOR REACTION SPACES

Andrew Miller Fairlie, Atlanta, Ga.

Application October 28, 1938, Serial No. 237,493

8 Claims. (Cl. 261-94)

This invention relates to manufactured forms of material designed for use as filling or packing in reaction spaces, chemical towers, chambers and the like, wherein chemical reactions take place, and equally as filling or packing for enclosed spaces employed for effecting the washing, drying, humidifying, heating, cooling, absorption or mixing of a gas or gases, or for the concentration of liquids, or for any operation wherein a gas or a mixture of gases and one or more liquids are conducted into the same packed or partially packed enclosed space.

One object of this invention is to provide a form of filling for packed spaces affording a greater surface area per unit of space occupied than is afforded by prior forms of packing.

Another object is to provide a form of filling material affording more free space and less resistance to gas-flow per unit of surface area than is afforded by prior forms of packing.

A third object is to provide a form of filling for packed spaces presenting a greater surface area accessible to the gases and liquids supplied to such packed spaces, with particular attention to avoidance of the comparatively useless horizontal surfaces of previous forms of filling material, whose under sides are not wetted by the descending liquid, whose upper sides receive no direct impingement of the ascending gases, and which operate, moreover, as shelters which keep the descending liquid from wetting surfaces, both vertical and horizontal, that are beneath; thus materially diminishing the area of useful or efficient surface in reaction spaces packed with forms of filling embodying or presenting horizontal or sheltering surfaces.

Briefly, this invention comprises a plurality of circular or elliptical partitions, comprised within the outline of a sphere, spheroid, ellipsoid or the like, arranged in different planes and intersecting one another along their medial lines, such partitions being partially enveloped around their edges by a partial shell, covering or envelope, the area of whose outside surface is equivalent to at least one-fourth and less than ninety per cent of the whole external surface of the tri-dimensional geometrical body corresponding to the aforesaid partitions.

In the accompanying drawing several examples of the forms of filling within the scope of this invention are illustrated. However, it is not practicable to show in the drawing all of the conceivable modifications based on the disclosures herein, and the scope of this invention is by no means limited to the particular details of the designs

shown in the drawing. Like parts in the illustrations shown are indicated by like characters.

Fig. 1 is a section on a plane through the line 1-1 of Fig. 6, and Fig. 6 is a section on the line 6-6 of Fig. 1. Fig. 2 is a section through the line 2-2 of Fig. 7, and Fig. 7 is a section through the line 7-7 of Fig. 2. Fig. 3 is a section through the line 3-3 of Fig. 8, and Fig. 8 is a section through the line 8-8 of Fig. 3. Fig. 4 is a section through the line 4-4 of Fig. 9, and Fig. 9 is a section through the line 9-9 of Fig. 4. Fig. 5 is a section through the line 5-5 of Fig. 10, and Fig. 10 is a front elevation of Fig. 5. Fig. 11 is a front elevation of the modification shown in vertical section in Fig. 6, and Fig. 12 is a rear elevation of the same. Figs. 13, 14, 15, and 16 are elevations, showing modifications in the details of the packing unit.

Figures 1 and 6 represent different views of a filling body whose construction is that of a partly hollow sphere, which is partly covered or enveloped by a partial shell or envelope partially enclosing three circular partitions intersecting one another at a common line considered as the vertical axis of the sphere. The angles formed by the intersection of the disks are preferably equal, though not necessarily so.

Figures 2 and 7 are similar, respectively, to Figures 1 and 6, with the exception that the three circular disks of Figures 1 and 6 are replaced by three curved partitions intersecting one another along the axis of the sphere as shown in Figure 2.

Figures 3 and 8 are similar, respectively, to Figures 1 and 6, with the exception that in Figures 3 and 8 only two of the disks are vertical, the third disk being horizontal. The two vertical disks are shown at right angles to each other, and they intersect each other at a common center line which coincides with the vertical axis of the sphere; while the third disk intersects both of the other two disks medially and at right angles along two lines of intersection which are horizontal.

