(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 747 804 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
31.01.2007 Bulletin 2007/05

(51) Int Cl.:
A63B 69/00 *(2006.01)* ***A63B 21/00*** *(2006.01)*
A63B 23/04 *(2006.01)*

(21) Application number: **06117613.7**

(22) Date of filing: **20.07.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **29.07.2005 IT RA20050029**

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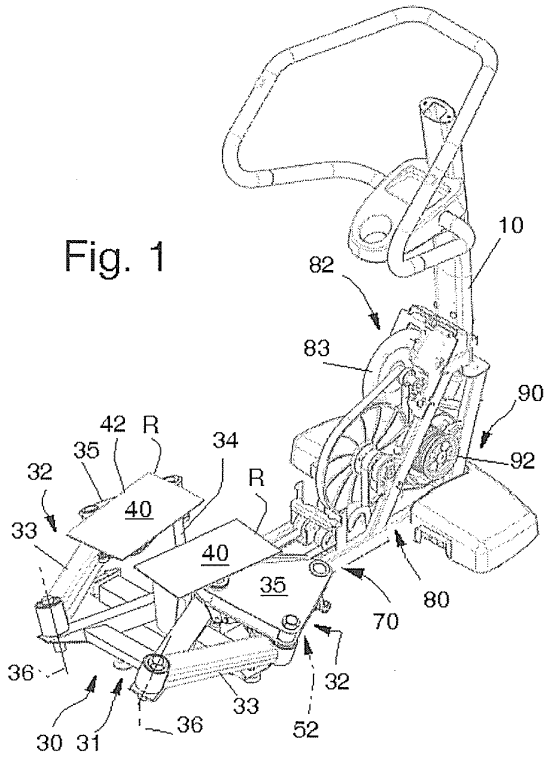
(54) Gymnastic machine

(57) Gymnastic machine (1) having a frame (10) supporting a load unit (20) and including an exercise station (30) having at least one functional group (31) mechanically connected to the load unit (20) to exchange mechanical energy with the load unit (20); the group (31) including at least one articulated quadrilateral (32) coupled to the frame (10) and an implement (40) connected to the articulated quadrilateral (32) and movable with respect to the frame (10) to exchange energy with the load unit (20); the implement (40) being shaped in such a way as to be interfaceable with a particular portion of an extremity of a user and being movable over an open path (P); a restraint device (52) being provided in combination with at least one articulated quadrilateral to control, in use, the displacement of the implement (40) relative to the frame (10) in such a way that, in use, the implement (40) is movable along path (P) according to a substantially curvilinear composite movement.

Fig. 1



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Description

[0001] The present invention relates to a machine effectively usable for executing physical exercises. In general , this invention can have application both in gymnastic machines for the execution of exercises aimed principally at muscular development, and in machines set up for the execution of training of cyclical type, and therefore aimed principally at the development of resistance to prolonged exertion. In more detail the present invention relates to a gymastic machine having at least one implement usable for the repeated execution of reciprocating movements over an open path through the use of an articulated device.

BACKGROUND TO THE INVENTION

[0002] In the field of gymnastic machine there are known machines for the execution of exercises which involve/recruit a single muscle area; machines for the execution of exercises which recruit several muscle areas simultaneously or in succession, and for this reason are designated "funct ional"; and machines which enable the development of resistance to prolonged muscular exertion, by means of which it is possible to perform repetitive aerobic/cardiovascular exercises. Normally, machines of the first type are equipped with load units with counter wieghts, in which the exercise provides for the execution of a succession of eccentric and concentric efforts, while machines of the second type are equipped with load units which can exchange energy with the user continuously while he/she carries out a cyclical movement without break in continuity. Among the latter, the most widespread are stationary bicycles, treadmills for welking or running, so-called "steppers" for simulating a route with steps, and elliptical machines for walking and/or running on movable foot boards on closed elliptical trajectories.

[0003] Stationary bicycles, steppers and elliptical machines have load units designed to operate by absorbing the power exerted by a user, while treadmills may be either of the type actuated by a user, or motorised with an actuator which determines the delivery of power by the user. Steppers, also, are of the ?floating type, in the sense that the power transmitted to the load unit during the operation of the footboards determines the average height of the user's centre of gravity with respect to the base of the machine, and therefore influences the amplitude of the movement.

