CONVENTION

AUSTRALIA

Patents Act 1990

REQUEST FOR A STANDARD PATENT

AND NOTICE OF ENTITLEMENT

The Applicant identified below requests the grant of a patent to the nominated person identified below for an invention described in the accompanying standard complete patent specification.

[70,71]Applicant and Nominated Person:

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[54]Invention Title:

DEVICE FOR THE PROTECTION OF ANODE HANGER NIPPLES

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[31,33,32]

Details of basic application(s):

930956 NORWAY NO 17 March 1993

Applicant states the following:

1. The nominated person is the assignee of the actual inventor(s)

2. The nominated person is
   - the applicant
   - the assignee of the applicant
   - authorised to make this application by the applicant
   of the basic application.

3. The basic application(s) was/were the first made in a convention country in respect of the invention.

The nominated person is not an opponent or eligible person described in Section 33-36 of the Act.

9 March 1994

Norsk Hydro a.s
By PHILLIPS ORMONDE & FITZPATRICK
Patent Attorneys
By

Our Ref: 360207

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The present invention concerns a device for protecting anode hanger nipples when manufacturing aluminium in a Hall-Heroult electrolysis process, made of a composite material consisting of carbon residues, hardening material, water and a catalyst. The device is characterised by two or more prefabricated, dimensionally stable parts which are designed to be joined in an arrangement in situ.
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COMPLETE SPECIFICATION
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Related Art:

Name of Applicant:
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Invention Title:
DEVICE FOR THE PROTECTION OF ANODE HANGER NIPPLES

Our Ref : 360207
POF Code: 1346/1346

The following statement is a full description of this invention, including the best method of performing it known to applicant(s):

- 1 -
The present invention concerns a device for the protection of the lower part of an anode hanger (hereinafter called a nipple) during the production of aluminium in a Hall-Heroult electrolysis process, made of a composite material consisting of carbon residues, hardening material, water and a catalyst.

The anode hanger functions like an electric current conductor and fastening device for the anode in an electrolysis cell. The lower part of the anode hanger consists of two or more steel bolts which are fixed in the anode by casting.

Aluminium is generally manufactured from aluminium oxide dissolved in a bath consisting mainly of melted cryolite. The bath is typically kept at a temperature of 940 - 980°C. The cathode represents the bottom of an electrolysis cell formed like a vessel containing the bath, while the anodes are submerged into the bath from above. The current is passed through an electrolysis cell from the anode hanger and through the anode and the bath/metal layer to the cathode. The anode is oxidised from its base surface upwards by the oxygen which is formed in the decomposition phase of the aluminium oxide. In order to be able to utilise the anode to the maximum, the nipples to which the anode is fastened must be protected against the liquid bath which is forced in towards the nipples when the anode approaches critical consumption level.

Without a protective device the bath would attack the nipples with erosion of the iron as a result, which is very damaging for the quality of the metal. The normal method of protecting the nipples today is to make a formwork of aluminium tape or cardboard around the nipple so that an annulus is formed between the formwork and the nipple which is filled with a granulate consisting of carbon, preferably coke, and a binding material consisting of pitch.
This composite is heated up by the temperature transition from the anode and is melted and calcinated to form a solid, dimensionally stable protective device. The disadvantage of this procedure is that during this process the composite gives off PAH (polycyclic aromatic hydrocarbons) gases which are registered today as possible carcinogens. Furthermore, it is an expensive procedure as high quality raw materials are used.

The aim of the present invention was to improve commonly known solutions for protecting nipples beyond the known technology. A further aim was to produce a device which is reasonable to produce in terms of cost, is simple to join around the nipples after the anode is in place and which provides effective nipple protection.

In accordance with the present invention, this was achieved by means of a device mentioned in the introduction and which is characterised in that it consists of two or more prefabricated parts which are designed to be joined in an arrangement around each of the nipples.

The present invention will be described in the following with one example and with reference to the enclosed drawings.

