To all whom it may concern:

Be it known that I, IENS P. LIHME, a citizen of the United States of America, and a resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Acid Cooling and Generating Chambers, of which the following is a specification.

My invention relates to improvements in acid cooling and generating chambers employed in the manufacture of sulfuric acid, and has for its object, the provision of means for more effectively generating said acid, and for very materially reducing the cost of the plant for manufacturing said acid.

My improvements as herein explained are particularly applicable to an intermediate chamber designed to be positioned between the different acid chambers, which, by reason of the greater facility afforded therein for the union of the elements or groups thereof forming said acid, and for the ready release of nitrogen trioxid, serves not only to effect the desired combination or union more readily, but permits of a very material reduction in the size, area and cost of the lead chambers, while maintaining the gaseous elements at a much lower temperature, whereby the leaden walls of said chambers are preserved from attack.

I will explain my invention as embodied in an intermediate chamber of an acid-producing plant; the same comprising series of ventilating pipes or passages and alternating acid-generating or condensing cellular partitions, through which the gaseous elements are passed to effect their cooling, subsequent combination or conversion into acid, and release of the combining medium.

My invention will be more readily explained by making reference to the accompanying drawings, wherein:

Figure 1 illustrates by a perspective view, partially broken away, the intermediate acid-cooling and generating chamber of my invention; Fig. 2 is an enlarged detail in longitudinal section, showing the base of a ventilating pipe, and a portion of the tile partition and Fig. 3 is an enlarged fragment in perspective, partially broken away, illustrating the tile walls with their inner recesses or basins.

The structure shown, it will be understood, is ordinarily positioned between the acid chambers proper, and is so designed as to afford as little resistance to the flow or passage of the gaseous elements, as is possible. Said chamber consists essentially of a lead lined compartment a, having inlet and outlet pipes v, v' for the gases. Within said chamber are provided alternating series of lead ventilating pipes c, which are constantly open above and below to the air, and are cooled by the circulation of the air therethrough. Alternating therewith are partition walls d, of longitudinally perforated tiles d', the same having interior recesses or basins d", adopted to hold the generated acid. These tiles are formed of any suitable size from acid-resisting material, as for example with double openings d", separated by a strengthening web d", extending from the forward lip d" to the top of the tile, as best shown in Fig. 3. Single tiles d'" as alternately positioned at the ends, may likewise be used. It will be understood, of course, that these tiles may be made of any suitable material, which is acid-proof or acid resisting, since it is obvious that the tiles are constantly subject to the condensing acid at a relatively elevated temperature, and, in consequence, would render the acid impure, were the material subject to attack thereby. At the further end of the chamber is an exit pipe e, an acid receptacle f, and a second pipe g for drawing off the accumulated supply of acid, which may be duplicated between each of the condensers d, d', if desired.

In the detail shown in Fig. 2, I have illustrated the lead floor h of the chamber, carrying the lead angle plates i, which inclose the bases of the ventilating pipes c. These pipes are seated over a short thimble j extending through the floor, while above, said pipes are burned or securely sealed into the ceiling of the chamber to form a gas tight joint.

It has seemed unnecessary to describe the ordinary wooden framing or structure for supporting the leaden walls of my improved cooling chamber, and the tile partitions, since any builder would be able to provide the same to meet given conditions.

I will now endeavor to explain the function of my improved structure, as I understand it, and the process of acid manufacture as conducted therein.

The gaseous elements, comprising sulfur dioxid, nitrogen trioxid, oxygen, and a small
amount of water uniting to form nitrosulfuric acid, find entrance to the chamber through the opening \( b \), and first come in contact with the series of cooling pipes \( c \), which serve to lower the temperature thereof, since the heat readily passes through the lead walls of said pipes, and is carried away by the circulation of the air. The gaseous or vaporous acid in the form of a mist containing a slight excess of water, then comes in contact with the first tile partition \( d \), and here the gaseous nitrosulfuric acid encounters the more or less dilute sulfuric acid in the respective basins \( d' \) of the tiles and upon the walls thereof, thus splitting up and forming sulfuric acid, which collects at the bottom of the chamber, and gaseous nitrogen trioxide which is thus freed and will serve again and again to effect the successive combinations with sulfur dioxide, water and oxygen to form nitrosulfuric acid, which in turn is split up as previously described. This operation is caused to occur repeatedly in rapid succession by the continuing contact of the gases, vapor and mist with the series of cooling pipes, and the exposed surfaces of the tile partitions or acid condensers. The temperature, which is raised upon the condensation and splitting out of the sulfuric acid is readily reduced to the proper working point, and one which does not deleteriously affect the lead walls and pipes of the chamber, through the constant conduction and radiation of heat to the air circulating within the cooling or ventilating pipes \( c \).

