H. F. CHAPPELL.

APPARATUS FOR TREATING ALUNITE.

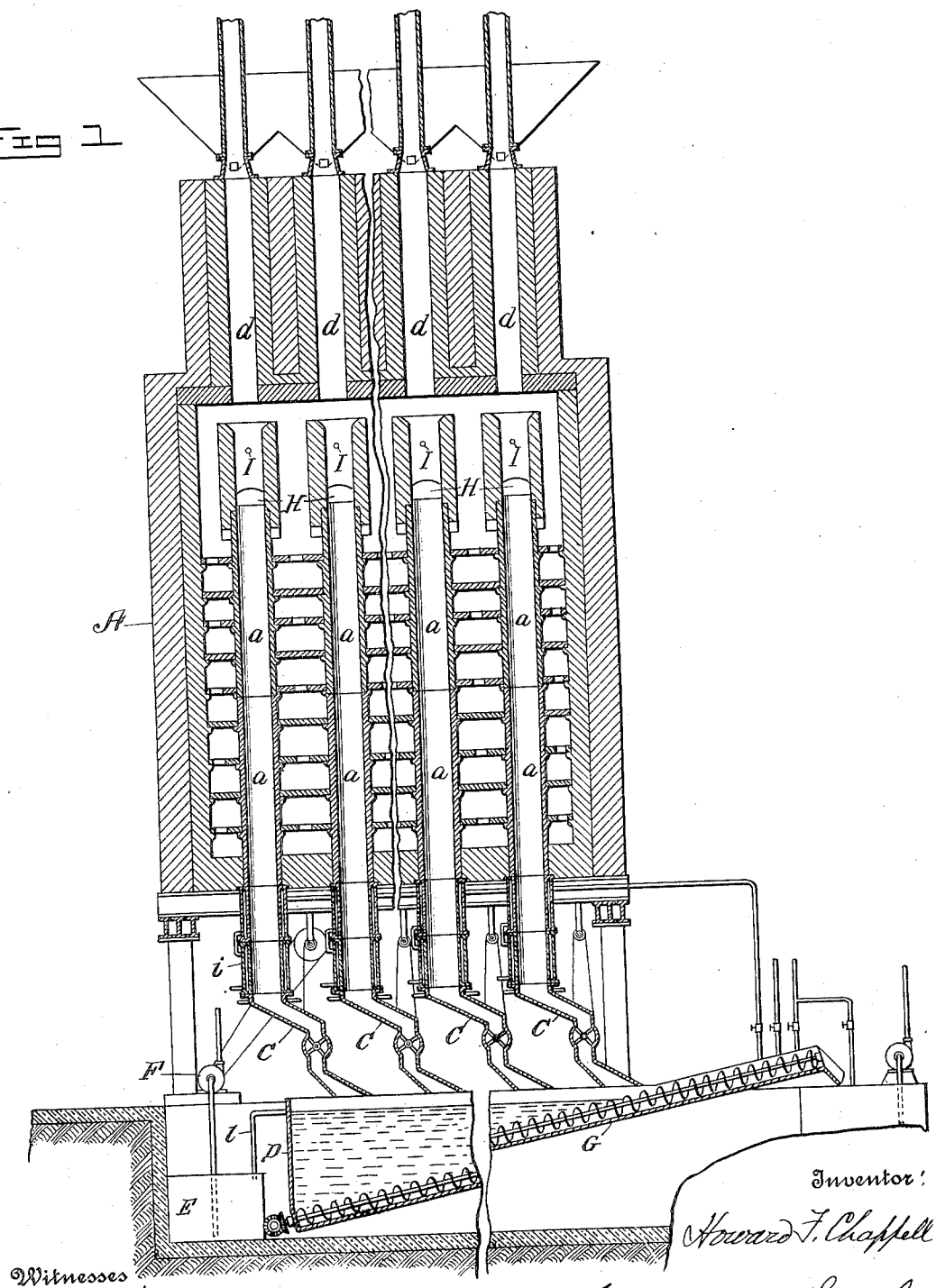
APPLICATION FILED OCT. 15, 1913.

Patented Mar. 3, 1914

1,089,110.

3 SHEETS—SHEET 1.

Fig 1.



