July 28, 1925. 1,547,623

E. L. SMALLEY

ELECTRIC FURNACE

Filed Aug. 11, 1922 3 Sheets-Sheet 1

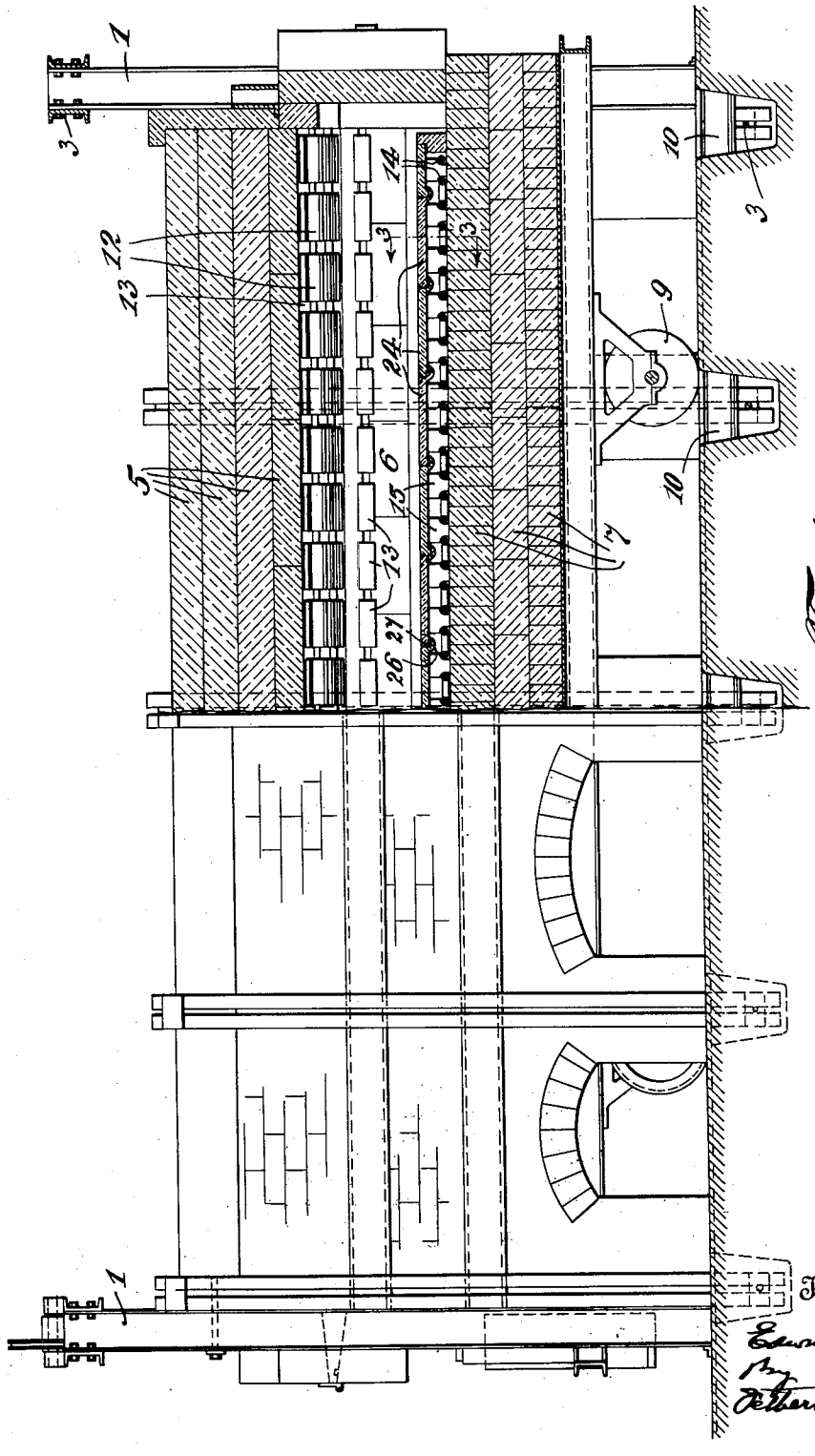


Fig. 1.

