No. 701,218. Patented May 27, 1902.

F. MORANI.

ELECTRIC FURNACE.

(Application filed July 24, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1

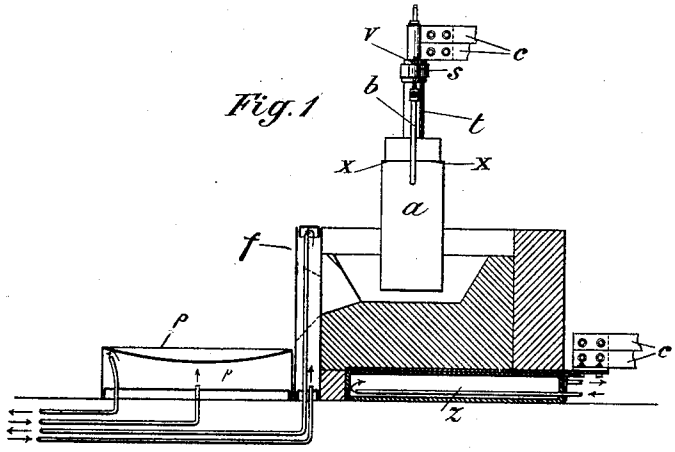


Fig. 2

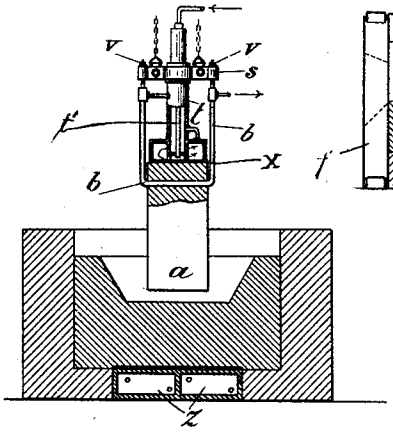


Fig. 3

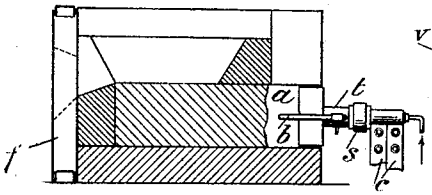
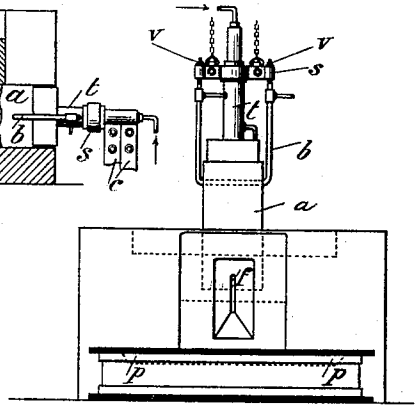


Fig. 4



Witnesses:
N. L. Bogan
Dennis Sunby

Inventor
Fausto Morani
By James L. Norris.
Atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 701,218. Patented May 27, 1902.

F. MORANI.

ELECTRIC FURNACE.

(Application filed July 24, 1900.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 5.

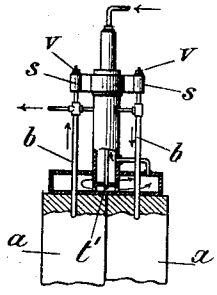


Fig. 6.

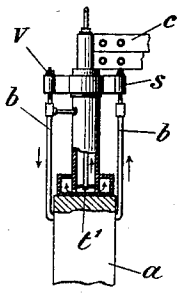


Fig. 7.

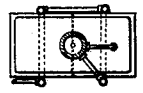


Fig. 8.

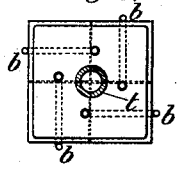


Fig. 9.

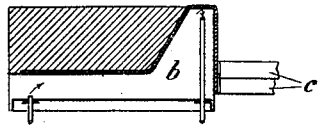


Fig. 10

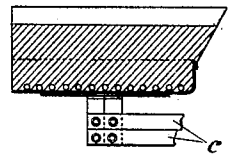


Fig. 11.

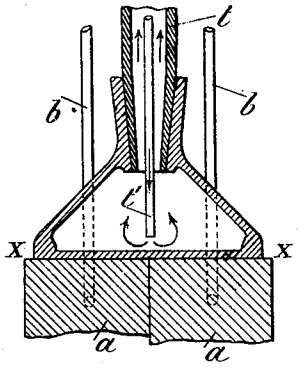


Fig. 12.

