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V. J. CHAPMAN

ELECTRIC FURNACE

Filed March 26, 1925

Fig. 1.

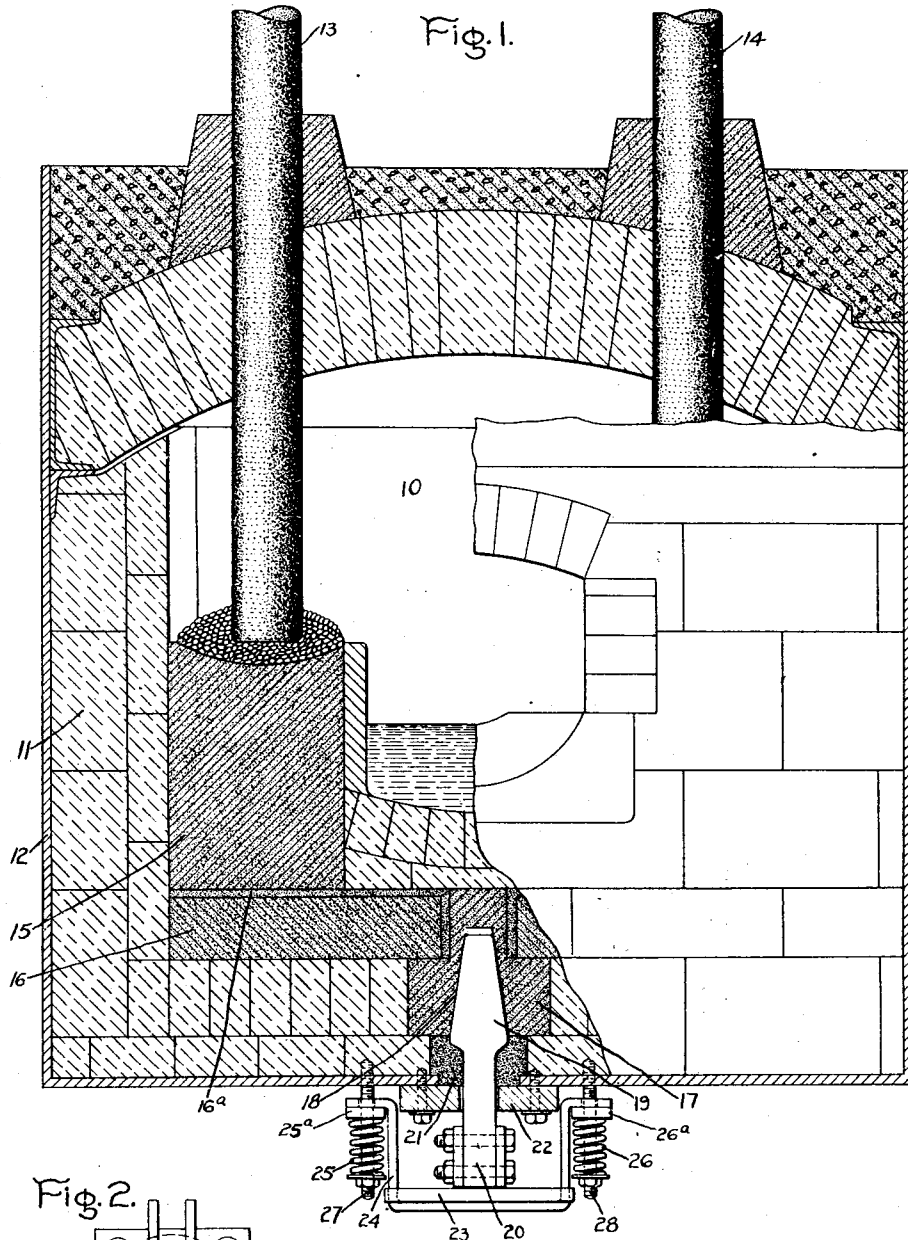
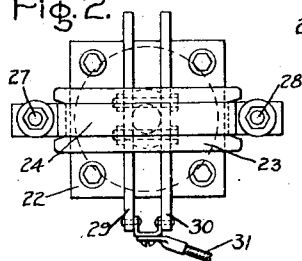


Fig. 2.



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UNITED STATES PATENT OFFICE.

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ELECTRIC FURNACE.

Application filed March 26, 1925. Serial No. 18,561.

My invention relates to electric furnaces, more particularly to electric furnaces provided with one or more electrodes for generating heat, and has for its object the provision of an improved electrical connection for the electrode.

In certain electric furnaces of the electrode type, particularly those adapted for three phase operation, an electrode is provided which is fixed in the bottom of the furnace crucible and extends upward into the furnace chamber where it is in arcing relation with an upper adjustable electrode. It is customary to have the bottom electrode project from the furnace to provide for the making of an electrical connection with it. This arrangement has the disadvantage that the electrode is exposed to oxidation, and furthermore dissipates an appreciable amount of heat.

In carrying out my invention I completely enclose the bottom electrode, and establish an electrical connection with it by means of a member of relatively high electrical conductivity which is in engagement with the electrode at a point within the furnace wall.

For a more complete understanding of my invention reference should be had to the accompanying drawing in which Fig. 1 is a vertical section view of an electric furnace embodying my invention, while Fig. 2 is a fragmentary bottom plan view of the apparatus for making the electrical connection with the bottom electrode.

Referring to the drawing, I have shown my invention in one form as applied to an electric furnace comprising a heating chamber 10 formed by walls built from heat refractory bricks 11, the brick walls being enclosed in a metallic protecting shell or casing 12. Extending into the furnace chamber through the top of the furnace wall are two electrodes 13 and 14 made of a suitable material such as carbon or graphite. These upper electrodes are preferably adjustable in any suitable manner so that they can be fed into the chamber 10 as they are burned away.

