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(54) **METHOD FOR THE HEATING OF ANODE BLOCKS, AND AN ARRANGEMENT FOR THE HEATING OF ANODE BLOCKS.**

VERFAHREN ZUM ERHITZEN VON ANODENBLÖCKEN UND ANORDNUNG ZUM ERHITZEN VON ANODENBLÖCKEN

PROCÉDÉ POUR LE CHAUFFAGE DE BLOCS ANODIQUES, ET CONCEPTION DU CHAUFFAGE DE BLOCS ANODIQUES

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Description

[0001] The present invention relates to a method for the heating of anode blocks, and to an arrangement for the heating of anode blocks.

[0002] During the production process for primary aluminium, objects known as "anode blocks" are used. The blocks consist of granulated graphite. Holes are present in these blocks in order to attach electrical contacts of iron, known as "yokes", by moulding. The sizes of the blocks may vary, and the number of contact holes into which contacts are to be attached may also vary. There is normally between three and six holes. The blocks may have different dimensions: the dimensions may, for example, be 1300 x 500 x 500 millimetre.

[0003] The anode blocks are exchanged at regular intervals. The anode blocks are then renovated and stored until they are to be reused.

[0004] Water can collect in the holes in the blocks as a result of precipitation, since the blocks are often stored outdoors, to a certain extent. The blocks, furthermore, are also exposed to moist air. Water is sucked into the blocks, or is absorbed into the blocks, since the material of the blocks is porous.

[0005] Water must be removed and the blocks must be dried before a secure attachment of contacts by moulding can be carried out. This is currently carried out through first the removal of liquid water by blowing with pressurised air, and then the heating of the block with the aid of gas burners in order to dry it. The problem with this procedure is that the gas in the burners contains a certain amount of water vapour that initially condenses onto the block before the temperature of the block has been sufficiently raised. A result of this is that it takes far too long to dry the blocks.

[0006] Document US4347661 discloses a method where the holes are heated by means of inductive heat from electrical heat inductive coils.

[0007] It is one requirement that the drying time be considerably reduced. The present invention solves this problem.

[0008] The present invention thus relates to a method for heating anode blocks, which anode blocks are used in the production of aluminium and comprise contact holes into which it is arranged that electrical contacts are to be attached, and it is characterised in that the holes are caused to be heated by means of radiative heat from electrical resistive elements arranged to be used at high temperatures, in that the wire of the elements is in the form of shanks with two or more legs, in that each one of the elements is caused to be arranged in a cup with an open end surface, and in that one cup for each hole in the anode block is caused to lie in front of the hole in question.

[0009] Furthermore, the invention relates to an arrangement of the type and with the principal characteristics specified by patent claim 5.

[0010] The invention will be described in more detail

below, partially with reference to an embodiment of the invention shown in the attached drawings, where:

- Figure 1 shows an arrangement according to the invention seen from the side with an anode block that lies beneath it,
- Figures 2 and 3 show different perspective sketches of the arrangement according to the invention and an anode block.

[0011] Figure 1 shows an arrangement 1 for the heating of anode blocks 2, which anode blocks are used during the production of aluminium and which comprise contact holes 3 into which it is arranged that electrical contacts are to be attached.

[0012] According to the invention, the arrangement 1 comprises electrical resistive elements 4, 5, 6, shown in Figure 3, arranged to be used at high temperatures. It is preferred to use resistive elements that are manufactured by KANTHAL AB, Sweden, and that are marketed under the name "Kanthal Super". This element can be heated in operation up to 1900 °C. The wires of the elements 4-6 are formed as shanks with two or more legs. Each one of the elements 4-6 is arranged in a cylindrical cup 7, 8, 9 with an open end surface. It is preferable that the cup is cylindrical. The cups 7-9 with the resistive elements 4-6 are equal in number to the number of holes 3 in the anode block 2. The cups 7-9 are placed into a holder 10 that is common for all cups such that one cup 7-9 for each hole 3 in the anode block 2 is caused to lie in front of the hole 3 in question.

[0013] The use by this arrangement of radiative heat from high-temperature elements entails a method of heating of much greater efficiency than the previous art technology that has been described, since no water is added at the beginning of the heating process. A much higher power can be achieved over a limited surface through the use of high-temperature elements, and this also contributes to a more rapid heating and drying of the anode blocks.

[0014] According to one preferred embodiment of the invention, the said elements are caused to be a high-temperature element.

[0015] According to another preferred embodiment, the said cup is caused to be of a fibre insulation material comprising Al_2O_3 and/or SiO_2 .

[0016] According to a further preferred embodiment, each resistive element is caused to develop a power of approximately 10-20 kW.

