Feb. 16, 1926. 1,572,881

P. H. BRACE

ELECTRIC FURNACE RESISTOR

Filed Nov. 14, 1922

Fig. 2.

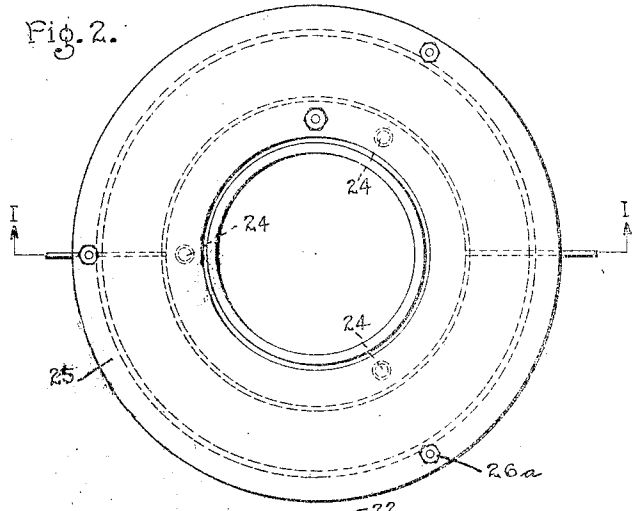


Fig. 1.

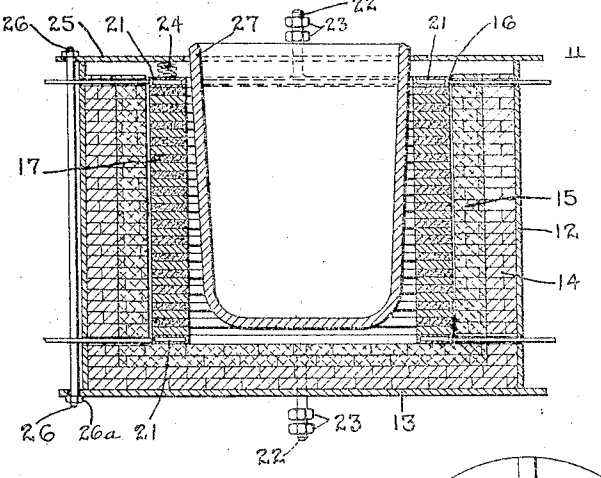


Fig. 4.

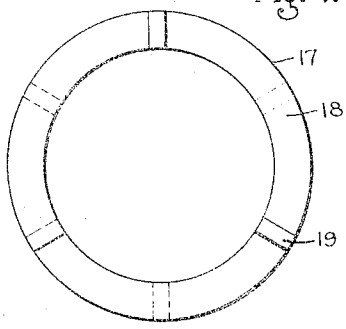


Fig. 3.

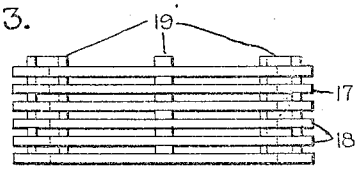
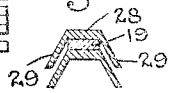


Fig. 6.



Fig. 5.



WITNESSES:

P. H. Crock

A. M. Bielel

INVENTOR

Porter H. Brace.

BY

Oberly & Sloan

ATTORNEY

Patented Feb. 16, 1926. 1,572,881

UNITED STATES PATENT OFFICE

PORTER H. BRACE, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

ELECTRIC-FURNACE RESISTOR.

Application filed November 14, 1922. Serial No. 600,808.

To all whom it may concern:

Be it known that I, PORTER H. BRACE, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electric-Furnace Resistors, of which the following is a specification.

My invention relates to electric furnaces and particularly to electric-resistance furnaces.

The object of my invention is to provide a compact, rugged, built-up corbonaceous resistor that shall have a relatively high electric resistance.

In practicing my invention, I provide a plurality of members of a refractory resistor material located in co-extensive spaced relation and a plurality of symmetrically spaced refractory electric-conducting blocks operatively engaging the adjacent members. The alternate sets of blocks are staggered relatively to each other. Water cooled electric-circuit terminals are provided at each end of the sets of blocks and also resilient compressing means for the members, blocks and terminals.

In the single sheet of drawings,

Figure 1 is a view, in vertical section, of an electric-resistance furnace comprising the device embodying my invention, taken on the line I—I of Fig. 2,

Fig. 2 is a top plan view of an electric furnace comprising the device embodying my invention,

Fig. 3 is a view, in side elevation, of a heating element embodying my invention,

Fig. 4 is a top plan view thereof,

Fig. 5 is a fragmentary view, in cross-section, of a modified form of a resistor element, and

Fig. 6 is a fragmentary view, in side elevation, of a further modification of a resistor element.

