

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 225 548 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **04.08.93** (51) Int. Cl.⁵: **H05B 7/06**, F27D 1/06,
F27D 11/08

(21) Application number: **86116468.9**

(22) Date of filing: **27.11.86**

(54) **Brick for a bottom electrode, a rear lining or a hearth connection.**

(30) Priority: **02.12.85 SE 8505660**

(43) Date of publication of application:
16.06.87 Bulletin 87/25

(45) Publication of the grant of the patent:
04.08.93 Bulletin 93/31

(84) Designated Contracting States:
DE FR GB IT

(56) References cited:
US-A- 4 541 099

(73) Proprietor: **ASEA AB**

S-721 83 Västeras(SE)

(72) Inventor: **Rappinger, Bo**
Sandgårdsgatan 6
S-723 36 Västeras(SE)
Inventor: **Stenkvist, Sven-Einar**
Ormbergssvängen 10
S-724 62 Västeras(SE)

(74) Representative: **Boecker, Joachim, Dr.-Ing.**
Rathenauplatz 2-8
W-6000 Frankfurt a.M. 1 (DE)

EP 0 225 548 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid (Art. 99(1) European patent convention).

Description

The invention relates to a brick for a bottom electrode, a rear lining or a hearth connection according to the pre-characterising part of claim 1.

With this kind of bricks, the required combination of good electrical conductivity and good heat insulating poses a problem. Too good a heat insulation may often involve poor electrical conductivity and vice versa. Electric conduction at the bottom of a d.c. furnace is sometimes arranged by means of bricks or compounds containing graphite. However, the addition of graphite deteriorates the heat insulating capacity, whereby cooling and/or a thicker lining are required to avoid thermal overload of the furnace shell at the bottom or in the wall, or of the shell in a ladle wall.

Insulating bricks with a varying degree of open porosity (50-90 %) are available on the market. In the case of d.c. furnaces (ladles) these bricks involve two decisive disadvantages. They are not electrically conductive and their mechanical strength is too poor for them to be used as rear insulating lining. Furthermore, gas flushing bricks with a directional open porosity are available on the market, but these bricks are electrically non-conductive.

The invention aims at developing a brick of the above-mentioned kind, which combines good electrical conductivity, good heat insulating, and considerable mechanical strength.

To achieve this aim the invention suggests a brick according to the introductory part of claim 1, which is characterized by the features of the characterizing part of claim 1.

Further developments of the invention are characterized by the features of the additional claims.

According to the invention, an electrically conductive, carbonaceous material has been added, completely or partially, to the open porosity.

To achieve a continuous carbon conductor in pressed magnesite graphite bricks, 13 per cent by weight coal ($\approx$ 20 per cent by volume) is required at the present time. These bricks are to be regarded as chemically bound. In ceramically bound bricks with a porosity of about 20 %, it is presently possible to reach a content of carbonized residue of a maximum of 5 per cent by weight by means of impregnation. With a proper choice of the pore size of the grains and the viscosity of the coal carrying impregnating agent, it should be possible to obtain contents of carbonized residue of 13-23 % at a porosity of 50-90 %, which is sufficient to provide electrical conduction at the bottom of a d.c. arc furnace or ladle.

The cold compression strength of chemically bound magnesite graphite bricks is 20-35 MPa and for insulating bricks about 2 MPa. With a combina-

tion of both types of binding, the mechanical strength after impregnation and heat treatment (carried out once or several times) is increased. Instead of impregnation, or complementary to impregnation, spray treatment can be carried out as well.

The impregnating agent may, for example, consist of tar, pitch or resin, or of a suspension of graphite, soot or the like, or synthetic resin. The heat treatment is suitably carried out at a temperature when the binder is being coked, for example at 350 °C or thereabove.

In bricks having a directional porosity, such as gas flushing bricks, the channels are filled with a material which, in the same way as described above, is allowed to coke. Depending on the degree of filling and the degree of graphitization, a sectional surface of channels of 3-30 % may be sufficient for the bottom of a d.c. arc furnace.

The invention will now be described in greater detail with reference to the accompanying drawings showing - by way of example - in

Figure 1 a d.c. arc furnace, in which bricks according to the invention are employed,

Figure 2 part of the bottom electrode (rear lining) of the d.c. arc furnace,

Figure 3 a brick according to the invention.

The d.c. arc furnace in Figure 1 is provided with an electrode having a hollow channel for reduction purposes. The arc 1 is struck between the electrode and the melt 2. Numerals 3, 4, 5 and 6 designate the various brick layers, with 3 being the layer located nearest to the melt 2 and 6 the layer located nearest to the hearth connection.

Figure 2 shows the brick layers (3-5) in greater detail and also the hearth connection 7. Either layer 5 or layer 6, that is, that part of the brick bottom or wall located nearest to the cold side, may consist of bricks according to the invention.

Figure 3 shows a pressed brick of aluminium oxides, magnesite, or zirconium oxide. As will be seen, the brick is porous, and the open pores 8 have been impregnated with a carbonaceous material, for example pitch, tar, a suspension of graphite, soot or the like, synthetic resin, etc., for the purpose of achieving a carbon content in the brick which constitutes a conductor for the current, that is, the brick is electrically conductive while at the same time its porosity provides for good thermal insulation.

