July 1, 1930. E. L. SMALLEY 1,768,865

HEATING ELEMENT MOUNTING CONSTRUCTION

Filed May 22, 1928 3 Sheets-Sheet 1

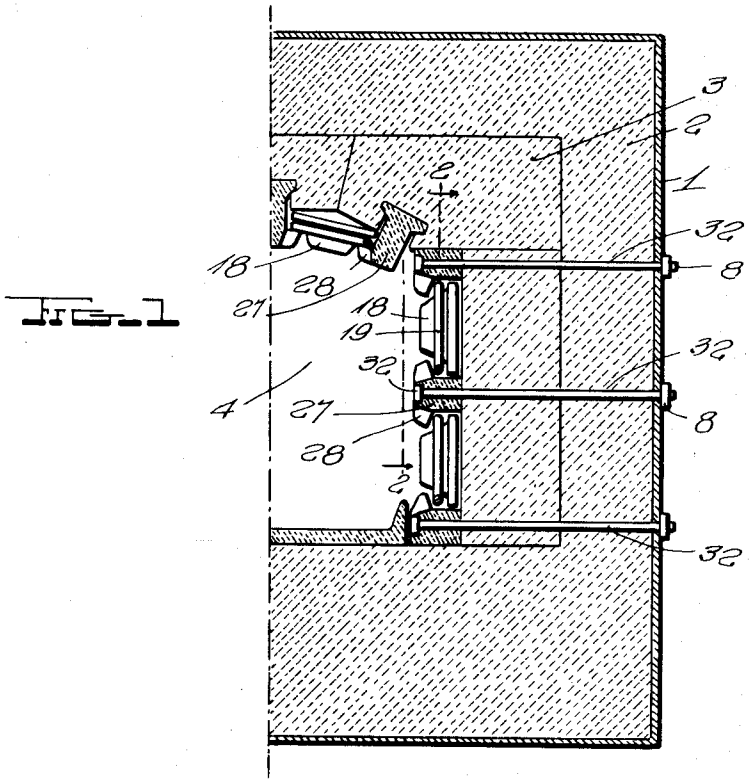


Fig. 1

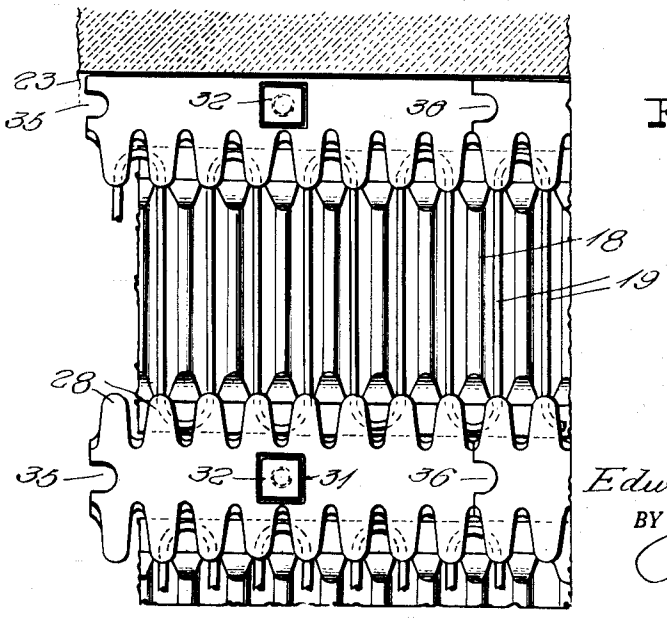


Fig. 2

INVENTOR.
Edwin L. Smalley,
BY John B. Brady
ATTORNEY.

