



(11) **EP 3 578 694 A1**

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

(43) Date of publication:
11.12.2019 Bulletin 2019/50

(51) Int Cl.:
C25D 17/22 (2006.01)

(21) Application number: **17887748.6**

(86) International application number:
PCT/CN2017/118615

(22) Date of filing: **26.12.2017**

(87) International publication number:
WO 2018/121526 (05.07.2018 Gazette 2018/27)

(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 TN

(72) Inventors:
• **HUANG, Potao**
Kaohsiung 81546 (TW)
• **LIU, Yaochung**
Kaohsiung 81546 (TW)

(74) Representative: **Petraz, Gilberto Luigi et al**
GLP S.r.l.
Viale Europa Unita, 171
33100 Udine (IT)

(30) Priority: **28.12.2016 US 201662439606 P**

(71) Applicant: **Hallmark Technology Co., Ltd.**
Kaohsiung 81546 (TW)

(54) **ELECTROPLATING DEVICE FOR SMALL COMPONENT**

(57) Disclosed in the present invention is an electroplating device for a small component. The electroplating device for a small component comprises one or more electroplating units (102). Each electroplating unit (102) is provided with an electroplating roller (2), an electroplating tank (3), a driver (4), and a movable frame (5). The driver is disposed in the electroplating tank (4), and is used for the electroplating roller (2) to intermittently rotate. The movable frame (5) is disposed on one top of the electroplating tank (3). The electroplating roller (2) can be taken away from the electroplating tank (3) by moving the movable frame (5), and is placed into another electroplating tank (5), and the number of the electroplating tanks (5) can be expanded to be greater than one, so as to achieve the objective of continuous production.

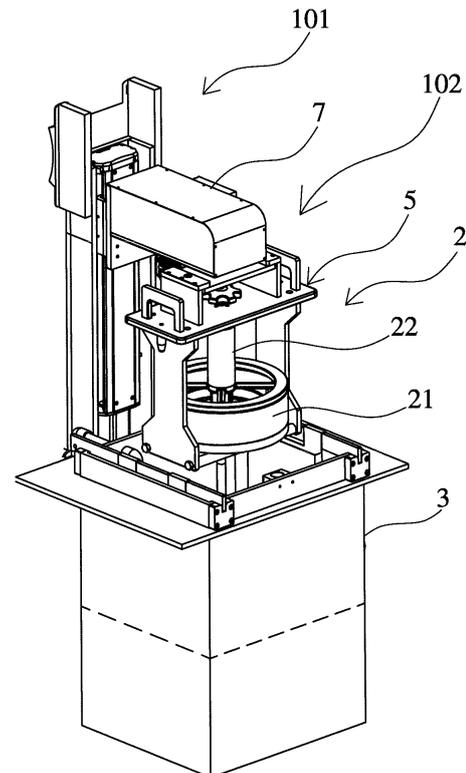


FIG. 1

EP 3 578 694 A1

Description

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority of International Application No. PCT/CN2017/118615, filed on December 26, 2017, which claims priority to US Provisional Application No. 62/439,606, filed on December 28, 2016. The entire disclosures of each of the above applications are incorporated herein by reference.

FIELD OF INVENTION

[0002] The present disclosure relates to an electroplating device, and in particular, relates to an electroplating device for a small component.

BACKGROUND OF INVENTION

[0003] Usually, there are two ways of plating, one is hanging plating and the other is barrel plating. Hanging plating is a plating method in which components are mounted on a hanger for plating deposition, and is generally used for plating of large-sized components. For small components that are incapable or unsuitable for hanging, due to factors, such as shapes and sizes, barrel plating is generally used. Barrel plating, also known as roller plating, is to place a certain number of small components in a specific roller, and to deposit various metal or alloy coatings on the surface of the components in an indirect conductive manner in a rolling state of the specific roller, thereby achieve surface protection, decoration, or functional purposes. Compared with the hanging plating, the barrel plating process which the components undergo greatly changes. The hanging plating is performed in a state where the components are separately packaged, and the barrel plating is performed in a state in which the components sometimes gather and sometimes separate. In this process, a mixing cycle of the components is generated. In addition, the hanging plating is performed while the components are completely exposed, and the barrel plating is carried out in a low concentration solution in a closed barrel (although there are holes in the wall). The change in the process the components are plated results in two major defects in the barrel plating, namely the defects caused by the mixing cycle and the structural defects of the barrel plating. The above defects have a serious impact on the production efficiency of the barrel plating and the improvement of the product quality, so that the superiority of the barrel plating cannot be fully exerted.

[0004] Furthermore, in the current barrel plating technique, the roller connects a driving device. After the components to be plated are loaded in the roller, the roller is placed in a plating tank and the driving device is activated, so that the components to be plated are turned over, thereby facilitating the contact of the electroplating solution with the components to produce an electrochemical

effect. Plating the surface of needle-like or flaky microelectronic components is usually carried out in a plating roller. There are many kinds of plating rollers in the prior art. Most of the plating rollers are driven by horizontal driving devices. These plating rollers generally have problems of complicated structures, difficulty in solution replacement, low plating efficiency, and high maintenance costs.

