H. PETERSEN.

METHOD OF MAKING SULFURIC ACID.

APPLICATION FILED JAN. 3, 1908.

908,696.

Patented Jan. 5, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

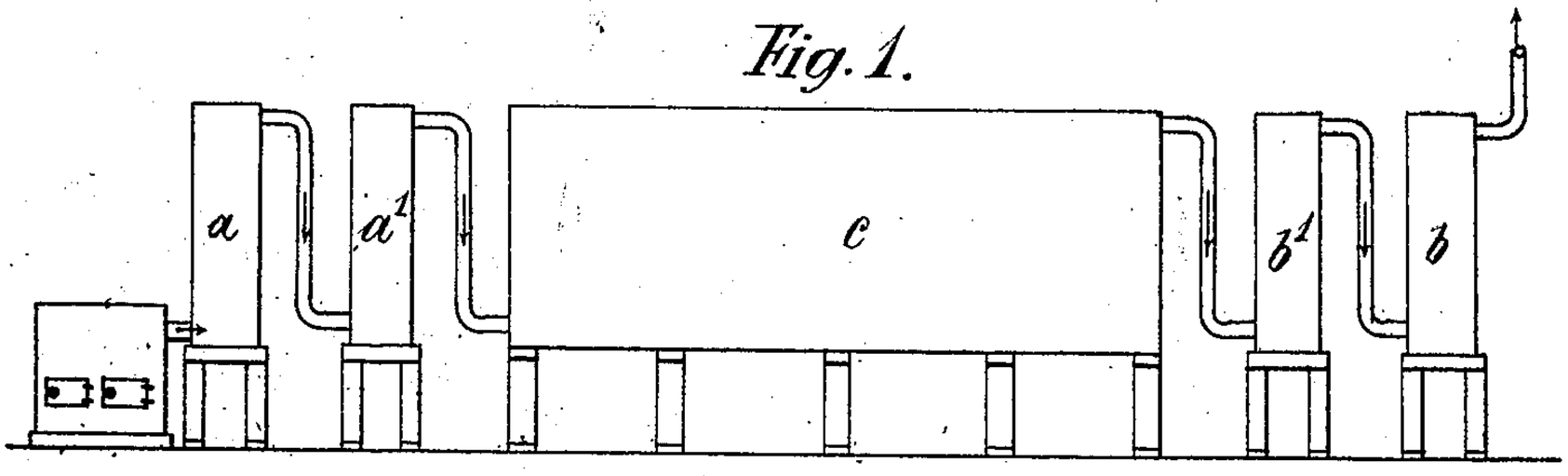


Fig. 2.