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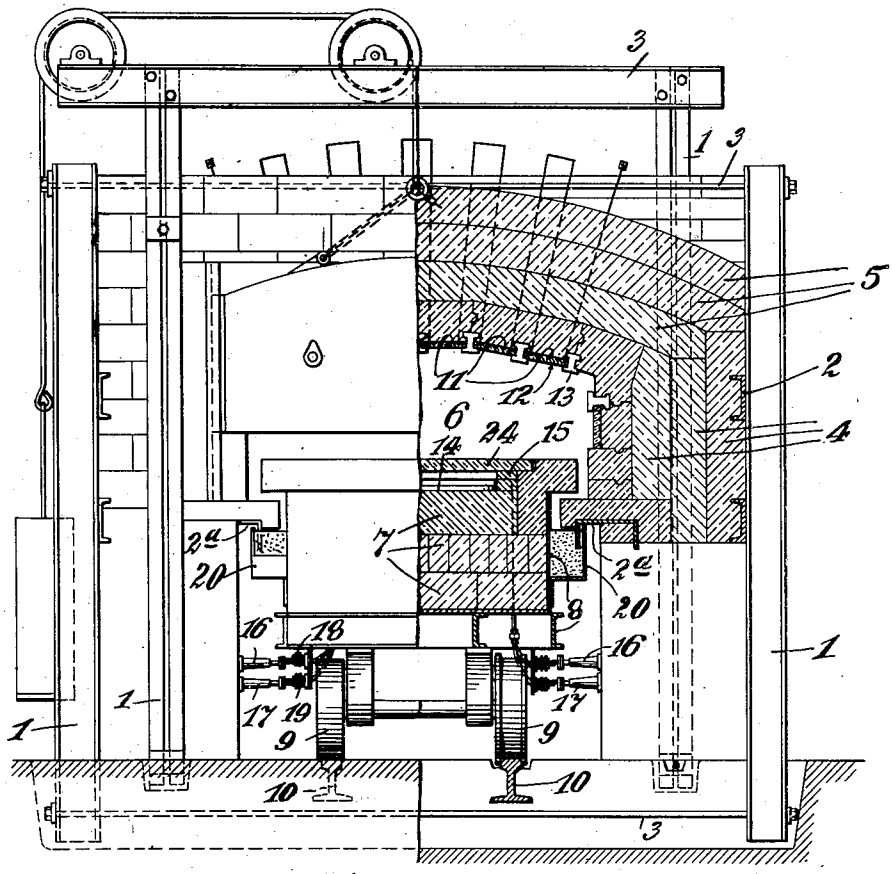


Fig. 2.

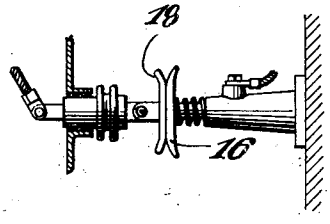


Fig. 6.

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ELECTRIC FURNACE

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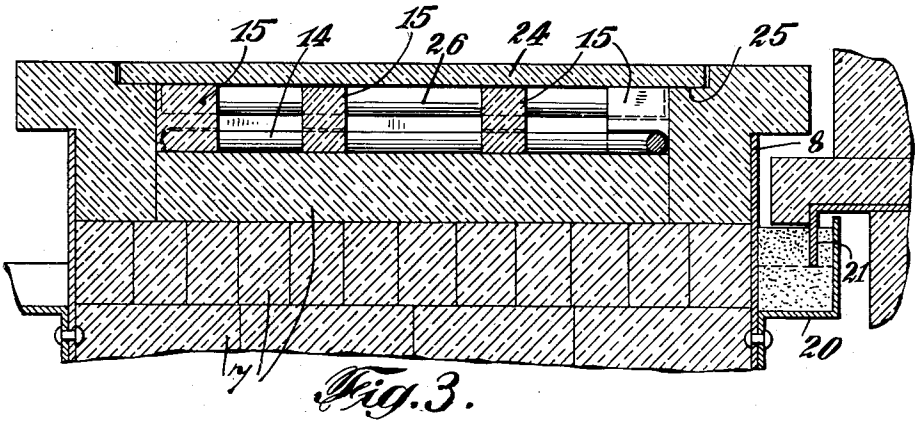


Fig. 3.