[0005] In addition, there is also a plating roller disposed at a lower end of a drive shaft for enabling the electroplating tank provided with the anode to be rotationally driven. The centrifugal force is applied when the plating roller is rotationally driven, so that the electroplating solution flows out from the inside of the plating roller to the outside, and then the electroplating solution flows into the inside from the outside. However, the plating roller is fixed at the lower end of the drive shaft and cannot be shifted and replaced. Therefore, the plating process enabling the automatic shifting and the tank replacement cannot be achieved.

[0006] As a result, it is necessary to provide an improved electroplating device for a small component to solve the problems existing in the conventional technologies, as described above.

SUMMARY OF INVENTION

[0007] An object of the present disclosure is to provide an electroplating device for a small component, wherein a driver is disposed under a electroplating tank, and a electroplating roller is rotated by an engagement portion and a drive motor being engaged with each other. The electroplating roller is easily shifted from one electroplating tank to another electroplating tank to perform the tank replacement operation by shifting the roller and replacing the tank. The electroplating fluid is exchanged quickly by the forced vortex blades at the bottom of the electroplating roller to overcome the defects caused by the mixing cycle and the structural defects of the barrel plating, thereby improving the electroplating rate and efficiency of the small components.

[0008] To achieve the above objects, the present disclosure provides an electroplating device for a small component. The electroplating device includes at least one electroplating unit, wherein each of the at least one electroplating unit includes a movable frame, an electroplating roller, an electroplating tank, and a driver. The electroplating roller includes a cylinder body, a rotating shaft, and an engaging portion, wherein a first end of the rotating shaft is disposed on the cylinder body, and the engaging portion is disposed at a bottom of the cylinder body. The electroplating tank is configured to receive an electroplating solution to soak the electroplating roller. The driver is configured to drive rotations of the engaging portion so as to rotate the electroplating roller.

[0009] In one embodiment of the present disclosure, the driver includes a drive motor configured to engage with the engaging portion of the electroplating roller,

thereby driving the cylinder body to rotate intermittently.

[0010] In one embodiment of the present disclosure, the movable frame includes a fixing plate, two side plates, two auxiliary rods, and a rotary joint, wherein the side plates are disposed on two sides of the fixing plate, the auxiliary rods are disposed between the side plates, wherein the cylinder body is located above the auxiliary rods. The rotary joint is pivotally connected to the fixing plate and configured to combine with a second end of the rotating shaft.

[0011] In one embodiment of the present disclosure, the movable frame includes two cathode bases disposed on two sides of a bottom of the fixing plate (51) and configured to electrically connect to a cathode ring.

[0012] In one embodiment of the present disclosure, the cylinder body includes a base, a surrounding wall, and an upper cover, wherein the base is combined with the surrounding wall, a cathode ring is formed on an inner surface of the surrounding wall, and the rotating shaft connects to the upper cover from the base and extends outward.

[0013] In one embodiment of the present disclosure, the electroplating device further comprises a leaked solution receiving plate disposed on a drive motor of the driver and configured to receiving the electroplating solution leaked from the electroplating tank.

[0014] As described above, the driver is disposed under the electroplating tank, and the electroplating roller is rotated by the engagement portion and the drive motor being engaged with each other. Not only can the electroplating roller be easily shifted and replaced, but also the electroplating rate and efficiency of the small components can be improved. Moreover, the electroplating device of the small component has a simple structure, so that subsequent maintenance costs are low.

DESCRIPTION OF DRAWINGS

[0015]

FIGs. 1 and 2 are schematic views of a partial structure of an electroplating device for a small component according to a first preferred embodiment of the present disclosure.

FIG. 3 is a perspective view of a partial structure of an electroplating device for a small component according to a second preferred embodiment of the present disclosure.

FIG. 4 is a cross-sectional view along A-A tangent according to FIG. 3.

FIG. 5 is a schematic view of the electroplating device for the small component showing two electroplating tanks according to the second preferred embodiment of the present disclosure.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0016] The structure and the technical means adopted by the present disclosure to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings.

[0017] Furthermore, directional terms described by the present disclosure, such as upper, lower, front, back, left, right, inner, outer, side, longitudinal/vertical, transverse/horizontal, etc., are only directions by referring to the accompanying drawings, and thus the used directional terms are used to describe and understand the present disclosure, but the present disclosure is not limited thereto.

[0018] Referring to FIGs. 1 and 2, an electroplating device for a small component according to a first preferred embodiment of the present disclosure is illustrated for electroplating or electroless plating small components, such as chip type resistors, inductors, capacitors, connectors, precision parts, etc. The electroplating device for the small component includes a base body 101 and at least one or more electroplating units 102. The detailed structure of each component, assembly relationships, and principle of operation in the present invention will be described in detail hereinafter.

[0019] Referring to FIGs. 1 and 2, in the electroplating device for the small component, one electroplating unit 102 is disposed on the base body 101, and each of the at least one electroplating unit includes an electroplating roller 2, an electroplating tank 3, a driver 4, and a movable frame 5. It should be noted that, in other embodiments, a plurality of electroplating units 102 can be disposed on the base body 101, which is not limited to the embodiment.

