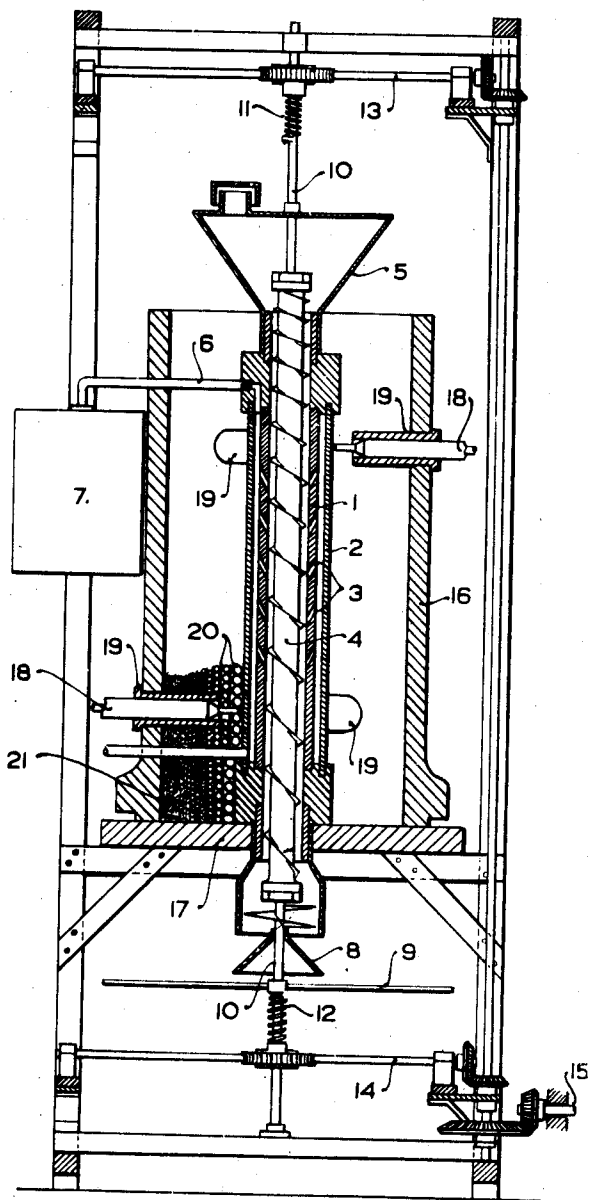


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ELECTRIC FURNACE
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ELECTRIC FURNACE

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3 Claims. (Cl. 12-8)

This invention relates to electric furnaces intended for carrying out chemical, metallurgical or heat-treatment operations at high temperatures.

In a furnace according to the present invention, generation of heat is effected partly by the resistance encountered by the electric current in its passage through the furnace, partly by small electric arcs generated between the particles of coarse granular material, into which the electrodes project. Said material surrounds the furnace chamber in which the treatment is to be carried out, in such a manner that the size of the granules or particles decreases, from the inside towards the outside, to an exceedingly small value. That is to say, the outer layer of the granular material is formed by fine powder, which, in virtue of the very high intermediate resistance between its particles, actually functions as an insulator, both electrically and thermally. The granules of the inner layer of said material, however, have a relatively large size, say of 3-8 mm., so that electric arcs can be formed between the same.

In order that the above statements may be more readily understood, reference is had to the annexed drawing, which illustrates, in a vertical sectional elevation, an electric furnace constructed in accordance with the invention.

The furnace chamber proper is constituted by a vertical inner cylinder 1 of graphite, petroleum coke, Carborundum, zirconium carbide or other material suitable for the purpose. Said inner cylinder is surrounded, with a narrow interspace, by an outer cylinder 2 of similar material.

The furnace chamber 1, the wall of which is provided with upwardly inclined narrow passages 3, is fitted with an impeller screw 4 of refractory material such as graphite or petroleum coke, the pitch of said screw increasing from the upper to the lower end. The screw impeller projects upwardly into a hopper 5 for receiving the material to be treated, for instance suitably ground ore with the required fluxes.

At the upper end, the interspace between the cylinders 1 and 2 communicates, through a conduit 6, with a condensing chamber 7.

The lower end of the furnace chamber opens some distance vertically above a conical screen 8, which serves for distributing the material discharged from said chamber over a table 9 secured to the spindle 10 of the impeller 4.

The spindle 10 is driven at both ends, through the medium of elastic couplings 11, 12, by worms on shafts 13, 14 adapted to be rotated, through

mitre wheels, by a common shaft 15 in such a manner that the speed of the impeller 4 is say about one revolution per minute.

The outer cylinder 2 is surrounded, with a relatively wide interspace, by a refractory jacket 16 of asbestos, magnesia, aluminium oxide or the like, said jacket resting on a refractory slab 17, which itself is supported by a steel framework, to which also the bearings of the driving gear are secured.

