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(54) **MUSCLE TRAINING DEVICE, TRAINING DEVICE PULLER AND TRAINING SET**

MUSKELTRAININGSVORRICHTUNG, TRAININGSVORRICHTUNGSZIEHER UND TRAININGSSET

DISPOSITIF D’ENTRAÎNEMENT MUSCULAIRE, EXTRACTEUR DE DISPOSITIF D’ENTRAÎNEMENT ET ENSEMBLE D’ENTRAÎNEMENT

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(56) References cited:
US-A1- 2003 134 722
US-A1- 2007 161 472
US-A1- 2007 270 293
US-B1- 6 443 877

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Description

Object of the invention

[0001] The present invention falls within the technical field of gymnastic apparatus for developing or strengthening the muscles of the body by overcoming resistances, more specifically those using elastic resistant devices anchored to a fixed structure and refers in particular to a muscle training device, as disclosed in claim1, especially conceived for use in domestic environments, although not limited to such application. The invention also refers to a puller, as disclosed in claim 7, for a training device and to a training set, as disclosed in claim 9, comprising the device and the puller.

[0002] The muscle training device of the invention presents a resistance based on elastic bands instead of weights and comprises a structure anchorable to a wall which allows the realization of linear displacements in the Cartesian axes X and Y, and additionally allows rotations in the Y axis.

Background of the invention

[0003] In the technical field of gymnastic apparatus for muscle development there are devices, generically known as weight training racks, which allow a wide variety of strength and power exercises to be performed.

[0004] As a first example of the present prior art, patent document publication number US7632221B relates to a weight training device having a plurality of stations that allow the user to perform a wide range of exercises targeting different muscle groups. Variable resistance is provided by a pair of weight stacks having cables leading to the various dumbbell locations. In this device the mechanical interface between the structure and the extensor tubes is fixed and therefore does not allow a displacement of the extensor tubes longitudinally through the structure. Furthermore, the resistance is exerted by stacked, user-selectable weights.

[0005] US Patent US10532239B1 describes an exercise apparatus comprising a triangular prism-shaped frame with an upper and lower bar on which clamps and pulleys are attached. The clamps allow the pulleys to be attached to the frames, allowing the pulleys to be independently distributed along guides. However, once placed in the desired location, the pulleys are fixed to the structure and are not allowed to move in two orthogonal directions of the pulleys, and independently, so that two degrees of freedom for the movement of the pulleys cannot be obtained.

[0006] These weight training racks are part of the usual equipment of gyms, but there are also known devices of smaller dimensions that allow their installation and use in domestic environments. This reduction in size also implies greater structural simplicity, which limits the variety of exercises that can be performed and the efforts they can withstand.

[0007] The patent with publication number US7654946B1 consists of a muscular exercise apparatus that has a series of independent handles. All the pullers, by means of a set of pulleys fixed to the structure and free connecting different cables, act on a set of weights stacked and selectable by the user. In this machine the end of the cable is anchored directly to the handle and does not resolve the action with a closed cable, passing through the handle. These independent pullers can move on a single axis, which limits the variety of exercises that this machine allows the user to perform.

[0008] Document number US2003134722 discloses a self-spotting system for free weights which enables the constructive use of such free weights without the need for a spotter. Using a free weight holder sliding along a rail, an adjacent free weight support provides and determines the lowermost travel of the associated free weight. In alternative embodiments, a parallelogram design for the free weight holder is set forth as well as a handle system which may optionally incorporate free weights and allow the use of the self-spotting system for single weights in conjunction with weights coupled to the handle system by a line or cable. Additionally, weight bar restraining and locking systems are set forth which provide secure means by which weightlifting bars can be secured into place, lowering the risk of slippage, dropping and the associated injury and damage that may occur when weights slip or fall.

[0009] There is therefore a need for a muscle training device for domestic environments that complies with the following premises:

- The device must allow to develop all the exercises that are performed on the machines installed in gyms, in order to be able to work with all muscle groups and in many different ways.
- The device must be compact to allow its installation without taking up the space of a complete gym, so that it can be installed even in a room of a private home.
- The device must allow a regulation of the load to be overcome during exercise, as occurs in those used in gyms, to facilitate the progression of the user. This load must be sufficient for the user's development to be similar to that obtained in a gymnasium.

[0010] Finally, it is also desirable that the device allows a measurement of the effort made. This feature is not common in weight machines, although it is common in machines such as exercise bikes and is a disadvantage due to the very nature of exercises based on weightlifting, which require constant evolution.

[0011] The weight is not a correct measure of the work, but the energy consumed, that is, the power developed by the user over a period of time. The device must therefore have elements that allow this measurement to be made.

Description of the invention

[0012] The first object of the invention consists of a muscle training device which makes it possible to overcome the aforementioned objections of the present state of the art. For this purpose, the device basically comprises:

- a support structure that can be fixed to a wall, vertical wall or external structure,
- a resistant element, which generates an opposition in reaction to the movement performed by a user during exercise, and
- a closed cable linked to the resistant element and operated by the user by means of pullers.

[0013] The support structure is formed by a plurality of commercial profiles and pulleys and comprises fixed elements and movable elements. By means of the displacement of the movable elements, it allows the location of the pullers in different positions, which in turn allows to perform different exercises for different muscle groups of the user.

[0014] The support structure is designed to serve several purposes:

- Holding of the resistant element, which allows to transfer and concentrate the effort made by the user on the resistant element.
- To support the stress in the direction of the reaction of the resistant element, which in this case is carried out by two central pillars.
- To support the movable elements of the device: On these central pillars, which counteract the effort generated by the resistant element, the movable elements move, which transfer the movement made by the user to the resistant element by means of the closed cable.
- Acting as a support for the pulleys and the closed cable, which connect the user's working points with the resistant element in any position.

[0015] The resistant element consists of a rectangular frame that is anchored to the wall, with two vertical pillars through which a horizontal bar moves. Rubber bands or similar elastic elements are anchored at one end to a lower bar fixed to the frame, and at the opposite end to the horizontal movable bar that moves guided by the vertical pillars. By means of some lugs or other similar system, it is possible to select the number of rubber bands that connect with the mobile bar and, therefore, the effort to be made for the mobile bar to move vertically.

[0016] The replacement of the weights, which are used in most gym machines, could be done by magnetic resistance, resistance to the displacement of a fluid, a pneumatic system, a system of generator and battery that would allow the use of the work done by the user, etc.

[0017] There are several advantages to the option of the rubbers located on a frame:

- The overall weight and size of the device are decisively reduced.
- The rubber band system is simple, economical and easy to maintain and replace consumables.
- The resistance of the bands is progressive and not constant, like the weights, which is less harmful to the user. The vast majority of gym exercises begin with the working muscle at its maximum extension, a position in which injury is easier, and which in this case coincides with the lower resistance of the bands. As the muscle contracts, gaining strength, the bands stretch and increase their resistance.
- The direction of resistance is no longer limited by gravity to the Y-axis, from bottom to top, as the rubbers act the same in whichever direction they are stretched.
- It is much easier to measure the power and thus the energy being developed to move the moving part of the heavy-duty machine than in the case of a set of weights.
- Working with rubber bands is much safer for the user as it avoids entrapment with heavy weights. This feature is decisive for domestic use, where the user will normally exercise individually and without assistance.

[0018] The closed cable has no free ends and is not anchored at any point to the supporting structure, which allows more degrees of freedom of movement for the transmission of stress between the pullers and the resistant element.

[0019] Existing gym machines generally work in two ways:

- Connecting one end of a cable to a stack of weights, while the other end connects to a puller employed by the user, so that a series of pulleys transfer the displacement of the puller to the weights. This situation does not generate any degree of freedom in the position of the puller when executing the exercise.
- Connecting one end of a cable to the weight stack while the other connects to the fixed structure. This second option allows the puller to unhook from the cable and slide along the cable, anchoring itself in any position within this direction to do the job, which is a degree of freedom.

[0020] In this case the cable is closed on itself. At any point along the route taken by the cable, if it is pulled by means of a puller, the resistant element acts, which allows more degrees of freedom in the position of the puller. In order not to limit the degrees of freedom generated by the structure, the puller must be able to act on the closed cable at any position and angle of pull, the closed cable being through the puller assembly. The handle must also be able to move along the cable axis.

[0021] Therefore, the structure with two or more degrees of freedom and the pullers are interrelated and necessary products for the operation of the machine, although independent, with the same purpose: the flexibility in the position of the pullers to be able to perform all the gymnastic exercises. It could be developed another realization of structure with other degrees of freedom and the same puller or this structure could have another solution for a puller while allowing to act with a closed cable in any position.

