Aug. 15, 1944. R. C. UPTON 2,355,761

ELECTRICALLY HEATED MOLTEN BATH FURNACE

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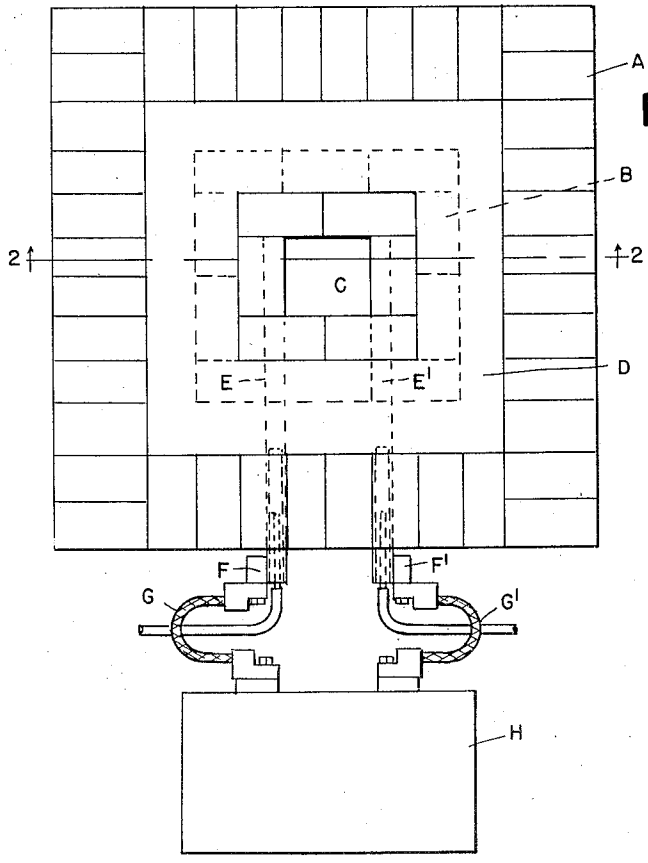



FIG.1.

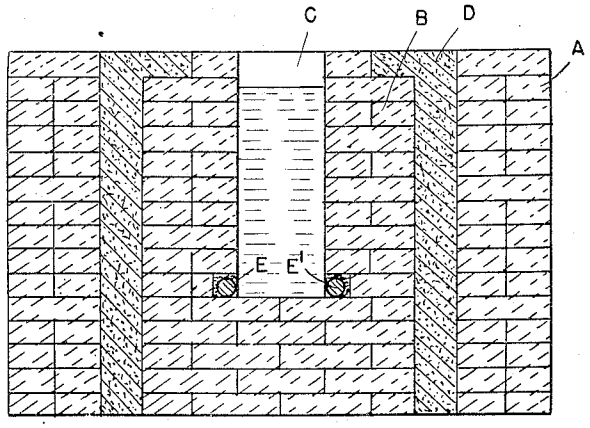



FIG.2.

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FIG.4.

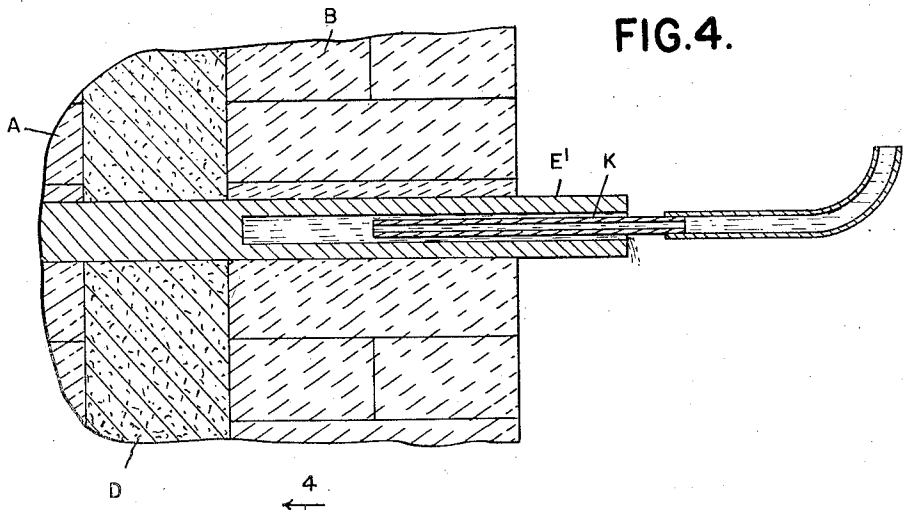
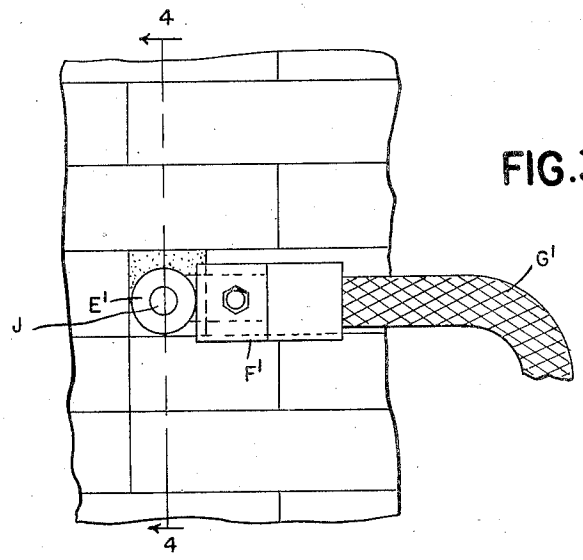



