(No Model.)

O. H. & W. W. TOBEY.

PROCESS OF AND APPARATUS FOR ROASTING ORES.

No. 315,089. Patented Apr. 7, 1885.

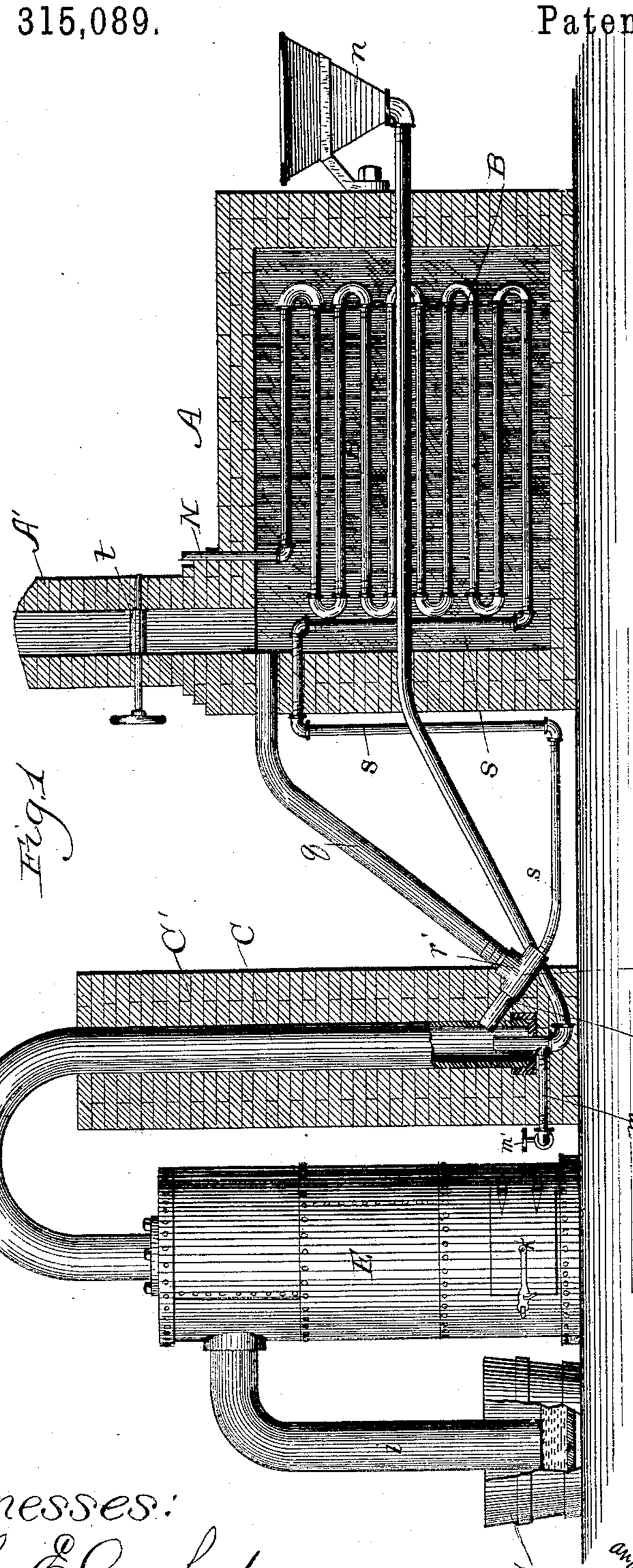


Fig. 3

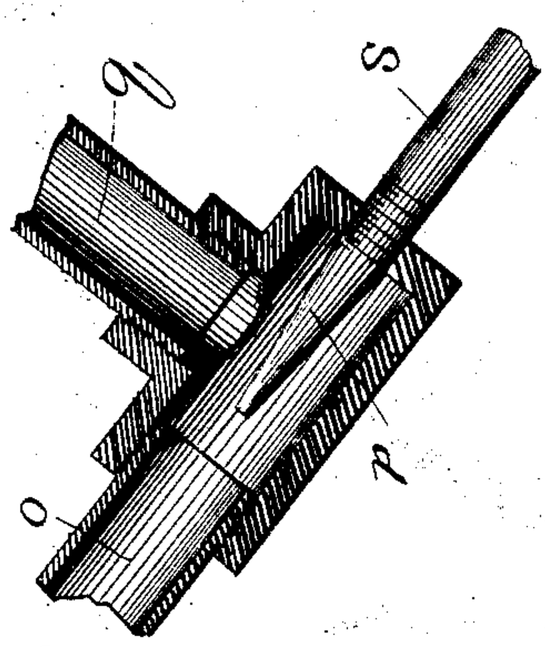
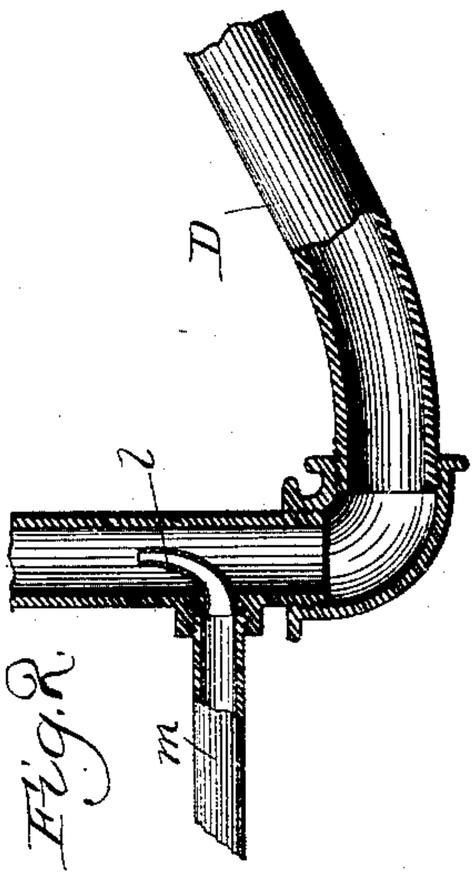


Fig. 4



Witnesses:
Chas. E. Gaylord.
Douglas Dyrenforth.

Inventors:
Orville H. Tobey
and William W. Tobey
By Dyrenforth and Dyrenforth
Attorneys.

UNITED STATES PATENT OFFICE.

ORVILLE H. TOBEY, OF CHICAGO, ILLINOIS, AND WILLIAM W. TOBEY, OF NEW YORK, N. Y.

PROCESS OF AND APPARATUS FOR ROASTING ORES.

SPECIFICATION forming part of Letters Patent No. 315,089, dated April 7, 1885.

Application filed May 17, 1884. (No model.)

To all whom it may concern:

Be it known that we, ORVILLE H. TOBEY, of Chicago, in the county of Cook and State of Illinois, and WILLIAM W. TOBEY, of New York, in the county and State of New York, both citizens of the United States, have invented a new and Improved Process of and Apparatus for Roasting Ores; and we hereby declare the following to be a full, clear, and exact description of the same.

Our process relates to the roasting of the ore to eliminate the constituent parts which render it refractory; and our invention consists in heating the ore in a comminuted state, commingling it with the products of combustion from a furnace and with superheated steam, and impelling it through a flue.

Our invention consists, further, in the mechanism by means of which we prefer to carry our process into effect, and which is represented in the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section of the furnace and flue, showing various details, and also the receptacles for the roasted ore after passing through the flue; and Figs. 2 and 3, enlarged sectional views of details.