[0022] The resulting device is compact in its folded arrangement, and allows for private use, as it can be installed in the room of a home, occupying only part of the available space.

[0023] The device also includes measuring elements that allow the determination of the power exerted by the user during the traction exercises on the elastic bands of the resistant element.

[0024] In the preferred embodiment of the device, these measuring elements comprise sensors that detect the stress performed by the user during exercise, which are linked to an external controller element for storage, processing and remote sending of the information collected. This allows remote monitoring and analysis of the activity performed, either by the user himself or by an expert, trainer or similar.

[0025] It is also envisaged that the device incorporates integrated video cameras that allow the recording of the exercise for analysis and correction, if necessary.

[0026] It is also foreseen that the device includes a display or interface element, integrated or removable, as a portable touch screen that allows the analysis of the results obtained in training sessions over time, compatible with access from the user's mobile device via an app.

[0027] On the other hand, this interface, with the help of the video cameras, can allow access to a training database according to the objective (general maintenance, of a muscle group, focused on a sport, etc.), classes directed remotely in real time, group classes, consultations with experts (training monitors, nutritionists, physiotherapists, doctors, etc.), competitions between all or certain users, access to the device's spare parts shop, etc.

[0028] The goal is to create a platform for users of these devices in which all third-party services that are provided by a high-level gym, which feeds back and grows with the number of users.

Description of the drawings

[0029] To complement the description being made and in order to assist in a better understanding of the features of the invention, in accordance with a preferred example of a practical embodiment thereof, there is attached as an integral part of said description a set of drawings in which, by way of illustration and not limitation, the following has been depicted:

Figure 1.- Shows a perspective view of the muscle training device, in which some of its main constituent elements can be seen.

Figure 2.- Shows a view of the support structure of the device.

Figure 3.- Shows a second view of the device.

Figure 4.- Shows a detail view of the carriage and puller.

Figure 5.- Shows an exploded view of the puller.

Figure 6.- Shows a partial view of the device.

Figure 7.- Shows a partial view of the resistant element of the device.

Figure 8.- Shows a sequence of action of the resistant element of the device.

Preferred embodiment of the invention

[0030] There follows, with the aid of the figures referred to above, a detailed explanation of an example of a preferred embodiment of the object of the present invention.

[0031] The described muscle training device, shown in figure 1, basically consists of a support structure (1) and a resistant element (2), linked to the support structure (1) by means of a closed cable (3). A user can operate the resistant element (2) by means of pullers (4). The resistant element (2) offers a resistance to the displacement performed by the user by means of the pullers (4), which allows to develop a muscular exercise.

[0032] The support structure (1) comprises static elements, which can be fixed to an external fixed structure, wall or vertical wall, and dynamic elements, which allow the position of the pullers (4) to be changed.

[0033] The external fixed structure could be included in a compartment or cabinet to standardize the sizes of the equipment and improve the aesthetics of the whole. The static elements of the support structure (1) are central pillars (5) with vertical orientation (Y axis), and lateral pillars (6), parallel to the central pillars (5). In order to provide the central pillars (5) with additional mechanical resistance, they are anchored to the external fixed structure by means of intermediate plates (7) along their development, and end plates (8) at their upper and lower ends.

[0034] The dynamic elements of the support structure (1) comprise two drive arms (9) movable along the central pillars (5), two corresponding slides (10) movable along the side pillars (6), and two corresponding carriages (11) movable along each of the arms (9), to which the pullers (4) are attached and through which the user performs the exercise.

[0035] As can be seen in the attached figures, in this preferred embodiment, each of the arms (9) is made up of profiles joined together at their ends to form a rectangle. Each arm (9) has an outer end (12), linked to the slides (10), and an inner end (13), linked to the central pillars (5).

[0036] The outer end (12) allows the slides (10) to be anchored to the arm (9) by means of a coupling element, which in this case is a pin.

[0037] The profile of the inner end (13) acts as a sleeve for the arm (9) on its central pillar (5). With the outer end (12) anchored to the slide (10), the Y-axis (vertical) displacement of the arm (9) is allowed, so that it can slide along the central pillars (5) and the lateral pillars (6), as shown in Figure 2. After unclamping the outer end (12) of the arm (9) from the slides (10), the turning or rotating movement on the Y-axis is also allowed, as shown in Figure 3.

[0038] This rotation of the arm (9) in the "Y" axis is limited so that it can only be carried out in the upper and lower extreme positions of the central pillars (5), in order to avoid the risks for the user derived from overhanging work. For this purpose, each of the central pillars (5) incorporates a longitudinally welded plate located at the height at which the aforementioned rotation is to be avoided.

[0039] The inner end (13) of the arm (9) has a non-complete circular section, so it does not encounter any opposition in the vertical displacement in the arrangement in which the slides (10) are coupled, but it does when trying to rotate, as it is prevented by this plate.

[0040] As has just been indicated, the extreme positions of the central pillars (5) do not have this plate and, therefore, the rotation of the arms (9) is allowed so that they can work at 90° to the support structure (1). In this position, the arms (9) would work in a cantilevered position and would therefore have little mechanical resistance, which is why it is necessary to provide them with additional supports.

[0041] Figure 3 shows the two elements designed for this function. In the lower position on the central pillars (5), the arms (9) are attached to the structure of a bench (14), which also expands the exercise possibilities. In the upper position of the arms (9) on the central pillars (5), they can rest on an external reinforcement structure (15).

[0042] In the embodiment shown in the attached figures, the external reinforcement structure (15) is freestanding, but could be part of or supported by the bench (14) or anchored to an upper slab.

[0043] The longitudinal profiles that make up each of the arms (9) serve as guides for the respective carriages (11), allowing the displacement of the pullers (4) along the horizontal axis "X".

[0044] Each puller (4), shown in detail in figures 4-5, comprises in turn a rotating assembly (16) which moves the carriage (11), a free pulley (17) linked to the rotating assembly (16) and a hook (18), which hangs from the free pulley (17) and which in this preferred embodiment is a carabiner, for temporary attachment of handles, knobs, bars and similar elements, to which the user grips in order to operate the puller (4) and thus perform the exercises.

[0045] The rotating assembly (16) allows a 360° rotation of the puller (4), the axis of this rotation coinciding with the generatrix of the closed cable (3) and can be moved along this axis and operate in any position. The rotating assembly (16) comprises a part attached to the carriage (11), consisting of two L-shaped elements (33) with a threaded side that is anchored to the carriage (11) and an upper bushing through which the closed cable (3) runs.

[0046] The rotating assembly (16) is completed by two side bushings (19) which act as a sleeve for the L-shaped elements (33) and which are attached to two internal pulleys (21), fixed to support plates (22) which close and cover the rotating assembly (16). The internal pulleys (21) guide the closed cable (3) towards the free pulley (17) at all times by means of a 360° rotation.

[0047] The closed cable (3), guided by an inner bush of the L-element (33) which is jacketed by the corresponding side bush (19), passes towards its corresponding internal pulley (21) and towards the free pulley (17) to return towards the other internal pulley (21) and pass through the other inner bush of the L-element (33), itself jacketed by the side bush (19).

[0048] Along the travel, there are a series of bushings (20), which rotate freely on an internal axis attached to the support plate (22), which help to guide the closed cable (3). Figure 5 shows the exploded view of the rotating assembly (16). The L-shaped elements (33) guide the closed cable (3) and anchor the puller (4) to the carriage (11).

[0049] Therefore, the dynamic elements of the support structure (1) allow the three movements initially mentioned:

- Each of the arms (9) can move independently in the "Y" axis;
- Each of the carriages (11) allows a displacement in the "X" axis; and
- Each one of the arms (9), in its uncoupled arrangement from the lateral pillars (6) and the slides (10), allows 360° turns on the "Y" axis, in the upper and lower extreme positions of the arm (9) stroke.

[0050] The closed cable (3) passes through a plurality of fixed pulleys (23), linked to the support structure (1) and, in any position permitted by the dynamic elements of the support structure (1), transfers the user's effort to the resistant element (2) during the exercise.

[0051] It is important to mention at this point that the closed cable (3) is not anchored to the support structure (1) which, as explained above, contributes to a greater number of degrees of freedom, although it makes it necessary to develop a puller (4) with the characteristics of the one included in this preferred embodiment.

