G. ESCHELLMANN & A. HARMUTH.

CONTACT CHAMBER.

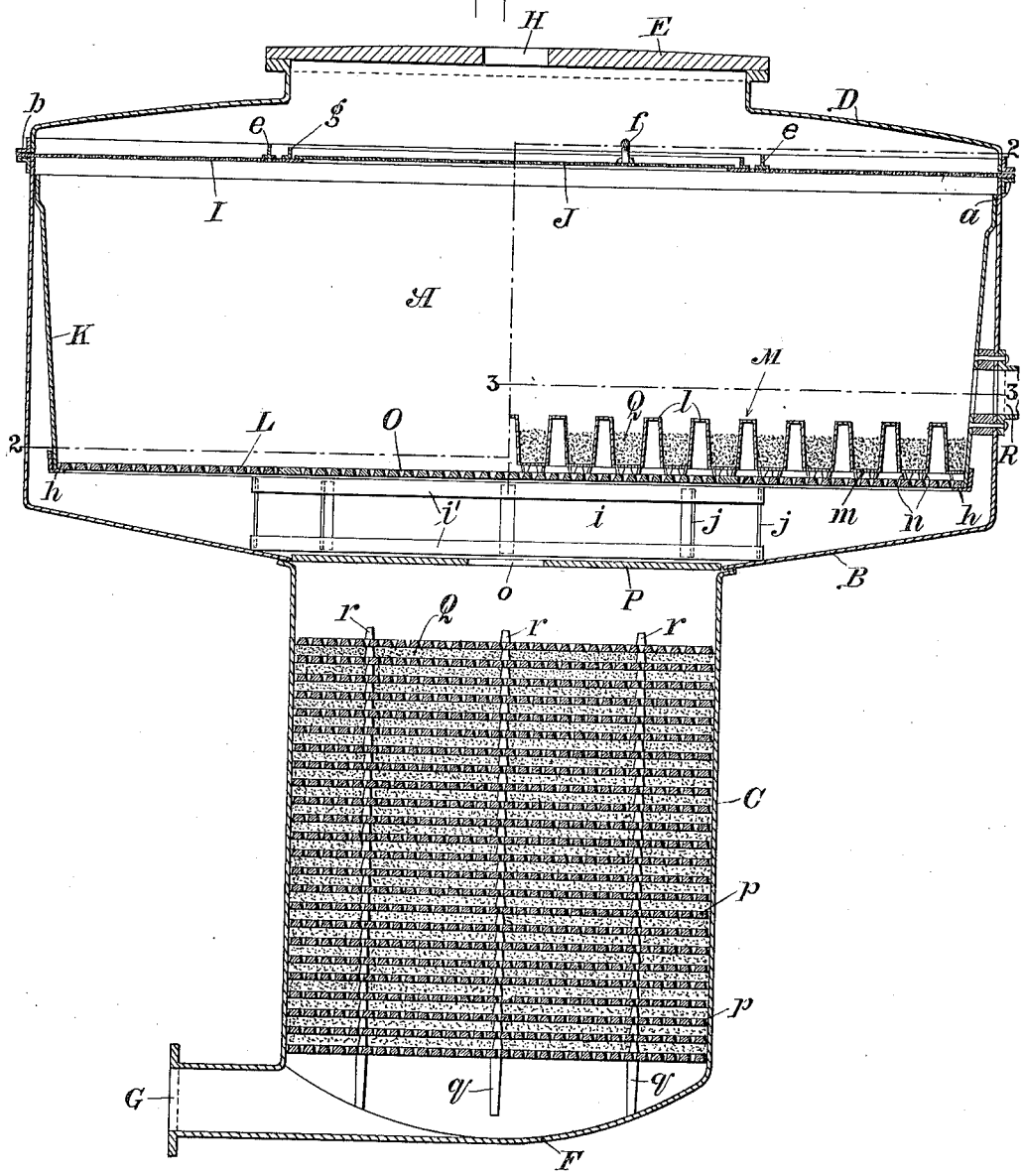
APPLICATION FILED NOV. 26, 1909.

**1,030,508.**

Patented June 25, 1912.

3 SHEETS—SHEET 1.

Fig. 1.

