No. 769,534. PATENTED SEPT. 6, 1904.

A. E. CUMMER.

PROCESS OF CALCINING ALUMINA SULFATE, &c.

APPLICATION FILED JAN. 24, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

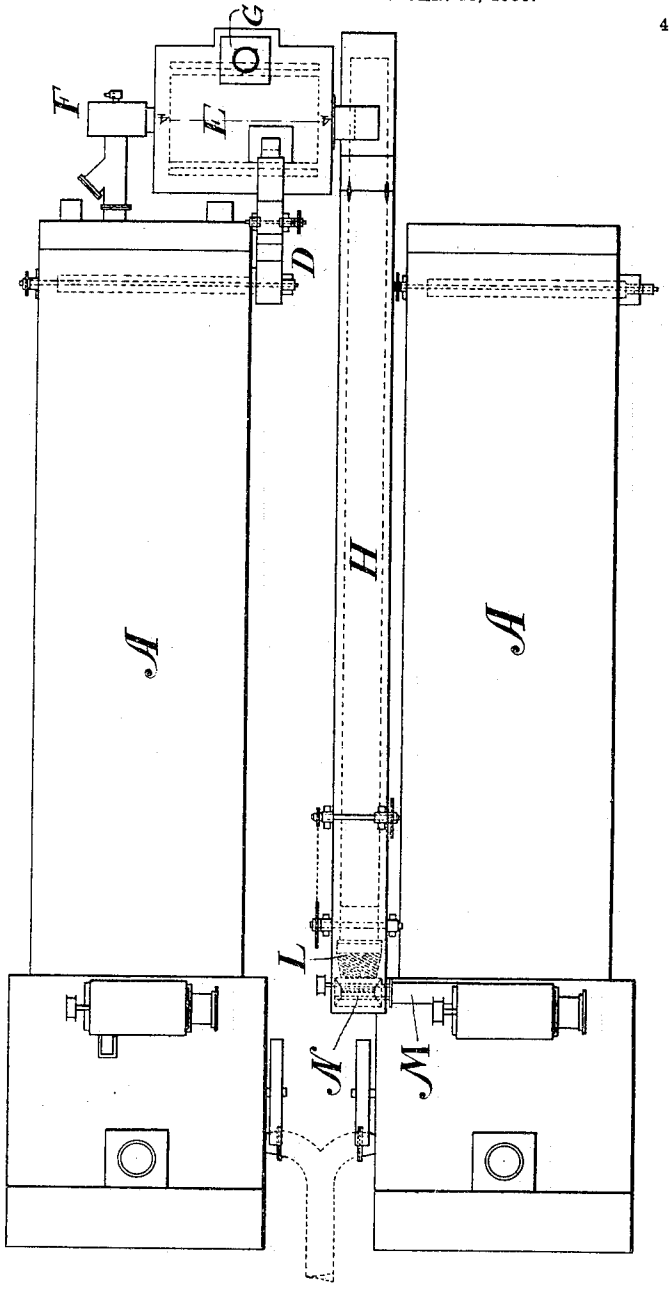


Fig. 1.

