June 16, 1931. O. A. COLBY 1,810,643

DENTAL FURNACE

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Fig.1.

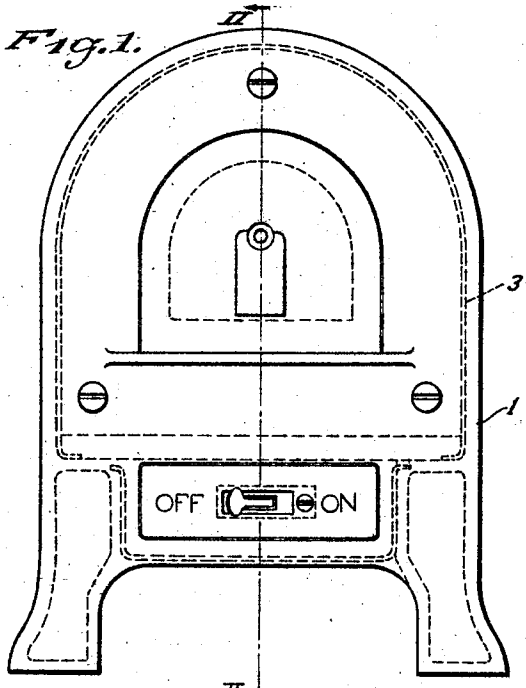
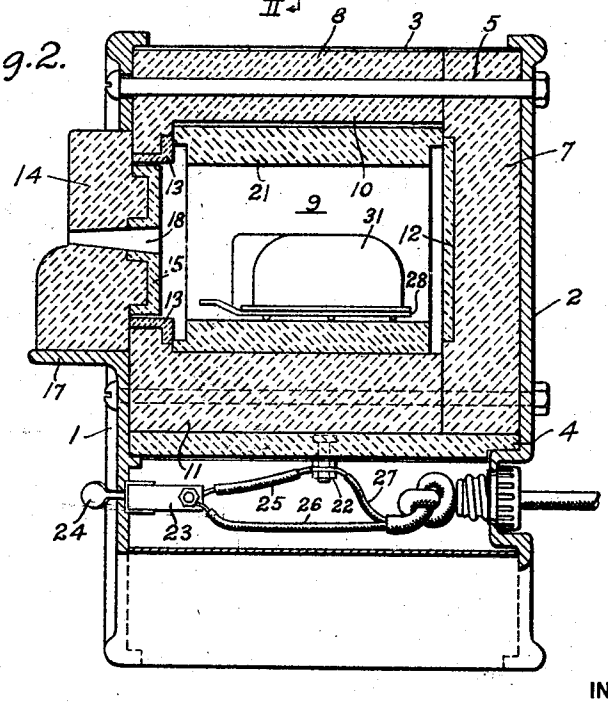


Fig.2.



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Fig. 3.

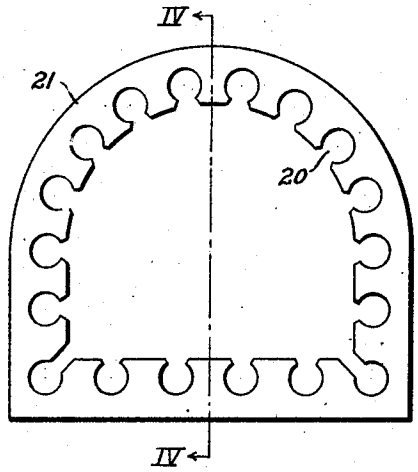


Fig. 4.

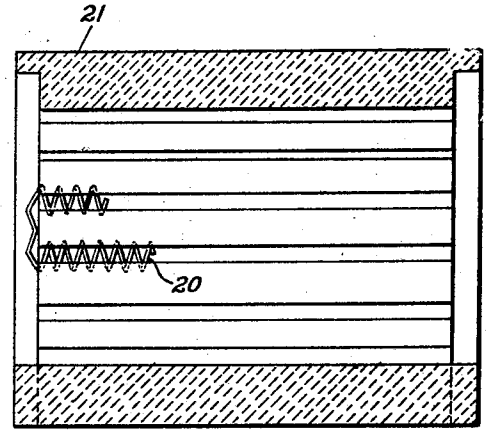


Fig. 5.

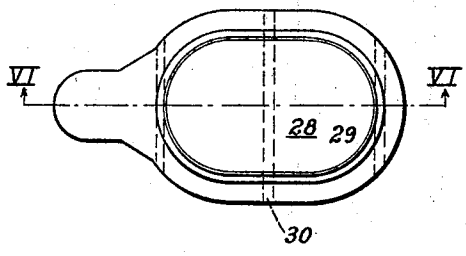


Fig. 6.