[0004] Among machines for cyclical training, the gymnastic machine is known described with reference to Italian patent application no. RA2004A000044, filed on 16 September 2004 by the applicant, whose text is incorporated for brevity, both with reference to the criticism of the prior art, and with reference to the description of devices usable for the execution of gymnastic exercises which imitate the typical movement of skating. In the description in application no. '044 by the applicant, the teachings are discussed of US patents nos. 5,718,658 and 6786850, and the inventive concept is explained of an articulated device with crossed arms. This inventive concept leads to the construction of a machine having arms which at rest are mutuallly crossed, each of which supports a footboard usable by the foot of a user. Each footboard is constrained to rotate with respect to a fulcrum carried integrally with the free end of the corresponding arm through an articulated device fitted with asymmetrical levers owing to the necessity of limiting the longitudinal dimensions of the machine itself. Naturally this produces a significant complication in production, with a corresponding considerable economic impact, for example because of the need to produce asymmetrical frames, having fulcrumpins inclined differently. This aspect contributes to increasing the cost of the machine, particularly because of the numerous pieces of workshop equipment which must be provided in order to simplify production work, particularly in the case of small production volumes. In fact, it should be noted that in the case of specialist gymnastic machines such as the one in question, it is rare to reach production volumes sufficient to justify investment in automatic production plant, where the welding and the positioning of the portions to be rigidly connected to each other are carried out through the use of robotic tools.

SUMMARY OF THE PRESENT INVENTION

[0005] In general, the present invention relates to a machine effectively usable for executing training exercises. In general, this invention can have application both in gymnastic machines for the execution of exercises aimed principally at muscular development, and in machines set up for the execution of training of cyclical type, and therefore aimed principally at the development of resistance to prolonged exertion. In more detail the present invention relates to a gymnastic machine having at least one implement usable for the repeated execution of reciprocating movements over an open path through the use of an articulated device.

[0006] An object of the present invention is to create a gymnastic machine for the simulated execution of the movement of skating, having compact dimensions and free of the disadvantages described above.

[0007] An object of the present invention is to create a gymnastic machine having a high degree of structural symmetry and limited overall measurements in relation to the extent of the movement which may be carried out on it, in such a way as to simplify the production procedure and therefore allow the costs of production to be minimised.

[0008] A further object of the present invention is to construct a gymnastic machine for the simulated execution of the movement of skating, which should be usable indifferently by users who are already practised in the movements of skating, and by users who are not practised in this movement.

[0009] According to the present invention a gymnastic machine is constructed whose characteristics are described by reference to claim 1 and following.

BRIEF DESCRIPTION OF THE DRAWNGS

[0010] The invention will now be described by reference to the attached drawings, which illustrate some non-limiting examples of its embodiment, in which:

- Fig. 1 is a schematic perspective view of a first preferred embodiment of the present invention;
- Fig. 2 is a schematic plan view, on an enlarged scale and with parts removed for clarity, of the machine in figure 1;
- Fig. 3 is a schematic rear view , on an enlarged scale and with parts removed for clarity, of the machine in figure 1;
- Fig. 4 is a schematic view seen from below, on an enlarged scale and with parts removed for clarity, of the machine in Figure 1;
- Fig. 5 is a schematic perspective view of a front portion of figure 1 from a lateral point of view;
- Fig. 6 is a schematic perspective view of a rear portion of figure 1 from a lateral point of view.

DETAILED DESCRIPTION OF AT LEAST ONE EMBODIMENT OF THE PRESENT INVENTION

[0011] In figure 1, no. 1 indicates, in its entirety, a gymnastic machine having a frame 10 which supports a load unit 20 and an exercise station 30 arranged side by side. This station 30 is capable of exchanging mechanical energy with load unit 20 and has a group 31 of mechanical components articulated together, which include at least one articulated quadrilateral 32 coupled to the frame 10, and an implement 40 shaped so as to be interfaceable with a particular portion of an articular extremity of a user. In the example used to illustrate the present invention, it was decided to opt for a solution in which the extremity of a user is the lower one, therefore a foot, without this choice being considered limiting for the possibility of applying the invention itself to other articular extremities of a user. Each articulated quadrilateral 32 includes some mechanical members, which have been designated here and in what follows according to the terminology used in the field of general mechanics, to facilitate the interpretation of the text. In particular, each articulated quadrilateral 32 includes a first equaliser 33, coupled rotationally to frame 10 along an axis 36, a second equaliser 34, also coupled rotationally to frame 10 on an axis 37 and a connecting rod 35 linked to equalisers 33 and 34 by means of known rotational joints 38 and 39. Each implement 40 is coupled to the respective connecting rod 35 in freely rotatable manner around an axis 41 inclined in a particular manner with respect to a face 42 of footboard 40 itself, which defines a support plane of footboard 40, as will be better explained in what follows the present description.

