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(54) A MACHINE FOR USE IN PROCESSING OF RUBBER COT ARBOURS

MASCHINE ZUR VERWENDUNG BEI DER VERARBEITUNG VON GUMMIBESCHICHTUNGSSPINDELN

MACHINE CONÇUE POUR TRAITER DES ARBRES PORTE-CYLINDRES EN CAOUTCHOUC

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Description**FIELD OF INVENTION:**

5 [0001] The invention relates to a field of textile machinery. More particularly it relates to the processing of rubber cot arbours. Specifically it relates to automatic processing of finished and unfinished rubber cot arbours. Even more precisely, it relates to a machine for use in processing of rubber cot arbours.

PRIOR ART:

10 [0002] In textile machinery rubber cot arbours assemblies are widely used. The rubber cot arbours assembly is mainly used in producing compact yarn on ring spinning machines of textile manufacturing.

[0003] There are large quantities rubber cot arbours assemblies used in a spinning mill to run a machine for ring-spinning and similar type of applications with compact spinning system. The rubber cot arbours assembly consists of a two-part housing, big rubber cot arbour, small rubber cot arbour, a gear assembly and an Allen screw.

15 [0004] In existing systems, in a spinning mill at regular intervals/schedules, the grinding of big & small rubber cot arbours of the rubber cot arbours assembly or similar type assembly is being carried out. This is required due to continuous running wear-out of the surface and hence surface roughness change. For carrying out the grinding of rubber cot arbours during regular maintenance schedule, the rubber cot arbours assemblies have to be disassembled by removing the small and big cot from the assembly.

20 [0005] Referring to figures 1(a) and 1(b), the rubber cot arbour assembly (1) includes small (2) and big (3) rubber cot arbours. The both rubber cot arbours are in contact with each other with the help of covers (4, 5) to be fitted with Allen screw (9). The Allen screw used for holding two part (4, 5) of covers requires exact tightening torque. The rubber cot arbour assembly (1) further includes gear assembly (6) which is operationally in contact with the gear assemblies (7, 8) of the small and big rubber cot arbours respectively.

25 [0006] For finishing purpose it is required to remove the cover. Conventionally and in the state of art technology, the screwing and unscrewing operations are carried out manually by the operator/labourer. Apart from screwing and unscrewing, there are various other activities involved in processing of rubber cot arbours which also require human intervention. But since rubber cot arbours are very dedicated articles, there are chances of getting it damaged due to manual handling. Also manual handling is not accurate and is also time consuming. Further manual handling demands for skilled operator/labourer. In short due to manual handling production cost increases.

30 [0007] WO 2008/062442 A2 discloses a device for holding and guiding rubber cots, of the type used in drafting rollers, and comprises a rotary table equipped with multiple means for holding centreless rubber cots and presenting them to a grinding station. The device enables to increase grinding productivity.

35 [0008] The EP 2 239 355 A1 describes a preparation machine for rectification of textile machine rollers.

[0009] The apparatus has a vibratory feeding receptacle for receiving a plurality of rollers having air guides attached to the axles thereof. Said rollers are then advanced in conjunction with said vibratory feeding receptacle for delivering rollers from such receptacle through an article guide arrangement to an air guide separation device. Separated rollers are arranged in rows in a manner to be easily re-installed after maintenance. The apparatus further carries out a cleaning process for cleaning fiber fluff around the axles of the rollers. The maintenance procedure of a ring spinning machine can thereby substantially be shortened.

[0010] The SU 802 418 discloses a device for removing and putting on elastic covers on rollers of textile machines.

[0011] The JP-A-H01162830 discloses a method and jig for assembling rollers of a spinning machine.

[0012] Most of the prior art discloses devices for assembling the rubber cots on their shafts.

45 [0013] Hence it is necessary to develop a mechanism to handle rubber cot arbours which will be free from foregoing problems.

OBJECT OF THE INVENTION:

50 [0014] The principle objective of the present invention is to provide a machine for use in processing of rubber cot arbours which is devoid of the deficiencies associated with the conventional rubber cot arbours processing mechanisms.

[0015] Another objective of the invention is to provide the machine for use in processing of rubber cot arbours which performs the processing of rubber cot arbours automatically without any human intervention.

[0016] Further objective of the invention is to provide a machine for use in processing of rubber cot arbours which protects rubber cot arbours from damage occurred due to manual processing.

[0017] Another objective of the invention is to provide the machine for use in processing of rubber cot arbours which ensures fast and error less processing of rubber cots.

[0018] Another objective of the invention is to provide the machine for use in processing of rubber cot arbours which

ensures less manpower and thereby reduces production cost.

[0019] Still another objective of the invention is to provide the machine for use in processing of rubber cot arbours which is easy to operate and maintain.

5 [0020] Yet another objective of the invention is to provide the machine for use in processing of rubber cot arbours in which it is easy to modify the settings of the machine.

STATEMENT OF THE INVENTION:

10 [0021] Accordingly, in order to achieve the aforementioned objectives, the present invention provides a machine for use in processing of a rubber cot arbours assembly, the rubber cot arbours assembly includes at least a set of two rubber cot arbours namely a first rubber cot arbour and a second rubber cot arbour, the first rubber cot arbour having smaller diameter than the second rubber cot arbour, the first and second rubber cot arbours being accommodated in a housing including a top cover and a bottom cover, the top cover and bottom cover of the housing being attached to each other through a fastening means, the machine comprising:

15 a first rotary disc being driven rotatably by a first driving unit, the first rotary disc includes four holding stations for holding the rubber cot arbours assemblies, each of the four holding station located on the first rotary disc at an angle of 90° apart from adjacent holding stations;

20 a second rotary disc being driven rotatably by a second driving unit, the second rotary disc includes four processing stations for enabling the processing of rubber cot arbours, each of the four processing stations located on the second rotary disc at an angle of 90° apart from adjacent processing stations, each processing station comprises a gripping assembly to hold the rubber cot arbours assembly for screwing and unscrewing purpose, the gripping assembly comprises:

- 25
- a gripper unit including an upper jaw and lower jaw, the upper jaw being configured to hold the top cover and the lower jaw being configured to hold the bottom cover and thereby to accommodate the rubber cot arbours,
 - a slider clamping unit to enable vertical sliding movement of the upper jaw and lower jaw, the upper jaw and lower jaw of the gripper unit are connected to the slider clamping unit,
 - 30 - a pair of vacuum units being connected to the gripper unit and slider clamping unit, the vacuum units being configured to control movement of the upper jaw and lower jaw and proper gripping of the top cover and bottom cover in the upper jaw and lower jaw respectively;

35 a pair of screwing and unscrewing assembly for screwing and unscrewing of the fastening means, each of the screwing and unscrewing assembly comprises:

- a screwing and unscrewing unit to screw and unscrew the fastening means,
- a driving unit being connected to the screwing and unscrewing unit to operate the screwing and unscrewing unit,
- 40 - a sliding unit comprising a linear guide to enable vertical movement of the screwing and unscrewing unit;

45 a plurality of loading units and unloading units for loading and unloading unprocessed rubber cot arbours assemblies and finished rubber cot arbour sets and unloading processed rubber cot arbours assemblies and unfinished rubber cot arbour sets, on and from, the holding stations of the first rotary disc and the processing stations of the second rotary disc;

50 a master processing and controlling unit being connected to the first driving unit, second driving unit, processing stations, screwing and unscrewing assemblies, loading units, unloading units for controlling operations of the first driving unit, second driving unit, processing stations, screwing and unscrewing assemblies, loading units, unloading units; and

a mounting assembly to accommodate the first rotary disc, second rotary disc and screwing and unscrewing assemblies, first driving unit, and second driving unit.

55 [0022] According to an another embodiment of the invention, there is provided a machine for use in processing of a rubber cot arbours assembly, the rubber cot arbours assembly includes at least a set of two rubber cot arbours namely a first rubber cot arbour and a second rubber cot arbour, the first rubber cot arbour having smaller diameter than the second rubber cot arbour, the first and second rubber cot arbours being accommodated in a housing including a top cover and a bottom cover, the top cover and bottom cover of the housing being attached to each other through a fastening

means, the machine comprising:

5 a first rotary disc being driven rotatably by a first driving unit, the first rotary disc includes four holding stations for holding the rubber cot arbours assemblies, each of the four holding station located on the first rotary disc at an angle of 90° apart from adjacent holding stations;

10 a second rotary disc being driven rotatably by a second driving unit, the second rotary disc includes two processing stations for enabling the processing of rubber cot arbours, each of the two processing stations located on the second rotary disc at an angle of 180° apart from adjacent processing stations, each processing station comprises a gripping assembly to hold the rubber cot arbours assembly for screwing and unscrewing purpose, the gripping assembly comprises:

- 15 - a gripper unit including an upper jaw and lower jaw, the upper jaw being configured to hold the top cover and the lower jaw being configured to hold the bottom cover and thereby to accommodate the rubber cot arbours,
- a slider clamping unit to enable vertical sliding movement of the upper jaw and lower jaw, the upper jaw and lower jaw of the gripper unit are connected to the slider clamping unit,
- 20 - a pair of vacuum units being connected to the gripper unit and slider clamping unit, the vacuum units being configured to control movement of the upper jaw and lower jaw and proper gripping of the top cover and bottom cover in the upper jaw and lower jaw respectively;

25 a third rotary disc being driven rotatably by a third driving unit, the third rotary disc includes four holding stations for holding the rubber cot arbours, each of the four holding station located on the third rotary disc at an angle of 90° apart from adjacent holding stations;

30 a pair of screwing and unscrewing assembly for screwing and unscrewing of the fastening means, each of the screwing and unscrewing assembly comprises:

- a screwing and unscrewing unit to screw and unscrew the fastening means,
- a driving unit being connected to the screwing and unscrewing unit to operate the screwing and unscrewing unit,
- 35 - a sliding unit comprising a linear guide to enable vertical movement of the screwing and unscrewing unit;

40 a plurality of loading units and unloading units for loading and unloading unprocessed rubber cot arbours assemblies and finished rubber cot arbour sets and unloading processed rubber cot arbours assemblies and unfinished rubber cot arbour sets, on and from, the holding stations of the first rotary disc, the holding stations of the third rotary disc and the processing stations of the second rotary disc;

45 a master processing and controlling unit being connected to the first driving unit, second driving unit, third driving unit, processing stations, screwing and unscrewing assemblies, loading units, unloading units for controlling operations of the first driving unit, second driving unit, third driving unit, processing stations, screwing and unscrewing assemblies, loading units, unloading units; and

a mounting assembly to accommodate the first rotary disc, second rotary disc, third rotary disc, screwing and unscrewing assemblies, first driving unit, second driving unit and third driving unit.

45 **BRIEF DESCRIPTION OF DRAWINGS:**

[0023]

50 **Figure 1(a)** : Shows perspective view of rubber cot arbours assembly being used in a spinning machine.

Figure 1(b) : Shows perspective view of rubber cot arbours assembly of figure 1 in disassembled form.

Figure 2 : Shows block diagram of a machine for use in pro-cessing of rubber cot arbours assembly in accordance to first embodiment of the present invention.

55 **Figure 3** : Shows component symmetric diagram of the machine of figure 2.

Figure 4(a) : Shows perspective view of the machine of figure 2.

- 5 **Figures 4(b)-4(d)** : Shows different views of the machine of figure 2.
- Figure 5** : Shows block diagram of a machine for use in pro-cessing of rubber cot arbour's assembly in accordance to second embodiment of the present invention.
- 5 **Figure 6** : Shows component symmetric diagram of the machine of figure 5.
- Figure 7(a)** : Shows perspective view of the machine of figure 5.
- 10 **Figures 7(b) -7(d)** : Shows different views of the machine of figure 5.
- Figure 8** : Shows perspective view of the disc being used in machine of figure 5 and installed with gripping assembly.
- 15 **Figures 9(a)-9(c)** : Shows different views of the disc being used in machine of figures 2 and 5 and installed with holding stations.
- Figure 10(a)** : Shows perspective view of device suitable for use in machine of figures 2 and 5 for screwing and/or unscrewing operation during processing of finished and unfinished rubber cot arbour's.
- 20 **Figure 10(b)** : Shows another view of device of figure 10(a).
- Figures 11** : Shows perspective view of the gripping assembly being used in machines of figure 2 and 5.
- 25 **Figures 12(a) to 12(u)** : Shows schematic representation of the working of the device of figure 10(a).

DETAILED DESCRIPTION OF THE INVENTION:

30 **[0024]** Further objective and particular features of the invention are exemplified in the embodiment shown in accompanying drawings and described below.

Meaning of terms:

35 **[0025]**

Rubber cot arbour set: Rubber cot arbour set referred hereinafter means a set of two rubber cot arbour's. Out of these two cots one rubber cot arbour is having a smaller diameter than the other rubber cot arbour.

40 **Processing of rubber cot arbour's:** Processing of rubber cot arbour's referred hereinafter includes activities like removal of the cover from the unfinished rubber cot arbour set, putting the cover on finished rubber cot arbour set, providing rubber cot arbour set automatically to buffing machine for buffing operation and automatically taking the buffed rubber cot arbour set from the buffing machine and other similar activities.

Finished rubber cot arbour: Finished rubber cot arbour referred hereinafter includes rubber cot arbour's having buffing or similar operation completed.

45 **Unfinished rubber cot arbour:** Unfinished rubber cot arbour referred hereinafter includes rubber cot arbour's requiring buffing or similar operation to be carried out.

First embodiment of the invention:

50 **[0026]** Referring to figure 2, block diagram of the machine (M1) for use in processing of a rubber cot arbour's assembly in accordance to the first embodiment of the present invention is illustrated. Mainly the machine (M1) includes first rotary disc (300), second rotary disc (400), a pair of screwing and unscrewing assembly (100, 100a) and master processing and controlling unit (600).

55 **[0027]** Referring to figures 1(a) and 1(b), The rubber cot arbour's assembly includes at least a set of two rubber cot arbour's (2, 3). The rubber cot arbour (2) is having smaller diameter than the rubber cot arbour (3). The rubber cot arbour's (2, 3) are accommodated in a housing. The housing includes top cover (4) and bottom cover (5). The top cover (4) and bottom cover (5) of the housing are attached to each other through a fastening means (9). Preferably, the fastening means (9) is an Allen screw.

[0028] Referring to figures 2 to 4(d) and 9(a), the first rotary disc (300) is driven rotatably by a driving unit (700). The

first rotary disc (300) includes four holding stations (301, 302, 303, 304) for holding the rubber cot arbours. Each of the four holding station are located on the first rotary disc (300) at an angle of 90° apart from adjacent holding stations. Referring to figure 9(a), each of the four holding station (301, 302, 303, 304) of the first rotary disc includes a jaw (305, 306, 307, 308) to hold the rubber cot arbours. The driving unit (700) includes a servo motor. Typically, the first rotary disc (300) is connected to the driving unit (700) through a shaft.

[0029] The second rotary disc (400) is driven rotatably by a driving unit (700a). The driving unit (700a) includes a servo motor. Typically, the second rotary disc (400) is connected to the driving unit (700a) through a shaft. The second rotary disc (400) includes four processing stations (200, 200a, 200b, 200c) for enabling the processing of rubber cot arbours. Each of the four processing stations (200, 200a, 200b, 200c) located on the second rotary disc at an angle of 90° apart from adjacent processing stations. Each processing station (200, 200a, 200b, 200c) comprises a gripping assembly to hold the rubber cot arbours (2,3) for screwing and unscrewing purpose. Each processing station (200, 200a, 200b, 200c) further comprises a control unit (207, 207a, 207b, 207c) to control operation of the gripping assembly. Typically, the control unit (207, 207a, 207b, 207c) is electro pneumatic in construction.

[0030] Referring to figure 10 (a) and 10 (b), the screwing and unscrewing assembly (100, 100a) for screwing and unscrewing of the fastening means (9) is illustrated. The screwing and unscrewing assembly (100, 100a) includes a screwing and unscrewing unit (115, 116, 117, 115a, 116a, 117a) to screw and unscrew the fastening means (9). The screwing and unscrewing unit (115, 116, 117, 115a, 116a, 117a) comprises a bit (117, 117a) fixed through ratchet (116, 116a). The screwing and unscrewing unit is driven by a driving unit (114, 114a). The driving unit (114, 114a) is preferably a servo motor (114, 114a). The servomotor (114, 114a) is operatively connected to the screwing and unscrewing unit (115, 116, 117, 115a, 116a, 117a) through a shaft (105, 105a). The shaft (105, 105a) is connected to the ratchet (116, 116a) by means of ratchet adaptor (115, 115a). The screwing and unscrewing assembly (100, 100a) ensures required tightening torque for the fastening means (9). Mainly the tightening torque is predetermined based on the dimensions of the fastening means (9). A sliding unit (102, 102a, 103, 103a) is provided in the screwing and unscrewing assembly (100, 100a). The sliding unit (102, 102a, 103, 103a) comprises a linear guide (102, 102a) to enable vertical movement of the screwing and unscrewing unit. The screwing and unscrewing unit (115, 116, 117, 115a, 116a, 117a) is operatively connected to the linear guide (102, 102a) through slider (103, 103a). The slider (103, 103a) is connected to the screwing and unscrewing unit (115, 116, 117, 115a, 116a, 117a) through mounting parts (106, 104, 109, 106a, 104a, 109a) of the slider (103, 103a). The servomotor (114, 114a) is fixed on mounting part (106, 106a) by means of flange (113, 113a). The screwing and unscrewing assembly (100, 100a) further includes mounting bracket (101, 101a).

[0031] Referring to figure 11, the gripping assembly includes a gripper unit including an upper jaw (205, 205a, 205b, 205c) and lower jaw (206, 206a, 206b, 206c). The upper jaw (205, 205a, 205b, 205c) is configured to hold the top cover (4) and the lower jaw (206, 206a, 206b, 206c) is configured to hold the bottom cover (5) and thereby to accommodate the rubber cot arbours (2,3). A slider clamping unit (201, 201a, 201b, 201c) is provided in the gripping assembly to enable vertical sliding movement of the upper jaw (205, 205a, 205b, 205c) and lower jaw (206, 206a, 206b, 206c). The upper jaw (205, 205a, 205b, 205c) and lower jaw (206, 206a, 206b, 206c) of the gripper unit are connected to the slider clamping unit. The gripper assembly further includes a pair of vacuum units (203, 203a, 203b, 203c, 204, 204a, 204b, 204c). The vacuum units (203, 203a, 203b, 203c, 204, 204a, 204b, 204c) are connected to the gripper unit and slider clamping unit. The vacuum units (203, 203a, 203b, 203c, 204, 204a, 204b, 204c) are configured to control movement of the upper jaw (205, 205a, 205b, 205c) and lower jaw (206, 206a, 206b, 206c). The vacuum units (203, 203a, 203b, 203c, 204, 204a, 204b, 204c) are also configured for proper gripping of the top cover (4) and bottom cover (5) in the upper jaw (205, 205a, 205b, 205c) and lower jaw (206, 206a, 206b, 206c) respectively. The gripping assembly further includes mounting bracket (202, 202a, 202b, 202c).

[0032] The plurality of loading units and unloading units are for loading and unloading of the rubber cot arbours, on and from, the holding stations (301, 302, 303, 304) of first rotary disc and processing stations (200, 200a, 200b, 200c) of second rotary disc. Each of the loading unit includes multiple loading magazine (901, 902, 904) and unloading unit includes multiple unloading magazine (900, 903, 905). Each of the loading and unloading unit includes robotic loading/unloading arm (500, 510, 520, 530, 540, 550) for loading and unloading of the rubber cot arbours. For providing vertical and horizontal movements of the robotic arms, horizontal pneumatic driven axis units (502, 512, 522, 532, 542, 552) and vertical electric driven axis units (503, 513, 523, 533, 543, 553) are provided in the loading and unloading units. The horizontal pneumatic driven axis units (502, 512, 522, 532, 542, 552) and vertical electric driven axis units (503, 513, 523, 533, 543, 553) are driven by servo drive (504, 514, 524, 534, 545, 554). The horizontal pneumatic driven axis units (502, 512, 522, 532, 542, 552), vertical electric driven axis units (503, 513, 523, 533, 543, 553) and servo drive (504, 514, 524, 534, 545, 554) are controlled by electro-pneumatic controller (501, 511, 521, 531, 541, 551). The driving unit (700) of first rotary disc is connected to the servo drive (504) and driving unit (700a) of second rotary disc is connected to the servo drive (534).

