

Aug. 25, 1925.

1,551,180

E. B. THORNHILL

FURNACE

Original Filed Jan. 21, 1921

Fig. 1.

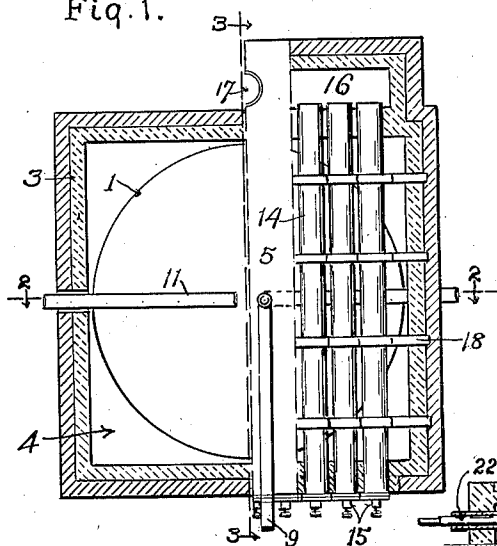


Fig. 2.

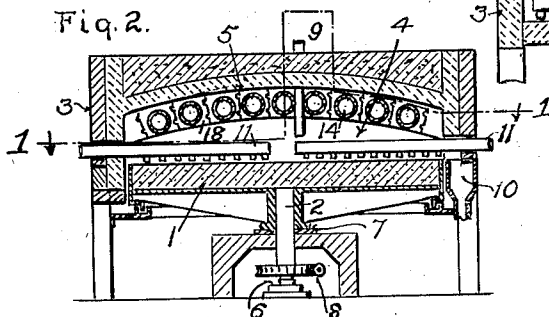


Fig. 3.

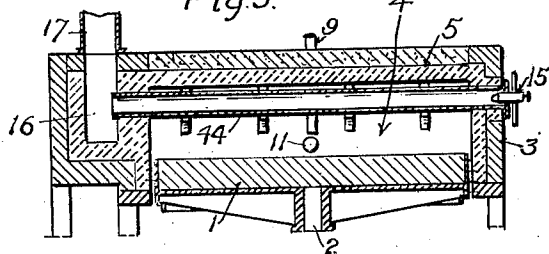
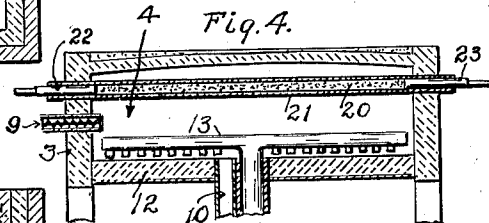


Fig. 4.



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1,551,180

UNITED STATES PATENT OFFICE.

EDWIN B. THORNHILL, OF HURLEY, NEW MEXICO, ASSIGNOR TO THORNHILL-ANDERSON COMPANY, OF MUSKOGEE, OKLAHOMA, A CORPORATION OF OKLAHOMA.

FURNACE.

Original application filed January 21, 1921, Serial No. 438,957. Divided and this application filed September 11, 1922. Serial No. 587,314.

To all whom it may concern:

Be it known that I, EDWIN B. THORNHILL, a citizen of the United States, residing at Hurley, in the county of Grant and State of New Mexico, have invented a new and useful Improvement in Furnaces, of which the following is a specification.

This invention relates to furnaces and particularly to improved heating elements for use therein, and the main object of the invention is to provide heating elements which are adapted to heat the interior of the furnace and the material therein by radiation, and which are of such construction as to provide for maximum efficiency in conduction and radiation of heat, while at the same time providing the requisite strength and durability.

This application is a division of my application Ser. No. 438,957, filed January 21, 1921, in which the heating means herein shown were disclosed in connection with a furnace for carrying out a process for production of sponge iron and other products. My improved heating elements may, however, be employed with advantage in any furnace wherein heating by radiation is desired.

The accompanying drawings illustrate apparatus embodying my invention, Fig. 1 being a horizontal section, on line 1—1 in Fig. 2, of a rotary hearth furnace provided with my improved heating elements; Fig. 2 a section on line 2—2 in Fig. 1; Fig. 3 a vertical section on line 3—3 in Fig. 1; and Fig. 4 a vertical section of a modification.

Referring to Figs. 1 to 3, the furnace therein shown comprises a rotary hearth 1, mounted to rotate on a vertical shaft 2, and a furnace casing or enclosure 3, which extends over and around said hearth to form a heating chamber 4 above the hearth. Said furnace casing is shown as having an arched shaped roof 5, but it may be of any suitable form and may be constructed of any suitable material, for example, ordinary brick lined with firebrick.