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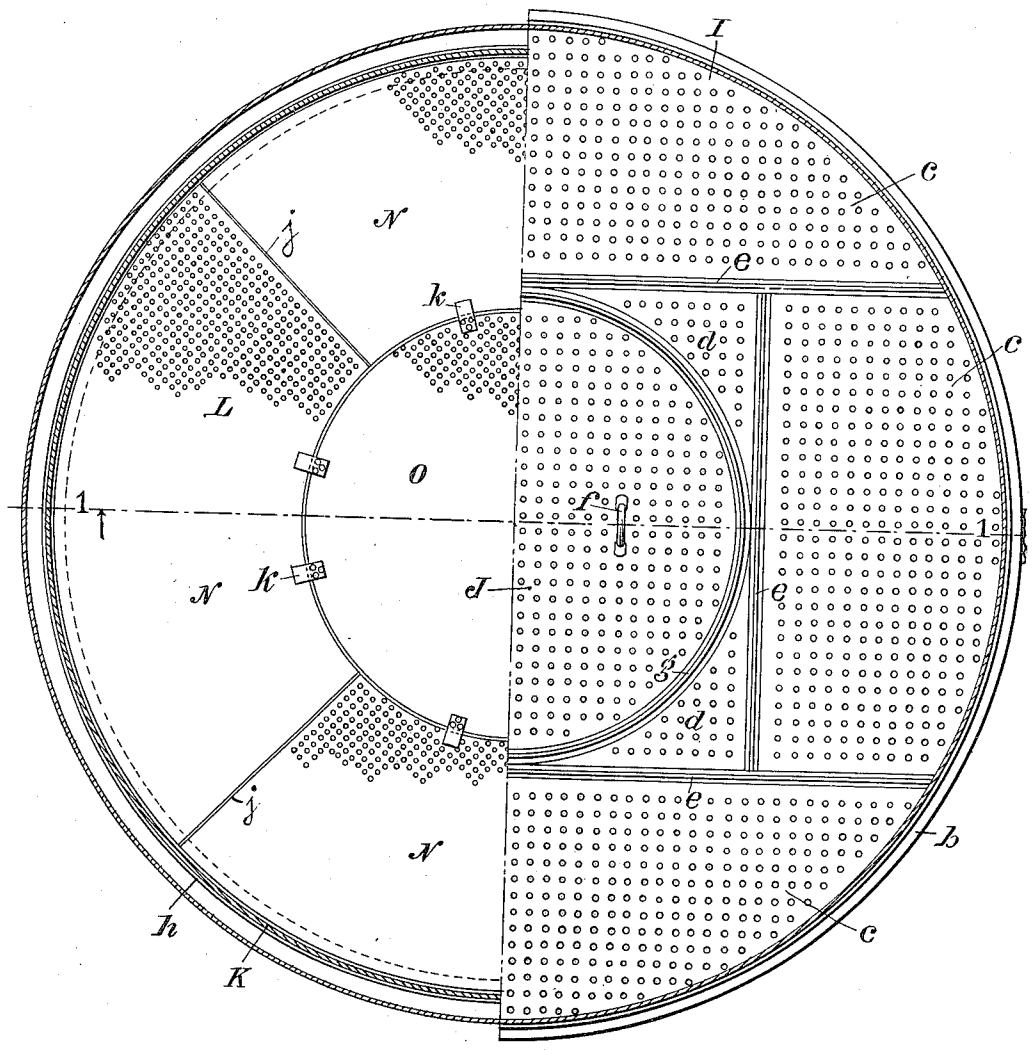
3 SHEETS—SHEET 2.

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 3.

