Oct. 31, 1950 H. G. M. CARTOUX 2,527,914

ELECTRIC TILTING FURNACE

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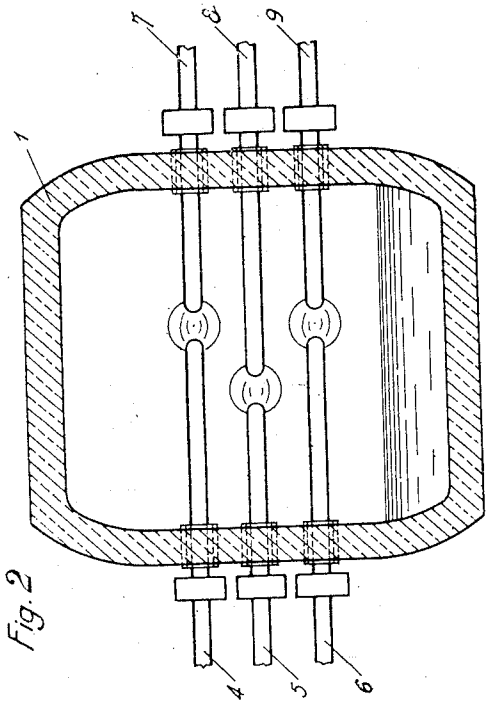

Fig. 2

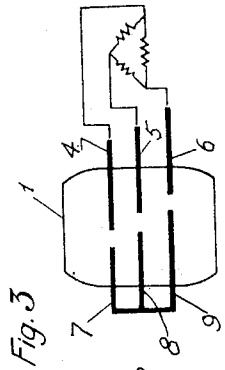

Fig. 3

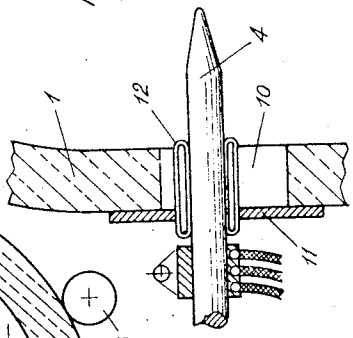

Fig. 4

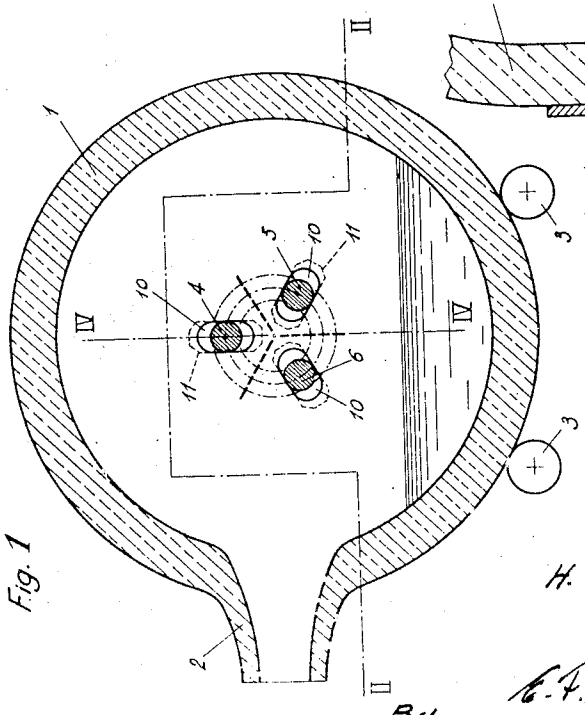

Fig. 1

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ELECTRIC TILTING FURNACE

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7 Claims. (Cl. 13—10)

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The present invention has for its object electric furnaces operating with three phase current and chiefly those furnaces operating with indirect arcs i. e. arcs passing outside the load undergoing treatment.

