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(54) Stripping apparatus and method for removing an electrodeposited metal layer from a cathode plate

(57) Apparatus and method for removing an electrodeposited metal layer from a cathode plate comprising a feeding zone, a metal stripping unit, a discharge zone, and a carousel with a substantially horizontal axis of rotation comprising engaging means such that:
(i) in a first position, first engaging means face the end of the conveyor feeding line so as to pivotally engage the first coated cathode plate present on said line;
(ii) In a second position, the engaged first cathode is brought into position in the stripping unit by rotation of the carousel, whilst a second coated cathode is engaged into the next engaging means of the carousel; and
(iii) In a third position the stripped first cathode plate is discharged onto the discharge zone by further rotation of the carousel whilst the second cathode is brought into position in the stripping unit and a third coated cathode is engaged in the next engaging means facing the conveyor feeding line.

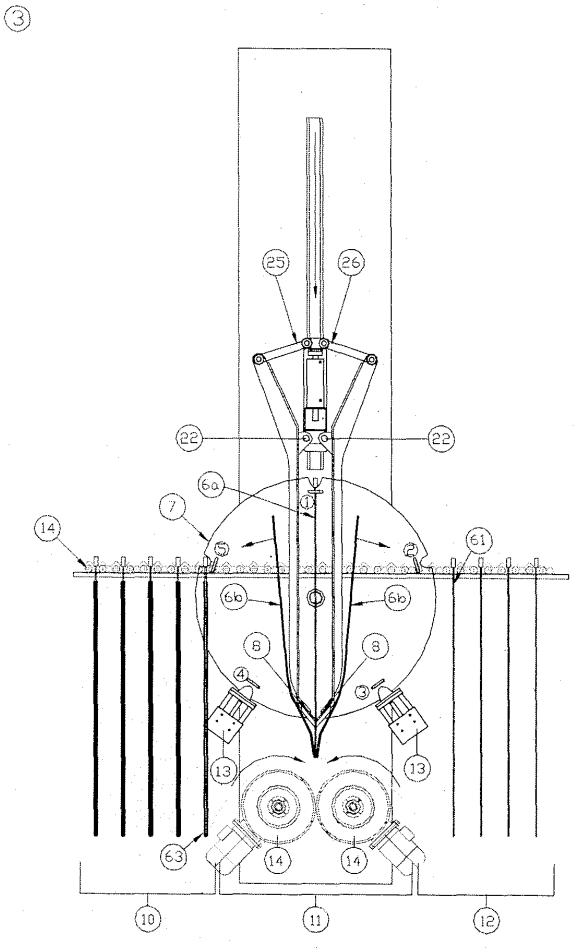

Figure 4

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Description

Field of invention

[0001] The present invention relates to the field of metal production by cathodic electrodeposition and in particular to the removal of the electrodeposited metal coating from the cathodic support plate.

Background of the invention

[0002] Metal refinement by electrolysis is a well known technique applied for the production of metals like zinc, copper, silver, etc. and consists of inserting a cathode into an electrolytic cell containing a solution including an ion of the metal to be refined. Upon application of an electric field across the cell, metal is electrolytically deposited onto the surfaces of the cathode in contact with the solution to form a metal coating. The top of the cathode is generally located above the level of the solution so as to leave an area of the cathode which remains uncoated. When the metal coating has grown to the desired thickness, it must be scraped or stripped off the cathode.

[0003] In some techniques, the metal coating is scraped off the surface of the cathode while the latter is still immersed in the electrolytic solution. For example, In US 3,772,003 the cathode is in the shape of a rotating drum partially immersed in the electrolytic solution. The deposited metal is removed continuously as the cathode drum rotates by a scraping blade tangently contacting the surface thereof which stands out of the solution level. In US 4,273,640 disc-shaped cathodes are rotatably mounted in an electrolytic cell such as to be partially immersed in the elecrolytic solution. As the cathode rotates, a metal coating is formed on the surface thereof and is scraped by a blade immersed in the solution. In US 5,565,083 the cathode is in the form of a plate and the deposited metal is removed from the major surfaces of the cathode plate with a scraper blade moving relative to the cathode while this is still immersed in the electrolytic cell. In a different approach, EP 436,602 discloses a cathode in the shape of e.g., a drum which is lifted out of an electrolytic cell when the coating is of a sufficient thickness. Then scraping knives located below the drum and mounted on hinges so as to form a funnel or truncated cone are displayed such that when the cathode is driven down, the metal coating deposited on its inner surface is scraped off by the funnel forming blades and recovered in the centre thereof as the drum is immersed again for further coating. These techniques all have the advantage of being continuous or semi-continuous, but they do not permit the recovery of the metal in the form of a sheet, but rather in a particulate form.

[0004] In order to obtain the refined metal in the shape of sheets, it is necessary to allow enough time for a metal coating of a sufficient thickness to build up on the immersed surfaces of the cathode before removing the coating. This led to the development of sequential batch processes, wherein a plurality of cathodes, usually rectangular plates, are first immersed in a corresponding number of electrolytic cells in an electrodeposition unit for a time sufficient to build up a metal coating of the desired thickness. In a second step the coated cathodes are removed from the electrolytic cells and brought to a stripping unit where the metal coating is separated from the main surfaces of the cathode plates by blades or knives in relative movement with the interface between the cathode plate and the metal coating. The refined metal is recovered in the shape of sheets and is conveyed away for further processing, while the scraped electrode plates are removed, their surfaces cleaned and are returned to the electrodeposition unit.

