

(19)



Europäisches
Patentamt
European
Patent Office
Office européen
des brevets



(11)

EP 3 438 329 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
06.02.2019 Bulletin 2019/06

(51) Int Cl.:
C25C 7/08 (2006.01)

(21) Application number: **16891324.2**

(86) International application number:
PCT/ES2016/070125

(22) Date of filing: **25.02.2016**

(87) International publication number:
WO 2017/144740 (31.08.2017 Gazette 2017/35)

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **Lefevre, Yves
33202 Gijón (Asturias) (ES)**

(72) Inventor: **Lefevre, Yves
33202 Gijón (Asturias) (ES)**

(74) Representative: **Herrero & Asociados, S.L.
Cedaceros, 1
28014 Madrid (ES)**

(54) CATHODE STRIPPING MACHINE

(57) A cathode stripping machine (3) comprising a first operating level (1) comprising an infeed mechanism (4) of the cathodes (5) to the machine, a first transfer mechanism (8.1) for transferring said cathodes inside the machine, a treatment mechanism with a stripping head having two stripping frames (7), each acting on one cathode simultaneously, a second transfer mechanism (8.2) for transferring the cathodes, and an outfeed mechanism

(9) of the sheets.

The machine further comprises a second reception level (2) located below the first level, comprising, for each of the resulting sheets, a sheet reception system (10), a conveyor belt (11), and a sheet removal station (12), as well as a shared collection and weighing table (13) with rollers for both sheets.

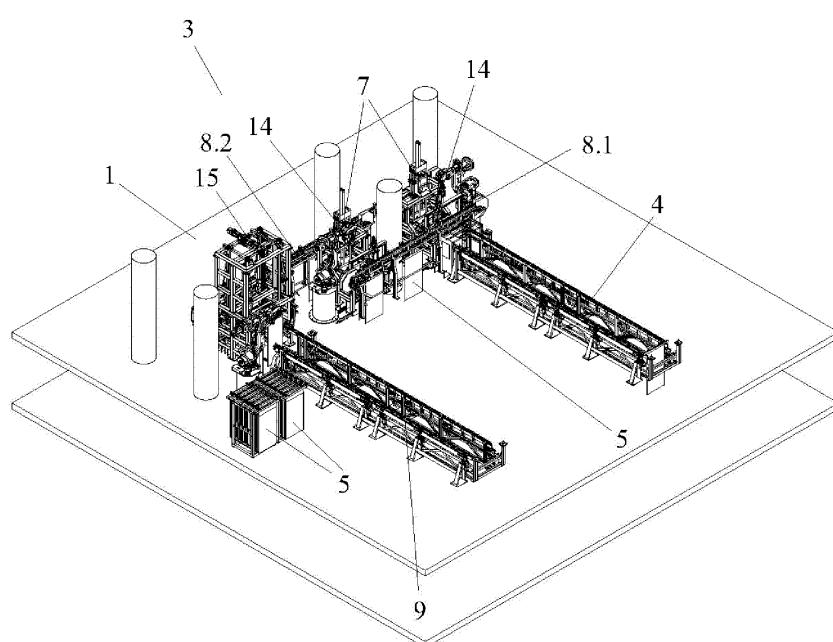


Fig. 1

Description**Technical field of the invention**

[0001] The present invention corresponds to the technical field of cathode stripping machines, which are necessary for separating the metal sheets obtained by electrolysis on said cathodes.

Background of the invention

[0002] There are metals that are in very high demand, which are obtained by an electrolysis process that causes the metal sought to be deposited on cathodes submerged in a specific solution. These cathodes tend to have a square or rectangular shape.

[0003] Once the material sought has been deposited forming a coating sheet or layer on the two faces of each of the cathodes submerged in the solution, said sheets must be removed from the cathodes. Initially this operation was carried out manually, resulting in a process that requires the intervention of labor intensive work and is slow and laborious, both due to the separating operation and due to the fact that it must be carried out on each cathode individually.

[0004] Currently, these aspects have greatly improved mainly due to the existence of machines that reduce the work and streamline the process.

[0005] However, they still have certain drawbacks due to the way in which the sheets are stripped with respect to the faces of the cathodes and that they are still fairly slow processes. Some of the forms of separation that were used consisted of striking the assembly with pneumatic hammers, which in addition to being very acoustically disruptive, after a short period of time the cathodes begin to show deformations due to the strikes.

[0006] The reference documents ES0372891 and ES2005673 can be mentioned as examples of the state of the art.

[0007] The first reference document ES0372891 relates to a hydraulic method for stripping the zinc deposited on the cathodes for the electrolytically obtaining the same, wherein once the cathodes are removed from the tank, each one of the faces thereof is subjected to a high-pressure water jet directed such that it impacts on the separation line between the aluminum sheet and the zinc deposited thereon, with a specific angle to cause the zinc to detach.