[0052] The purpose of the fixed pulleys (23) is to follow the movements of the dynamic elements of the supporting structure (1) without the cable (3) losing tension, so that the transmission of force is effective in any position.

[0053] In the preferred embodiment shown in the attached figures, each of the arms (9) has four fixed pulleys (23), two at the inner end (13) and two at the outer end (12). The upper end plate (8) has six, the lower end plate (8) has two, each of the carriages (11) has three and lastly, the resistant element (2) has an additional fixed pulley (23).

[0054] With this arrangement, the closed cable (3), coming from the fixed pulleys (23) of the upper end plate (8), travels the following path on the arm (9): upper fixed pulley (23) of the inner end (13), upper fixed pulley (23) of the outer end (12), lower fixed pulley (23) of the outer end (12), fixed pulleys (23) of the carriage (11) and lower fixed pulley (23) of the inner end (13), to thus connect with the two fixed pulleys (23) located on the lower end plate (8).

[0055] From said fixed pulleys (23) of the lower end plate (8), the closed cable (3) connects with the opposite arm (9), making the reverse route to reconnect with the fixed pulleys (23) of the upper end plate (8). These receive the closed cable (3) from the arms (9), guide it and connect it to a hoist (24) consisting of a triple pulley. The hoist (24) shaft is connected to the resistant element (2) by means of a separate connecting cable (25).

[0056] This hoist (24) allows the development of a greater stroke of each puller (4) without having to increase the final size of the device. On the other hand, it is possible to divide the effort that the user makes to lift a resistance, so it is necessary to use more or stiffer resistors.

[0057] Figure 7 shows the resistant element (2) of the device. As can be seen, the resistant element (2) comprises a fixed frame (26), attachable to the external wall or structure and to the lower end plate (8) of the support structure (1), some elastic elements (27), in this case elastic bands, and a mobile frame (31) that moves along the fixed frame (26), driven by the closed cable (3), dragging one end of the elastic elements (27).

[0058] In this preferred embodiment, the fixed frame (26) comprises two vertical columns, and the mobile frame (31) comprises a cross beam that moves along these vertical columns. The mobile frame (31) also includes a housing for the connection cable (25) coming from the hoist (24), and holes (29) for the selective insertion of pins that join the free upper end of the elastic elements (27). Said elastic elements (27) are fixed solidly by their other lower ends to the fixed frame (26) in any case.

[0059] Thus, in order for a user to determine the resistance that the user wishes to overcome during his exercise, he must select, by means of the pins to be anchored in the holes (29), how many elastic elements (27) are attached to the movable frame (31) at its upper end.

[0060] When pulling one or both pullers (4), the hoist (24) rises, as it is the only free pulley in the device. This free pulley is to be understood as a pulley that has an allowed relative movement. This movement causes the mobile frame (31) of the resistant element (2) to ascend, activating the resistance for the user to develop the muscular exercise.

[0061] The device also incorporates at least one load cell (30) to traction, linked to the elastic elements (27), which allows to know the instantaneous power exerted during the development of the traction exercise of the elastic elements (27). The measurement of this power over time thus makes it possible to know the energy developed by the user.

[0062] As can be seen in the attached figures, the load cell (30) is preferably located between a lower profile of the fixed frame (26), and a profile which is solidary to all the fastening elements, and each of these fastening elements is solidary to one of the elastic elements (27) at its lower end.

[0063] It is contemplated the possibility of incorporating in the device a control unit, linked to the traction load cell (30), and equipped with display elements such as a screen or similar, for reading, storing, processing, sending and displaying the information collected by said load cell (30).

Claims

1. Muscle training device comprising:

- a support structure (1), consisting of:
    - static elements, attachable to an external fixed structure, and
    - dynamic elements,
- at least one puller (4) that can be moved and operated by a user;
- a resistant element (2) linked to the support structure (1), which exerts a resistance to at least one puller (4) for the performance of a muscular exercise;
- fixed pulleys (23) linked to the support structure (1);
- a hoist (24) linked to the support structure (1) and the resistant element (2); and
- a closed cable (3), without free ends and not anchored to the support structure (1), linked to the resistant element (2) and to the supporting structure (1) through the fixed pulleys (23) and the hoist (24) and operable by means of at least one puller (4), such as to allow at least two degrees of freedom of displacement and/or rotation in the puller (4);

the device being **characterised in that**:

- the static elements comprise two vertical central pillars (5), and two lateral pillars (6), parallel

to the central pillars (5); and
- the dynamic elements comprise:

  - at least one drive arm (9) simultaneously movable along one central pillar (5) and one lateral pillar (6);
  - at least one carriage (11) movable along each arm (9), to which at least one puller (4) is attached; and
  - a slide (10) linked to the at least one drive arm (9) and the corresponding lateral pillar (6), so that the at least one drive arm (9) can slide along the corresponding central pillar (5) and the corresponding lateral pillar (6).

2. Muscle training device according to claim 1 wherein each arm (9) comprises:

- an outer end (12), linked to the corresponding carriage (11) by a coupling element, which can be uncoupled from the carriage (11), and
- an inner end (13), linked to the corresponding central pillar (5), which allows the arm (9) to slide along the central pillar (5),

such that the inner end (13) allows rotation of the arm (9) on the axis of the central pillar (5) after disengagement of the outer end (12) from the corresponding carriage (11).

3. Muscle training device according to any one of the preceding claims wherein the central pillars (5) of the support structure (1) additionally comprise:

- intermediate plates (7), fixed along its development, and
- end plates (8) fixed at their upper and lower ends,

for reinforcement of the connection with the external fixed structure and improvement of the structural strength of the device.

4. Muscle training device according to any one of the preceding claims, wherein the resistant element (2) comprises:

- a fixed frame (26), attachable to the external structure and to the support structure (1);
- elastic elements (27), fixed at one end to the fixed frame (26); and
- an upper profile (31) that moves along the fixed frame (26), driven by the closed cable (3), pulling the other end of the elastic elements (27).

5. Muscle training device according to claim 4, which further incorporates at least one traction load cell (30), linked to the elastic elements (27), for determining the instantaneous power exerted during the traction exercise of the elastic elements (27).

6. Muscle training device according to claim 5, which further incorporates a control unit, linked to the load cell (30) and provided with display elements, for reading, storing, processing, sending and displaying the information collected by the at least one load cell (30).

7. Puller (4) for muscle training device according to claim 1, wherein the device comprises at least one closed cable (3), being the puller (4) **characterised in that** it comprises:

- a rotating assembly (16) which rotates and moves along coinciding with the axis of the generatrix of the closed cable (3);
- a free pulley (17) linked to the rotating assembly (16); and
- a hook (18), which hangs from the free pulley (17), for temporary attachment of a user's grip element;

such that the rotating assembly (16) allows a 360° rotation of the puller (4), the axis of this rotation coinciding with a longitudinal axis of the cable (3).

8. Puller (4) according to claim 7 wherein the rotating assembly (16) comprises:

- two L-shaped elements (33), which allow guiding the cable (3) closed and anchoring the assembly (16) to an element;
- two upper bushings (19) which can rotate on the L-shaped elements (33);
- support plates (22) for closing, covering and supporting the upper bushings (19); and
- internal pulleys (21) and internal bushes (20) fixed to the support plates (22) for guiding the cable (3) towards the free pulley (17).

9. Muscle training set comprising:

- a muscle training device according to any one of claims 1 to 6; and
- at least one puller (4) according to any one of claims 7-8;

the set being **characterised in that**:

  - the closed cable (3), without free ends, runs through the puller (4) and is pass-through to the puller (4); and
  - the rotating assembly (16) can be anchored to the carriage (11) and the puller (4) is therefore linked to the displacement of the carriage (11),

so that by means of the fixed pulleys (23) and the hoist (24), the puller (4) acts on the resistant element (2) when actuated, and therefore, the action of the puller (4) is possible for any position that the dynamic elements of the structure generate, thanks to its two or more degrees of freedom and for any angle allowed by the rotating assembly (16).