[0033] The master processing and controlling unit (600) is operatively connected to the driving unit (700), driving unit (700a), processing stations (200, 200a, 200b, 200c), screwing and unscrewing assemblies (100, 100a), servo drive (504, 514, 524, 534, 545, 554) and electro-pneumatic controller (501, 511, 521, 531, 541, 551) for controlling operations

of the first driving unit, second driving unit, processing stations, screwing and unscrewing assemblies, loading units, unloading units. The master processing and controlling unit (600) includes at least one processor. The tightening torque for the fastening means (9) can be controlled/changed through the master processing and controlling unit (600). The master processing and controlling unit (600) may include various sensors or like to sense and respond to various activities relating to operation of the screwing and unscrewing assembly (100, 100a) and gripping assembly.

[0034] The mounting assembly (800) accommodates the rotary disc (300), rotary disc (400), screwing and unscrewing assemblies (100, 100a), driving unit (700) and driving unit (700a). Typically, the mounting assembly includes a mounting table. The rotary discs (300, 400) are mounted on top region (800a) of the mounting table and drive units (700, 700a) are placed in bottom region (800b) of the mounting table. Referring to figures 12(a) to 12(u), detailed working of the screwing and unscrewing assembly (100, 100a) is illustrated.

i. Upper jaw (205, 205a, 205b, 205c) move upward and lower jaw (206, 206a, 206b, 206c) move downward. Placing rubber cot arbour set (2, 3) having cover (4, 5) fitted on it, on the gripping assembly. **[Figures 12(a)-12(c)]**

ii. Unscrewing, by the screwing and unscrewing assembly (100, 100a) set in unscrewing mode, the fastening screw (9) to separate rubber cot arbour set (2, 3) of from the cover (4, 5). After unscrewing, the cover held partially by the upper jaw (205, 205a, 205b, 205c) and partially by the lower jaw (206, 206a, 206b, 206c). **[Figures 12(d)-12(h)]**

iii. Removing unfinished rubber cot arbours (2, 3) from separated rubber cot arbour set for further process i.e. buffing. **[Figures 12(i)-12(j)]**

iv. Upper jaw (205, 205a, 205b, 205c) move upward and lower jaw (206, 206a, 206b, 206c) move downward. Placing the finished rubber cot arbour set on the lower jaw (206, 206a, 206b, 206c) of the gripping assembly. **[Figures 12(k)-12(m)]**

v. Fixing the cover (4, 5) on the rubber cot arbour using fastening screw (9). The screwing done by the screwing and unscrewing assembly (100, 100a) set in screwing mode. **[Figures 12(n)-12(r)]**

vi. Upper jaw (205, 205a, 205b, 205c) move upward and lower jaw (206, 206a, 206b, 206c) move downward. Removing rubber cot arbour set (2, 3), having cover (4, 5) fitted on it, from the gripping assembly. **[Figures 12(s)-12(u)]**.

Working of the machine (M1) of present invention:

[0035] The operation of the proposed machine is carried out in the following manner (Figure 4(b)):

i. Placing rubber cot arbour set (2, 3), having cover fitted on it, on one of the station (303) of the first rotary disc (300).

ii. Setting one of the screwing and unscrewing assembly (100) in unscrewing mode and other (100a) in screwing mode.

iii. Placing the station (303) of step (i) between upper and lower jaws (205c, 206c) of gripper unit of one of the station (201c) of second rotary disc (400).

iv. Unscrewing, by the screwing and unscrewing assembly (100) set in unscrewing mode, the fastening screw to separate rubber cot arbour set (2, 3) of step (i) from the cover. After unscrewing the cover held partially by the upper jaw and partially by the lower jaw.

v. Unloading and sending the separated rubber cot arbour set of step (iv) for further finishing process i.e. buffing. Due to sending the station holding the separated rubber cot arbour gets empty and ready for collecting next to be processed rubber cot arbour set having cover fitted on it.

vi. Placing the finished rubber cot arbour set on the lower jaw of one of the station (201, 201a) of the second rotary disc (400).

vii. Fixing the cover of step (iv) on the rubber cot arbour set of step (vi) using fastening screw. The fixing is done by the screwing and unscrewing assembly (100a) set in screwing mode.

viii. Unloading, by unloading unit, of the covered rubber cot arbours set of step (vii) for further use.

ix. Repeating steps (i) to (viii) for next rubber finished and unfinished cot arbours.

Second embodiment of the invention:

[0036] Referring to figure 5, block diagram of the machine (M2) for use in processing of a rubber cot arbours assembly in accordance to the second embodiment of the present invention is illustrated. Mainly the machine (M2) includes first rotary disc (3000), second rotary disc (4000), third rotary disc (3000a), a pair of screwing and unscrewing assembly

(1000, 1000a) and master processing and controlling unit (6000).

[0037] Referring to figures 5 to 7(d), 8 and 9(a), the first rotary disc (3000) is driven rotatably by a driving unit (7000). The first rotary disc (3000) includes four holding stations (3001, 3002, 3003, 3004) for holding the rubber cot arbours. Each of the four holding station are located on the first rotary disc (3000) at an angle of 90° apart from adjacent holding stations. Referring to figure 9(a), each of the four holding station (3001, 3002, 3003, 3004) of the first rotary disc includes a jaw (3005, 3006, 3007, 3008) to hold the rubber cot arbours. The driving unit (7000) includes a servo motor. Typically, the first rotary disc (3000) is connected to the driving unit (7000) through a shaft.

[0038] The second rotary disc (4000) is driven rotatably by a driving unit (7000b). The driving unit (7000b) includes a servo motor. Typically, the second rotary disc (4000) is connected to the driving unit (7000b) through a shaft. The second rotary disc (4000) includes two processing stations (2000, 2000a) for enabling the processing of rubber cot arbours. Each of the two processing stations (2000, 2000a) located on the second rotary disc at an angle of 180° apart from adjacent processing station. Each processing station (2000, 2000a) comprises a gripping assembly to hold the rubber cot arbours (2, 3) for screwing and unscrewing purpose. Each processing station (2000, 2000a) further comprises a control unit (2007, 2007a) to control operation of the gripping assembly. Typically, the control unit (2007, 2007a) is electro pneumatic in construction.

[0039] The third rotary disc (3000a) is driven rotatably by a driving unit (7000a). The third rotary disc (3000a) includes four holding stations (3001a, 3002a, 3003a, 3004a) for holding the rubber cot arbours. Each of the four holding station are located on the third rotary disc (3000a) at an angle of 90° apart from adjacent holding stations. Referring to figure 9(a), each of the four holding station (3001a, 3002a, 3003a, 3004a) of the third rotary disc includes a jaw (3005a, 3006a, 3007a, 3008a) to hold the rubber cot arbours. The driving unit (7000a) includes a servo motor. Typically, the third rotary disc (3000a) is connected to the driving unit (7000a) through a shaft.

[0040] Referring to figure 10 (a) and 10 (b), the screwing and unscrewing assembly (1000, 1000a) for screwing and unscrewing of the fastening means (9) is illustrated. The screwing and unscrewing assembly (1000, 1000a) includes a screwing and unscrewing unit (1150, 1160, 1170, 1150a, 1160a, 1170a) to screw and unscrew the fastening means (9). The screwing and unscrewing unit (1150, 1160, 1170, 1150a, 1160a, 1170a) comprises a bit (1170, 1170a) fixed through ratchet (1160, 1160a). The screwing and unscrewing unit is driven by a driving unit (1140, 1140a). The driving unit (1140, 1140a) is preferably a servo motor (1140, 1140a). The servomotor (1140, 1140a) is operatively connected to the screwing and unscrewing unit (1150, 1160, 1170, 1150a, 1160a, 1170a) through a shaft (1050, 1050a). The shaft (1050, 1050a) is connected to the ratchet (1160, 1160a) by means of ratchet adaptor (1150, 1150a). The screwing and unscrewing assembly (1000, 1000a) ensures required tightening torque for the fastening means (9). Mainly the tightening torque is predetermined based on the dimensions of the fastening means (9). A sliding unit (1020, 1020a, 1030, 1030a) is provided in the screwing and unscrewing assembly (1000, 1000a). The sliding unit (1020, 1020a, 1030, 1030a) comprises a linear guide (1020, 1020a) to enable vertical movement of the screwing and unscrewing unit. The screwing and unscrewing unit (1150, 1160, 1170, 1150a, 1160a, 1170a) is operatively connected to the linear guide (1020, 1020a) through slider (1030, 1030a). The slider (1030, 1030a) is connected to the screwing and unscrewing unit (1150, 1160, 1170, 1150a, 1160a, 1170a) through mounting parts (1060, 1040, 1090, 1060a, 1040a, 1090a) of the slider (1030, 1030a). The servomotor (1140, 1140a) is fixed on mounting part (1060, 1060a) by means of flange (1130, 1130a). The screwing and unscrewing assembly (1000, 1000a) further includes mounting bracket (1010, 1010a).

[0041] Referring to figure 11, the gripping assembly includes a gripper unit including an upper jaw (2050, 2050a) and lower jaw (2060, 2060a). The upper jaw (2050, 2050a) is configured to hold the top cover (4) and the lower jaw (2060, 2060a) is configured to hold the bottom cover (5) and thereby to accommodate the rubber cot arbours (2,3). A slider clamping unit (2010, 2010a) is provided in the gripping assembly to enable vertical sliding movement of the upper jaw (2050, 2050a) and lower jaw (2060, 2060a). The upper jaw (2050, 2050a) and lower jaw (2060, 2060a) of the gripper unit are connected to the slider clamping unit. The gripper assembly further includes a pair of vacuum units (2030, 2030a, 2040, 2040a). The vacuum units (2030, 2030a, 2040, 2040a) are connected to the gripper unit and slider clamping unit. The vacuum units (2030, 2030a, 2040, 2040a) are configured to control movement of the upper jaw (2050, 2050a) and lower jaw (2060, 2060a). The vacuum units (2030, 2030a, 2040, 2040a) are also configured for proper gripping of the top cover (4) and bottom cover (5) in the upper jaw (2050, 2050a) and lower jaw (2060, 2060a) respectively. The gripping assembly further includes mounting bracket (2020, 2020a).

[0042] The plurality of loading unit and unloading units are for loading and unloading of the rubber cot arbours, on and from, the holding stations (3001, 3002, 3003, 3004) of first rotary disc, processing stations (2000, 2000a) of second rotary disc and the holding stations (3001a, 3002a, 3003a, 3004a) of third rotary disc. Each of the loading units includes multiple loading magazine (9001, 9002, 9003) and unloading unit includes multiple unloading magazine (9000, 9004, 9005). Each of the loading and unloading unit includes robotic loading/unloading arm (5000, 5100, 5200, 5300, 5400, 5500) for loading and unloading of the rubber cot arbours. For providing vertical and horizontal movements of the robotic arms, horizontal pneumatic driven axis units (5002, 5102, 5202, 5302, 5402, 5502) and vertical electric driven axis units (5003, 5103, 5203, 5303, 5403, 5503) are provided in the loading and unloading units. The horizontal pneumatic driven axis units (5002, 5102, 5202, 5302, 5402, 5502) and vertical electric driven axis units (5003, 5103, 5203, 5303, 5403, 5503)

are driven by servo drive (5004, 5104, 5204, 5304, 5404, 5504). The horizontal pneumatic driven axis units (5002, 5102, 5202, 5302, 5402, 5502), vertical electric driven axis units (5003, 5103, 5203, 5303, 5403, 5503) and servo drive (5004, 5104, 5204, 5304, 5404, 5504) are controlled by electro-pneumatic controller (5001, 5101, 5201, 5301, 5401, 5501). The driving unit (7000) of first rotary disc is connected to the servo drive (5004) and driving unit (7000b) of third rotary disc is connected to the servo drive (5304).

[0043] The master processing and controlling unit (6000) is operatively connected to the driving unit (7000), driving unit (7000a), driving unit (7000b), processing stations (2000, 2000a), screwing and unscrewing assemblies (1000, 1000a), servo drive (5004, 5104, 5204, 5304, 5404, 5504) and electro-pneumatic controller (5001, 5101, 5201, 5301, 5401, 5501) for controlling operations of the first driving unit, second driving unit, processing stations, screwing and unscrewing assemblies, loading units, and unloading units. The master processing and controlling unit (6000) includes at least one processor. The tightening torque for the fastening means (9) can be controlled/changed through the master processing and controlling unit (6000). The master processing and controlling unit (6000) may include various sensors or like to sense and respond to various activities relating to operation of the screwing and unscrewing assembly (1000, 1000a) and gripping assembly.

[0044] The mounting assembly (8000) accommodates the rotary disc (3000), rotary disc (4000), rotary disc (3000a), screwing and unscrewing assemblies (1000, 1000a), driving unit (7000), driving unit (7000a) and driving unit (7000b). Typically, the mounting assembly includes a mounting table. The rotary discs (3000, 3000a, 4000) are mounted on top region (8000a) of the mounting table and drive units (7000, 7000a, 7000b) are placed in bottom region (8000b) of the mounting table.

[0045] Referring to figures 12(a) to 12(u), detailed working of the screwing and unscrewing assembly (1000, 1000a) is illustrated.

i. Upper jaw (2050, 2050a) move upward and lower jaw (2060, 2060a) move downward. Placing rubber cot arbour set (2, 3) having cover (4, 5) fitted on it, on the gripping assembly. **[Figures 12(a)-12(c)]**

ii. Unscrewing, by the screwing and unscrewing assembly (1000, 1000a) set in unscrewing mode, the fastening screw (9) to separate rubber cot arbour set (2, 3) of from the cover (4, 5). After unscrewing, the cover held partially by the upper jaw (2050, 2050a) and partially by the lower jaw (2060, 2060a). **[Figures 12(d)-12(h)]**

iii. Removing unfinished rubber cot arbours (2, 3) from separated rubber cot arbour set for further process i.e. buffing. **[Figures 12(i)-12(j)]**

iv. Upper jaw (2050, 2050a) move upward and lower jaw (2060, 2060a) move downward. Placing the finished rubber cot arbour set on the lower jaw (2060, 2060a) of the gripping assembly. **[Figures 12(k)-12(m)]**

v. Fixing the cover (4, 5) on the rubber cot arbour using fastening screw (9). The screwing done by the screwing and unscrewing assembly (1000, 1000a) set in screwing mode. **[Figures 12(n)-12(r)]**

vi. Upper jaw (2050, 2050a) move upward and lower jaw (2060, 2060a) move downward. Removing rubber cot arbour set (2, 3), having cover (4, 5) fitted on it, from the gripping assembly. **[Figures 12(s)-12(u)].**

Working of the machine (M2) of present invention:

[0046] The operation of the proposed machine is carried out in the following manner (Figure 7):

i. Placing rubber cot arbour set, having cover fitted on it, on one of the station (3004) of the first rotary disc (3000).

ii. Setting one of the screwing and unscrewing assembly (1000a) in screwing mode and other (1000) in unscrewing mode.

iii. Placing the station (3004) of step (i) between upper and lower jaws of gripper unit of one of the station (2000) of second rotary disc (4000).

iv. Unscrewing, by the screwing and unscrewing assembly (1000) set in unscrewing mode, the fastening screw to separate rubber cot arbour set of step (i) from the cover. After unscrewing the cover held partially by the upper jaw and partially by the lower jaw.

v. Unloading and sending the separated rubber cot arbour set of step (iv) for further finishing process i.e. buffing. Due to sending, the station holding the separated rubber cot arbour gets empty and ready for collecting next to be processed rubber cot arbour set having cover fitted on it.

vi. Rotate the second rotary disc (4000) by 180° and thereby the gripper unit of the station (2000a) having cover attached partially by the upper jaw and partially by the lower jaw get rotated by 180°. Due to rotation, station (2000) of the second rotary disc (4000) becomes available for next operation of unscrewing of cover as stated in steps (iii) and (iv) above.

vii. Placing the buffed rubber cot arbour set in between the lower jaw and upper jaw by one of the holding station (3002a) of the third rotary disc (3000a) in the station (2000a) of the second rotary disc (4000).

viii. Fixing the cover of step (iv) on the rubber cot arbour set of step (vii) using fastening screw. The fixing is done

by the screwing and unscrewing assembly (1000a) set in screwing mode.

ix. Unloading, by unloading unit, of the covered rubber cot arbours set of step (viii) for further use.

x. Repeating steps (i) to (viii) for next finished and unfinished rubber cot arbours.

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Claims

1. A machine (M1) for use in processing of a rubber cot arbours assembly, the rubber cot arbours assembly (1) includes at least a set of two rubber cot arbours (2, 3) namely a first rubber cot arbour (2) and a second rubber cot arbour (3), the first rubber cot arbour (2) having smaller diameter than the second rubber cot arbour (3), the first and second rubber cot arbours (2,3) being accommodated in a housing including a top cover (4) and a bottom cover (5), the top cover (4) and the bottom cover (5) of the housing being attached to each other through a fastening means (9), the machine (M1) comprising:

15 a first rotary disc (300) being driven rotatably by a first driving unit (700), the first rotary disc (300) includes four holding stations (301, 302, 303, 304) for holding the rubber cot arbours assemblies, each of the four holding station located on the first rotary disc (300) at an angle of 90° apart from adjacent holding stations;

20 a second rotary disc (400) being driven rotatably by a second driving unit (700a), the second rotary disc (400) includes four processing stations (200, 200a, 200b, 200c) for enabling the processing of rubber cot arbours (2, 3), each of the four processing stations (200, 200a, 200b, 200c) located on the second rotary disc at an angle of 90° apart from adjacent processing stations, each processing station (200, 200a, 200b, 200c) comprises a gripping assembly to hold the rubber cot arbours assembly for screwing and unscrewing purpose, the gripping assembly comprises:

25 - a gripper unit including an upper jaw (205, 205a, 205b, 205c) and lower jaw (206, 206a, 206b, 206c), the upper jaw (205, 205a, 205b, 205c) being configured to hold the top cover (4) and the lower jaw (206, 206a, 206b, 206c) being configured to hold the bottom cover (5) and thereby to accommodate the rubber cot arbours (2,3),

30 - a slider clamping unit (201, 201a, 201b, 201c) to enable vertical sliding movement of the upper jaw (205, 205a, 205b, 205c) and lower jaw (206, 206a, 206b, 206c), the upper jaw (205, 205a, 205b, 205c) and lower jaw (206, 206a, 206b, 206c) of the gripper unit are connected to the slider clamping unit,

35 - a pair of vacuum units (203, 203a, 203b, 203c, 204, 204a, 204b, 204c) being connected to the gripper unit and slider clamping unit, the vacuum units (203, 203a, 203b, 203c, 204, 204a, 204b, 204c) being configured to control movement of the upper jaw (205, 205a, 205b, 205c) and lower jaw (206, 206a, 206b, 206c) and proper gripping of the top cover (4) and bottom cover (5) in the upper jaw (205, 205a, 205b, 205c) and lower jaw (206, 206a, 206b, 206c) respectively;

a pair of screwing and unscrewing assembly (100, 100a) for screwing and unscrewing of the fastening means, each of the screwing and unscrewing assembly comprises:

40 - a screwing and unscrewing unit (115, 116, 117, 115a, 116a, 117a) to screw and unscrew the fastening means,

- a driving unit (114, 114a) being connected to the screwing and unscrewing unit to operate the screwing and unscrewing unit,

45 - a sliding unit (102, 103, 102a, 103a) comprising a linear guide (102, 102a) to enable vertical movement of the screwing and unscrewing unit;

a plurality of loading units and unloading units for loading and unloading unprocessed rubber cot arbours assemblies and finished rubber cot arbour sets and unloading processed rubber cot arbours assemblies and unfinished rubber cot arbour sets, on and from, the holding stations (301, 302, 303, 304) of the first rotary disc and the processing stations (200, 200a, 200b, 200c) of the second rotary disc; a master processing and controlling unit (600) being connected to the first driving unit (700), second driving unit (700a), processing stations (200, 200a, 200b, 200c), screwing and unscrewing assemblies (100, 100a), loading units, unloading units for controlling operations of the first driving unit, second driving unit, processing stations, screwing and unscrewing assemblies, loading units, unloading units; and

50 a mounting assembly (800) to accommodate the first rotary disc (300), second rotary disc (400) and screwing and unscrewing assemblies (100, 100a), first driving unit (700), and second driving unit (700a).