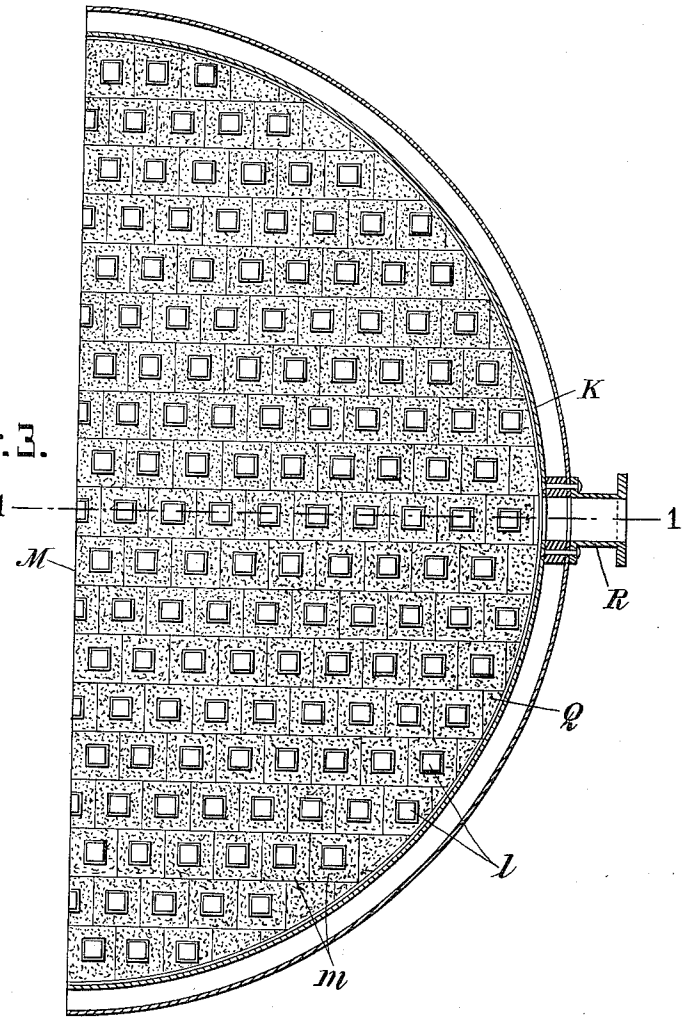
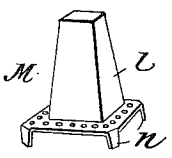



Fig. 4.

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# UNITED STATES PATENT OFFICE.

GEORG ESCHELLMANN AND ALBERT HARMUTH, OF ST. PETERSBURG, RUSSIA, ASSIGNORS TO GENERAL CHEMICAL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

## CONTACT-CHAMBER.

1,030,508. Specification of Letters Patent. Patented June 25, 1912.

Application filed November 26, 1909. Serial No. 529,933.

*To all whom it may concern:*

Be it known that we, GEORG ESCHELLMANN, a subject of the King of Great Britain, and ALBERT HARMUTH, a subject of the King of Prussia, German Emperor, both residing at St. Petersburg, Russian Empire, have invented a new and useful Improvement in Contact-Chambers, of which the following is a specification, reference being had to the drawings which are made a part of said specification.

Our invention relates to a contact chamber adapted to contain catalytic material as is required in what is now well known as the contact process of manufacturing sulfuric anhydrid from sulfurous-acid gas and oxygen (or air).

A further and most important object of our invention is to provide a contact chamber in which all parts are made easy of access for replacement or repair.

A further object of our invention is to enable such repairs as may be necessary to be confined to the exact portion of the apparatus which is at fault without the necessity of materially interfering with or of discarding and replacing adjacent parts not concerned in said fault; to this end the essential parts of our contact chamber are well subdivided and assembled as a system of units any one of which may be removed and replaced without affecting the remaining units.

A still further object of our invention is to obtain the maximum efficiency in the conversion of the entering sulfurous acid gas and oxygen into emerging sulfuric anhydrid. This we accomplish by certain features of mechanical design and of arrangement of the catalytic material with reference to the flow of the aforesaid gases through the chamber and by further providing for a suitable commingling of said gases as they thus pass through the chamber.

Still further objects of our invention will appear as the specification proceeds.

On the annexed sheets of drawings we have illustrated a preferred embodiment of our invention in which—

Figure 1 is a central vertical section taken along the line 1—1 of Figs. 2 and 3, the right hand upper half showing our improved supporting means for the catalytic material while the left hand upper half omits such upper supporting means although showing the underlying perforated plate thereof; Fig. 2 is a plan view taken along the broken line 2—2 of Fig. 1; Fig. 3 is a plan view of the upper right hand of Fig. 1, taken along the line 3—3 thereof; and Fig. 4 is a perspective view of one of the pyramidal units.

Referring to the drawings, which are drawn to scale, our contact chamber comprises an upper cylindrical portion A, preferably of sheet iron, about 13 feet in diameter joined by a tapering portion B below to a somewhat longer but smaller diametered cylindrical portion C. At the top, the cylinder B is provided with a flanged ring *a* to which may be bolted the flanged ring *b* which borders the end closure of the cylinder, said closure comprising the head D and cover E, which latter may be fastened to D by any of the well-known methods used in this class of construction. The bottom of the lower cylinder C is formed into a convex sheet F and is provided with an outlet pipe G.

