

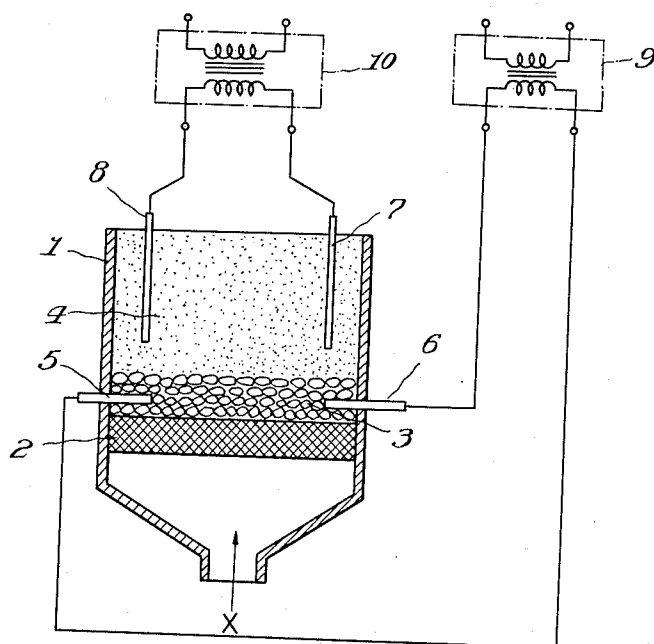
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FLUID POWDER ELECTRIC FURNACE

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FLUID POWDER ELECTRIC FURNACE

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5 Claims. (Cl. 13—9)

This invention relates to a new and improved electric furnace of the type wherein electric conductive particles maintained in a fluid state are heated by conduction of an electric current.

In the case of the fluid powder electric furnace previously proposed by the present inventor (Japanese Patent Pub. No. 5503/1961, Patent Appln. No. 13531/1959 filed on April 27, 1959), that is, in the case of a fluid powder, electric furnace wherein electric conductive particles such as carbon particles are maintained in a suspended state by blowing a gas thereinto and caused to generate heat by passing electric current therethrough, if the said gas blown in is one which contains oxygen, such as air, it will be difficult to increase above a certain value the carbon monoxide (CO) content of the surrounding, fluid medium. Consequently, for heat treatment of, for example, high-carbon steel, the said furnace has the disadvantage in that decarbonization to a certain extent cannot be avoided.

It is an object of the present invention to provide a new and improved suspended powder, electric furnace wherein the above-mentioned disadvantage does not exist.

The said object, other objects, and advantages of the present invention have been achieved by a powder, electric furnace wherein carbon lumps or masses of a lump size which is sufficiently large to prevent the said lumps from being suspended in a chamber by application of air pressure are laid to a certain layer thickness on the upper surface of a gas-pervious bottom plate permitting flow of gas therethrough. This layer or bed of carbon masses is heated by electric conduction to a temperature higher than the required temperature of the surrounding medium of the furnace. Gas is supplied to a body of carbon particles to hold them in a suspended state within the furnace. The gas is applied through the layer of heat-emitting carbon lumps, whereby the carbon monoxide content of the gas within the body of suspended carbon particles is greatly increased.

The details of the invention will be more clearly apparent by reference to the following description taken in conjunction with the accompanying drawing, which is a schematic diagram, in elevational and section view, with a part thereof shown as electric circuit diagrams, illustrating one example embodiment of the furnace according to the invention.

As illustrated, the furnace comprises, essentially, a fluid container 1; a heat-resistant, gas-pervious bottom plate 2, which permits flow of gas therethrough, disposed horizontally within the container 1; a bed or layer of carbon lumps or masses 3 laid to the required layer thickness on the bottom plate 2; a body of carbon particles 4 in a suspended state above the layer of carbon lumps 3; electrodes 5 and 6 disposed within the layer of carbon lumps 3 and connected to an electric power source 9; and electrodes 7 and 8 disposed within the body of carbon particles 4 and connected to an electric power source 10. The bottom of the fluid container 1 is provided with an opening for supplying a gas thereinto.

When a gas containing carbon, for example, air, is supplied from below the bottom plate 2 as indicated by the arrow X, the gas flows through the bottom plate 2 and layer of carbon lumps 3 and causes the carbon particles 4 to assume a floating suspended state, but the

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lumps 3 are not caused to assume a suspended state. If, under the foregoing condition, electric current is caused, by means of the electrodes 5 and 6, to flow through the layer of carbon lumps 3 and to heat the said lumps to a temperature higher than that of the fluid, surrounding medium, the oxygen within the gas supplied will react with the lumps to form carbon monoxide, and almost no oxygen will exist within the body of suspended carbon particles. The resulting carbon monoxide content of the surrounding gas or atmosphere containing the suspended particle body will be much higher than that in the case wherein the layer of lumps 3 is not used. This difference is substantiated by the following results of comparative tests for the case wherein electric current is passed through the carbon lump layer and the case wherein it is not passed.

