March 24, 1936. A. W. FANNIN 2,035,306

ELECTRIC FURNACE

Filed Aug. 30, 1933

Fig. 1.

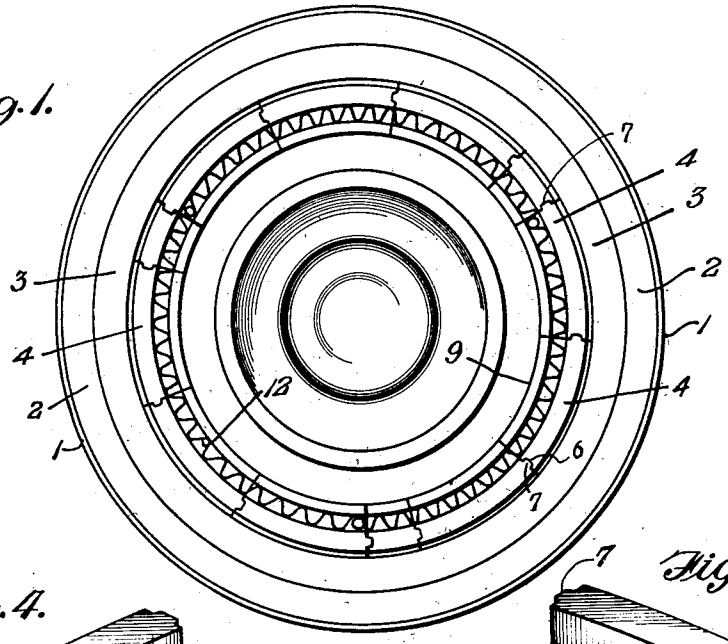


Fig. 3.

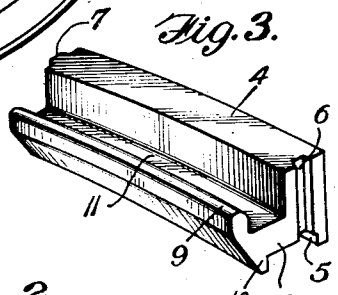


Fig. 4.

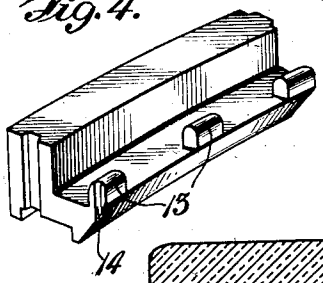


Fig. 5.

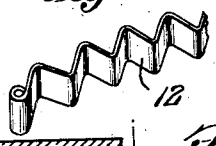


Fig. 2.

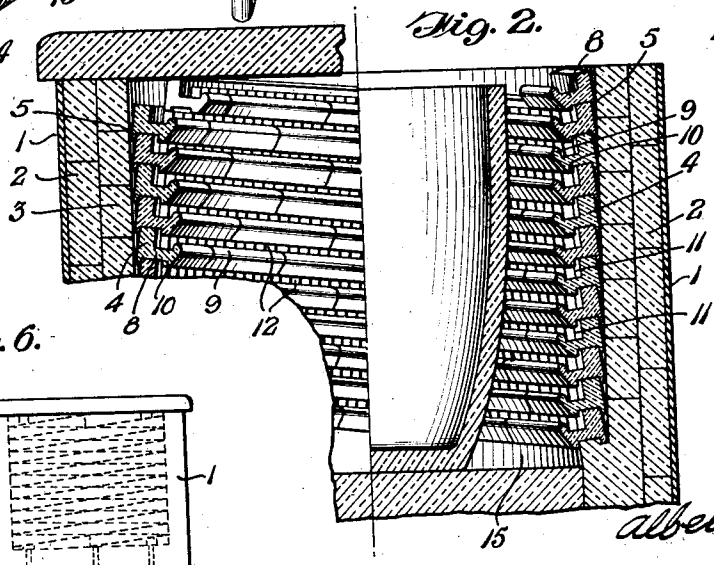


Fig. 6.

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ELECTRIC FURNACE

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5 Claims. (Cl. 13—25)

This invention relates to the construction of electrically heated metal melting furnaces and relates particularly to the shape of the heating element and the manner of mounting it as well as the supporting blocks that hold the element in proper position.

The structure lends itself particularly to round furnaces but is also adapted to furnaces of other shapes.

In electric heating furnaces generally the heating element is more or less imbedded in the supporting structure in such a manner that it is difficult of access when it becomes necessary to make repairs or replace parts, this imbedding of the element has been necessary in order to hold it in place and to allow for proper expansion when in a heated condition, and at the same time the imbedding material tends to cover the element somewhat and thus interfere with a free radiation of the generated heat so that the cost of operation is sometimes quite excessive since more current must be used to force the heat through the obstructing imbedding material and thus supply sufficient heat to the heating space.

