May 17, 1932. P. L. J. MIGUET ET AL 1,858,455

ELECTRIC FURNACE

Filed June 12, 1930 2 Sheets-Sheet 1

Fig. 1.

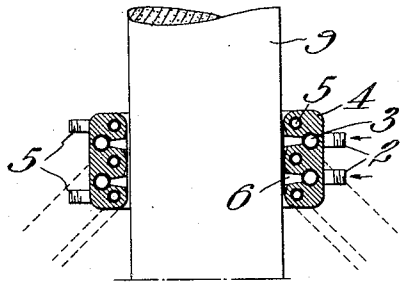
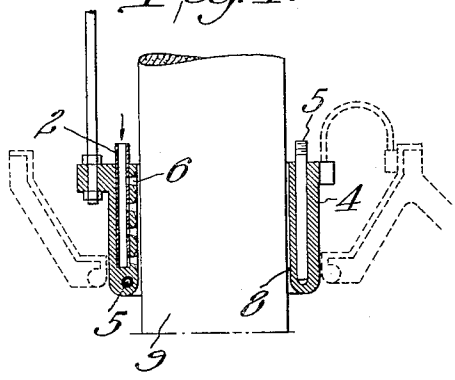


Fig. 4.



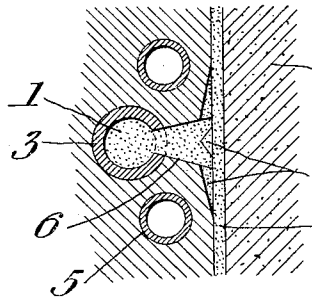


Fig. 3.

Fig 2.

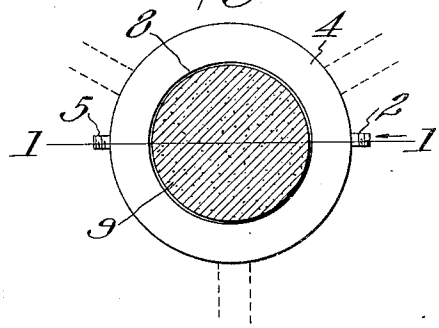
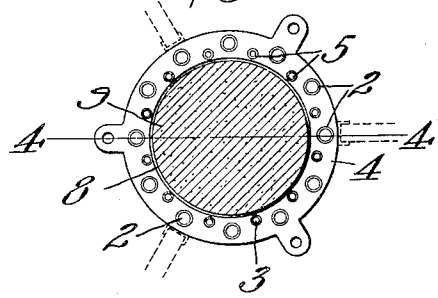


Fig. 5.



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Fig. 6.

