No. 847,003. PATENTED MAR. 12, 1907.

B. VON ISCHEWSKY.

ELECTRIC FURNACE.

APPLICATION FILED FEB. 15, 1906.

Fig: 1.

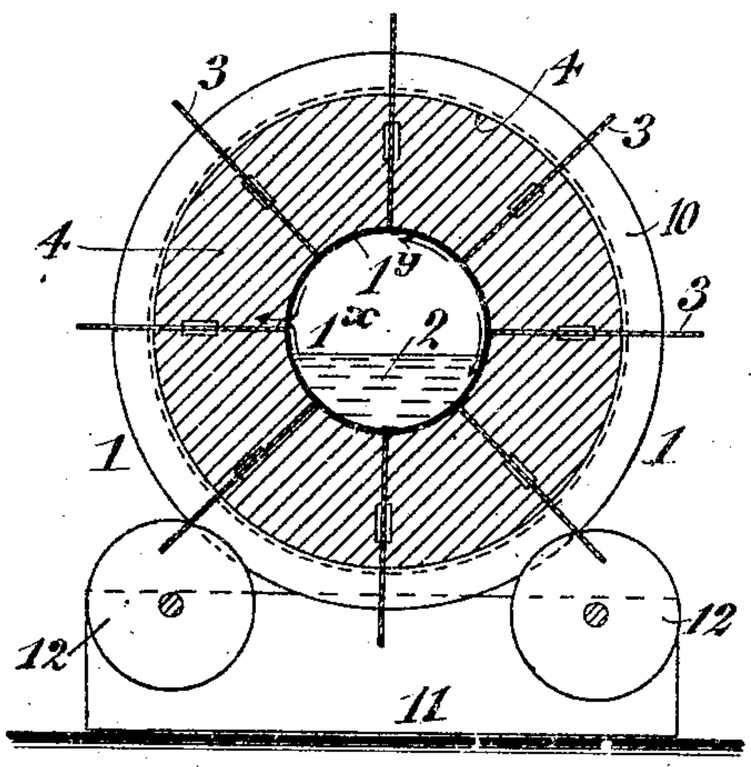


Fig: 2.

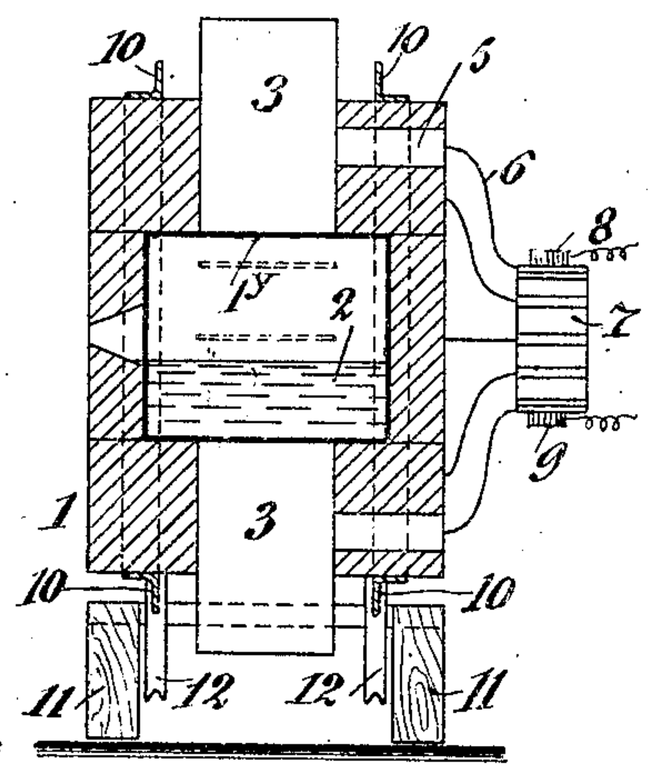
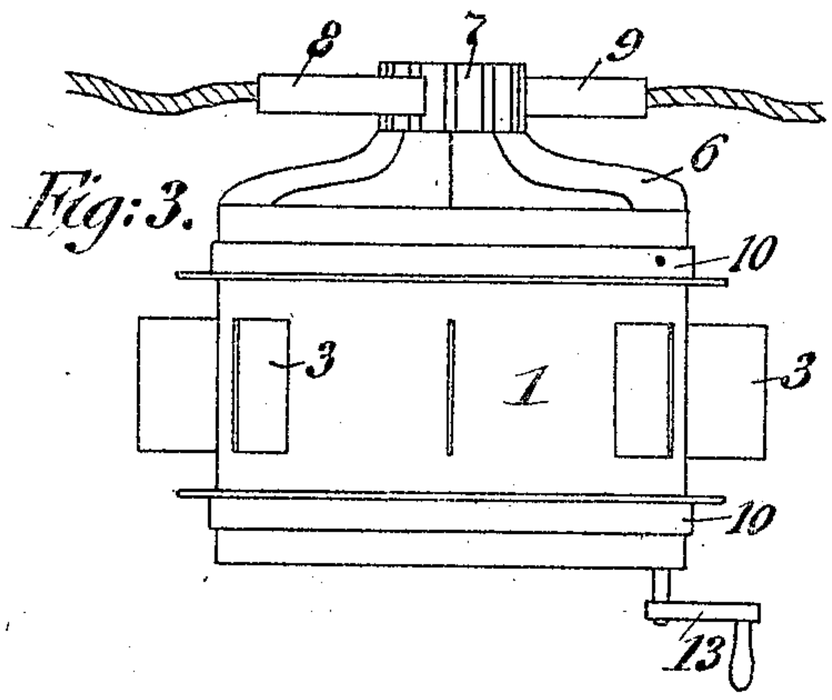