2. The machine as claimed in claim 1 wherein each of the four holding station (301, 302, 303, 304) of the first rotary disc includes a jaw (305, 306, 307, 308) to hold the rubber cot arbours.

3. The machine as claimed in claim 1 wherein the driving unit of the screwing and unscrewing assembly includes a servo motor (114, 114a).

4. The machine as claimed in claim 1 wherein each processing station (200, 200a, 200b, 200c) of the second rotary disc comprises a control unit (207, 207a, 207b, 207c) to control operation of the gripping assembly.

5. The machine as claimed in claim 4 wherein the control unit (207, 207a, 207b, 207c) is electro pneumatic in construction.

6. The machine as claimed in claim 1 wherein the master processing and controlling unit (600) includes at least one processor.

7. The machine as claimed in claim 1 wherein the master processing and controlling unit (600) controls the tightening torque for the fastening means (9).

8. A machine (M2) for use in processing of a rubber cot arbours assembly, the rubber cot arbours assembly (1) includes at least a set of two rubber cot arbours (2, 3) namely a first rubber cot arbour (2) and a second rubber cot arbour (3), the first rubber cot arbour (2) having smaller diameter than the second rubber cot arbour (3), the first and second rubber cot arbours (2, 3) being accommodated in a housing including a top cover (4) and a bottom cover (5), the top cover (4) and bottom cover (5) of the housing being attached to each other through a fastening means (9), the machine (M2) comprising:

a first rotary disc (3000) being driven rotatably by a first driving unit (7000), the first rotary disc (3000) includes four holding stations (3001, 3002, 3003, 3004) for holding the rubber cot arbours assemblies, each of the four holding station located on the first rotary disc (3000) at an angle of 90° apart from adjacent holding stations; a second rotary disc (4000) being driven rotatably by a second driving unit (7000b), the second rotary disc (4000) includes two processing stations (2000, 2000a) for enabling the processing of rubber cot arbours (2, 3), each of the two processing stations (2000, 2000a) located on the second rotary disc at an angle of 180° apart from adjacent processing stations, each processing station (2000, 2000a) comprises a gripping assembly to hold the rubber cot arbours assembly for screwing and unscrewing purpose, the gripping assembly comprises:

- a gripper unit including an upper jaw (2050, 2050a) and lower jaw (2060, 2060a), the upper jaw (2050, 2050a) being configured to hold the top cover (4) and the lower jaw (2060, 2060a) being configured to hold the bottom cover (5) and thereby to accommodate the rubber cot arbours (2, 3),
- a slider clamping unit (2010, 2010a) to enable vertical sliding movement of the upper jaw (2050, 2050a) and lower jaw (2060, 2060a), the upper jaw (2050, 2050a) and lower jaw (2060, 2060a) of the gripper unit are connected to the slider clamping unit,
- a pair of vacuum units (2030, 2030a, 2040, 2040a) being connected to the gripper unit and slider clamping unit, the vacuum units (2030, 2030a, 2040, 2040a) configured to control movement of the upper jaw (2050, 2050a) and lower jaw (2060, 2060a) and proper gripping of the top cover (4) and bottom cover (5) in the upper jaw (2050, 2050a) and lower jaw (2060, 2060a) respectively;

a third rotary disc (3000a) being driven rotatably by a third driving unit (7000a), the third rotary disc (3000a) includes four holding stations (3001a, 3002a, 3003a, 3004a) for holding the rubber cot arbours, each of the four holding station located on the third rotary disc (3000a) at an angle of 90° apart from adjacent holding stations; a pair of screwing and unscrewing assembly (1000, 1000a) for screwing and unscrewing of the fastening means, each of the screwing and unscrewing assembly comprises:

- a screwing and unscrewing unit (1150, 1160, 1170, 1150a, 1160a, 1170a) to screw and unscrew the fastening means,
- a driving unit (1140, 1140a) being connected to the screwing and unscrewing unit to operate the screwing and unscrewing unit,
- a sliding unit (1020, 1030, 1020a, 1030a) comprising a linear guide (1020, 1020a) to enable vertical movement of the screwing and unscrewing unit;

a plurality of loading units (9001, 9002, 9003) and unloading units (9000, 9004, 9005) for loading and unloading unprocessed rubber cot arbours assemblies and finished rubber cot arbour sets and unloading processed rubber cot arbours assemblies and unfinished rubber cot arbour sets, on and from, the holding stations (3001, 3002, 3003, 3004) of the first rotary disc, holding stations (3001a, 3002a, 3003a, 3004a) of the third rotary disc (3000a) and processing stations (2000, 2000a) of the second rotary disc;
 a master processing and controlling unit (6000) being connected to the first driving unit (7000), second driving unit (7000b), third driving unit (7000a), processing stations (2000, 2000a), screwing and unscrewing assemblies (1000, 1000a), loading units (9001, 9002, 9003), unloading units (9000, 9004, 9005) for controlling operations of the first driving unit, second driving unit, third driving unit, processing stations, screwing and unscrewing assemblies, loading units, unloading units; and
 a mounting assembly (8000) to accommodate the first rotary disc (3000), second rotary disc (4000), third rotary disc (3000a), screwing and unscrewing assemblies (1000, 1000a), first driving unit (7000), second driving unit (7000b) and third driving unit (7000a).

9. The machine as claimed in claim 8 wherein each of the four holding station (3001, 3002, 3003, 3004) of the first rotary disc includes a jaw (3005, 3006, 3007, 3008) to hold the rubber cot arbours.
10. The machine as claimed in claim 8 wherein each of the four holding station (3001a, 3002a, 3003a, 3004a) of the third rotary disc includes a jaw (3005a, 3006a, 3007a, 3008a) to hold the rubber cot arbours.
11. The machine as claimed in claim 8 wherein the driving unit of the screwing and unscrewing assembly includes a servo motor (1140, 1140a).
12. The machine as claimed in claim 8 wherein each processing station (2000, 2000a) of the second rotary disc comprises a control unit (2007, 2007a) to control operation of the gripping assembly.
13. The machine as claimed in claim 12 wherein the control unit (2007, 2007a) is electro pneumatic in construction.
14. The machine as claimed in claim 11 wherein the master processing and controlling unit (6000) includes at least one processor.
15. The machine as claimed in claim 11 wherein the master processing and controlling unit (6000) controls the tightening torque for the fastening means (9).

Patentansprüche

1. Maschine (M1) zur Verwendung bei dem Verarbeiten einer Anordnung von gummibezogenen Wellen, wobei die Anordnung von gummibezogenen Wellen (1) wenigstens ein Set von zwei gummibezogenen Wellen (2, 3) enthält, und zwar einer ersten gummibezogenen Welle (2) und einer zweiten gummibezogenen Welle (3), wobei die erste gummibezogene Welle (2) einen geringeren Durchmesser als die zweite gummibezogene Welle (3) aufweist, wobei die erste und die zweite gummibezogene Welle (2, 3) in einem Gehäuse untergebracht sind, das eine obere Abdeckung (4) und eine untere Abdeckung (5) enthält, wobei die obere Abdeckung (4) und die untere Abdeckung (5) des Gehäuses durch ein Befestigungsmittel (9) aneinander festgemacht sind, wobei die Maschine (M1) Folgendes umfasst:

eine erste Drehscheibe (300), die durch eine erste Antriebseinheit (700) drehbar angetrieben wird, wobei die erste Drehscheibe (300) vier Haltestationen (301, 302, 303, 304) zum Halten der Anordnungen von gummibezogenen Wellen enthält, wobei jede aus den vier Haltestationen auf der ersten Drehscheibe (300) in einem Winkel von 90° getrennt von angrenzenden Haltestationen gelegen ist;

eine zweite Drehscheibe (400), die durch eine zweite Antriebseinheit (700a) drehbar angetrieben wird, wobei die zweite Drehscheibe (400) vier Verarbeitungsstationen (200, 200a, 200b, 200c) zum Ermöglichen des Verarbeitens von gummibezogenen Wellen (2, 3) enthält,

wobei jede aus den vier Verarbeitungsstationen (200, 200a, 200b, 200c) auf der zweiten Drehscheibe in einem Winkel von 90° getrennt von angrenzenden Verarbeitungsstationen gelegen ist, wobei jede Verarbeitungsstation (200, 200a, 200b, 200c) eine Greifanordnung zum Halten der Anordnung von gummibezogenen Wellen zum Zweck des Schraubens und Losschraubens umfasst, wobei die Greifanordnung Folgendes umfasst:

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- eine Greifereinheit, die eine obere Backe (205, 205a, 205b, 205c) und eine untere Backe (206, 206a, 206b, 206c) enthält, wobei die obere Backe (205, 205a, 205b, 205c) konfiguriert ist, um die obere Abdeckung (4) zu halten und die untere Backe (206, 206a, 206b, 206c) konfiguriert ist, um die untere Abdeckung (5) zu halten und dadurch die gummibezogenen Wellen (2, 3) aufzunehmen,
- eine Gleitklemmeinheit (201, 201a, 201b, 201c), um eine vertikale Gleitbewegung der oberen Backe (205, 205a, 205b, 205c) und der unteren Backe (206, 206a, 206b, 206c) zu ermöglichen, wobei die obere Backe (205, 205a, 205b, 205c) und die untere Backe (206, 206a, 206b, 206c) der Greifereinheit mit der Gleitklemmeinheit verbunden sind,
- ein Paar von Unterdruckeinheiten (203, 203a, 203b, 203c, 204, 204a, 204b, 204c), die mit der Greifereinheit und Gleitklemmeinheit verbunden sind, wobei die Unterdruckeinheiten (203, 203a, 203b, 203c, 204, 204a, 204b, 204c) konfiguriert sind, um die Bewegung der oberen Backe (205, 205a, 205b, 205c) und der unteren Backe (206, 206a, 206b, 206c) zu steuern und zum sachgemäßen Greifen der oberen Abdeckung (4) und der unteren Abdeckung (5) in der oberen Backe (205, 205a, 205b, 205c) beziehungsweise der unteren Backe (206, 206a, 206b, 206c);

ein Paar einer Schraub- und Losschraubanordnung (100, 100a) zum Schrauben und Losschrauben des Befestigungsmittels, wobei jede aus der Schraub- und Losschraubanordnung Folgendes umfasst:

- eine Schraub- und Losschraubeinheit (115, 116, 117, 115a, 116a, 117a) zum Schrauben und Losschrauben des Befestigungsmittels,
- eine Antriebseinheit (114, 114a), die mit der Schraub- und Losschraubeinheit verbunden ist, um die Schraub- und Losschraubeinheit zu betreiben,
- eine Gleiteinheit (102, 103, 102a, 103a), die eine Linearführung (102, 102a) umfasst, um eine vertikale Bewegung der Schraub- und Losschraubeinheit zu ermöglichen;

mehrere Ladeeinheiten und Entladeeinheiten zum Laden und Entladen von unverarbeiteten Anordnungen von gummibezogenen Wellen und fertigen Sets von gummibezogenen Wellen und Entladen von verarbeiteten Anordnungen von gummibezogenen Wellen und unfertigen Sets von gummibezogenen Wellen auf und von den Haltestationen (301, 302, 303, 304) der ersten Drehscheibe und den Verarbeitungsstationen (200, 200a, 200b, 200c) der zweiten Drehscheibe;

eine Hauptverarbeitungs- und -steuereinheit (600), die mit der ersten Antriebseinheit (700), der zweiten Antriebseinheit (700a), den Verarbeitungsstationen (200, 200a, 200b, 200c), den Schraub- und Losschraubanordnungen (100, 100a), den Ladeeinheiten und den Entladeeinheiten verbunden ist, um den Betrieb der ersten Antriebseinheit, der zweiten Antriebseinheit, der Verarbeitungsstationen, der Schraub- und Losschraubanordnungen, der Ladeeinheiten und der Entladeeinheiten zu steuern; und
eine Montageanordnung (800) zum Aufnehmen der ersten Drehscheibe (300), der zweiten Drehscheibe (400) und der Schraub- und Losschraubanordnungen (100, 100a), der ersten Antriebseinheit (700) und der zweiten Antriebseinheit (700a).

2. Maschine nach Anspruch 1, wobei jede aus den vier Haltestationen (301, 302, 303, 304) der ersten Drehscheibe eine Backe (305, 306, 307, 308) enthält, um die gummibezogenen Wellen zu halten.
3. Maschine nach Anspruch 1, wobei die Antriebseinheit der Schraub- und Losschraubanordnung einen Servomotor (114, 114a) enthält.
4. Maschine nach Anspruch 1, wobei jede Verarbeitungsstation (200, 200a, 200b, 200c) der zweiten Drehscheibe eine Steuereinheit (207, 207a, 207b, 207c) umfasst, um den Betrieb der Greifanordnung zu steuern.
5. Maschine nach Anspruch 4, wobei die Steuereinheit (207, 207a, 207b, 207c) in der Konstruktion elektropneumatisch ist.
6. Maschine nach Anspruch 1, wobei die Hauptverarbeitungs- und -steuereinheit (600) wenigstens einen Prozessor enthält.
7. Maschine nach Anspruch 1, wobei die Hauptverarbeitungs- und -steuereinheit (600) das Anzugsmoment für das Befestigungsmittel (9) steuert.
8. Maschine (M2) zur Verwendung bei dem Verarbeiten einer Anordnung von gummibezogenen Wellen, wobei die

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Anordnung von gummibezogenen Wellen (1) wenigstens ein Set von zwei gummibezogenen Wellen (2, 3) enthält, und zwar einer ersten gummibezogenen Welle (2) und einer zweiten gummibezogenen Welle (3), wobei die erste gummibezogene Welle (2) einen geringeren Durchmesser als die zweite gummibezogene Welle (3) aufweist, wobei die ersten und zweiten gummibezogenen Wellen (2, 3) in einem Gehäuse untergebracht sind, das eine obere Abdeckung (4) und eine untere Abdeckung (5) enthält, wobei die obere Abdeckung (4) und die untere Abdeckung (5) des Gehäuses durch ein Befestigungsmittel (9) aneinander festgemacht sind, wobei die Maschine (M2) Folgendes umfasst:

eine erste Drehscheibe (3000), die durch eine erste Antriebseinheit (7000) drehbar angetrieben wird, wobei die erste Drehscheibe (3000) vier Haltestationen (3001, 3002, 3003, 3004) zum Halten der Anordnungen von gummibezogenen Wellen enthält, wobei jede aus den vier Haltestationen auf der ersten Drehscheibe (3000) in einem Winkel von 90° getrennt von angrenzenden Haltestationen gelegen ist;

eine zweite Drehscheibe (4000), die durch eine zweite Antriebseinheit (7000b) drehbar angetrieben wird, wobei die zweite Drehscheibe (4000) zwei Verarbeitungsstationen (2000, 2000a) enthält, um die Verarbeitung von gummibezogenen Wellen (2, 3) zu ermöglichen, wobei jede aus den zwei Verarbeitungsstationen (2000, 2000a) auf der zweiten Drehscheibe in einem Winkel von 180° getrennt von angrenzenden Verarbeitungsstationen gelegen ist, wobei jede Verarbeitungsstation (2000, 2000a) eine Greifanordnung zum Halten der Anordnung von gummibezogenen Wellen zum Zweck des Schraubens und Losschraubens umfasst, wobei die Greifanordnung Folgendes umfasst:

- eine Greifereinheit, die eine obere Backe (2050, 2050a) und eine untere Backe (2060, 2060a) enthält, wobei die obere Backe (2050, 2050a) konfiguriert ist, um die obere Abdeckung (4) zu halten und die untere Backe (2060, 2060a) konfiguriert ist, um die untere Abdeckung (5) zu halten und dadurch die gummibezogenen Wellen (2, 3) aufzunehmen,

- eine Gleitklemmeinheit (2010, 2010a), um eine vertikale Gleitbewegung der oberen Backe (2050, 2050a) und der unteren Backe (2060, 2060a) zu ermöglichen, wobei die obere Backe (2050, 2050a) und die untere Backe (2060, 2060a) der Greifereinheit mit der Gleitklemmeinheit verbunden sind,

- ein Paar von Unterdruckeinheiten (2030, 2030a, 2040, 2040a), die mit der Greifereinheit und der Gleitklemmeinheit verbunden sind, wobei die Unterdruckeinheiten (2030, 2030a, 2040, 2040a) konfiguriert sind, um die Bewegung der oberen Backe (2050, 2050a) und der unteren Backe (2060, 2060a) zu steuern und zum sachgemäßen Greifen der oberen Abdeckung (4) und der unteren Abdeckung (5) in der oberen Backe (2050, 2050a) beziehungsweise der unteren Backe (2060, 2060a);

eine dritte Drehscheibe (3000a), die durch eine dritte Antriebseinheit (7000a) drehbar angetrieben wird, wobei die dritte Drehscheibe (3000a) vier Haltestationen (3001a, 3002a, 3003a, 3004a) zum Halten der Anordnungen von gummibezogenen Wellen enthält, wobei jede aus den vier Haltestationen auf der dritten Drehscheibe (3000a) in einem Winkel von 90° getrennt von angrenzenden Haltestationen gelegen ist;

ein Paar einer Schraub- und Losschraubanordnung (1000, 1000a) zum Schrauben und Losschrauben des Befestigungsmittels, wobei jede aus der Schraub- und Losschraubanordnung Folgendes umfasst:

- eine Schraub- und Losschraubeinheit (1150, 1160, 1170, 1150a, 1160a, 1170a) zum Schrauben und Losschrauben des Befestigungsmittels,

- eine Antriebseinheit (1140, 1140a), die mit der Schraub- und Losschraubeinheit verbunden ist, um die Schraub- und Losschraubeinheit zu betreiben,

- eine Gleiteinheit (1020, 1030, 1020a, 1030a), die eine Linearführung (1020, 1020a) umfasst, um eine vertikale Bewegung der Schraub- und Losschraubeinheit zu ermöglichen;

mehrere Ladeeinheiten (9001, 9002, 9003) und Entladeeinheiten (9000, 9004, 9005) zum Laden und Entladen von unverarbeiteten Anordnungen von gummibezogenen Wellen und fertigen Sets von gummibezogenen Wellen und Entladen von verarbeiteten Anordnungen von gummibezogenen Wellen und unfertigen Sets von gummibezogenen Wellen auf und von den Haltestationen (3001, 3002, 3003, 3004) der ersten Drehscheibe, den Haltestationen (3001a, 3002a, 3003a, 3004a) der dritten Drehscheibe (3000a) und den Verarbeitungsstationen (2000, 2000a) der zweiten Drehscheibe;

eine Hauptverarbeitungs- und -steuereinheit (6000), die mit der ersten Antriebseinheit (7000), der zweiten Antriebseinheit (7000b), der dritten Antriebseinheit (7000a), den Verarbeitungsstationen (2000, 2000a), den Schraub- und Losschraubanordnungen (1000, 1000a), den Ladeeinheiten (9001, 9002, 9003) und den Entladeeinheiten (9000, 9004, 9005) verbunden ist, um den Betrieb der ersten Antriebseinheit, der zweiten Antriebseinheit, der dritten Antriebseinheit, der Verarbeitungsstationen, der Schraub- und Losschraubanordnungen, der

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Ladeeinheiten und der Entladeeinheiten zu steuern; und eine Montageanordnung (8000) zum Aufnehmen der ersten Drehscheibe (3000), der zweiten Drehscheibe (4000), der dritten Drehscheibe (3000a), der Schraub- und Losschraubenanordnungen (1000, 1000a), der ersten Antriebseinheit (7000), der zweiten Antriebseinheit (7000b) und der dritten Antriebseinheit (7000a).