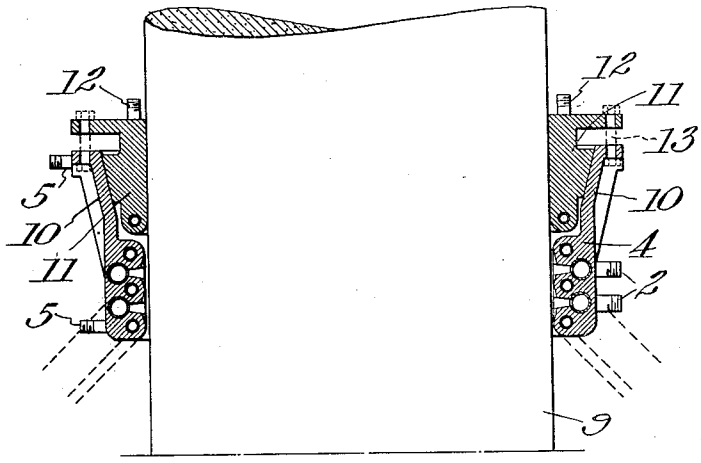
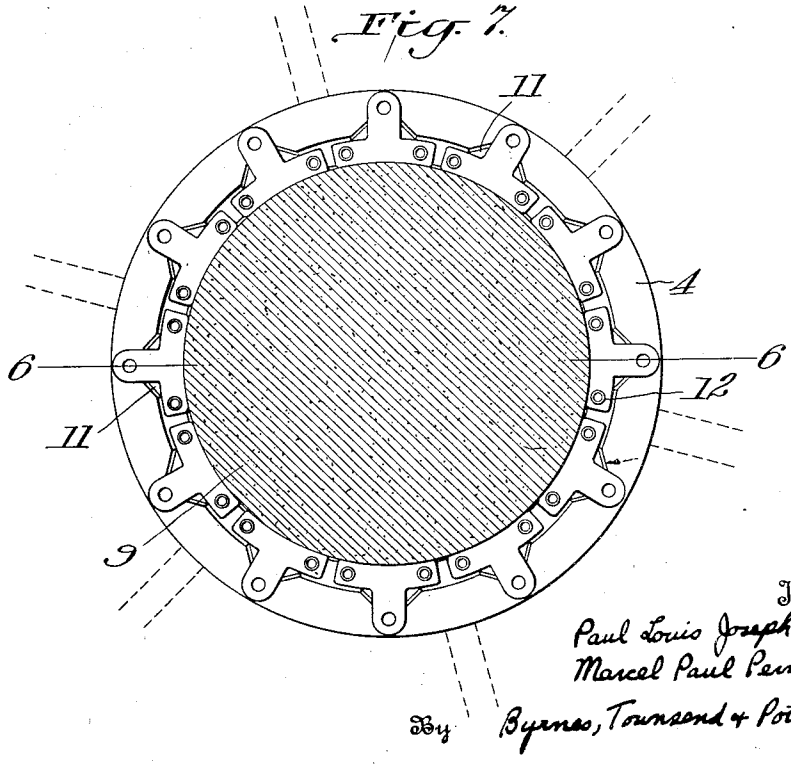


Fig. 7.



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UNITED STATES PATENT OFFICE

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ELECTRIC FURNACE

Application filed June 12, 1930, Serial No. 460,749, and in France February 20, 1930.

The present invention relates to improvements in electric furnaces and particularly to novel means and methods for establishing electrical connection with the electrodes of electric furnaces.

In United States application Serial No. 348,645, filed March 20, 1929, there was described among other structures an electrode-connecting device consisting of a sort of stuffing box insuring electric transmission by means of granules of anthracite highly compressed between the electrode and the metallic collar supplying the current.

When used in a fixed position, that is to say, during the periods of twenty-four, thirty-six or forty-eight hours between successive slippages of the electrode, such an arrangement obviously assures, in comparison with strictly metallic connections, the triple advantage of avoiding all gaseous circulation in the section which it occupies, of making all the points of the surface of contact participate in the transmission of current, and finally of interposing between the electrode at high temperature and the cooled current-supplying collar a carbonaceous substance of reduced thermal conductivity; this triple advantage having the effect of facilitating the closing of the furnace, of avoiding any appreciable potential drop because of insufficient contact, and finally of decreasing heat loss through the electrode.

During the slippage, on the other hand, this arrangement presents not only the inconvenience, common to all devices analogous to the usual studying box, of necessitating the loosening of the upper collar which compresses the anthracite granules, but also that of the loss during the slippage of an appreciable proportion of the granules; this loss making it necessary, in the absence of any practical method of introduction at the side opposite the electrode, to raise the compression collar in order to replace the granules and therefore to reduce the power of the furnace during the time necessary for this replacement.

For this reason, in the present invention the usual stuffing box, compressing a substance originally solid although of deformable volume, is replaced by a device of analogous function but acting upon a substance practically liquid until it arrives at the annular space heretofore reserved for the anthracite granules, the solidification of this substance only taking place under the influence of heat or of the current in the electrode and the complementary absorptive action by the porous mass of carbon in the case of electrodes which do not have impervious or practically impervious metallic sleeves.

Obviously there is needed a substance, simple or complex, having naturally an appreciable conductivity, such for example as the semi-solid paste obtained by the suitable malaxation of the following mixture:

	Parts
Conductive carbon powder paste through a 200-mesh screen	450
Sugar	200
Water	350

This mixture retains its pasty texture as long as it does not lose an appreciable amount of its water, that is to say, until it arrives in the annular space between the electrode and the collar carrying the current, in the same manner as "Alemite" greasing between an axle and the bearing; the width of the annular space being reduced as far as the expansion of the electrode will permit.