July 1, 1930. E. L. SMALLEY 1,768,865

HEATING ELEMENT MOUNTING CONSTRUCTION

Filed May 22, 1928 3 Sheets-Sheet 2

FIG. 3

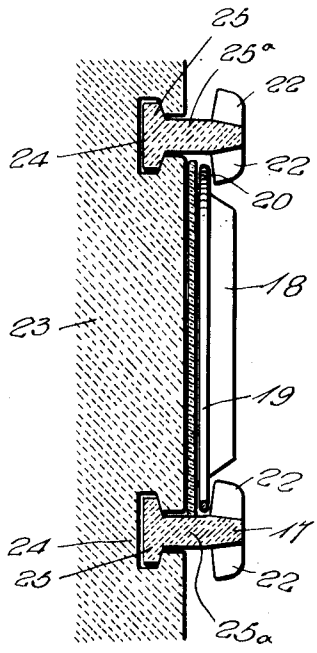


FIG. 4

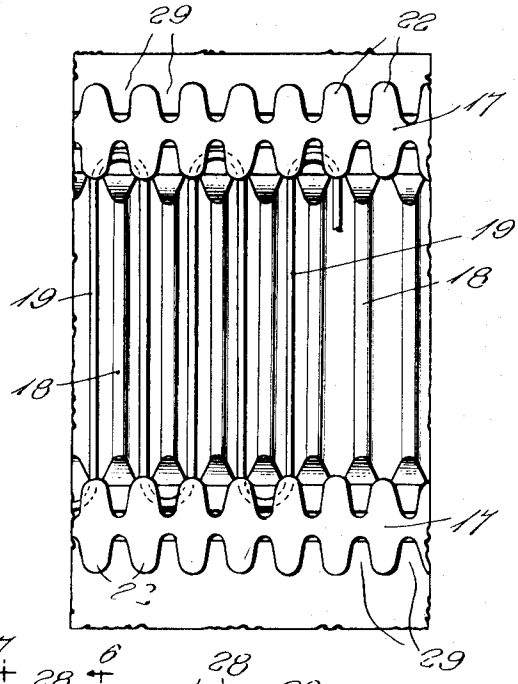


FIG. 5

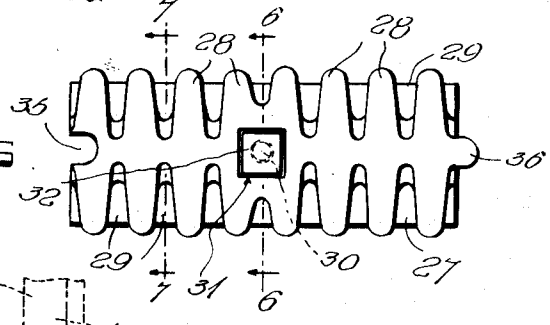


FIG. 6

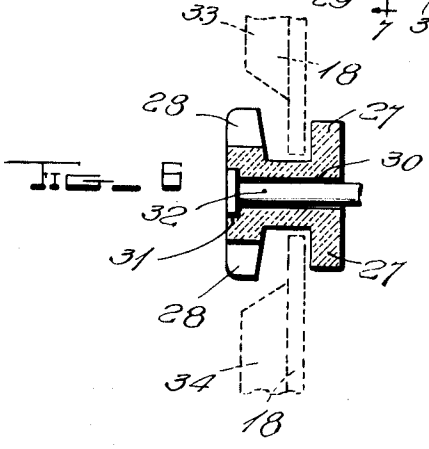
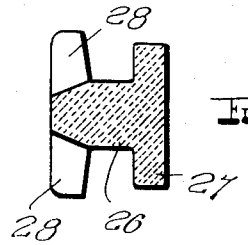