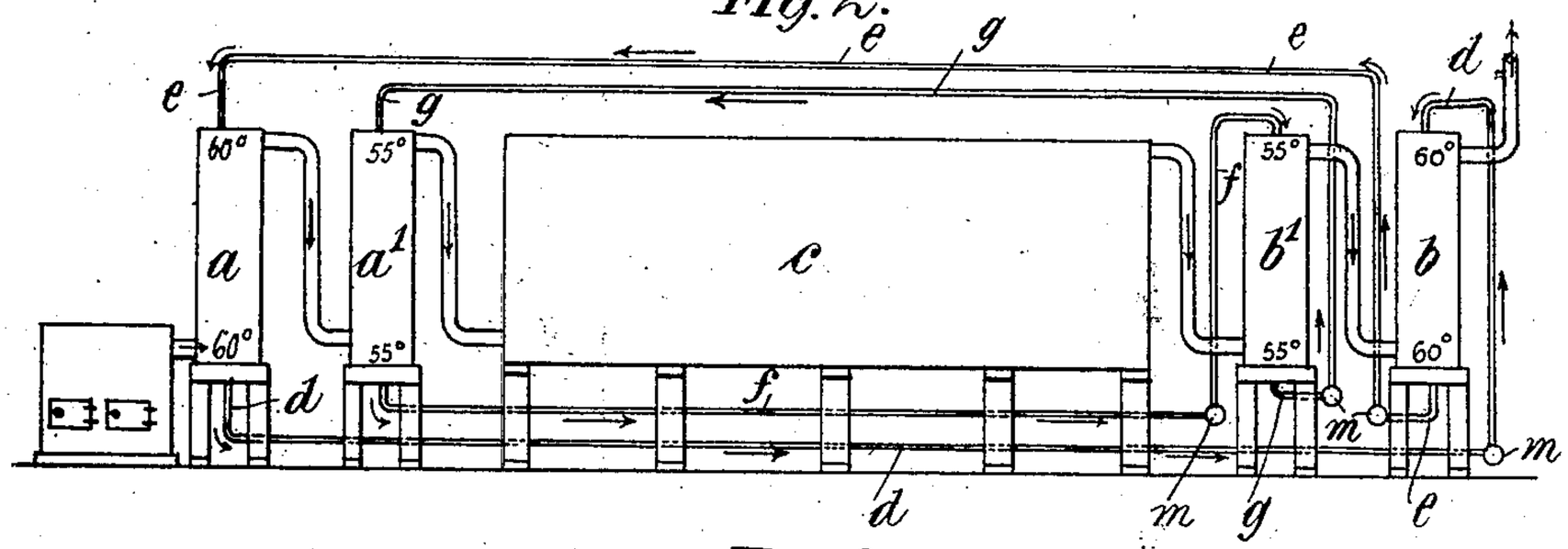
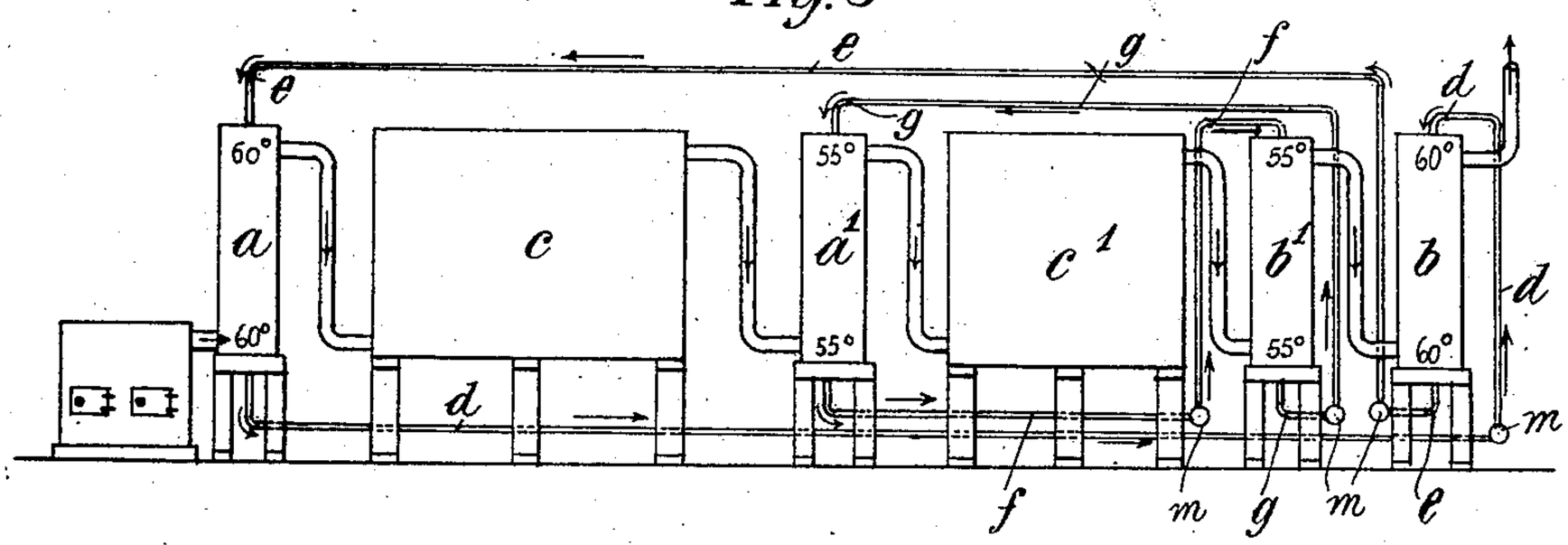


Fig. 3



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2 SHEETS—SHEET 2.

Fig. 4.

