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(54) **An exercise machine**

(57) An exercise machine comprises: a mounting frame (1); at least two user positions (18, 181, 205); power transmission means (2) designed to connect corresponding machine actuators (3) in such a way that the power applied by the users to the actuators (3) and

transmitted by the transmission means (2) reciprocally and alternately produces an active force and a resistant force.

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## Description

**[0001]** The present invention relates to an exercise machine, preferably of isotonic type.

**[0002]** The fitness sector today offers an extremely wide variety of exercise machines. These machines can be divided broadly into two categories: isotonic machines and cardiovascular machines.

**[0003]** Isotonic machines normally comprise a working position for the user who uses his/her physical power to apply a force that is opposed by gravity acting on a set of passive elements forming what is normally called a weight stack.

**[0004]** In the present invention, the working position is the location where the user places his/her body, whether seated or standing, which means that this position coincides with an area where the weight of the user's body is supported by the ground, with or without a footplate.

**[0005]** Machines of this type have a portal frame which is located in a vertical plane and which accommodates a plurality of blocks, each having a predetermined weight. The user selects the number of blocks to be used for the required exercise, thus creating a stack of desired weight which applies the resistant force that must be overcome by the user's muscular strength; between the resistant force and the active part of the exercise apparatus there is usually a connecting element, normally consisting of a cord or cable wound several times around pulleys and designed to carry the resistant force to the point where the user must apply his/her physical power to overcome it.

**[0006]** Thus, in the above type of solution, the resistant force is provided by gravity. Alternatively, more complex machines may be used in which the resistant force is produced by a motor or alternator connected to a source of electric power and providing controlled torque.

**[0007]** Whichever the solution adopted, exercise machines of this kind (as generally used for recreational, rehabilitation and similar applications) are designed in such a way that the user competes against himself/herself. In other words, the user has to perform a training protocol without any active opponent, which, in the long run, may lead to deconcentration or even refusal to perform exercises according to established rules.

**[0008]** Another disadvantage is that the correct performance of the protocol depends entirely on the user and it is therefore difficult to control the uniformity of the training or to assess (unless this is done in separate stages) the individual progress of two or more trainees, such as, for example, the members of a sports team or persons required to reach a minimum fitness level.

**[0009]** The present invention therefore has for an object to overcome the above mentioned disadvantages by providing an exercise machine that allows users to train not in isolation but in association with other users so as to be able to interact with each other while performing an exercise.

**[0010]** According to the invention, this object is achieved by an exercise machine as defined in the main appended claim.

**[0011]** The advantages achieved by the invention lie essentially in the fact that the users training simultaneously on the same machine not only follow a predetermined protocol but also have the opportunity of measuring their strength against each other, thus reducing the risk of demotivation and providing a competitive stimulus to achieving the targets set by the protocol.

**[0012]** Another advantage is that of permitting the activities of different trainees following the same or similar training programmes to be standardised, thus making it possible to assess the effectiveness of a programme on different individuals.

**[0013]** Further advantages are achieved thanks to the characteristics defined in the dependent claims.

**[0014]** The technical characteristics of the invention, with reference to the above aims, are clearly described in the claims below and its advantages are apparent from the detailed description which follows, with reference to the accompanying drawings which illustrate preferred embodiments of the invention provided merely by way of example without restricting the scope of the inventive concept, and in which:

- Figure 1 is a general diagram of an exercise machine according to the invention;
- Figure 1a is a diagram showing the connection of adjustable length between the user positions;
- Figure 2 is a perspective view of a first preferred embodiment of a machine according to the invention, belonging to the category of exercise machines generally known as "lat machines";
- Figure 3 is a front view of the machine of Figure 2;
- Figure 4 is a side view of the machine of Figure 2;
- Figure 5 is a perspective view of a second preferred embodiment of a machine according to the invention, belonging to the category of exercise machines generally known as "upper machines";
- Figure 6 is a top view of the machine of Figure 5;
- Figure 7 is a side view of the machine of Figure 5;
- Figure 8 is a perspective view of a third preferred embodiment of a machine according to the invention, belonging to the category of exercise machines generally known as "abductor machines";
- Figure 9 is a top view of the machine of Figure 8;
- Figure 10 is a side view of the machine of Figure 8;
- Figure 11 is a perspective view of a fourth preferred embodiment of a machine according to the invention, resulting from the combination of two machines, placed face to face, belonging to the categories of exercise machines generally known as "chest presses" and "upper machines";
- Figure 12 is a top view of the machine of Figure 11;
- Figure 13 is a side view of the machine of Figure 11;
- Figure 14 is a graph showing an example curve representing a load applied by the users progressively

