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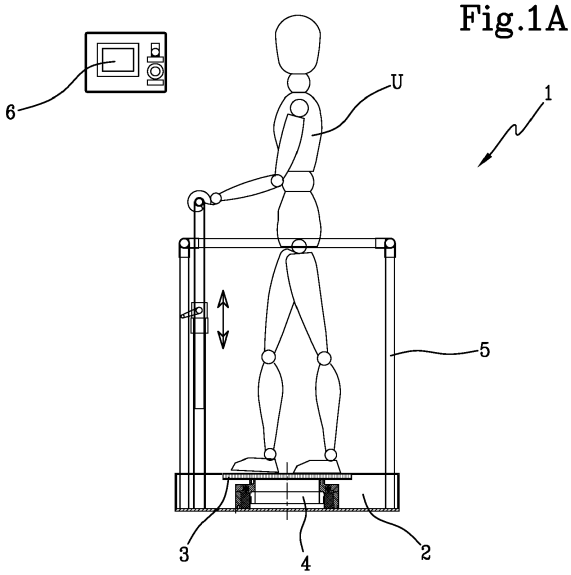
(54) **DEVICE FOR PHYSIOTHERAPEUTIC TREATMENTS**

(57) A device for physiotherapeutic treatments comprises a base body (2), a platform (3), motorized means (4), a fixed frame (5) and a control unit (6). The platform (3) is rotatably coupled to the base body (2) and is configured to support the body of a user. The motorized means (4) are configured to rotate the platform (3) with respect to the base body (2) and are controlled by the control unit (6). The fixed frame (5) is coupled to the base body (2) and defines a handrail for the user.

Fig.1A



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Description

[0001] The present invention concerns the technical field of the devices for physiotherapy and muscle training.

[0002] In particular, the present invention concerns a device specifically designed for performing physiotherapeutic processes and/or for training the musculature involved in walking.

[0003] Changing direction while walking is a typical activity in every day life, which is necessary to perform basic functional activities (such as moving around a table or following a curved trajectory along any non-linear path), and is likewise a crucial activity in sports performance.

[0004] A well-set and performed curve requires effective coordination between the movements of the lower limbs and of the trunk.

[0005] In fact, in this type of movement asymmetric changes occur in the length of the step of the two limbs (the step of the leg towards the inside of the curve is shorter as a function of the angle of curvature) and the forces of reaction to the ground are appropriate so as to orient the center of mass in the new direction.

[0006] Minimal but important postural adjustments are also necessary to reduce the walking speed when turning is initiated, to create the centripetal force necessary to avoid the outward imbalance of the curve, and to modulate the centripetal force as a function of the desired speed.

[0007] The performance of this movement is therefore obviously complex as it involves a large number of muscles and requires a high level of coordination between them.

[0008] In particular, the muscles responsible for the rotation of the leg along the longitudinal axis are the muscles of the pelvis, which rotate the femur in its coxofemoral joint.

[0009] The pelvis in turn rotates with respect to the trunk, and the coordination between the nerve commands directed to the muscles of the pelvis (which are active asymmetrically during the walk between the right and left leg) and those inserted on the spine is critical for the correct performance of the curved trajectory.

[0010] In addition, the weight of the body, whose center of mass lies outside the distance between the trajectories of the two feet, requires the muscles of the pelvis and of the column being able to produce adequate forces to maintain dynamic balance during the path along the curved trajectory.

[0011] In general, the steps that occur during the curve account for about 35-40% of all steps in a typical day, and the daily number of steps while turning increases when one is in narrow spaces.

[0012] People when getting older change direction less efficiently than young and middle-aged subjects.

[0013] Regardless of the mechanisms that may be responsible for this decreased efficiency, the frequency of falls therefore increases in the elderly.

[0014] Falls during rotation are responsible for fractures of the femur eight times more than what happens when walking along a straight trajectory.

[0015] It is also known that the change in direction during walking is difficult not only in subjects with reduced mobility due to trauma or ageing.

[0016] Even patients suffering from particular diseases, such as for example Parkinson's disease, may find it difficult to perform a movement in a curve, this also leading them to a block and to have to make small steps before being able to change direction (a problem known as 'freezing').

[0017] It is also known that patients with hemiparesis due to a cerebral vascular event have incorrect postures and problems in walking curved trajectories, which can persist even after a conventional rehabilitation treatment. It has been suggested that efficacy measures of walking in a curve predict (and can prevent) recurrent falls in elderly people hospitalized in the community.

[0018] It is also worth remembering the enormous social and financial cost of fall fractures.

[0019] There is a recent document on Fragility in Italy and another equally recent document by the World Health Organization on the need for rehabilitation in Europe that highlight the problems related to these needs (Health Workforce and Service Delivery, 2022).

[0020] The relevance of the problem is also testified by the use of tests in the physiatric field that measure the time needed to rotate on the spot (the 'TURN 180 test') or the times needed to travel preset '8-like trajectories' on wide paths or even, in the sports field, the ability to make frequent and rapid changes in direction (the so-called 'Repeated Sprint Ability').

[0021] It is therefore evident how strongly felt in the reference sector is the need to develop new tools that allow to perform a physical treatment capable of exercising the intra- and extra-rotator muscles of the leg on the pelvis in a manner consistent with their function during the curved walk in order to develop strength in the aforementioned muscles and to urge neuromuscular coordination.

[0022] It is also necessary to address the problem of reinforcement and coordination of the muscles responsible for the intra- and extra-rotation of the lower limbs, both for a preventive purpose (reducing the likelihood of falls due to insufficient development of strength), for a rehabilitation purpose (rehabilitation of the altered or slow walking due to problems related to neurodegenerative diseases) or yet for a therapeutic purpose (restoration of the locomotor function along non-linear paths after fractures of the femur or of the pelvis).

[0023] In this context, the technical task underlying the present invention is to propose a device for physiotherapeutic treatments that overcomes at least some of the drawbacks of the above-mentioned prior art.

[0024] In particular, the object of the present invention is to provide a device for physiotherapeutic treatments for the motor training of the user in a curve that is easily transportable and easy to use.

[0025] The defined technical task and the specified aims are substantially achieved by a device for physiotherapeutic treatments comprising the technical characteristics set forth in one or more of the appended claims. According to the present invention there is shown a device for physiotherapeutic treatments.

[0026] The device essentially comprises a base body, a platform, motorized means, a fixed frame and a control unit.

[0027] The platform is rotatably coupled to the base body.

[0028] The platform is further configured to support the body of a user.

[0029] The motorized means are configured to rotate the platform.

[0030] In particular, the motorized means are configured to rotate the platform with respect to the base body.

[0031] The fixed frame is coupled to the base body and defines a handrail for the user.

[0032] The control unit is coupled to the motorized means for controlling a rotation speed of the platform.

[0033] Advantageously, the device described herein allows to perform in a simple and efficient way stimulation and simulation operations of a walk along a curved trajectory, for physiotherapeutic purposes or even simply for training the user's motor system to perform this type of movement.

[0034] In other words, the device proposed herein essentially allows to march on the spot by rotating on the axis of the body, where however the rotation acts only on the lower limbs and partly on the pelvis and its articulation with the spine, since the trunk, the head, the shoulder girdle and the arms do not participate in the rotation since the user rests on a fixed handrail. The dependent claims herein incorporated for reference, correspond to different embodiments of the invention.

