Dec. 30, 1924. 1,521,028

G. M. LITTLE

RESISTOR FOR ELECTRIC FURNACES

Filed May 24, 1921

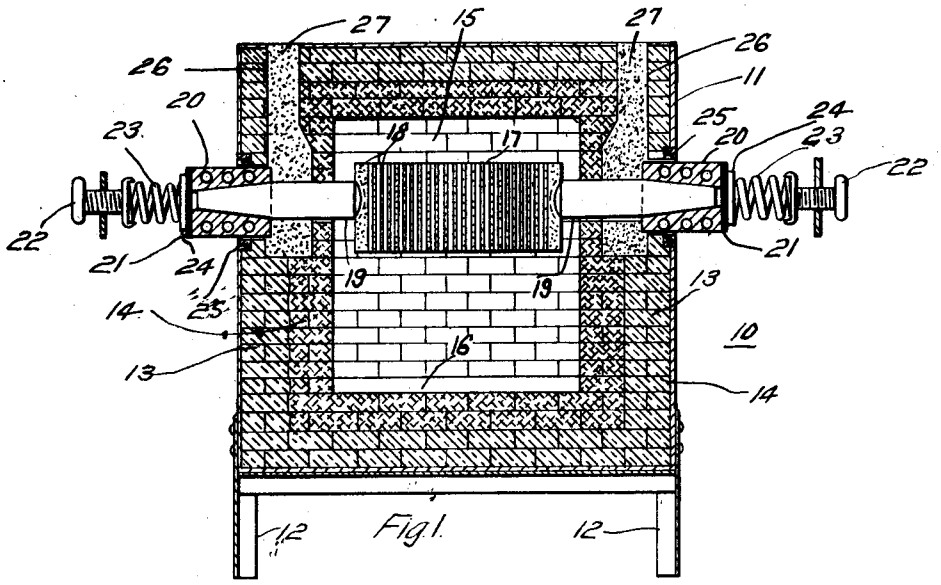


Fig1.

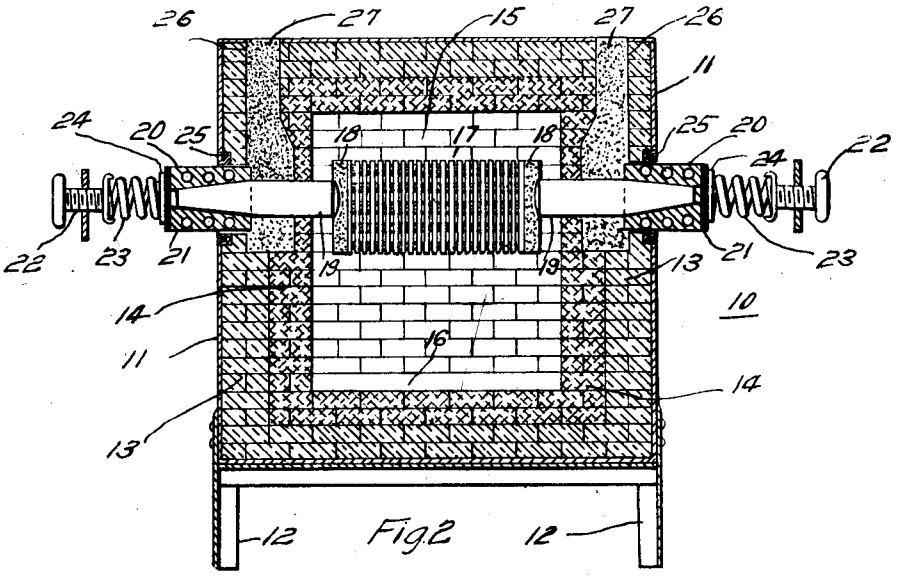


Fig2

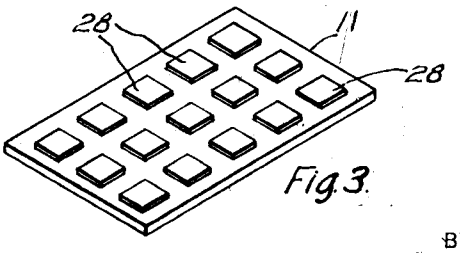


Fig.3.

