J. THOMSON.
ELECTRIC FURNACE.
APPLICATION FILED SEPT. 1, 1909.

950,881. Patented Mar. 1, 1910.

Fig. 1.

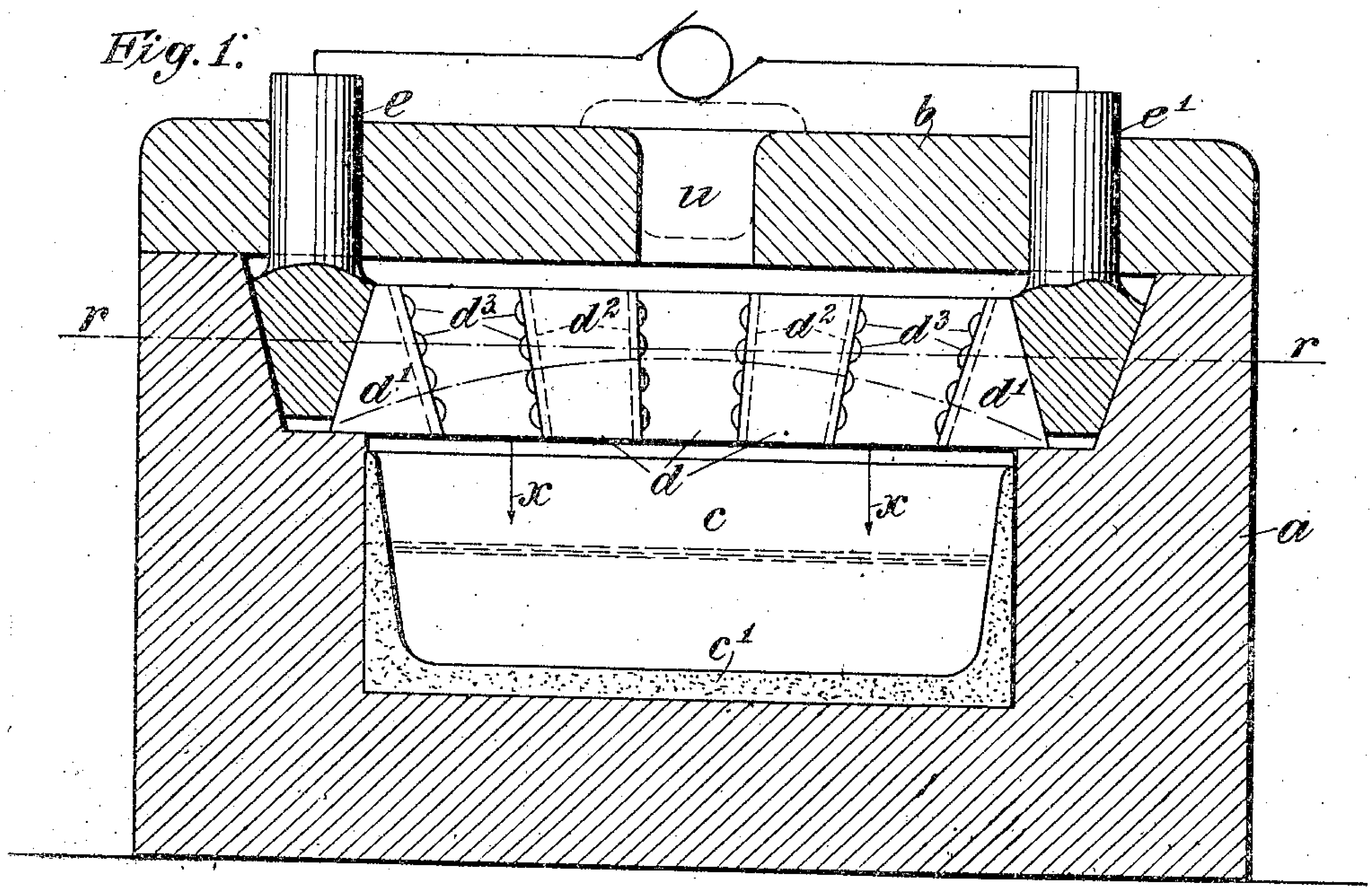
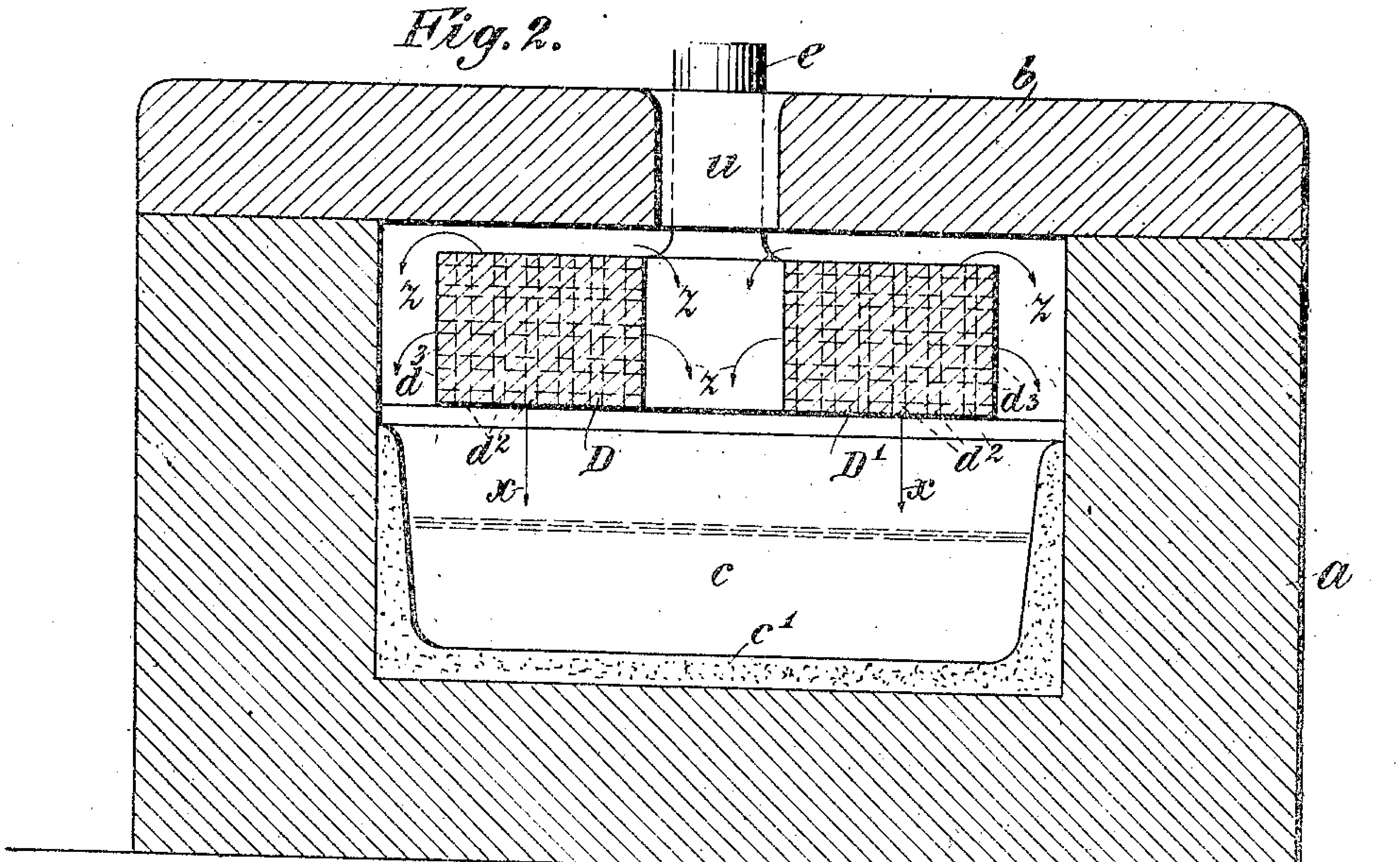
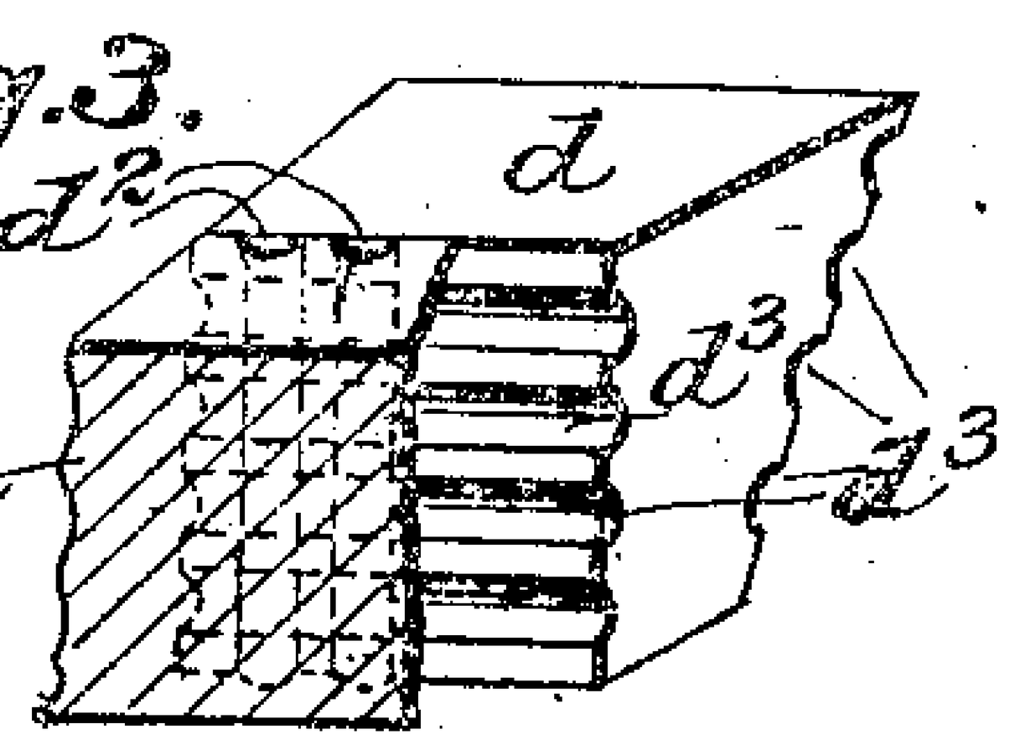