Other difficulties have attended the use of the ordinary type of electric furnace. After the inner lining has been in use for some time the frequent heating and cooling causing the lining to crack and check renders the inner surface of the heating space more or less irregular and rough, and continued checking will eventually cause pieces to separate and drop away from the surface and when this condition is reached it usually means a complete replacement of the lining and if the heating element happens to be imbedded in this lining it entails quite an expensive job.

The purpose of this invention is to provide a lining for an electric heating furnace that is made up of individual blocks stacked one on the other to form spiral grooves into which the heating element may be laid after the lining blocks are in place. The blocks to have grooves facing the heating space so that the heating element will be exposed and heat may be radiated directly into the heating space without having to pass through any insulating or lining material.

Such a construction places the heating element in the best possible position relative to the articles to be heated and also places it in constant view for inspection and examination at any time. The lining blocks being interlocked with loose joints are held in place to afford full free expansion under heat.

The grooves provided by stacking the blocks one on the other and end to end provides a space for the insertion of a continuous ribbon heating element after the blocks are placed in their operating positions, and the width and depth of the grooves thus formed is large enough to use a heating element made of a flat ribbon of suitable material that is crinkled to afford contraction and expansion without interference from surrounding material.

It is also possible with one standard block to adapt it to furnaces of varying diameters and sizes as well as shapes, this makes it possible to construct temporary furnaces for special or rush jobs without excessive expense, and the blocks being unattached, except loosely are easily and quickly stacked and disassembled for use again.

In case a block cracks or breaks in use and should be replaced it is only necessary to withdraw the ribbon heating element sufficiently to remove the block by hand, replace a new block and replace the heating element and the repair is made in a few minutes and without material expense.

It is therefore a principal object of the invention to provide a lining block for electrical melting furnaces that is unattached and that forms the sole support for the heating element.

It is a further object of the invention to provide a lining block for heating furnaces having a groove in its face to contain and support a heating element.

It is a further object of the invention to provide a lining block for electric heating furnaces that is adapted to stack one on the other and to have a loose interlocking engagement so that the stack of blocks are held in operative position but are free to expand and contract individually.

It is also an object of the invention to provide a lining block for electric melting furnaces that is adapted to be stacked one on the other and to be interlocked at the ends in a loose manner to permit free expansion and contraction to each individual block and to form a continuous groove for the reception of a heating element.

It is also an object of the invention to provide a lining for electrical melting furnaces having one or more continuous spiral grooves in the face of the lining material so arranged that the heating element may be inserted into the groove after the lining has been positioned in the furnace.

It is also an object of the invention to provide

an electric melting furnace having a loosely applied lining made up of individual blocks the positioning of the blocks forming a continuous groove into which a crinkled ribbon heating element may be inserted after the blocks and complete lining is placed.

It is a further object of the invention to provide a lining for an electric melting furnace composed of blocks of a size and shape that they are adapted to form the lining for furnaces of different sizes and shapes and in every instance to form one or more continuous grooves for the reception of a ribbon or rod heating element after the lining is placed.

With such objects in view as well as other advantages which may be inherent in the invention, consisting in the parts and combinations hereinafter set forth and claimed, it is understood that the several necessary elements, parts and combinations constituting the same may be varied in their proportions, placement and general arrangement without departing from the scope and nature of the invention, and in order to render the invention more clearly understood, there are shown, in the accompanying drawing, somewhat diagrammatically, means and mechanism for placing the same in concrete form, without limiting the improvement to the particular construction shown.

Referring now to the drawing:

Figure 1 represents a plan of an electrical melting furnace embodying this invention.

Figure 2 represents a vertical cross section of Figure 1 and illustrates the manner of stacking the lining blocks and the position of the heating element.

Figure 3 represents one of the blocks.

Figure 4 shows a modified construction of block.

Figure 5 represents a short section of the ribbon heating element showing the crinkled shape to provide for expansion and contraction.

Figure 6 is a diagrammatic view showing the manner of stacking the blocks to form a plurality of grooves for the use of a three phase current. This view also indicates the manner of carrying the current to the crinkled ribbon after it is placed into the grooves.

1 represents a sheet metal shell, 2 an outer lining of insulating material and 3 an inner lining of refractory material.

4 represents one of the individual porcelain blocks which is clearly shown in Figure 3.

The block 4 comprises a rear wall with a depending ledge 5, an interlocking groove 6 on one end and a tongue 7 on the other end. A ledge 8 extending at substantially right angles from the back wall and having a lip along its front side as at 9 and with a ledge 10 along the lower front edge.

When the blocks are stacked one on the other and end to end as in Figure 2 it will be seen that the ledge 5 of each block hooks back of the top edge of the back wall; the ledge 8 rests on the top surface of the back wall and the ledge 10 overlaps the front top edge of the back wall. The assemblage in this manner forming a continuous groove 11 into which the crinkled ribbon 12 may be threaded after the blocks are all placed. This arrangement of the blocks 4 forms a complete inner lining for the furnace and the open front groove 11 for holding the ribbon loosely provides unobstructed means for direct radiation of the heat emanating from the heated ribbon.

