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(54) **COMPACT INERTIA DEVICE FOR STRENGTH TRAINING**

(57) Compact inertial device for muscle training, consisting of a pulling body (1) and a drive rope (2). The pulling body (1) in turn comprises a rotating main shaft (4), a reel (8) mounted on the main shaft (4), an inertia element (6) linked solidly to one end of the main shaft (4) for accumulation of kinetic energy from the rotation of the main shaft (4), and a planetary gear (5), which in turn

comprises a central gear mounted on the main shaft (4), for multiplication of the transmission speed from the main shaft (4) driven by the reel (8) to the inertia element (6). In its preferred embodiment, the spool (8) is a conical spool with a smaller diameter sector to which one end of the rope (2) is solidly attached.

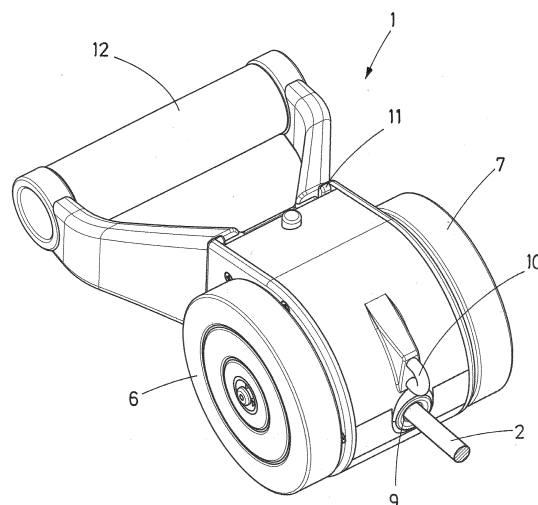


FIG.1

Description

OBJECT OF THE INVENTION

[0001] The present invention falls within the technical field of gymnastic apparatus for strengthening muscles, more specifically those apparatus comprising resistant devices with rotating bodies, and refers in particular to a compact muscle training device based on resistance to a traction force exerted by inertia discs and which can be used either by a single user or by two users simultaneously.

[0002] More specifically, the present invention relates to a training, toning, muscle building and rehabilitation device for pulling resistance based on inertia discs or rings arranged on a rotating shaft. The device further comprises a grip handle, a transmission element for multiplying the revolutions of the shaft, and a connecting cord which is solidly linked at one end to a conical reel for driving the transmission.

BACKGROUND TO THE INVENTION

[0003] During the development of bodybuilding exercises, two phases of movement can be differentiated: a concentric or positive phase, in which the muscle insertions are brought closer together and the movement goes against gravity, so that the muscle is shortened or concentrated when contracting, and an eccentric or negative phase, where the muscle insertions are distanced and the movement is generated in favour of gravity, so that the muscle continues contracted, but lengthens.

[0004] Although the muscle is contracted in both phases, they are contractions with different effects. The main difference lies in the fact that eccentric contraction is more efficient from a neuromuscular point of view, because this lengthening produces a greater activation of actin-myosin bridges, generating a greater muscle contraction. Eccentric contractions also have a lower metabolic demand and produce greater hypertrophy, which makes them very effective when it comes to gaining muscle. On the downside, it is worth mentioning that they are very aggressive for muscle and connective tissue, and if performed inappropriately can cause injuries.

[0005] Within the technical field of gymnastic apparatus for muscle development, a plurality of devices are known. For example, the international PCT application with publication number WO2015019118 discloses a device for providing constant resistance values against displacement. The device comprises a cylinder connected to a cone or cam or variable diameter pulley, which engages and balances the preselected resistance value of one or more elastic means, such as springs, on one side (cylinder side) by the variable torque generated by an externally applied constant force, and on the other side (cone or cam or variable diameter pulley side) by appropriately varying the geometrical characteristics defining the torque, including radii, distances or angles.

[0006] European patent application publication number EP0364954 discloses a rowing machine for muscle training that incorporates a planetary or epicyclic gear in conjunction with an inertia disc to increase the speed of rotation.

[0007] On the other hand, small inertial devices are also known. For example, the US patent with publication number US2009093350 refers to a transportable sports training and rehabilitation system, based on a pulling body consisting of a handle, an inertia motor or discs and a cylindrical coil in which a rope is picked up and released, which is hooked at the opposite end to a point, which can be a part of the user's own body or another person. This system has two handles or attachment points, making it possible to reverse the active end from which the force is exerted.

[0008] Likewise, document US3841627 discloses a transportable sports training and rehabilitation system comprising two pulling bodies, one of which integrates, in addition to a handle, an inertia disc and a cylindrical coil in which a rope is picked up and released, which is hooked at its opposite end to the second handle.

[0009] However, currently existing devices comprise inertia elements of high weight and dimensions, which also limit the versatility of such a device, not allowing it to adapt to different forces and types of shooting.

DESCRIPTION OF THE INVENTION

[0010] The object of the invention consists of a compact inertial device for muscle training, which is basically made up of a pulling body and a transmitter cord or belt, which is solidly linked at one end to the pulling body, while it can be attached at the opposite end to a fixed point or to a fastening element.

[0011] The pulling body in turn consists of a rotating main shaft, to the ends of which inertia elements, preferably inertia discs, are solidly attached. A reel, on which the rope is wound, is mounted solidly and coaxially on the main shaft. In the preferred embodiment of the device, the reel is conical, and one end of the rope is solidly attached to its smaller diameter base. The pulling body also incorporates an epicyclic or planetary gear, the central gear of which is solidly mounted on the main shaft, with the interposition of a torque-limiting clutch.

[0012] An outer casing surrounds and contains the above-mentioned elements of the pulling body. This housing has an eyelet-type through-hole opening through which the rope is taken up and released during winding and unwinding on the reel, and a coupling element, intended to house a handle for gripping the pulling body for manual operation by a user.

[0013] The rotary motion of the reel, driven by the rope, is transferred to the inertia discs via the planetary gearing, with a transmission ratio that causes the inertia disc to rotate "R" turns with a single turn of the reel.

[0014] The device is based on the "flywheel training" devices known as inertial pulley training, but differs from

them thanks to its reduced size and weight, due to the fact that it has a high-capacity "R" ratio speed multiplier gear internally, which allows the inertia discs to rotate R times more than the devices without planetary gearing. As a result, the apparent moment of inertia of the discs is R^2 compared to that of an ungeared device.

[0015] Thus, with inertia discs of very small dimensions, but rotating at many revolutions, the same inertia is achieved as with the large discs commonly used in current "flywheel training" devices, which means a great reduction in material, transport and storage costs. These smaller inertia discs also lower the centre of mass and the volume of the device, allowing for much lower, lighter and more economical fixture platforms than current device platforms.