Witnesses

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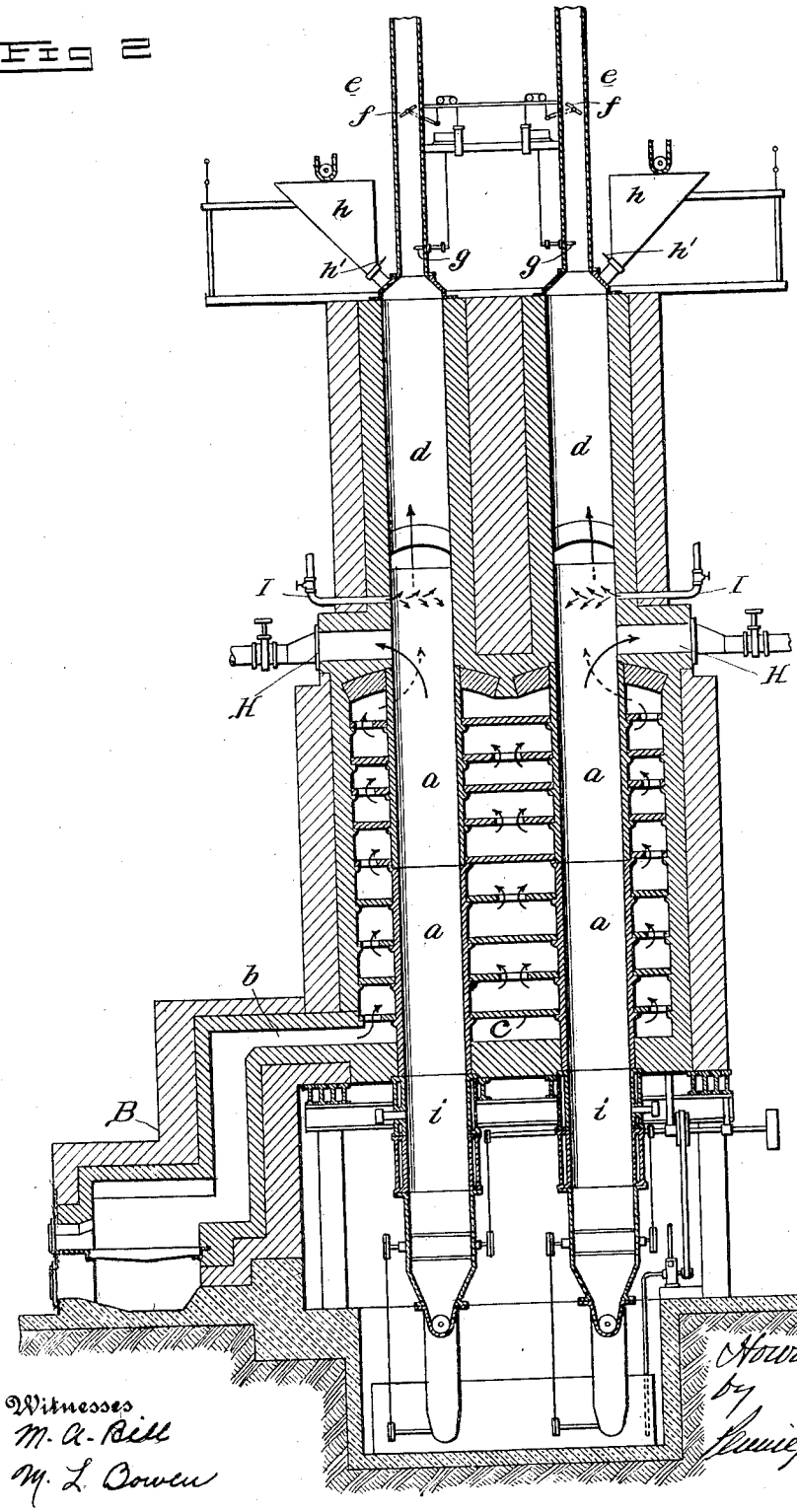
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3 SHEETS—SHEET 2.

Fig 2



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3 SHEETS—SHEET 3.