Patentansprüche

1. Muskeltrainingsgerät umfassend:

- eine Tragstruktur (1) bestehend aus:

  - statischen Elementen, die an einer externen festen Struktur befestigt werden können, und
  - dynamischen Elementen,

- mindestens einen Zugelement (4), der von einem Benutzer bewegt und benutzt werden kann,
- ein Widerstandselement (2), das mit der Tragstruktur (1) verbunden ist und einen Widerstand gegen mindestens einen Zugelement (4) für die Ausführung einer Muskelübung ausübt,
- feste Rollen (23), die mit der Tragstruktur (1) verbunden sind,
- eine Hebevorrichtung (24), die mit der Tragstruktur (1) und dem Widerstandselement (2) verbunden ist,
- ein geschlossenes Seil, ohne freie Enden, das nicht an der Tragstruktur (1) verankert ist und das über die festen Rollen (23) und die Hebevorrichtung (24) mit dem Widerstandselement (2) und der Tragstruktur (1) verbunden ist und das - mittels mindestens einem Zugelement (4) betätigt werden kann, so dass mindestens zwei Freiheitsgrade der Verschiebung und/oder Drehung in dem Zugelement (4) möglich sind,

wobei das Gerät **dadurch gekennzeichnet ist, dass**

- die statistischen Elemente zwei vertikale Mittelpfosten (5) und zwei Seitenpfosten (6), die parallel zu den Mittelpfosten (5) angeordnet sind, umfassen,
- die dynamischen Elemente umfassen:

  - mindestens einen Antriebsarm (9), der gleichzeitig entlang eines Mittelpfostens (5) und eines Seitenpfostens (6) bewegbar ist.
  - mindestens einen Schlitten (11), der entlang jedem Arm (9) beweglich ist und an mindestens einem Zugelement (4) befestigt ist,
  - ein Gleitelement (10), das mit mindestens einem Antriebsarm (9) und dem entsprechenden Seitenpfosten (6) verbunden ist, so dass mindestens ein Antriebsarm (9) entlang des entsprechenden Mittelpfostens (5) und des entsprechenden Seitenpfostens (6) gleiten kann.

2. Muskeltrainingsgerät nach Anspruch 1, wobei jeder Arm (9) umfasst:

- ein äußeres Ende (12), das mit dem entsprechenden Schlitten (11) durch ein Kupplungselement verbunden ist, das von dem Schlitten (11) abgekoppelt werden kann,
- ein inneres Ende (13), das mit dem entsprechenden Mittelpfosten (5) verbunden ist und das dem Arm (9) ermöglicht entlang des Mittelpfostens (5) zu gleiten, so dass das innere Ende (13) eine Drehung des Arms (9) um die Achse des Mittelfpfostens (5) nach dem Lösen des äußeren Endes (12) von dem entsprechenden Schlitten (11) ermöglicht.

3. Muskeltrainingsgerät nach einem der vorherigen Ansprüche, wobei die Mittelpfosten (5) der Tragstruktur (1) zusätzlich umfassen:

- Zwischenplatten (7), die entlang ihrer Ausdehnung befestigt sind,
- Endplatten (8), die an ihren oberen und unteren Enden befestigt sind, zur Verstärkung der Verbindung mit der externen festen Struktur und zur Verbesserung der strukturellen Festigkeit der Vorrichtung

4. Muskeltrainingsgerät nach einem der vorherigen Ansprüche, wobei das Widerstandselement (2) umfasst:

- einen festen Rahmen (26), der an der externen Struktur und an der Tragstruktur (1) befestigt werden kann,
- elastische Elemente (27), die an einem Ende des festen Rahmens (26) befestigt sind,
- ein oberes Profil (31), das sich entlang des festen Rahmens (26) bewegt, angetrieben durch das geschlossene Seil, das das andere Ende des elastischen Elements (27) zieht.

5. Muskeltrainingsgerät nach Anspruch 4, das weiter mindestens ein Zugkraftmesszelle (30) aufweist, die mit dem elastischen Element (27) verbunden ist, um die ausgeübte Momentanleistung, während der Zugübung der elastischen Elemente

(27) zu bestimmen.

6. Muskeltrainingsgerät nach Anspruch 5, das weiter eine Steuereinheit aufweist, die mit der Messzelle (30) verbunden ist und mit einem Anzeigeelement, zum Lesen, Speichern, Verarbeiten, Senden und Anzeigen der von der mindestens einen Messzelle (30) erfassten Informationen versehen ist.

7. Zugelement (4) für ein Muskeltrainingsgerät nach Anspruch 1,

wobei das Gerät mindestens ein geschlossenes Seil (3) umfasst, wobei das Zugelement (4) **dadurch gekennzeichnet ist, dass** es umfasst:

- eine Drehvorrichtung (16), die sich dreht und entlang der Achse der Mantellinie des geschlossenen Seils bewegt,
- eine freie Rolle (17), die mit der Drehvorrichtung verbunden ist,
- einen Haken (18), der an der freien Rolle (17) hängt, zum vorübergehenden Befestigen eines Griffelements eines Benutzers,

so, dass die Drehvorrichtung (16) eine 360° Drehung des Zugelements (4) ermöglicht, wobei die Achse dieser Drehung mit einer Längsachse des Seils (3) übereinstimmt.

8. Zugelement (4) nach Anspruch 7, wobei die Drehvorrichtung (16) umfasst:

- zwei L-förmige Elemente (33), die das geschlossenen Führen des Seils (3) und das Verankern der Vorrichtung (16) an einem Element ermöglichen,
- zwei obere Buchsen (19), die auf den L-förmigen Elementen (33) drehen können,
- Stützplatten (22) zum Schließen, Abdecken und Stützen der oberen Buchsen (19),
- interne Rollen (21) und interne Buchsen (20), die an den Stützplatten (22) befestig sind, um das Seil (3) zur freien Rolle (17) zu führen.

9. Muskeltrainingssatz, umfassend:

- ein Muskeltrainingsgerät nach einem der Ansprüche 1-6,
- mindestens ein Zugelement (4) nach einem der Ansprüche 7-8,

wobei der Satz **dadurch gekennzeichnet ist, dass**:

- das geschlossene Seil (3), ohne freie Enden, durch das Zugelement (4) verläuft und zum Zugelement (4) durchgesteckt ist,
- die Drehvorrichtung (16) am Schlitten (11) verankert werden kann und das Zugelement (4) dadurch mit der Verschiebung des Schlittens (11) verbunden ist, so dass mittels der festen Rollen (23) und der Hebevorrichtung (24) das Zugelement (4) bei Betätigung auf das Widerstandelement (2) wirkt und dadurch die Betätigung des Zugelements (4) in jeder Position, die die dynamischen Elemente der Struktur erzeugen, möglich ist, dank seiner zwei oder mehreren Freiheitsgrade und für jeden von der Drehvorrichtung (16) möglichen Winkel.

Revendications

1. Dispositif d'entraînement musculaire comprenant :

- une structure de support (1), constituée :
- d'éléments statiques, pouvant être fixés à une structure fixe externe, et
- d'éléments dynamiques,
- d'au moins un appareil de traction (4) qui peut être déplacé et actionné par un utilisateur ;
- d'un élément de résistance (2) relié à la structure de support (1), qui exerce une résistance sur au moins un appareil de traction (4) pour la réalisation d'un exercice musculaire ;
- de poulies fixes (23) reliées à la structure de support (1) ;
- d'un appareil de levage (24) relié à la structure de support (1) et à l'élément de résistance (2) ; et
- d'un câble fermé (3), sans extrémités libres et non ancré à la structure de support (1), relié à l'élément de résistance (2) et à la structure de support (1) par l'intermédiaire des poulies fixes (23) et de l'appareil de levage (24) et pouvant être actionné au moyen d'au moins un appareil de traction (4), de manière à permettre au moins deux degrés de liberté de déplacement et/ou de rotation dans l'appareil de traction (4) ;

le dispositif étant **caractérisé en ce que** :

- les éléments statiques comprennent deux montants centraux verticaux (5), et deux montants latéraux (6), parallèles aux montants centraux (5) ; et
- les éléments dynamiques comprennent :
- au moins un bras d'entraînement (9) mobile simultanément le long d'un montant central (5) et d'un montant latéral (6) ;
- au moins un chariot (11) mobile le long de chaque bras (9), auquel est fixé au moins un appareil de traction (4) ; et
- un coulisseau (10) relié à l'au moins un bras d'entraînement (9) et au montant latéral (6) correspondant, de sorte que l'au moins un bras

d'entraînement (9) puisse coulisser le long du montant central (5) correspondant et du montant latéral (6) correspondant.

2. Dispositif d'entraînement musculaire selon la revendication 1 dans lequel chaque bras (9) comprend :

- une extrémité extérieure (12), reliée au chariot (11) correspondant par un élément d'accouplement, qui peut être découplé du chariot (11), et
- une extrémité interne (13), reliée au montant central (5) correspondant, qui permet au bras (9) de coulisser le long du montant central (5),

de sorte que l'extrémité interne (13) permette la rotation du bras (9) sur l'axe du montant central (5) après désengagement de l'extrémité externe (12) du chariot (11) correspondant.