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9. Maschine nach Anspruch 8, wobei jede aus den vier Haltestationen (3001, 3002, 3003, 3004) der ersten Drehscheibe eine Backe (3005, 3006, 3007, 3008) enthält, um die gummibezogenen Wellen zu halten.
10. Maschine nach Anspruch 8, wobei jede aus den vier Haltestationen (3001a, 3002a, 3003a, 3004a) der dritten Drehscheibe eine Backe (3005a, 3006a, 3007a, 3008a) enthält, um die gummibezogenen Wellen zu halten.
11. Maschine nach Anspruch 8, wobei die Antriebseinheit der Schraub- und Losschraubenanordnung einen Servomotor (1140, 1140a) enthält.
12. Maschine nach Anspruch 8, wobei jede Verarbeitungsstation (2000, 2000a) der zweiten Drehscheibe eine Steuereinheit (2007, 2007a) umfasst, um den Betrieb der Greifanordnung zu steuern.
13. Maschine nach Anspruch 12, wobei die Steuereinheit (2007, 2007a) in der Konstruktion elektropneumatisch ist.
14. Maschine nach Anspruch 11, wobei die Hauptverarbeitungs- und -steuereinheit (6000) wenigstens einen Prozessor enthält.
15. Maschine nach Anspruch 11, wobei die Hauptverarbeitungs- und -steuereinheit (6000) das Anzugsmoment für das Befestigungsmittel (9) steuert.
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Revendications

1. Machine (M1) conçue pour traiter un ensemble d'arbres à manchons de caoutchouc, l'ensemble d'arbres à manchons de caoutchouc (1) comprend au moins un ensemble de deux arbres à manchons de caoutchouc (2, 3), à savoir un premier arbre à manchons de caoutchouc (2) et un second arbre à manchons de caoutchouc (3), le premier arbre à manchons de caoutchouc (2) ayant un diamètre inférieur à celui du second arbre à manchons de caoutchouc (3), les premier et second arbres à manchons de caoutchouc (2, 3) étant logés dans un boîtier comprenant un couvercle supérieur (4) et un couvercle inférieur (5), le couvercle supérieur (4) et le couvercle inférieur (5) du boîtier étant fixés l'un à l'autre par un moyen de fixation (9), la machine (M1) comprenant :
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un premier disque rotatif (300) étant entraîné en rotation par une première unité d'entraînement (700), le premier disque rotatif (300) comprend quatre postes de support (301, 302, 303, 304) destinés à supporter les ensembles d'arbres à manchons de caoutchouc, chacun des quatre postes de support étant situé sur le premier disque rotatif (300) à un angle de 90° par rapport aux postes de support adjacents ;

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un deuxième disque rotatif (400) étant entraîné en rotation par une seconde unité d'entraînement (700a), le deuxième disque rotatif (400) comprend quatre postes de traitement (200, 200a, 200b, 200c) pour permettre le traitement d'arbres à manchons de caoutchouc (2, 3),

chacun des quatre postes de traitement (200, 200a, 200b, 200c) étant situé sur le deuxième disque rotatif à un angle de 90° par rapport aux postes de traitement adjacents, chaque poste de traitement (200, 200a, 200b, 200c) comprend un ensemble de préhension pour retenir l'ensemble d'arbres à manchons de caoutchouc à des fins de vissage et de dévissage, l'ensemble de préhension comprend :

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- une unité de préhension comprenant une mâchoire supérieure (205, 205a, 205b, 205c) et une mâchoire inférieure (206, 206a, 206b, 206c), la mâchoire supérieure (205, 205a, 205b, 205c) étant configurée pour retenir le couvercle supérieur (4) et la mâchoire inférieure (206, 206a, 206b, 206c) étant configurée pour retenir le couvercle inférieur (5) et ainsi recevoir les arbres à manchons de caoutchouc (2, 3),

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- une unité de serrage à glissière (201, 201a, 201b, 201c) pour permettre un mouvement de coulissement vertical de la mâchoire supérieure (205, 205a, 205b, 205c) et de la mâchoire inférieure (206, 206a, 206b, 206c), la mâchoire supérieure (205, 205a, 205b, 205c) et la mâchoire inférieure (206, 206a, 206b, 206c) de l'unité de préhension sont reliées à l'unité de serrage à glissière,

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- une paire d'unités d'aspiration (203, 203a, 203b, 203c, 204, 204a, 204b, 204c) étant reliées à l'unité de préhension et à l'unité de serrage à glissière, les unités d'aspiration (203, 203a, 203b, 203c, 204, 204a,

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204b, 204c) étant configurées pour contrôler le mouvement des mâchoires supérieure (205, 205a, 205b, 205c) et inférieure (206, 206a, 206b, 206c) et la préhension correcte des couvercles supérieur (4) et inférieur (5) dans la mâchoire supérieure (205, 205a, 205b, 205c) et la mâchoire inférieure (206, 206a, 206b, 206c) respectivement ;

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une paire d'ensembles de vissage et de dévissage (100, 100a) pour visser et dévisser les moyens de fixation, chacun des ensembles de vissage et de dévissage comprend :

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- une unité de vissage et de dévissage (115, 116, 117, 115a, 116a, 117a) pour visser et dévisser les moyens de fixation,
- une unité d'entraînement (114, 114a) étant reliée à l'unité de vissage et de dévissage pour faire fonctionner l'unité de vissage et de dévissage,
- une unité coulissante (102, 103, 102a, 103a) comprenant un guide linéaire (102, 102a) pour permettre le mouvement vertical de l'unité de vissage et de dévissage ;

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une pluralité d'unités de chargement et d'unités de déchargement pour charger et décharger les ensembles d'arbres à manchons de caoutchouc non traités et les ensembles d'arbres à manchons de caoutchouc finis et pour décharger les ensembles d'arbres à manchons de caoutchouc traités et les ensembles d'arbres à manchons de caoutchouc non finis, sur et à partir, des stations de support (301, 302, 303, 304) du premier disque rotatif et des stations de traitement (200, 200a, 200b, 200c) du deuxième disque rotatif ;

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une unité de traitement et de commande maître (600) étant reliée à la première unité d'entraînement (700), à la seconde unité d'entraînement (700a), aux postes de traitement (200, 200a, 200b, 200c), aux ensembles de vissage et de dévissage (100, 100a), aux unités de chargement et aux unités de déchargement pour commander les opérations de la première unité d'entraînement, de la seconde unité d'entraînement, des postes de traitement, des ensembles de vissage et de dévissage, des unités de chargement et des unités de déchargement ; et un ensemble de montage (800) pour loger le premier disque rotatif (300), le deuxième disque rotatif (400) et les ensembles de vissage et de dévissage (100, 100a), la première unité d'entraînement (700) et la seconde unité d'entraînement (700a).

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30 **2.** Machine selon la revendication 1, dans laquelle chacun des quatre postes de support (301, 302, 303, 304) du premier disque rotatif comprend une mâchoire (305, 306, 307, 308) pour maintenir les arbres à manchons de caoutchouc.

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3. Machine selon la revendication 1, dans laquelle l'unité d'entraînement de l'ensemble de vissage et de dévissage comprend un servomoteur (114, 114a).

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4. Machine selon la revendication 1, dans laquelle chaque poste de traitement (200, 200a, 200b, 200c) du deuxième disque rotatif comprend une unité de commande (207, 207a, 207b, 207c) pour commander le fonctionnement de l'ensemble de préhension.

5. Machine selon la revendication 4, dans laquelle l'unité de commande (207, 207a, 207b, 207c) est de construction électro pneumatique.

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6. Machine selon la revendication 1, dans laquelle l'unité de traitement et de commande maître (600) comprend au moins un processeur.

7. Machine selon la revendication 1, dans laquelle l'unité de traitement et de commande maître (600) commande le couple de serrage des moyens de fixation (9).

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8. Machine (M2) conçue pour traiter un ensemble d'arbres à manchons de caoutchouc, l'ensemble d'arbres à manchons de caoutchouc (1) comprend au moins un ensemble de deux arbres à manchons de caoutchouc (2, 3), à savoir un premier arbre à manchons de caoutchouc (2) et un second arbre à manchons de caoutchouc (3), le premier arbre à manchons de caoutchouc (2) ayant un diamètre inférieur à celui du second arbre à manchons de caoutchouc (3), les premier et second arbres à manchons de caoutchouc (2, 3) étant logés dans un boîtier comprenant un couvercle supérieur (4) et un couvercle inférieur (5), le couvercle supérieur (4) et le couvercle inférieur (5) du boîtier étant fixés l'un à l'autre par un moyen de fixation (9), la machine (M2) comprenant :

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un premier disque rotatif (3000) étant entraîné en rotation par une première unité d'entraînement (7000), le

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premier disque rotatif (3000) comprend quatre postes de support (3001, 3002, 3003, 3004) destinés à supporter les ensembles d'arbres à manchons de caoutchouc, chacun des quatre postes de support étant situé sur le premier disque rotatif (3000) à un angle de 90° par rapport aux postes de support adjacents ;

un deuxième disque rotatif (4000) étant entraîné en rotation par une seconde unité d'entraînement (7000b), le deuxième disque rotatif (4000) comprend deux postes de traitement (2000, 2000a) pour permettre le traitement d'arbres à manchons de caoutchouc (2, 3), chacun des deux postes de traitement (2000, 2000a) étant situé sur le deuxième disque rotatif à un angle de 180° par rapport aux postes de traitement adjacents, chaque poste de traitement (2000, 2000a) comprend un ensemble de préhension pour retenir l'ensemble d'arbres à manchons de caoutchouc à des fins de vissage et de dévissage, l'ensemble de préhension comprend :

- une unité de préhension comprenant une mâchoire supérieure (2050, 2050a) et une mâchoire inférieure (2060, 2060a), la mâchoire supérieure (2050, 2050a) étant configurée pour retenir le couvercle supérieur (4) et la mâchoire inférieure (2060, 2060a) étant configurée pour retenir le couvercle inférieur (5) et ainsi recevoir les arbres à manchons de caoutchouc (2, 3),

- une unité de serrage à glissière (2010, 2010a) pour permettre un mouvement de coulissement vertical de la mâchoire supérieure (2050, 2050a) et de la mâchoire inférieure (2060, 2060a), la mâchoire supérieure (2050, 2050a) et la mâchoire inférieure (2060, 2060a) de l'unité de préhension sont reliées à l'unité de serrage à glissière,

- une paire d'unités d'aspiration (2030, 2030a, 2040, 2040a) étant reliées à l'unité de préhension et à l'unité de serrage à glissière, les unités d'aspiration (2030, 2030a, 2040, 2040a) étant configurées pour contrôler le mouvement des mâchoires supérieure (2050, 2050a) et inférieure (2060, 2060a) et la préhension correcte des couvercles supérieur (4) et inférieur (5) dans la mâchoire supérieure (2050, 2050a) et la mâchoire inférieure (2060, 2060a) respectivement ;

un troisième disque rotatif (3000a) étant entraîné en rotation par une troisième unité d'entraînement (7000a), le troisième disque rotatif (3000a) comprend quatre postes de support (3001a, 3002a, 3003a, 3004a) destinés à supporter les arbres à manchons de caoutchouc, chacun des quatre postes de support étant situé sur le troisième disque rotatif (3000a) à un angle de 90° par rapport aux postes de support adjacents ;

une paire d'ensembles de vissage et de dévissage (1000, 1000a) pour visser et dévisser les moyens de fixation, chacun des ensembles de vissage et dévissage comprenant :

- une unité de vissage et de dévissage (1150, 1160, 1170, 1150a, 1160a, 1170a) pour visser et dévisser les moyens de fixation,

- une unité d'entraînement (1140, 1140a) étant reliée à l'unité de vissage et de dévissage pour faire fonctionner l'unité de vissage et de dévissage,

- une unité coulissante (1020, 1030, 1020a, 1030a) comprenant un guide linéaire (1020, 1020a) pour permettre le mouvement vertical de l'unité de vissage et de dévissage ;

une pluralité d'unités de chargement (9001, 9002, 9003) et d'unités de déchargement (9000, 9004, 9005) pour charger et décharger les ensembles d'arbres à manchons de caoutchouc non traités et les ensembles d'arbres à manchons de caoutchouc finis et pour décharger les ensembles d'arbres à manchons de caoutchouc traités et les ensembles d'arbres à manchons de caoutchouc non finis, sur et à partir, des stations de support (3001, 3002, 3003, 3004) du premier disque rotatif, des stations de support (3001a, 3002a, 3003a, 3004a) du troisième disque rotatif (3000a) et des stations de traitement (2000, 2000a) du deuxième disque rotatif ;

une unité de traitement et de commande maître (6000) étant reliée à la première unité d'entraînement (7000), à la seconde unité d'entraînement (7000b), à la troisième unité de traitement (7000a), aux postes de traitement (2000, 2000a), aux ensembles de vissage et de dévissage (1000, 1000a), aux unités de chargement (9001, 9002, 9003) et aux unités de déchargement (9000, 9004, 9005) pour commander les opérations de la première unité d'entraînement, de la seconde unité d'entraînement, de la troisième unité d'entraînement, des postes de traitement, des ensembles de vissage et de dévissage, des unités de chargement et des unités de déchargement ; et

un ensemble de montage (8000) pour loger le premier disque rotatif (3000), le deuxième disque rotatif (4000), le troisième disque rotatif (3000a) et les ensembles de vissage et de dévissage (1000, 1000a), la première unité d'entraînement (7000), la seconde unité d'entraînement (7000b) et la troisième unité d'entraînement (7000a).

9. Machine selon la revendication 8, dans laquelle chacun des quatre postes de support (3001, 3002, 3003, 3004) du premier disque rotatif comprend une mâchoire (3005, 3006, 3007, 3008) pour maintenir les arbres à manchons de caoutchouc.

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10. Machine selon la revendication 8, dans laquelle chacun des quatre postes de support (3001a, 3002a, 3003a, 3004a) du troisième disque rotatif comprend une mâchoire (3005a, 3006a, 3007a, 3008a) pour maintenir les arbres à manchons de caoutchouc.
- 5 11. Machine selon la revendication 8, dans laquelle l'unité d'entraînement de l'ensemble de vissage et de dévissage comprend un servomoteur (1140, 1140a).
12. Machine selon la revendication 8, dans laquelle chaque poste de traitement (2000, 2000a) du deuxième disque rotatif comprend une unité de commande (2007, 2007a) pour commander le fonctionnement de l'ensemble de
10 préhension.
13. Machine selon la revendication 12, dans laquelle l'unité de commande (2007, 2007a) est de construction électro pneumatique.
- 15 14. Machine selon la revendication 11, dans laquelle l'unité de traitement et de commande maître (6000) comprend au moins un processeur.
15. Machine selon la revendication 11, dans laquelle l'unité de traitement et de commande maître (6000) commande
20 le couple de serrage des moyens de fixation (9).

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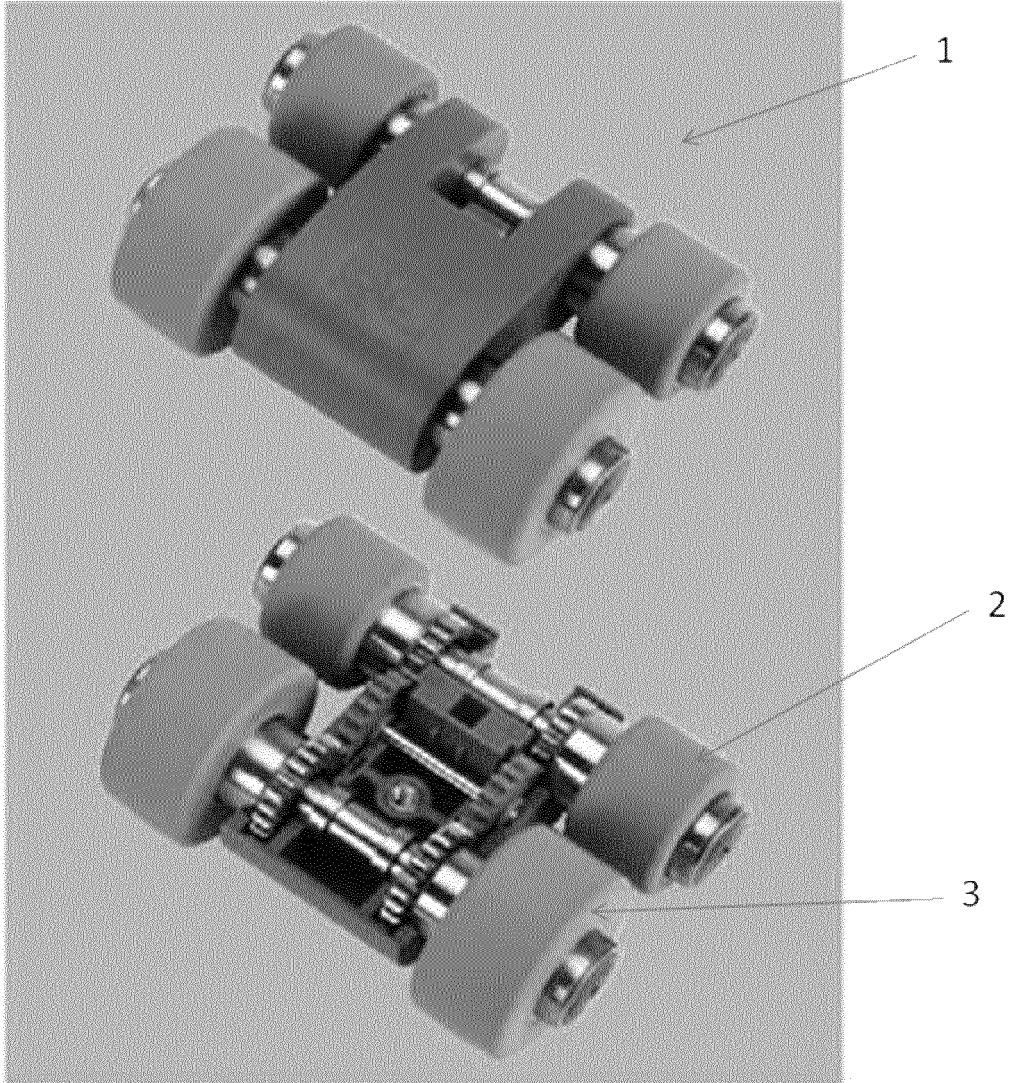


Fig. 1(a)

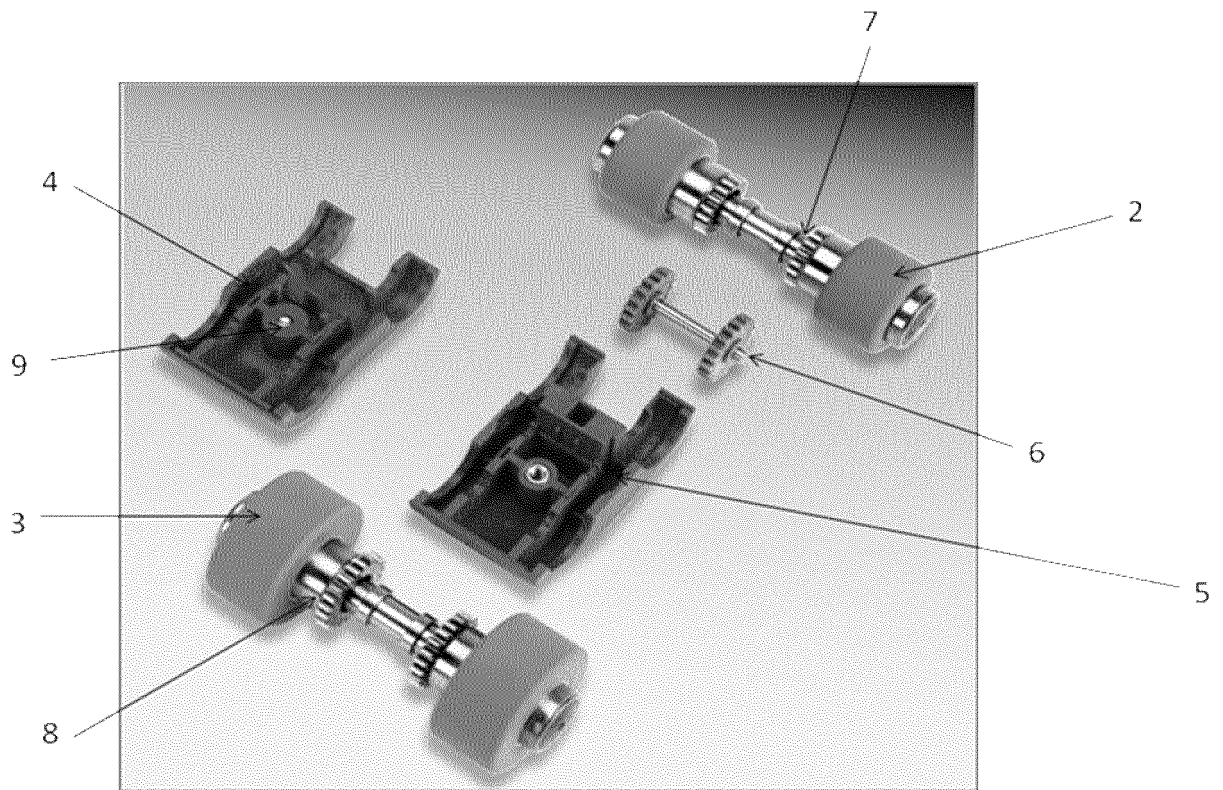


Fig. 1(b)

