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(54) **ELECTROLYTIC CATHODE ASSEMBLY AND ELECTROLYTIC CELL**

(57) Provided are an electrolytic cathode assembly and an electrolytic cell. The electrolytic cathode assembly therein comprises a cathode plate; a wrapping strip, which seals a side of the cathode plate; and an insulating clamp, which is located above the wrapping strip on one side and which sealedly clamps on the cathode plate.

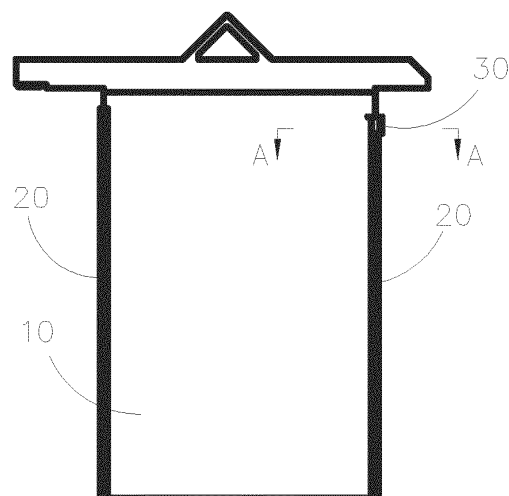


Fig. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and benefits of Chinese Patent Application Serial No. 201610970410.8 and Chinese Patent Application Serial No. 201621194073.X, both filed with the State Intellectual Property Office of P. R. China on October 28, 2016, and the entire content of which is incorporated herein by reference.

FIELD

[0002] The present disclosure relates to the field of chemical industry, and more particularly to an electrolytic cathode assembly and an electrolytic tank.

BACKGROUND

[0003] In a zinc hydrometallurgy process, due to fluctuation of a liquid level of an electrolyte in an electrolytic tank, a zinc sheet is formed with its upper edge has an irregular wave-shape, such that a zinc stripping blade is difficult to insert between the zinc sheet and a cathode plate, which is disadvantageous for stripping of the zinc sheet. Therefore, in the field of modern zinc electrolysis, a pre-stripping port is usually disposed on a cathode of the zinc electrolysis.

[0004] At present, the cathode of the zinc electrolysis in the latest technology is mainly composed of a cathode of the zinc electrolysis, two insulating strips with equal length and a pre-stripping sheet. The insulating strips are hot pressed on two edges of the cathode of the zinc electrolysis. A machined hole for the stripping port is pre-processed in each of front and back sides of the cathode plate at a position of a liquid line, and an insulating pre-stripping sheet is cast in the stripping port, at which no zinc or less amount of the zinc is deposited after electrolysis, and thus a pre-stripping port is formed for feeding a blade to strip the zinc sheet. This structure has the following shortcomings: (1) the pre-stripping sheet and the cathode of the zinc electrolysis are bonded together by bonding force of these two materials, working environment of the electrolysis is about 50 °C, while stripping environment is about 25 °C, under such frequent alternation of heating and cooling, the pre-stripping sheet will loosen or fall off to form gap, and under the corrosion of a strong acid in the tank, the electrolytic zinc will grow in the gap, leading to that the zinc sheet is difficult to be stripped; (2) as the pre-stripping sheet is fixed on the cathode of the zinc electrolysis, the loosening of the pre-stripping sheet will lead the stripping blade to shovel onto the aluminum cathode plate, which is easy to damage the stripping blade; (3) the cathode plate needs to be processed, thereby increasing manufacturing costs of the cathode; (4) replacement of the pre-stripping sheet is complex if the pre-stripping sheet is damaged.

[0005] Therefore, the existing cathode of the zinc electrolysis needs to be improved.

SUMMARY

[0006] Embodiments of the present disclosure seek to solve at least one of the problems existing in the related art. For this, an objective of the present disclosure is to provide an electrolytic cathode assembly, which enables a pre-stripping region to be formed on a cathode plate in a simple and reliable manner, without modifying the cathode plate, and is easy to replace.

