

A. ROY.

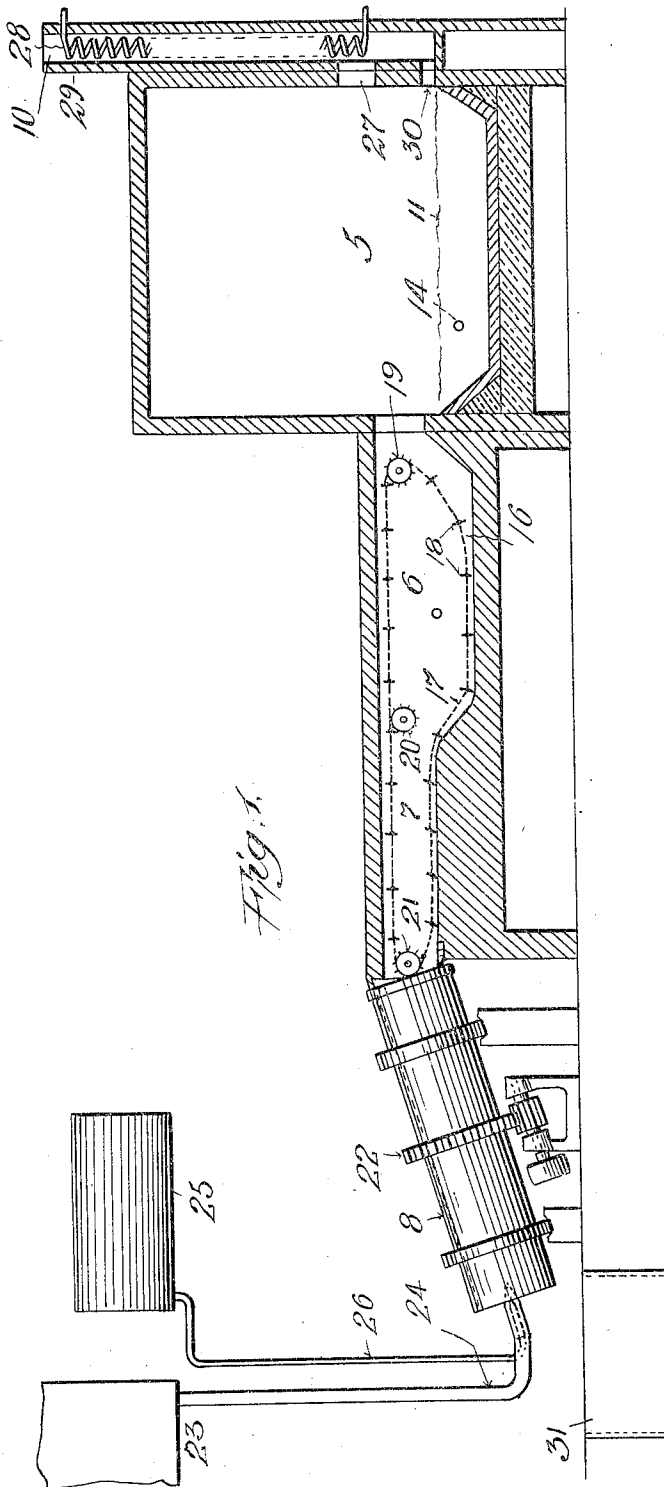
COMBINED DISSOLVING, CRYSTALLIZING, AND CALCINING APPARATUS.

APPLICATION FILED DEC. 12, 1918.

1,369,840.

Patented Mar. 1, 1921.

