April 2, 1929. P. L. J. MIGUET 1,707,406

FURNACE ELECTRODE

Filed Feb. 9, 1927

Fig. 1

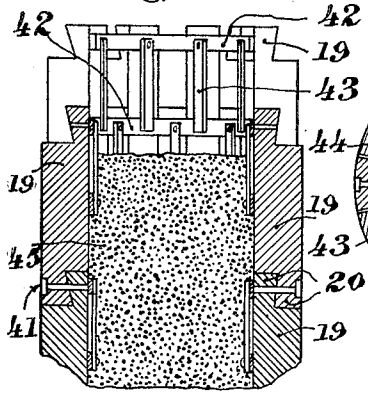


Fig. 2

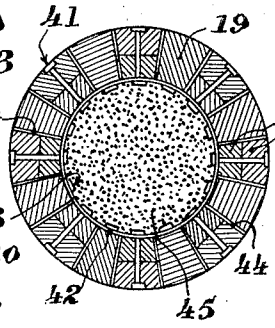


Fig. 3

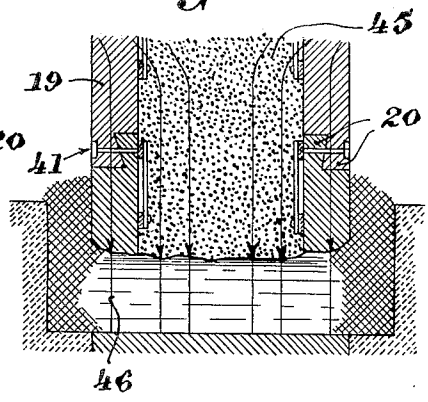


Fig. 4

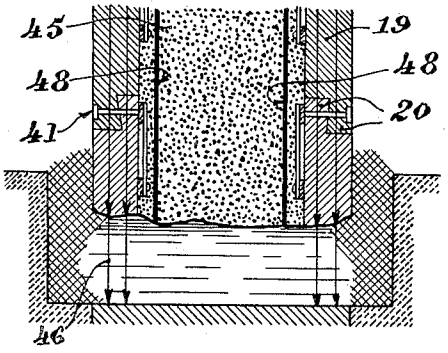


Fig. 5

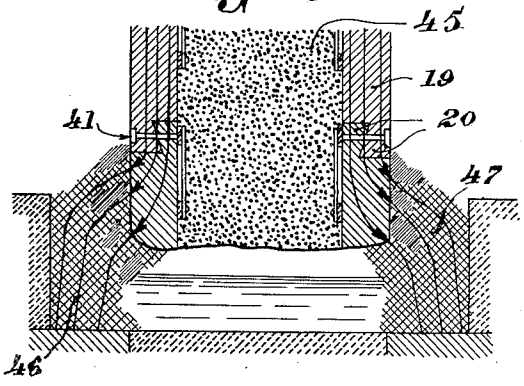


Fig. 6

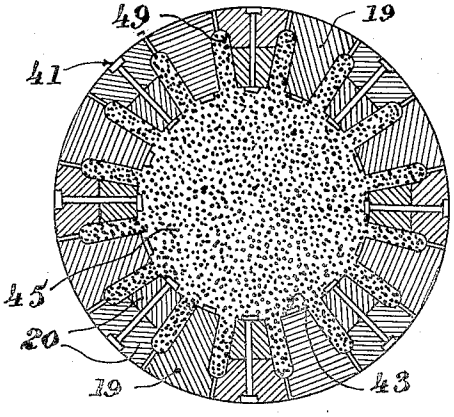
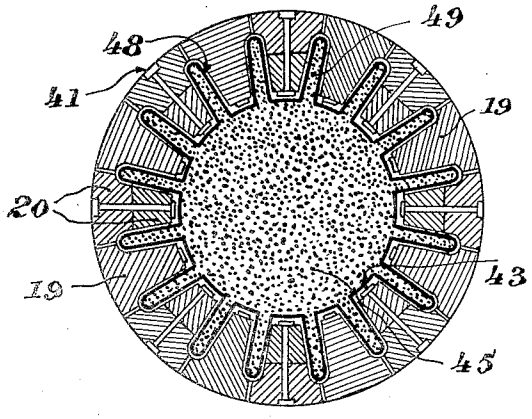


Fig. 7



Inventor

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By A. Singer, Atty.

