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(54) Apparatus with rotating axes for physical training

(57) A physical training apparatus (1) with swivel axes (X, Y, Z) comprises:
- a support base (10),
- a plurality of concentric rings (2, 3, 4) with an inner ring (2) on which a user (100) can be restrained in a position of use and an outer ring (4) supported in a swivellable manner by the support structure (10),
- swivellable restraining means (5a,5b, 6a,6b, 7a,7b) for interconnecting the inner ring (2) and the outer ring (4) by means of an intermediate ring (3), at diametrally opposed points of the rings (2, 3, 4),
- a plurality of masses (8a, 8b, 8c, 8d) movable around at least one of the rings (2, 3, 4),
- moving means (20a, 20b, 21, 22, 23) for moving the masses (8a, 8b, 8c, 8d) between a first position in which they are uniformly distributed around the inner ring (2) so that the centre of gravity (G) and the geometric centre of the inner ring (2) almost coincide and a second position in which the movable masses (8a, 8b, 8c, 8d) are arranged in such a way that the centre of gravity (G) and the geometric centre of the inner ring (2) are spaced apart.

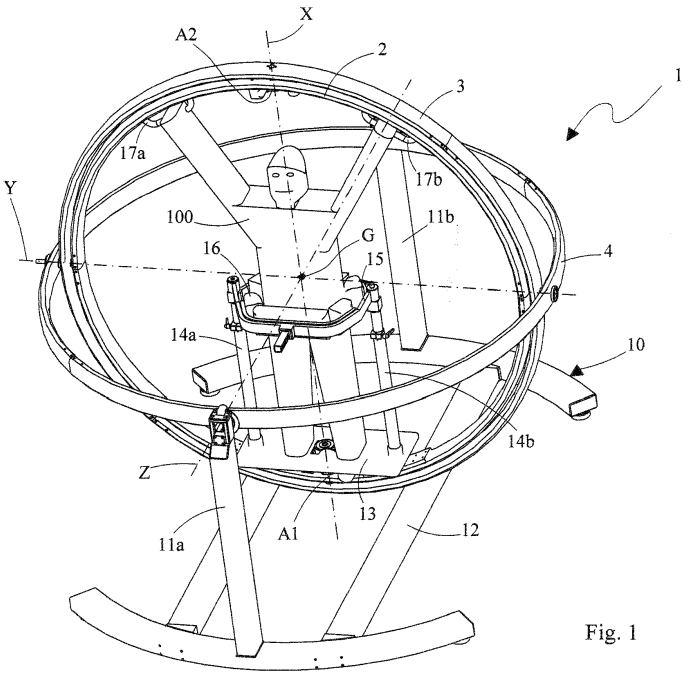

Fig. 1

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Description

Technical field

[0001] The subject of the present invention is a physical training apparatus with swivel axes of the type described in the preamble to the main claim.

Background Art

[0002] In the field of physical training apparatus, it is known to produce gyroscopic devices comprising a plurality of concentric rings (typically three concentric rings) which are hinged to one another by means of swivel joints at diametrally opposed points so that each ring is restrained on at least one ring adjacent thereto and can swivel relative thereto about a common diametral axis.

[0003] The outermost ring is also restrained on a support structure so as to be swivellable relative thereto about its own diametral axis which is fixed relative to the support structure. The swivel axes of the inner rings thus swivel relative to a fixed reference on the support structure.

[0004] The swivel joints are arranged on the rings in such a way that the swivel axes are generally not aligned with one another so that, for an apparatus with at least three rings, the innermost ring can be arranged in any orientation relative to a fixed reference on the base structure.

[0005] The dimensions of the above-described apparatus are such as to contain a user restrained on the innermost ring.

[0006] The present invention is suitable for a gyroscopic physical training device, particularly but not exclusively including non-motorized axes in which the movement of the rings is controlled by the user by balancing his body weight relative to the centre of the rings.

[0007] Apparatus of the type described above has been known for decades, for example, see US patent 3141669, and is normally used for recreational, physiotherapeutic or gymnastic purposes, for example, for cardiovascular exercises or for improving the sense of balance of pilots and astronauts, etc. One of the problems which apparatus of the type described above has is that of providing the user who is restrained on the apparatus with an effective, simple and safe stopping system.