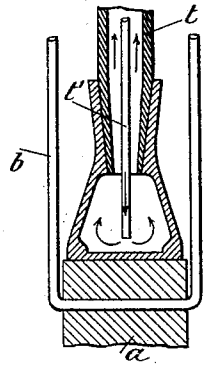
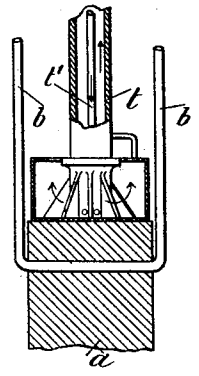


Fig. 13



Witnesses:
N. L. Boyle
Dennis Sunby.

Inventor
Fausto Morani
By James L. Norris
Atty

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FAUSTO MORANI, OF ROME, ITALY.

ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 701,218, dated May 27, 1902.

Application filed July 24, 1900. Serial No. 24,726. (No model.)

To all whom it may concern:

Be it known that I, FAUSTO MORANI, a subject of the King of Italy, residing at Rome, in the Kingdom of Italy, have invented certain new and useful Improvements in Electric Furnaces of Great Power, (for which I have applied for Letters Patent in the Kingdom of Italy on May 18, 1900,) of which the following is a full and clear description.

The difficulties attending the construction of electric furnaces of great power have been found to be so great that it has been necessary to limit their power to a few hundred kilowatts, while in many cases it may be useful to employ furnaces much more powerful. The difficulties generally to be overcome in furnaces of such a character are, first, the conducting of the electric current to the electrode; second, the use of alternating currents of several thousand amperes on account of the conductive action which manifests itself in the conductors leading to the furnace; third, that the intense heat developed in an electric furnace of great power does not allow of the metallic masses being brought near the zone of maximum thermic action. Consequently a large part of the electrode remains unserviceable, involving loss in the working of the furnace, and, fourth, in furnaces where several electrodes are employed, each connected to a separate conductor, and if worked with alternating currents induction effects become serious and involve the use of very expensive dynamos and large quantities of copper or render impossible the use of several electrodes in the furnace. To overcome these various difficulties, I employ in the manner hereinafter set forth independent supports and conductors for the electrodes. To insure perfect contact of the electrodes with the conductor and to maintain this during the working of the furnace and to guard the electrode-support and the conductor from the heat of the furnace and of the current, the part which conducts the current to the electrode must be distinct from the support of the electrode. For this purpose the conducting part is given contact-surface sufficient for the current which is to be supplied to the furnace and to the support dimension sufficient for its mechanical action. Moreover, both parts are furnished with a continuous circulation of cold water, cooling the surface opposite to that subjected to the destructive action of the heat.

Referring to the drawings, wherein like letters of reference indicate corresponding parts throughout the several views, Figure 1 is a side elevation, partly in longitudinal section. Fig. 2 is a vertical section. Fig. 3 is a longitudinal sectional view showing the arrangement of the electrode and conductor in the bottom of the furnace and extending through one wall thereof. Fig. 4 is a front elevation of the furnace. Figs. 5, 6, 7, and 8 illustrate various ways of connecting several electrodes to a single conductor. Figs. 9 and 10 are longitudinal sections of the furnace, showing different forms of the arrangement of conductors. Figs. 11, 12, and 13 are vertical sections of a modified form of arrangement for the circulation of a cooling means.

Fig. 1 of the annexed drawings shows one of these arrangements. The electrode *a* is supported by one or more yokes *b* of form suited to the shape of the electrode. These yokes are firmly held in a cross-head *s* by bolts and nuts *v* sufficiently far from the hot zone of the furnace. The surface of contact with the electrode, flat or shaped to suit that of the electrode, is fixed to the cross-head by a metal tube *t*. The bolts and nuts *v* effect good contact of the electrode to the conducting-piece and adjust their adhesion.

Fig. 2 is a vertical section of the arrangement shown in Fig. 1, from which may be understood the method by which the yoke or yokes and the contact-surface can have a continuous current of water circulated through them. The tube *t* is joined at its one end to the conductor *c*, Fig. 1, and at its other end to the surface of contact, as at *x*, with the electrode *a*. The interior smaller tube *t'* leads a continuous current of water to this surface, and special openings at the lower end of the main tube *t* effect complete circulation of the water, which or part of which also cools the yoke or yokes which support the electrode, as may be readily understood from the drawings. Figs. 11, 12, and 13 show modified arrangements for the same purpose.

