G. W. WHITE.

APPARATUS FOR CALCINING ORES.

No. 46,287. Patented Feb. 7, 1865.

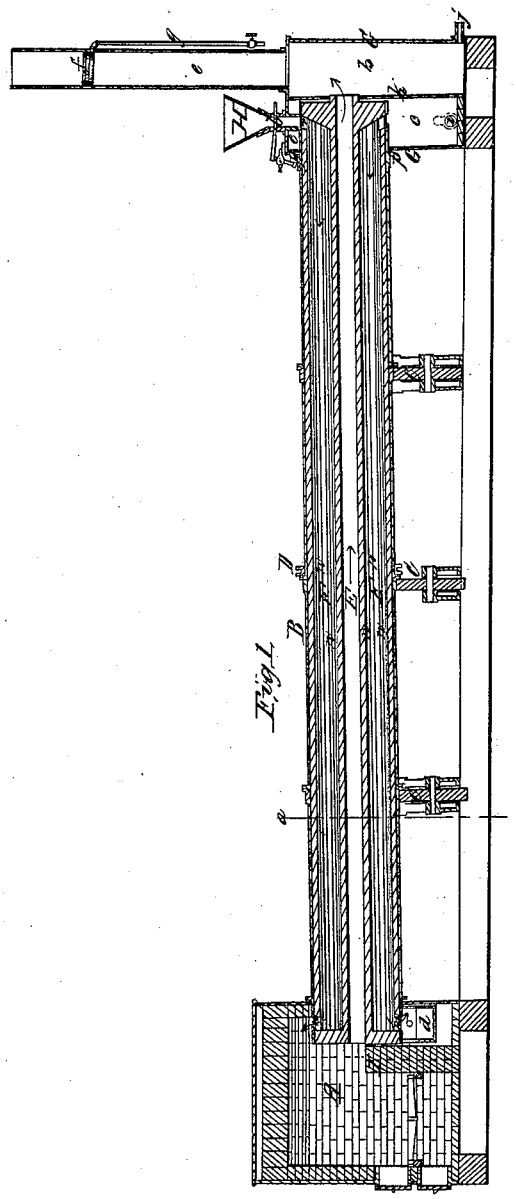

Fig. 1.

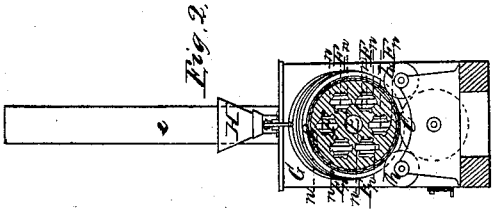

Fig. 2.

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GEORGE W. WHITE, OF NEW YORK, N. Y.

## IMPROVED APPARATUS FOR CALCINING ORES.

Specification forming part of Letters Patent No. **46,287**, dated February 7, 1865.

*To all whom it may concern:*

Be it known that I, GEORGE W. WHITE, of the city, county and State of New York, have invented a new and Improved Apparatus for Calcining Ores and other Substances; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, which form part of this specification, in which—

Figure 1 is a central longitudinal vertical section of the apparatus. Fig. 2 is a transverse section at *a a*.

Similar letters of reference indicate corresponding parts in both figures.

The principal parts of my apparatus consist of a furnace and an inclined rotating cylinder in which the ore or other substance to be calcined is subjected to the action of heat from the furnace. The principal points in which it differs from other apparatus consisting of such a furnace and cylinder are, first, in having separate flues or passages for the gases of combustion generated in the furnace and for the ore or substance to be calcined, so that the said substance is not exposed to contact with the gases of combustion; second, in having the furnace located at the opposite end of the cylinder to that at which the ore enters, so that the ore or other substance to be calcined may be subjected to a gradually-increasing temperature as the calcining progresses; third, in having the calcining flues or passages so combined with the furnace that the gases eliminated from the ore in the calcining process may enter into combustion in the furnace, and thereby effect a saving of fuel. There are also some minor points of difference which will be hereinafter explained.