[0012] As is well-known, each point of each connecting rod 35 describes curves in space shaped in a particular way, whose conformation depends on the position of the point itself on the connecting rod 35. For example: curvilinear, convex or bi convex, and in particular, not just curvilinear shapes but even ovoidal or extended figure-of-eight shapes, and therefore having a crossing. Seeing that connecting rod 35 is suitably shaped and has the implement 40 coupled toit in a suitable position, the implement 40 itself is movable along a particular path P, visible in figure 2, which in the casein question is curved and open, as will be better described further on. For greater clarity, figure 2 shows the path of one of the two axes 41 of the rotational kinematic pair between connecting rod 35 and foot board 40 of the articulated quadrilateral 32 illustrated on the right in figure 2 itself.

[0013] The connecting rod 35, furthermore is shaped like a prism with a triangular base of limited thickness, which carries in proximity to the respective corners, and therefore to the apexes of the base triangle, the kinematic pairs corresponding to axes 38, 39 and 41, previously described. The points of each component of the two articulated quadrilaterals 32 move on paths parallel to a plane. Preferably, but without limiting effect, this plane is inclined with respect to the horizontal, as is easily visible in the attached figures. The result is that path P is inclined downwards in such a way that each implement 40 is movable starting from a higher level in proximity to a longitudinal median plane M of machine 1 itself and a lower level located to the side.

[0014] Here and in what follows, for pure convenience, a preference is made for referring to the concrete case of a machine 1 employable for the simulation of the skating movement, without this choice necessarily being interpreted as an implicit limitation of the applicability of the present inventive concept to gymnastic machines usable for the execution of other forms of training than that of skating. In line with what has been stated, the machine 1 has two articulated quadrilaterals 32 arranged side by side and located symmetrically on opposite sides of plane M, fully analogously with what occurs in the known machines for simulating the skating movement. A preference is therefore made for assigning implement 40 the designation of foot board 40. Plane M is visible by reference to figure 2.

[0015] Again for reasons of convenience, it has been preferred not to complicate the attached drawings and the present description with the addition of a device, known and not illustrated, for the control and monitoring of machine 1, a device which is normally indicated by the term "console", referring to the casing which contains it. In fact, not withstanding that such a console normally has instruments for regulating particular functional aspects of the machine connected with physiological parameters of the user, the description of such a device would have added nothing to the inventive content of the present invention.

[0016] The exercise station 30 includes, for each articulated quadrilateral 32, a second articulated quadrilateral 52 whose reference frame is represented by connecting rod 35. In more detail, each quadrilateral 52 includes a first equaliser 53, coupled rotationally to the connecting rod 35 coaxially with axis 41, a second equaliser 54, also coupled rotationally to connecting rod 35 coaxially with axis 39 and a connecting rod 55 of determinate length, linked to equalisers 53 and 54 by means of spherical joints 56 and 57. It will be noted that each articulated quadrilateral 32 is capable of moving the respective articulated quadrilateral 52 through the respective equaliser 34, which is rigidly connected to equaliser 54 in such a way as substantially to constitute, in use, a single body, and therefore a movement of quadrilateral 32 generates a determinate movement of quadrilateral 52 and vice versa. The footboard 40 and the crank 53, furthermore, constitute a single member. In particular, the equaliser 53 is capable of constraining the rotation of the footboard 40 with respect to connecting rod 35 in such a way as to control in rotation a foot resting on an upper face 42 of the footboard 40 itself with respect to the corresponding connecting rod 35.

[0017] The choice of spherical joints for connecting the equalisers 53 and 54 through the respective connecting rod 55 has the advantage of allowing the correct functioning of the articulated quadrilateral 52 itself even in the event that equalisers 53 and 54 were constrained to rotate on axes 41 and 39 not parallel to each other, or in the event that the execution of the (known and not illustrated) housings of the (known and not illustrated) fulcrumpins of equalisers 53 and 54 on connecting rod 35 were to present a lack of parallelism, or in the event that deformation were to arise in the housings and/or in the pins such as to compromise the parallelism between axes 41 and 39 following improper use of the machine 1 itself. By virtue of what has been described above, the production specifications for connecting rod 35 and the respective (known and not illustrated) housings of equalisers 53 and 54, and of the respective (knownandnot illustrated) fulcrum pins can be defined with a greater degree of tolerance, with positive consequences for the production costs, which will be significantly reduced.