[0008] This method offers an alternative mode that prevents the surfaces of the cathodes from being damaged, but it is still slow since the separation is carried out on each cathode individually, and the cathodes and the pressurized water injectors must be accurately levelled so that the water accurately impacts on the waterline thereof and not elsewhere, since any small variation, due to the evaporation in the electrolysis tanks for example, would mean that the application of the water jet would not fulfil its purpose.

[0009] The reference document ES2005673 relates to a method for stripping electrolytically deposited copper from a cathode, wherein said cathode is subjected to bending stress at a magnitude greater than the adhesion strength between the deposited copper and the cathode, but without exceeding the yield strength thereof, thus making at least part of the copper deposited separate from the cathode, and the deposited copper can then be stripped, by means of a wedge or gas jet.

[0010] Again, it is a method that does not achieve high levels of production since each cathode must be treated individually with the gas jet or with a wedge and the cathodes must also be previously bent, which increases the time used and over time, the cathodes can break due to fatigue.

Description of the invention

[0011] The cathode stripping machine, which has a sheet-shaped metal deposit on each one of the two opposite faces thereof shown here, comprises a first operating level and a second reception level located below the first level.

[0012] The first operating level comprises an infeed mechanism of the cathodes, a first transfer mechanism for transferring said cathodes inside the machine, a treatment mechanism with a stripping head having two stripping frames, each acting on one cathode simultaneously, a second transfer mechanism for transferring the cathodes, and an outfeed mechanism of the cathodes without sheets.

[0013] In turn, the second level comprises for each of the resulting sheets, a sheet reception system, a conveyor belt, and a sheet removal station, as well as a shared collection and weighing table with rollers for both sheets.

[0014] In a preferred embodiment, the cathode reception mechanism of the first level comprises a parallel beam system, where a first beam is fixed and second beam is walking, the movement of which in a vertical direction is caused by a hydraulically actuated pivoting pusher assembly and the movement in a horizontal direction is caused by a synchronized double hydraulic cylinder assembly between them by means of a hydromechanical flow divider.

[0015] In accordance with a preferred embodiment, the first transfer mechanism for transferring the cathodes to the stripping mechanism is formed by an aerial chain conveyor and the second transfer mechanism for transferring the cathodes is formed by an aerial twin cable conveyor.

[0016] According to a preferred embodiment, each one of the two stripping frames of the treatment mechanism of the first level comprises cathode washing means, formed by a series of water manifolds with spray nozzles fastened to the stripping head.

[0017] Likewise, and in accordance with a preferred embodiment, each stripping frame of the treatment

mechanism of the first level comprises first advance means of the cathodes along the stripping head, formed in each case by a walking beam mechanism actuated hydraulically that has an anti-sway system.

[0018] In accordance with another aspect, in a preferred embodiment, the treatment mechanism comprises a guided blade system for each one of the stripping frames of the cathodes, wherein said blade system is secured to the stripping head.

[0019] According to a preferred embodiment, the treatment mechanism comprises pre-stripping means for each stripping frame formed by a robot with a blade for each cathode.

[0020] In this case, and in a preferred embodiment, the treatment mechanism comprises pre-stripping starting means that have a frame with movable cutting means.

[0021] Moreover, said pre-stripping starting means are suitable for checking the level of adhesion between the cathode and the sheet thereon.

[0022] According to a preferred embodiment, the first operation level of this cathode stripping machine comprises a scrubbing frame located downstream from the second transfer mechanism and is formed by two scrubbing mechanisms, one for each one of the cathodes processed simultaneously.

[0023] Each one of said scrubbing mechanisms supports a scrubbing device and second advance means responsible for taking each cathode from the second transfer mechanism through the scrubbing frame and to the outfeed mechanism, wherein said second advance means are formed by a walking beam.

[0024] In this case and in a preferred embodiment, the scrubbing device comprises a lifting mechanism formed by a mobile trolley guided by means of vertical rails, a sub-assembly of brushes fixed to connecting rods and, an irrigation system formed by a series of manifolds provided with spray nozzles.

[0025] In accordance with a preferred embodiment, the sheet reception system of the second level comprises a damping system of said sheets formed by a hatch actuated by means of pneumatic bellows and a sheet accompanying system.

[0026] In this case and according to a preferred embodiment, the sheet reception system comprises two pairs of wheels downstream of the damping system actuated by means of electric geared motors in order to control the drop speed of the sheets.

[0027] In a preferred embodiment, the sheet removal station comprises a fixed reception frame, a reception robot and a guide device.

[0028] The stripping machine that is presented herein significantly improves upon the state of the art.

[0029] This is because the two cathodes are acted upon simultaneously, which means that the process time is considerably reduced.

[0030] In addition, the shape in which the machine is designed has a perfect control over the steps to be carried out, both for each pair of cathodes and for the sheets that

detach therefrom. This is controlled through two, perfectly synchronized, levels of the machines that reduce the time used in stripping the cathodes and significantly increases the productivity of the machine.

