No. 815,516. PATENTED MAR. 20, 1906.

C. E. DEWEY.

APPARATUS FOR CONVERTING ZINC SULFATE SOLUTION INTO ZINC OXID.

APPLICATION FILED JAN. 24, 1905.

3 SHEETS—SHEET 1.

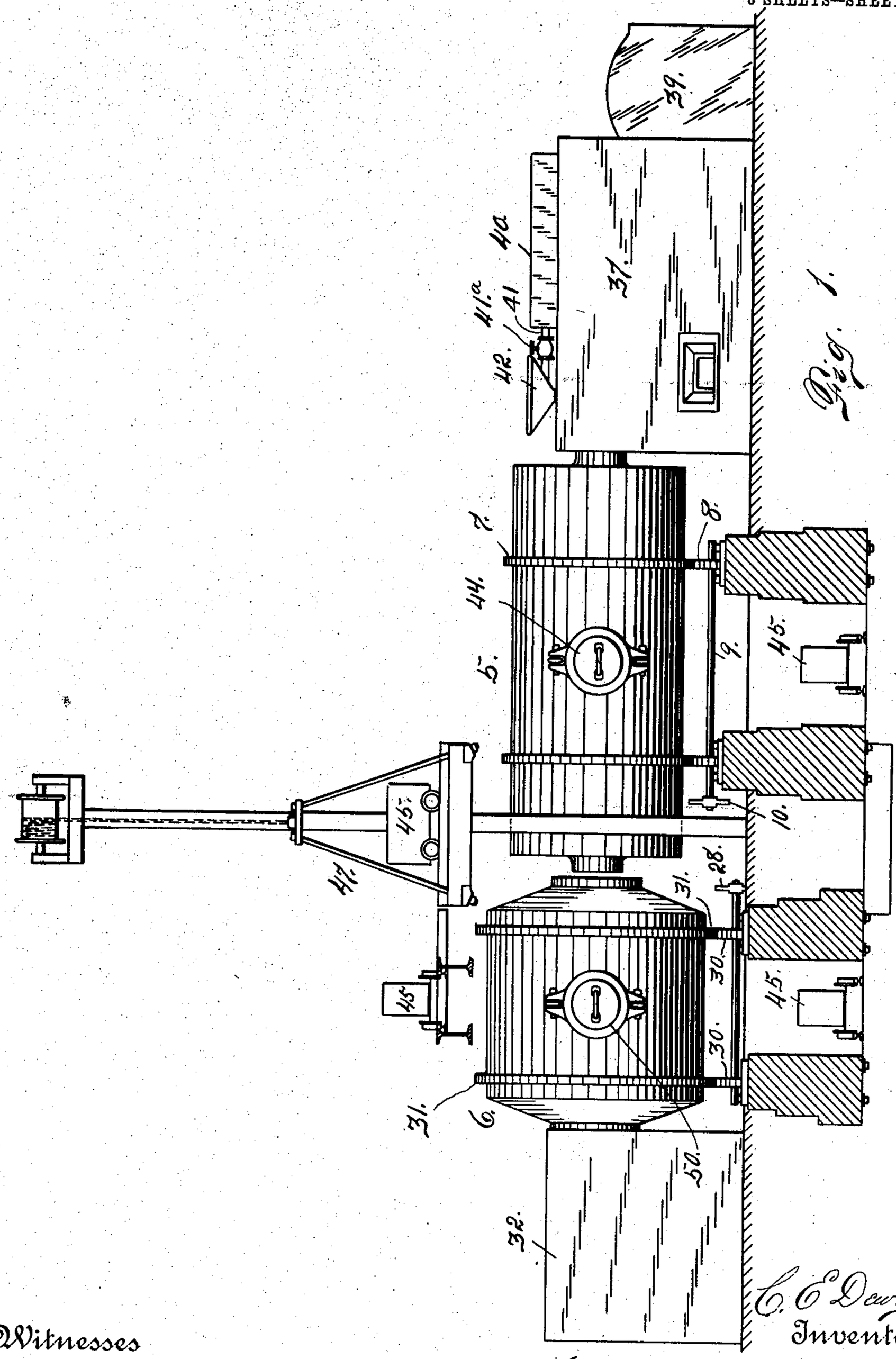

Fig. 1.

