

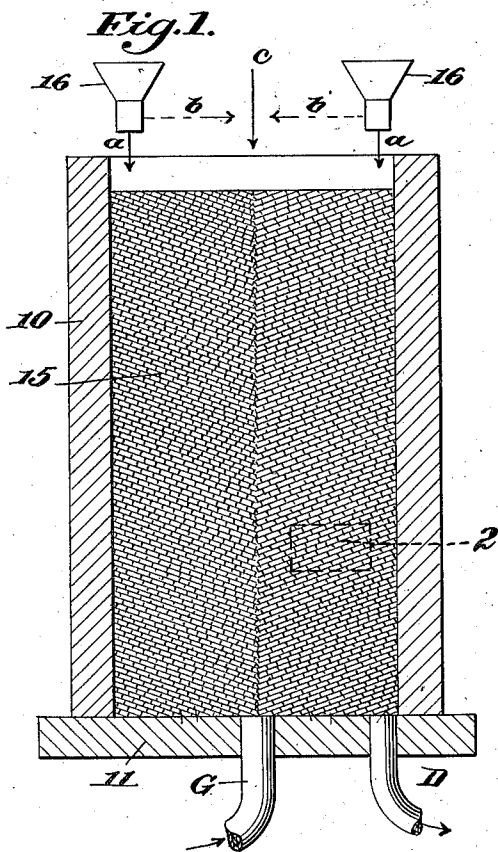
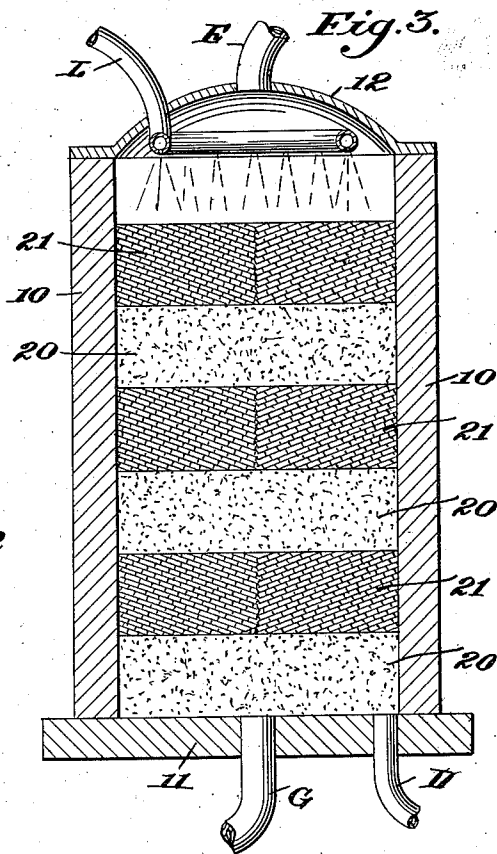
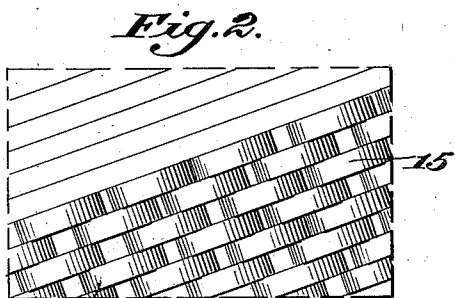
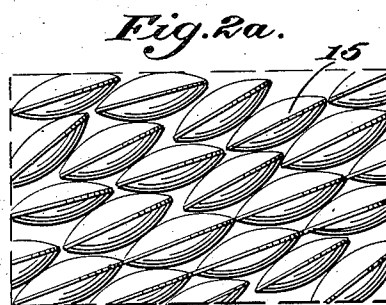
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CHAMBER OR TOWER FILLED WITH FILLING MATERIAL

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CHAMBER OR TOWER FILLED WITH
FILLING MATERIAL

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5 Claims. (Cl. 261—94)

In order to bring liquids in towers or reaction chambers into the most intimate contact possible with gases or vapors, such towers and chambers are filled with filling materials of the most varied kind and shape or the filling materials are so disposed in regular arrangement that the irrigating liquid is thoroughly distributed and several channels and contact surfaces are offered to the gas stream, without an accompanying excessive increase of the resistance of the filled chamber to the passage of the gas. Fillings or arrangements are known which fulfill this purpose relatively completely.

It has, however, been found that if the height of such towers and reaction chambers is increased beyond a certain extent, such increase in height does not lead to a proportionate increase in effect. This is due to the fact that the distributing effect of the filling on the downwardly trickling liquid causes more and more of the liquid to flow downward along the peripheral wall. In order to make a complete use of the upper part of a tower, the irrigating liquid must be uniformly distributed when introduced. Each successive lower section tends to have a uniform distribution of the liquid remaining in the body of the mass, as distinguished from the liquid which has passed to the peripheral walls and is trickling therealong. Hence, a constantly increasing part of the liquid flows downward adjacent the side walls. This quantity of liquid is almost completely lost so far as irrigation and the intended action is concerned, and the centre of the chamber becomes more and more deprived of irrigating liquid. This disadvantage becomes specially marked when the operation is carried out in countercurrent and, consequently, a great height of the chamber or tower is of particular value, as for example in enriching operations, washing ammonia out of coal gas and the like.

