

Jan. 15, 1924.

1,481,228

T. RONDELLI

ELECTRIC FURNACE

Filed June 22, 1920

3 Sheets-Sheet 1

Fig. 1

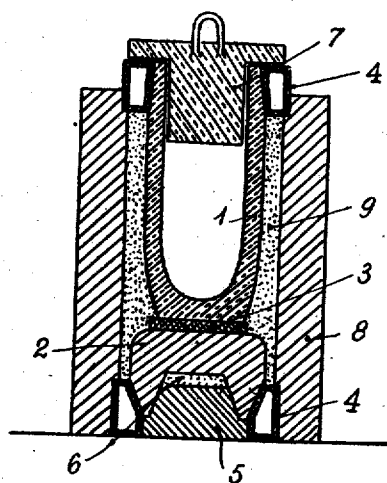


Fig. 2

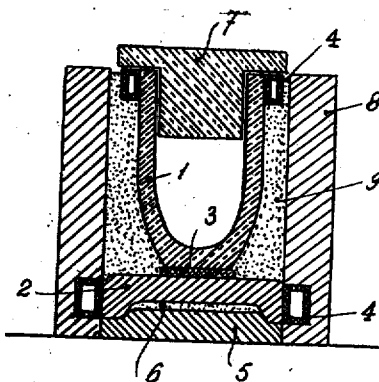
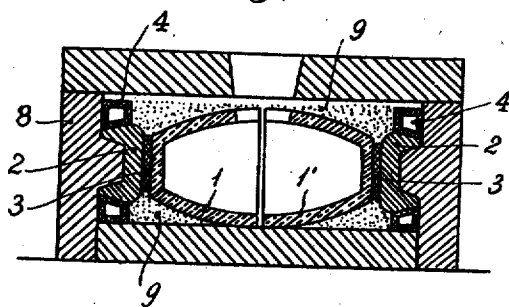


Fig. 3



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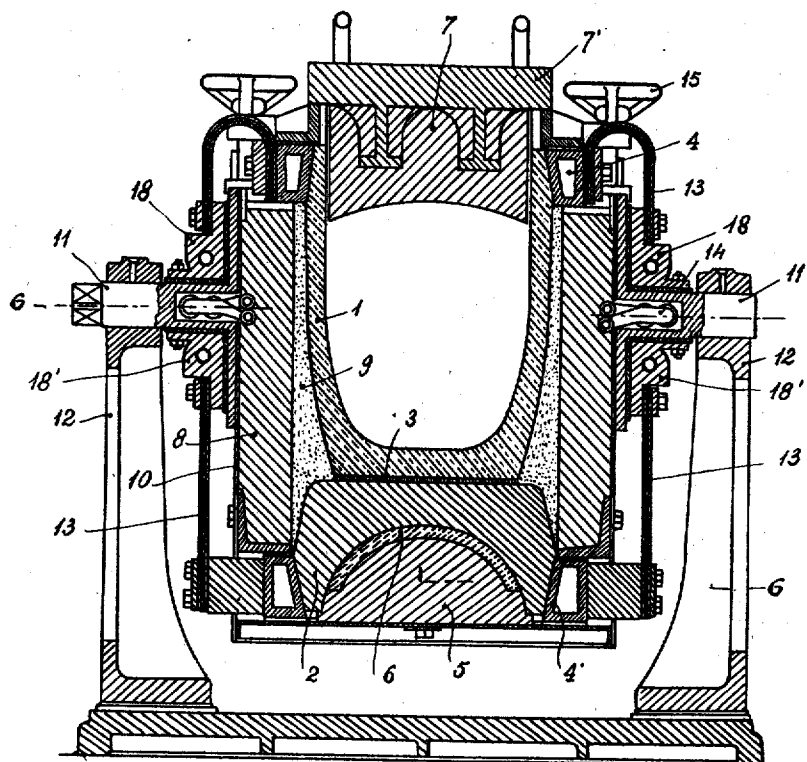
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Fig. 4



