

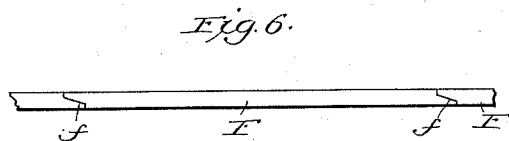
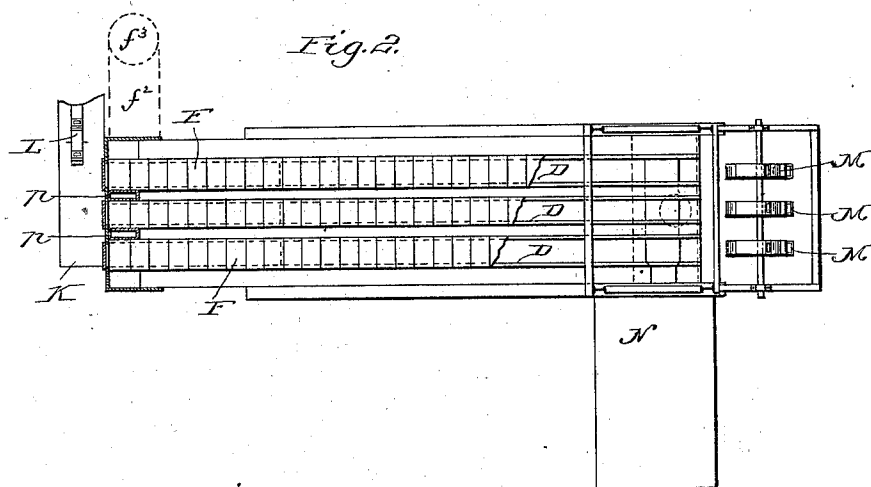
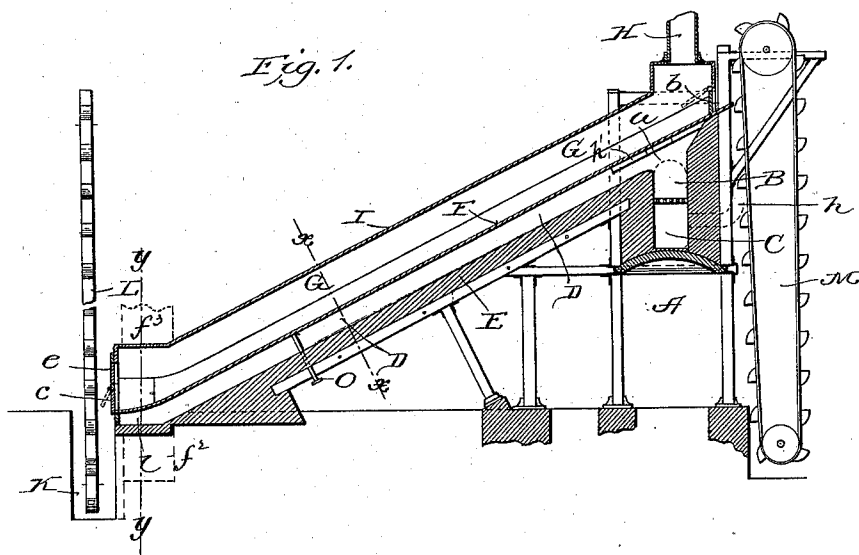
(No Model.)

2 Sheets—Sheet 1.

J. P. WETHERILL.
ORE DRIER.

No. 560,876.

Patented May 26, 1896.



witnesses:

Harry E. Johnson.
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Inventor:

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(No Model.)

