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(54) Title: ASSEMBLY APPARATUS

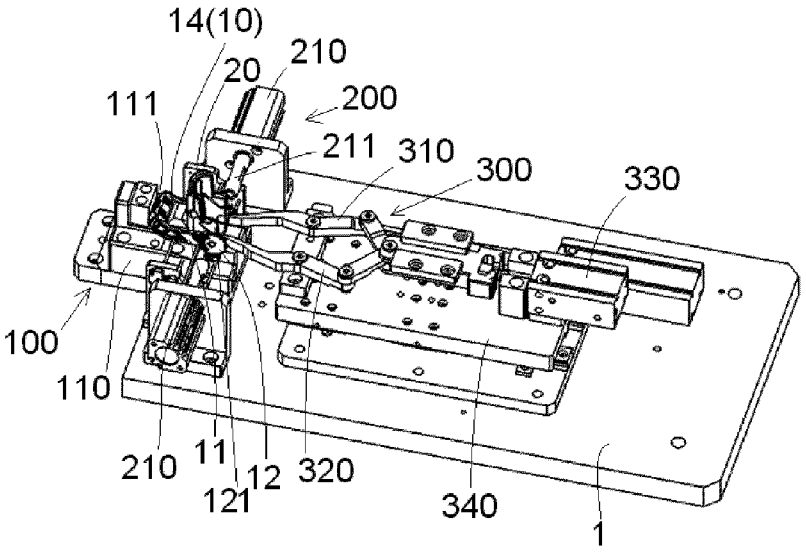


Fig. 2

(57) Abstract: An assembly apparatus adapted to assemble a first member to a second member includes: a base; a positioning module mounted on the base and adapted to position the first member and the second member; and an expanding module mounted on the base and adapted to expand outwardly the distance between a pair of elastic legs, so as to allow the second member to be place d between the pair of elastic legs. After the pair of expanded elastic legs of the first member is released by the expanding module, the second member is clamped by the pair of elastic legs of the first member, and protrusions of the second member are fitted into installation holes of the first member, respectively. The assembly apparatus may achieve the automatic assembly of the first member and the second member.

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[Continued on next page]

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Assembly Apparatus

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Chinese Patent Application No. 201710349217.7 filed on May 17, 2017 in the State Intellectual Property Office of China, the whole disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

Embodiments of the present disclosure relate to an assembly apparatus adapted to assemble a first member with a pair of elastic legs to a second member.

Description of the Related Art

In the relevant art, it is desired, sometimes, to assemble a first member with a pair of elastic legs to a second member. Upper end portions of the pair of elastic legs of the first member are connected with each other, while lower end portions thereof are separated from each other. An installation hole is formed in the lower end portion of each of the pair of elastic legs. A protrusion adapted to be fitted into the installation hole is formed on each sidewall of the second member.

Before assembling, a distance between the lower end portions of the pair of elastic legs of the first member is less than a distance or width between a pair of sidewalls of the second member. As a result, an expanding tool is required to expand outwardly the lower end portions of the pair of elastic legs of the first member, so that the distance between the lower end portions of the pair of the elastic legs of the first member is slightly greater than the distance between the pair of sidewalls of the second member. The second member is then placed between the expanded lower end portions of the pair of elastic legs of the first member, and a location of the first or second member is adjusted to align the installation hole of the first member with the protrusion of the second member. Finally, the expanding tool is released to allow the second member to be clamped between the pair of elastic legs of the first member and the protrusion of the second member to be fitted into the installation hole of the first member, thereby finishing assembling the first member to the second member.

In the related art, the above assembly process is usually performed manually. Typically, an operator takes the expanding tool in one hand to expand outwardly the pair of elastic legs of the first member, and with the other hand he or she seizes the second member and places it between the pair of expanded elastic legs of the first

member. Such a manual assembly process is time consuming and inefficient, and increases assembly cost.

SUMMARY OF THE INVENTION

An objective of the present disclosure is to solve at least one aspect of the above mentioned problems and disadvantages occurred in the prior art.

According to an object of the present disclosure, there is provided an assembly apparatus which may automatically assemble a first member to a second member, thereby lowering assembly cost.

