W. D. LUDWICK.

ELECTRIC MELTING FURNACE.

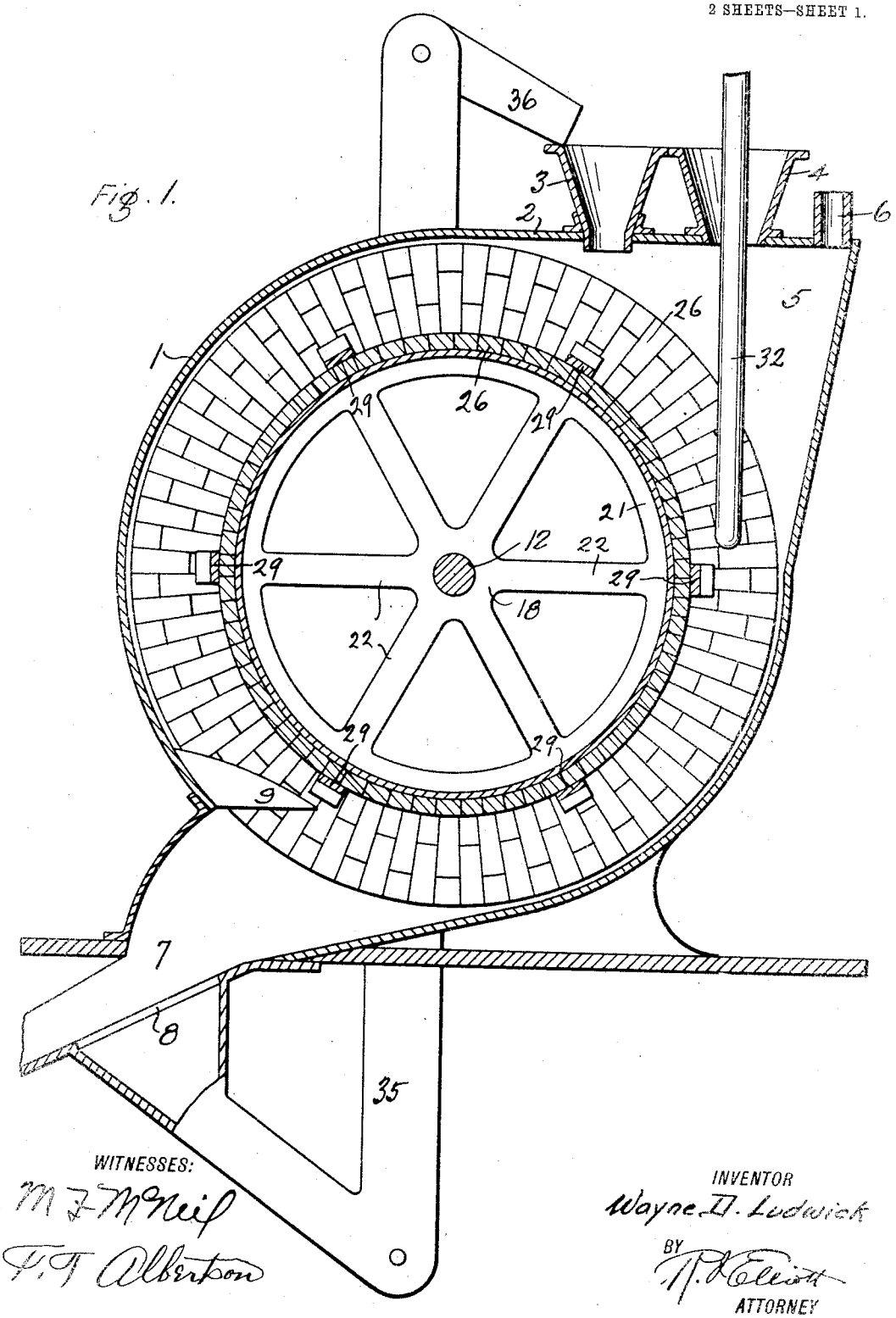
APPLICATION FILED JAN. 9, 1911.

1,038,614.