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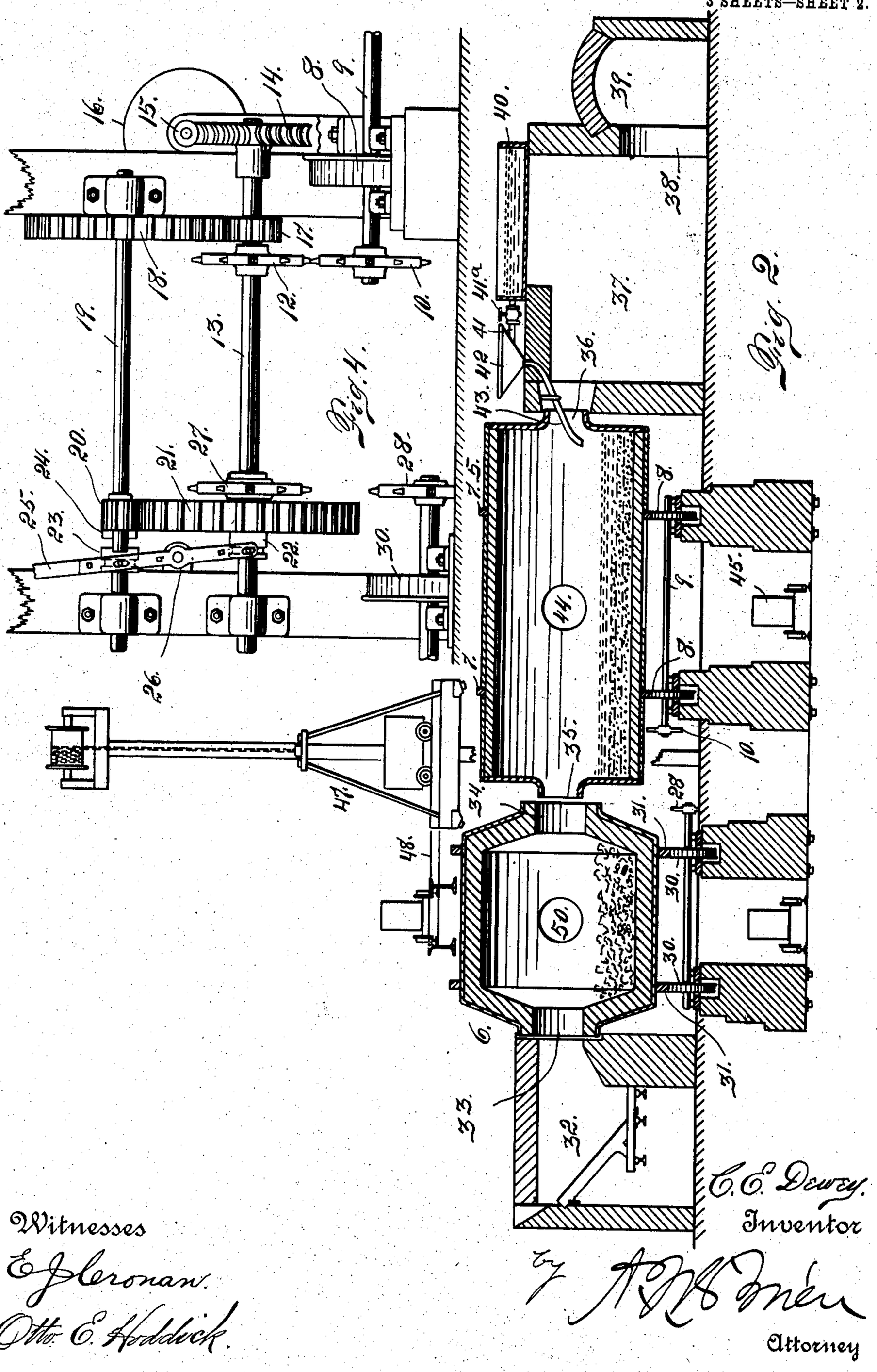
3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

