O. SERPEK.

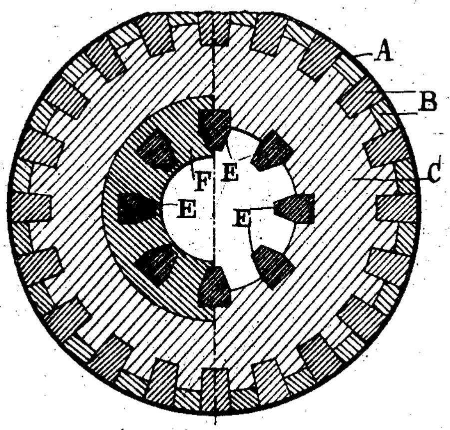
ELECTRICAL RESISTANCE FURNACE.

APPLICATION FILED JUNE 21, 1910.

1,044,927. Patented Nov. 19, 1912.

2 SHEETS—SHEET 1.

Fig. 1



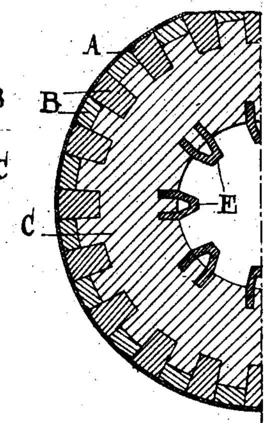


Fig. 2

Fig. 3

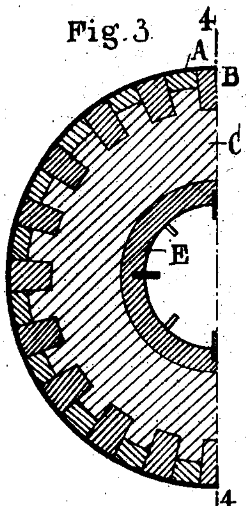


Fig. 4

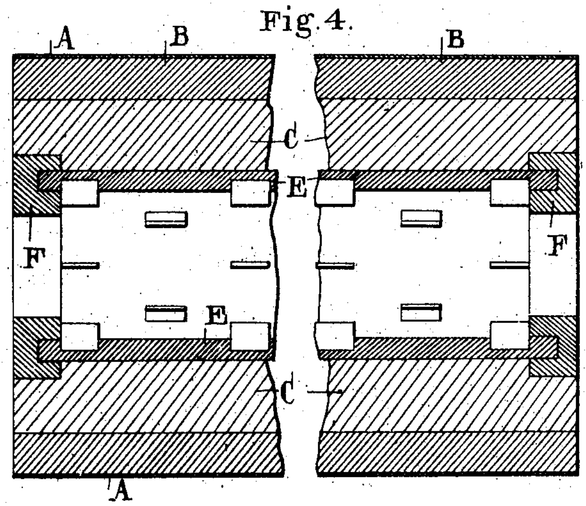


Fig. 5.

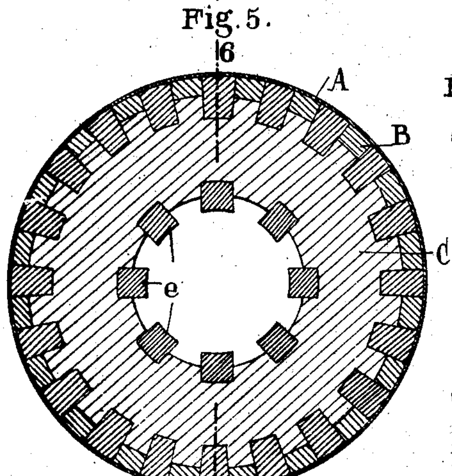
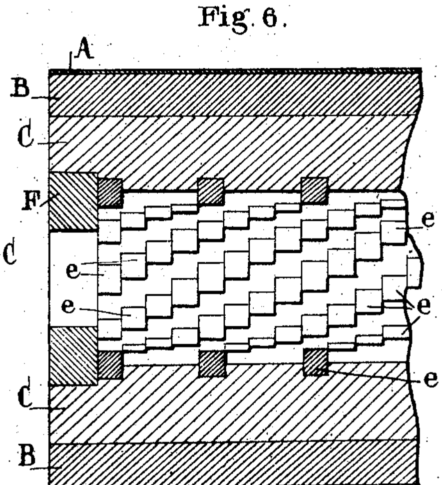


Fig. 6.



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2 SHEETS—SHEET 2.

Fig. 7.