Condition of lump layer	When heated	When not heated
Temperature of lump layer, ° C.....	1,100	900
Temperature of fluid particle body, ° C.....	900	900
CO content within fluid particle body (CO/CO ₂), percent.....	96	86

It has been found also, that, when carbon steel of 0.8% carbon content (Japanese Industrial Standards Designation SK5) is heated at 900° C. for 30 minutes in the present furnace, its surface exhibits evidence of decarbonization when the layer of lumps is not heated, but does not exhibit evidence of decarbonization when the lump layer is heated.

In order to heat the layer of lumps or masses 3 by passing electric current therethrough, it is possible to heat this layer by disposing the electrodes 7 and 8, for heating the carbon particle body, in the close vicinity of the lump layer 3, thereby passing electric current simultaneously through this layer 3 also, whereby the necessity of installing the electrodes 5 and 6 as indicated in the drawing is obviated.

The carbon particle body for fluid motion to be used in the furnace according to the present invention is preferably composed, for practical purposes, of beaded, non-crystalline carbon of 20- to 80-mesh grain size. The carbon lumps 3 to be laid on the bottom plate are preferably carbon particles of 8- to 16-mesh grain size. In actual practice, the carbon lumps 3 are consumed as the operation progresses. They are replenished with new lumps supplied through the upper part of the furnace, and this replenishment can be accomplished without stopping the operation of the furnace.

If, because of the properties of the bottom plate, it must be prevented from directly contacting the carbon lumps at a high temperature, for example, 1,100° C., a granular substance (for example, Al₂O₃ or ZrO₂ particles) with heat-resistant, electrically non-conductive, and non-fluid properties may be disposed between the layer of lumps 3 and the bottom plate 2. With apparent specific gravities of 0.5 or higher, the said granular substance and carbon lumps 3 exhibit non-fluid property.

When it is necessary to establish a distinct temperature difference between the temperature (for example: 900° C.) of the fluid, carbon particle body 4 and the temperature (for example: 1,100° C.) of the lumps 3, this may be accomplished by placing a layer of particles of a non-fluid substance, for example, ZrO₂, between the particle body 4 and lump layer 3.

Although this invention has been described with respect to a particular embodiment thereof and a few minor modifications, it is not to be so limited as further changes and modifications may be made therein

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which are within the full intended scope of the invention, as defined by the appended claims.

What is claimed is:

1. A furnace comprising, means defining a chamber, a heat-resistant gas-pervious support in said chamber, a bed of carbon masses on said support, carbon particles dispersed on said bed of carbon masses, means to supply a gas comprising oxygen under pressure through said gas-pervious support to suspend the carbon particles in said chamber above said carbon masses, means to flow a current through at least said bed of carbon masses, thereby to form an atmosphere in said chamber when said furnace is in operation in which the carbon monoxide content is at a selected level.

2. A furnace comprising, means defining a chamber, a heat-resistant gas-pervious support in said chamber, a bed of carbon masses on said support, carbon particles dispersed on said bed of carbon masses, means to supply a gas comprising oxygen under pressure through said gas-pervious support to suspend the carbon particles in said chamber above said carbon masses, means to flow a current through at least said bed of carbon masses, thereby to form an atmosphere in said chamber when said furnace is in operation in which the carbon monoxide content is at a selected level, and a gas-pervious layer of thermal insulative electrically non-conductive material disposed between said support and said bed of carbon masses.

3. A furnace comprising, means defining a chamber, a heat-resistant gas-pervious support in said chamber, a bed of carbon masses on said support, carbon particles dispersed on said bed of carbon masses, means to supply a gas comprising oxygen under pressure through said gas-pervious support to suspend the carbon particles in said chamber above said carbon masses, means to flow a current through at least said bed of carbon masses, thereby to form an atmosphere in said chamber when said furnace is in operation in which the carbon monoxide con-

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tent is at a selected level, and a gas-pervious layer of thermal insulative electrically non-conductive material disposed between said carbon particles and said bed of carbon masses.

4. A furnace comprising, means defining a chamber, a heat-resistant gas-pervious support in said chamber, a bed of carbon masses on said support, carbon particles dispersed on said bed of carbon masses, means to supply a gas comprising oxygen under pressure through said gas-pervious support to suspend the carbon particles in said chamber above said carbon masses, means to flow a current through said bed of carbon masses, a pair of spaced electrodes in said chamber, means to apply a voltage to said electrodes, thereby to form an atmosphere in said chamber when said furnace is in operation in which the carbon monoxide content is at a selected level, and a gas-pervious layer of thermal insulative electrically non-conductive material disposed between said support and said bed of carbon masses.

5. A furnace comprising, means defining a chamber, a heat-resistant gas-pervious support in said chamber, a bed of carbon masses on said support, carbon particles dispersed on said bed of carbon masses, means to supply a gas comprising oxygen under pressure through said gas-pervious support to suspend the carbon particles in said chamber above said carbon masses, means to flow a current through said bed of carbon masses, and a pair of spaced electrodes in said chamber, means to apply a voltage to said electrodes, thereby to form an atmosphere in said chamber when said furnace is in operation in which the carbon monoxide content is at a selected level.

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