and compared to a reference level;

- Figures 15a and 15b schematically illustrate further embodiments of the machine according to the invention;
- Figures 16 and 16a-16c schematically illustrate yet another embodiment of the machine according to the invention.

**[0015]** With reference to Figure 1, an exercise machine according to the invention, in its most general configuration of kinematic components, essentially comprises the following:

- a mounting frame 1;
- a reversible power transmission mechanism 2 mounted on the frame 1;
- at least two user work positions equipped with actuators 3 operatively connected to the transmission mechanism 2 and designed to be operated by the users who alternately and reciprocally apply an active force and a resistant force through the transmission mechanism 2.

**[0016]** Advantageously, as shown in the diagram of Figure 1, the transmission mechanism may consist wholly or partly of a set of rigid levers joined to each other and, if necessary, combined with cable mechanisms, as described in more detail below.

**[0017]** In all its preferred embodiments, the machine is preferably equipped with a load sensor designed to indicate a value (and, if necessary, a threshold) of the force load applied by the users.

**[0018]** Figure 1a schematically illustrates the connection between the user positions. The length of the connection can be adjusted by means of a motor M designed to move the pin 23x of a pulley 22 vertically in the direction indicated by the arrow F, thus shifting the actuators between the initial positions 3 and 3a.

**[0019]** Preferably, the cable 24 is also equipped with load sensors 224, load cells 226 and dampers 225.

**[0020]** Figure 14 is a graph showing an example curve representing the load C applied by the user, measured by a sensor and displayed by a display unit indicated schematically by the reference letter D in Figure 14, compared to a reference level R representing the training programme, in such a way as to stimulate the users, individually and in competition with each other, to keep up with the programme.

**[0021]** Still with reference to Figure 14, the invention also contemplates the possibility of a progressive indication of the load C by the display unit D or by a separate unit in order to enable the users to check the level they have reached at any point in time.

**[0022]** It should be stressed that all the embodiments described below are offered purely as examples of the inventive concept without thereby limiting the possibility of extending the concept to other solutions, all falling within the scope of the appended claims. This is intend-

ed as confirmation of the possibility of extending the inventive concept to a wide range of different machines.

**[0023]** With reference to the embodiment illustrated in Figures 2 to 4, the machine frame consists of a portal frame 11 supported at the bottom by a base 19 and having, at the top of it, a crossbeam 12 mounted in turn on a forked support 131.

**[0024]** The work position of each user consists of a seat 18 and rollers 17 adjustable in height by means of a telescopic support 171 that can be locked in a desired location by a height selector block 172.

**[0025]** The rollers 17 are preferably covered with soft padding and used to hold down the legs of the users sitting in the seats 18.

**[0026]** The power transmission mechanism consists of a system of pulleys 22 rotating on pins 23 fixed to the crossbeam 12, and having trained around them a flexible cable 24 with a handlebar 30 at each end, preferably of ergonomic form to facilitate gripping by the users.

**[0027]** During use, the two users sitting in the seats 18 with the rollers 17 resting on their legs in such a way that they can grip the actuators 30 with both hands and alternately apply a force (according to a well-known training technique) which is transmitted to the other user through the cable 24.

**[0028]** In this way, one of the two users applies an active force whilst the other exerts a resistant force, if necessary according to a predetermined training protocol.

**[0029]** Preferably, a load sensor 241, located for example on the cable 24, indicates when the load reaches a predetermined threshold value set for safety reasons and/or as a check on the exercise being performed.