According to an aspect of the present disclosure, there is provided an assembly apparatus adapted to assemble a first member to a second member. The first member includes a pair of elastic legs, upper end portions of which are connected with each other, and a lower end portions of which are formed with an installation holes, respectively, and a protrusion adapted to be fitted into the installation hole is formed on each sidewall of the second member. The assembly apparatus includes: a base; a positioning module mounted on the base and adapted to position the first member and the second member; and an expanding module mounted on the base and adapted to expand outwardly a distance between the pair of elastic legs of the first member, so as to allow the second member to be placed between the pair of elastic legs. After the pair of expanded elastic legs of the first member is released by the expanding module, the sidewalls of the second member are clamped by the pair of the elastic legs of the first member, and the protrusions of the second member are fitted into the installation holes of the first member, respectively.

According to an exemplary embodiment of the present disclosure, when the first member and the second member are positioned on the positioning module, the installation holes in the lower end portions of the elastic legs of the first member are aligned with the protrusions of the sidewalls of the second member, respectively.

According to a further exemplary embodiment of the present disclosure, the positioning module includes a positioning block mounted on the base and on which there are formed with a first positioning groove adapted to position the first member and a second positioning groove adapted to position the second member.

According to a further exemplary embodiment of the present disclosure, the expanding module includes: an expanding tool comprising a pair of finger parts that are openable and closable; and a driving device adapted to drive the pair of finger parts of the expanding tool to open or close. The pair of finger parts of the expanding tool are disposed on inner sides of the elastic legs of the first member respectively to

expand outwardly the distance between the pair of elastic legs of the first member.

According to a further exemplary embodiment of the present disclosure, when the distance between the pair of expanded elastic legs of the first member is expanded by the pair of finger parts of the expanding tool to a predetermined value, the second member is placed between the pair of elastic legs of the first member, and mounted and positioned on the positioning module.

According to a further exemplary embodiment of the present disclosure, the expanding module further includes a mounting base plate adapted to be mounted on the base, the expanding tool and the driving device being mounted on the mounting base plate.

According to a further exemplary embodiment of the present disclosure, the mounting base plate is removably mounted on the base.

According to a further exemplary embodiment of the present disclosure, the assembly apparatus further includes a pushing device adapted to push inwardly the pair of elastic legs of the first member to force the protrusions of the second member to be fitted into the installation holes of the first member, respectively.

According to a further exemplary embodiment of the present disclosure, the pushing device includes a pair of cylinders mounted on the base, located on both sides of the first member and comprising a pair of telescopic mechanisms adapted to simultaneously and inwardly push the pair of elastic legs of the first member.

According to a further exemplary embodiment of the present disclosure, the lower end portions of the elastic legs of the first member are in a disc form.

According to a further exemplary embodiment of the present disclosure, prior to being expanded, a distance between the lower end portions of the pair of elastic legs of the first member is slightly less than a width of the pair of sidewalls of the second member.

In the above exemplary embodiments of the present disclosure, the assembly apparatus may achieve the automatic assembly of the first member and the second member, thereby improving the assembly efficiency and reducing the assembly cost.

Other objectives and advantages of the present disclosure will become apparent from the following description of the present disclosure when taken in conjunction with the accompanying drawings, and may give a comprehensive understanding of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features of the present disclosure will become more

apparent by describing in detail exemplary embodiments thereof with reference to the accompanying drawings, in which:

Fig. 1 shows an illustrative perspective view of a first member and a second member according to an exemplary embodiment of the present disclosure;

Fig. 2 shows an illustrative perspective view of an assembly apparatus for assembling the first member and the second member as shown in Fig. 1 according to an exemplary embodiment of the present disclosure, wherein an expanding tool is in an expanding state for expanding outwardly a pair of elastic legs of the first member; and

Fig. 3 shows an illustrative perspective view of the assembly apparatus for assembling the first member and the second member as shown in Fig. 1 according to an exemplary embodiment of the present disclosure, wherein an expanding tool is in a releasing state for not expanding outwardly the pair of elastic legs of the first member.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

The technical solution of the present disclosure will be described hereinafter in further detail with reference to the following embodiments, taken in conjunction with the accompanying drawings. In the specification, the same or similar reference numerals indicate the same or similar parts. The description of the embodiments of the present disclosure hereinafter with reference to the accompanying drawings is intended to explain the general inventive concept of the present disclosure, and should not be constructed as a limitation to the present disclosure.