WITNESSES =
Will V. McKnight.
D. G. Davies

INVENTOR.
Albert E. Cummer
by Thos B. Hall his Atty

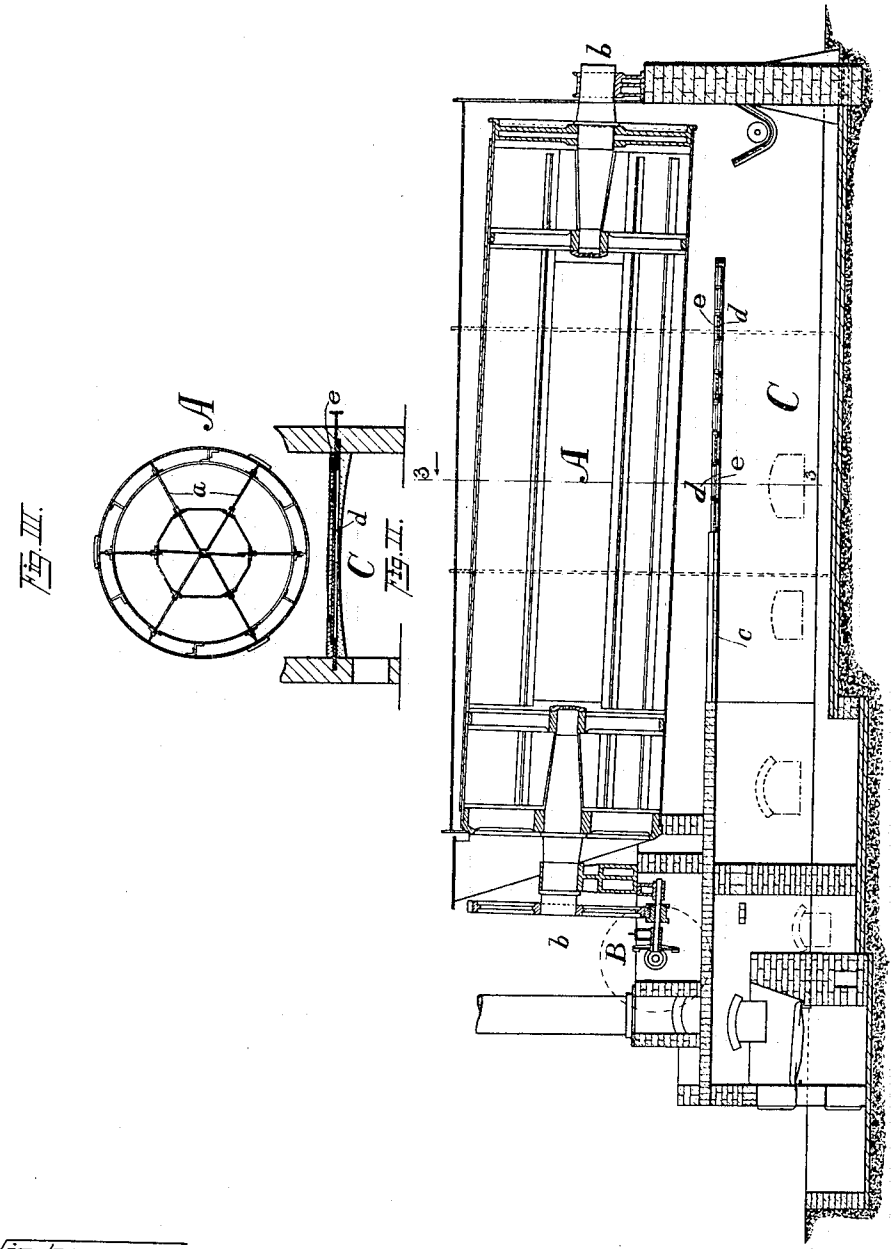
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NO MODEL. 4 SHEETS—SHEET 2.



WITNESSES=
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NO MODEL. 4 SHEETS—SHEET 3.