3. Dispositif d'entraînement musculaire selon l'une quelconque des revendications précédentes dans lequel les piliers centraux (5) de la structure de support (1) comprennent en outre :

- des plaques intermédiaires (7), fixées le long de son développement, et
- des plaques d'extrémité (8) fixées au niveau de leurs extrémités supérieure et inférieure,

pour le renforcement du raccordement avec la structure fixe externe et l'amélioration de la résistance structurale du dispositif.

4. Dispositif d'entraînement musculaire selon l'une quelconque des revendications précédentes, dans lequel l'élément de résistance (2) comprend :

- un châssis fixe (26), pouvant être fixé à la structure externe et à la structure de support (1) ;
- des éléments élastiques (27), fixés au niveau d'une extrémité au cadre fixe (26) ; et
- un profilé supérieur (31) qui se déplace le long du cadre fixe (26), entraîné par le câble fermé (3), tirant l'autre extrémité des éléments élastiques (27).

5. Dispositif d'entraînement musculaire selon la revendication 4, qui incorpore en outre au moins une cellule de charge de traction (30), reliée aux éléments élastiques (27), afin de déterminer la puissance instantanée exercée lors de l'exercice de traction des éléments élastiques (27).

6. Dispositif d'entraînement musculaire selon la revendication 5, qui incorpore en outre une unité de commande, reliée à la cellule de charge (30) et dotée d'éléments d'affichage, pour la lecture, le stockage, le traitement, l'envoi et l'affichage des informations collectées par l'au moins une cellule de charge (30).

7. Appareil de traction (4) pour un dispositif d'entraînement musculaire selon la revendication 1, dans lequel le dispositif comprend au moins un câble fermé (3), l'appareil de traction (4) étant **caractérisé en ce qu'**il comprend :

- un ensemble rotatif (16) qui tourne et se déplace de manière à coïncider avec l'axe de la génératrice du câble fermé (3) ;
- une poulie libre (17) reliée à l'ensemble rotatif (16) ; et
- un crochet (18), qui est suspendu à la poulie libre (17), pour la fixation temporaire d'un élément de préhension d'un utilisateur ;

de sorte que l'ensemble rotatif (16) permette une rotation de 360° de l'appareil de traction (4), l'axe de cette rotation coïncidant avec un axe longitudinal du câble (3).

8. Appareil de traction (4) selon la revendication 7 dans lequel l'ensemble rotatif (16) comprend :

- deux éléments en forme de L (33), qui permettent de guider le câble (3) fermé et d'ancrer l'ensemble (16) à un élément ;
- deux bagues supérieures (19) qui peuvent tourner sur les éléments en forme de L (33) ;
- des plaques de support (22) pour fermer, recouvrir et supporter les bagues supérieures (19) ; et
- des poulies internes (21) et des bagues internes (20) fixées aux plaques de support (22) destinées à guider le câble (3) en direction de la poulie libre (17).

9. Ensemble d'entraînement musculaire comprenant :

- un dispositif d'entraînement musculaire selon l'une quelconque des revendications 1 à 6 ; et
- au moins un appareil de traction (4) selon l'une quelconque des revendications 7 à 8 ;
l'ensemble étant **caractérisé en ce que** :

  - le câble fermé (3), sans extrémités libres, s'étend à travers l'appareil de traction (4) et est traversant jusqu'à l'appareil de traction (4) ; et
  - l'ensemble rotatif (16) peut être ancré au chariot (11) et l'appareil de traction (4) est ainsi relié au déplacement du chariot (11),

de sorte qu'au moyen des poulies fixes (23) et de l'appareil de levage (24), l'appareil de traction (4) agisse sur l'élément de résistance (2) lorsqu'il est actionné, et par conséquent, l'action de l'appareil de traction (4) est possible pour n'importe quelle position que génèrent les éléments dynamiques de la structure, grâce à ses deux degrés ou plus de liberté et pour n'importe quel angle autorisé par l'ensemble rotatif (16).

