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(72) Inventor; and
(71) Applicant: **VULJAJ, Sokolj** [ME/ME]; Kodrabudan 01, Tuzi, 81206 (ME).

(74) Agent: **VOSSIUS & PARTNER (NO 31)**; Patentanwälte Rechtsanwälte mbB, Siebertstrasse 3, 81675 München (DE).

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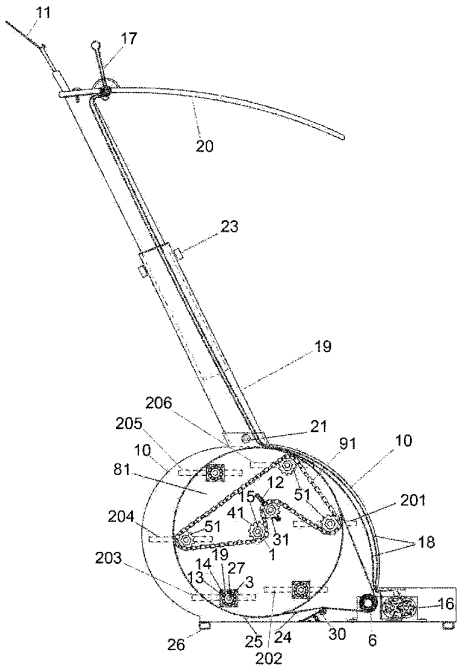

FIG. 2

(57) **Abstract:** A stair climbing machine comprising a housing, a first roller arranged in the housing and being rotatably about a center axis with respect to the housing, a resistance mechanism, a stationary element that is not rotatable with respect to the housing, a first plurality of rotation elements being rotatably supported in the first roller, and a first plurality of steps, each of the first plurality of steps being fixed to a respective one of the first plurality of rotation elements. The stationary element is disposed on the center axis, each rotation element of the first plurality of rotation elements is arranged on the first roller at the same distance from the center axis, and each of the first plurality of rotation elements is mechanically coupled to the stationary element via a first torque-transmitting connection.

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Stair Climbing Machine

The present invention relates to the field of sports equipment. More specifically the present invention relates to training and/or fitness devices and in particular to a moving staircase and/or stair climbing machine.

For the majority of people, the need for physical activity is ever growing. It is well-known that climbing stairs is among the best exercises for losing weight, preserving lung and cardiovascular health, and strengthening of the whole body in general. Beside a large number of training appliances for running and cycling, training staircases similar to escalators have lately appeared in the market. Such a training staircase may also be known as stair climbing machine, stair climbing device, stair exerciser apparatus, stairway machine, stepper or moving staircase.

The published application US 2020/187316 A1 (see also US 9,993,682 B2) portrays such a staircase that works using an electric power supply. Namely, it moves through a channel and two axles are moved by an electric motor that has the possibility of adjusting the speed. The appliance proved to be very successful, and it is used in contemporary fitness centres or training facilities.

The negative side of such appliances, however, is a high price tag and an expensive production, which might not only be disadvantageous for selling to fitness centres but also might put it almost out of reach for potential home users. Another downside of this appliance is its rather bulky size, making it particularly difficult to arrange it in small spaces such as it might be the case in a home setting or in small city fitness centres, e.g., downtown.

Thus, there is a need for a stair climbing machine which at least partly overcomes the above-described disadvantages.

It is an object of the present invention to provide a stair climbing machine and/or moving staircase which improves the state of the art at least in terms of some of the outlined needs such as costs, production effort, footprint, energy consumption and/or ease of use. Additionally or alternatively, it is an object of the present invention to provide an appliance, machine or device, preferably suitable to be used for efficient training at home and/or in training facilities, more preferably a stair climbing machine and/or moving staircase, which preferably is one or more of the following: practical, simple to use, lightweight, compact,

usable or runnable without electric power, easy to manufacture, such that it is convenient for end users as well as for manufacturers.

According to the present invention, this object is achieved by a stair climbing machine comprising a housing, a first roller arranged in the housing, the first roller being rotatably about a centre axis with respect to the housing, a resistance mechanism, a first stationary element that is not rotatable with regard to the housing, wherein the first stationary element preferably is disposed on the centre axis, a first plurality of rotation elements being rotatably supported in the first roller, and a first plurality of steps, each of the first plurality of steps being fixed to a respective one of the first plurality of rotation elements. Each rotation element of the first plurality of rotation elements is preferably arranged on the first roller at the same distance from the centre axis, and each of the first plurality of rotation elements is mechanically coupled to the first stationary element via a first torque-transmitting connection. Such a configuration preferably may result in a stair climbing machine having at least a simple, lightweight and/or robust design, being cost-efficient in manufacturing, being applicable without external electric power supply and/or having a small installation space, i.e. footprint.

A torque-transmitting connection, at least in the scope of the present disclosure, may be understood to be a connection between two or more elements that allows torque to be transmitted from one element to the other (ones). In other words, two or more elements being coupled via a torque transmitting connection may be forced to rotate as soon as one of the elements is set in rotation. A torque-transmitting connection may preferably be realized by one or more transmission elements such as, for example, a chain or a belt (for example a flat belt, a V-belt, or a toothed belt). Preferably, the transmission element (i.e., the element realizing the torque-transmitting connection) itself does not have to be torsion proof or torsion resistant.

The housing preferably is configured to be placed on a flat and/or horizontal surface, such as a floor. Preferably, the stair climbing machine comprises slip-resistance supporting feet to place it on the floor. The housing preferably comprises one or more covers, casings and/or a frame enclosing at least partially the first roller and/or the resistance mechanism. The housing preferably comprises a bearing on which the first roller is rotatably supported and/or in which the centre axis of the first roller is arranged.

Each step of the first plurality of steps preferably comprises a stepping surface, the stepping surface preferably being substantially flat. The stepping surface may be provided with a non-slip layer, e.g., a non-slip coating or a non-slip pad, which preferably increases the grip when stepping thereon. The steps and/or the stepping surfaces of the stair climbing machine preferably are horizontal and/or configured to maintain a horizontal orientation during rotation of the roller. The steps and or the stepping surfaces of the stair climbing machine preferably are oriented parallel and/or configured to maintain a substantially parallel orientation to the surface on which the housing is configured to be placed, e.g., the floor.

A mounting with which each of the first plurality of steps is fixed to the respective one of the first plurality of rotation elements preferably is a torque-proof mounting, e.g., a shaft-hub connection. In other words, a fixed connection may be provided, which may suppress relative rotation between the two components, i.e., the step and the respective rotation element. The fixed connection may be configured to supress relative movement. Suppressing rotation preferably is equivalent to restricting the rotational degree of freedom, suppressing movement may be equivalent to restricting all degrees of freedom (e.g., also translation).

The first stationary element preferably is fixed to the housing. More preferably, a fixed connection of the stationary element to the housing is torque-proof and suppresses at least relative rotation. A stationary element, according to the present disclosure, may be understood as an element which preferably is stationary with respect to the housing. The stationary element may be rotationally symmetric and/or of the same type (e.g., pinion, pulley, or gear) as the rotation elements.

The roller preferably is a carrier, such as a disc (preferably with a rotationally symmetric circumferential surface) or a carrier with a centre region and a plurality of arms extending radially therefrom (preferably at least three, at least four, or at least five arms extending from the centre region, more preferably in a rotationally symmetric manner). The roller preferably is rotationally symmetric (e.g., point symmetric) with respect to the roller's centre of gravity and/or its centre axis. The roller preferably extends further in a direction perpendicular to the centre axis than in a direction of the centre axis.

In the stair climbing machine, preferably, the rotation elements of the first plurality of rotation elements are equidistantly disposed around the first roller. In other words, the rotation

elements forming the first plurality of rotation elements may be arranged rotationally symmetric around the first roller, preferably around the centre axis of the first roller.

The stair climbing machine preferably comprises a second plurality of rotation elements rotatably supported on the first roller or on a second roller, and a second plurality of steps, each of the second plurality of steps being fixed to a respective one of the second plurality of rotation elements. Preferably, the stair climbing machine further comprises a second stationary element that is not rotatable with regard to the housing, wherein the second stationary element is disposed on the centre axis of the first and/or second roller. The second stationary element preferably is of the same type (e.g., pinion, pulley, or gear) than the first stationary element.

Preferably, each rotation element of the second plurality of rotation elements is arranged on the first or second roller at the same distance from the centre axis, and each of the second plurality of rotation elements is mechanically coupled to the first or second stationary element via a second torque-transmitting connection.

The second roller preferably is fixedly coupled to the first roller.

The second roller may be of the same type as the first roller (e.g., a disc or a carrier, see the description provided for the first roller above), and/or the first and the second roller may be identical and/or mirror-symmetrical in shape.

Each step of the first and/or second plurality of steps preferably has a width extending parallel to the centre axis and a depth, the depth preferably extending perpendicular to the centre axis and parallel to either the surface on which the housing is configured to be placed on and/or to the floor on which the stair climbing machine is set up. Stated differently, each step and/or stepping surface may preferably extend in a first direction with the centre axis defining a width of the step and also in a second direction perpendicular to the centre axis defining a depth of the step. A thickness of the step may be defined in a third direction perpendicular to both, the first and the second directions, and/or perpendicular to the stepping surface.