[0007] Therefore, according to a first aspect of the present disclosure, an electrolytic cathode assembly is provided. According to embodiments of the present disclosure, the electrolytic cathode assembly includes a cathode plate; first and second edge-covering strips configured to seal first and second side edges of the cathode plate respectively; and an insulating clamp, disposed above the first edge-covering strip and clamping the cathode plate.

[0008] In the electrolytic cathode assembly according to embodiments of the present disclosure, the insulating clamp is clamped on the cathode plate, such that a clamped region is sealed, and an electrolyte will not enter an inside of the insulating clamp when the electrolysis is carried out in a tank using the electrolytic cathode, thereby preventing an electrolytic metal from completely cladding the cathode. When stripping the electrolytic metal, an external force is applied to remove the insulating clamp, and a pre-stripping region is formed at a place where a head of the insulating clamp is located, which is convenient for feeding a stripping blade. The clamped region of the cathode plate is sealed under the long-lasting clamping force of the insulating clamp, thereby effectively preventing the electrolytic metal from completely cladding the cathode. Moreover, the insulating clamp is separable from the cathode plate and thus is easy to be replaced. Furthermore, there is no need to change the structure of the existing cathode plate and mechanically process the cathode plate, which simplifies production process and saves costs.

[0009] Further, the electrolytic cathode assembly according to above embodiments of the present disclosure may have the following additional technical features.

[0010] According to embodiments of the present disclosure, the insulating clamp is H-shaped, and includes: a clamping part; a controlling part; and a connecting part for connecting the clamping part and the controlling part, in which the clamping part is openable around the controlling part. Thereby, the insulating clamp has effective and long-lasting clamping force, and the sealing effect is good.

[0011] According to embodiments of the present disclosure, a length of the insulating clamp is in a range of greater than 5 mm to less than 100 mm. As a result, the formed stripping region is of a moderate size.

[0012] According to embodiments of the present dis-

closure, the clamping part is made of an elastic, insulative and anticorrosive material. Thereby, the sealing effect is good, and the service life is long.

[0013] According to embodiments of the present disclosure, the first edge-covering strip below the insulating clamp is shorter than the second edge-covering strip in length. Thereby, it is convenient to adjust a position of the insulating clamp in the electrolyte.

[0014] According to a second aspect of the present disclosure, an electrolytic tank is provided. According to embodiments of the present disclosure, the electrolytic tank includes: a tank body, defining space for accommodating an electrolyte; an electrolytic anode assembly, disposed in the electrolyte; an electrolytic cathode assembly as described hereinbefore and disposed in the electrolyte; and a power supply, connected to both the electrolytic anode assembly and the electrolytic cathode assembly.

[0015] According to the electrolytic tank of embodiments of the present disclosure, the insulating clamp is used in the electrolytic cathode assembly to clamp the cathode plate, such that the clamped region is sealed, and the electrolyte will not enter the inside of the insulating clamp when the electrolysis is carried out in the electrolytic tank using the electrolytic cathode, thereby preventing the electrolytic metal from completely cladding the cathode. When stripping the electrolytic metal, an external force is applied to remove the insulating clamp, and a pre-stripping region is formed at a place where a head of the insulating clamp is located, which is convenient for feeding a stripping blade. The clamped region of the cathode plate is sealed under the long-lasting clamping force of the insulating clamp, thereby effectively preventing the electrolytic metal from completely cladding the cathode. Moreover, the insulating clamp is separable from the cathode plate and thus is easy to be replaced. Furthermore, there is no need to change the structure of the existing cathode plate and to mechanically process the cathode plate, which simplifies production process and saves costs.

[0016] According to embodiments of the present disclosure, a bottom end of the first edge-covering strip and a bottom end of the second edge-covering strip both extend to seal at least a part of a bottom edge of the cathode plate, an upper end of the first edge-covering strip below the insulating clamp is beneath a liquid level of the electrolyte, and an upper end of the second edge-covering strip is above the liquid level of the electrolyte.

