

1,428,909.

Patented Sept. 12, 1922.

Fig. 1.

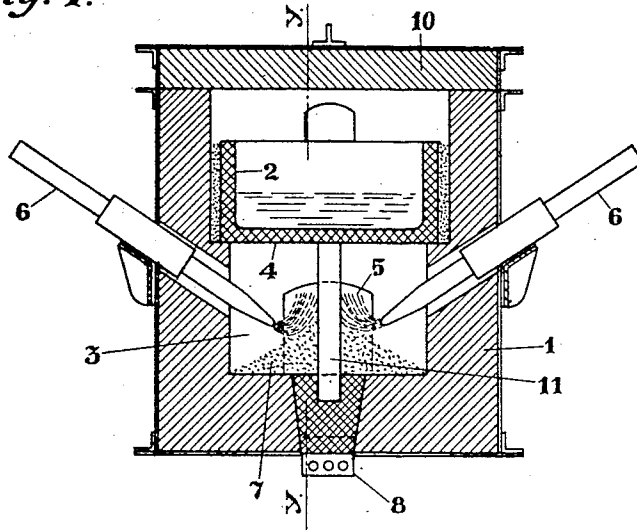
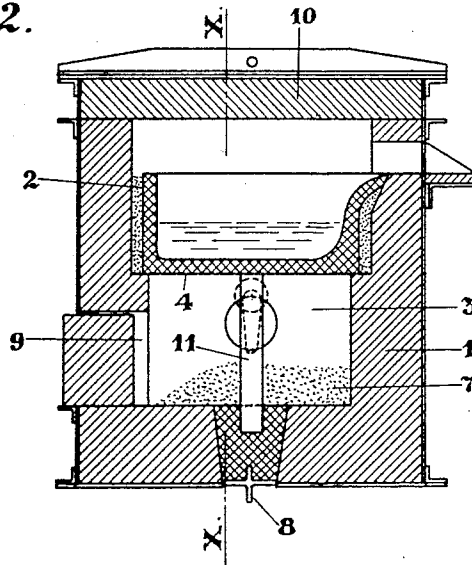


Fig. 2.



Witnesses:

E. O. Magnusson
H. Sandberg

Inventor:

Ivan Rennerfelt

Patented Sept. 12, 1922.

BEST AVAILABLE COPY

1,428,909

UNITED STATES PATENT OFFICE.

IVAR RENNERFELT, OF DJURSHOLM, SWEDEN.

ELECTRIC FURNACE.

Application filed August 12, 1921. Serial No. 491,815.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, IVAR RENNERFELT, a citizen of the Kingdom of Sweden, and resident of Djursholm, in the county of Stockholm Lan and Kingdom of Sweden, have invented certain new and useful Improvements in Electric Furnaces (for which I have filed applications in Sweden July 8th, 1918, Patent No. 49911; Germany July 27th, 1919, Patent No. 328233; Switzerland September 23rd, 1919, Patent No. 84829; Austria May 12th, 1920), of which the following is a specification.

My invention relates to improvements in the construction of an electrically heated crucible furnace and has for its object to provide a furnace especially suitable for melting such metals and alloys of metals, which are to a certain extent easily gasified at rather low temperatures. It is well known in the art that electric melting of yellow brass, which contains a large percentage of zinc, if undertaken in an arc furnace of the steel melting type, means a very undesirable evaporation of zinc, causing considerable losses. One of the reasons for this is, that the surface of the charge is exposed to intense heating from powerful arcs in too close proximity to the metal. The rate of heating, therefore, is far from being as uniform all over the charge as desirable and an excessive, very harmful, heating is practically unavoidable. The difficulty is, furthermore, enlarged by the fact that the zinc gases after having been developed are superheated by contact with the arcs and the electrodes, making a condensation inside of the furnace practically impossible. In order to avoid or at least reduce the amount of evaporation of zinc from, for instance, yellow brass I propose to apply the heat to the lower parts of the charge in a manner similar to the well known method of heating a liquid in a kettle. To obtain this object in a practical way I build a shaft furnace with a lower heating chamber, provided with electrodes or other means for transforming electric energy into heat and an upper melting chamber, which may consist of a crucible of any preferred shape. If desired, the melting chamber may be obtained by means of a partition inserted in a suitable place in the shaft, said partition consisting of a material, which is a

good conductor of heat. To obtain a high thermoelectric efficiency it is necessary not only to carefully insulate the sidewalls and bottom of the heating chamber but also to use extremely refractory materials so as to make it possible to employ a very high temperature in the chamber underneath the melting room. This is especially desirable because the rate of transmission of heat upwards depends directly on the difference in temperature on the lower and upper side of the partition.