FIG.3.




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FIG.5.

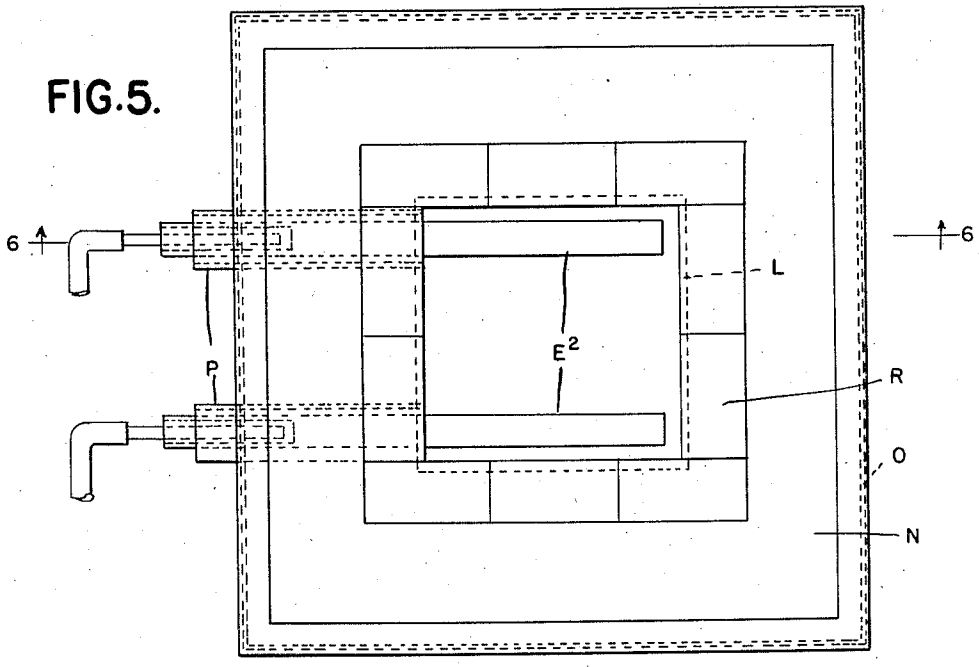
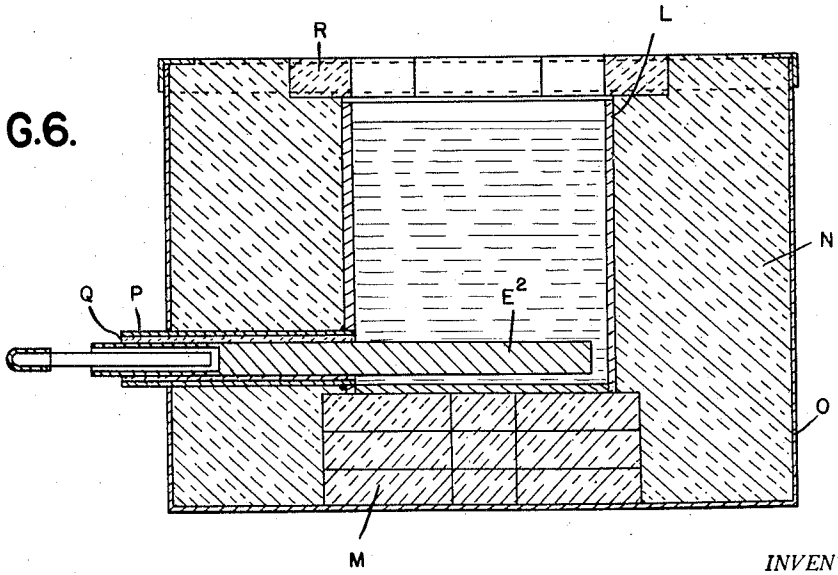