Figures 4 and 9 are similar, respectively, to Figures 1 and 6, with the exception that the partial covering or envelope, as well as the disks, are shown with their surfaces corrugated, or crimped.

Figures 5 and 10 represent a modification of the shape shown in Figure 1, in which a sphere is engirdled, at the circumference that is midway between the ends of the vertical axis, by a narrow ridge projecting outwardly from the outer surface of said sphere, the purpose of this ridge being explained below.

Figures 11 to 14 inclusive show different designs of covering or envelope for enclosing the intersecting disks or partitions shown in the preceding figures. Figure 11 shows a front view of an envelope whose shape is similar to that of one-half the covering of a baseball. Figure 12 shows a rear elevation of the same envelope as Figure 11, the view being from a point diametrically opposite to the viewpoint of Figure 11. Figure 13 shows an envelope at the lower half only of the sphere, with an orifice at the bottom for the passage of gas or liquid. Figure 14 shows an envelope around the middle zone of a sphere, like a girdle or belt, the upper and lower edges of this envelope being substantially equal circles, parallel to each other.

Figure 15 represents a partly hollow and partly enclosed cylinder with semi-spherical ends. This shape may be regarded as an elongated modification of Figure 14.

Figure 16 represents, in outline, an ellipsoid, and may be regarded as an elongated modification of Figure 13.

In all of the figures, the vertical axis of the filling body is the axis of the envelope or covering. The symbol 1 represents a diaphragm or partition whose vertical center line coincides with the vertical axis of the body. The outer surface of the partial covering or envelope of the filling body is represented by 2, and the inner surface of the same by 3. The various vertical diaphragms or partitions intersect at 4. The horizontally-disposed diaphragm or partition of Figure 8 is indicated by 5, and in Figures 13 and 16, the orifice at the bottom of the envelope of the filling body is designated by 6. The encircling ridge-shaped belt of Figures 5 and 10 (the object of which is, by tilting the filling body, to hinder the assumption of a horizontal position, and also to add to the rigidity of the packing unit) is indicated by 7. This ridge may be continuous, to form a complete circle around the equator of the packing unit, or it may be intermittent or broken into sections, or the ridge may be replaced by a series of outwardly projecting protuberances or knobs, so arranged as to constitute an unstable resting place for the filling body, and designed to tilt the unit out of a horizontal position in the packed space.

In all of the designs shown in the drawing except that of Figure 8, all of the diaphragms or partitions are disposed vertically to insure exposure of both sides of each diaphragm to the gases as well as the liquids supplied to the reaction space, and also to minimize resistance to gas-flow. In the case of the horizontally-disposed diaphragm of Figure 8, the resistance of the horizontal position may be relieved by means of the perforations 8.

The preferred forms of diaphragms are those shown in cross section in Figures 2 and 4. The curved or corrugated partitions present substantially greater surfaces than the plane-surfaced disk form of Figure 1, and the vertical position of these partitions secures the advantages mentioned above.

The preferred shape for the filling body is spherical, as shown for all of the designs except Figures 15 and 16. The spherical form presents a maximum of surface area per unit of space occupied, and a minimum of resistance to gas-flow between individual packing units contiguous to each other.

The preferred form of envelope or covering for this filling body is the baseball cover design

shown in Figures 10, 11 and 12. This form presents a complete 50 per cent of the total surface of a sphere externally, with practically no obstruction to gas-flow when in the vertical position, and the undulating edges of this form of envelope favor the entrance and exit of gases and liquids to the interior of the filling body. This form of envelope is also superior to other forms, regardless of its position (vertical, horizontal or oblique) in the packed space, presenting a minimum of under surface unwetted by the liquid supplied to the packed space, and a minimum of upper surface inaccessible to the flowing gas. The shape of envelope called herein the baseball envelope may be made from a blank shaped like the outline of a figure 8 whose upper and lower loops or rings are equal in size and connected to each other by a relatively narrow neck. By bending a blank thus fashioned into a circular shape, until the bulging extremities of the 8 approach each other but yet are separated by the same distance as the width of the neck of the 8 at its narrowest part, thereafter shaping the surface to form a concave interior and a convex exterior, the baseball envelope is complete. In practice, the baseball envelope and its internal disks or partitions may be shaped simultaneously by means of suitable dies in certain types of stamping or compression machines, and in such case it may be expedient, while retaining the convex external shape of the envelope, to make the internal shape cylindrical, instead of spherically concave, as shown in Figures 6 and 8; or partly concave and partly cylindrical, as shown in Figure 9. In practice the edges of the partitions are compressed into the substance of the belt or envelope and are made integral therewith.

