# United States Patent [19]

**Horibe et al.**

[11] **3,746,771**

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[54] **POKING DEVICE FOR ELECTRIC SMELTING FURNACE OF CLOSED-TYPE**


[75] Inventors: **Koichi Horibe; Shoji Kaneko; Tomoyuki Sato; Kiyoshi Haniu,** all of Arai, Japan

[73] Assignee: **Tanabe Kakoki Co., Ltd.,** Niigata-ken, Japan



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Aug. 6, 1971 Japan ..... 46/59492

[52] **U.S. Cl.** ..... **13/1,** 13/9, 13/33, 263/23

[51] **Int. Cl.** ..... **F27d 3/00,** H05b 7/02

[58] **Field of Search** ..... 13/1, 9, 31, 33; 263/23, 26



[56] **References Cited**

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*Primary Examiner*—Roy N. Envall, Jr.

*Attorney*—Solon B. Kemon, Carroll Palmer et al.



[57] **ABSTRACT**

An improved poking device for extremely high temperature electric smelting furnace of closed-type characterized by an assembly consisting of a water-cooled protecting cylinder fixed inside of the furnace lid to each of the poking apertures bored therethrough; a poking rod which passes up and down through said protecting cylinder; and driving means connected with said poking rod.


**3 Claims, 2 Drawing Figures**

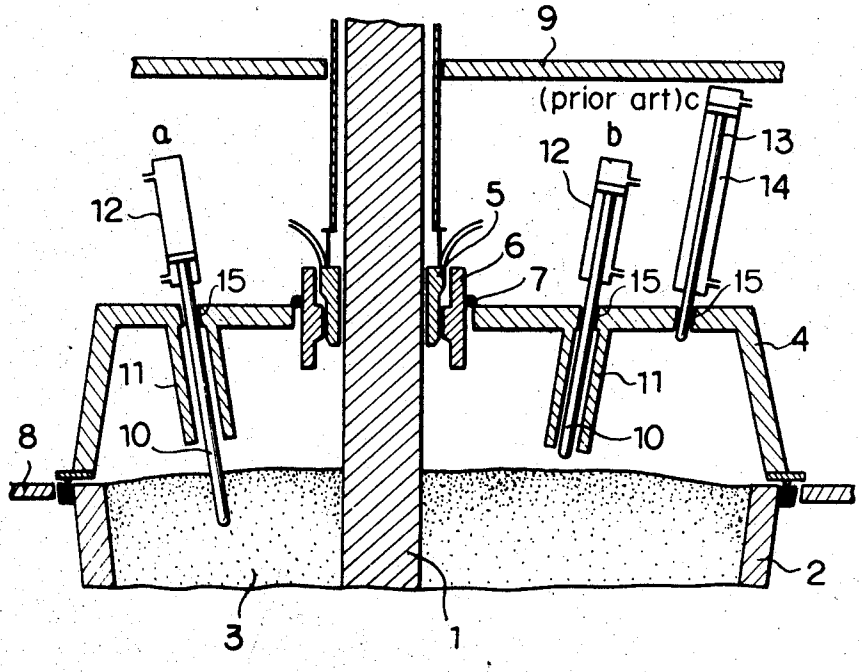
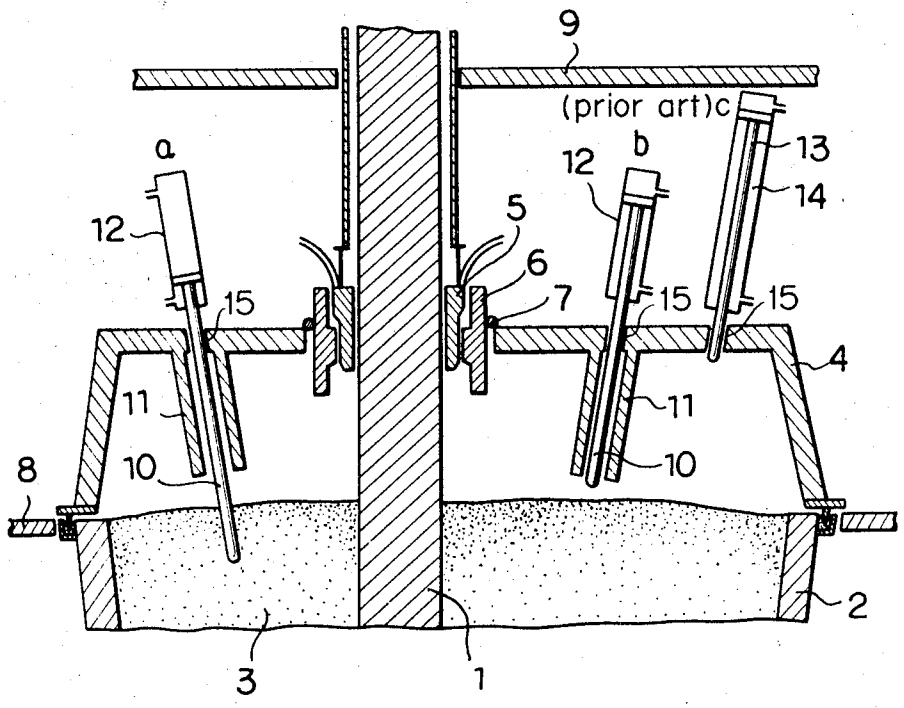