[0020] Referring to FIGs. 1 and 2, the electroplating roller 2 includes a cylinder body 21, a rotating shaft 22, an engaging portion 23, and a current conducting layer 24, wherein a first end of the rotating shaft 22 is disposed on the cylinder body 21, and the engaging portion 23 is disposed at a bottom of the cylinder body 21. Furthermore, the cylinder body 21 includes a bottom base 211, a surrounding wall 212 and an upper cover 213. A tenon of the bottom base 211 is engaged with the surrounding wall 212, a cathode ring 210 is formed on an inner surface of the surrounding wall 212, and the upper cover 213 covers the surrounding wall 212 to define an internal space (not labeled). The current conducting layer 24 is disposed on the bottom base 211 of the cylinder body 21, and the rotating shaft 22 is connected to the upper cover 213 from the bottom base 211 and extends outward.

[0021] Referring to FIGs. 1 and 2, the electroplating tank is a rectangular container in which a partition 103 is disposed. The upper portion of the partition 103 is used for accommodating an electroplating solution, and the electroplating roller 2 can be immersed in the electroplat-

ing tank 3. One or more anode baskets 103 can be immersed in the electroplating tank 3.

[0022] Referring to FIGs. 1 and 2, the driver 4 is disposed below the bottom of the electroplating tank 3, and configured to drive rotations of the engaging portion 23 so as to rotate the electroplating roller 2. The driver 4 includes a drive motor 41 and an electrode connector 42, wherein the drive motor 41 is a DC drive motor for engaging with the engaging portion 23 of the electroplating roller 2, and further rotates the cylinder body 21 by the engaging portion 23. For example, a jaw of the engaging portion 23 is engaged with a groove of the drive motor 41. The electrode connector 42 is disposed on the drive motor 41 for electrically connecting to a cathode. Moreover, the electroplating tank 2 further includes a cathode conductor 25 disposed in the engaging portion 23 for electrically contacting the electrode connector 42.

[0023] Referring to FIGs. 1 and 2, the movable frame 5 is combined on the base body 101 and configured to move on the base body 101. The movable frame 5 is located at a top of the electroplating tank 3. The electroplating roller 2 can be pulled away from the electroplating tank 3 by moving the movable frame 5, and placed in another electroplating tank (not shown). In addition, a second end 222 of the rotating shaft 22 is pivotally connected to the movable frame 5, and the engaging portion 23 is located below the first end 221 of the rotating shaft 22. It is further noted that the movable frame 5 includes a fixing plate 51, two side plates 52, two position blocks 53, two auxiliary rods 54, and a cover body 55. The fixing plate 51 is configured to pivotally connect the second end 222 of the rotating shaft 22. The two side plates 52 are combined on two sides of the fixing plate 51. The two position blocks 53 are disposed on two sides of the fixing plate 51 and located outside the two side plates 52. The two position blocks 53 are respectively fixed on the side plates 52 for alignment. Two auxiliary rods 54 are disposed between the side plates 52 such that the cylindrical body 21 is located above the auxiliary rods 54. The cover body 55 is configured to be screwed together with the first end 221 of the rotating shaft 22 to be fixed on the fixing plate 51.

[0024] Referring to FIGs. 1 and 2, the base body 101 includes a lifting base 7, wherein the movable frame 5 is disposed on the lifting base 7. The movable frame 5 is moved by the lifting base 7 to move between a soaking position near the electroplating tank 3 and a preparation position away from the electroplating tank 3.

[0025] It is further noted that an inner surface of the surrounding wall 212 of the cylinder body 21 of the electroplating roller 2 can be provided with the cathode ring 210. The cathode ring 210 can be connected to a cathode conductor 25 in the engaging portion 23 and electrically connected to the electrode connector 42. The small components in the cylinder body 21 are brought to the surface of the cathode ring 210 by the centrifugal force of the electroplating roller 2 at the time of rotation.

[0026] It is to be noted that the current conducting layer

24 is made of titanium metal, or titanium-plated or titanium-sprayed material. The cylinder body 21 is made of a plastic material. An intermediate layer (not shown) is disposed between the current conducting layer 24 and the cylinder body 21, and the intermediate layer is made of a plastic material.

[0027] According to the above structure, the engaging portion 23 and the drive motor 41 are engaged with each other to drive the electroplating roller 2 to intermittently rotate by disposing the driver 4 below the bottom of the electroplating tank 3, and the surface of the cathode ring 210 can be electrically connected to the electrode connector 42. With the centrifugal force of the electroplating roller 2 at the time of rotation, the small components in the cylinder body 21 are taken to the surface of the cathode ring 210, thereby achieving the effect of uniform plating of the surface of the small components.

[0028] As described above, the driver 4 is disposed in the electroplating tank 3, and the electroplating roller 2 is rotated by the engagement portion 23 and the drive motor 41 being engaged with each other. Not only can the electroplating roller 2 be easily shifted and replaced, but also the electroplating rate and efficiency of the small components can be improved. Moreover, the electroplating device for the small component has a simple structure, so that subsequent maintenance costs are low.