[0008] In known apparatus with non-motorized swivel axes, stopping is achieved by the user by bending his legs and thus shifting his centre of gravity towards his feet. The inner ring thus tends to be arranged naturally in a vertical plane, facilitating the user's exit from the apparatus.

[0009] This manoeuvre cannot be performed by all users, in particular due to inexperience, physical or mental handicap or panic.

[0010] In these cases, external operators have to intervene and, since they have to stop the swivelling of the rings manually, they are subjected to the risk of accidents in the event of impact with the swivelling masses.

Description of the invention

[0011] The objective of the invention is to provide a physical training apparatus with swivel axes which is designed structurally and functionally to overcome the problems discussed with reference to the prior art mentioned.

[0012] This and other objectives which will be explained further below are addressed and achieved by the invention by means of an apparatus formed in accordance with the appended claims.

Brief description of the drawings

[0013] The characteristics and the advantages of the invention will become clearer from the following detailed description of a preferred embodiment thereof which is described by way of non-limiting example with reference to the appended drawings, in which:

Figure 1 is an axonometric view of an apparatus with swivel axes according to the present invention,
Figure 2 is a front view of the apparatus of Figure 1,
Figure 3 is a section taken on the section line III-III through a detail of Figure 2,
Figure 4 is a section taken on the section line IV-IV through a detail of Figure 2,
Figure 5 is a section taken on the section line V-V through a detail of Figure 2,
Figure 6 is a section taken on the section line VI-VI through a detail of Figure 2, and
Figure 7 is a section taken on the section line VII-VII through a detail of Figure 2.

Preferred embodiment of the invention

[0014] With reference to the appended drawings, a physical training apparatus with swivel axes is generally indicated 1 and comprises a support structure 10 and a plurality of concentric rings. In the non-limiting example of the appended drawings, three rings are provided, an inner ring 2, an intermediate ring 3, and an outer ring 4. The support structure 10 comprises a pair of pillars 11a, 11b supported by a base frame 12 which is constituted by a plurality of longitudinal members almost lying in a plane and held together rigidly. The base frame 12 can be placed on a support surface, for example, a floor surface. The outer ring 4 is supported so as to be swivellable on the ends of the pillars 11a, 11b remote from the frame 12 by swivelling restraining means constituted by two swivel joints 7a, 7b. The swivel joints 7a, 7b are connected to the outer ring 4 in respective diametrally opposed positions so that the outer ring 4 can swivel relative to the support structure 10 about a diametral axis Z. Further swivelling restraining means are provided for interconnecting the inner ring 2 and the outer ring 4 via the intermediate ring at diametrally opposed points of the rings

2, 3, 4. These restraining means comprise a pair of swivel joints 6a,6b interposed between the outer ring 4 and the intermediate ring 3 so that the intermediate ring 3 can swivel relative to the outer ring 4 about a diametral axis Y common to the rings 3, 4, and a pair of swivel joints 5a,5b interposed between the inner ring 2 and the intermediate ring 3 so that the inner ring 2 can swivel relative to the intermediate ring 3 about a diametral axis X common to the rings 2, 3.

[0015] The swivel joints 6a,6b are arranged on the outer ring 4 at an angular spacing of 90° from the joints 7a, 7b, respectively, so that the axes Y and Z are perpendicular to one another.

[0016] The joints 5a, 5b are arranged on the intermediate ring 3 at an angular spacing of 90° from the joints 6a,6b, respectively, so that the axes X and Y are perpendicular to one another.

[0017] The arrangement of the diametral axes X, Y and Z enables the inner ring 2 to be arranged at any orientation relative to a fixed reference on the support structure 10.

[0018] Three incremental encoders (not shown) are provided for each pair of swivel joints 5a,5b, 6a,6b, 7a, 7b, to detect the angular positions of each ring 2, 3, 4, in particular of the inner ring 2.

