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(54) **ISOMETRIC EXERCISE MACHINE**

(57) Machine comprising a base structure (2) stably supported on the floor and an upright gantry structure (3) above the base structure (2) and at least one seat (4) with a backrest (5) in an area between a rear area (2c) and a central area (2b) of the base structure (2), wherein the machine (1) is provided with at least one triaxial sensor positioned on at least one projecting element (7), and furthermore, the backrest (5) of the seat (4) is provided

with at least one armrest (8) and the seat (4) is provided with at least one single restraint system (10). The restraint systems incorporated in the seat and backrest of the machine of the invention, allow the posture of the user to be corrected and the correct position to be ensured during the performance of the exercises, avoiding future injuries and reinforcing the accessibility of the machine of the invention to all types of users.

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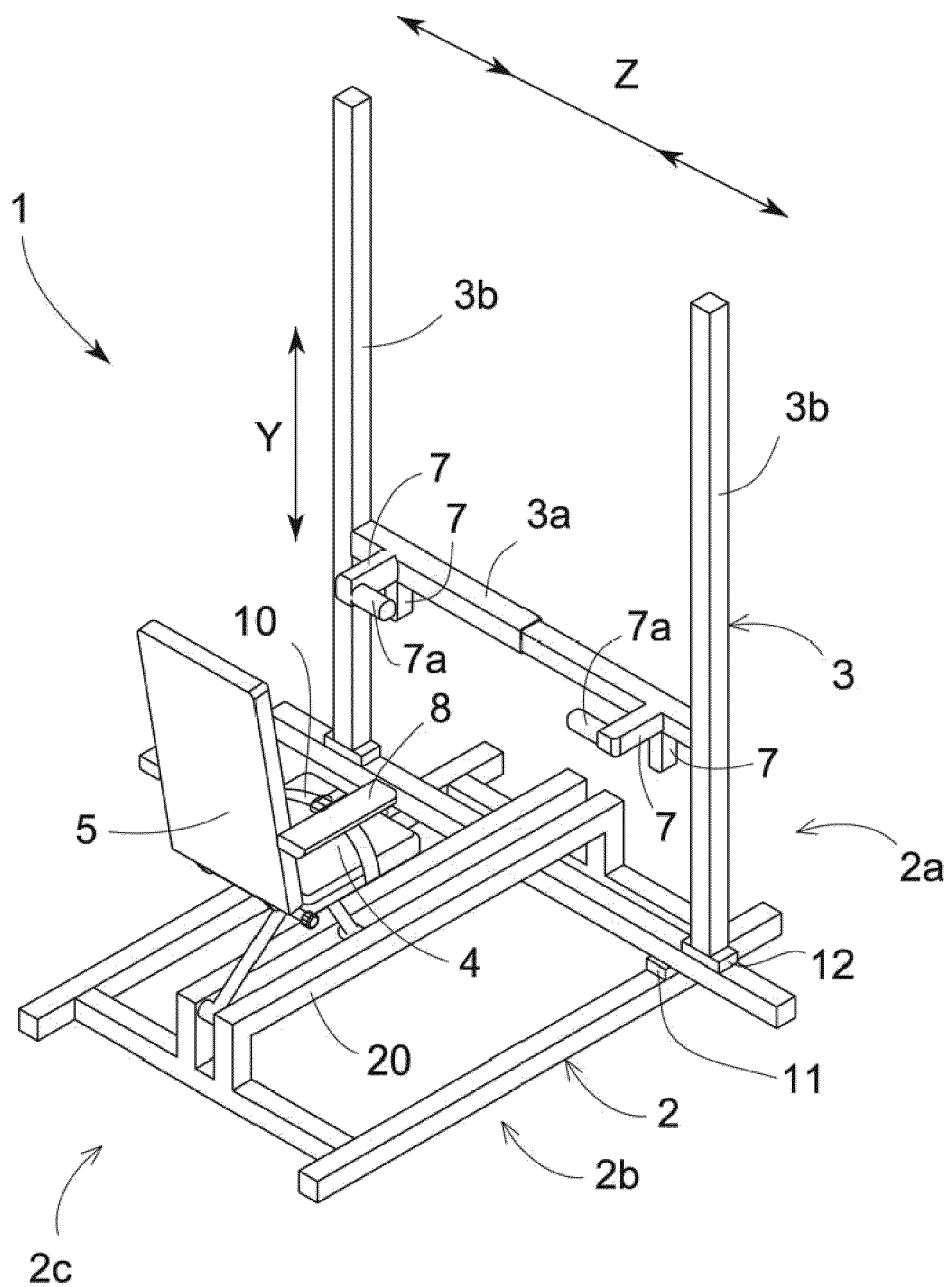