Patented Apr. 2, 1929. 1,707,406

UNITED STATES PATENT OFFICE.

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FURNACE ELECTRODE.

Application filed February 9, 1927, Serial No. 167,023, and in France December 21, 1926.

This invention relates to improvements in electrical furnaces and especially improvements in electrodes for such furnaces, and is an improvement on electrodes of the type described and claimed in my application for Letters Patent of the United States filed September 29, 1926, Serial No. 138,540.

The object of the present invention is to provide an improved electrode comprising a hollow frame, a conductive continuous hollow cylindrical body composed of coupled sectors each separately mounted on and secured to said frame and a core which fills the central bore or channel formed in said frame and which may be formed as a part of the working charge of the furnace in which the electrode is used and said core may be composed of nonconductive material such as silica, in which event no current passes therethrough, or may be formed of conducting material such as carbon, in which latter case an insulating layer is interposed between said sectors and said core or filling mass.

One specific object of the present invention is to effect improvements in the construction of the frame to which the sectors are secured.

Another object is to effect improvements in the construction of the sectors.

Another object is to effect improvements in the means for detachably securing the sectors to the frame.

Another object is to effect such improvements in the construction of the electrode as an entirety, composed of the frame and the sectors, as to greatly facilitate the assembling and disassembling of the various parts of which the electrode is composed.

With the above and other objects in view, the invention consists in the construction, combination and arrangement of devices hereinafter described and claimed.

The invention will be described with reference to the accompanying drawings:

Figs. 1 and 2 are respectively a sectional elevation and a sectional plan of a circular continuous electrode obtained by piecing together sectors staggered relatively to each other and mounted on a metallic interior frame.

Figs. 3, 4 and 5 are respectively a sectional elevation of an electrode for reduction or electrolysis, the internal mass or core of which is accessible to the current which flows to the base of the furnace wherein said electrode is arranged; a sectional elevation of a similar electrode, the internal mass or core of which is not accessible to the current, said electrode being disposed in a furnace similar to that referred to; and a sectional elevation of a similar electrode, the internal mass or core of which is accessible to the current, said electrode being disposed in a furnace such as described in my application No. 121,189 for Letters Patent of the United States and in which the current passes towards the lateral walls.

Fig. 6 is a transverse section of an electrode with a filling mass or core having lateral projections, said mass being constituted either wholly or partly of raw materials.

Fig. 7 is a sectional view of a modified form of the invention provided with an insulating envelope in its interior.

As shown in Figures 1 and 2, the carbon sectors 19, which are of equal size are arranged in vertical series, those of each sector row being staggered with respect to those of adjacent rows to break the horizontal joints between them, and are affixed individually by means of bolts 41 on rings 42, which are connected together by uprights 43. Grooves or radial spaces 44 are provided between the assembled sectors, and are filled afterwards with clay or cement. The sectors of each vertical row are connected together, end to end, by dovetailed joints 20. This construction greatly facilitates the assembling and disassembling of the sectors, and their attachment to and detachment from the frame. The electrode thus constructed forms a closed bundle, of straight-line form, in which superheating and accumulations of gases are avoided by rendering the filling mass or core 45 inaccessible to the current, said mass forming only an interior protection, and said bundle having the same absolute transverse section as that of the known kind and allowing the same density of current, which may vary, in case of reduction and according to the chosen material, between 4 and 5 amperes per square centimeter.