[0029] Referring to FIGs. 3, 4 and 5, an electroplating device for a small component according to a second preferred embodiment of the present disclosure is illustrated, and the same component names and drawing numbers of the above preferred embodiment are generally used, the differences are that the movable frame 5 can be moved by an external device, such as a mechanical arm, so that one of the electroplating roller 2 can be moved to another electroplating tank 3' from the electroplating tank 3. The electroplating roller 2 further includes a power line guide ring 26 disposed in the cylinder body 21 and spaced apart from the surrounding wall 212. The movable frame 5 includes a fixing plate 51, two side plates 52, two auxiliary rods 54, two holding elements 56, a rotary joint 56, and two cathode bases 58, wherein the side plates 52 are disposed on two sides of the fixing plate 51, the auxiliary rods 54 are disposed between the side plates 52, and the cylinder body 21 is located above the auxiliary rods 54. The rotary joint is pivotally connected to the fixing plate and configured to combine with a second end of the rotating shaft. The holding elements 56 are respectively disposed on two sides of a top surface of the fixing plate 51. The rotary joint 57 is pivotally connected to the fixing plate 51 for combining with the second end 222 of the rotating shaft 22. The cathode bases 58 are disposed on two sides of the bottom of the fixing plate 51 for electrically connecting to the cathode ring 210 via a cathode wire 59 and the rotating shaft 22. In addition, the bottom of the cylinder body 21 is provided with forced vortex blades, which can exchange the electroplating solution therein quickly. The drive motor 41 is disposed below the bottom of the electroplating tank 3, and the electroplating

device further includes a leakage plate 43 disposed between the drive motor 41 and the bottom of the electroplating tank 3 for receiving the electroplating solution leaked from the electroplating tank 3.

[0030] According to the above structure, the cylinder body 21 and the rotating shaft 22 can be disengaged from the movable frame 5 after the rotary joint 57 is loosened. The cathode bases 58 located on the sides of the bottom of the fixing plate 51 can be electrically connected to the cathode ring 210 when electrically contacting, and the cathode bases 58 are disconnected from the cathode ring 210 when the fixing plate 51 is removed. In addition, when the cathode ring 210 is rotationally accelerated to a specified rotational speed, the small components (objects to be electroplated) in the cylinder body 21 are pressed against the cathode ring 210 by centrifugal force, and the small components are electroplated by power supply. After a period of time, the power supply is stopped and the cathode ring 210 is decelerated to a low speed. The small components (objects to be electroplated) in the cylinder body 21 are mixed by gravity falling on the bottom of the cylinder body 21. After the small components (objects to be electroplated) are mixed, the cathode ring 210 is rotated and accelerated to the specified rotation speed. The small components (objects to be electroplated) intermittently undergo the low-speed mixing, the high-speed electroplating, then, the low-speed mixing, and the high-speed electroplating in such a way. Therefore, the surface of the small components (the object to be plated) may have a great effect of uniform electroplating.

[0031] The present disclosure has been described with preferred embodiments thereof and it is understood that many changes and modifications to the described embodiments can be carried out without departing from the scope and the spirit of the invention that is intended to be limited only by the appended claims.

Claims

1. An electroplating device for a small component, **characterized in that** the electroplating device comprises:
 - at least one electroplating unit (102), wherein each of the at least one electroplating unit (102) includes:
 - a movable frame (5);
 - an electroplating roller (2) including a cylinder body (21), a rotating shaft (22), and an engaging portion (23), wherein a first end of the rotating shaft (22) is disposed on the cylinder body (21), and the engaging portion (23) is disposed at a bottom of the cylinder body (21);
 - an electroplating tank (3) configured to receive an electroplating solution to soak the electroplating roller (2); and
 - a driver (4) configured to drive rotations of the engaging portion (23) so as to rotate the elec-

troplating roller (2).

2. The electroplating device for the small component according to claim 1, **characterized in that** the driver (4) includes a drive motor (41) configured to engage with the engaging portion (23) of the electroplating roller (2), thereby driving the cylinder body (21) to rotate intermittently.
3. The electroplating device for the small component according to claim 1, **characterized in that** the movable frame (5) includes:
 - a fixing plate (51);
 - two side plates (52) disposed on two sides of the fixing plate (51);
 - two auxiliary rods (54) disposed between the side plates (52), wherein the cylinder body (21) is located above the auxiliary rods (54); and
 - a rotary joint pivotally connected to the fixing plate (51) and configured to combine with a second end of the rotating shaft (22).
4. The electroplating device for the small component according to claim 3, **characterized in that** the movable frame (5) includes two cathode bases (58) disposed on two sides of a bottom of the fixing plate (51) and configured to electrically connect to a cathode ring (210).
5. The electroplating device for the small component according to claim 1, **characterized in that** the cylinder body (21) includes a base (211), a surrounding wall (212), and an upper cover (213), wherein the base (211) is combined with the surrounding wall (212), a cathode ring (210) is formed on an inner surface of the surrounding wall (212), and the rotating shaft (22) connects to the upper cover (213) from the base (211) and extends outward.
6. The electroplating device for the small component according to claim 1, **characterized in that** the electroplating device further comprises a leaked solution receiving plate (43) disposed on a drive motor (41) of the driver (4) and configured to receiving the electroplating solution leaked from the electroplating tank (3).