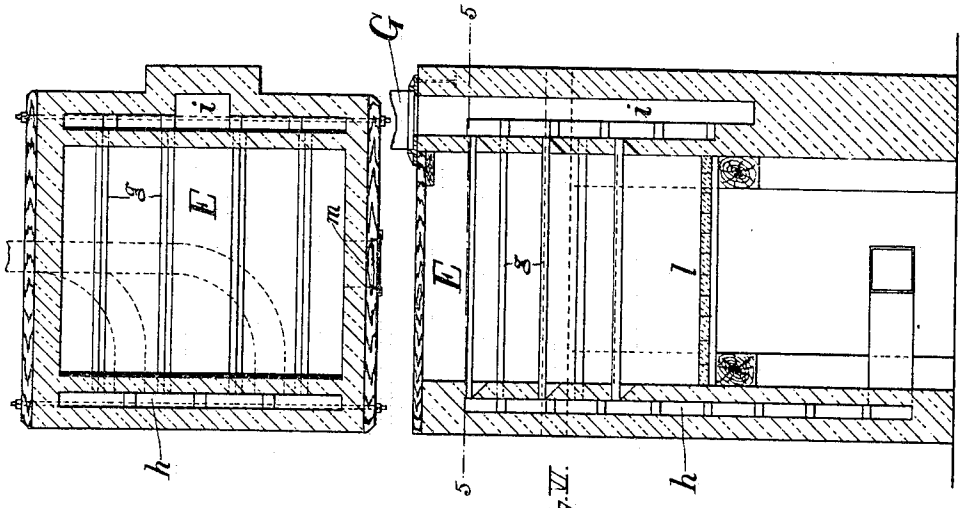


Fig. V. Fig. W.

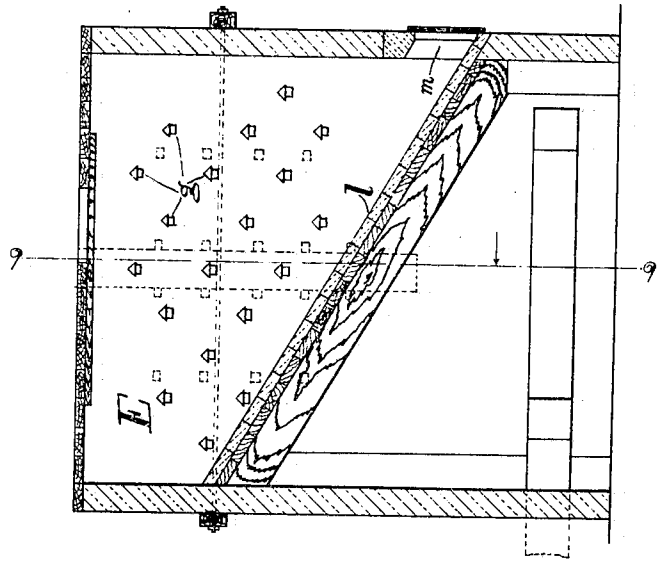


Fig. X.

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NO MODEL. 4 SHEETS—SHEET 4.