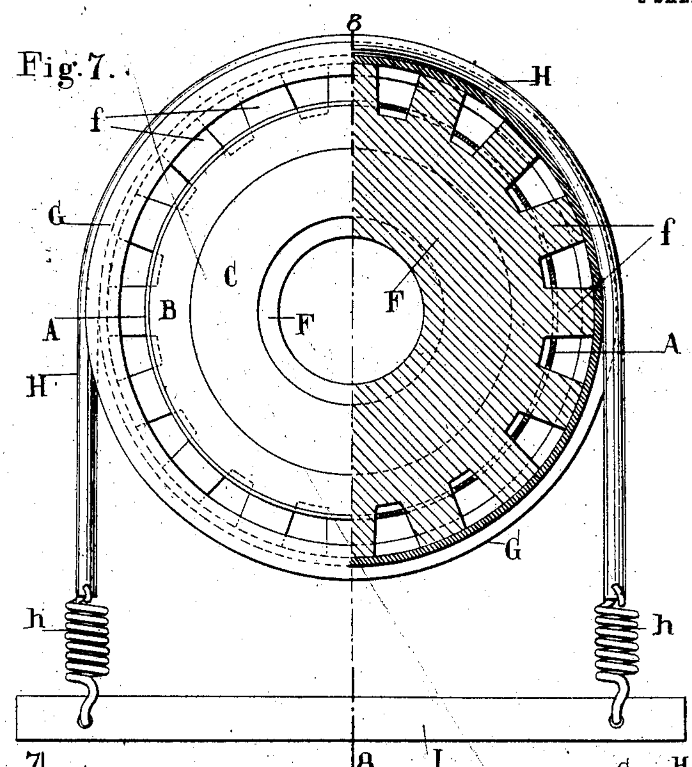


Fig. 8.

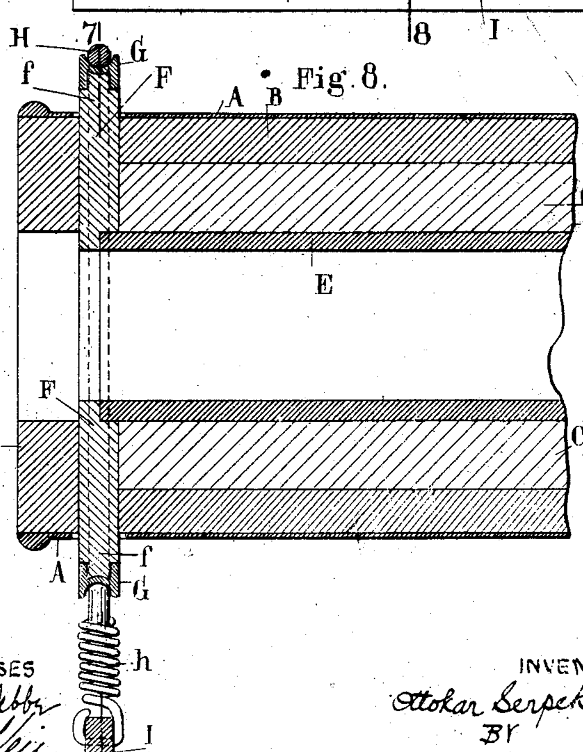
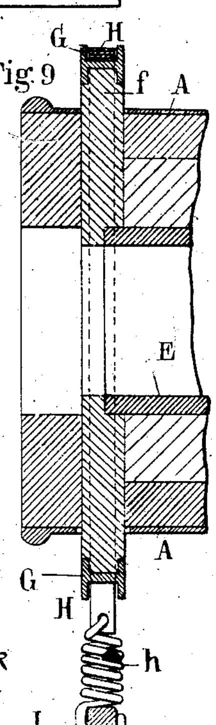


Fig. 9



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ELECTRICAL RESISTANCE-FURNACE.

1,044,927. Specification of Letters Patent. Patented Nov. 19, 1912.

Application filed June 21, 1910. Serial No. 568,158.

To all whom it may concern:

Be it known that I, OTTOKAR SERPEK, a subject of the Emperor of Austria-Hungary, and a resident of 12 Rue Roquepine, Paris, France, have invented new and useful Improvements in Electrical Resistance-Furnaces, of which the following is a specification.

This invention relates to electrical resistance furnaces intended especially for the manufacture of aluminium nitrid.

It is well known that if aluminium be brought in presence of carbon to a high temperature, it can fix or combine with nitrogen so as to give rise to aluminium nitrid. Moreover, experiments have shown that to obtain this reaction under the best conditions possible, it is necessary to operate at high temperatures which are nevertheless lower than those at which the formation of carbid would become possible, namely in the neighborhood of 1800° C. In spite of the knowledge of these facts serious difficulties have been encountered hitherto in the attempt to carry out this manufacture, for want of having used an apparatus which allows of obtaining the suitable temperature and of distributing it uniformly over the whole of the mass under treatment. Electrical arc furnaces or those with a resistance consisting of the actual mass under treatment, the only ones employed hitherto, are found to afford only a very irregular distribution of heat; the temperature is too high in certain zones where the current elects to pass, while the rest of the mass is at too low a temperature; consequently there is formed in the over heated parts a stratum of carbid, which can only with difficulty be decomposed and forms an obstacle to the propagation of the desired reaction so that in the balance the substance obtained contains principally carbid more or less pure, mixed with a small proportions of nitrids.

The present invention has now for object the application to this manufacture of a rotary resistance furnace in which the resistance no longer consists of the actual material treated, but is independent thereof; it consists either of a tube or of a series of rectilinear, helicoidal or other bars, fitted into the casing of the furnaces and extending for its entire length; the resistances are connected at each end to the terminals of the electrical supply. The furnace is in the form of a hollow cylinder or tube open at its opposite ends and preferably slightly inclined so as to feed slowly forward the material under treatment which is in this way passed continuously into the furnace while being subjected also to an energetic stirring by contact with the resistances; this allows of obtaining a suitable and constant temperature and of distributing it equally through the mass under treatment.