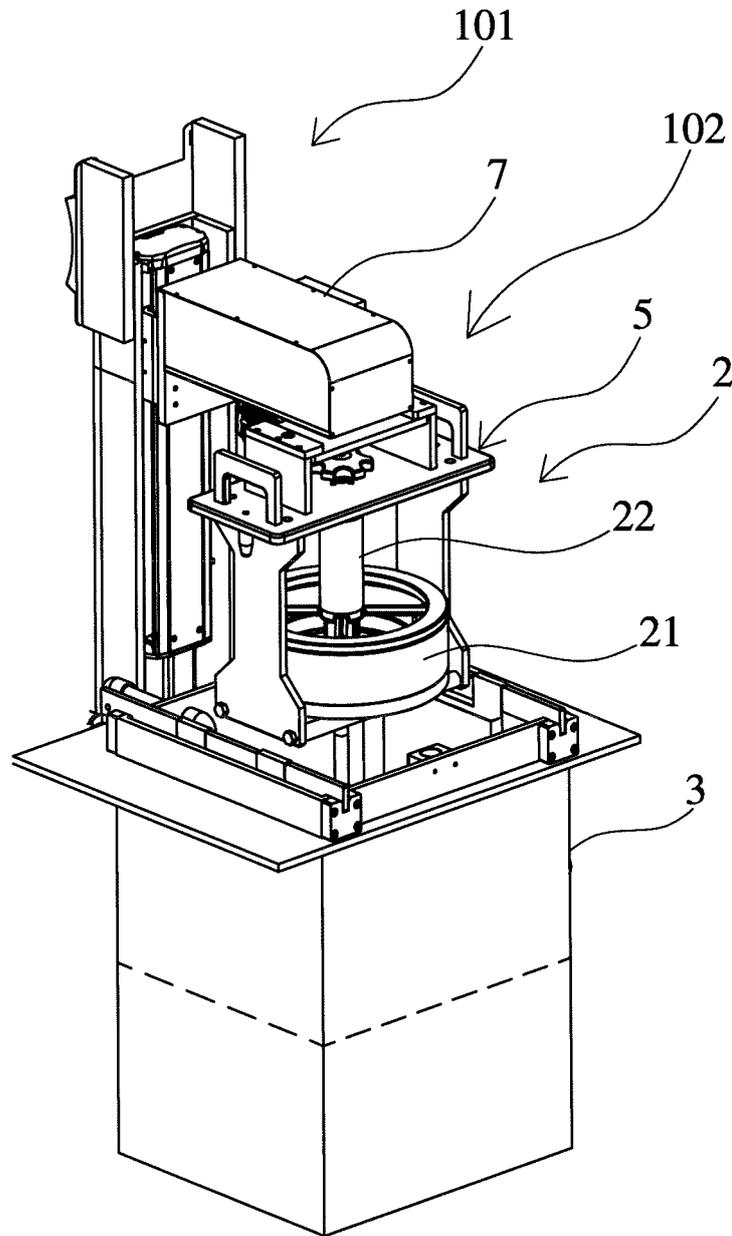


FIG. 1

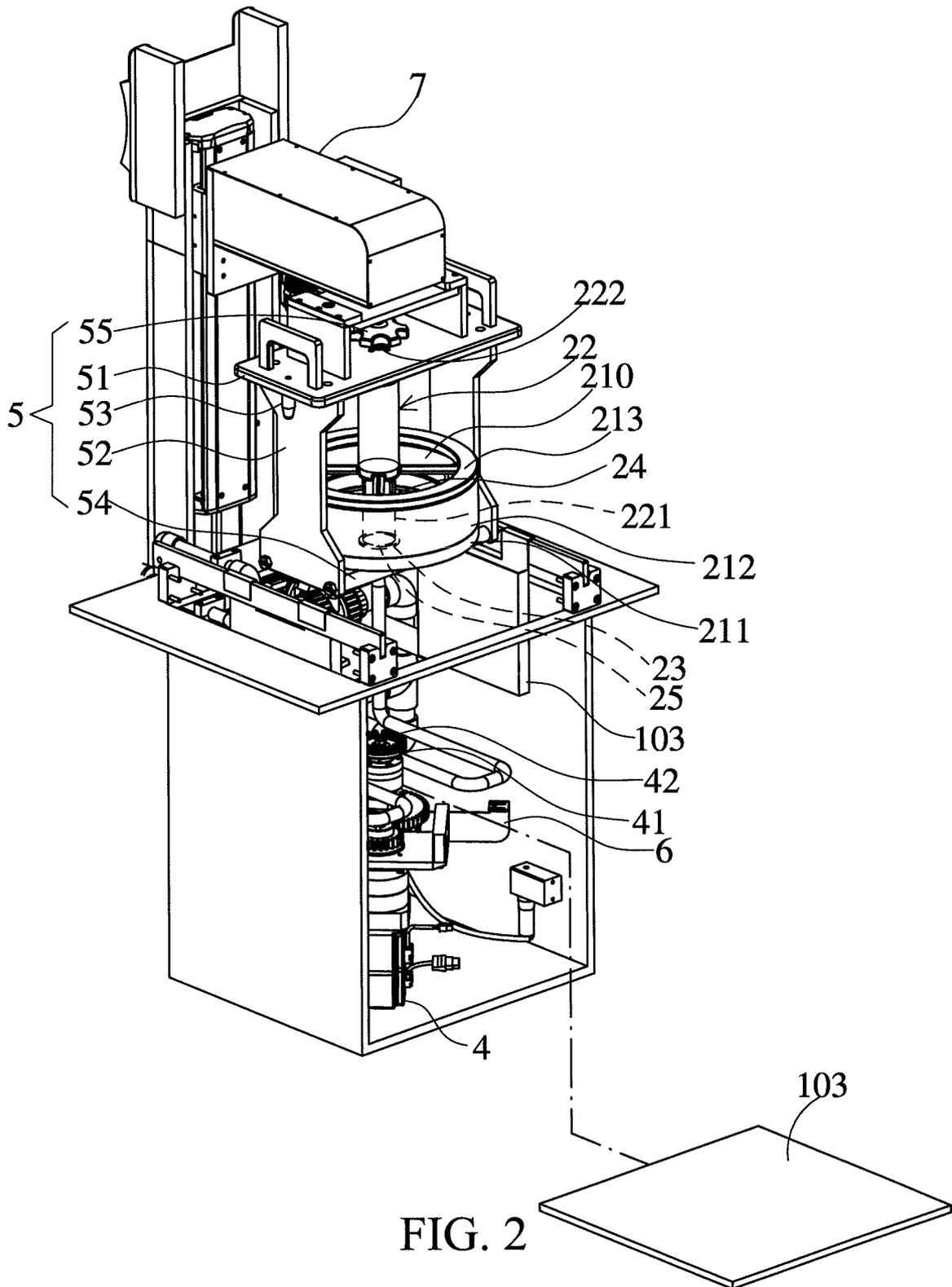


FIG. 2

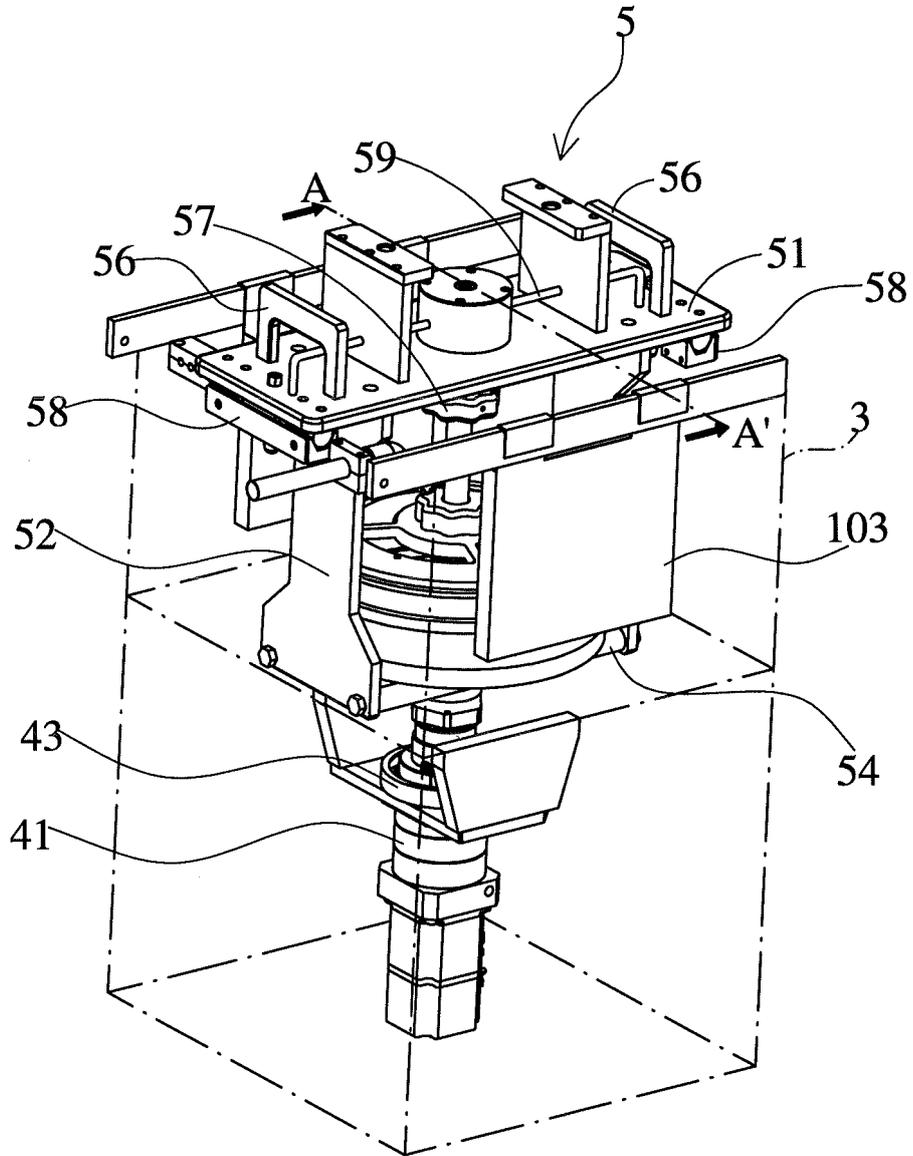


FIG. 3

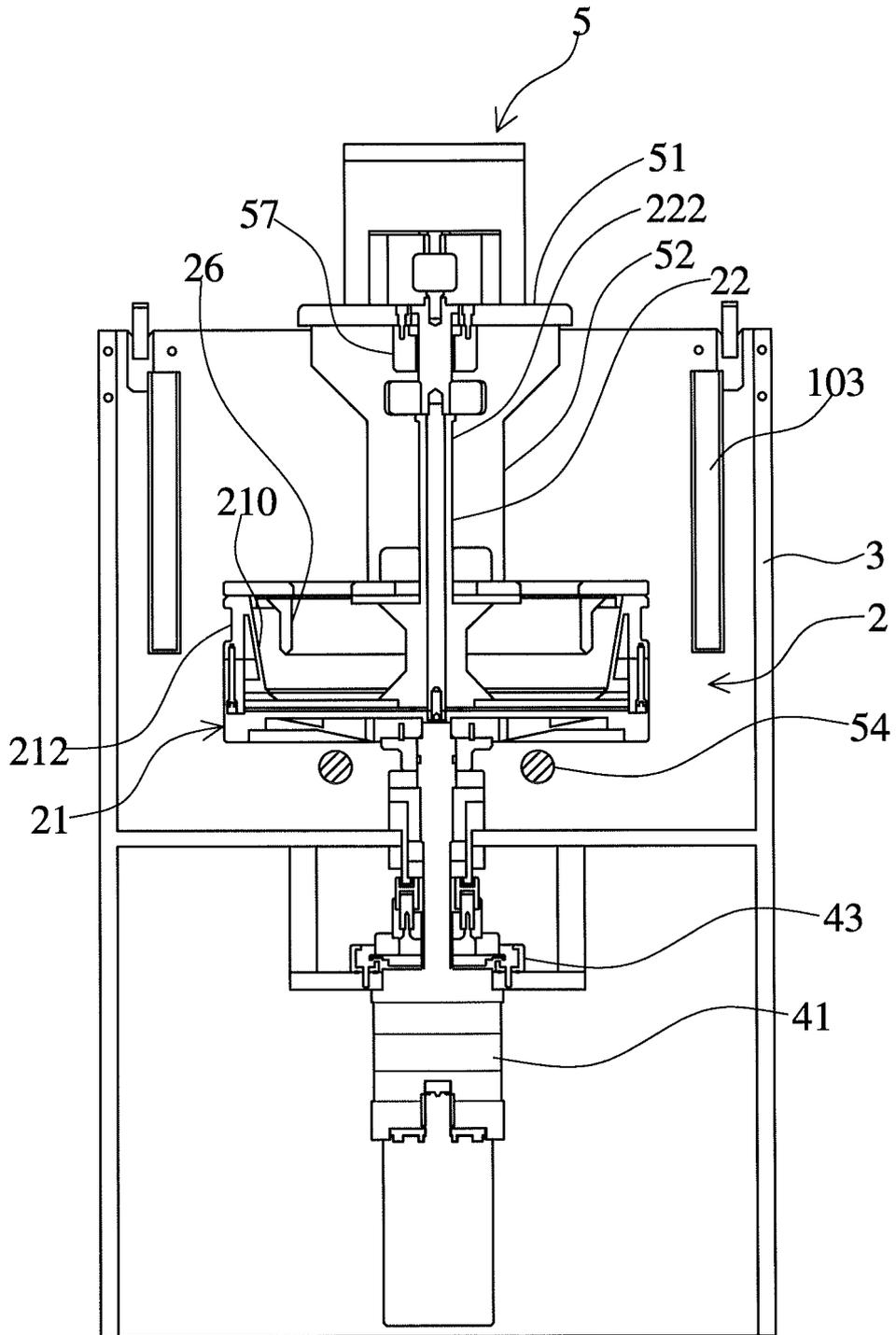


FIG. 4

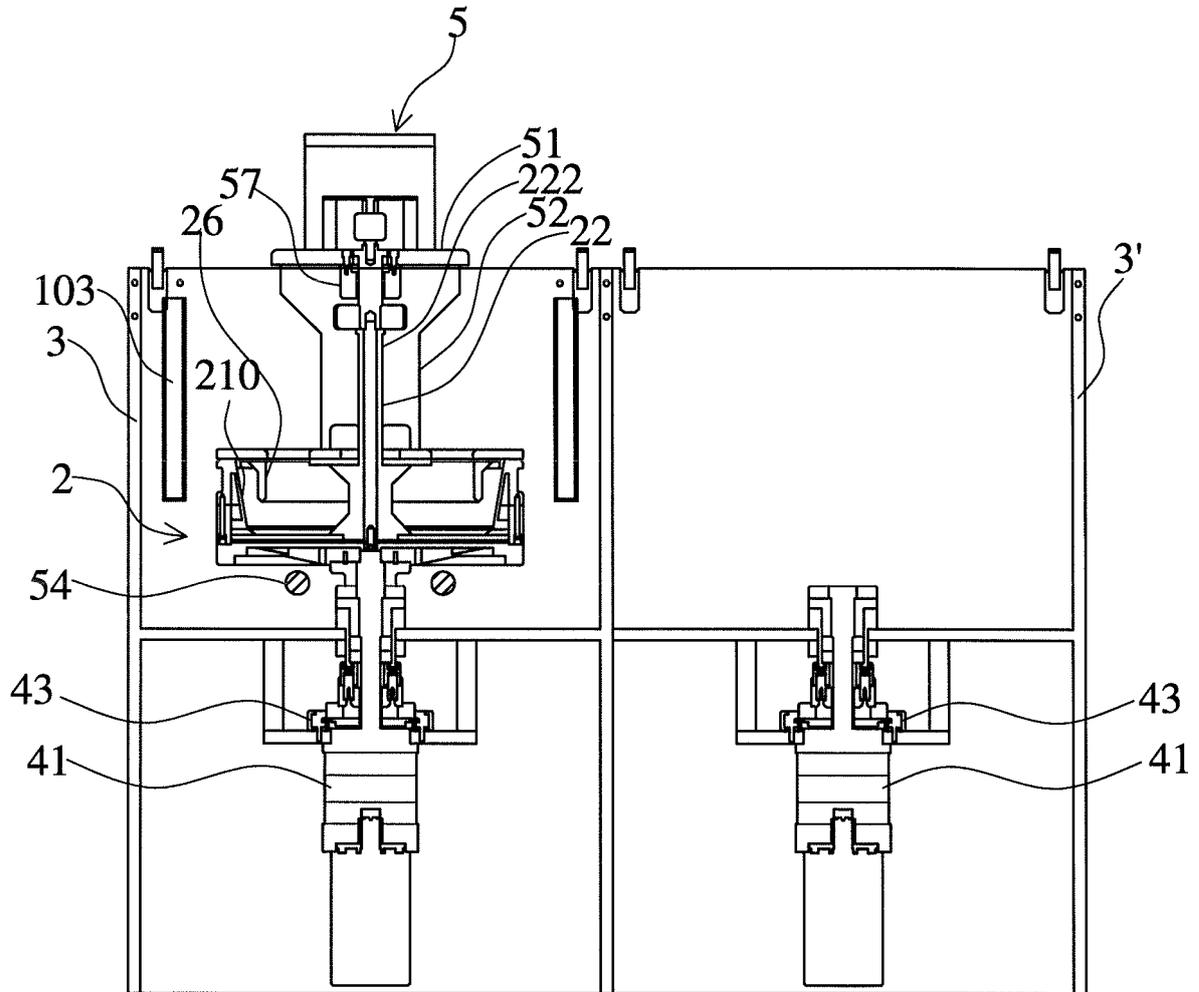


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/118615

5	A. CLASSIFICATION OF SUBJECT MATTER		
	C25D 17/22 (2006.01) i		
	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)		
	C25D		
15	Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
	CNABS, CNKI, WPI, EPODOC: 电镀, 筒, 卡合, 拆卸, 转, 轴, 移动, 驱动, 马达, electroplat+, electrodeposit+, plat+, deposit+, drum?, roller?, barrel?, demount+, rotat+, roll+, shaft, axis, mov+, driv+, motor		
20	C. DOCUMENTS CONSIDERED TO BE RELEVANT		