In the furnace according to the invention, the three arcs are formed between an isolated neutral and the three electrodes fed respectively by the corresponding phases whereby the arcs are arranged in star formation. The isolated neutral may be constituted by three auxiliary electrodes corresponding respectively to the current feeding electrodes and connected one with another. The terms "isolated neutral" or "neutral," as used herein, signify that the neutral is connected electrically to the source of power only by means of arcs established between itself and the furnace electrodes.

An arrangement for the purpose of adjusting the arcs individually and at the same time preventing direct arcing from electrode to electrode may consist in using current feeding electrodes parallel with one another and distributed round an axis at a sufficient distance therefrom, which distance may be adjustable, independently of the length of the arc.

With three current feeding electrodes parallel with one another and distributed round an axis, it is of advantage to use a neutral constituted by three auxiliary or counter electrodes corresponding each to one of the current feeding electrodes.

It is then possible in fact to shift the arcs one with reference to the other in the direction of the axis round which they are grouped. This leads to creating in the furnace three heating zones the location of which may be chosen in accordance with the requirements. This allows either making the heating of the furnace chamber more uniform or on the contrary superheating if required at one zone rather than at another zone.

There is shown in appended drawing in a diagrammatic manner and by way of example a form of execution of a furnace in accordance with the invention:

Fig. 1 is a cross sectional transversal view of the furnace.

Fig. 2 is a longitudinal cross-section thereof through line II—II of Fig. 1.

Fig. 3 is a wiring diagram.

Fig. 4 is a partial cross-section along line IV—IV of Fig. 1.

In the example chosen, the furnace is a horizontal rocking furnace. The cylindrical casing

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of the furnace 1 is provided with a casting spout 2 and rests on rollers 3. The current leading electrodes 4, 5, 6 pass through one of the ends of the furnace. They are parallel to the central axis thereof and are distributed at 120° from one another. The neutral is also formed by three counter-electrodes 7, 8, 9 passing through the other end of the furnace and alined respectively with the corresponding current feeding electrodes. In the furnace shown by way of example, the neutral electrodes are electrically connected one with the other.

The distance between the current feeding electrodes as well as the distance between the neutral electrodes may be adjusted by spacing more or less these electrodes with reference to the axis of the furnace in the radial direction, the apertures 10 through which said electrodes enter the furnace having for this purpose the desired elongated shape. Refractory elements 11 fixed to the fire screen 12 ensure the fluid-tight closure of these apertures. Any suitable device, not shown, is adapted to lock the electrode at the desired distance from the furnace axis.

As shown in Figs. 2 and 3, the arcs may occupy different points of the length of the furnace so as to distribute the heating in accordance with requirements.

The furnace may be fed through a delta or a star connection according to the conditions under which it is to operate. It is possible, as well known in the art, to pass without any difficulty from one coupling to the other by operating electrical switches so as to modify the power of the furnace through a change in the coupling. It is possible moreover to make the power vary by modifying the voltage through the agency of a transformer and of an induction coil provided with a plurality of interchangeable terminals.

When the furnace is hot, the value of the additional self induction is reduced and it may even be done away with when there are provided highly sensitive regulators in particular in the case of impedance adjusting means. However any form of adjustment of the voltage is suitable, whether through intensity, power or impedance.

Of course, the invention is not limited to the example described and illustrated and many modifications may be brought thereto. Thus the furnace instead of being a rocking furnace may be of the rotary or of the semi rotary rocking type. It is also obvious that the furnace may have a horizontal or oblique axis and may be mounted on a frame adapted to rock itself in

different planes and the electrodes may be independent of the furnace casing.

The furnace in accordance with the invention may be used to particular advantage in the manufacture of ferro-alloys and the like metals and alloys through silicothermic and aluminothermic processes.

As a matter of fact, if the raw material is preheated in the furnace and if the metals and metalloids used for reduction are melted therein, the yields are improved owing to the omission of the losses due to the partial vaporizing and consequently passing away of the load, while obtaining high grade products devoid of carbon.