The centre axis preferably extends in a width direction of the stair climbing machine and/or in the width direction (the first direction) of the steps. Preferably, axes or shafts around which the steps rotate with respect to the roller or rollers are parallel to the centre axis and/or

arranged rotationally symmetric around the centre axis and/or equidistantly spaced from the centre axis, preferably in a radial direction from the centre axis..

The second roller and/or the second stationary element preferably is arranged on the centre axis at a distance to the first roller and/or to the first stationary element. Stated differently, the second roller and/or the second stationary element preferably is spaced from the first roller and/or first stationary element in a width direction of the stair climbing machine. Preferably, the second plurality of rotation elements is arranged proximate the second roller and/or the second stationary element, and the first plurality of rotation elements preferably is arranged proximate the first roller and/or the first stationary element.

The first and/or second plurality of steps preferably is arranged between the first and the second roller.

Preferably, the first roller, the first plurality of rotation elements, and/or the first stationary element is arranged on a first side of the housing in the width direction of the machine. Preferably, the second roller, the second plurality of rotation elements, and/or the second stationary element is arranged on a second side of the housing in the width direction of the machine.

The stair climbing machine preferably comprises an axle extending about the centre axis. The first and/or second roller preferably are rotatably supported on the axle, e.g., by bearings, and the first and/or second stationary elements preferably are fixed to the axle, e.g., by welding, a form fit (e.g., a feather key connection), or an interference fit. Alternatively, the first and/or second stationary elements may be formed integrally and/or monolithically with the axle.

Preferably, the first and/or second plurality of rotation elements are rotatably supported at eccentric positions on the respective first and/or second roller.

Preferably, the stair climbing machine comprises a third torque-transmitting connection configured to couple the first roller to the resistance mechanism.

Preferably, in the stair climbing machine, the first and/or second torque-transmitting connection ensures that each of the respective first and/or second plurality of rotation elements rotates with identical angular velocity. Alternatively or additionally, the first and/or second torque-transmitting connection may ensure that each of the respective first and/or second plurality of rotation elements maintains its orientation with respect to the housing,

more preferably that each of the respective first and/or second plurality of steps maintains its orientation with respect to the housing, when the first roller is rotated and/or while the stair climbing machine is in use. Preferably, this is achieved by coupling the first and/or second plurality of rotation elements to each other and to the first and/or second stationary element, more preferably via the first and/or second torque-transmitting connection, respectively. Such an arrangement may ensure that each step is maintained aligned with the other steps and/or maintained horizontally, irrespectively of the rotation angle of the respective first and/or second roller.

Each of the rotation elements of the first and/or second plurality of rotation elements preferably is provided as a gear (such as a pinion) or a pulley. The first and/or second stationary element preferably is provided as a gear (such as a pinion) or a pulley. More preferably, the first and/or second stationary element and each of the first and/or second plurality of rotation elements may be of the same type (e.g., a gear, such as a pinion).

Each of the rotation elements of the first plurality of rotation elements and/or each of the rotation elements of the second plurality of rotation elements preferably has the same diameter and/or number of teeth. The first and/or second stationary element and each of the first and/or second plurality of rotation elements may have the same diameter and/or number of teeth. In this manner, a simple mechanical connection of the elements may be achieved, and production costs may be reduced.

The first torque-transmitting connection preferably is achieved by one of the following:

a) the first plurality of rotation elements are mechanically coupled to each other via a first transmission element and at least one of the first plurality of rotation elements is coupled to the first stationary element via a second transmission element;
b) the first plurality of rotation elements are mechanically coupled to each other and to the first stationary element via a first transmission element; or
c) each of the first plurality of rotation elements are mechanically coupled to the stationary element, either directly or via a first transmission element.

The second torque-transmitting connection preferably may be achieved by one of the following:

d) the second plurality of rotation elements are mechanically coupled to each other via a third transmission element and at least one of the second plurality of rotation elements is coupled to the first stationary element or to the second stationary element via a fourth transmission element;

e) the second plurality of rotation elements are mechanically coupled to each other and to the first stationary element or to the second stationary element via a third transmission element; or

f) each of the second plurality of rotation elements is mechanically coupled to the first stationary element or to the second stationary element, either directly or via a third transmission element.

Such first and/or second torque-transmitting connections may lead to a mechanism which is cost-efficient in production, implementable in a small assembly space and/or robust in use.

The stair climbing machine preferably comprises one or more of the above-mentioned torque-transmitting connections a) to f) alone or in combination. For example, the stair climbing machine may comprise option a) or d) alone, option b) and e) in combination, or option c) and f) in combination.

The first, the second, the third and/or the fourth transmission element may be one of a chain, a belt or a gear. Preferably, the type of the first, the second, the third and/or the fourth transmission element is selected dependent on the type of the first and/or second rotation elements (which preferably is identical to the type of the first and/or second stationary element).

Preferably, the rotation elements of the first and/or second plurality of rotation elements are pinions and the first, second, third and/or fourth transmission elements are chains, or the rotation elements of the first and/or second plurality of rotation elements are pulleys and the first, second, third and/or fourth transmission elements are belts, or the rotation elements of the first and/or second plurality of rotation elements and the first, second, third and/or fourth transmission elements are one or more gears.

The resistance mechanism of the stair climbing machine preferably is a deceleration system configured to slow down rotational speed of the first and/or second roller, more preferably to slow down rotational speed of the first and/or second roller without consuming electrical energy. The resistance mechanism preferably is one or a combination of a brake, such as a

mechanical brake, a hydraulic brake or a dynamic brake (electric, e.g. a generator), a hydrodynamic brake (e.g. a water resistance system) or a hydraulic pump. Alternatively or additionally, the resistance mechanism may provided for a dynamic resistance system which ensures that it takes the more energy to rotate the first and/or second roller the higher the rotational speed of the first and/or second roller is. The stair climbing machine with the resistance mechanism preferably is configured to allow a person to train on it while the stair climbing machine does not consume any electrical energy for moving the steps and/or rotating the first and/or second roller. In other words, the stair climbing machine with the resistance mechanism preferably is configured to allow a person to train on it while the stair climbing machine does not rely on an external power supply (e.g., consume energy other than the muscular energy of a person training on it). The stair climbing machine and/or the resistance mechanism preferably is configured to prevent the first and/or second roller to rotate at a rotational speed higher than 50 revolutions per minute (rpm), more preferably higher than 30 rpm. Preferably, these maximum revolutions per minute are achieved when a load of up to 300 Nm, preferably up to 800 Nm is applied, preferably to each step that is currently at a specified position in the rotation cycle. Preferably, the stair climbing machine has 3 to 10 steps, more preferably 4 to 8 steps.

The third torque-transmitting connection of the stair climbing machine preferably is a mechanical or electrical coupling. More preferably, the third torque-transmitting connection may be achieved by one of a belt or a chain. Alternatively, the third torque-transmitting connection may be achieved by a magnetic or electric field.

The stair climbing machine preferably does further comprise one or more chain or belt tensioners. For example, three chain or belt tensioners may be arranged in the stair climbing machine. The number of chain or belt tensioners may be at least equal to the number of torque-transmitting connections. Preferably, one chain or belt tensioner may be arranged at each transmission element (or transmission elements) providing the respective torque-transmitting connection.

The first and/or second roller may each form a carrier configured to rotatably support the respective first and/or second plurality of rotation elements, preferably at a predefined distance to the centre axis. More preferably, the first and/or second roller may be a disc.

Forming the first and/or second roller as a disc may provide for cost effective manufacturing of the stair climbing machine.

Preferably, the stair climbing machine further comprises one or more supports configured to be gripped by a user while exercising on the stair climbing machine. The one or more supports may comprise one or more handles.

The stair climbing machine may comprise at least one user interface for adjusting a resistance of the resistance mechanism. The user interface may be provided on at least one of the one or more supports, preferably on at least one of the one or more handles.

The stair climbing machine may comprise a controller. The user interface may communicate with a controller of the stair climbing machine, wherein the controller preferably communicates with the resistance mechanism.

Preferably, each of the one or more supports is provided as a support extension that extends away from the centre axis, more preferably in an upward direction. The one or more support extensions may extend from the cover or casing that houses the first and/or second roller. The one or more support extensions may be part of the housing and/or frame. Alternatively or additionally, the one or more support extensions may extend from the housing.

The one or more support extensions may preferably be one or more telescopic support extensions.

The controller may be a hydraulic controller, preferably comprising a valve (e.g. control valve) or a lever configured to adjust a valve.

Alternatively, the controller may be a mechanical controller, such as a cable pull, e.g., comprising a Bowden cable and/or a spring; or a lever to adjust a cable pull, e.g., to pull a Bowden wire.

Alternatively, the controller may be an electrical controller that may be hardwired to the user interface and/or an actuator of the resistance mechanism, or that may communicate with the user interface and/or an actuator of the resistance mechanism via radio waves (such as via the Bluetooth standard). The user interface may communicate with the controller directly or via an additional device, such as, e.g., a smartphone or a tablet of a user. Optionally, a smartphone or a tablet of the user may itself form the user interface.