[0031] In addition, the stripping is carried out with blades and a pre-stripping is carried out beforehand and a pre-stripping initiator, such that the sheets of the surfaces of the cathodes are separated without causing any damage or scratches thereon.

10 Brief description of the drawings

[0032] For the purpose of helping to make the characteristics of the invention more readily understandable, in accordance with a preferred practical embodiment thereof, said description is accompanied by a set of drawings constituting an integral part thereof which, by way of illustration and not limitation, represent the following:

20 Figure 1 shows a perspective view of the upper level of the cathode stripping machine, for a preferred embodiment of the invention.

Figure 2 shows a plan view of the upper level of the cathode stripping machine, for a preferred embodiment of the invention.

25 Figure 3 shows an elevation view of the cathode stripping machine, for a preferred embodiment of the invention.

Figure 4 shows a profile view of the cathode stripping machine, for a preferred embodiment of the invention.

30 Figure 5 shows a perspective view of the stripping mechanism of the cathode stripping machine, for a preferred embodiment of the invention.

Figure 6 shows a cross section of the blades of the stripping mechanism of the cathode stripping machine, for a preferred embodiment of the invention.

40 Detailed description of a preferred embodiment of the invention

[0033] In light of the figures provided, it can be seen how in a preferred embodiment of the invention, the cathode 5 stripping machine 3, which cathodes have a metal deposit in the form of a sheet on each one of the two opposite faces thereof that is presented herein, comprises a first operating level 1 and a second reception level 2 located below said first level 1. In this case, a machine with aluminum cathodes on which a sheet of zinc accumulates due to electrolysis is considered.

[0034] As shown in figures 1 to 4, the first operating level 1 comprising an infeed mechanism 4 of the cathodes 5 to the machine, a first transfer mechanism 8.1 for transferring said cathodes inside the machine, a treatment mechanism with a stripping head having two stripping frames 7, each acting on one cathode simultaneously, a second transfer mechanism 8.2 for transferring the cathodes, and an outfeed mechanism 9 of the cath-

odes without zinc sheets.

[0035] Likewise, as can be seen in figures 3 and 4, the second level 2 comprises for each of the resulting sheets, a sheet reception system 10, a conveyor belt 11, and a sheet removal station 12, as well as a shared collection and weighing table 13 with rollers for both sheets.

[0036] A crane is responsible for depositing the cathodes 5 in the infeed mechanism 4 thereof in the machine. In this preferred embodiment of the invention, said infeed mechanism 4 of the cathodes of the first level 1 comprises a parallel beam system, with a first fixed beam and a second walking beam. The movement of this second walking beam is caused in a vertical direction by a hydraulically actuated pivoting pusher assembly, while in a horizontal direction it is caused by a synchronized double hydraulic cylinder assembly between them by means of a hydromechanical flow divider.

[0037] Downstream of the infeed mechanism 4 of the cathodes, in this preferred embodiment of the invention, there is the first transfer mechanism 8.1 for transferring the same to the treatment mechanism. This first transfer mechanism 8.1 is formed by an aerial cable conveyor. Its purpose is to move the cathodes 5 from the alignment of the infeed mechanism 4 to the alignment of the stripping head.

[0038] The treatment mechanism of the first level, which is shown in figure 1, in this preferred embodiment of the invention, has on each one of the two stripping frames 7, cathode washing means, formed by a series of water manifolds with spray nozzles fastened to the stripping head.

[0039] In addition, in this preferred embodiment of the invention, both stripping frames 7 of the treatment mechanism respectively comprise first advance means of the cathodes 5 along the stripping head, formed in each case by a walking beam mechanism actuated hydraulically that has an anti-sway system.

[0040] In this preferred embodiment of the invention, the treatment mechanism comprises a guided blade system 6 for each one of the stripping frames 7 of the cathodes, wherein said blade system is secured to the stripping head. The purpose of the stripping frames 7 is to house the mechanisms responsible for completely separating the aluminum cathode and the zinc sheet, causing the latter to fall towards the lower level of the machine.

[0041] As shown in figure 1, in this preferred embodiment of the invention, before the stripping frames 7, the treatment mechanism comprises pre-stripping means 14 for each stripping frame 7 formed by a robot with a blade for each side of the cathode. The aim of these pre-stripping means 14 is to achieve an initial detachment of a small area of zinc throughout the upper portion of the cathode, without breaking the zinc sheet or damaging the surface of the cathode.

[0042] The robot equipped with the blade, in addition to being capable of carrying out the pre-stripping by means of said blades each acting on each face of the cathode, in the event that it detects difficulties in the pre-

stripping, a rejection order is generated for said cathode and the robot is able to remove it.

[0043] After the cathodes have passed through the treatment mechanism, they are deposited on the second transfer mechanism 8.2, which in this preferred embodiment of the invention is formed by an aerial twin cable conveyor.