[0019] The inner ring 2 has dimensions such that a user 100 can be restrained inside it in a position of use in which the user 100 is arranged along a diameter A of the inner ring 2, which lies along the diametral axis X, with his feet positioned in the vicinity of a first end A1 of the diameter A and his head arranged towards an opposite, second end A2 of the diameter A. The diametral axis X of swivelling of the inner ring 2 relative to the intermediate ring 3 is thus aligned with the longitudinal axis of the user 100 in the position of use.

[0020] In the vicinity of the end A1, there is a support base 13 on which the feet of the user 100 can be restrained by means of a restraining system (known *per se* and not shown in detail in the drawings) comprising two support brackets for the heels and a clamping device arranged at instep level. Two supports 14a, 14b extend from the support base 13 and support a restraining ring 15 which is provided with padding 16 on the inside and in which the user 100 is accommodated and restrained in the region of his waist so that the centre of gravity of the user 100 almost coincides with the centres of the rings 2, 3 and 4. The ring 15 can be opened to allow the user 100 to get in and out.

[0021] To facilitate the user's entry to and exit from the structure 1, the rings are arranged as in Figure 1 with the outer ring 4 horizontal and parallel to the base frame 12 and the intermediate ring 3 and the inner ring 2 coplanar and arranged perpendicularly relative to the outer ring 4.

[0022] A pair of handles 17a, 17b which can be gripped by the user in the position of use are provided in the half-portion of the inner ring 2 comprising the second end A2 of the diameter A. The handles 17a, 17b are arranged on the ring 2 on opposite sides of the end A2 and at an angular spacing of about 30° therefrom.

[0023] The rings 2, 3 and 4 are formed by respective aluminium profiles with almost oval, closed cross-sections having respective internal cavities 30 extending circumferentially. Each of the internal cavities 30 is delimited by two opposed, inner and outer, annular walls 30a and 30b, and by two opposed, circular ring-shaped, flat walls 30c, 30d. The walls 30c, 30d are perpendicular to the annular walls 30a, 30b and are connected thereto by means of curved-sectioned walls 30e, 30f, 30g, 30h. Respective circumferentially extending ribs 26 (three ribs 26 for each wall 30c, 30d in the embodiment shown in the appended drawings) project from the walls 30c, 30d towards the internal cavities 30 and are spaced apart by respective recesses 28 (two recesses 28 in the embodiment shown in the appended drawings). A plurality of channelled guides are defined in the recesses 28 between the mutually facing sides of pairs of adjacent ribs 26 (two guides 27a, 27b for each wall 30c, 30d in the embodiment shown in the drawings) for guiding a plurality of masses (four masses 8a, 8b, 8c, 8d in the embodiment shown in the drawings) which are movable around the inner ring 2 inside the respective cavity 30.

[0024] Each of the masses 8a, 8b, 8c, 8d has an arcuate shape so that it can be housed in the inner ring 2 and is provided with a pair of projections 32 facing towards the inner and outer walls 30c, 30d, respectively, each projection 32 being engaged with a respective guide 27a. The masses 8a, 8b, 8c, 8d are movable between a first position in which they are distributed uniformly around the inner ring 2 so that the centre of gravity G of the assembly constituted by the rings 2, 3 and 4 and possibly by the user, and the geometric centres of the rings 2, 3 and 4 almost coincide, and a second position in which the movable masses 8a, 8b, 8c, 8d are arranged in such a way that the centre of gravity G and the geometric centres of the rings 2, 3 and 4 are spaced from one another with the centre of gravity G shifted along the diameter A towards the user's feet.

[0025] In the first position, the movable masses 8a, 8b, 8c, 8d are distributed so as to be arranged at an angular spacing of about 45° from the longitudinal axis W1 and the transverse axis W2 of the user 100 in the position of use.

[0026] In the second position, the movable masses 8a, 8b, 8c, 8d are shifted towards the end A1 of the diameter A. In particular, the movable masses 8a, 8b positioned in the half-portion of the ring containing the end A1 of the diameter A are shifted towards the end A1 whereas the movable masses 8c, 8d that are positioned in the half-portion of the ring containing the end A2 of the diameter A are shifted towards the transverse axis W2.