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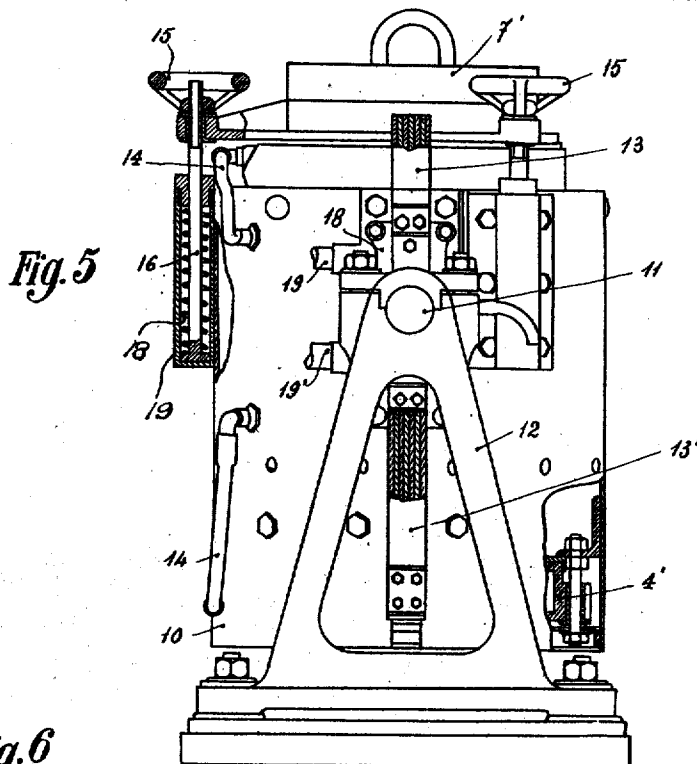
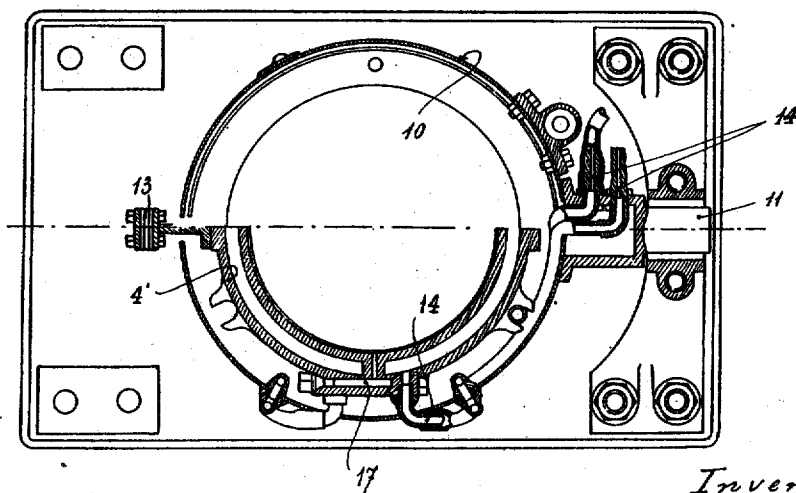


Fig. 6



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UNITED STATES PATENT OFFICE.

TITO RONDELLI, OF LONDON, ENGLAND.

ELECTRIC FURNACE.

Application filed June 22, 1920. Serial No. 390,970.

To all whom it may concern:

Be it known that I, TITO RONDELLI, a subject of the King of Italy, and resident of London, England, have invented certain new and useful Improvements in Electric Furnaces (for which I have filed applications as follows: Italy, filed April 30, 1917, No. 159,684; France, filed Mar. 12, 1919, No. 497,220; and Great Britain, Aug. 10, 1918, No. 127,458), of which the following is a specification.

This invention relates to electric resistance furnaces and has for its object improvements in electric furnaces of the kind in which the resistant body provides the furnace chamber or crucible.

The main object of this invention is an arrangement by means of which the heat is properly distributed in the furnace chamber and the heat dissipation is reduced.

Another object of the present invention is to prevent the corrosion of the resistant body.

The improvements according to this invention result in an increase in the efficiency of the furnace and in a cheap maintenance of the same.