[0017] According to embodiments of the present disclosure, the liquid level of the electrolyte is located at 1/4 to 2/3 of the insulating clamp from a lower end of the insulating clamp.

[0018] According to embodiments of the present disclosure, the liquid level of the electrolyte is located at 1/3 to 1/2 of the insulating clamp from the lower end of the insulating clamp.

[0019] Additional aspects and advantages of embodiments of present disclosure will be given in part in the

following descriptions, become apparent in part from the following descriptions, or be learned from the practice of the embodiments of the present disclosure.

5 BRIEF DESCRIPTION OF THE DRAWINGS

[0020] These and other aspects and advantages of embodiments of the present disclosure will become apparent and more readily appreciated from the following descriptions made with reference to the drawings, in which:

Fig. 1 is a schematic diagram showing a structure of an electrolytic cathode assembly according to an embodiment of the present disclosure;

Fig. 2 is a schematic diagram showing a local structure of an electrolytic cathode assembly according to an embodiment of the present disclosure;

Fig. 3 is a schematic diagram showing a structure of an insulating clamp according to an embodiment of the present disclosure; and

Fig. 4 is a schematic diagram showing a structure of an electrolytic tank according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0021] Embodiments of the present disclosure will be described in detail below, examples of which are shown in the accompanying drawings, in which the same or similar elements and elements having same or similar functions are denoted by like reference numerals throughout the descriptions. The embodiments described herein with reference to the accompanying drawings are explanatory and illustrative, which are used to generally understand the present disclosure. The embodiments shall not be construed to limit the present disclosure.

[0022] In the specification, it is to be understood that terms such as "central", "upper", "lower", "front", "rear", "left", "right", "vertical", "horizontal", "top", "bottom", "inner" and "outer" should be construed to refer to the orientation as then described or as shown in the drawings under discussion. These relative terms are only for convenience of description, but do not indicate or imply that the device or element referred to must have a particular orientation, or be constructed or operated in a particular orientation, and thus shall not be construed to limit the present disclosure.

[0023] According to an aspect of the present disclosure, an electrolytic cathode assembly is provided. The electrolytic cathode assembly is explained and illustrated referring to Fig. 1 and according to embodiments of the present disclosure. The electrolytic cathode assembly 100 includes a cathode plate 10, first and second edge-covering strips 20 and an insulating clamp 30. According to embodiments of the present disclosure, the first and second edge-covering strips 20 cover first and second side edges of the cathode plate 10 respectively to seal

the first and second side edges of the cathode plate 10 respectively. Fig. 2 is a partial sectional view in an A-A direction of an electrolytic cathode assembly. Referring to Fig. 2, in embodiments of the present disclosure, the insulating clamp 30 is located above the first edge-covering strip 20 on the first side of the cathode plate, and is clamped on the cathode plate 10 to seal the cathode plate 10. When the electrolysis is carried out in a tank using the electrolytic cathode assembly, an electrolyte will not enter an inside of the insulating clamp, thereby preventing an electrolytic metal from completely cladding the cathode. When stripping the electrolytic metal, an external force is applied to remove the insulating clamp, and a pre-stripping region is formed at a place where a head of the insulating clamp is located, which is convenient for feeding a stripping blade to strip the electrolytic metal.

[0024] According to the electrolytic cathode assembly of embodiments of the present disclosure, the insulating clamp has long-lasting clamping force, which enables the clamped region of the cathode plate to be sealed, thereby effectively preventing the electrolytic metal from completely cladding the cathode. Moreover, the insulating clamp is separable from the cathode plate, and thus is easy to be replaced. Furthermore, there is no need to change the structure of the existing cathode plate and mechanically process the cathode plate, which simplifies production process and saves costs.