	Category*	Citation of document, with indication, where appropriate, of the relevant passages	
		Relevant to claim No.	
25	X	JP 08239799 A (UYEMURA C & CO., LTD.), 17 September 1996 (17.09.1996), description, paragraphs [0013], [0016]-[0023] and [0033], and figures 1, 6 and 7	1-6
	A	JP 2002322591 A (SEKISUI CHEMICAL CO., LTD.), 08 November 2002 (08.11.2002), entire document	1-6
	A	US 5487824 A (UEMURA KOGYO KABUSHIKI KAISHA), 30 January 1996 (30.01.1996), entire document	1-6
30	A	CN 1576400 A (KAMAYA ELECTRIC CO., LTD.), 09 February 2005 (09.02.2005), entire document	1-6
35	<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
	* Special categories of cited documents:	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
40	“A” document defining the general state of the art which is not considered to be of particular relevance	“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	
	“E” earlier application or patent but published on or after the international filing date	“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 such documents, such combination being obvious to a person skilled in the art	
45	“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)	“&” document member of the same patent family	
	“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		
50	Date of the actual completion of the international search 22 March 2018	Date of mailing of the international search report 29 March 2018	
55	Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer ZHU, Feng Telephone No. (86-10)-62084540	

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/118615

	Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
5				
	JP 08239799 A	17 September 1996	JP 3128459 B2	29 January 2001
10	JP 2002322591 A	08 November 2002	JP 3694249 B2	14 September 2005
	US 5487824 A	30 January 1996	TW 305884 B	21 May 1997
			JP 3126867 B2	22 January 2001
			JP H07118896 A	09 May 1995
15	CN 1576400 A	09 February 2005	JP 4358568 B2	04 November 2009
			TW I351449 B	01 November 2011
			JP 2005036298 A	10 February 2005
20			CN 1576400 B	07 September 2011
			TW 200510573 A	16 March 2005
25				
30				
35				
40				
45				
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

- CN 2017118615 W [0001]
- US 62439606 [0001]