Patented Sept. 17, 1912.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

M. F. McNeil

F. T. Alberton

INVENTOR

Wayne D. Ludwick

BY

T. L. Elliott

ATTORNEY

W. D. LUDWICK.

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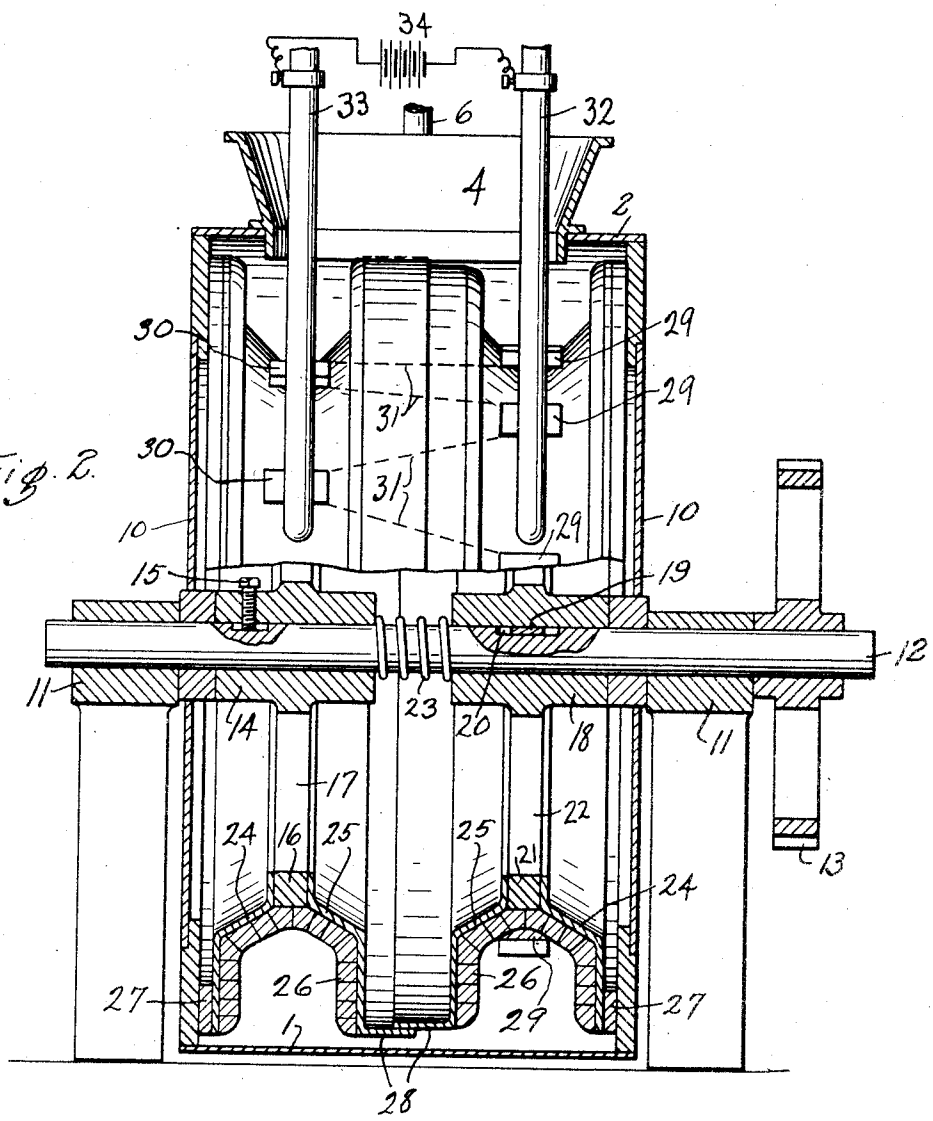
2 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:

M. J. McNeil

F. T. Atherton

INVENTOR

Wayne D. Ludwick

BY R. E. Ellis

ATTORNEY

UNITED STATES PATENT OFFICE.

WAYNE D. LUDWICK, OF NEAR TACOMA, WASHINGTON, ASSIGNOR OF FIFTY-ONE ONE-HUNDREDTHS TO HENRY HEWITT, JR., OF TACOMA, WASHINGTON.

ELECTRIC MELTING-FURNACE.

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To all whom it may concern:

Be it known that I, WAYNE D. LUDWICK, a citizen of the United States, residing near Tacoma, in the county of Pierce and State of Washington, have invented a new and useful Electric Melting-Furnace, of which the following is a specification.