[0025] With reference to Fig. 3, in embodiments of the present disclosure, the insulating clamp 30 is H-shaped, and includes a clamping part 31, a connecting part 32 and a controlling part 33. The connecting part 32 is configured to connect the clamping part 31 and the controlling part 33. The clamping part 31 is openable around the controlling part 32. Thereby, the clamping part of the insulating clamp is clamped on the cathode plate, avoiding the electrolyte to enter the inside of the insulating clamp and preventing the electrolytic metal from completely cladding the cathode. The controlling part controls an opening size and clamping tightness of the clamping part, thereby ensuring the insulating clamp has effective and long-lasting clamping force, making the clamping part of the insulating clamp have good sealing effect, avoiding the entry of the electrolyte, and preventing the electrolytic metal from completely cladding this clamped region of the cathode plate, so as to form a stripping region at the clamped region, which facilitates the stripping of the electrolytic metal covered on the cathode plate.

[0026] According to embodiments of the present disclosure, a size of the insulating clamp is adjustable based on a size of the cathode plate, as long as a size of the stripping region clamped by the insulating clamp benefits the stripping of the electrolytic metal. In some embodiments of the present disclosure, a length of the insulating clamp 30 is in a range of greater than 5 mm to less than 100 mm. As a result, the stripping region formed by using the insulating clamp is of a moderate size, which benefits

the stripping of the electrolytic metal. If the insulating clamp is too small, the formed stripping region is too small, and it is difficult to strip the electrolytic metal. If the insulating clamp is too large, the formed stripping region is too large, which not only reduces the electrolytic efficiency, but also influences the setting of other elements of the electrolytic tank.

[0027] According to embodiments of the present disclosure, the clamping part 31 is made of an elastic, insulative and anticorrosive material. As shape adjustment is easy for an elastic material, it is convenient to clamp the clamping part of the insulating clamp to the cathode plate, and remove the insulating clamp from the cathode plate after electrolysis. Moreover, the clamping part of the insulating clamp has elasticity, and thus the insulating clamp can be reused, thereby reducing costs of the electrolysis. Furthermore, the insulating clamp has good anticorrosive effect, which reduces or even avoids the corrosion effect of the electrolyte on the insulating clamp, and prolongs service life of the insulating clamp.

[0028] According to some embodiments of the present disclosure, the insulating clamp 30 may be integrally molded by the elastic, insulative and anticorrosive material. Thereby, the insulating clamp is easy to produce, and is durable and less prone to damage.

[0029] According to embodiments of the present disclosure, the first edge-covering strip 20 below the insulating clamp 30 is shorter than the second edge-covering strip 20 in length. As a metal layer is adsorbed on a surface of the cathode plate, and bonding tightness between edges of the metal layer and the cathode plate is high, it is difficult to feed the blade and to strip the metal layer. Moreover, a position of the insulating clamp is a feeding position of the blade, if the insulating clamp is located at an edge line of the metal layer, that is, the edge line of the metal layer is located between an upper end and a lower end of the insulating clamp, the blade may be fed obliquely above the metal layer. From the mechanical point of view, a fulcrum position at such an angle is good, and lever force is large, as a result, it is easy to strip the metal layer. In the process of electrolysis, a liquid level of the electrolyte determines a position of the metal layer. When the length of the first edge-covering strip below the insulating clamp is less than that of the second edge-covering strip, the liquid level of the electrolyte is exactly located between the upper end and the lower end of the insulating clamp, ensuring that the feeding position of the blade is obliquely above the metal layer, thereby making the metal layer easy to be stripped.

[0030] According to another aspect of the present disclosure, an electrolytic tank is provided. The electrolytic tank is explained and illustrated with referring to Fig. 4 and according to embodiments of the present disclosure. The electrolytic tank 1000 includes a tank body 200, an electrolytic anode assembly 300, an electrolytic cathode assembly 100 as described above and a power supply 400. According to embodiments of the present disclosure, the tank body 200 defines space for accommodat-

ing an electrolyte. The electrolytic anode assembly 300 and the electrolytic cathode assembly 100 are disposed in the electrolyte. The power supply 400 is connected to both the electrolytic anode assembly 300 and the electrolytic cathode assembly 100.