The baseball or figure 8 type of covering, shell or envelope for spheroidal forms of filling for reaction spaces is one of the features of this invention, regardless of the construction or design of framework (intersecting partitions or otherwise) on which the envelope or covering is mounted. Moreover, the baseball or figure 8 type of shell or envelope, similar to the form of envelope or shell shown in Figures 10, 11 and 12, but without any enclosed framework or intersecting partitions, or with merely one or more ridges or ribs similar to the ridge 7 of Figure 10, either vertical, oblique or horizontal, and either outside or inside said shell, may be used as a form of filling for reaction spaces and the like, and all such modifications of the baseball type of packing unit fall within the scope of this invention.

The preferred position of the shell or envelope on each unit is such that the horizontal circumference dividing the partial shell into two equal parts will be equidistant at all points from the two ends of the common line of intersection of the partitions as shown in Figures 11 and 12. The said line of intersection is therefore considered to be the vertical axis of the packing unit as a whole, and also the vertical axis of the partial shell or envelope, and the unit is considered to be in the vertical position when the said line of intersection, or vertical axis, is vertical.

The filling bodies herein described may be made of shale, porcelain or other ceramic material, or of carbon, silica-ware, cast iron, steel, silicon-iron or other iron or steel alloy, or of any suitable metal or metallic alloy, or of sulfur or mixtures of sulfur with sand, coke, etc., or of any other material suitable for the purpose in

hand. The material of which these units are manufactured should be resistant to the gases and liquids with which they will come in contact.

I claim:

1. A filling body for reaction spaces, chemical towers and the like, consisting of a tri-dimensional, partially hollow geometrical structure of curvilinear outline in all its exterior surfaces, comprising a plurality of partitions of extended surface intersecting one another along a central axis, and an envelope of generally spherical or ovate form whose axis is coincidental with said central axis at least partially surrounding and enclosing said partitions.

2. A filling body for reaction spaces, chemical towers and the like, comprising a plurality of partitions of circular outline and of substantially equal diameters, intersecting one another along their respective diameters in a common line of intersection, and a belt equidistant at all points from the center of said line of intersection partially surrounding and formed integral with said partitions at the edges thereof.

3. A filling body as described in claim 1, the partitions of which have curved surfaces.

4. A filling body as described in claim 1, the envelope or the partitions of which are corrugated or crimped.

5. A filling body as described in claim 1, of which the belt or envelope has the shape of one-half the covering of a baseball.

6. A filling body as described in claim 1, of which the envelope or covering, if straightened and flattened out, assumes the shape of the outline of a figure 8 having two loops of equal size connected by a relatively narrow neck.

7. A spheroidal-shaped filling body for reaction spaces, chemical towers and the like, comprising an internal framework of spheroidal outline, in combination with a spheroidal partial covering or envelope which, if straightened and flattened out, assumes the shape of the outline of a figure 8 having loops of equal size connected by a relatively narrow neck.

8. A form of filling for reaction spaces, chemical towers and the like, comprising a curved, shell-like body fashioned in the shape of a partial sphere, at least partly hollow interiorly, the exterior of said shell-like body being similar in shape to one-half the covering of a baseball, said shell-like body, when straightened and flattened out, assuming the shape of the outline of a figure 8 having two loops of equal size connected by a relatively narrow neck.

ANDREW MILLER FAIRLIE.