[0017] According to another further preferred embodiment, the distance between the said open end surface and the anode block is caused to exceed a couple of millimetres and to lie below a couple of centimetres.

[0018] This method has been shown to be able to reduce significantly the drying time for anode blocks from that required by the prior art technology. The drying time is as short as approximately 4 minutes with the dimensions of the anode block given above as examples.

[0019] The present invention thus solves the problem described in the introduction.

[0020] It has, in addition, proved to be the case when testing the arrangement that the drying time can be further reduced by blowing air, in association with the heating process, through the cups down into the holes of the anode block using a suitable and previously known blowing arrangement.

[0021] The present invention is not by any means limited to a method or an arrangement to be used with anode blocks having three holes. The invention can be used for all designs of anode block with holes.

[0022] Several embodiments have been described above. However, the invention can be varied in ways that will be obvious for one skilled in the art, and thus the invention is not to be seen as limited to the embodiments described above, since it can be varied within the scope of the attached patent claims.

Claims

1. A method for heating anode blocks, which anode blocks (2) are used in the production of aluminum and comprise contact holes (3) into which it is arranged that electrical contacts are to be attached, **characterised in that** the holes (3) are caused to be heated by means of radiative heat from electrical resistive elements (4, 5, 6) arranged to be used at high temperatures, **in that** the wire of the elements (4, 5, 6) is in the form of shanks with two or more legs, **in that** each one of the elements (4, 5, 6) is caused to be arranged in a cup (7, 8, 9) with an open end surface, **in that** one cup (7, 8, 9) for each hole (3) in the anode block (2) is caused to lie in front of the hole in question (3) and **in that** the said cup (7, 8, 9) is caused to be of a fibre insulating material comprising Al_2O_3 and/or SiO_2 .
2. A method according to claim 1, **characterised in that** said elements (4, 5, 6) are caused to be high-temperature element.
3. A method according to claim 1 or 2, **characterised in that** each resistive element (4, 5, 6) is caused to develop a power of approximately 10-20 kW.
4. An arrangement for the heating of anode blocks, which anode blocks (2) are used in the production of aluminium and comprise contact holes (3) into which it is arranged that electrical contacts are to be attached, **characterised in that** the arrangement comprises electrical resistive elements (4, 5, 6) arranged to be used at high temperature, **in that** the wire of the elements (4, 5, 6) is in the form of shanks with two or more legs, **in that** each one of the elements (4, 5, 6) is arranged in a cup (7, 8, 9) with an open end surface, **in that** the cups (7, 8, 9) with the

resistive elements (4, 5, 6) are equal in number to the number of holes (3) in the anode block (2), and **in that** the cups (3) are placed in a holder (10) that is common for all the cups such that one cup (7, 8, 9) for each hole (3) in the anode block (2) is caused to lie in front of the hole in question (3) and **in that** the said cup (7, 8, 9) is manufactured from a fibre insulating material comprising Al_2O_3 and/or SiO_2 .

5. An arrangement according to claim 4, **characterised in that** the said element (4, 5, 6) is a high-temperature element.
6. An arrangement according to claim 4 or 5, **characterised in that** each resistive element (4, 5, 6) is arranged to develop a power of approximately 10-20 kW.

20 Patentansprüche

1. Verfahren zum Heizen von Anodenblöcken, wobei die Anodenblöcke (2) bei der Herstellung von Aluminium verwendet werden und Kontaktbohrungen (3) aufweisen, in welchen Vorkehrungen für die Anbringung von elektrischen Kontakten getroffen sind, **dadurch gekennzeichnet, dass** bewirkt wird, dass die Bohrungen mit Hilfe von Strahlungswärme von elektrischen Widerstandselementen (4, 5, 6) erhitzt werden, welche für die Verwendung bei hohen Temperaturen ausgelegt sind, dass der Draht der Elemente (4, 5, 6) in Form von Bügeln mit zwei oder mehr Schenkeln vorliegt, dass jedes der Elemente (4, 5, 6) in einem Napf (7, 8, 9) mit einer offenen Stirnfläche angeordnet ist, dass ein Napf (7, 8, 9) für jede Bohrung (3) in dem Anodenblock (2) vor der in Rede stehenden Bohrung (3) liegt, und dass bewirkt wird, dass der Napf (7, 8, 9) aus einem isolierenden Fasermaterial besteht, welches Al_2O_3 und/oder SiO_2 aufweist.
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** bewirkt wird, dass die Elemente (4, 5, 6) Hochtemperaturelemente sind.
3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** bewirkt wird, dass jedes Widerstandselement (4, 5, 6) eine Leistung von etwa 10-20 kW entwickelt.
4. Anordnung für das Heizen von Anodenblöcken, wobei die Anodenblöcke (2) bei der Herstellung von Aluminium verwendet werden und Kontaktbohrungen (3) aufweisen, welche so ausgelegt sind, dass elektrische Kontakte darin angebracht werden können, **dadurch gekennzeichnet, dass** die Anordnung aufweist, dass die elektrischen Widerstandselemente (4, 5, 6) für die Verwendung bei hoher Tem-