[0005] In US 1,553,080 of 1921, a coated plate is lifted out of an electrolytic cell and as it is being lifted is engaged in a stripping device comprising fixed blades. The relative movement of the raising cathode and the fixed knives causes the removal of the metal deposit from the surface of the cathode. In most techniques, however, the relative movement of the stripping blades and the interface between the cathode and the metal coating consists of mobile blades running over the surface of a fixed cathode (cf. e.g., US 4,806,21 3).

[0006] US 3,996,127 discloses an apparatus wherein a plurality of coated cathode plates are conveyed to a stripping unit in a conveying line wherein the plates are hung side by side, forming a garland. Although this equipment allows the coated cathode plates to be delivered to the stripping unit in an automated step-by-step process, the side-by-side arrangement of the cathodes is not compatible with today's productivity requirements and space restrictions. For these reasons, most stripping apparatuses comprise a conveyor wherein the coated cathodes are arranged in a face-to-face relationship instead.

[0007] in JP 3138388, JP 5501 8584, and JP 62224694, apparatuses are disclosed wherein the metal coating of a plurality of coated cathode plates arranged in a face-to-face relationship are simultaneously stripped by a corresponding number of stripping blades. This batch process is interesting but is complex and expensive as it requires the movement of a plurality of stripping blades to be coordinated. Yet another apparatus is disclosed in WO 02/097170 wherein the stripping is carried out in two steps: a first lateral stripping followed by a second, vertical scraping step. The former lateral stripping is carried out while the cathode is still hanging on the conveying line. Although the plates are arranged in a face-to-face relationship in all these apparatuses, they must be separated from one another by a distance sufficient to allow the insertion of the stripping blades in between. In order to increase the number of plates being conveyed to the stripping unit, and hence reduce the size of the line, many apparatuses comprise a supply line where the coated cathode plates are arranged in a close packed face-to-face arrangement and further comprise a transfer device to transfer individual plates from the

supply line to the stripping unit.

[0008] In order to transfer coated cathode plates one by one to the stripping unit various systems were proposed. Individual feeding systems comprising a bars and pistons mechanism allowing individual plates to be transferred from the conveyor to the stripping unit are described in US 3,625,806, US 3,847,779 and EP 470,033. These systems, however, are rather complex and may suffer from fatigue problems due to the repetitive reciprocating motions they are subjected to. Furthermore, they are rather slow, since several components must move back and forth in perfect coordination to feed a first cathode plate to the stripping unit and to catch the next one from the conveyor.

[0009] Alternative to the bars and pistons feeding mechanisms, US 3,689,396 describes a first step-by-step conveyor in connection with a second, continuous conveyor to convey individual plates from the first conveyor to the stripping unit. As an alternative thereto, a carousel loading individual cathode plates from the conveyor to various processing stations were proposed in EP 482,258. The rotating axis of the carousel in this document is substantially vertical, and the stripping operation requires several stages which are too long according to today's standards.

[0010] There thus remains a need in the art for stripping apparatuses which are quick, durable, reliable, and compact.

Summary of the invention

[0011] The present invention is defined in the appended independent claims. Preferred embodiments are defined in the dependent claims. The present invention provides a novel apparatus for removing an electrodeposited metal layer from a cathode plate comprising:

(a) a feeding zone comprising a conveyor to convey coated cathode plates arranged in a face to face relationship to,
(b) a metal stripping unit wherein the electrodeposited metal is stripped off the two main surfaces of the cathode plates with two knives; and
(c) a discharge zone wherein the stripped cathode plates are conveyed away in a face to face arrangement for further handling, and further comprising,
(d) a carousel with a substantially horizontal axis of rotation comprising engaging means such that:

(i) in a first position, first engaging means face the end of the conveyor feeding line so as to pivotally engage the first coated cathode plate present on said line;
(ii) In a second position, the engaged first cathode is brought into position in the stripping unit by rotation of the carousel, whilst a second coated cathode is engaged into the next engaging means of the carousel; and
(iii) In a third position the stripped first cathode plate is discharged onto the discharge zone by further rotation of the carousel whilst the second cathode is brought into position in the stripping unit and a third coated cathode is engaged in the next engaging means facing the conveyor feeding line.

[0012] It also concerns a process for removing an electrodeposited metal layer from a cathode plate comprising the following steps:

(e) feeding coated cathode plates arranged in a face to face relationship to a carousel having an axis of rotation substantially horizontal.;
(f) loading a first coated cathode plate onto the carousel and bringing it to a metal stripping unit by rotation of the carousel, whilst a second coated cathode is loaded onto the carousel
(g) stripping the electrodeposited metal off the two main surfaces of the first cathode plate present in the stripping unit by driving two knives (8) down the interface between the cathode plate and the metal coating (6b);
(h) recovering the stripped metal sheet in a receiving unit for conveying it away for further handling; and
(i) bringing the stripped first cathode plate to a discharge zone by further rotation of the carousel, which simultaneously drives the second coated cathode plate to the stripping unit and loads a third coated cathode plate onto the carousel.

