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ELECTRIC FURNACE

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2 Sheets-Sheet 1

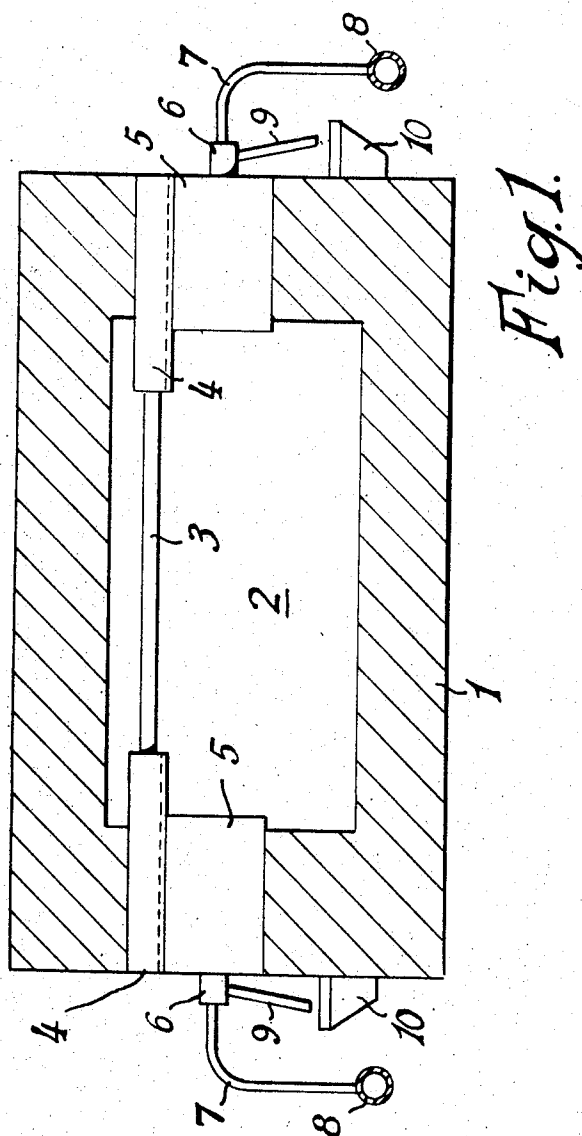


Fig. 1.

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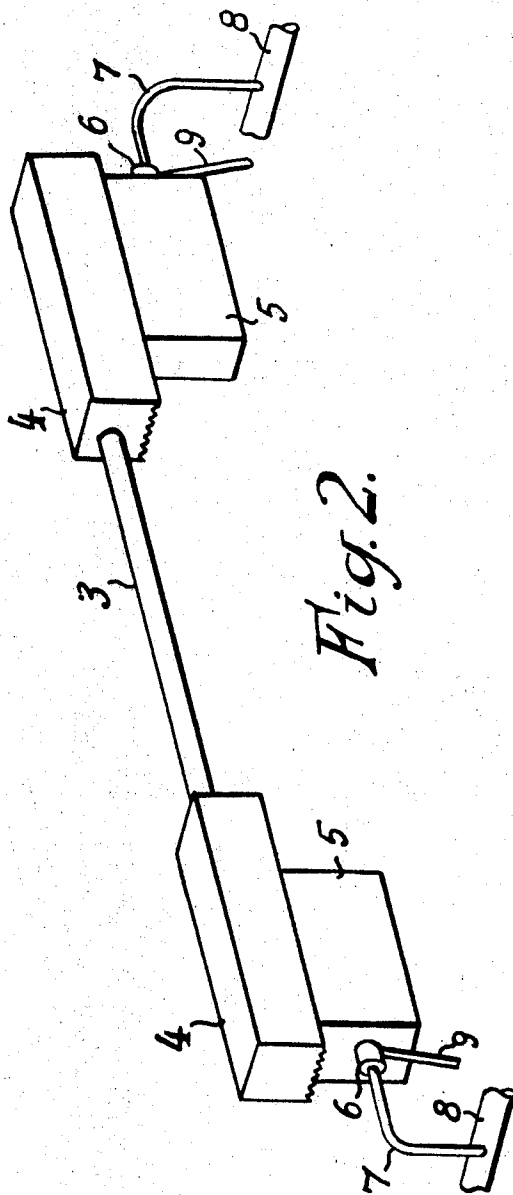


Fig. 2.

