

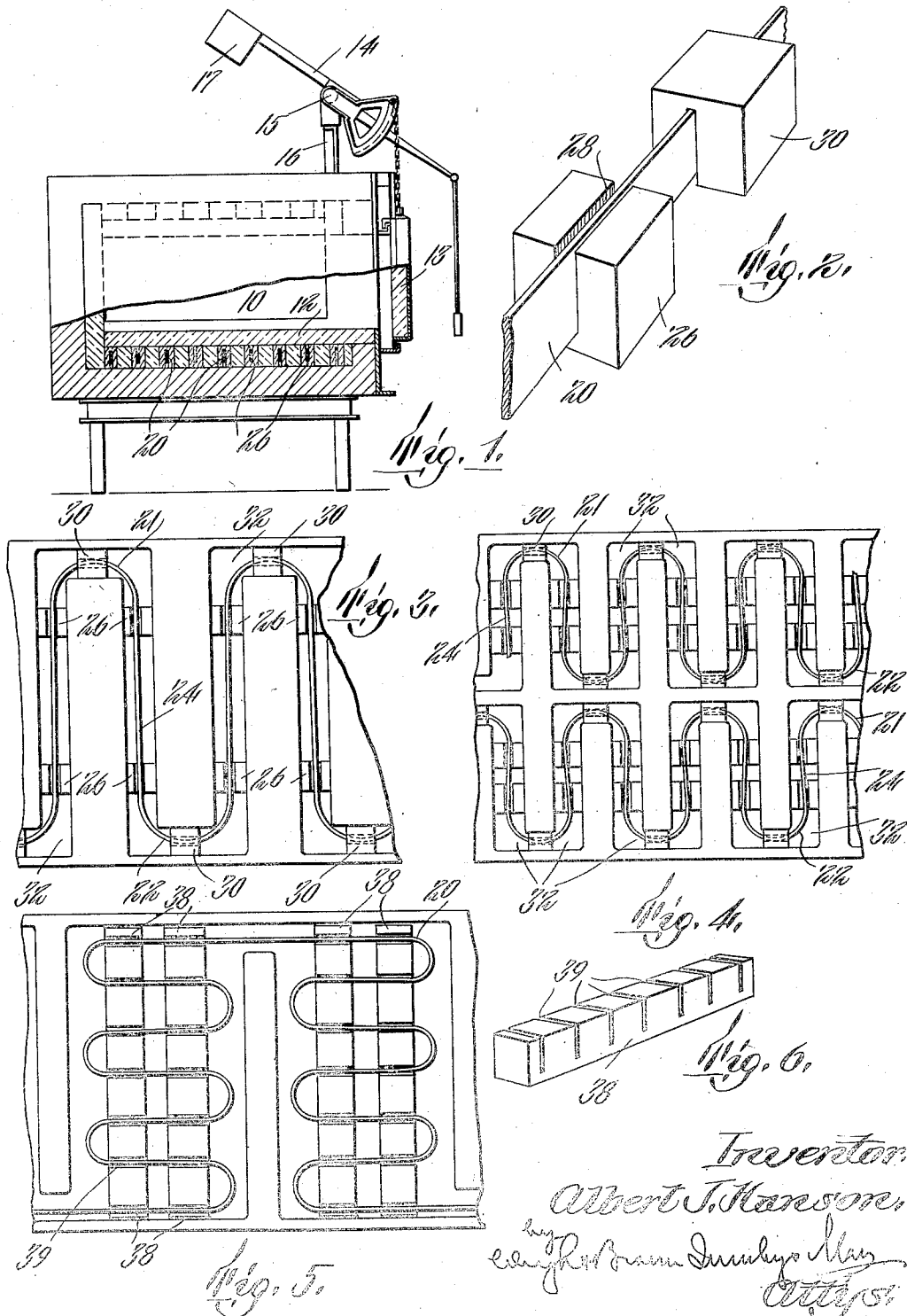
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ELECTRIC RESISTANCE FURNACE

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ELECTRIC RESISTANCE FURNACE.

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This invention relates to an electric resistance furnace.

One object of the invention is to provide an electric resistance furnace, and particularly an electric resistance furnace of the type in which the resistor is muffled or confined in the furnace wall, of novel and improved construction and in which the resistor is supported in a manner to enable the furnace to be operated at a high thermal efficiency and without incurring the liability of short-circuiting the resistor or burning out the same.

A further object of the invention is to provide a novel resistor support for electric resistance furnaces.

To these ends, provision is made for operatively supporting the resistor at a plurality of points in its length by a plurality of insulating members which are spaced apart, and arranged to provide between them an air space surrounding the resistor. In the preferred embodiment of the invention, the resistor thus supported is confined in either the top or bottom walls of the heating chamber of the furnace, or in both, and is protected or muffled by the hearth or by the top wall of the heating chamber. Provision is also made for insulating and spacing the resistor from the hearth or the top wall of the heating chamber to permit the use of a metal hearth, or a metal top wall of the heating chamber.