[0035] Further features and advantages of the present invention will become more apparent from the indicative and thus non-limiting description of a preferred but non-exclusive embodiment of a device for physiotherapeutic treatments, as illustrated in the appended drawings, in which:

- figures 1A-4A show side views of different possible embodiments and structural details of a device according to the present invention, while figures 1B-3B illustrate corresponding views from above;
- figures 5A-5C and 6A-6C illustrate further views relating to possible embodiments of the device according to the present invention.

[0036] A device for physiotherapeutic treatments, referred to for simplicity in the following of this description as a device 1, is generally indicated in the figures attached with reference numeral 1.

[0037] Said device 1 is specifically configured for the performance of a training and/or physiotherapy session aimed at improving the motor skills of a subject with particular reference to the performance of walks with curved trajectories.

[0038] From a structural point of view, said device 1 essentially comprises a base body 2, a platform 3, motorized means 4, a frame 5 and a control unit 6.

[0039] The base body 2 preferably has an internally hollow or alveolar structure such as to reduce the amount of overall material that composes it thereby reducing its total weight and keeping the device 1 overall light and easily movable.

[0040] Again in order to achieve an overall weight reduction, the base body 2 can be made using plastic materials.

[0041] In general, the base body 2 also has a reduced footprint and is characterized by a substantially parallel-epipoidal shape with sides comprised between 40 cm and 70 cm long and a height comprised between 10 and 25 cm, thus being easily graspable and transportable.

[0042] The platform 3 is instead rotatably coupled to the base body 2.

[0043] In other words, the platform 3 is stably constrained to the base body 2 in such a way that it can rotate with respect to it, in particular in a rotation plane corresponding to an upper surface of the base body 2.

[0044] Said platform 3 is also configured to support the body, therefore the weight, of a user U both when he or she is in a stationary configuration and when he or she is instead placed in rotary motion, specifically defining a horizontal plane on which the user U can stand.

[0045] In particular, the platform substantially has a circular shape having a diameter comprised between 40 cm and 60 cm.

[0046] In this way, the platform 3 is configured to receive restingly both feet of the user U straddling a geometric center thereof and to then be rotated in a horizontal plane.

[0047] Operationally, the platform 3 therefore defines a plane for the user U to march on the spot and in use, i.e. once the platform 3 is rotated (for example clockwise), the right foot resting on the platform 3 is passively extra-rotated together with the leg (the rotation of the tibia on the foot and the one of the femur on the knee are of minimum amplitude while that at hip level is of maximum amplitude).

[0048] During the next phase of lifting the limb, the user U naturally returns the lower limb to the 'straight' position and then rests it on the rotating disc and so on.

[0049] The same happens for the other limb, which will instead be intra-rotated by the movement of the platform 3.

[0050] In this way, an inverse sequence of intra- and extra-rotation will occur depending on whether the platform 3 rotates clockwise or counterclockwise.

[0051] Operationally, the movement of the platform 3 is mediated by the motorized means 4, which are configured to rotate it with respect to the base body and, at the choice of the user U, clockwise or counterclockwise. In greater detail, as exemplarily illustrated in figures 3A

and 3B, the motorized means 4 may comprise an electric motor 4a housed internally to the base body 2 and comprising a rotor that is coaxial and integral with the platform 3.

[0052] In this way, the activation of the electric motor 4a directly causes the rotation of the platform 3 reducing the losses due to intermediate elements for the transmission of the motion and simplifying the overall structure of the device 1.

[0053] Alternatively, as illustrated in figures 4A and 4B, the motorized means may comprise an electric motor 4a, housed internally to the base body 2 in a position flanking the platform 3.

[0054] In this context the motorized means 4 further comprise a toothed belt 4b configured to connect the electric motor 4a with the platform 3 transmitting the motion from the first to the second.

[0055] Advantageously, in this way it is possible to maximize the precision of the control of the motorized means 4 on the movement of the platform 3 allowing to vary the rotation speed thereof in a particularly accurate manner.

[0056] In accordance with a further possible embodiment, the motorized means 4 are means that can be activated directly by the user U.

[0057] In this context, the motorized means 4 may comprise a pedalboard which can be activated in rotation by the user's hands, which is connected with a suitable transmission mechanism (for example a transmission chain and a bevel gear) with the platform 3.

[0058] In this context, the user U can rotate the pedalboard with a circular movement of his or her hands and this movement is transmitted by the transmission mechanism to the platform 3 which is in turn rotated.

[0059] In this way it is possible to control in a particularly accurate and precise manner the rotation mode of the platform 3, as well as to allow the user U to perform a more complete physical exercise that also involves his or upper limbs.

[0060] More particularly, the pedalboard is supported by the fixed frame 5 and is preferably adjustable in height.

[0061] In general, in the case where the motorized means 4 are of the automatic type, i.e. made with an electric type motor as illustrated in figures 3A to 4B, the selection of the speed and direction of rotation of the platform 3 is controllable by means of the control unit 6, which is specifically coupled to the motorized means 4 in such a way as to manage its activation mode. Preferably, said control unit 6 comprises a screen on which information of interest to the user U (or in general to those who are managing and deciding the operating regime of the device 1) can be displayed, which may comprise data specifically relating to the operating conditions of the device, such as speed and rotation direction of the platform 3, or data relating to the user U, for example biometric data such as weight, heart rate and similar data (which can be measured by means of suitable sensors included in the device 1 itself).

[0062] Preferably, the screen is of the touch type and provides a simple and efficient interface for receiving inputs from the user U as a function of which it is possible to vary one or more of the operating parameters of the device 1.

[0063] Furthermore, the control unit 6 can be advantageously connectable with a remote terminal so as to be able to exchange information with it.

[0064] Such a remote terminal may be a personal device such as for example a computer, a smartphone or a tablet or a remote database such as for example a cloud computing on which the operation data of the device 1 is also stored to allow a subsequent analysis thereof.

[0065] Preferably, the control unit 6 is connectable with the remote terminal by means of a wireless communication protocol such as for example a Wi-Fi® protocol or a Bluetooth® protocol.

[0066] Advantageously the control unit 6 may further comprise a metronome (digital or analogue) by means of which it is possible to help the user U to maintain a predetermined walking rhythm.

[0067] Preferably, the operation of the metronome is controlled by the control unit 6 as a function of at least the rotation speed of the platform 3.

[0068] To avoid disorientation and the risk of falling by the user U, during the rotation of the platform 3 the latter can rest, in particular with his or her own hands, on the fixed frame 5, which is coupled to the base body 2 (and therefore does not participate in the rotation of the platform 3) and defines a fixed handrail for the user U.

[0069] In other words, during use of the device 1 the user U can lean against the handrail and perform on the spot the movement prompted by the rotation of the platform 3 using a fixed and stable reference that allows him or her to maintain a correct position, in particular of the trunk and head, during the entire process avoiding disorientation and dizziness.

[0070] This handrail can also be adjusted in height to adapt it to the specific needs of use.

[0071] Advantageously, the fixed frame 5 may comprise, in particular at the portion thereof defining the handrail, one or more contact sensors connected to the control unit 6 and engageable by the user U during use of the device 1.

[0072] In particular, such contact sensors may be installed at a point where the hands of the user U rests on the handrail.