Electric current is introduced by electrodes 18 passed through apertures provided, at different levels, in the jacket 16. Said electrodes are radially slidable in suitably cooled bushes 19, and the inner end of each electrode is provided with a readily renewable wearing piece of reduced cross section, said piece being preferably screwed into the inner end of the main electrode.

The interspace between cylinder 2 and jacket 16 is filled with granular material. The inner layer, i. e. the layer engaging the outer wall of cylinder 2, consists of relatively coarse granules 20 of coke, graphite or the like. The outer layer, i. e. the layer contacting with the inner wall of jacket 16, consists of soot (lamp black, carbon black) 21, either or not mixed with magnesia, aluminium oxide or the like, and may be suitably compressed, for instance, briquetted. The space intermediate said layers 20 and 21 is filled with granular carbon, the size of these granules decreasing, in outward direction, from a size corresponding to that of the granules of the layer 20, to a size corresponding to that of the particles of layer 21.

The modus operandi of the described furnace is as follows:

First, the electrodes 18 are moved inward, until their wearing pieces directly contact with the outer cylinder 2, whereupon the current is switched on. The current will now flow principally through the cylinder 2, which is thus quickly heated to the required temperature. Thereafter, the screw impeller 4 is rotated, whereby the material to be treated is caused to slowly descend from the hopper 5 and through the reaction chamber to the bottom opening thereof. When the furnace proper and the material therein have reached the desired temperatures, so that from that moment onward the electrical energy supplied through the electrodes 18 only serve for maintaining said temperatures, the electrodes are retracted a little, whereby the current will pass for the greater part through the coarse carbon granules, which by that time have already assumed a high temperature. As a consequence, small electric arcs will be formed between said granules,

and the total strength of the current will be considerably reduced.

As stated, the very fine carbon powder (soot) on the outer side of the space between cylinder 2 and jacket 16 acts as a heat insulator, so that the jacket 16 remains relatively cool. Besides, said powder also acts as an electric insulator, especially when magnesia or the like has been admixed thereto.

10 If desired, the electrodes can be adjusted by automatic means under the control of a suitable thermostat.

The chamber 7 serves for collecting and condensing gaseous products that may be formed in the reaction chamber, for instance zinc vapours.

The increase of the pitch of screw 4 in downward direction prevents the materials under treatment from clogging the reaction chamber.

20 What I claim is:—

1. An electric furnace comprising a base, a reaction chamber, an inner wall structure surrounding said chamber, said structure consisting of a double-wall jacket, inclined channels in the inner wall of said jacket and connecting the reaction chamber with the inner space of the same, a condenser connected to said jacket, an outer wall encircling said inner wall structure, a space between said two walls, means for introducing the charge into said chamber, means for discharging the treated charge from the same, an insulating layer located adjacent to the inner surface of said outer wall and filling a section of said space, a plurality of concentric layers between said insulating layer and the outer surface of said inner wall structure, said concentric layers forming the furnace heating zone proper and consisting of current conducting particles of which the size gradually increases in the direction from said insulating layer towards said inner wall structure and displaceable electrodes supported by said outer wall and protruding through said heating insulating layer into said heating zone proper.

2. An electric furnace comprising a base, a reaction chamber, an inner wall structure surrounding said chamber, said structure consisting of a double-wall jacket, inclined channels in the inner wall of said jacket and connecting the reaction chamber with the inner space of the same, a condenser connected to said jacket, an outer wall encircling said inner wall structure, a space between said two walls, means for introducing the charge into said chamber, a screw conveyor transporting the charge through the same, the pitch of said conveyor increasing from its upper to its lower end and means for discharging the treated charge from said chamber, an insulating layer located adjacent to the inner surface of said outer wall and filling a section of said space, a plurality of concentric layers between said insulating layer and the outer surface of said inner wall structure, said concentric layers forming the furnace heating zone proper and consisting of current conducting particles of which the size gradually increases in the direction from said insulating layer towards said inner wall structure and displaceable electrodes supported by said outer wall and protruding through said heat insulating layer into said heating zone, said electrodes being provided with exchangeable tips.

3. An electric shaft furnace comprising a base, a reaction chamber, an inner wall structure surrounding said chamber, an outer wall encircling said inner wall structure, means for feeding the charge to said shaft from above and for discharging the same from below, an insulating layer located next to the inner surface of said outer wall, a plurality of at least three concentric layers of current conducting particles between said insulating layer and said inner wall-structure forming the heating zone of the furnace, the particle size of said layers gradually increasing in the direction from said insulating layer towards said inner wall structure and displaceable electrodes supported by said outer wall.

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