[0044] As shown in figure 1, in this preferred embodiment of the invention, the cathodes are transferred by means of said second transfer means 8.2 to a cathode scrubbing frame 15. Said scrubbing frame 15 is formed by two scrubbing mechanisms, one for each one of the simultaneously processed cathodes.

[0045] Each scrubbing mechanism fastens a scrubbing device and second advance means responsible for taking each cathode from the second transfer mechanism 8.2 through the scrubbing frame and to the outfeed mechanism 9, wherein said second advance means are formed by a walking beam.

[0046] In this preferred embodiment of the invention, said scrubbing device comprises a lifting mechanism formed by a mobile trolley guided by means of vertical rails, a sub-assembly of brushes fixed to connecting rods and, an irrigation system formed by a series of manifolds provided with spray nozzles.

[0047] As may be seen in figures 3 and 4, according to this preferred embodiment of the invention, the sheet reception system 10 of the second level 2 comprises a damping system of said sheets formed by a hatch actuated by means of pneumatic bellows and a sheet accompanying system.

[0048] According to this preferred embodiment of the invention, the sheet removal station 12 comprises a fixed reception frame, a reception robot and a guide device.

[0049] The embodiment described only constitutes one example of the present invention, and therefore, the specific details, terms and sentences used in the present specification must not be considered as limiting, but rather they must only be understood as a basis for the claims and as a representative basis that provides a comprehensible description as well as sufficient information in order for a person skilled in the art to apply the present invention.

[0050] Significant improvements with respect to the state of the art are achieved with the cathode stripping machine presented herein.

[0051] As such, a machine that is capable of acting on two cathodes at the same time is achieved, which means that in the same period of time, the number of cathodes that undergo the stripping is much greater than in earlier machines, significantly increasing the productivity thereof.

[0052] It is a fully organized machine which includes the actions the must be carried out with the cathodes. In this way, all the possible actions that must be carried out on the cathodes are mechanized.

[0053] As such, the labor of any phase of the process carried out by the machine is eliminated.

Claims

1. A cathode stripping machine (3) having a metal deposit in the form of a sheet on each one of the two opposite faces thereof, **characterized in that** it comprises

- a first operating level (1) and a second reception level (2) located below the first level;
- wherein the first level (1) comprises an infeed mechanism (4) of the cathodes in the machine, a first transfer mechanism (8.1) for transferring said cathodes (5) inside the machine, a treatment mechanism with a stripping head having two stripping frames (7), each acting on one cathode (5) simultaneously, a second transfer mechanism (8.2) for transferring the cathodes, and an outfeed mechanism (9) of the cathodes without sheets, and;
- wherein the second level (2) comprises for each of the two resulting sheets, a sheet reception system (10), a conveyor belt (11), and a sheet removal station (12), as well as a shared collection and weighing table (13) with rollers for both sheets.

2. Cathode stripping machine (3), according to claim 1, **characterized in that** the cathode (5) infeed mechanism (4) of the first level (1) comprises a parallel beam system, where a first beam is fixed and second beam is walking, the movement of which in a vertical direction is caused by a hydraulically actuated pivoting pusher assembly and the movement in a horizontal direction is generated by a synchronized double hydraulic cylinder assembly between them by means of a hydromechanical flow divider.

3. Cathode stripping machine (3), according to any of the preceding claims, **characterized in that** the first transfer mechanism (8.1) for transferring the cathodes to the treatment mechanism is formed by an aerial chain conveyor and the second transfer mechanism (8.2) for transferring the cathodes is formed by an aerial twin cable conveyor.

4. Cathode stripping machine (3), according to any of the preceding claims, **characterized in that** each stripping frame (7) of the treatment mechanism of the first level (1) comprises cathode scrubbing means, formed by a series of water manifolds with spray nozzles fastened to the stripping head.

5. Cathode stripping machine (3), according to any of the preceding claims, **characterized in that** each stripping frame (7) of the treatment mechanism of the first level (1) comprises first advance means of the cathodes (5) along the stripping head, formed in both cases by a hydraulically-actuated walking beam

6. Cathode stripping machine (3), according to any of the preceding claims, **characterized in that** the treatment mechanism comprises a guided blade system (6) for each one of the stripping frames (7) of the cathodes, wherein said blade system (6) is fastened to the stripping head.

7. Cathode stripping machine (3), according to any of the preceding claims, **characterized in that** the treatment mechanism comprises pre-stripping means (14) for each stripping frame (7) formed by a robot with a blade for each side of the cathode.

8. Cathode stripping machine (3), according to claim 7, **characterized in that** the treatment mechanism comprises pre-stripping starting means that have a frame with movable cutting means, suitable for checking the level of adhesion between the cathode (5) and the sheet thereon.