[0013] The major difference between the present invention and the known apparatuses is that the coated cathodes are fed individually to the stripping unit by a carousel having a substantially horizontal axis of rotation. This has several advantages. First the carousel always rotates in the same direction which ensures smoother and quicker operations as well as more durability than systems comprising reciprocating parts, which are subject to fatigue failures. Second, the present invention is compact since the coated cathode plates are conveyed in a close packed arrangement prior to being fed to the stripping unit, and the carousel width is substantially flush with the rest of the apparatus and occupies little area on the floor compared with a carousel rotating around a vertical axis as in EP 482,258. Third, with the appropriate stripping device as defined below, the stripping process can be shortened by reducing the number of movements required to complete this task. In particular, a stripping device particularly suitable for removing an electrodeposited metal layer from a cathode plate comprises:

(a) a scissor-like frame comprising two reciprocating members pivotally connected to a central member;
(b) a pair of stripping knives mounted at one end of each reciprocating member at a distance from the connection point thereof to the central member at

least equal to the height of the cathode plate to be stripped;
(c) first driving means to open and close the scissor-like frame, and thus to drive apart and closer together the knives, respectively; and
(d) second driving means for driving the whole scissor-like frame down and up again, over a distance at least equal to the height of the cathode plate to be stripped.

[0014] An apparatus according to the present invention further comprising a stripping device as described above is preferred and is particularly advantageous because it allows the stripping cycle to be completed with a total of five moves: (1) first rotation of the carousel to bring the coated cathode into position; (2) closing of the scissor-like frame to bring the stripping knives into contact with the top of the cathode; (3) driving the knives down along the interface between the metal coating and the cathode plate to remove the metal sheet; (4) driving the knives up again and open the scissor like frame; and (5) with a second rotation of the carousel bring the uncoated cathode plate to a discharge zone. As this happens, the next coated cathode plate is already in position at the stripping unit, ready to undergo steps (2)-(5) again. The total stripping cycle (1)-(5) for one cathode can be as short as less than 7 s, preferably less than 5 s, and most preferably, less than 4 s.

Brief description of the Figures

[0015]

Figure 1: side view of a preferred stripping apparatus at a first stage, wherein a first cathode plate on the conveyor is engaged onto the carousel;

Figure 2: side view of a preferred stripping apparatus at a second stage, wherein the first cathode plate on the conveyor is being driven to the stripping unit by rotation of the carousel, and the scissor-like frame is open;

Figure 3: side view of a preferred stripping apparatus at a third stage, wherein the first cathode plate is at the stripping unit, the scissor-like frame is closed and the stripping knives in contact with the main surfaces of the cathode;

Figure 4: side view of a preferred stripping apparatus at a fourth stage, wherein the stripping knives are driven down along the interface between the cathode and the metal coating thus separating it from the cathode surfaces;

Figure 5: side view of a preferred stripping apparatus at a fifth stage, wherein the stripping knives are driven up again and the stripped metal sheet is collected by the guiding means;

Figure 6: front view of a preferred stripping apparatus at said third stage.

Detailed description of the invention

[0016] The stripping apparatus of the present invention comprises four main sections: (a) a conveyor (10), (b) a stripping unit (11), (c) a receiving unit (14) for receiving the stripped metal sheets, and (d) a discharge conveyor for bringing the cathode plates to further processing (e.g., the surface of plates can be cleaned for further immersion into an electrolytic cell and start the cycle again).

(a) conveyor (10)

[0017] The function of the conveyor (10) is to bring the coated cathode plates from out of the electrolytic bath to the stripping unit. For reasons of space economy the conveyor brings the plates in a close packed arrangement. According to the present invention, the cathode plates are arranged on the conveyor in a face-to-face arrangement. They may be fixed to the conveying line by any means known in the art. For example, they can be hung to a single or a pair of chain or rail conveyors. The electrodes may be fixed to a support comprising fixing means to the conveyor, or the fixing means can be integral to the cathode plates, without any external support frame. The conveyor drives the cathode plates step-by-step towards the stripping unit. The downstream side of the conveyor transfers the first cathode plate (62) present onto the carousel (7) of the stripping unit. In this context, the step-by-step frequency of the conveyor is in phase with the step-by-step rotation of the carousel as defined below.

(b) stripping unit

[0018] The stripping unit comprises a carousel (7) for bringing each cathode plate one by one to its stripping position and a pair of knives run through the whole interface between the cathode plate and the metal coating. The carousel (7) rotates over a substantially horizontal axis which is located not higher than the conveyor line. Preferably, the conveyor line is at a level comprised between the horizontal axis of rotation of the carousel and its top ridge as illustrated in the Figures. The conveyor line connects with engaging means, such as a pair of slots (1) of the carousel (7) to transfer and pivotally hang a coated cathode plate (62) thereto as illustrated in Figure 1. In this position of the carousel, the next slot (2) downstream of slot (1) is in stripping position: Figure 1 shows a cathode plate (61) after stripping. Upon a first rotation of the carousel (7) the coated cathode plate (62) loaded on pair of slots (1) is brought into stripping position within

range of the stripping knives, whilst at the same time the cathode plate (61) which was stripped before is driven onto the discharge line (12) and the next coated cathode plate (63) is being transferred from the conveyor (11) to the pair of slots (5).

[0019] At this stage it is preferred to clamp the carousel into position with clamping means (13) to ensure that the system remains stable during the stripping operation. In Figure 3, clamping means (13) are illustrated as connecting with slots (3) and (4) located below the axis of rotation of the carousel, but any clamping system preventing carousel (7) from rotating can be used instead. The carousel could also be clamped through the motor controlling its rotation, but this solution requires the use of powerful motors which add to the cost of the apparatus.