In addition, in the following detailed description, for the sake of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, one or more embodiments may also be practiced without these specific details. In other instances, well-known structures and devices are illustrated schematically in order to simplify the drawing.

According to a general technical concept of the present disclosure, there is provided an assembly apparatus adapted to assemble a first member to a second member. The first member includes a pair of elastic legs, upper end portions of which are connected with each other, and a lower end portions of which are formed with an installation holes, respectively. A protrusion adapted to be fitted into the installation hole is formed on each sidewall of the second member. The assembly apparatus includes: a base; a positioning module mounted on the base and adapted to position the first member and the second member; and an expanding module mounted on the

base and adapted to expand outwardly a distance between the pair of elastic legs of the first member, so as to allow the second member to be placed between the pair of elastic legs. After the pair of expanded elastic legs is released by the expanding module, the sidewalls of the second member are clamped by the pair of the elastic legs of the first member, and the protrusions of the second member are fitted into the installation holes of the first member, respectively.

Fig. 1 shows an illustrative perspective view of a first member 10 and a second member 20 according to an exemplary embodiment of the present disclosure. Fig. 2 shows an illustrative perspective view of an assembly apparatus for assembling the first member 10 and the second member 20 as shown in Fig. 1 according to an exemplary embodiment of the present disclosure, wherein an expanding tool is in an expanding state for expanding outwardly a pair of elastic legs 11 of the first member 10.

As shown in Figs. 1-2, in an illustrated embodiment, the assembly apparatus is adapted to assemble the first member 10 to the second member 20. As clearly shown in Fig. 1, the first member 10 includes a pair of elastic legs 11, upper end portions15 of the pair of elastic legs 11 are connected with each other via a beam 14, and a lower end portion 12 each of the pair of elastic legs 11 is formed with an installation hole 13. A protrusion 23 adapted to be fitted into the installation hole 13 is formed on each sidewall of the second member 20.

As shown in Fig. 2, in an illustrated embodiment, the assembly apparatus mainly includes a base 1, a positioning module 100 and an expanding module 300. The positioning module 100 is mounted on the base 1 and adapted to position the first member 10 and the second member 20. The expanding module 300 is mounted on the base 1 and adapted to expand outwardly a distance between the pair of elastic legs 11 of the first member 10, so as to allow the second member 20 to be placed between the pair of elastic legs 11.

Fig. 3 shows an illustrative perspective view of an assembly apparatus for assembling the first member 10 and the second member 20 as shown in Fig. 1 according to an exemplary embodiment of the present disclosure, wherein an expanding tool is in a releasing state for not expanding outwardly the pair of elastic legs 11 of the first member 10.

As shown in Fig. 3, in an illustrated embodiment, after the pair of expanded elastic legs 11 of the first member 10 is released by the expanding module 300, the sidewalls of the second member 20 are clamped by the pair of the elastic legs 11 of the first member 10, and the protrusions 23 of the second member 20 are fitted into

the installation holes 13 of the first member 10, respectively.

As shown in Figs. 1-3, in an illustrated embodiment, when the first member 10 and the second member 20 are positioned and held on the positioning module 100, the installation holes 13 in the lower end portions 12 of the elastic legs 11 of the first member 10 are aligned with the protrusions 23 on the sidewalls of the second member 20, respectively.

As shown in Figs. 2-3, in an illustrated embodiment, the positioning module 100 includes a positioning block 110 mounted on the base 1 and on which there is formed with a first positioning groove 111 adapted to position the first member 10 and a second positioning groove 121 adapted to position the second member 20. In this way, during an operation of fitting the protrusions 23 of the second member 20 into the installation holes 13 of the first member 10, respectively, the first member 10 and the second member 20 both are not moved and/or turned over.

As shown in Figs. 2-3, in an illustrated embodiment, the expanding module 300 mainly includes an expanding tool and a driving device 330. The expanding tool includes a pair of finger parts 310, 320 that are openable and closable. The driving device 330 is adapted to drive the pair of finger parts 310, 320 of the expanding tool to open or close by a transmission mechanism.

As shown in Fig. 2, in an illustrated embodiment, the pair of finger parts 310, 320 of the expanding tool are disposed on inner sides of the pair of elastic legs 11 of the first member 10, respectively, in order to expand outwardly the distance between the pair of elastic legs 11 of the first member 10 by first ends of the finger parts 310, 320.

