



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.02.2014 Bulletin 2014/06

(51) Int Cl.:
C25D 17/24 (2006.01)

(21) Application number: **13178607.1**

(22) Date of filing: **30.07.2013**

(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

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(30) Priority: **03.08.2012 IT MI20121384**

(54) **A cataphoretic and electrolytic electrodeposition system for small metal parts**

(57) A cataphoretic and electrolytic electrodeposition system for small metal parts comprises a tank (2) for containing a treatment bath, a receptacle (3) for containing the parts to be treated, a first electrode applied in the said tank (2), a second electrode applied to the receptacle (3), an electric direct current generator at whose opposite poles said first and second electrode are connected, and rotation actuation means (7) for the receptacle (3), the

receptacle (3) having a perforated hollow longitudinal body (4) closed at a first longitudinal end thereof and open at a second longitudinal end thereof defining a mouth (8) for loading and unloading parts, there being further provided means (6) for tipping the receptacle (3) from a position of immersion in the tank (2) for the treatment of the parts to a position for gravity unloading of the treated parts through said mouth (8).

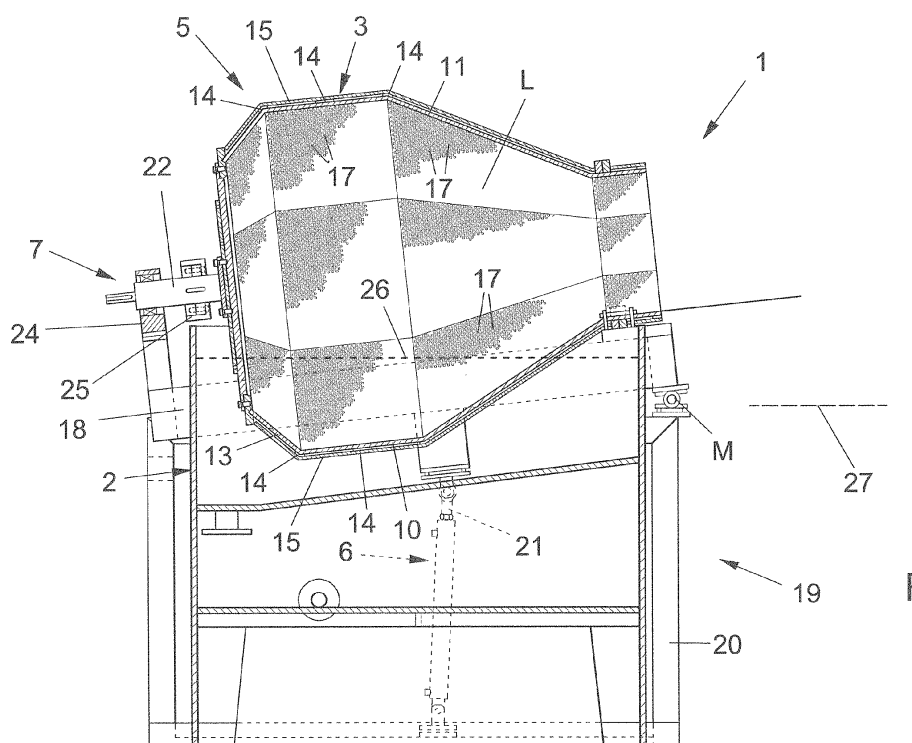


FIG. 1

Description

[0001] The present invention refers to a cataphoretic and electrolytic electrodeposition system for small metal parts.

[0002] There are known galvanic systems for coating by cataphoresis, in which the metal parts to be coated are individually hung on special hooks for the treatment.

[0003] These types of systems are particularly suitable for treating parts of large sizes, but they obviously cannot be easily applied for the treatment of small metal parts en masse.

[0004] There are also known galvanic systems for plating small metal parts with a material that exhibits particular characteristics such as "stainlessness", brilliance, and abrasion resistance. The achievable platings, according to the bath employed, may include chrome-plating, copper-plating, nickel-plating, etc. These systems often comprise a perforated barrel positioned with its axis being horizontal inside a tank containing the treatment bath and rotating about its horizontal axis during treatment. For loading and unloading the parts to be treated, the barrel has an opening that is closable by a special cover, which extends along an entire longitudinal generatrix of the barrel itself. A first electrode positioned coaxially in the barrel and a second electrode positioned in the tank, are connected at opposite poles of the direct current generator.

[0005] Known barrel plating systems are quite costly and a drawback thereof is that the unloaded treated parts pile up on a belt conveying them to a subsequent treatment which may not prove to be uniform owing to the presence of many contact zones between the parts, and resulting in the production of a substantial amount of rejects.