FIG. 1


9
(prior art)c
a
b
12
13
14
5
6
7
15
4
11
10
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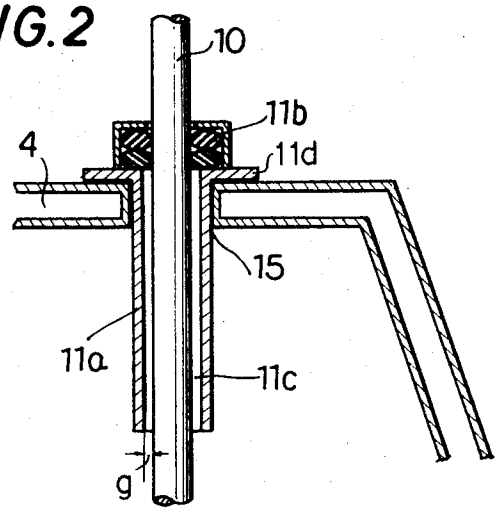
2
3
1

FIG. 2


10
11b
11d
4
15
11a
11c
g

# POKING DEVICE FOR ELECTRIC SMELTING FURNACE OF CLOSED-TYPE

This invention relates to an electric smelting furnace of closed-type, and more particularly to a poking device therefor.

In most open-type electric furnaces used for manufacturing calcium carbide or ferroalloys, there has generally been employed a hand poking means using a long poking iron rod to be pierced into the raw materials charged in the furnace so as to break a coagulated surface layer of said raw materials in order to cause gas generated from the reaction zone in the furnace heart to be easily gone out therefrom and to cause said raw materials to be fallen into said furnace heart without difficulty.

Recently, large scale electric furnaces of closed-type are often employed for the sake of good environment around the furnace usually without poking, but sometimes with rotation of the furnace bed so as to prevent the coagulation of charged raw materials.

However, a poking means is required when extremely high temperature smelting of a ferroalloy, such as metallic silicon or ferrosilicon containing more than 70 percent silicon, is performed using a closed-type furnace. That is, the coagulation of charged raw materials at the surface layer in such a furnace is so severe that it is not sufficient to adopt a means of furnace bed rotation but is necessary to use a poking machine.

In the operation of large scale closed-type smelting furnace, there must be used a poking machine of great size having a very long poking rod so as to reach into the charged raw materials through the furnace lid of high level. Therefore, said long poking rod is exposed to an extremely high temperature atmosphere in the furnace lid space and is often bent or molten down, resulting in that the poking operation must be stopped.

Moreover, the length of poking machine on the furnace lid is too long to be located narrowly between the upper furface of furnace lid and the ceiling of upper floor as shown later in FIG. 1, c, causing the operation thereof to be very troublesome.

An object of the present invention is to provide an improved poking device suitable to an electric smelting furnace of closed-type accompanying extremely high temperature operation thereof.

Another object of the present invention is to provide an improved poking device having a poking machine of comparatively short length.

These objects can be attained in accordance with the present invention by fixing a water-cooled protecting cylinder, of which the lower end almost reaches to the surface of charged raw materials in a closed-type smelting furnace to each of poking apertures bored through the furnace lid so as to cause the poking rod of a poking machine to be passed up and down through said protecting cylinder.

Further objects and advantages of this invention will become apparent with reference to the following description and the accompanied drawing, in which;

FIG. 1 is a diagrammatic and longitudinal sectional view of the lid part of a closed-type smelting furnace, having some poking assemblies of the invention and of the prior art type; and

FIG. 2 is an enlarged sectional partial view showing a lower half part of novel poking assembly in detail.



In FIG. 1, there are shown two aspects of novel poking assemblies, *a* and *b*, and one aspect of an ordinary poking machine, *c*. In the aspect *c*, the length of poking rod 13 connected with the poking machine 14 is not sufficient in order to pierce the end part of the rod 13 through a poking aperture 15 of the furnace into the layer of raw materials 3 as considered from the figure, but still the length of poking machine 14 is too long to be located narrowly between the upper surface of furnace lid 4 and the ceiling of upper floor 9, causing the operation of said poking machine to be very troublesome. Further, the poking rod 13 is exposed to an atmosphere of extremely high temperature in the inner space of furnace lid 4 during the poking operation, resulting in that the rod 13 is liable to bend or melt.