[0016] The main advantage of a conical rope reel is that, when starting to unwind the rope, the pulling force required is lower, as it starts to unwind from the part with the largest diameter. The resistance exerted by the reel, and therefore the pulling force required to unwind the rope, increases progressively as the radius of the cone decreases. Likewise, the conical reel facilitates the correct winding of the rope when it is reeled in.

[0017] In order for the user to use the device, he must initially sufficiently pre-load the conical reel by winding onto it a quantity of the transmitter rope, immobilise this rope by means of a ratchet, and fix the opposite end of the rope, on which an anchoring element is located, to a static point against which the opposite pull is to be made.

[0018] The device allows both individual use and shared use. In individual use there are two modes of operation: in the first mode, a single user operates the device through the pulling body, the rope being attached at one end to a static element through the anchoring element, so that the pulling body held by the user moves and the opposite end of the rope remains fixed. Alternatively, in the second mode, the pulling body is held anchored by an attachment to a static element in the environment and the user pulls on the free end of the rope by means of a handle linked to the anchoring element.

[0019] In the case of shared use, two users, one operating the pulling body and the other holding the free end of the rope by means of a handle linked to the anchorage element, simultaneously pull the transmitting rope in opposite directions, so that both users share the efforts according to the pulling force applied.

[0020] In the case of individual use of the device, and with the device already preloaded, the exercise starts with a pulling phase or concentric phase, in which the user pulls the pulling body through the handle by means of a concentric muscular contraction in which his muscle is shortened. The transmitter rope begins to unwind, rotating the conical reel on which it is wound, which in turn rotates the main shaft on which it is solidly mounted. As mentioned above, as the main shaft is linked to the central gear of the planetary gear, the inertia element rotates at a speed "R" times greater than that of the bevel spool, "R" being the reduction ratio.

[0021] In this pulling phase, the user makes a physical effort to pull the rope by means of which a progressive acceleration is obtained, both in the movement of the device and in the angular acceleration of the inertia discs. As a result, the inertia discs themselves are loaded with angular momentum, and this phase ends when the user reaches the final position of this phase of the exercise, corresponding to the maximum pulling distance.

[0022] The next phase of the exercise, known as the intermediate dead centre phase, begins when the transmitter rope has been fully unwound from the conical reel, which stops rotating. At this point, the inertia discs are fully loaded to their maximum angular velocity, and continue to rotate in the same direction.

[0023] The discs, rotating at their maximum speed, drag the planetary gear and this, in turn, drag the conical reel, which continues to rotate in the same direction. The rope begins to wind around it, starting at the end with the smallest radius, and in the opposite direction to the previous one, thus beginning the collection or eccentric phase, in which the user must make an eccentric muscular effort to hold the rope so that the reel slows down and stops at the same point at which the exercise began. Thus, the length of rope wound on the reel determines the total exercise distance to be performed.

[0024] In the last phase of the exercise or end dead centre phase, the main shaft stops, as well as the gear and the reel to which it is solidly linked, the value of the angular velocity of the inertia discs being equal to zero. However, the bevel spool is sufficiently loaded with rope to allow the user to restart a new exercise in the pull or concentric phase, except that the shaft and gearing will rotate in the opposite direction on this occasion.

[0025] In the case of simultaneous use of the device by two users, the same sequence of the above-mentioned four phases is maintained, but with the difference that one of them holds one end of the rope through a handle linked to the coupling element while the other grips the pulling body through the handle, in order to pull in the opposite direction.

DESCRIPTION OF THE DRAWINGS

[0026] In order 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, a set of drawings is attached hereto as an integral part of the said description, in which the following is illustratively and non-limitingly depicted:

Figure 1.- Shows a front perspective view of the pulling body and the rope of the inertial device.

Figure 2.- Shows a rear perspective view of the pulling body.

Figure 3.- Shows a detail view of a cross-section of

the pulling body.

Figure 4.- Shows a detailed exploded view of the drawbar body.

Figure 5.- Shows a detail view of the ratchet for the rope of the device.

Figure 6.- Shows a view of the device in individual use according to a first option.

Figure 7.- Shows a view of the device in individual use according to a second option.

Figure 8.- Shows a view of the device in shared use.

Figure 9.- Shows a detail view of a support platform.

Figure 10.- Shows a detail view of the device in use with an incorporated pulley.

Figure 11.- Shows a view of the device in individual use according to a third option.

PREFERRED EMBODIMENT OF THE INVENTION

[0027] A detailed explanation of an example of a preferred embodiment of the subject matter of the present invention is given below with the aid of the figures referred to above.

[0028] The described compact inertial muscle training device, shown in figure 1, basically consists of a pulling body (1) and a transmitter rope (2), which is solidly linked at one end to the pulling body (1), from which it is wound and unwound.

[0029] The pulling body (1), the exploded view of which is shown in figure 4, comprises an external casing (3) inside which is housed a transversely oriented rotating main shaft (4). A central gear of a planetary gear (5), which in turn comprises external gears or planets, is solidly coupled to this main shaft (4).

[0030] Likewise, an inertia element (6), consisting in this case of an inertia disc, is solidly coupled to said main shaft (4). In the preferred embodiment described here, the opposite end of the main shaft (4) incorporates an additional inertia element (7), consisting of another inertia disc solidly linked through its centre to said main shaft (4), without the interposition of any type of intermediate gear or multiplier element.

[0031] Mounted solidly and coaxially on a central sector of the main shaft (4) is a reel (8), which in the preferred embodiment described here is a conical reel, which in turn has a sector of smaller diameter, to which one end of the rope (2) is solidly attached. This rope (2) is automatically wound and unwound on the reel (8), thus producing a rotation on the main shaft (4) on which the reel (8) is solidly mounted.

[0032] The inertia element (6) accumulates rotational

energy from the rotation of the main shaft (4). As the device incorporates the planetary gear (5), the rotational energy transmitted by the main shaft (4) is multiplied in the planetary gear (5) before being transmitted to the inertia element (6), to which it is solidly coupled. Thus, with an inertia element (6) of small dimensions, high values of moment of inertia are achieved thanks to the intermediate action of the planetary gear (5).

[0033] In the preferred embodiment described here, the planetary gear (5) used has a transmission ratio of 13,5, so that one revolution of the spool (8) causes the inertia element (6) to rotate 13,5 turns.