[0006] Therefore, the technical task of the present invention is to realize a cataphoretic and electrolytic electrodeposition system for small metal parts that makes it possible to eliminate the technical drawbacks of the prior art described hereinabove.

[0007] Within the scope of this technical task, one aim of the invention is to realize a cataphoretic and electrolytic electrodeposition system for small metal parts that is highly efficient, simple and economical in construction, and versatile in its adaptability to applications of different types, particularly to coating by cataphoresis, to treatments suitable for conferring corrosion resistance, brilliance, and abrasion resistance, and to surface activation and passivation treatments.

[0008] The technical task of the present invention, as well as the latter and other aims, are achieved by realizing a cataphoretic and electrolytic electrodeposition system for small metal parts, comprising a tank for containing a treatment bath, a receptacle for containing the parts to be treated, a first electrode applied in said tank, a second electrode applied to the receptacle, an electric direct current generator at whose opposite poles said first and second electrode are connected, and rotation actuation

means for the receptacle, said receptacle having a perforated hollow longitudinal body closed at a first longitudinal end thereof and open at a second longitudinal end thereof defining a mouth for loading and unloading parts, there being further provided means for tipping the receptacle from a position of immersion in the tank for the treatment of the parts to a position for gravity unloading of the treated parts through said mouth, **characterized in that** said second electrode comprises one or more loop electrical conductors applied along the outer perimeter of said body, one or more longitudinal electrical conductors applied to the external side of the said body and intersecting said one or more loop electrical conductors, and electrically conductive pins in contact with said one or more loop conductors and/or said one or more longitudinal conductors, said pins being disposed through the wall thickness of the said body and extending into the internal cavity of said body. Additional characteristics of the present invention are also defined in the claims herein below.

[0009] Further characteristics and advantages of the invention will become clearer in the description of a preferred, but not exclusive embodiment of the cataphoretic and electrolytic electrodeposition system for small metal parts according to the invention, illustrated by way of approximate and non-limiting example in the attached drawings, in which:

Figure 1 shows the system with the receptacle for containing the parts in the position of immersion in the tank;

Figure 2 shows the system with the receptacle for containing the parts in the position for unloading the parts;

Figures 3 and 4 show axonometric views of the receptacle;

Figure 5 is a detailed view of a zone of the hollow body of the receptacle;

Figure 6 is a cross section of a part of the hollow body of the receptacle.

[0010] With reference to the figures cited, a cataphoretic and electrolytic electrodeposition system for small metal parts is shown and it is generically indicated by the reference numeral 1.

[0011] The system 1 comprises a tank 2 for containing a treatment bath, a receptacle 3 for containing the parts to be treated and that has a hollow longitudinal body 4, a first electrode (not shown) applied in said tank 2, a second electrode 5 applied to the receptacle 3, an electric direct current generator (not shown) at whose opposite poles the first and the second electrode 5 are connected, means 6 for tipping the receptacle 3 from a position of immersion in the tank 2 for the treatment of the parts to a position for unloading the treated parts, and rotation actuation means 7 of the receptacle 3.

[0012] The hollow longitudinal body 4 has a plurality of calibrated through holes 17 passing through the thick-

ness thereof so as to enable the bath to flow into and out of the receptacle 3.

[0013] The hollow longitudinal body 4 is closed at a first longitudinal end thereof and open at a second longitudinal end thereof defining a mouth 8 for loading and unloading parts.

[0014] The hollow longitudinal body 4 is made up of flat faces that are angled with respect to each other and suitable for bringing about the tipping of the parts to be treated when the receptacle 3 is set in rotation so as to ensure a uniform surface treatment of the parts.

[0015] Advantageously, the hollow longitudinal body 4 is tapered toward the loading and unloading mouth 8 so as to ensure a calibrated exiting of the treated parts.

[0016] The hollow longitudinal body 4 is delimited laterally by various portions that coaxially follow each other in succession in the direction of its longitudinal axis L and comprises at least one portion 10 configured in the form of a prism and a portion 11 configured in a cone-shaped form. More precisely, the hollow longitudinal body 4 comprises in sequence a prismatic portion 12 delimiting the loading and unloading mouth 8, the cone-shaped portion 11, the prismatic portion 10, and a cone-shaped portion delimiting the base 9.

[0017] The holes 17 involve at least the prismatic portion 10, but they may also involve other parts of the hollow longitudinal body 4, including the base 9.