The aspects of novel poking assembly according to this invention are schematically shown in *a* and *b* of FIG. 1. The assembly is composed of a water-cooled (the water-cooling structure is not shown in FIG. 1) protecting cylinder 11 fixed to each of poking apertures 15, whereby the lower end of the protecting cylinder reaches almost to the surface level of charged raw materials 3 in a furnace body 2; a poking rod 10 which passes up and down as shown in *a* and *b* through the poking aperture 15 and the protecting cylinder 11; and a portable or stationary driving machine 12 connected with the poking rod 11.

For reference, the numeral 8 indicates the operating floor, and the numeral 5 indicates an electrode holder for each electrode 1, a protecting cylinder 6 for each electrode holder, and a sealing packing 7 between the protecting cylinder 6 and the hole of furnace lid 4 respectively. The raw material charging chutes are not shown in FIG. 1.

As the part of poking rod 10 existing in the protecting cylinder 11 is prevented from the high temperature exposure in the lid space, there is no occurrence of bending or melting of the poking rod. Furthermore, the lengths of poking rod 10 and driving machine 12 can be saved as to be shorter than those of ordinary assembly as shown in *c* of FIG. 1, and so the locating and the handling of these poking assemblies is improved.

More detailed construction of the protecting cylinder 11 in FIG. 1 is shown in FIG. 2. A protecting cylinder 11*a* (the water-cooling construction thereof being not shown in the figure) which has a stopping guard 11*d* at the upper end thereof, is inserted into the inner space of water-cooled furnace lid 4 through an aperture 15 of the water-cooled furnace lid 4. The poking rod 10 connected with a poking machine (not shown in FIG. 2) is passed up and down through the cylindrical inner space 11*c* of the protecting cylinder 11*a*, and is gastightened by means of a stuffing packing box 11*b* attached to the stopping guard 11d.

It is preferred that the gap distance *g* between the inner side of protecting cylinder 11*a* and the poking rod 10 is less than 2 cm. The reason for this is as follows. In the case of high temperature smelting of ferroalloy, such as metallic silicon or ferrosilicon containing more than 70 percent silicon, the gas generated from the furnace heart contains a large amount of adhesive dust therein, and said dust deposits on the surface of any quiescent position of the furnace. Therefore, the inner space 11*c* of the protecting cylinder 11*a* is gradually filled with the dust which deposits on the cylinder wall adhesively and becomes solid. This somewhat resilient solid deposit rather acts a role of a lubricant and

an aid of gastightening. However, when the gap distance $g$ is 2 cm or more, the abovementioned feature becomes negligible.

Owing to this invention, the design and the operation of extremely high temperature electric smelting furnace of closed-type is notably improved.

What we claim is:

**1.** In a closed-type electric smelting furnace having a furnace lid and poking rods which pass up and down through poking aperatures in the lid, an improved poking assembly which comprises a water-cooled protecting cylinder fixed upon the inside of said furnace lid at each said poking aperatures therethrough, said protecting cylinder surrounding the poking rod which passes through said poking aperature, the lower end of said protecting cylinder reaching almost to the surface level of charged raw materials in the furnace, a stuffing box filled with packing positioned adjacent the upper end of said protecting cylinder and means connected to said poking rod for driving the rod up and down within said protecting cylinder.

**2.** In a closed-type electric furnace which is used for extremely high temperature smelting of a ferro alloy having a furnace lid in which there are a plurality of poking aperatures therethrough and a corresponding number of poking rods which extend from without the furnace into it through said aperatures, an improved poking assembly which comprises a water-cooled protecting cylinder fixed upon the inside of said furnace lid at each of said poking aperatures, said protecting cylinder surrounding the poking rod which extends through the poking aperature, the lower end of said protecting cylinder reaching almost to the surface level of charged raw materials in the furnace, the gap distance between the inner side of said protecting cylinder and the poking rod which it surrounds being less than 2 cm., a stuffing box filled with packing positioned adjacent the upper end of said protecting cylinder forming a substantially gas tight seal at said upper end between said protecting cylinder and said poking rod and means connected to said poking rod above said furnace lid for driving the poking rod up and down within said protecting cylinder.

**3.** The improved poking assembly of claim **2** wherein the ferroalloy is one selected from the group consisting of metallic silicon and ferrosilicon containing more than 70 percent silicon.

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