

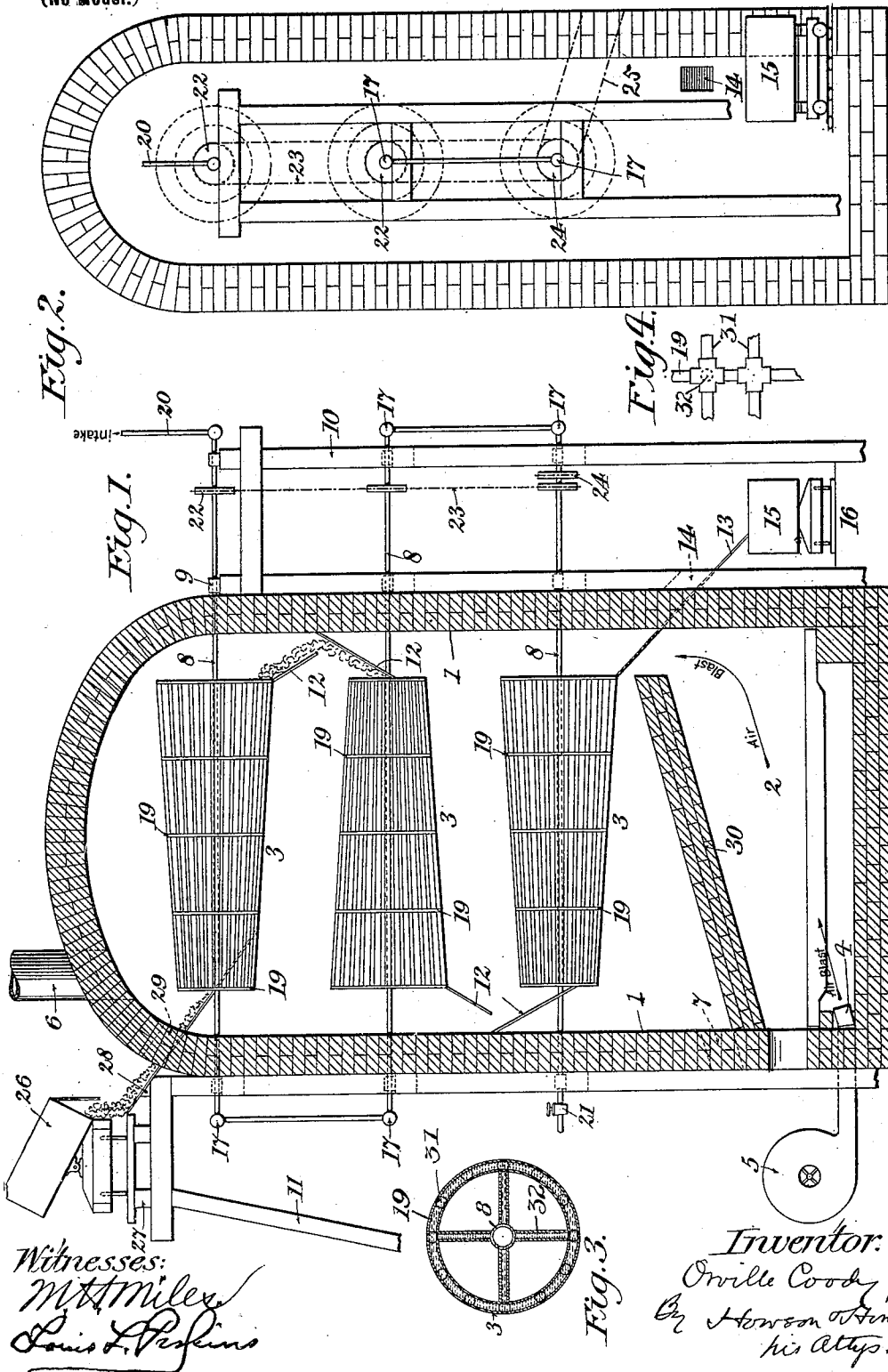
No. 659,582.

Patented Oct. 9, 1900.

O. COODY.
PHOSPHATE ROCK DRIER.

(Application filed Mar. 14, 1900.)

(No Model.)



UNITED STATES PATENT OFFICE.

ORVILLE COODY, OF MOUNT PLEASANT, TENNESSEE.

PHOSPHATE-ROCK DRIER.

SPECIFICATION forming part of Letters Patent No. 659,582, dated October 9, 1900.

Application filed March 14, 1900. Serial No. 8,634. (No model.)

To all whom it may concern:

Be it known that I, ORVILLE COODY, a citizen of the United States, residing at Mount Pleasant, Maury county, Tennessee, have invented certain new and useful Improvements in Phosphate-Rock Driers, of which the following is a specification.

My invention relates to apparatus for drying and screening materials such as phosphate-rock and the like, and more particularly to driers for phosphate-rock in which the rock to be dried is subjected to intense heat.

