

W. F. McNABB.
ELECTRIC FURNACE.
APPLICATION FILED SEPT. 15, 1913.

1,100,191.

Patented June 16, 1914

FIG. 2

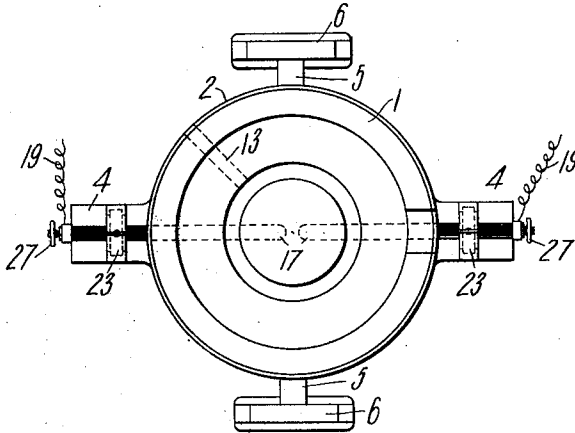


FIG. 3

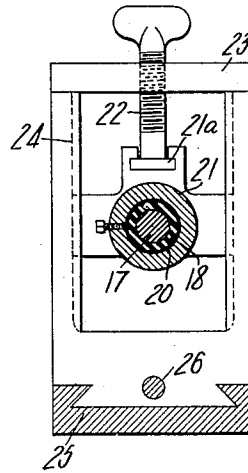
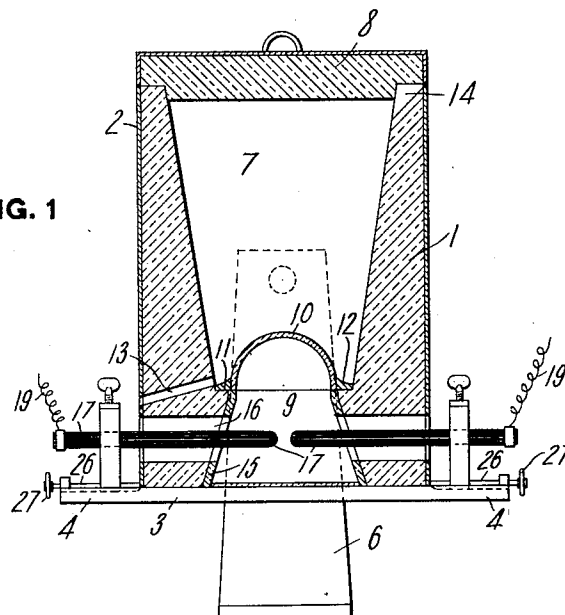


FIG. 1



WITNESSES

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UNITED STATES PATENT OFFICE.

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ELECTRIC FURNACE.

1,100,191.

Specification of Letters Patent.

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Application filed September 15, 1913. Serial No. 789,830.

To all whom it may concern:

Be it known that I, WILLIAM F. McNABB, a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electric Furnaces, of which the following is a specification.

This invention relates to electric furnaces, such as are used for reducing metals from metal bearing substances or from their ores, or for melting metals or other substances.

The object of the invention is to provide an electric furnace of simple design, which is highly efficient, wherein the heat is applied economically and without undue loss, wherein the electric arc is generated out of direct contact with the material, thereby enabling the material to be easily melted in case a "freeze" takes place, and wherein the electrodes are readily adjustable in various ways to regulate the temperature.

The invention comprises the construction and arrangement of parts hereinafter described and claimed.

In the drawings, which represent one embodiment of the invention, Figure 1 is a sectional elevation; Fig. 2 is a plan view, the furnace cover being removed; and Fig. 3 is a detail elevation of the electrode supporting and adjusting means.

The furnace comprises a body wall or stack 1 formed of fire brick or other suitable refractory material, and which, if desired, may be provided with a metal shell or jacket 2. Said body has a metal bottom or base 3, which may rest directly upon or be fixed to the floor or suitable legs or supports, and which is provided with two or more electrode carrying ledges or shelves 4 hereinafter referred to. In the form shown the furnace is of the tilting type, having trunnions 5 supported by uprights or pillars 6, although it may be fixed or stationary, if desired.

The upper portion of the furnace is hollow to provide a downwardly tapering or hopper shaped, crucible chamber 7 in which the material to be melted or treated is placed, and which may be closed by a suitable cover 8 applied to the top of the furnace. Beneath the crucible chamber 7 is an arc chamber 9, the two chambers being separated by a wall 10, preferably formed by, or consisting of an inverted bowl shaped carbon or graphite crucible with its rim

resting on an annular ledge 11 of the furnace wall and held in place thereon by a setting 12 of clay or refractory material applied after the crucible is laid in place. A tap hole 13 leads out through the wall of the furnace just above the bottom setting 12, so it may be tapped without tilting, but it is also provided with a pouring opening 14, so it may be emptied by tilting if desired.