The mixture of sulfurous acid gas and oxygen is led into the apparatus at the inlet H to which a suitable pipe connection may be attached. At the top of the larger cylinder A is a perforated plate comprising an outer ring portion I and an inner one piece disk portion J. The ring portion, for reasons of convenience and economy of manufacture as well as for convenience in assembling in repairs, comprises a number ing an outer ring portion I and an inner segments *d;* the outer edges of the *c* segments are conformed to the flanges *a*, *b*, and are clamped permanently between said flanges when the chamber is assembled while other edges are provided with suitable inverted T flanges *e* to aid in positioning and supporting mutually the several segments. The smaller disk J has a diameter a little larger than the inner diameter of ring I and is thereby adapted to rest upon said ring as shown in the figures. Handles *f* enable the center disk to be readily lifted from place and a circular

flange *g* affixed to ring I maintains said disk in its central position. Beneath the perforated plate system just described is a truncated funnel K of sheet metal riveted around its top to the upper cylinder A and carrying at its bottom a ring provided with an internally projecting flange *h*. This flange *h* together with a central structure *i* constitutes a support for the system upon which rests the layer of catalytic material which is first met by the incoming gas. The structure *i* comprises upper and lower hoops or rings *i' i'* joined by verticals *j* and rests upon the tapered bottom B. The supporting system for this first layer of catalytic material comprises broadly a lower perforated plate L and immediately over said plate a second perforated system constituted of a plurality of units M. The lower perforated plate L is divided along radial lines *j'* into a number of ring sections N the exterior of each section resting upon flange *h* and the interior upon the upper hoop *i'*; the plate is completed by a central perforated disk having attached to its periphery a series of lugs *k*, said lugs overhanging the disk so as to rest upon the aforementioned perforated sections N.

Upon the perforated plate system just described rests a second perforated system which comprises a plurality of identical units M, which units consist each of a truncated pyramid *l* having a closed top and open below. Each pyramid is at the center of a perforated rectangle *m*. Each of these rectangles has small supporting legs or distance pieces *n* attached to its under surface whereby said rectangle may be supported upon the lower perforated plate, and at a short distance therefrom. Preferably these distance pieces are formed from the rectangle itself either by turning vertically downward each corner, or by punching out some portion of each rectangle and turning the same downward. At the junction of B and C is placed a plate O having a central perforation *o*; this plate rests upon the upper outwardly flanged rim of C and is retained laterally by the inner terminal edges of B. In the lower cylindrical portion C is contained a system of 25 identical perforated plates *p* (in the drawing the top plate is omitted) the lower one which rests upon a series of six verticals *g* themselves resting upon the concave bottom F. These verticals may be joined together at the top in any desired way so as to form a little table or preferably may be attached in some permanent fashion to the lowest perforated plate, thus making a table of said plate. Upon each perforated plate and separating it from its neighboring plate above is a series of distance pieces *r*. These distance pieces are all of the same height thus keeping the plates parallel and equi-distant and are preferably placed in line with the lower verticals *q*.

The catalytic material Q, preferably platinized asbestos, is placed as indicated upon the upper perforated plate system in a thick layer coming nearly to the top of the pyramids *l*. Upon the lower perforated plate system the catalytic material is loosely placed upon each plate before its next upper plate is put into position. Generally we prefer the thickness of the top layer to be about 5.1 inches and that of each of the thinner layers to be about 1.6 inches. We find that these thicknesses will require the incoming gas to be supplied at a plus pressure equivalent to about 6 cms. of mercury for the thick layer and about 10 cms. of mercury for the 25 thinner layers *i. e.*, a total pressure equivalent to about 16 cms. of mercury will be required. The contact chamber being set up and filled with catalytic material as shown, suppose that for some reason it is desired to replace any or all of said catalytic material. For such purpose cover E and inner perforated disk J are first removed the latter being lifted right through the opening of D any units may then be individually removed without materially disturbing the remaining units. Access to the lower system of plates *p* is obtained by removing all the units M which are supported by the central perforated disk O; said disk and the lower centrally perforated disk P may then both be lifted out at the top of the contact chamber. It will then be possible to successively lift through the openings thus established, each of the lower perforated plates *p* one after the other. The sections N would not require to be removed at all unless possibly for the purpose of recovering any catalytic material which may have fallen upon them while the above disassembling was going on. For purposes of repair or replacement sections N may also be lifted out through the head D when desired while sections *c* of the top perforated plate are easily taken out by first removing said head D, the fastening means used to hold flanges *a* and *b* together being, of course, released for the purpose.

From the above it will be seen that repairs and replacements may thus be made not only very conveniently but also with a minimum of expense as only that particular piece of the apparatus requiring repair or replacement need be handled or supplied. It is clear also that in apparatus of such large dimensions as our invention here described there is also a great economy of material possible when the structural and functional parts are relatively small.