Fig 3

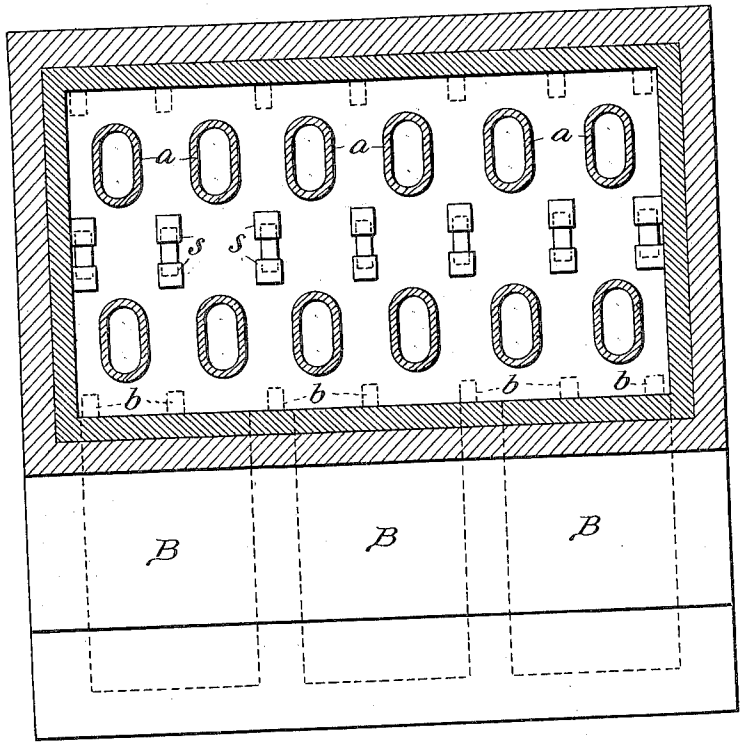


Fig 4

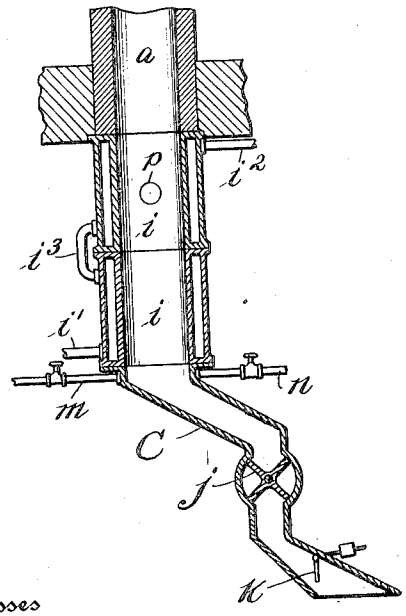
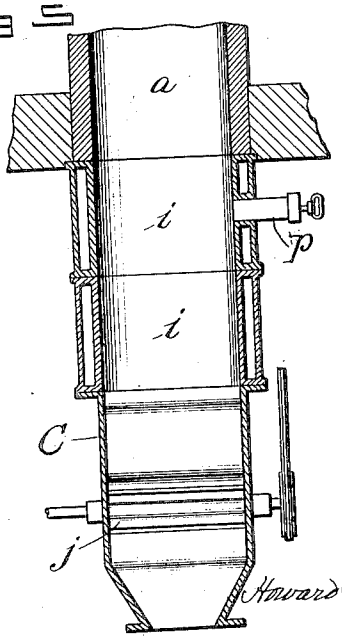


Fig 5



Witnesses

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR TREATING ALUNITE.

1,089,110. Specification of Letters Patent. Patented Mar. 3, 1914.

Original application filed May 8, 1913, Serial No. 766,269. Divided and this application filed October 15, 1913. Serial No. 795,207.

To all whom it may concern:

Be it known that I, HOWARD F. CHAPPELL, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Apparatus for Treating Alunite; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In an application for Letters Patent of the United States filed by me under date of May 8, 1913, Serial No. 766,269, I have described a method of calcining alunite, in two stages; the treatment proposed having for its purpose to obtain increased uniformity of product, economy of fuel, certainty as to the time factor involved, and regularity of progress of the calcining operation as a whole. So, also, it had for its further object to facilitate the recovery, to advantage, of the sulfur gases and vapors given off during the operation and incidentally to render the calcining operation innocuous to vegetation in the locality in which the calcination is practised.

In the accompanying drawings, I have illustrated a furnace adapted for the practise of the method referred to, upon a considerable commercial scale, and the present invention, constituting a division of my application above referred to, relates to the features of possible novelty involved in the said furnace and its adjuncts.

In the drawings,—Figure 1 represents a longitudinal sectional view of such a furnace partly broken away midway of its length, so as to accommodate the view to the scale upon which the drawing is made; Fig. 2 represents a vertical transverse section thereof; Fig. 3 represents a horizontal transverse section and partial plan view; Figs. 4 and 5 represent, respectively, views taken at right angles to each other and illustrating the discharge end of one of the furnace muffles.

Similar letters of reference indicate similar parts throughout the several views.