The walls of the arc chamber 9 are lined, as at 15, with carbon or graphite, in order to protect them from the arc, and are pierced, as at 16, to provide holes or slots through which the electrodes 17 project into said chamber. Each electrode comprises a bar or rod of carbon, graphite or a composition thereof, mounted in an insulating ring 18 and having a current lead 19 connected to its outer end. The insulating ring 18 is preferably provided with a metal sleeve or jacket 20 and is held or clamped in a casing 21 having a swivel connection 21^a to a screw 22 threaded into a frame 23. Casing 21 slides vertically in ways 24 in frame 23 and may be adjusted to different heights or levels therein by turning the screw 22. Frame 23 is mounted to slide toward and from the furnace on ways 25 on the edge or shelf 4 and may be adjusted thereon by a feed screw 26 having an operating handle 27.

In use of the furnace the charge of material to be melted or treated is placed in the crucible 7. The cover is applied and the current turned on and an arc is produced between the two electrodes. The length and intensity of this arc may be adjusted by turning either or both of the screws 26 and varying the distance between the electrodes. These screws also enable the arc to be kept central under the crucible 10 and the electrodes to be fed in as they are consumed. By adjusting the vertical screws 22 the electrodes may be moved nearer to or farther from the crucible bottom and the heat applied in the most effective manner.

It will be observed that the arc is produced in chamber 9 outside of the crucible chamber 7 and below the same. It is consequently out of direct contact with the metal or other material being treated and produces no deleterious effect thereon. Moreover, in case the current is accidentally shut off, or if, for any other reason, the material solidifies or "freezes", it can be again melted by merely starting up the current,

when an arc is immediately produced as before. This avoids the necessity of chipping or blasting out the solid charge, which is necessary in case of a "freeze" in the furnace where the electrodes are immersed in the molten mass. Under such circumstances the molten metal at the bottom of the crucible "freezes" in contact with the lower electrodes and becomes practically a part thereof, with only the "glass" or flux between it and the other electrode, and preventing the formation of a new arc when the current is turned on.

The concave under surface of the inverted small crucible 10 enables the heat of the arc to be distributed uniformly in all directions, and not confined to a limited portion of the bath or molten material. Also, the arc is below the level of the crucible bottom, so the heat rises and produces the maximum effect at or near the bottom of the furnace where the molten metal collects. The latter is consequently kept very fluid and is not liable to solidify or freeze during normal operation of the furnace.

When the melting or reducing operation is finished the charge is withdrawn, either through the tap hole 13, or by tilting and pouring the furnace.

The apparatus is simple and the cost of maintenance is low. When the crucible bottom 10 wears out or burns through it may be readily broken out or removed and a new crucible installed. The crucible bottom is formed of carbon or graphite, as stated, and consequently is a good conductor of heat. The temperature of the furnace is easily regulated and may be maintained practically uniform by proper manipulation of the electrodes.

What I claim is:

1. An electric furnace, comprising a crucible having a bottom provided with an arched portion, a pair of electrodes having their coöperating end portions lying beneath the arched portion of said crucible bottom, and electric connections for producing an arc between said electrodes.

2. An electric furnace, comprising a crucible having its bottom convex upwardly, and means for producing an arc beneath said furnace bottom.

3. An electric furnace, comprising a body wall having a crucible chamber and an arc chamber therein, a wall separating said chambers, said wall being concave down-

wardly, and means for producing an arc in said arc chamber.

4. An electric furnace, comprising a body wall having a crucible chamber therein and an arc chamber beneath said crucible chamber, a separating wall between said chambers and having a concave under surface, and means for producing an arc in said arc chamber.

5. An electric furnace, comprising a crucible having its bottom concave downwardly to form an arc chamber, a pair of electrodes having their coöperating end portions lying beneath said crucible bottom, and means for adjusting said electrodes in said arc chamber.

6. An electric furnace, comprising a crucible having an arched bottom forming an arc chamber therebeneath, a pair of electrodes having their end portion in said arc chamber, and means for adjusting said electrodes with reference to each other.

7. An electric furnace, comprising a crucible having its bottom concave downwardly to form an arc chamber, a pair of electrodes having their end portions lying in said arc chamber, and means for varying the distance between said electrodes and crucible.

8. An electric furnace, comprising a crucible having its bottom concave downwardly to form an arc chamber, a pair of electrodes having their end portions lying in said arc chamber, and means for varying the distance between said electrodes and the distance between said crucible and electrodes.

9. An electric furnace, comprising a body wall having an inner chamber provided with a bottom ledge, an inverted crucible having its rim resting on said ledge, and a pair of electrodes having their coöperating end portions located beneath said crucible.

10. An electric furnace, comprising a body wall having an inner chamber provided with a bottom ledge, an inverted crucible having its rim resting on said ledge, a pair of electrodes having their coöperating end portions located beneath said crucible, and means for adjusting said electrodes with reference to said crucible.

In testimony whereof, I have hereunto set my hand.

WILLIAM F. McNABB.

Witnesses:

ELBERT L. HYDE,
C. B. SANDERSON.