[0027] When the movable masses 8a, 8b, 8c, 8d are in the second position, the inner ring 2 is thus arranged naturally in a vertical plane, owing to the shifting of the centre of gravity G, facilitating stopping of the movement as well as the entry and exit of the user to and from the apparatus 1. According to further variants of the inven-

tion, the movable masses 8a, 8b, 8c, 8d are positioned around one or more of the rings 2, 3, 4, for example, around the intermediate ring 3. In this latter case, for the apparatus 1 of the appended drawings, when the intermediate ring 3 is arranged in a vertical plane, the inner ring 2 is also in a vertical plane since the axis X is oriented in the same manner as the longitudinal axis of the user 100.

[0028] Moving means are provided on the apparatus 1 for shifting the movable masses 8a, 8b, 8c, 8d between the first and second positions and include a pair of electric motors 20a, 20b positioned at the ends A1 and A2, respectively, and respective geared transmissions 25 for transmitting the drive from each of the motors 20a, 20b to a respective pair of movable masses 8a, 8b and 8c, 8d.

[0029] Each transmission 25 comprises a pinion 21 which is connected to the output shaft of the respective electric motor 20a, 20b and is housed in the cavity 30 of the inner ring 2. Each transmission 25 also comprises two gearing arrangements between the pinion 21 and two ring gear portions 22, 23 which are also housed in the cavity 30 of the inner ring 2. The two ring gear portions 22, 23 are guided by respective guides 27b formed in the inner and outer walls 30c, 30d of the inner ring 2, respectively, and move around the inner ring 2 in opposite directions since the two gearing arrangements between the pinion 21 and the ring gears 22, 23 are arranged in diametrally opposite positions relative to the same pinion 21.

[0030] Each of the ring gear portions 22, 23 is restrained on a respective mass of the movable masses 8a, 8b, 8c, 8d by means of respective connecting screws 35 so that the movable masses 8a, 8b, 8c, 8d are movable around the inner ring 2 by means of the electric motors 20a, 20b, via the transmissions 25. Respective absolute encoders 24 are also provided on the inner ring 2 in positions adjacent each of the electric motors 20a, 20b and are provided with respective pinions 24a which mesh with the ring gear portions 22, 23 that are coupled with the respective motors 20a, 20b. The positions of the movable masses 8a, 8b, 8c, 8d can thus be identified at any moment by means of the encoders 24. Both the electric motors 20a, 20b and the absolute encoders 24 are connected to an electrical supply by means of electrical connections represented schematically by the broken line 37 in Figure 2 and extending through the cavities 30 and through the swivel joints 5a,5b, 6a,6b, and 7a,7b.

[0031] Control means (not shown) for the moving means are provided on the apparatus 1 for the actuation of the electric motors 20a, 20b and the consequent movement of the movable masses 8a, 8b, 8c, 8d and can be operated by the user 100 whilst he is restrained in the position of use.

[0032] The control means comprise a plurality of pushbuttons arranged on the restraining ring 15 or on the handles 17a, 17b.

[0033] According to a variant of the invention, the control means are of the remote type since they are optionally also operable by an operator who is not restrained on the apparatus 1.

[0034] According to a further variant of the invention, the control means are operated by the intervention of a control system (not shown) in dependence on the angular positions of the rings, which are detected by means of the signals received from the incremental encoders provided in the swivel joints 5a,5b, 6a,6b and 7a,7b.

[0035] The invention thus achieves the objective set, enabling the swivelling of the rings to be stopped by the movement of the masses 8a, 8b, 8c, 8d and the consequent shifting of the centre of gravity G of the apparatus 1, without prejudicing the safety of the user restrained on the apparatus or of an external operator.

[0036] At the same time, the invention affords other advantages since it is also applicable to apparatus similar to the apparatus 1 but with motorized axes. In this case in fact the application of the present invention provides an additional stopping system usable, for example, in the event of a malfunction or damage to the motors.