peratur ausgelegt sind, dass der Draht der Elemente (4, 5, 6) in Form von Bügeln mit zwei oder mehr Schenkeln vorliegt, dass jedes der Elemente (4, 5, 6) in einem Napf (7, 8, 9) mit einer offenen Stirnfläche angeordnet ist, dass die Näpfe (7, 8, 9) mit den Widerstandselementen (4, 5, 6) gleich der Anzahl der Bohrungen (3) in dem Anodenblock (2) sind, und dass die Näpfe (3) in einem Halter (10) angeordnet sind, der für alle Näpfe derselbe ist, sodass ein Napf (7, 8, 9) für jede Bohrung (3) in dem Anodenblock (2) vor der in Rede stehenden Bohrung (3) liegt, und dass der Napf (7, 8, 9) aus einem isolierenden Fasermaterial hergestellt ist, welches Al_2O_3 und/oder SiO_2 aufweist.

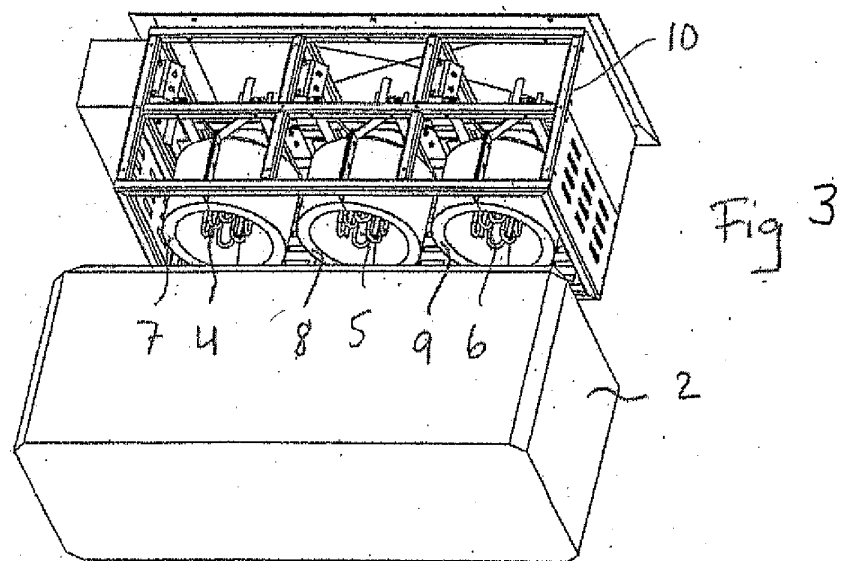
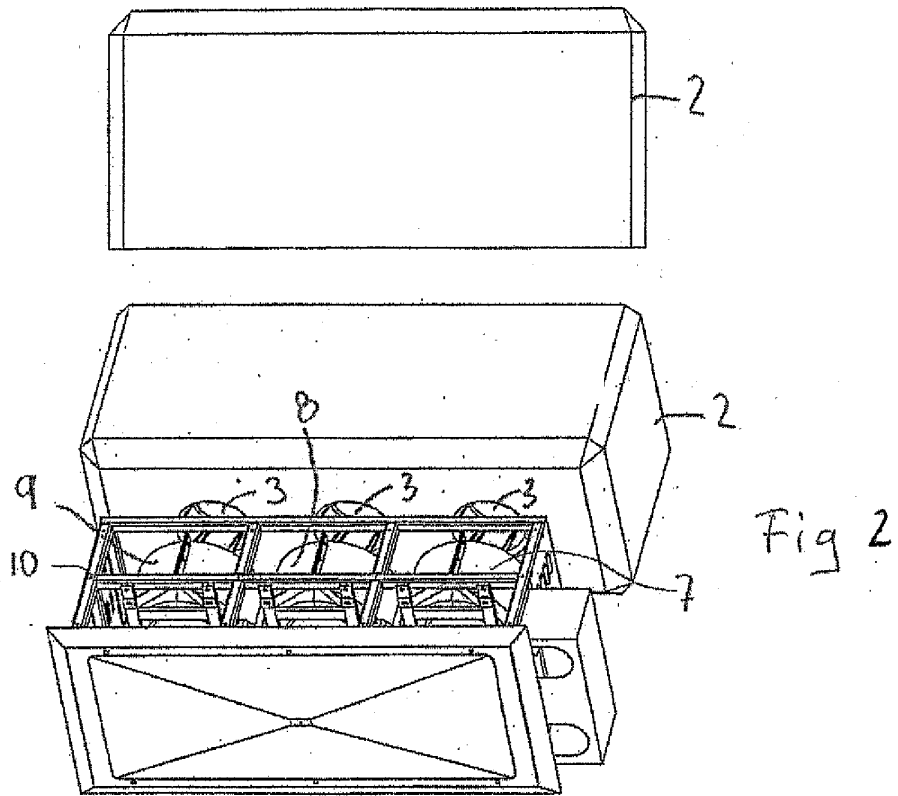
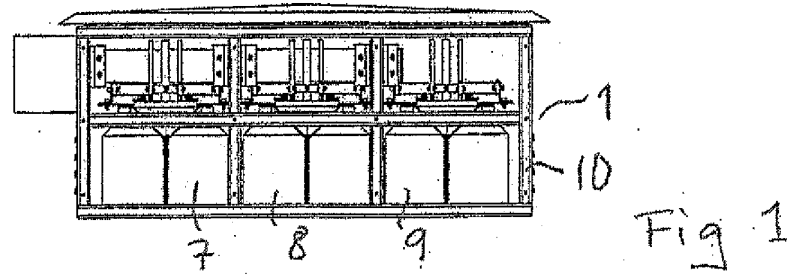
5. Anordnung nach Anspruch 4, **dadurch gekennzeichnet, dass** das Element (4, 5, 6) ein Hochtemperamentelement ist.
6. Anordnung nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** jedes Widerstandselement (4, 5, 6) so ausgelegt ist, dass es eine Leistung von in etwa 10-20 kW entwickelt.