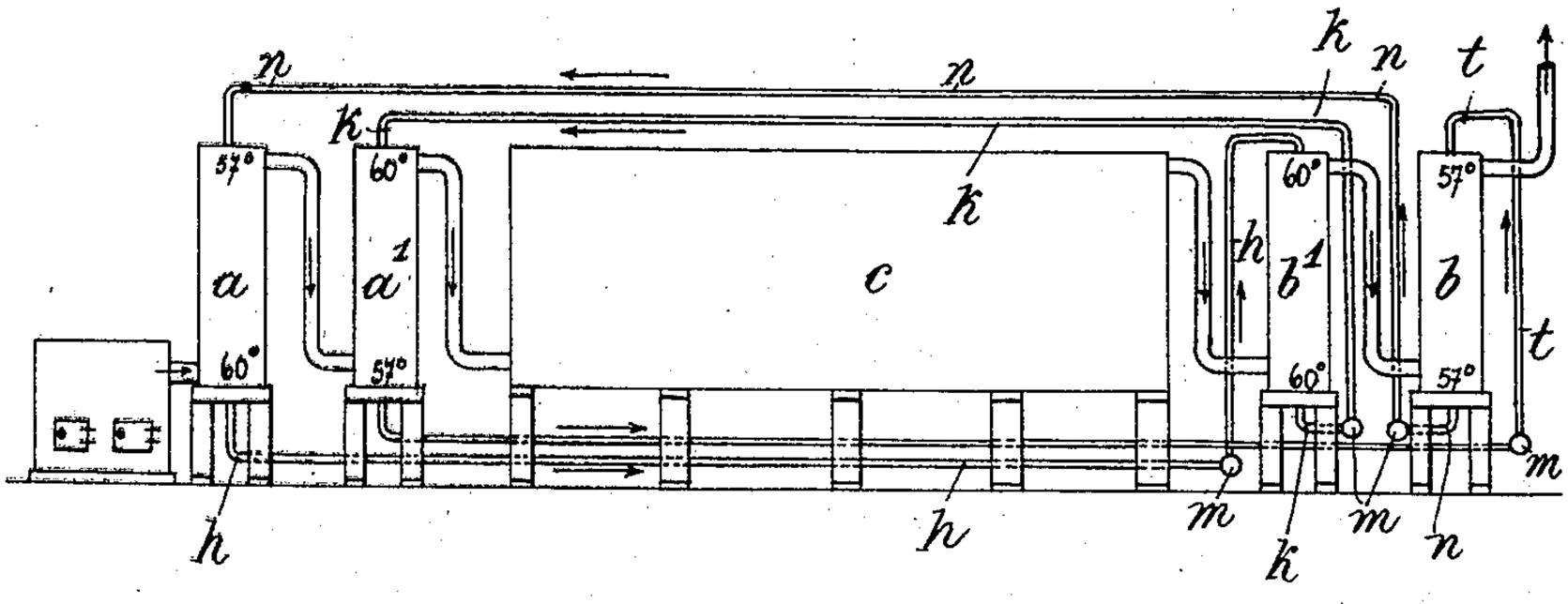
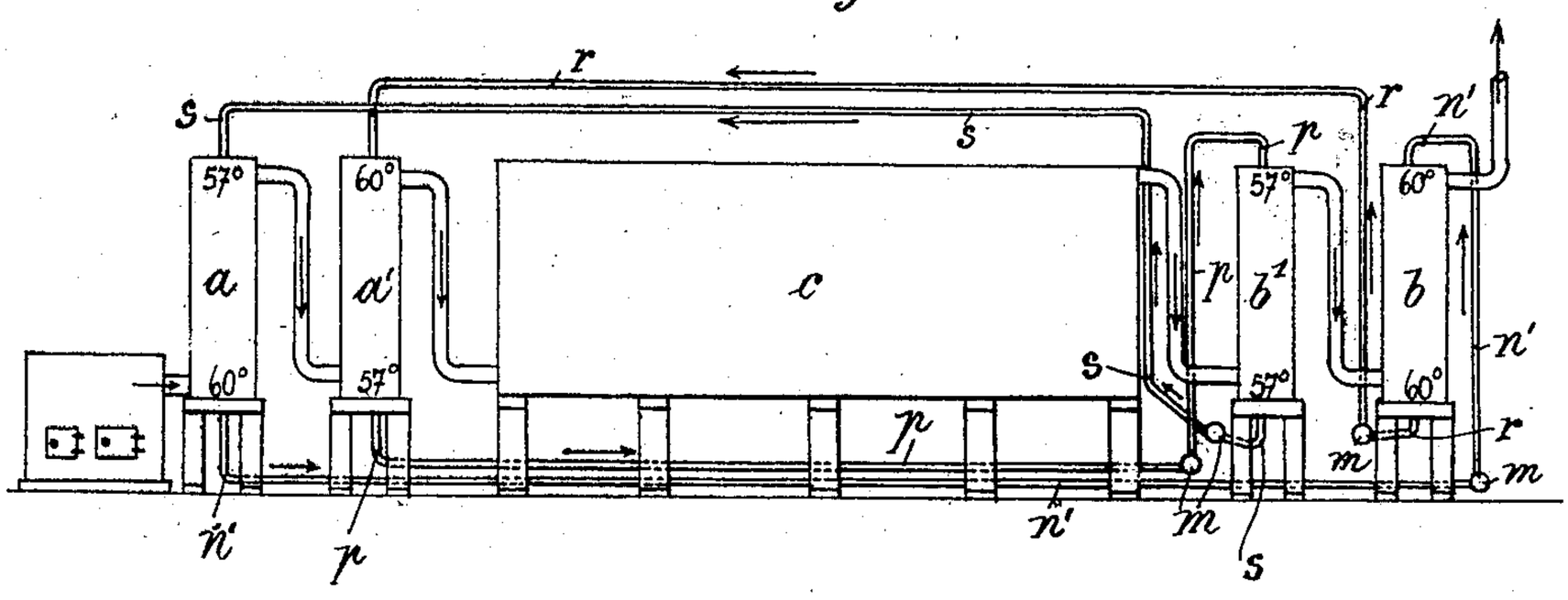


