March 15, 1932. F. A. FAHRENWALD 1,849,288

ELECTRIC FURNACE RESISTOR ELEMENT

Filed July 11, 1930

Fig. 1.

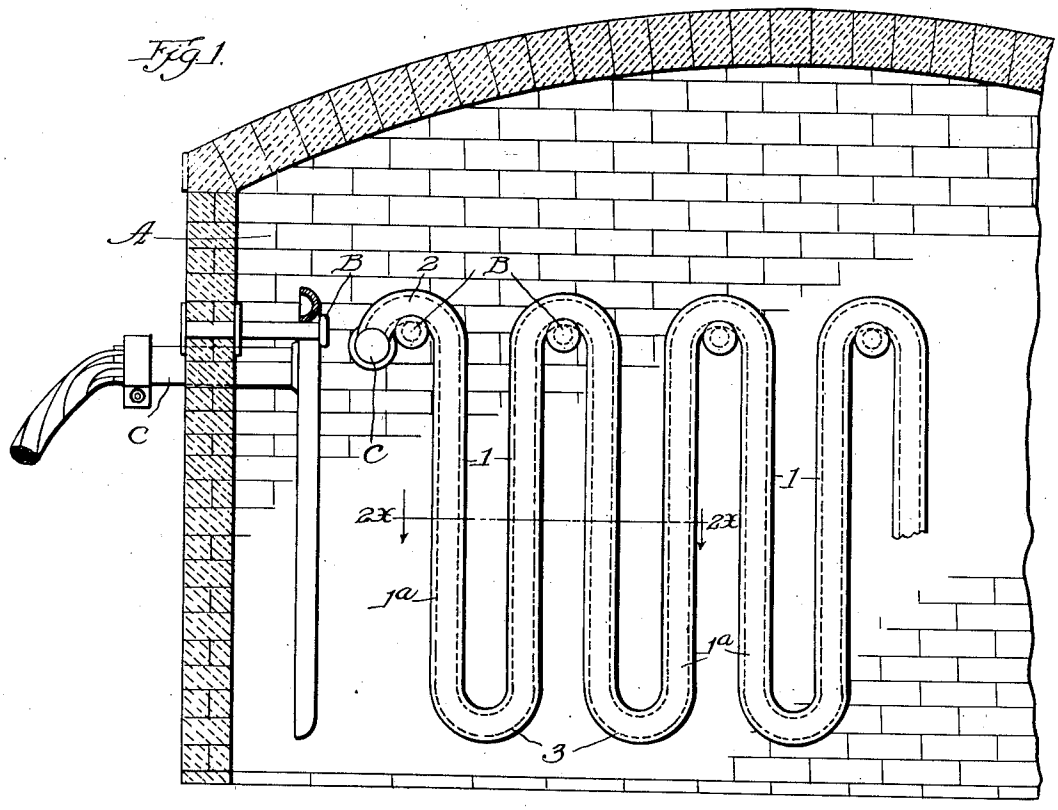


Fig. 2



Fig. 3.

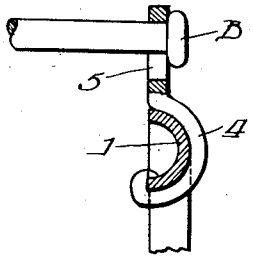


Fig. 6.

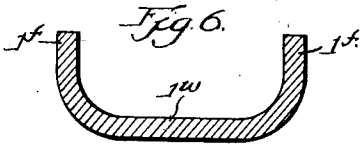


Fig. 4.

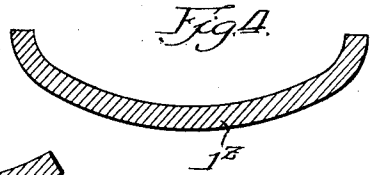
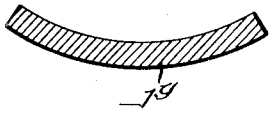


Fig. 5.



Witness:

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UNITED STATES PATENT OFFICE

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ELECTRIC FURNACE RESISTOR ELEMENT

Application filed July 11, 1930. Serial No. 467,219.

This invention relates to industrial furnaces of the kind in which the required heat is developed by electric resistance, and has for its object to provide a form of resistor or resistance grid which can be produced to good advantage by foundry methods from high heat resisting alloy, and which will have the capacity of retaining its form and integrity when produced in the form of a series of connected loops as if the resistance strip were doubled upon itself, and mounted upon conventional or other suitable supports carried by the furnace wall, for instance, inwardly projecting hangers over which the respective upper doublings of the grid may be engaged and from which the loops of depending members will remain in suspension.