9. Cathode stripping machine (3), according to any of the preceding claims, **characterized in that** the first operating level (1) comprises a scrubbing frame (15) located downstream from the second transfer mechanism (8.2) and formed by two scrubbing mechanisms, one for each one of the cathodes (5) processed simultaneously, wherein each scrubbing mechanism fastens a scrubbing device and second advance means responsible for taking each cathode (5) from the second transfer mechanism (8.2) through the scrubbing frame (15) and to the outfeed mechanism (9), wherein these second advance means are formed by a walking beam.

10. Cathode stripping machine (3), according to claim 9, **characterized in that**, the scrubbing device comprises a lifting mechanism formed by a mobile trolley guided by means of vertical rails, a sub-assembly of brushes fixed to connecting rods, and an irrigation system formed by a series of manifolds provided with spray nozzles.

11. Cathode stripping machine (3), according to any of the preceding claims, **characterized in that** the sheet reception system (10) of the second level (2) comprises a damping system of said sheets formed by a hatch actuated by means of pneumatic bellows and a sheet accompanying system.

12. Cathode stripping machine (3), according to claim 11, **characterized in that** the sheet reception system (10) comprises two pairs of wheels downstream of the damping system actuated by means of electric geared motors in order to control the drop speed of the sheets.

mechanism that has an anti-sway system.

13. Cathode stripping machine (3), according to any of the preceding claims, **characterized in that** the sheet removal station (12) comprises a fixed reception frame, a reception robot and a guide device.