Claims

1. Apparatus (1) with swivel axes (X, Y, Z) for physical training, comprising:

- a support structure (10),
- a plurality of concentric rings (2, 3, 4) including at least one inner ring (2) on which a user (100) can be restrained in at least one position of use and at least one outer ring (4) supported in a swivellable manner by the support structure (10),
- swivellable restraining means (5a,5b, 6a,6b, 7a,7b) for interconnecting the inner ring (2) and the outer ring (4) at diametrally opposed points of the rings (2, 3, 4),
- a plurality of masses (8a, 8b, 8c, 8d) movable around at least one of the rings (2, 3, 4),

characterized in that it further comprises moving means (20a, 20b, 21, 22, 23) for moving the masses (8a, 8b, 8c, 8d) between a first position in which the masses (8a, 8b, 8c, 8d) are uniformly distributed around the inner ring (2) so that the centre of gravity (G) and the geometric centre of the inner ring (2) almost coincide and a second position in which the movable masses (8a, 8b, 8c, 8d) are arranged in such a way that the centre of gravity (G) and the geometric centre of the inner ring (2) are spaced apart.

2. Apparatus according to Claim 1 wherein the plurality of masses (8a, 8b, 8c, 8d) are movable around the inner ring (2).

3. Apparatus according to Claim 1 or Claim 2 wherein,

in the position of use, the user (100) is arranged along a diameter (A) of the inner ring (2) so that, when the movable masses (8a, 8b, 8c, 8d) are in the first position, the centre of gravity of the inner ring (2) almost coincides with the centre of gravity of the user (100) and, when the movable masses (8a, 8b, 8c, 8d) are in the second position, the centre of gravity (G) of the inner ring (2) is shifted along the diameter (A) towards the user's feet.

4. Apparatus (1) according to any one of the preceding claims wherein control means are provided for the moving means (20a, 20b, 21, 22, 23), the control means being operable by the user (100) restrained in the position of use.

5. Apparatus (1) according to any one of the preceding claims wherein the moving means (20a, 20b, 21, 22, 23) comprise at least one electric motor (20a, 20b) and a transmission (25) for transmitting the drive from the motor (20a, 20b) to at least one of the movable masses (8a, 8b, 8c, 8d).

6. Apparatus according to Claim 5 wherein the transmission (25) comprises at least one gearing arrangement (21, 22).

7. Apparatus according to Claim 6 wherein the transmission (25) comprises at least a first gearing arrangement (21, 22) between a pinion (21) fixed to the output shaft of the electric motor (20a) and at least one first ring gear portion (22) movable around the inner ring (2), the at least one first ring gear portion (22) being restrained on at least one first mass of the movable masses (8a, 8b, 8c, 8d).

8. Apparatus (1) according to Claim 7 wherein the transmission (25) comprises at least one second gearing arrangement (21, 23) between the pinion (21) and at least one second ring gear portion (23) movable along the inner ring (2), the at least one second ring gear portion (23) being restrained on at least one second mass of the movable masses (8a, 8b, 8c, 8d), the first and second gearing arrangements being positioned arranged at diametrally opposed points of the pinion (21) so that the first and second ring gear portions (22, 23) are movable in opposite directions.

9. Apparatus (1) according to Claim 6 or Claim 7 wherein the inner ring (2) comprises a cavity (30) extending circumferentially, the pinion (21), the ring gear portion (22, 23), and the movable masses (8a, 8b, 8c, 8d) being housed in the cavity (30).

10. Apparatus (1) according to any one of Claims 7 to 9 wherein the inner ring (2) comprises at least one guide (27a, 27b) for guiding the at least one ring gear portion (22, 23) and/or the movable masses (8a, 8b, 8c, 8d).

11. Apparatus (1) according to any one of Claims 5 to 10 wherein a pair of electric motors (20a, 20b) is mounted in diametrally opposed positions on the inner ring (2), each motor (20a, 20b) being associated with a respective transmission (25) comprising a pair of ring gear portions (22, 23) movable around the inner ring (2) in opposite directions, each of the ring gear portions (22, 23) being restrained on at least one respective mass of the movable masses (8a, 8b, 8c, 8d).

12. Apparatus (1) according to any one of the preceding claims wherein the swivellable restraining means (5a,5b, 6a,6b, 7a,7b) comprise at least one pair of swivel joints (5a,5b) interposed between two adjacent rings (2, 3) of the plurality of concentric rings (2, 3, 4), the swivel joints being positioned in diametrally opposed positions so that the two rings (2, 3) are rotatable relative to one another about a common diametral axis (X).