In other words, the invention may relate to and/or the above-defined object of the present invention is achieved by a moving staircase for training that has its own case (10), a left and right telescopic carrier (19) with handles (20), specified by the fact that the case (10) has an axle (1) in the inner central part that is fixed on the outer side by bolts (15), on which a reel (8) turns on bearings (7), between the reel (8) and the case (10) on the axle (1) are fixed chainrings (4), the sides of the reel(8) have six holes close to the outer line where the bearings (13) are mounted symmetrically in a manner of a hexagon, and are fixed on the outer side of the reel (8) on their own cases (19), by bolts (14), on which each of the six steps (2) with axles (3) on one side, on the axle (3) out of the reel (8) have one chainring (5) in the following order: on the left side the first, third, and fourth step, while on the right side the second, fifth, and sixth step, and are connected by chains (9) where on each side three chainrings (5) are connected with the central chainring (4), which makes all chainrings connected by chains (9) on a horizontal plane, and they turn together with the reel (8) and the steps (2) on the bearings (13) around the chainrings (4) that do not turn, between the two chainrings (4 and 5) is a tension chainring (31) that turns on its own channel (12), al chainrings have the same size, on the bottom of the case (10) is fixed by bolts (29) a jagged hydraulic pump (16) that is connected through its own pulley (6) and belt (24) to the pulley (25) that is fixed on the reel (8), having a pipe (16) that stretches to the handle (20) through a valve (17), for the gradual change of the flow, and back to the pump.

In the following, preferred embodiments of the invention are described by way of example with reference to the figures. The embodiments are only exemplary and not intended to limit the scope of the present disclosure in any way. In particular, the invention is not limited to the embodiments shown in the figures. The figures show:

Figure 1 a perspective view of the stair climbing machine in a first exemplary embodiment;

Figure 2 a side view of the stair climbing machine of Fig. 1;

Figure 3 a side view of the stair climbing machine of Fig. 1, opposite to the side view of Fig. 2;

Figure 4 a cross-section of the stair climbing machine of Fig. 1 in a front view; and

Figure 5 a side view of the stair climbing machine in a second exemplary embodiment, the side view being similarly to Fig. 2.

Figure 1 shows a schematic of a stair climbing machine, also known as moving staircase, according to the present invention in a perspective view according to a first exemplary embodiment. The stair climbing machine is configured to be placed on a floor by supporting feet 26 which are mounted to a housing 10. According to the exemplary embodiment shown, the stair climbing machine is placed on the x-y plane (floor level), having a height defined in the z-direction, a width defined in the y-direction and a depth defined in the x-direction (with reference to the coordinate system of Fig. 1).

The stair climbing machine in its lower part comprises a plurality of steps 2 rotatably supported in two rollers 81, 82. The steps 2 are provided with a drive mechanism and configured such that the steps 2 (together with the rollers 81, 82) rotate in the stair climbing machine, preferably around a centre axis, when a person walks on the steps. This allows a person to technically walk up (climb) an unlimited number of steps continuously without substantially moving from their initial spot.

The rollers 81, 82, the drive mechanism, and the steps 2 together may also be referred to as a stepping mechanism. With reference to the disclosed embodiments, directions may be defined in view of a person who walks on the stair climbing machine. The positive x-direction preferably defines a forward direction, while lateral directions preferably are defined along the y-axis. A left side (first side) of the stair climbing machine preferably is defined on the left side of the person, a right side (second side) of the stair climbing machine preferably is defined on the right side of the person.

The stair climbing machine accommodates the stepping mechanism in its lower portion. The stair climbing machine therefore may generally be belly-shaped or roller-shaped in its lower portion.

In addition to the stepping mechanism, the stair climbing machine comprises at least one support extension (in the present embodiment two support extensions) comprising a handle 20 and extending away from the lower portion. The support extension 19 and/or handle 20 (see, e.g., Figure 2) define a height of the stair climbing machine. The handle 20 preferably is designed to guide or support a person who is walking on the steps. It is therefore preferred

that the handle 20 is height-adjustable. In this manner, each person can adjust the height of the handle 20 according to their body size for improved comfort while training.

The support extension preferably is a telescopic support extension 19. While one telescopic support extension 19 might be sufficient, in the present case the handle 20 is coupled to two telescopic support extensions 19, each telescopic support extension 19 being arranged on one side (left and right) of the stair climbing machine. As will be appreciated by those skilled in the art, two separate handles may also be provided (e.g., one on each side of the user, i.e., lacking the bridge connecting the handle 20 from the left to the right side). In either case, with the telescopic support extensions, the height of the stair climbing machine is adjustable.

The telescopic support extensions 19 can be set to a desired height by bolts 23. The bolts 23 preferably fix an outer part of the telescopic support extensions 19 (the outer part preferably being fixed to the housing 10) to an inner part of the telescopic support extensions 19 (the inner part being connected to the handle 20 or forming the handle 20) at a desired height. Preferably, the bolts 23 do either clamp the inner part to the outer part or the inner part comprises rows of holes and the bolts 23 engage with respective holes of the inner part at a desired height. The telescopic support extensions 19 preferably are part of the housing 10 and in the embodiment depicted, they are fixed to the housing 10 by bolts 21.

The stair climbing machine according to the present embodiment further comprises a universal carrier 11, provided at the handle 20. The universal carrier 11 might be configured to hold, e.g., a smartphone or a tablet. Convenience of using the machine thus can preferably be increased.

In the area of the handle 20 there is further provided a controller 17 providing a user interface for adjusting the performance of the stepping mechanism, i.e., the resistance. Stated differently, the controller 17 is configured to adjust how much energy a person needs to walk on the steps 2 and/or how fast the steps 2 (or, more detailed the stepping mechanism) rotate depending on a weight of a person walking on the steps 2. The type of the controller 17 may be chosen in accordance with the resistance mechanism used in the stepping mechanism. Preferably, the controller 17 is a mechanical, electric, or hydraulic controller.

Figure 1 further gives an overview about a preferred design of the stepping mechanism in the lower portion of the stair climbing machine. The stair climbing machine in this preferred embodiment comprises, e.g., six steps 2. Each of the steps 2 has a stepping surface on its upper

side (in z-direction) which extends in the x- and y-direction and defines a width (in y-direction) from a first lateral edge to a second lateral edge and a depth (in x-direction) of the step. In other words, each step extends, along the y-axis, from a first lateral side (left side) to a second lateral side (right side) defining a width of the step, and each step extends along the x-axis defining a depth of the step. Each step has a thickness which is substantially smaller than the step's extension in width or depth. All steps are oriented equally, with the stepping surface preferably being horizontally. Such orientation of each of the steps is ensured by the stair climbing machine, i.e., the stepping mechanism, being configured in accordance with the present invention.

The steps 2 can preferably be identified as a first plurality of steps including steps 201, 204 and 206, and as a second plurality of steps including steps 202, 203, 205. Each of the steps 2 comprises at least one rotation element 5, which, in the present embodiment, is a pinion 5. In the present embodiment, each of the first plurality of steps comprises a first rotation element 51 on its lateral side at the first side of the stair climbing machine and each of the second plurality of steps comprises a second rotation element 52 on its lateral side at the second side of the stair climbing machine. Each of the steps 2 (steps of the first and of the second plurality of steps) are supported in a first roller 81 at the first side of the stair climbing machine, and in a second roller 82 on the opposite side (second side of the stair climbing machine). Each of the first and second rotation elements 51, 52 is fixed to a respective one of the first and second plurality of steps 2 such that the steps 2 rotate together with the respective rotation element 51, 52. Preferably, each step 2 comprises a shaft 3 extending along the y-axis, e.g. further than the stepping surface to the first and/or second side. The step 2 is non-rotationally fixed, e.g., fixedly coupled to the shaft 3. A respective first and/or second rotation element 51, 52 is non-rotationally fixed (e.g., fixedly coupled) to the shaft 3, e.g., by using one of a shaft-hub-connection well known in the art, e.g., a interference fit or a form fit (such as a feather key connection). A circlip may be used to fix an axial relative position of the shaft 3 and the respective rotation element 51, 52.

The rollers 81, 82 are supported at the housing 10 rotatably about their centre axis. The centre axis may extend through a centre of symmetry of the rollers 81, 82 and along the y-axis. In other words, the rollers are rotatable around their centre axis with respect to the housing 10.

The rollers 81, 81 may be connected to each other, preferably by a sleeve 8. The sleeve 8 preferably is formed around the centre axis and extends along the centre axis, as it will more clearly be apparent from Figure 4. Preferably the centre axes of the rollers 81, 82 are congruent with a main axis 1 of the stair climbing machine, the main axis 1 connecting a first (left) and second (right) side of the housing 10.

At the housing 10, there is provided at least one stationary element 4 that is fixedly, i.e. non-rotatable, connected to the housing 10. In the exemplary embodiment shown, there are provided two stationary elements 4, i.e. one stationary element 4 at each side of the housing 10 (a first stationary element 41 and a second stationary element 42). The stationary elements 4 are in more detail explained with reference to Figures 2, 3 and 4.

The rollers 81, 82 support the steps 2 rotatably. In other words, the steps 2 are held by the rollers 81, 82 with one rotational degree of freedom relative to the rollers 81, 82. Preferably, the steps 2 are supported in the rollers 81, 82 by bearings, more preferably by ball bearings or plain bearings. The support of the steps 2 in the rollers 81, 82 is in more detail explained with reference to Figures 2, 3 and 4.