In the known resistance furnaces comprising a main resistance body formed of an uninterrupted or solid body, say a crucible or chamber of carbon or graphite, the parts feeding the current are connected directly to said body and heat is developed to an equal extent throughout the several portions of said body. Therefore said feeding parts are intensely heated by the heat transmitted from said body and as they require to be provided with cooling means for preventing their expansion from giving rise to imperfect contacts and to overheating, the large amount of heat absorbed by the feeding parts is dissipated by said cooling means.

According to this invention in a furnace of the described type the current is fed to one or both ends of said resistant body by means of a part of low resistance providing a large surface of contact with the resistant body and having a recess filled with refractory material.

According to another feature of this invention a layer of high resistance material is located between the facing surfaces of the main resistant body and the current feeding part. As a large amount of heat is developed in said layer by Joule effect, the por-

tions of the furnace adjacent to said layer are intensely heated and by the provision of said layer in contact with the bottom of the furnace chamber or crucible a very intense heating is obtained at said bottom as required for carrying out metallurgical treatments.

On the contrary in known resistance furnaces the resistance and hence the heating are low in the zone occupied by the metal because the current tends to flow through this metal.

Further by inserting the resistant layer above referred to between the furnace chamber or crucible and the current feeding part the voltage drop across the furnace poles may be made as high as desired even when the resistance of the main body is comparatively low. Thus the current intensity does not need to have an exceedingly high value for obtaining a desired heating effect.

On the annexed drawings are shown some embodiments of this invention.

In said drawings Figure 1 is a central vertical section of a crucible furnace according to this invention; Figure 2 is a similar section of a modified construction; Figure 3 is a central section of a furnace comprising two crucibles which provide the furnace chamber; Figure 4 is a central vertical section of another construction; Figure 5 is a side view of this construction and Figure 6 is a horizontal section on the line 6-6. Figures 4 and 5.

The furnace shown by Figure 1 comprises a casing 8 of refractory material which is provided at its bottom with a block 5 of refractory material and a hollow conducting ring 4' adapted to be connected with one of the feeding conductors, not shown. On said block is located a member 2 of comparatively large size which contacts with said ring 4' and is provided with a recess in its portion opposite the block 5; this recess is filled with a layer of reducing material 6, say amorphous graphite powder. On the top of the member 2 is located a layer 3 of a material having a higher electrical resistance than said member 2, as graphite of lamellar structure. The crucible 1 is made of carbon, graphite or other suitable material and bears on said layer 3; at its upper mouth this crucible is encircled by a current feeding ring 4. The mouth of the crucible is closed by a plug 7 of refractory material and the space

between the casing 8 and the crucible 1 is filled with a proper material 9 such as amorphous graphite in powdered condition, which is a material having practically no conductivity.

The construction shown by Figure 2 is similar to that above described in all respects, excepting that the member 2 has a much larger diameter as compared with the diameter of the region of the crucible contacting with the intermediate layer 3.

In Figure 3 is shown a furnace comprising a chamber provided by two crucibles 1—1' arranged with their axes horizontal and their mouths close to each other; the end of each crucible bears against a member 2 with an interposed layer 3 of resistant material and the current is supplied by conducting rings 4—4' each embracing one of said members 2. As described in connection with other figures the crucibles 1—1' are enclosed within a refractory casing 8 and a filling of nonconducting material 9.

In the furnace built as above described the current flowing from one to the other of the rings 4 passes through the member or members 2, layer or layers 3 and the body of the crucible, and the highest development of heat is obtained in each layer 3, owing to the high resistance of the material forming this layer.

Therefore the crucible is heated by the heat developed by Joule effect in its own wall and further its portion contacting with the layer 3 is highly heated by the heat developed in said layer; the temperature of the crucible thus decreasing from its bottom towards its mouth.

On the contrary the heating by Joule effect is negligible in the member 2 on account of the size of this member. The feeding parts 4 and the conductors connected thereto are prevented from absorbing a large amount of heat on account of their distance from the hottest parts of the furnace, and on account of the block 5 and plug 7 intercepting any line of radiation from hot portions of the furnace.