Fig. 2.



WITNESSES:

Fig. 3.



INVENTOR

BY

ATTORNEYS

UNITED STATES PATENT OFFICE.

JOHN THOMSON, OF NEW YORK, N. Y., ASSIGNOR TO IMBERT PROCESS COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRIC FURNACE.

950,881. Specification of Letters Patent. Patented Mar. 1, 1910.

Application filed September 1, 1909. Serial No. 515,701.

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.

The invention relates more particularly to improvements in resisters of electric furnaces and to the parts immediately associated therewith, and one of its objects is to provide a resister, composed of a plurality of members, which may be supported or suspended at its ends upon the furnace walls, but which shall otherwise be self supporting while spanning the chamber in a direct line.

In another application for Letters Patent filed September 1, 1909, Serial No. 515,698 I have shown how a resister, composed of a plurality of elements, may be supported wholly from its ends through the interlocking of its elements. In the present case, the resister elements are not interlocked with each other nor with the terminals but, in accordance with the invention, are composed of irregular or wedge-blocks arranged to form what is known architecturally as a flat arch.

Another object of the invention is to form the resister or elements thereof so that it shall have a high resistivity and also to provide means for automatically compensating variations in its length due to thermal changes, without materially increasing or decreasing the initial compression therein.

Referring to the drawings, Figures 1 and 2 are respectively a longitudinal center section and a transverse center section through an electric furnace embodying the improvements, and, Fig. 3 is a perspective view, partly broken away, showing two adjacent blocks and the grooves formed in their abutting faces.

In said furnace the melting chamber *c* is suitably formed in the brick-work *a*, being provided with a refractory lining *c'* and a cover *b* through which a charging opening *a* may be formed.

The resister is compounded in two sections, denoted generally by D and D', and these sections are shown as being connected up in parallel between the terminals *e* and *e'*. In the drawings, the heat waves passing to the charge are represented by arrows, the arrows *x* representing the direct waves and the arrows *z* the indirect waves. Each section of the resister is constructed, in the present case, of irregular or wedge-blocks *d* whose sides generally converge to a common center but are formed to produce a beam whose upper and lower surfaces are parallel each to the other, thus constituting what is designated architecturally as a flat arch. The controlling advantages of this form of arch over that where the upper and lower surfaces are arcs of circles, are that the expansive and contractive actions, due to thermal changes, may be maintained in a straight line, as *r*, and that the cross sectional area from the center of one terminal to that of the other is uniform. The end blocks of each section of the resister, denoted by *d'*, rest upon the brick-work of the furnace and the intervening blocks between the end-blocks are supported through said end blocks. Now, it will be understood that when the resister becomes highly heated the blocks will expand thus requiring some means to be provided, in cases where they are closely compacted, as here, for preventing deformation thereof and for preserving so far as possible the initial compression therebetween. For this purpose, the ends of the resister sections are beveled and the brick-work facing the ends of the resister sections is beveled in the opposite direction, as shown clearly in Fig. 1 of the drawings, and wedge-shaped connecting or conducting pieces are inserted between the brick-work and the ends of the resister sections. In the present case, these pieces are formed integral with the terminals *e* and *e'* respectively and thus may be referred to as the terminals. Assuming now that the angle on each side of each connector piece or terminal is approximately equal to that of the wedge-blocks, then the sum of the two is double and for a given end-thrust along the line *r*, the said connector piece or terminal will have twice the tendency to rise over that of any of the resister mem-