[0073] In this context, the control unit 6 is configured to deactivate the motorized means 4 in response to a disengagement of the user U from the contact sensor.

[0074] In other words, when the user U leaves or in any case is no longer detected by the contact sensor, the control unit 6 deactivates the motorized means 4 interrupting the rotation of the platform 3 thus guaranteeing overall a particularly safe and reliable use.

[0075] Furthermore, the same control unit 6 can be reversibly coupled to the fixed frame 5, in such a way as

to be easily accessible to the user U and at the same time be easily detached if it is wished to allow an easier management of the operation of the device 1 by a third party (for example a doctor, a physiotherapist, a trainer...).

[0076] In this context, a distinction would be made between the user U understood strictly as the person who positions him- or herself on the platform 3 and the user understood instead as the person who, through the manipulation of the control unit 6, manages and commands the operation of the device 1.

[0077] In general, it should therefore be noted that the control unit makes it possible to determine the operating speed of the device 1, with particular reference to the direction and speed of rotation of the platform 3.

[0078] Said platform 3 can in fact be moved clockwise or counterclockwise according to different angular speeds in continuous or impulsive mode. Preferably, the control unit 6 is configured to store a plurality of different usage profiles each characterized by specific values associated with at least one of the following parameters: rotation direction of the platform 3, angular speed of the platform 3, duration of the rotation of the platform 3. For example, it is possible to provide specific usage profiles (operably modifiable by the user U) associated with predetermined and predefined usage routines of the device defined and identified by precise sequences of movement of the platform 3 in terms of speed, direction and duration. By way of example, one of these usage profiles may envisage moving the platform 3 in a clockwise direction with increasing speed from 0°/s to 60°/s in a predefined time interval and then returning to 0°/s and starting repeating the same procedure, but initiating a counterclockwise rotation of the platform 3.

[0079] These cycles can be repeated a predefined number of times and optionally be interspersed by a period of predefined duration of non-rotation of the platform 3.

[0080] A further possible usage profile may provide for controlling rapid and short rotations of the platform of 45° (regardless in clockwise or counterclockwise direction) at the speed of for example 90°/s or 180°/s (without slow and gradual start) for a duration of 500 ms or 250 ms. respectively.

[0081] In accordance with a possible embodiment, exemplarily illustrated in figures 1A to 2B, the fixed frame 5 further outlines a plurality of walls that completely circumscribe the platform 3.

[0082] For example, the fixed frame 5 may comprise a plurality of bars extending vertically from the vertices of the upper surface of the base body 2 and connected above by further horizontal bars.

[0083] In this context, the walls outlined by the fixed frame 5 actually delimit a receiving volume within which the user U can position him- or herself in order to step onto the platform 3 and use the device 1.

[0084] Preferably, at least one of the walls is openable to allow an entry of the user U into the receiving volume.

[0085] For example, one of the horizontal bars can be hinged at its own end so as to allow its rotation or in general lifting in order to generate an opening for the passage of the user U.

[0086] In general, the bars used to define the walls also contribute to the definition of the handrail or, alternatively (as illustrated in the attached figures), the handrail can be made/defined by means of distinct bars that are separate from those designed to form the walls delimiting the receiving volume.

[0087] In accordance with an aspect of the present invention, the device 1 may further comprise a support structure configured to support or help support the user U during operation of the device 1.

[0088] As illustrated in figures 2A and 2B, such a support structure can be integrated into the support frame 5 and essentially comprise a pair of rods 7, 8 and a sling 9 coupled thereto.

[0089] In detail, the fixed frame 5 may comprise a first rod 7 developing vertically away from the base body 2 and a second rod 8 extending horizontally above the platform 3 away from a terminal end of the first rod 7.

[0090] The sling 9 is then coupled to the second rod 8, in such a way that the former is suspended above the platform 2 in order to be able to support the weight of the user U.

[0091] This feature makes the device 1 advantageously usable even by subjects with poor mobility and strength in the lower limbs and therefore unable to support their own weight by themselves.

[0092] Preferably, the height of the sling 9 is adjustable, i.e. the device 1 comprises adjusting means 10 configured and operable to vary a distance of the sling from the base body.

[0093] As illustrated in figure 2A, said adjusting means 10 can be realized by means of one or more cables that constrain the sling 9 to the second rod 10.

[0094] Advantageously, the device 1 may further comprise a load cell 11 and/or a shock absorber 12 that are interposed between the sling 9 and the second rod 9.

[0095] The shock absorber allows the sling 9 to support in a particularly efficient way the weight of the user U accompanying in a homogeneous way the variations in the vertical position of the bust of the user U during the walk in a curve operated on the platform 3.

[0096] The load cell 11 allows to monitor and measure in real time the portion of weight of the body of the user U that must be supported by the sling 9, thus allowing to determine the actual ability of the user U to support his or her own weight during a walk along a curvilinear path.

[0097] Furthermore, the load cell 11 can be directly connected to the control unit 6 to cause a deactivation of the motorized means 4.

[0098] In particular, if the load cell 11 detects that the portion of weight of the body of the user U that the sling 9 is supporting exceeds a predetermined threshold value, then it outputs a signal that is read by the control unit 6 causing the deactivation of the motorized means 4.

[0099] In this way, if the user is in difficulty and fails to use the device correctly, for example following a start of fall, he or she is still supported by the sling 6 and the load cell 11 detects this difficult situation by deactivating in response the rotation of the platform 3.

[0100] In accordance with further possible embodiments illustrated in figures 5A-5C and 6A-6C, the fixed frame 5 can have a different shape suitable for defining walls delimiting the platform 3 only on three sides, in such a way as to leave open a direction for the user U to climb onto the platform 3. Figures 6A-6C instead illustrate a different possible shape for the support structure of the sling 9.

[0101] In this context, the sling 9 is supported by a pair of first rods 7 developing vertically away from the base body 2 and having a curved terminal position in such a way as to present an end positioned above a center of rotation of the platform 3 to which the sling 9 is coupled.

[0102] Advantageously, the present invention achieves the proposed objects, obviating the drawbacks lamented in the prior art, making available to the user a device 1 for the performance of physiotherapeutic treatments, applicable in any case also in the sports field, for the training of the motor skills of the athletes.

[0103] In general, the device 1 described herein therefore provides a simple and efficient tool implementable in a wide variety of situations in which it is useful/necessary to work out on, to train or improve the ability of a subject to perform changes in direction and thus training the ability to move smoothly along curved trajectories.

Claims

1. Device for physiotherapeutic treatments comprising:

- a base body (2);
- a platform (3) rotatably coupled to the base body (2) and configured to support the body of a user (U);
- motorized means (4) configured to rotate the platform (3) with respect to the base body (2);
- a fixed frame (5) coupled to the base body (2) and defining a handrail for the user (U);
- a control unit (6) coupled to the motorized means (4) and configured to control a rotation speed of said platform (3).

2. Device according to claim 1, wherein the base body (2) has an internally hollow or alveolar structure, preferably said base body (2) being made of a plastic material.

3. Device according to claim 1 or 2, wherein the motorized means (4) comprise an electric motor (4a) housed internally to the base body (2) and comprising a rotor that is coaxial and integral with the platform (3).

4. Device according to claim 1 or 2, wherein the motorized means (4) comprise:

- an electric motor (4a) housed internally to the base body (2) in a position flanking the platform (3);
- a toothed belt (4b) configured to connect the electric motor (4a) with the platform (3).

