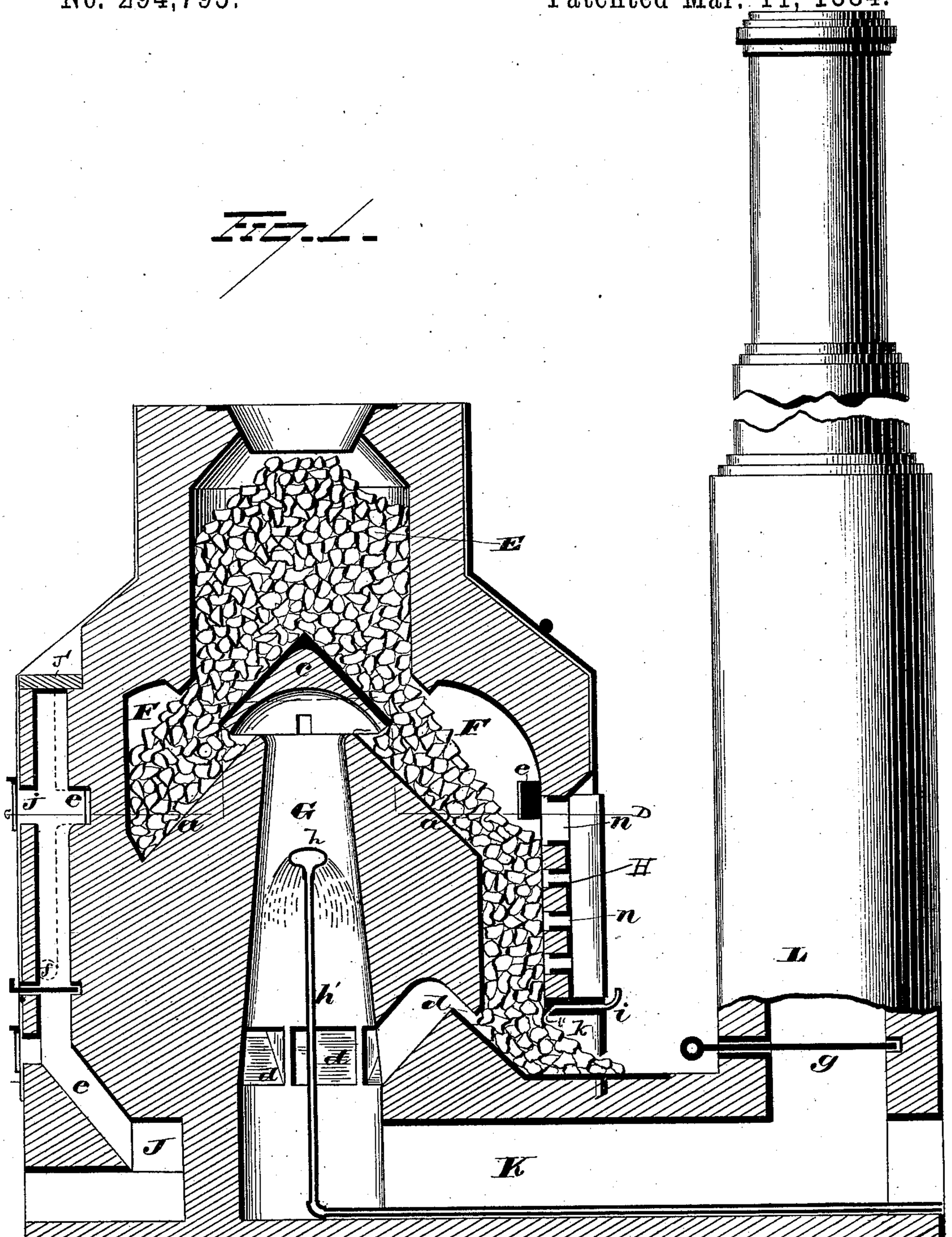
(No Model.) 3 Sheets—Sheet 1.

N. M. LANGDON.

ORE ROASTING FURNACE.

No. 294,795. Patented Mar. 11, 1884.

Fig. 1.



WITNESSES

S. G. Nottingham

Geo. Cook.

INVENTOR

A. M. Langdon

By H. A. Simmons

Attorney

(No Model.)

