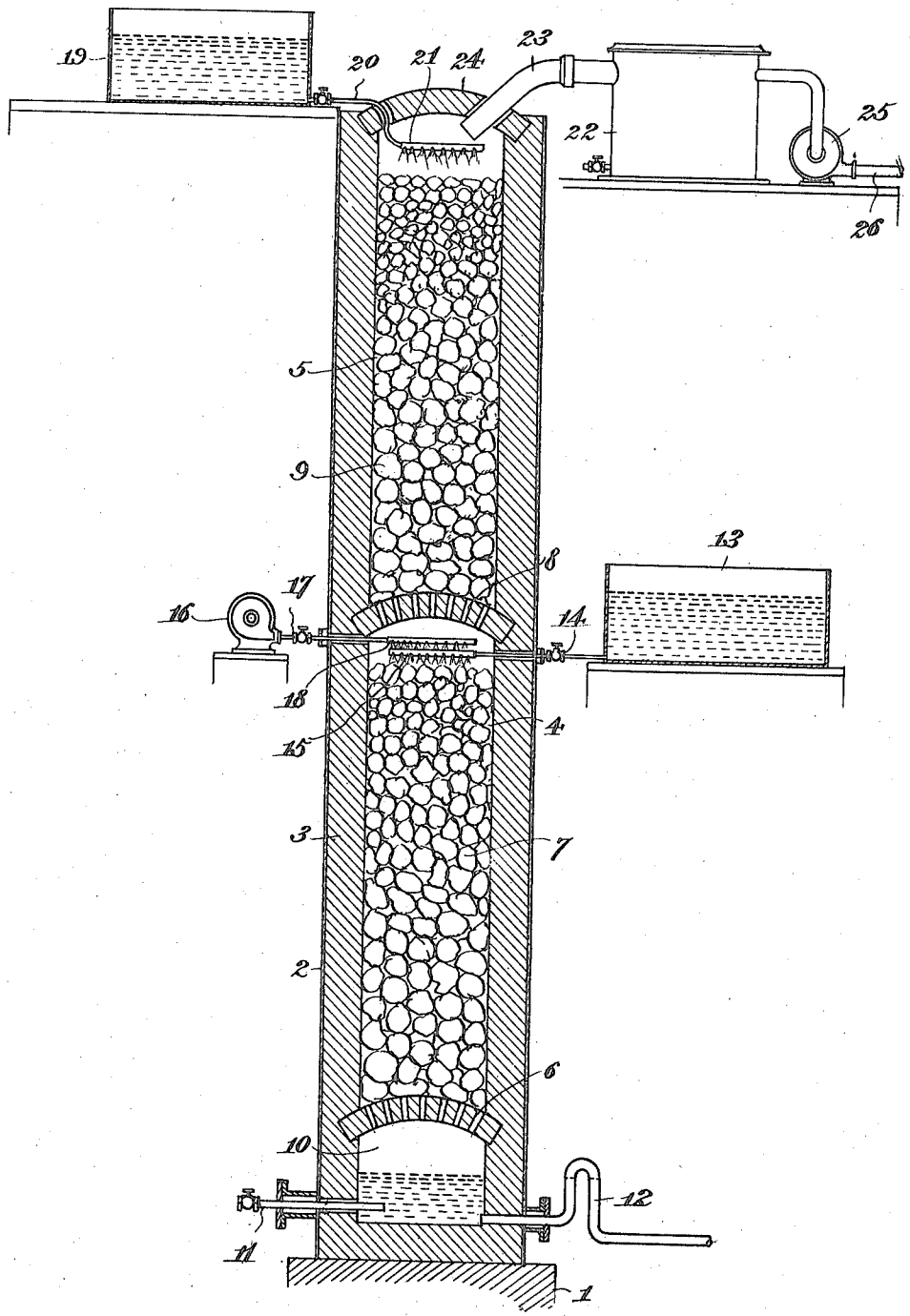
I. HECHENBLEIKNER.

DENITRATION OF SULFURIC ACID.

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1,264,512.

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DENITRATION OF SULFURIC ACID.

1,264,512. Specification of Letters Patent. Patented Apr. 30, 1918.

Application filed February 10, 1917. Serial No. 147,963.