[0034] The casing (3) includes a through opening (9) through which the rope (2) passes for its deployment and retraction on the reel (8), as well as a hook (10) which projects from the casing (3) in the vicinity of the through opening (9). The casing (3) also comprises a coupling (11) for temporary attachment of the pulling body (1) to various external elements. For example, as shown in Figures 1 to 4, a grip handle (12) is temporarily attachable to said coupling (11) for manual actuation of the pulling body (1).

[0035] In the preferred embodiment of the device, the coupling (11) consists of a prominent sector (13) of quadrangular geometry starting from the casing (3), which has a groove (14) that surrounds the prominent sector (13) perimetrically, designed to house the corresponding couplings of the handle (12) or of a fastening element (15) in which it is desired to immobilise the pulling body (1), as illustrated in figure 7.

[0036] The device also incorporates a ratchet (16), shown in detail in figure 5, which can be attached to the rope (2) for adjusting the length that can be rewound and unwound on the reel (8). As can be seen in the aforementioned figure 5, the ratchet (16) has a through hole (17) for coupling an anchoring element, such as a carabiner, which allows connection to external elements such as a handle (18), shown in figure 8, which allows it to be gripped by a second user. The ratchet (16) also incorporates a latching ring (19).

[0037] It is also envisaged that a pulley (20) is incorporated into the rope (2) to increase the pulling resistance, this pulley (20) being particularly suitable for performing exercises involving the work of large muscle groups, such as squats or weightlifting, without the need to modify the inertia elements (6, 7). For this purpose, the rope (2) must pass through the pulley (20) and return to the pulling body (1), as illustrated in figure 10, so that the ratchet (16) is fixed to it by means of a carabiner that can be inserted into the hook (10).

[0038] It is also envisaged that a number of additional elements will be incorporated to improve and add functionalities to the device. For example, first of all, it is envisaged to incorporate a safety element to prevent entrapment and return strokes at the start of the rope retraction phase (2). This element consists in its preferred version of a force limiting clutch, consisting of a pre-calibrated spring and two opposing wheels which disengage

the main shaft (4) from the central gear of the planetary gear (5), in the event of exceeding a pre-established limit force value.

[0039] It is also foreseen the additional incorporation of an externally operable gear change, linked to the central shaft (4) and designed to vary the transmission ratio of the planetary gear (5) to obtain different previously established reduction ratios. Optionally, it is also envisaged the inclusion of a remotely operated brake for blocking the rotation of the inertia element (6) and, if applicable, the additional inertia element (7), in the final dead centre phase, which allows the user to carry out additional isometric (static) exercises, thus increasing the versatility of the device.

[0040] It is also possible to incorporate electronic elements to increase the performance of the device. For example, a revolution counter consisting of an electronic module that detects, by means of a sensor, preferably optical, the revolutions and direction of rotation of the reel (8), in order to subsequently analyse the work curves and extract parameters such as caloric consumption, time, speed, force, performance, and other parameters. It is also foreseen to add a wireless transmitter connected to the lap counter to send the data collected by it to a mobile device equipped with a computer application that acts as an operational interface with the user.

[0041] It is also envisaged that various elements for attaching the pulling body (1) to the device will be incorporated into the device to enable various types of exercises to be carried out. For example, a support platform (21), shown in figure 6, equipped with elements for coupling with the coupling (11), and designed to support the feet during the execution of exercises such as squats or weightlifting. In its preferred embodiment, illustrated in figure 9, the platform (21) is foldable and has a curved geometry face, with a central sector higher than the perimeter edges.

[0042] It is also envisaged that additional inertia discs can be temporarily attached to the main shaft (4) by means of bolts or similar quick coupling means.

[0043] Figures 6, 7, 8 and 11 show the device in different uses, both individual use and shared use, which show its great versatility, as indicated in the description.

Claims

1. A compact inertial muscle training device comprising:

- a pulling body (1), further comprising:

- a rotating main shaft (4),
- a reel (8) mounted solidly and coaxially on the main shaft (4), and
- an inertia element (6) solidly linked to one end of the main shaft (4) for accumulation of kinetic energy from the rotation of the

main shaft (4), and

- a drive rope (2), attached at one end to the reel (8), which can be rewound and unwound on the reel (8),

the inertial device being **characterised in that** it additionally comprises a planetary gear (5) which in turn comprises a central gear linked solidly to the main shaft (4) for multiplication of the transmission speed from the main shaft (4) to the inertia element (6).

2. Inertial device according to claim 1, wherein the reel (8) is a conical reel having a sector of smaller diameter to which one end of the rope (2) is solidly attached.

3. Inertial device according to claim 1 wherein the pulling body (1) additionally comprises an external casing (3) comprising in turn:

- a through opening (9) for passage of the rope (2), and
- a coupling (11).

4. Inertial device according to claim 3, wherein the casing (3) additionally comprises an attachment hook (10).

5. Inertial device according to claim 3 **characterised in that** the coupling (11) comprises:

- a prominent section (13) projecting from the casing (3), and
- a groove (14) that surrounds the prominent area (13) perimetrically.

6. Inertial device according to claim 3, **characterised in that** it incorporates a handle (12) which can be temporarily inserted into the coupling (11) for gripping the pulling body (1).

7. Inertial device according to claim 1, **characterised in that** it additionally comprises a ratchet (16) attachable to the rope (2) for adjusting the length of the rope (2) windable and unwindable on the reel (8).

8. Inertial device according to claim 7 **characterised in that** the ratchet (16) comprises

- a through hole (17) for attachment of an anchor element, and
- an attachment ring (19) for attaching a pulley.

9. Inertial device according to claim 1, **characterised in that** it incorporates a pulley (20) linkable to the rope (2) to increase the pulling resistance.

