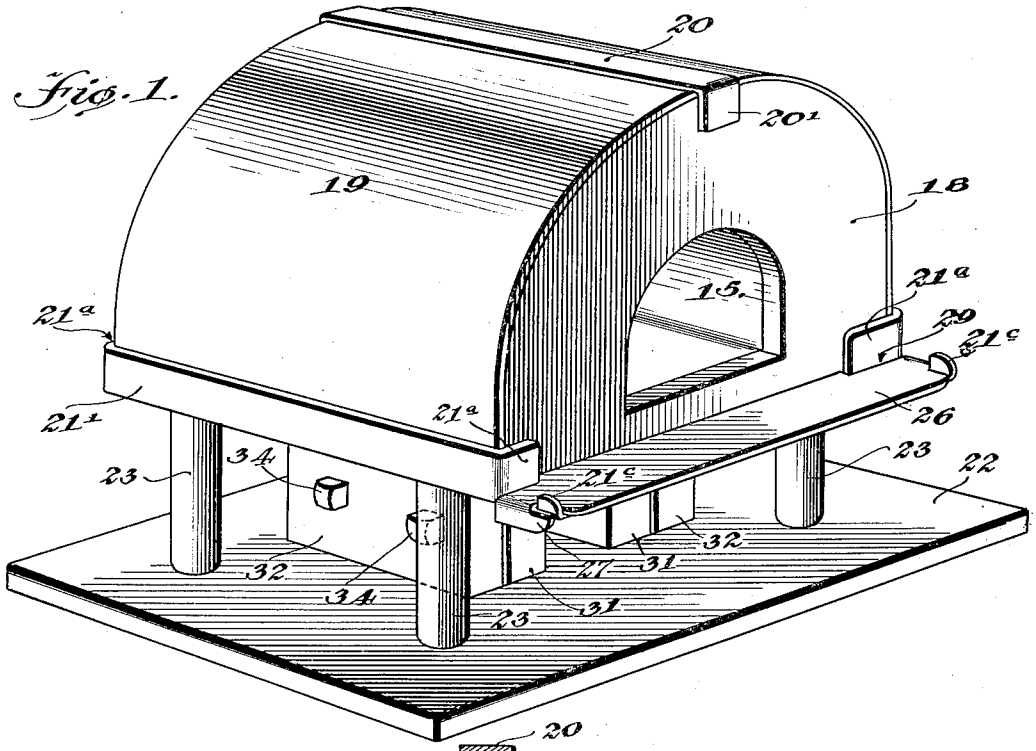
May 6, 1930. A. J. ASCH 1,757,895

ELECTRIC FURNACE

Filed Jan. 5, 1928 2 Sheets-Sheet 1

Fig. 1.


20
20¹
19
18
15
21ª
21ª
21ª

May 6, 1930. A. J. ASCH 1,757,895

ELECTRIC FURNACE

Filed Jan. 5, 1928 2 Sheets-Sheet 2

Fig. 3.