5

10

15

20

25

30

35

40

45

50

55

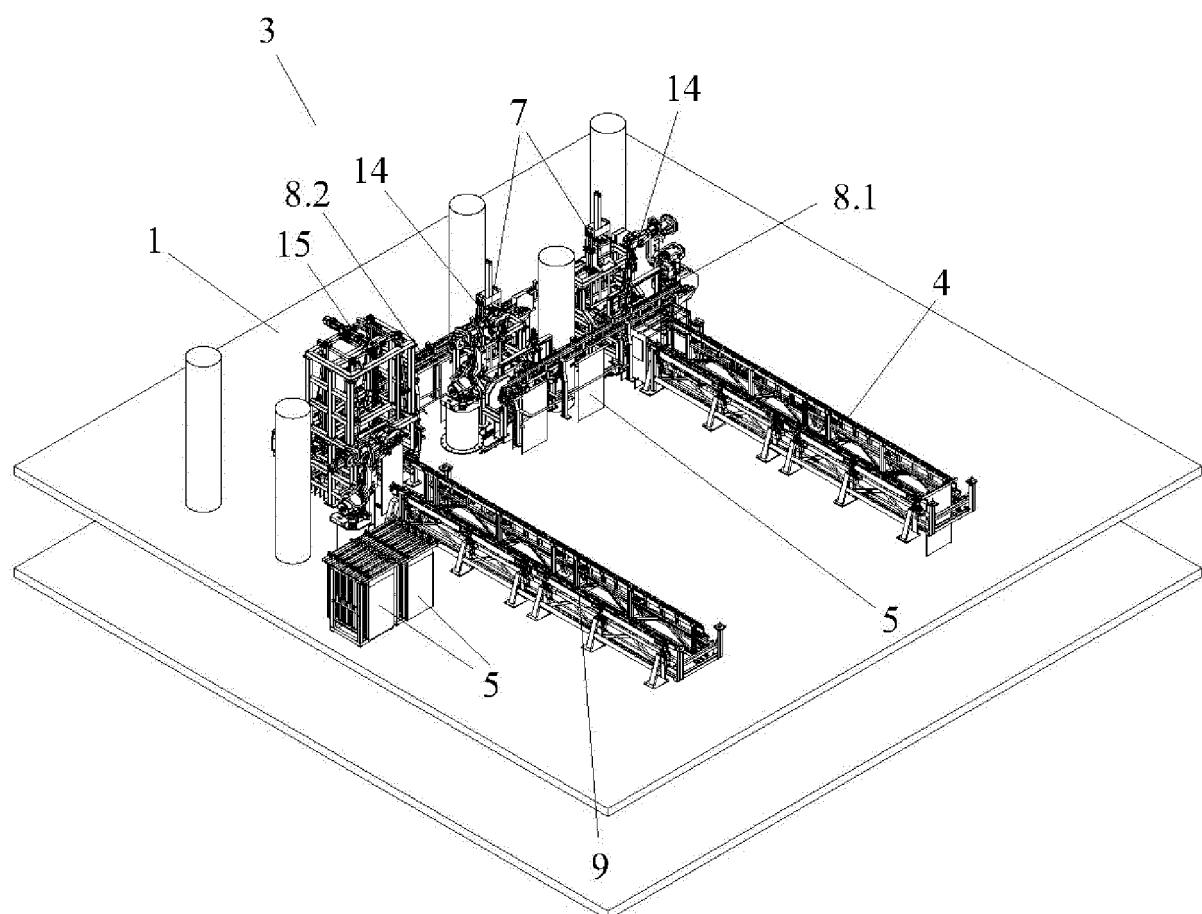


Fig. 1

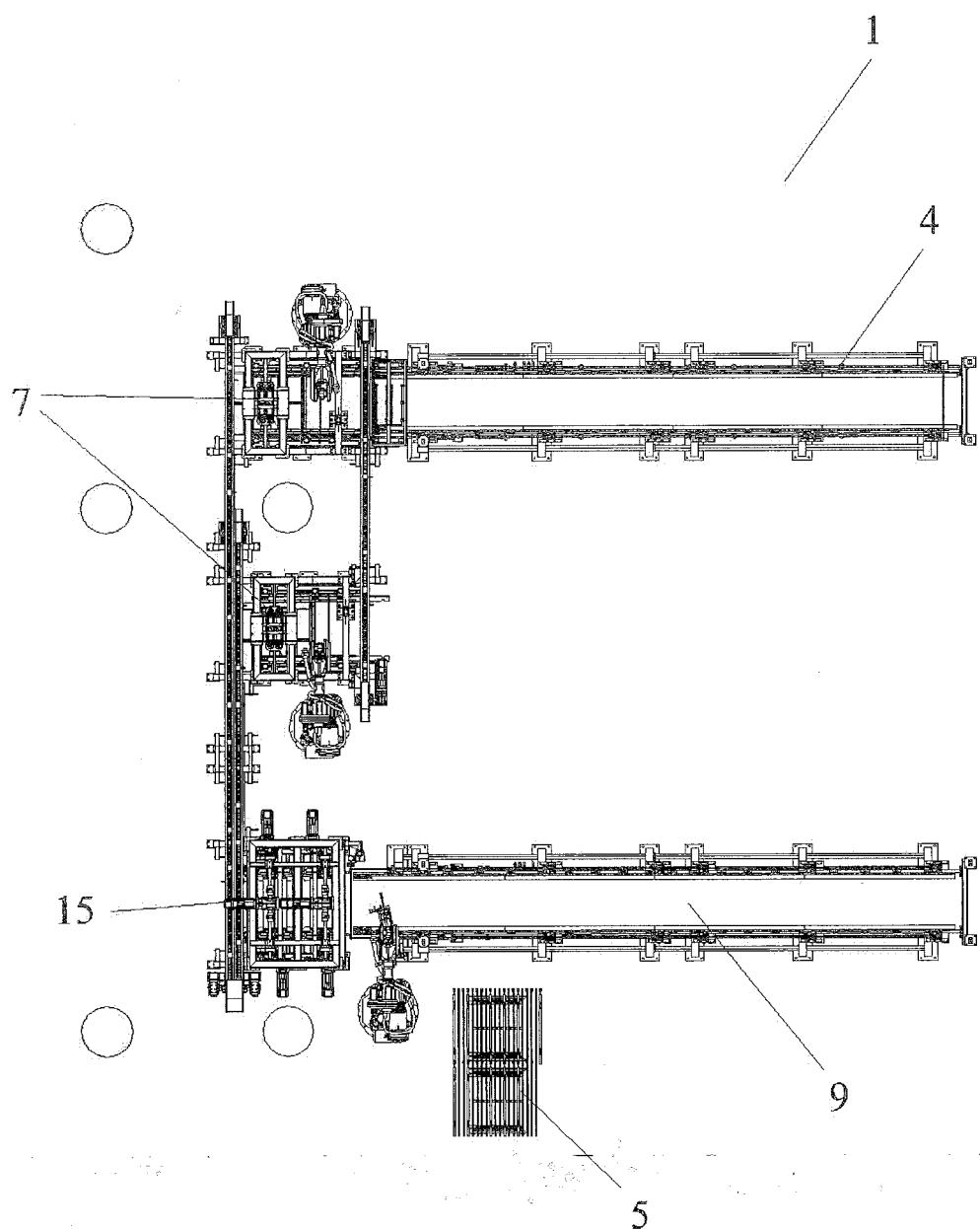


Fig. 2

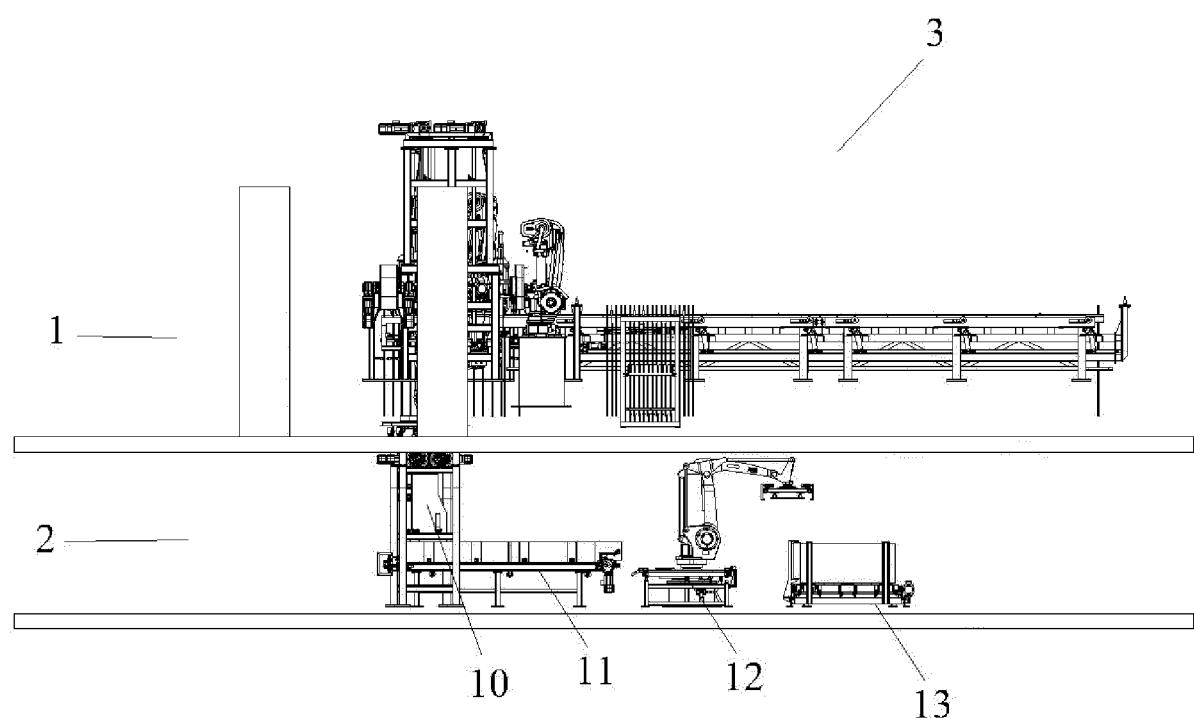


Fig. 3

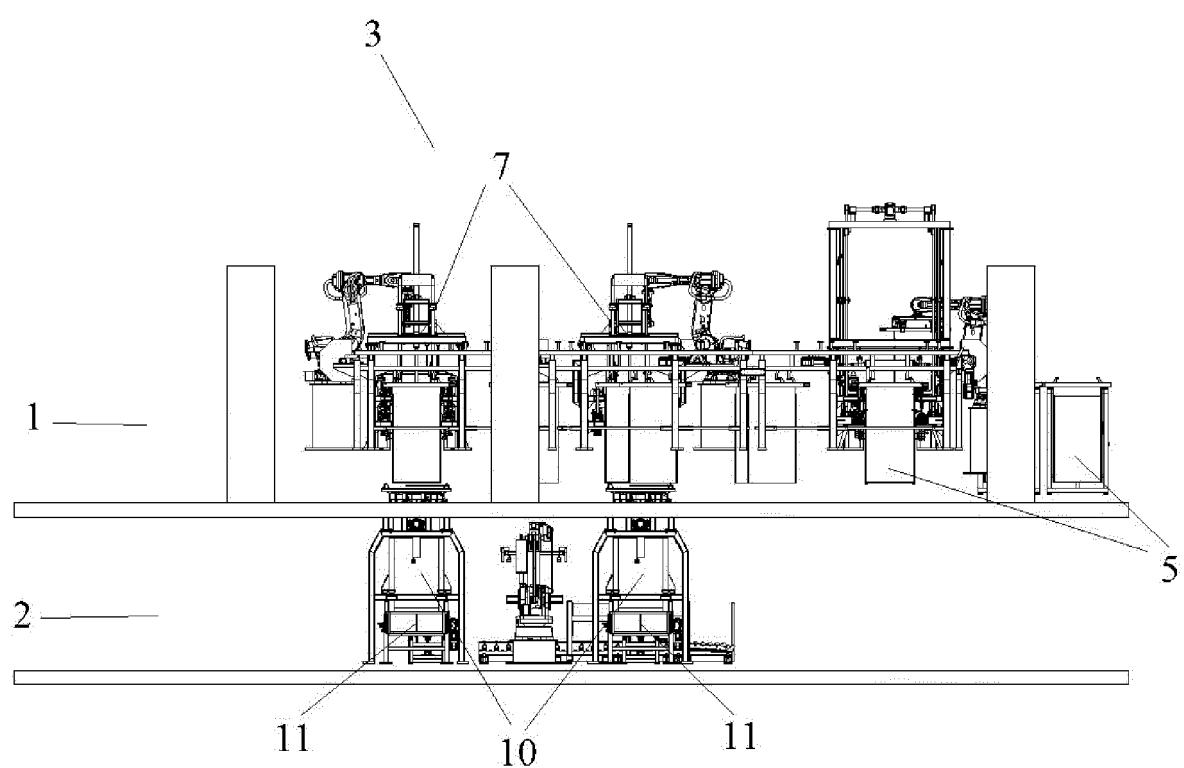


Fig. 4

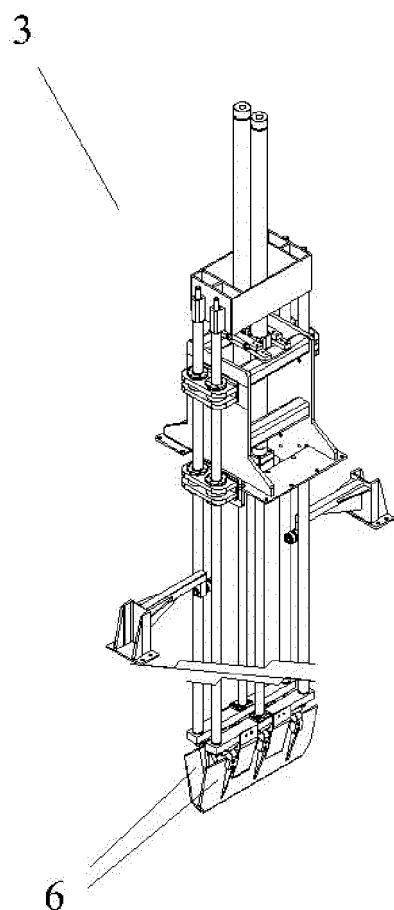


Fig. 5

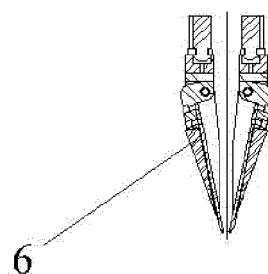


Fig. 6

INTERNATIONAL SEARCH REPORT		International application No. PCT/ES2016/070125	
5	A. CLASSIFICATION OF SUBJECT MATTER		
	C25C7/08 (2006.01)		
	According to International Patent Classification (IPC) or to both national classification and IPC		
10	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		
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
	EPODOC, INVENES		
	C. DOCUMENTS CONSIDERED TO BE RELEVANT		
20	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	A	WO 2014019070 A1 (MATUSCH STEPHAN FRANK) 06/02/2014, pages 7 - 12; figures.	1-13
25	A	WO 2014072540 A1 (ZINCOBRE INGENIERÍA S L U) 15/05/2014, pages 8 – 12.	1-13
	A	EP 2141265 A1 (TECHNIC ONE S A) 06/01/2010, paragraphs[0011 - 0027].	1-6
30	A	EP 2518186 A1 (JIANGXI NERIN EQUIPMENT CO LTD) 31/10/2012, paragraphs[0004 - 0058].	1-10