5. Device according to any one of the preceding claims, wherein the fixed frame (5) outlines a plurality of walls that completely circumscribe the platform (3) delimiting a receiving volume for the user (U), at least one of said walls being openable to allow an entry of the user (U) into the receiving volume.

6. Device according to any one of the preceding claims, wherein the fixed frame (5) comprises a contact sensor connected to the control unit (6) and engageable by the user (U) during use of the device, said control unit (6) being configured to deactivate the motorized means (4) in response to a disengagement of the user (U) from the contact sensor.

7. Device according to any one of the preceding claims, wherein the fixed frame (5) comprises:

- a first rod (7) developing away from the base body (2);
- a second rod (8) extending above the platform (3) away from a terminal end of the first rod (7).
- a sling (9) coupled to the second rod (8) so as to be suspended above the platform (3) and configured to support the body of the user (U).

8. Device according to claim 7, comprising adjusting means (10) configured to vary a distance of the sling (9) from the base body (2).

9. Device according to claim 7 or 8, comprising a load cell (11) interposed between the sling (9) and the second rod (8).

10. Device according to any one of claims 7 to 9, comprising a shock absorber (12) interposed between the sling (9) and the second rod (8).

11. Device according to any one of the preceding claims, wherein the control unit (6) is reversibly coupled to the fixed frame (5).

12. Device according to any one of the preceding claims, wherein the control unit (6) comprises a touch screen configured to receive input from a user (U) and to vary the rotation speed of the platform (3) as a function of at least said input.

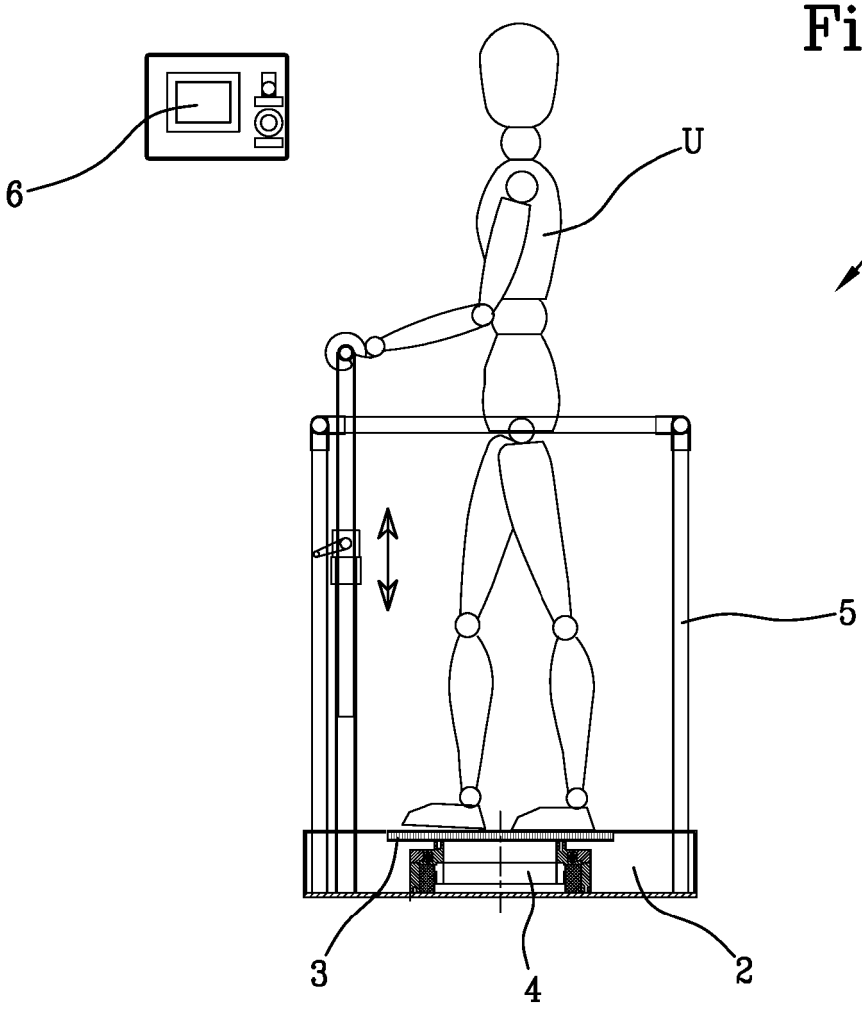
13. Device according to any one of the preceding claims,

wherein the control unit (6) is connectable with a remote terminal, preferably by means of a wireless communication protocol.

14. Device according to any one of the preceding claims, wherein the control unit (6) comprises a metronome.

15. Device according to any one of the preceding claims, wherein the platform (3) has a circular shape having a diameter comprised between 40 cm and 60 cm.