In the present embodiment, there is provided a first plurality of steps (steps 201, 204, 206) having a first plurality of rotation elements (rotation elements 51) on the side of the steps which is supported in the first roller 81 (left side of the steps). At least some rotation elements 51 of the first plurality of rotation elements are coupled to the first stationary element 41 via a first torque-transmitting connection. The first torque-transmitting connection in the present embodiment is realized by a first chain 91. Stated differently, at least some of the rotation elements 51 of the first plurality of rotation elements (in the present embodiment three rotation elements 51) are coupled to the first stationary element 41 in such a way that a torque from each of the coupled rotation elements 51 is transferred to the stationary element 4. While such functionality may be realized in different ways (and any of these is encompassed by the present disclosure), according to the present exemplary embodiment, three of the first rotation elements 51 are coupled to each other and to the stationary element 41 by a transmission element (i.e., the chain 91) forming the first torque-transmitting connection.

Moreover, there is provided a second plurality of steps (202, 203, 205) having a second plurality of rotation elements (rotation elements 52) on the side of the steps which is supported in the second roller 82 (right side of the steps). At least some rotation elements 52

of the second plurality of rotation elements are coupled to the second stationary element 42 via a second torque-transmitting connection. The second torque-transmitting connection in the exemplary embodiment is realized by a second chain 92. To the second torque-transmitting connection, preferably the same applies as to the first torque-transmitting connection stated above. In particular, the second torque-transmitting connection in the present case is provided by one transmission element (i.e., the chain 92) connecting three of the second rotation elements 52 to each other and to the second stationary element 42, thereby forming the second torque-transmitting connection.

Such mechanism preferably ensures that, when a person steps on a step 2 of the stair climbing machine, the first and second rollers 81, 82 rotate while the respective step 2 (and preferably all other steps 2) maintains its orientation with respect to the housing 10, i.e., remains in a horizontal orientation.

The rotational speed of the first and/or second roller 81, 81 is slowed by a resistance mechanism 16. In the exemplary embodiment shown, the resistance mechanism is a hydraulic pump which is coupled to the first roller 81 via a third torque-transmitting connection. The coupling is realized by a third transmission element, i.e., a belt 24, forming the third torque-transmitting connection. The belt 24 extends around the first roller 81 comprising a first pulley 25 and around a pulley 6 which is coupled to the resistance mechanism 16 to drive the hydraulic pump when getting rotated.

In view of the above, the stair climbing device can be used to infinitely walk upstairs. A person using the device walks on the steps 2, thereby rotating the first and/or second rollers 81, 82 while the steps 2 preferably remain in their initial orientation (because of the first and second torque-transmitting connection). The rotational speed of the rollers 81, 82 is slowed down by the resistance mechanism 16 (because of the third torque-transmitting connection) to an extend that can be varied by the user via the controller 17. In the exemplary embodiment shown, the controller 17 may comprise a valve, e.g., a control valve, coupled with the hydraulic pump via one or more pipes 18, thereby adjusting a hydraulic resistance of the hydraulic pump (which adjusts the resistance of the rollers 81, 82 and thereby the resistance of the stair climbing machine when training). The controller 17 and pipes 18 in other embodiments might not be of a hydraulic type but of a mechanical or electrical type, i.e., the controller 17 might

comprise a circuit or a mechanical spring (and not necessarily a valve) and the connection 18 might comprise an electric wire or a cable pull, e.g., a Bowden cable.

Figure 2 shows a sideview of the stair climbing machine when viewed from the left side (in negative y-direction). Optional covers of the housing 10 are removed. The left side of the stepping mechanism thus is visible (in particular, the first plurality of rotation elements 51, the first roller 81, and the first chain 91). The single elements of the stepping mechanism, their connection and support can thus be described in further detail with reference to the left side (first side) of the stair climbing machine.

In connection with Figure 2, the expressions "left" and "right" refer to the side views of the machine and not to the machine as such.

In comparison with Figure 1, the roller 81 has been rotated by approximately 180 degrees about its centre axis. In other words, the roller 81 has further been rotated by three steps 2. Therefore, the step 206 which has been in the lower left corner in Figure 1, is in the upper right corner in Figure 2.

Each of the six steps 2, i.e., the steps of the first plurality of steps 201, 204, 206 and the steps of the second plurality of steps 202, 203, 205, is rotatably supported in the first roller 81 by a respective bearing 13. Stated differently, the shaft or shafts 3 of each of the six steps 2 are rotatably supported in the first roller 81 by a respective bearing 13. These bearings 13, are best visible in Figure 2 for the steps of the second plurality of steps 202, 203, 205 (since they are not covered by the rotation elements 51 of the first plurality of rotation elements), i.e. step 202 in the lower right corner, step 203 in the lower left corner, and step 205 in the upper left corner. Although not visible, these bearings 13 are provided as well at the remaining three steps 2 (the first plurality of steps 201, 204, 206), but in the present side view are hidden by the rotation elements 51. In case of ball bearings being used, as in the exemplary embodiment, each of the bearings 13 comprises an inner ring 27, an outer ring 19 and rolling elements provided in a cage and being disposed between the inner ring 27 and the outer ring 19. The outer ring 19 is fixed to the first roller 81, preferably by bolts 14. The inner ring 27 is fixed to the axle 3 which is part of (or fixed to) the respective step 2 (preferably, by one of the above-mentioned shaft-hub connections, such as, e.g., a interference fit).

The three steps of the first plurality of steps 201, 204, 206, each of which is provided with a rotation element 51 of the first plurality of rotation elements, are connected to each other

and to the first stationary element 41 via the first chain 91. While each of the rotation elements 51 is rotatable together with the respective step 2 and relative to the first roller 81, the first stationary element 41 is non-rotationally coupled with respect to the housing 10. For example, the first stationary element 41 may be fixedly coupled with respect to the stationary main axis 1 of the housing 10 (e.g., by a shaft-hub connection). An axial fixation element 15 (e.g., a nut) may be used to fixate an axial position of the first stationary element 41 on the main axis 1.

The first chain 91 may extend around all rotation elements 51 of the first plurality of rotation elements (e.g., in the exemplary embodiment shown, around all three rotation elements 51) and around the first stationary element 41. A first chain tensioner 31 which is slidably disposed in a groove 12 of the first roller 81 (or, alternatively, of the housing 10), may be provided to adjust a tension of the first chain 91, preferably in order to ensure smooth operation of the stepping mechanism (e.g., by ensuring that the rotation elements 51 and the first stationary element 41 remain coupled with the first chain 91). With such configuration, it may be ensured that the roller 81 rotates about its centre axis (which, in the present embodiment may be coaxial to the main axis 1) while the steps 2 (i.e., the first plurality of steps 201, 204, 206) which are rotatably supported in the first roller 81 maintain their orientation with respect to the housing (preferably due to their torque-transmitting connection with the first stationary element 41).

The different planes (x-z-planes) in width direction of the stair climbing machine (y-direction), in which the bearings, the rotation elements, etc. are provided will be explained in more detail with reference to Figure 4 below.

Referring again to Figure 2, it will be appreciated that the first roller 81 is connected in a torque-transmitting manner to the resistance mechanism 16 by the belt 24. The belt 24 extends around the first pulley 25 which may be formed by the circumferential surface of the first roller 81 (or, alternatively, fixedly coupled with the first roller 81) and around the second pulley 6 of the resistance mechanism 16 (which drives the resistance mechanism, i.e., in the exemplary embodiment shown, the hydraulic pump). The tension of the belt 24 is ensured by a belt tensioner 30.

A level of resistance of the stair climbing machine can be adjusted by the controller 17, which is provided at the handle 20 and connected to the resistance mechanism 16. In the exemplary

embodiment shown, the resistance mechanism 16 is a hydraulic pump and it is preferred that the controller 17 comprises a valve, e.g. a control valve, and is hydraulically connected to the hydraulic pump via pipes 18. The resistance of the resistance mechanism 16, and thus the level of work to be performed for moving the stairs of the stair climbing machine, can be adjusted by changing the hydraulic pressure at the pump via the valve comprised in the controller 17.

In alternative embodiments, the resistance mechanism 17 might be different from a hydraulic pump, e.g., an electric generator or any kind of mechanic or dynamic brake. In accordance with the type of resistance mechanism 16, a respective type of controller 17 and connection 18 can be provided, e.g. a controller 17 comprising a circuity and a connection 18 comprising an electric wire or a connection 18 comprising a pull wire, e.g., a Bowden cable.

Figure 3 shows a sideview of the stair climbing machine when viewed from the right side (in positive y-direction). In other words, Figure 3 shows the stair climbing machine in a side view opposite to the side view of Figure 2. In Figure 3 as well, optional covers of the housing 10 are removed to make the right side of the stepping mechanism better visible (second plurality of rotation elements 52, second roller 82, second chain 92).

As it is apparent from Figure 3, all six steps 2 are rotatably supported in the second roller 82 by bearings 13 as well. Stated differently, the shaft or shafts 3 of each of the six steps 2 are rotatably supported in the second roller 82 by bearings 13 as well. These bearings 13 are visible in Figure 3, in particular, at the steps 201, 204, 206 of the first plurality of steps, which are not provided with a second rotation element 52. Although not visible, these bearings 13 are provided as well at the three steps 202, 203, 205 of the second plurality of steps, but in the side view of Figure 3 are hidden by the second rotation elements 52.