When the furnace is to have several separate electrodes or several electrodes grouped together, the same arrangement is applied to

each electrode or each group of electrodes. In the first place the electrodes are supported by yokes which are held in position and tightened by bolts and nuts, fixing them to the cross-head *s* sufficiently far from the hot zone of the furnace, as shown in Figs. 5 and 6. Then the current is conducted to the group of electrodes by means of one or more contact-surfaces of suitable form cooled by a continuous circulation of cold water. This circulation can be arranged in various ways, one of which is shown in Figs. 5 and 6 and in plan in Fig. 7. An arrangement on the same principle is shown in Fig. 8 applied to a group of four electrodes, forming one pole of the current which supplies the furnace. In cases where several electrodes or groups of electrodes form different poles or are supplied by currents of different phases of the same alternating current obviously every electrode or group of electrodes may have the same arrangement applied to it for conducting the current and for supporting the weight of the electrodes. For furnaces the bottom or one or more walls of which consist of fixed electrodes the above-described arrangement is applied to each of these fixed electrodes of the kind shown in Figs. 1 and 2 or that shown in Fig. 3.

If in forming the bottom or walls of the furnace it is desired not to use the same material as that of the electrodes but some special material, the same principle as that described above may be adopted by placing the bottom or wall of the furnace on a conductor cooled on its side opposite to that exposed to the heat—that is to say, by making conductors the form of metal casings with water circulation or by putting them in contact with such a casing, or, finally, in giving them a tubular form with water circulation. The second of these arrangements is shown at *z* in longitudinal section in Fig. 1 and in transverse section in Fig. 2. Fig. 9 shows contact to conductor *c* made by a cooled metal surface. In Fig. 10 the conductor is in the form of a casing and the cooling of the side opposite to that heated is effected by water circulating through a number of tubes.

The extraction of the product from the furnace is effected through one or more slits in the furnace-wall, as shown in the drawings, instead of the tap-holes, such as are used at present. In order to prevent disaggregation of the material of which the slit is formed by the action of the molten material at a high temperature and in large outflow or by the action of tools for detaching it which might produce considerable enlargement of the outlet, allowing issue not only of the molten material but also that which has not been melted, thus interfering with the working of the furnace, the slit in the wall is formed in a hollow casing of steel or other suitable metal provided with a continuous circulation of water on the side opposite to the side exposed to the heat. Such slits do not undergo change of dimension, and therefore avoid the objections hereinbefore set forth. In the drawings, *f* denotes a hollow casing provided with a vertically-extending slit. Constructing the furnace with a slit in the manner as set forth possesses a notable advantage over the arrangements heretofore adopted in that it allows outflow of the carbid at such height from the floor of the furnace as is considered best for the working of the furnace, a result that can only be attained by means of long slits of invariable width.

In order to insure purity of the product, it is of advantage to collect it on a metal surface constantly cooled by water. Such an arrangement is indicated at *p* and consists of a hollow metallic casing with a depressed top provided with inlet and overflow pipes for the water circulation.

In Figs. 5, 6, 7, 8, 11, and 12 are shown various ways of connecting several electrodes for furnaces supplied by a single conductor *c*, but with a current of intensity greater than can be borne by a single electrode. The same advantages may be obtained from groups of four electrodes connected, as in Fig. 8, or with groups of any number of electrodes by arranging for each group conductors in planes at ninety or one hundred and eighty degrees to each other.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electric furnace, an electrode, a supporting-yoke for suspending the same in said furnace and constructed to permit of the circulation of a cooling medium, a casing connected to said electrode and in communication with said yoke, means for circulating a cooling medium through said casing, and a conductor suitably connected thereto.

2. In an electric furnace, an electrode, a hollow yoke connected therewith, and a casing in contact with said electrode and in suitable communication with a source of electrical energy, said casing and yoke constructed to permit of the circulation of a cooling medium.

3. In an electric furnace, an electrode, a hollow yoke connected therewith and adapted to conduct a cooling medium, a cross-head, means for adjustably securing the yoke to the cross-head, a hollow casing extending through the cross-head and contacting with the electrode, a connection for establishing communication between the yoke and the casing to permit of the circulation of the cooling medium, and an electrical conductor connected with said casing.

4. In an electric furnace, an adjustable yoke for suspending an electrode and adapted to conduct a cooling medium, and a casing contacting with said yoke and in communication with a source of electricity, said casing

communicating with said yoke to permit of the circulation therethrough of said cooling medium.

5. In an electrical furnace, an adjustable hollow yoke for suspending an electrode, a casing contacting with the electrode, a connection between the casing and the yoke for establishing communication between them, and a suitable connection between said casing and a source of electrical energy.

6. In an electric furnace, a hollow yoke connected to an electrode, a casing contacting with the electrode, means for establishing communication between said yoke and casing, means for supplying said yoke and casing with a cooling medium, and a suitable connection between said casing and a source of electrical energy.

In witness whereof I have hereunto set my signature in the presence of two witnesses.

FAUSTO MORANI.

Witnesses:
HECTOR DE CASTRO,
S. W. ZANARD.