The acid as generated, trickles down the tile partitions, and collects in the bottom of the chamber, from which it may be drawn off as required. It should be observed that in my improved chamber, the acid is not diluted by water or vapor sometimes introduced to effect a cooling action.

To illustrate how much greater efficiency is secured in the manufacture of acid, when my invention is employed, I may state that instead of from twenty to twenty-eight cubic feet of lead chamber space commonly provided for each pound of sulfur burned during twenty-four hours, I am enabled to reduce the chamber space, so that but from six to eight cubic feet are necessary, with consequent material savings in outlay and cost, and the necessary space required. In the cooling and generating chamber itself, as herein described, I calculate that two pounds of sulfur may be burned each twenty-four hours, for every cubic foot of space.

From a consideration of the foregoing, it will be seen that said chamber provides a minimum of resistance to the passage of the gaseous elements, which resistance presents a cogent objection to the use of different earlier types of acid-producing apparatus. Although I have stated that my improved structure preferable is positioned between the several acid chambers of a sulfuric acid producing plant, which chambers, accordingly, may be built of much smaller cubic capacity, and before the Gay Lussac tower, as well, I do not wish to be understood as necessarily confining the application of my invention thereto; but I may eventually find it desirable to employ such chambers alone in the manufacture of sulfuric acid, or commercial products requiring similar conditions for their production. Neither do I consider my invention as one which is restricted to the precise structural details herein depicted and described. Thus glass may be substituted at an increased cost for the tile partitions which I have herein referred to.

Accordingly, I claim as new, and desire to secure by these Letters Patent, the following:

1. An acid cooling and generating chamber having a series of spaced acid-cooling ventilated pipes arranged at intervals throughout its length and transverse of the latter, and partition walls disposed between said pipes and distantly spaced therefrom, said walls consisting of longitudinally perforated tiles disposed in superimposed relation, substantially as set forth.

2. In an acid producing or generating chamber, the combination with a lead-lined chamber externally sealed, series of vertical lead pipes extending therethrough wherein currents of air circulate to cool the same, of partition walls disposed midway between each of said series of pipes and spaced at a distance therefrom; said partition walls being formed of acid-proof tiles with numerous transverse openings therethrough, means for supplying the acid-producing elements to said chamber and for conducting away the acid as formed, substantially as set forth.

3. An acid cooling and generating chamber having a series of spaced acid-cooling ventilated pipes arranged at intervals throughout its length and transverse of the latter, and partition walls disposed between said pipes and spaced therefrom, said walls consisting of a plurality of elements each having an interior basin to hold the generated acid, substantially as set forth.

4. In a sulfuric acid-making plant, the combination with adjacent chambers thereof of an intermediate chamber comprising a lead-lined compartment having a series of air cooling pipes disposed in spaced and transverse relation therein, and condensing partitions disposed between said series of pipes and consisting of elements having open ends and formed with interior basins to hold the generated acid, substantially as set forth.

5. An acid cooling and generating chamber consisting of a lead-lined compartment having a series of spaced acid-cooling ventilated pipes arranged at intervals throughout its length and transverse to the latter, and
condensing partitions disposed between said series of ventilating pipes, each of said partitions being formed with a plurality of apertures which extend longitudinally through the same and with a plurality of interior basins to hold the generated acid, substantially as set forth.

6. In a sulfuric acid-making plant, the combination with adjacent chambers thereof, of an intermediate chamber comprising a lined compartment formed with a series of ventilating pipes at spaced intervals throughout its length, and partition walls disposed between said series of pipes, each of said walls consisting of a series of open-ended receptacles formed with interior basins, and disposed in superimposed relation, substantially as set forth.

7. An acid cooling and generating chamber consisting of a receptacle closed on all sides and having an inlet and an outlet in its ends, a series of spaced transversely arranged acid-cooling ventilated pipes located at intervals throughout the length of said receptacle, and a series of partition walls disposed between said series of pipes, said walls being spaced at their ends from said pipes, and consisting of a plurality of tiles formed with basins and arranged in superimposed relation and transverse of the length of said receptacle, substantially as set forth.

8. An acid cooling and generating chamber consisting of a receptacle having an inlet and an outlet in its opposite ends, a series of spaced acid-cooling ventilated pipes arranged at intervals throughout the length of said receptacle and transverse of the same, and partition walls disposed between said pipes, said walls consisting of tiles arranged in superimposed relation and having interior basins to hold the generated acid, substantially as set forth.

9. An acid cooling and generating chamber, consisting of a receptacle having a series of spaced transversely disposed ventilated pipes, and partition walls arranged between said series of pipes; said walls consisting of tiles having interior basins and being open at the ends, substantially as set forth.

Signed at Cleveland, this 11th day of March, 1905, in the presence of two subscribing witnesses.

IENS P. L IHME.

Witnesses:

G. E. GISNSY,

ALBERT LYNN LAWRENCE.