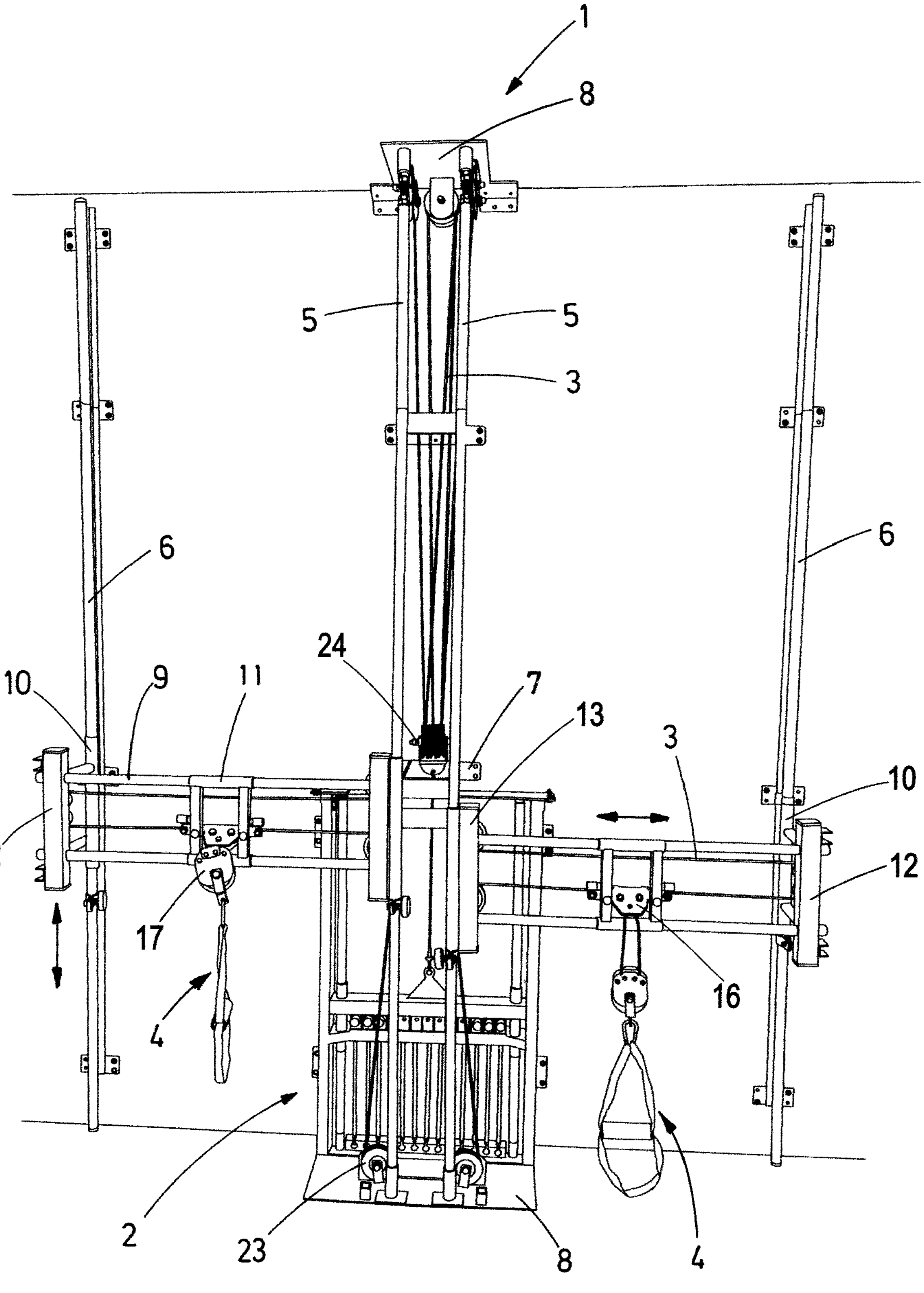

FIG. 1

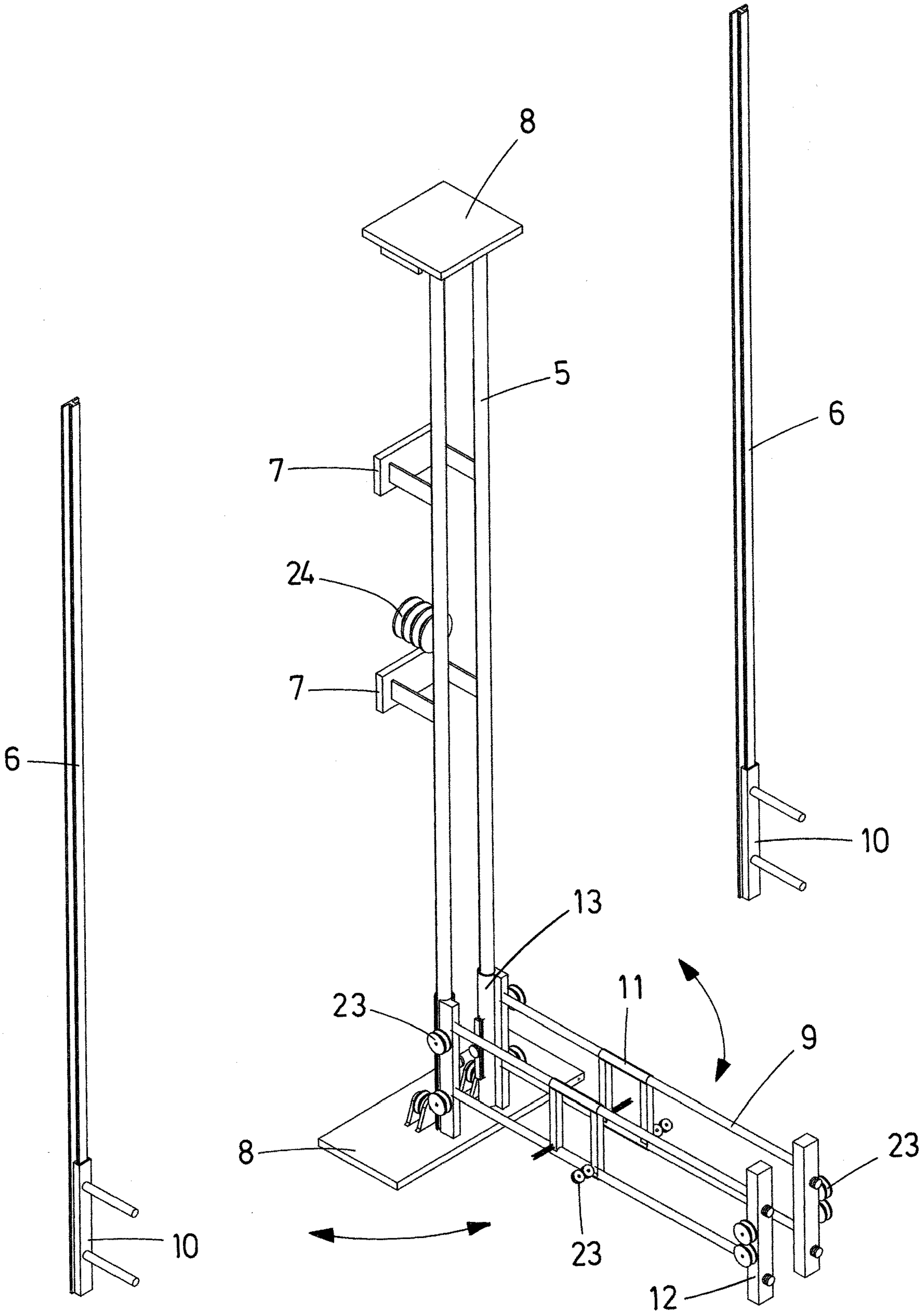

FIG. 2

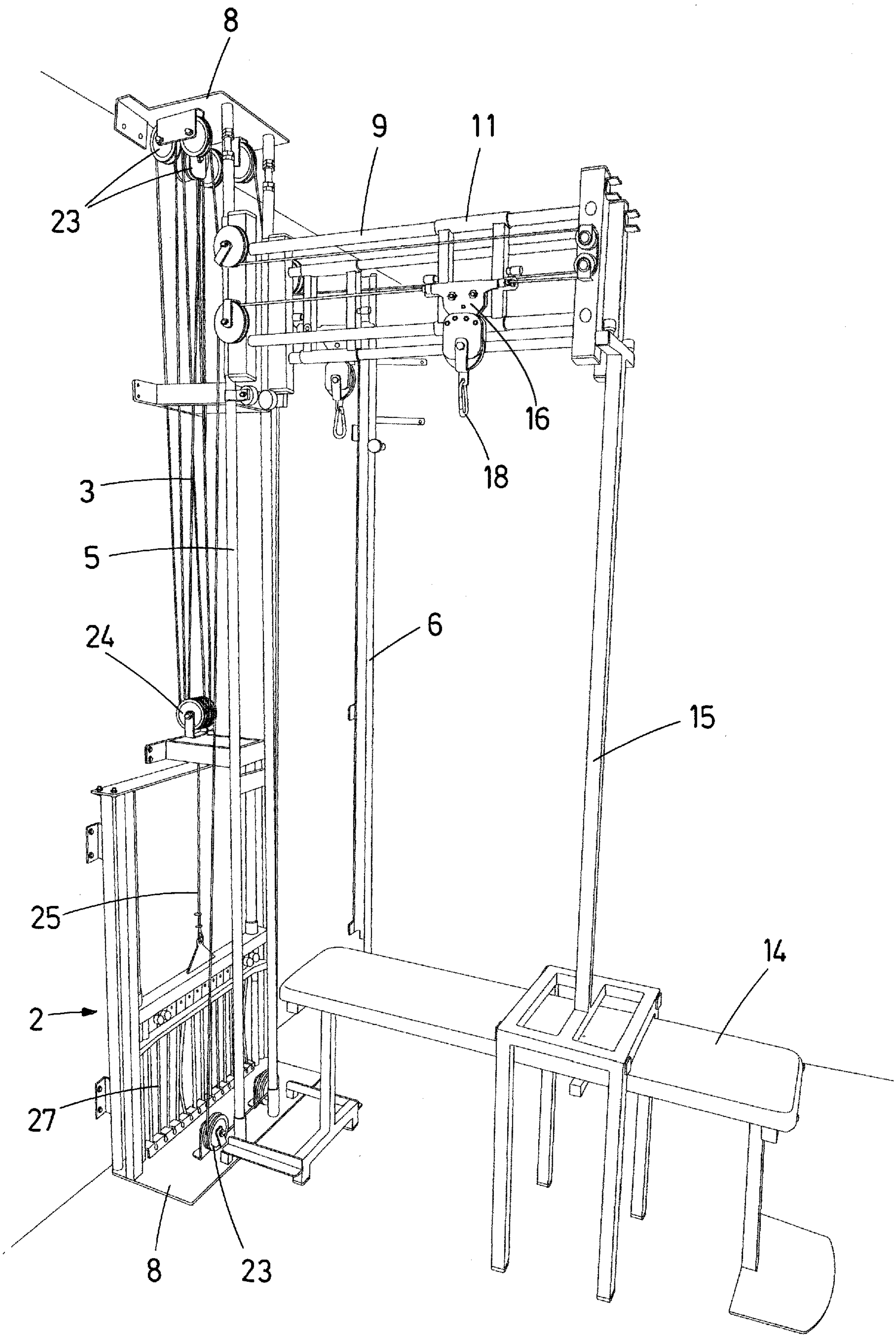

FIG. 3

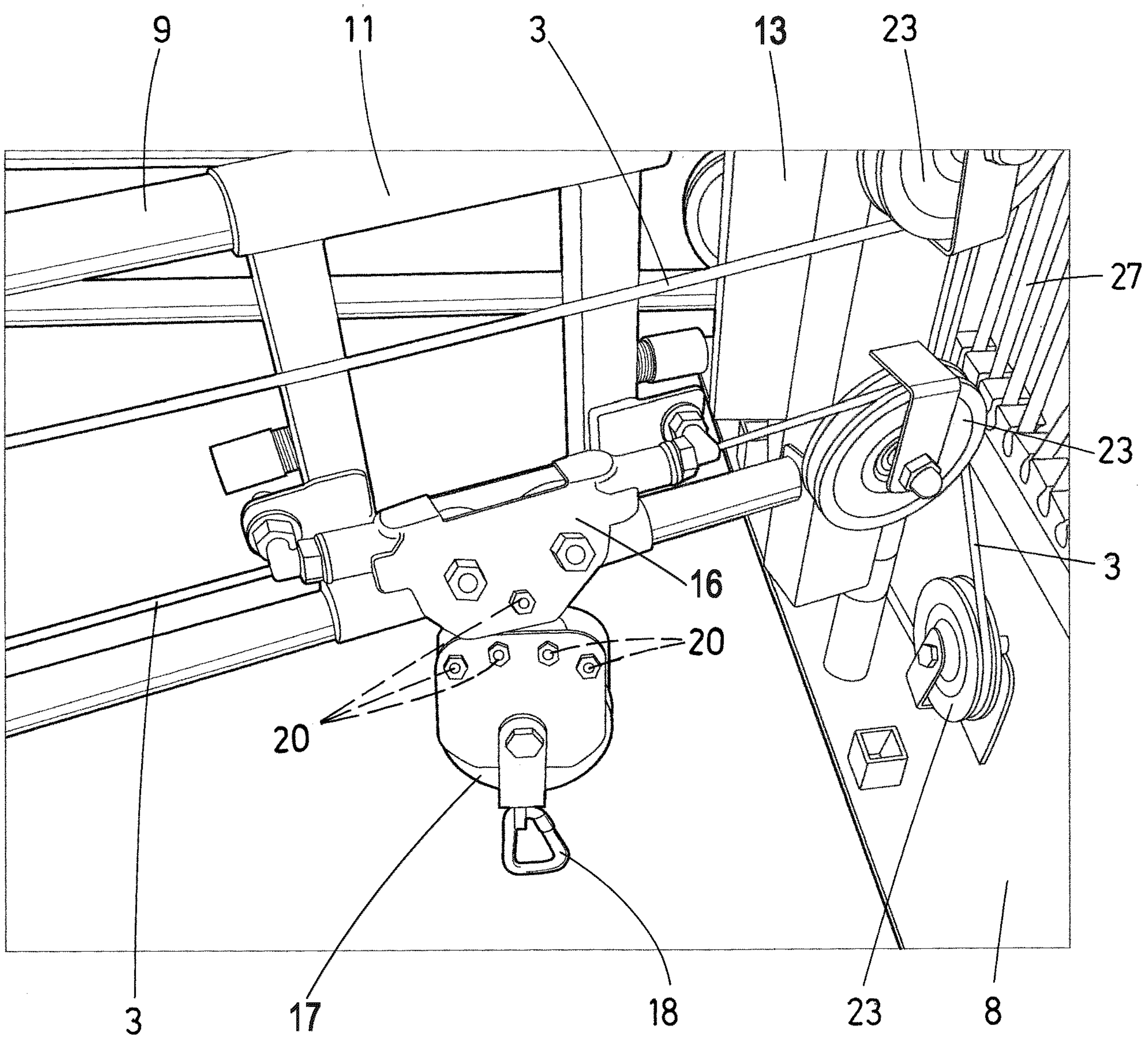