By using bricks which are chemically or ceramically bound and have a porosity of about 20 %, a content of carbonized residue of at the most 5 per cent by weight can be attained by means of impregnation. With a porosity of 50-90 %, contents of carbonized residue of 13-23 % can be attained. Complementary to the impregnation, spraying of

the bricks can be used. In certain cases, only spraying may be sufficient. The treatment can be carried out once or several times. As mentioned above, the cold compression strength of the chemically bound magnesite graphite bricks is 20-35 MPa and for insulating bricks about 2 MPa.

The embodiment of the bricks according to the above may be varied in many ways within the scope of the following claims.

Claims

1. Brick for use in a bottom electrode, a rear lining or a hearth connection of a d.c. arc furnace, **characterized** in that the brick consists of a porous material with an electric conductivity too poor for the afore-said purposes, that said porous material has been impregnated by means of immersion into and/or spraying with an organic fluid, and that thereafter the brick has been coked, thus creating electric current carrying paths containing coal which paths render the brick sufficiently electrically conductive.
2. Brick according to claim 1, **characterized** in that said organic fluid used for impregnating said porous material consists of pitch, tar, resin or a suspension of graphite, soot, or synthetic resin.
3. Brick according to any of claims 1 or 2, **characterized** in that coking of the brick has been effected at a temperature of 350 °C.
4. Brick according to any of the preceding claims, **characterized** in that it has a porosity of 50-90% and a content of carbonized residue after treatment of 13-23 per cent by weight.
5. Brick according to any of claims 1 to 4, **characterized** in that it has a directional porosity (gas flushing brick) providing channels in the brick which are filled with a carbonaceous material which is caused to become coked, said channels occupying 3-30 % of the sectional surface of the brick.

Patentansprüche

1. Ziegel zur Verwendung in einer Bodenelektrode, einer Ofenauskleidung oder einem Herdanschluß bei einem Gleichstrom-Lichtbogenofen, **dadurch gekennzeichnet**, daß der Ziegel aus einem porösen Material besteht, dessen elektrische Leitfähigkeit für die vorgenannten Zwecke zu klein ist, daß das genannte poröse Material imprägniert worden ist durch Eintau-

chen in oder durch Besprühen mit einer organischen Flüssigkeit und daß danach der Ziegel derart verkohlt worden ist, daß kohlehaltige, den elektrischen Strom leitende Pfade entstanden sind, welche den Ziegel ausreichend elektrisch leitfähig machen.

2. Ziegel nach Anspruch 1, **dadurch gekennzeichnet**, daß die genannte organische Flüssigkeit zur Imprägnierung des genannten porösen Materials aus Pech, Teer, Harz oder einer Suspension aus Graphit, Ruß oder synthetischem Harz besteht.
3. Ziegel nach einem der Ansprüche 1 oder 2, **dadurch gekennzeichnet**, daß das Verkohlen des Ziegels bei einer Temperatur von 350 °C durchgeführt wurde.
4. Ziegel nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet**, daß er eine Porosität von 50 - 90 Prozent hat und einen Gehalt an durchkohlten Rückständen nach der Behandlung von 13 - 23 Gewichtsprozent.
5. Ziegel nach einem der Ansprüche 1 - 4, **dadurch gekennzeichnet**, daß er eine gerichtete Porosität ("gas flushing"-Ziegel) hat, durch welche Kanäle im Ziegel entstanden sind, welche mit einem kohlehaltigem Material gefüllt sind, welches verkohlt wird, wobei diese Kanäle 3 - 30 Prozent der Schnittfläche des Ziegels einnehmen.

Revendications

1. Brique destinée à être utilisée dans une électrode de sole, dans un revêtement arrière ou dans une connexion de soie d'un four à arc à courant continu, caractérisée en ce que la brique consiste en une matière poreuse ayant une conductivité électrique trop médiocre pour les fins mentionnées ci-dessus, en ce que la matière poreuse a été imprégnée par immersion et/ou par projection d'un fluide organique, et en ce qu'ensuite, la brique a été cokéfiée, ce qui crée des trajets de passage du courant électrique contenant du carbone, ces trajets rendant la brique suffisamment conductrice de l'électricité.
2. Brique suivant la revendication 1, caractérisée en ce que le fluide organique utilisé pour imprégner la matière poreuse consiste en poix, en goudron, en résine ou en une suspension de graphite, de suie ou de résine synthétique.

3. Brique suivant l'une quelconque des revendications 1 ou 2, caractérisée en ce que la cokéfaction de la brique a été effectuée à une température de 350 ° C.

5

4. Brique suivant l'une quelconque des revendications précédentes, caractérisée en ce qu'elle a une porosité de 50 à 90 % et une teneur en résidu carbonisé après traitement de 13 à 23 pour cent en poids.

10

5. Brique suivant l'une quelconque des revendications 1 à 4, caractérisée en ce qu'elle a une porosité directionnelle (brique à balayage par du gaz) ménageant des canaux dans la brique, qui sont remplis d'une matière carbonée, laquelle est cokéfiée, ces canaux occupant de 3 à 30 % de la surface de la section de la brique.

15

20

25

30

35

40

45

50

55