To all whom it may concern:

Be it known that I, INGENUIN HECHENBLEIKNER, a citizen of the United States, residing at Charlotte, in the county of Mecklenburg and State of North Carolina, have invented certain new and useful Improvements in Denitration of Sulfuric Acid, of which the following is a specification.

My invention relates to a process of and apparatus for denitrating sulfuric acids containing nitric acid compounds, or compounds of nitrogen oxid.

In the present instance it is my purpose to resort to the use of such a process, carried out by such an exceedingly simple apparatus, that I am enabled to obtain nitric acid of exceptional purity, economically, and with the expenditure of but little time and labor from an operating standpoint.

As is well known, sulfuric acid containing compounds of nitric acid or nitrogen oxid may be treated in a tower, casing or column to drive off the nitrogen compounds, provided the sulfuric acid is of the proper concentration. In previous methods of manufacture, so far as I am aware, the nitrogen oxid compounds escape from the sulfuric acid solution as nitrogen monoxid, nitrogen dioxid, and nitric acid and must be condensed separately and subjected to relatively expensive treatment in separate apparatus to produce pure nitric acid.

With my invention, however, I am enabled to produce pure nitric acid by a single operation, and with a unitary structure, converting in one operation as it were, all the nitrogen compounds in the nitric vapors before they leave the distilling tower or column.

With the above recited objects and others of a similar nature in view my invention consists in the improved process and apparatus set forth in and falling within the scope of the appended claims.

The accompanying drawing is a view mainly in vertical section showing an apparatus by means of which my process may be carried into effect, certain of the parts being shown in elevation, however.

Referring now to the accompanying drawing, in detail, the numeral 1 indicates the base or foundation for the distilling tower or column and has mounted thereon the casing 2 having the usual lining 3. This column is divided into two chambers, a lower chamber 4 and an upper chamber 5. The lower chamber 4 is provided with a supporting arch 6 for retaining the packing 7, of such column, while a second arch 8, which is located midway of the tower or column, constitutes a bottom for the upper chamber 5 as well as a roof for the lower chamber. These two arch supports 6 and 8 are of course perforated or of grate-like formation to permit the passage of fluids and gases. The upper chamber is also provided with a packing shown at 9. The lower section of the lower chamber 4 constitutes an acid pit as indicated by the numeral 10 while at 11 is shown a valved steam pipe leading into this pit, a syphon overflow 12 provided for the acid, leading from the pit 10. I have shown a receptacle for holding the sulfuric acid which contains the nitrogen oxid compounds, and leading from this receptacle is a valved discharge pipe 14 projecting into the upper section of the lower chamber 4 and terminating in an acid distributer 15 through which the acid is showered down on the packing 7, and permitted to trickle through the latter. At 16 I have shown a blower having a valve pipe 17 leading into the upper section of the lower chamber 4 and terminating in a distributing head 18, through which oxygen in any preferred form, either as air, pure oxygen or ozonized air is forced by the blower and thus introduced into the lower chamber. A second sulfuric acid reservoir 19 is provided adjacent the upper end of the tower or column and is also equipped with a valved pipe 20 which conducts relatively concentrated sulfuric acid into the upper end of the upper chamber, such acid being distributed or showered down upon the packing 9 through a distributing head 21. A nitric acid condenser conventionally illustrated at 22 is also located adjacent the upper end of the column or tower and is provided with a gas conduit 23 projecting through the top 24 of the tower or column, this conduit 23 conducting the gas into the condenser, an exhaust fan 25 connected with the condenser being provided for producing a draft to

draw the gases from the tower or column into the condenser where they are properly condensed, this fan being provided with the usual waste or exhaust pipe 26. An outlet pipe for the condensed acid is shown at 27.

The above is a description of the structural features of my invention and its operation may be briefly related as follows.