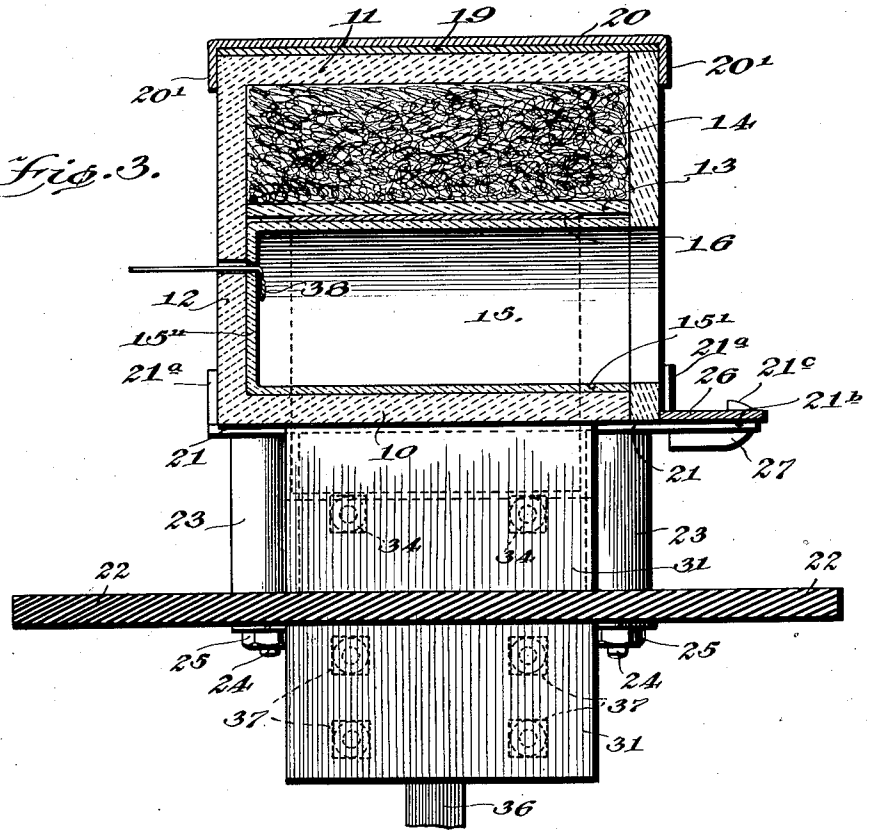
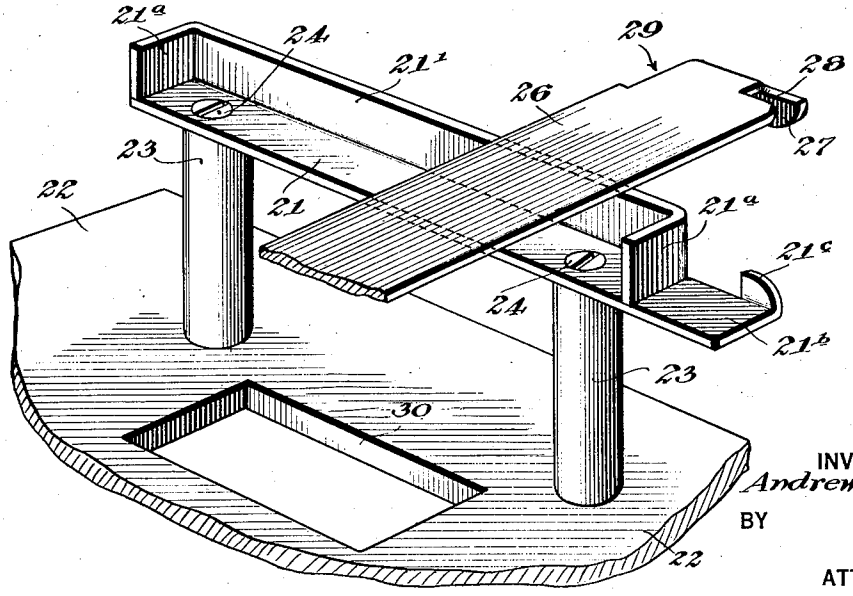


Fig. 4.



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UNITED STATES PATENT OFFICE

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ELECTRIC FURNACE

Application filed January 5, 1928. Serial No. 244,676.

This invention relates to electric furnaces generally, and more particularly to those types of such furnaces as are usually employed in dental laboratories and the like for porcelain, bridge and crown work.

Heretofore in the dental practice, certain serious disadvantages have been observed and otherwise experienced in the operation of electric furnaces of the character mentioned, regardless of design or make, and particularly those employed in dental porcelain baking. In these special furnaces, a heating element of extremely high resistance, generally platinum wire, is usually embedded in a refractory such as fire clay, and it is well known that a break down of the furnace refractory wall structure, commonly known as the muffle, often occurs in their operation. These break downs, in a greater percentage of cases coming under observation, have been determined to be due largely to the difference in the co-efficient of expansion of the resistance element and that of the refractory or fire clay, or, in other words, it has been found that in building up heat in one of these furnaces, the platinum resistance element reaches a maximum heating condition before the refractory or heating clay, and in cooling down, the latter is hotter than the former, thus making the expansion and contraction variable, and to a greater degree than the variation caused by the initial difference in the co-efficients of expansion. A further disadvantage and otherwise serious objection to these types of furnaces, wherein the heating or resistance element is embedded in the refractory, is the usual total destruction of the furnace structure by the breaking down of the refractory material, and the consequent impracticability of repair or replacement of the main parts of a furnace.

The principal object of the invention is, therefore, to provide for a furnace structure of the class set forth, and one which is of an extremely simplified construction and arrangement of parts, such as will effectively overcome the disadvantages aforesaid, in a manner that the life of the furnace will be prolonged for an indefinite period, and the parts thereof will be adapted for quick and easy replacement whenever necessary or desired.

