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ELECTRICALLY HEATED DRUM-TYPE FURNACE

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Fig. 1

Fig. 2

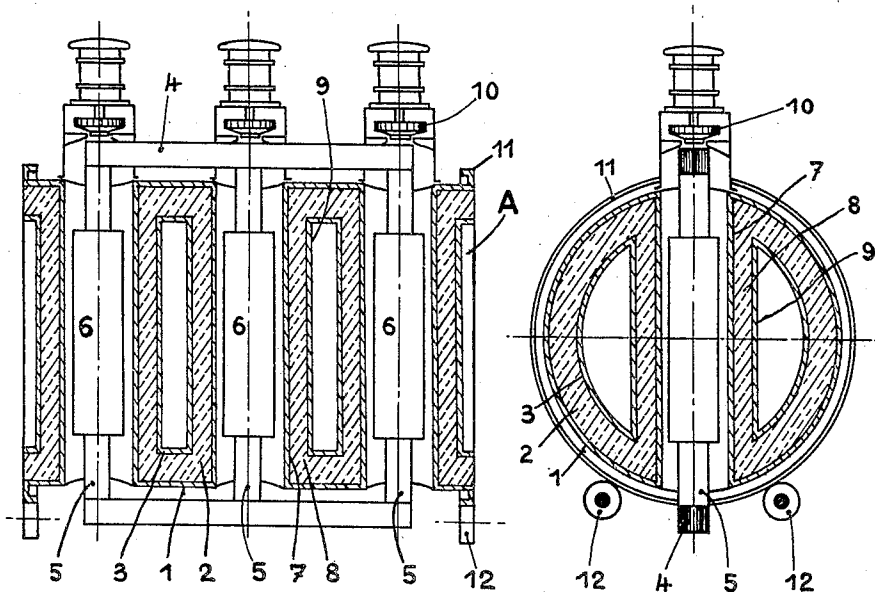
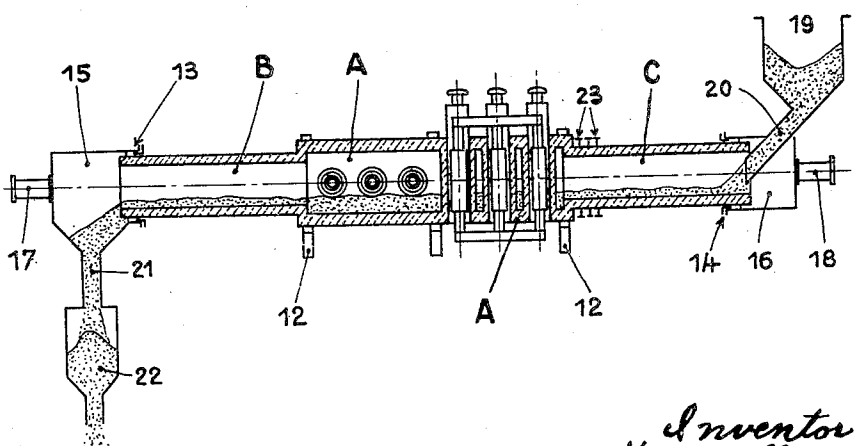


Fig. 3



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## UNITED STATES PATENT OFFICE

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ELECTRICALLY HEATED DRUM-TYPE  
FURNACE

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In Switzerland June 22, 1942

3 Claims. (Cl. 13-26)

Drum-type furnaces are generally employed for performing chemical reactions between solid and gaseous bodies. In the case of an exothermic reaction, the heat created may be used for maintaining the temperature necessary for the reaction within the furnace, whereas for an endothermic reaction, the heat required for the reaction as such as well as the heat-losses of the furnace must be replaced.

In known drum-type furnaces it has been tried to generate the necessary heat by means of electrical resistances mounted within the furnace. This however did not prove successful, because such resistances deteriorate too quickly. For this reason, this method of heating cannot be practically applied, especially not for high temperatures of reaction, such as 900°-1100° C.

It has also been tried to generate the necessary heat within the furnace by means of electrical arcs. This method of heating however cannot be employed for reactions requiring even and exactly constant temperatures, because of the too high temperature of the arc, because of the danger of sintering, because of uneven heat-distribution and because of the impossibility of accurately regulating the temperature by means of electrical arcs.

The present invention concerns an electrically heated drum-type furnace which eliminates the afore-mentioned disadvantages. It is of the known rotating type and has a slightly inclined longitudinal axis and differs from the known drum-type furnace inasmuch as it is provided over at least one part of its length with electrical transformers. The wired core-legs of the latter penetrate the furnace and its secondary consists of a metallic cylinder, preferably of iron, which forms a part of the inner wall of the furnace.

This arrangement makes it possible, to generate the heat in great heating-surfaces, the temperature of which can be accurately regulated and controlled. Due to the great heating-surface within the furnace, the heat is evenly distributed from the inside towards the outside so that there exists a relatively small temperature-difference between the heating element and the heated body. For this reason, dangerous over-temperatures cannot exist, provided that the temperature has been correctly regulated in the first place.