A is the furnace, provided with a chimney, A′, containing a damper, *t*. A coil of pipes placed vertically within the furnace forms the steam-superheater B, from which a pipe, *s*, leads to a T branch or chamber, *r*, into the stem *r′* of which a conduit, *q*, leading from the interior of the furnace, is connected. The steam-pipe *s* is provided at its extremity with a nozzle, *p*, Fig. 3, which projects into the annular head of the T-branch across the opening of the conduit *q*, whereby the products of combustion from the furnace are drawn through the conduit *q* by the suction effect of the jet of steam escaping from the nozzle *p*. A pipe, *o*, connects the T-branch *r* with the interior of a siphon-shaped flue, C, the vertical side of which is supported within masonry C′. A conduit, D, for the comminuted ore, which is fed through a hopper, *n*, suitably braced, as shown, at one extremity, leads through the interior of the furnace A into the flue C toward its lower end, and is bent toward its extremity to cause the end of the conduit to stand vertically within the flue. A steam-pipe, *m*, connected with the boiler and provided with a suitable steam-valve, *m′*, enters the vertical portion of the ore-conduit D and terminates in an upward-projecting nozzle, *l*, Fig. 2, which lies within the vertical portion of the conduit D. The flue C communicates at its bent end with a vertical receptacle, E, at the top of the same. The receptacle E is provided toward its lower side with a door, *k*, and toward its upper end it communicates, by means of a pipe, *i*, with a tank, G, containing water.