The complex substance given as an example, having naturally the requisite conductivity, the considerable advantages of simplification and automatic operation brought about by its substitution for the granules of anthracite in the stuffing box for supplying current shown and figured in the cited United States application will be obvious from the comparison made with "Alemite" greasing.

As far as concerns electrodes of small diameter, the most apparent of the advantages are evidently, from the constructional point of view: the elimination of the compression collar and the means of tightening it which are replaced by simple supply or distributor tubes for the conductive material embedded in the body of the collar supplying the current, thus affording a material economy in first cost;

From the point of view of slippage: the automatic replacement of loss of solidified conductive substance by semi-solid conductive substance through the supply tubes which permanently communicate with one or more reservoirs maintained under suitable pressure, thus making possible the maintenance of the furnace at full power at all times;

From the point of view of tightness: the instantaneous closing of the cracks which may be formed in the body of the solidified conductive substance, thus making possible the closure of the furnace without any danger either of explosion by the introduction of air or of the poisoning of the workmen by the escape of noxious gas or vapor.

As far as concerns electrodes of large diameter, the last two of these advantages clearly exist and are even increased by the practical impossibility of using the known type of stuffing box for electrodes having, for example, a diameter of six meters necessary for the application of five hundred thousand amperes.

The first advantage, on the other hand, is compromised by the necessity of increasing the space left for the conductive material because of the very appreciable expansion of the electrode; this increase in the width of the space necessitating the presence of centering wedges.

The presence of these centering wedges, the form of which is also subject-matter of the present invention, makes at the same time for the insuring of good transmission of current by taking part in the transmission.

The figures of the accompanying drawings, which show by way of illustration different forms of the invention, make plain the advantages of the construction as a whole, as well as those peculiar to each form.

In the drawings:

Figs. 1, 2 and 3 are, respectively, a sectional elevation, a plan view, and a detail on enlarged scale of the stuffing box of the invention applied to the closed furnace with semi-fixed electrode of U. S. application Serial No. 348,285;

Figs. 4 and 5 are, respectively, a sectional elevation and a plan view of the invention applied to the open furnace with movable electrodes of the above-mentioned application; and

Figs. 6 and 7 are, respectively, a sectional elevation and a plan view of the stuffing box of the invention applied to electrodes of large diameter.

In Figures 1, 2 and 3 the semi-solid conductive material 1 arrives under pressure through the horizontal tubes 2 into the distributing conduits 3 embedded in the fixed collar 4 for supplying current, the semi-solid material expanding through the conical holes 6 carrying spiders 7 into the usual packing space 8 between the electrode 9 and the collar-supplying current 4. The collar 4 is cooled by water circulation 5.

In Figures 4 and 5 the conductive semi-solid material 1 arrives under pressure through vertical tubes 2 embedded in the movable conducting collar 4 (cooled by multiple water circulation 5) to expand in the same manner as in the previous figures but without distributing conduits into the space 8 between the collar and the electrode.

In Figures 6 and 7 the current-supplying collar 4 carries a superior member 10 providing a space for the electrode-centering wedges 11 which are cooled by water circulation 12 and secured by bolts 13 preferably having reversed threads; the wedges which may, if necessary, insure the transmission of current, be preferably characterized on the side of the current-supplying collar by a prismatic shape which has the double advantage of increasing the surface of contact and of preventing all rotation about the electrode 9.

With small electrodes which are easily adjusted and have small expansion, the necessary space reserved for the semi-solid conductive substance is not more than two to three mm. and there is no trouble even if the interposition of a continuous or nearly continuous metallic sleeve prevents the absorptive action of the carbon on the water of the semi-solid material given by way of example and permits the elimination of the water only by the direct thermal effect of the current.