Fig. 5.



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METHOD OF MAKING SULFURIC ACID.

No. 908,696. Specification of Letters Patent. Patented Jan. 5, 1909.

Application filed January 3, 1908. Serial No. 409,235.

To all whom it may concern:

Be it known that I, HUGO PETERSEN, a chemical engineer and a subject of the German Emperor, a resident of 181 Kaiser-Allée, in the city of Wilmersdorf, near Berlin, Kingdom of Prussia and German Empire, have invented a certain new and useful Method of Making Sulfuric Acid, of which the following is a specification.

This invention has reference to means for increasing the amount of oxids of nitrogen, circulated in a lead chamber system for making sulfuric acid, in proportion to the amount of sulfur dioxid gases which are to be submitted to the lead chamber treatment.

According to my invention, an indefinite amount of oxids of nitrogen can be kept in circulation in the system, irrespective of the amount of sulfur dioxid gases to be treated, and without interfering in the least with the strength or with the denitration of the nitrous vitriol, treated in the Glover towers of the system, by submitting the gases to two different Glover-treatments and Gay-Lussac treatments, separate from each other, these treatments being distinguished by the fact, that, while in one of them the usual concentrated sulfuric acid of, say sixty degrees Baumé, strength is used in the Gay-Lussac towers, resulting in a nitrous vitriol of correspondingly high strength, the other treatment is carried on by making use of sulfuric acid of lower strength, of say about 54 to 57 degrees Baumé, in the Gay-Lussac towers, resulting in the production of correspondingly weaker nitrous vitriol. These two treatments with strong and weak acids are kept separate from each other, so that the weak nitrous vitriol, obtained by Gay-Lussac treatment with the above mentioned weak acid is kept separate from the nitrous vitriol, obtained by treatment of the gases with the ordinary strong acid. The sulfur dioxid gases are treated in succession either first with the weak nitrous vitriol, and then with the strong nitrous vitriol in a system of Glover towers, and, after having passed through the lead chambers, first with strong, and then with weak Glover sulfuric acid, as obtained in the respective Glover towers, or the gases may first be made to act upon the stronger, and then upon the weaker nitrous vitriol, the Gay-Lussac treatment being also correspondingly reversed. Weak sulfuric acid of about 54 to 57 degrees Baumé, possesses the property of readily absorbing the lower oxids of nitrogen, and of liberating the same again at comparatively low temperatures, and without the necessity of any further dilution of this acid, while ordinary rinsing sulfuric acid, having a strength of about 60 degrees Baumé, parts with the oxids of nitrogen absorbed only by the application of a very high temperature or by dilution with steam or water. It is obvious therefore, that by carrying out the sulfuric acid making process in two different stages of the Glover treatment and Gay-Lussac treatment, and in one and the same lead chamber system, any dilute acid, obtained by denitration of nitrous vitriol, can be utilized over again as such for purposes of absorption of oxids of nitrogen without the necessity of concentration and without interfering in the least with the concentration of the strong acids, used in the system.