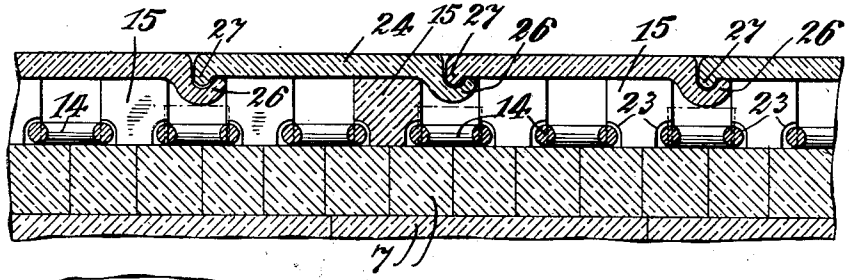


Fig. 5.

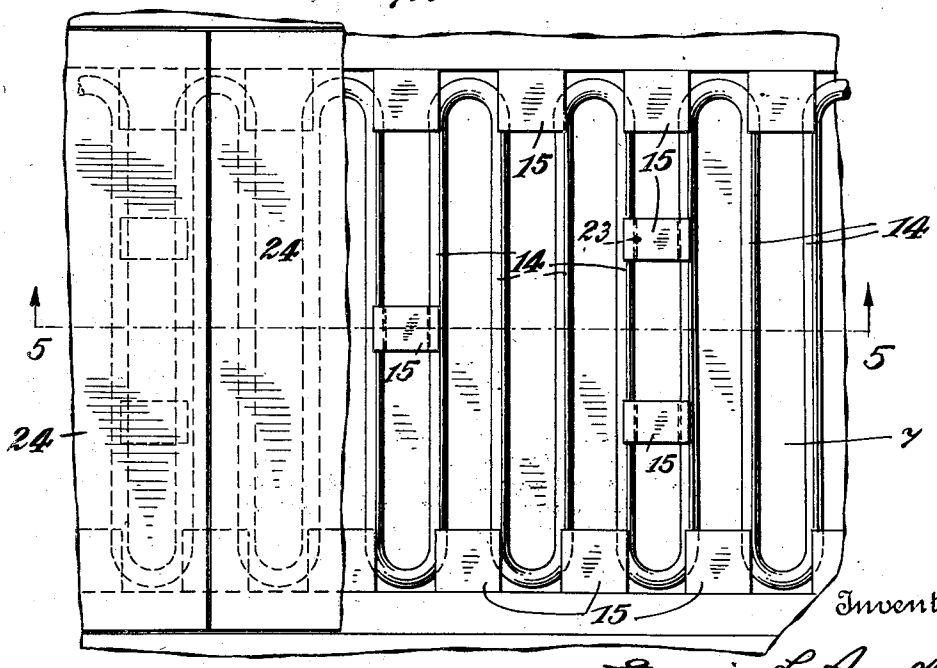


Fig. 4.

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Patented July 28, 1925. 1,547,623

UNITED STATES PATENT OFFICE.

EDWIN L. SMALLEY, OF SOUTH ORANGE, NEW JERSEY, ASSIGNOR TO ELECTRIC HEATING APPARATUS COMPANY, OF NEWARK, NEW JERSEY.

ELECTRIC FURNACE.

Application filed August 11, 1922. Serial No. 581,192.