2 Sheets—Sheet 2.

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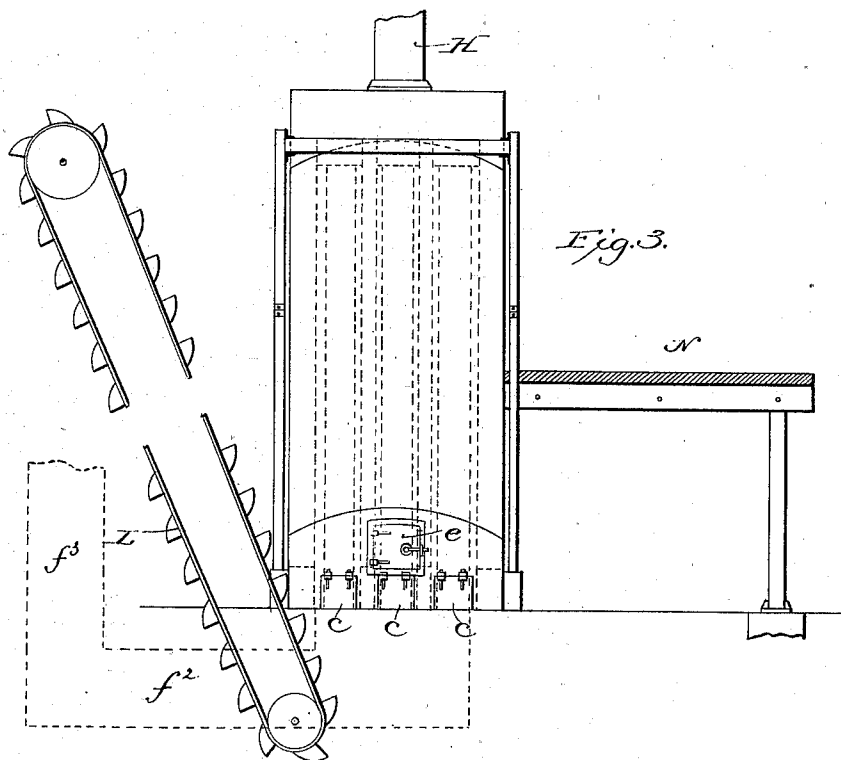


Fig. 4.

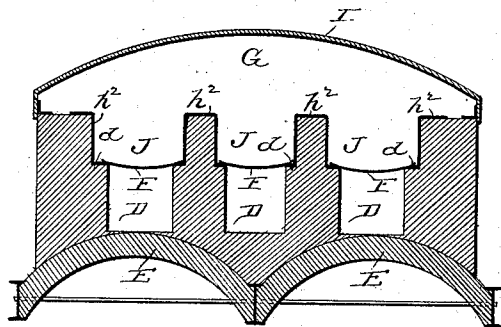
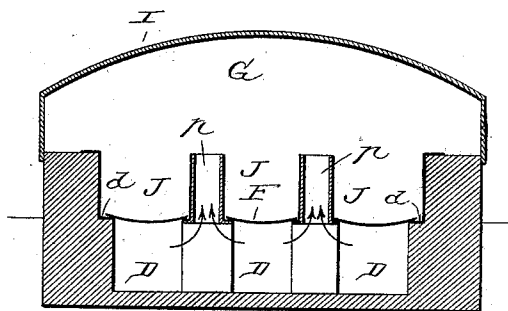


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN PRICE WETHERILL, OF SOUTH BETHLEHEM, PENNSYLVANIA.

ORE-DRIER.

SPECIFICATION forming part of Letters Patent No. 560,876, dated May 26, 1896.

Application filed April 1, 1895. Serial No. 544,059. (No model.)

To all whom it may concern:

Be it known that I, JOHN PRICE WETHERILL, a citizen of the United States, residing at South Bethlehem, in the county of Northampton and State of Pennsylvania, have invented certain new and useful Improvements in Drying Ores; and I do hereby 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.

The invention has reference to apparatus for drying ores, and relates more especially to certain new and useful improvements in that class of devices intended for drying wet ores preliminarily to the usual further metallurgical operations.

In the accompanying drawings, Figure 1 is a vertical longitudinal section of the entire apparatus. Fig. 2 is a ground plan, and Fig. 3 a front elevation, of the same. Figs. 4 and 5 are respectively cross-sections of the flues and chutes on the lines $x x$ and $y y$ of Fig. 1, and Fig. 6 is a detail of the flue cover-plates.

Referring to the figures, A denotes an elevated furnace of any approved pattern, having the usual fire-box B and ash-pit C.

D D indicate flues leading from the fire-box and extending in a downwardly-inclined direction, said flues being preferably constructed of brickwork and being supported upon arches E, running out from the masonry of the furnace proper and sustained by I-beams, girders, and posts from any suitable foundation, all as represented in the several figures. I have shown three of these flues in the drawings, but whether a single flue or a plurality be employed is obviously a matter of convenience, either being within the plain contemplation of the invention.

No particular length or inclination of the flues is herein prescribed, both being variable with the character of the material to be treated and the conditions under which the work is to be done.

