

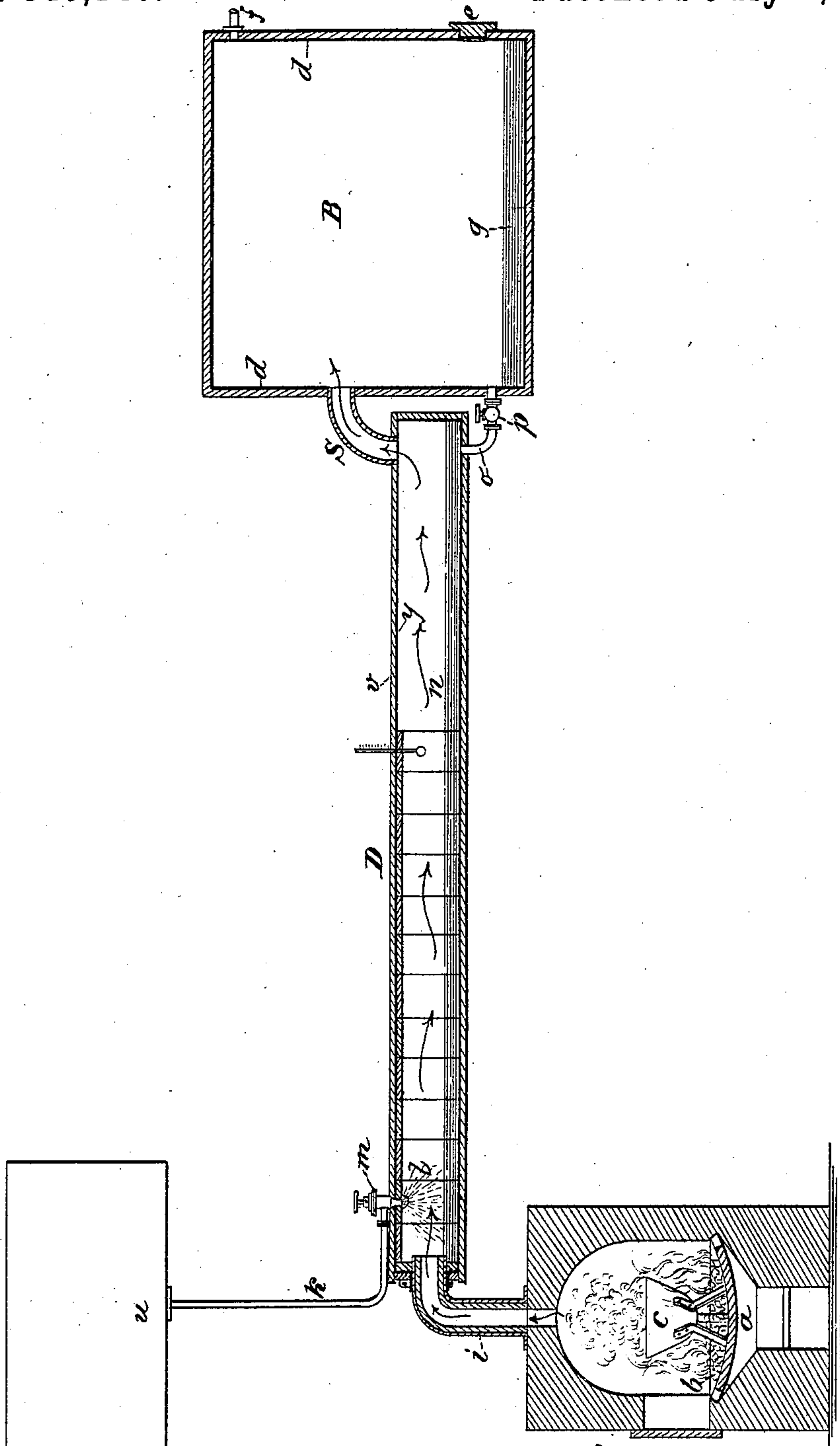
(No Model.)

J. HUGHES.

PROCESS OF MAKING SULPHURIC ACID.

No. 345,140.

Patented July 6, 1886.



WITNESSES

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# UNITED STATES PATENT OFFICE.

JOHN HUGHES, OF STAPLETON, NEW YORK.

## PROCESS OF MAKING SULPHURIC ACID.

SPECIFICATION forming part of Letters Patent No. 345,140, dated July 6, 1886.