Phosphate-rock when mined and washed contains a considerable moisture which must be eliminated from the rock before it is shipped from the mines, and in order to effect the proper amount of drying it has been found necessary to subject the rock to intense heat. In the operation of ordinary furnaces for this purpose it is found that the parts of the drying apparatus quickly burn out or warp when subjected to the intense heat necessary, and it is therefore my object to provide an apparatus which will effectually perform the operation of drying and will be more durable and less subject to frequent renewal or repair of parts than heretofore, and, further, to provide an apparatus in which the flame of the fuel may be applied directly to the rock, while at the same time the dust and dirt, which in some mines contain an objectionably high content of iron and alumina, are separated from the phosphate.

With these objects in view my invention consists in the novel construction and arrangement of parts hereinafter fully described with reference to the accompanying drawings and more particularly pointed out in the claims.

In the drawings, Figure 1 is a transverse vertical sectional elevation of my invention. Fig. 2 is an end elevation thereof. Fig. 3 is a transverse section of the screen employed. Fig. 4 is an enlarged fragmentary detail, showing the construction of the screen.

Referring now to the drawings, in which the same reference characters relate to the same or corresponding parts in all the views, the numeral 1 indicates a chamber constructed of brick, the inner ones of which may be fire-brick and of suitable shape, that shown

being rectangular, which chamber incloses in its bottom portion a suitable furnace 2 and rotating frusto-conoidal drying-screens 3, which screens are exposed on all sides and subjected to the intense heat from the products of combustion arising from the furnace 2 and to the direct flames from the furnace, the latter of which has a forced-air-blast pipe 4 introduced near the bottom and leading from the blower 5, of any suitable construction. The products of combustion rise after performing the work of drying the phosphate contained in the rotating screens and pass off through the smoke stack or pipe 6 at the top of the chamber.

The top of the furnace formed by the crown-wall 30 is inclined, as shown, so as to form a trough for directing the screenings falling through the screens through a suitable outlet or discharge passage 7 in the side of the furnace-wall and thence to a convenient receptacle or upon the ground, whence they are removed as desired.

The chamber 1 may be lined with fireproof lining, such as fire-brick, such chamber in the present instance being shown as made of brick, the inner ones of which may be fire-brick, and is preferably arched at the top. This chamber is perforated at suitable points in its side walls, forming bearings in different horizontal planes for hollow shafts 8, of metal, such as wrought-iron, which support the screens 3, the ends of such shafts projecting from the chamber and preferably supported in trunnions 9, mounted upon a suitable framework 10 and 11 on either side of the furnace and drying-chamber.

The screens are in the form of a frustum of a cone and are mounted on hollow shafts, with the larger ends or bases of adjacent screens in opposite directions, so that the material when fed into the small end of the screen as the latter is rotated will pass gradually down the inclined surface of the screen to be discharged out of the larger base end. The upper screen discharges the material upon suitable chutes 12, of wrought iron or steel, which direct the material into the next lower screen, the latter discharging its material upon similar chutes, which direct the material into the next lower screen, and so on, the lowest screen directing the dried material upon a

chute 13, extending through an opening 14 in the side wall of the furnace-chamber and thence into a suitable receptacle, such as a car 15, mounted upon a track 16. One or
5 more of the chutes may be perforated, as the screen 13, if desired, in order to permit the most direct action of heat upon the material as it passes downward.

The hollow shafts are connected with each
10 other by universal water-tight joints 17 and to the series of pipes 31, which form the screen structure, by radial pipes 32, communicating with peripheral pipes 19 at the ends of the screens and, if desired, at suitable intervals
15 between the ends, such pipes being spaced apart sufficiently to form proper meshes for the discharge of the screened dirt, governed by the sizes of the material which it is proposed to dry and screen. The first hollow
20 shaft of the series, preferably the upper one, is connected by a water-tight universal joint 17 to an inlet 20, leading from a suitable source of cold-water supply, preferably from a tank elevated a considerable distance above
25 the drier, so that the water may be readily conveyed back to the washer from the drier. The water passes through the hollow shaft and the pipes forming the screens in succession and is discharged from the lowest or last
30 pipe of the series, as shown at 21, and thence to the washer.

The hollow shafts may be rotated by any suitable connections to a motive power, such as sprocket-wheels 22, driven by chains 23,
35 connecting the several shafts and driving-sprockets 24, a pulley transmitting motion from the motive power or engine to one of the shafts through the medium of a chain or belt 25, and said screens may be rotated in the same
40 direction or alternating directions, as desired and as will be readily understood.

The phosphate-rock is broken into lumps of suitable size and is conveyed by a dumping-car 26 on a track 27, running from the
45 mines or crushers or washer upon the top of the framework 11, from which extends a hopper or chute 28, directing the broken rock through the hopper-opening 29 in the top of the furnace into the first screen.