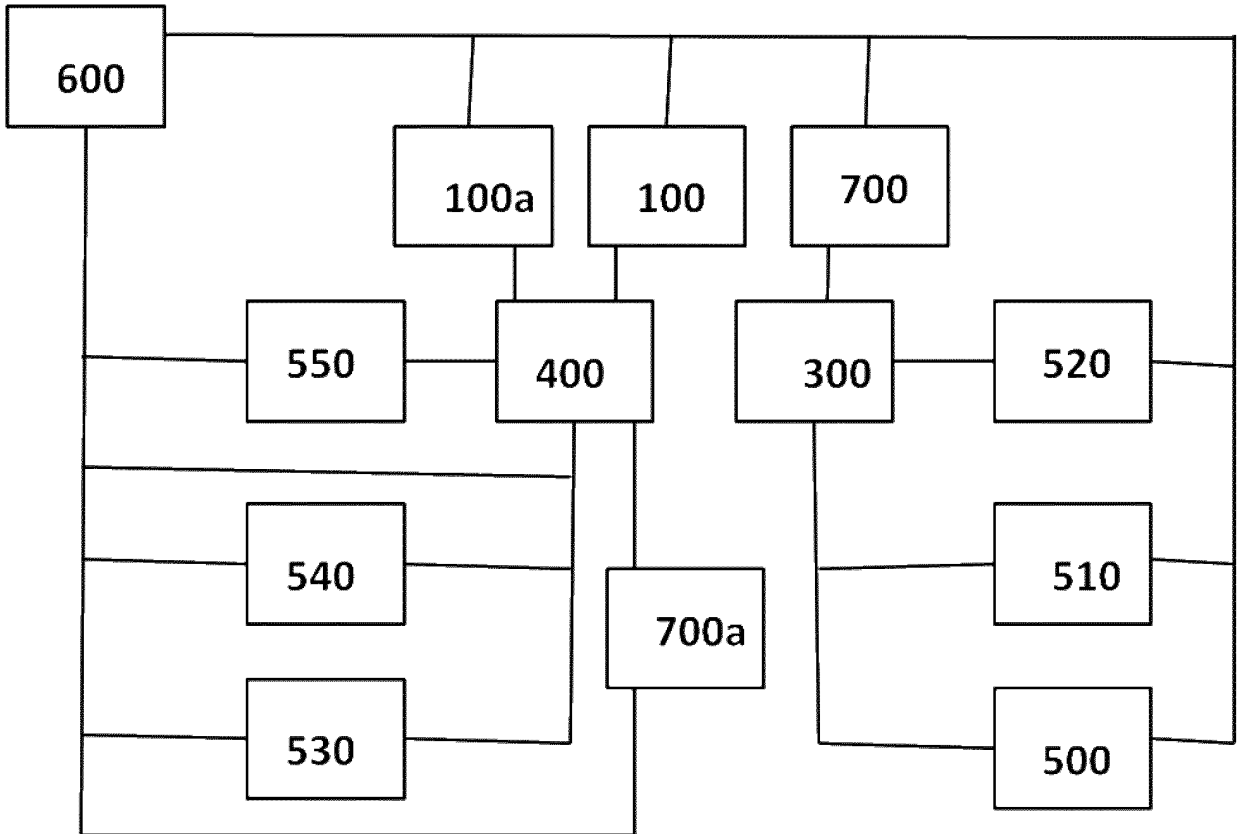


Fig. 2

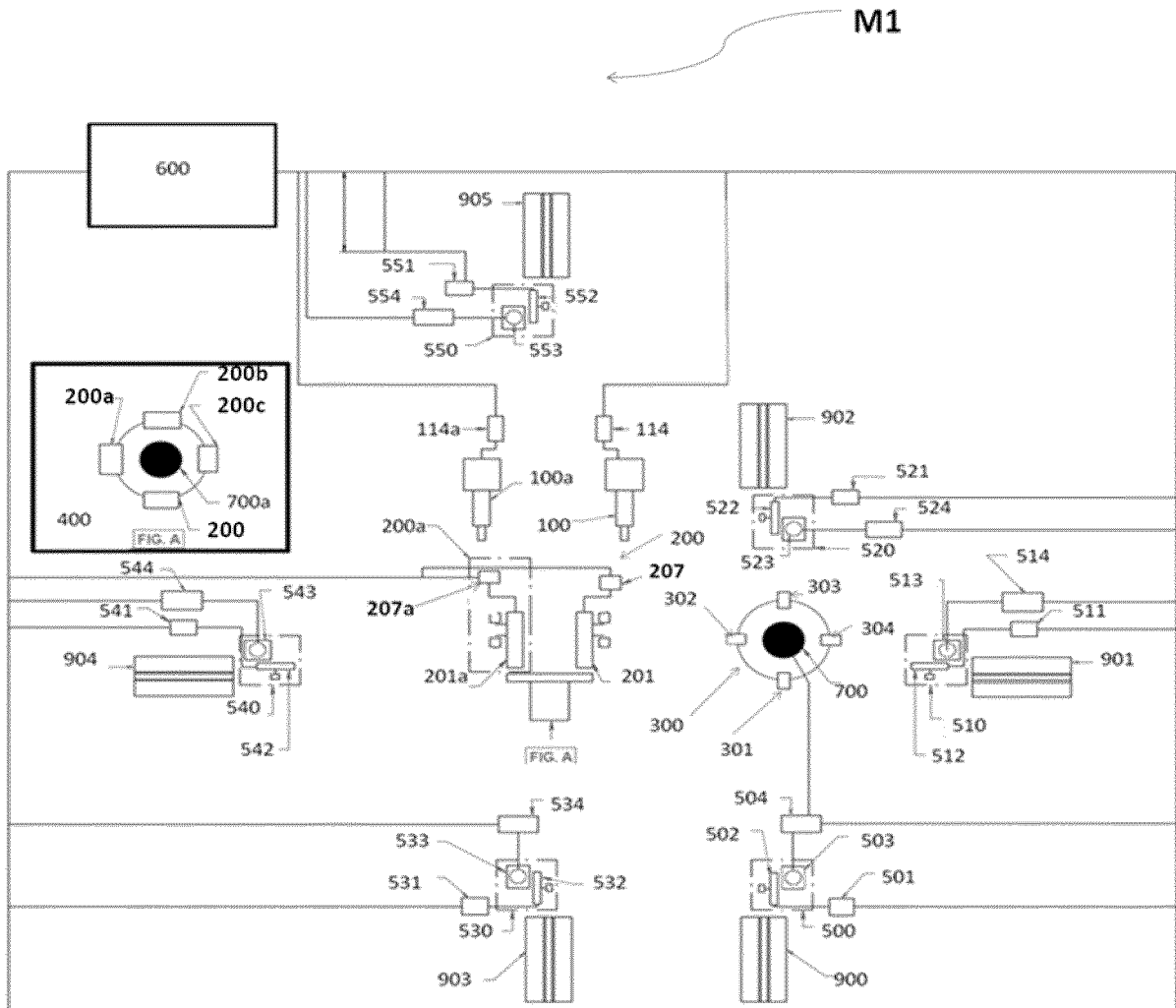


Fig. 3

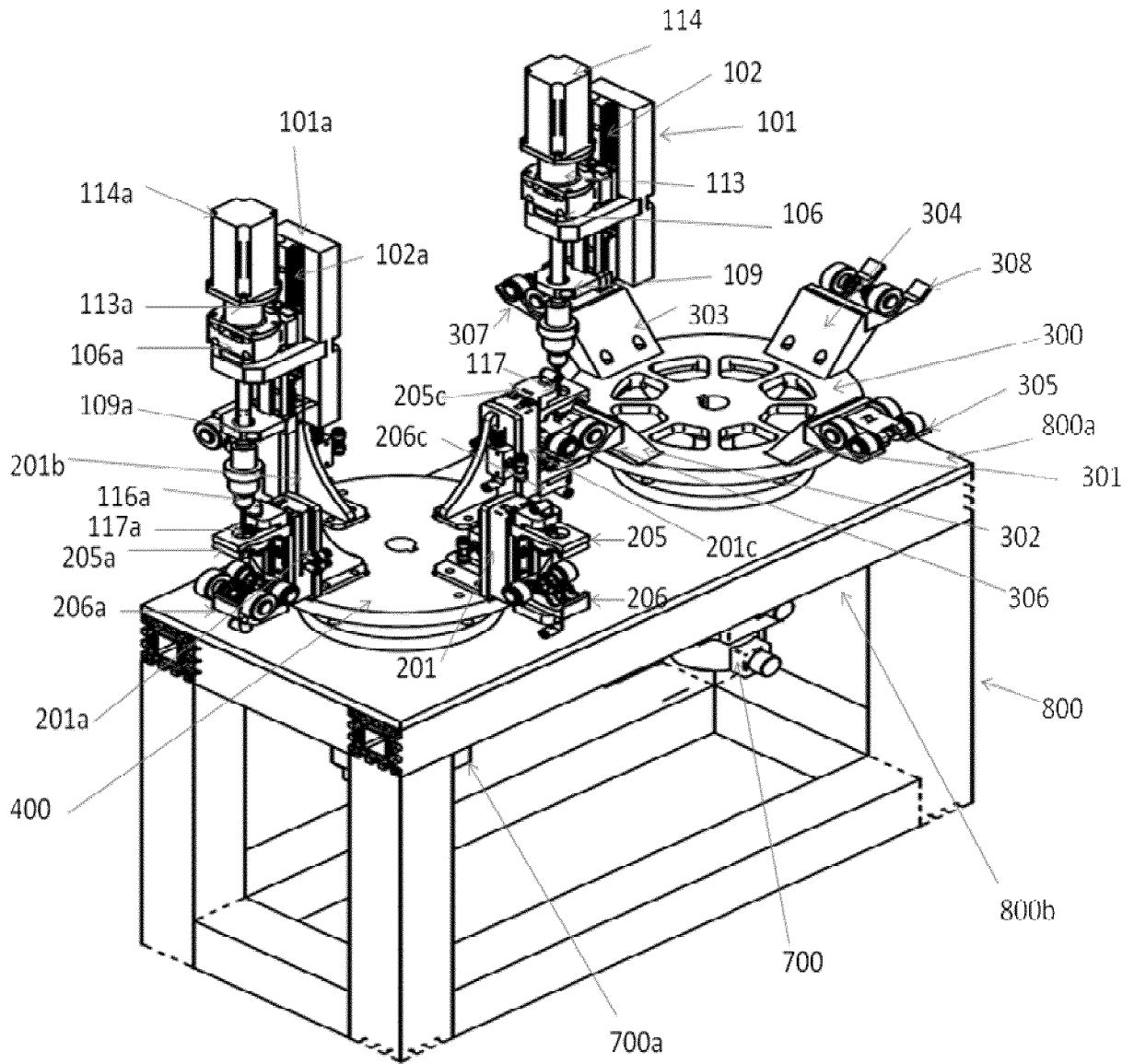


Fig. 4(a)

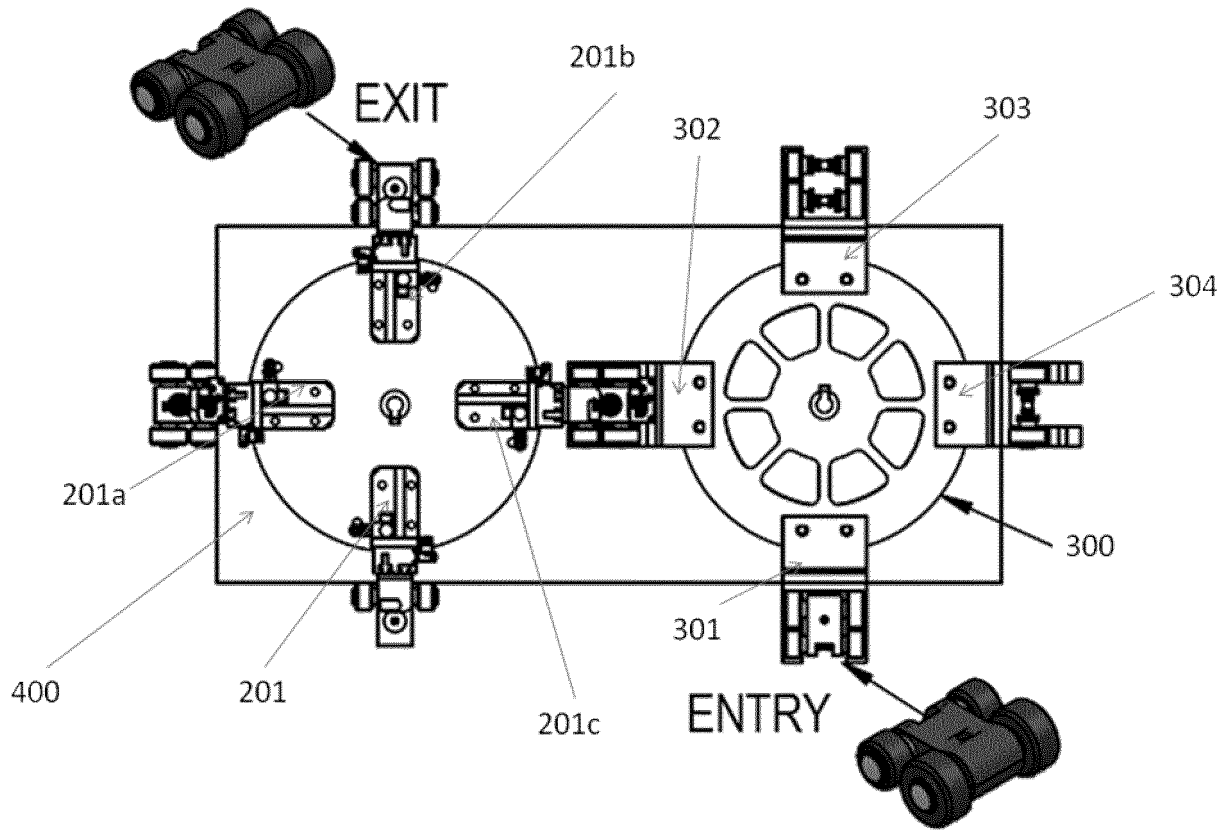


Fig. 4(b)

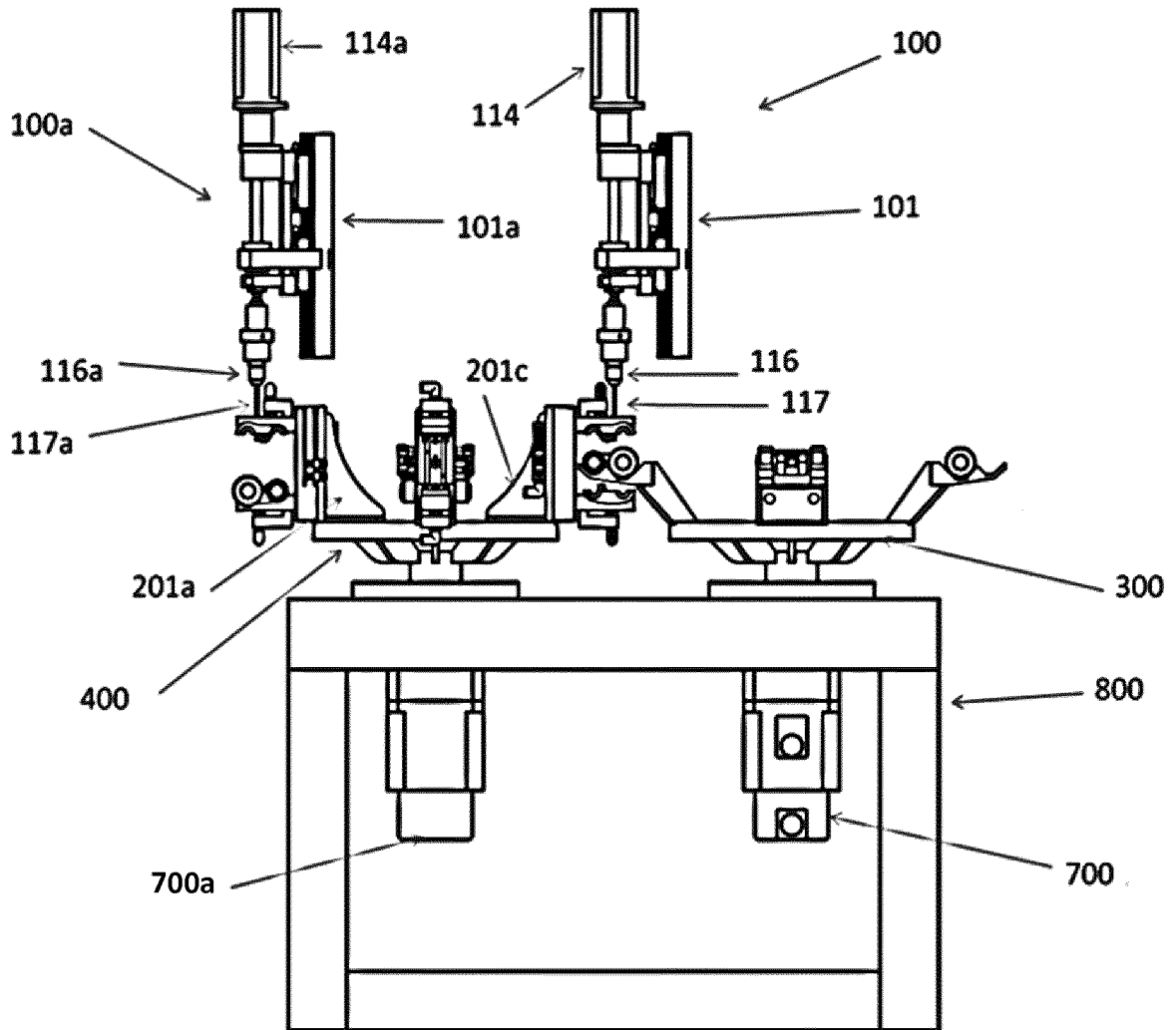


Fig. 4(c)

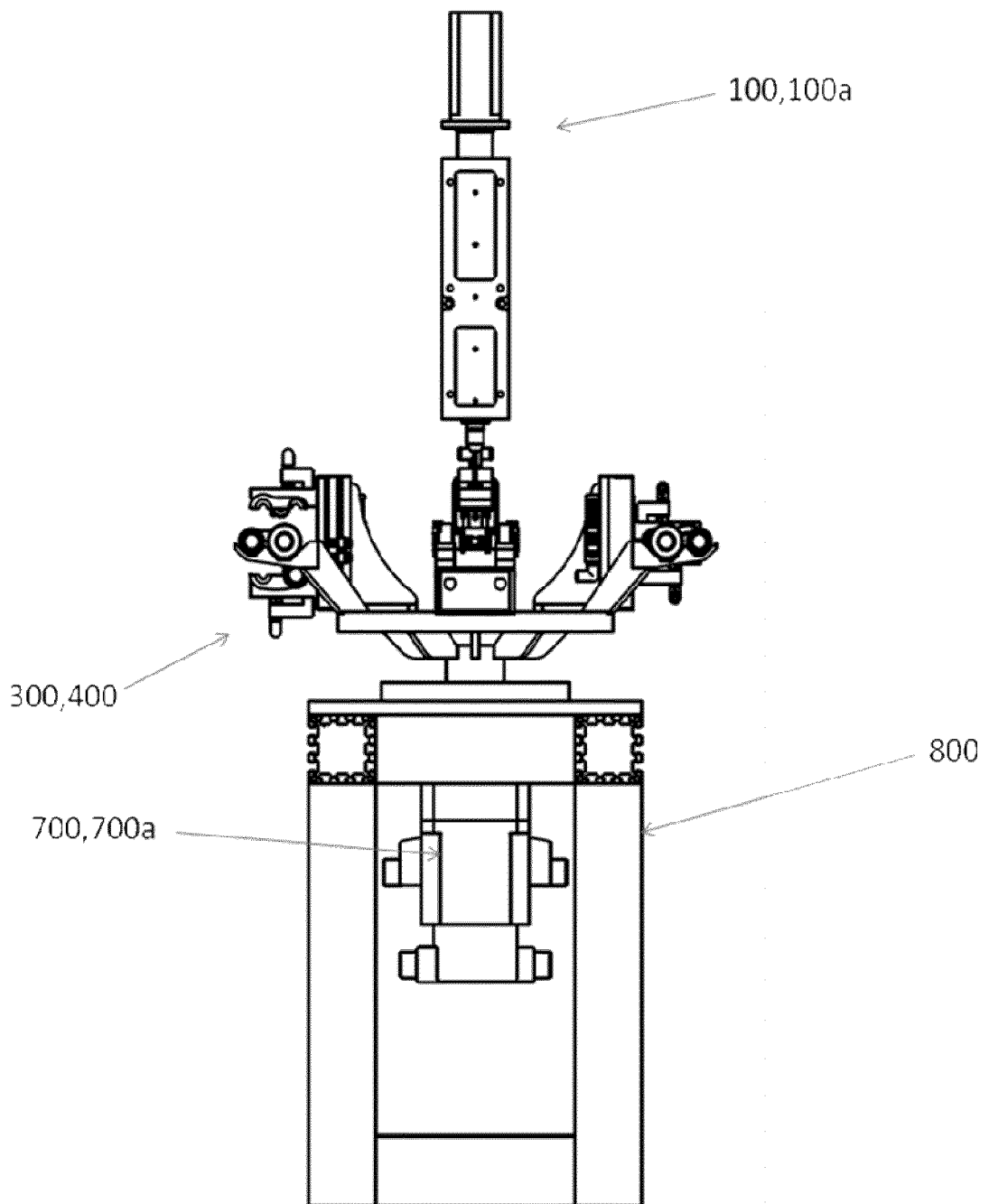


Fig. 4(d)