[0018] The second electrode 5 comprises one or more loop electrical conductors 14 applied along the outer perimeter of the hollow longitudinal body 4 and one or more longitudinal electrical conductors 15 applied along external longitudinal generatrices of the hollow longitudinal body 4 and intersecting the loop conductors 14.

[0019] The loop conductors 14 are positioned on the prismatic portion 10 of the hollow longitudinal body 4.

[0020] The longitudinal conductors 15 are angularly equispaced.

[0021] The loop conductors 14 and the longitudinal conductors 15 are formed by flat bars. The second electrode 5 further comprises electrically conductive pins 16 that are supported by the loop conductors 14 and by the longitudinal conductors 15.

[0022] The pins 16 are disposed through the thickness of the hollow longitudinal body 4 in such a manner as to extend into the internal cavity thereof.

[0023] Advantageously, the parts that are set in motion by the rotation of the receptacle 3 in order to be treated, remove by friction the material that is continuously deposited on the ends of the pins 16 positioned in the cavity of the longitudinal body 4 and thus ensure a high level of treatment efficiency, together with a reduction in energy consumption.

[0024] The loop conductors 14, longitudinal conductors 15 and the pins 16 are made of stainless steel for example.

[0025] The hollow longitudinal body 4 may be made in one piece only or it may comprise removable sectors that permit access to the cavity thereof so as to carry out

inspections and cleaning of the pins 16.

[0026] The material constituting the hollow longitudinal body 4 is for example a polypropylene-based material.

[0027] The system 1 comprises a supporting frame 19 for the receptacle 3, having a fixed part 20 of the frame that can be rested on the ground and a part 18 of the frame that is hinged to the fixed part 20 with a pivot axis M.

[0028] The pivotable part 18 of the frame, in turn, supports the receptacle 3 in rotation about the longitudinal axis L thereof.

[0029] The pivot axis M of the pivotable part 18 of the frame is perpendicular to the rotation axis of the receptacle 3 and is located in a position adjacent to the loading and unloading mouth 8.

[0030] In any operating position of the pivotable part 18 of the frame 19, the loading and unloading mouth 8 is external to the lateral profile of the tank 2 so as to facilitate procedures for loading and unloading the parts.

[0031] The means for tipping 6 the receptacle 3 comprises at least one linear hydraulic cylinder 21 that connects the pivotable part 18 of the frame to the fixed part of the frame 19.

[0032] The rotation actuation means 7 for the receptacle 3 comprises a motor-driven rotation shaft 22 (the drive motor is not shown) that is rigidly joined to the base wall 9 coaxially with the longitudinal axis L of the receptacle 3.

[0033] Special annular bearings 23, 24 keyed to the prismatic portion 12 of the hollow longitudinal body 4 and to the rotation shaft 22, respectively, and fixed to the pivotable part 18 of the frame support and guide the receptacle 3 in rotation.

[0034] The contactor board 25 of the direct current generator is also keyed to the rotation shaft 22.

[0035] Owing to the pivoting of the pivotable part 18 of the frame, the receptacle 3 performs a tipping procedure that is reversible between the position of partial immersion in the tank 2, in which it is arranged with its longitudinal axis L inclined upward so as to place the loading and unloading mouth 8 at a greater height than the base 9, and the unloading position, in which it is arranged with its longitudinal axis L inclined downward so as to place the loading and unloading mouth 8 at a lower height than the base 9 so as to facilitate the exiting of the parts by gravity.

[0036] Advantageously, the receptacle 3 does not require a cover for closing the loading and unloading mouth, given that in the position of partial immersion, the loading and unloading mouth 8 thereof remains outside of the tank 2 in a raised position with respect to the rest of the receptacle 3 and it cannot be reached by the parts which remain confined in the lower part of the receptacle 3 during rotation of the receptacle 3.

[0037] In the position of immersion of the receptacle 3 in the tank 2, the receptacle 3 penetrates only partially into the tank 2 and the bath in the tank 2 is at a level 26 such as to cover the zones of the base 9 and of the portions 10, 11 and 13 of the longitudinal body 4 that are positioned below the loading and unloading mouth 8. It

should be noted that the unloading of the treated parts onto the belt 27 that conveys them to the next treatment takes place in a calibrated manner by virtue of the size and configuration of the mouth 8 of the hollow longitudinal body 4. Furthermore, during the unloading of the treated parts, the belt 27 is advanced so as to achieve a uniform distribution on the belt 27, without any piling up of the treated parts, as is necessary to eliminate or minimize production rejects in the next en-masse treatment of the parts.