This invention relates to improvements in electric furnaces for fusing iron oxids or other materials, and has for its object to provide an apparatus for melting ore in the form of sand into a mass which is cooled and broken into chunks of such size as to make it adaptable for use in a blast or converting furnace.

Further objects of my invention are to provide a rotary hearth with means for supplying ore to the hearth in granular condition and with electrodes adjacent the hearth adapted to melt the granular ore and to form it into a homogeneous mass; to provide means for passing the ore, which has not been melted, again through the furnace a second time in such position therein that it will be in the hottest part thereof; to provide in a rotary hearth electric furnace means whereby the consumption of electric energy is practically constant during the rotation of the hearth; and to provide means to allow for the expansion or contraction of the parts of the machine.

I attain these and other objects by the devices, mechanisms and arrangements illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section of my improved electric melting furnace; and Fig. 2 is a vertical cross-section thereof, a portion thereof being shown in elevation.

Similar numerals of reference refer to similar parts throughout the several views.

The improved electric melting furnace is shown in the drawings as having two rotating hearths, such arrangement being adapted for an alternating current, it being understood however that the number of hearths are increased, without material change in the construction, for a multiphase current.

The furnace consists of a casing formed substantially drum-shaped, having suitable inlet hoppers, gas chambers, outlet chutes and return conveyers; in which a plurality of hearths are rotatably supported, said hearths carrying electrical conductors or blocks spaced thereon; and in which the electrodes are inserted in suitable positions, one electrode for each hearth.

The housing or casing 1 of the furnace is provided with a flattened top 2, forming a space for the two receiving hoppers 3 and 4 and forming a gas chamber 5 from which a pipe 6 leads the gas to any desired place. Opposite each of the rotating hearths within the casing is provided an outlet chute 7, said chutes being at the bottom of the casing and each being provided with a suitable screen 8 in its bottom, adapted to separate the fused lumps of ore from the unfused sand. A dog or stripper 9 is mounted within the casing, immediately above each chute 7 and coming into close proximity with the rotating hearth to strip the cooled fused ore therefrom. The sides 10 of the casing are suitably secured thereto and are adapted to close the ends to prevent the escape of gas therefrom.

A pair of suitable bearings 11 are mounted at each end of the machine. A shaft 12 is mounted therein in the axis of the casing, said shaft passing through the said sides 10 and being suitably rotated by any approved power applied in any desired manner as by the gear 13. A hub 14 is mounted rigidly on the shaft 12, being secured thereto by the set screw 15. This hub carries a rim 16, secured thereto by suitable spokes 17, on which is mounted one of the rotating hearths as hereinafter described. Another hub 18 is slidably mounted on the shaft 12, rotating therewith however, being secured thereto by a key 19 engaging in an elongated slot or keyway 20 in the shaft 12. The hub 18 carries a rim 21 by means of suitable spokes 22. The two hubs 14 and 18 are pressed apart, the one from the other, by means of the spring 23 wound around the shaft 12 and engaging their inner faces. This spring keeps them pressed with a constant force against the end plates 10 and allows them to expand without binding on the said ends.

Referring now to the rotating hearths, a description of one hearth will be understood as applying to all as they are all similar in construction. Metal rings 24 and 25 are secured to each side of the rim 16, the two such rings extending out beyond and to each side of the rim, in such shape that when the space therebetween is lined with some refractory material, such as the fire bricks 26, the cross-section thereof shall be substan-

tially U-shaped. The outer side of the ring 24, adjacent to the end plate 10, is provided with a bearing ring 27 adapted to bear against the said plate to prevent the passage of sand or of gas between the hearth and the ends of the casing. The rings 25, which are adjacent each other on adjacent hearths, are provided with flanges 28, said flanges being made of different diameters so that one will fit within the other, allowing for the expansion of the hearths without increasing the pressure on the end plates 10.

Metal blocks 29 are secured at regular intervals in the base of the U-shaped lining on one hearth, and similar blocks 30 are similarly secured in the other hearth. The blocks 29 and 30 are arranged in staggered relation in adjacent hearths and are connected together electrically, by means of the electric conductors of any suitable form as indicated at 31.