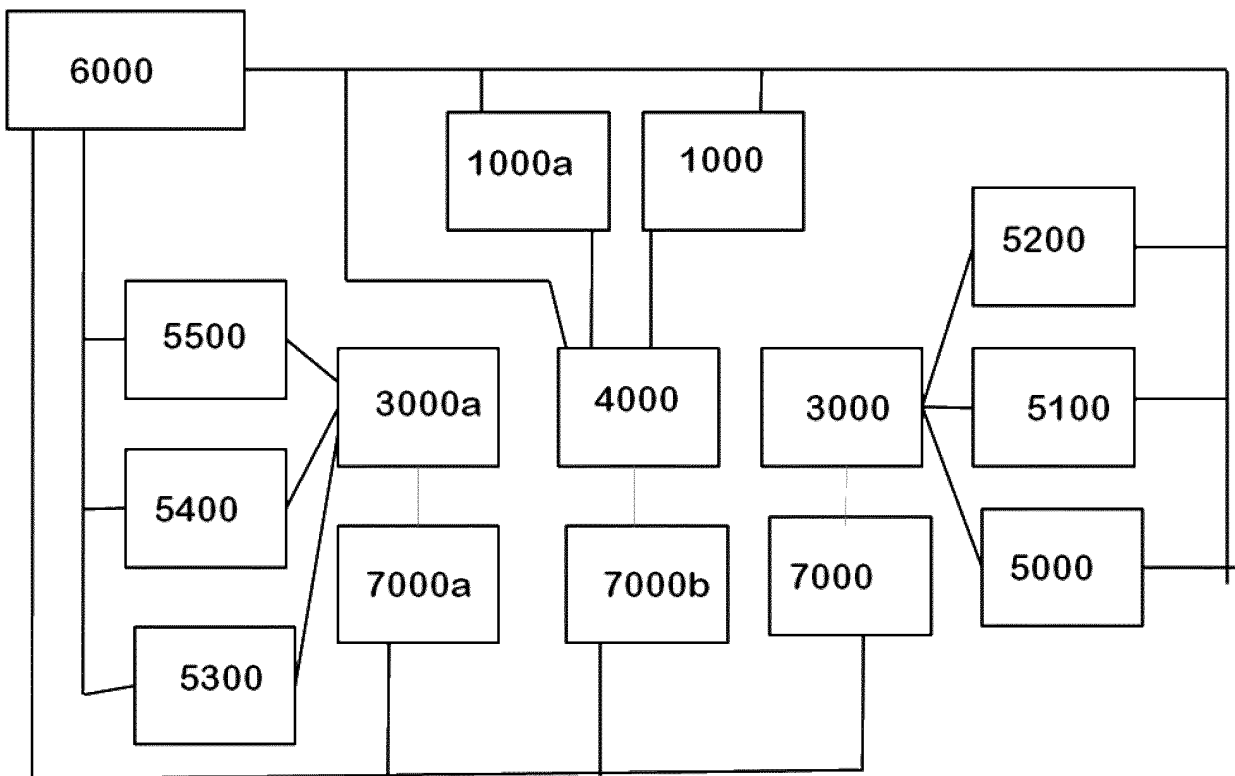


Fig. 5

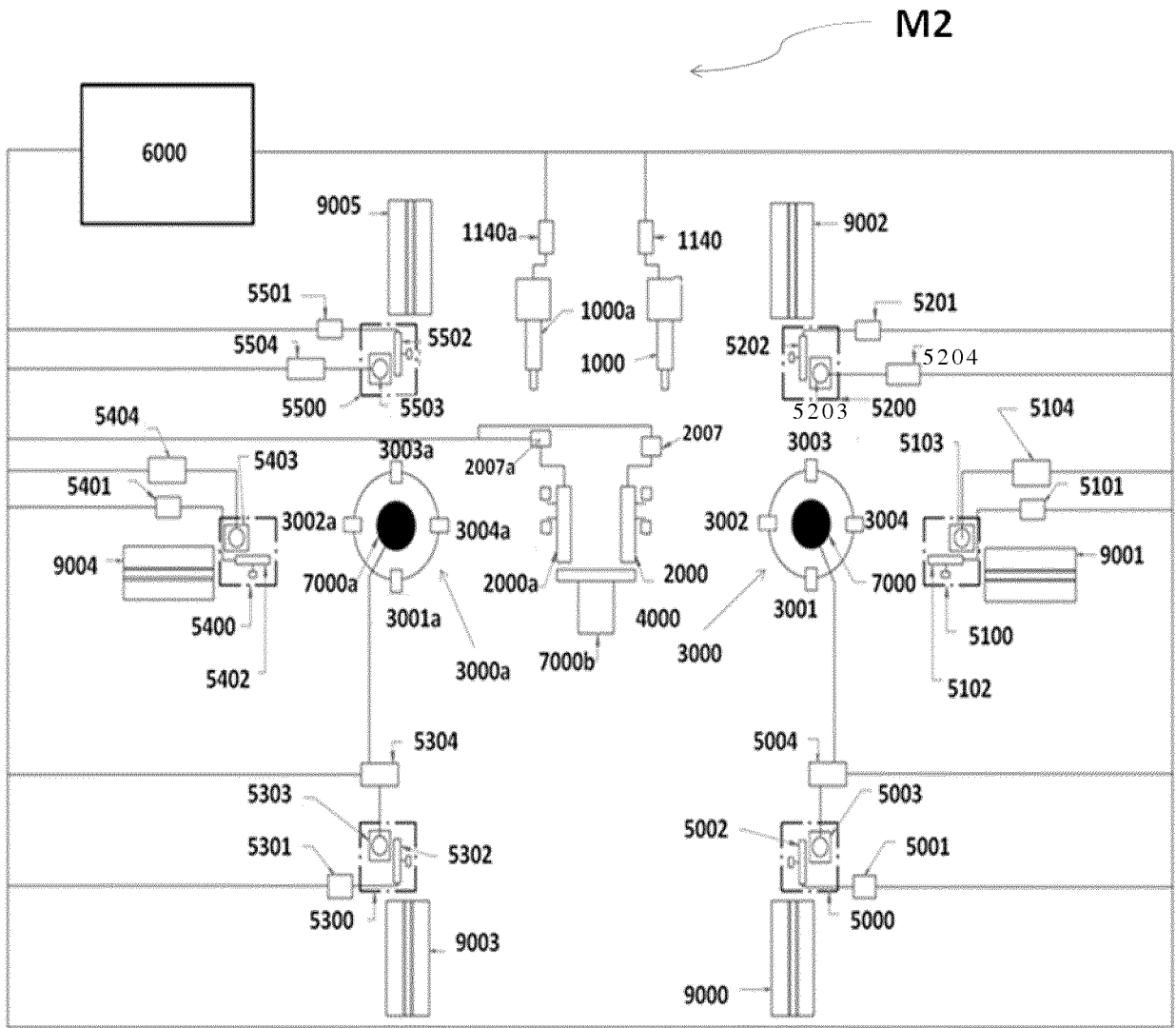


Fig. 6

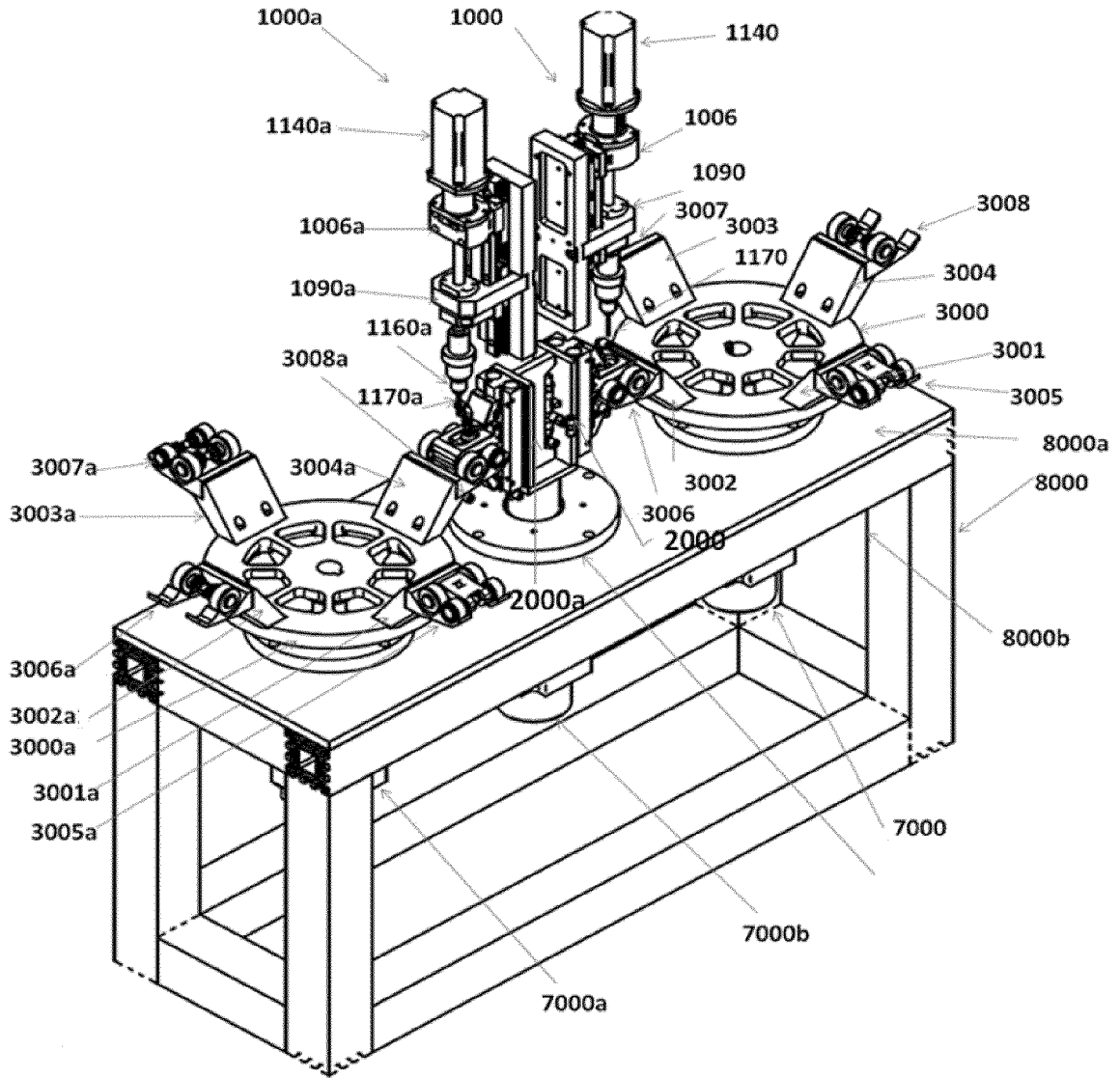


Fig. 7(a)

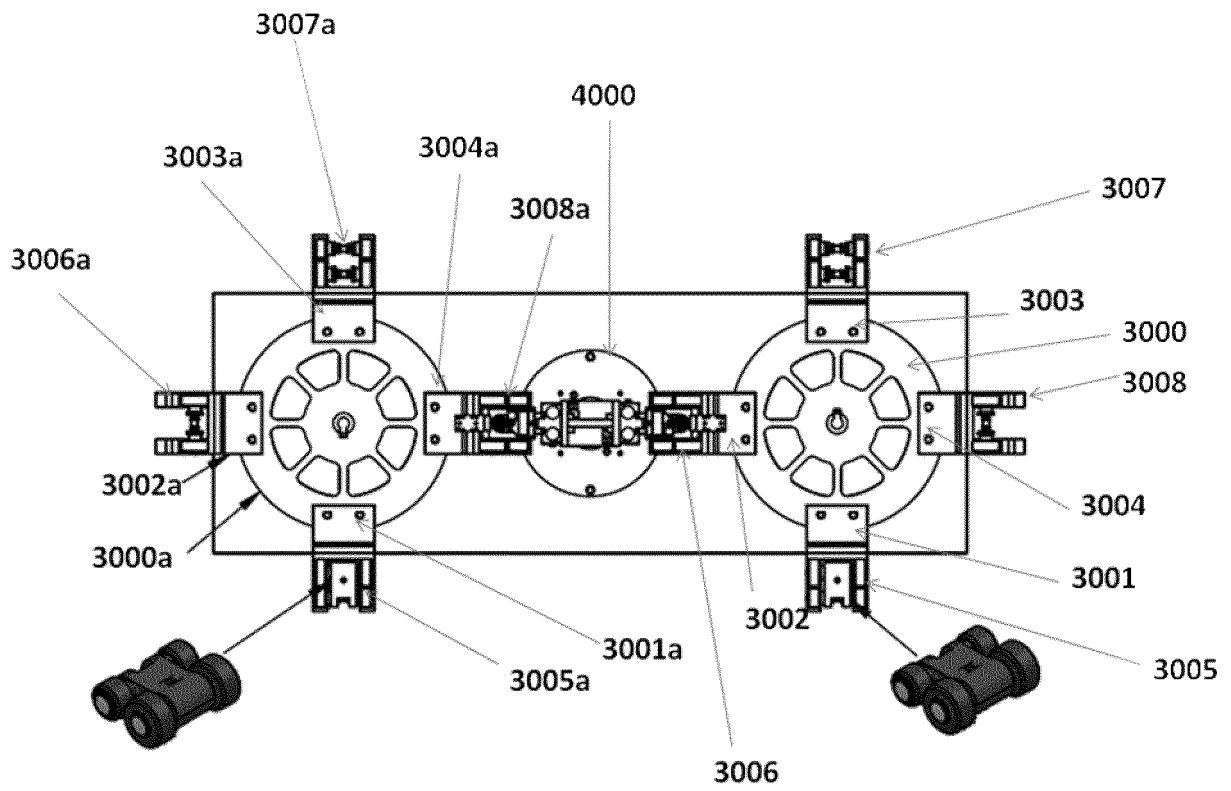


Fig. 7(b)

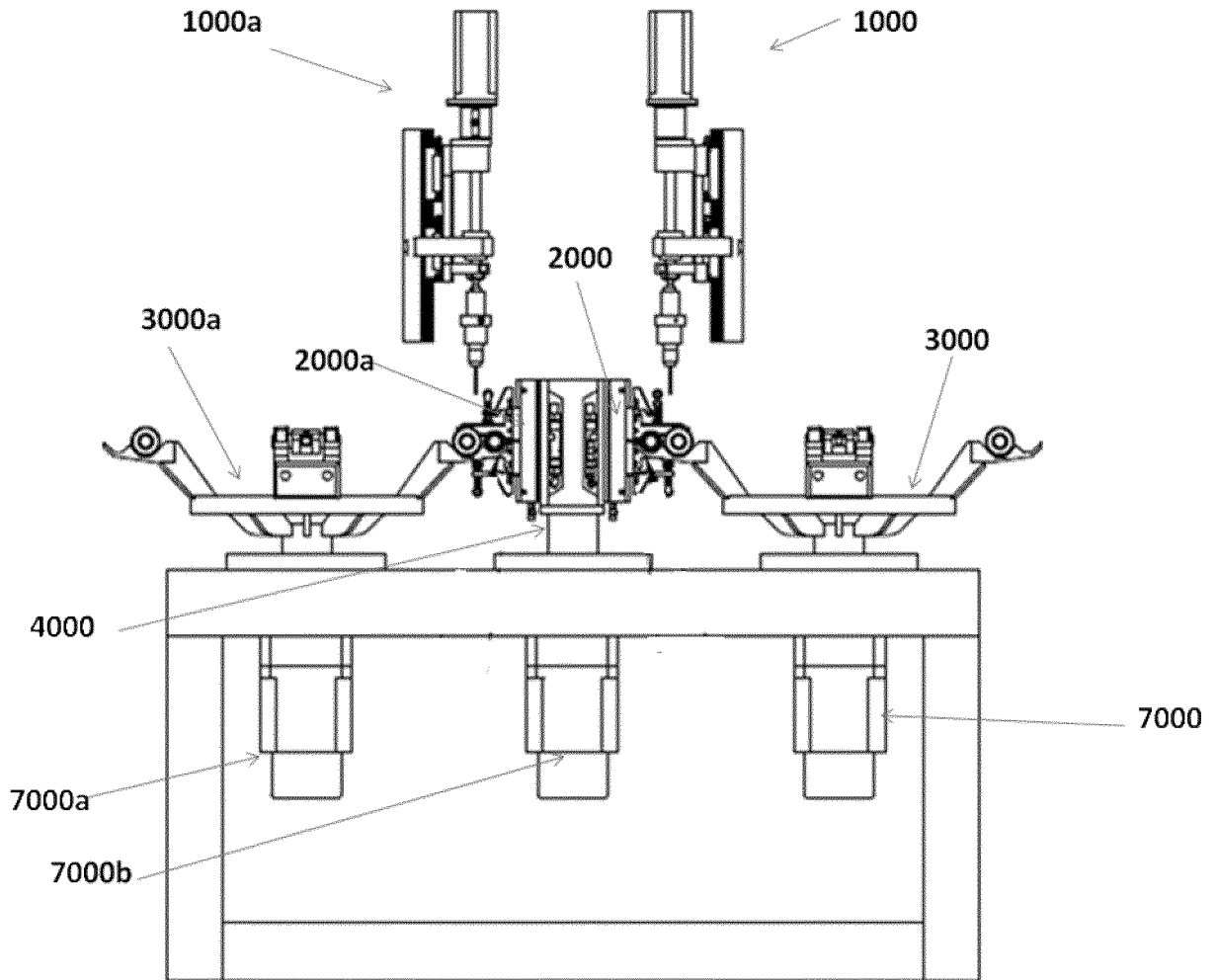


Fig. 7(c)