3 Sheets—Sheet 2.

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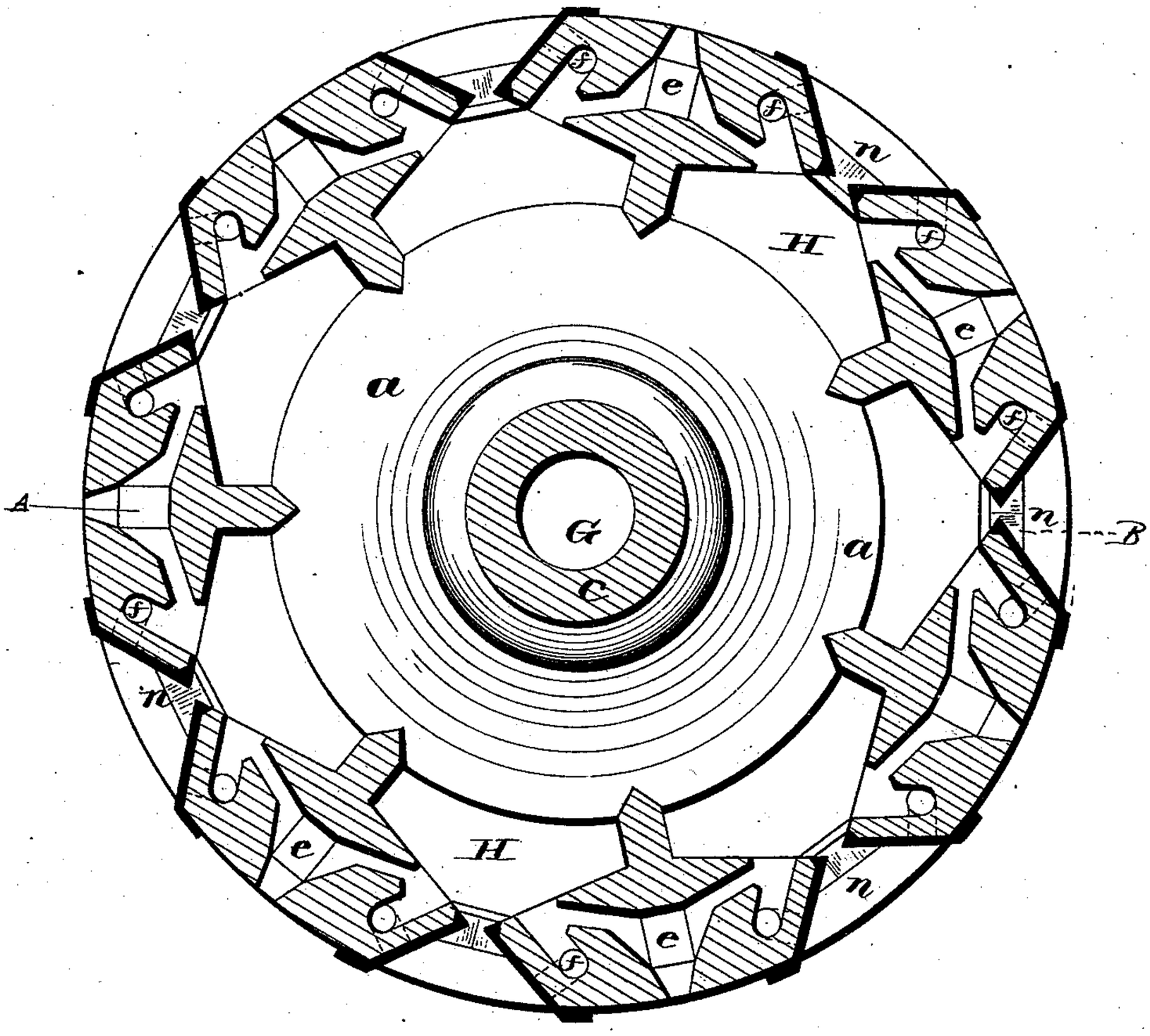
FIG. 2.



WITNESSES

S. G. Nottingham

Geo. Cook

INVENTOR

N. M. Langdon.

By H. A. Seymour.