**[0030]** With reference to the embodiment illustrated in Figures 5 to 7, the machine frame consists of an up-turned U structure 11 supported at the bottom by a beam 101 and a crossbeam 102.

**[0031]** Mounted on the beam 101 there are two pairs of uprights, the first pair 103 being vertical and the second pair 104 being slightly inclined and upwardly converging.

**[0032]** The two pairs of uprights 103, 104 are joined at the top of the frame by respective bars 105, which are slightly inclined to the horizontal and converge at the centre of the frame where they join the U structure 100.

**[0033]** Each of the user work positions consists of a seat 181, adjustably mounted for height along the upright 104, and a rest 173 for the user's chest.

**[0034]** The distance of the chest rest 173 from the user can be adjusted by operating on a support 174 that slides inside the bars 105 and can be locked in a desired position using customary selective lock devices 175.

**[0035]** At the height of the adjustable support 174, the bars 105 mount curved arms 106 facing the user position and having two joints 107 fitted at the ends of them.

**[0036]** The joints 107 have pivoted on them the first ends of a pair of handlebars 108 each of which is fitted with a handle 109 at the other end.

**[0037]** The handlebars 108 are mounted crossways

relative to each other and can be rotated towards each other by the user.

**[0038]** The power transmission mechanism consists of cables -- not illustrated in the drawings -- which start at the joints 107 and run preferably inside the components of the frame to connect, through customary pulley type devices, the pair of handlebars 108 of one user work position with the pair of handlebars 108 of the other user work position.

**[0039]** During use, the users sit in the seats 181 gripping the handles 109 and move the latter alternately to and fro, if necessary according to a predetermined training protocol. In other terms, while one of the users exerts an active force and pulls the handlebars 108 towards himself/herself, the other applies a resistant force to oppose this action.

**[0040]** With reference to the embodiment illustrated in Figures 8 to 10, the machine frame consists of a U-shaped structure 201 supported at the bottom by a main beam 202 and a crossbeam 203.

**[0041]** Symmetrically mounted at the ends of the main beam 202, there are two curved uprights 204 each fitted with a seat 205 fixed to an upper horizontal section 206 of the upright 204 itself.

**[0042]** Under each seat 205 there extend two shafts 207 which are fixed at the bottom to a transversal support 219 and about which two structures 208 rotate symmetrically in such a way as to resist the outward movement of the legs of the users sitting in the seats 205.

**[0043]** Looking in more detail, each of the structures 208 consists of an approximately horizontal arm 210 which can rotate with a first end about a shaft 207 and which, at the other end, is attached to the intermediate vertical section 213 of a bar 211.

**[0044]** The bar 211 has an upper horizontal section 214, to which there is fixed a rest or pad 215 for engaging the user's thighs, and a lower inclined section 216 fitted with a footrest 217.

**[0045]** At the sides of each seat 205 there are handles 218, which the user holds for stability, and an adjustment lever 220.

**[0046]** The power transmission mechanism between the two user work positions consists of a system of cables (not illustrated in the drawings since it is of known type) that run preferably inside the components of the frame to connect the opening movement of the structures 208 of one work position to the corresponding closing movement of the levers 208 of the other work position.

**[0047]** Thus, while one user spreads his/her legs outwards against the thigh pads 218 exerting an active force that opens the structures 208, the other user may apply a resistant force. This exercise may form part of a predetermined training protocol.

**[0048]** With reference to the embodiment illustrated in Figures 11 to 13, the machine frame is divided into two halves, one like the frame described above with reference to Figures 5 to 8 (the corresponding components

are thus labelled with the same reference numbers) facing the other half consisting of a side upright 301 fixed at the bottom to the beam 101 and joined by an intermediate section 302 to a second upright 303, also fixed to the bottom beam 101.

**[0049]** The upper end of the upright 301 has a crossbeam 309 that is curved inwardly with its concave section facing the centre of the machine.

**[0050]** The user work position is mounted on the upright 303 and consists of a seat, adjustably mounted for height on the upright 303, and a backrest 305 fixed to the upright 303.