FIG.1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a stationary machine for muscle training, and more particularly, to a machine for exercising the musculature of the entire body isometrically, such as those used in rehabilitation centres.

PRIOR ART

[0002] Used in the field of sports and rehabilitation, isometric exercises involve subjecting a muscle or specific group of muscles to tension without movement of the joints. Said exercises consist of activating a muscle or muscle group while maintaining a particular posture for a specific length of time, i.e. the muscle or muscle group is contracted without changing the length of the muscle during the exercise.

[0003] Several isometric muscle training products and machines are known, in which the main component is an elastic band that must be stretched and kept taut by the muscle group whereon it is wished to work. The elastic bands are provided in differing degrees of rigidity with a rating in kilograms equivalent to muscle work with dumbbells.

[0004] Another type of isometric training machine or apparatus is that known in patent application US4607841A, patent ES2712464T3 and patent

[0005] The invention in patent application US4607841A describes an exercise machine having an upright support and a base, whereon engageable members are mounted on the upright support for the user to exert a force thereagainst. In addition, a scale is mounted on the base on which to support the user and to measure the force exerted by the user against the engageable members. A display is connected to the base to provide a visual indication of the force measured by the scale. Optionally, the engageable members are also movable vertically and transversely in a controlled manner, at predetermined speeds, directions and lengths of travel.

[0006] Another known invention is described in patent ES2712464T3. This invention includes a frame which has a base and a sidewall joined to the base. The base has an exercise platform for supporting a user's body. Also provided is a restraint arm assembly connected to the frame. The restraint arm assembly includes a swing arm pivotally connected to the base and a restraint arm carried by the swing arm and positionable above the exercise platform to inhibit movement of a portion of the user's body so as to allow the user to perform isometric exercises. An indexing assembly is also provided to fix the swing arm in a predetermined angular position and a restraint accessory is positionable for inhibiting move-

ment of the user's limb while exercising isometrically.

[0007] Patent US10729369B2 also describes a training machine similar to that of patent ES2712464T3 above. The machine in patent US10729369B2 consists of an upright frame, instrumentation support that can be moved along the upright frame, and a strong and sturdy floor base. The instrumentation comprises a plurality of force sensors placed in different positions to detect the forces applied in different directions depending on the exercise to be performed. In addition, the invention describes a control panel whereon the applied force is displayed.

[0008] Existing equipment and machines allow isometric forces to be applied and measured and shown on a display for the purposes of tracking exercise. However, it is possible for the user to perform the exercise and apply force in an incorrect posture, resulting in a risk of injury. In addition, the devices described are intended for users without motor disabilities, since, in many embodiments, the user must be in a standing position to perform the exercise.

[0009] The objective of the present invention is therefore to provide an isometric muscle exercising machine that offers several improvements over existing machines with respect to comfort, safety and accessibility for all types of users, enabling them to improve their quality of life through an improvement in their physical condition.

BRIEF DESCRIPTION OF THE INVENTION

[0010] The objective of the present invention is to provide a machine for muscle exercising by means of isometric training. The machine of the invention is provided with a base structure that is supported stably on the floor.

[0011] Upon this base a vertical gantry structure is located in a frontal area of the base structure and also at least one seat with a backrest in a central area of the base structure for the purpose of enabling the user to be seated while performing the different isometric exercises.

[0012] The machine of the invention is characterised in that the gantry structure is provided with a horizontal bar and some projecting elements on which at least one triaxial sensor is positioned, such that it can measure the forces exerted by the user on the different projecting elements.