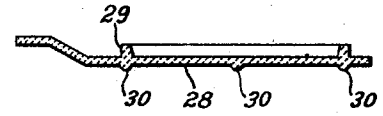


Fig. 7.

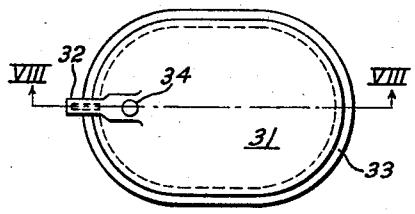
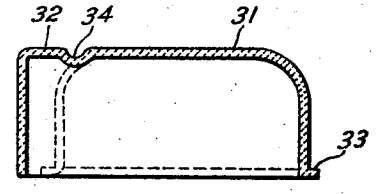


Fig. 8.



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UNITED STATES PATENT OFFICE

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DENTAL FURNACE

Application filed February 14, 1928. Serial No. 254,208.

My invention relates to electric furnaces and more particularly to an electrically-heated furnace adapted for use in dental laboratories for the heat treatment or glazing of artificial teeth.

In the practice of dentistry it is common for the dentist either to construct special porcelain teeth or to purchase manufactured porcelain teeth and cut or grind them to a desired size and shape. In the cutting and grinding operations, however, the glazed surface of the tooth is destroyed and voids are exposed, in which bacteria and food deposits may collect, and result in a discoloration of the tooth. It becomes necessary, therefore, to apply a coating to the tooth which may be glazed to cover the voids. Further, it is necessary, in some instances, to stain or color portions of an artificial tooth to make it harmonize in color with the natural teeth.

All of these procedures involve heat-treatment, and have usually been effected by employing an electric resistance furnace having a heating element composed of platinum wire. In view of the inherent expense of such a furnace, it has been attempted to employ resistance-heating elements composed of various iron alloys, and particularly those containing nickel and chromium, but the applications have invariably proved to be unsuccessful.

Various methods of construction have been employed in attempting to utilize a nickel-chromium alloy for this purpose. In one construction the resistance element was completely separated from the work to be heated, by a muffle substantially covering the side walls of the heating chamber. This method proved objectionable in view of the time required to bring the furnace up to operating temperature, which undesirably lengthened the time of the cycles of operation. In another construction the heating element was embedded in the side walls of the furnace chamber, but, at the relatively high operating temperature desired (approximately 1950° F.), the element rapidly burned out and the construction proved to be impracticable from a cost standpoint.

In another construction, the heating element was so disposed upon the walls of the heating chamber that the work to be heated was directly exposed to heat radiating therefrom. This construction was found to be objectionable because the element spalled, responsive to repeated heating and cooling, and flakes of material cast therefrom stained and spotted the light-colored porcelain, resulting in a worthless product.

An object of the present invention, therefore, is the provision of a dental furnace so constructed that the use of a commercial type of resistance heating element is practicable, and wherein the work being heated is at all times protected from particles falling from the heating element and from the furnace walls.

Another object of my invention is to provide, in a dental furnace, means for protecting the work to be heated which is removable from the heating chamber, and which has a sufficiently low heat-storage capacity whereby the work may be enclosed and protected during the heating and cooling operations without a substantial increase in time in the cycles of operation.

In practicing my invention, I provide a relatively small heating chamber, means for supporting a nickel-chromium resistance element on the longitudinal walls and floor thereof, means for minimizing the spalling of material from the walls and resistance element, and an improved means for protecting the tooth during the heating and cooling operations.

In the accompanying drawings,

Figure 1 is a view in front elevation of a dental furnace embodying my invention,

Fig. 2 is a view in vertical longitudinal section taken on the line II—II of Fig. 1,

Fig. 3 is a view in end elevation of a resistor support constituting a part of my invention,

Fig. 4 is a view in longitudinal section taken on the line IV—IV of Fig. 3,

Fig. 5 is a plan view of a work-supporting tray,

Fig. 6 is a view in longitudinal section taken on the line VI—VI of Fig. 5,

Fig. 7 is a plan view of a work-protecting

cover adapted to cooperate with said tray, and

Fig. 8 is a view in vertical section taken on the line VIII—VIII of Fig. 7.

Referring more particularly to the drawings, a furnace embodying my invention comprises a pair of cast metallic plates 1 and 2 and a metallic shell 3, disposed therebetween, constituting a metallic furnace casing. The lower portion of the casing is closed by a plate 4, of electric-insulating material, constituting a terminal block as hereinafter described. The casing is maintained in assembled relation by means of a plurality of clamping bolts 5 extending longitudinally therethrough. The cast metallic plate 1 is provided with an opening to afford access to the interior of the casing.