The principal object of this invention is to overcome this disadvantage.

According to the invention the liquid is conveyed away from the walls towards the centre, by filling the towers or reaction chambers so full with filling materials, that their surfaces or principal surfaces effect a unilateral deflection of the downwardly trickling liquid towards the axis of the tower, and thus counteract the tendency of the irrigating liquid to force itself against the walls.

The surfaces or principal surfaces thus form an acute angle from above with the axis of the tower.

All filling materials with surfaces having different dimensions in different directions are suitable but spherical or approximately spherical or cubical filling materials are unsuitable.

The introduction of the filling materials, by pouring in such a way that the surfaces or principal surfaces exert the desired deflection, is then possible, if the pouring of the filling material is entirely or partially effected adjacent the walls of the chamber to be filled.

The filling materials thereby dispose themselves at the angle of repose natural to them and, on continuing to pour in adjacent from the walls, the further materials introduced slide along the incline, so that the surfaces or principal surfaces of the filling materials are turned in the desired manner at an acute angle towards the axis of the tower or chamber.

This method of pouring adjacent the walls with an angle of slope increasing from the centre towards the wall, is suitable for all filling materials, which are plate-shaped or elongated and for ring-shaped filling materials which are greater in height than in diameter.

In the case of other filling materials, the same effect may be obtained by pouring from the axis outwards, i. e. in the case of ring-shaped filling bodies, which are less in height than in diameter.

If such filling bodies were poured adjacent the walls the deflecting surfaces, i. e. the cylindrical surfaces, would be so arranged that they would deflect the current of liquid towards the walls.

The introduction of the filling materials by pouring offers no difficulties, it being possible to a slight extent to form the initial inclined surfaces at the start by disposing the filling materials accordingly.

If these filling materials are allowed to slide down over their own inclined surfaces, the chief planes of these plates all become more or less disposed in the direction of the slope and will of course produce a very considerable deviation, which may in certain circumstances even become excessive. This deviation would moreover in certain circumstances have the disadvantage, that the gas stream would be considerably deviated towards the outer side of the hollow chamber.

If such a shape is imparted to the filling materials, that the difference of the dimensions of the filling materials in two directions more or less perpendicular to one another is considerably less than in the case of a plate shape, effects of the exactly desired degree can be obtained. For example, filling materials are employed in which

the outer circumference is lens-shaped or oval. Fragments of coke or stone may be employed, provided they are oblong in shape or deviate from the spherical. These filling materials may of course also be hollow and provided with perforations, indentations and the like, provided they have such a shape that on being poured in obliquely they impart a deviation from the vertical to entering jets of liquid. Thus, for example, filling rings may also be employed, the height of which is greater than the diameter. The filling of a hollow chamber in this manner is not appreciably more costly than the method hitherto usually employed.

Finally the residual inner cone is levelled off by filling up from the outer edges.

Illustrative forms of practicing the invention are shown in the accompanying drawing in which:

Figure 1 is an upright section through a trickle tower or chamber, indicating the arrangement of the filling material therein and the method of placing such material.

Figure 2 is an enlarged view of the portion indicated by dotted lines on Figure 1.

Figure 2a is a similar fragmentary section showing a different type of forming material.

Figure 3 is a view similar to Figure 1, showing a layer-wise arrangement of such material.

In the drawing, the trickle tower or chamber has the upright walls 10 and a bottom wall 11. When charged, the chamber is usually covered at the top by a member 12 as indicated in Figure 3. Gas inlet and outlet conduits G and E operate in conjunction with liquid inlet and outlet conduits L and D.

In Figure 1, the entire chamber space is charged with a filling material 15 which comprises a mass of bodies each having a greater dimension in one direction than in a direction at right angles thereto. The center of gravity of the body is therefore so located that the body tends to lie at rest with its greater dimension disposed in the direction of the angle of repose assumed by the bodies when they are dumped into a pile and the successive bodies tend to slide, along the slope of the bodies already present, from the apex of the pile toward its lower margin.

This charging is accomplished according to Figure 1 by depositing the bodies through the pouring device 16 in the direction of arrows *a*, so that the material is deposited adjacent the walls 10 and the slope is formed by the sliding of the bodies downwardly and toward the axis of the chamber, the bodies coming to rest and providing, so to speak, strata or layers in which the bodies incline downwardly away from the walls and toward the center or axis of the chamber. The pouring device 16 may initially be within the chamber and close to its bottom to avoid fragmentation or breaking of the bodies as they are deposited. It can be carried regularly around the chamber during the depositing operation, while withdrawing it in an upward direction as the annular pile is formed with the conical surfaces of repose of the material forming in the directions indicated by the lines within the chamber. Ultimately, the pouring device 16 is entirely withdrawn from the filled portion of the chamber and then moved in the direction of arrow *b* toward the axis so that the final charging may be accomplished in the direction of the arrow *c* in extension of the axis of the chamber.