Attorney

(No Model.) 3 Sheets—Sheet 3.

N. M. LANGDON.

ORE ROASTING FURNACE.

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Fig. 3.

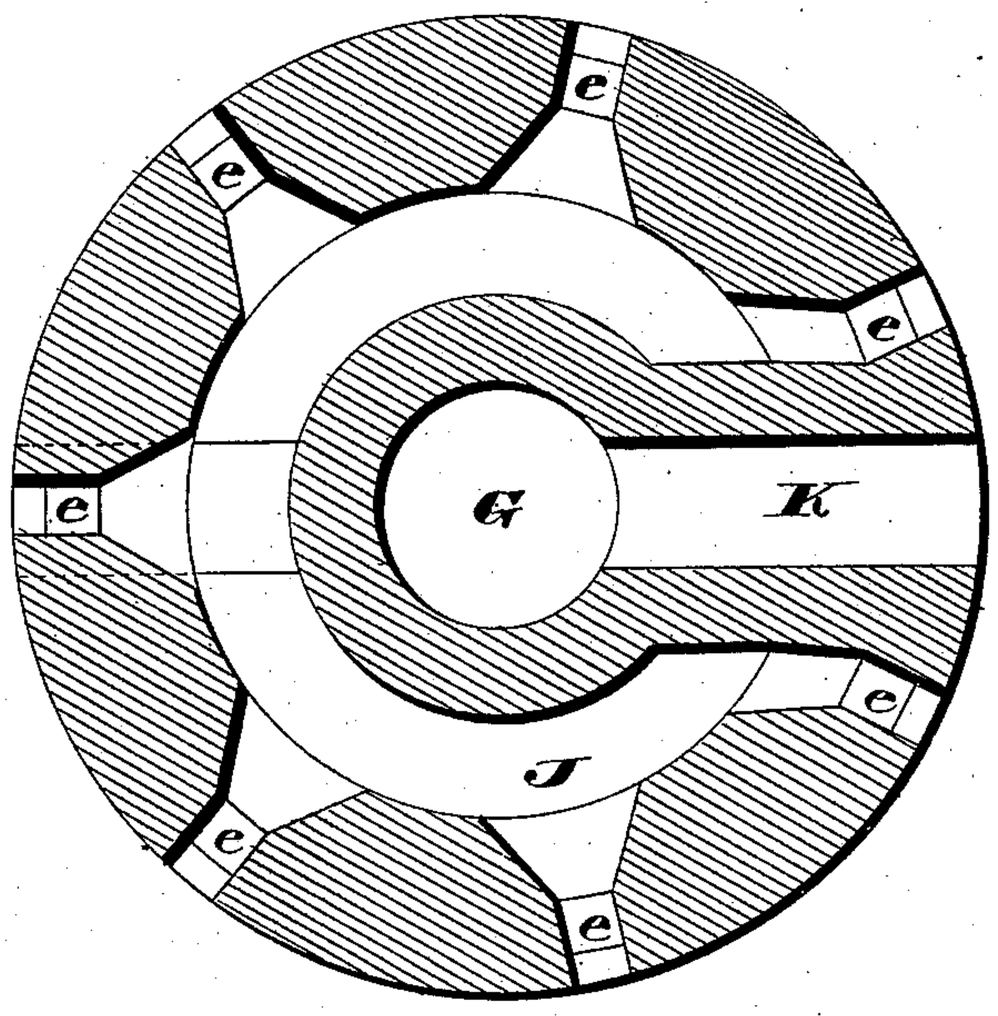
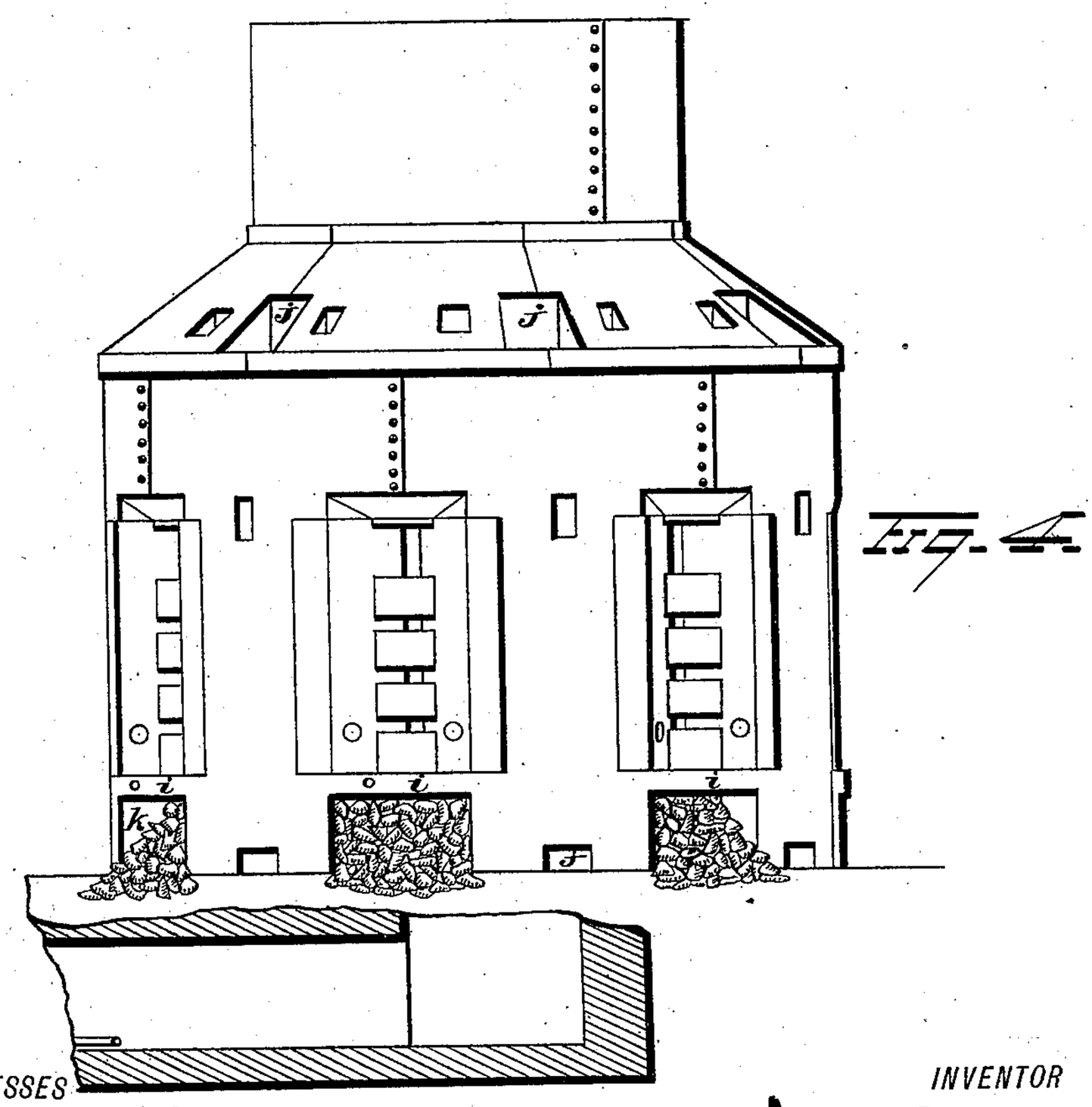