Fig.1A



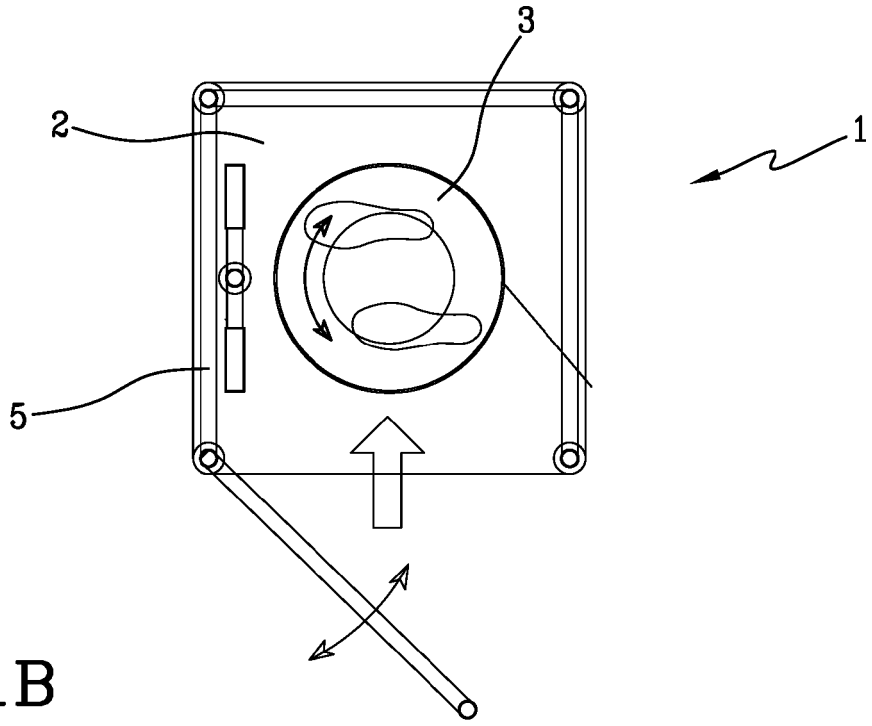


Fig.1B

Fig.2A

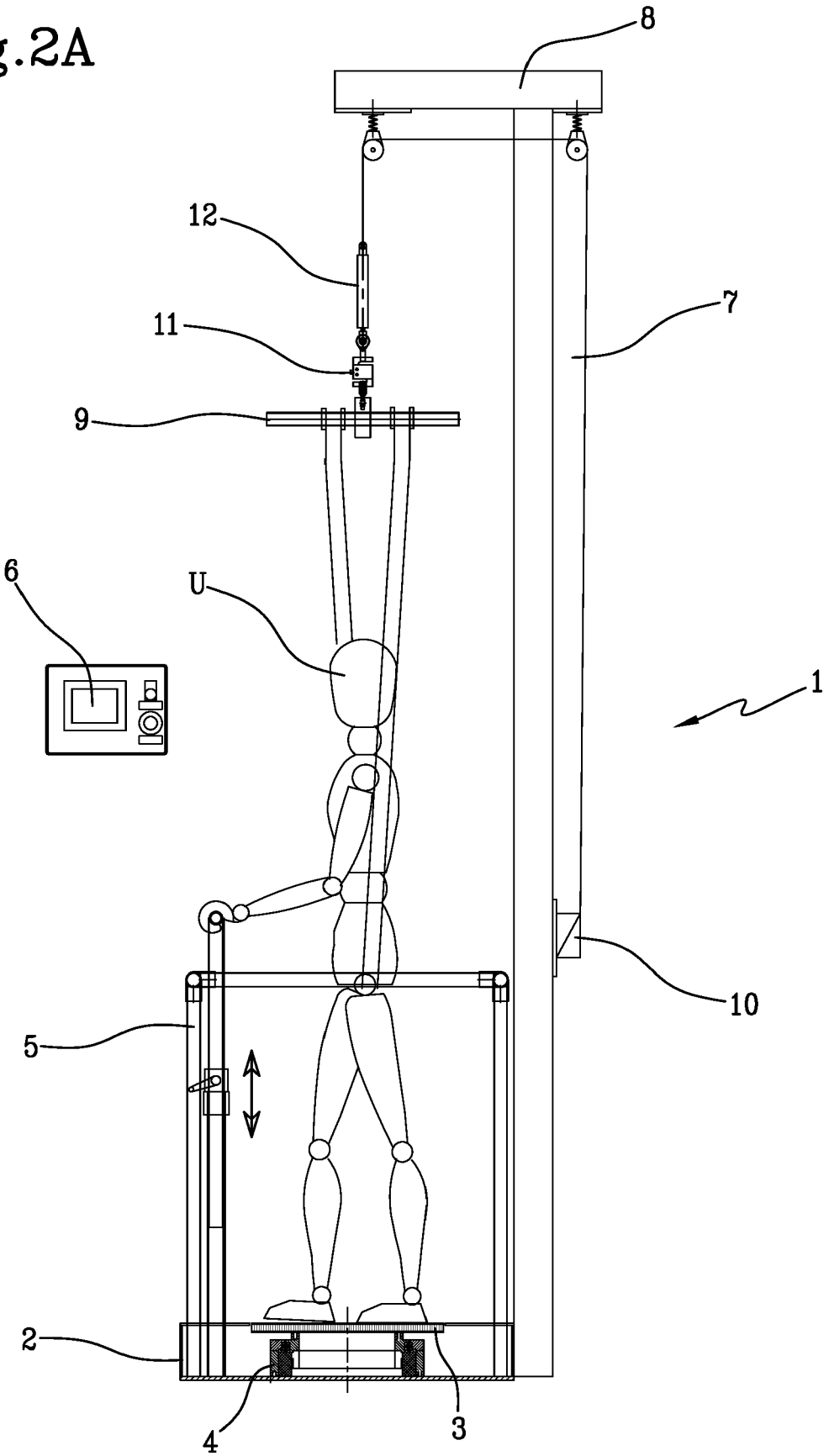
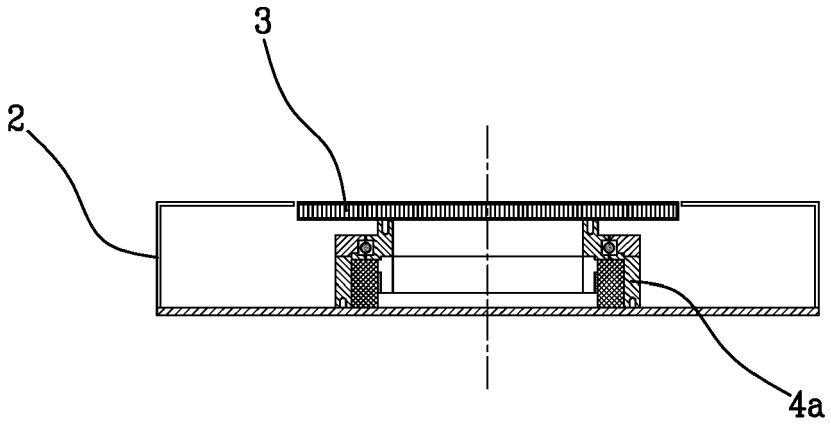


Fig.3A



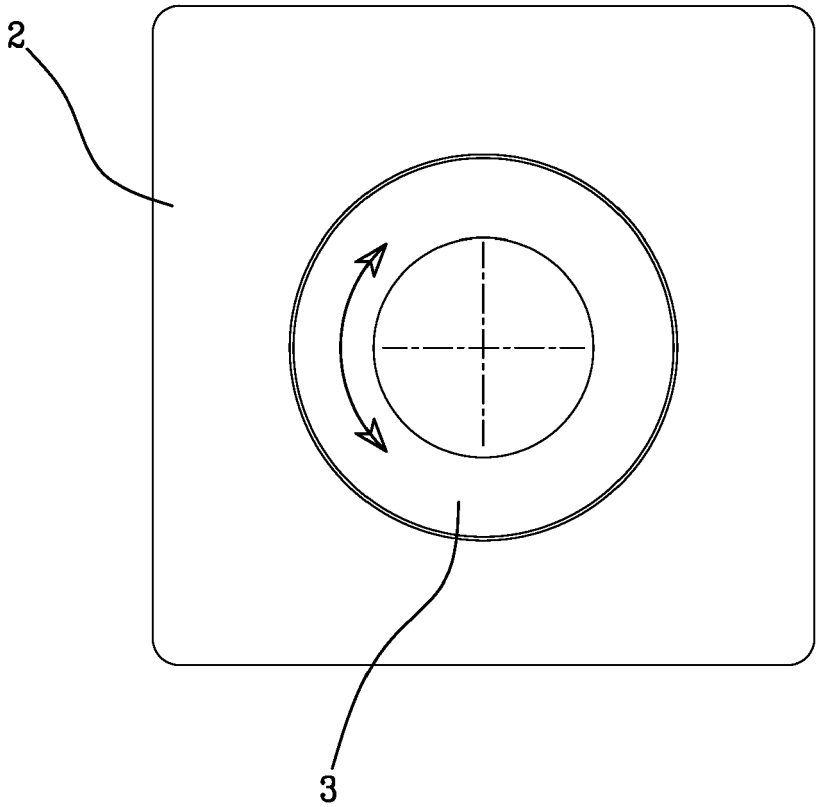
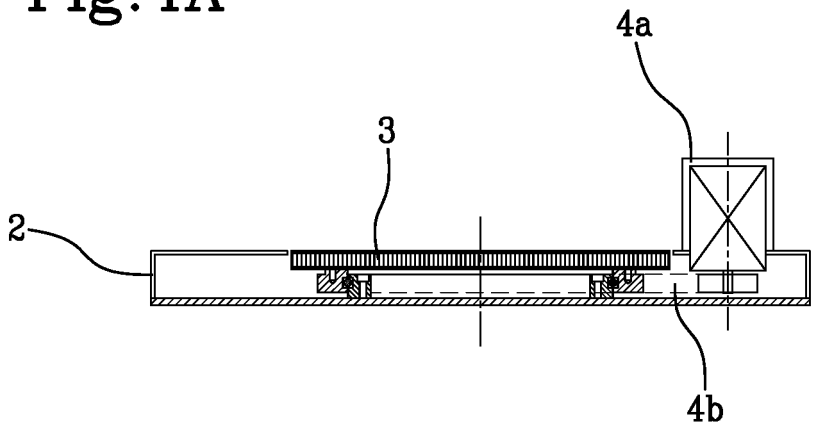