A further object of the invention is to provide for a form of heating element which will be readily capable of generating the desired or necessary amount of heat with a much lower resistance characteristic than it has heretofore been thought possible to employ for the purpose, and which will have a greater radiating surface for a given cross sectional area, such as will also give a substantial uniform radiation of the heat throughout the effective heating zone of the furnace.

Another object of the invention is to provide for a resistance element of the character mentioned, and one which is of a nature to render it unnecessary and undesirable that the same be embedded in the refractory material or fire clay forming the outer muffle of the furnace, and as a consequence whereof the same can and will be supported within the furnace in a manner that it can readily creep and weave, or otherwise exercise all of its expansion and contraction movements without restriction, and, therefore, without danger of distortion, damage or breakage.

A further object of the invention is to provide for a furnace of the type set forth, wherein the several parts of the same are capable of being readily, easy and quickly taken apart for inspection, cleaning or replacement of parts, and thereafter the parts re-assembled into set up operative position with equal facility.

A still further object of the invention is to provide for a furnace as hereinbefore characterized, and one embodying a separate and readily removable inner muffle, which, when positioned within the outer muffle, acts to house the heating or resistance element between the same and the latter in a manner to effectively protect the element from exposure to atmosphere, and from any and all possible injury incident to the operation of the furnace.

Another important object of the invention is to form the inner muffle of the furnace from a material, such as silica quartz, or the

like, which has a zero co-efficient of expansion, and therefore, will not check, crack or break down, either in building up heat or in cooling down, thus entirely eliminating usual refractory repairs to or replacement of the same.

A further object of the invention is to provide for a furnace structure wherein the parts of the same may be readily manufactured and assembled without the initial expense of purchase of the platinum metal for the heating elements therefor, and which expense need not be incurred until a furnace is ready for use, such procedure being made possible by reason of the fact that the heating elements are not incorporated in the refractory parts of the furnaces but are separate therefrom, and may be readily placed in position or removed as occasion may require.

With the foregoing and other equally important objects and advantages in view, the invention resides in the certain new and useful combination, construction and arrangement of parts as will be hereinafter more fully described, set forth in the appended claims, and illustrated in the accompanying drawings, in which:

Figure 1 is a perspective view of a practical embodiment, assembly and mounting of the improved furnace,

Figure 2 is a vertical section taken on the line 2—2 of Figure 3,

Figure 3 is a vertical longitudinal section taken on the line 3—3 of Figure 2, and

Figure 4 is an enlarged fragmentary detail, in perspective, of the furnace support and the mounting therefor.

Referring to the drawings, wherein similar characters of reference designate corresponding parts throughout the several views thereof, the preferred embodiment of the invention, as shown therein, comprises an outer muffle of a refractory material, such as fire clay or the like, which is formed to provide a flat bottom wall 10, an upper and outer arched or semi-cylindrical wall 11, a vertical back or rear wall 12, and an inner arched or semi-cylindrical wall 13, the latter being disposed on the bottom wall 10, and centered thereon in uniformly spaced relation with respect to the upper and outer arched wall 11. This inner arched wall 13, however, is preferably formed of a different refractory material from that of the walls 10, 11 and 12, namely alundum, while the space between the same and the outer arched wall 11 is completely filled with a heat resisting or insulating material 14, such as asbestos or the like.

An inner muffle 15, preferably of silica quartz, which has a zero co-efficient of expansion, is removably positioned within the space of the inner arched wall 13, and the radius of the curved wall of this inner muffle is only slightly less than that of the latter, such as will readily allow for the comparative free and easy insertion and removal of the inner muffle into and out of operative position. Formed in the bottom wall 10 of the outer muffle is a pair of spaced parallel slits 16, downwardly through which are projected the opposite ends of a heating or low resistance element 17, which is preferably in the form of a strip of sheet metal or metal foil, such as platinum, the intermediate portion of which is interposed between the opposed curved surfaces of the arched wall 13 of the outer muffle and the arched wall of the inner muffle 15.

As shown in Figures 2 and 3, the inner muffle 15, in addition to its arched or semi-cylindrical wall structure, is provided with a flat bottom wall 15′, which rests directly on the bottom wall 10 of the outer muffle, and a back or rear end wall 15″. The inner muffle 15 is of a length to have this back or rear wall 15″ to abut the back or rear wall 12 of the outer muffle, and the edges of its front open end disposed flush in the plane of the front edges of the walls 10 and 11 of the outer muffle when positioned within the latter. A front end wall 18 is removably abutted against the front ends of the outer and inner muffles, but is provided with an opening in the same of a shape and size conforming to that of the front open end of the inner muffle, whereby access may be readily had to the interior of the latter.

