J. THOMSON.

ELECTRIC FURNACE.

APPLICATION FILED SEPT. 1, 1909.

994,217. Patented June 6, 1911

Fig. 1.

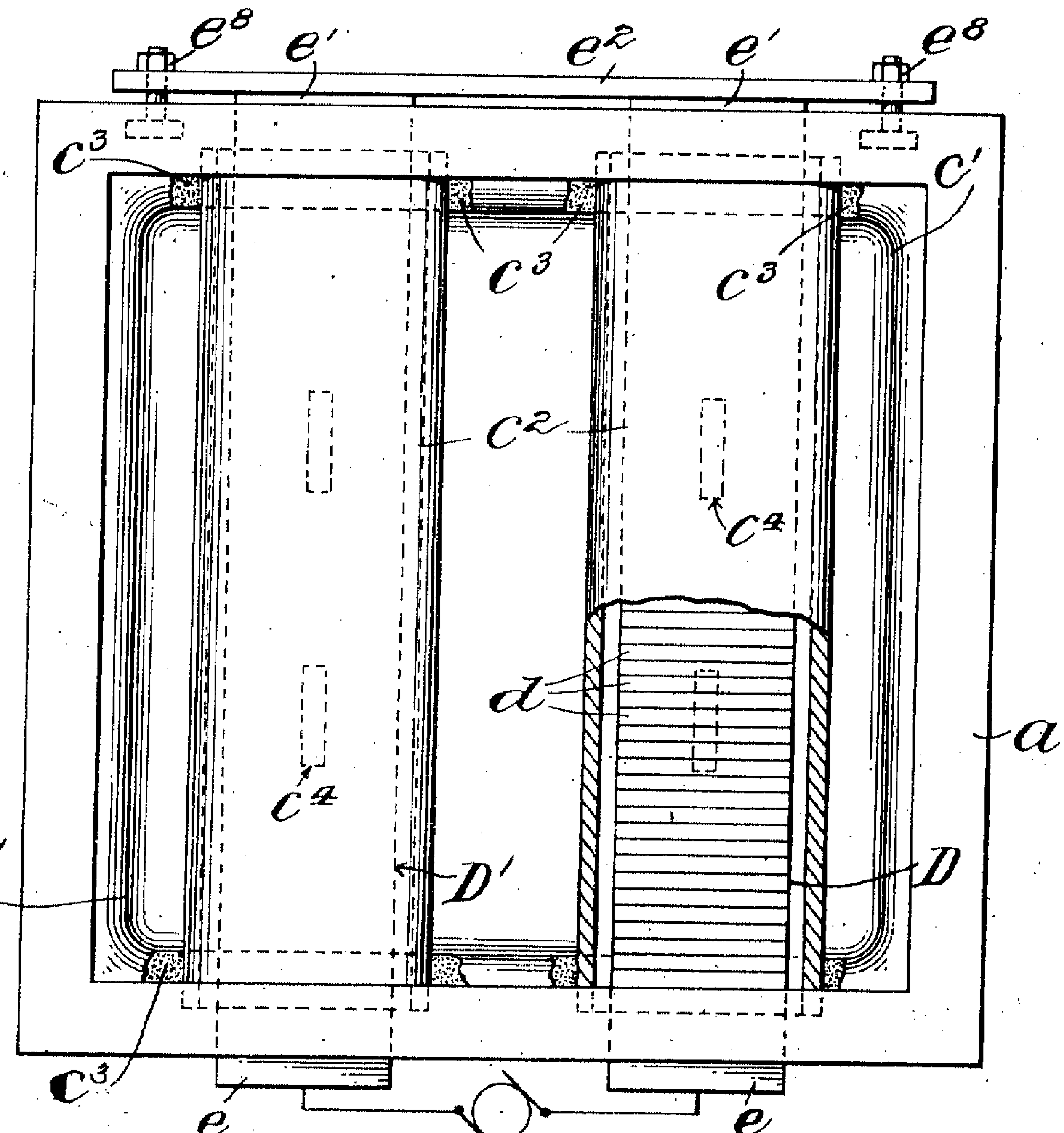
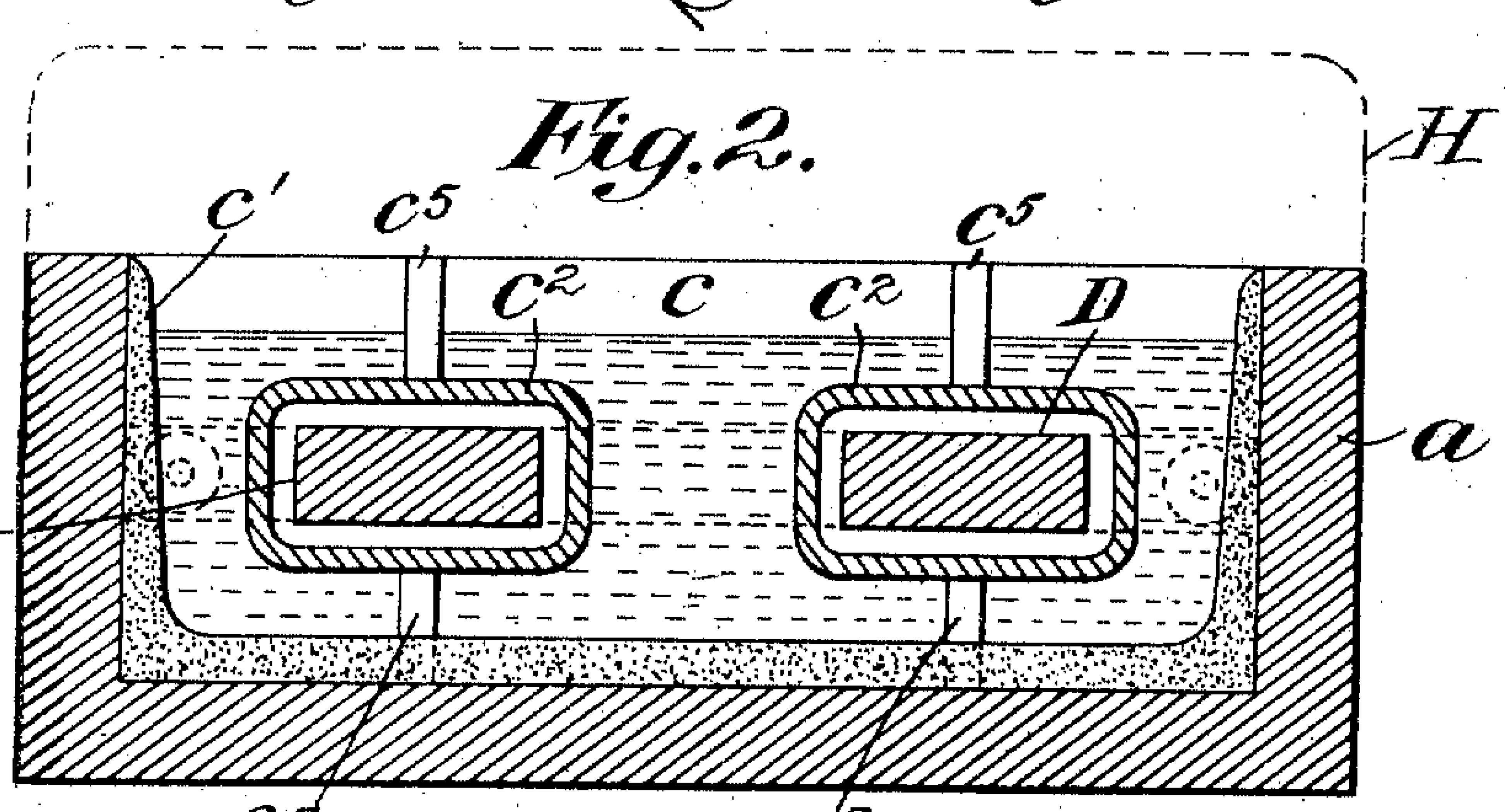