Application filed August 6, 1885. Serial No. 173,710. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN HUGHES, of Stapleton, Richmond county, New York, a citizen of the United States, have invented an Improved Process for the Manufacture of Sulphuric Acid, of which the following is a specification.

The object of my invention is to utilize the heat of the burning sulphur to vaporize the water necessary to unite with the sulphurous and nitric fumes to form the sulphuric acid, and also to insure the more perfect mixture and union of the gases, and the more rapid and perfect condensation of the acid in the acid-chamber, thereby saving fuel and simplifying the apparatus and the attendance, and facilitating the production of the acid. To these ends I pass the hot sulphurous and nitric fumes from the sulphur-furnace into a preliminary vaporizing and mixing conduit, where it is projected against a supply of water, whereby the hot fumes vaporize the water and unite therewith to form sulphuric-acid vapor, and this sulphuric-acid vapor is thence passed from the vaporizing and mixing conduit into a large chamber, where it is condensed.

My invention therefore consists, mainly, in the improved process here outlined, as hereinafter fully set forth.

In the annexed drawing the figure presents a longitudinal section of an apparatus for carrying out my improved process.

In this drawing, A indicates the sulphur-furnace at one end of the apparatus, which is presumed to be of the ordinary construction, *a* being the hearth or "sole," on which the burning sulphur *b* and the niter-pot *c* are supported.

B indicates the large chamber at the opposite end of the apparatus, which chamber is presumed to be constructed in the usual manner of sulphuric-acid chambers, being lined with lead, as indicated at *d*, provided with one or more man-holes, as at *e*, and with an outlet-pipe, as at *f*, to connect to an exhauster, condenser, or draft-flue to insure a draft or circulation in the chamber. A layer of weak sulphuric acid, *g*, is also placed on the floor of the chamber, as usual; but no steam-pipes connect to or discharge into the chamber, as is usually the case.

Now, *i* indicates the discharge-pipe from the sulphur-furnace which conveys the sulphurous and nitric fumes therefrom; but this pipe, instead of discharging into the acid-chamber B, as usual, discharges into a preliminary vaporizing and mixing trunk or conduit, D, placed intermediate between the furnace and the chamber, as shown. The furnace-pipe *i* discharges directly into the initial end of the conduit D, while the terminal end of the conduit discharges through the elbow-pipe *s* into the chamber B at or about the middle thereof, as shown.

In a practical apparatus I prefer to have the conduit D about four feet square and fifty feet long, the chamber B being eighteen feet high, twenty-two feet wide, and one hundred feet long, while the pipe *i* is about eighteen inches in diameter and the pipe *s* about two feet in diameter, the furnace A being made, of course, of proportionate capacity; but these dimensions or proportions may of course be varied. A water-supply pipe, *k*, discharges into the conduit D near the initial end thereof in front of the mouth of the furnace-pipe *i*, said water-pipe proceeding from an elevated water-tank, *u*, or other water-supply, and connecting to a rose or spraying device, *l*, in the conduit, and being provided with a valve, *m*, so that a shower or spray of water may be injected into the conduit in front of the furnace-pipe *i*, and across the stream of hot gases issuing therefrom. The furnace-pipe *i* opens into the conduit D some distance above the floor thereof, so as to allow a layer of water, *n*, to accumulate on the floor thereof to the depth of six or seven inches, as illustrated. Near the terminal end of the conduit an overflow-pipe, *o*, extends from the base of the conduit, and discharges into the chamber B, and is provided with a valve, *p*, which may be so regulated as to allow the accumulated water (which will eventually become weak acid) to flow into the chamber at any rate desired, usually at such a rate as will maintain a constant level in the conduit.

The general construction of the apparatus having been now set forth, the operation will be made apparent. The chamber B being therefor connected by pipe *f* with the flue or with a condenser or exhauster, so as to estab-