In starting up the apparatus, it is first

necessary to get rid of any moisture which is contained in the mass of catalytic material. To accomplish this we utilize a valve R in the side of the upper cylinder, opening the same and forcing hot air from H through said upper cylinder and directly out at R. This gradually heats up the contact chamber as a whole together with catalytic material contained therein and compels evaporation of any moisture content; when this is accomplished R may be closed and the sulfurous acid gas and air led in at H, passed through the catalytic layers, and out at G. Of a given quantity of sulfurous acid gas and oxygen entering at H the greater part of its conversion into emergent surfuric anhydrid will be effected in the upper and thicker layer of catalytic material; the total heat units due to the reaction will, of course, also be greatest in this top layer. The purpose of the centrally perforated plate P, between the top layer and the stack of lower thin layers is to thoroughly commingle the current of gas undergoing transformation in the contact chamber and to equalize the temperature thereof after it has passed the top layer; this is accomplished by requiring the total flow to converge toward and contact so as to pass through the opening *o* on the under side of which the gas flow will again spread out and distribute itself over the entire surface of the stack of thin layers aforesaid. By spacing the truncated funnel K away from the upper cylinder A (save at the upper circle of contact where the former is supported by the latter) a jacket of substantially dead gas is provided which greatly aids the ordinary heat insulating covering (not shown), with which we prefer to cover the outside of the apparatus, in preventing undue heat radiation from the upper cylinder into the surrounding atmosphere. As to the pyramidal units M they also, besides their structural advantages have a very important use in the heat economy of the apparatus inasmuch as they will conduct heat from within the mass of the upper layer Q of catalytic material and radiate the same from the exposed tops of said pyramids into the entering gases. In the same way, said gases after having passed entirely through the top layer of catalytic material and having been highly heated by reason of the reaction there taking place, will give up much of this excess heat to the plate L from which the pyramids will conduct it and, as before, radiate it into the entering gases above the top layer Q.

Many changes of detail as *e. g.*, the number, size and shape of the several perforated plates, of the pyramidal units M, of the thickness of the layers of catalytic material, and of other dimensions, may be made without affecting the spirit of our invention which is embodied in the following claims.

We claim—

1. In a contact chamber, interposed in the path of the gases being transformed, a layer of catalytic material having a relatively large superficial area, a layer of said material subsequent thereto having a relatively smaller superficial area, and a centrally perforated plate between said layers, as and for the purpose described.

2. In a contact chamber, interposed in the path of the gases being transformed, a relatively thick layer of catalytic material, a plurality of relatively thin layers of said material subsequent thereto, and a centrally perforated plate between said thick layer and the plurality of thin layers, as and for the purpose described.

3. In a contact chamber, means comprising a plurality of identical separable elements adapted to support a layer of catalytic material, each of said elements including an upwardly and centrally tapered portion and a laterally extending portion, said laterally extending portion being provided with perforations as and for the purpose described.

4. In a contact chamber, a system of identical separable units adapted to support a layer of catalytic material, the said unit comprising an upwardly extending pyramid joined at its base to laterally extending perforated flanges, as and for the purpose described.

5. In a contact chamber, a system of identical separable units adapted to support a layer of catalytic material and a perforated plate adjacent to, but spaced from said system and adapted to support the same, as and for the purpose described.

6. In a contact chamber having a system of identical separable units adapted to support a layer of catalytic material, the combination of said unit, which comprises an upwardy extending pyramid joined at its base to laterally extending perforated flanges provided with legs, with a perforated plate below but separated from said unit and adapted to support the same, as and for the purpose described.

7. A contact chamber provided with an inlet and outlet and a support for a catalytic material between said inlet and outlet, said support being provided with projections to increase its radiating surface.

8. A contact chamber provided with an inlet and an outlet and a support for a catalytic material located between said inlet and outlet and provided with projections of pyramidal form to increase its radiating surface.

9. A contact chamber provided with an

inlet and an outlet and a support for a catalytic material located between said inlet and outlet and provided with tapering projections to increase its radiating surface.

10. A contact chamber provided with an inlet and an outlet, and a support for a catalytic material located between said inlet and outlet and provided with projections extending toward the inlet.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

GEORG ESCHELLMANN.
ALBERT HARMUTH.

Witnesses:
H. A. LOVIAGUINE,
E. FLEISHER.