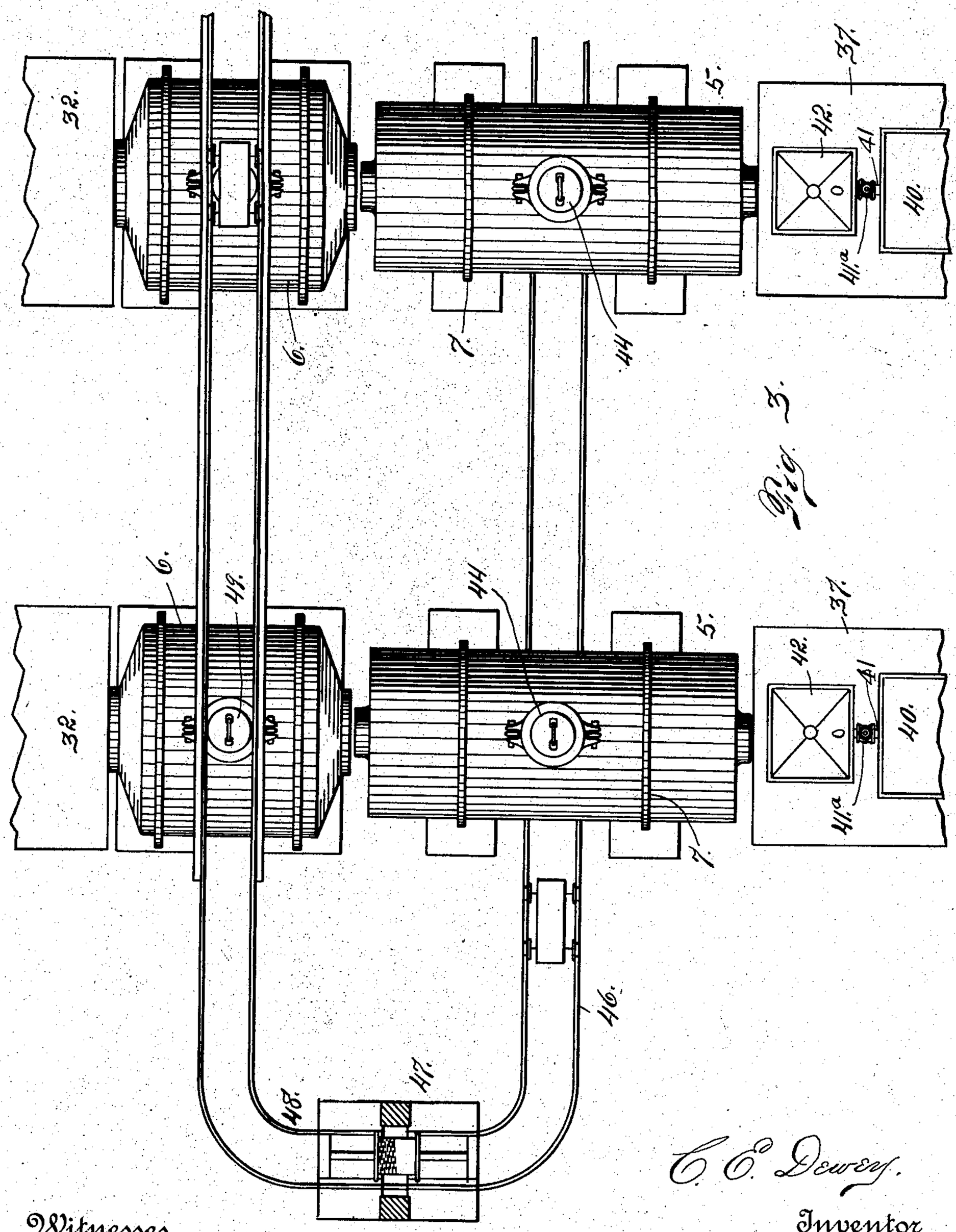

Fig. 3.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR CONVERTING ZINC-SULFATE SOLUTION INTO ZINC OXID.

No. 815,516. Specification of Letters Patent. Patented March 20, 1906.

Application filed January 24, 1905. Serial No. 242,570.

To all whom it may concern:

Be it known that I, CHAUNCEY E. DEWEY, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Apparatus for Converting Zinc-Sulfate Solution into Zinc Oxid; and I do 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, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in apparatus for converting zinc-sulfate solution into zinc oxid, my object being to carry out the aforesaid function on a commercial scale. In my improved apparatus two independently-revoluble cylinders are mounted in axial alinement, their adjacent extremities being open and in such proximity to each other that the heat may readily pass from one to the other. In one of these cylinders the calcining operation or the operation of removing the sulfuric acid from the zinc sulfate is effected, while in the other the solution is evaporated to dryness or approximately so. The calcining cylinder or chamber is located in suitable proximity to a furnace or fire-box whereby the heat and products of combustion pass directly from the fire-box into one end of the rotary chamber or cylinder, while the heat and products of combustion pass from the calcining-chamber into the evaporating-chamber, and thence into a dust-chamber located at the extremity of the evaporating-chamber remote from the calcining-chamber. In connection with the apparatus just described I employ suitable means for rotating the said cylinders or chambers and also means for feeding the zinc-sulfate solution in the first instance to the evaporating-chamber. I further employ means for transferring the zinc sulfate after taking it from the evaporating-chamber and delivering it to the calcining-chamber all as hereinafter more fully described, reference being made to the accompanying drawings, in which is illustrated an embodiment of the invention