13. Apparatus (1) according to Claim 12 wherein the plurality of rings is constituted by three rings (2, 3, 4), an inner ring, an intermediate ring and an outer ring, respectively, the inner ring (2) being swivellable relative to the intermediate ring (3) and the intermediate ring (3) being swivellable relative to the outer ring (4), about respective diametral axes (X, Y).

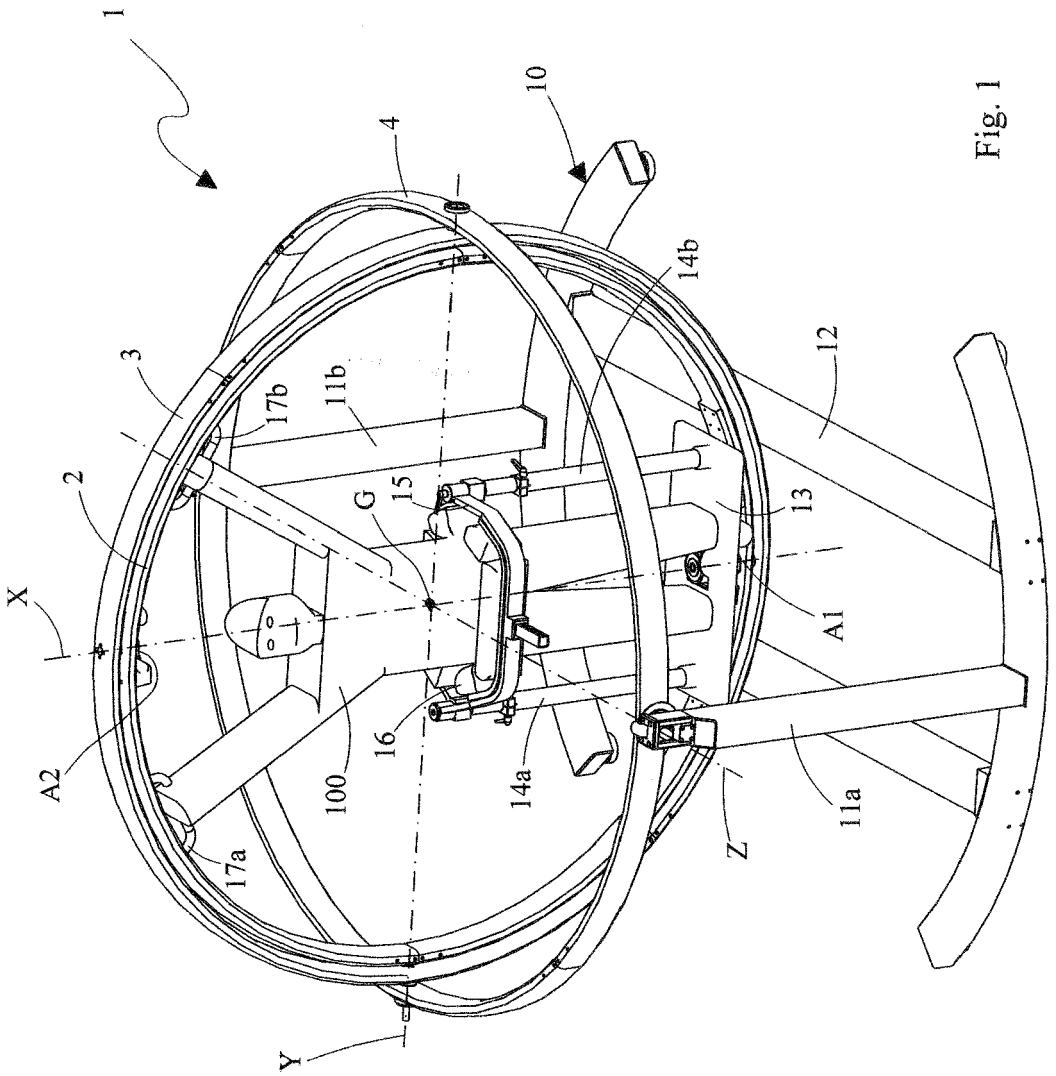
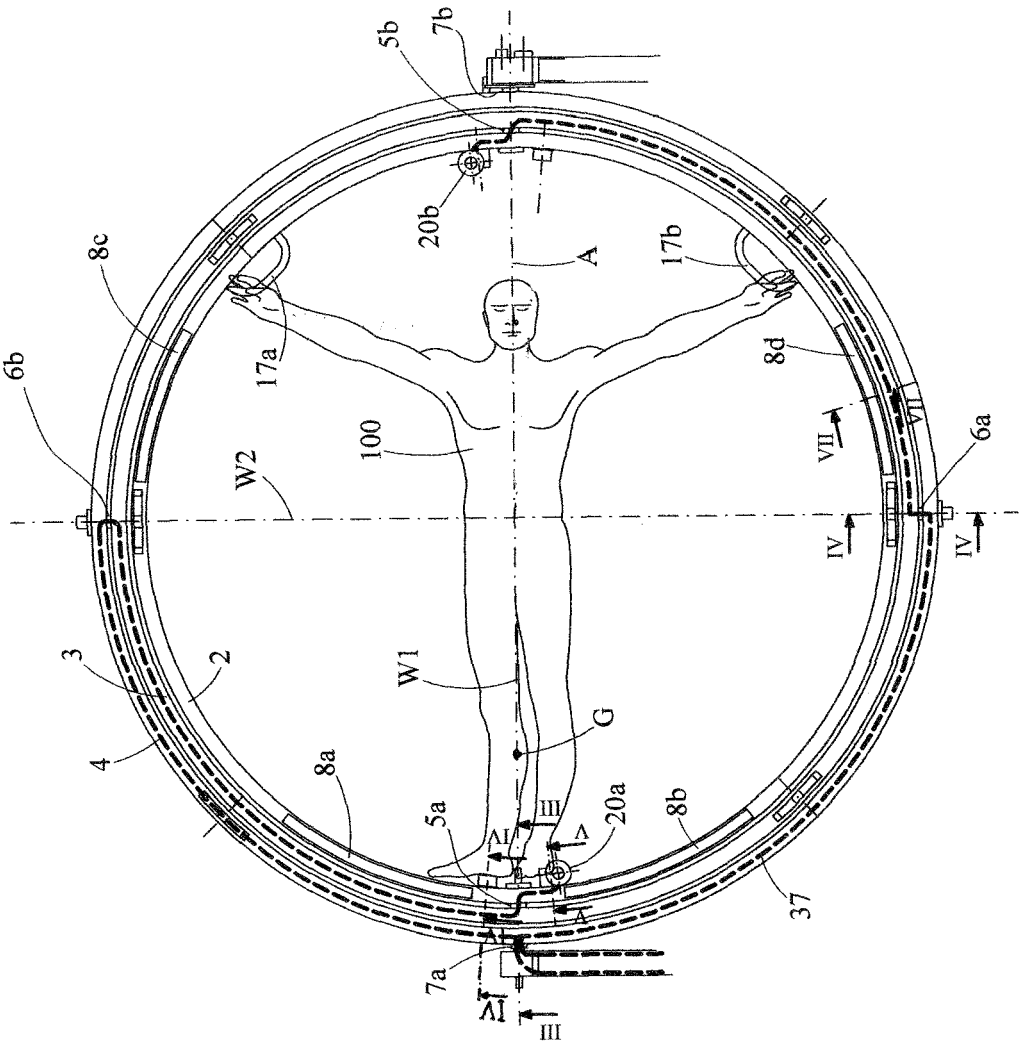