In an illustrated embodiment, the transmission mechanism comprises a guiding portion 350, a movable portion 351 and a pair of driving linkages 352. The movable portion 351 is linearly moved under driving of the driving device 330 and guidance of the guiding portion 350. First ends of the pair of driving linkages 352 are pivotally connected with second ends of the pair of finger parts 310, 320, respectively. Second ends of the pair of driving linkages 352 are pivotally connected with the guiding portion 350.

As shown in Fig. 2, in an illustrated embodiment, when the distance between the pair of elastic legs 11 of the first member 10 is expanded to a predetermined value by the pair of finger parts 310, 320 of the expanding tool, the second member 20 is placed between the pair of elastic legs 11 of the first member 10, and mounted and positioned on the positioning module 100.

As shown in Fig. 2, in an illustrated embodiment, the expanding module 300

further includes a mounting base plate 340 adapted to be mounted on the base 1, the expanding tool and the driving device 330 being mounted on the mounting base plate 340. The mounting base plate 340 is removably mounted on the base 1.

Each of the pair of finger parts 310, 320 is pivotally connected to the mounting base plate 340 at a portion between the first and second ends of the finger part. In this way, when the driving device 330 drives the movable portion 351 to move away from the positioning module 100, the second ends of the pair of finger parts 310, 320 are closed, so that the first ends of the pair of finger parts 310, 320 are opened to expand outwardly the distance between the pair of elastic legs 11 of the first member 10; and when the driving device 330 drives the movable portion 351 to move toward the positioning module 100, the second ends of the pair of finger parts 310, 320 are opened, so that the first ends of the pair of finger parts 310, 320 are closed to release the pair of elastic legs 11 of the first member 10. In an illustrated embodiment, the driving device 330 may comprises any one of a stepping motor, a pneumatic cylinder, a hydraulic cylinder, and an electromagnetic pull-in mechanism.

As shown in Figs. 2-3, in an illustrated embodiment, the assembly apparatus further includes a pushing device 200. After the pair of expanded elastic legs 11 of the first member 10 is released by the expanding module 300, the pushing device 200 pushes inwardly the pair of elastic legs 11 of the first member 10, so as to force the protrusions 23 of the second member 20 to be fitted into the installation holes 13 of the first member 10, respectively.

As shown in Figs. 2-3, in an illustrated embodiment, the pushing device 200 includes a pair of cylinders 210 mounted on the base 1. The pair of cylinders 20 are located on both sides of the first member 10, and includes a pair of telescopic mechanisms 211 adapted to simultaneously and inwardly push the pair of elastic legs 11 of the first member 10. In an alternative embodiment, the pushing device 200 may comprises a stepping motor or an electromagnetic pull-in mechanism.

As shown in Fig. 1, in an illustrated embodiment, the lower end portions 12 of elastic legs 11 of the first member 10 are in a disc form.

In an embodiment of the present disclosure, prior to being expanded, the distance between the lower end portions 12 of the pair of elastic legs 11 of the first member 10 is slightly less than the width between the sidewalls of the second member 20. After being expanded, the distance between the lower end portions 12 of the pair of elastic legs 11 of the first member 10 is expanded to be large enough to place the second member 20 between the elastic legs 11 of the first member 10.

A process for assembling the first member 10 to the second member 20 will be

illustrated hereinafter with reference to Figs. 1-3.

First, as shown in Fig. 2, placing and mounting the first member 10 on the positioning module 100;

Second, as shown in Fig. 2, expanding the distance between the pair of elastic legs 11 of the first member 10 by the expanding module 300 to a predetermined value;

Next, as shown in Fig. 2, placing the second member 20 between the pair of elastic legs 11 of the first member 10, and mounting and positioning the second member 20 on the positioning module 100;

Next, as shown in Fig. 3, releasing the pair of expanded elastic legs 11 of the first member 10 by the expanding module 300, so as to allow the pair of elastic legs 11 of the first member 10 to clamp the sidewalls of the second member 20;

Finally, simultaneously and inwardly pushing the pair of elastic legs 11 of the first member 10 by the pushing device 200, so as to fit the protrusions 23 of the second member 20 into the installation holes 13 of the first member 10.