Figure 4 shows a modified block structure having instead of the lip 9 a series of short lips 13 which will serve to hold the crinkled ribbon 12 in place quite as well as the full lip and gives a more open groove that is less obstructive to the direct radiation.

In the block of Figure 4 there is shown also an additional interlocking groove 14 which may be used if it is found necessary to hold the ends of the blocks more securely.

It is to be noted the block assembly shows that the blocks are tipped slightly forward, this is to provide a space for the ledge 5 and permit the back line of the blocks to rise vertically, and it also tips the groove opening 11 slightly downward to give less obstruction to the direct radiation.

In Figure 2 a crucible has been shown in position in the furnace and has been shown with a space between the outside of the crucible and the inner surface of the block lining, this space may vary according to the manner in which the crucible is placed and lifted from the furnace. If tongs are used for engaging the outside of the crucible then the space shown may be necessary but if the crucible is lifted in some other manner then the inner surface of the block lining can be very close to the crucible wall and thus reduce the free space in the furnace and economize somewhat on current for a given heat.

In order to generate a spiral groove, or a multiple of spiral grooves as the blocks are laid there is a starting ledge 15 built in the bottom of the enclosure on which the first layer of blocks rest and which gives the proper inclination to the blocks to generate the grooves in the proper manner.

The diagrammatic view of Figure 6 indicates how the blocks would be laid to provide three separate grooves for the use of a three phase current and also indicates how the terminals 16 lead away from the furnace.

The heating element may be made of nichrome or some other suitable material and being crinkled as shown in Figure 5 and being in continuous strips long enough after crinkling to fill a groove from end to end, may be threaded into the grooves after the blocks are laid by simply pushing the ribbon into the grooves from the top when they will follow the grooves spirally and when they reach the lower ends of the grooves may be suitably fastened to the conductors 16.

It is thus seen that the heating element, while quite closely confined is free for expansion and contraction in the groove 11 and can radiate its heat directly to the crucible without having to pass through any other material than air. The construction and arrangement of the blocks 4 also form a very efficient heating surface. Continued use will heat the blocks 4 to a high temperature and their radiation will also help materially to utilize the heat thus diverted from the crucible and radiate it into the crucible space and thus help materially in the melting operation.

If the heating ribbon should burn out or be damaged in any manner the defective parts may be threaded out of the retaining grooves and new elements threaded in without in any manner disturbing the blocks 4 which is a very decided advantage in electric furnace construction.

What I claim as new and desire to secure by Letters Patent is:

1. A lining and heater element for an electric melting furnace comprising a series of tiers of refractory blocks stacked one on the other, each tier consisting of a plurality of sections, inter-

locking means for holding said blocks in assembled relation, a groove in each block aligning with the grooves in adjacent blocks to form a continuous spiral channel, a heating element adapted to be threaded into said channel from one end thereof and means associated with said blocks for holding said element against lateral movement in normal operation but permitting lateral displacement when replacing a broken section.

2. A lining and heater element for an electric melting furnace comprising a series of tiers of refractory blocks stacked one on the other and end to end to form a spiral path around the said furnace, interlocking means for holding said blocks in assembled relation, a groove in each block aligning with the grooves in adjacent blocks to form a continuous spiral channel around the said furnace, a heating element crinkled laterally relative to its length and adapted to be threaded into said spiral channel from one end thereof and means associated with said blocks for holding said element against lateral movement in normal operation but permitting lateral displacement when replacing broken blocks.

3. A liner and heater element for electric melting furnaces comprising a series of refractory blocks of porcelain or like material stacked in spiral arrangement and end to end relation around the inner wall of a furnace, interlocking means integral with said blocks for holding said blocks in assembled relation, a groove in each block aligning with the grooves in adjacent blocks to form a continuous spiral channel around the wall of said furnace, a heating ribbon crinkled laterally relative to its length and adapted to be threaded into said channel from one end thereof and means integral with each block for holding said ribbon against lateral movement relative thereto in normal operation but permitting lateral displacement when replacing broken blocks.

4. A liner and heating element for electric melting furnaces comprising a series of refractory blocks of L shaped cross section with ledges along the base of the L lengthwise of the blocks to form interlocking means for holding said blocks in assembled relation when stacked one on the other and in end to end relation, a groove on one end of each block and a tongue on the other end to interlock with adjacent blocks to hold said blocks in assembled relation, a ledge along the top edge of the L base to form an open face groove in each of said blocks the grooves of each block aligning with the grooves of adjacent blocks to form a continuous channel, a heating element adapted to be threaded into said channel from one end thereof, said heating element being crinkled to provide for expansion.

5. In an electric furnace a refractory member for lining the interior surface thereof by stacking a plurality of said members one on the other and in end to end relation, said members being of L shaped cross section and having a series of projections along the top outer edge of the L base to form an open sided channel for a heating element, the stacking of said members forming a continuous spiral trackway around said furnace, and a ribbon like heating element crinkled cross wise and adapted to lie in said trackway and be held therein by said projections in normal operation but permitting lateral displacement when replacing a broken member.

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