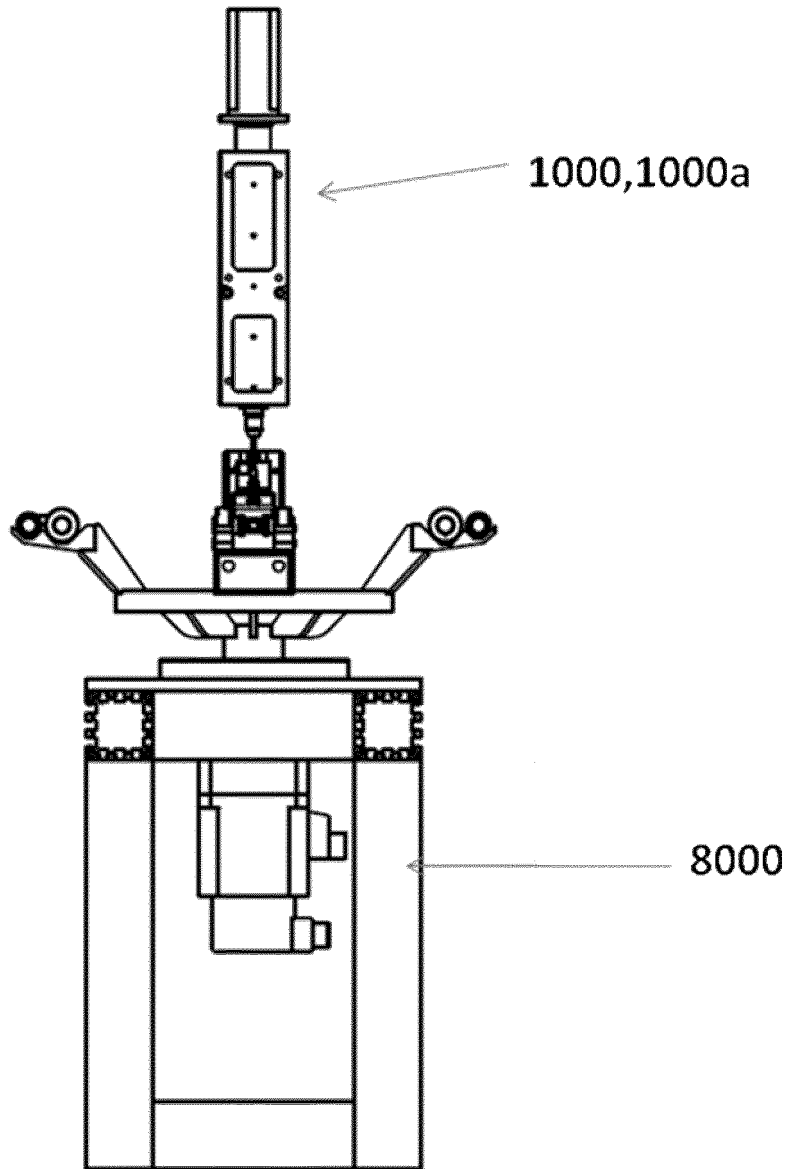


Fig. 7(d)

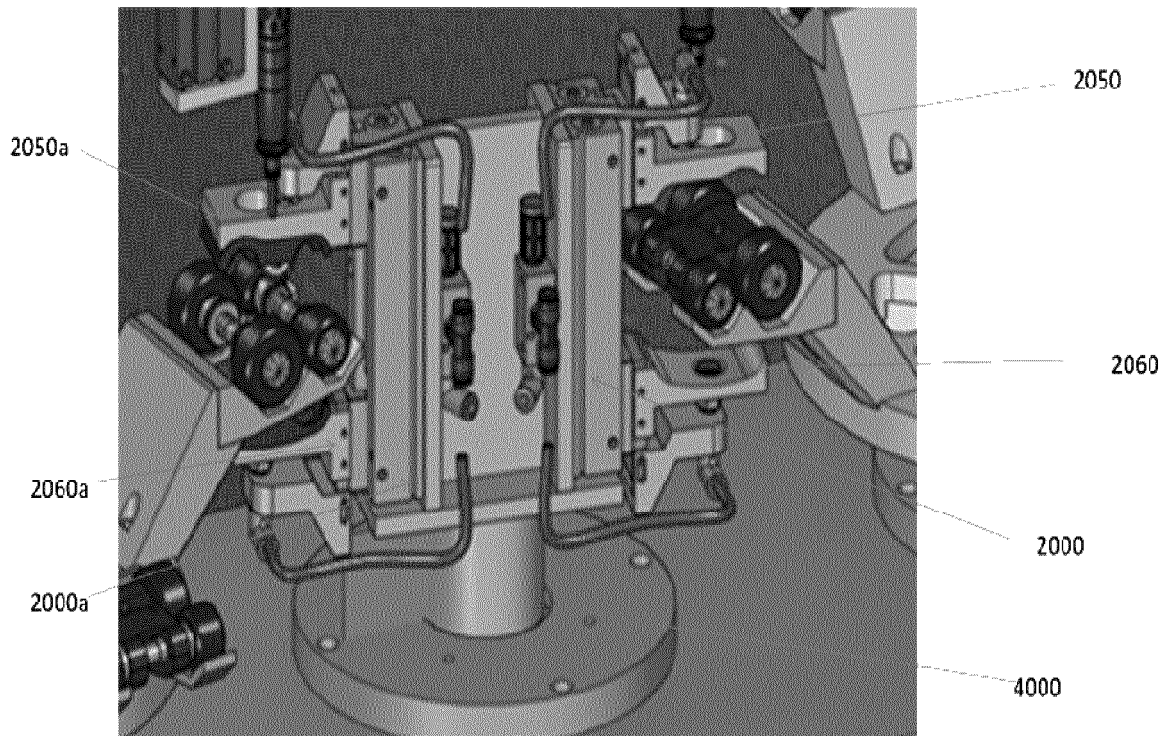


Fig. 8

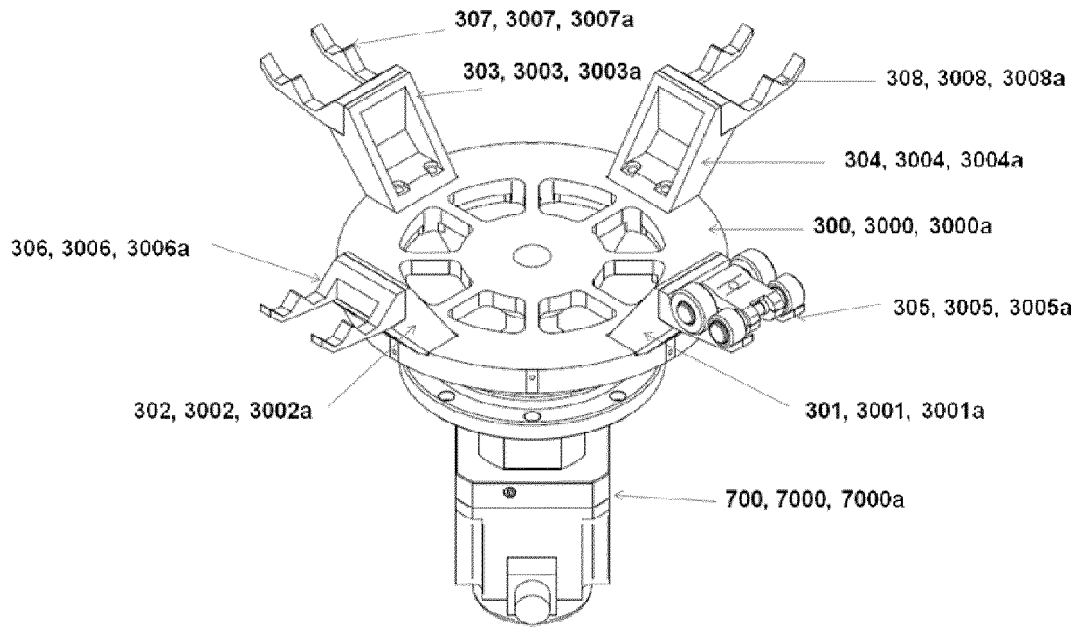


Fig. 9(a)

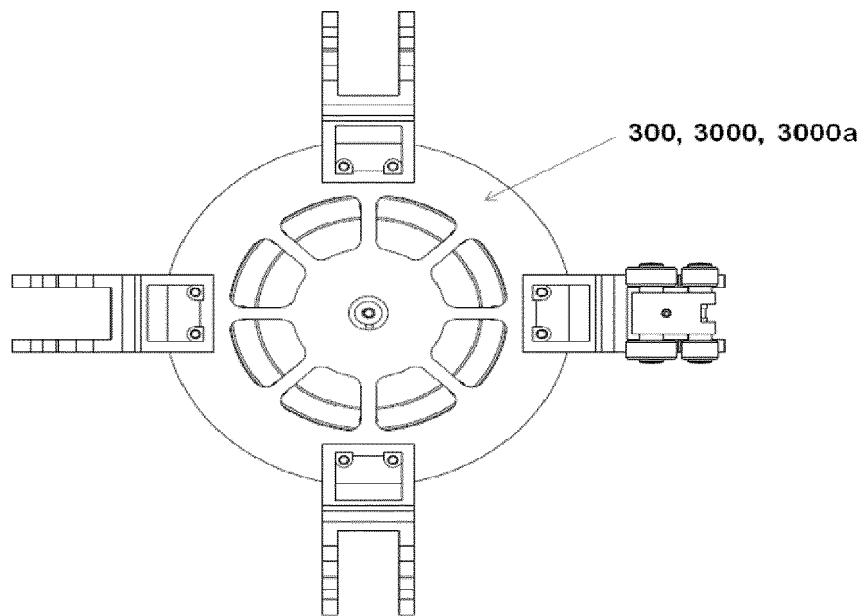


Fig. 9 (b)

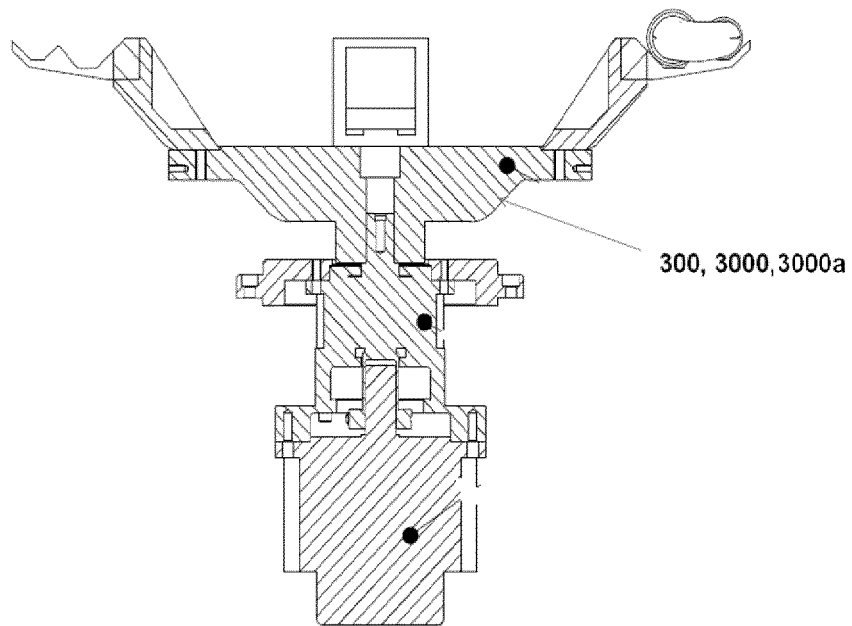


Fig. 9 (c)

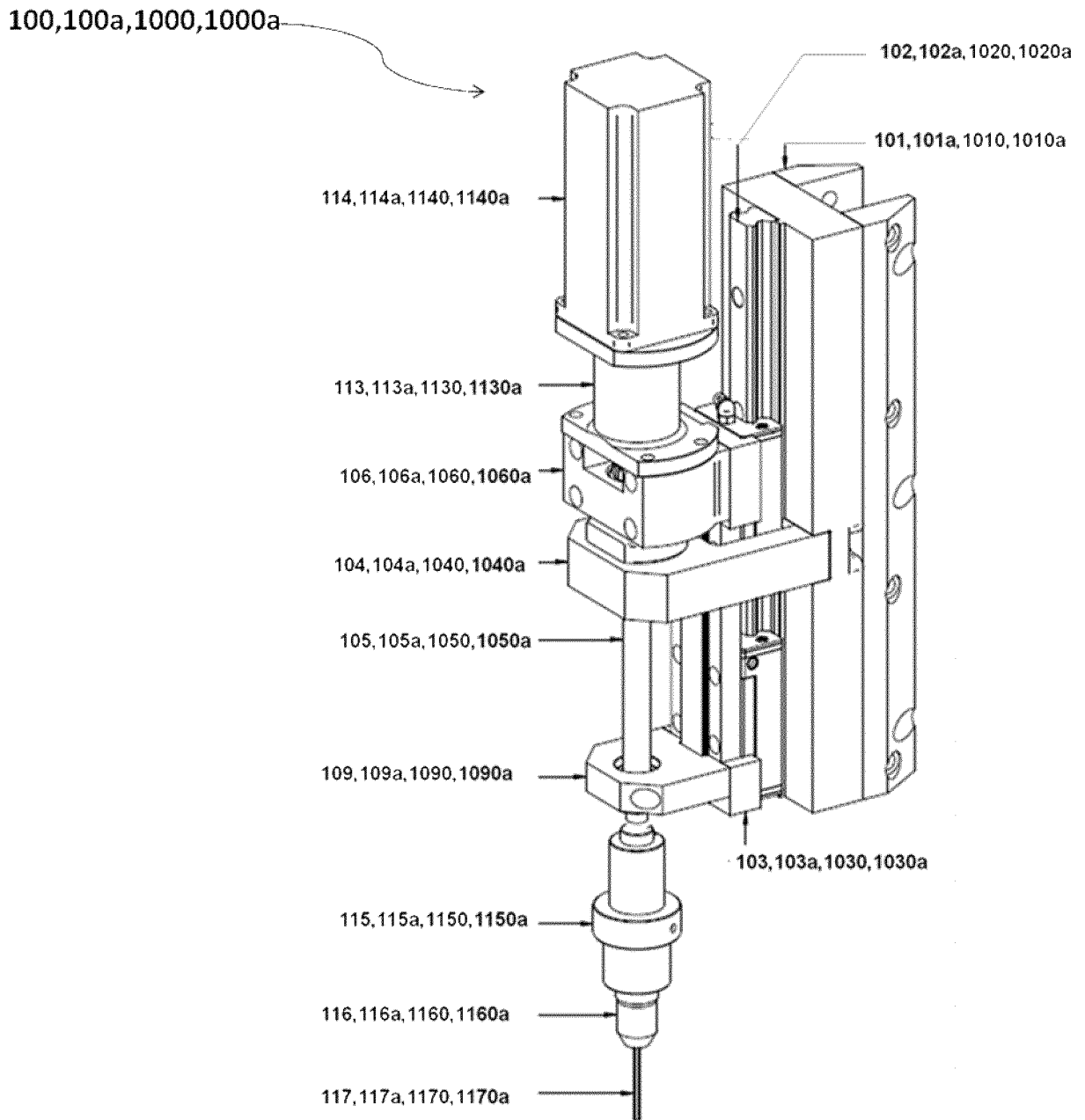


Fig. 10(a)

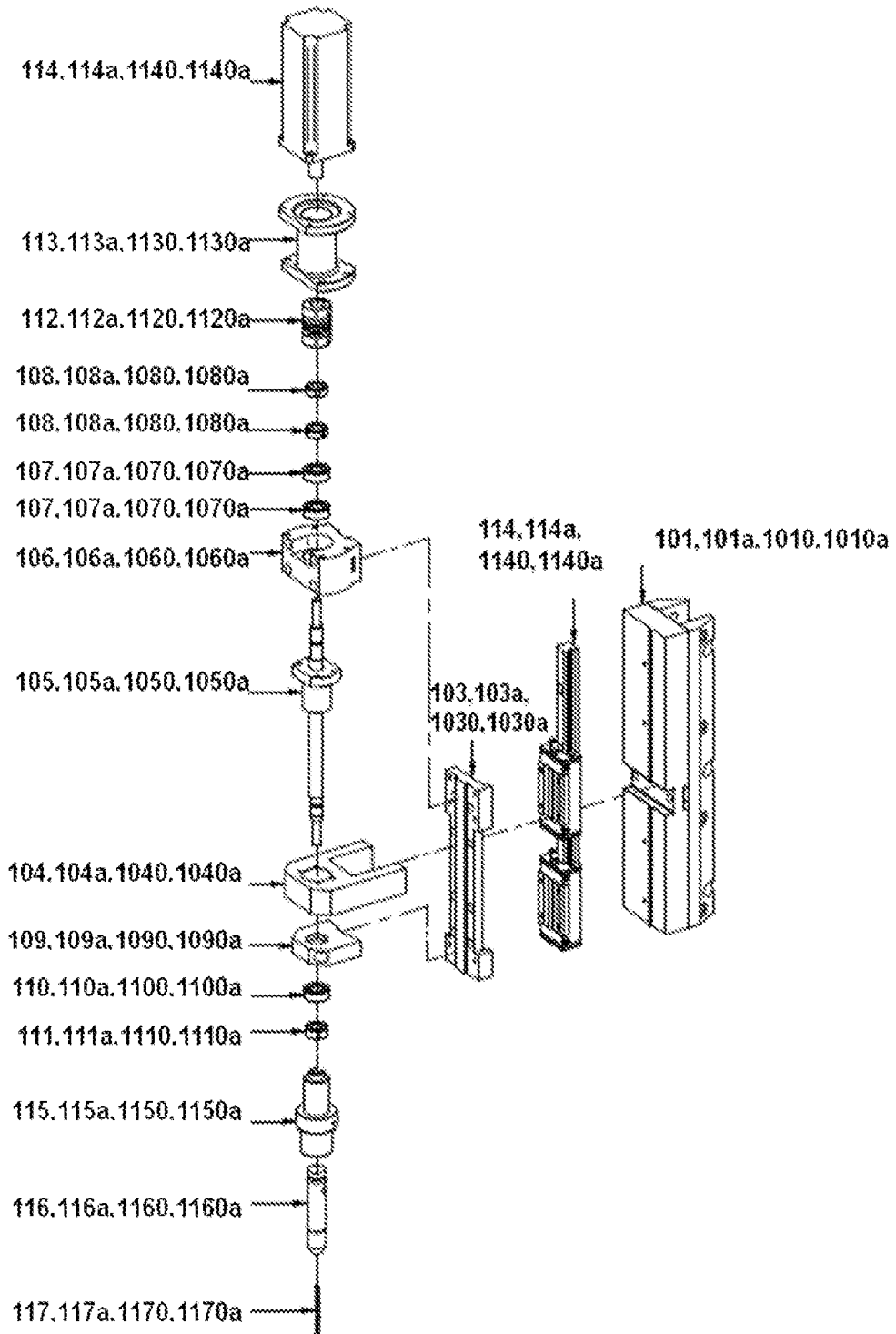


Fig. 10(b)

