April 18, 1933. H. SCHULTZE 1,904,548

REVOLVING TUBE FURNACE

Filed June 13, 1929

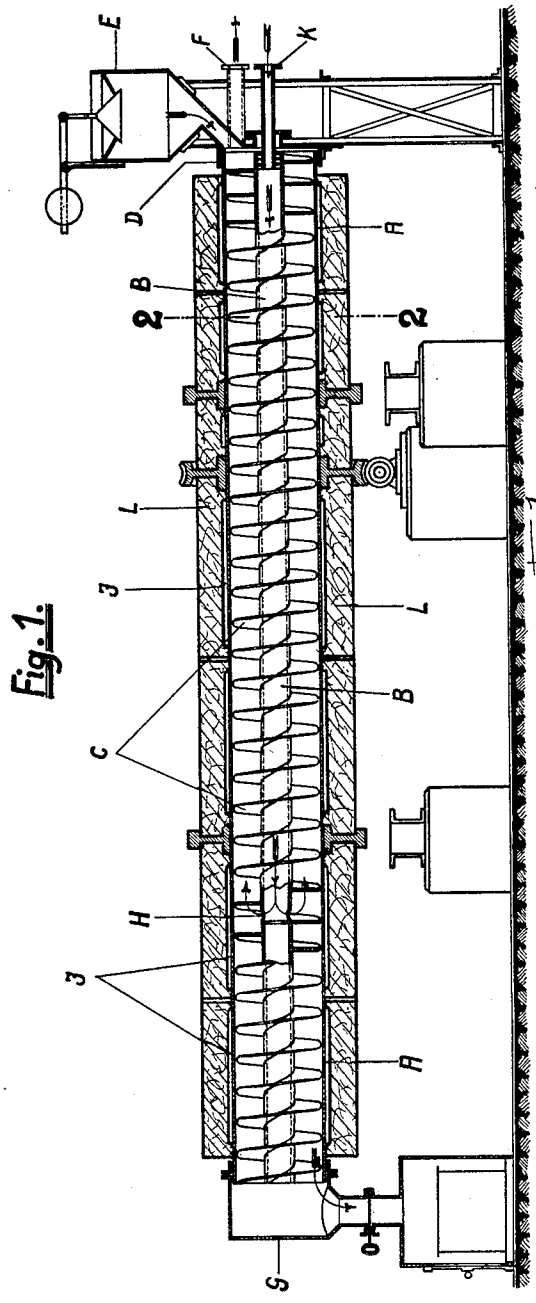


Fig. 1.

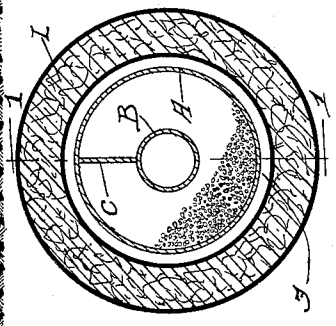


Fig. 2.

Inventor
Hermann Schultze
By Hauff & Harland
Attorneys

Patented Apr. 18, 1933 1,904,548

UNITED STATES PATENT OFFICE

HERMANN SCHULTZE, OF FRANKFORT-ON-THE-MAIN-GRIESHEIM, GERMANY, ASSIGNOR TO I. G. FARBENINDUSTRIE AKTIENGESELLSCHAFT, OF FRANKFORT-ON-THE-MAIN, GERMANY, A CORPORATION OF GERMANY

REVOLVING TUBE FURNACE

Application filed June 13, 1929, Serial No. 370,567, and in Germany May 2, 1927.

I have filed application in Germany on May 2, 1927.

My present invention relates to a revolving cylinder furnace of which I intend to make use especially in performing the production of sodium sulfate according to Hargreaves process which comprises acting in the heat upon sodium chloride with SO_2, steam and sufficient air to ensure a quantity of oxygen in the gases at least sufficient for oxidizing SO_2 to SO_3.

Attempts have been made to improve the Hargreaves process by effecting the reaction in revolving furnaces. However, all such proposals have failed to provide an unobjectionable result.

