G. MASSIP.

ELECTRIC FURNACE.

APPLICATION FILED SEPT. 23, 1910.

1,005,725. Patented Oct. 10, 1911.

Fig. 1.

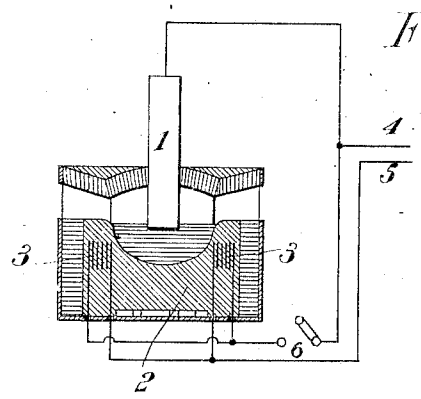


Fig. 2.

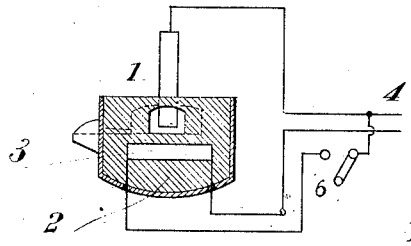


Fig. 4.

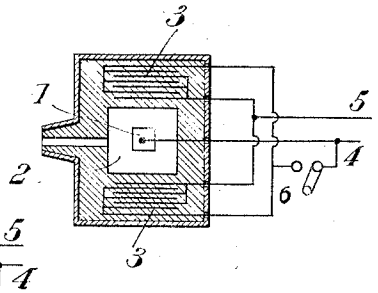


Fig. 3.

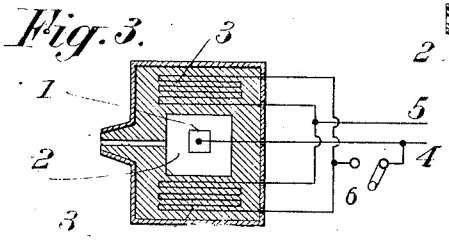


Fig. 5.

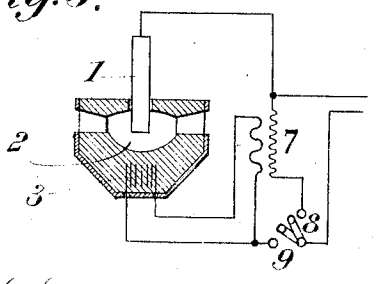
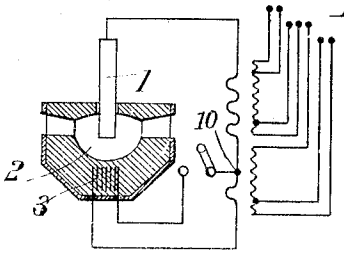


Fig. 6.



Witnesses:

W. A. Williams

J. M. Drew

Inventor:

By Georges Massip

John Thomas

Attorney.

UNITED STATES PATENT OFFICE.

GEORGES MASSIP, OF PARIS, FRANCE.

ELECTRIC FURNACE.

1,005,725. Specification of Letters Patent. Patented Oct. 10, 1911.

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To all whom it may concern:

Be it known that I, GEORGES MASSIP, a citizen of the French Republic, and resident of Paris, France, have invented a certain new and useful Electric Furnace with a Hearth Containing no Carbon and Becoming a Conductor by Heat Resistances, of which the following is a specification.

In electric furnaces which are employed for manufacturing steel and iron alloys containing only a low percentage of carbon, the material of which the hearth is made, must be such that they cannot supply any carbon to the molten metals. Now, as the fire proof materials which are usually employed for the construction of the hearth are non-conductors at an ordinary temperature, the employment of electric furnaces wherein the current is supplied through the hearth (which method is the most efficient method of working and the one in which the control is most easily exerted) has met with difficulties. It has been tried to remedy this drawback either by inserting into the hearth metallic poles which were in relation with the bath, or by means of walls made of clay and having an increasing conductivity or by still other means. Now, the conductivity of fire proof materials is increased by heating and these materials become really good conductors at a high temperature.

According to the process which forms the subject matter of this invention, the normally non-conductive hearth is internally heated by means of the current whereby the hearth becomes a conductor.

In the accompanying drawings Figure 1 shows by way of example and diagrammatically one form of embodiment of an electric furnace constructed according to the present invention; Figs. 2 to 6 are modifications.