	A	CA 2349394 A1 (AISCO SYSTEMS INC ET AL.) 30/11/2002, pages 4 - 12; figures.	1-13
35	<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
40	* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance. "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure use, exhibition, or other means. "P" document published prior to the international filing date but later than the priority date claimed		
45	"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 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
50	Date of the actual completion of the international search 13/04/2016	Date of mailing of the international search report (19/04/2016)	
55	Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer C. Galdeano Villegas Telephone No. 91 3493099	

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

Information on patent family members

		International application No.	
		PCT/ES2016/070125	
5	Patent document cited in the search report	Publication date	Patent family member(s)
10	WO2014103393 A1	03.07.2014	NONE
15	WO2014072540 A1	15.05.2014	NONE
20	CA2349394 A1	30.11.2002	KR20040035599 A KR100864224B B1 ZA200309279 A US2002179431 A1 US6797133 B2 PL364393 A1 PL207124B B1 NO20035261 A MXPA03010798 A JP2004537648 A JP4202909B B2 EP1402088 A2 EA005101 B1 CN1527891 A CN100570012C C WO02097170 A2 WO02097170 A3 BR0210051 A AU2002302267B B2
25			29.04.2004 17.10.2008 17.11.2004 05.12.2002 28.09.2004 13.12.2004 30.11.2010 27.11.2003 07.03.2005 16.12.2004 24.12.2008 31.03.2004 28.10.2004 08.09.2004 16.12.2009 05.12.2002 10.07.2003 17.08.2004 20.09.2007
30	WO2014019070 A1	06.02.2014	NONE
35	EP2518186 A1	31.10.2012	RU2499087 C1 JP2013515849 A JP5595518B B2 US2012255409 A1 US8783145 B2 CA2785606 A1 CA2785606 C WO2011076137 A1 CN102051642 A CN102051642B B CN101717973 A
40	EP2141265 A1	06.01.2010	27.10.2015 05.11.2012 01.06.2011 12.02.2014 07.01.2010 26.06.2014 11.05.2011 20.06.2012 07.01.2010 22.04.2010
45			ES2390007T T3 CN102084036 A CN102084036B B AU2009265804 A1 AU2009265804B B2 EP2318571 A2 EP2318571 B1 WO2010000717 A2 WO2010000717 A3
50			
55			

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- ES 0372891 [0006] [0007]
- ES 2005673 [0006] [0009]