Referring to the drawings A indicates a bench or fire chamber within which are located a series of upright retorts or muffles *a*, which may, conveniently, be twelve in number, as indicated in Fig. 3. These retorts are similar to those used for the gasification of coal, and they may conveniently be heated from three producers B, having flues *b* which discharge below the lowermost bench floor *c*. The bench is provided with a series of such floors, one above the other, with an intervening space, and these floors are provided with appropriate openings so as to give the gases a zig-zag course in rising through the fire chamber. This is readily effected, for instance, by permitting the gases to rise through openings near the side walls of the fire chamber in alternate floors and through middle openings in the intermediate floors, as indicated by the arrows in Fig. 2. The floors, as shown, may be readily supported upon projections on the outer sides of the retorts and like projections from the inner side walls of the fire chamber.

At their upper ends, the retorts *a* open into perpendicular shafts *d* of the same interior cross-sectional dimensions as the retort and of approximately the same length.

It will be further noted that the fire gases which have been used for heating the retorts or muffles, likewise enter the perpendicular shafts *d* referred to, and pass from their points of entrance at the bottom of the shafts *d* upward through the charge contained therein finally making their exit through the exit chimneys or flues *e*. These flues *e* are provided with regulating dampers *f* adapted to be automatically governed by any suitable intermediate mechanism, if desired, from a pyrometer *g*. I have merely illustrated the intermediate mechanism diagrammatically, inasmuch as available constructions for this purpose are well known and do not require specific illustration and description.

The shafts *d* are adapted to be charged from suitable hoppers *h* having regulating gates *h'*, as shown, and the hoppers may be charged conveniently from suitable elevators or otherwise. It is likewise convenient and desirable to have a single hopper feed a number of retorts, as indicated, for instance, in Fig. 1. To facilitate the draft, the exit flues *e* may be provided with an exhaust fan (not shown).

Each of the retorts discharges at its bottom into a water-jacketed casing *i*, which may be made up of two sections as shown more fully in Figs. 4 and 5 having a water inlet at i' and a water exit at i^2, the

sections being connected by a communicating pipe i^3. These water cooled casings serve to regulate the temperature of the calcined product on its way to the discharge chute C, which is inclined laterally, so as to sustain the main weight of the charge, thereby appropriately relieving the weight that would otherwise be imposed upon the discharge gate *j*. Below the discharge gate *j* is located a swinging weighted valve *k*, whose function is to prevent steam generated from the calcined product as it falls into the water receptacle D from entering the bottom of the retorts. The receptacle D is provided with an inclined bottom and a water level is maintained, as indicated, with a suitable overflow pipe *l* leading into a tank E from which the material collected can be withdrawn by a pump F, or otherwise. An elevating screw conveyer G lifts the quenched calcined product and discharges it into a suitable receptacle. Each of the water-jacketed casings is provided with a tube *p* through which suitable test samples may be withdrawn from time to time, if desired.

At the bottom of each of the casings into which the retorts are discharged are located two pipes, one of which as *m* serves for the admission of air and the other, as *n*, serves for the admission of steam, both of these pipes being provided with regulating valves so as to permit the air and steam to be admitted in regulated amount. The air or steam passes through the completely calcined alunite and becomes highly preheated before entering the retort proper, thereby making available the heat of the calcined alunite for use in the interior of the retorts, thus supplementing the heat imparted from without by the fire gases. Furthermore, the upward passage of the air or steam, as the case may be, facilitates the removal of the gases from the retorts and greatly decreases the fuel consumption.

Immediately above the tops of the retorts, exit pipes H are provided for the purpose of removing the gases generated in the retorts. Immediately above these pipes and on opposite sides of the shaft, but below the flues which lead into the shafts *d* are located pipes I, provided with valves. These pipes I are used to admit air or other aeriform fluid under pressure. This air, when properly regulated, prevents the fire gases which heat the retorts from entering the retorts, inasmuch as the air or other aeriform fluid thus admitted acts as a barrier to the downflow into the retorts *a* of the fire gases, as is indicated by the arrows in Fig. 2, and this is effected without in any way interfering with the proper updraft through the stacks *d*.

It is important that the combustion chamber between the fire boxes or generators B and the retort-chamber should be sufficiently large to permit of practically complete combustion of the furnace gases before they enter the retort chamber. Furthermore, the distribution of the gases on their circuitous course through the horizontal flues should be capable of regulation, as, for instance, by fire-tile slides *s* which are capable of being operated from the exterior of the furnace so as to regulate the effective size of the openings and to direct the gases in the desired direction, as is the practice in the gasifying of coal in vertical retorts heated by horizontal flues.