Fig. 4.



WITNESSES

S. G. Nottingham

Geo. Cook.

INVENTOR

N. M. Langdon,

By A. A. Simmons

Attorney

UNITED STATES PATENT OFFICE.

NELSON M. LANGDON, OF CHESTER, NEW JERSEY.

ORE-ROASTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 294,795, dated March 11, 1884.

Application filed October 11, 1882. (No model.)

To all whom it may concern:

Be it known that I, NELSON M. LANGDON, of Chester, in the county of Morris and State of New Jersey, have invented certain new and useful Improvements in Ore-Roasting Furnaces; 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 pertains to make and use the same.

My invention relates to an improvement in perpetual ore-roasting furnaces, and the process of roasting or calcining and desulphurizing ores and minerals, and is designed particularly as an improvement on Patent No. 241,227, granted to me May 10, 1881.

The object of this invention is to provide an ore-roasting furnace of simple and economical construction adapted to the process of thoroughly and economically roasting or calcining and desulphurizing ores and minerals of various kinds; further, to employ steam as an agent for effecting the oxidation and desulphurization of the ores and minerals.

With these ends in view my invention consists in an ore-roasting furnace in which a reverberatory heating chamber or furnace provided with a central gas-escape or "downtake," and having an inclined or sloping bottom, is arranged to receive the ore for heating and roasting in a layer of uniform thickness distributed over the bottom thereof by gravity from an ore-supply chamber located centrally above it, and to deliver the ore, when heated, into ore-chambers located below, where the ores or minerals are subjected to the oxidizing and desulphurizing action of steam.

My invention further consists in the parts and combinations of parts, as will be more fully described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a longitudinal vertical section of my improved furnace through the line A B of Fig. 2. Fig. 2 is a horizontal sectional view through the line C D of Fig. 1. Fig. 3 is a horizontal sectional view, showing the arrangement of flues at the bottom of the furnace, and Fig. 4 is a view in elevation of the furnace.

E represents an ore-supply chamber, which, when the furnace is in operation, is kept full, or nearly so, of the material to be roasted, broken to the proper size. This chamber E is situated above the reverberatory heating-furnace F, which latter is provided with an inclined or sloping bottom, *a*, and a central downward gas-escape or downtake, G. A cap or hood, *c*, raised above and overlapping the entrance to the downtake, prevents the ore from entering therein.

The angle of inclination of the bottom *a* of the heating-furnace should be about the same as the angle of repose of the material to be roasted, and the proper thickness of ore in the heating-chamber is obtained by varying the relative proportions of the ore-supply chamber E. Located beneath and rising into the heating-furnace F, near its outer edge, are the ore-chambers H, which, when the furnace is in operation, are constantly charged with ore, which gravitates downward from the said furnace. The ore-chambers H and the downtake G are connected together by the flues *d*, which latter are adapted for the passage of the sulphurous gases generated in the ore-chamber, and are made angular in shape to prevent the ore from working inward into the downtake G.

The furnace F is supplied with gas from the flues *e*, situated at suitable intervals apart in the walls of the furnace, and with air from the pipes *f*, also situated in the walls of the chamber alongside of the gas-flues. The lower ends of the gas-flues *e* connect with the circular distributing-flue J, which latter is connected to any suitable gas supply or reservoir, while the air-pipes *f*, which are open at their outer ends, pass through the walls of the furnace and terminate flush with the outer surface thereof. Both the air-pipes and gas-flues are provided with valves or dampers, by means of which the amount of air and gas supplied to the furnace is regulated and controlled.

The downtake is adapted for the escape of gas, and is connected to the chimney or stack L by the flue K. The stack L is provided with a damper, *g*, by means of which the draft is regulated and controlled.

h is a water rose or sprinkler situated in the downtake G and secured to the upper end of the water-supply pipe *h'*. This rose or sprink-

ler can be employed for creating a draft, instead of using the stack L, and, besides creating or assisting to create a draft, the water from it will absorb and take up a large proportion of the sulphurous gas generated in the ore-chambers. This last-mentioned function performed by the water is important and advantageous in localities where the escaping gas would be injurious to vegetation.

i are hollow plates connected to a suitable steam-generator, and secured in the wall of the kiln or furnace directly opposite and in front of the ore-chambers H. These plates are provided on their inner faces with numerous perforations or holes, *i'*, for the passage of steam directly into the ore-chambers H.

j are openings in the kiln-wall, by means of which access is obtained to the flues for the purpose of cleaning the same. When the furnace is in operation, the upper ends of the flues are covered by the plates *j'*.