50 It is to be observed that in the operation of my apparatus the products of combustion of the furnace are intensely heated under the influence of the forced air-blast, the air in said blast being heated as it passes through
55 the furnace and mixing with the products of combustion causes the same to be heated to such an intense degree as to effectually dry the phosphate in the rotating screens, as the said phosphate is exposed on all sides repeatedly to the action of the heat of the products
60 of combustion as they rise in the furnace and to the direct flame of the furnace.

While I have shown three screens, which I have found to be sufficient under ordinary
65 conditions for properly drying the phosphate-rock, it is to be distinctly understood that I am not to be limited to these or any number

of screens, as the number of screens may be varied to suit different conditions without departing from the spirit of my invention. 70

It will be observed that my screens are exposed to the products of combustion on all sides, being located within the furnace-chamber, so that the dirt and dust are separated as the heat dries the phosphate-rock, and,
75 furthermore, the calcination drives off a portion of the carbonate, materially reducing the content of this element and rendering the said rock higher or richer in calcium phosphate. 80

I claim as my invention—

1. In a furnace for drying phosphate-rock, the combination of a chamber having a furnace in the lower portion thereof, one or more hollow shafts rotatably mounted in said chamber above the furnace, means for rotating
85 said shaft or shafts, a water-supply pipe connecting said shafts with a source of water-supply, a frusto-conoidal screen, fixed to each shaft, constructed of pipes in communication
90 with the hollow shaft, whereby a circulation of water may be maintained throughout the screen structure, and for feeding phosphate-rock into the small end of the screen, substantially as described. 95

2. In a furnace for drying phosphate-rock, the combination of a furnace-chamber having a furnace in the lower portion thereof, a plurality of hollow shafts mounted in the side walls of said furnace in different horizontal
100 planes and communicating with one another, a pipe leading from a source of water-supply connected to the upper hollow shaft, a screen composed of pipes communicating with and
105 fixed to each shaft, means for rotating the hollow shafts, means for successively directing the rock from the upper screens to the lower screens and for discharging the dried
110 rock from the lowest screen through the wall of the furnace-chamber, and means for feeding the rock through the top of the furnace to the upper screen, substantially as described.

3. In a furnace for drying phosphate-rock, the combination of the furnace-chamber having a furnace in the bottom, a plurality of hollow shafts, rotatably mounted in said chamber, one above another, connected with a source of water-supply and communicating
115 with one another, means for rotating said shafts, a frusto-conoidal screen composed of pipes fixed to, and communicating with, each shaft, the small end of each lower screen being directly below the large end of the screen
120 above it, a chute for directing the rock through the top of the furnace into the small end of the upper screen, and chutes for directing the rock from the large end of each screen to the small end of the screen below, and a chute
125 for directing the rock from the lowest screen through a discharge-opening in the wall of the chamber, substantially as described. 130

4. In a furnace for drying phosphate-rock, the combination of a chamber having a furnace in the bottom, an inclined crown-wall

above said furnace adapted to direct the screenings through an opening in the chamber-wall, a plurality of hollow shafts rotatably mounted in bearings, one above another, in the walls of the chamber, and communicating with one another, a pipe connecting the upper shaft with a source of water-supply, a frusto-conoidal screen composed of pipes, fixed to, and communicating with, each hollow shaft, means for rotating said shafts, chutes connecting the discharge ends of the upper screens with the inlet end of the next lower screen, a chute for feeding the rock through the top of the furnace to the upper screen, and a chute for discharging the dried rock through the wall of the chamber, substantially as described.

5. In a furnace for drying phosphate-rock, the combination of a furnace-chamber, having a furnace at the bottom, a series of frusto-conoidal screens within the furnace-chamber composed of hollow pipes, hollow shafts mounted in bearings one above another in the chamber-walls, and communicating with the pipes of the screen structure, a pipe for conveying water to the hollow shafts, pipes connecting the hollow shafts, all having universal joints to permit the shafts to rotate, means for rotating the shafts, chutes connecting the discharge ends of the screens with the inlet ends of the screen next below, a chute for feeding the rock through the top of the furnace to the upper screen, a chute for directing the dried material through

the wall of the chamber, and a chute for discharging the screened dust and dirt from said chamber, substantially as described.

6. The herein-described drier for phosphate-rock, consisting of a chamber having a furnace in the bottom, an inclined crown-wall above said furnace adapted to discharge screenings through an opening in the wall of the chamber, a series of frusto-conoidal screens composed of pipes rotatably mounted in different longitudinal planes above said crown-wall, the large ends of the said screens alternating with the small ends of the screens next below, hollow shafts supporting said screens and communicating with the pipes forming the same, chutes connecting the discharge of the screens with the inlet ends of the screens next below, pipes connecting the hollow shafts, universal joints between said pipes and shafts, means for rotating the shafts, a chute for feeding the rock through an opening in the top of the chamber to the small end of the upper screen, and a chute for directing the dried rock from the lower screen through an opening in the chamber-wall, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ORVILLE COODY.

Witnesses:

E. W. WINRIGHT,
G. I. ALFORD.