The outer arched wall 11 of the outer muffle is to be enclosed by a housing or wall 19 of sheet metal, preferably sheet steel, which, when disposed in proper position, has its forward edge portion extended in a manner to overlap the edge of the front wall 18 of the furnace. This metal housing or wall 19 is to be held in place on the furnace at the upper side thereof by means of a clamping member 20, which is preferably made from a strip of resilient metal, and has its opposite end portions 20′ angularly bent downwardly to engage over the opposite ends of the furnace, the forward of the end portions 20′ engaging over the removable front end wall 18 to initially retain the latter in position.

The furnace, as thus constructed and arranged, is to be supported in proper position of use in a mounting which comprises a pair of parallel angularly flanged members, each having one of their flanges 21 supported in horizontal plane above a table or supporting plate 22 on the upper ends of pairs of spaced standards or posts 23. These standards or posts 23 are provided in the form of metal tubes, preferably brass, secured in vertical position on the supporting table or plate 22 by having fastening bolts or screws 24 passed downwardly through the bores thereof, and through openings formed in the table or plate 22 in alinement with the bores. In the use

of bolt fastenings, the lower ends of the same will be projected below the table or plate 22 to have threaded thereon the securing nuts 25, while the head portions of these fastenings are preferably countersunk into the upper faces of the flanges 21.

With the parts of the furnace proper assembled as hereinbefore explained and held in assembled condition by the clamp member or bar 20, the same is placed in position on the supporting flanges 21, and between the vertical flanges 21′, the opposite ends of the latter being angularly bent inwardly over the flanges 21, as at 21^a, to engage at the forward and rear ends of the furnace in a manner to retain the same against endwise displacement. The forward ends of the flanges 21 are extended beyond the angular portions 21^a, as at 21^b, and are provided with upturned portions, forming lugs 21^c at the forward ends of their outer side edges. The upper edges of these upturned portions or lugs 21^c are curved downwardly in a forward direction and merge into the forward end edges of the flange portions 21^b. A member or plate 26 is extended between and supported on these flange ends 21^b, and has its opposite ends turned downwardly to provide flange portions 27, which engage at the outer side edges of the flange portions 21^b. Recesses 28 are formed in the front edge member or plate 26, immediately inward of the end flanges 27, and are to be engaged over the lugs 21^c of the flange ends 21^b, whereby an interlocking engagement obtains between the same to retain the member or plate in position on the latter. The opposite ends of the rear edge of the member or plate 26 are recessed, as at 29, to engage over the inturned portions 21^a of the vertical flanges 21′, and so that the intermediate edge portion of the member or plate, between the recesses 29, will snugly engage against the lower edge portion of the front wall 18 of the furnace. The length of the member or plate 26 is such that its end flanges 27 will snugly engage at the outer side edges of the flange portions 21^b, and in a manner to tension the furnace supports in their entirety toward one another, and thereby exert a clamping action on the opposite sides of the furnace structure. Thus, the furnace will be securely sustained in position, and the opposite ends of the housing or wall 19 will be clamped between the vertical flanges 21′, and the arched wall of the outer muffle.

To connect the heating or resistance element 17 in circuit with a suitable source of current supply (not shown), the ends of the same, depending downwardly through the slits 16, in the bottom wall 10 of the outer muffle of the furnace, are to be clamped between the upper ends of a pair of connectors, each of which is preferably formed in three parts 31, 32 and 33, the part 31 being of a length equal to the combined length of the parts 32 and 33, when the latter are disposed in end to end abutting relation, substantially as is shown in Figure 2. Thus, each of the free ends of the heating or resistance element 17 will be clamped between the upper end of the part 31, of a connector, and of the part 32, the latter part being secured to the former by means of screws or the like 34. The opposed faces of the upper end portions of the connector parts 31 and 32 are preferably faced with a thin film or coating of platinum 35, of an area slightly greater than that of the ends of the heating or resistance element 17 to be positioned therebetween. The free ends 36 of the circuit conductors leading from the source of current supply (not shown), are to be similarly clamped between the lower end connector part 31 and the separate lower part 33, the latter part being secured to the former part by means of screws or the like 37. For the purpose of securely clamping the conductor ends 36 in position between the parts 31 and 33 of the connectors, the opposed faces of these parts are preferably formed to provide alined grooves 38, which open downwardly of the lower ends of the parts to allow for the insertion of the conductor ends 36 upwardly thereof for opening and loosening up of the clamping screws 37. When properly assembled, these connectors are supported in position beneath the furnace, and depend through openings 30 formed in the supporting plate or table 22, substantially as is shown in Figures 2 and 3.