FIG.6.




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# UNITED STATES PATENT OFFICE

2,355,761

## ELECTRICALLY HEATED MOLTEN BATH FURNACE

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Application April 23, 1943, Serial No. 484,249

9 Claims. (Cl. 13—23)

The invention relates to molten bath furnaces of that type in which the heat is electrically generated, the molten bath constituting the resistor. It is the object of the invention to obtain a simple construction of furnace of this type avoiding certain detrimental features of constructions heretofore used and having certain novel advantageous features. To this end, the invention consists in the construction as hereinafter set forth.

In the drawings:

Fig. 1 is a plan view of the furnace;

Fig. 2 is a vertical section on line 2—2, Fig. 1;

Fig. 3 is a side elevation of a portion of the furnace showing the electrical connection to one of the electrodes;

Fig. 4 is a section on line 4—4, Fig. 3;

Fig. 5 is a plan view of a modified construction; and

Fig. 6 is a vertical section on line 6—6, Fig. 5.

As illustrated, A is an outer wall preferably formed of brick laid to form an enclosure preferably of rectangular form. Within this enclosure and spaced from the wall A is a second wall B formed of refractory brick and enclosing a central chamber C for holding the molten bath. The space between the walls A and B is filled with a refractory concrete D. E and E' are electrodes preferably formed of metal and extending through the walls into the bath below the surface thereof. As specifically shown, these electrodes are arranged parallel to each other with their inner faces substantially flush with the opposite inner surfaces of the walls B and at a level just above the bottom B' of the chamber C but such specific arrangement is not essential. These electrodes may be laid into the brickwork during the building of the walls A and B and occupy spaces left in one tier of brick. The electrodes extend outward beyond the wall A and their outer ends are attached by fittings F and F' to electrical conductors G and G' leading from the transformer H. The spaces about the electrodes in the tier of brick are originally filled with a cement as indicated at I thereby sealing them into the walls. However, when under heat the differential expansion of the metal and brickwork will break the seal so as to leave crevices through which the molten material might leak out from the chamber C. To avoid this defect, I cool a portion of the electrodes within the wall to a temperature at which the molten salt will freeze thereby forming a seal. Preferably this cooling means is formed by axially boring the outer end portion of each electrode to form a chamber J therein. Water is constantly supplied to this chamber from a smaller conduit K inserted therein and the heated water escapes through the space surrounding this conduit.

With the construction as thus described, when the chamber C is filled with a fused salt or other material for forming the molten bath, current is supplied to the electrodes E and E' and the molten material within the chamber will form an electrically conductive heating resistor between said electrodes. Thermo-convection will cause a constant circulation of the molten material to maintain a substantially uniform temperature in the whole bath. As the electrodes extend into the molten bath below the surface thereof, they will be protected from oxidation and the heated portions of said electrodes extending outward through the brickwork will also be protected from oxidation by the cement and molten material filling any crevices thereabout.

Where as specifically shown the electrodes are parallel to each other and upon opposite sides of the chamber C, they are preferably arranged in pockets so that their inner faces only are substantially flush with the inner faces of the chamber wall. Thus, the work introduced into the bath will not come into direct contact with these electrodes and the uniform spacing between all portions will produce a uniform rate of heat generation in the molten material at the bottom of the chamber.

Certain materials that are used for forming the molten bath will have a corrosive action on refractory brickwork. I have, therefore, designed a modified construction of furnace for using such material which is illustrated in Figs. 5 and 6. In this construction I employ a metal container L preferably formed from sheets of steel welded together. This container rests upon an insulating hearth M and is surrounded with insulating material N held by an outer metallic wall O. Near the bottom of the container L there are openings in one or more of the side walls for the passage of the electrodes $E^2$ and metallic tubes P surround these electrodes being welded at their inner ends to the container L and passing outward through the insulating material N and outer casing O. An insulating cement Q is arranged between the tube P and electrode and the latter is provided with cooling means for its outer portion similar to the construction previously described. A refractory ring R surrounds the upper end of the container L extending outward therefrom.