Fig. 2.



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ELECTRIC FURNACE.

994,217. Specification of Letters Patent. **Patented June 6, 1911.**

Application filed September 1, 1909. Serial No. 515,700.

To all whom it may concern:

Be it known that I, JOHN THOMSON, a citizen of the United States, and a resident of the borough of Manhattan of the city of New York, in the county and State of New York, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

This invention relates to improvements in electric furnaces of the type in which heat is generated by passing the current through a resistor ordinarily formed of carbon.

The general object of the improvements is to provide a furnace of this type in which the thermal loss due to radiation shall be as little as possible; and in accordance with the improvements the resistor is arranged so as to be either partially or wholly immersed in the bath. In order that the resistor may be electrified, while thus partially or wholly surrounded by the material to be heated, a casing or shield is provided to envelop the resistor and thus prevent the bath from coming in contact with it. By this means too, the resistor is protected from the effects of the oxygen and other active constituents of the gases of the melting chamber, this in fact being another object which the invention is designed to effect.

A convenient and practical embodiment of the invention is illustrated in the furnace shown in the accompanying drawings, in which,

Figure 1 is a top plan view of said furnace with the cover removed, showing a portion of the interior in horizontal section, and, Fig. 2 is a transverse central section of Fig. 1, the cover being, in this instance, indicated by the broken lines, as H.

The brick casing a is provided with a refractory lining c' to form the melting chamber c across which the resistor extends. In the present case, the resistor is comprised of two main sections, D and D', each section having a pair of limiting terminals e and e', whereby the two sections may be electrified separately or in parallel or, as illustrated in the present case, connected up in series by having the terminals e' joined by the connector piece e^2 and the terminals e connected to an electric circuit as shown. The terminals e' are arranged to be slidable and bolts and nuts e^3 are provided for imparting, through the connector piece e^2, the required amount of end-thrust upon the terminals e' for a purpose presently to be explained.

The resistor, so far as the present invention is concerned, may be constructed in various ways; in the present case, each section thereof is built by aggregating a plurality of individual members d, the opposing faces of which are formed so as to interlock with each other, whereby under a suitable end-thrust, acting along each section, the latter may be supported in a direct line without any extraneous means of support except at the terminals. The details of construction of the elements of such a resistor and their relation to the terminals are more particularly set forth in Letters Patent No. 950,879, dated March 1, 1910, filed September 1, 1909, and it will, therefore, be unnecessary to repeat that description here.