**[0051]** The actuators in this case consist of a pair of arms 308 mounted crossways and able to counter-rotate about pins located at the ends of the crossbeam 309.

**[0052]** The arms 308 are also fitted with customary handgrips 310.

**[0053]** The power transmission mechanism consists of a pulley and cable system 311 partly installed on the crossbeam 309 and not described in any detail since it is of well known type.

**[0054]** According to the invention, the transmission mechanism is such that, starting at the end 308 the force exerted by the user at the work position 304 is transmitted to the actuators 108 of the user position 181 and vice versa.

**[0055]** As in the other preferred embodiments described above, the cables of the transmission mechanism may follow a different path, running preferably inside the components (preferably tubular) of the machine frame.

**[0056]** Moreover, in all the embodiments, the means for connecting the user positions may comprise means for adjusting the length of the connection according to the physical characteristics of the users.

**[0057]** The connecting means may also include elastic means or dampers to smooth the transient effects of passing from an active force to a resistant force and vice versa.

**[0058]** Figures 16, 16a and 16b illustrate yet another embodiment of the invention.

**[0059]** The machine comprises a base 401 mounting an upright 400 consisting preferably of a tube, for example with an oval cross section, acting as a guide for a work unit 404.

**[0060]** Advantageously, the single upright structure 403 enables the users to move all the way round the machine and to change their positions relative to the actuators to perform different exercises.

**[0061]** The work unit 404, slidable along the guide 403, may be fixed in position by a locking element 405, consisting, for example, of a clamp screw that moves as one with the work unit 404 and engages by contact or interference with the vertical guide 403.

**[0062]** At the top end 420 of the upright 400 there are two pulleys 409 positioned horizontally side by side, whilst another two transmission pulleys 410 are posi-

tioned at the bottom end, close to the base 401.

**[0063]** The sliding work unit 404 is in turn equipped with four pairs of opposing horizontal plates 406, between which there are mounted, preferably rotating about horizontal axes, four supports 408 arranged in pairs on opposite sides of the upright 403 and each mounting a pair of pulleys 407 with horizontal axes and positioned over each other vertically.

**[0064]** Advantageously, the rotation of the supports enables users to easily perform exercises requiring the actuators to be moved apart as well as exercises in which the users have to change their positions relative to the actuators by moving around the machine.

**[0065]** In the embodiment illustrated, the work unit 404 mounts all the pulleys 407 which are therefore adjustable as one.

**[0066]** It will be understood, however, that the invention also contemplates that the height of the pulleys might also be adjusted independently at the two sides of the upright, in such manner as to individually vary one or both of the pulling points of one or both of the users.

**[0067]** The machine also comprises two cables 412, 412' passing through respective pulleys 407, 409, 410 and actuated by opposite pairs of handles 414a / 414b and 415a / 415b operated by two users (not illustrated in the drawings) standing on opposite sides of the upright 403 at the schematically illustrated exercise positions labelled 413.

**[0068]** It will be understood that the handles might be substituted by actuators or handlebars of any kind suitable for performing the exercise.

**[0069]** Looking in more detail, the cables 412, 412' constitute a twin-cable arrangement, that is to say, a double path of twin cables each of which, with reference, for example, to the cable 412, is fixed at one end to a first actuator 414a, passes through the overlaid pulleys 407 of one support 408 positioned at a first side of the upright 403 and, in succession, through the corresponding upper and lower pulleys 409 and 410 to connect up with the opposite actuator 414b after passing through the central overlaid pulleys 407 of the support 408 at the opposite side of the upright 403.

**[0070]** An identical path through the corresponding central, upper and lower pulleys 407, 409 and 410, is followed by the second cable 412' which connects the opposing actuator 415a and 415b.

**[0071]** In the embodiment being described, there are two of each of the pulleys 407, 409, 410 on each side of the machine so as to enable two users to exercise both arms at the same time, but without thereby excluding the possibility of having a single pulley or more than two pulleys, according to requirements.