In the operation of my improved furnace and process the ore from the supply-chamber E distributes itself over the inclined bottom *a* of the heating-furnace F and fills the ore-chambers H. The ore in the heating-furnace is brought to a proper temperature by the combustion of gas and air entering from the flues *e* and pipe *f*, and the escaping products of combustion and liberated sulphurous gases pass off through the ore and through the flues *d* into the downtake G. When the ore in the heating-furnace F has reached the proper temperature, a portion of the ore in the ore-chambers H is withdrawn through the opening or terminals *k* of the ore-chambers H, and the heated ore is worked down with bars passed through the openings *n*. As the heated ore falls from the furnace F into the ore-chambers, the space thus formed in the furnace is automatically supplied with raw ore from the supply-chamber E, which in turn is heated to the proper temperature. Steam, superheated or otherwise, is admitted into the ore-chambers H through the perforated plates *i*, where it is converted by the heat of the ore into its constituent elements—oxygen and hydrogen—which absorb and take up sulphur from the ore, and become converted into sulphurous-acid and sulphureted-hydrogen gas, and escape from the ore-chambers through the flues *d* into the downtake G. The necessary draft to carry off the escaping gases from the downtake G is obtained by a suitable stack or chimney, L, or by a spray of water from the rose or sprinkler *h*, which, in addition to creating a draft, will absorb and take up a large proportion of the sulphurous gas, which is important in localities where the escaping gas would be injurious to vegetation. By drawing the ore from the ore-chambers when the ore in the heating-furnace has attained the proper temperature, and keeping the supply-chamber well filled, the operation of roasting is made continuous.

The advantages of using steam, superheated or otherwise, instead of air for the purpose of effecting oxidation and desulphurization are readily apparent when the fact is considered that for equal volumes of steam and air at the same density the steam possesses the capacity of taking up three times as much sulphur as the same volume of air, the oxygen and hydrogen of the steam both having an affinity for sulphur, while the inert nitrogen, composing four-fifths of the volume of air, not only has no affinity, but actually to a great extent, by reason of its diluent properties, neutralizes its accompanying oxygen. To illustrate: Two volumes of steam will take up three volumes of sulphur and become converted into two volumes of sulphureted hydrogen and one volume sulphurous acid, while two volumes of air will take up only one volume of sulphur and become converted into eight volumes of nitrogen and one volume of sulphurous acid.

It is evident that numerous changes in the construction of my kiln can be resorted to without departing from the spirit of my invention, and hence I consider myself at liberty to make such changes and alterations therein as fairly fall within the spirit and scope of my invention.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an ore-roasting furnace, a reverberatory heating or combustion chamber having an inclined or sloping bottom and a central downtake provided with a cap arranged above and over the entrance to said downtake, substantially as set forth.

2. In an ore-roasting furnace, a reverberatory heating or combustion chamber provided with a bottom having a slope or inclination of about the angle of repose of the ore to be roasted, in combination with a supply-chamber located above said heating-chamber and extending downwardly a sufficient distance to prevent the ore from filling the reverberatory space of the heating-chamber, substantially as set forth.

3. The combination, with a reverberatory heating-chamber having an inclined bottom whose slope or inclination is about that of the angle of repose of the ore to be roasted, of a supply-chamber extending downward sufficiently to prevent the ore from filling the reverberatory space of the heating-chamber, and a series of ore-chambers arranged to receive the ore by gravity from said heating-chamber, substantially as set forth.

4. In an ore-roasting furnace, the combination, with a series of ore-chambers, of a central downtake connected with said ore-chambers by passages adapted to convey gases, but so constructed as to prevent the admission of ore to said downtake, substantially as set forth.

5. In an ore-roasting furnace, the combination, with a series of ore-chambers and an exit-flue, of a central downtake connected near its lower end to said ore-chambers by

angular passages, as and for the purpose set forth.

6. In an ore-roasting furnace, the combination, with ore-chambers, a central downtake, and flues connecting the downtake with the lower portions of said ore-chambers, of steam-conduits located in the outer walls of the ore-chambers for admitting steam in direct contact with the ore, and a rose or sprinkler arranged within the downtake, substantially as set forth.

7. In an ore-roasting furnace, the combination, with the central downtake having a gas-passage near its lower end connecting with an ore-chamber, of a rose or sprinkler for water arranged within the downtake, substantially as set forth.

8. The combination, with the heating-chamber, of gas-flues and air-pipes arranged in the wall of the furnace, said gas-flues connecting at their lower ends with a distributing-flue, and both said flues and pipes being provided with suitable valves or dampers, substantially as set forth.

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

NELSON M. LANGDON.

Witnesses:
H. W. CRABBE,
O. E. THURBER.