bers. The consequence is that the terminals, being freely mounted in the cover, will rise or fall as the resister expands or contracts, whereby a practically uniform state of contact resistance can be automatically maintained. And it will be obvious that the wedge connector pieces or terminals may be employed in other forms of resisters particularly where the resister elements are closely compacted, as in the present case, with the same utility and effect. Where the lower ranges of electrical resistance are desired, the wedge-blocks should have smooth surfaces at their contacting faces, but where higher resistances are to be obtained, as is usual in modern practice, these faces may be formed so that only a portion of one face will contact with its opposing face. For, longitudinal recesses d^3 may be formed in one of the faces of each block so that, when the blocks are placed together with the faces containing the longitudinal recesses abutting against smooth faces, as illustrated in Fig. 1, then the raised portions formed by the longitudinal recesses in any face will alone contact with the opposing smooth face and will form line contacts, as is obvious. Again, by forming transverse grooves, as d^2, whose raised portions may contact against a smooth surface, the same result is accomplished as in the case of the longitudinal grooves. Finally, by combining longitudinal recesses in one surface and transverse recesses in an abutting surface, the recesses in such opposing surfaces lying at right angles to each other as indicated in Fig. 2, there will result a point or dot contact between opposing blocks. Thus, where line contacts are employed a comparatively high resistance may be obtained, and where point and dot contact are used, a still higher resistance will result. It is to be noted, particularly in view of the application for Letters Patent alluded to hereinbefore, that in the instances here cited there is no interlocking of the recesses nor do they act in any way to sustain or assist in sustaining the resister as a whole. Moreover, the recesses have a contingent advantage in that they afford, especially when the grooves are crossed upon each other, an excellent and rapid escape for the heat developed in the interior of the resister.

It will be obvious that the terminals may be otherwise located than in the cover and that, instead of moving vertically, the connector pieces at the ends of the resister sections may move along the line r against any adequate medium of resilient or manual adjustment (not shown) without departing from the spirit of the invention.

I claim as my invention:

1. An electric furnace having a self-supporting resister composed of a plurality of irregular blocks arranged in the form of a flat arch.

2. An electric furnace having a self-supporting resister composed of a plurality of irregular carbon blocks shaped so as to form when assembled a flat arch.

3. An electric furnace having a resister composed of a plurality of elements and wedge shaped conducting pieces at each end of the resister, said pieces being movable to compensate for thermal changes.

4. An electric furnace having a resister composed of a plurality of members and supported from the end members thereof, and wedge shaped conducting pieces abutting against said end members respectively, said pieces being movable to compensate for thermal changes.

5. An electric furnace having a self-supporting resister composed of a plurality of irregular blocks arranged to form a flat arch, and means for automatically compensating variations in the length of the resister due to thermal changes.

6. In an electric furnace, a resister composed of wedge shaped carbon blocks arranged in a direct line and supported wholly from the end blocks.

7. In an electric furnace, a flat resister formed of wedge-blocks, the said resister spanning the melting chamber and being supported wholly by the brick-work at each end and terminal connections for said resister.

8. In an electric furnace, a flat resister formed of wedge-blocks, the said resister spanning the melting chamber and being supported by the brick-work, and beveled conducting pieces at the ends of the resister against which the resister impinges right and left, the said conducting pieces being adapted to yield to compensate variations in the length of the resister due to thermal changes.

9. In an electric furnace, a flat resister composed of wedge-blocks, and wedge-terminals interposed at each end between the resister and the brick-work.

10. An electric furnace having a compound resister each section of which is composed of wedge-blocks arranged in a direct line, and wedge terminals at each end connecting said sections in parallel and adapted to compensate variations in the length of said sections due to thermal changes.

11. In an electric furnace, a resister formed of a plurality of members, some of the members having one surface grooved to reduce the area of contact between such members and adjacent members.

12. In an electric furnace, a resister composed of wedge-blocks, some of the blocks having one surface grooved to reduce the area of contact between such blocks and adjacent blocks.

13. In an electric furnace, a resister composed of a plurality of members having grooved surfaces, the blocks being arranged so that the grooves run crosswise to each other in opposing faces of adjacent blocks in order to produce point contacts between the blocks.

14. In an electric furnace, a resister composed of wedge-blocks whose contacting surfaces are grooved crosswise to each other in order to produce point contacts at or near the intersections of said grooves.

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

JOHN THOMSON.

Signed in the presence of—

M. ROLLINS,

G. MCGRANN.