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Patented Dec. 30, 1924. 1,521,028

UNITED STATES PATENT OFFICE.

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RESISTOR FOR ELECTRIC FURNACES.

Application filed May 24, 1921. Serial No. 472,094.

To all whom it may concern:

Be it known that I, GEORGE M. LITTLE, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Resistors for Electric Furnaces, of which the following is a specification.

My invention relates to electric furnaces and particularly to electric-resistance furnaces and it has for its object to provide a combination electric-furnace resistor comprising carbonaceous plates and granular carbonaceous material.

In my co-pending application, Serial No. 454,776, filed March 23, 1921, I have disclosed a resistance type of furnace in which the resistor consists of a plurality of relatively thin carbonaceous plates which are resiliently pressed against each other. The resistance of such a resistor element is relatively low, so that, in order to obtain the required heating effect, it is necessary to provide a source of electric energy of relatively low voltage and of high current capacity. The energy loss in the contact terminals and in the leads between the terminals of the furnace and the transformer or the control panel are, therefore, relatively high.

In practicing my invention, I provide a resistor element comprising a plurality of carbonaceous plates which are maintained in spaced-apart relation by interposing between two adjacent plates a thin layer of granular carbonaceous material or a plurality of relatively small carbonaceous plates. The built-up resistor element described above is resiliently compressed by suitable means and maintained in its operative position in the furnace chamber by the same compressing means.

In the single sheet of drawings:

Figure 1 is a view, in vertical cross-section, of an electric-resistance furnace comprising the device embodying my invention:

Fig. 2 is a view, in vertical cross-section of an electric resistance furnace comprising a modification of the device embodying my invention, and

Fig. 3 is a view, in perspective, of one element of the resistor employed in the modification illustrated in Fig. 2.

An electric-resistance furnace 10, comprises an outer metallic casing or framework 11, provided with suitable supporting members 12. Outer walls 13 comprise a plurality of bricks or blocks of any suitable heat-insulating material. Inner walls 14 comprise a plurality of bricks or blocks of any suitable high-temperature-resisting material. The inner walls are suitably spaced apart to form a furnace chamber 15 of any suitable or desired contour and dimensions.

As this type of furnace is intended to be employed for heating metallic objects, a suitable opening 16 is provided near the bottom of the furnace chamber through which the materials to be heated may be inserted and removed.

A resistor located in the chamber 15 comprises a plurality of carbonaceous plates 17.

In the modification illustrated in Figure 1, the adjacent plates 17 are spaced apart a short distance by means of a layer of granular carbon. To cause the granular carbon to adhere to a plate, it is only necessary to paint one of the flat surfaces of each plate with a thin layer of adhesive, such as dextrine, and sift a thin layer of granular carbon on this layer of adhesive. After a sufficient number of plates have been thus prepared, they may be stacked together, clamped, and then dried by the application of heat, after which the resistor is ready to be placed in the furnace chamber.

In order to provide a proper terminal for each end of the resistor, the graphite plate 18 is located at each end of the resistor and is provided with a depression in its outer surface. An electrode 19 consisting of carbonaceous material is provided, the inner end of which is adapted to operatively engage the depression in the graphite member 18. The electrode 19 may be substantially circular in lateral cross-section and relatively elongated to extend outwardly through the wall of the furnace.

A water-cooled metallic contact terminal 20 is mounted on the outer end of the electrode 19, and is provided with a central ap-

erture 21, substantially conical in form to fit on the tapering outer end of the electrode 19.

Resilient compressing means are provided and comprise an adjustable screw 22 and a helical spring 23, one end of which is pressed against the outer end of the contact terminal 20, an insulating member 24 being placed between the end of the spring 23 and the contact terminal 20 to properly insulate the two members from each other. It is to be understood that the resilient compressing means, as illustrated, is schematic only and that any suitable or desired resilient compressing means may be employed.