Each of the two upper electrodes cooperates with a lower electrode which is built into the bottom of the furnace. Only one of the bottom electrodes is shown, this being the bottom electrode 15 cooperating with the upper electrode 13. It will be understood that a similar bottom electrode is provided

for the upper electrode 14. The two bottom electrodes extend into the bottom wall of the furnace and terminate at a point near the exterior of the bottom wall. As shown the electrode 15 is electrically connected by way of block 16 with a centrally located block 17, the lower end of which terminates within the furnace wall. It will be understood that the bottom electrode cooperating with the upper electrode 14 is electrically connected with the block 17 in a similar manner. The blocks 16 and 17 are constructed of the same material as the electrode 15 and constitute a part of the electrode 15. A suitable packing cement 16^a, such as a mixture of graphite and hot tar, is used to form the joints between the parts 15, 16 and 17.

The block 17 is provided with a conical recess 18 in which fits the tapered end 19 of a terminal member 20 of smaller cross-section, made of an electrically conducting material, such as copper. The terminal bar 20 projects from the shell 12 for connection to a suitable electrical supply circuit. The terminal member 20 is sealed in the furnace wall by means of a suitable refractory non-porous cement 21, such as a mixture of fire clay and sodium silicate, which also insulates it electrically from the shell 12. Closely surrounding the terminal member is an insulating bushing 22 made of a suitable material, such as asbestos lumber, which is secured by means of bolts to the exterior of the shell.

It will be observed that the electrical connection between the terminal member 20 and the block 17, forming a part of the lower electrode, is made at a point within the furnace wall and that the block 17 is completely enclosed by the furnace wall and thus protected from oxidation. This arrangement furthermore conserves the heat generated in the furnace since the lower end of the block 17 is surrounded by heat insulating material. The loss of heat due to conduction through the terminal member 20, which has approximately the same conductivity as the electrode, is much less than would occur if the electrode itself projected from the bottom of the furnace. This is due to the fact that a copper terminal member having substantially the same electrical conductivity as the graphite or carbon electrode, has a much lower heat conductivity.

In order to hold the terminal member in close contact with the block 17 at all times,

notwithstanding the difference in the expansion and contraction of the two parts when heated and cooled, resilient means are provided for forcing the terminal member 20 inward. This comprises a cross bar 23, made of a suitable insulating material, such as asbestos lumber, which is in engagement with the outer end of the terminal member. Passing over the cross bar 23 is a U shaped strap 24 having its ends bent outward at right angles to form seats for helical springs 25 and 26. The lower ends of the springs rest against stops carried by bolts 27 and 28 which pass through the springs and through holes in the ends of the strap 24, and are secured to the casing 12. The springs 25 and 26 acting on the strap 24 force the terminal member upward in close contact with the block 17. Asbestos washers 25^a and 26^a are provided between the springs and the strap to reduce the conduction of heat from the shell 12 to the springs.

For the purpose of cooling the outer end of the terminal member 20 heat radiating copper bars 29 and 30 are secured to it. These bars 29 and 30 are utilized in establishing an electrical connection between the terminal member and a suitable source of supply, a conductor 31 being connected thereto. The outer end of the terminal member may be given a suitable coating, as a protection against oxidation, such as a surface layer of aluminum.

While I have described my invention as embodied in concrete form and as operating in a specific manner in accordance with the provisions of the patent statutes, it should be understood that I do not limit my invention thereto, since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

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

1. An electric furnace comprising a refractory crucible, a carbonaceous electrode terminating within the wall of said crucible, and a metallic terminal member having substantially the same electrical conductivity as said electrode secured in electrically conducting engagement with said electrode at a point within said wall.

2. An electric furnace comprising a refractory crucible, a carbonaceous electrode terminating within the wall of said crucible, a metallic terminal member of smaller cross-

section having one end in electrically conducting engagement with said electrode at a point within said wall, said terminal member having substantially the same electrical conductivity as said electrode, and cooling means for the projecting end of said terminal.

3. An electric furnace comprising a refractory crucible, a carbonaceous electrode secured in the wall of said crucible, a metallic terminal member in engagement with said electrode at a point within said wall, and resilient means for holding said terminal member in engagement with said electrode so as to maintain a good electrical contact between them, said terminal member having substantially the same electrical conductivity as said electrode.

4. An electric furnace comprising a refractory crucible, an electrode secured in the bottom of said crucible, a terminal member of good electrical conductivity projecting from said crucible having its inner end in engagement with said electrode at a point within the wall of said crucible, said terminal member having substantially the same electrical conductivity as said electrode, resilient means for holding said terminal member in engagement with said electrode, and means forming a tight joint between said crucible and said terminal.

5. An electric furnace comprising a refractory crucible, a refractory electrode secured in the wall of said crucible having its outer end terminating in the interior of said wall, the outer end of said electrode being provided with a conical recess, a metallic terminal member having a tapered end fitting in said recess, and means for securing said tapered end in said recess so as to maintain a good electrical contact between said electrode and said terminal member.

6. An electric furnace comprising a refractory crucible, an electrode secured in the bottom of said crucible and enclosed thereby, said electrode being provided with a conical recess, a metallic terminal member having a tapered end fitting in said recess, resilient means for forcing said terminal member into said recess so as to maintain a good electrical contact between them upon expansion and contraction of said crucible, and means forming a tight joint between said terminal and said crucible.

In witness whereof, I have hereunto set my hand this 25th day of March, 1925.

VERNI J. CHAPMAN.