Now, my experiments have demonstrated that a satisfactory result is dependent on certain conditions which hitherto were not sufficiently recognized. The most important of these conditions are the following:

(1) It is necessary to employ porous lumps or bricks of sodium chloride even in revolving furnace work.

(2) The pieces of salt must be of small dimensions in order that the gases may penetrate easily and quickly into the innermost parts thereof.

(3) A steady supply of gas and the maintenance of a uniform temperature must be ensured by accurate regulation, so as to avoid agglomeration or caking of salt ensuing from local overheating, to which the failure of prior experiments was principally due.

(4) The inclusion of incompletely formed sulfate (due to some of the lumps getting ahead of the others during their passage through the furnace) should be prevented by accurately controlling the travel of the salt through the furnace.

Consequently, the revolving furnace must be so designed as to ensure the perfectly controlled and undisturbed counterflow between the solid and gaseous constituents of the reaction, and that the salt bricks are uniformly conveyed, without endangering their shape and with a minimum of relative displacement.

The invention will hereinafter be more fully described with reference to the accompanying drawing which illustrates diagrammatically a revolving tube-furnace suitable for carrying the herein described method into practical effect.

Fig. 1 is a longitudinal section of the furnace, Fig. 2 is a section along line 2—2 of Fig. 1. The same reference characters are used in both figures to indicate the same parts.

In said drawing A denotes a revolving cylinder which is completely traversed by an axially disposed hollow shaft B round which is mounted a helix C, the inner rim of which is secured to the said hollow shaft B, whereas its outer edge extends as closely as possible towards the inner wall of the revolving cylinder A. Adjoining to one end of the cylinder A and suitably packed is arranged a stationary head member D, provided with a feed hopper E for the salt pieces, together with a gas outlet pipe F and gas intake connection K leading to the hollow shaft B. At the other end is a cap or closure G connected with a double valve chamber through which the finished product is discharged into a receiver for removal. For the greater portion of its length the hollow shaft B serves as a preheater for the reaction gases (SO_2, air, and steam) introduced at the head end through K, which gases are then allowed to issue through openings H, the hollow shaft B being closed behind the holes H, into the furnace chamber A. Then the gases pass in reversed direction of flow and in countercurrent to the salt pieces backward to the head member D following the helical path along hollow shaft B passing over the charge x disposed in A (not shown in the drawing), whose quantity is not sufficient to contact hollow shaft B, while A is rotating.

In Fig. 2 the disposition of the charge x during working is shown.

At the head end, the gases are finally withdrawn through the outlet F, for conveyance to the hydrochloric acid absorption plant.

For the purpose of heating up, and also for regulating the temperature when re-

quired, the revolving cylinder A is provided with an electric resistance heater, divided into sections J, each of which can be set in action according to the internal temperature attained. Should the shutting off of the heating current no longer suffice to lower the temperature of the exothermic reaction to a sufficient extent, detachable portions L of the heat insulating jacket may be removed one after the other. The regulation of the temperature in the furnace may also be effected by varying the temperature of the mixture of SO_2, air, and steam.

Throughout the entire zone of contact between the salt bricks and the sulfurous gases, the temperature is kept at approximately 520° C., but in any case above 460° C., so as to prevent caking due to the formation of bisulfate. After the hot salt bricks have passed over into a zone free from SO_2 gas (behind H), the final product is cooled having retained its small grained form by being guided at a slow rate in the turns of the helix C, and the sulfate is discharged, into the air or other inert gases, by means of the double valve chamber behind the cap G.

I claim:

In a revolving furnace, in combination, a revolving cylinder, a stationary hollow shaft located in the cylinder and provided with an outer helix attached to the shaft along its total length having a diameter nearly equal to that of the revolving cylinder, an inlet at one end of said shaft for introducing reaction gases into the latter, an outlet for gas in said shaft at a distance from said inlet of more than half the length of said shaft, and an outlet for gas on said revolving cylinder at the same end where the gas inlet is provided on the shaft.

In testimony whereof I have hereunto set my hand.

HERMANN SCHULTZE.