In the drawings, Figure 1 is an elevation of the apparatus looking in the direction of the arrow in Fig. 3. Fig. 2 is a vertical section taken through the two rotary tanks or cylinders employed, together with the fire-box, dust-chamber, and smoke-flue in alinement with the said cylinders. Fig. 3 is a top or plan view of two sets of cylinders illustrating the manner of increasing the capacity of a plant of this character. Fig. 4 is a detail view of the mechanism for imparting the rotary movement to the alined tanks or cylinders

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate the cylinder in which the evaporation takes place, and 6 the calcining-cylinder or the tank in which the sulfuric acid is driven off from the zinc sulfate. These two cylinders are in axial alinement with each other and are mounted to rotate. The cylinder 5 is provided with rings 7, forming circular tracks which engage wheels 8, mounted on a shaft 9. One extremity of this shaft is provided with a sprocket-wheel 10, which may be connected with a sprocket 12, (see Fig. 4,) mounted on a shaft 13, provided at one extremity with a worm-wheel 14, engaged by a worm 15. The worm-shaft is provided with a pulley 16 for transmitting power to the worm-shaft from a line-shaft or any suitable motor. (Not shown.) Upon the shaft 13 is mounted a small gear 17, which meshes with a larger gear 18, fast on a shaft 19. Upon the last-named shaft is mounted a pinion 20, meshing with a larger gear 21, mounted on the shaft 13. The gears 20 and 21 are normally loose on their respective shafts; but they may be made fast on the same through the instrumentality of suitable clutch mechanism. The shaft 13 is provided with a clutch-sleeve 22, splined on the shaft and adapted to interlock with the wheel 21 when the clutch-sleeve is properly adjusted, as shown in Fig. 4. Upon the shaft 19 is also mounted a clutch-sleeve 23, adapted to engage interlocking lugs 24 formed on the pinion 20. A lever 25 is employed for shifting the respective clutches. This lever is fulcrumed intermediate the shafts 13 and 19, as shown at 26.

The two clutch-sleeves 22 and 23 may be alternately thrown into position to lock their respective gears on the shaft. In other

words, when the gear 21 is locked to rotate with the shaft 13, as shown in Fig. 4 of the drawings, the pinion or small gear 20 is an idler. On the other hand, when the lever 25 is shown in the position the reverse of that shown in Fig. 4 the pinion 20 is locked on the shaft 19, while the gear 21 is loose on said shaft. In this event motion is transmitted first from the shaft 13 to the shaft 19 through the instrumentality of the gears 17 and 18 and then from the shaft 19 to the gear 21 through the instrumentality of the pinion 20. A sprocket-wheel 27 is also connected with the gear 21, whereby a motion is transmitted to a sprocket 28, fast on a shaft 29, carrying two flanged wheels 30, which engage circular tracks 31, fast on the calcining-cylinder 6. In this way motion is communicated to the calcining-cylinder either directly from the shaft 13 or from the shaft 13 through the instrumentality of the shaft 19, as heretofore explained.

The two cylinders 5 and 6 are open at both extremities. At one end of the cylinder 6 is located a fire-box 32 for supplying the cylinders 5 and 6 with the necessary heat for the performance of the calcining and evaporating function. The heat and products of combustion enter the cylinder 6 through the opening 33 adjacent the fire-box and escape therefrom through the opening 34 at its opposite end into an opening 35 in one extremity of the cylinder 5. The products of combustion finally escape from the cylinder 5 through an opening 36 at its opposite end into a dust-chamber 37, and thence through an opening 38 near the bottom of the chamber into a flue 39, leading to the stack. (Not shown.)

A pan 40 may be mounted on top of the dust-chamber for the purpose of heating the zinc-sulfate solution preparatory to its discharge into the evaporating-chamber. In this event a valve-controlled conduit 41 leads from the pan 40 to a funnel-shaped hopper 42, also mounted on the dust-chamber 37, and provided with a discharge-conduit 43, leading into the opening 36 of the tank. If it is not desired to first heat the sulfate solution, the valve 41ª of the conduit 41 is closed and the solution placed in the hopper 42 in the first instance. After the contents of the tank 5 have been evaporated to dryness, the same being in a loose or disintegrated condition, as heretofore explained, the cylinder is stopped with its manhole 44 lowermost. This manhole is then opened by removing its head or cover and the contents of the cylinder discharged into a car 45. This car is then propelled in any suitable manner along a track 46 to an elevator 47, through the instrumentality of which the car is elevated to a track 48, which occupies a position above the calcining tank or cylinder 6. This cylinder is stopped with its manhole uppermost. Its cover 49 is removed and the contents of the car discharged into the cylinder 6 through the opening 50. This opening is then closed, after which the cylinder is rotated until the zinc sulfate has been converted into zinc oxid, this being the final step of the process.