FIG. 7



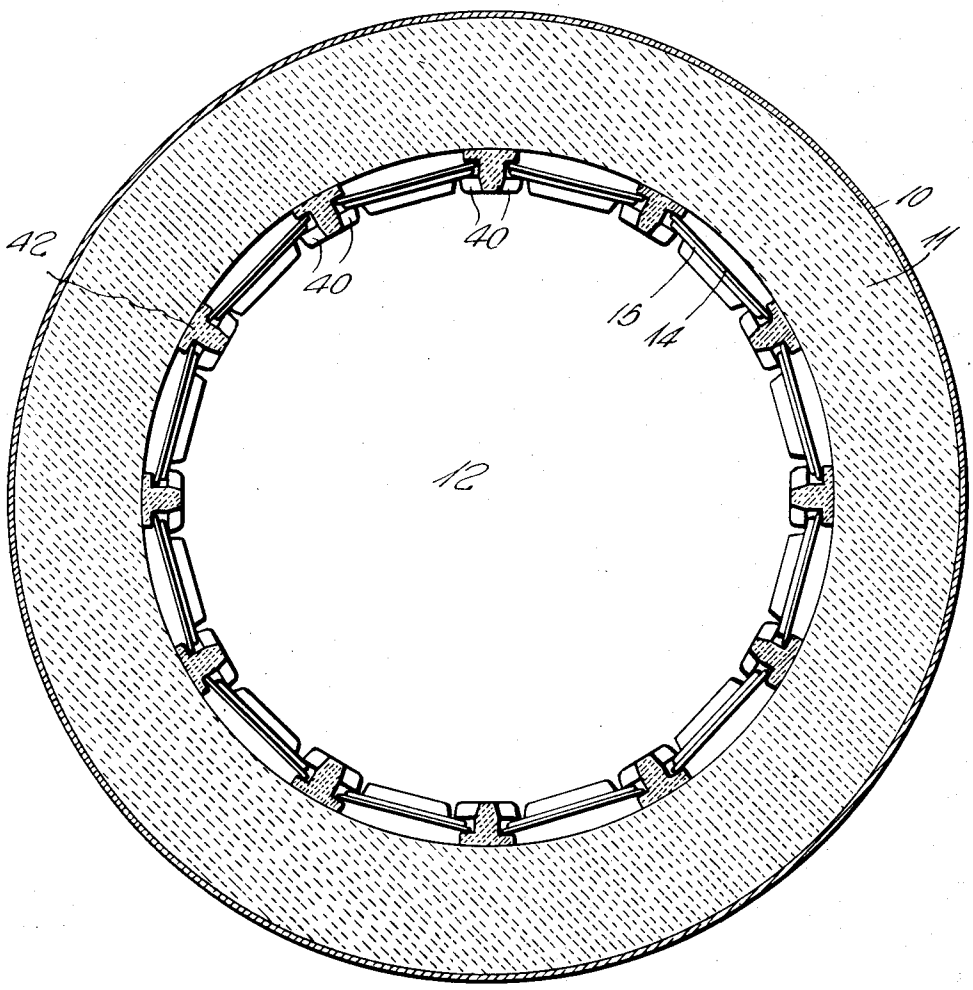
INVENTOR.
Edwin L. Smalley,
BY John B. Brady
ATTORNEY.

July 1, 1930. E. L. SMALLEY 1,768,865

HEATING ELEMENT MOUNTING CONSTRUCTION

Filed May 22, 1928 3 Sheets-Sheet 3

FIG. 8



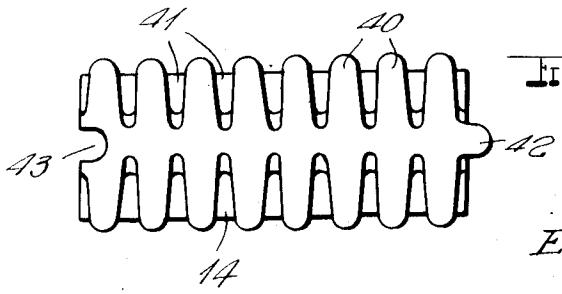


FIG. 9

INVENTOR.
Edwin L. Smalley,
BY John B. Brady
ATTORNEY.

Patented July 1, 1930 1,768,865

UNITED STATES PATENT OFFICE

EDWIN L. SMALLEY, OF WHITEFISH BAY, WISCONSIN, ASSIGNOR TO HEVI DUTY ELECTRIC COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN

HEATING-ELEMENT-MOUNTING CONSTRUCTION

Application filed May 22, 1928. Serial No. 279,810.

My invention relates broadly to electric furnaces and more particularly to a construction of mounting for the electrical heating elements of a furnace.

One of the objects of my invention is to provide a ceramic refractory of an improved form shaped to increase the rate of heat release from the bends of the heater coils lodged in corrugated reflector plates within an electric furnace structure.

Another object of my invention is to provide a construction of lightweight ceramic material for installation within a furnace chamber for mounting heater elements therein in a manner whereby the speed of heating from cold to operating temperature may be increased.

Another object of my invention is to provide a construction of heater element support which will prevent foreign particles such as iron oxide from lodging back of the projecting flanges on the head of the heater element support in an electric furnace chamber construction.

Still another object of my invention is to provide a preformed ceramic refractory for installation in a cylindrical vertical electric furnace in a manner whereby the coils and reflecting plates are held in self-supporting position.

A further object of my invention is to provide a means of supporting a heating coil with its corrugated reflecting plate against a flat faced wall which permits of the use of heat insulating material in molded shapes and avoids the usual fire-brick lining.