Fig: 3.



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ELECTRIC FURNACE.

No. 847,003. Specification of Letters Patent. Patented March 12, 1907.

Application filed February 15, 1906. Serial No. 301,122.

To all whom it may concern:

Be it known that I, BASILIUS VON ISCHEWSKY, a subject of the Emperor of Russia, residing at Kiew, in the Empire of Russia, have invented a new and useful Electric Furnace, of which the following is a specification.

The hitherto-known electric furnaces for metallurgic purposes present the characteristic feature that the required electric current has a very low pressure and a very large strength. Such a current may be supplied direct, as is the case with Héroult's furnace, for instance, or it may be obtained from a current of high pressure by transformation, as is, for example, the case with Kjellin's furnace, which, owing to its special construction, acts as a transformer. This property of the hitherto-known electric furnaces has prevented their exploitation on a large scale, so that the application of the electricity to metallurgic purposes was rendered difficult.

My invention relates to an electric furnace which is suitable for all kinds of currents and presents the special advantage that it permits the use of currents of high pressure in a most favorable manner. This electric furnace is lined with electric conductors of the second class—that is to say, such materials which become conductive only at a higher temperature—and, further, this furnace is provided with a plurality of electrodes, which are so disposed as to form Jablochkoff's candles and cause an intensive heating of the internal layer of the furnace-wall, and thereby transmit the heat by radiation to the charge. At the same time the current can be conducted through the metal of the charge, which is often desirable for the production of certain reactions. There are known furnaces, it is true, which are not intended for working metals and are lined with electric conductors of the second class; but the latter cannot produce the effect of Jablochkoff's candles. There are, moreover, known furnaces the walls of which are turned into ordinary electric conductors by the addition of a conductive material, (such as graphite;) but such furnaces require the employment of currents of low pressure, and for a large strength of current they do not prove valuable, since the graphite causes a rapid waste of the furnace-walls, so that their conducting power is necessarily impaired.

The construction and the wall of my electric furnace are almost the same as those of the usual Bessemer or Thomas converter or Martin furnace, and an electric current of a high pressure is employed and is conducted through the wall, it being preferably introduced into the furnace at the vault or ceiling. The wall is made of oxids, preferably magnesia, calcium oxid, and other oxids, either basic or acid oxids, the same as in Martin furnaces, or mixtures of the said materials may be employed, the essential point being that they should have sufficient conducting power and resistance at a corresponding temperature. The electrodes, particularly those of carbon, are embedded in the wall of the furnace in such a manner that they adjoin the internal layer of the furnace-wall.

In the accompanying drawing, in which the same parts are denoted by the same reference characters throughout. the several views, Figure 1 is a vertical longitudinal section through an electric furnace constructed in accordance with the invention. Fig. 2 is a vertical transverse section, and Fig. 3 is a top plan view.

Referring to the drawing, 1 denotes the furnace proper, which is constructed in the form of a horizontally-mounted hollow cylinder having an interior space 1^x, in which the mass to be melted, which is denoted by reference-numeral 2, is placed.