In the construction shown in Fig. 3 two cylinders 5 and two cylinders 6 are employed. As the cylinders 5 are duplicates of each other, which is also true of the cylinders 6, it is not necessary to refer to the two sets of cylinders more in detail, except to state that the number of cylinders is immaterial and may be multiplied to any extent, according to the desired capacity of the plant.

From the foregoing description the use and operation of my improved apparatus will be readily understood. Assuming that there is sufficient heat in the fire-box 32 to perform the calcining and evaporating functions, the zinc-sulfate solution may be discharged into the pan 40, whereby it is heated by virtue of the heated condition of the dust-chamber 37, to which products of combustion pass on their way to the stack. After this heating the solution is discharged into the cylinder 5, which I will assume is caused to rotate through the instrumentality of suitable mechanism, as heretofore explained. The surplus heat from the calcining-chamber, passing to the evaporating-chamber, is still sufficiently high for purposes of evaporation. By reason of the rotary action of the cylinder during the process of evaporation the zinc sulfate is kept broken up, and as soon as the evaporation is completed or the zinc sulfate is dry the rotation of the cylinder is stopped and its contents discharged into a car and transferred to the cylinder 6, where the process is completed by subjecting the zinc sulfate to a higher degree of heat, whereby the sulfuric acid is driven off.

If desired, the pan 40 may be placed within the chamber 37 and suitable means provided for conducting its contents into the cylinder 5.

Attention is also called to the fact that in practicing the process carried out by the apparatus herein described it is preferred to place a quantity of fine coal in the solution. During the treatment within the evaporating-cylinder this coal will become thoroughly mingled with the contents of the cylinder, and when the latter are evaporated to dryness the coal will be evenly distributed therethrough. Hence when the zinc sulfate is discharged into the calcining chamber or cylinder the coal facilitates the calcining operation whereby the sulfuric acid is removed.

The process may be carried out without the use of coal; but it is believed preferable to add the coal, as just explained

Having thus described my invention, what I claim is—

1. In an apparatus for converting zinc sul-

fate into zinc oxid, the combination of two independently-revoluble axially-alined chambers arranged in suitable proximity to each other and having adjacent open extremities, means for delivering heat to one chamber at its extremity remote from the other chamber, means for delivering the zinc-sulfate solution to the chamber remote from the heat-generating means, and means exterior to the chambers for transferring the contents of the last-named chamber to its companion chamber, substantially as described.

2. The combination with a suitable source of heat, of a calcining-chamber mounted to rotate and having open ends, one end being adjacent the source of heat, an evaporating-chamber also mounted to rotate and having open ends, one end of the evaporating-chamber being adjacent the open end of the calcining-chamber remote from the source of heat, means for delivering zinc-sulfate solution to the extremity of the evaporating-chamber remote from the calcining-chamber, and means exterior to both chambers for transferring the contents of the evaporating-chamber to the calcining-chamber, substantially as described.

3. The combination with a suitable source of heat, of a calcining-chamber mounted to rotate and having open extremities, one of which is adjacent the source of heat, an evaporating-chamber arranged in axial alinement with the calcining-chamber, the evaporating-chamber having open ends and also mounted to rotate, suitable means for imparting rotary movement to the two chambers, and means exterior to both chambers for transferring the contents of the evaporating-chamber to the calcining-chamber.

4. The combination with a fire-box or source of heat, an open-ended calcining-chamber mounted to rotate and having one extremity adjacent the source of heat, an open-ended evaporating-chamber also mounted to rotate and having one of its ends as close to the calcining-chamber as is consistent with independent movement, means exterior to both chambers for transferring the contents of the evaporating-chamber to the calcining-chamber, a dust-chamber located at the extremity of the evaporating-chamber remote from the calcining-chamber, suitable means for delivering the material to be treated, to the extremity of the evaporating-chamber remote from the calcining-chamber, and suitable means for imparting rotary movement to the two chambers independently of each other, substantially as described.

5. The combination of two independently-revoluble horizontally-arranged and axially-alined open-ended chambers mounted in suitable proximity to each other, one of the chambers being a calcining-chamber and the other an evaporating-chamber, means for delivering heat to the calcining-chamber at the extremity remote from the evaporating-chamber, means for delivering the material to be treated, to the extremity of the evaporating-chamber remote from the calcining-chamber, means for imparting rotary movement to the two chambers, and means for transferring the contents of the evaporating-chamber to the calcining-chamber, including upper and lower tracks and an elevator for elevating the material from the plane of one track to the plane of the other track, substantially as described.

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

CHAUNCEY E. DEWEY.

Witnesses:

DENA NELSON,

A. J. O'BRIEN.