Fig. 1 shows a section through a Hall-Heroult electrolysis cell in which a new, almost consumed anode is located.

Fig. 2 shows an anode hanger with a mounted anode and a protective device.

Fig. 3 shows a protective device in perspective.
Fig. 1 shows the principle of a conventional Hall-Heroult electrolysis cell in which the cathode 1, together with the liquid aluminium metal 2, forms the base of an electrolysis vessel. The anode 4 is moved down into the liquid cryolite bath towards the base of the electrolysis vessel as the anode becomes worn and in order to preserve a roughly constant distance between the wear surface of the anode and the base of the electrolysis vessel. The device 5 prevents the aggressive bath attacking and eroding the steel nipples 6 to which the anode 4 is fastened and which conduct electric current to the anode. The bath is covered with an insulating layer 7 of crushed bath materials and aluminium oxide.

Fig. 2 shows an anode hanger with a mounted anode 4 and nipples 6 with an example of a device 5 in accordance with the present invention for protection against the cryolite bath. Section A-A shows an annulus 9 between nipple 6 and the device 5 which can be filled with crushed bath and aluminium oxide to avoid cracks in the device 5 on account of the effects of the dilation forces.

Fig. 3 shows an advantageous design of the present invention in which the upper part is provided with a diagonal part 10 to ease filling the annulus 9 with crushed bath and aluminium oxide, as well as a male/female connection 11. The design of the male/female connection is shown in section B-B which shows that, using diagonal surfaces between the male and female parts, it is possible to fasten the two parts together with a simple grip. The simple design of the male and female parts makes the device 5 easy to mass-produce and means that it can be joined in a very short time and effectively protect the nipple, which results in large savings in production.
In the examples mentioned in the above and shown in Figs. 2 and 3, the protective device 5 is designed so that an annulus is formed between it and the nipples. The present invention, as it is defined in the claims, is not, however, restricted to this design but can be produced from a material which eliminates the dilation forces and allows them to reach right in to the nipples. Furthermore, the parts which make up the device 5 can be fastened to each other by means of a binder, and/or the parts can be fastened to the anode and/or the nipples by means of such a binder. Furthermore, the protective device 5 can have a shape different to the ring shape shown in the diagrams, for example a square.
The claims defining the invention are as follows:

1. Device (5) for protecting anode hanger nipples (6) when manufacturing aluminium in a Hall-Heroult electrolysis process, made, for example, of a composite material consisting of carbon residues, hardening material, water and catalyst, characterised by two or more prefabricated, dimensionally stable parts which are designed to be joined in an arrangement (5) around each of the nipples.

2. Device in accordance with claim 1, characterised in that the parts of the device can be locked together at the ends, which are designed in the form of a male/female connection (11).

3. Device in accordance with claims 1 and 2, characterised in that the device (5) is designed in such a way that an annulus (9) is formed between the nipple (6) and the device (5), which can be filled with, for example, crushed bath and aluminium oxide so that the expansion of the nipples (6) in connection with a rise in temperature does not affect the device (5).

4. Device in accordance with claim 3, characterised in that the upper part of the device is provided with a diagonal part (10) to make it easier to pour crushed bath and aluminium oxide into the annulus (9).
5. Device in accordance with claims 3 and 4, characterised in that the size of the annulus (9) is sufficiently large for the crushed bath and aluminium oxide material to cover the whole of the surface of the nipple which is enclosed by the device (5).

6. Device in accordance with claims 1-5, characterised in that the parts are jointed together by means of a binder.

7. Device in accordance with claims 1-6, characterised in that the parts are fastened to the nipples and/or the anode by means of a binder.

DATED: 8th March, 1994
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ABSTRACT

The present invention concerns a device for protecting anode hanger nipples when manufacturing aluminium in a Hall-Heroult electrolysis process, made of a composite material consisting of carbon residues, hardening material, water and a catalyst. The device is characterised by two or more prefabricated, dimensionally stable parts which are designed to be joined in an arrangement in situ.