In this way, the first member 10 is assembled to the second member 20.

It should be appreciated by those skilled in the art that the above embodiments are intended to be illustrative, modifications may be made to the above embodiments by those skilled in the art, and structures described in various embodiments may be freely combined without having structural and principle conflict.

Although the present disclosure has been described with reference to the attached drawings, the embodiments disclosed in the drawings are intended to illustrate the preferred embodiments of the present disclosure, but should not be constructed as a limitation to the present disclosure.

Although some embodiments of the general concept of the present disclosure has been shown and described, it would be appreciated by those skilled in the art that modifications may be made to these embodiments without departing from the principle and spirit of the present disclosure, the scope of which is defined in the claims and their equivalents.

It should be noted that term “comprising” or “including” should be understood as not excluding other elements or steps, and term “a” or “an” should be understood as not excluding plural elements or steps. Further, any reference numerals in claims should not be understood as a limitation to the present disclosure.

What is claimed is,

1. An assembly apparatus, adapted to assemble a first member (10) to a second member (20),

the first member (10) including a pair of elastic legs (11), upper end portions (15) of which are connected with each other, and lower end portions (12) of which are formed with an installation holes (13), respectively, a protrusion (23) adapted to be fitted into the installation hole (13) being formed on each sidewall of the second member (20),

characterized in that the assembly apparatus includes:

a base (1);

a positioning module (100) mounted on the base (1) and adapted to position the first member (10) and the second member (20); and

an expanding module (300) mounted on the base (1) and adapted to expand outwardly a distance between the pair of elastic legs (11) of the first member (10), so as to allow the second member (20) to be placed between the pair of elastic legs (11),

after the pair of expanded elastic legs (11) of the first member (10) is released by the expanding module (300), the sidewalls of the second member (20) are clamped by the pair of the elastic legs (11) of the first member (10), and the protrusions (23) of the second member (20) are fitted into the installation holes (13) of the first member (10), respectively.

2. The assembly apparatus according to claim 1, wherein:

when the first member (10) and the second member (20) are positioned on the positioning module (100), the installation holes (13) in the lower end portions (12) of the elastic legs (11) of the first member (10) are aligned with the protrusions (23) of the sidewalls of the second member (20), respectively.

3. The assembly apparatus according to claim 1, wherein:

the positioning module (100) includes a positioning block (110) mounted on the base (1), a first positioning groove (111) adapted to position the first member (10) and a second positioning groove (121) adapted to position the second member (20) being formed on the positioning block.

4. The assembly apparatus according to claim 1, wherein:

the expanding module (300) includes:

an expanding tool comprising a pair of finger parts (310, 320) that are openable and closable; and

a driving device (330) adapted to drive the pair of finger parts (310, 320) of the expanding tool to open or close,

the pair of finger parts (310, 320) of the expanding tool are disposed on inner sides of the elastic legs (11) of the first member (10), respectively, to expand outwardly the distance between the pair of elastic legs (11) of the first member (10).

5. The assembly apparatus according to claim 4, wherein:

when the distance between the pair of expanded elastic legs (11) of the first member (10) is expanded by the pair of finger parts (310, 320) of the expanding tool to a predetermined value, the second member (20) is placed between the pair of elastic legs (11) of the first member (10), and mounted and positioned on the positioning module (100).

6. The assembly apparatus according to claim 4, wherein:

the expanding module (300) further includes a mounting base plate (340) adapted to be mounted on the base (1), the expanding tool and the driving device (330) being mounted on the mounting base plate (340).

7. The assembly apparatus according to claim 6, wherein:

the mounting base plate (340) is removably mounted on the base (1).

8. The assembly apparatus according to claim 1, further including a pushing device (200) adapted to push inwardly the pair of elastic legs (11) of the first member (10) to force the protrusions (23) of the second member (20) to be fitted into the installation holes (13) of the first member (10), respectively.

9. The assembly apparatus according to claim 8, wherein:

the pushing device (200) includes a pair of cylinders (210) mounted on the base (1), located on both sides of the first member (10) and comprising a pair of telescopic mechanisms (211) adapted to simultaneously and inwardly push the pair of elastic legs (11) of the first member (10).