To all whom it may concern:

Be it known that I, EDWIN L. SMALLEY, a citizen of the United States, residing at South Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a clear and exact specification.

My invention relates to improvements in electrical furnaces and the same has for its object more particularly to provide a furnace which is efficiently and economically operated and in which the material to be heated may be readily conveyed to and removed therefrom.

Further said invention has for its object to provide a furnace in which the bottom or base thereof is movable into and out of the furnace and in which the heating elements are automatically controlled by the movement of said support or base.

Further said invention has for its object to provide a furnace in which improved means is provided for retaining the resistor elements in place upon the furnace wall or support.

Further said invention has for its object to provide a furnace in which the heating elements thereof are protected against the access of foreign matter or the like thereto.

Other features and advantages of my invention will hereinafter appear.

In the drawings:—

Figure 1 is a side elevation of my improved electric furnace shown partly in section.

Fig. 2 is a front elevation thereof, partly in section.

Fig. 3 is a partial section, enlarged, taken on the line 3—3 of Fig. 1.

Fig. 4 is a partial, top view, enlarged, of the car floor, the covering plates for the heater units being broken away.

Fig. 5 is a section on the line 5—5 of Fig. 4, and

Fig. 6 is an enlarged, detail top view of a conductor rail and contact shoe.

In the furnace construction here represented, let 1 indicate the vertical members of its metallic frame, 2, 2^a, the longitudinel members, and 3 the transverse members. The brick work, forming the walls 4 and top 5, is of any suitable character. The furnace interior, 6, is shown as open at its bottom, that is to say, while the furnace walls and top are of integral or continuous structure, the bottom thereof is movable, being in the form of a car, composed of the bricking 7, having a metallic frame 8 and mounted on wheels 9, that run on rails 10.

The heating units disposed along the walls 4 and top 5 are represented as resistors 11 carried by refractory plates 12, which are themselves supported by rails 13 that project from the inner surfaces of said walls and top.

With electric furnaces of large size such as are comprehended by my invention for the heat treatment of large objects, especially where such objects have considerable length, it is desirable that the base portion of the furnace, upon which the objects are to be supported, should be movable into and out of the housing. Therefore I have provided the car structure referred to, with wheels to run on a track that extends completely under the furnace and also extends beyond the furnace, so that the car can be loaded up with the objects to undergo treatment outside the furnace, and then moved into the furnace to form a constituent part thereof. When the objects upon the car have received their heat treatment the car can be withdrawn from the furnace.

It is desirable, in an electric furnace, that its floor, as well as its sides and top, should be provided with sources of heat, so that the heating zone may extend clear around the furnace interior.

To meet this requirement I have devised the movable furnace bottom, herein represented, with furnace bricking, resistor elements 14 disposed thereon, and spacers 15, the latter as examples of means for maintaining the alignment of the resistor lengths, thus preventing distortion thereof and possible short circuiting.

I have also found it desirable to institute automatic means for energizing the resistor element or elements upon a movable furnace bottom, and to that end have provided stationary rails 16, 17, within the furnace, forming respective terminals of a power circuit, and have installed contact shoes 18, 19 upon the car, connected with the resistor terminals, to serve as collectors therefor. Since the shoes 18, 19 are so disposed upon the car that they will effect sliding contact, respectively, with the rails 16, 17, it follows that a circuit can be closed through the re-

sistors 14 in the mere act of moving the car bottom into the furnace.

Therefore, as will be apprehended, the movable furnace bottom forming a part of my invention, in effect itself constitutes a complete heating unit whose functioning may depend solely upon its being moved into the furnace, and which becomes de-energized as soon as it is withdrawn therefrom; all without the expenditure of time and labor in adjusting or releasing electrical connections.

The metallic frame of the car structure is shown as having secured thereto, at its opposite sides, longitudinal angle members 20 that comprise troughs to contain sand, and pendent flanges 21 that extend from the metallic framework of the furnace are adapted to enter these troughs when the car is moved into the furnace, to thereby form sand seals, thus preventing the escape of furnace heat.