Thus, the material is deposited in the chamber

by gravitational fall in a downward direction as indicated by the arrows *a* and at points or lines along the chamber walls, so that the individual bodies slide downwardly over one another with their greater dimension substantially in the direction of the prevailing surface of repose. Thus, a regularity of position is attained by the individual bodies, so that their deflecting surfaces receive the trickling liquid and deflect it toward the axis or center, and thus counteract the tendency of the trickling liquid to move toward the walls of the chamber and assure a uniform distribution of the liquid in its downward trickling or irrigating movement.

Figure 2 is a conventional view indicating the tendency of the bodies when of disk or plate-like shape to arrange themselves in a substantially regular order as described herein.

A similar arrangement is attained by bodies of lens-shape, when similarly deposited, as shown in Figure 2a.

In Figure 3, the trickle chamber or tower is charged with successive layers of material. The layers 20 are of material which has no unilateral deflecting power, while the intermediate layers 21 are deposited in the manner described for the charging material 15 of Figure 1, and thus have a unilateral deflecting capacity. With this arrangement, the layers 20 tend to cause the liquid to move toward the walls, but operate to distribute the ascending gases regularly, while the layers 21 tend to deflect the liquid toward the axis, but in some instances may produce an outward deflection of the gases if the resistance to gas movement, of such layers 21, is not sufficient to assure a uniformity of distribution.

Further, in order to produce a definite degree of deviating effect, filling materials, which fulfill these requirements, may be mixed with filling materials which do not fulfil these requirements.

As hereinbefore mentioned, appreciable deviation of the gas stream towards the walls of the hollow chamber or tower would be expected in the proposed method of pouring with a filling material having a pronounced plate shape. If the filling offers an appreciable resistance to the passage of the gas, this will counteract the tendency of the gas to force itself against the wall. Particularly in the case of towers and chambers of large diameter, a counter effect may also be obtained by disposing the gas outlet in the centre of the tower. Finally, if the resistance of the filling to the movement of the gas must not be considerable, individual layers of finer filling materials may be disposed according to our German Patent application C. 42,492, which, owing to their resistance to the gas movement, again uniformly distribute the same over the entire cross section.

The filling materials as described in our German Patent application C. 47,322 may also be with advantage employed.

The proposed filling materials may, of course, consist of any desired material.

What I claim is:

1. A process for filling a trickle chamber with a mass of bodies presenting surfaces in definite relative positions for directing the flow through the chamber, which comprises preparing filling bodies each having a greater dimension in one direction than in a direction at a right angle thereto, and pouring the bodies into the chamber to form a pile therein, the individual bodies sliding upon one another along the angle of repose

of the pile being formed and coming to rest with said greater dimension in a plane parallel to said angle of repose.

2. A process for filling a trickle chamber with
5 a mass of bodies presenting surfaces in definite relative positions for directing the flow of liquid through the chamber, which includes preparing filling bodies each having a greater dimension in one direction than in a direction at right angles
10 thereto, and pouring the bodies into the chamber from several points adjacent the walls of the chamber, so that the individual bodies slide upon one another and determine an angle of repose, each body arranging itself with the greater di-
15 mension thereof coming to rest in a direction substantially parallel to the angle of repose for providing deflecting surfaces for counteracting the tendency of the liquid to move toward the walls of the chamber.

20 3. A trickle chamber structure comprising upright confining walls and a filling comprising a mass of slidable bodies each having at least one dimension thereof greater than a dimension at right angles to said one dimension and arranged
25 with said greater dimension substantially in the direction of the angle of repose of said bodies when poured to form a pile, the surfaces of said bodies which provide paths of preferential flow

for the trickling liquid being inclined downward and inward and constantly tending to deflect the flow toward the center of the chamber, whereby to counteract the tendency of the liquid to move toward the walls.

4. A trickle chamber structure as in claim 3, in which the filling comprises a plurality of masses of slidable bodies having the said directed arrangement, said masses forming vertically spaced layers, the space between each two such layers
10 being occupied by a filling material in non-directed arrangement for distributing flowing gases.

5. A trickle chamber structure comprising upright confining walls and a filling comprising a
15 mass of slidable plate-like bodies having greater dimensions in one plane than in the direction of thickness at right angles to said plane, said bodies presenting surfaces inclined upwardly toward the walls and being located with the said
20 planes substantially in the direction of the surface of repose of said bodies when poured to form a pile, the surfaces of said bodies providing paths of flow for the trickling liquid constantly tend-
25 ing away from the walls whereby to counteract the tendency of the liquid to move toward the walls.

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