2 SHEETS—SHEET 1.



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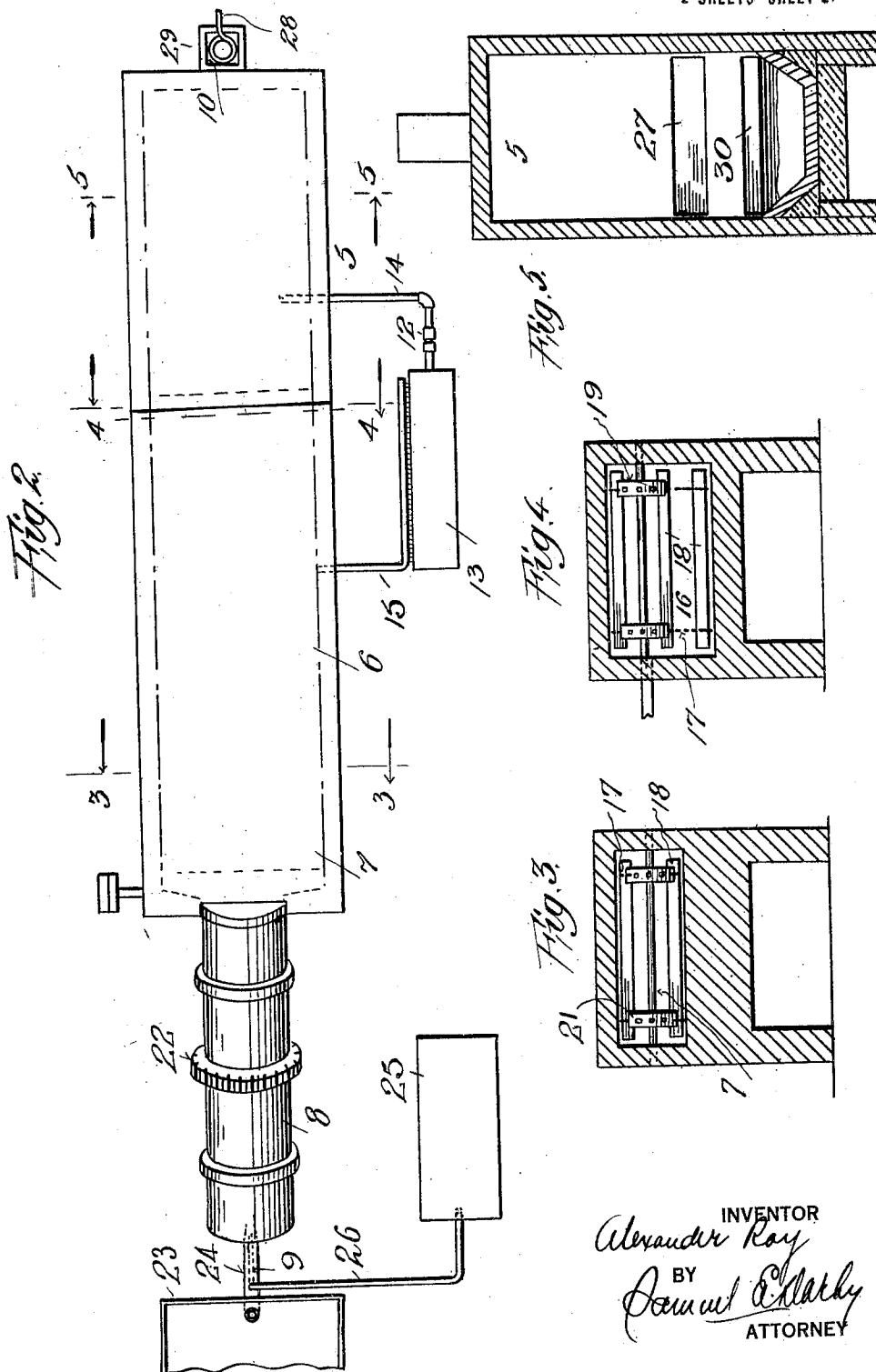
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INVENTOR
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UNITED STATES PATENT OFFICE.

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COMBINED DISSOLVING, CRYSTALLIZING, AND CALCINING APPARATUS.

1,369,840.

Specification of Letters Patent.

Patented Mar. 1, 1921.

Application filed December 12, 1918. Serial No. 266,490.

To all whom it may concern:

Be it known that I, ALEXANDER ROY, a subject of the King of England, residing at Huntington, county of Suffolk, State of New York, have made a certain new and useful Invention in Combined Dissolving, Crystallizing, and Calcining Apparatus, of which the following is a specification.

This invention relates to combined dissolving, crystallizing and calcining apparatus.

The object of the invention is to provide an apparatus of the character referred to which is simple in construction and arrangement, economical to manufacture and efficient in operation.

The invention consists substantially in the construction, combination, location and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawing, and finally pointed out in the appended claims.

In the accompanying drawing,—

Figure 1 is a view in longitudinal central vertical section through a combined dissolving, crystallizing and calcining apparatus embodying the principles of my invention.

Fig. 2 is a top plan view, somewhat diagrammatic, of the construction shown in Fig. 1.

Figs. 3, 4 and 5 are views in cross section on the lines 3, 3; 4, 4; and 5, 5, of Fig. 2, respectively.

The same part is designated by the same reference numeral wherever it occurs throughout the several views.

In carrying out my invention I propose to construct an apparatus to consist of a calcining, a drying, a boiling down or crystallizing, and a dissolving portion or chamber, said several chambers being so relatively arranged and disposed that they are successively heated from the same source of heat applied initially to the calcining portion of the apparatus, the excess heat from the calcining chamber being utilized in the other chambers of the apparatus. Associated with the furnace structure, as above indicated, is a condensing chamber, in which condensation of the vapors carried along with the products of combustion of the heating medium is effected.