**[0072]** During operation, the two users, each in his/her exercise position 413, grip the actuators on the corresponding side of the machine, and alternately pull the two actuators (for example, 414a and 415a) in such that the two users, thanks to the path followed by the cables 412 and 412', oppose each other in alternately pulling

the actuators.

**[0073]** On a machine constructed in this way, the two users may oppose or second each other in performing different types of exercises for the purposes of muscular strengthening, cardiovascular training, muscular stretching or even proprioceptive training in which one of the two users tests the balance of the other.

**[0074]** Further, thanks to the adjustability of the vertical position of the work unit 404 and to the rotatability of the supports 408, the point and angle at which the cable is pulled outwards, that is to say, the direction of the force applied by the users, can be varied according to the type of exercise and to the part of the body to be exercised.

**[0075]** It follows that the upper or the lower pulley in the pairs of pulleys 407 mounted on the work unit 404 is activated according to the position of the work unit relative to the user's grip.

**[0076]** Further, the length of the cables 412 / 412' pulled out of the machine can be adjusted to suit the type of exercise which the users have to perform, and according to the distance from the machine required by the exercise.

**[0077]** Looking in more detail, the length of the cable 412/412' that can be pulled out of the machine can be adjusted by making the cable follow a path such that, on leaving the lower pulley 410, it winds one or more times around a corresponding pulley 419, mounted on idle rollers on the upright 403 and then proceeds along the path described above towards the upper pulley 409 and from there to the opposite actuator.

**[0078]** With this solution, each turn around the pulley 419 corresponds to a reduction of the active length of the cable 412/412', that is to say, the extent to which the cable can be pulled out of the machine using the opposite actuator 414a,b and 415a,b.

**[0079]** According to another characteristic of the machine, the upper pulleys 409 are mounted in a protective guard 427 and are connected to a dynamo 423 which powers a lamp 422 located above the user work positions 413.

**[0080]** When the lamp switches on, it provides an indication of the speed at which the exercise is being carried out and may also constitute a performance target to be achieved.

**[0081]** In addition, the base 401, which must normally have a certain weight to guarantee machine stability, may consist of a hollow container 426 equipped with a filler opening 425, so that the machine itself is relatively light for transportation purposes but, once positioned, can be weighted down by filling the container with liquid (or sand or other suitable material) to increase the stability of the machine during use. To facilitate handling, the machine of Figure 16 may also be equipped with wheels 424 fitted to the edge of the base 401 slightly off the ground so as to touch the ground only if the upright 403 is tilted to enable it to be moved from one place to another.

**[0082]** In the embodiments described above, an additional resistant force, consisting, for example, of traditional weights, may be applied to one or both sides of the machine besides the alternate active / resistant force applied by the users. This would compensate for excessive differences in strength between the two users.

**[0083]** By way of example, Figures 15a and 14b schematically illustrate a machine according to the invention in which a set of weights P, variable in number and composition according to requirements, is applied to one of two user positions.

**[0084]** In the embodiment of Figure 15a, the weights are positioned close to one of the actuators 3, so as to increase the resistant force applied to the other actuator.

**[0085]** In Figure 15b the weights P are applied to one of the two actuators by means of an additional system of cables 24 and pulleys 22.

**[0086]** Looking in more detail at the embodiment illustrated in Figure 15b, the pulleys of the additional system have two grooves so that the actuator concerned is connected to the other actuator through a first cable 24 passing around one groove in the pulleys 22 and to the weight stack P through a second cable passing around the other groove in the same pulleys.

**[0087]** Obviously, the weight stack P may be varied according to requirements and may be applied to one or both user positions.

**[0088]** Figure 15b also shows a load cell CC advantageously applied to a point 29 where one of the pulleys 22 is fixed to the frame 1.

**[0089]** In this case, the load cell is applied to the point where the pulley located at the centre of symmetry is attached to the frame but it may be fitted at any other suitable position.