To improve the transmission of heat the surface of the partition should be made as large as possible for practical reasons. If a crucible is used, the shape of same should be rather wide and shallow, i. e., it should more resemble a plate or a wash bowl than a crucible such as generally used in coke fired crucible furnaces.

To facilitate the use of very wide crucibles the bottom of same may be supported by means of one or more columns of preferably carbon electrodes, standing on the bottom of the heating chamber or arranged in a crosswise position between opposite sides of the furnace shaft. In the heating chamber one or more electrodes and bottom contacts admit electric energy in any preferred way. To improve the regulation of the power at starting and under running conditions, the bottom of the heating chamber may be covered with a layer of carbon or graphite in the form of a fine powder, which serves as a contact material for the arcs from the electrodes and also as a steadying resistance. To permit supervision of the arcs and refilling, when needed, of the contact powder, an opening should be provided in the walls of the heating chamber.

The furnace may be built either for use with a stationary crucible, which is emptied by tilting the furnace or for using a removable crucible, the furnace being nontilting. The former alternative is generally to be preferred as the loss of heat is decreased and the life of the crucible increased by not removing the crucible from the furnace.

From a purely metallurgical point of view the melting condition in a furnace as described are very favorable. The heat readily penetrates the bottom of the melting room and by causing the charge to melt improves the contact between the heat conducting

partition and the upper unmelted parts of the charge. Overheating of the charge is practically eliminated and, consequently, also gasifying of zinc, if the charge consists of yellow brass. Should, however, metallic gases develop at the bottom, no harm is done as the rate of evaporation will be fairly slow. Furthermore, gases, which may develop, will, when rising upwards through the charge, practically all condense when coming in contact with the upper comparatively cool parts of the charge. The melting chamber may be perfectly closed, as no electrodes enter same. This means that a considerable vapor pressure may be obtained, which, as well known in the art, prevents or lessens gasifying of the charge.

A furnace built according to the present invention is illustrated on the accompanying drawing in which Fig. 1 is a vertical section, taken at lines X—X in Fig. 2, which is a vertical section taken at lines y—y in Fig. 1. Similar letters refer to similar parts in the several views.

A shaft furnace 1 is divided into two chambers, an upper crucible 2 and a lower heating chamber 3. The bottom 4 of the crucible is heated by means of arcs 5 generated by electrodes 6, projecting into the heating chamber. On the bottom of this a quantity 7 of graphite or carbon serves as a contact and resistance material. A bottom contact 8 may be employed for the admission of the energy when desirable. An opening 9 in the side wall of the heating chamber permits watching the arcs and introducing more powder when required. On top of the melting room a cover 10 may be employed for heat insulating or other purposes. When using a very wide crucible which is supported at the circumference a centrally located support 11 consisting of carbon or other suitable material may be provided.

The heating of the crucible in the manner stated is facilitated by the arcs being deviated upwards in the same way as de-

scribed in Letters Patent No. 1103379 of the United States. The cause of the phenomenon apparently is an electrodynamic repulsion of small particles of carbon emanating from the electrodes and from the contact material at the points heated by the arcs.

Having now fully described my invention, I claim:

1. In an electric furnace having an upper chamber, a lower chamber, with poorly heat conducting walls, a heat conducting partition between said chambers and means for heating the lower chamber electrically the combination with each other of at least two electrodes projecting into the lower chamber, for the purpose of generating an electric arc in the lower chamber.

2. In an electric shaft furnace the combination of a lower heating chamber having poorly heat conducting walls electrodes in said chamber for heating same electrically a contact powder on the bottom of the chamber, a contact extending through said bottom and an upper melting chamber consisting for instance of a graphite crucible.

3. In an electric shaft furnace the combination of a lower heating chamber having poorly heat conducting walls electrodes in said chamber for heating same electrically and an upper melting chamber consisting of a crucible supported on a refractory projection from the bottom of the heating chamber.

4. In an electric shaft furnace the combination of a lower heating chamber, an upper melting chamber and means for heating the latter by causing electric arcs in the lower chamber to be deviated upwards from the points of a plurality of electrodes projecting into the said heating chamber.

Signed at Stockholm in the county of Stockholms Lan and State of Sweden this 26th day of July A. D. 1921.

IVAR RENNERFELT.

Witnesses:

W. C. ERIKSON,
S. IVERSON.