[0038] With the system illustrated, wherein the first electrode acts as an anode and said second electrode as a cathode, based on the characteristics of the bath it is possible to coat with a cataphoretic film all those metal parts which owing to their dimensions and shapes are difficult to hang on a frame and not without incurring exorbitant expenses that would render the process hardly compatible with the market from an economic perspective.

[0039] The process of electrodeposition by cataphoresis on small metal parts carried out with the system of the present invention can be easily automated and managed without complex and meticulous inspections by skilled personnel and it makes it possible to obtain a coating film of a uniform thickness on all parts with a very high deposition yield.

[0040] One of the preferred applications is found in the automotive sector, where increasingly higher levels of corrosion resistance are being pursued as a strong need, for example levels of corrosion resistance to salt spray (fog) exceeding 700 hours in white salt spray.

[0041] These results can be achieved with a first deposit of zinc or zinc alloy and a second deposit with an acrylic cataphoretic resin, which can both be easily carried out in an extremely economical manner with a system pursuant to the teachings of the present invention. In this case, the cost of the treatment is much lower than conventional treatments by virtue of the reduction of system costs and the reduction of labour costs as related to simpler management of the system. Possible applications in the automotive sector are related to screws, bolts and nuts, but also to safety components that can be installed in automobiles, such as striker plates for locks, buckles for safety belts, fittings for brake systems, etc. Advantageously, merely by replacing the treatment bath, the same system can also be utilized for other types of applications, even outside of the automotive sector, for example for the surface deposition of metals suitable for conferring a high level of corrosion resistance.

[0042] The cataphoretic and electrolytic electrodeposition system for small metal parts thus conceived is susceptible to numerous modifications and variants, all of which falling within the scope of the inventive concept. Moreover, all the details may be replaced with technically equivalent elements.

[0043] All materials used, as well as the dimensions, may in practice be of any type, according to requirements and the state of the art.

Claims

1. A cataphoretic and electrolytic electrodeposition system (1) for small metal parts, comprising a tank (2) for containing a treatment bath, a receptacle (3) for containing the parts to be treated, a first electrode applied in the said tank (2), a second electrode applied to the receptacle (3), an electric direct current generator at whose opposite poles said first and second electrode are connected, and rotation actuation means (7) for the receptacle (3), said receptacle (3) having a perforated hollow longitudinal body (4) closed at a first longitudinal end thereof and open at a second longitudinal end thereof defining a mouth (8) for loading and unloading parts, there being further provided means (6) for tipping the receptacle (3) from a position of immersion in the tank (2) for the treatment of the parts to a position for gravity unloading of the treated parts through said mouth (8), **characterized in that** said second electrode (5) comprises one or more loop electrical conductors (14) applied along the outer perimeter of said body (4), one or more longitudinal electrical conductors (15) applied to the external side of the said body (4) and intersecting said one or more loop electrical conductors (14), and electrically conductive pins (16) in contact with said one or more loop conductors (14) and/or said one or more longitudinal conductors (15), said pins (16) being disposed through the wall thickness of the said body (4) and extending into the internal cavity of said body (4).
2. The cataphoretic and electrolytic electrodeposition system (1) for small metal parts according to the preceding claim, **characterized in that** said body (4) has flat faces.
3. The cataphoretic and electrolytic electrodeposition system (1) for small metal parts according to the preceding claim, **characterized in that** said body (4) is tapered toward said loading and unloading mouth (8).
4. The cataphoretic and electrolytic electrodeposition system (1) for small metal parts according to any preceding claim, **characterized in that** said body (4) has at least one portion (10) configured in the form of a prism and at least one portion (11) configured in a cone-shaped form coaxial with the first portion.
5. The cataphoretic and electrolytic electrodeposition system (1) for small metal parts according to any preceding claim, wherein the body (4) of the receptacle (3) exhibits an axis (L), **characterized in that** it comprises a supporting frame (19) for the receptacle (3), having a fixed part (20) and a pivotable part (18) that supports said receptacle (3) in rotation

about the axis thereof (L).

6. The cataphoretic and electrolytic electrodeposition system (1) for small metal parts according to the preceding claim, **characterized in that** said pivotable part (18) has a pivot axis (M) that is adjacent to the said loading and unloading mouth (8) and oriented perpendicularly to the longitudinal axis (L) of the said body (4) of the receptacle (3).