It will be noted, particularly by referring to Figs. 2 and 3, that the top of the bricking of the car is recessed to form a receptacle to contain the resistor elements, and that these elements, which may be composed of spaced, end connected members of any suitable character, here shown as return bend coils, are maintained in position by spacer blocks or members 15 of refractory material interposed between said element 14 and the walls of the receptacle and disposed between successive strands or portions of said elements at points between the successive bends thereof to maintain said strands in spaced relation, said blocks being provided with grooves or recesses 23 therein receiving adjacent portions of said element and permitting the blocks to extend over the strands to hold the same against the substantially smooth unbroken surface of the bottom on which the element is disposed.

By the use of these spacer blocks the resistors are retained in their set positions without the interposition of continuous insulation between the resistor lengths, and thus an open heat field is provided in the horizontal plane of the resistors which I find highly conducive to thermal efficiency.

Practice has proven that the absence of separating material between the adjacent lengths of a resistor, thereby leaving the lateral plane occupied by the resistor element otherwise entirely clear or free, has the effect of permitting more rapid heat release to the furnace interior.

The element 14 is protected by covering means composed of a plurality of members or plates 24 fitting in recesses 25 formed in the walls of the car and supported thereby and by the blocks 15. A closed joint is provided between adjacent edges of the several plates to prevent access of foreign material or of dirt to the elements 14. The means employed for this purpose consists in providing each plate with an upwardly facing groove 26 along one edge and with a downwardly extending flange 27 along the opposite edge of the same, the flange 27 of one plate fitting into the groove 26 of the adjacent plate, whereby the plates are interengaged or overlapped and a closed joint is provided. The plates or covers 24 serve as a support or top on which the material to be heated is placed for entry into the furnace.

Variations within the spirit and scope of my invention are equally comprehended by the foregoing disclosure.

I claim:—

1. An electric furnace comprising a top portion, a base portion constituting a movable support for conveying the material to be heated, a heating element carried by said base portion, and means for energizing said heating element, substantially as specified.

2. An electric furnace comprising a top portion, a base portion enclosing with said top portion the interior space of said furnace, and constituting a movable support for conveying the material to be heated, a heating element carried by said base portion, and means for energizing said heating element, substantially as specified.

3. An electric furnace comprising a refractory top portion, a refractory base portion enclosing with said top portion the interior space of said furnace, and constituting a movable support for conveying the material to be heated, a heating element carried by said base portion, means for energizing said heating element, and a cover for said heating element directly exposed to the heat thereof and serving to support the material to be heated, substantially as specified.

4. An electric furnace comprising a top portion, a base portion constituting a movable support for conveying the material to be heated, a return-bend resistor element disposed horizontally upon said base portion, and a cover for said resistor element directly exposed to the heat thereof and serving to support the material to be heated, substantially as specified.

5. An electric furnace comprising a refractory top portion, a refractory base portion enclosing with said top portion the interior space of said furnace, and constituting a movable support for conveying the material to be heated, a return-bend resistor element disposed horizontally upon an upper surface of said base portion, means for energizing said resistor element, and a cover for said resistor element directly exposed to the heat thereof and serving to support the material to be heated, substantially as specified.

6. An electric furnace comprising a refractory top portion, a refractory base portion constituting a movable support for conveying the material to be heated, a pre-

formed return-bend resistor element disposed horizontally upon said base portion, refractory means interposed at intervals between the strands of said resistor element for maintaining the same in position on said base portion, a cover for said resistor element directly exposed to the head thereof and serving to support the material to be heated, and means for energizing said resistor element, substantially as specified.

7. An electric furnace comprising a refractory top portion, a refractory base portion enclosing with said base portion the interior space of said furnace, and constituting a movable support for conveying the material to be heated, a return-bend resistor element disposed horizontally upon said base portion, refractory means interposed at intervals between the strands of said resistor element for maintaining the same in position, a cover for said resistor element directly exposed to the heat thereof and serving to support the material to be heated, a resistor element in said furnace above the plane of said cover, and means for energizing said resistor elements, substantially as specified.