The temperature of the gases in the bottom of the retort-heating chamber or bench should be approximately 1500° C., and the fire gases should leave the chamber and enter the bottom of the shafts *d* at about 750° C.

The alunite to be calcined is screened to a convenient size, say one inch mesh. Any large amount of dust or fines should be removed. The ore is then fed into the hoppers and passes therefrom into the upper end of the shafts *d*. In starting the furnace, it is preferable to have each retort and shaft filled with ore that has previously been completely calcined. The products of combustion from the generators B should then be admitted into the retort-chamber and the temperature raised gradually until, as hereinbefore indicated, the temperature of the gases entering the shafts *d* is not less than 750° C. and those entering the retort-chamber at the bottom thereof not less than 1500° C. After these temperatures have continued for about one hour, and when the lower end of the vertical center of the charge of the retorts is not less than 900° C., the automatic rotating gates *j* are started. The rotation of the gates is continued until a sample of the alunite removed through the sampling tubes *p* at the bottom of the retorts just shows a faint trace of soluble alumina. The number of revolutions of the said automatic discharge gate should then be very slightly decreased. It is contemplated to keep the discharge of the calcined alunite and the admission of the feed in such correspondence that the retorts will remain practically full during the operation.

The recovery of the sulfuric acid from the retorts or muffles is effected, by withdrawing the gases through the exit pipes H, or the like provided for the purpose, this withdrawal being effected by any suitable exhaust (not shown), familiar to the art. They are first, preferably, received in a suitable condenser or condensers wherein the sulfuric acid and SO_3 are recovered by condensation or by condensation assisted by absorption, and the SO_2 is converted into sulfuric acid either by the lead chamber

process or by the contact process, as the case may be. In fact, the particular manner of recovering the gases available as sulfuric acid may be appropriately varied to accommodate itself to the particular choice of the operator, the local market conditions, freight facilities, and the like.

Having thus described my invention, what I claim is:

1. Apparatus for calcining alunite and the like, comprising an upright retort or muffle, a shaft for supplying said retort or muffle, and a heating chamber surrounding the retort for heating the retort externally, said heating chamber communicating with the shaft so as to pass the fire gases from the heating chamber into and through the shaft; substantially as described.

2. Apparatus for calcining alunite and the like, comprising an upright retort or muffle, a shaft for supplying said retort or muffle, a heating chamber surrounding the retort for heating the retort externally, said heating chamber communicating with the shaft so as to pass the fire gases from the heating chamber into and through the shaft, exit conduits for withdrawing the gases from the retort, and means for preventing the fire gases from being drawn into the retort; substantially as described.

3. Apparatus for calcining alunite and the like, comprising an upright retort or muffle, a shaft for supplying said retort or muffle, a heating chamber surrounding the retort for heating the retort externally, said heating chamber communicating with the shaft so as to pass the fire gases from the heating chamber into and through the shaft, exit conduits for withdrawing the gases from the retort, and means for preventing the fire gases from being drawn into the retort, said means consisting of a pipe for admitting into the retort above the exit for the retort gases a supply of aeriform fluid under pressure; substantially as described.

4. Apparatus for calcining alunite and the like, comprising an upright retort or muffle, a shaft for supplying said retort or muffle, a heating chamber surrounding the retort for heating the retort externally, said heating chamber communicating with the shaft so as to pass the fire gases from the heating chamber into and through the shaft, and means for admitting air into the bottom of the retort; substantially as described.

5. Apparatus for calcining alunite and the like, comprising an upright retort or muffle, a shaft for supplying said retort or muffle, a heating chamber surrounding the retort for heating the retort externally, said heating chamber communicating with the shaft so as to pass the fire gases from the heating chamber into and through the shaft, and means for admitting steam into the bottom of the retort; substantially as described.

6. Apparatus for calcining alunite and the like, comprising an upright retort, an exit conduit for the discharge of the retort gases, means for heating the retort externally, and a discharge chute for the retort, said discharge chute having a lateral inclination thereby permitting it to sustain the weight of the charge, being provided with a discharge valve at its lower end; substantially as described.

7. Apparatus for calcining alunite and the like, comprising an upright retort, an exit conduit for the discharge of the retort gases, means for heating the retort externally, and a discharge chute for the retort, said discharge chute having a lateral inclination thereby permitting it to sustain the weight of the charge, being provided with a discharge valve at its lower end, a water trough into which the chute discharges, and means for preventing the entrance of steam from the water trough into the retort; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

HOWARD F. CHAPPELL.

Witnesses:

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M. A. BILL.