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7. The cataphoretic and electrolytic electrodeposition system (1) for small metal parts according to any preceding claim, **characterized in that** said tipping means (6) comprises at least a linear hydraulic cylinder (21).

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8. The cataphoretic and electrolytic electrodeposition system (1) for small metal parts according to any preceding claim, **characterized in that** said loading and unloading mouth (8) is positioned externally to the lateral profile of the said tank (2) when said receptacle (3) assumes said position of immersion in the tank (2) and when it assumes said unloading position.

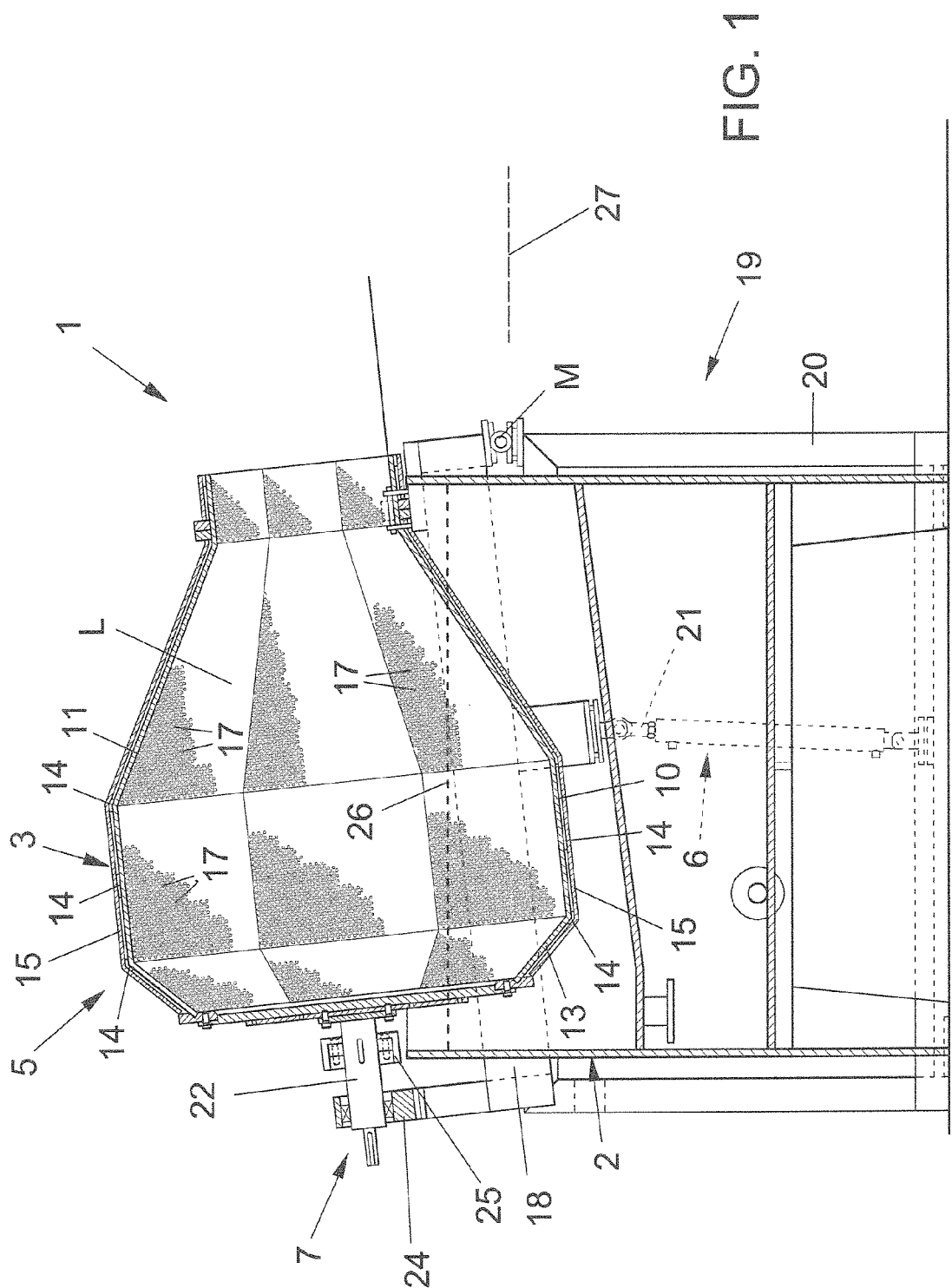
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9. The cataphoretic and electrolytic electrodeposition system (1) for small metal parts according to any preceding claim, **characterized in that** said rotation actuation means (7) comprises a motor-driven rotation shaft (22) that is rigidly joined to a base (9) of the hollow longitudinal body (4) coaxially with the longitudinal axis (L) of the said hollow longitudinal body (4).