[0013] The incorporation of triaxial sensors enables measurements of force to be made in all 3 spatial dimensions, determining the directions wherein the user exerts the force. In this way, it is possible to correct the way in which the exercise is being performed and to balance the position and the application of the force. Moreover, the sensors are connected to a software application and a display enabling the user to view whether or not the exercise is being performed correctly and to store all the parameters associated with the exercise session for purposes of medical monitoring.

[0014] The machine of the invention is also characterised in that the backrest and seat are provided with at

least one armrest on either side of the backrest and restraint systems to ensure correct user position. The backrest restraint system is a double cross-restraint system for the user's upper body and the seat restraint system is a single restraint system for the user's lower body.

[0015] Additionally, the backrest of the machine may be reclined, a characteristic which, together with the armrests on the seat, enables accessibility of the machine to all types of user regardless of their degree of mobility.

[0016] Finally, the restraint systems incorporated into the seat and backrest of the machine of the invention make it possible to correct and ensure the correct posture of the user during the performance of the exercises, thus avoiding future injuries and reinforcing the accessibility of the machine of the invention to of all types of users.

BRIEF DESCRIPTION OF DRAWINGS

[0017] The details of the invention are shown in the accompanying drawings, which are not intended to limit the scope of the invention:

- Drawing 1 shows a rear perspective view of the machine (1) of the invention.
- Drawing 2 shows a profile view of the machine (1) of Drawing 1.
- Drawing 3 shows an embodiment of the invention with the backrest (5) in the horizontal position.

DETAILED DESCRIPTION OF THE INVENTION

[0018] The invention relates to a machine (1) for exercising muscles isometrically. Isometric exercises are the non-impact alternative to the usual muscle-building exercises performed with dumbbells or kettlebells. As mentioned above, isometric exercises are based on generating tension through contraction or extension of the muscles or muscle groups to be toned statically without movement of the joints, thus preventing possible wear and tear therein.

[0019] Drawing 1 shows the preferred embodiment of the machine (1) of the invention which, as can be seen, comprises a base structure (2) supported stably on the ground, whereon the other elements of the machine (1) are mounted. The base structure (2) is provided with a projecting structure (20) in the centre of the base structure (2) extending from a front area (2a) to a rear area (2c), supporting a seat (4) with backrest (5), upon which a user is positioned to perform isometric exercises on the machine (1). Drawing 1 also shows a gantry structure (3) located in the front area (2a) of the base structure (2). The gantry structure (3) is provided with at least one vertical bar (3b) on either side of the base structure (2), wherein the vertical bars (3b) are joined by at least one telescoping horizontal bar (3a). Thus, the vertical bars (3b) of the gantry (3) are movable in one direction (Z) by way of rails (12) shown in Drawing 1. In this way the vertical bars (3b) can be moved towards or away from

one another while the length of the horizontal bar (3a) is altered. Additionally, the gantry structure (3) is also movable in one direction (L) from the front area (2a) of the base structure (2) to the rear area (2c) of the base structure (2) by means of rails (11), as shown in Drawings 1 and 2. Optionally, the horizontal bar (3a) is also movable along the vertical bars (3b) in one direction (Y) as shown in Drawing 2.

[0020] Optionally, the horizontal bar (3a) is provided with at least one projecting element (7) whereon at least one grip (7a) is positioned which is disconnectable and interchangeable with other grips (7a) for the performance of different isometric exercises. Given that the gantry structure (3) is movable and the grips (7a) can be changed, the machine (1) may be adapted to different users for the performance of different isometric exercises, since the gantry structure (3) can be moved towards or away from a user positioned on the seat (4). The grips (7a) may be cylindrical as shown in the drawings or have a flat surface to achieve a more ergonomic sensation in the grips (7a).