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ELECTRIC FURNACE

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5 Claims

ABSTRACT OF THE DISCLOSURE

The invention relates to an electric furnace comprising a heating chamber and a plurality of individual resistive linear heating elements each extending through the heating chamber and removably mounted in the furnace, each heating element being slidably supported against a conducting block at opposite sides of the heating chamber with each conducting block being electrically insulated from adjacent blocks and having its own current supply connection.

This invention relates to an improved electric furnace having multiple linear heating elements.

In an electric furnace with multiple linear heating elements, failure of one or more of the elements will result in an uneven heating pattern and possibly then insufficient power input for the heating process. It is thus desirable to design the furnace so that the damaged element or elements can be renewed as quickly as possible, and to this end it has been proposed to mount the elements in the furnace so that they can be removed without shutting down the furnace.

The present invention seeks to provide an improved furnace of the kind in which damaged or burnt-out heating elements can be removed and replaced without switching off the main power supply to the furnace, each heating element having its own power supply so that the current flowing through each heating element can easily be determined.

According to the present invention an electric furnace comprising a heating chamber and a plurality of individual resistive linear heating elements each extending through the heating chamber is characterised in that each heating element is slidably supported against a conducting block at opposite sides of the heating chamber, each conducting block being electrically insulated from adjacent blocks and having its own current supply connection.

By slidably mounting the element or elements in the furnace an element can readily be removed from the chamber. In normal use an element is replaced because it is broken and under these circumstances each end of the element would be removed by pulling it from the furnace. In the rare case of an unbroken element being replaced it would be necessary to push from one end and pull from the other end simultaneously.

With a furnace in accordance with the invention, one or more damaged or burnt-out elements can be replaced as soon as instrument checks show that they are faulty. In consequence fluctuations of heating chamber temperature can be kept to a minimum, and as the time required to change an element can be short, the loss of heat from the furnace during this period when an element is being changed can be small.

Where the heating element is of circular cross-section it is convenient to mount the element between end pieces, each end piece being designed to slidably cooperate with the associated block.

Conveniently, the current transmitting mating surfaces

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between the ends of the heating element (or the end pieces—where such are employed) and the blocks are serrated, the serrations extending parallel to the long dimension of the heating element. These serrations increase the surface area of the mating surfaces and provide locations to confine movement to a direction parallel to the long dimension of the element and parallel to the mating surfaces.

One embodiment of electric furnace in accordance with the invention will now be described, by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a schematic cross-section through the heating chamber of the furnace, and

FIG. 2 is a schematic isometric view of one heating element as employed in the furnace of FIG. 1.

The furnace shown in the drawing comprises a thermally insulating casing 1 defining a heating chamber 2. A number of graphite or other carbonaceous heating elements 3 are arranged in parallel across the top of the heating chamber 2 to radiate heat down onto work placed beneath them.

Each heating element 3 is of circular cross-section and is supported between two electrically conducting end pieces 4, one on each side of the heating chamber 1, electrical connection between a heating element 3 and an end piece 4 being obtained by engaging a tapered end of the element 3 in a recess in the end piece 4.

Each end piece 4 rests upon an individual support block 5 built into and electrically insulated from the furnace casing 1. The end pieces 4 and the support blocks 5 are made from graphite or other carbonaceous material. Every end piece and support block is (disregarding the connection provided by the elements 3) electrically insulated from every other end piece and support block.

Each support block 5 has a water-cooled metal connector 6 fitted to it, by means of which current is fed from a main bus bar 8 via a hollow lead 7. The water supply to the connector 6 is through the bus bar 8 and lead 7 and cooling water is taken away by a pipe 9 and a drain 10.