8. The combination with an electric furnace having a floor, of a resistor composed of endwise connected, separated strands located on said floor, and spacers of relatively short length disposed between adjacent strands of the resistor, thereby leaving a heat zone clearance in the lateral plane of the resistor strands.

9. The combination with an electric furnace having a floor, of a resistor composed of endwise connected, separated strands located on said floor, and spacer blocks of relatively short length disposed between adjacent resistor strands, the blocks having undercut recesses for the lodgement of said strands.

10. The combination with an electric furnace having a floor, of a resistor composed of endwise connected, separated strands located on said floor, spacers of relatively short length disposed between adjacent resistor strands thereby leaving a heat zone clearance in the lateral plane of the resistor lengths, and covering plates for said resistor.

11. An electric furnace comprising a base portion having a horizontal surface, a resistor element disposed upon said surface, and a cover for said resistor element composed of a plurality of members in the same horizontal plane, and means provided at the adjacent edges of said members forming a closed joint between the same, substantially as specified.

12. An electric furnace comprising a movable support conveying the material to be heated and movable into and out of said furnace, means carried thereby for heating said material and movable therewith, and means for energizing said heating means to heat said material when said support is in operative position within said furnace, substantially as specified.

13. An electric furnace comprising a movable support conveying the material to be heated and movable into and out of said furnace, a resistor element carried by said support for heating said material and movable therewith, and means for energizing said element to heat said material when said support is in position within said furnace, substantially as specified.

14. An electric furnace comprising a support movable into and out of said furnace, heating means carried by said support, and automatic means for controlling the circuit of said heating means to energize and de-energize the same as said support is moved, substantially as specified.

15. An electric furnace comprising a support movable into and out of said furnace, heating means carried by said support, and automatic means for energizing said heating means when said support is moved into position within said furnace, substantially as specified.

16. An electric furnace comprising a support for conveying the material to be heated and movable into and out of said furnace, a resistor element carried by said support and movable therewith, and automatic means for energizing said element as said support is moved into said furnace whereby to heat said material, substantially as specified.

17. An electric furnace comprising a wall, heating means thereon, a support movable into and out of said furnace, heating means carried by said support and movable therewith, and automatic means controlled by movement of said support for energizing and de-energizing certain of said heating means.

18. An electric furnace comprising a wall, heating means thereon, a support for conveying the material to be heated and movable into and out of said furnace, and heating means carried by said support and movable therewith, said several heating means providing a heating zone enclosing said material when said support is in operative position within said furnace, substantially as specified.

19. An electric furnace comprising a base portion movable into and out of said furnace, a top on said base portion for supporting material to be heated, and heating means carried by said base portion below said top, substantially as specified.

20. An electric furnace comprising a wall, heating elements thereon, a base portion movable into and out of said furnace, a top on said base portion for supporting the ma-

terial to be heated, and a heating element carried by said base portion below said top, whereby to permit of said material being subjected to the heat of said elements, substantially as specified.

21. An electric furnace comprising a wall, heating elements upon the inner surface thereof, a car adapted to be moved into and out of said furnace, a top on said car for supporting the material to be heated, a resistor element mounted on said car below said top, and automatic means operable to energize said resister element when said car is moved into said furnace, substantially as specified.

22. An electric furnace comprising a support of refractory material, a return-bend resistor element thereon including a plurality of strands spaced from each other, and separate spacer blocks of refractory material interposed between said strands at spaced points, substantially as specified.

23. An electric furnace comprising a support of refractory material having a substantially smooth unbroken surface, a return bend-resistor element disposed thereon and emboding a plurality of strands arranged in spaced relation, and spacing members of insulating material interposed at intervals between said strands for maintaining the same duly in operative position upon the surface of said support, substantially as specified.