A still further object of my invention is to provide a construction of heater element mounting for maintaining a heater element adjacent the interior walls of a furnace chamber in a manner in which direct radiation of heat from the turns of the heater element is not impeded.

My invention will be more fully understood by referring to the following specification and the accompanying drawings in which:

Figure 1 illustrates a fragmentary cross-sectional view taken through an electric furnace embodying the principles of my invention; Fig. 2 is an enlarged elevational view looking in the direction of line 2—2 in Figure 1, showing the resistors and the mounting thereof within an electric furnace in accordance with my invention; Fig. 3 is a cross-sectional view through the furnace wall showing one method of mounting the heating elements with respect thereto; Fig. 4 is a front view of the heating elements illustrated in Fig. 3; Fig. 5 is a front view of one section of the refractory which serves to support the heating elements with respect to the furnace wall; Fig. 6 shows a cross-sectional view through the refractory in line 6—6 of Fig. 5; Fig. 7 ilustrates a cross-sectional view through the refractory on line 7—7 of Fig. 5; Fig. 8 illustrates the arrangement of the heating elements within a circular furnace chamber where the heating elements are formed in accordance with the principles of my invention and Fig. 9 illustrates one of the refractories which serves to support the heating elements in the arrangement shown in Fig. 8.

The elimination of the fire-brick lining decreases, to a remarkable extent, the amount of time required in bringing the furnace from cold to operating temperature. For example, a furnace constructed in accordance with my invention has reached an operating temperature of 1600° F. in one hour and a quarter starting with the furnace cold, while with the same kw. input per hour in the same size furnace having a fire-brick lining, it has required a period of three hours for the furnace to reach its operating temperature.

The elimination of the fire brick lining reduces the overall size of the furnace, thereby using less floor space, and at the same time decreases the number of square feet of outside area of the furnace shell, and results in a remarkably lower radiation loss from the furnace.

Referring to Fig. 1 of the drawings, reference character 1 designates a form of steel shell enclosing heat insulating material 2 and fire-brick arch 3, all forming furnace chamber 4. By means of special shaped

refractories 27 having fluted heads 28 and square headed bolts 32 and nuts 8, corrugated reflector plates 18 having coils 19 are retained in the position shown against the side walls of the furnace chamber 4. Another shape of the special ceramic refractory 27, having a fluted head 28 retains similar corrugated reflector plates and coils in the arch of the furnace. In certain other forms of refractory construction, I have successfully used the bolted form of ceramic refractory mounted on a flat arch of a furnace, and in the latter case I do away with the fire-clay arch shown in Fig. 1.

Fig. 2 is a typical illustration of a furnace wall 23 showing the method of mounting a heating element consisting of a return bend coil 19 lodged in corrugated reflecting and radiating plates 18. The refractory member has a body portion 26 and a base portion 27 with a spaced relationship between projecting base 27 and flutings 28, so that a corrugated reflector plate 18 and heating coil 19 can be held in position shown by outline 33 in Fig. 6 as against a flat wall of a furnace; or a similar corrugated refractory 18 and coil 19 can be supported in an angular position, or in a horizontal or vertical position which makes the assembly suitable for a self-supporting assembly, as shown in Fig. 8.

It is sometimes desirable as against a flat surface wall to bolt these I shaped refractories 26 to the outside furnace shell by means of bolts 32, as shown in Figs. 1 and 6, and shown in assembly as tied in by nuts 8 in Fig. 1.

In Figs. 1, 2, 5 and 6 a square headed bolt 32 is shown lodged in hole 30, having square countersunk recess 31. Groove 35 at one end of refractory offers a reception means for lug 36 of an adjacent refractory, where a multiple number of such refractories are used. The combination of tongue 36 in grooves 35 keeps successive numbers of refractories in alignment.

In Fig. 3, 25^a is shown as a modified form of the special shaped ceramic refractory, whereby the base portion 25 lodges in an undercut groove 24 of a furnace wall 23, such furnace wall being formed of any suitable material, such as fire-clay. These refractories 25 have flutings 22 projecting over return bends 20 of coils 19, and also overlap a portion of reflector plates 18, thereby retaining coil 19 in corrugated reflector 18. The ceramic refractories 25 are slidably arranged in the grooves of the furnace wall 23. These flutings 22, of head portion 17, and flutings 28 of Figs. 5 and 6, provide spaces between the projections forming openings as 29 in Fig. 5. This affords direct radiation of the heat released from the return bends of coil 19 and causes a lower temperature in the return bend than results with a solid type of head. When these special shaped refractories extend horizontally, as in the side coil of furnace shown in Fig. 3, the openings 29 between the flutings 22 prevent the accumulation of fine particles, such as iron oxide from accumulating back of the flanges 22, as the scale is free to flow through openings 29 as in Fig. 5.