[0018] The control of the movement of each footboard 40 confers on each articulated quadrilateral 32, and in particular on each respective footboard 40, the capacity to support the feet of a user in a mating, and therefore bilateral, manner along the path P from and towards a rest position R of footboard 40, in which the latter lies alongside plane M and then alternating a first thrust phase with a subsequent return phase to the position R. By virtue of what has been described above, this occurs along the whole of path P, which is inclined downwards in its respective outer part, with the aim of increasing the safety of machine 1 for careless or inadequately trained or skilled users. Naturally, in the event that it is necessary to adapt the behaviour of footboard 40 to the needs of users, the component 55 can also have length adjustable at will.

[0019] On the basis of what has been described above, the rotation of the footboard 40 with respect to the connecting rod 35 is controlled by quadrilateral 52 by means of equaliser 53 which, in its turn, is controlled by quadrilateral 32, by means of equaliser 34. The assembly, therefore, of the two quadrilaterals 32 and 52 may be interpreted as a device capable of controlling the movement of the implement 40 relative to the frame 10 in such a way that a foot placed on foot board 40 is guided in space along a composite path with the modalities described above in conditions of contact and rest relative to face 42, through the combination of the rotational movement of footboard 40 around axis 41 and the movement of connecting rod 35 with respect to frame 10. The footboard 40 is constrained with respect to connecting rod 35 so that face 42 is maintained substantially parallel to a determinate horizontal plane starting in the rest position R. As a result, in the particular case in which all the points on the equalisers and on the connecting rod 35 of the corresponding articulated quadrilateral 32 move on paths parallel to a horizontal plane, the face 42 will be perpendicular to axis 41. In other cases, as for example with reference to the attached figures, in order for face 42 of footboard 40 to be substantially horizontal in position R, the face 42 will have to be not perpendicular with respect to axis 41, and inclined in relation to the specifications of the case. By virtue of what has been described above, the corresponding group 31 is capable of producing a composite movement of the respective footboards 40 starting from the rest position R in which the footboards are arranged parallel to each other and longitudinally with respect to machine 1, as is visible in figure 1. In particular, the composite movement of each footboard during the thrust phase of the relative connecting rod 35 towards the outside, and simultaneous rotation of equalisers 33 and 34, includes a rotation around axis 41, an inclination inwards, and simultaneously a forwards rotation, to lower a front portion 44 of footboard 40 and simultaneously to raise a respective rear portion 45. The inclination inwards of footboard 40 allows varus of the knee to be reduced and favours the stability of the ankle in the lateral thrust, while the forwards inclination of footboard 40 favours stabilisation of the user's centre of gravity on the foot which rests on footboard 40 located alongside longitudinal median plane M in respective position R, and therefore in an advanced position with respect to the other footboard 40, on which the thrust is currently being applied. In the event that the footboard 40 were to remain constantly parallel to itself, the user would have to displace his/her centre of gravity on the rearward thrust stroke, weakening the support capacity of the leg which is in a forward position. This also allows the sole of each of the user's feet to be kept substantially perpendicular and at rest with respect to an upper face 42 of the relative footboard 40 in the course of the evolution of the position of the corresponding footboard 40, and therefore constantly mating with this face 42. In this way, it will be

possible to fully exploit the movement imparted by the user, in full respect of joint biomechanics, with the result that the thrust produced will be the maximum producible by a user in training, and therefore in full dynamic equilibrium. In addition, it follows that this makes optional the recourse to a holding component capable of embracing at least one transverse portion of the foot, and thus allows simplified construction of the individual footboards 40, which will also be able to be smooth on their upper surface, with the added advantage of a reduction in cost. By transference, the compound movement of footboard 40 may also be summed up by the term ?eversion movement', because of the affinity which this movement has with the movement of flexion and pronation which the sole of a foot can execute when the relative leg is maintained in a static condition.

[0020] The layout of each group 31 on opposite sides of longitudinal median plane M has significant advantages from the point of view of overall dimensions and functionality for the machine 1 as a whole, given that it allows compact stations 30 to be constructed to small dimensions, both as regards overall measurements on plan and in elevation. This last characteristic constitutes a very important advantage as it allows machine 1 to be made more easily accessible at the time when the user wants to utilise it, and therefore when it is necessary to climb onto footboards 40. It should further more be borne in mind that the particular conformation of the group 31 of station 30 allows a user to bring each footboard 40 onto the opposite side of plane M as the one on which the respective articulated quadrilateral 32 is located, in particular conditions of operation, to suit the skating style of each user. Lastly, it is clear that, as may be seen in figure 2, quadrilaterals 32 of group 31 are shaped symmetrically to each other, making station 30 simpler and less expensive to construct because of the reduced number of parts which must be kept in stock. In addition, it is as well to state that this simplification also produces a reduction in the costs of maintenance.