As shown in Figures 2 and 3, a thermo couple 38 will be provided in the rear end of the inner muffle 15, and is arranged to have its free ends lead downwardly of the rear wall 15″ thereof, and through the rear wall 12 of the outer muffle for connection in circuit with a suitable temperature indicating instrument or the like (not shown) in the usual manner.

From the foregoing, it will be readily apparent that the heating or resistance element 17, although made as it is from fragile metal foil or thin plate, will be as fully housed and otherwise protected from injury by being confined between the inner arched wall 13 of the outer muffle, and the arched wall of the inner muffle 15 as are the heating and resistance elements of other makes of furnaces, when the latter are embedded in the refractory material forming the inner wall of such furnaces, and also that, in the event of an injury to or the break down of the foil or sheet form of heating or resistance element 17, the same may be readily removed from position by merely disconnecting its ends from the circuit connectors, and withdrawing the inner muffle 15 from the outer muffle after the furnace has been displaced from its mounting, and a new one placed in position. It is also to be noted that in the case of the accidental break down or fusing of the

foil of platinum heating or resistance element 17, or its damage from any other cause, the metal itself is recoverable for use in other dental work, as for instance in crown work, and consequently and by reason of its not being embedded in the refractory material of the inner arched wall of the outer muffle, its loss as the heating or resistance element of the furnace does not result in a total loss of the outer muffle structure or an otherwise serious financial loss, which would ordinarily be suffered by the operator of furnaces of known makes.

It is to be further noted that in the use of a single relatively thin strip of platinum or a sheet of platinum foil of appreciable area for the heating element of the furnace, an increased cross sectional area of metal is secured which effects a lower resistance to the passage of electric current through the same, and a corresponding increase of radiating surface and, consequently, a more uniform distribution of heat throughout the interior of the furnace, than would be the case in the use of the usual form of wire coil heating element. As an evidence of these facts, it is suggested by way of example that if the strip or sheet of platinum is one inch wide and .001 inch in thickness, as is contemplated for use in the present instance of the invention, the strip or sheet of platinum will have a cross sectional area of .001 square inch, and a radiating area per running inch of 2.002 square inches. Now, comparing the foregoing results with a wire heating element of the same cross sectional area, we find that the wire used would have to be .036 inch in diameter, and would have a radiating surface of only .113 square inch per running inch. This means that a piece of wire of the same cross sectional area, and, therefore, of the same resistance, would only have 1/18 of the radiating surface, and, therefore, would only be able to impart to the interior of the furnace 1/18 of the amount of heat generated thereby. Now, it will be readily obvious that if the same amount of heat were generated in a piece of wire of the same resistance per inch in length, such a wire would burn out immediately because it would not be able to radiate its heat fast enough. Again, if a piece of wire were used, which would have the same radiating area or surface per inch and the same resistance as the strip or sheet form of heating element, then that wire would be .093 of an inch in diameter, and it would have to be 6.76 inches in length for each inch of strip or sheet form of heating element employed. These latter dimensions of the wire form of resistance element will give the exact equivalent in both radiating surface and in resistance, as compared with the strip or sheet, but this amount of wire would weigh approximately forty-seven times as much as the equivalent strip or sheet of the platinum foil form of heating element, and the cost of the wire at the present market value of platinum would be approximately forty-seven times as much as that of the platinum foil.

Without further description, it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention or its scope as claimed.

Having thus fully described the invention, what is claimed is:

1. An electric furnace comprising an outer muffle, an inner muffle removably housed within the outer muffle, a resistance heating element having the form of a relatively thin sheet of platinum of substantially rectangular form interposed between the inner of the opposed walls of the outer and inner muffles and having the free end portions thereof projecting outwardly of a wall of the outer muffle, and circuit connectors engaged with the projected end portions of the resistance element.

2. An electric furnace comprising an outer muffle, an inner muffle housed within the outer muffle, a resistance heating element having the form of a relatively wide strip of platinum foil of substantially rectanglar form interposed between the inner of the opposed walls of the outer and inner muffles and having the free end portions thereof projecting outwardly of a wall of the outer muffle, and circuit connectors removably engaged with the projected end portions of the resistance element.

Signed in the county of New York and State of New York, this 3d day of January, 1928.

ANDREW J. ASCH.