10. The assembly apparatus according to claim 1, wherein:

the lower end portions (12) of the elastic legs (11) of the first member (10) are in a disc form.

11. The assembly apparatus according to claim 1, wherein:

prior to being expanded, a distance between the lower end portions (12) of the pair of elastic legs (11) of the first member (10) is slightly less than a width of a pair of sidewalls of the second member (20).

DRAWINGS

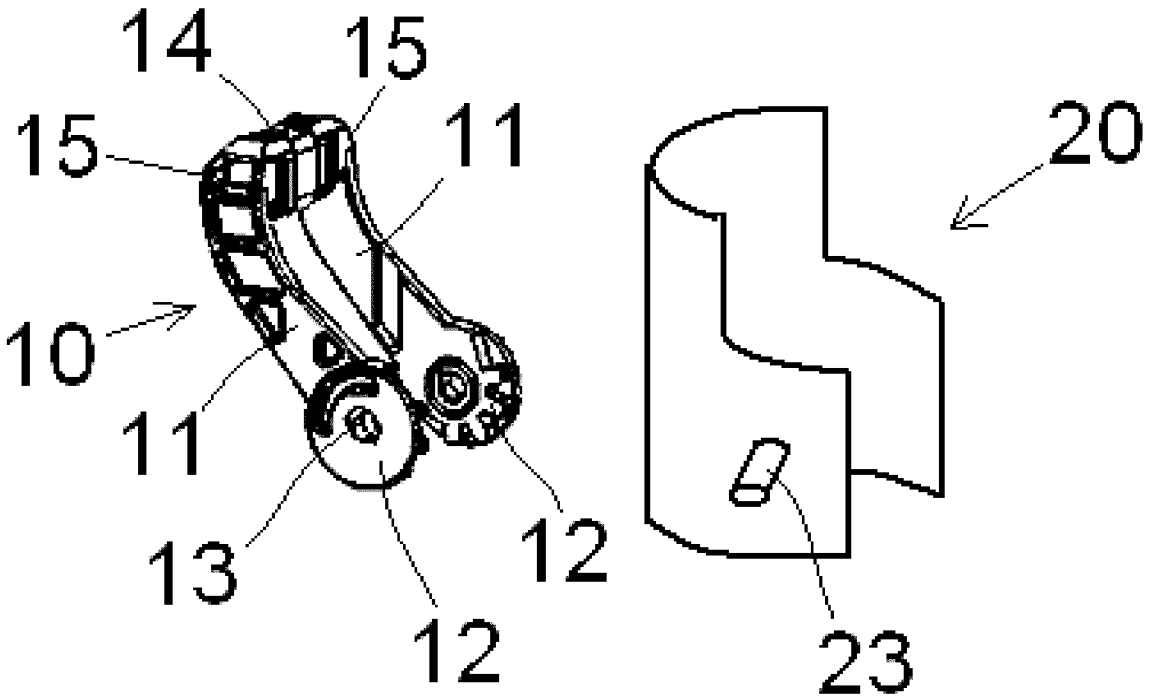


Fig. 1

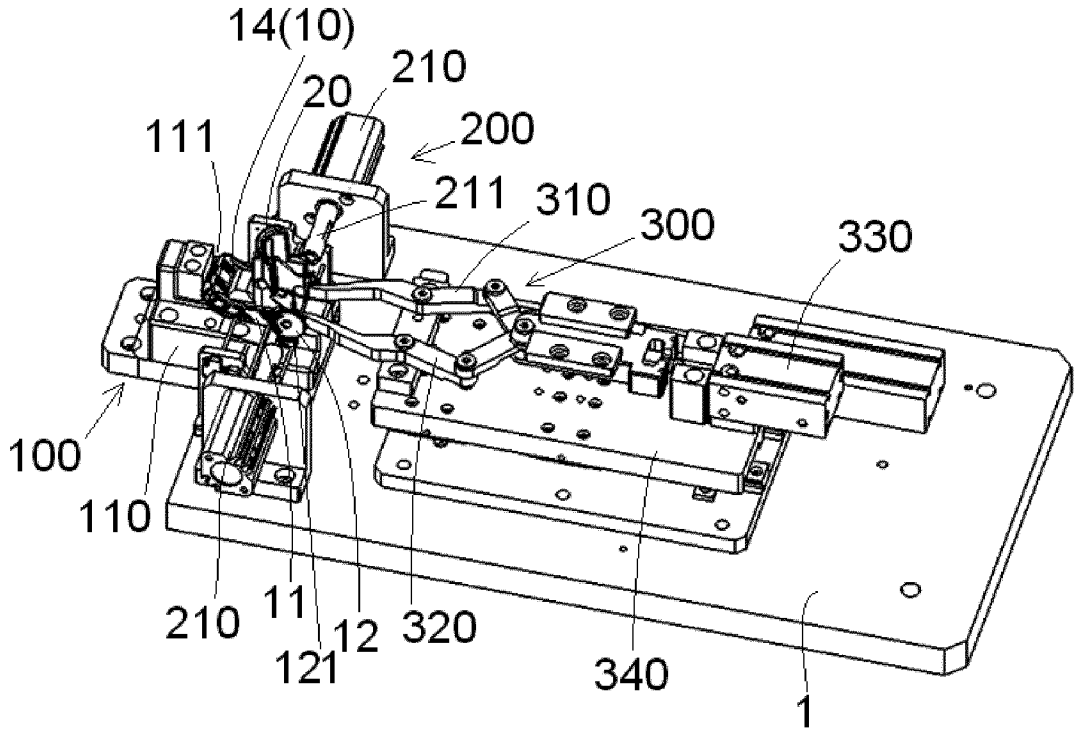

14(10)
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121
340
1

Fig. 2

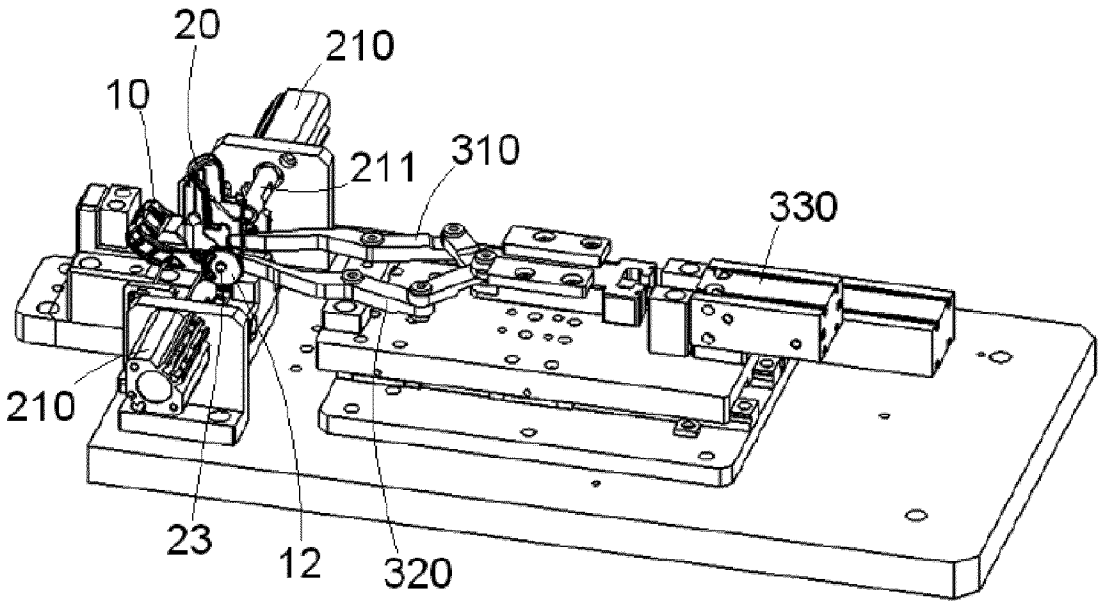


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/062568

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/629 H01R43/18
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01R

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/123325 A1 (MAFFEIS GIUSEPPE [IT]) 20 May 2010 (2010-05-20) paragraph [0021] - paragraph [0023]; figures 5,6	1-11
X	US 5 230 635 A (TAKENOUCHI KENJI [JP] ET AL) 27 July 1993 (1993-07-27) column 8, line 50 - page 9, line 36; figure 1	1-10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* 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 application or patent but published on or after the international filing date

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"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

"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 such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 June 2018	18/07/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Bouhana, Emmanuel

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2018/062568

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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