FIG. 4

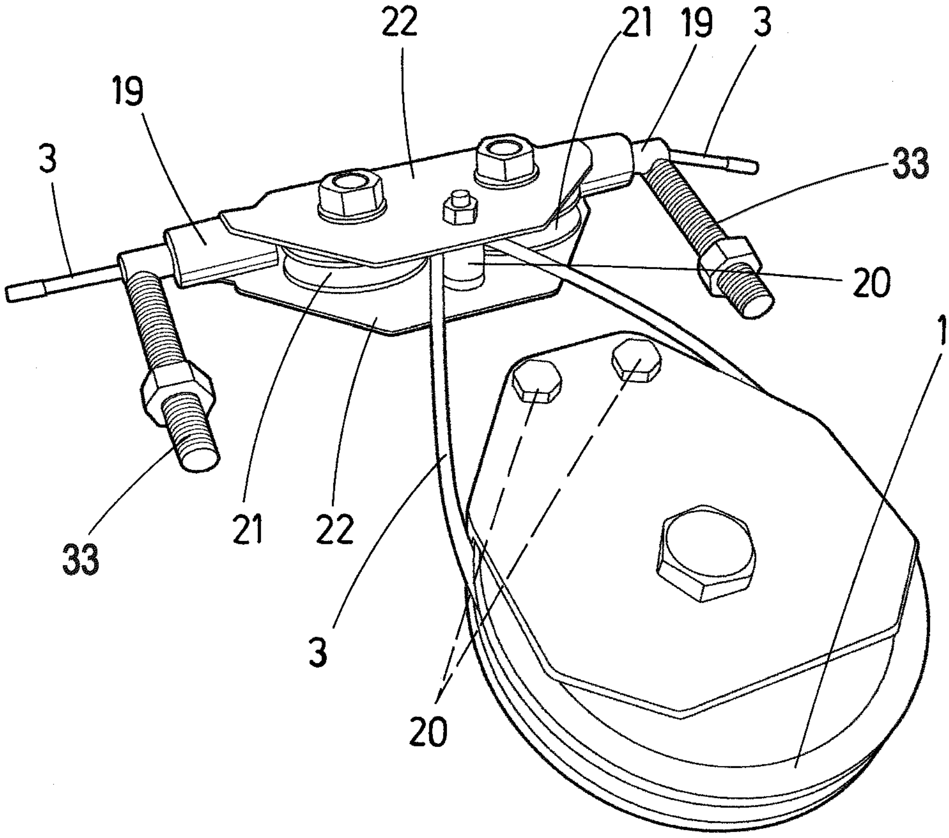

FIG. 5

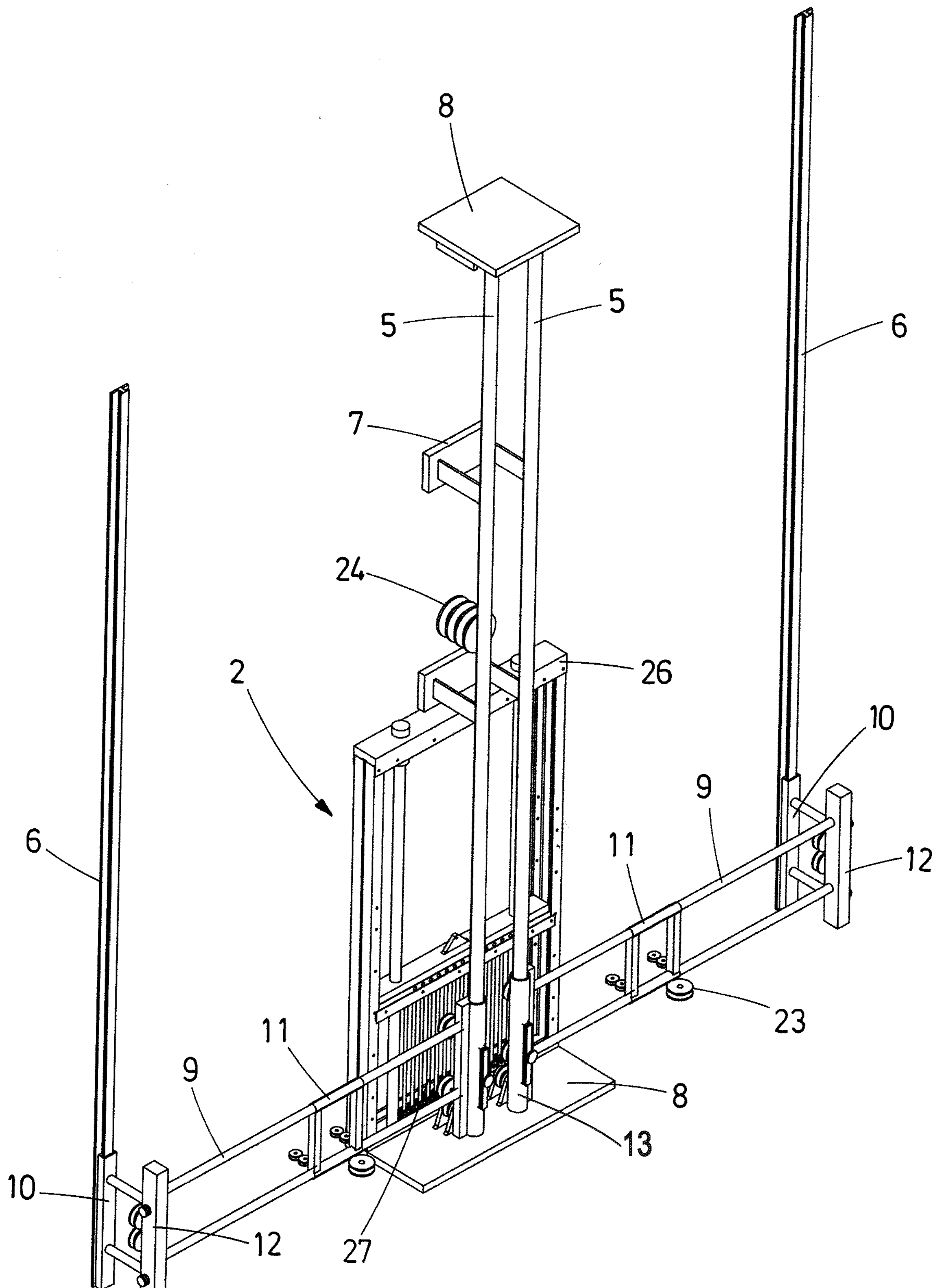

FIG. 6

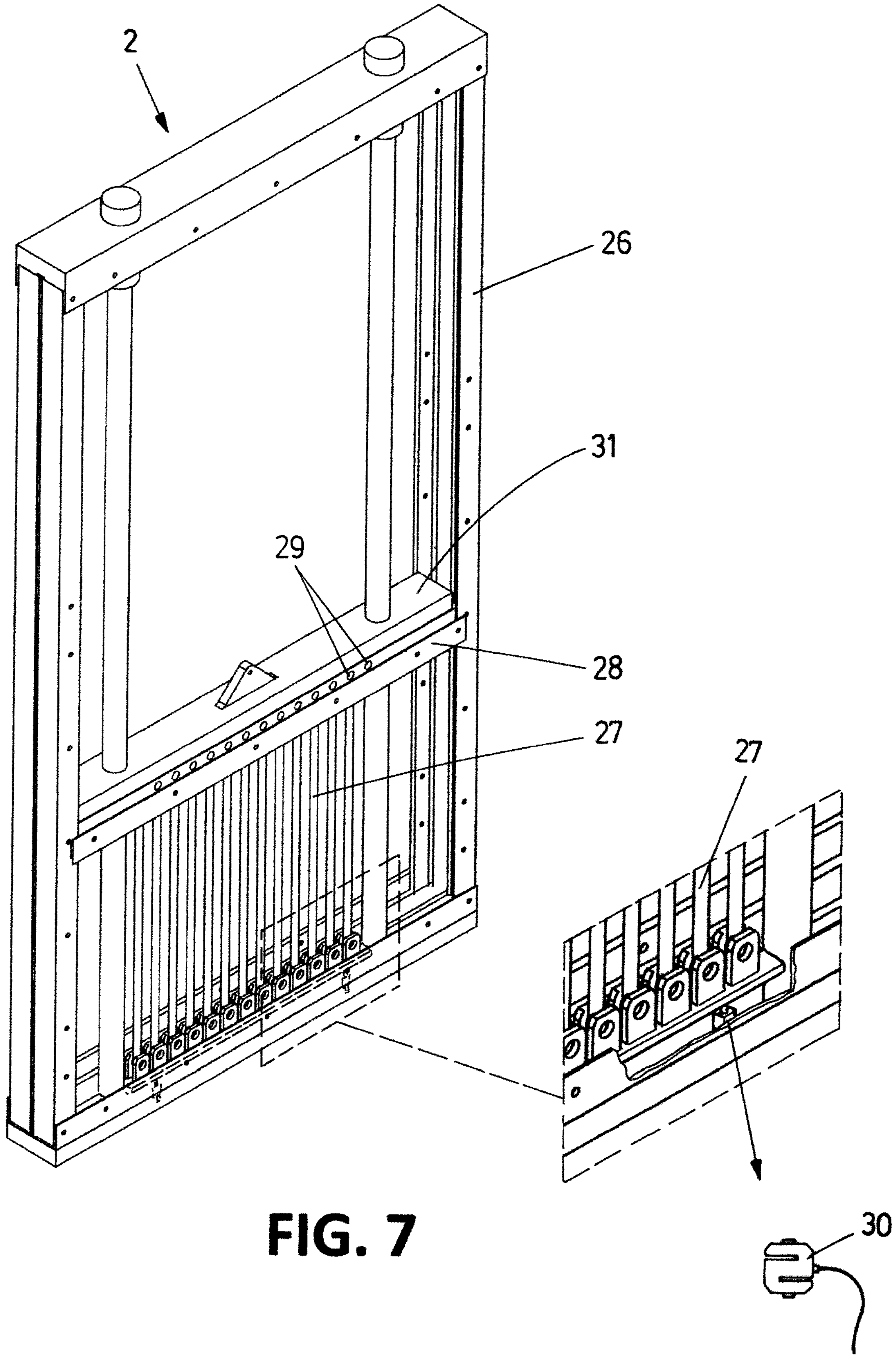

FIG. 7