10. Inertial device according to claim 3, **characterised in that** it incorporates a support platform (21) linkable to the coupling (11) for fixing the pulling body (1).
11. Inertial device according to claim 10 **characterised in that** the platform (21) is foldable. 5
12. Inertial device according to claim 3 **characterised in that** it additionally comprises a fastening element (15) linkable to the coupling (11) for immobilisation of the pulling body (1). 10
13. Inertial device according to claim 1, **characterised in that** it incorporates a force limiting clutch for de-coupling the main shaft (4) from the central gear of the planetary gear (5). 15
14. Inertial device according to claim 13, **characterised in that** the force limiting clutch consists of a pre-calibrated spring and wheels facing the main shaft (4). 20

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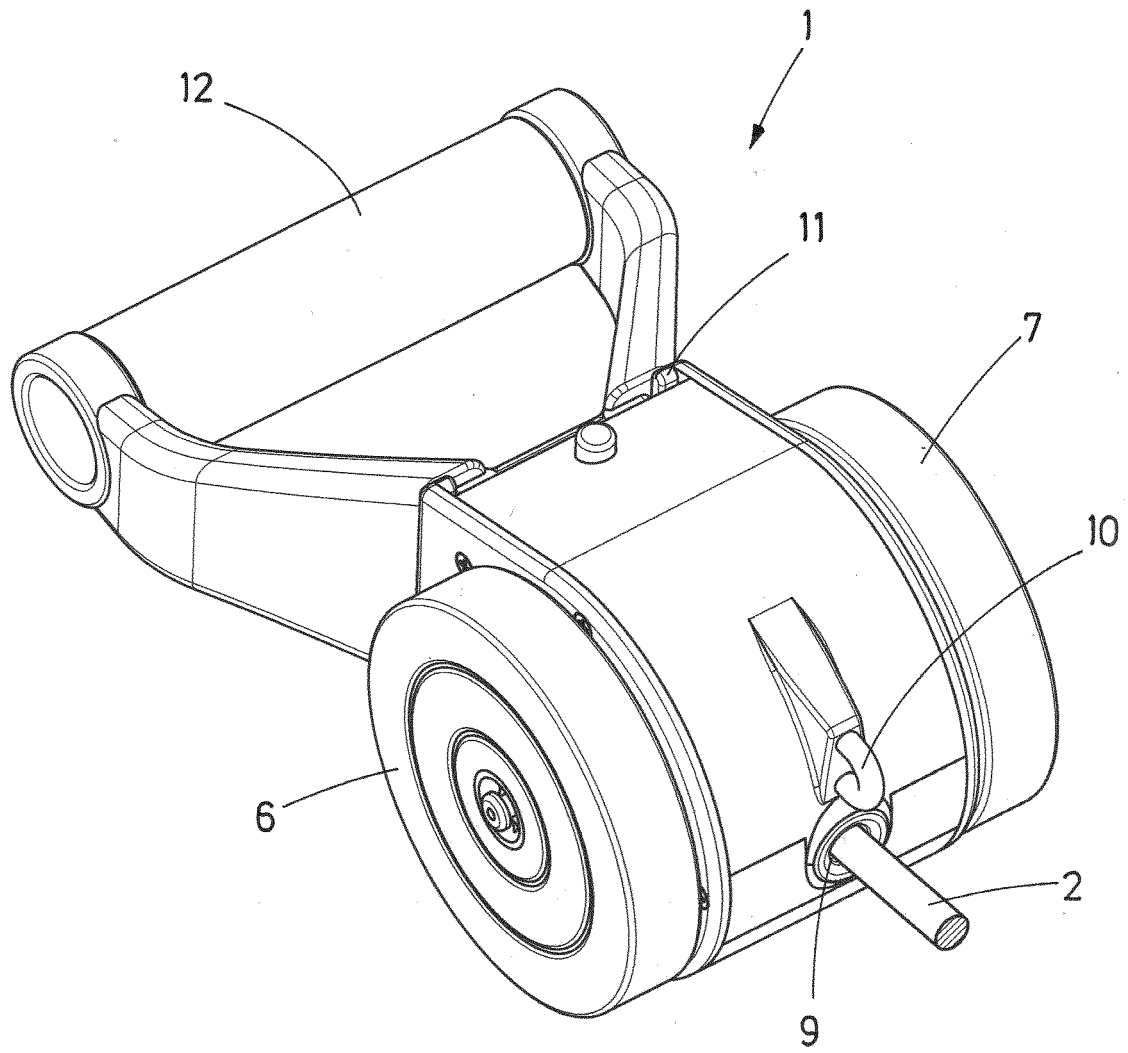