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10. The cataphoretic and electrolytic electrodeposition system (1) for small metal parts according to any preceding claim, **characterized in that** in said immersion position, said body (4) of said receptacle (3) exhibits a longitudinal axis (L) that is inclined upward so as to place said loading and unloading mouth (8) at a greater height than the said base (9).

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11. The cataphoretic and electrolytic electrodeposition system (1) for small metal parts according to any preceding claim, **characterized in that** said hollow longitudinal body (4) is formed by individually removable sections.

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12. The cataphoretic and electrolytic electrodeposition system (1) for small metal parts in accordance with any preceding claim, wherein said first electrode acts as an anode and said second electrode as a cathode.

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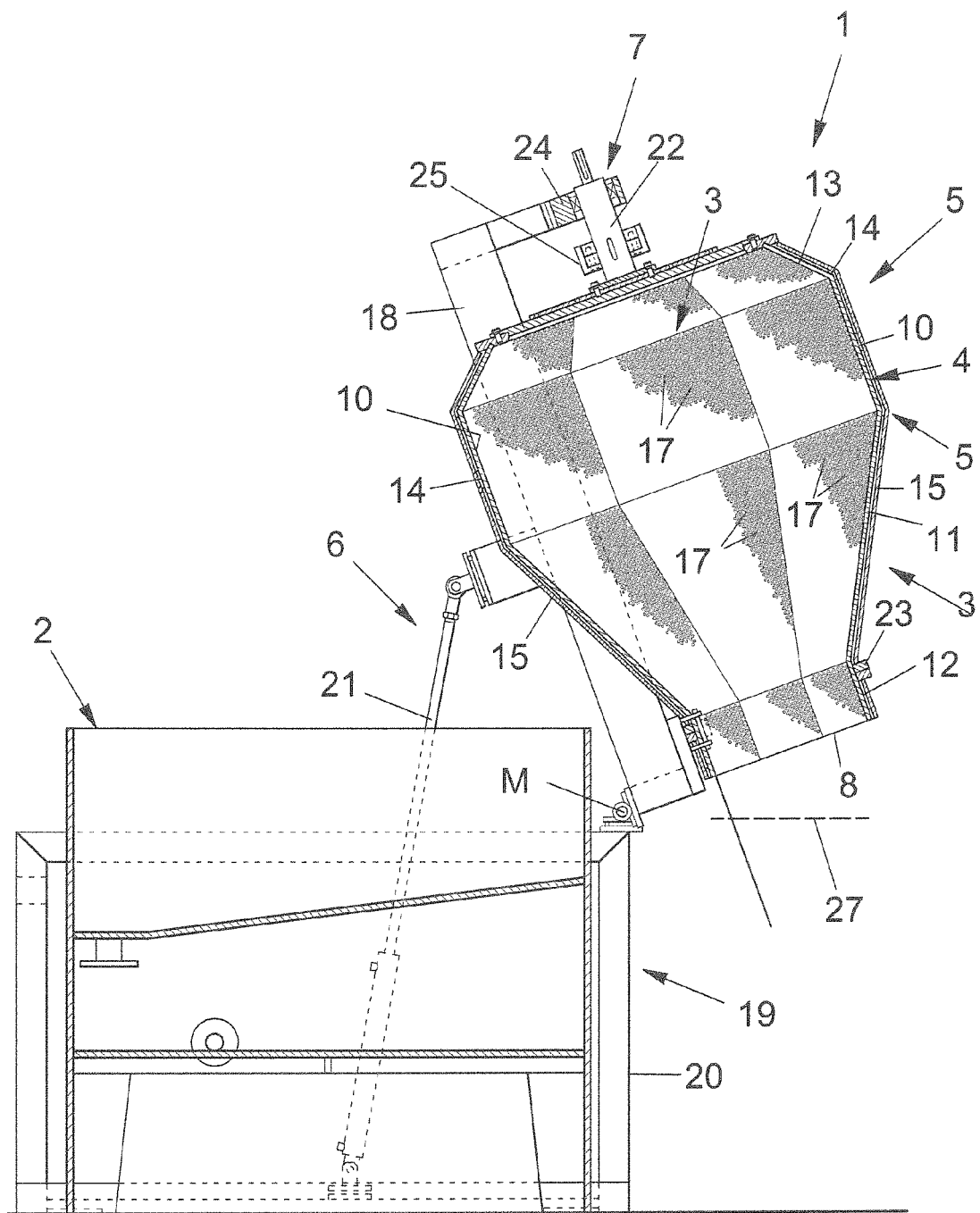