The layer 9 of amorphous graphite forms a reducing medium encircling the resistant body 1 and thus this body is prevented from being burnt and giving rise to any reaction with the refractory material of the casing.

The layer 3 may conveniently consist of lamellar graphite and thus it may be easily replaced at a very low cost.

By the construction according to this invention the life of the essential parts of the furnace is extended and the cost of its operation and maintenance is reduced.

The arrangement of a layer 3 of the described character between the member 2 connected with the current feeding parts and the crucible provides also the advantage that the furnace may be caused to work with any

desired voltage drop across its poles, he cause by modifying the thickness or the nature of the layer 3 any desired value may be imparted to the resistance of the furnace notwithstanding the crucible has a low resistance as usual; said layer 3 may be easily replaced when the furnace is not in operation.

Preferably the filling 9 consists of powdered amorphous graphite which has practically no conductivity; the portion of this filling which contacts with the outer surface of the crucible undergoes a partial modification and hardens under the high temperature to which it is subjected, whereby it takes up a conductivity which compensates for possible corrosions of the inner surface of the crucible.

Figures 4, 5 and 6 show a further embodiment of the furnace according to this invention. In this construction the crucible 1 is enclosed within a refractory sleeve 8 mounted in a metal casing 10; this casing is provided with trunnions 11 journaled on standards 12. The bottom of the casing 10 is closed by a plug 5 of refractory material and carries the feeding ring 4'; the crucible 1 is supported by a hollow member 2 which bears on the plug 5 through the intermediary of a layer 6 of reducing material and between the bottom of the crucible 1 and the member 2 is located a layer 3 of high resistance material as lamellar graphite.

Said member 2 may conveniently consist of the bottom of a crucible out of service and the layer 6 may consist of amorphous graphite.

The outer portion of the mouth of the crucible is encircled by a conducting ring 4' intended to feed the current to the furnace in cooperation with the bottom ring 4'.

Each of said feeding rings 4—4' consists of two semi-circular segments which are connected to the ends of resilient blades 13—13'. The first blade 13 is connected by means of insulated blocks 18, to the conductor 19 (Figure 5) and is thereby connected to one terminal of the source of the current supply; the other blade 13' is connected through the insulating block 18', to the conductor 19' and to the opposite pole of said source.

As shown on the drawing the segments forming said rings 4—4' are made hollow and to provide for a water circulation; this water is fed through ducts 14 located in the trunnions 11.

The mouth of the crucible 1 is closed by a plug 7 of refractory material which is secured to a cover plate 7'; this plate 7' is held in position by hand operated nuts 15 each of which engages a screw-threaded rod 16 connected to the casing 10 through the intermediary of a spring 18 and a sleeve 19.

As shown by Figure 6 the segments forming each ring 4—4' are clamped together

and forced on the cooperating portion of the crucible 1 or member 2 by means of bolts 17.

5 The space between the refractory sleeve 8 and the crucible 1 is filled with a layer 9 of amorphous graphite in powdered condition, as described in connection with other figures.

10 What I claim as my invention and desire to secure by United States Letters Patent is:—

1. In an electric resistance furnace comprising a main resistant body providing the furnace chamber or crucible; a member of large size made of a material of the same character as said main resistant body for feeding the current to said body, said member being provided with a recess on its side opposed to its face adjacent to said main resistant body, refractory material located in said recess, a layer of high resistance material located between said member and the facing portion of said main resistant body

and conductors contacting with the peripheral surface of said member and connected with a pole of a current supply.

25 2. In an electric resistance furnace comprising a crucible of resistant material provided with means connecting its mouth end with a pole of a current supply; a member of large size and made of a material of the same character as said crucible, this member being located adjacent to the bottom of said crucible and being recessed on its side opposed to its face adjacent to the crucible, refractory material located in said recess, a layer of high resistance material located between said member and crucible and means contacting with the peripheral surface of said member for connection with the other pole of said current supply.

40 Signed at London, England, this 28th day of May, A. D. 1920.

TITO RONDELLI.