Such construction permits lateral expansion of the current without change of the composition of the filling mass and without interposition of an insulating layer, ensures really the practical isolation of said filling mass so that no current passes therethrough.

Experiments have shown, that the density of current, with regard to the entire section

of the electrode should be decreased to about 2 amperes per square centimeter and secondly that the transverse section of the filling mass should not be much greater than that of the sectors, so that, finally, said sectors are submitted, considering that superheating and gaseous accumulations near the axis must be avoided, to a current of 4 and 5 amperes per square centimeter, in the same manner as the straight-line bundles.

In the form of the invention shown in Figure 3 the filling mass 45 is of conducting material and hence current passes therethrough as well as through the hollow cylindrical conducting body formed by the sectors 19, the lines of the current being indicated at 46.

In the form of the invention shown in Figure 4, an insulating cylinder 48 is interposed between the filling mass of conducting material 45 and the carbon sectors so that current is prevented from passing through the filling mass.

In the form of the invention shown in Figure 5, the filling mass 45 is of nonconducting material, which may be the same as of the working charge in the furnace and the distribution of the current 46 occurs principally in the heterogeneous fusion bed. In all of the forms of the invention superheating and gaseous accumulations near the axis are avoided.

Superheating and axial gaseous accumulations are especially liable to occur in very large electrodes, but these are avoided by my invention which operates to maintain the current near the periphery.

In Figure 6 I illustrate another modified form of the invention in which radial inwardly openings in recess 49 are formed between the carbon sectors 19 and which are filled with the same material as constitutes the filling core 45. This construction causes the material of the filling mass to somewhat closely approach the periphery of the electrode and is especially important when the electrode is used in treating aluminum, in which fluor, produced by electrolysis must be retained by alumina and carbon contained in the filling mass.

In Figure 7 I show a modified form of electrode of substantially the kind shown in Figure 6, but in the interior of which is placed an insulating envelope 48. This insulating envelope may be only a simple layer of insulating varnish or other appropriate material applied as an insulating coating or paint, against the internal surface of the sectors and the metallic pieces or parts assembling the same or may be otherwise suitably constructed.

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

1. An electrode for electric furnaces, comprising a hollow frame, a conductive continuous exterior body formed by coupled sectors individually mounted on the outside of said frame and a core filling the central chamber or bore formed in said frame.

2. An electrode for electric furnaces comprising a hollow frame, a conductive continuous exterior body formed by coupled sectors individually mounted on the outside of said frame, and a mass of material filling the central chamber or bore formed in said frame.

3. An electrode for electric furnaces, com prising a hollow frame, a conductive continuous body, formed by coupled sectors individually mounted on the outside of said frame, a mass of conductive material filling the central channel formed in said frame, and means for preventing current from passing through the filling mass.

4. An electrode for electric furnaces, comprising a cylindrical hollow metallic frame, carbon sectors joined together and individually mounted on the outside of said frame, bolts for connecting each of said sectors to said frame and a core, filling the central chamber or bore formed in said frame.

5. An electrode for electric furnaces, comprising a cylindrical hollow frame, a conductive exterior body formed by sectors joined together and individually mounted on the outside of said frame and provided with radial grooves on their inner sides, and a mass of material filling the central channel formed in said frame and said grooves.

6. An electrode for electric furnaces, comprising a hollow frame, a conductive continuous exterior body formed by coupled sectors individually mounted on the outside of said frame, a mass of conductive material filling the central channel formed in said frame and an insulating layer interposed between said frame and said filling mass.

7. An electrode for electric furnaces comprising a hollow frame, a conductive continuous exterior body formed by coupled sectors individually mounted on the outside of said frame and providing radial grooves on the inner face of said body, a filling mass, constituted in part by the working material intervening in the reduction process performed in the furnace, said filling mass being arranged in the central channel formed in said frame and in said grooves, and means for preventing current from passing through said filling mass.

In witness whereof I affix my signature.

PAUL LOUIS JOSEPH MIGUET.