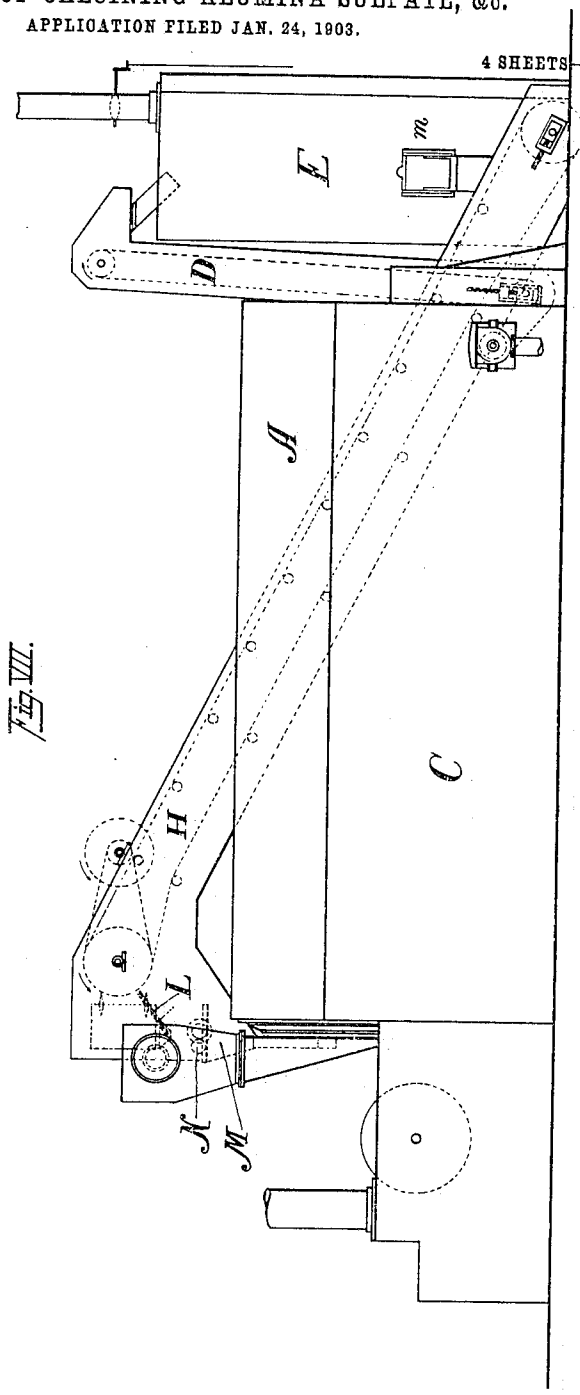


Fig. VIII.

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No. 769,534. Patented September 6, 1904.

UNITED STATES PATENT OFFICE.

ALBERT E. CUMMER, OF CLEVELAND, OHIO.

PROCESS OF CALCINING ALUMINA SULFATE, &c.

SPECIFICATION forming part of Letters Patent No. 769,534, dated September 6, 1904.

Application filed January 24, 1903. Serial No. 140,381. (No specimens.)

To all whom it may concern:

Be it known that I, ALBERT E. CUMMER, a citizen of the United States, and a resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Calcining Alumina Sulfate or Like Material, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

The invention relates to improvements in the process of treating aluminium sulfate and other substances having similar properties to calcine the same. Such materials in their ordinary commercial forms are extensively associated with water, which it is desirable to eliminate to a considerable degree for certain purposes. The elimination of the water is accomplished by comminuting the material and subjecting it to the action of heat. If at any time during the process of calcination the material should become overheated, the surfaces of the particles become hardened and glazed through superficial or external melting. The crust thus formed prevents the ready egress of the water from the interior of the particles, and, furthermore, the particles that have become so glazed and incrusted on further heating at an increased temperature burst and form flocculent masses, which are objectionable. In practicing this process of calcination it has been found that as the water becomes eliminated the temperature to which the material can be subjected can be raised without overheating and without consequent glazing or incrusting of the particles through the melting of their surfaces. For an instance, material containing about forty per cent. of moisture to start with can be subjected to the action of heat at a temperature of about 180° Fahrenheit without becoming overheated. As the water becomes eliminated the temperature can be gradually raised, so that when the material contains about thirty per cent. of moisture it can be subjected to heat at a temperature of about 210°, and when it contains about twenty-five per cent. of moisture the temperature can be raised to about 300° or even more without overheating. Consequently as the moisture becomes gradually eliminated the temperature can be constantly increased, the rate of increase being in the same progression as the elimination of the water.

The primary object of the present invention is to take advantage of the foregoing property of aluminium sulfate and like substances in the calcination of the same.

The invention in the present instance consists, primarily, in comminuting the material to be treated, subjecting it to the action of heat just below the temperature at which the particles would become incrusted or glazed through the melting of their surfaces, and constantly increasing the temperature as the melting-point of the material advances through the elimination of the moisture. In practice it has also been found in spite of all precautions that some of the material becomes overheated during the early part of the process, possibly through an excess of moisture above the estimated quantity, and some of the particles become incrusted and glazed through the melting of their surfaces. These glazed and incrusted particles will not readily part with the moisture contained in them during the remainder of the process. Also when in such form near the end of the process and when the application of heat has almost reached the limit the particles burst into flocculent masses. As the glazing and incrusting generally occur during the early application of heat and as the bursting occurs during the latter application, there is a considerable interval of time during which the particles can be treated to avoid the bursting and whereby advantage can be taken of the calcination through which such particles have already passed.

The invention further consists in crushing the material at a point intermediate of the beginning and the completion of the application of heat to disrupt any of the particles that may have become glazed or incrusted through superficial melting brought about by overheating.