Resistors consisting of flat strips of flexible material wound in serpentine form about upper and lower spaced projections on the inner furnace wall of an electric furnace have long been used in electric resistance furnaces. But resistors of this type are subject to injury in use, besides requiring sustention and guidance at their lower as well as their upper loops, and they are objectionable for other reasons. Resistors of massive form have also been used, produced by foundry methods, and such resistors have been designed with special sections adapting them to retain their form under the distorting stresses of high temperature, but few of these forms are suitable for the purpose owing to the problem of maintaining uniform density throughout the resistor under cooling problems at the time of casting.

The present invention has for its object to provide a special section for resistors or grids used in electric furnaces, which section will afford high efficiency in retention of form against distorting stresses at high temperatures; one which will be an easy section to cast with uniform density of metal throughout, and will lend itself with advantage to embodiment in a resistance grid comprising a number of vertical loops as well as to convenient suspension upon existing hangers or mounting means found within conventional types of electric furnace.

The invention consists in making the resistor grid with an arcuate transverse section which, while having the effect of stiffening flanges as a form retaining means, will avoid employment of any angular relations between a flange or flanges and the web or body of the resistor, and will insure desired uniform solidification of metal entering into the grid in the cooling process when the grid is cast and will make an altogether desirable form of grid from the viewpoint of surface radiation, rigidity of doublings or loops of the grid, and its capacity to sustain itself in suspension.

In the accompanying drawings—

Figure 1 is a sectional view showing the interior of a conventional electric furnace with a known form of hanger or grid-suspending means upon which a resistor or grid embodying the features of the present invention is installed.

Figure 2 is a section on line $2x$—$2x$ of Figure 1.

Figure 3 represents a modified means for suspending the grid; and

Figures 4, 5, and 6 illustrate variations in the design of a resistor of arcuate section.

A represents a portion of an electric furnace built of masonry, B represents hangers projecting from the walls of such furnace, and C represents a circuit connector, all of which may be of known construction.

Mounted upon the hangers B is a resistor element 1 given the form of a grid comprising a series of parallel vertical legs 1a united by upper doublings or loops 2 and lower doublings or loops 3. Such a grid may be supported in the furnace by leaving it in suspension with its upper doublings 2 engaged over supports B, or it may be equipped with a hanger 4 (Figure 3) having a form especially adapted to the resistor section and constructed with an eye 5 by which it may be hung upon the support B.

In order to make the resistor 1 rigid against distortion under the influence of heat, a large part of its section is given a direction or directions at substantial angles to the general plane of the grid which the resistor forms; but the several portions of the resistor sections are merged together without angles of

meeting and preferably without material change in the thickness of the metal. This is due to the fact that the section of the resistor is arcuate in form, being either a simple arc of a circle as illustrated at 1 in Figure 2 where the arc is substantially a semi-circle or at 1*y* in Figure 5 where a segment is employed that is considerably less than a semi-circle, or a complete arc as shown at 1*z* in Figure 4 where it is substantially one-half of an ellipse divided on its major axis; or it may be of other arcuate forms appropriate to the avoidance of abrupt changes in direction or thickness of metal. As suggested in Figure 6, some of the lines of the section of the resistor may be straight lines, as in the production of the web portion 1*w* and stiffening flanges 1*f*, so long as the flange portion and web portion are united by arcs of sufficient radius to avoid abrupt changes in direction.

An important feature of the invention incident to the various designs which may be employed, is that the resistor may be cast with its hollow side up, and when so cast, all inclined or upwardly extending portions will stand in such relation to the lowermost portion as will insure solidification of the metal under the influence of gravity at the time the cast is cooled; and a portion of the lines along the middle or web portion of the body which lies horizontal in casting may even be straight if the upwardly extending parts are sufficient in mass to make effective risers in feeding molten metal toward the middle of the casting; and, of course, the upstanding of flange-like portions, so long as they merge with the web-like portions through means of arcuate portions, can include straight lines as illustrated in Figure 6. The form of section shown in Figure 6 is intended to be included in the term "substantially arcuate section."

I claim:

A heat-developing resistor for electric furnaces, comprising an integral casting of heat resisting material having massive section and comprising a series of members united by curved portions, the section of the resistor throughout, and including the curved portions, being of uniformly curved channel form, free from angles or abrupt deflections.

Signed at Chicago, Illinois, this 1st day of July, 1930.

FRANK A. FAHRENWALD.