These and other features of the invention will be hereinafter described, and particularly pointed out in the claims at the end of this specification.

In the drawing illustrating the preferred embodiment of the invention,

Figure 1 is a side elevation partly in section showing the construction of the hearth of an electric resistance furnace embodying the present invention.

Figure 2 is a perspective illustrating one of the members preferably used for supporting the resistor and spacing it from the hearth.

Figures 3, 4 and 5 are sectional plans illustrating different arrangements of the resistor, and

Figure 6 is a perspective of one of the insulating resistor supports used in connection with the resistor arrangement illustrated in Figure 5.

Considerable difficulty has been heretofore experienced in those types of electric resistance furnaces in which the resistor is muffled in the wall of the heating chamber, because of the tendency to build up a high temperature in the immediate vicinity of the resistor, with the result that in practice the resistor frequently burned out when the furnace was operated at high temperature. At the present time for high temperature work, the more common practice is to mount the resistors in an exposed position upon the walls of the heating chamber of the furnace to permit direct radiation from the resistor into the heating chamber. In certain types of electric resistance furnaces, and particularly those in which it is desirable to heat the hearth or the top wall of the heating chamber, it is desirable to confine or muffle the resistor in the wall of the furnace. In accordance with the present invention, the resistor is operatively supported within the wall in such manner as to avoid the difficulties heretofore experienced in burning out the resistors, and at the same time to permit the furnace to be operated at high temperature and with good thermal efficiency.

Referring to the drawing in which for purposes of illustration, the resistor is shown as confined in the hearth or bottom wall of the furnace, 10 represents the heating chamber of the furnace having a hearth 12 upon which the articles to be heated may be placed. The furnace may and preferably will be provided with the usual door 13 closing one side thereof, and which is herein illustrated as suspended upon one end of a lever 14, pivoted at 15 in a bracket 16 on the top of the furnace and having the usual counter-weight 17 for assisting in raising and lowering the door.

The hearth 12 (which preferably is removable) is heated by a resistor 20 comprising preferably the usual ribbon resistor commonly used in electric resistance furnaces, and which is preferably of a general sinuous shape having bends 21, 22 at opposite sides thereof and intermediate portions 24 connecting the bends. The resistor 20 is supported by a plurality of individual insulating supporting members 26 which are spaced apart and are arranged to cooperate with different portions of the resistor to support the same in operative position, and to pro-

vide air spaces surrounding the portions of the resistor between the insulating supports. As illustrated in Figures 2, 3 and 4, the insulating supporting members 26 comprise blocks of carborundum, or other insulating material having high thermal transmitting and radiating properties and which are provided with open slots 28 extending downwardly through the mid-portion of the block from the upper surface thereof to near the lower surface. The resistor 20 is arranged to be supported within the slot 28 having its lower edge resting upon the bottom of the slot and being restrained from lateral movement by the side walls of the slot. The insulating supporting members or blocks 26 act to hold the edges of the resistors away from the adjacent wall portions of the furnace. This is of particular importance where the resistors are arranged beneath a hearth as when they are so located insulating dust finds its way beneath the hearth and accumulates therebelow. When there is no substantial space beneath the resistors this dust soon surrounds the resistors, destroying the circulation of air therearound, whereupon they may become overheated and burn out. Such dust may accumulate for a considerable period before it interferes with the proper functioning of the resistors which are supported elevated substantially from the base portion beneath the hearth, as in the construction illustrated.

The insulating blocks 26 are preferably arranged in the furnace wall, so as to support the resistor at a sufficient number of different points in its length to prevent short-circuiting of the resistor, and this result may be accomplished while at the same time preserving ample air space between adjacent supporting block 26 to permit efficient and unrestricted radiation from the major portion of the resistor. The insulating blocks 26 being composed of carborundum or similar material having high thermal transmitting and radiating properties, do not appreciably interfere with the radiation of the heat from the resistor. The heat thus radiated into the air space surrounding the resistor passes rapidly by conduction through the hearth 12, which is composed of a material having good thermal transmitting properties and the necessary mechanical strength. The hearth may be of carborundum or other similar material, or may be of metal. With this construction, it will be observed that opportunity is afforded the heat to efficiently radiate from the resistor, and at the same time, provision is made for permitting the heat to be rapidly removed through the hearth 12 into the heating chamber of the furnace, thus preventing the accumulation of excess heat in the vicinity of the resistor, and consequently reducing to a minimum the liability of burning out the resistor.