The invention also consists in the additional features hereinafter particularly pointed out.

The annexed drawings and the following description set forth in detail one mode of carrying out the invention, such disclosed mode constituting but one of various ways in which the principle of the invention may be used.

In such drawings, Figure I is a plan view of the two driers and their connecting means. Fig. II is a longitudinal vertical section of one of the two drying-chambers and its drier. Fig. III is a detail transverse vertical section on line 3 3 of Fig. II. Fig. IV is a detail vertical section of the bin on line 4 4 of Fig. I. Fig. V is a detail horizontal section of the bin on line 5 5 of Fig. VI. Fig. VI is a detail vertical section of the bin on line 6 6 of Fig. IV. Fig. VII is a side elevation of the entire apparatus.

The apparatus herein shown employs two driers in duplicate of each other and each mounted over a separate heating-chamber, the two separate heating-chambers being in duplicate of each other. Hence the detail description of one said drier applies equally to the other and the detail description of one said heating chamber applies equally to the other. Each said drier is a hollow cylinder A, provided with longitudinal partitions *a*. It is journaled at a slight horizontal inclination upon suitable end bearings *b*, passing through the line of its longitudinal axis and is adapted to be slowly revolved on such bearings by suitable driving mechanism B. Each said heating-chamber is an oblong structure C, adapted to have the drier closely fitted thereto, so as to prevent escape of the heated air while permitting free revolution of such drier on its longitudinal axial bearings. It is provided with a longitudinal arch *c* near its upper portion, having at different points of its length heated-air openings *d*, controlled by covers *e*, operated from the outside of the chamber. These openings *d* communicate, respectively, with different transverse portions of the drier. Such transverse portions are to be severally provided with thermometers. By suitable manipulation heated air is either let into or cut off from any one of said transverse portions of the drier. The operator watching the thermometers thus maintains said different transverse portions of the drier at their respectively-desired temperatures. The latter constantly increase from the receiving end of the drier throughout its entire length to its discharge end.

The material to be subjected to the calcining process is crushed preferably to about pea size and is then fed into the first one of the two driers A. The interior longitudinal partitions *a* divide up the said material into different cross-sectional portions throughout the length of the drier, thereby causing such material to be the better maintained in contact with the heating-walls of the drier. As the driving mechanism B slowly revolves said drier on its longitudinal axis its contents are subjected to a trembling movement angularly to its length. The material being treated is thus constantly shifted, so as to change the portions thereof that are brought into contact with the wall-surfaces of the drier. This agitation of the material will also prevent the particles from adhering to each other. By reason of the inclination of the drier, together with its said rotary movement, its contents are gradually fed down its length while simultaneously being tumbled therein. Concurrently with such rotary movement of said drier the latter is subjected to a heated temperature which constantly increases throughout its length from its receiving end to its discharging end—from about 180° to about 210° Fahrenheit. Assuming that the material contains about forty per cent. of moisture when it is fed into the receiving end of said first drier, such material is subjected to the action of the drier for about two hours and then is discharged while containing about thirty per cent. of moisture. Upon leaving this first drier the hot partially-calcined material is then hoisted by elevator D and discharged into the top of bin E. This bin is provided with a number of horizontal transverse flues *g*, each angular in cross-section and having its opposite ends connected, respectively, with vertical flues *h* and *i*. Said flue *h* is connected with a blower-fan F. Said flue *i* is connected with a stack G. The lower portion of the bin is formed with a hopper *l* and a discharge-opening *m*.