But with the very large electrodes requiring a space up to ten or even twelve millimeters in width, this direct thermal effect of the current alone would not act with the necessary quickness and it is necessary, when not using pre-baked electrodes, to replace the continuous or practically continuous sleeve, which maintains the shape of the mass to be baked or carbonized, with a sheet perforated as finely and as closely together as possible, or by a metal fabric of suitable texture; either one permitting the semi-solid conductive material to come in contact at least in large part with the already baked or carbonized mass and to lose the greater part of its water in contact therewith.

This substitution also has the advantage of suppressing practically all effective participation of the sleeve in the conduction of the current exactly as in the case of electrodes partially baked in place; this lack of participation having the effect of preserving the sleeve until it arrives in the neighborhood of the material being treated and thus diminishing as far as possible the oxidizing action of air on the electrode.

It goes without saying that this replacement may be effected not only in the case of electrodes with a single sleeve, but also with those with multiple sleeves, such for example

as round or polygonal bundles or of metallic covers formed of arched wedges filled with a paste of carbon and tar or simply with cokeable coal to be baked or carbonized in place, each of these cases being comprised within the scope of the present invention.

We claim:

1. An electrode connection for electric furnaces comprising a conducting member adapted to encircle an electrode and to define an annular space between said member and the electrode and means for supplying a semi-solid conductive paste to said annular space.

2. An electrode connection for electric furnaces comprising a conducting member adapted to encircle an electrode and to define an annular space between said member and the electrode, conduits embedded in said member and communicating with said annular space and means for supplying a semi-solid conductive material through said conduits into said annular space.

3. An electrode connection for electric furnaces comprising a conducting member adapted to encircle an electrode and to define an annular space between said member and the electrode, means for supplying a semi-solid conductive paste to said annular space, and means for circulating a cooling medium within said member.

4. An electrode connection for electric furnaces comprising a conducting member adapted to encircle an electrode and to define an annular space between said member and the electrode and means for supplying a semi-solid conductive paste under pressure to said annular space.

5. An electrode connection for electric furnaces comprising a conducting member adapted to encircle an electrode and to define an annular space between said member and the electrode, means for supplying a semi-solid conductive paste to said annular space, and a plurality of wedge-shaped members positioned between the upper portion of said conducting member and the electrode and adapted to maintain said electrode in substantially concentric relation to said conducting member.

6. An electrode connection for electric furnaces comprising a conducting member adapted to encircle an electrode and to define an annular space between said member and the electrode, means for supplying a semi-solid conductive paste to said annular space, and a plurality of wedge-shaped members positioned between the upper portion of said conducting member and the electrode and adapted to maintain said electrode in substantially concentric relation to said conducting member, said members having prismatic extensions on the surface contacting with said conducting member and adapted to coact with corresponding prismatic depressions on the interior surface of the conducting member to prevent rotation of the latter about the electrode.

7. In an electric furnace, in combination an electrode comprising a carbonaceous conductive core and a foraminous metallic member about the core, adapted to maintain the shape of said core and to permit contact of a semi-solid conducting paste therewith; a conducting member adapted to encircle said electrode and to define an annular space between said member and said electrode; and means for supplying a semi-solid conductive paste to said annular space.

8. A method of establishing electrical connection between an electrode and an encircling conducting member which comprises supplying to the space between said electrode and said member a semi-solid conductive paste adapted to solidify with the loss of its liquid constituent.

9. A method of establishing electrical connection between an electrode and an encircling conducting member which comprises supplying under pressure to the space between said electrode and said member a semi-solid conductive paste adapted to solidify with the loss of its liquid constituent.

10. A method of establishing electrical connection between an electrode and an encircling conducting member which comprises supplying under pressure to the space between said electrode and said member a semi-solid conductive paste adapted to solidify under the action of heat or under the absorptive action of the porous mass of the electrode.

11. A method of establishing electrical connection between an electrode and an encircling conducting member which comprises supplying under pressure to the space between said electrode and said member a semi-solid conductive paste comprising carbonaceous material and water in sufficient amount to render the material fluent.

In testimony whereof, we affix our signatures.

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MARCEL PAUL PERRON.