[0021] With reference to figure 1, and particularly to figures 5 and 6, the load unit 20 includes at least one dissipating device 80, capable of transforming in to electrical energy the mechanical movement energy of each footboard 40 with respect to the corresponding connecting rod 35, in a simillar way to patent application no. RA2004A000044 by the applicant, to which please refer for the corresponding teachings, summarily recalled here for brevity. In particular, each equaliser 33 is connected mechanically to the corresponding load unit 20 through a transmission 70 having at least one flexible component 71. The dissipating device 80 also includes at least one electromagnetic brake 82 and a storage component for mechanical energy, in the case in point and without limiting effect a flywheel 84 coaxial with a disc 83 for the electromagnetic brake 82. The mechanical transmission 70 is located between the load station 30 and the flywheel 84 to transform a reciprocating movement of each implement 40 from and towards position R into a rotation of flywheel 84 and of disc 83 of electromagnetic brake 82. Naturally electromagnetic brake 82 includes a control unit 86, capable of modulating the resistance to the rotation of the flywheel 84 according to the needs of the user in training.

[0022] Stilll according to figure 1, and with particular reference to figures 5 and 6, the machine 1 includes a reaction device 90 connected to the load unit 20 and connected to each articulated quadrilateral 32 to return each footboard 40, in use, to its respective rest position R through flexible component 71. For this purpose, the device 90 is fitted with an elastic element 92, connected mechanically to foot board 40, and including at least one axial torsion spring 92 located with its respective longitudinal axis transverse to longitudinal median plane M similarly to what has already been described in patent application no. RA2004A000044 by the applicant.

[0023] Finally, it is clear that modifications and variations may be made to machine 1 here described and illlustrated without for this reason departing from the protective scope of the present invention.

[0024] In any case it is as well to state that, differently from what is found in patent documents US5,391,130 and WO9409858, which illustrate gymnastic machines which utilise articulated quadrilaterals and foot boards linked to respective connecting rods of the quadrilaterals themselves, in machine 1 each footboard 40 is linked to the respective connecting rod 32 adjacent to the extension of connecting rod 32 towards the inside of the quadrilateral, in other words towards the fulcrum axes 38 and 39 of the corresponding equalisers 33 and 34, and footboard 40, in this way, is linked to connecting rod 35 adjacent to a position almost intermediate between fulcrum axes 38 and 39 themselves. From this particular configuration it follows that the exercise station 30 is more compact than those in documents US5,391,130 and WO9409858, but also than the exercise station described in patent application no. RA2004A000044 by the applicant.

Claims

1. A gymnastic machine (1) having a frame (10) supporting a load unit (20) and including an exercise station (30) having at least one functional group (31) mechanically connected to said load unit (20) to exchange mechanical energy with said load unit (20); said group (31) including at least one articulated quadrilateral (32) coupled to said frame (10) and an implement (40) connected to said articulated quadrilateral (32) and movable with respect to said frame (10) to exchange mechanical energy with said load unit (20); said implement (40) being shaped in such a way as to be interfaceable with a particular portion of an extremity of a user and being movable over an open path (P); each said articulated quadrilateral (32) including a first equaliser and a second equal-

iser (33,34) carried rotatably by said frame (10) around respective first and second axes (36,37) and rotationally linked to each other by a connecting rod (35) in line with respective third and fourth axes (38,39); said implement (40) being coupled to said connecting rod (35) in rotatable manner around a determinate axis (41);
characterised by the fact of including means of restraint (52) supported by said connecting rod (35) to control, in use, the displacement of said i implement (40) relative to said frame (10); said means of restraint (52) including articulated means (52) having a first lever (53) integral with said implement (40) in such a way that, in use, said implement (40) is movable along said path (P) according to a substantially curvilinear composite movement.

2. The machine according to claim 1, **characterised by** the fact that said composite movement results from the combination of a movement of inclination inwards of said implement (40), to reduce varus of the knee and favour the stability of the ankle, and of a forwards rotation of said implement (40), with a lowering of a front portion (44) of said implement (40), and at the same time with a raising of a rear portion (45) of said implement (40) for the purpose of stabilising the centre of gravity of a user intraining.