The shaft 2 for the rotary hearth may be mounted in suitable bearings 6 and 7 and may be driven by any suitable means, indicated at 8, so as to gradually rotate the hearth. Suitable feed means 9 for supplying the material to the hearth, and outlet means 10 for discharging the material from

the hearth, may be provided in the usual manner of rotary hearth furnaces, and rabbling means, indicated at 11 may also be provided for turning over the material and gradually advancing it from the feed means to the outlet. It will be understood, however, that any other desirable furnace construction may be used. For example, as shown in Fig. 4, the hearth may be stationary as indicated at 12 and the rabbling means, indicated at 13, may be rotated in the usual manner of such furnaces. In fact, as regards the present invention, the construction of the hearth and the presence or absence of rabbling means is immaterial, my present invention relating to the construction of the heating means for the furnace chamber, irrespective of the manner in which the material to be treated is introduced into or withdrawn from the furnace, and also irrespective of the nature and purpose of the heating operation performed on such material, provided the heating is by radiation in the manner hereinafter set forth.

Heating means 14 extend in the heating chamber 4 and above hearth 1, so as to heat the material on the hearth by radiation, said heating means being out of contact with the material being treated. Said heating means consist of heating elements formed preferably as straight horizontal tubes of suitable resistant material extending through the side walls of the furnace, said tubes being open at one end for reception of burners 15 and opening at the other end into an outlet chamber 16 communicating with a stack 17. Said tubes 14 may consist of any suitable refractory material, preferably material of good thermal conductivity, for example, carborundum, or similar material, and are supported from the roof of the furnace chamber or casing in any suitable manner, for example, by passing through openings in blocks 18 which interlock with one another and extend across the furnace chamber in the form of an arch, said blocks being of suitable refractory material. With the described construction, the heating elements, extending parallel to one another through the heating chamber and over the hearth thereof, are so positioned as to provide for most effective radiation of heat from said elements on to the material

supported on the hearth and the construction and mounting of said elements are such as to provide the required strength and durability of the construction.

5 In the operation of the furnace, the material to be heated is supplied to the hearth or floor of the furnace in any suitable manner, so as to be exposed to radiation from the heating elements. The heating devices
10 14 are brought to a high temperature by operation of the burners 15, the flames from which pass within and through the heating tubes 14 and heat the walls of such tubes so that they become incandescent: the heat
15 being conducted through the walls and radiated from the outer surfaces thereof, part of the heat so radiated passing directly to the material distributed or placed on the hearth and part of such heat being radiated to the
20 top and sides of the heating chamber 4 and being radiated therefrom to the material on the hearth. By this means the temperature of the heating chamber is maintained at the point required for effective and economical
25 heating of the ore or other material; for example, in case the furnace is used for iron ore reduction, a temperature of from 950° to 1000° C. may be maintained.

The source of heat used for radiating heat
30 to the material being treated may be of any suitable character. Thus, in place of the heating elements above described, I may use electrical heating elements, such as indicated at 20 in Fig. 4, and comprising a conductor
35 of considerable resistance connected in an electrical circuit and enclosed in a tube of refractory material, preferably carborundum. As an illustration, this conductor is shown as consisting of fragments of coke,
40 or other form of carbon, indicated at 20 and contained within a tube 21 of refractory material such as carborundum; electrodes 22 and 23 extending into opposite ends of the tubes 21 and making contact with the high resistance material 20 therein, such electrodes being connected to an electrical circuit for supply of electric current thereto. It will be understood that any number of the heating elements may be provided and that the same may extend over the hearth so as to

heat the entire area of the hearth, or the material thereon, to the proper temperature.

What I claim is:

1. In a furnace, a casing formed with a heating chamber provided with means for
55 supporting material to be heated, and heating elements extending through the said chamber and over the material supporting means, so as to heat the material by radiation, said heating elements comprising straight horizontal
60 tubes of refractory material and means for applying heat internally to said tubes.

2. In a furnace, a casing formed with a heating chamber provided with means for
65 supporting material to be treated, and heating means consisting of straight horizontal tubes of carborundum extending through said chamber and over the material supporting
70 means, so as to heat the material by radiation, and means for heating said tubes internally.

3. A furnace comprising a casing formed with a chamber adapted to contain the material to be heated and having a roof extending over said chamber, and heating
75 means for said chamber comprising a plurality of straight horizontal carborundum tubes extending through the walls of said chamber, means connected to the roof of
80 the chamber for supporting said tubes, and means for heating said tubes internally.

4. In a furnace, a casing formed with a heating chamber and with an outlet chamber at one end of said heating chamber, a plurality of straight horizontal heating tubes
85 extending through said chamber and open at both ends, one end of each of said tubes communicating with the outer air and the other end communicating with the said outlet chamber, burner means adapted to direct
90 hot products of combustion into the respective tubes at the open ends thereof, and means for supporting material to be heated below said tubes so as to be heated by radiation
95 therefrom.

In testimony whereof I have hereunto subscribed my name this 28th day of August, 1922.

EDWIN B. THORNHILL.