[0020] Once in stripping position, a pair of stripping knives (8) is brought into contact with the two main surfaces of the cathode, at a level located above the coating line. In this respect, according to the present invention, the knives (8) are mounted at the end of long arms (20) connecting to form a scissor-like frame, said arms being long enough to allow the knives to be run from the top to the bottom of the cathode plate.

[0021] In operation, the scissor-like frame (20) is open during rotation of the carousel (7) to give clearance to the coming coated (62) and to the departing stripped cathode plates (61) as illustrated in Figure 2. Once the cathode plate is in stripping position and the carousel is preferably clamped into position, the scissor-like frame closes its arms thus bringing the knives (8) into contact with the uncoated top section of the cathode plate (cf. Figure 3). The scissor-like frame is then driven down to run the knives through the interface between the metal coating and the cathode plate (cf. Figure 4). In order to ease the stripping work of the knives, a wedge like tool (31) can be positioned ahead of the knives to initiate a crack at the interface and allow the knives to run into this crack (cf. Figure 6).

[0022] When the coated metal sheet is detached from the cathode plate it falls down and is recovered by guiding means (14) which gently guide the metal sheet to a receiving unit for conveying it for further handling. At this point the scissor-like frame (20) is driven up again until the knives reach their starting position (cf. Figure 5) and is then opened to give clearance to the departing cathode plate which has just been stripped and for the coming coated cathode plate (63) upon further rotation of the carousel (after removal of the clamping means (13), if it applies).

[0023] Stripping devices of other types can be conveniently used with the stripping apparatus of the present invention, but the one described above, with the knives mounted at the end of a scissor-like frame is particularly preferred as it allows to substantially reduce the size of the equipment and reduce the number of knives movements required to carry out the stripping operation: closing the scissor-like frame, driving it down, driving it up, and opening the scissor-like frame. Such economy of movements allows the control unit to be simpler and saves a lot of time. The time required for one stripping cycle with the apparatus of the present invention is estimated between 3 and 7 s, preferably between 3 and 6 s, most preferably between 3 and 5 s, leading to stripping cycle time reductions of up to 70% with respect to existing stripping lines.

[0024] Figure 6 illustrates a front view of the stripping unit showing cathode plates (62) and (61) hanging on the carousel (7), the former at its stripping position and the latter at its transfer position onto the discharge zone (12). The carousel's rotation is driven by motor (30). The knives (8) are shown in stripping position, contacting the uncoated top section of the cathode plate (62). It can be appreciated from Figure 5 that the alignment of the cathode plate (62) to be stripped and the stripping knives (8) is critical for the stripping operation. For this reason it may be advantageous to provide the carousel with alignment means (1 5) for bringing the cathode in alignment with the stripping knives (8) as the cathode is driven to the stripping unit (11). A simple and efficient alignment means (15) consists of curved handles positioned in the inner side of the carousel's walls, vis-à-vis each slot and such that a cathode (62) loaded on a pair of slots (5) is progressively and smoothly being aligned as it pivots around its hanging hinges upon rotation of the carousel (7) until it reaches its stripping position in stripping unit (11). Other alignment means can be used, but this is so simple and flawless that it is particularly preferred.

(c) Receiving unit (14)

[0025] The coating sheets (6b) are made of purified metal which is usually very ductile and can weigh a couple of hundreds of kilograms. As the stripping knives (8) run down along the coating-cathode interface the metal sheet (6b) detaches itself from its support (6a) and eventually falls down. The receiving unit (14) serves to ensure that the falling metal sheet (6b) does not crash and crumple under the impact. Several types of receiving units exist in the market as for instance the ones described in US2007/0272561 or in US 3,625,806, and can be conveniently used in the present invention. As an alternative, a receiving unit (14) comprising a series of wheels facing each other and mounted with rubber tyres to damp the impact. The series of wheels are so arranged as to bring the falling metal sheet (6b) from a substantially vertical position as it falls to a horizontal one as it is laid down onto a conveying belt or any other receiving element. Usually a number of sheets are stacked on said receiving element before being conveyed away for further processing.

[0026] When stripped off the cathode surfaces (6a), a metal sheet (6b) is folded in two, the folding line corresponding to the bottom edge of the cathode which was immersed in an electrolytic cell. If all the folded metal sheets are stacked with the folding line on the same side, the pile will tilt on one side and will be unstable. In order

to increase the stability of a stack of metal sheets, it is preferred that the arrangement of the series of wheels is suitable for laying the metal sheets onto the receiving element with their folding lines with alternating orientations. This can be achieved by disposing a first series of facing wheels in alignment with the hanging cathode to catch the falling metal sheet and a second series of facing wheels alternatingly guiding the metal sheets so as to lay them onto the receiving element once with the folding line positioned upstream and next with the folding line positioned downstream with respect to the direction of motion of the line for each new falling sheet. In particular, the second series of facing wheels may be mounted on a carriage, itself pivotally mounted below the first series of wheels. By oscillating said carriage with each new metal sheet, the folding line thereof is led downstream or upstream to achieve the desired effect.

(d) discharge zone (12)

[0027] The discharge line (12) is located downstream of the carousel (7) and is adapted to receive the stripped cathode plates being evacuated from their stripping position. The discharge zone comprises a conveyor similar to the one described in point (a) supra. Similarly the stripped cathodes are conveyed away step-by-step from the carousel for further handling. Generally the surfaces of the cathode plates are treated and then the plates are brought back to the electrolytic cells for further electrolytic metal deposition.