3. Gymnastic machine (1) having a frame (10) supporting a load unit (20) and including an exercise station (30) having at least one functional group (31) mechanically connected to said load unit (20) to exchange mechanical energy with said load unit (20); said group (31) including at least one articulated quadrilateral (32) coupled to said frame (10) and an implement (40) connected to said articulated quadrilateral (32) and movable with respect to said frame (10) to exchange mechanical energy with said load unit (20); said implement (40) being shaped in such a way as to be interfaceable with a particular portion of an extremity of a user and being movable over an open path (P); each said articulated quadrilateral (32) including a first equaliser and a second equaliser (33, 34) carried rotatably by said frame (10) around respective first and second axes (36, 37) and rotationally linked to each other by a connecting rod (35) in line with respective third and fourth axes (38, 39); said implement (40) being coupled to said connecting rod (35) in rotatable manner around a determinate axis (41);
characterised by the fact of including means of restraint (52) supported by said connecting rod (35) to control, in use, the displacement of said implement (40) relative to said frame (10); said means of restraint (52) including articulated means (52) having a first lever (53) integral with said implement (40) in such a way that, in use, said implement (40) is movable along said path (P) according to a substantially curvilinear composite movement and presenting decreasing vertical levels as it proceeds laterally from a longitudinal portion of said frame (10).

4. The machine according to claim 3, **characterised by** the fact that said path (P) is substantially level.

5. The machine according to any of the preceding claims, **characterised by** the fact of including two articulated quadrilateral (32), each of which is provided with a respective said implement (40); said frame (10) being symmetrical and said articulated quadrilaterals (32) being located side by side and shaped symmetrically with respect to a longitudinal median plane (M).

6. The machine according to any of the preceding claims, **characterised by** the fact that said first lever (53) is coupled rotationally to said connecting rod (35) in line with a respective said axis (41); said means of restraint (52) including a second lever (54) coupled rotationally to said connecting rod (35) on said axis (39) and a third lever (55) linked to said members (53) and (54) through respective articulations (56) (57); said second lever (54) being integral with said second equaliser (34); said first lever (53) being integral with said implement (40) to determine said composite movement.

7. The machine according to claim 6, **characterised by** the fact that said articulations (56) (57) include spherical pairs (56) (57) to permit the synchronous movement of said first and second levers (53) (54) even in conditions of lack of parallelism of respective fulcrum axes (41) (39) in the respective coupling to said connecting rod (35).

8. The machine according to any of the preceding claims, **characterised by** the fact that said connecting rod (35) is shaped in such away as to support said implement (40) on the side of the corresponding said first and second axes (36, 37) of the relative first and second equalisers (33, 34).

9. The machine according to claim 8, **characterised by** the fact that said connecting rod (35) is shaped in such away as to present, at rest, said determinate axis (41) located on the side of said longitudinal plane (M) and in a substantially intermediate position between said first and second axes (36, 37) of the relative first and second equalisers (33, 34), in such a way as to confer compact and limited dimensions on said exercise station (30).

10. The machine according to claim 8 or 9, **characterised by** the fact that said connecting rod (35) presents a substantially triangular shape, with said third axis (38), determinate axis (41), and said fourth

axis (39) positioned adjacent to the apexes of said connecting rod (35); said determinate axis (41) being carried by an apex of said connecting rod (35) of substantially triangular shape located on the side of said longitudinal plane (M).

11. The machine according to any one of the preceding claims, **characterised by** the fact that said implement (40) includes a footboard (40) having an interface (42) substantially level at least around said determinate axis (41) to support an extremity of a user; said determinate axis (41) being inclined in determinate manner with respect to said interface (42).

12. The machine according to claim 11, **characterised by** the fact that said determinate axis (41) is positioned on said connecting rod (35) in such away as to trace a path having at least one substantially circular stretch.

13. The machine according to any one of the preceding claims, **characterised by** the fact that said load unit (20) includes at least one dissipating device (80) capable of transforming into electrical energy the mechanical movement energy of each said implement (40) with respect to the corresponding said connecting rod (35); said first equaliser (33) being connected mechanically to said load unitt (20) through a transmission (70) having at least one flexible component (71).

14. The machine according to claim 13, **characterised by** the fact that said dissipating device (80) includes at least one electromagnetic brake (82) and a mechanical energy storage component (84) coaxial with each other; said mechanical transmission (70) being located between the said load station and the said mechanical energy storage component (84) in order to transform a reciprocating movement of each said inplement (40) into a rotation of said electromagnetic brake (82).

15. The machine according to claim 14, **characterised by** the fact of including a reaction device (90) having an elastic element (92) for each said articulated quadrilateral (32) and mechanically connected to said implement (40) in order, in use, to return the respective said implement (40) to the respective rest position (R) through said flexible component (71).

16. The machine according to claim 15, **characterised by** the fact that each said elastic element (92) includes at least one torsion spring (92).