Fig.3B

Fig.4A



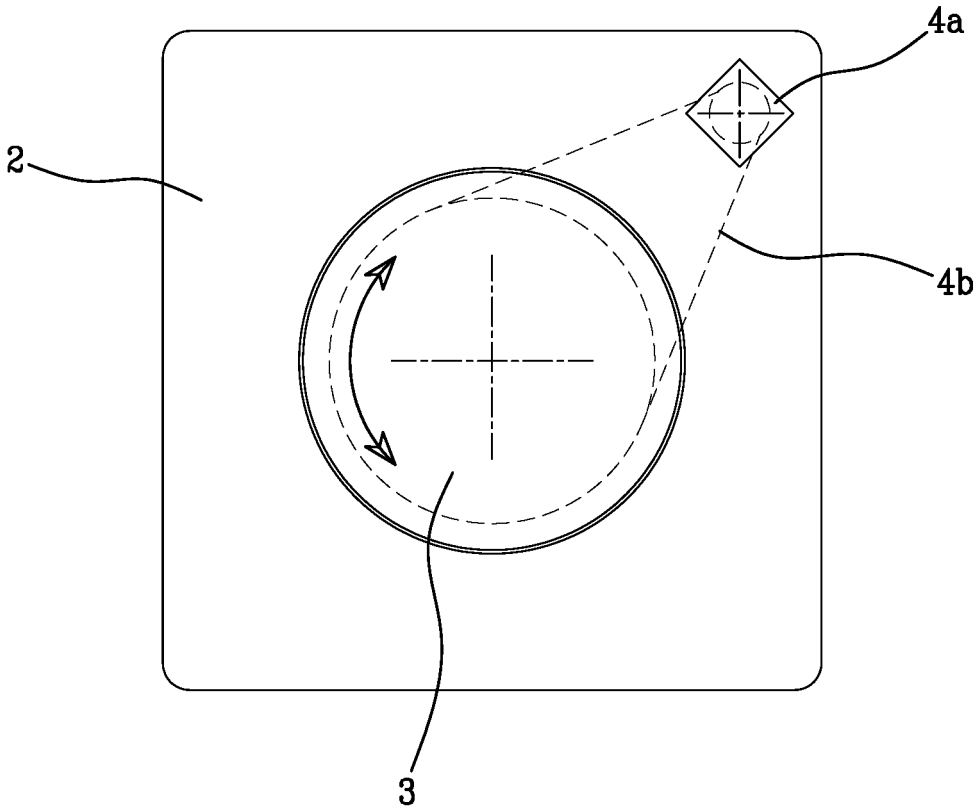
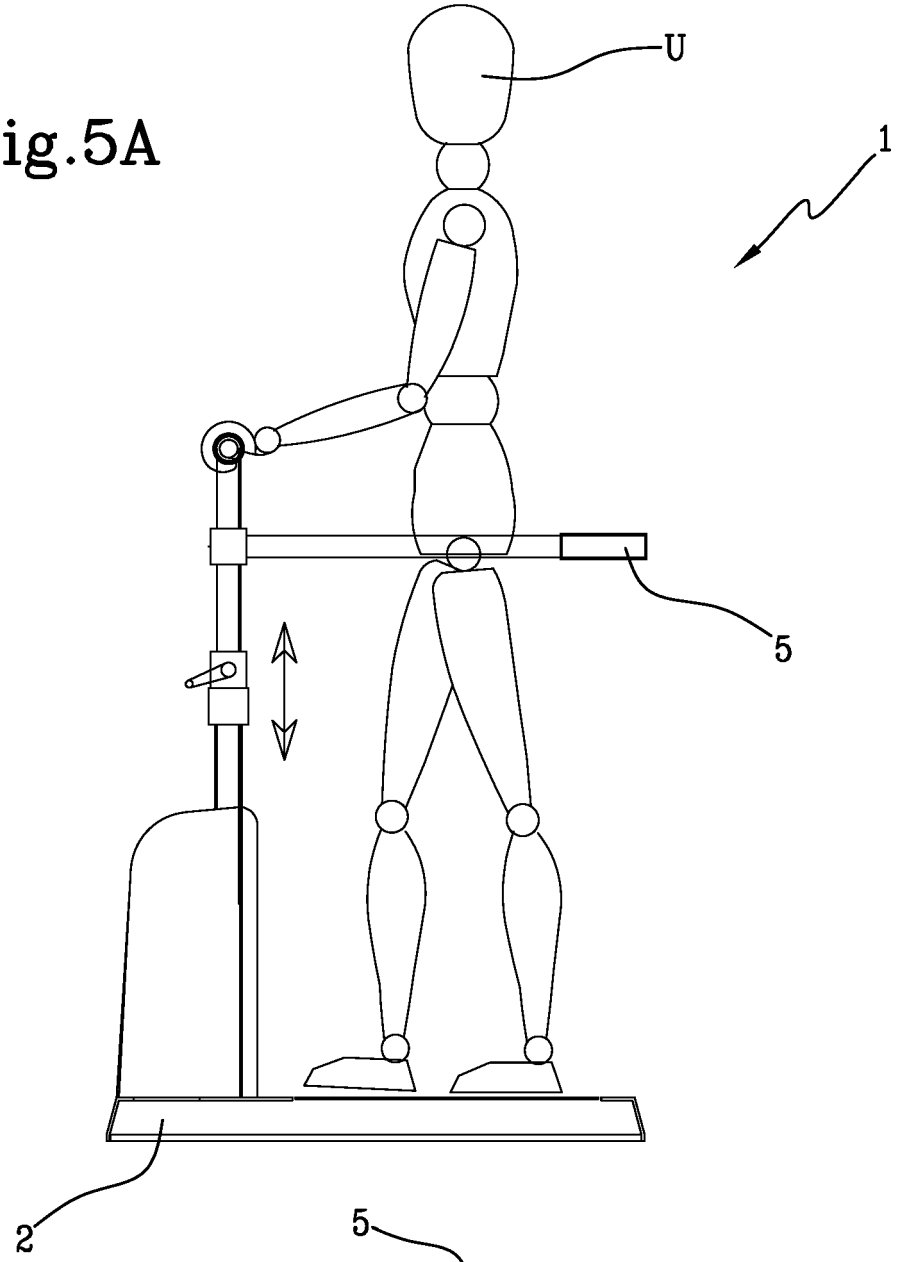