[0031] According to the electrolytic tank of embodiments of the present disclosure, the insulating clamp is used in the electrolytic cathode assembly to clamp the cathode plate, such that the clamped region is sealed, and the electrolyte will not enter the inside of the insulating clamp when the electrolysis is carried out in the tank using the electrolytic cathode assembly, thereby preventing the electrolytic metal from completely cladding the cathode. When stripping the electrolytic metal, an external force is applied to remove the insulating clamp, and a pre-stripping region is formed at a place where a head of the insulating clamp is located, which is convenient for feeding the stripping blade. The clamped region of the cathode plate is sealed under the long-lasting clamping force of the insulating clamp, thereby effectively preventing the electrolytic metal from completely cladding the cathode. Moreover, the insulating clamp is separable from the cathode plate and thus is easy to be replaced. Furthermore, there is no need to change the structure of the existing cathode plate and to mechanically process the cathode plate, which simplifies production process and saves costs.

[0032] According to embodiments of the present disclosure, a bottom end of the first edge-covering strip 20 and a bottom end of the second edge-covering strip 20 both extend to seal at least a part of a bottom edge of the cathode plate 10. An upper end of the first edge-covering strip 20 below the insulating clamp 30 is beneath a liquid level of the electrolyte, and an upper end of the second edge-covering strip 20 is above the liquid level of the electrolyte. As described above, because the metal layer is adsorbed on the surface of the cathode plate, and the bonding tightness between edges of the metal layer and the cathode plate is high, it is difficult to feed the blade and strip the metal layer. Moreover, the position of the insulating clamp is the feeding position of the blade, if the insulating clamp is located at the edge line of the metal layer, that is, the edge line of the metal layer is located between the upper end and the lower end of the insulating clamp, the blade may be fed obliquely above the metal layer. From the mechanical point of view, the fulcrum position at this angle is good, and the lever force is large, as a result, it is easy to strip the metal layer. In the process of electrolysis, the liquid level of the electrolyte determines the position of the metal layer. When the upper end of the first edge-covering strip below the insulating clamp is beneath the liquid level of the electrolyte, and the upper end of the second edge-covering strip is above the liquid level of the electrolyte, the liquid level of electrolyte is exactly located between the upper end and the lower end of the insulating clamp, ensuring that the feeding position of the blade is obliquely above the metal layer, thereby making the metal layer easy to be stripped.

[0033] According to embodiments of the present disclosure, the liquid level of the electrolyte is located at 1/4 to 2/3 of the insulating clamp from a lower end of the insulating clamp. Due to the fluctuation of the liquid level of the electrolyte, a liquid level line is often inclined, and thereby the edge of the metal layer is inclined. The liquid level of the electrolyte is located at 1/4 to 2/3 of the insulating clamp from the lower end of the insulating clamp, which ensures that a height of the metal layer is lower than the upper end of the insulating clamp.

[0034] According to preferred embodiments of the present disclosure, the liquid level of the electrolyte is located at 1/3 to 1/2 of the insulating clamp from the lower end of the insulating clamp. The inventors have found through researches that, when the blade is fed at an angle of 30 to 60 degrees relative to a horizontal, a position of a contact point (i.e., the fulcrum) between the stripping blade and the cathode plate is better, the lever force is larger, and it is easier to strip the metal layer. Through experiments, analysis and calculations, the inventors have found that, when the liquid level of the electrolyte is located at 1/3 to 1/2 of the insulating clamp from the lower end of the insulating clamp, a longitudinal height of the formed stripping region is suitable, such that a feeding angle of the blade is 30 to 60 degrees relative to the horizontal, thereby making the metal layer easier to be stripped and the stripped metal layer more complete.