The side walls of the flues D are provided with ledges or shoulders d throughout their length, and upon the supports thus formed are laid the removable cover-plates F constituting the top wall of the flues. These plates may be made of metal or refractory material,

as preferred, and when of metal should be slightly concaved on their upper sides, the better to resist the warping tendency of the heat. They are preferably rectangular in shape and are rabbeted on their meeting edges, as shown at f in Fig. 6, so as to make a tight cover and at the same time present a continuous smooth surface on their upper sides. As shown in Fig. 1, these plates form a continuous cover for the flue-spaces extending from the upper side wall of the fire-box to the foot of the incline. Where they cross the fire-box they are supported upon arches (indicated by the dotted lines a) and cover the space between the arches, so as to completely inclose the top of the fire-box. At the foot of the incline the flues are closed to the outer air and communicate by means of passages p (into which they open laterally) with a single enlarged return-flue space G, extending back over the tops of flues the entire length thereof to a chimney H, located above the fireplace of the furnace. The hood or cover I of this flue-space may be a brickwork arch if desired, but, as ordinarily the heat from the products of combustion traversing the flues D would be largely absorbed before reaching the foot of the incline, it might be constructed more with a view to affording access to the flue-plates than to retention of heat, and with this object in view would probably be best formed of metal with provision for getting at the plates, especially at the upper part near the fireplace, where, owing to the intense heat, frequent removal of these plates would be required.

As indicated in Figs. 4 and 5, the uptake flue-space inclosed by the hood or cover I is not divided into separate flues, but constitutes one return-flue chamber common to all the flues D. This return-flue space G constitutes a downwardly-inclined covered chute, into the upper end of which the material to be dried is delivered through flap doors b , which are preferably made self-closing, so as to preclude the entrance of air sufficient to interfere with the draft of the chimney. The bottom of this flue-space is divided lengthwise into open-topped troughs or gutters J, corresponding to the flue D beneath, said divisions being formed by upward extensions

of the walls and partitions forming the flues D, and the cover-plates F constituting the flooring of these several troughs. These troughs or small chutes should be arranged at such an angle to the horizontal that the ore that is continuously fed in at the top by an elevator or other feeding device M will move slowly down the same under the action of gravity only. The inclination should not, however, be such as to clog or pile the material upon itself, and it is advisable at or near the delivery end to provide a short nearly horizontal ledge, as at *l*, Fig. 1, to slightly retard the escape of the dried material, which, it will be understood, tends to flow more rapidly than the undried ore at the top of the chute. At the foot of the incline the troughs are provided with freely-swinging doors *c*, permitting the discharge of the ore into a pit or receptacle K, whence it may be conducted away by an elevator or other conveyer L. Above the doors *c* the lower end of the flue-space G is furnished with a door *e*, affording access to the interior at this point for cleaning, &c.

It will be noticed that although the chimney is immediately over the furnace there is no direct communication between it and the furnace, and that the products of combustion must traverse the flues D and return over the top of the ore as it passes down the incline before they reach the chimney. This method I find well calculated to give the full effect of the heat, the bottoms of the troughs or chutes J being kept hot throughout their length by the furnace-gases, which, after parting with most of their heat, pass up the return-flue in direct contact with the ore. The location of the chimney in the above-described relation to the fireplace is of no special importance, excepting in so far as such location brings it in proximity to the mouth of the chute and the point where the greatest heat is applied, so that the moisture driven off from the wet ore is immediately conducted away.

It has been customary heretofore in this class of devices to subject the incoming material at first to a mild heat, the temperature increasing until it reaches the exit, where the heat is greatest. In my invention, however, I apply the greatest heat in the first instance, and the material as it passes on through the apparatus is subjected to a gradually-decreasing temperature, thus enabling me to deprive the incoming wet ore of the excess of moisture immediately and to conduct the same away directly without conducting the evaporations over any portion of the material being dried and with greater economy of heat.

In Figs. 2 and 3, N denotes an elevated platform affording convenient access to the furnace for firing, cleaning, &c. The flues D are preferably provided at some convenient point suitably removed from the fireplace with dampers O for the more complete con-

trol of the draft and to regulate the application of heat to the bottoms of the overlying gutters or troughs. It will be understood, of course, that the chimney should be of sufficient height to induce the necessary draft to effect an active combustion of the fuel, or, if preferred, forced draft may be obtained by the employment of a blast, as indicated in dotted lines at *h*, Fig. 1.