Said angular transverse flues *g* are adapted to open up and temporarily divide different portions of the material from each other. A thorough ventilation of the material is thus insured, the angles of the transverse flues distributing the material and permitting the air which passes through said flues to quickly and thoroughly produce desired action upon the material. The material remains in such bin subject to said ventilating action about an hour, such ventilation being effected with either hot or cold air, determined, as follows, by the condition of such material received from the first drier: If the material partially calcined in the first drier should prove to have been not overheated therein, then it is to be still further calcined while in the bin. In such instance said angular transverse flues *g* will circulate hot air of about 210° Fahrenheit throughout the material, thus continuing in the bin the desired calcining procedure. Upon delivery of the material from said bin it is carried by belt H, which upwardly inclines from the bin to the head of the second drier. The hinged screen L will in such instance be lifted out of the line of passage of said material, so as to permit the latter to pass directly through feed-spout M into the upwardly-inclined end of the second drier; but if, on the other hand,

the material partially calcined in the first drier should prove to have been overheated therein, and thereby becomes enveloped with a hard coating, then it is to be subjected in the bin to a treatment preparatory to placing it in proper condition to be subjected to further calcining. Such material overheated in the first drier has a glaze about its exterior which renders the further escape of moisture therefrom slow and difficult. It hence becomes advisable to thereupon open up such incrusted material, so that the contained water may not be imprisoned therein during the further calcining thereof. To such end in order to best prepare this surface-hardened material for the opening-up treatment it is first cooled. In such instance the vertical air-flue *h* is to be connected at its lower end with a source of air of the desired low temperature—such, for illustration, as may then be the atmospheric temperature. Such cooled air is thereupon circulated throughout the hot incrusted material in the said bin. When sufficiently cool, said incrusted material is thereupon conveyed by said upwardly-inclined belt H to the head of the second drier. There it is delivered upon the screen L, then inclined downwardly in the line of passage of said material. The fine portion of the material will pass down through such screen. The rest of the material is passed from off said screen down between rolls N. These rolls crack or break the lumps or crust or hard coating of the material, thereby placing the latter again in proper condition for further calcining. The said fine portion of the material which passed through said screen joins with said broken or cracked material delivered from said rolls, and the combined product enters the second drier through said feed-spout M. The longitudinal partitions of this second drier subdivide the material there being treated. The slow rotary movement of such drier, with its longitudinal horizontal inclination from its receiving end to its discharging end, subject the material to a tumbling action while passing it along. The heating-chamber over which this second drier is individually mounted is adapted to supply heated temperatures to different transverse sectional portions of the drier, constantly increasing in degree of heat from its receiving end to its discharging end, such degree, Fahrenheit, ranging from about 210° at the receiving end to about 300° at its discharging end. In this second drier the moisture of the said material is evaporated to an extent such as to cause the resultant product to contain about twenty-five per cent. of moisture. The length of time that said material is being subjected to the action of this second drier is about two hours. During such time the material is being constantly shifted about by the rotary motion of the drier, so as to always present new portions to the direct-heating contact of the interior walls.

From the foregoing the following is apparent: On the one hand, in the event that the material has passed through the first drier without having been overheated, and therefore without any crust or hard formation about it, then such material is in proper condition for further calcining. It thereupon receives such further calcining respectively in the bin and in the second drier, in each severally, as hereinbefore set forth. On the other hand, in the event that the material discharged from the first drier should prove to have been overheated therein, and thereby rendered more or less impervious to the escape of water therefrom, then such material is subjected to a cool ventilation in the bin and is thereafter broken or cracked so as to open up the said crust or hard coating. Alike, in either of said two events, the material is thereafter subjected to the action of the second drier.

The length of time that the material remains in either of the two driers or in the intermediate bin, as well as the temperatures employed, respectively, in such driers and bin, may vary according to the particular premises in hand in any given instance. Likewise, variations may obtain as to the percentages of moisture removed in each step of the foregoing procedure.

The particularly-detailed procedure herein set forth has been given as an illustration of the process as applied to calcining sulfate of aluminium containing about forty per cent. of moisture when received for treatment and which it is desired to deliver from treatment when containing about twenty-five per cent. of moisture. The described gradual and constantly-increasing heat treatment operates most efficiently in calcining the material, evaporating the more accessible moisture of the material at first, and thereafter operating the more effectually upon the interior moisture with least tendency to develop crust or hard coating.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the procedure hereinbefore disclosed provided the means stated by any one of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention—

1. The process of treating aluminium sulfate and like substances to calcine the same consisting in comminuting the material, then subjecting it to the action of heat at a temperature little less than the point at which the particles would become glazed or incrusted through superficial melting.