Claims

1. Apparatus for removing an electrodeposited metal layer (6b) from a cathode plate (6a) comprising:

   (a) a feeding zone (10) comprising a conveyor feeding line (14) to convey coated cathode plates (62) arranged in a face to face relationship to,
   (b) a metal stripping unit (11) wherein the electrodeposited metal (6b) is stripped off the two main surfaces of the cathode plates (6a) with two knives (8); and
   (c) a discharge zone (12) wherein the stripped cathode plates are conveyed away in a face to face arrangement for further handling,
   characterized in that, it further comprises
   (d) a carousel (7) with a substantially horizontal axis of rotation comprising engaging means (1)-(5) such that:

      (i) in a first position, first engaging means (1) face the end of the conveyor feeding line so as to pivotally engage the first coated cathode plate (62) present on said line;
      (ii) In a second position, the engaged first cathode (62) is brought into position in the stripping unit (11) by rotation of the carousel (7), whilst a second coated cathode (61) is engaged into the next engaging means (5) of the carousel; and
      (iii) In a third position the stripped first cathode plate (62) is discharged onto the discharge zone (12) by further rotation of the carousel whilst the second cathode (61) is brought into position in the stripping unit (11) and a third coated cathode is engaged in the next engaging means (4) facing the conveyor feeding line.

2. Apparatus according to claim 1, wherein the stripping unit (11) comprises:

   (e) a scissor-like frame on which are mounted the knives (8) and comprising:

      (i) closing means (23-25) for closing the scissor-like frame (20) to bring the knives (8) into contact with the two main surfaces of the cathode in position in the stripping unit (11); and
      (ii) driving means for driving the scissor-like frame downwards to strip the deposited metal (6b) off the cathode (6a) with the knives (8).

3. Apparatus according to any of the preceding claims, further comprising guiding means (14) located below the stripping unit (11) for guiding the stripped metal sheets (6b) to a receiving unit for conveying them away for further handling.

4. Apparatus according to the preceding claim, wherein the guiding means comprise at least one pair of rotatably mounted wheels and so separated as to accommodate therebetween a stripped metal sheet (6b) falling from the stripping unit.

5. Apparatus according to any of the preceding claims, wherein the carousel comprises clamping means (13) to firmly hold the cathode in position in the stripping unit (11).

6. Apparatus according to any of the preceding claims, wherein each pair of means (1-5) of the carousel is provided with alignment means (15) for bringing the cathode in alignment with the stripping knives (8) as the cathode is driven to the stripping unit (11).

7. Apparatus according to the preceding claim wherein the alignment means (15) consist of curved handles positioned in the inner side of the carousel's walls, vis-à-vis each engaging means and such that a cathode (62) loaded on one set of engaging means (5)

is progressively being aligned as it pivots around an axis parallel to the axis of rotation of the rotating carousel (7) until it reaches its stripping position in stripping unit (11).

8. Process for removing an electrodeposited metal layer (6b) from a cathode plate (6a) comprising the following steps:

(a) feeding coated cathode plates arranged in a face to face relationship from an electrolytic deposition unit to a carousel (7) having an axis of rotation substantially horizontal.;
(b) loading a first coated cathode plate (62) onto the carousel (7) and bringing it to a metal stripping unit (11) by rotation of the carousel, whilst a second coated cathode (61) is loaded onto the carousel (7);
(c) stripping the electrodeposited metal (6b) off the two main surfaces of the first cathode plate (6a) present in the stripping unit (11) by driving two knives (8) down the interface between the cathode plate (6a) and the metal coating (6b);
(d) recovering the stripped metal sheet (6b) in a receiving unit for conveying it away for further handling; and
(e) bringing the stripped first cathode plate (62) to a discharge zone (12) by further rotation of the carousel (7), which simultaneously drives the second coated cathode plate (61) to the stripping unit (11) and loads a third coated cathode plate (63) onto the carousel.

9. Process according to claim 8 wherein the stripping step comprises:

- bringing the knives (8) into contact with the top of the two main surfaces of the cathode plate (62) by closing a scissor-like frame (20) located on top of the plate and on which the knives (8) are mounted; and
- driving the knives downward along the interface between the cathode plate (6a) and the metal sheet (6b).

10. Process according to claim 8 or 9, wherein the recovering step comprises guiding the stripped metal sheet (6b) falling from the stripping unit (11) with guiding means (14) to a receiving unit for conveying it away for further handling.

11. Process according to any of claims 8 to 10, wherein the cathodes simultaneously and progressively pivot around an axis parallel to the axis of rotation of the carousel and are aligned with respect to the position of the knives as the carousel rotates between the loading zone (10) and the stripping unit (11).

12. Process according to any of claims 8 to 11, wherein the carousel is clamped into position prior to the stripping step when a coated cathode plate (62) is in position in the stripping unit (11).

13. Process according to any of claims 9 to 12, wherein the stripping step comprises the following steps:

- the scissor-like frame (20) holding the knives (8) is in an open position while the carousel rotates to bring a coated cathode plate (62) to the stripping unit (11) such that the knives leave enough clearance for the cathode plate to pass from the conveyor feeding line (14) to the stripping position;
- once the cathode plate (62) is in position in the stripping unit, the carousel is clamped into position and the scissor-like frame (20) is closed to bring the knives (8) into contact with the surface of the cathode plate (6a);
- the metal coating (6b) is stripped off the plate by driving the frame (20) down so that the knives (8) run down along the interface between the coating (6b) and the cathode plate (6b), falls into the guiding means (14) and is led to a receiving unit.