A is a furnace of ordinary build, lined with fire-brick, and into which projects one end of the cylinder B. This cylinder is supported on rollers C C C, and kept in position by guide-rollers *h h*, Fig. 2. The several rollers are arranged to incline the cylinder downward toward the furnace. Rotary motion is conveyed to the cylinder by means of a chain working in the grooved pulley D upon its exterior. The inside of the cylinder B is formed of fire-brick into several flues or passages—one, E, in the center, which I call the "combustion" flue or passage, for the passage of the products of combustion from the furnace to the smoke-stack *e*, and others, F F, arranged at equal distances apart around E, for calcining the ore. Each of the calcining-passages F F has grooves running longitudinally through their entire length, as in the drawings, or provided with cavities *n n* or projections, for the purposes hereinafter specified. These calcining-passages terminate at both ends on the circumference of the cylinder, as shown at *m* and *r* in Fig. 1. The upper end of the cylinder projects into a chamber, G, having a vertical division, *k*, through the center, making one compartment, *b*, which communicates with the flue E, for the exit of the products of combustion from the said flue to the smoke-stack *e*, and one compartment, *c*, through the upper part of which the ore is fed through the openings *r* into the calcining-passages F F as the cylinder rotates. At the bottom of the compartment *c* is an opening, *i*, by which the ore that may be split can be removed.

H is a hopper with a feed device, *l*, attached, worked by cams *p*, placed at proper distances apart on the outside of the cylinder B, for the purpose of feeding a specific quantity of ore into the calcining-passages at each rotation of the cylinder. At the back end of the furnace A, and directly under the delivery ends *m* of the calcining-passages, is placed the trough *d*, arranged at an inclination, and having a stream of water flow into it at the upper end, so as to wash down the ore as it is discharged. This trough projects through the side of the furnace behind the bridge-wall I, and conveys the ore to any desired spot.

Near the top of the smoke-stack *e* is placed a coil of pipe, *f*, having a number of small holes pierced through the inside diameter, to which is connected the water-pipe *g*. The water supplied through the pipe *g* has sufficient head to be forced through the coil horizontally in every direction, which prevents the escape of fine particles of ore and washes them down into the compartment *b*, where they are drawn off through the opening *j*.

The action of this apparatus is as follows: A fire is built in the furnace A, and the cylinder B is heated up by the frame and gaseous products of combustion passing through the central flue, E, to a sufficient temperature, which is many degrees higher at the furnace end than at the other end, where the ore is received. The red arrows indicate the direction of the

flame. The cylinder is rotated about twenty revolutions per minute. The ore in a pulverized or crushed condition is put into the hopper H, and at each revolution of the cylinder the feed device *l* permits a small quantity of ore to enter each one of the different calcining-passages, the said device being opened, while the openings *r* are out of communication with the throat of the hopper, so that the gases are not permitted to escape from the said passages to the atmosphere. The calcining-passages being grooved, or otherwise having their surfaces constructed in an equivalent manner and inclined, the ore is lifted up and dropped forward a little at every revolution of the cylinder, thus gradually working its way toward the delivery end of the passages, as indicated by the black arrows. The sulphurous and other gases eliminated from it by heat pass out of the delivery-openings *m* of the said passages as they, by the rotation of the cylinder, severally communicate with the upper part of the furnace, as indicated by the red arrows, and the said gases undergoing combustion in the furnace help to generate heat, thereby saving fuel. By feeding the ore into the calcining-passages in specific quantities at the cooler ends of the passages F F farthest from the furnace, the ore is submitted at first to a comparatively low temperature, and gradually introduced to a higher one, while at the same time it is kept in constant motion in being lifted and showered through the heat which is free from the products of combustion, and each atom thereby has its surface exposed to the action of the heat. The ore is thus entirely freed from sulphur while slagging, and other unfavorable effects are avoided.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in the rotating cylinder, of separate combustion and calcining flues or passages, substantially as and for the purpose herein specified.

2. The furnace located at the opposite end of the rotating cylinder to that at which the ore or other substance to be calcined enters, substantially as and for the purpose herein set forth.

3. So combining the calcining flues or passages of the rotating cylinder with the furnace that the gases eliminated from the ore or other substance in the said passages may enter into combustion in the furnace, substantially as and for the purpose specified.

4. In a rotating cylinder with separate combustion and calcining flues or passages, combined with a furnace, as described, constructing the inner surfaces of the separate calcining-passages with grooves, cavities, or projections, substantially as and for the purpose herein specified.

5. The coiled perforated water-pipe *f*, placed in the smoke-stack or vertical flue, in combination with the rotating cylinder, substantially as and for the purpose herein specified.

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