Fig.4B

Fig.5A



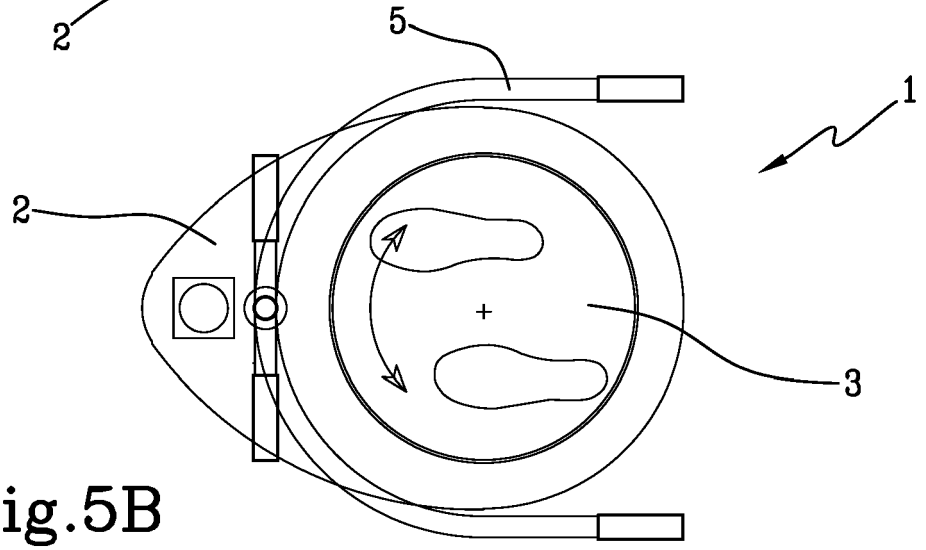


Fig.5B

Fig.5C

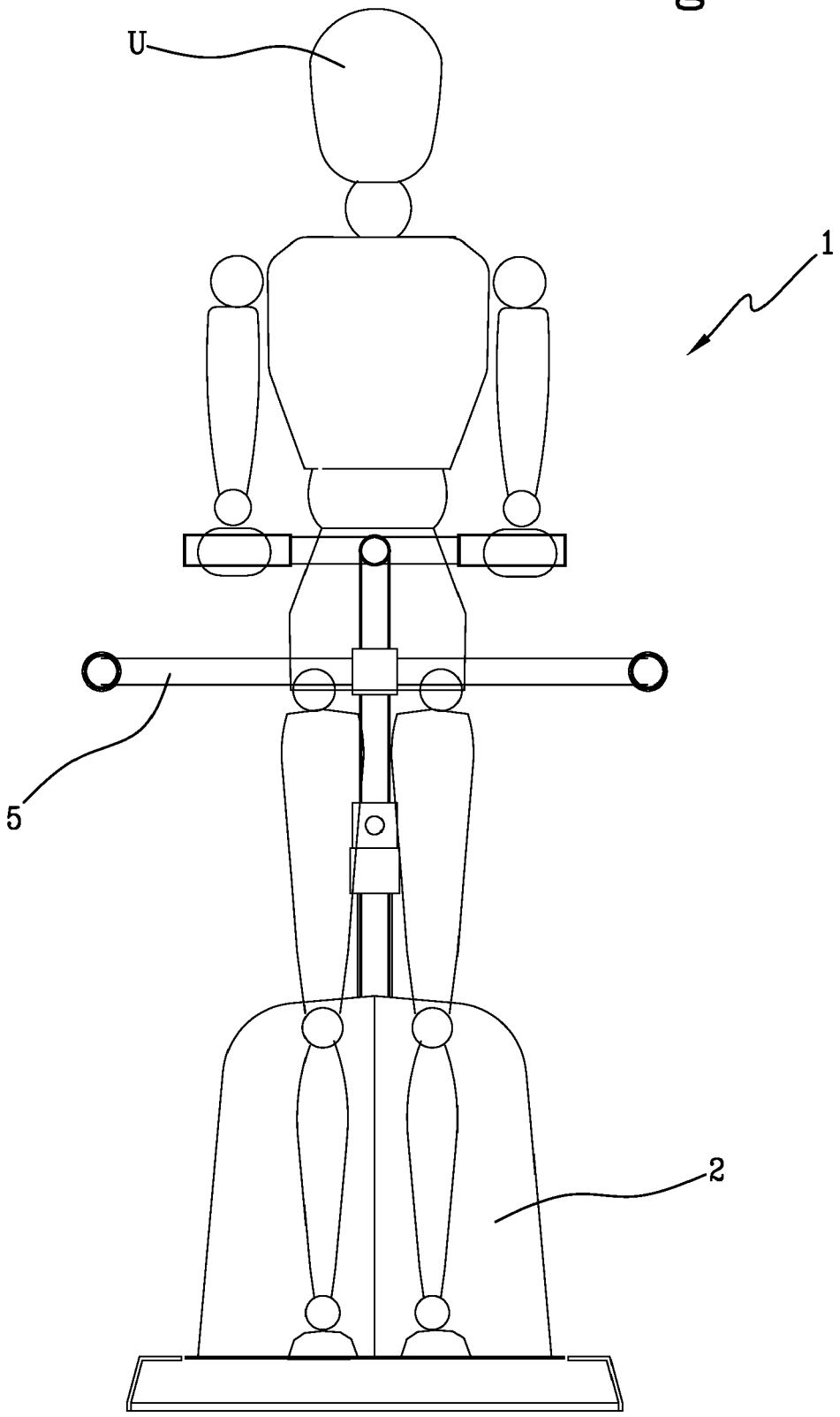
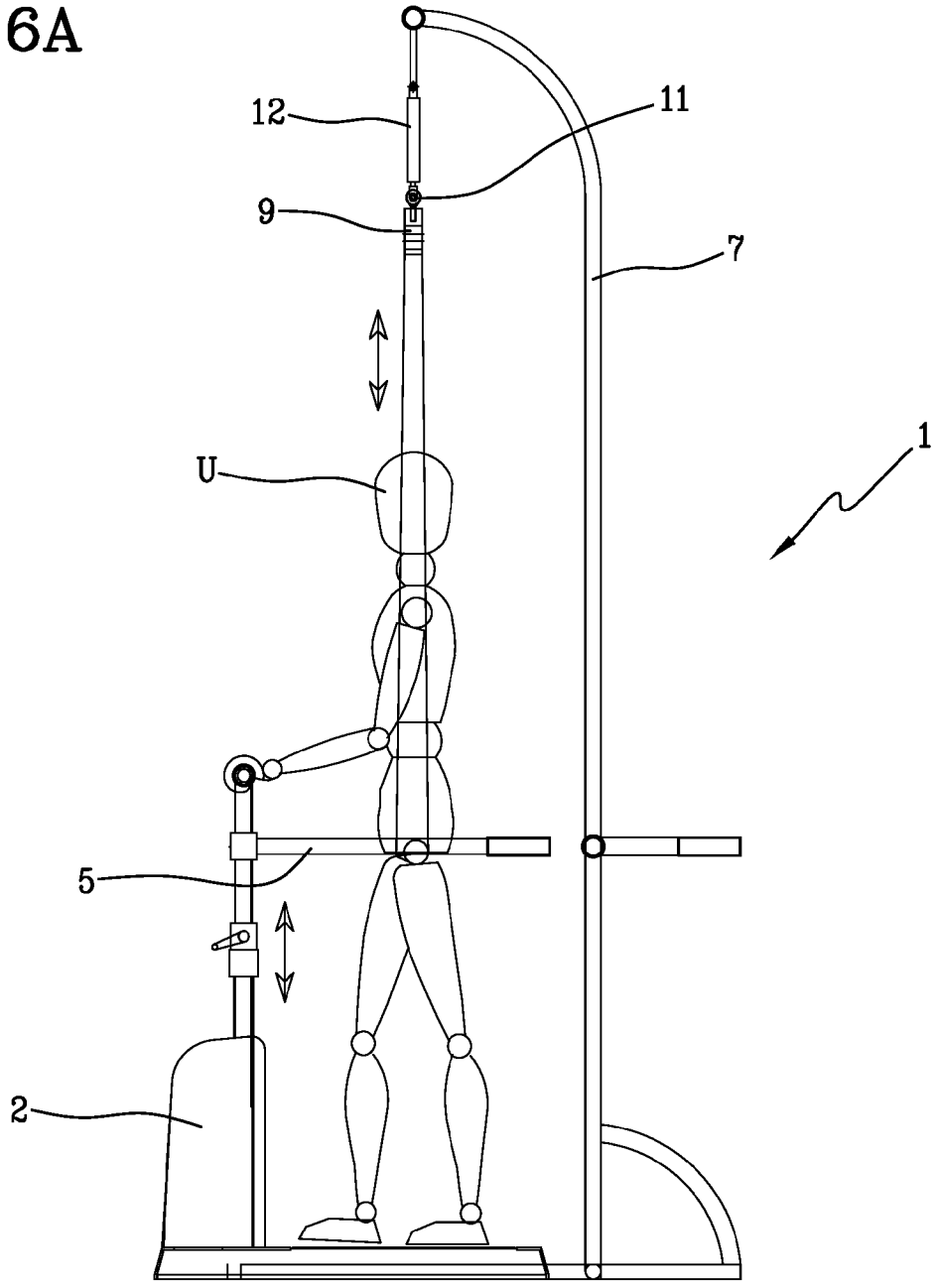