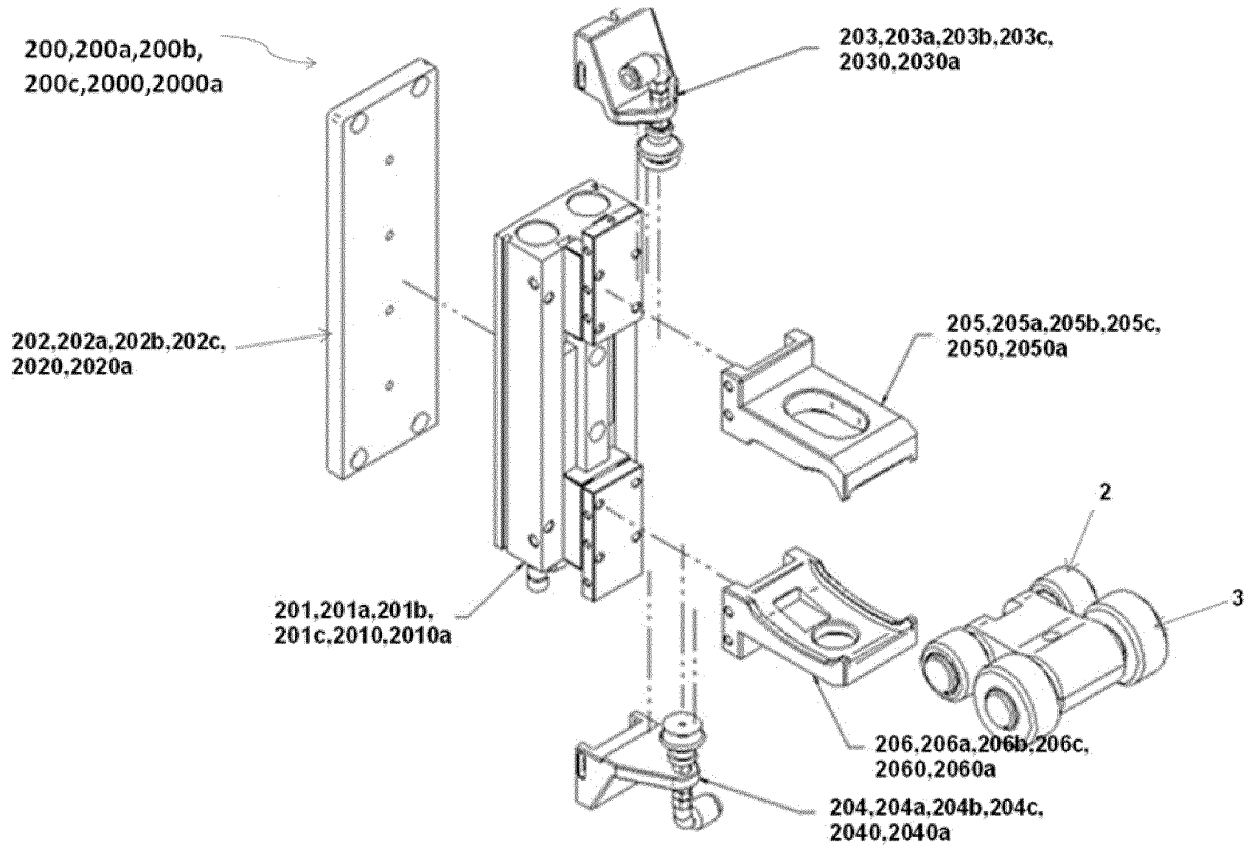


Fig. 11

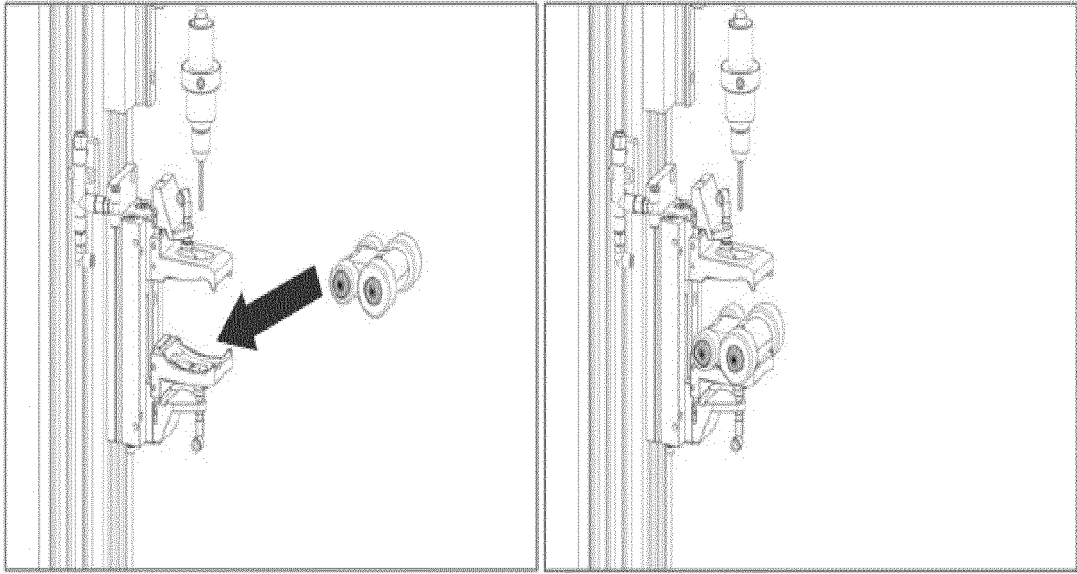


Fig. 12(a)

Fig. 12(b)

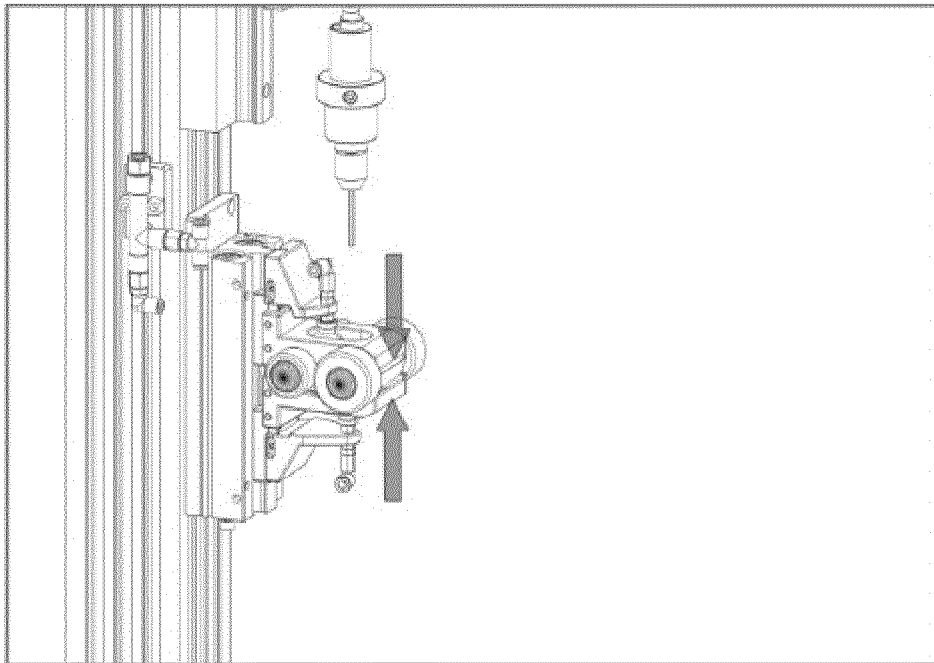


Fig. 12(c)

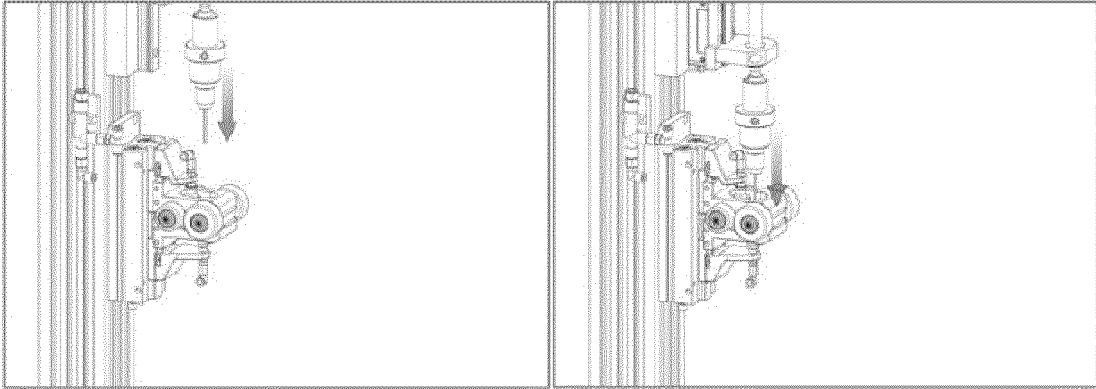


Fig. 12(d)

Fig. 12(e)

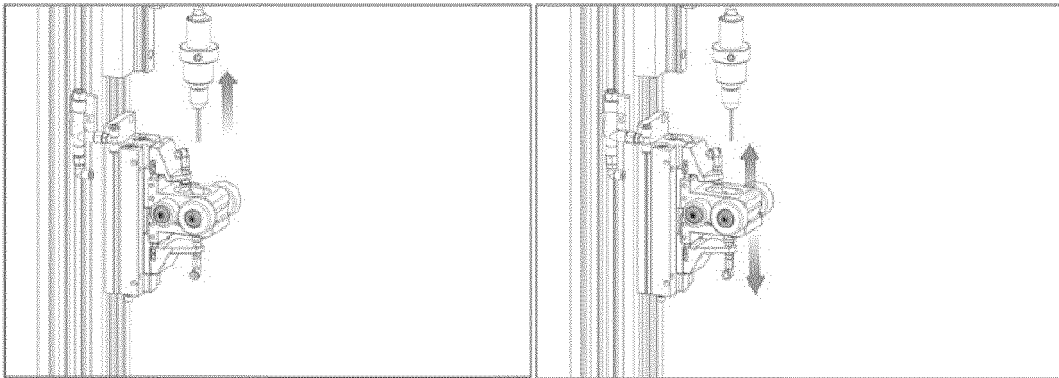


Fig. 12(f)

Fig. 12(g)

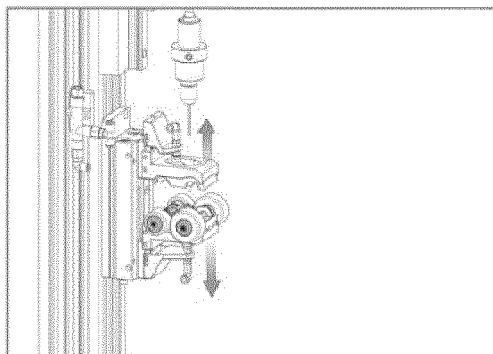


Fig. 12(h)

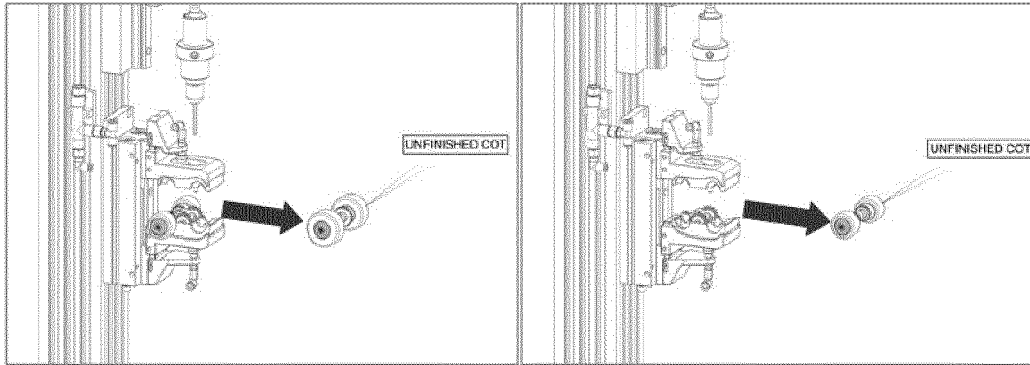


Fig. 12(i)

Fig. 12(j)

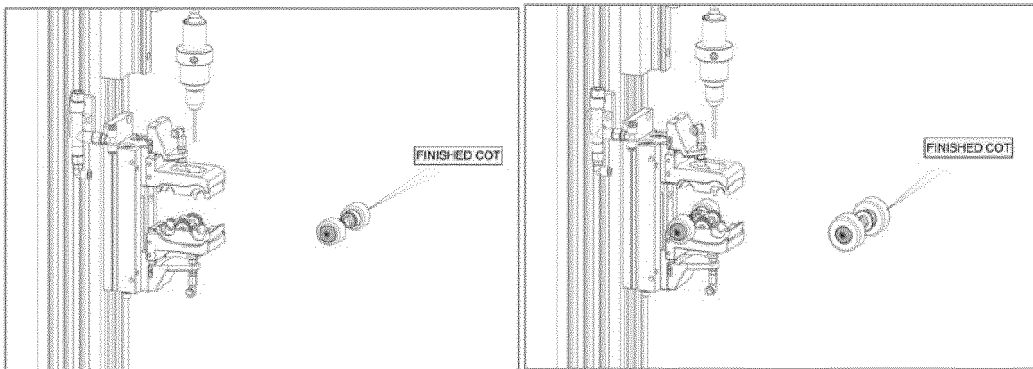


Fig. 12(k)

Fig. 12(l)

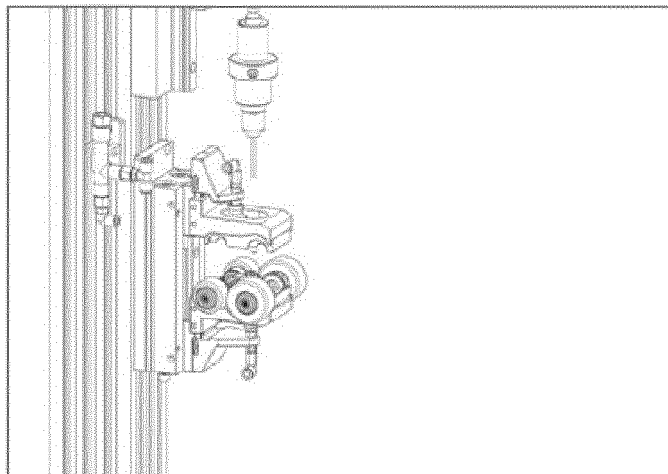


Fig. 12(m)

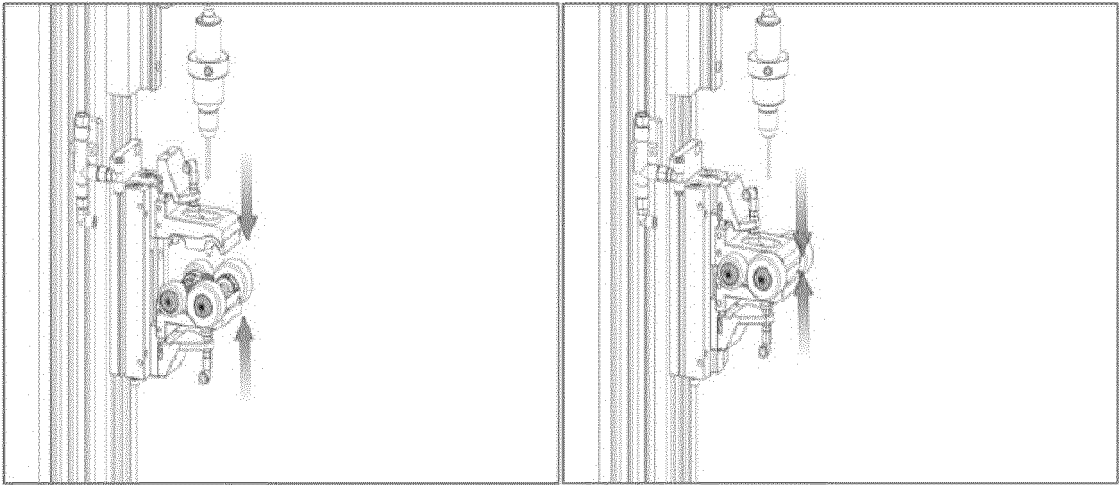


Fig. 12(n)

Fig. 12(o)

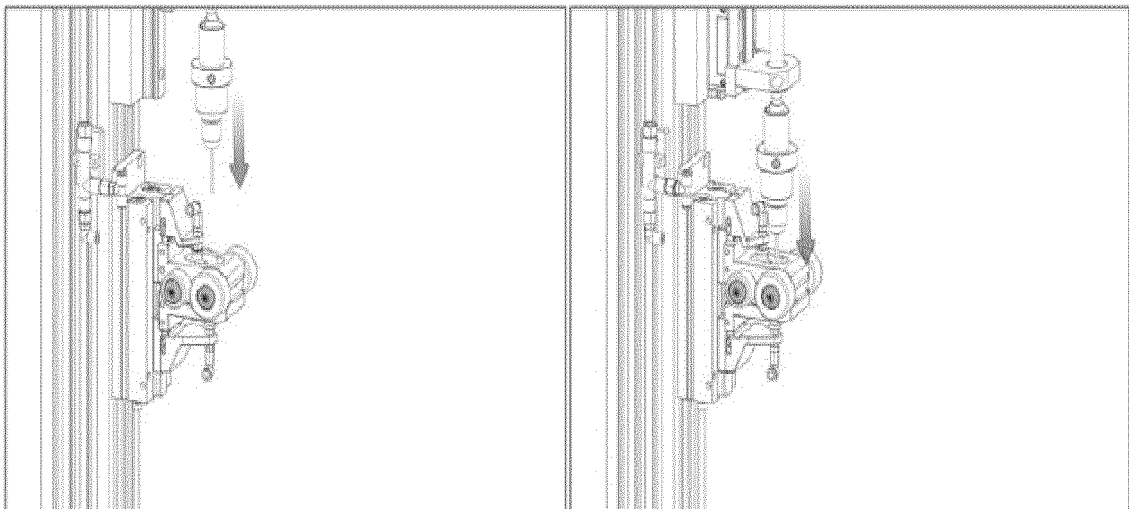


Fig. 12(p)

Fig. 12(q)

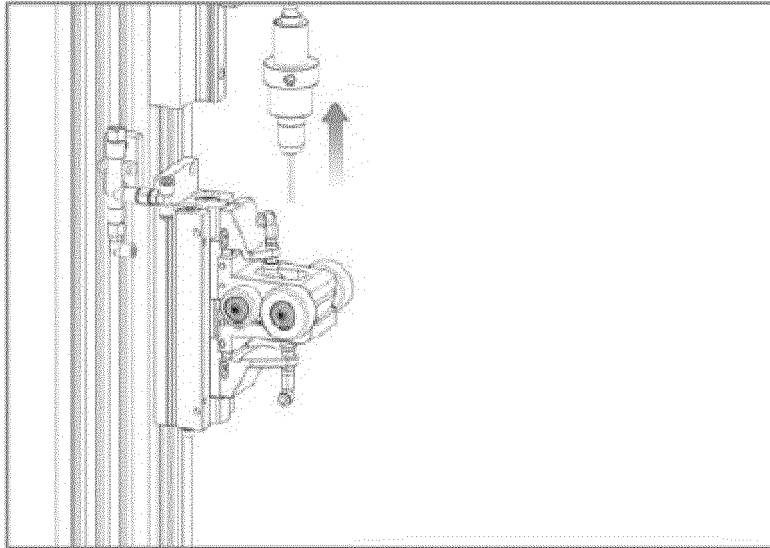


Fig. 12(r)

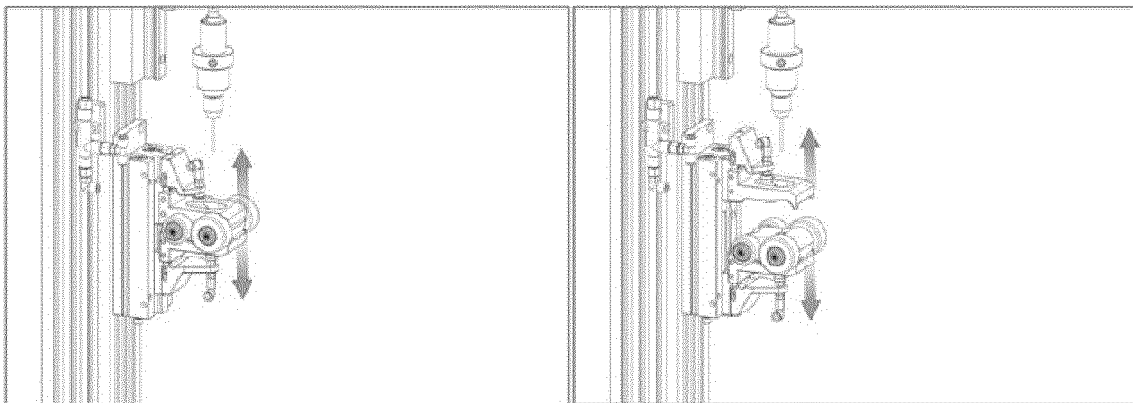


Fig. 12(s)

Fig. 12(t)

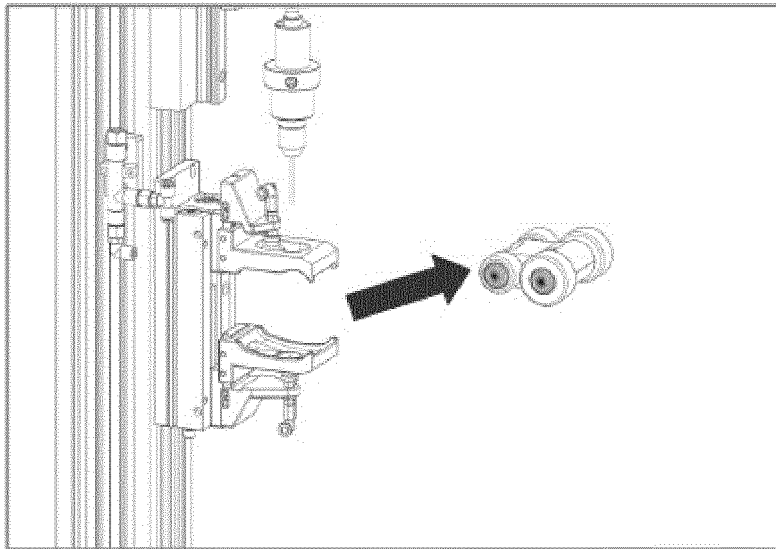


Fig. 12(u)

REFERENCES CITED IN THE DESCRIPTION

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