When a metal hearth is used, provision is made for insulating the resistor therefrom and for maintaining the top of the resistor spaced from the hearth, and for this purpose, insulating spacing members 30 are interposed between the resistor and hearth. The insulating spacing members 30 may and preferably will comprise blocks of carborundum or other electrical insulating material having high thermal transmitting and radiating properties and of the same construction as the resistor supporting blocks 26, and may be inverted and hung upon the resistor ribbon in the manner illustrated in Figure 2. The insulating resistor supporting blocks 26 may be affixed in the wall of the heating chamber by cement or otherwise, and as illustrated in Figures 3 and 4, the blocks 26 are located in channels 32 formed in the brickwork, and which are arranged to communicate with one another to form a continuous channel way of the desired shape to conform to the shape of the resistor. In practice, bricks known in the trade as "soaps" comprising split bricks, $2\frac{1}{4}$ inches in width, 9 inches in length and $2\frac{1}{2}$ inches in thickness, may be used in laying up the spacing partitions 34 between adjacent channels 32. With this construction a channel width of $\frac{3}{4}$ of an inch is provided for receiving a resistor and in which the intermediate portions 24 of each loop of the resistor are spaced three inches between the centers, which provides an amount of resistor suitable for heating the hearth of an ordinary type of heat treating furnace. The hearth 12 is arranged to cover both the resistor 20 and the insulating supporting blocks 26, and is preferably removably supported upon the brickwork at the front and sides of the furnace.

The modification illustrated in Figure 4 is of the same general construction as that illustrated in Figure 3, with the exception that the resistors 20 are arranged in two sections, and a double set of channels 32 are provided for receiving the resistor sections and their supporting blocks. This arrangement of the resistor is particularly adapted for efficiently heating relatively wide furnaces, and the double resistor arrangement is particularly suitable for connection to a two-phase power system.

In the modification illustrated in Figure 5, a plurality of resistor sections are arranged side by side upon the brickwork below the hearth and are connected in series. The resistor sections are preferably supported upon insulating bars 38, preferably of carborundum or like material having good thermal transmitting and radiating properties. The bars 38 are provided with a plurality of slots 39 therein, in which the intermediate portions 24 of the resistor sections are laid and may be cemented to the brickwork to pre-

vent movement of the resistor sections. This arrangement of the resistor enables the resistor sections to be spaced near together to provide a relatively large amount of the resistor for high temperature work, and at the same time ample air space is provided around the major portion of the resistor to permit efficient radiation of heat therefrom and rapid passage of the heat through the hearth so as to prevent the building up of an excessive temperature in the vicinity of the resistor and consequently reducing to a minimum the liability of burning out the resistor.

While the different features of the invention have been illustrated and described as embodied in a construction for heating the hearth of an electric resistance furnace, they may with advantage be used for heating the dome or top of the furnace, and if found desirable, any wall of the heating chamber of the furnace.

Having thus described the invention, what is claimed is:

1. In an electric resistance furnace, in combination, a chamber wall, a ribbon resistor, insulating means for supporting the resistor upon the chamber wall arranged to provide an air space around a substantial portion of the resistor, and an imperforate covering for the resistor and supporting means.

2. In an electric resistance furnace, in combination, a chamber wall, a resistor, a plurality of insulating supporting members cooperating with different portions of the resistor and spaced apart to provide an air space surrounding the portions of the resistor between said insulating supports, and an imperforate covering for the resistor and its support.

3. In an electric resistance furnace, in combination, a chamber wall, a resistor, a covering member for the resistor, and means for insulating and spacing the resistor from the wall and from said covering member includ-

ing a plurality of insulating blocks having slots therein arranged above and below said resistor with the resistor received within said slots.

4. In an electric furnace provided with a heating chamber, a chamber wall, a plurality of relatively small insulating members on said wall spaced apart a sufficient distance from one another to leave substantial air spaces therebetween, a resistor engaging said members and extending through said air spaces, and an imperforate covering for the resistor and insulating members.

5. In an electric furnace provided with a heating chamber, a chamber insulating wall, a refractory imperforate heat-conducting wall spaced from said insulating wall, a plurality of relatively small insulating members between said walls and spaced apart a sufficient distance from one another to leave substantial air spaces therebetween, and a resistor engaging said members and extending through said air spaces, certain of said members insulating the heat-conducting wall from said resistor.

6. In an electric resistance furnace, in combination, a chamber wall provided with a plurality of channels therein, a resistor ribbon, and insulating blocks positioned in said channels, each block having a slot to receive an edge of said ribbon to hold said ribbon spaced from the bases of said channels and to provide an air space surrounding the ribbon between said blocks.

7. In an electric resistance furnace, in combination, a chamber, a chamber wall, insulating members on said wall, a resistor supported on said insulating members spaced substantially from said wall, an imperforate cover for said resistors and insulating members, said cover being spaced from said resistor.

In testimony whereof I have affixed my signature.

ALBERT J. HANSON.