In Fig. 1 which shows the general arrangement of a furnace, 1 designates the movable upper electrode, 2 is the hearth, 3 shows the arrangement of the heating resistance, 4 and 5 are the current supply conductors. When the electrode is raised a bridge switch or circuit closer 6 connects the terminal point of the resistances 3 with the rod or conductor 4. The hearth is thus heated in increasing proportions. When the temperature has reached a sufficient height, the electrode is lowered and the connection at 6 interrupted. This at the same time produces the lighting of the furnace. Under ordinary circumstances the hearth lining which is inserted into the circuit keeps its high temperature and consequently its conductivity owing to the transmission of the heat to the bath according to the heat effect governed by the Joule law. Owing to the fact that the current is conveyed into the middle of the hearth through conductors having a small resistance and owing to the insulating mantle surrounding the entire furnace, the losses of heat in the furnace are reduced to a minimum value. The metallic molten bath through which the current passes, is still heated by the voltaic arc, or by the resistance of the metallic slag and by the resistance of the conductive intermediate walls, which circumstances are extremely favorable to the object in view which is to obtain pure and homogeneous metals. Besides, the furnace may be kept warm with a small consumption of current during the periods of rest, which is a very important item from the point of view of the cost and the solidity of the furnace as it allows of the furnace being rapidly lighted again.

The heat resistances may be formed by rods of metal (as shown by Figs. 2 and 3) which are arranged in alternate relation so as to avoid self induction, the clay wall being erected in a warm state between said rods and being generally made of the same material as the hearth lining *i. e.* preferably of magnesia. The resistances may also consist (as shown by Fig. 4) of thin plates arranged alternately between each other, the free spaces existing between plates being filled with stamped earth mixed with a substance containing carbon which allows the passage of the current even at a low temperature. It is needless to say however that the lining of the hearth is made of material containing no carbon. The heating resistances may be arranged in series connection, branched or arranged in a shunt on the supply circuit of the furnace or be arranged as an independent circuit under the hearth or on the walls. As the heat resistances really require a low tension current, the most economical process will be to insert a converter 7 (Fig. 5) only by means of a switch at 8 for heating purposes into the circuit (the movable electrode being lifted up). When the switch is opened at 9 the lighting of the furnace takes place.

When the furnace is worked by the sec-

ondary current of a converter, the primary current which is subdivided in such a manner that it may be inserted into the circuit gradually according to the tensions which it is desired to obtain (see Fig. 6) it will be sufficient to insert the heating circuit at a point 10 in order to obtain at the points of connection tensions which vary between the desired low limits.

In distinguishing my invention more clearly, I wish to especially point out that there are no metallic elements in the hearth which appear on the inner surface of the hearth or crucible, but the heating resistances are embedded in the hearth at a point removed from the inner surface so that the refractory material alone and exclusively constitutes the conductive body when highly heated.

Having now fully described my said invention, what I claim and desire to secure by Letters Patent is:—

1. An electric furnace comprising a hearth whose entire inner surface is made of refractory material which is a non-conductor of electricity when cold, heating resistances embedded within said hearth and away from its inner surface, an electric circuit for heating these resistances, and changing the hearth surface from a non-conductor to a conductor, a movable electrode within the furnace and a main electric circuit one terminal of which is conected to this movable electrode and the other terminal to the highly heated and conductive hearth.

2. An electric furnace comprising a hearth whose entire inner surface is made of refractory material which is a non-conductor of electricity when cold, heating resistances embedded within said hearth and away from its inner surface, an electric circuit for heating these resistances and changing the hearth surface from a non-conductor to a conductor, a movable electrode within the furnace and a main electric circuit one terminal of which is connected to this movable electrode and the other terminal to the highly heated and conductive hearth, the hearth heating circuit being a shunt branch of the main working circuit.

3. An electric furnace, comprising a hearth whose entire inner surface is made of refractory material which is a non-conductor of electricity when cold, heating resistances embedded within said hearth and away from its inner surface, an electric circuit for heating these resistances and changing the hearth surface from a non-conductor to a conductor, a movable electrode within the furnace, and a main electric circuit, one terminal of which is connected to this movable electrode and the other terminal to the highly heated and conductive hearth, the resistance heating circuit being inductively energized through a converter.

4. An electric furnace, comprising a hearth whose entire inner surface is made of refractory material which is a non-conductor of electricity when cold, heating resistances embedded within said hearth and away from its inner surface, an electric circuit for heating these resistances and changing the hearth surface from a non-conductor to a conductor, a movable electrode within the furnace, and a main electric circuit, one terminal of which is connected to this movable electrode, and the other terminal to the highly heated and conductive hearth, both the resistance heating circuit and the main electric circuit being inductively energized through a converter.

In testimony whereof I have hereunto set my hand in presence of two witnesses.

GEORGES MASSIP.

Witnesses:
DEAN B. MASON,
JACK H. BAKER.