**[0090]** This solution offers the advantage of measuring the load in a structurally and functionally simple manner.

**[0091]** The invention described has evident industrial applications and can be subject to modifications and variations without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

## Claims

1. An exercise machine comprising: a mounting frame (1); at least two user positions (18, 181, 205, 413); power transmission means (2) designed to connect corresponding machine actuators (3) and accessible by the users in such a way that the power applied by the users on one or more of the actuators (3) is transmitted by the transmission means (2) to one or more of the remaining actuators and reciprocally and alternately constitutes for the users an active force and a resistant force for moving the actuators relative to the user positions.

2. The machine according to claim 1, **characterised in that:** the frame (1) consists of a portal frame (11) supported at the bottom by a base (19) and having, at the top of it, a crossbeam (12); each user position consists of a seat (18) and upper rest rollers (17); the transmission mechanism (2) consists of a system of pulleys (22) rotating on pins (23) fixed to the crossbeam (12), and having trained around them a flexible cable (24) with a handlebar (30) at each end where the user work positions are.

3. The machine according to claim 2, **characterised in that** the rollers (17) are made of soft material and can be adjusted in height by means of a telescopic support (171) that can be locked in a desired position using a height selector block (172).

4. The machine according to claim 2, **characterised in that** it comprises force detecting means consisting of a load sensor (241) located on the cable (24) and designed to indicate when the load reaches a predetermined threshold value.

5. The machine according to claim 1, **characterised in that:** the frame consists of an upturned U-shaped structure (100) supported at the bottom by a beam (101) and a crossbeam (102), on which there are mounted two pairs of uprights, the first pair (103) being vertical and the second pair (104) being inclined and upwardly converging, joined at the top of the frame by respective bars (105), which converge at the centre of the frame where they join the upturned U structure (100); each user work position consists of a seat (181) fixed to a respective upright (104) and a rest (173) for the user's chest fixed to a respective upper bar (105); the actuators consist of curved arms (106) facing the user position and having two joints (107) fitted at the ends of them, which have pivoted on them the first ends of a pair of handlebars (108) each of which is fitted with a handle (109) and which are mounted crossways relative to each other and can be rotated towards each other by the user; the transmission mechanism consists of a system of pulleys and cables extending from the joints (107) and through the arms (106) and the bars (105) to connect the pair of handlebars (108) of one user work position with the pair of handlebars (108) of the other user work position.

6. The machine according to claim 5, **characterised in that** the seat (181) is adjustably mounted for height on the upright (104) and the chest rest (173) is adjustably mounted for distance from the user by means of a support (174) that slides inside the bars (105).

7. The machine according to claim 5, **characterised in that** it comprises force detecting means consist-

ing of a load sensor located on the cable and designed to indicate when the load reaches a predetermined threshold value.