[0021] The machine (1) of the invention is characterised by being provided with at least one triaxial sensor positioned on at least one projecting element (7) of the horizontal bar (3a) of the gantry structure (3), whereon the user exerts force for the performance of the different exercises. Specifically, the triaxial sensors are affixed within the structure of the projecting elements (7). The triaxial sensors allow vibrations to be measured simultaneously on the three orthogonal axes, horizontal, vertical and axial, using only one sensor. In this way, it is possible to ascertain the magnitude of the force applied by the user on the grips (7a) in each of the axes thus determining whether or not the force is applied in the correct direction and enabling it to be corrected as necessary. The triaxial sensor is therefore responsible for measuring the force exerted by the user on the grips (7a) of the projecting elements (7) of the horizontal bar (3a) of the gantry structure (3) regardless of the position in which the gantry structure (3) is located, according to the exercise being performed.

[0022] Optionally, the isometric exercising machine (1) is provided with a display (12) positioned between the vertical bars (3b) of the gantry structure (3), whereon the forces exerted on the grips (7a) and measured by the sensors are displayed. That is to say, the sensors are connected by wireless technology, such as Bluetooth or Wi-Fi, to the display (12), which in turn is provided with an operating system whereon a software application can be installed that performs pre-processing of the forces on each axis. Thus the display (12) shows the information related to the performance of the exercise and enables the user's progress to be stored.

[0023] On the basis of all of the aforesaid, thanks to the triaxial sensors, the display (12) and the software assembly described above, it is possible to view the direction of the force, the value, the time during which the user exerts the force on the machine (1), and different

graphics and indications of how the exercise should be correctly performed. All of the aforesaid enables users to compare their sessions, programme new ones and improve the extent, manner and direction in which they exert the force.

[0024] As shown in the drawings, the seat (4) whereon the user sits to perform the different exercises, is located on the projecting structure (20) between the rear area (2c) and an intermediate area (2b) of the base structure (2). Additionally, the seat (4) is provided with a backrest (5) reclining from a vertical to a horizontal position as shown in Drawings 2 and 3.

[0025] In this way, due to the mobility of the gantry structure (3) in directions (L) and (Z), the mobility in a vertical direction (Y) of the horizontal bar (3a) and the rotation of the backrest (5), it is possible to perform a wide variety of exercises in order to work on different muscle groups, such as the user's upper and lower musculature, on the same machine (1).

[0026] For example, for the purposes of performing upper body or even cervical exercises, the gantry (3) may be moved from the front area (2a) to the rear area (2c) and the horizontal bar (3a) placed at the height of the back of the user's head for the purpose of performing cervical training exercises. Another exercise that is possible by keeping the gantry (3) between the rear zone (2c) and the central zone (2b), is shoulder training, when the horizontal bar (3a) is positioned above the user. In this way, by adjusting the different positions of the gantry (3), the distance between the vertical bars (3b) and the height at which the horizontal bar (3a) is situated, the user can train limbs, the abdominal area, the lumbar area, the torso or even the hip. In summary, the machine (1) of the invention is very versatile and various exercises can be performed on a single machine (1).

[0027] As can also be seen in the drawings, albeit schematically, the machine (1) of the invention is also characterised in that on the backrest (5) and seat (4), an upper and lower restraint assembly (9, 10) is included for correct positioning of the user's body and at least one armrest (8) is included on either side of the backrest (5) for positioning the user's arms. The backrest (5) is provided with a double cross-restraint system (9) secured at four points on the backrest (5) to impede movement of the user's upper body. That is, the restraint system (9) is provided with two securing points on the upper part of the backrest (5) and two other securing points on the lower part of the backrest (5). More specifically, the double restraint system (9) is composed of two belts whereby one is secured to the upper right end and lower left end of the backrest (5) and the other belt is secured to the upper left end and lower right end of the backrest (5). Likewise, the seat (4) is provided with at least one single restraint system (10) for the user's lower body which is secured to at least two points of the seat (4) in order to impede movement of the user's lower body.

[0028] Due to the restraint systems (9, 10) and the armrest (8), the user's posture may be corrected and/or re-

strained during the different isometric exercises in order to prevent injury.

[0029] On the basis of the aforesaid, the invention describes a machine (1) that allows better accessibility and comfort in order that all types of users, regardless of their degree of mobility, can exercise and strengthen their bodies by means of different isometric exercises.