Fig. 1

Fig. 2


5b
7b
20b
A
17b
8c
17a
8d
6b
100
W2
VII
VII
6a
IV
IV
3
2
W1
G
4
8a
5a
III
20a
8b
III
37
A
7a
IV
III

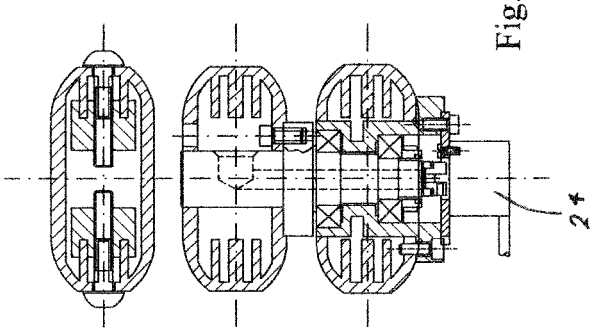


Fig. 4

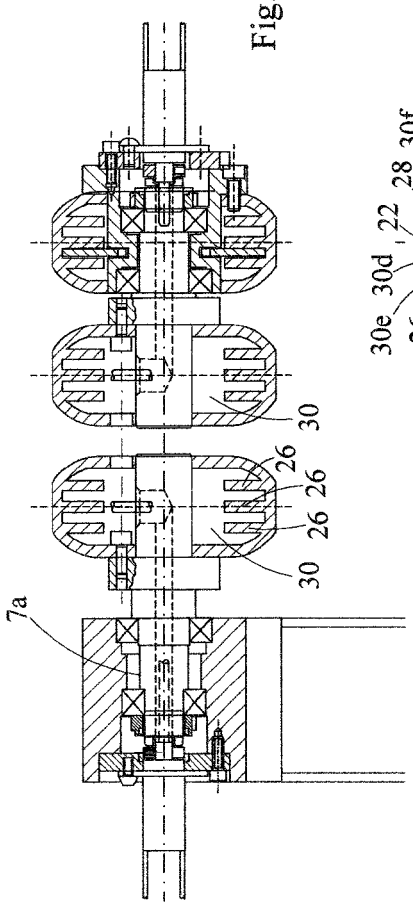


Fig. 3

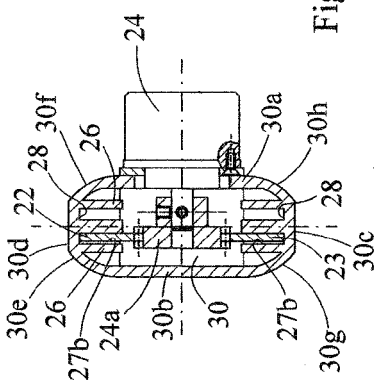


Fig. 6

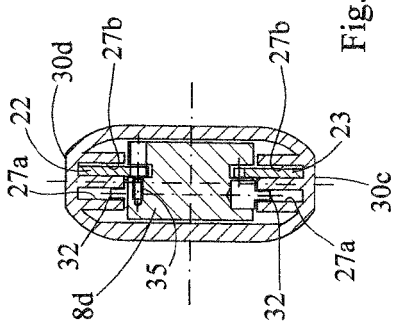


Fig. 7

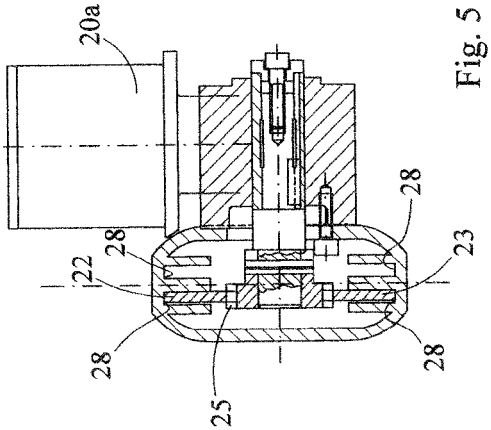


Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 11 16 9238

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 082 786 A1 (WILFRIED LEFEV DR INGOLF PIECH [DE]) 29 July 2009 (2009-07-29) * the whole document *	1	INV. A63B19/04
A,D	US 3 141 669 A (YUN CHUL) 21 July 1964 (1964-07-21) * the whole document *	1	
A	US 5 702 307 A (MORAN KRISTEN G [US]) 30 December 1997 (1997-12-30) * the whole document *	1	
A	DE 200 06 998 U1 (BOELLERT JENS [DE]) 3 August 2000 (2000-08-03) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (IPC) A63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 September 2011	Millward, Richard

CATEGORY OF CITED DOCUMENTS

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19-09-2011

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US 5702307 A	30-12-1997	NONE	
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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