In Fig. 8 a transverse section of a vertical cylindrical or pot type furnace is shown, having cylindrical steel shell 10, enclosing heat insulating material 11, such as kieselguhr, forming furnace chamber 12. The inner surface of insulating wall 11 may be cylindrical in form. By means of the special shaped ceramic refractory of Fig. 7, shown as 42 in Fig. 8, reflector plates 14 having coils 15 coiled thereon are self-supporting against the furnace walls. These refractories are self-bracing and are sustained by reason of their own positioning around the interior of the furnace walls. This eliminates the necessity of bolts, such as shown in Figs. 1, 2, 5 and 6.

I have found by actual practice and test that the temperature of the return bends of coils lodged back of fluted heads such as 28 is 50 to 75° F. cooler than similar bends lodged back of flanges of solid type T shaped supports, such as shown in the structure of my Letters Patent No. 1,614,321, dated January 11, 1927.

While I have described a preferred embodiment of my invention, I desire it to be understood that modifications may be made by those skilled in the art within the scope of the appended claims without departing from the principles of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. Means for mounting resistance elements within a furnace structure comprising a plurality of refractory members extending from a furnace wall, said refractory member having a plurality of laterally extending fluted portions, a heat reflecting member secured between the fluted portions of adjacent refractory members, said heat reflecting member having a plurality of corrugations along the surface thereof, a resistor element having a plurality of turns, said turns being disposed in said corrugations in said heat reflecting member, and having portions thereof extending beneath the fluted edges of said refractories, whereby said turns are maintained in position with respect to said heat reflecting member.

2. Means for mounting a resistor comprising a plurality of refractory members spaced one from the other, said refractory members each having an overlapping flange portion, each flange portion being fluted along the edge thereof, a heat reflecting member lo-

cated between said overlapping flange portions, said heat reflecting member having a corrugated surface, a resistor in the form of a wire member wound in parallel extending turns in the corrugations of said heat reflecting member with the turns thereof extending beneath adjacent fluted portions of the flange portions of said refractories, the fluted edge portions of each of said refractories being aligned with the corrugations of said heat reflecting member and protruding over the return ends of the wire turns in said corrugations.

3. In an electric furnace structure a supporting member for a heater element comprising a refractory having a laterally extending corrugated surface for receiving the turns of a heating element, a web portion protruding substantially perpendicular to said surface, said laterally extending surface having a plurality of serrations along the edge thereof, said serrations serving to engage portions of the heating element for maintaining the heating element in an operative position.

4. In an electric furnace structure, a set of refractories extending parallel one to the other and protruding perpendicular to the wall of the furnace, said refractories having laterally extending surfaces thereon, a heat radiating surface constituted by a plate located intermediate said refractories, a multiplicity of corrugations in said plate extending perpendicular to the axes of said refractories, and a heater element positioned between the corrugations in said heat radiating surface and the laterally extending surfaces of said refractories, the laterally extending surfaces of said refractories being serrated for maintaining said heater element in position between said corrugations on said plate.

5. In an electric furnace structure, a set of refractories spaced one from another and protruding from a furnace wall, each of said refractories including a web portion and a laterally extending cap portion, each cap portion being serrated along the edges with the serrated portions of each set of refractories directed toward each other, a heat reflecting plate disposed between the web portions of said refractories, and a heating element carried by said heat reflecting plate and secured between the serrated portions of said refractories.

6. In an electric furnace structure, a set of parallel extending refractories protruding from the furnace wall, each of said refractories including a web portion and a top portion, the refractories of each set being interlocked end to end and having a laterally extending portion integral with said top portion and serrated at the edges thereof, a heat reflecting plate having a corrugated surface thereon, said plate being disposed between the web portions of said refractories, and a heating element wound in the corrugations of said heat reflecting plate and secured in position beneath the serrated edges of said refractories.

In testimony whereof I affix my signature.

EDWIN L. SMALLEY.