8. The machine according to claim 1, **characterised in that**: the frame consists of a U-shaped structure (201) supported at the bottom by a main beam (202) and a crossbeam (203), the main beam (202) having mounted at the ends of it two curved uprights (204) with an upper horizontal section (206); each user work position consists of a seat (205) mounted on the horizontal section (206) of the uprights (204); each actuator consists of a pair of shafts (207) fixed at the bottom to a transversal support (219) and about which two structures (208) rotate symmetrically in such a way as to resist the spreading out movement of the legs of the users sitting in the seats (205); the power transmission mechanism consists of a system of pulley and cables passing through the shafts (207) and the beam (202) in such a way as to connect the opening movement of the structure (208) at one user work position to the corresponding closing movement of the structure (208) at the other user work position.
9. The machine according to claim 8, **characterised in that** each of the structures (208) consists of a pair of arms (210) which can rotate with a first end about a shaft (207) and which, at the other end, is attached to the intermediate vertical section (213) of a bar (211) having an upper horizontal section (214) to which there is fixed a rest (215) for engaging the user's thighs, and a lower inclined section (216) fitted with a footrest (217).
10. The machine according to claim 8, **characterised in that** at the sides of each seat (205) there are handles (218), which the user holds for stability, and an adjustment lever (220).
11. The machine according to claim 1, **characterised in that**: the frame consists of an upturned U-shaped structure (100) supported at the bottom by a beam (101) and a crossbeam (102), at one end of which there are mounted two uprights, the first (103) being vertical and the second (104) being inclined and upwardly converging, the uprights being joined at the top of the frame by a bar (105), which joins the U-shaped structure (100) at the centre of the frame, the second end of the beam (101) having mounted on it a side upright (301) fixed at the bottom to the beam (101) and joined by an intermediate section (302) to a second upright (303), also fixed to the bottom beam (101), where the upper end of the upright (301) has a crossbeam (309) that is curved inwardly with its concave section facing the centre of the machine; the first user work position consists of a seat (181) fixed to a respective upright (104) and a rest (173) for the user's chest fixed to a respective upper bar (105) and the second user work position consists of a seat, adjustably mounted for height on the upright (303) and a backrest (305) fixed to the upright (303); the first actuator consists of curved arms (106) facing the user position and having two joints (107) fitted at the ends of them, which have pivoted on them the first ends of a pair of handlebars (108) each of which is fitted with a handle (109) and which are mounted crossways relative to each other and can be rotated towards each other by the user, and the second actuator consists of a pair of arms (308) mounted crossways and able to counter-rotate about pins located at the ends of the crossbeam (309); the transmission mechanism consists of a system of pulleys and cables extending in succession through the frame to connect the pair of handlebars (108) of one user work position with the pair of arms (308) of the other user work position.
12. The machine according to claim 1, **characterised in that** the frame comprises an upright (403) and the transmission means consist of at least one cable (412, 412') passing in succession through a plurality of pulleys; the actuating means consisting of at least two handles (414a,b; 415a,b) fitted at the ends of the cable (412, 412') on each side of the upright (403) for use by at least two users in their respective work positions (413).
13. The machine according to one or more of the foregoing claims, **characterised in that** it comprises a first and a second cable (412, 412') having handles at their ends, so that two pair of handles (414a-415a; 414b-415b) are available at two respective user work positions (413), each of said pair of handles being formed by two handles which are fitted respectively to an end of said first and of said second cable (412, 412').
14. The machine according to claim 12 or 13, **characterised in that** the plurality of pulleys comprises an initial pulley (407) mounted on the upright (403), at least one intermediate pulley (409, 410) vertically offset from the first pulley and an end pulley (407) mounted on the upright (403) and vertically offset from the intermediate pulley.
15. The machine according to one of the foregoing claims from 12 to 14, **characterised in that** either the initial or the end pulley (407) or both are adjustably mounted for height on the upright.
16. The machine according to claim 15, **characterised in that** the initial and end pulleys (407) are adjustable in height independently of each other.
17. The machine according to one of the foregoing

- claims from 12 to 16, **characterised in that** the upright consists of a central tubular element (403) on which there slides a work unit (404) mounting the initial and end pulleys (407) and comprising at least two pairs of handles (414a-415a; 414b-415b) fitted at respective user work positions (413) at the respective ends of two transmission cables (412, 412').
18. The machine according to one of the foregoing claims, **characterised in that** at the connecting means there are means (214, 216) for detecting the applied force designed to detect a value proportional to the force itself and to send it to display means.
19. The machine according to claim 18, **characterised in that** the detecting means consist of an extensometric cell connected in series on a cable.
20. The machine according to one of the foregoing claims, **characterised in that** the means for connecting the actuators (3) comprise means (M, 23x, 419) for correcting their length according to the physical characteristics of the users.
21. The machine according to one of the foregoing claims, **characterised in that** the connecting means comprise elastic or damping means designed to smooth the transient effects of passing from an active force to a resistant force and vice versa.
22. The machine according to one of the foregoing claims, **characterised in that** it comprises force detecting means consisting of one or more load sensors (214, 216) located on a cable or joint and designed to indicate when a predetermined load has been reached.
23. The machine according to one of the foregoing claims, **characterised in that** it comprises a device (D) for displaying the level of the load (C) reached, as a progressive value or as a value compared to a reference level (R) representing the training programme.
24. The machine according to one of the foregoing claims, **characterised in that** it comprises additional means for applying a resistant force to oppose the active force exerted by a user on one or more actuators.
25. The machine according to claim 23, **characterised in that** the additional resistant means consist of one or more weights (P) applied to the actuator (3) of at least one of the user work positions in such a way as to increase the resistant force exerted on the other actuators.
26. The machine according to claim 24, **characterised in that** the additional resistant means consist of one or more weights (P) applied to one of the two actuators by means of an additional system of cables and pulleys.
27. The machine according to one of the foregoing claims, **characterised in that** it comprises a load cell (CC) applied to a point (29) where one of the pulleys (22) is fixed to the frame (1).
28. The machine according to one of the foregoing claims, **characterised in that** the connecting means comprise means (215) for damping the load.
29. The machine according to one of the foregoing claims, **characterised in that** the connecting means comprise articulated levers (2) and/or pulley systems (22) with one or more cables (24) connecting the actuators (3).