The furnace in accordance with the invention allows the execution of high power and high capacity as required for such reactions. To these qualities may be added the simplicity of construction and the reduced cost price together with the possibility of connecting directly the furnace with three phase current distributing mains. A rocking furnace allows avoiding any inclusions due to the stirring of the slag with the metal, said method being used sometimes for obtaining precious metals or alloys or highly commercially valuable alloy.

The furnace in accordance with the invention is chiefly adapted for use in the manufacture of titanium, manganese, chromium alloys, for that of ferro-manganese or superrefined ferro-chromium, of silicothermic or aluminothermic chromium, but it may also serve for preparing as well nonferrous alloys and ferrous alloys.

What I claim is:

1. An electric furnace comprising a hollow casing including end walls and an intermediate wall for holding a charge to be melted, said hollow casing mounted for rocking about a generally horizontal axis passing approximately through the center of gravity of the casing, three elongated electrodes passing through an end wall of the casing and spaced substantially at equal angles about said horizontal axis and parallel thereto, three counter-electrodes passing through the opposite end wall of the casing and aligned with said electrodes, the outer end of each of the electrodes being connected to a terminal of a three-phase power system, the three counter-electrodes being electrically connected to form an isolated neutral, so that an arc is formed between each electrode and its respective counter-electrode, means for adjusting said electrodes and counter-electrodes away from said horizontal axis while keeping them generally parallel thereto.

2. An electric furnace as recited in claim 1 wherein elongated slots are provided in the end walls for admission of the electrodes and counter-electrodes, said slots extending along lines extending radially outwardly from said horizontal axis at angles of approximately 120 degrees to each other.

3. An electric furnace as recited in claim 2 wherein each electrode and counter-electrode is provided with a fire screen located in its respective slot, each fire screen having a refractory element attached thereto to insure a fluid-tight closure of said slots.

4. An electric furnace comprising a hollow casing including end walls and an intermediate wall for holding a charge to be melted, said hollow casing mounted for rocking about a generally horizontal axis passing approximately through the center of gravity of the casing, three elongated electrodes passing through an end wall of the casing and spaced substantially at equal angles about said horizontal axis and parallel thereto, three counter-electrodes passing through the opposite end wall of the casing and aligned with said electrodes, the outer end of each of the electrodes being connected to a terminal of a three-phase power system, the three counter-electrodes being electrically connected to form an isolated neutral, so that an arc is formed between each electrode and its respective counter-electrode, means for adjusting each electrode and its respective counter-electrode in and out of the casing to move the respective arc to any point within the casing along the line defined by its respective electrode and counter-electrode, a pouring spout upon the intermediate wall generally medially of the end walls.

5. An electric furnace comprising a hollow casing including end walls and an intermediate wall for holding a charge to be melted, said hollow casing mounted for rocking about a generally horizontal axis passing approximately through the center of gravity of the casing, three elongated electrodes passing through an end wall of the casing and spaced substantially at equal angles about said horizontal axis and parallel thereto, three counter-electrodes passing through the opposite end wall of the casing and aligned with said electrodes, the outer end of each of the electrodes being connected to a terminal of a three-phase power system, the three counter-electrodes being electrically connected to form an isolated neutral, so that an arc is formed between each electrode and its respective counter-electrode, means for adjusting said electrodes and counter-electrodes away from said horizontal axis while keeping them generally parallel thereto, means for adjusting each electrode and its respective counter-electrode in and out of the casing to move the respective arc to any point within the casing along the line defined by its respective electrode and counter-electrode, a pouring spout upon the intermediate wall generally medially of the end walls.

6. An electric furnace as recited in claim 5 wherein elongated slots are provided in the end walls for admission of the electrodes and counter-electrodes, said slots extending along lines extending radially outwardly from said horizontal axis at angles of approximately 120 degrees to each other.

7. An electric furnace as recited in claim 6 wherein each electrode and counter-electrode is provided with a fire screen located in its respective slot, each fire screen having a refractory element attached thereto to insure a fluid-tight closure of said slots.

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