10 Claims

1. Isometric exercise machine (1) provided with a base structure (2) stably supported on the floor and an upright gantry structure (3) above the base structure (2) and at least one seat (4) with a backrest (5) in an area between a rear area (2c) and a central area (2b) of the base structure (2), wherein the machine (1) is **characterised in that**:

- The gantry structure (3) is provided with at least one triaxial sensor positioned on at least one projecting element (7) of a horizontal bar (3a) of the gantry structure (3) and wherein
- The backrest (5) of the seat (4) is provided with at least one armrest (8) on either side of the backrest (5) and at least one double cross-restraint system (9) to secure the user's upper body, wherein
- The seat (4) is provided with at least one single restraint system (10) for securing the user's lower body.

2. Isometric exercise machine (1) in accordance with Claim 1, wherein the triaxial sensors are situated within the structure of at least one projecting element (7) of the horizontal bar (3a), whereon at least one grip (7a) is positioned for the performance of the isometric exercise.

3. Isometric exercise machine (1) in accordance with Claim 1, wherein the gantry structure (3) is longitudinally movable in a direction (L) from a front area (2a) of the base structure (2) to the rear area (2c) of the base structure (2) by means of rails (11).

4. Isometric exercising machine (1) in accordance with Claim 1, wherein the gantry structure (3) provided with at least one vertical bar (3b) on either side of the base structure (2) joined by at least the horizontal bar (3a) whereon the grips (7a) are secured on the projecting elements (7).

5. Isometric exercise machine (1) in accordance with Claim 4, wherein the horizontal bar (3a) is vertically moveable in a direction (Y) along the vertical bar (3b).

6. Isometric exercise machine (1) in accordance with Claim 4, wherein the horizontal bar (3a) is telescopic,

allowing at least one vertical bar (3b) to be movable in one direction (Z).

7. Isometric exercising machine (1) in accordance with Claim 2, wherein the grips (7a) are disconnectable and interchangeable with others. 5
8. Isometric exercise machine (1) in accordance with Claim 1, wherein the gantry structure (3) is provided with a display (12) located between the vertical bars (3b), whereon the force applied to the grips (7a) and measured by at least one sensor is displayed. 10
9. Isometric exercise machine (1) in accordance with Claim 1, wherein the backrest (5) of the seat (4) is reclinable from a vertical position to a horizontal position in a rotational direction (R). 15
10. Isometric exercise machine (1) in accordance with Claim 1, wherein the double restraint system (9) of the backrest (5) is secured to at least four points of the backrest (5) to restrict the movement of the user's upper body. 20
11. Isometric exercise machine in accordance with Claim 10, wherein the double restraint system (9) of the backrest (5) is provided with two belts such that one is secured at the upper right end and at the lower left end of the backrest (5) and the other belt is secured at the upper left end and at the lower right end of the backrest (5). 25 30
12. Isometric exercise machine (1) in accordance with Claim 1, wherein the single restraint system (10) of the seat (4) is secured to at least two points on the seat (4) to restrict the movement of the user's lower body. 35
13. Isometric exercising machine (1) in accordance with Claim 12, wherein the restraint system (10) of the seat (4) is provided with a belt secured to each side of the seat (4). 40