Referring to the drawing, 5 designates the dissolving portion or chamber of the appa-

ratus, 6 the boiling down or crystallizing chamber, 7 the drying chamber, 8 the calcining chamber, 9 the source of heat, and 10 the condensing chamber.

The materials to be treated are admitted into the chamber 5 where they are subjected to a dissolving operation from heat derived from the excess of supply thereof to the boiling down or crystallizing chamber, presently to be more specifically described.

The chamber 5 is preferably provided with an acid-proof lining. The dissolving operations are carried on in the vat 11, disposed in the bottom of chamber 5, the acid-proof lining of said chamber serving to resist corrosive action of vapors generated in or entering said chamber.

From the chamber 5 the material under treatment is delivered into the boiling down or crystallizing chamber 6. This delivery may be accomplished in many ways. I have indicated for this purpose a pump 12 which draws the material from the dissolving chamber 5 through the connection 14, and delivers the same through a filter press 13 and connection 15 into the boiling down or crystallizing chamber 6.

The chamber 6 includes a vat portion 16 which is preferably lined with acid-proof material. Operating longitudinally through the chamber 6, and the vat 16, thereof, is an endless conveyer 17 having transversely disposed vanes 18. The conveyer 17 operates over suitable guiding and driving rolls 19, 20, 21, the rolls 19, 20 are respectively disposed at opposite ends of the chamber 6, while the roll 21 is located at the remote end of the drying chamber 7. By this arrangement the conveyer not only operates through the boiling down or crystallizing chamber, but also through the drying chamber. The lower portion of the endless conveyer contains sufficient slack to permit said conveyer to dip into the tank or vat 16, and to carry the contents thereof into and through the drying chamber 7. The floor of the drying chamber is raised above the vat 16, and, if desired, may be slightly inclined downwardly toward the remote or delivery end of said chamber.

Communicating with the drying chamber and into which the drying chamber delivers is the calcining chamber 8. This chamber may be conveniently constructed in tubular form and supported in a position

downwardly inclined from the delivery end of the drying chamber. In practice I prefer to axially rotate the calcining chamber. Rotating means for accomplishing this are indicated at 22.

The heating medium may be supplied in many different ways. I have indicated a simple arrangement wherein a hydrocarbon fuel burner 9 is disposed at the discharge end of the calcining chamber 8, and in such relation thereto as to direct the flame and other heated products of combustion of the fuel medium into the open end of said chamber. The fuel supply may be conveniently carried in the fuel tank 23, and delivered therefrom to the burner 9 through pipe 24. If desired steam may be injected along with the fuel medium or as constituting a constituent of such medium, and I have indicated at 25, a steam boiler having a delivery connection 26 to the burner 9 for this purpose.

The vapors and gases from the calcining, drying, evaporating and dissolving chambers, or such of them as may not be condensed before, as well as the products of combustion of the fuel medium, pass from the chamber 5 through an opening 27, into a condensing chamber or tower 10, in which is located a coil 28, through which a cooling medium is circulated. The gases or vapors which remain uncondensed after passage through the condensing chamber, escape through the open top or end of the condenser or tower. Any condensate collecting or deposited in the condensing chamber drains back into the dissolving chamber 5, through the opening 30.

The heated products of combustion from the burner 9 pass through the calcining chamber, and thence, successively, through the drying, crystallizing and dissolving chambers and supply the required heat for the operations carried on in said chambers. These several chambers open, successively, the one into the other, and hence the various operations are carried on continuously and economically.

A suitable bin or receptacle 31, disposed below the discharge end of the calcining chamber serves to receive the finished material delivered from said chamber.

It will be seen from the foregoing description that I provide an exceedingly simple construction and arrangement consisting of combined boiling, crystallizing, drying and calcining apparatus, wherein great economies are effected in carrying out the several operations.

While I do not desire to be limited or restricted to the specific use to which the apparatus of my invention may be put, the following will illustrate one use to which it may be put. Serpentine ore which includes magnesium silicates is placed in the dissolv-

ing chamber 5. This ore is dissolved with sulfuric acid and produces magnesium sulfate and finely powdered silicate impurities. The magnesium sulfate solution is drawn off by pump 12, separated from the impurities in the filter press 13, as hereinbefore described, and allowed to run into the boiling down tank where it is boiled down to magnesium sulfate crystals, which are dragged out by the chain 17 into the drying chamber 7. These crystals when dried are moved by the chain so as to fall into the calcining furnace 8 where they are calcined to magnesium oxid. I have found that the sulfur of sulfuric acid when calcined from the magnesium sulfate does not leave magnesium sulfate as sulfur dioxid but as sulfuric acid due to the catalytic effect of the magnesium oxid or possibly the magnesium oxid and the iron which it contains. This acid goes over into the condensing chamber or boiling chamber where a large amount of it falls due to the cooling action of the size of the chamber and any remainder uncondensed is condensed in the condensing chamber and added to the large dissolving chamber in a manner which will be obvious. Thus it will be seen that the apparatus forming the subject matter of my invention forms an effective efficient system for the production of magnesium oxid.