3 denotes the carbon electrodes, which are arranged in a vertical plane in a series extending completely about the cylindrical furnace-wall and pass inwardly through the furnace wall and abut at their inner ends against the inner layer 1^y of the latter. This wall is formed by a plurality of radial bricks 4, and the electrodes are disposed radially between said bricks, as shown. By this arrangement of the electrodes, the bricks of the wall, and the interior layer 1^y the latter may be heated to incandescence in the nature of Jablochkoff candles, said layer being formed of a material which is a conductor of the second class—that is to say, a material which becomes electrically conductive only at a high temperature. The electrodes 3 are secured in the furnace-wall in such a manner as to permit their being pushed inwardly as they are burned away, and said electrodes are connected together by lateral pieces 5, as shown in Fig. 2. Said pieces 5 are in turn connected to conductors 6, as shown in Figs. 2 and 3, and said conductors are in electrical

communication with a commutator 7, against which bear two brushes 8 and 9, through which the current is supplied.

In order that the rotation of the furnace in the vertical plane in which the electrodes are located may be effected, the same is provided with longitudinal peripheral rails 10, which rest on rollers 12, mounted on a suitable base 11. The furnace is illustrated as being provided with a crank 13, by which the same may be manually rotated; but it is apparent that in large and heavy furnaces rotary motion can be imparted by gear-wheels or other suitable means.

To start the furnace, hot slag or other hot material is introduced into the same and the furnace then turned somewhat, so that the inner layer of the wall is heated up to such an extent as to become electrically conductive. When the current is switched in, it is conducted from one electrode, over the interior layer of the furnace-wall, to the next electrode, and so on, so that the furnace-wall is heated up and produces by radiation the melting of the metal. By the arrangement of the electrodes in contact with the inner layer of the furnace-wall said layer quickly becomes heated to the required degree. The course of the current is denoted by the arrows on Fig. 1 of the drawing. The current will pass from the internal layer 1^y through the metal, and thereby product chemical reactions. If necessary, the direction of the current may be reversed or an alternating or multiphase current may be used instead of a direct current. In the case of a rotatory current at least three electrodes must be employed and they must have the same cross-section. In general, however, and when circumstances permit it, a greater number of electrodes is preferably provided, as shown, so as to form a sort of Jablockhoff's candles, which heat merely the internal layer of the furnace-wall. In the case of currents of low pressure it may be advisable to employ as many electrodes as possible, they being of the same cross-section. The number and arrangement of the electrodes must be such that no short-circuiting can take place between two electrodes through the metal bath. Under all circumstances it is necessary that at least one electrode be outside the bath, so that the current shall be compelled to pass along the lining of the furnace.

As already mentioned, the current passing from the internal layer 1^y through the metal of the charge will produce reactions between the added materials, the furnace-walls and the fluxes of other bodies, so that the current may be utilized for refining the metal or for carrying out other known methods, such as removing the carbon, silicon, phosphorus, &c.

The most important applications of the new electric furnace are as follows:

First. For Martin furnaces, (of course the usual generators and heat-accumulators may be dispensed with or they may merely serve for the preliminary heating.) The carbon of the pig-iron or cast-iron should in this case go into calcium carbid and combinations of the iron. In some cases also suitable admixtures may be used for fining purposes.

Second. For Bessemer or Thomas converters, if the pig-iron or cast-iron is too poor in heat-generating substances, such as silicon or phosphorus.

Third. For the production of crucible steel.

Fourth. For the production of copper and nickel by the Bessemer process in case the ores are rich in metal, also for working metals difficult to melt.

Fifth. For reheating metals which have cooled down during their working—for example, in rolls or beneath the steam-hammer.

Sixth. For heating deep furnaces, and, seventh, for melting the materials which have been stored upon the hearth or in the boshes of a blast-furnace for want of coke or from other reasons.

The essential advantages of the new electric furnace are as follows: First, it has no carbon electrodes in contact with the charge, which is of special importance for processes of removing the carbon; second, when using consecutively electric furnaces with basic and acid linings all the added material can be removed; third, when employing liquid metals out of the blast-furnace (Pilz furnace) the electric furnace will work more economically than the Martin furnace or even the crucible furnace; fourth, the electric furnace permits the refining of such kinds of pig-iron or cast-iron as are quite poor in silicon or phosphorus, and it is useful for working the richest copper mattes by means of the Bessemer process; fifth, it renders impossible the formation of air-bubbles and other defects in cast-steel; sixth, its output is by far larger than that of the Martin furnace, and, seventh, the temperature can be easily adjusted at any time.

What I claim as my invention, and desire to secure by Letters Patent, is—

An electric furnace comprising a hollow cylindrical body having a lining of material which is electrically conductive only at a high temperature, and a plurality of electrodes housed in the cylindrical wall of said body and abutting at their inner ends against said lining.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

BASILIUS VON ISCHEWSKY.

Witnesses:

GUSTAVE HARTWIG,

BASILIUS LEBEDEFF.