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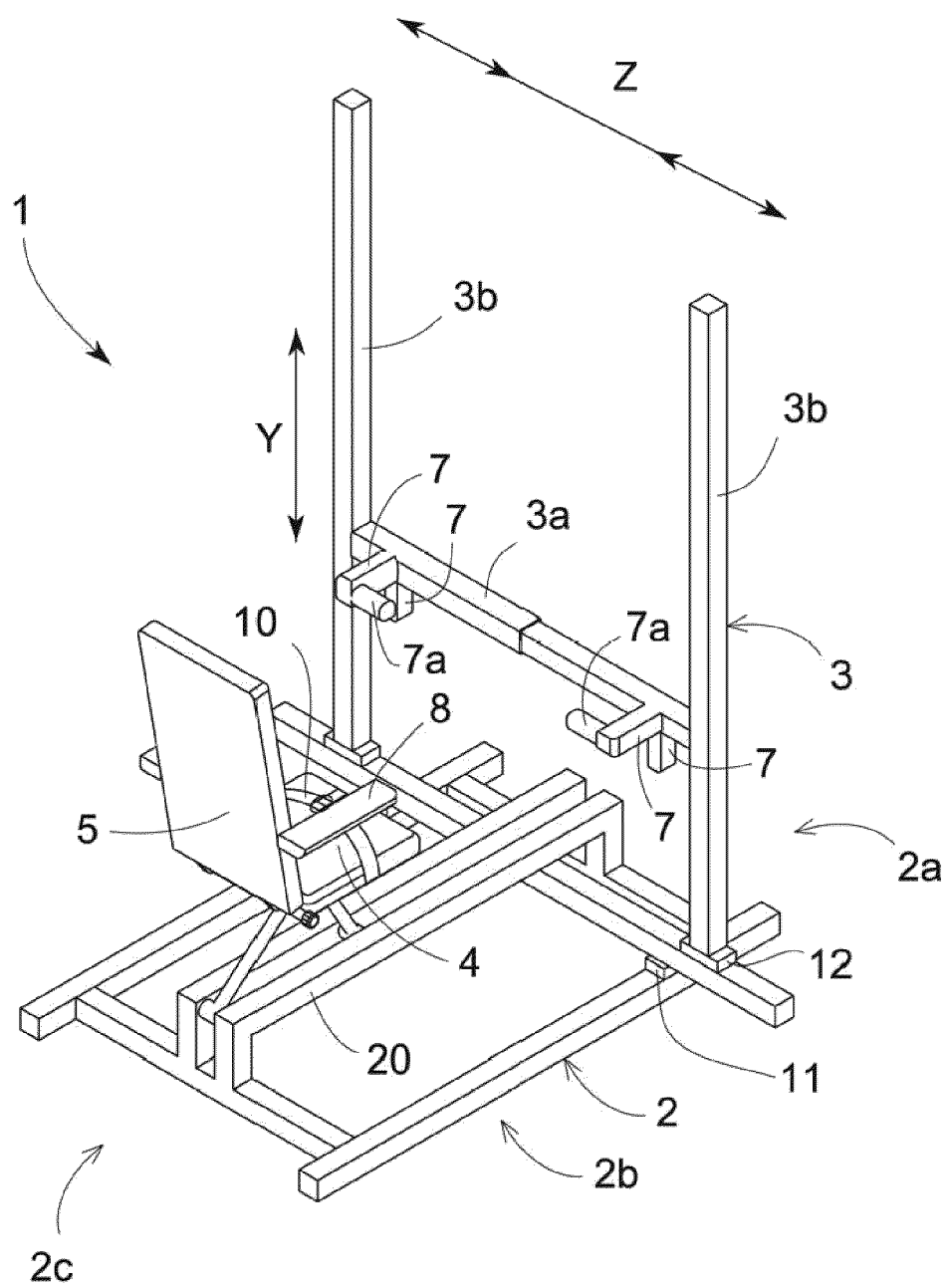