FIG.1

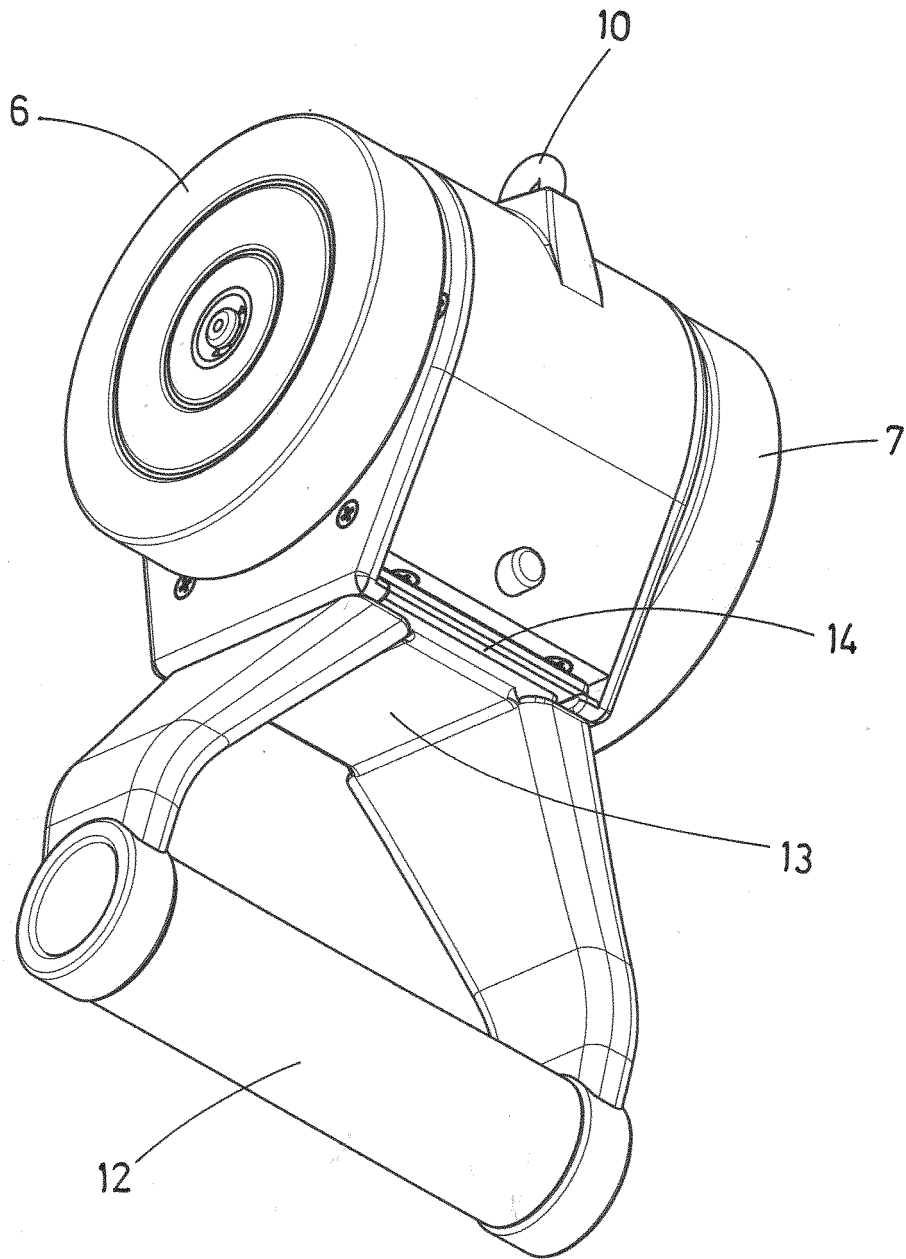


FIG.2

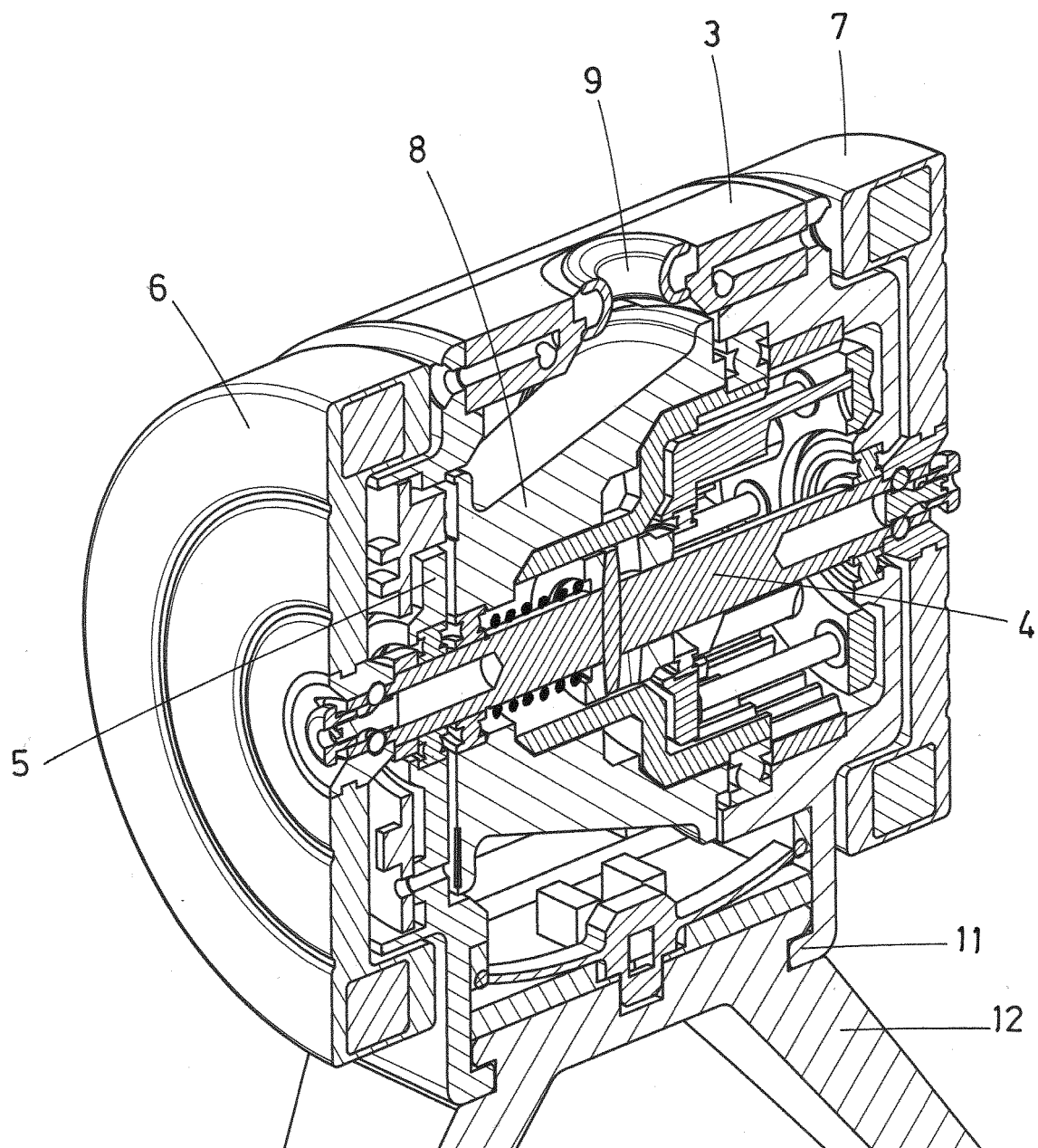


FIG.3

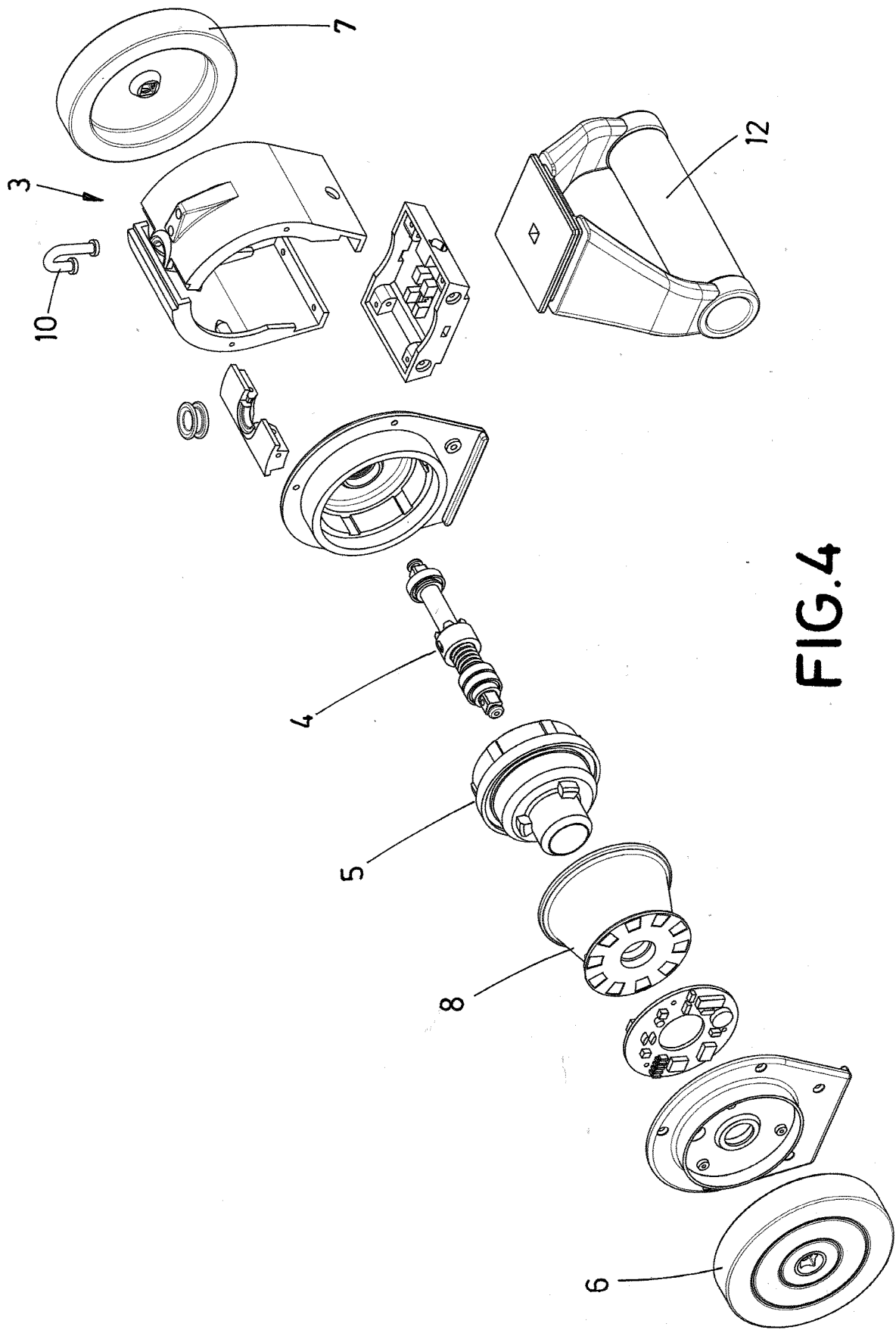


FIG.4

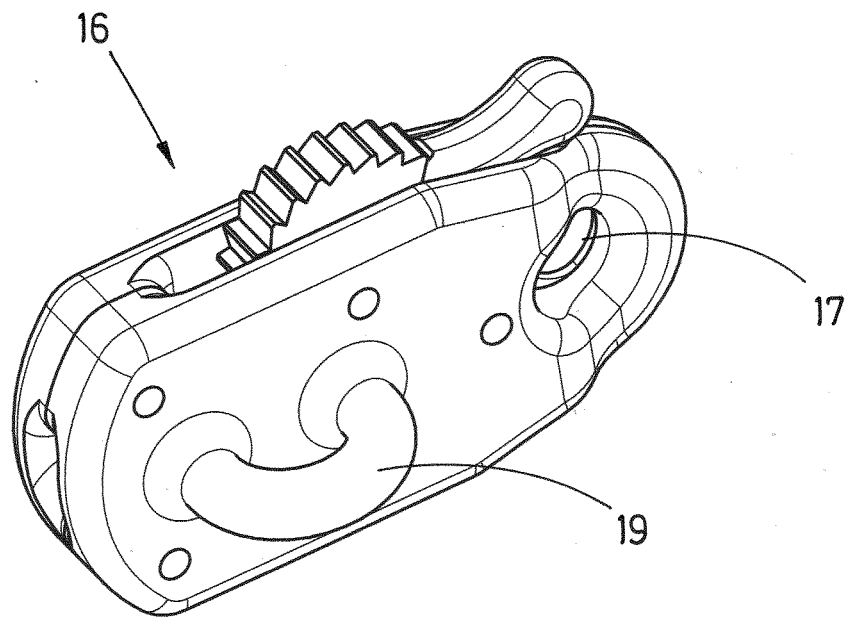


FIG. 5

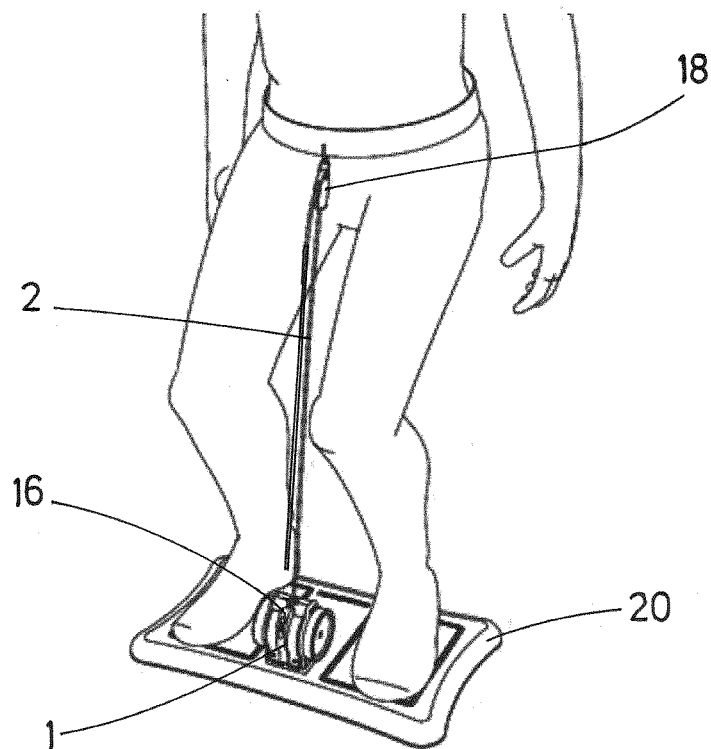


FIG. 6

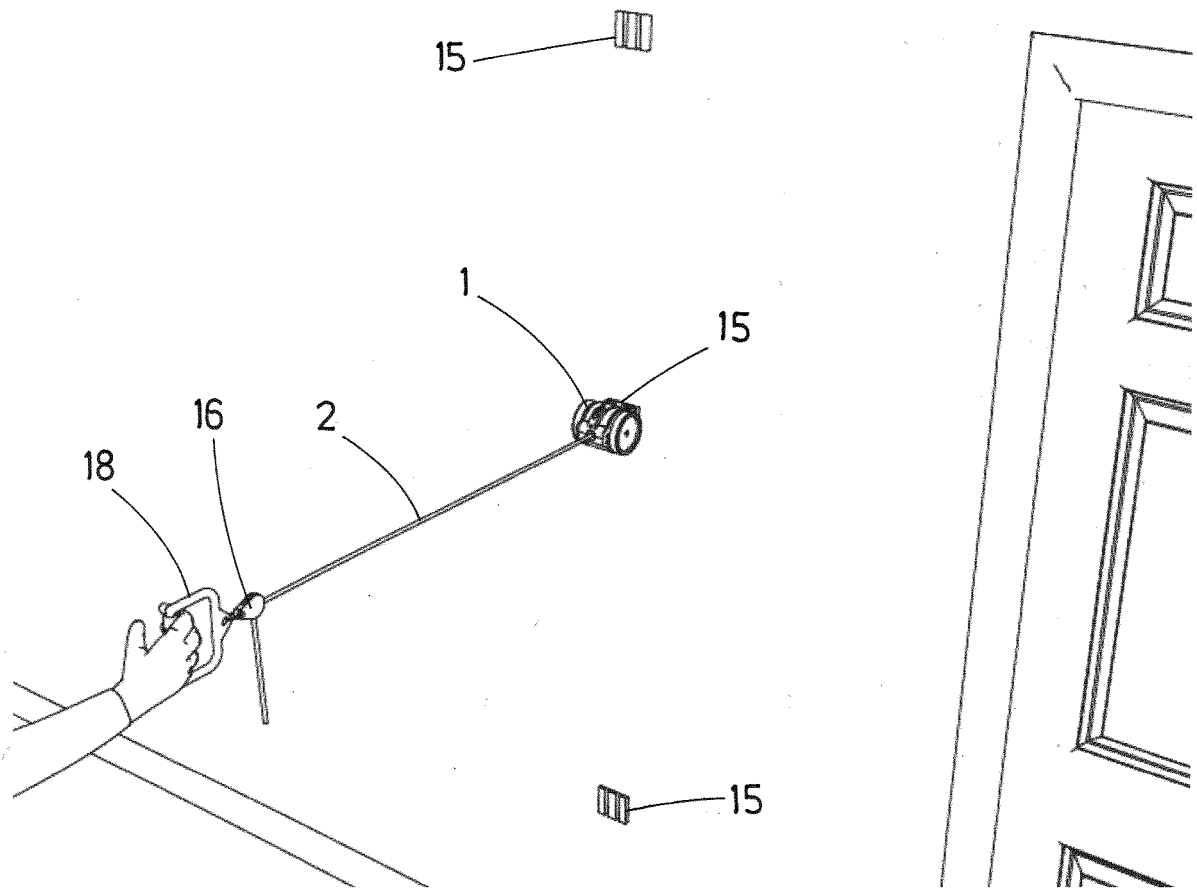


FIG. 7

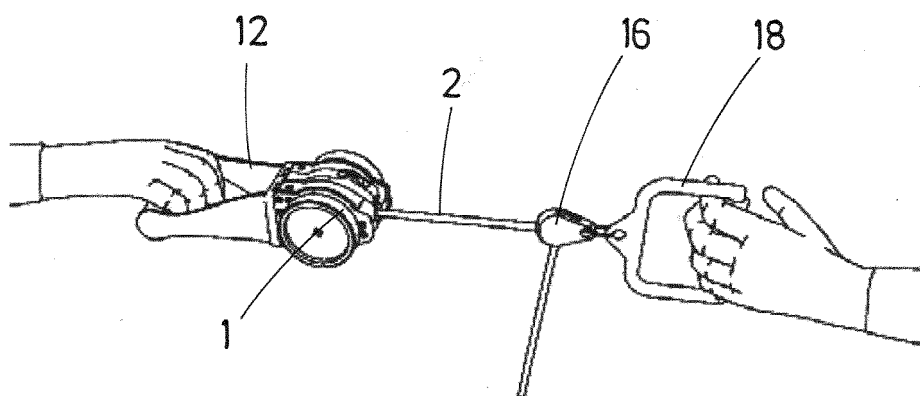


FIG. 8

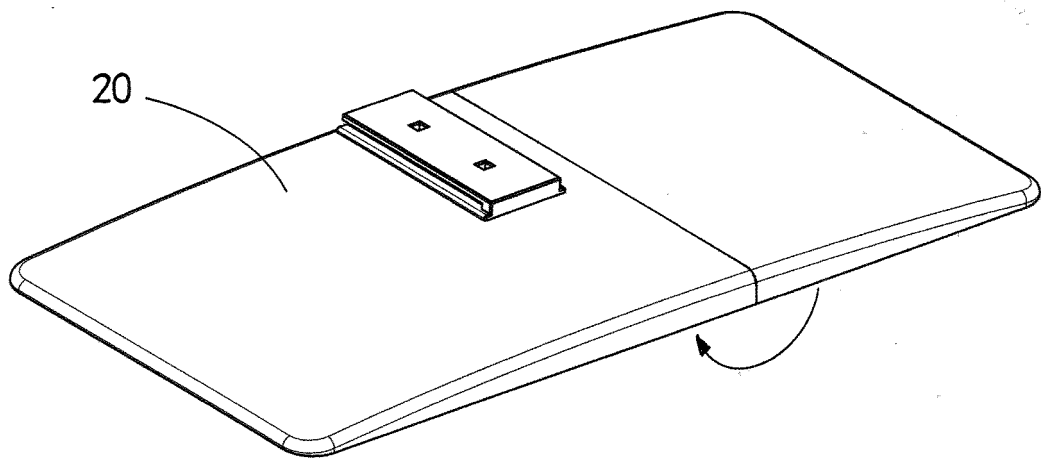