The top surface of each support block 5 and the bottom surface of the corresponding end piece 4 are serrated with grooves extending in the long direction of the element 3 to give large area mating contact surfaces for the transfer of current from the support blocks to the end pieces.

The water feed lead 7 to the water-cooled connector 6 of each support block is of heavy gauge copper and is arranged so that electric current flow therethrough can be measured by means of a "tong test" type of ammeter or some other simple current transformer arrangement. In this way the condition of each element 3 can be checked periodically and the need for renewal can be determined.

It will be apparent that each pair of end pieces and the corresponding heating element form a heating unit which has freedom of movement in the long direction of the element and so will be able to accommodate expansion and contraction of the heating element. Since the parts of each heating unit are assembled by pushing them together, differences in length from one heating element to another can also be accommodated by the end pieces seating closer together or further apart upon their respective support blocks.

The length of each end piece is chosen so that its mass will be sufficient to ensure that it will seat firmly upon its support block even when the heating element is projecting to a point just short of the end piece at the other side of the heating chamber. If required, an electrically insulated spring-loaded roller or other pressure device (not shown) may be arranged to act on the top surface of the end piece at one or both ends. Such a pressure device will increase the contact pressure between the end piece and the support block.

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Each end piece 4 may have, at its outer end, a projection (not shown) shaped so that it can be engaged with an electrically insulated extractor tool to facilitate the withdrawal of an end piece when necessary.

When a heating element breaks, a suitable reception box can be brought up on each side of the furnace and aligned with the respective end piece at the end of the element concerned. The end pieces are then drawn out of the furnace into these boxes (conveniently by means of the extractor tool previously referred to).

The stubs of the broken element are removed from each end piece, a new element is inserted into one end piece and passed through the heating chamber to engage with the other end piece which by this time has been replaced in its original working position. As soon as the new element engages the other end piece, current flow through it is restored.

Any arcing which may occur as the heating element enters the other end piece is of short duration and is contained inside the heating chamber where it can do no harm.

The above example describe the application in some detail but it will be appreciated that the same principle of removable electrodes can be applied to other furnace arrangements. Thus, for example, the invention can be applied to heating elements, located in the bottom and/or the side and/or the end of a furnace chamber. In addition the same principle can be applied to furnaces operating over lower temperature ranges where heating elements (with or without end pieces) and support blocks may be made of a material other than a carbonaceous material.

What is claimed is:

1. An electric furnace comprising a heating chamber and a plurality of individual resistive linear heating elements each extending through the heating chamber and removably mounted in the furnace characterized in that each heating element is supported on conducting blocks at opposite sides of the heating chamber, each conducting block being electrically insulated from adjacent blocks and having its own current supply connection; and the current transmitting mating surfaces of each heating element and the corresponding block being provided with

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interengaging serrations extending parallel to the long dimension of the heating element.

2. An electric furnace comprising a heating chamber and a plurality of individual resistive linear heating elements each extending through the heating chamber and removably mounted in the furnace characterized in that each heating element is supported on conducting blocks at opposite sides of the heating chamber, each conducting block being electrically insulated from adjacent blocks and having its own current supply connection; and each heating element comprising a central portion removably supported by end pieces of larger cross-section which end pieces in turn rest on the corresponding conducting blocks.

3. An electric furnace as claimed in claim 1 characterized in that each current supply connection is a tube, serving for the supply of liquid coolant to the respective support block.

4. An electric furnace as claimed in claim 3, characterized in that each conducting block along one side of the furnace is connected to a first electrically conducting coolant conduit by a separate electrically conducting tube, and each conducting block along the other side of the furnace is connected to a second electrically conducting coolant conduit by a separate electrically conducting tube, the two conduits serving as bus bars for supplying electric current to the individual elements.

5. An electric furnace according to claim 1, wherein each heating element is slidably supported on conducting blocks at opposite sides of said heating chamber.

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