As above mentioned the flat top 2 of the casing 1 is provided with the hoppers 3 and 4. A hopper 3 is provided in line with the axis of each of the rotating hearths and is adapted to feed hot unfused sand thereto. A long hopper 4 extends past all of the hearths and is adapted to feed cold sand equally to each hearth. The hopper 3 is nearer vertically over the shaft of the hearths than is the hopper 4. The electrodes 32 and 33 are inserted through the hopper 4 and are connected with any suitable source of electric energy as indicated diagrammatically at 34. Each electrode extends downward into close proximity to the blocks in the hearth.

A conveyer, indicated conventionally at 35, collects the heated but unfused sand, which falls through the screen 8, and deposits it through the chute 36 into the corresponding hot hopper 3.

The operation of this machine is substantially as follows: Cold sand, consisting of finely divided iron ore previously concentrated, either mixed or unmixed with other suitable elements, is fed into the machine through the cold hopper 4; as the hearths rotate they draw this sand downward; as one of the blocks on the hearth passes near the corresponding electrode the current passes thereto and melts the ore therebetween and near thereto; the sand farthest from the center of the hearth will remain more or less unfused but will receive a great deal of heat; the fused sand cools somewhat as soon as it is carried away from the electrode, but sticks to the hearth until it is engaged by the stripper which breaks it therefrom whence it falls into the chute 7; the hot unfused sand is collected and carried by the conveyer 35 to the hopper 3 whence it falls directly onto the hearth and forms a layer under the cold sand coming from the hopper 4; the hot sand thus is placed in the hottest part of the furnace and is fused. Since the blocks 29 and 30 are staggered, it follows that when one is nearest its electrode the other is farthest from the other electrode and as one approaches the other recedes so that the total distance which the current passes through from one electrode to the other is constant and therefore the resistance is practically constant and the power needed to operate the furnace is practically constant.

Having described my invention, what I claim is:

1. In an electric melting furnace, the combination of a plurality of rotating hearths; a corresponding number of electrodes, each electrode adjacent one hearth; conducting blocks within said hearths; means for introducing the elements to be fused equally to each of the hearths; means for separating the fused elements from those remaining unfused from each hearth; and means for introducing the unfused elements from each hearth to the hottest part of said hearth.

2. In an electric melting furnace, the combination of a plurality of rotating hearths; a corresponding number of electrodes, each electrode adjacent one hearth; conducting blocks within said hearths, said blocks being equally spaced therearound and being arranged in staggered relation to each other in adjacent hearths, and being electrically connected together; means for introducing the elements to be fused between the blocks and the electrodes; means for separating the fused elements from those remaining unfused; and means for introducing said unfused elements in the hottest part of the hearth.

3. In an electric melting furnace, the combination of a casing; a rotating shaft mounted therein; a hearth rigidly secured to said shaft; a hearth slidably secured to said shaft beside said rigid hearth and rotating therewith; and yielding means engaging said slidable hearth and pressing it away from the other hearth whereby the axial expansion of the hearths compresses said yielding means and said yielding means maintains an even pressure between the hearths independent of the temperature thereof.

4. In an electric melting furnace, the combination of a casing; a rotating shaft mounted therein; a hearth rigidly secured to said shaft; a hearth slidably secured to said shaft beside said rigid hearth and rotating therewith; telescoping flanges formed on the adjacent sides of the rims of said hearths; and yielding means engaging said slidable hearth and pressing it away from the other hearth whereby the axial expansion of said hearths compresses said yielding means causing said flanges to telescope.

5. In an electric melting furnace, the combination of a casing; a rotating shaft mounted therein; a hearth rigidly secured to said shaft; a hearth slidably secured to said shaft beside said rigid hearth and rotating therewith; refractory lining for said hearths; telescoping flanges formed on the adjacent sides of the rims of said hearths; conducting blocks within said hearths, said blocks being equally spaced therearound and being arranged in staggered relation to each other in adjacent hearths, and being electrically connected together; electrodes mounted within said casing and each extending adjacent a hearth; means for introducing the elements to be fused between the blocks and the electrodes; means for separating the fused elements from those remaining unfused; means for introducing said unfused elements in the hottest part of the hearth; and yielding means engaging said slidable hearth and pressing it away from the other hearth whereby the axial expansion of said hearths compresses said yielding means causing said flanges to telescope.

WAYNE D. LUDWICK.

Witnesses:
M. F. McNeil,
Herbert West.