Fig.6A



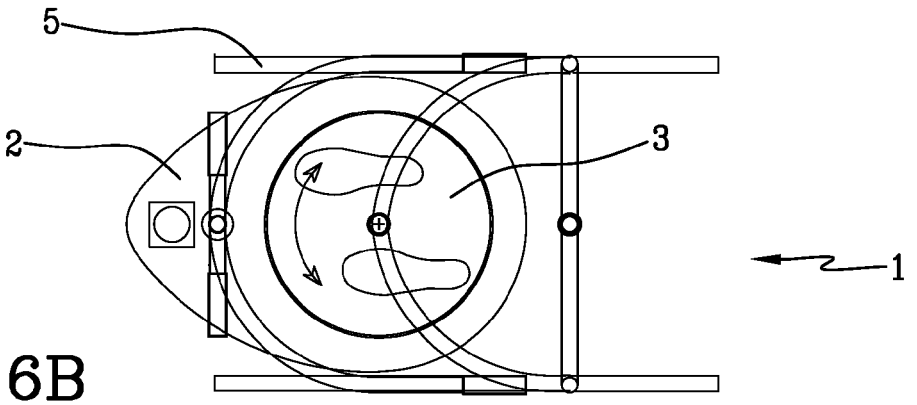


Fig.6B

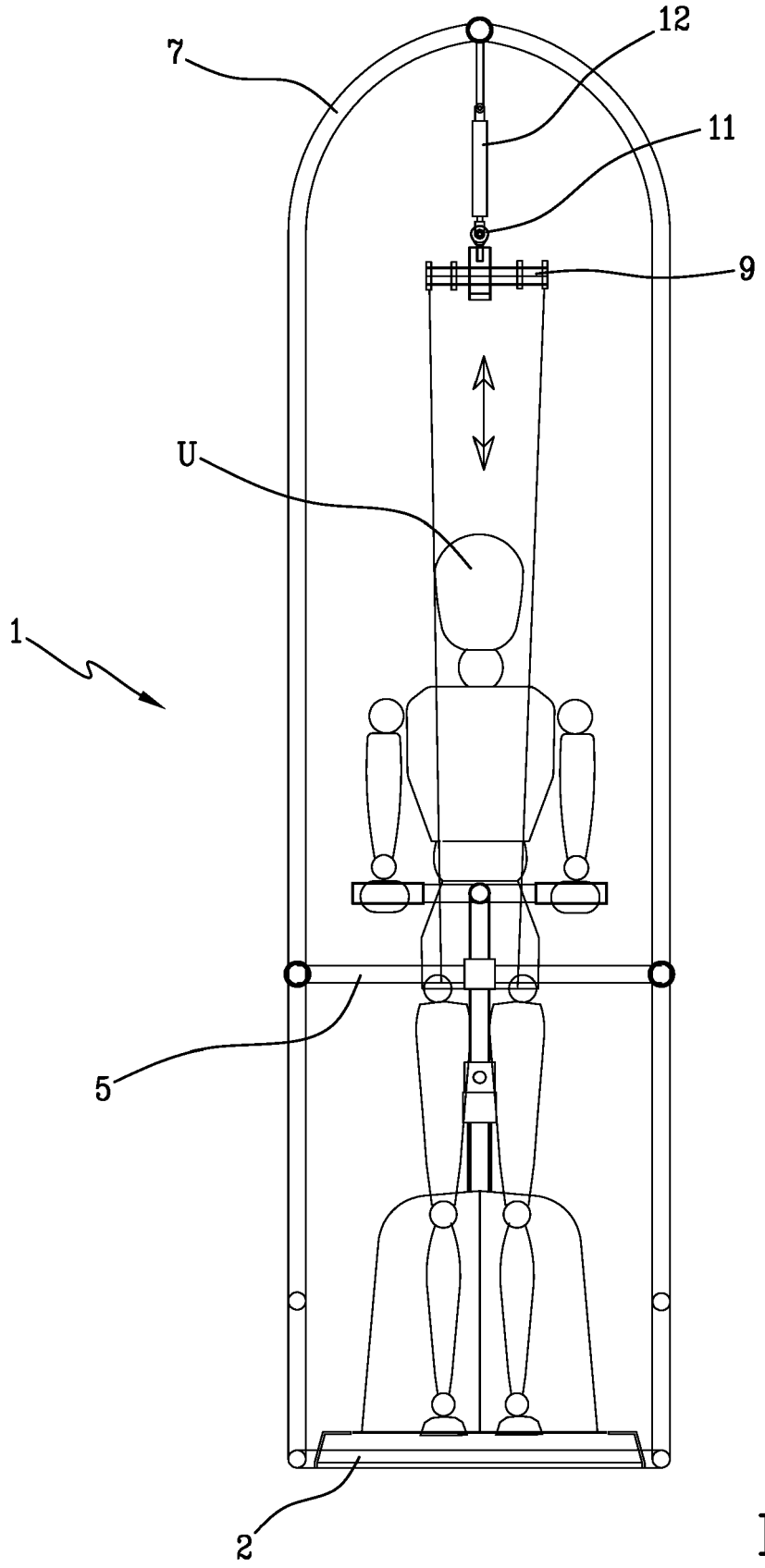


Fig.6C

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EUROPEAN SEARCH REPORT

Application Number
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Munich	5 October 2023	Teissier, Sara

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