As further shown in the side view of Figure 3, the three remaining steps 202, 203, 205 of the second plurality of steps that are not connected to the first stationary element 41 via the first torque-transmitting connection, are connected to a second stationary element 42 on the second side (right side) of the stair climbing machine via a second torque-transmitting connection. The three steps 202, 203, 205 of the second plurality of steps, each of which is provided with a second rotation element 52 of the second plurality of rotation elements, are connected to the second stationary element 42 and to each other via a second chain 92. Stated differently, steps 202, 203 and 205 are connected to each other and to the second stationary

element 42 via the second chain 92. Each of the second rotation elements 52 is rotatable together with the respective step 2 and relative to the second roller 82.

The second chain 92 is preferably installed functionally identically to the first chain 91. In other words, the second chain 92 may extend around each of the second rotation elements 52 and around the second stationary element 42 while a chain tensioner 31 may be provided to maintain proper tension on the second chain 92.

The second rotation elements 52 preferably are of the same type as the first rotation elements 51.

The second stationary element 42 is preferably of the same type as the first stationary element 41.

The second stationary element 42 is fixedly coupled with respect to the housing 10 (e.g., in the exemplary embodiment shown, with respect to the stationary main axis 1 of the housing 10).

In alternative embodiments the first and second stationary elements 41, 42 may be provided by a single stationary element. E.g., both the first and the second plurality of rotation elements 51, 52 could be provided on the same side of the machine.

In the exemplary embodiment shown in Figures 1 to 4, the first and second rollers 81, 82 are fixedly coupled to each other and thus rotate together. It is therefore preferred that the connection of the first and/or second rollers to the resistance mechanism 16 is realized only by one belt 24 passing around the first pulley 25 (at the first roller 81) and the second pulley 6 (driving the resistance mechanism), as shown in the background in Figure 3.

Figure 4 shows a cross section of the stair climbing machine parallel to the y-z-plane in a front view (when viewed in the positive x-direction). The stepping mechanism, i.e., the first and second plurality of rotation elements 51, 52, the first and second chains 91, 92 and the stationary elements 41, 42 are provided on respective left and right sides of the first and second rollers 81, 82, respectively. The first and second rollers 81, 82 are fixed to each other by a sleeve 8 which is supported by bearings 7 on the main axis 1 of the housing 10. The bearings 7 allow rotational movement of the rollers 81, 82 relative to the main axis 1. In other words, the rollers 81, 82 are rotatable about the main axis 1. Preferably, the bearings 7 are ball bearings, cylindrical roller bearings or plain bearings.

As indicated above, the first roller 81 comprises a pulley 25. In the present embodiment, the first pulley 25 is attached to the first roller 81 or formed on an outer surface of the first roller 81. The belt 24 extends around the first pulley 25.

Each of the steps 2 is supported in the first roller 81 and in the second roller 82. In more detail, each of the steps 2 may be supported in through-holes of the respective first and second rollers 81, 82, preferably by the bearings 13. A shaft 3 of each step passes through the first roller 81 (more specifically through a through hole of the first roller 81) and through the second roller 82 (more specifically through a through hole of the second roller 82) and is axially fixed, e.g., by a nut or circlip 27. While the first roller 81 preferably supports the steps 2 in a first plane, the first plane preferably being perpendicular to the roller's centre axis, the first rotation elements 51 and the first stationary element 41 are arranged in a second plane, the second plane preferably being parallel to the first plane and/or perpendicular to the centre axis. All of the first rotation elements 51 and the stationary element 41 are connected via the first chain 91, preferably in the second plane.

The second roller 82 preferably supports the steps 2 in a third plane, the third plane preferably being perpendicular to the roller's centre axis. The second rotation elements 52 and the second stationary element 42 are arranged in a fourth plane, the fourth plane preferably being parallel to the third plane and/or the second plane and/or perpendicular to the centre axis. All of the second rotation elements 52 and the stationary element 42 are connected via the second chain 92, preferably in this third plane.

The steps 2, preferably the stepping surfaces of the steps 2, extend in a width direction between the first roller 81 and the second roller 82. The first roller 81 and the second roller 82 preferably are spaced at a distance Y to each other. Preferably this distance Y is at least 40 cm, more preferably at least 60 cm and/or at most 100 cm, more preferably at most 90 cm. As it is apparent from Figure 4, each of the steps 2 is oriented horizontally, i.e. with the stepping surfaces extending horizontally. Although the steps 2 rotate about the main axis 1 and/or with the rollers 81, 82 about their centre axis, the horizontal orientation of the steps 2 is maintained.

Preferably, the described mechanism is beneficial in at least one or more of the following: being lightweight, easy to manufacture, space-saving, robust, cost-efficient, intuitive to use. The described step climbing machine is preferably at least one or more of the following: simple

in its design, cost-efficient, intuitive to use, usable without electric energy supply from outside of the machine, arrangeable in narrow spaces.

Figure 5 shows a second embodiment of the stair climbing machine with an alternative stepping mechanism, in a side view when viewed from the left side (in negative y-direction). In other words, Figure 5 shows the stair climbing machine according to the second embodiment in the same view as Figure 2 shows the first embodiment of the stair climbing machine.

In Figure 5, optional covers of the housing 10 are removed. The left side (first side) of the stepping mechanism thus visible while the right side (second side) is hidden behind the first roller 81.

With reference to Figure 5, only differences of the alternative embodiment when compared to the embodiment of Figure 1 to 4 are addressed. The remaining components and connections, which are not discussed with reference to the second embodiment of Figure 5, may be similar or identical to the respective components in the first embodiment, as discussed with reference to Figures 1 to 4. In other words, components and connections which are not mentioned to be differently arranged, provided or omitted, preferably do not deviate from the embodiment described with reference to Figures 1 to 4.

The main difference of the embodiment shown in Figure 5 to the first embodiment is that the whole drive mechanism of the stepping mechanism can be realized on one side of the stair climbing machine (e.g., the left side). In the second embodiment, the second plurality of rotation elements 52, the second chain 92 and the second stationary element 42 are omitted.

As in the first embodiment, each of the steps 2 is supported in the first roller 81 and in the second roller 82. However, none of the steps 2 requires a rotation element 5 on the side of the second roller 82 (the second side or right side not shown in Figure 5), since all of the steps are provided with a rotation element 5 on the side of the first roller 81 (the first side or left side, as shown in Figure 5). Stated differently, in the embodiment of Figure 5, all steps 2 are comprised in the first plurality of steps and are provided with a rotation element 5 of the first plurality of rotation elements. The second plurality of rotation elements and/or steps preferably is omitted. Consequently, it may be sufficient to provide a single stationary element 4, preferably on the first side of the stair climbing machine. A second stationary element may be omitted.

In the second embodiment, each of the steps 2 is non-rotationally fixed to a rotation element 5 of the first plurality of rotation elements (for example, six rotation elements 5 may be provided, one for each of the six steps 2). A first torque-transmitting connection is provided, which connects all rotation elements 5 to the stationary element 4. The first torque transmitting connection is configured to transfer a torque from each of the rotation elements 5 to the stationary element 4. The first torque transmitting connection may be provided by one or two (or more) transmission elements, e.g. two chains 9, 99 (see Figure 5).

According to the arrangement shown in Figure 5, each of the (e.g., six) rotation elements 5 are coupled to one another via a first chain 9. This is, a torque which is introduced in one of the rotation elements 5 gets transferred to the remaining rotation elements 5. One of the steps 2, i.e., step 203 comprises a rotation element 500 from where torque is transferred to the stationary element 4.

The rotation element 500 may be provided by one of the rotation elements 5 (e.g., a wider rotation element 5 may be used) or by a further rotation element (e.g., a further gear, e.g., pinion) that is non-rotationally fixed to one of the steps 2 (e.g., in the same way as the rotation element 5 of the first plurality of rotation elements and/or coaxially to the rotation element 5 of the first plurality of rotation elements). For example, in Figure 5, the rotation element 5 is hidden behind a further rotation element 500 which is mounted to step 203.

The rotation element 500 coupled to step 203 is rotatable together with the step 203 relative to the first roller 81.

The rotation element 500 may be coupled to the stationary element 4 via a further chain 99.

In this manner, a torque-transmitting connection of each of the rotation elements 5 to the stationary element 4 is provided. Stated differently, each of the rotation elements 5 is coupled to the stationary element 4 to maintain its orientation relative to the stationary element 4 independently form the rotational angle of the first roller 81.