lish a draft through the apparatus, the over-flow-valve *p* is closed and the water-valve *m* is opened, so as to flood the bottom of the conduit and inject a spray of water into the conduit in advance of the furnace-pipe *i*. The sulphur-furnace *A* is now started, so as to produce the usual sulphurous and nitric fumes in the ordinary manner, and these fumes in an intensely hot state will then rise through the pipe *i* and discharge into the conduit *D*, being thus projected over and against the surface of the water-layer *n*, and into and against the water spray falling from the sprinkler *l*. The intense heat of the fumes will therefore at once vaporize a large portion of the water against which they are thus projected, thereby forming steam, which, with the fumes, will reverberate and flow along the conduit over the water, and finally mix and chemically unite to form sulphuric-acid vapor, part of which will condense in the conduit and become absorbed by the water *n*, while the major part will enter the large chamber *B* and be condensed therein in the usual manner, and which acid, trickling down the sides of the chamber, will accumulate in the base thereof, from which it may be removed for concentration as required. As soon as the apparatus commences working, as described, the valve *p* is opened to the required extent to allow the surplus liquid to flow into the acid-chamber. The layer of liquid *n* will consist of nearly pure water on the top and acid at the bottom, as the acid formed in the conduit will gravitate to the bottom of the water, where it will be constantly removed through the pipe and valve *o p*, so as to keep the water-level constant, or nearly so. If, on testing the acid which is being condensed in the chamber *A*, it is found below the correct density, then the flow of water at the valve *m* may be reduced, so that by regulating said valve *m*, and also the valve *p*, and urging the furnace *A* more or less, the production of the acid in the chamber *B* may be regulated as desired, and the operation will be continuous. It is not absolutely necessary that the water be supplied in a spray into the conduit *D* across the orifice of the pipe *i*, as it will suffice to keep up a fresh supply in the conduit in any suitable way and project the hot fumes against said water; but the spray, as shown, is considered much more efficient. The conduit *D* will be lined with lead, and so constructed as to resist the heat and corrosive action of the fumes at the entering end; but the special construction of the apparatus does not concern my present invention, as I have made the apparatus the subject of a second application, in which this construction is more elaborately set forth. It may now be seen that by my improved process I dispense entirely with the use of the steam-boiler, and with the cost of fuel and attendance therefor, and greatly simplify the apparatus and the operation. As the heat of the sulphur fumes generates steam directly from the water against which it is

projected, and as the acid vapor is produced in the preliminary vaporizing or mixing conduit before it reaches the chamber, the vapors hence enter said chamber in a perfectly or nearly perfectly mixed and combined condition, and at a much lower temperature than usual, and are therefore in a condition to become rapidly and perfectly condensed. This expedites the production of the acid, prevents waste, and, what is of great importance, also prevents "foul working" or "subliming" in the chamber, which occurs frequently when the sulphur and nitric fumes are discharged directly into the chamber in connection with the steam-jets, as in the old system, and which defect usually occurs from a too-high temperature and an imperfect mixture in the chamber, which cannot nor is not likely to occur in my system; hence by this improvement not only is the cost of materials and attendance reduced materially and production facilitated and apparatus and operation simplified, but the chamber is also rendered very durable by the prevention of foul working, as above indicated, thereby presenting many advantages for this mode of manufacture.

I am aware of the system set forth in the English patent of Sprengel, No. 3,189 of 1873, and disclaim the same as distinct from my invention, for in that case a spray of sulphuric acid is discharged in the acid-chamber in proximity to the issue of the gases from the sulphur-furnace for the purpose of absorbing the oxides of nitrogen, and at the same time water is dispersed by steam-jets at different points in the chamber remote from the issue of gases from the furnace.

What I claim is—

1. The process for producing sulphuric acid, consisting in projecting the hot sulphur and nitric fumes from the sulphur-furnace directly against a supply of fresh liquid water, and thereby vaporizing the water and causing the vapor and fumes to mix to form sulphuric-acid vapor, and thence condensing said acid vapor.

2. The process described for making sulphuric acid, consisting in projecting the hot sulphur and nitric fumes from the sulphur-furnace directly against and through a spray of water, and thereby vaporizing said water and causing the same to unite with the fumes to form the acid, and thence condensing said acid vapor, substantially as set forth.

3. The process of making sulphuric acid herein set forth, consisting in projecting the hot sulphur and nitric fumes from the sulphur-furnace against a supply of water in an intermediate vaporizing or mixing chamber, and thence vaporizing said water and causing said vapor and fumes to mix or unite in said intermediate chamber, and thence passing the acid mixture or vapor into a condensing-chamber, substantially as herein shown and described.

4. The process of producing sulphuric acid



herein set forth, consisting in projecting the  
hot sulphur and nitric fumes from the sulphur-furnace into an intermediate vaporizing  
and mixing chamber against and over a mass  
5 of freshly-supplied water in a prolonged layer  
or bed, conducting the acid mixture thus produced in an elongated or extended passage  
over said water-bed, and finally discharging  
the same into a condensing-chamber, substantially as shown and described.

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