FIG.1

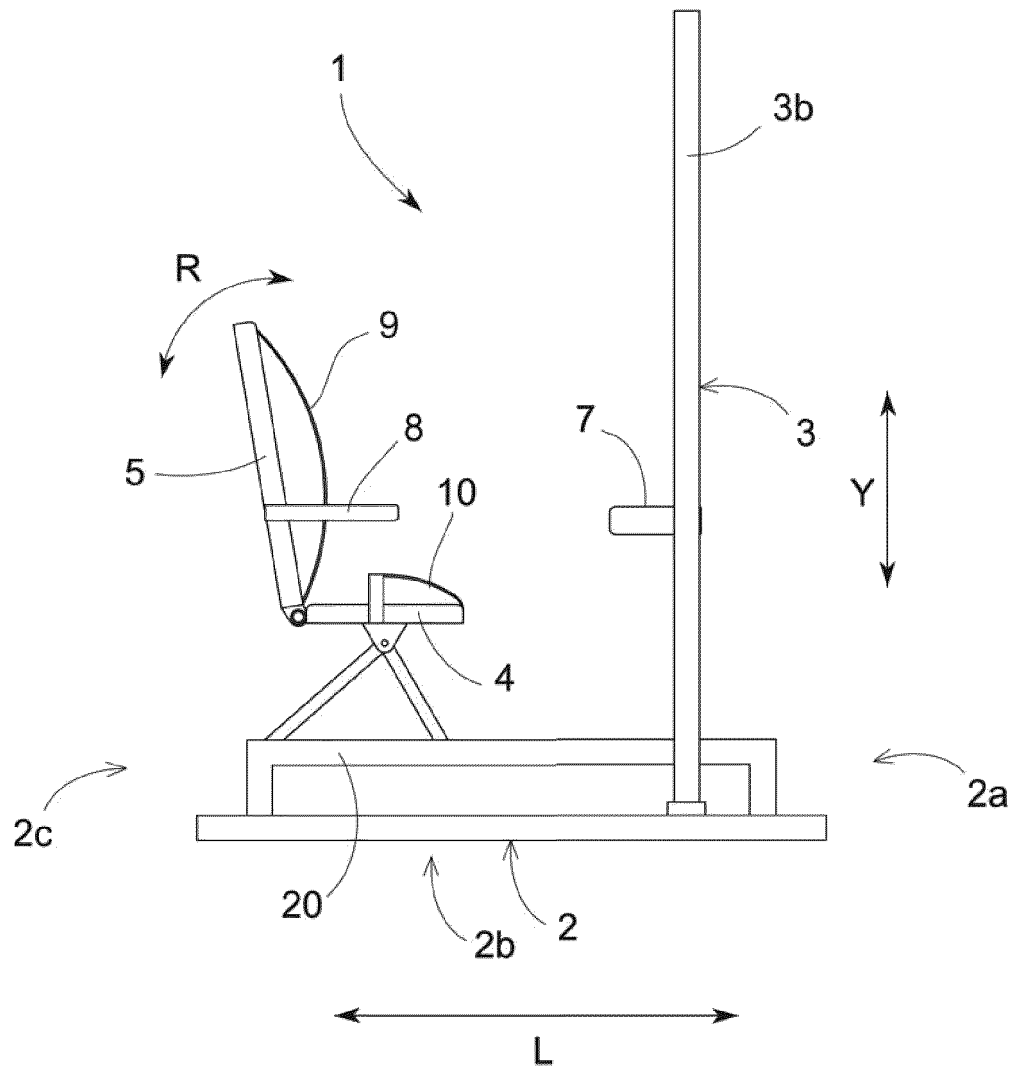


FIG.2

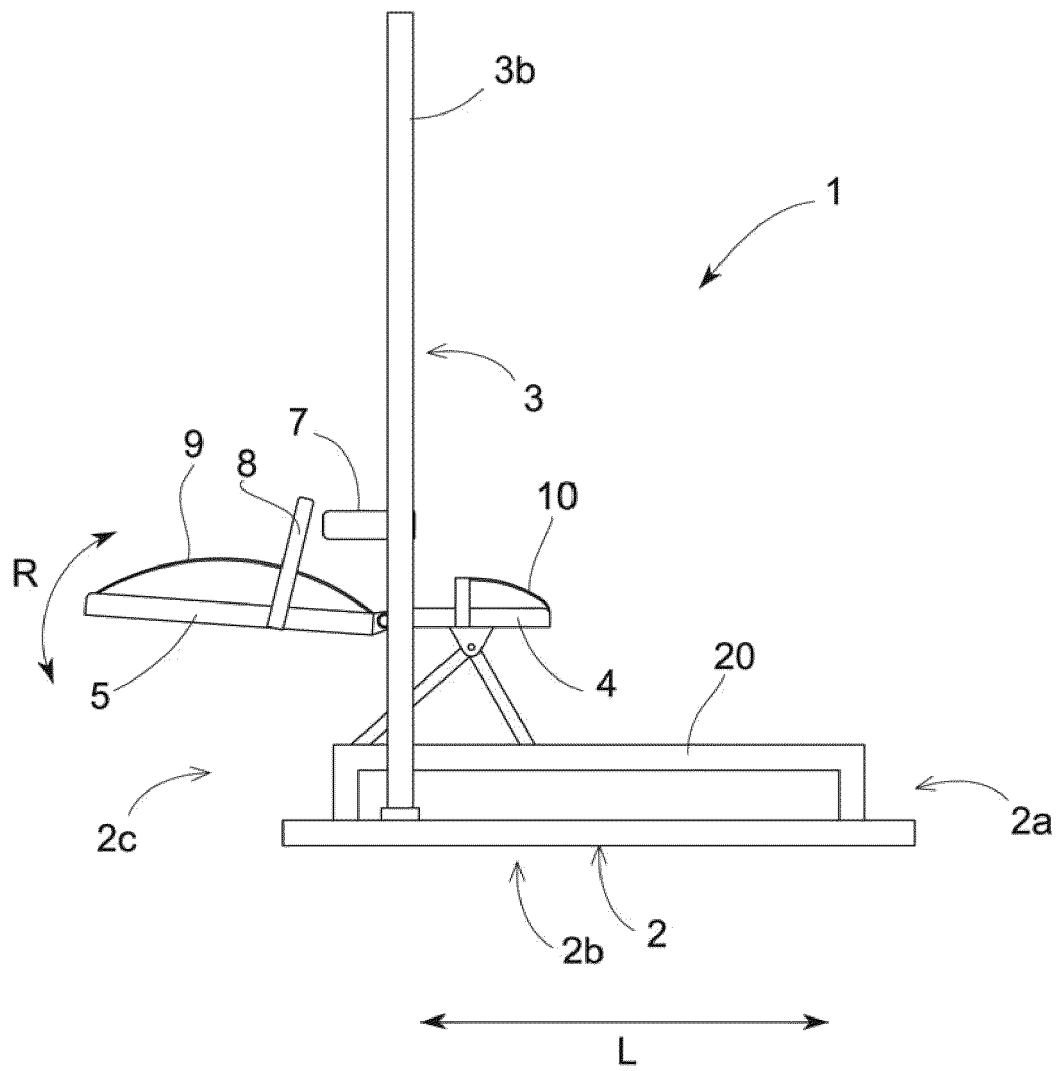


FIG.3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2022/070329

5	A. CLASSIFICATION OF SUBJECT MATTER	
	A63B21/002 (2006.01)	
	According to International Patent Classification (IPC) or to both national classification and IPC	
10	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	
15	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	
20	Category*	Citation of document, with indication, where appropriate, of the relevant passages
	X	US 2013102440 A1 (HUTCHINS KENNETH M ET AL.) 25/04/2013, paragraphs [0059-0063], figures 9-26.
25	A	US 2020353310 A1 (BISSONNETTE MICHAEL ET AL.) 12/11/2020, description; figures 29-35.
	A	US 9446288 B1 (PAZAN STEVEN E) 20/09/2016, the whole document.
30	A	RYTKOSKI U et al., Measurement of low back mobility, isometric strength and isoinertial performance with isostation B-200 triaxial dynamometer. Journal Of Spinal Disorders United States Feb 1994., 31/01/1994, Vol. 7, N° 1, pages 54 - 61, ISSN 0895-0385 (Print), <DOI: pubmed:8186590>, the whole document.
35		
40	☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.	
45	* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance. "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure use, exhibition, or other means. "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 documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
50	Date of the actual completion of the international search 24/08/2022	Date of mailing of the international search report (29/08/2022)
55	Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer M. Cañadas Castro Telephone No. 91 3495429

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2022/070329

C (continuation).		DOCUMENTS CONSIDERED TO BE RELEVANT
Category *	Citation of documents, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4702108 A (AMUNDSEN LOUIS R ET AL.) 27/10/1987, description; figures 1-33.	10-13

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

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PCT/ES2022/070329

Information on patent family members

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US9446288 B1	20.09.2016	NONE	
US4702108 A	27.10.1987	NONE	

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REFERENCES CITED IN THE DESCRIPTION

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