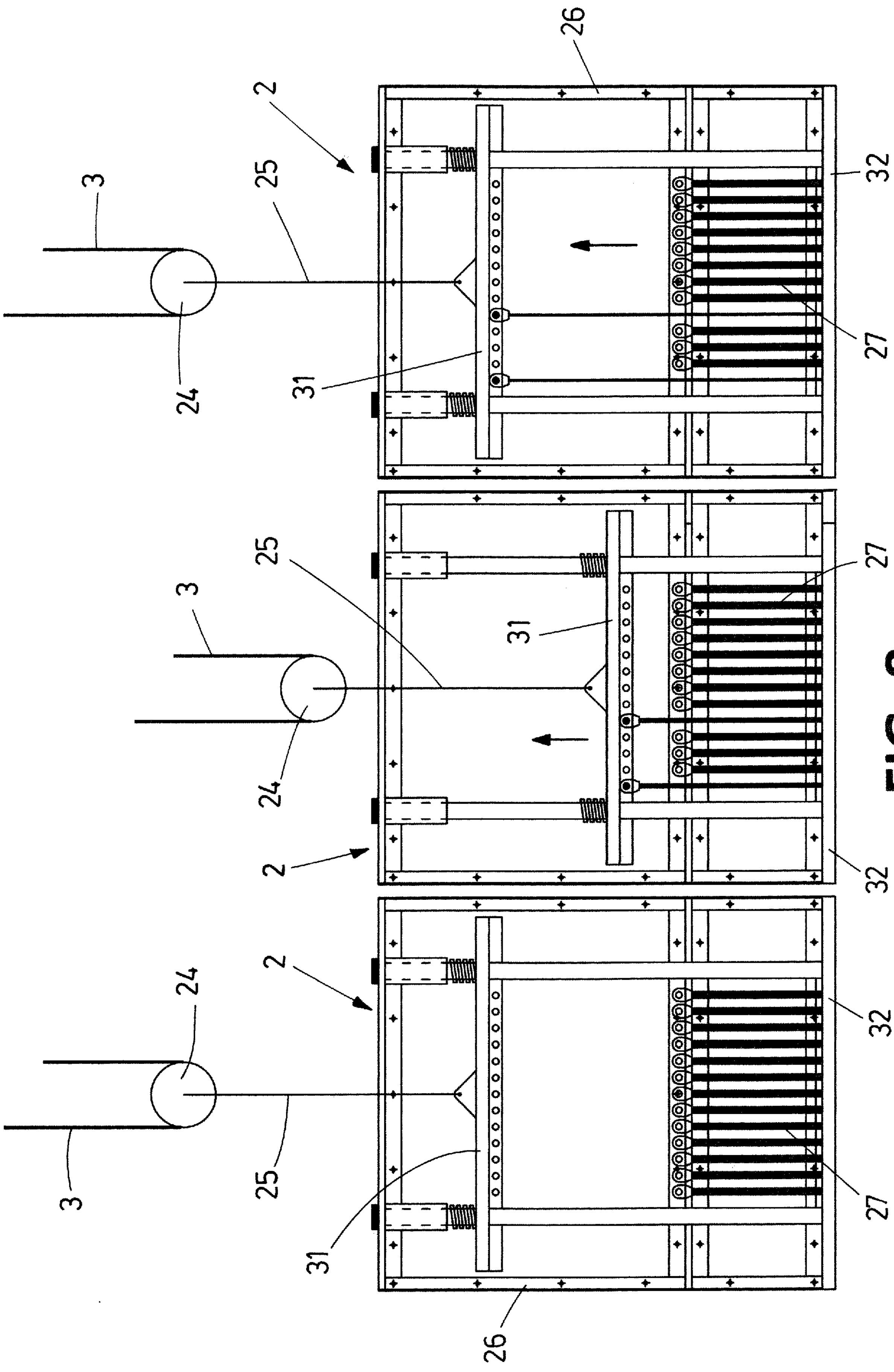

FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 7632221 B **[0004]**
- US 10532239 B1 **[0005]**
- US 7654946 B1 **[0007]**
- US 2003134722 A **[0008]**