W. Ennis,

Roasting Ores.

No. 112,698. Patented Mar. 14. 1871.

Fig. 1.

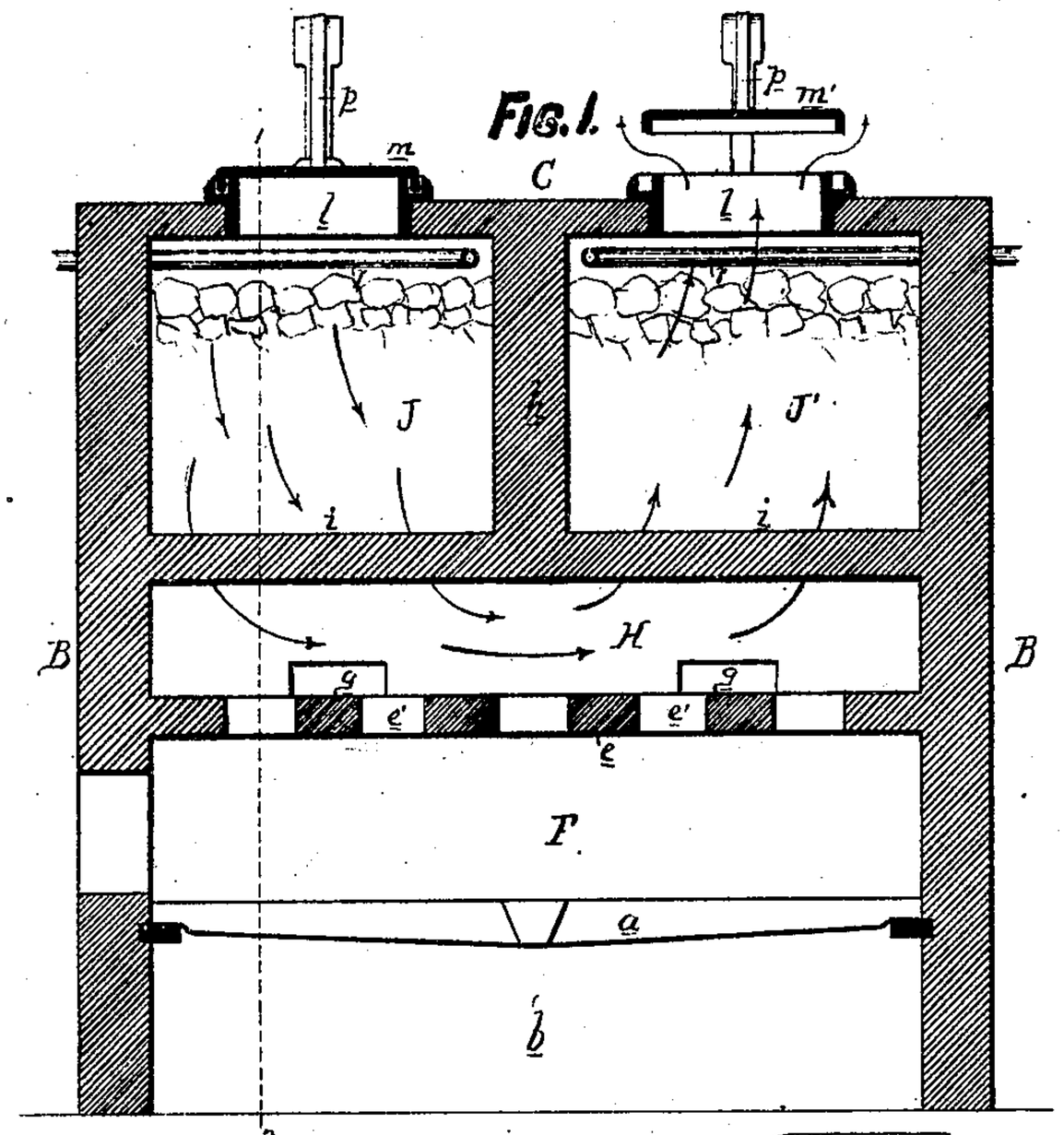
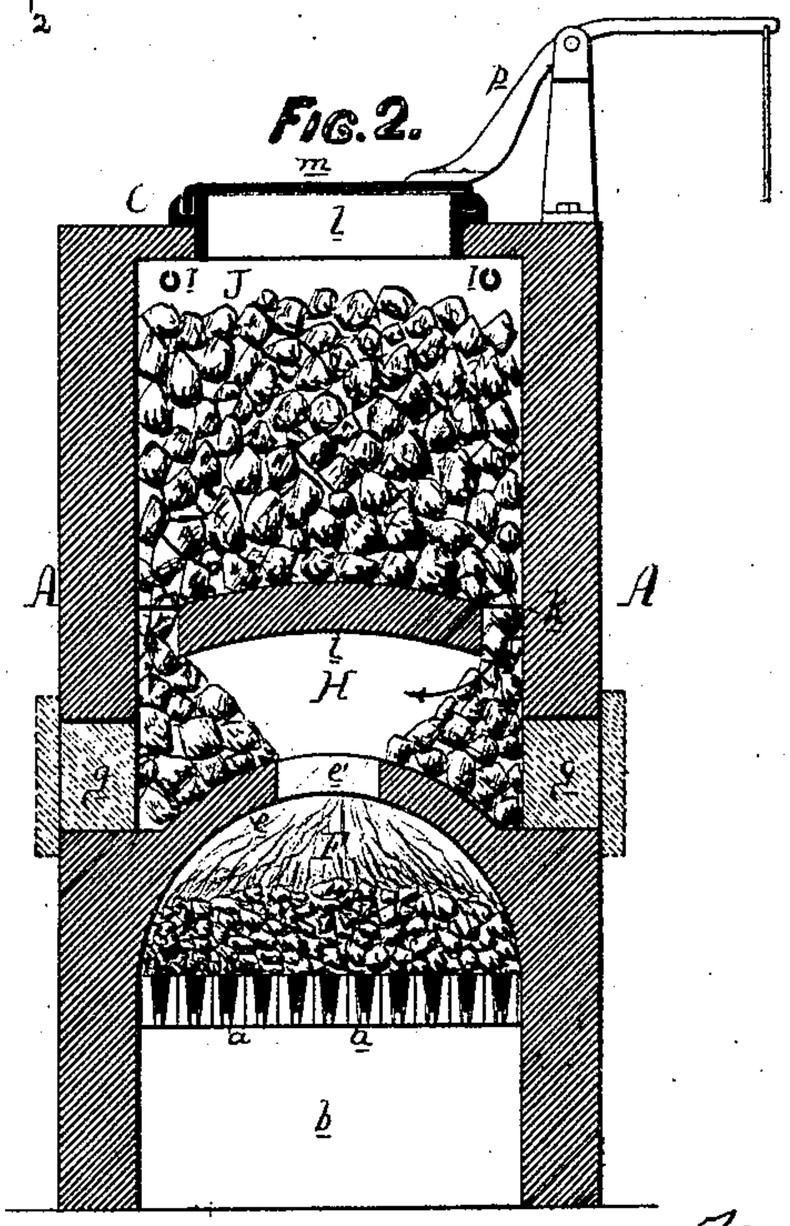