[0035] Reference throughout this specification to "an embodiment," "some embodiments," "an example," "a specific example," or "some examples," means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the present disclosure. Thus, the appearances of the phrases such as "in some embodiments," "in one embodiment," "in an embodiment," "in another example," "in an example," "in a specific example," or "in some examples," in various places throughout this specification are not necessarily referring to the same embodiment or example of the present disclosure. Furthermore, the particular features, structures, materials, or characteristics may be combined in any suitable manner in one or more embodiments or examples.

[0036] Although explanatory embodiments have been shown and described, it would be appreciated by those skilled in the art that changes, modifications, alternatives and variant can be made in the embodiments without departing from spirit and principles of the present disclosure, and the scope of the present disclosure is defined by claims and equivalents thereof.

Claims

1. An electrolytic cathode assembly, comprising:
 - a cathode plate;
 - first and second edge-covering strips configured

- to seal first and second side edges of the cathode plate respectively; and
an insulating clamp, disposed above the first edge-covering strip and clamping the cathode plate. 5
2. The electrolytic cathode assembly according to claim 1, wherein the insulating clamp is H-shaped, and comprises: 10
- a clamping part;
a controlling part; and
a connecting part for connecting the clamping part and the controlling part,
wherein the clamping part is openable around the controlling part. 15
3. The electrolytic cathode assembly according to claim 1, wherein a length of the insulating clamp is in a range of greater than 5 mm to less than 100 mm. 20
4. The electrolytic cathode assembly according to claim 1, wherein the clamping part is made of an elastic, insulative and anticorrosive material. 25
5. The electrolytic cathode assembly according to claim 1, wherein the first edge-covering strip below the insulating clamp is shorter than the second edge-covering strip in length. 30
6. An electrolytic tank, comprising:
- a tank body, defining space for accommodating an electrolyte;
an electrolytic anode assembly, disposed in the electrolyte; 35
an electrolytic cathode assembly according to any one of claims 1 to 5 and disposed in the electrolyte; and
a power supply, connected to both the electrolytic anode assembly and the electrolytic cathode assembly. 40
7. The electrolytic tank according to claim 6, wherein a bottom end of the first edge-covering strip and a bottom end of the second edge-covering strip both extend to seal at least a part of a bottom edge of the cathode plate, and
wherein an upper end of the first edge-covering strip below the insulating clamp is beneath a liquid level of the electrolyte, and an upper end of the second edge-covering strip is above the liquid level of the electrolyte. 45 50
8. The electrolytic tank according to claim 7, wherein the liquid level of the electrolyte is located at 1/4 to 2/3 of the insulating clamp from a lower end of the insulating clamp. 55
9. The electrolytic tank according to claim 8, wherein the liquid level of the electrolyte is located at 1/3 to 1/2 of the insulating clamp from the lower end of the insulating clamp.