Having now set forth the objects and nature of my invention and a construction embodying the principles thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent, is,—

1. In a chemical recovery apparatus, a dissolving, a crystallizing, a drying, and a calcining chamber, said chambers opening successively the one into the other, in combination with means for supplying a heating medium to the calcining chamber, the excess heat from said calcining chamber being supplied successively to said drying, crystallizing and dissolving chambers.

2. In a chemical recovery apparatus, a dissolving, a crystallizing, a drying, and a calcining chamber, said chambers opening successively the one into the other, in combination with means for supplying a heating medium to the calcining chamber, the excess heat from said calcining chamber being supplied successively to said drying, crystallizing and dissolving chambers, and a condensing chamber communicating with said dissolving chamber.

3. In a chemical recovery apparatus, a dissolving, a crystallizing, a drying, and a calcining chamber, said chambers opening successively the one into the other, in combination with a conveyer operating through said drying and crystallizing chamber, means for transferring the material from the dissolving to the crystallizing chamber, and

a common source of heat for all of said chambers, said source of heat being applied to the calcining chamber and the excess of heat therefrom being utilized successively
5 in said drying, crystallizing and dissolving chambers.

4. In a chemical recovery apparatus, a dissolving, a crystallizing, a drying, and a calcining chamber, said chambers opening
10 successively the one into the other, in combination with a conveyer operating through said drying and crystallizing chambers, means for transferring the material from the dissolving to the crystallizing chamber,
15 and a common source of heat for all of said chambers, said source of heat being applied to the calcining chamber, and the excess of heat therefrom being utilized successively in said drying, crystallizing and dissolving
20 chambers, and a condensing chamber communicating with said dissolving chamber.

5. In a chemical recovery apparatus, a dissolving, a crystallizing, a drying, and a calcining chamber, said chambers opening
25 successively the one into the other, in combination with means to transfer the material under treatment from the dissolving to the crystallizing chamber, means to convey the material from said crystallizing
30 chamber to and through the drying chamber and delivering the same to the calcining chamber, and a source of heat supplied to the calcining chamber, the excess of heat from said chamber being utilized successively
35 in said drying, crystallizing and dissolving chambers.

6. In a chemical recovery apparatus, a dissolving, a crystallizing, a drying, and a calcining chamber, said chambers opening
40 successively the one into the other, the floor or bottom of the drying chamber being elevated above the bottom of the crystallizing chamber, means for delivering the material from the dissolving to the crystallizing
45 chamber, means for conveying the material from the crystallizing to and through the

drying chamber, and delivering the same into the calcining chamber, and a single source of heat for all of said chambers, said source of heat being applied to the calcining
50 chamber, and the excess of heat therefrom being utilized successively in said drying, crystallizing and dissolving chambers.

7. In a chemical recovery apparatus, a dissolving, a crystallizing, a drying, and a
55 calcining chamber, said chambers opening successively the one into the other, in combination with means for supplying a heating medium to the calcining chamber, the excess heat from said calcining chamber being sup-
60 plied successively to said drying, crystallizing and dissolving chambers, and means for axially rotating said calcining chamber.

8. In a chemical recovery apparatus, a dissolving, a crystallizing, a drying and a
65 calcining chamber, said chambers opening successively the one into the other, in combination with means for supplying a heating medium to the calcining chamber, the extra heat from said calcining chamber be-
70 ing supplied successively to said drying, crystallizing and dissolving chambers, said calcining chamber being inclined downwardly from the drying chamber.

9. In a chemical recovery apparatus, a
75 dissolving, a crystallizing, a drying, and a calcining chamber, said chambers opening successively the one into the other, in combination with means for supplying a heating medium to the calcining chamber, the
80 extra heat from said calcining chamber being supplied successively to said drying, crystallizing and dissolving chambers, said calcining chamber being inclined downwardly away from the drying chamber; and
85 means to axially rotate said calcining chamber.

In testimony whereof I have hereunto set my hand on this 5th day of December A. D., 1918.

ALEXANDER ROY.