The kind of furnace and the details of the foundations, the supports, the brickwork, &c., as well as the kind of elevators or conveyers employed, are matters of construction and are not of the essence of the invention. The construction herein illustrated is simple, efficient, and comparatively inexpensive, and in localities where a natural elevation or hillside is available the flues and chutes could be cheaply constructed on its slope, thereby dispensing with some of the outside parts and effecting a reduction in the cost of setting up the apparatus.

The construction being as above described the mode of operation and the handling of the material require no further special explanation.

In practice I prefer to urge the fire to such a degree as might, perhaps, be prejudicial to the iron plates immediately above it, and in order to protect the plates at this point from injury I preferably employ below them a protecting-layer of firebrick-tiles, as indicated at *h'*. I also prefer to employ, in addition to the rabbeted plates covering the flues, rabbeted plates *h*², lining the sides of the chute and having side flanges upon their lower ends, upon which the plates F are adapted to rest. The plates *h*² serve to lessen the frictional resistance that would otherwise be opposed to the descent of the ore by the brick walls of the chute. Those of the plates *h*² which are intermediate of the outside ones are formed as cap-pieces for the brickwork of the partition-walls between adjacent chutes, and the outside plates *h*² may be conveniently formed by subdividing these cap-pieces longitudinally.

Where anthracite coal or other combustible giving a short flame is employed, I find that the hood through which the products of combustion are conducted to the stack at the upper part of the furnace, and the stack itself may be dispensed with, and instead thereof the products of combustion are led off at the lower end of the chute through a flue *f*² to an adjacent stack *f*³, as indicated in dotted lines.

Having thus fully described my invention, what I claim is—

1. In an apparatus for drying ores, an inclined combined flue and chute made up of two walls of masonry, each provided with a ledge below their top and a floor resting upon said ledge, forming a trough-like chute and a subjacent flue, the sides of the walls above the ledge being lined with wear-plates; substantially as described.

2. In an apparatus for drying ores, a com-

bined flue and chute structure, the flue being separated from the chute by a dividing-floor composed of metal plates resting upon the top of the flue-walls, the chutes being wider than the floor-plates so as to permit free expansion of the floor-plates; substantially as described.

3. In an apparatus for drying ores, a combined flue and chute structure, the flue being separated from the chute by a dividing-floor of metal plates and the walls of the chute being provided with metal plates having lower flanges upon which the floor-plates rest, said side plates having top flanges resting upon the top surfaces of the chute-walls; substantially as described.

4. In an apparatus for drying ores and the like, the combination of a furnace, a plurality of flues leading therefrom, a plurality of chutes overlying said flues and heated thereby, and a single return-flue overlying the chutes said return-flue being common to all the furnace-flues; substantially as described.

5. In an apparatus for drying ores and the like, the combination of a furnace, a flue leading therefrom, shoulders or ledges along the side walls of said flue, and a floor consisting of a series of separate and independent removable cover-plates supported on said ledges; substantially as described.

6. In an apparatus for drying ores and the like, the combination of a furnace, a flue leading therefrom, shoulders or ledges along the side walls of said flue, an overlying chute along which the material to be dried passes, and separate and independent removable cover-plates supported on said ledges and forming the top of the flue and the floor of the chute, said plates being rabbeted along

their meeting edges and overlapped; substantially as described.

7. In an apparatus for drying ores and the like, the combination of a furnace, a plurality of independent flues leading therefrom, a single return-flue overlying the independent flues and common to all of said flues, and a plurality of open-topped chutes located in said return-flue and through which the material passes, said chutes being coincident with the several independent furnace-flues, and the floors of said chutes forming the top walls of the flues; substantially as described.

8. In an apparatus for drying ores and the like, the combination of a downwardly-inclined chute, the bottom of said chute being divided into a plurality of gutters or troughs for the material to be dried, a furnace located at the inlet end of said chute, a plurality of flues leading from said furnace along the bottom of the chute, the individual flues corresponding with the several troughs or gutters in the chute, a return-flue inclosing the chute and communicating with said furnace-flues, a chimney at or near the inlet end of the chute, a pit or receptacle at the discharge end of the chute, means for feeding the material to be dried into the inlet end of the chute, and means for conducting the dried material away from the pit or receptacle; substantially as described.

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

JOHN PRICE WETHERILL.

Witnesses:

THAD. H. LIBBEY,
HARRY Y. DAVIS.