Each section of the resistor is suspended well down in the melting chamber and is provided with means to shield it from contact with the bath, such shield being preferably in the form of a refractory casing c^2 built into the furnace walls at each end and completely surrounding or enveloping that portion of the resistor which would otherwise be exposed to the melting chamber. The casing, however, has no physical contact with the resistor but, on the other hand, there is a clear space, as shown in Fig. 2 of the drawings, left between the inner surface of each section of the casing and the exterior surfaces of the corresponding portions of the resistor and the contiguous parts of the terminals which the casings encompass. The casings are thus electrically insulated by space from the resistor. Moreover, the ends of the casings are preferably left open so as to be free for the terminals to extend through, and where the ends rest in the refractory lining c' of the melting chamber, they are luted or built into the lining, as at c^3, Fig. 1, in order to prevent leakage of fluid metal around said ends.

Manifestly, by the foregoing construction, the resistor may be so disposed that the bath shall partially or wholly surround it, as the physical contact of the contents of the furnace chamber is wholly with the casing c^2. In this wise, all of the heat generated in the resistor, except that radiated outwardly at the terminals, is necessarily transmitted to the casing and thence, by direct conduction, to the charge. As heat will thus be very rapidly absorbed, so also can energy be correspondingly delivered to the resistor thereby deriving the advantageous condition of being able to furnish, through a given resistor, the largest possible quantity of heat units in the shortest period of time.

Before applying current to the resistor, the space between it and its casing may be filled, if desired, and so maintained, with an inert gas, displacing air and its contained oxygen; but no claim of invention is made herein to the surrounding of the resistor with an inert gas.

The material of which the casings are formed may be that best adapted for withstanding the action of the substance with which the casings are in contact. Ordinarily fire clay, "crucible mixtures", that is, combinations of graphite and clay, and recrystallized silicon carbid would be used. The peculiarly favorable features of the last named material are set forth in an earlier application for Letters Patent, filed May 13, 1909, Serial No. 495,585. But in any instance, the electrical conductivity of the casing-material needs not to be considered in that it is insulated from the resistor and its terminals by space. Again, as the casing is subjected almost entirely to compressive strains, the extent of which is limited by the depth of its immersion and the density of the fluid, its wall may be made about as thin as can readily be molded. To relieve the casing of transverse strains, it may be supported by refractory props c^4 and confined against flotation stresses by the parts c^5.

In many metallurgical operations this furnace may be run continuously, as once the bath is established the ore or metal can be readily fed, say through openings in the cover, and the accumulated residue can be drawn off through suitable taps (not shown). With respect to the resistor and its casings, it will be apparent that the effect of slags, pernicious gases, oxygen or the atmospheres of various metallic vapors is eliminated from the problem on account of the inclosing of the resistor, and need not be considered. Any temperature within the range of usual commercial requirements can be obtained and uniformly maintained, and the thermal loss due to radiation will be the least possible, in any like instance of heat insulation, in that no part of the melting chamber can be hotter than, or as hot as, the bath itself. And while the resistor and its casings are shown in the drawings as being completely immersed, it is pointed out that if for any purpose it should be desirable, they may readily be partially withdrawn thereby acting upon the bath by a combination of direct heat-conduction below and reverberation from the cover above. Moreover, this system lends itself equally well to forms of furnaces other than that denoted in the drawings, such say, as the oscillatory and rotary types.

I claim as my invention:

1. An electric furnace having a melting chamber provided with a refractory lining, a resistor the lower part of which is lower than the top of the lining and a casing extending around the lower part of the resistor to protect it from the molten metal in said chamber, there being a free space between the casing and the resistor, the resistor comprising interlocked resisting members.

2. An electric furnace having a melting chamber provided with a refractory lining, and an incased resistor, there being a free space between the resistor and its casing and the resistor and casing both being located at a lower elevation than the top of the lining, the resistor comprising interlocked resisting members.

3. An electric furnace having an incased resistor which is adapted to be immersed in a molten bath or charge of material to be melted, said resistor formed of a plurality of interlocking members.

4. An electric furnace having a resistor adapted to be immersed in a molten bath or charge of material to be melted said resistor being formed with a plurality of interlocked resisting members and a casing surrounding said resistor and separated therefrom by a free space.

5. An electric furnace having an incased resistor which is adapted to be immersed in a molten bath or charge of material to be melted, said resistor formed of a plurality of interlocking members operated in series, and electrically connected outside of the furnace chamber.

6. An electric furnace having a resistor adapted to be immersed in a molten bath or charge of material to be melted said resistor being formed with a plurality of interlocked resisting members and a casing surrounding said resistor and separated therefrom by a free space, the said resistor being electrically connected outside of the furnace chamber and the interlocking members thereof being operated in series.

This specification signed and witnessed this 31st day of August, A. D., 1909.

JOHN THOMSON.

Signed in the presence of—
M. Rollins,
G. McGrann.