FIG. 9

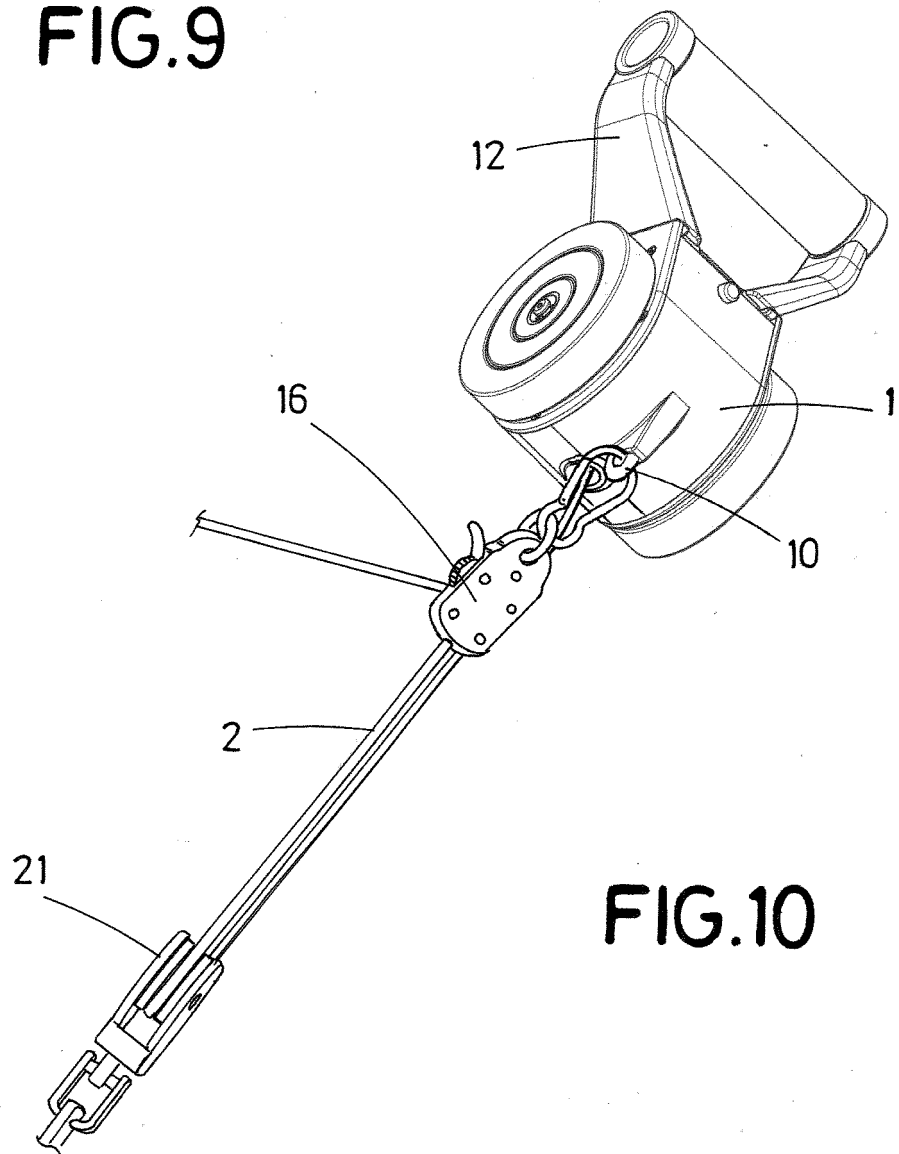


FIG. 10

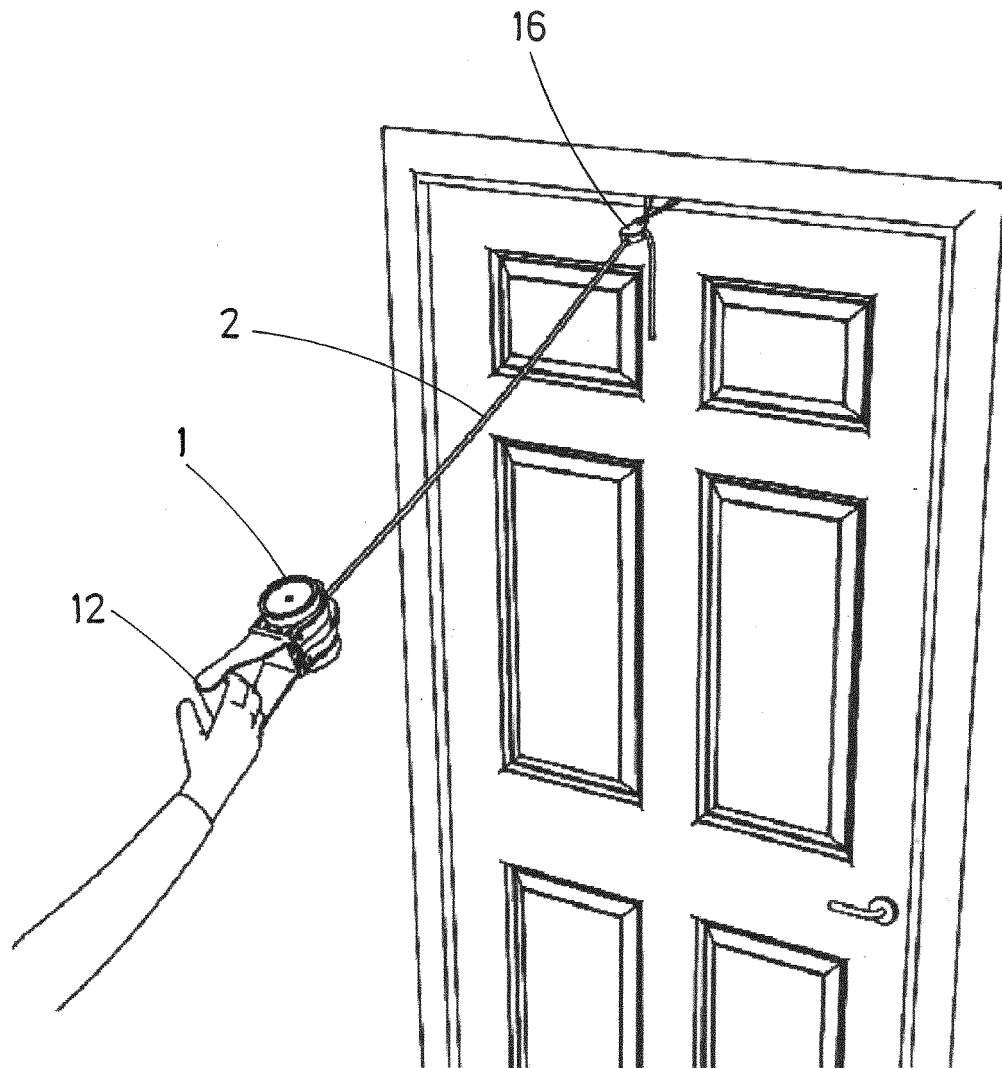


FIG.11

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2019/070724

A. CLASSIFICATION OF SUBJECT MATTER

A63B21/22 (2006.01)

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

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)

EPODOC, INVENES, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3841627 A (VETTER H) 15/10/1974, Column 3, line 41- column 4, line 43; figures 1-3	1, 3-14
Y	US 10080919 B1 (VUJICIC MARKO ET AL.) 25/09/2018, column 3, line 26 - column 13, line 64; figures 1, 6, 7.	1, 3-14
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"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
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Date of the actual completion of the international search
11/03/2020Date of mailing of the international search report
(13/03/2020)

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2019/070724

C (continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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INTERNATIONAL SEARCH REPORT

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