April 26, 1932. H. KREBS ET AL. 1,856,040

PROCESS FOR PRODUCING SULPHURIC ACID

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Fig. 1.

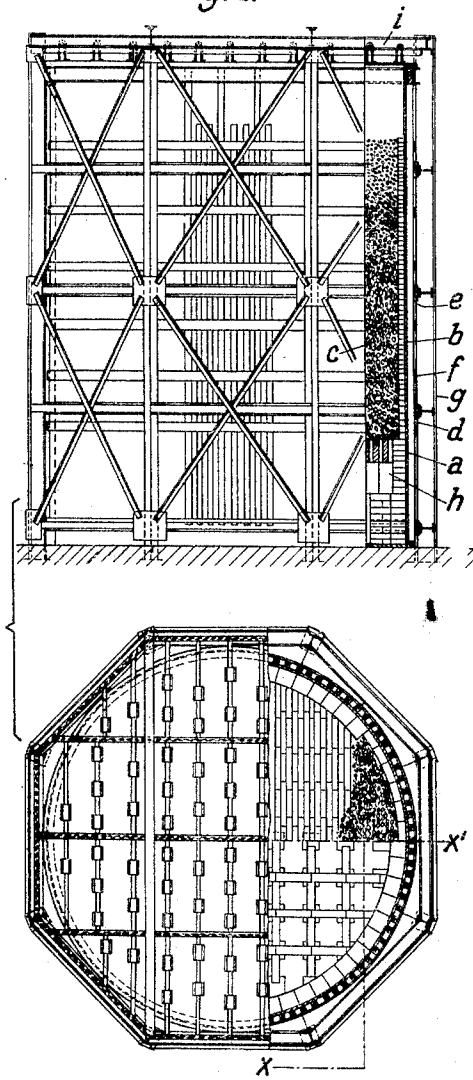
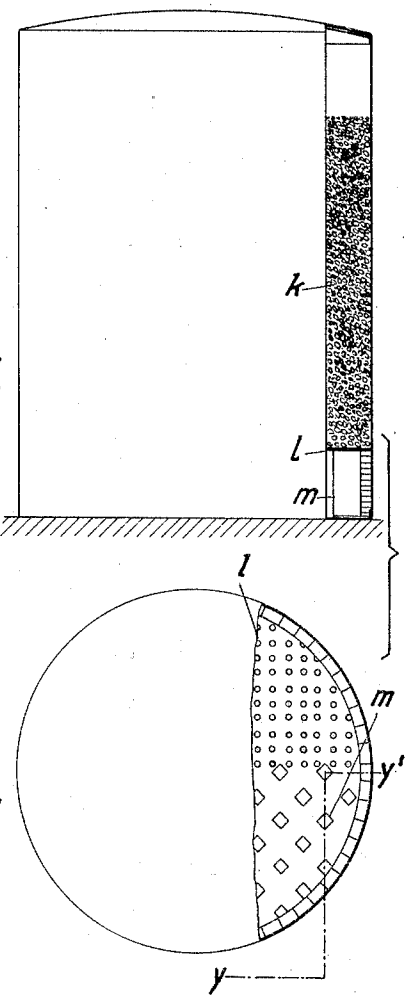


Fig. 2.



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UNITED STATES PATENT OFFICE

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PROCESS FOR PRODUCING SULPHURIC ACID

Application filed December 14, 1928, Serial No. 326,038, and in Germany January 24, 1928.

Our invention relates to improvements in apparatus for producing sulphuric acid.

In the manufacture of sulphuric acid, processes have recently been developed, which no longer make use of the customary lead chambers, but which carry out the sulphuric acid process in other apparatus and which at the same time aim at obtaining a sulphuric acid of higher concentration than that obtained by the chamber process. All these new processes have, however, like the old ones the disadvantage that the apparatus for carrying them out is constructed of lead, which possesses insufficient mechanical strength and chemical resistance. The low mechanical strength of the lead has the disadvantage, that difficult and expensive auxiliary constructions are necessary to impart the necessary strength and durability to the lead structures. To this must be added, that in the intense process it is impossible to avoid great temperature fluctuations and mechanical actions on the lead by vibrations or impinging acid. This fact results in the lead becoming rapidly fatigued, brittle and fragile. Equally serious are the drawbacks resulting from the insufficient chemical resistance of the lead against nitrous acids and gases. To obtain an intense action of the process, it is necessary to operate with acids of as high a nitrous content as possible. At certain places of the apparatus very large quantities of nitrous gases are therefore liberated, which have a strong chemical action upon the lead. The formation of the chamber crystals so extremely dangerous for the lead is thus unavoidable.