Revendications

1. Procédé pour chauffer des blocs anodiques, lesquels blocs anodiques (2) sont utilisés dans la production de l'aluminium et comprennent des trous de contact (3) dans lesquels on agence des contacts électriques qui doivent être fixés, **caractérisé en ce que** les trous (3) sont amenés à être chauffés au moyen de chaleur rayonnante à partir d'éléments électriques résistifs (4, 5, 6) agencés pour être utilisés à des températures élevées, **en ce que** le fil des éléments (4, 5, 6) se présente sous la forme de tiges avec deux pattes ou plus, **en ce que** chacun des éléments (4, 5, 6) est amené à être agencé dans une coupelle (7, 8, 9) avec une surface d'extrémité ouverte, **en ce qu'**une coupelle (7, 8, 9) pour chaque trou (3) dans le bloc anodique (2) est amenée à être positionnée en face du trou en question (3) et **en ce que** ladite coupelle (7, 8, 9) est amenée à être un matériau isolant en fibres comprenant Al_2O_3 et/ou SiO_2 .
2. Procédé selon la revendication 1, **caractérisé en ce que** lesdits éléments (4, 5, 6) sont amenés à être un élément à haute température.
3. Procédé selon la revendication 1 ou 2, **caractérisé en ce que** chaque élément résistif (4, 5, 6) est amené à développer une puissance d'approximativement 10 - 20 kW.
4. Agencement pour le chauffage de blocs anodiques, lesquels blocs anodiques (2) sont utilisés dans la

production de l'aluminium et comprennent des trous de contact (3) dans lesquels on agence des contacts électriques qui doivent être fixés, **caractérisé en ce que** l'agencement comprend des éléments électriques résistifs (4, 5, 6) agencés pour être utilisés à des températures élevées, **en ce que** le fil des éléments (4, 5, 6) se présente sous la forme de tiges avec deux pattes ou plus, **en ce que** chacun des éléments (4, 5, 6) est agencé dans une coupelle (7, 8, 9) avec une surface d'extrémité ouverte, **en ce que** les coupelles (7, 8, 9) avec les éléments résistifs (4, 5, 6) sont égales en nombre au nombre de trous (3) dans le bloc anodique (2) et **en ce que** les coupelles (3) sont placées dans un support (10) qui est commun pour toutes les coupelles de sorte qu'une coupelle (7, 8, 9) pour chaque trou (3) dans le bloc anodique (2) est amenée à être positionnée en face du trou en question (3) et **en ce que** ladite coupelle (7, 8, 9) est fabriquée à partir d'un matériau isolant en fibres comprenant Al_2O_3 et/ou SiO_2 .

5. Agencement selon la revendication 4, **caractérisé en ce que** ledit élément (4, 5, 6) est un élément à haute température.
6. Agencement selon la revendication 4 ou 5, **caractérisé en ce que** chaque élément résistif (4, 5, 6) est agencé pour développer une puissance d'approximativement 10 - 20 kW.



REFERENCES CITED IN THE DESCRIPTION

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