The drawing attached shows schematically an example of this invention for a three-phase alternating current system.

Figures 1 and 2 show a heating element in longitudinal and in cross-section.

Fig. 3 shows on smaller scale a drum-type furnace with two heating elements according to Figs. 1 and 2.

The body A of the heating element is cylindrical and consists of an outer envelope 1, a layer 2 of heat insulating material and an inner mantle 3. The body A is provided with a magnetic core 4 for a three-phase alternating current system, which is arranged in such a way, that its primary windings 6 are wound upon the core-leg 5 which penetrates the cylinder diametrically. Each core-leg 5 is located within a protecting tube 7, open at both ends and subdivided electrically in the direction of its longitudinal axis, this protecting tube 7 being surrounded by a layer of heat-insulating material 8. This layer 8 is located between the protecting tube 7 and a closed metallic mantle 9, preferably of iron, which forms the secondary of the transformer and at the same time a part of the interior wall of the furnace. Over one end of each core-leg 5 of the magnet core 4 there is provided a ventilating fan 10 for the purpose of cooling the primary windings 6 and the core-leg 5.

The body A is provided with spur-rings 11 around its circumference, by means of which it bears against spur-wheels 12 and is thus able to execute a rotating movement.

Fig. 3 shows a drum-type furnace composed of two heating elements A and the two pre-heaters B and C. These latter consist each of a cylindrical body with an outer envelope, an inner mantle and a layer of heat-insulating material arranged between the outer envelope and the inner mantle.

As will be noticed from the drawing, the two pre-heaters have a smaller diameter than the heating elements.

The body A, B, C of the furnace is slightly inclined towards the horizontal plane and the transformers of the two heating elements A are displaced 90° with respect to each other.

The two open ends of the furnace are arranged rotatably in two stationary bearings 13, 14, the latter being provided with stuffing means to prevent leakage of gas during rotation. Each bearing 13, 14 forms part of a closed hollow body 15, viz 16. A gas-intake 17 is connected to the hollow body 15, whereas a gas-exhaust 18 is connected to the hollow body 16.

A canal or chute 20 communicating with the hopper 19 protrudes into the open end of the pre-heater C.

The lower part of the hollow body 15 forms a hopper and is connected to the chute 21 which

in turn communicates with the storage-bin 22.

The transformers are fed over slip-rings 23 mounted on body C.

The furnace according to this invention functions as follows:

When energizing the primary windings 6, an induction current is produced in the metal-cylinder 9, heating the latter. Because of it being electrically subdivided, no induction-current is induced in the protection tube 7. The heat generated is transmitted to the interior of the drum-type furnace. By means of regulating the voltage, the temperature in the interior of the furnace may be adjusted to the desired value. On the left side the gas is carried to the furnace by means of the gas-intake 17. It then flows through the furnace and leaves the same at the right hand side by means of the gas-exhaust 18. The material to be heated reaches the furnace on the right hand side by means of the chute 20 and the hopper 19. As a consequence of the heating and of the rotation of the furnace the material to be heated will slowly wander through the furnace in the direction towards the left hand side and leaves the furnace again through the chute 21 to reach the bin 22.

In the pre-heater C the material is pre-heated by means of the hot gases coming from the heating elements A. The temperature, necessary for the reaction is reached within these heating elements. At its intake side in the pre-heater B, the gas is also heated by means of the hot material leaving the heating elements. This same gas is then heated to the temperature of the reaction within the heating elements in order that the chemical reaction may take place.

It is to be noted, that the furnace is rendered sufficiently tight at both ends by means of the material filling the chutes 20 and 21 as to permit the use of light gases, such as hydrogen, without danger of leak-losses. In the arrangement according to this invention, the heat-losses are at a minimum.

The body of the furnace may naturally also consist of more than two heating elements A and the transformers may be designed for single- or multiphase operation.

What I claim is:

1. In an electric furnace, a cylinder through which material to be treated extends axially, means for rotating said cylinder about its axis, said cylinder having an inner liner of metal, a tube extending transversely through the cylinder, an electromagnetic winding having a core located in said tube and serving as the primary of an induction heater, the secondary of which is comprised by the cylinder liner, and means for supplying electricity to the primary windings during rotation of the cylinder.

2. In an electric furnace, a cylinder through which material to be treated extends axially, means for rotating said cylinder about its axis, said cylinder having an inner liner of metal, a plurality of tubes extending transversely through the cylinder, electromagnetic windings having cores located in said tubes and serving as the primary of an induction heater, the secondary of which is comprised by the cylinder liner, and means for supplying electricity to the primary windings during rotation of the cylinder.

3. In an electric furnace, a cylinder through which material to be treated extends axially, means for rotating said cylinder about its axis, said cylinder having an inner liner of metal, a tube extending transversely through the cylinder, an electromagnetic winding having a core located in said tube and serving as the primary of an induction heater, the secondary of which is comprised by the cylinder liner, means for supplying electricity to the primary windings during rotation of the cylinder, and a preheating chamber connected gas tightly at an axial end of said cylinder.

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