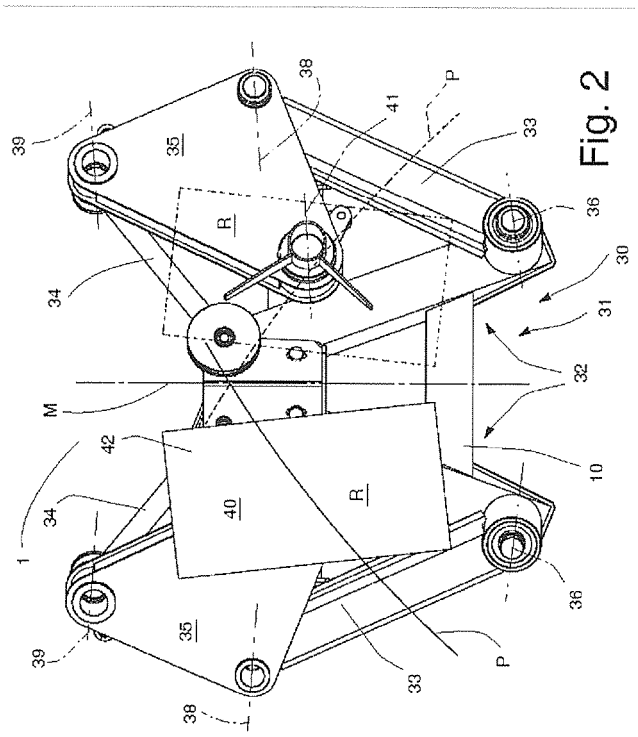

Fig. 2

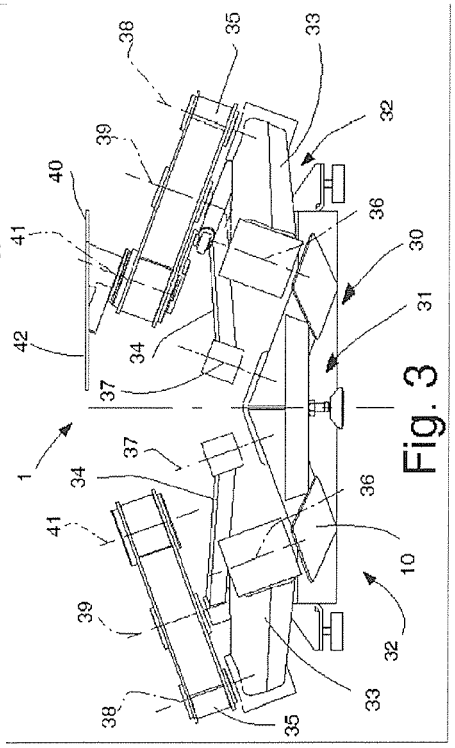

Fig. 3

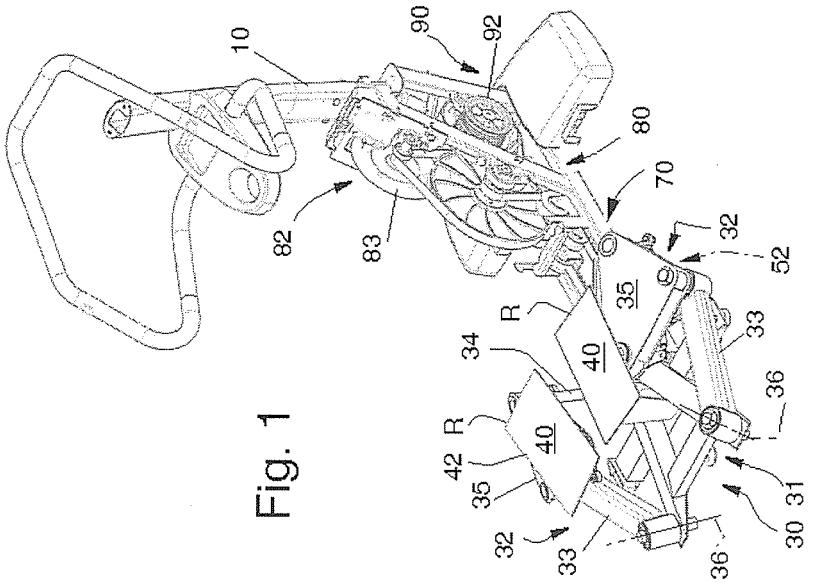

Fig. 1

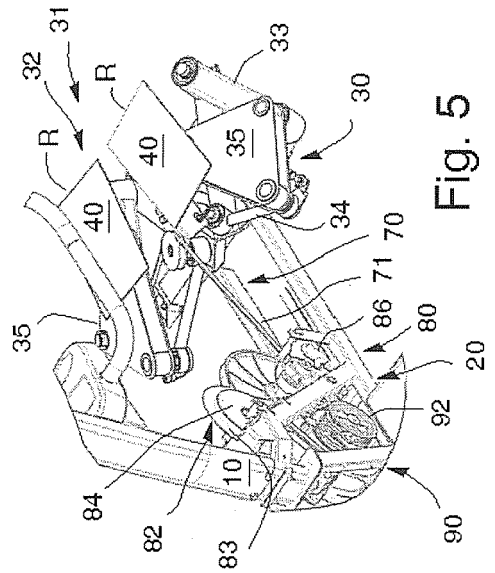

Fig. 5

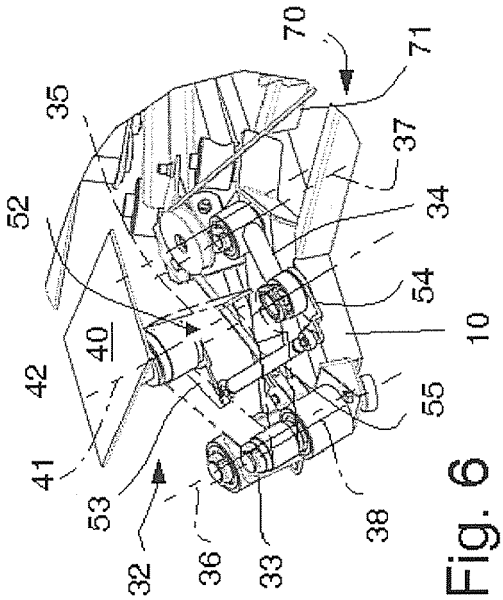

Fig. 6

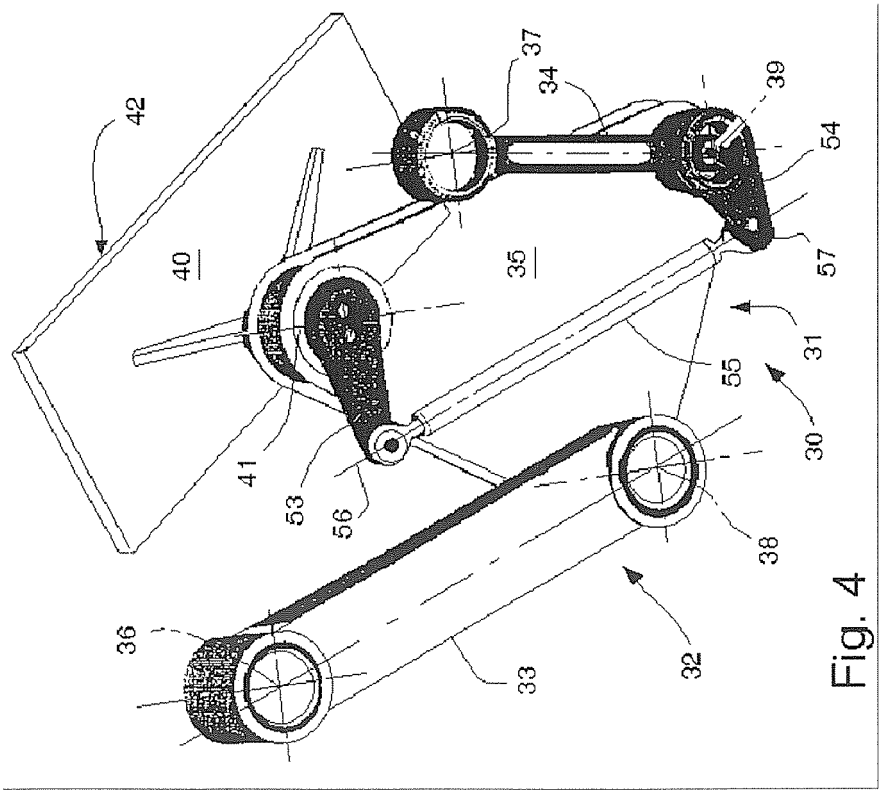

Fig. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 11 7613

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	WO 90/08572 A (SPORT SPECIFIC INC [CA]) 9 August 1990 (1990-08-09) * page 5, lines 6-25 - page 6, lines 1-25; figures 1,2 *	1-16	INV. A63B69/00 A63B21/00 A63B23/04
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A	US 2002/042329 A1 (NIZAMUDDIN NASH [CA]) 11 April 2002 (2002-04-11) * paragraphs [0037] - [0040]; figures *	1-16	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 October 2006	Teissier,Sara

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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