To this disadvantage of the lead from the mechanical point of view must thus be added the very serious disadvantage in chemical respects.

These drawbacks are effectively eliminated by our present invention. Our invention consists in apparatus for the manufacture of sulphuric acid in the construction of which the use of lead is entirely eliminated and the lead is replaced by a material which has no such disadvantages. This material is iron. By iron is to be understood iron in its widest sense, such as iron of all the commerical descriptions, for instance cast-iron, wrought-iron, mild steel, steel, cast steel and all iron alloys in which iron is the main constituent. Another object of our invention is to give the parts of the iron equipment the most economical shape and configuration to adapt them to the new purpose.

It has hitherto not been considered possible to replace the lead by iron, because it was feared that iron would be chemically strongly attacked by the gases and acids. We have, however, ascertained that the resistance of the iron against the gases and acids of intense processes exceeds that of the lead considerably, provided the process is conducted in the proper way. Under the proper way is to be understood that the carrying out of the formation of the acid is absolutely followed only with such circulating acids and produced acids which, in their graduation, exceed 55° Bé. The lowering of the acids from this graduation must, under all circumstances, be avoided since otherwise the maintenance of the apparatus could not be further guaranteed. The use of iron is further possible also in the old chamber process in Gay-Lussac towers and Glover towers.

The drawings affixed hereto and forming part of our specification shows our invention applied to a tower as used in the manufacture of sulphuric acid.

In the drawings

Fig. 1 shows an acid tower constructed of lead, for instance according to Petersen's system, in sectional plan and sectional elevation, the latter along line x—x' of the plan, and

Fig. 2, an acid tower according to our invention constructed of iron shows likewise in sectional plan and sectional elevation, the latter along line y—y', in order to show clearly the technical and economical progress attained by the replacement of lead by iron.

Referring to Fig. 1, it will be seen that it is necessary to protect the shell a constructed of lead of the hitherto used towers by a complete lining of acid-resisting bricks b before the filling proper c of the tower can be introduced. In towers of small diameter the lining of bricks must be so thick, that the internal pressure can be taken up by the

bricks. In towers of comparatively large diameter the pressure exerted upon the lead shell by the filling through the bricks may be taken up by an external structure. As this figure clearly shows it is in the latter case necessary to envelop the lead shell completely by an auxiliary structure consisting of longitudinal timber *d* and wooden segments *e*, which wooden structure is in its turn reinforced by iron bands *f* and a lateral supporting structure *g*. The leaden bottom of the tower must also be protected against the mechanical action of the dripping acid by a layer of acid-proof bricks or stones. It is furthermore necessary to provide for the granular filling of the tower a grid *h* of acid-proof bricks, which enables a uniform distribution of the gas below the filling *c*. The roof of the tower must be suspended from an iron auxiliary construction *i* and the weight of the roof be carried by special lateral stays.

Far simpler in construction is the tower, if, instead of lead, iron is used according to our invention. On referring to Fig. 2 of the drawings showing our improved tower it will be seen, that this tower consists of a simple iron container or receptacle, the roof of which supports itself without any auxiliary construction, the bottom of which possesses sufficient strength to resist mechanical actions and the side walls of which are capable of taking up the pressure of the filling materials *k* without the use of any auxiliary structure. The very complicated grid or grill of acid-proof bricks is dispensed with and its place is taken by a perforated iron plate *l*, which may rest upon low pillars *m* of iron or any suitable acid-proof material. We have ascertained that the costs of such a tower constructed of iron are about 40 p. c. less than those of one constructed of lead.

Various modifications and changes may be made without departing from the spirit and the scope of the invention, and we desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art.

We claim as our invention:—

A process for making sulphuric acid in accordance with the nitric oxid method which comprises bringing the reaction gases and vapors into contact with one another in a container of which the walls contacting with the acids are made mainly of ferrous metal while maintaining the concentration of the circulating acids and produced acids above a minimum at which the same is capable of attacking the walls of the container.

In testimony whereof we have affixed our signatures.

HANS KREBS.
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