An annular member 25, which may consist of asbestos, is placed around the contact terminal 20 to effectively insulate this terminal from the metallic framework of the furnace.

As the temperature of the electrode is relatively very high at its inner end where it engages the graphite member 18 and may be almost as hot in the walls 13 and 14, I provide means for preventing the oxidation of this heated electrode by air which may leak past the contact terminal 20. This means comprises a well or hopper 26 in which is located a mass 27 of granular carbonaceous material which may be tightly tamped in place around the electrode 19. Further description of this part of the furnace is believed unnecessary, inasmuch as it constitutes the subject of my co-pending application Serial No. 472,093, filed May 24, 1921.

In the modification illustrated in Fig. 2, the means for separating the adjacent plates 17 comprise a plurality of plates 28 of carbonaceous material of relatively small area. These plates may be caused to adhere to the flat surface of the plate 17 by substantially the same means as hereinbefore described in connection with the resistor illustrated in Fig. 1. The modified form of resistor illustrated in Figs. 2 and 3 has an advantage over that illustrated in Fig. 1, in that the thickness of the means spacing apart the adjacent plates 17 are more uniform in thickness. This is of advantage in preventing breakage of the plates 17 when they are compressed by the resilient compressing means hereinbefore described.

I have found that, while the resistance of the resistor illustrated in Fig. 1 is relatively high at the beginning, it decreases a relatively large amount in the first few days of its use and I attribute this result to the action of the sooty vapor which I use in furnaces of this type to protect the carbonaceous resistor against the oxidizing effect of air entering the opening 16. Means for producing such a sooty vapor are described and claimed in my co-pending application Serial No. 464,290, filed April 25, 1921. It may be noted that the area of contact of a grain of the granular carbonaceous material with the plate 17 may be relatively very small, and, in some cases, may even form a "point contact." If any soot is deposited around this grain of material, the area of contact between it and the adjacent plate will be increased to a very appreciable extent, thus, of course, decreasing the resistance of the resistor element.

By making the area of the small plates 28 relatively small, as compared to the area of the plate 17, the resistance of such a built-up resistor may be made substantially equal to, or even greater than, that of the combined plate and granular carbonaceous material, and the effect of soot deposited around the small plates 28 is not as great as is the case when granular carbonaceous material is used. Hence, the resistance is not reduced as much as in the modification illustrated in Fig. 1.

It may be noted that I have illustrated a single built-up resistor element so that the two terminal electrodes are located on opposite walls of the furnace but this is not essential and I may use two parallel resistor elements, each one resiliently pressed against one side wall of the furnace, the two terminal electrodes being, therefore, located in one side wall of the furnace. This is not an essential element of my invention, however, and in no wise affects the inventive idea.

It may be noted that the device embodying my invention provides a relatively simple built-up resistor which has a higher resistance than the resistor built up only of flat plates and that this resistor is relatively inexpensive and easy to make. The higher inherent resistance permits the use of a smaller current to obtain the same heating effect as is obtained with a built-up carbon-plate resistor heretofore used.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof and I desire that only such limitations shall be placed thereon as are imposed by the prior art or are specifically set forth in the appended claims.

I claim as my invention:

1. An electric furnace resistor comprising a plurality of thin flat plates of refractory material, means comprising granular electric-conducting material for electrically connecting said plates over only a relatively small portion of their area, said means serving also to maintain said plates in substantially spaced-apart relation, and means for maintaining said resistor under substantially constant compression.

2. In an electric furnace, a plurality of

furnace walls enclosing a furnace chamber, a resistor in said chamber comprising a plurality of thin flat plates of refractory electrical-conducting material, refractory granular electrical-conducting means for connecting the flat surfaces of adjacent plates over only a relatively small portion of their area and for spacing said successive plates apart, and means for holding said resistor in said chamber free of said walls.

In testimony whereof, I have hereunto subscribed my name this 18th day of May 1921.

GEORGE M. LITTLE.