Within the casing are disposed a plurality of blocks 7 and 8 of molded ceramic heat-insulating material defining a furnace chamber 9.

The block 8 comprises an arched portion 10, constituting the roof and side wall portions of the chamber, and a flat horizontally extending portion 11 integral therewith, constituting the floor of the chamber.

A plate 12 composed of a close-grained highly refractory material, such as porcelain, is partially embedded in the inner face of the block 7 and is substantially coextensive in area with the lateral dimensions of the furnace chamber. The block 7 is molded in a single piece and the plate 12, which has been preformed, is embedded therein in the molding operation. The block and plate are then baked as a unit and the resulting structure is a substantially unitary block having a portion of one face thereof composed of highly refractory material.

The block 8 is enlarged adjacent the forward portion thereof and extends a short distance toward the longitudinal axis of the furnace, as shown more particularly in Fig. 2, and a facing 13 of porcelain is disposed peripherally of the edge of the opening defined thereby. The porcelain is applied to the block 8 during the molding operation thereof, and the result, as in the case of the block 7, is a substantially integral structure.

The opening defined by the forward edge of the blocks 8 cooperates with the opening in the cast plate 1 to permit charging and removing material with respect to the furnace chamber.

The charging opening is normally closed during the heating operation by a block 14 of heat-insulating material which is provided with a facing, or cap 15, of porcelain, molded upon the inner face thereof in a manner similar to the porcelain facings 12 and 13. When in operative position the closure 14 fits relatively closely in the furnace opening and is supported upon a flange 17 cast integral with the plate 1. Manipulation of the closure is facilitated by means of an enlarged rib, extending vertically thereof, constituting a handle portion. A peephole 18 extends through the closure block 14, to permit the observation of conditions in the furnace chamber, and may be normally closed, if desired, by a removable refractory plug (not shown) in a well-known manner.

The heating element 20 comprises an electrical-resistance wire of refractory metallic material, such as a nickel chromium alloy, wound in the form of an elongated helix. The specific form of the element is obviously immaterial and may be varied as desired to meet the requirements of a particular installation.

The heating element 20 is supported in operative position by means of a shell 21, shown in detail in Figs. 3 and 4, composed of a close-grained highly refractory material, such as porcelain, and provided with a plurality of horizontally extending grooves on the inner surface thereof. The heating element is threaded through the grooves and operatively supported therein.

The grooves are somewhat restricted in lateral area adjacent the inner surface of the shell and thereby serve the double purpose of maintaining the heating element therein, and of reducing to a minimum the amount of material cast from the element into the heating chamber, responsive to the spalling thereof, consistent with the obtaining of a desired amount of direct heat radiation from the element.

The outer dimensions of the shell 21 are such that the roof, floor and side walls of the heating chamber, defined by blocks 7 and 8, are completely covered and the ends of the shell cooperate with the plate 11 and porcelain facings 12, to constitute a heating chamber, the walls of which are composed of a close-grained thermally-insulating material having highly refractory characteristics.

The heating element may comprise a plurality of sections of resistor wire adapted to be independently connected in an electric circuit to effect a desired temperature control, but I prefer, in the present embodiment to employ a single continuous element. The ends of the element are connected, respectively, to two terminal posts 22 secured to the terminal block 4.

A toggle snap switch 23, of a usual type, is secured to the cast plate 1 in such a manner that the operating lever 24 thereof projects through said plate. A terminal lead 25 is electrically connected, at the respective ends thereof, to one of the terminal posts 22, and a terminal of switch 23.

Leads 26 and 27, from a suitable source of power, are connected, respectively, to the other terminal of switch 23, and to the other ter-

minal post 22, and extend through a suitable opening in the cast plate 2. The opening is bushed to protect the leads against abrasion, in the usual manner.

With the construction described, the resistor supporting shell and the resistor element may be removed as a unit from the furnace chamber to facilitate the repair or replacement thereof. The removal may be accomplished by disconnecting the resistor element from the terminal posts 22, and removing the bolts 5, whereby the plate 2 and wall 7 may be removed and the shell 21 withdrawn longitudinally.

The work to be heated, an artificial tooth in the present embodiment, is supported within the heating chamber upon a removable tray 28 which is constructed of porcelain, or other suitable highly refractory material. The tray is provided with a vertical flange or bead 29, upon the upper surface thereof, adapted to surround the work, and laterally extending beads 30 on the under surface thereof, constituting spaced supports for the tray. One end of the tray is elongated, and in a plane substantially higher than the body of the tray, to provide means for facilitating the handling thereof incident to moving the same into and out of the heating chamber.