Fig. 2.



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WILLIAM ENNIS, OF PHILADELPHIA, PENNSYLVANIA.

Letters Patent No. 112,698, dated March 14, 1871; antedated March 7, 1871.

IMPROVEMENT IN FURNACES FOR TREATING ORES, &c.

The Schedule referred to in these Letters Patent and making part of the same.

I, WILLIAM ENNIS, of Philadelphia, county of Philadelphia, State of Pennsylvania, have invented an Improvement in Treating Ores, &c., of which the following is a specification.

Nature and Object of the Invention.

This invention consists of a certain process and apparatus, fully described hereafter, for roasting and desulphurizing ores and for other analogous purposes, the main object of my invention being the utilization of the gaseous matter evolved from one mass of ore or other material, by causing it to aid the products of combustion of a furnace in heating another mass of ore or other material.

Description of the Accompanying Drawing.

Figure 1 is a longitudinal vertical section of a furnace wherewith to carry out my invention, and

Figure 2, a transverse section of the same on the line 1 2, fig. 1.

General Description.

A A represent the side walls;
B B, the end walls; and
C, the roof of the furnace.

The lower portion of the furnace is occupied by the fire-place F, its grate-bars *a*, and ash-pit *b*, and above the arched top *e* of the fire-place is a chamber, H, which likewise occupies the entire length and breadth of the furnace.

The chamber H communicates freely with the interior of the fire-place through a number of openings, *c'*, in the arch *e*, and access can be had to the said chamber from the exterior of the furnace by means of two or more openings, *g g*, formed in each of the side walls A at a point immediately above the arch *e*.

The upper portion of the furnace is divided, by a transverse vertical partition, *h*, into two compartments or ovens, J and J', which are separated from the chamber H by a horizontal, but slightly arched, partition, *i*, the edges of the latter being a short distance from the side walls of the furnace, so as to form longitudinal passages *k k*, which afford free communication between the said upper compartments of the furnace and the intermediate chamber H.

At the top of the oven J is an opening, *l*, surmounted by a valve or damper, *m*, and at the top of the oven J' is a similar opening, surmounted by a damper, *m'*, and both of these dampers are adapted to sand joints, or are otherwise tightly fitted over their respective openings, and are both operated by levers *p*, or equivalent devices, in such a manner that they can be readily opened and closed either simultaneously or independently.

The compartments J and J' are also furnished, at points close to the roof C, with perforated steam or water-pipes *r*.

When the above furnace is to be used for roasting ores for the purpose of depriving them of sulphur or other volatile matter, the dampers *m* and *m'* are removed or raised sufficiently to permit the ore to be introduced through the openings *l* into the ovens J and J', which are both filled nearly to the top, as shown in the drawing.