Sulfuric acid containing nitrogen oxid compounds and nitric acid is permitted to pass from the receptacle 13 through the distributer 15 into the lower chamber 4 and flows down through the packing 7. In its passage the stream of acid meets the steam passing up through the packing, such steam of course being introduced through the steam pipe 11. This steam causes denitration of the acid which is completed in the bottom of the column or tower. The gases thus driven out from the acid consist of nitric acid, nitrogen dioxid, nitrogen monoxid and other nitrogen oxid compounds which in the presence of oxygen and water form nitric acid which is afterward condensed to form the commercial nitric acid. Such oxidation is also accomplished in the tower or column proper by the admission, through the distributer 18, of gases containing oxygen, either in the nature of air, or pure oxygen, or ozonized oxygen or ozonized air. The oxidation takes place very rapidly, especially if ozonized oxygen is used and the oxids of nitrogen in the gases combine with the oxygen and steam to form nitric acid. As a relatively great amount of steam must be utilized to denitrate the sulfuric acid to form the nitric acid fumes, concentrated sulfuric acid is conducted from the reservoir 19 and showered through the distributer head 21 in the upper part of the tower or column for the purpose of removing part of the water contained in the nitric acid fumes. Concentrated sulfuric acid is preferably used because it possesses manifest advantages for drying nitric acid vapors or fumes which contain a relatively great amount of surplus steam. Furthermore, the sulfuric acid thus added equalizes the concentration of the denitrated sulfuric acid escaping through the siphon 12, it being a well known fact that denitration cannot be completed if the concentration strength of the sulfuric acid is too low. I have found that sulfuric acid solution containing less than 60% sulfuric acid will lack capability of complete denitration attainable in an acid of higher concentration strength and that for practical purposes the best denitration can be accomplished by a concentration of strength of between 60 and 70% sulfuric acid. The gases in the lower chamber of the column or tower pass in the upper chamber 5 thereof and meet the acid showered down through the distributer 21, the gases thence passing or escaping through the conduit 23 to the condenser 22. Such gases as pass through the conduit 23 contain nitric acid fumes which when condensed result in nitric acid of exceptional purity. Of course the strength and quantity of the concentrated sulfuric acid flowing through the distributer 21 must be regulated so as to permit a sufficient amount of moisture in the shape of steam to pass into the condenser 22 with the oxygen and oxid fumes to cause the condensation of pure nitric acid.

Futhermore, it will be noted that after the acid has been condensed in the condenser 22 it is unnecessary to subject it to further treatment in a separate apparatus.

While I have herein shown and described the preferred embodiment of my invention I wish it to be understood that I do not limit myself to all the precise details herein set forth as modification and variation may be made without departing from the spirit of the invention or exceeding the scope of the appended claims.

What I claim is:

1. The herein described process which consists in subjecting a stream of sulfuric acid containing oxids of nitrogen to the action of steam, introducing oxygen into the resulting gases and subsequently condensing said gases.

2. The herein described process which consists in subjecting a stream of sulfuric acid containing oxids of nitrogen to the action of an opposing current of steam, introducing oxygen into the resulting gases, and subsequently condensing said gases.

3. The herein described process which consists in subjecting a stream of sulfuric acid containing oxids of nitrogen to the action of a counter-current stream of steam, introducing oxygen into the resulting gases, subjecting said gases to the action of a stream of relatively concentrated sulfuric acid, and then condensing the gases.

4. The herein described process which consists in spraying sulfuric acid containing oxids of nitrogen into a flowing stream of steam, and introducing oxygen into the resulting gases, to produce nitric acid fumes, and subsequently condensing the nitric acid fumes.

5. The herein described process which consists in distributing sulfuric acid containing oxids of nitrogen into an opposing current of steam, introducing oxygen into the resulting gases to oxidize the same to form HNO_3, and subsequently condensing the latter.

6. The herein described process which consists in distributing a stream of sulfuric acid containing oxids of nitrogen into an opposing current of steam, introducing oxygen, then introducing relatively concentrated sulfuric acid into the vapors and subsequently condensing the vapors.

7. The process of producing nitric acid

which consists in subjecting a stream of sulfuric acid containing oxids of nitrogen to the action of steam, introducing air to oxidize the resulting vapors, introducing concentrated sulfuric acid to obtain nitric acid fumes and subsequently condensing such fumes.

8. A denitrator comprising a chamber, a packing therefor, means for spraying sulfuric acid containing oxids of nitrogen and oxygen into the upper portion of the chamber, and means for introducing steam into the lower portion of the chamber in a direction to cause such steam to flow in opposition to the flow of the acid.

9. A denitrator comprising a column divided into two chambers, means for introducing sulfuric acid containing oxids of nitrogen and means for introducing oxygen into the lower one of said chambers, means for introducing concentrated sulfuric acid into the upper chamber, and a condenser connected with the last mentioned chamber.

In testimony whereof I affix my signature.

INGENUIN HECHENBLEIKNER.