FIG. 2

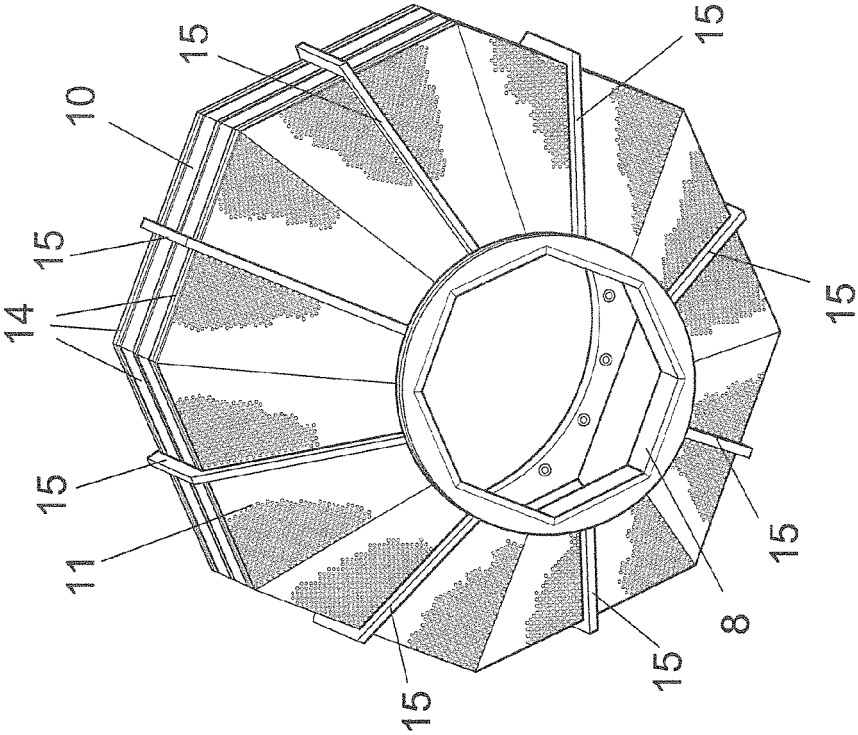


FIG. 4

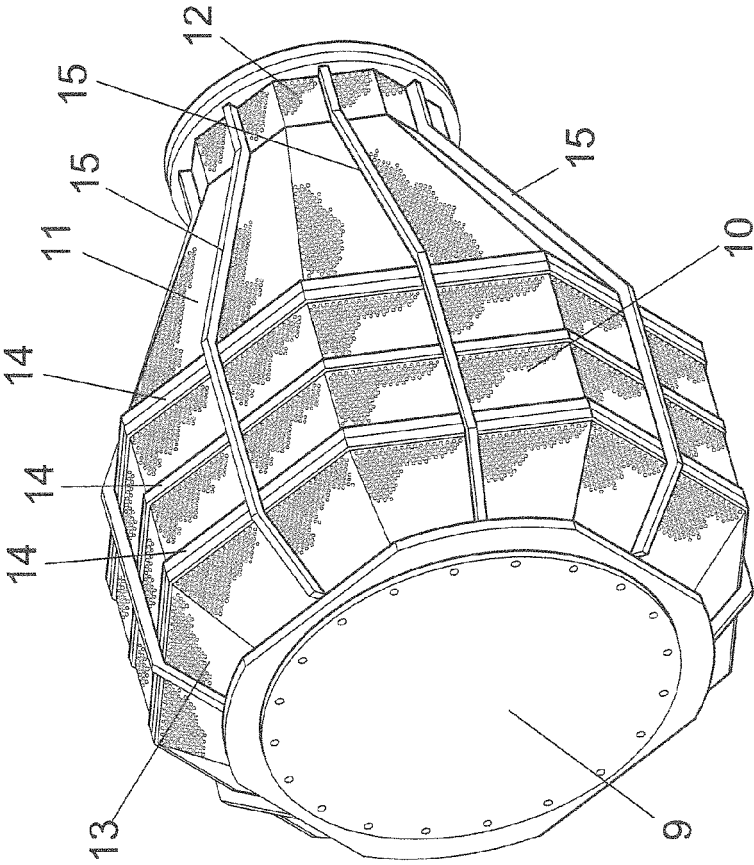
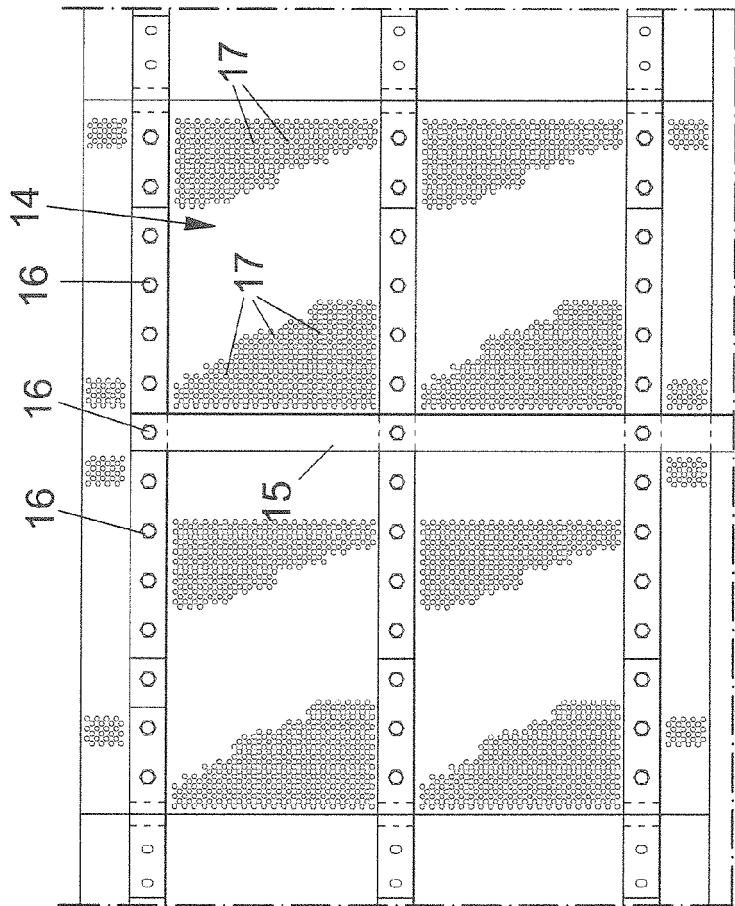
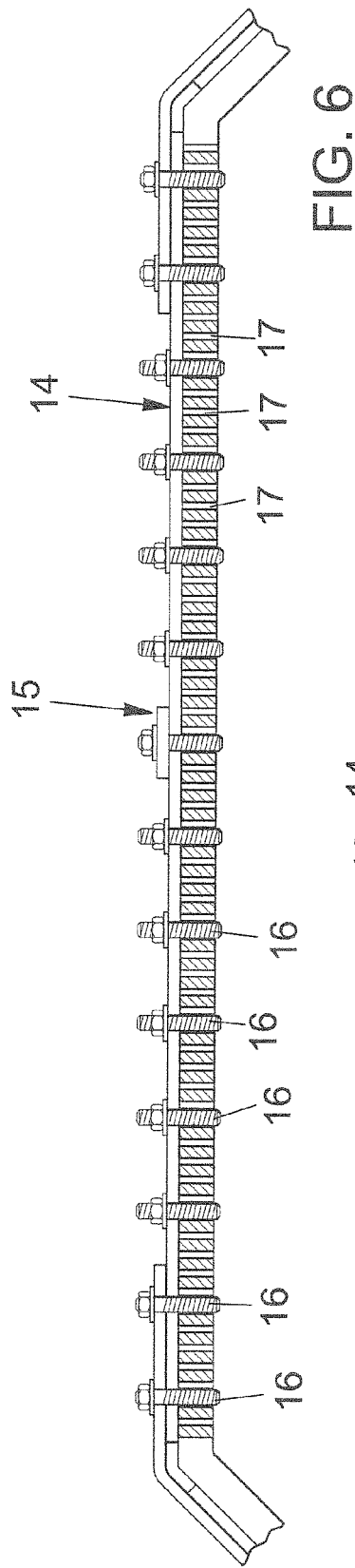


FIG. 3





EUROPEAN SEARCH REPORT

Application Number
EP 13 17 8607

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	US 2010/126537 A1 (UCHINO MASAhide [JP]) 27 May 2010 (2010-05-27) * paragraphs [0024], [0025]; figures 1-3 *	7	
			TECHNICAL FIELDS SEARCHED (IPC)
			C25D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 August 2013	Examiner Suárez Ramón, C
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 17 8607

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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