2. The process of treating aluminium sulfate

and like substances to calcine the same consisting in comminuting the material, then subjecting it to the action of heat at a temperature little less than the point at which the particles would become glazed or incrusted through superficial melting, and then constantly increasing the temperature as the melting-point of the material advances through the elimination of the water.

3. The process of treating aluminium sulfate associated with approximately forty per cent. of water consisting in comminuting the material and then subjecting it to the action of heat at a temperature of about 180°, Fahrenheit, and then constantly increasing the temperature as the point at which the particles would become glazed or incrusted through superficial melting advances until the temperature of about 300° is reached.

4. The process of treating aluminium sulfate and like substances to calcine the same consisting in comminuting the material, subjecting it to the action of heat to eliminate the water, and at a point intermediate of the beginning of the application of heat and the final application of the same crushing such part of the material in which by overheating the particles have become glazed or incrusted through superficial melting.

5. The process of treating aluminium sulfate and like substances to calcine the same consisting in comminuting the material, subjecting it to the action of heat to eliminate the water, interrupting the application of heat at an intermediate point and, preparatory to the final application of heat, crushing such part of the material in which by overheating the particles have become glazed or incrusted through superficial melting.

6. The process of treating aluminium sulfate and like substances to calcine the same consisting in comminuting the material, subjecting it to the action of heat to eliminate the water, interrupting the application of heat at an intermediate point and withdrawing from the partially-calcined material such part in which the particles by overheating have become glazed or incrusted by superficial melting and crushing such part and then returning it to the general mass preparatory to the final application of heat.

7. The process of treating aluminium sulfate and like substances to calcine the same consisting in comminuting the material, subjecting it to the action of heat to eliminate the water, interrupting the application of heat at an intermediate point and withdrawing from the partially-calcined material such part in which the particles by overheating have become glazed or incrusted by superficial melting and cooling such part, crushing such part and then returning it to the general mass preparatory to the final application of heat.

8. The process of treating aluminium sulfate and like substances to calcine the same consisting in comminuting the material, subjecting it to the action of heat at a temperature little less than the point at which the particles would become glazed or incrusted through superficial melting, constantly increasing the temperature as the melting-point of the material advances through the elimination of water, and crushing the partially-calcined material at a point intermediate of the beginning and the completion of the application of heat.

9. The process of treating aluminium sulfate and like substances to calcine the same consisting in comminuting the material, subjecting it to the action of heat at a temperature little less than the point at which the particles would become glazed or incrusted through superficial melting, constantly increasing the temperature as the melting-point of the material advances through the elimination of water, interrupting the application of heat at an intermediate point and cooling the partially-calcined material, and crushing the cooled material preparatory to subjecting it to the final application of heat.

10. The process of treating aluminium sulfate and like substances to calcine the same consisting in comminuting the material, subjecting it to the action of heat at a temperature little less than the point at which the particles would become glazed or incrusted through superficial melting, constantly increasing the temperature as the melting-point of the material advances through the elimination of water, and agitating the material during the application of heat.

11. The process of treating aluminium sulfate and like substances to calcine the same consisting in comminuting the material, subjecting it to the action of heat at a temperature little less than the point at which the particles would become glazed or incrusted through the superficial melting, constantly increasing the temperature as the melting-point of the material advances through the elimination of water, agitating the material during the application of heat to prevent the particles from adhering to each other, interrupting the application of heat at an intermediate point and cooling the partially-calcined material, and crushing the cooled material preparatory to subjecting it to the final application of heat.

Signed by me this 21st day of January, 1903.

ALBERT E. CUMMER.

Attest:

D. T. DAVIES,

THOS. B. HALL.