The annexed drawing illustrates by way of example a furnace constructed according to the present invention.

In this drawing:—Figure 1 represents two half cross-sections, one of the central part of the furnace and the other near one end. Figs. 2, 3 and 5 are transverse sections of modifications of the furnace in which the resistances have been given different shapes. Fig. 4 is a longitudinal section of the modification represented in Fig. 3, the section being taken on line 4—4 of that figure. Fig. 6 is a section of the modification represented in Fig. 5, on line 6—6 of that figure. Fig. 7 represents a modified form of furnace, showing a suitable slip-ring device or means for conveying the current; in this figure the furnace is represented one half in end view the other in section along line 7—7 of Fig. 8. Fig. 8 represents in section upon line 8—8 of Fig. 7 the portion of the furnace adjacent to the end. Fig. 9 represents in a similar manner a modification of the slip-ring.

The furnace consists of an exterior cover A of sheet-iron or the like provided internally with refractory bricks B. Upon this first lining is placed a second C formed of agglomerated nitrid. The chief substances of a refractory and insulating nature generally used can hardly be employed here either because they are attacked by the materials under treatment or because at the high temperatures at which the operation takes place they are softened or at least undergo some contraction which tends to loosen the material.

In the second lining C are fitted resistances E extending for the whole length of the furnace and projecting within the central cylindrical part of the furnace in which are placed the materials to be treated. When the furnace revolves, these materials are stirred up by these projecting resistances and by the contact are carried to a very high temperature; the stirring causes at the same time a more intimate contact of the nitrogen with the solid substances (alumina and carbon) upon which it has to react.

Instead of having the section indicated in Fig. 5, the resistances might have the section shown in Fig. 2, which allows of obtaining the same surface of contact for the material under treatment with a small cross-section and likewise a smaller fitting surface in the refractory lining. Moreover, instead of using several resistances a single one may be used covering the whole interior of the furnace in the form of a tube of circular or suitable polygonal section, as represented in Figs. 3 and 4. Within this resistance-forming tube a number of projections may be arranged to effect the stirring of the materials and prevent them from merely sliding upon the wall of the tube. Lastly, Figs. 5 and 6 represent another arrangement which may be used; the resistances are arranged helically, each helix being composed of resistance-elements *e* simply juxtaposed, so that the current passes by mere contact. This arrangement allows the progress of the material in the furnace to be accelerated or retarded according to the pitch and the direction of the helices.

The resistances consist of a mixture in suitable proportions of carbon and aluminium nitrid (say 60% to 80% aluminium nitrid to 40% to 20% carbon) and at each extremity they are fitted in holders F of carbon to which the current may be led by brushes or the like in any suitable manner, for example the arrangement shown in Figs. 7, 8 and 9 may be employed.

The carbon cap F into which the resistances are fitted, extends as far as the sheet-iron casing and carries upon its periphery a certain number of prolongations *f* resembling teeth and projecting from the furnace through openings formed in the casing A. All these teeth are connected externally by a metal ring G, which is itself provided upon its exterior surface with a groove into which there passes a metal wire H fixed at its ends by means of spring *h* to a bar I to which the current is led in any suitable manner. As the furnace revolves, the bar I remaining always horizontal, the cable H slips upon the metal ring G, in this way passing current to the latter and so to the carbon cap F.

Instead of a cable, a number of strips of metal foil G′ may be employed as shown in Fig. 9; these strips are arranged in a similar manner to the cable, the semicircular section of the groove being replaced by a rectangular section. This arrangement presents the advantage of increasing the area of the contact surfaces. For the same reason the anchoring points of the cable or of the foil strips may be brought together, so as to provide contact surface for more than a semi-circumference.

Of course the use of this furnace is not limited only to the manufacture of aluminium nitrid and it can be applied to the manufacture of other nitrids and in general to any reaction which requires a high temperature and a reducing atmosphere.

Claims—

1. A rotary electric resistance furnace, comprising a tubular furnace chamber open at its opposite ends for the continuous passage of the material to be treated as the furnace rotates, resistance elements embedded in the refractory lining at the interior of the furnace to come into contact with said material and means for leading electric current to the resistance elements.

2. A rotary electric resistance furnace, comprising a tubular furnace chamber and resistance elements extending lengthwise of said chamber and embedded in the refractory lining and projecting into the chamber to form a stirrer, in combination with means for leading an electric current thereto.

3. A rotary electric resistance furnace, comprising a tubular furnace chamber and resistance elements in the form of hollow bars extending lengthwise of said chamber and embedded in the refractory lining, in combination with means for leading an electric current thereto.

4. An electric resistance furnace, having a refractory lining and resistance elements carried thereby and shaped to form stirrers.

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

OTTOKAR SERPEK.

Witnesses:

CHARLES DONY,
JACQUES SIGOURNEY.