In other words, the invention may be described as follows with reference to the Figures:

This sports appliance is constructed to run without electric supply. The weight of the user should move the steps, and the level of difficulty by which the steps are moved can be adjusted by a hydraulic pump. This appliance has six steps (2), that turn around their axles (3), and altogether through the reel (8) around the main axle (1) while staying in a horizontal

position (figure 1 and 2). The case (10) in the inner central part has an axle (1), fixed with bolts (15) from the outside so that it does not turn, on which the reel (8) turns on bearings (7) (figure 4). The right side of the reel (8) can be separated by unscrewing the bolts (28) for the purpose of the assembly of the appliance. On the left and the right side of the axle (1) between the reel (8) and the case (10) are fixed chainrings (4) that do not turn. The left and the right side of the reel (8) have holes close around the line of their diameter where six bearings (13) are embedded symmetrically in the shape of a hexagon. These bearings (13) are fastened on the outer side of the reel (8) on their own case (19) by bolts (14). The steps (2) are installed on the bearings (13) by their axles (3) that spread through those bearings (13) to the outer side of the reel (8) and fastened with bolts (27). Each step (2), on the axle (3) outside of the reel (8) has on one side a fixed chainring (5). These chainrings (5) are fixed in the following manner, counting from the top (figure 1 and 2), on the left side the first, the third, and the fourth step, while on the right side on the second, fifth, and sixth step. The steps (2) are fixed on the reel (8) to be turned together with the chainrings (5) on the bearings (13) (figure 1 and 4). One chain (9) on the left side of the reel (8) is connected to the three chainrings (5) on that side and the fixed chainring (4) (figure 1), and on the right side the other chain (9) is connected to the remaining 3 chainrings (5) and the fixed chainring (4) (figure 3), which makes all steps connected on a horizontal plane by chains that turn together with the reel(8) around the fixed chainrings (4). The chains are tightened by chainrings (31) that turn on bearings, fixed in their own channels (12) between the chainrings (4 and 5). All chainrings have the same diameter. On the bottom of the case (10) a jagged hydraulic pump (16) is mounted with bolts (29) and serves the purpose of controlling the speed at which the steps turn (figure 1 and 2). The pump has a pulley (6) that is connected with a belt (24) to the pulley (25) that is fixed on the reel (8). This pump works in such a way that by moving the steps the belt activates the pump that has a closed system pipe (18) filled with oil. The pipe (18) is stretched from the pump to the handle (20) where it has a valve (17) and turns again in the pump. When the valve (17) is closed the pump blocks the steps. With a gradual opening of the valve (17) we can set the speed of the steps to be moved by the weight of the user, at a desired level. A spring stretcher (30) keeps the belt (24) tight at all times. The height of the handle (22) can be adjusted by a telescopic carrier (19) using bolts (23), that can be screwed or unscrewed by bolts (21). The handles possess a universal carrier of phones and tablets (11). The case has four legs (26).

Claims

1. A stair climbing machine comprising:

a housing;

a first roller arranged in the housing, the first roller being rotatably about a center axis with respect to the housing;

a resistance mechanism;

a stationary element that is not rotatable with respect to the housing, wherein the stationary element is disposed on the center axis;

a first plurality of rotation elements being rotatably supported in the first roller; and

a first plurality of steps, each of the first plurality of steps being fixed to a respective one of the first plurality of rotation elements; wherein

each rotation element of the first plurality of rotation elements is arranged on the first roller at the same distance from the center axis, and

each of the first plurality of rotation elements is mechanically coupled to the stationary element via a first torque-transmitting connection.

2. The stair climbing machine according to claim 1, wherein the rotation elements of the first plurality of rotation elements are equidistantly disposed at the first roller and/or wherein the first roller is rotationally symmetric.

3. The stair climbing machine according to claim 1 or 2, further comprising:

a second plurality of rotation elements being rotatably supported in the first roller or in a second roller, wherein the second roller is fixedly coupled to the first roller; and

a second plurality of steps, each of the second plurality of steps being fixed to a respective one of the second plurality of rotation elements; wherein

each rotation element of the second plurality of rotation elements is arranged on the first or second roller at the same distance from the center axis, and

each of the second plurality of rotation elements is mechanically coupled to the stationary element via a second torque-transmitting connection.

4. The stair climbing machine according to any one of the preceding claims, further comprising a third torque-transmitting connection configured to couple the first roller to the resistance mechanism.

5. The stair climbing machine according to any one of the preceding claims, wherein the first and/or second torque-transmitting connection ensures that each of the respective first and/or second plurality of rotation elements rotates with identical angular velocity.

6. The stair climbing machine according to any one of the preceding claims, wherein the first and/or second torque-transmitting connection ensures that each of the respective first and/or second plurality of rotation elements maintains its orientation with respect to the housing, preferably that each of the respective first and/or second plurality of steps maintains its orientation with respect to the housing, more preferably when the first roller is rotated.

7. The stair climbing machine according to any one of the preceding claims, wherein the rotation elements of the first and/or second plurality of rotation elements and preferably the stationary element are one of a pinion, a pulley or a gear.

8. The stair climbing machine according to claim 7, wherein the stationary element and each of the first and/or second plurality of rotation elements have the same diameter.

9. The stair climbing machine according to any one of the preceding claims, wherein the first torque-transmitting connection is achieved by one of the following:

the rotation elements of the first plurality of rotation elements are mechanically coupled to each other via a first transmission element and at least one of the first plurality of rotation elements is coupled to the stationary element via a second transmission element;

the rotation elements of the first plurality of rotation elements are mechanically coupled to each other and to the stationary element via a first transmission element; or

each rotation element of the first plurality of rotation elements is mechanically coupled to the stationary element, either directly or via a first transmission element.

10. The stair climbing machine according to any one of the preceding claims, wherein the second torque-transmitting connection is achieved by one of the following:

the rotation elements of the second plurality of rotation elements are mechanically coupled to each other via a third transmission element and at least one of the second plurality of rotation elements is coupled to the stationary element via a fourth transmission element;

the rotation elements of the second plurality of rotation elements are mechanically coupled to each other and to the stationary element via a third transmission element; or

each rotation element of the second plurality of rotation elements is mechanically coupled to the stationary element, either directly or via a third transmission element.

11. The stair climbing machine according to claim 9 or 10, wherein the first, the second, the third and/or the fourth transmission element is one of a chain, a belt or a gear.

12. The stair climbing machine according to any one of claims 9 to 11, wherein

the rotation elements of the first and/or second plurality of rotation elements are pinions and the first, second, third and/or fourth transmission elements are chains, or; wherein

the rotation elements of the first and/or second plurality of rotation elements are pulleys and the first, second, third and/or fourth transmission elements are belts, or; wherein

the rotation elements of the first and/or second plurality of rotation elements and the first, second, third and/or fourth transmission elements are one or more gears.

13. The stair climbing machine according to any one of the preceding claims, wherein the first and/or second plurality of rotation elements is rotatably supported at eccentric positions in the respective first and/or second roller.

14. The stair climbing machine according to any one of the preceding claims, wherein the resistance mechanism is a deceleration system configured to slow down rotational speed of the first and/or second roller.

15. The stair climbing machine according to any one of the preceding claims, wherein the resistance mechanism is one or a combination of a brake, such as a mechanic brake, a hydraulic brake, a dynamic brake, a hydrodynamic brake or a hydraulic pump.

16. The stair climbing machine according to any one of the preceding claims, wherein the third torque-transmitting connection is a mechanical or an electrical coupling, and preferably wherein the third torque-transmitting connection is achieved by one of a belt, a chain or an electric or magnetic field.

17. The stair climbing machine according to any one of the preceding claims, wherein the first and/or second roller is a carrier configured to rotatably support the respective first and/or second plurality of rotation elements, preferably at a predefined distance to the center axis, preferably wherein the first and/or second roller is a disc.

18. The stair climbing machine according to any one of the preceding claims, further comprising one or more supports extending from the housing, preferably one or more telescopic support extensions, the one or more support extensions supporting or comprising one or more handles, wherein at least one of the one or more handles preferably comprises a controller for adjusting a resistance of the resistance mechanism.

19. The stair climbing machine according to any one of the preceding claims, further comprising one or more chain or belt tensioners.