This construction operates the same as the

construction previously described but the molten bath will have no corrosive action on the metallic container L. Any leakage of the molten material through the tube P will be sealed by freezing around the cooled end of the electrode.

What I claim as my invention is:

1. In an electrically heated molten bath furnace, the combination with a wall enclosing a central chamber for containing the molten bath, an electrode extending through said wall into said chamber below the surface of the molten bath, and means for cooling a portion of said electrode within the wall but spaced from said chamber to a temperature at which any molten material of the bath will freeze thereby forming a seal.

2. In an electrically heated molten bath furnace, the combination with a wall enclosing a central chamber for containing the molten bath of an electrode extending through said wall into said chamber below the surface of the molten bath, a portion of said electrode extending from its outer end into the wall but spaced from said chamber being hollow, and means for flowing a cooling fluid through said hollow portion to cool the same to a temperature at which the molten material of the bath will freeze thereby forming a seal.

3. An electrically heated molten bath furnace comprising a refractory wall enclosing a central chamber for containing the molten bath, electrodes laid in said wall to extend therethrough into said chamber adjacent to the bottom thereof, a portion of each electrode extending from its outer end into the wall but spaced from said chamber being hollow, means for flowing a cooling fluid through said hollow portion to cool the same to a temperature at which the molten material of the bath will freeze, and electrical connections to the outer ends of said electrodes.

4. An electrically heated molten bath furnace comprising a wall formed of brickwork and enclosing a central chamber for containing the molten bath, electrodes laid in the space of one or more tiers of brick to extend through said wall into said chamber below the surface of the bath, means for cooling a portion of each electrode which is within the wall but spaced from said chamber to a temperature at which the molten material of the bath will freeze thereby forming a seal, and electrical connections to the outer ends of said electrodes.

5. An electrically heated molten bath furnace comprising an outer wall of brickwork forming an enclosure, a wall of refractory brickwork within said closure and spaced from said outer wall with a central chamber within said inner wall for containing the molten bath, refractory concrete filling the space between said walls, electrodes laid in said outer and inner walls to extend therethrough and into the molten bath in a plane below the surface of said bath, a portion of each electrode extending from the outer end thereof into said wall being hollow, a conduit extending into said hollow portion for introducing therein a cooling fluid which escapes through the space surrounding said conduit, and electrical connections to the outer ends of said electrodes.

6. An electrically heated molten bath furnace comprising a refractory wall enclosing a central chamber for containing the molten bath, said wall being formed of brickwork, electrodes laid in the space of one or more tiers of brick in a plane adjacent to the bottom of said chamber, said electrodes being parallel to each other with their inner end portions in pockets on opposite sides of said chamber, electrical connections to the outer ends of said electrodes, and means for cooling an outer end portion of each electrode extending into said wall but spaced from said chamber to a temperature at which the molten material of the bath will freeze thereby sealing any leak about said electrodes.

7. In an electrically heated molten bath furnace, a metallic container for the molten material of the bath, insulating material surrounding said container, a tube connected to said container near the lower end thereof and passing outward through said insulating material, an electrode extending through said tube into the molten bath insulating material between said electrode and tube, and means for cooling said electrode in the outer portion of the tube to a temperature at which the molten material will freeze.

8. An electrically heated molten bath furnace comprising a metallic container for the molten bath, a supporting part for said container, insulating material surrounding said container, an outer casing for holding said insulating material, tubes connected at their inner ends to said container and extending outward through said insulating material and outer casing, electrodes passing through said tubes into the molten bath, insulating material between said electrodes and tubes, means for cooling the outer ends of said electrodes to a temperature at which the molten material will freeze, and a refractory ring at the upper end of said container surrounding the same.

9. An electrically heated molten bath furnace comprising a refractory wall enclosing a central chamber for containing the molten bath, an electrode laid in a recess extending along a side of said chamber below the level of the molten material therein so as to expose only one face to the bath, said electrode extending out through said refractory wall, and means for cooling a portion of said electrode within said wall but spaced from said chamber to a temperature at which the molten material will freeze.

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