14. Stripping device suitable for removing an electrodeposited metal layer (6b) from a cathode plate (6a) comprising:

(a) a scissor-like frame comprising two reciprocating members (20) pivotally connected to a central member (21);
(b) a pair of stripping knives (8) mounted at one end of each reciprocating member (20) at a distance from the connection point (22) thereof to the central member (21) at least equal to the height of the cathode plate to be stripped;
(c) first driving means to open and close the scissor-like frame, and thus to drive apart and closer together the knives, respectively; and
(d) second driving means for driving the whole scissor-like frame down and up again, over a distance at least equal to the height of the cathode plate to be stripped.

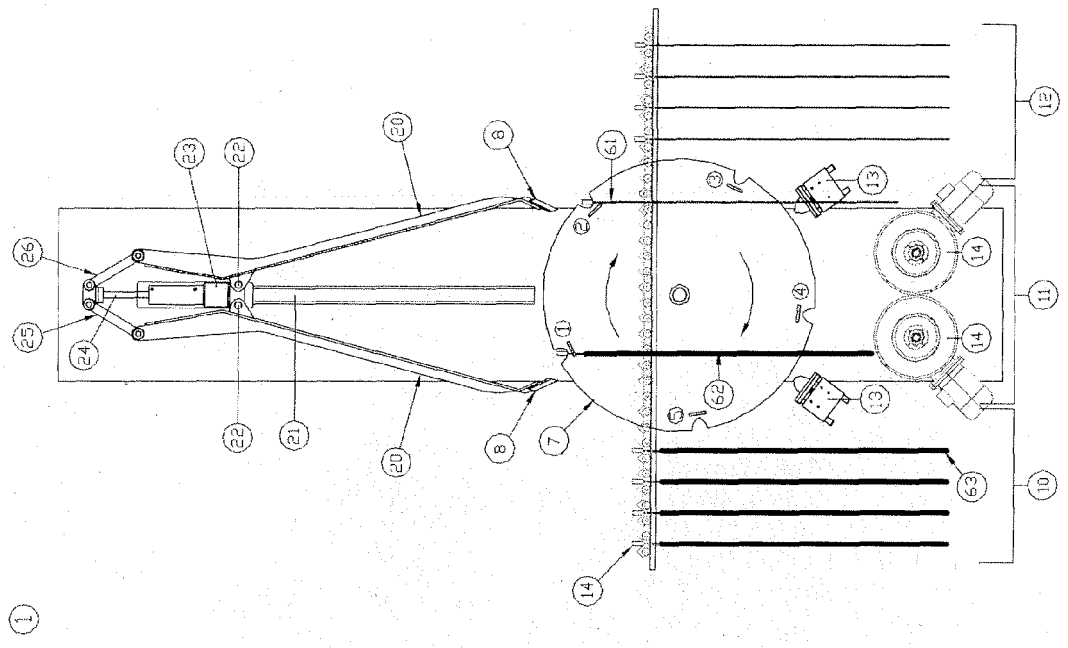

Figure 2

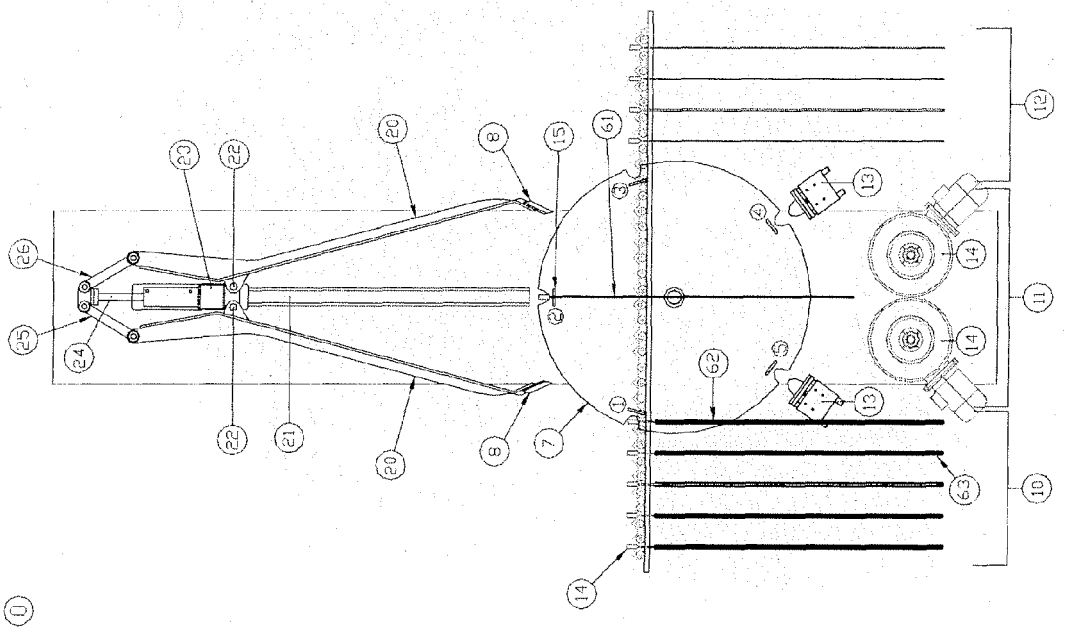

Figure 1

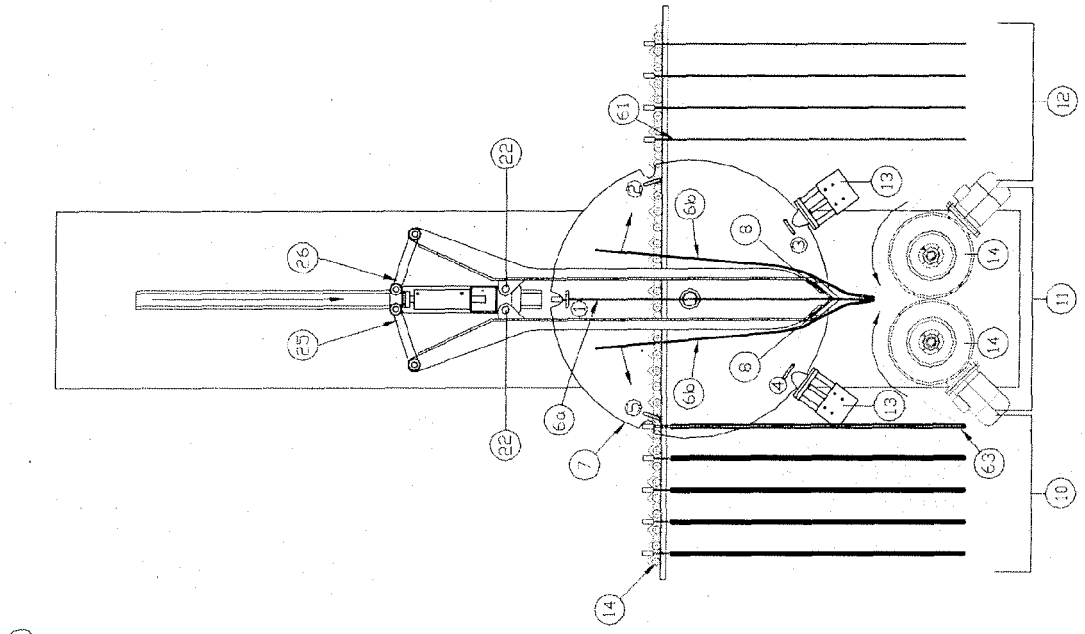

Figure 4

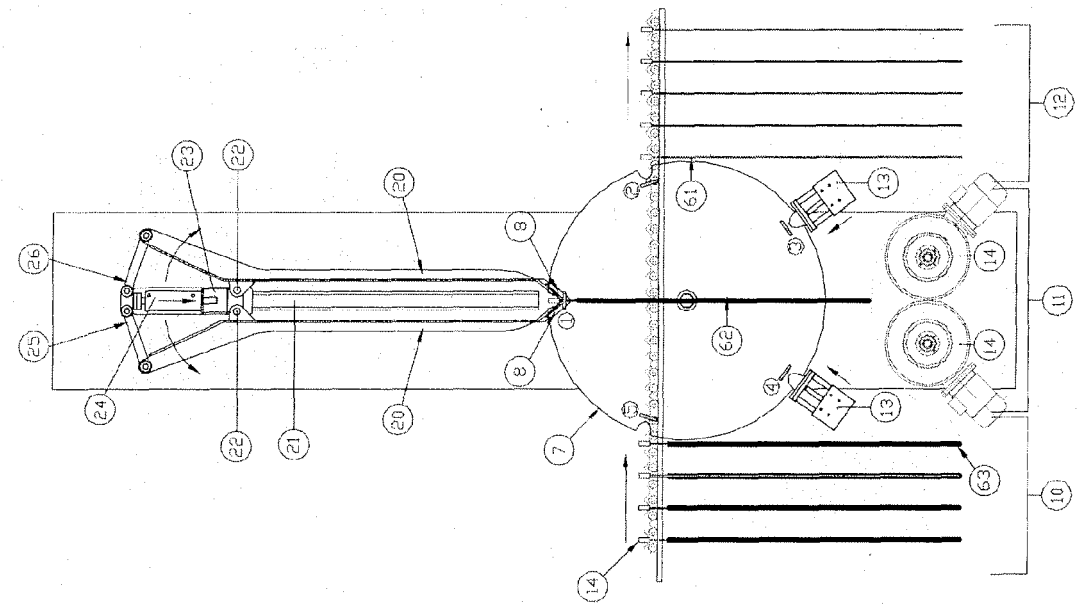

Figure 3

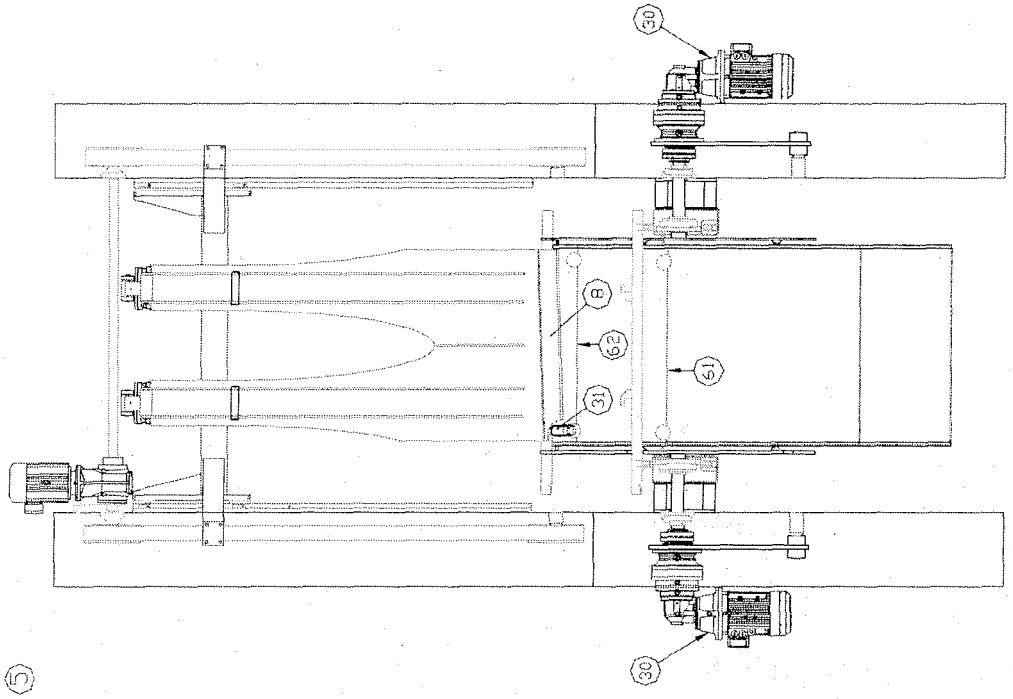

Figure 6