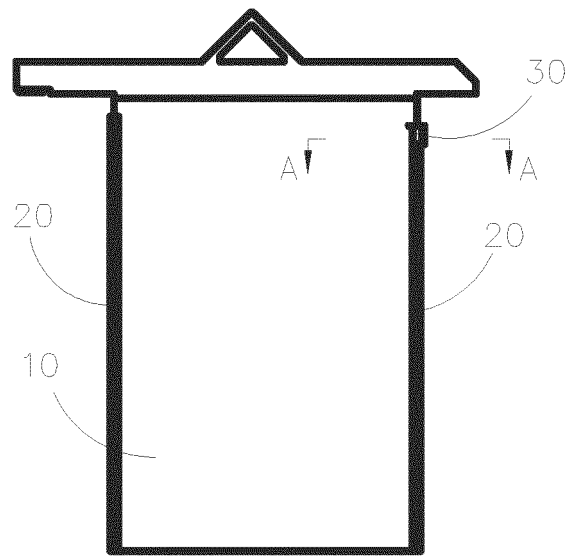


Fig. 1

A — A

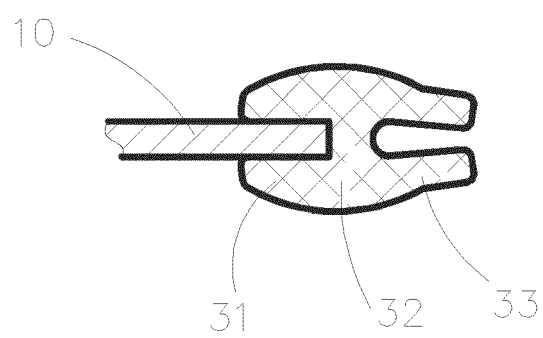


Fig. 2

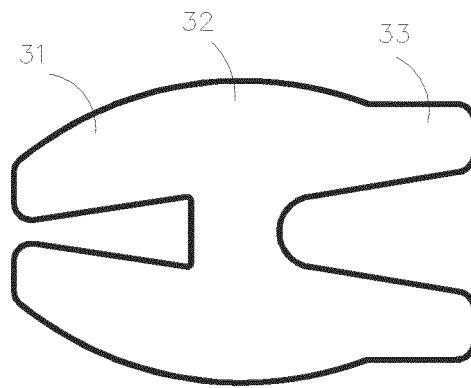


Fig. 3

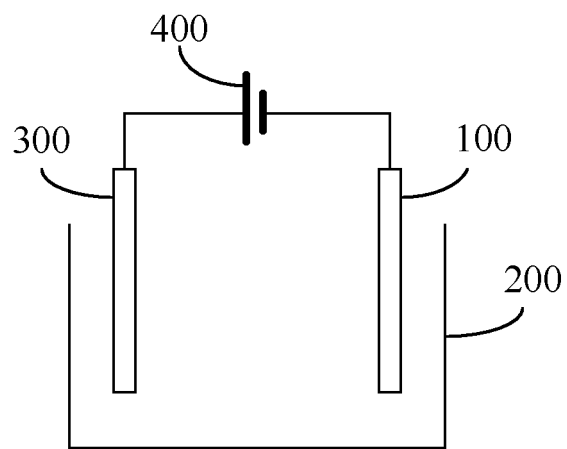


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/089772

A. CLASSIFICATION OF SUBJECT MATTER

C25C 7/02 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C25C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, CNPAT, CNKI: 电解, 阴极, 绝缘, 剥离, 夹, electrolyzation, cathode, insulation, strip+, decollement, desquamation, grip, clip, hold

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 206244895 U (JIANGXI NERIN EQUIPMENT CO., LTD.), 13 June 2017 (13.06.2017), description, paragraphs 5-16	1-9
A	CN 202730271 U (KUNMING UNIVERSITY OF SCIENCE AND TECHNOLOGY), 13 February 2013 (13.02.2013), description, paragraphs 23-25, and figures 1-5	1-9
A	CN 201793781 U (CHANGSHA ENGINEERING & RESEARCH INSTITUTE OF NONFERROUS METALLURGY), 13 April 2011 (13.04.2011), entire document	1-9
A	CN 102534689 A (CHINA ENFI ENGINEERING CORPORATION), 04 July 2012 (04.07.2012), entire document	1-9
A	CN 200949117 Y (YUNNAN CHIHONG ZN&GE CO., LTD.), 19 September 2007 (19.09.2007), entire document	1-9
A	JP 2006265699 A (NIKKO GOLD FOIL CO., LTD.), 05 October 2006 (05.10.2006), entire document	1-9
A	JP 2011162824 A (SUMITOMO METAL MINING CO.), 25 August 2011 (25.08.2011), entire document	1-9

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search
23 August 2017

Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CN2017/089772

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 206244895 U	13 June 2017	None	
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CN 102534689 A	04 July 2012	CN 102534689 B	16 July 2014
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Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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