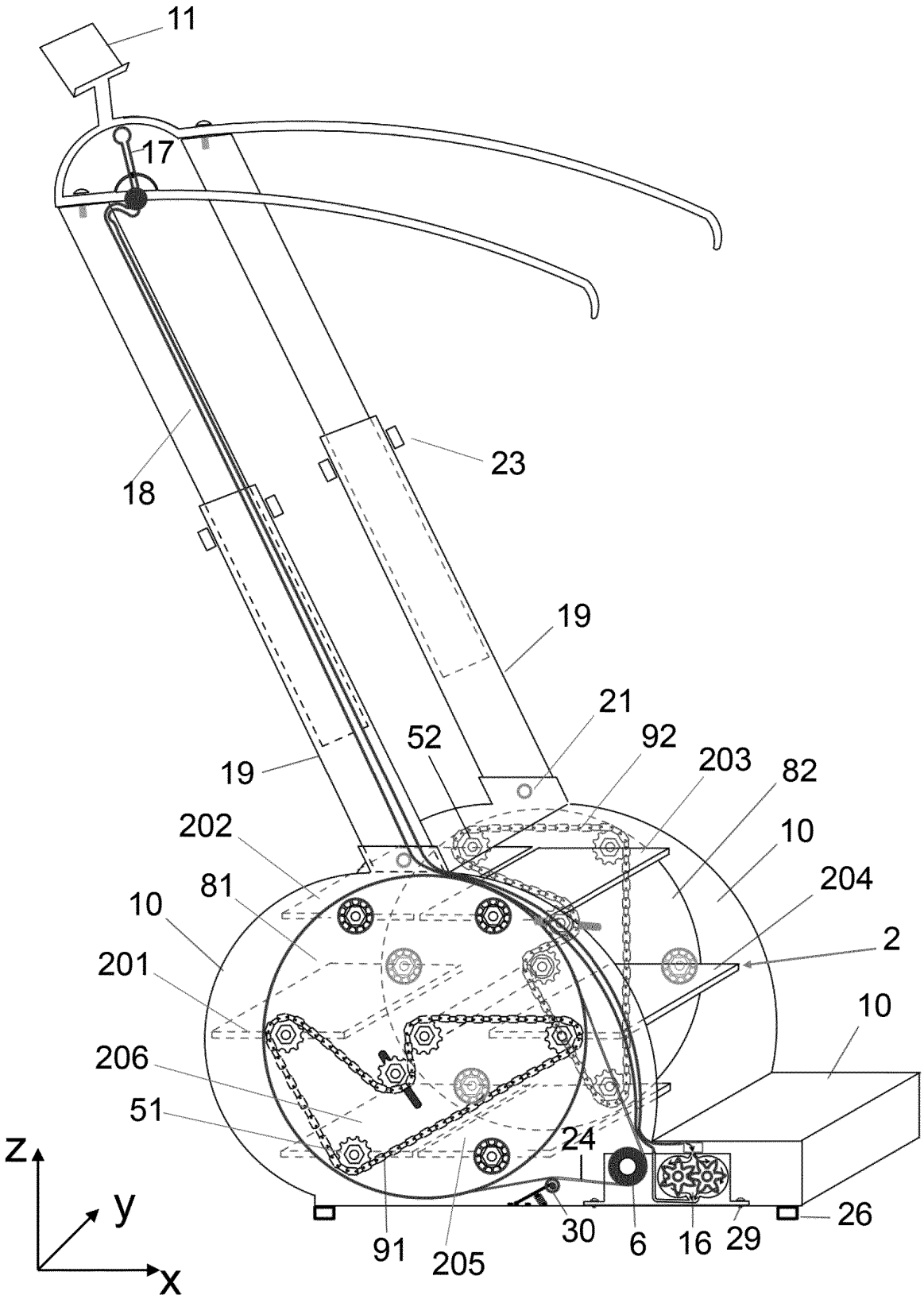
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FIG. 1

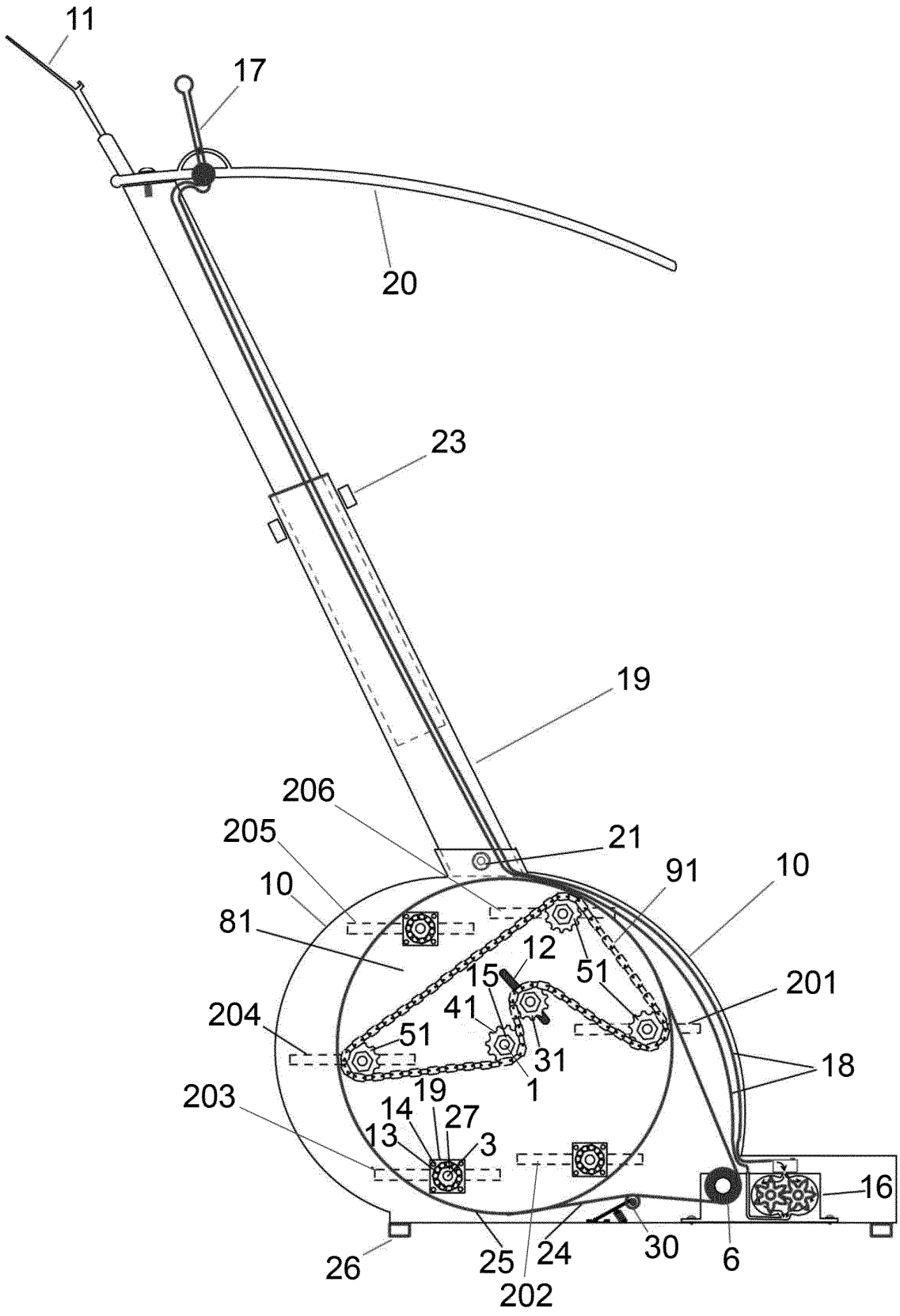
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FIG. 2

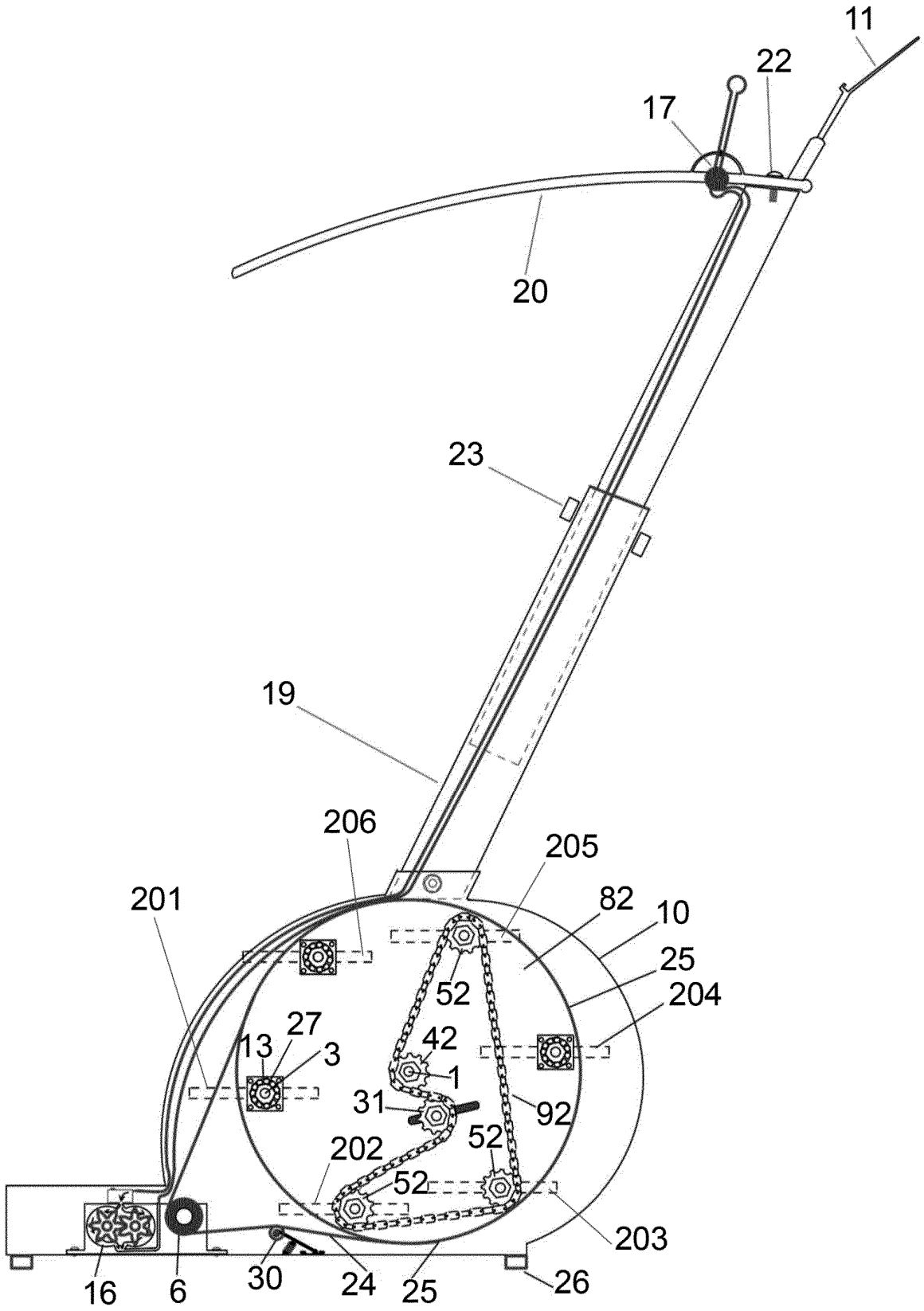
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FIG. 3