An electric-resistance furnace, designated generally by the numeral 11, comprises a metallic casing 12, of any suitable or desired contour and dimensions, which is provided with a metallic bottom plate 13 having an outer annular portion projecting beyond the casing 12. An outer lining 14, located within the casing 12, comprises a plurality of bricks or blocks of a suitable refractory heat-insulating material. An inner lining 15 comprises a plurality of bricks or blocks of a suitable high-temperature-resisting refractory material, the walls formed by the inner lining being so spaced apart as to provide a chamber 16 therein.

Within the chamber 16, which is here illustrated as being substantially cylindrical in contour, is located a built-up resistor or heating element 17 that comprises a plurality of relatively thin, flat rings 18 of a suitable resistor material, such as carbon, graphite, carborundum, or any similar material usually employed for high-temperature-resistance furnaces. The rings 18 are located in superposed co-axial relation and are spaced apart by a plurality of relatively narrow electrical conducting blocks 19 made of material that is like or similar to that of the rings 18, the blocks being symmetrically spaced around the circumference of the rings. The set of blocks operatively engaging the opposite surfaces of any one ring may be staggered relatively to each other, substantially as indicated in Fig. 4 of the drawing.

At each end of the heating element 17 is provided a metallic water cooled terminal member 21 which may be annular in form in order to provide a relatively large contact surface with the end ring. A rod or bar 22 may be provided to extend at right angles to the surface of each of the terminal members 21 and be electrically connected thereto and be provided with a plurality of nuts 23 having screw threaded engagement therewith, to permit of connecting thereto the ends of suitable supply-circuit conductors, (not shown).

In order to insure close operative engagement between the blocks 19 and the rings 18, I provide a plurality of resilient spring members 24, here shown as three in number, one end of each of which operatively engages the outer surface of one of the terminal members 21 and the other end of which is operatively engaged by a metallic cover plate 25. A plurality of rods 26 may be provided to extend through suitable openings in the bottom plate 13 and in the cover plate 25, and nuts 26 may be located thereon, outside of the bottom plate and the cover plate, to permit of securing any desired degree of pressure on the built-up heating element 17.

The outer diameter of the rings 18 is made slightly smaller than the diameter of the chamber 16 to provide a heat-insulating space therebetween. Within the substantially cylindrical heating chamber constituted by the built-up set of rings 18, I may locate a material container 27, illustrated in Fig. 1 of the drawings, as a crucible.

The use of the hereinbefore described heating element, is, however, not restricted to furnaces employing a material container, as it is obvious that a tubular heating element of any desired length may be built-up by the use of a suitable number of rings 18 and blocks 19 located substantially as hereinbefore described and as illustrated in the drawings, and that the material to be heat treated may be moved therethrough by any suitable means.

Fig. 5 illustrates rings of modified form having greater strength than the relatively thing flat rings 18 hereinbefore described. The rings illustrated in Fig. 5 may be made of substantially U-section, comprising a central flat portion 28 and two laterally extending side portions 29.

Each section may be made of relatively small area of cross-section, thereby obtaining a relatively high resistance as well as relatively great strength. The blocks 19 may be made substantially the same as hereinbefore described to permit engagement with the central portions 28 only. The greater strength of the rings permits a greater compressing force to be exerted by the hereinbefore desired compressing means, while still obtaining a relatively high resistance.

In Fig. 6, I have illustrated a modified form of built-up resistor comprising a plurality of relatively thin, flat, elongated, refractory bars 31 substantially rectangular in cross-section. A plurality of refractory electric-conducting blocks 19 are placed between each two adjacent bars 31, the alternating sets of blocks being staggered relatively to each other, substantially as indicated.

The hereinbefore described construction of co-axially located rings of a refractory electrical conducting material or of the substantially co-extensive bars 31, together with a plurality of alternately staggered and symmetrically spaced electrical-conducting blocks located between the adjacent rings or bars, provides a plurality of paths for the electric current which is caused to traverse the built-up resistor. Heat is generated not only by reason of the electric resistance of the bars or rings but also by reason of the contact resistance existing between the blocks and the rings or bars. Any desired number of spacing and electrical conducting blocks may be provided between the adjacent rings or bars, whereby it is possible to obtain any desired amount of resistance to an electric current.

As hereinbefore stated, the use of a built-up resistor embodying my invention is not confined to a substantially enclosed furnace chamber but may be employed wherever a built-up resistor, such as illustrated in Figs. 3 and 4, and in Fig. 6, or any modification thereof, is suitable, and will provide the desired amount of heat to effect the heat treatment of the material being operated upon.

Various changes in details and arrangement may be made without departing from the spirit and scope of the invention and such modifications are intended to be covered by the appended claim.

I claim as my invention:

An electric furnace resistor comprising a plurality of rings of a refractory resistor material, of substantially U-shape in radial section, located in coaxial spaced relation, and a plurality of symmetrically spaced refractory electrical-conducting blocks located between adjacent rings and operatively engaging the intermediate portion only of adjacent rings.

In testimony whereof, I have hereunto subscribed my name this 27th day of October 1922.

PORTER H. BRACE.