In view of the fact, that denitration is most readily effected by heat even without strong dilution of the nitrous vitriol, the acid passing off from the Glover towers immediately succeeding the burners will be very completely denitrated in the majority of cases, even when strong nitrous vitriol is used in this part of the plant, and the gases, passing from this first Glover tower or system of Glover towers, are still sufficiently hot to effect denitration in the second part of the Glover system, where either dilute nitrous vitriol of 54 to 57 degrees Baumé is used, or the nitrous vitriol is diluted by the water vapors escaping from the first system of Glover towers, in case these towers have been rinsed with weaker nitrous vitriol, and in accordance therewith, even any excess of oxids of nitrogen, fed to the system or set free by the two systems of different Glover towers, and not used up in the lead chambers, will not escape absorption in the two different systems of Gay-Lussac towers, succeeding the lead chambers. Hence, in view of the fact, that the efficiency of the lead chamber process depends to a large extent on the amount of oxids of nitrogen which are circulated through the system, the intensity of the reaction, and the efficiency of the plant can be much increased by the treatment, herein described, inasmuch as it is thereby possible,

to increase the amount of nitric acid or of niter, fed to the system, and the amount of oxids of nitrogen in consequence thereof, very much out of proportion to the amount of sulfur dioxid gases under treatment, and without incurring losses of nitric acid.

Upon the accompanying two sheets of drawing I have shown the general features of a plant for carrying out my invention in Figures 1 to 5 in various modifications, embodying the general features of my invention. Fig. 1 shows the course of the gases, the course of the liquid being not shown in this figure. The gases are conducted to the bottom of the first Glover tower *a* from which they pass into the second Glover tower *a'*, they rise in these towers and are then conducted into the chamber system of which one chamber *c* is shown, though a greater number of chambers may of course also be used. From the chamber the gases pass to the bottom of the first Gay-Lussac tower *b'* and then into the last Gay-Lussac tower *b*. In the succeeding figures of the drawing the figures or numbers indicated at the tops and bottoms of the towers show the degrees Baumé in strength of the acid admitted or running out at these points. In all the Figs. 2 to 5 the course of the gases has been indicated by pipes of broader diameter, while the courses of the liquids have been indicated by pipes of narrower diameter. The courses of the gases are all identical in the various figures and agree with the diagram of Fig. 1 of the drawing.

m in all the figures indicate acid eggs, force pumps or the like for lifting the various liquids to the tops of the towers and the like. In the diagram Fig. 2 the strong Glover acid is pumped to the top of the last Gay-Lussac tower *b* by means of the pipe *d*. The nitrous vitriol obtained is passed back through the pipe *e* to the top of the first Glover tower *a*. The circulation from the second Glover tower *a'* which is separate from the circulation just described, takes place as follows: from the second Glover tower *a'* at about 55 degrees Baumé by way of the pipe *f* to the top of the first Gay-Lussac tower *b'*, the nitrous vitriol from this tower being passed back through the pipe *g* to the top of the second Glover tower *a'*. In the modification Fig. 3 of the drawing two chambers *c* and *c'*, are used and the second Glover tower is placed between the chambers, the circulation being otherwise the same as that outlined with reference to Fig. 2 of the drawing. In Fig. 4 and Fig. 5 the uniting of the two circulations into one circulation is illustrated. In the modification of Fig. 4 strong Glover acid or strong nitrous vitriol of about 60 degrees Baumé may be fed to the top of the second Glover tower *a'*, where it becomes diluted by the vapors from the first Glover tower and is then passed through the pipe *t* to the top of the last Gay-Lussac tower *b*, the nitrous vitriol here obtained being then passed through the pipe *n* and to the top of the first Glover tower *a*, where it becomes denitrated and concentrated, the resulting Glover acid being passed by way of the pipe *h* to the top of the first Gay-Lussac tower *b'*, and the nitrous vitriol thus obtained passes through the pipe *k* to the top of the second Glover tower *a'*. In the modification of Fig. 5 the circulation may also be started by way of the second Glover tower *a'*, the weak Glover acid passing through the pipe *p* to the top of the first Gay-Lussac tower *b'* the nitrous vitriol thereby produced being pumped through the pipe *s* to the top of the first Glover tower *a* where the acid is denitrated and concentrated and passes at a strength of about 60 degrees Baumé through the pipe *n'* to the top of the second Gay-Lussac tower, the resulting nitrous vitriol being pumped by way of the pipe *r* to the top of the second Glover tower. By working in this manner, though there is but one continuous circulation of rinsing acids through the entire sulfuric acid making plant, yet, the two systems of Glover treatment and Gay-Lussac treatment with weak and with strong acids respectively are kept entirely separate from each other, the strengths of the different acids of the systems being maintained in a perfectly automatic manner.