24. An electric furnace comprising a support of refractory material, a return bend-resistor element disposed thereon and embodying a plurality of strands arranged in spaced relation, and spacing members of refractory material interposed between said strands adjacent to and between successive bends thereof, substantially as specified.

25. An electric furnace comprising a wall of refractory material having a substantially smooth unbroken surface, a return-bend resistor element disposed thereon and embodying a plurality of strands arranged in spaced relation, and means for retaining said element on said wall and for maintaining said strands in spaced relation, substantially as specified.

26. An electric furnace comprising a support of refractory material forming a shallow receptacle, a return-bend resistor element disposed in said receptacle and embodying a plurality of strands arranged in spaced relation, and a plurality of separate spacers of refractory material inserted between successive strands, substantially as specified.

27. An electric furnace comprising a support of refractory material forming a shallow receptacle, a return-bend resistor element disposed in said receptacle and embodying a plurality of strands arranged in spaced relation, and spacers of refractory material interposed between said strands at points between successive bends thereof and between said element and the wall of said receptacle, substantially as specified.

28. An electric furnace comprising a wall of refractory material, a return-bend resistor element disposed thereon and embodying a plurality of strands arranged in spaced relation, and separate spacer blocks interposed between said strands, and extending over the same to retain said element on said wall, substantially as specified.

29. An electric furnace comprising a support of refractory material, a return-bend resistor element disposed on said support and embodying strands arranged in spaced relation, separate spacer blocks arranged between said strands, and a cover disposed over said blocks and said elements and in spaced relation to said element, substantially as specified.

30. An electric furnace comprising a support of refractory material having a substantially smooth unbroken surface, a return-bend resistor element disposed on said surface and embodying a plurality of strands in spaced relation, separate spacer blocks disposed between said strands, and a cover positioned over said blocks in spaced relation to said element, substantially as specified.

31. An electric furnace comprising a support of refractory material providing a shallow receptacle, a return-bend resistor element disposed in said receptacle and embodying a plurality of strands arranged in spaced relation, separate spacer blocks of refractory material interposed between adjacent strands of said element at points between said element and the wall of said receptacle, and a cover disposed over said blocks and said receptacle in spaced relation to said element, substantially as specified.

32. An electric furnace comprising a support of refractory material, a resistor element disposed on said support, a cover composed of a plurality of members disposed over said element, and means provided at the adjacent edges of said members forming a closed joint between the same, substantially as specified.

33. An electric furnace comprising a support of refractory material, a resistor element disposed thereon, and a plurality of cover plates arranged over said element, said plates having interengaging adjacent edges, substantially as specified.

34. An electric furnace comprising a support of refractory material, a resistor element disposed thereon, and a plurality of cover plates arranged over said element, said plates having overlapping adjacent edges, substantially as specified.

35. An electric furnace comprising a bot-

tom of refractory material forming a shallow receptacle with a substantially smooth unbroken inner surface, a return-bend resistor element disposed within said receptacle upon said smooth surface thereof and embodying a plurality of strands arranged in spaced relation, separate spacer blocks of refractory material interposed between said element and the wall of said receptacle for maintaining said strands in spaced relation, and a plurality of cover plates mounted on said bottom over said receptacle, said cover plates having overlapping adjacent edges and constituting a support, substantially as specified.

36. An electric furnace comprising a support having a recess therein, a return-bend resistor element disposed in said recess, and embodying a plurality of strands arranged in spaced relation, and refractory means disposed at intervals between said strands for maintaining the same duly in operative position, substantially as specified.

37. An electric furnace comprising a support having a recess therein, a return-bend resistor element disposed in said recess, and embodying a plurality of strands arranged in spaced relation, refactory means disposed at intervals between said strands, and a cover for said resistor element directly exposed to the heat thereof, substantially as specified.

Signed at the borough of Manhattan in the city, county and State of New York, this 10th day of August, 1922.

EDWIN L. SMALLEY.