The ore when thus introduced into the ovens J and J' will also pass through the longitudinal passages *k k* into the intermediate chamber H, falling upon the top of the fire-place arch *e*, and arranging itself by its own gravity in about the manner shown in fig. 2, so as to leave a central longitudinal passage extending through the said chamber.

When the furnace has been thus filled with ore a fire is kindled upon the grate *a*, and one of the dampers, the damper *m*, for instance, of the oven J, is closed, while the opposite damper *m'* of the oven J' is opened to its full extent. The openings *g* of the chamber H are also sealed up, and steam or water is forced through the perforations of the pipe or pipes *r* onto the mass of ore in the chamber J, when the following operations will take place:

The products of combustion from the fire-place will pass through all of the openings *e'* of the arch *e* into the chamber H, and will circulate among and speedily heat the masses of ore arranged along the sides of the said chamber. The partition *i* will also become heated, as will also the masses of ore contained in the oven J, to a sufficient extent, at least, to vaporize the water and release a portion of the gases, so that a downward current will be created toward the chamber H, as indicated by the arrows in fig. 1.

The great volume of the heat, however, together with these vapors and gases, which will become ignited on entering the chamber H, pass upward through the mass of ore contained in the chamber J', and escape finally through the opening *l* in the top of the latter.

The ore in the chamber J' is uniformly heated by this intimate contact of the products of combustion, and as soon as the heat is deemed sufficiently intense the damper *m'* is closed and the damper *m* opened, while steam or water is cut off from the oven J, but is turned on to the pipe or pipes *r* of the oven J'. This will immediately reverse the operation, and will cause the heat to pass upward through the partially-heated ore in the oven J and escape from the opening in the top of the latter.

The reversing of the dampers, however, effects the most complete change in the oven J', for the ore in the latter, being highly heated, is in a most favorable condition for being deprived of volatile matter, such as sulphur, &c., and the steam or water which enters

this oven through the pipes *r* becomes decomposed by contact with the heated ore, oxidizes the same, and is a most effective agent in freeing the ore of the said volatile matter.

The formation of these gases in the oven J′ produces a strong downward current, and the said gases on entering the chamber H are immediately ignited and pass upward through the oven J to aid the products of combustion from the fuel on the grate in heating the ore contained in the said oven.

This method of utilizing the volatile and other gases, withdrawn from one mass of ore to aid in treating an adjacent mass, forms a most important feature of my invention, as it effects a great saving of fuel when the furnace is in full heat.

The ore contained in the chamber H being exposed to more intense heat than that in the ovens will not require so long a time to be deprived of its volatile matters, and may be removed from time to time through the openings *g g* in the sides of the furnace.

The ore when sufficiently treated can be also removed from one oven through these openings *g* without interrupting or interfefing with the heating of a mass of ore in the opposite oven, so that the operations can be conducted continuously and alternately with very little loss of heat.

The above furnace, although designed especially for roasting ores, will be found very useful for desulphurizing coal to be used in smelting furnaces, or for drying peat and other fuel to be used in the fire-place F or elsewhere.

In desulphurizing coal or drying fuel the operations are conducted precisely as above described, except that the heat required is not so intense, and the material when sufficiently treated can be withdrawn through the openings *g g*, and the ovens recharged through the openings *l l*, just as with the ore.

Although I have referred to two ovens, J and J′, only, to be worked alternately, it will be evident that three, four, or even a greater number of ovens communicating with each otherand with a fire-place below, but having independet valves or dampers above, can in some cases be employed to advantage without departing from the main features of my invention.

It is important in constructing the furnace that the longitudinal passages *k k* and openings *e′* of the arch *e* should be arranged in respect to each other in about the manner illustrated in the drawing, or, in other words, so that the ore, coal, or other granular material as it escapes through the said passages and becomes piled upon the arch shall have no tendency to escape through the said openings into the fire-place.

It will be seen that the gas which is evolved by the action of the heat on the material within the closed chambers is not discharged from the latter by any artificial blast, but that it issues from each chamber when its volume increases so that it cannot be contained within the same.

Claims.

1. The chambers J J′, with their steam-pipes *r*, openings *h l*, and covers *m* arranged in respect to the chamber H, communicating with a fire-place, F, substantially as described.

2. The openings *e′* in the arch *e*, arranged in respect to the passages *k* of the partition *i*, substantially in the manner described.

3. The combination of the fire-place F, arch *e* with its openings *e′*, partition *i* with its passages *k*, and two or more chambers, J and J′.

4. The chambers J and J′, communicating with each other and with a fire-place below, but having independent valves or dampers above, substantially as set forth.

5. The openings *g*, arranged in the side walls A in respect to the partitions *e* and *i*, substantially as set forth.

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

WILLIAM ENNIS.

Witnesses:
LOUIS BOSWELL,
HARRY SMITH.