A cover, or cap, 31, comprising relatively thin walls of highly refractory material, is substantially co-extensive in horizontal section with the outer dimension of the bead 29, and is adapted to cooperate therewith to completely enclose the work.

A projecting flange or lug 32 is formed integral with the cover to facilitate handling thereof, and a horizontally extending flange or rim 33 is formed on the lower peripheral edge of the cover.

A depression 34 is provided in the upper surface of the lug 32, and is adapted to contain a temperature indicating means, such as a gold pellet, as hereinafter described.

It is to be understood that the tray 28 and cover 31 are of very thin material and although offering substantially no hindrance to the flow of heat therethrough, are sufficiently refractory to withstand the relatively high operating temperature of the furnace chamber.

In operation, the artificial tooth to be heat-treated or glazed is suitably supported upon the tray 28 and the cover 31 is placed in operative position. A fusible material, preferably a piece of gold foil, is placed in the depression 34 in the cup, and the tray and cup are placed in the heating chamber, which has been heated to a desired degree.

It is desirable, in the present instance, to subject the work to a temperature of approximately 1950° F., and, since this temperature is approximately the melting point of gold, the melting of the gold foil in the depression 34 affords a reliable indication of the attainment of the proper operating temperature. The condition of the gold foil may be observed through the peephole 18 in the closure block 14.

Upon the attainment of the desired temperature, the closure block is removed and the work-supporting tray and cover are removed from the chamber and permitted to cool freely in the air. The cover may be maintained in operative position during a portion of the cooling period to prevent cracking of the surface of the heated tooth resulting from the contact of cold air therewith.

During the heating operation particles are cast from the heating element and chamber walls, and, in view of the finely divided character thereof, contamination of the work thereby is prevented with difficulty. By constructing the furnace chamber walls of a close-grained porcelain, and employing a substantially non-oxidizable heating element, the amount of material spalling therefrom may be effectively reduced. Irrespective of the quality of the materials, however, a certain amount of spalling occurs and the particles cast off are circulated through the chamber by convection currents therein.

By my invention, however, the work is maintained out of contact with the furnace chamber atmosphere at all times and the work is adequately protected from the relatively small amount of spalled material circulating in the furnace chamber atmosphere.

Although the heat-storage effect of the tray and cover is sufficiently small to offer substantially no resistance to the flow of heat therethrough, it is sufficient to maintain a small positive pressure within the cover, which pressure further tends to prevent contamination of the work by particles spalling from the heating element and furnace chamber walls.

The cover is maintained in operative position subsequent to the heating operation, so that the work is protected against atmospheric impurities, and at the same time, a too rapid cooling of the surface of the tooth is prevented.

Obviously, it is within the scope of the present invention to vary the structural details, of the furnace described, to meet the requirements of a particular installation, or application, of the invention.

The furnace structure proper is being claimed in this application, and the material container is being claimed in a divisional application.

Various modifications may be made in my invention without departing from the spirit scope thereof, and I desire, therefore, that only such limitation shall be placed thereon as are set forth by the prior art and imposed by the appended claims.

I claim as my invention:

1. In a furnace, a furnace wall including a relatively thick body of heat-insulating ceramic material, and a relatively thin embedded plate of porcelain constituting a substantially non-spalling heat-resistant face for said wall and molded substantially integral therewith.

2. In a furnace, a heating chamber and a charging opening communicating therewith, a door of molded ceramic material normally closing said opening, and a relatively thin facing of substantially non-spalling material on the inner surface of said door molded substantially integral therewith and of a higher degree of refractoriness than the molded ceramic material.

3. In an electrically heated dental furnace, a plurality of walls defining a heating chamber having a charging opening communicating therewith, a closure for said opening, means constituting a relatively thick lining of ceramic heat resistant refractory material disposed to completely cover the roof, floor and side walls of said chamber, and a facing of substantially non-spalling porcelain molded integral with the inner face of said closure and peripherally of said opening.

4. In an electric furnace including a plurality of relatively thick walls of ceramic heat-resisting material defining a furnace chamber, a shell of substantially non-spalling porcelain material arranged to cover the top, floor and side walls of said chamber, a plurality of grooves formed in the inner surface of said shell for receiving portions of a resistance element, relatively thin porcelain plates embedded in the end portions of the walls cooperating with said shell to constitute substantially non-spalling walls defining said chamber.

In testimony whereof, I have hereunto subscribed my name this 9 day of February, 1928.

ORA A. COLBY.