The operation of our device is as follows: A fire having been started in the furnace, for which purpose the damper *t* in the chimney A′ is opened, to be closed when the fire shall have made sufficient headway, steam from the boiler is admitted through the connecting-pipe N into the superheater B, whence it escapes in a superheated state, by way of the pipe *s*, through the nozzle *p*, which crosses the opening of the conduit *q* into the annular head of the T branch or chamber *r* at a point immediately opposite or beyond the farther edge of the opening in the said conduit. The products of combustion are thereby drawn through the conduit *q*, and are forced by the superheated steam, and commingled with the latter, into the flue C by way of the tube *o*. Comminuted ore having mixed with it a suitable chlorinating material in a proportion depending upon the nature of the ore to be treated is fed into the hopper *n*. Live steam from the boiler is admitted through the steam-pipe *m* and nozzle *l* into the vertical end of the ore-conduit D, creating a draft therein, by means of which the mixture of comminuted ore and chlorinating material is drawn in a heated condition, owing to the passage of the ore-pipe through the furnace, into the vertical portion of the conduit D, and with the mixture atmospheric air, also heated, is drawn through the hopper along with the ore mixture. The tube *o* and bent end of the conduit D meet toward a common point, in order that the greatest intensity of heat may be attained at the point of discharge of the ore, by the commingling of the additional supply of oxygen from the air mixed with the ore with the flame emanating

from the mouth of the tube *o*, which flame is produced by the combination of the superheated steam with the products of combustion. The ore, after being drawn into the vertical portion of the conduit D, is forced through the flame from the tube *o* by the combined action of the jet of steam emanating from the nozzle *l*, and the jet of superheated steam commingled with the products of combustion, up the flue C and around into the receptacle E, reaching the latter devoid of its refractory constituents. The ore thus roasted may be removed from the receptacle through the door *k*.

To provide an outlet for the products of combustion without necessitating the loss of that portion of the ore which would escape with them in the form of dust, the tank G is provided, communicates with the interior of the receptacle E toward its upper end by means of a pipe, *i*. The tank G is partially filled with water to the level of the discharge end of the pipe *i*, and the heated gases on striking the surface of the water escape into the surrounding atmosphere with the steam which they generate from the water, and the finer particles of ore sink to the bottom of the tank, whence they may readily be removed.

The T-branch *r* is not an indispensable feature of our device, but offered the most convenient means at hand of producing the necsary current, by means of the steam escaping from the nozzle *p*, to draw the products of combustion from the furnace through the conduit *q*. Another, and probably the preferred, way of constructing this portion of our device will be to form a bend or elbow in the conduit in lieu of the T-branch *r*, when the tube *o* will be a part of the conduit. The connection of the pipe *s* with such construction will be at the bend, when the nozzle can project into it in the manner and for the purpose hereinbefore described.

We are aware that it is not new, broadly stated, to subject ore in a comminuted state to heat for the purpose of preparing the ore for the separation from it of the baser elements, since we know that this has hitherto been attempted by forcing the ore commingled with steam through a worm heated externally, and also by subjecting comminuted ore to the action of steam and the products of combustion from a furnace and driving it through a continous passage until the desired effect has been produced.

We are likewise aware that it is old to attempt to refine ores by commingling them in a short flue or narrow chamber with the products of combustion from a furnace and superheated steam and impelling them thence into the open air or into a chamber, thus permitting to the ores only momentary contact with the heat.

What we claim as new, and desire to secure by Letters Patent, is—

1. The process herein described of removing the refractory constituents of ore by roasting, which consists in heating the ore in a comminuted state, commingling it with the products of combustion from a furnace and superheated steam, and impelling it through a flue, substantially as described.

2. An ore-roasting apparatus comprising, in combination, the following elements, viz: a furnace, A, a flue, C, a conduit, *q*, leading from the interior of the said furnace and communicating with the said flue, a steam-superheater, B, within the said furnace and communicating at one end with the steam-supply, and leading at its opposite end into the conduit *q*, an ore-conduit, D, passing through the furnace A and communicating with the said flue C, and means, substantially as described, to create a draft within the said conduit D to draw comminuted ore through the same, and to force it through the said flue C, the whole being constructed and arranged to operate in the manner set forth.

3. In an ore-roasting apparatus, the combination, with the furnace A, steam-superheater B, flue C, and ore-conduit D, provided with means, substantially as described, for creating a vacuum within the said conduit D to draw comminuted ore through the same, and to force the ore through the flue C, of a receptacle, E, provided with an outlet, and a receptacle, G, containing water and communicating with the said receptacle E at the said outlet, as and for the purpose set forth.

ORVILLE H. TOBEY.
WILLIAM W. TOBEY.

In presence of—
C. C. LINTHICUM,
DOUGLAS DYRENFORTH.