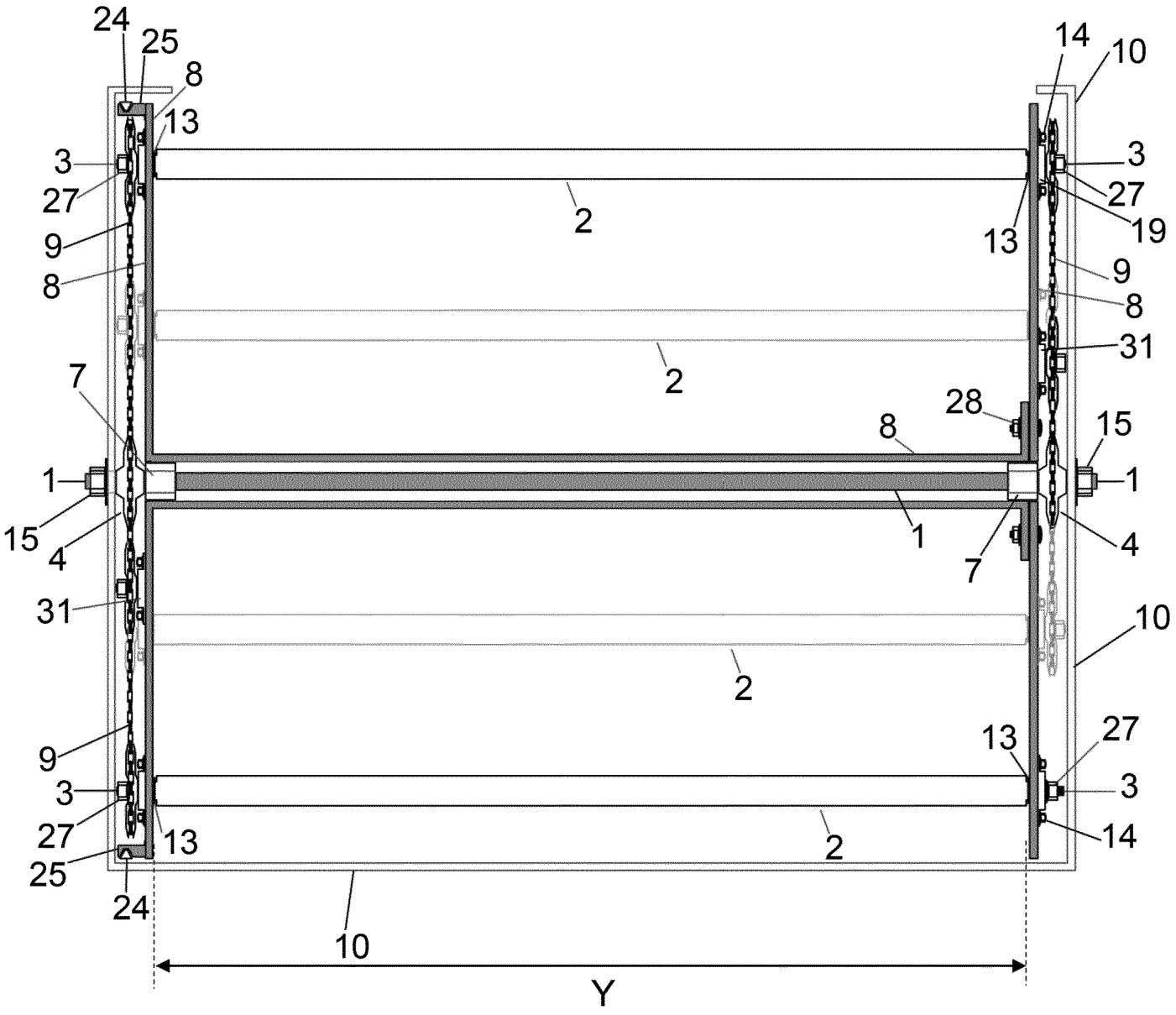
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FIG. 4

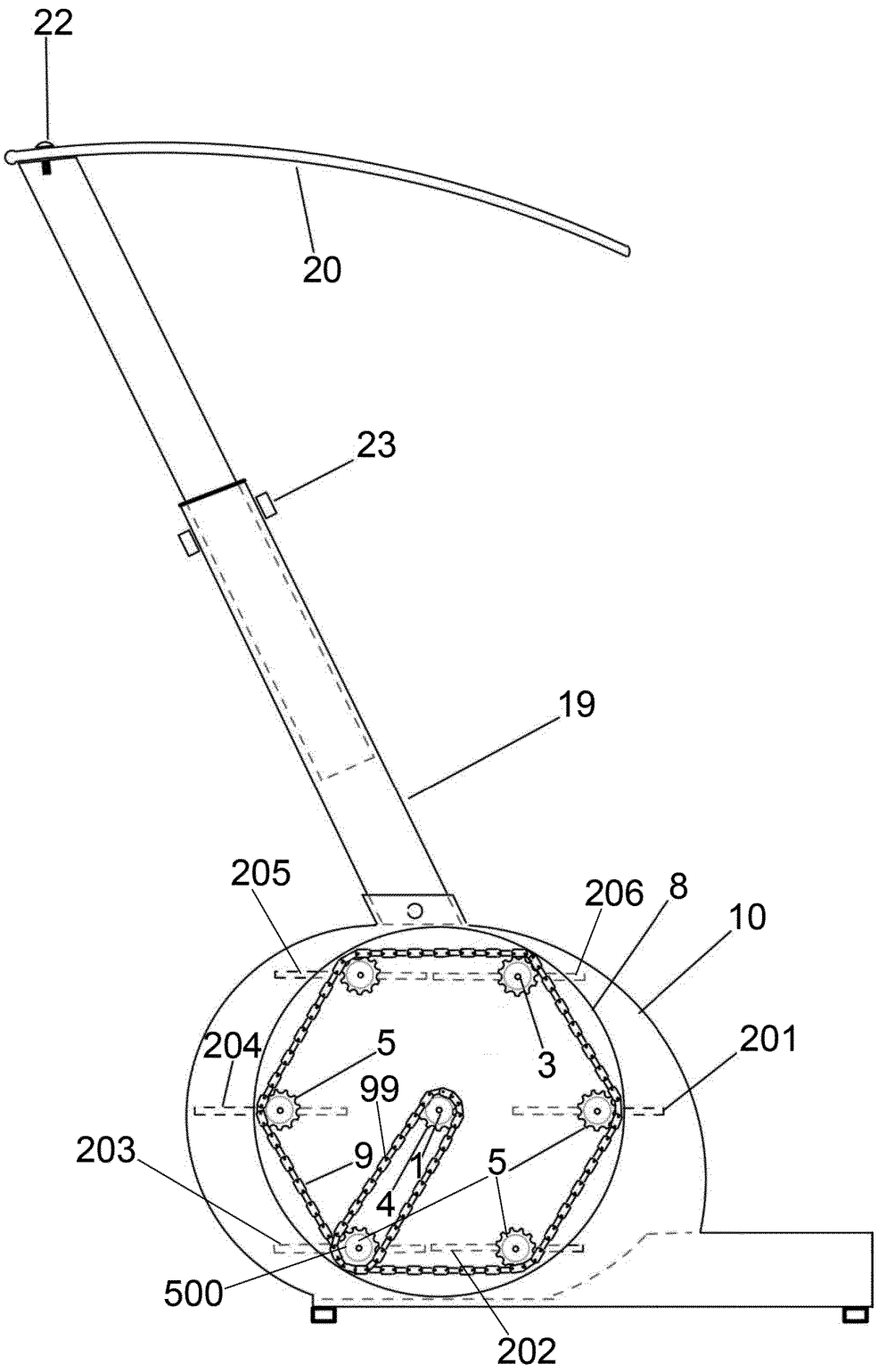

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/050405

A. CLASSIFICATION OF SUBJECT MATTER
INV. A63B22/04 A63B21/005 A63B21/00 A63B21/008 B62M3/04
ADD. A63B24/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A63B B62M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7 520 196 B2 (STALLARD GREGORY K [US]) 21 April 2009 (2009-04-21) paragraph [0005] paragraph [0015] - paragraph [0017] -----	1-19
X	US 2021/163095 A1 (SCHMIDT DAVID [AT]) 3 June 2021 (2021-06-03) paragraph [0025] paragraph [0031] paragraph [0035] claim 1 -----	1-19

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

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 February 2024	29/02/2024

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

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2024/050405

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7520196 B2	21-04-2009	NONE	
US 2021163095 A1	03-06-2021	CN 112437737 A	02-03-2021
		DE 202018003342 U1	29-10-2018
		EP 3823888 A1	26-05-2021
		JP 2022502314 A	11-01-2022
		US 2021163095 A1	03-06-2021
		WO 2020015852 A1	23-01-2020