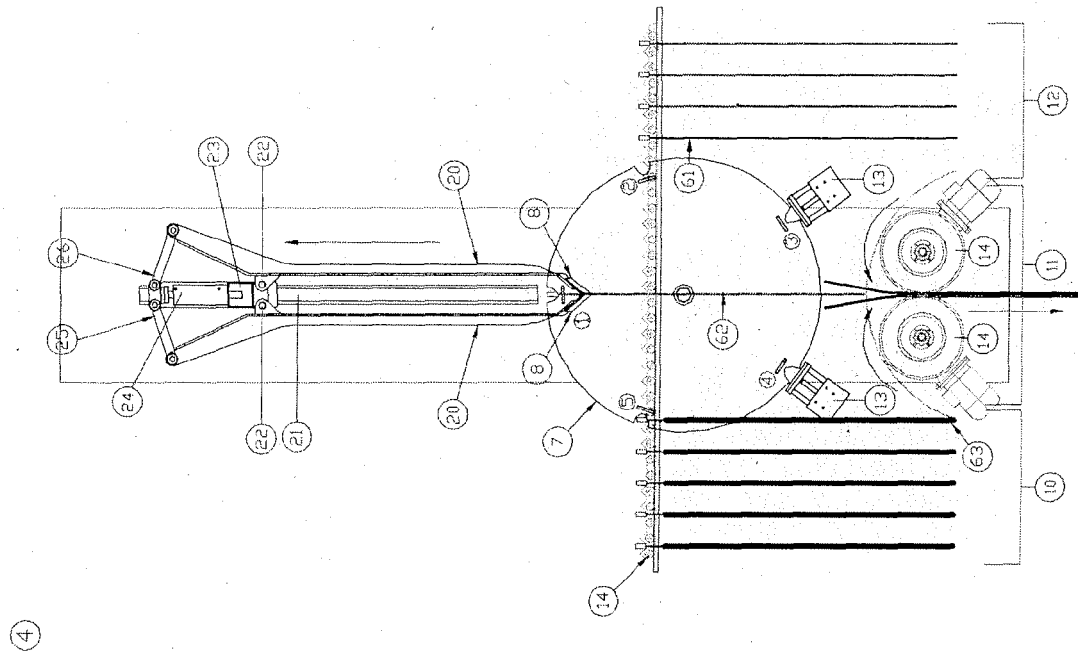

Figure 5

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EUROPEAN SEARCH REPORT

Application Number
EP 08 15 9745

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
D,A	EP 0 482 258 A (FALCONBRIDGE LTD [CA]) 29 April 1992 (1992-04-29) * column 1, line 34 - column 2, line 23; figures 1,11-13 * * column 7, lines 34-52 *	1-13	INV. C25C7/08
A	US 4 209 379 A (FREEMAN GEORGE M [CA] ET AL) 24 June 1980 (1980-06-24) * claim 1 *	1-13	
A	US 2007/272561 A1 (MORNHOLM BENGT [SE]) 29 November 2007 (2007-11-29) * abstract; figure 1 * * paragraphs [0017] - [0019] *	2-4,10	
			TECHNICAL FIELDS SEARCHED (IPC)
			C25C

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	3 December 2008	Hammerstein, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 08 15 9745

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-13

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 08 15 9745

The Search Division considers that the present European patentapplication does not comply with the requirements of unity of invention and relates to severalinventions or groups of inventions, namely:

1. claims: 1-13

Claims 1-13 are directed towards an apparatus and a method for removing an electrodeposited metal layer from a cathode plate, comprising a conveyor feeding line, a carousel for transporting the cathode plates to various positions, and a stripping unit comprising two knives for stripping the metal off the two surfaces of each cathode.

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2. claim: 14

Claim 14 is directed towards a stripping device for removing an electrodeposited metal layer from a cathode plate, comprising a scissor-like frame and a pair of stripping knives mounted thereon, as well as driving means operating the frame.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 15 9745

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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03-12-2008

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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