The Glover tower or towers which are rinsed with weaker nitrous vitriol, can be arranged at any place, wherever there is an opportunity of sulfur dioxid gases getting into said tower or towers; thus, they may be placed between the chambers, as shown for instance in Fig. 3 of the drawing.

With the method of working herein described, it is of course also possible to obtain sulfuric acid for the market from the Glover tower, as usual in sulfuric acid making plants, this marketable acid in most cases showing a strength of about 54 to 57 degrees Baumé; there being still a sufficient excess of such acid left in all cases for feeding the corresponding systems of Gay-Lussac towers. As shown in the accompanying diagrams, the rinsing of the entire plant may be started by feeding 60 degrees Baumé, sulfuric acid or sixty degrees Baumé nitrous vitriol to any part of the Glover or Gay-Lussac systems, the evaporation effected by the hot sulfur dioxid gases furnishing the necessary water of dilution, to produce lower degree acid for the rinsing of one of the systems. Inasmuch as weak nitrous vitriol and weak Glover acid of the strength referred to absorb sulfur dioxid gases much more readily than the ordinary strong acids and strong nitrous vitriol, the amount of sulfuric acid, formed in the Glover system itself is also greatly increased, the sulfur

dioxid absorbed by the weak nitrous vitriol being immediately converted into sulfuric acid by oxidation.

Having now described my invention, what I claim is:—

1. The herein described method of manufacturing sulfuric acid by the lead chamber process, which consists in generating sulfurous acid gases, passing said gases in contact with two supplies of nitrous vitriol of different strength in two separate steps, thereby forming two different supplies of Glover acid, submitting the escaping gases to lead chamber action, treating and absorbing the escaping gases which then contain oxids of nitrogen, in two separate steps with the two previously obtained Glover acids, thereby producing two separate supplies of nitrous vitriol and separately treating a new supply of sulfurous acid gases with each of said two supplies of nitrous vitriol.

2. The herein described method of manufacturing sulfuric acid by the lead chamber process, which consists in generating sulfurous acid gases, passing said gases in contact with a supply of strong nitrous vitriol and with a supply of weaker nitrous vitriol, thereby denitrating said supplies of nitrous vitriol and forming supplies of Glover acid of different strengths, submitting the resulting gases to lead chamber action, treating the escaping gases which then contain nitrogen oxids with the strong Glover acid, previously obtained, and separate therefrom in contact with the weaker Glover acid, previously obtained, thereby absorbing said oxids of nitrogen and forming a strong and a weak nitrous vitriol, and passing a new supply of sulfurous acid gas in contact with each of said supplies of nitrous vitriol.

3. The herein described method of manufacturing sulfuric acid by the lead chamber process, which consists in generating sulfurous acid gases, treating said gases with a supply of strong nitrous vitriol and separately with a supply of weak nitrous vitriol, thereby denitrating said nitrous vitriol and forming two different supplies of Glover acid, submitting the resulting gases to lead chamber treatment, and treating the escaping gases which then contain nitrogen oxids, with the previously obtained supplies of Glover acids of different strengths in separate stages, increasing the strength of the weaker nitrous vitriol, obtained in one of said stages by treating said weaker nitrous vitriol with a fresh supply of sulfurous acid gases, and treating the resulting stronger Glover acid with gases containing oxids of nitrogen.

4. The improvement in the art of making sulfuric acid by the lead chamber process, which consists in passing sulfur dioxid gases in two separate stages in contact with nitrous vitriol of about 60 degrees and of about 57 degrees Bé. respectively, then submitting the gases to the lead chamber treatment, and finally passing the escaping gases which contain oxids of nitrogen in contact with two different supplies of sulfuric acid of about 60 degrees Bé. and of about 57 degrees Bé. respectively to absorb the oxids of nitrogen.

5. The improvement in the art of making sulfuric acid by the lead chamber process, which improvement consists in passing sulfur dioxid gases in succession in contact with two supplies of nitrous vitriol of different strengths, submitting the gases to lead chamber treatment, and passing the escaping gases which contain oxids of nitrogen in contact with two different supplies of Glover sulfuric acid of different strengths.

In witness whereof I have hereunto set my hand in presence of two witnesses.

HUGO PETERSEN.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.