FIG. 1

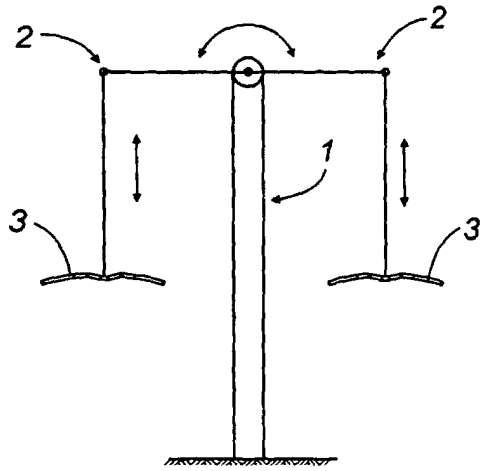


FIG. 1a

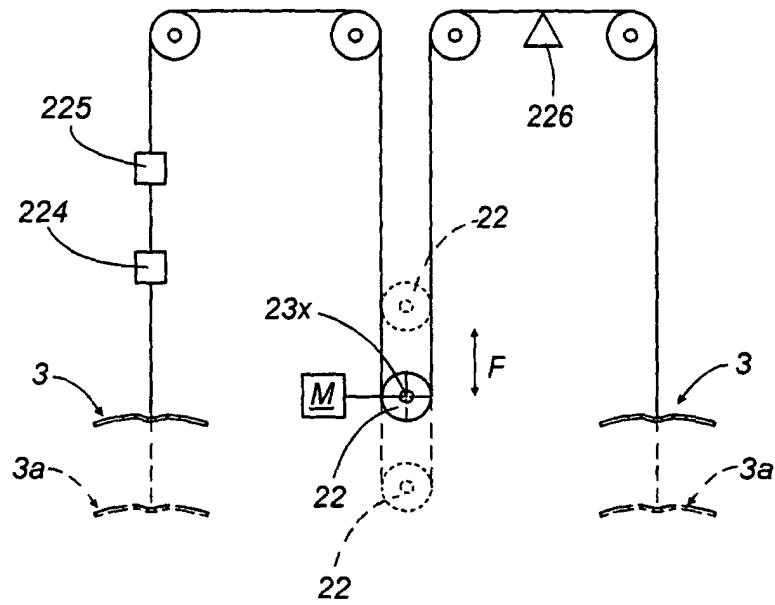


FIG. 14

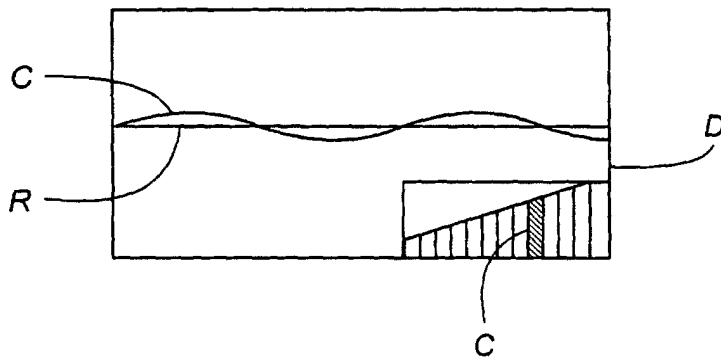


FIG. 2

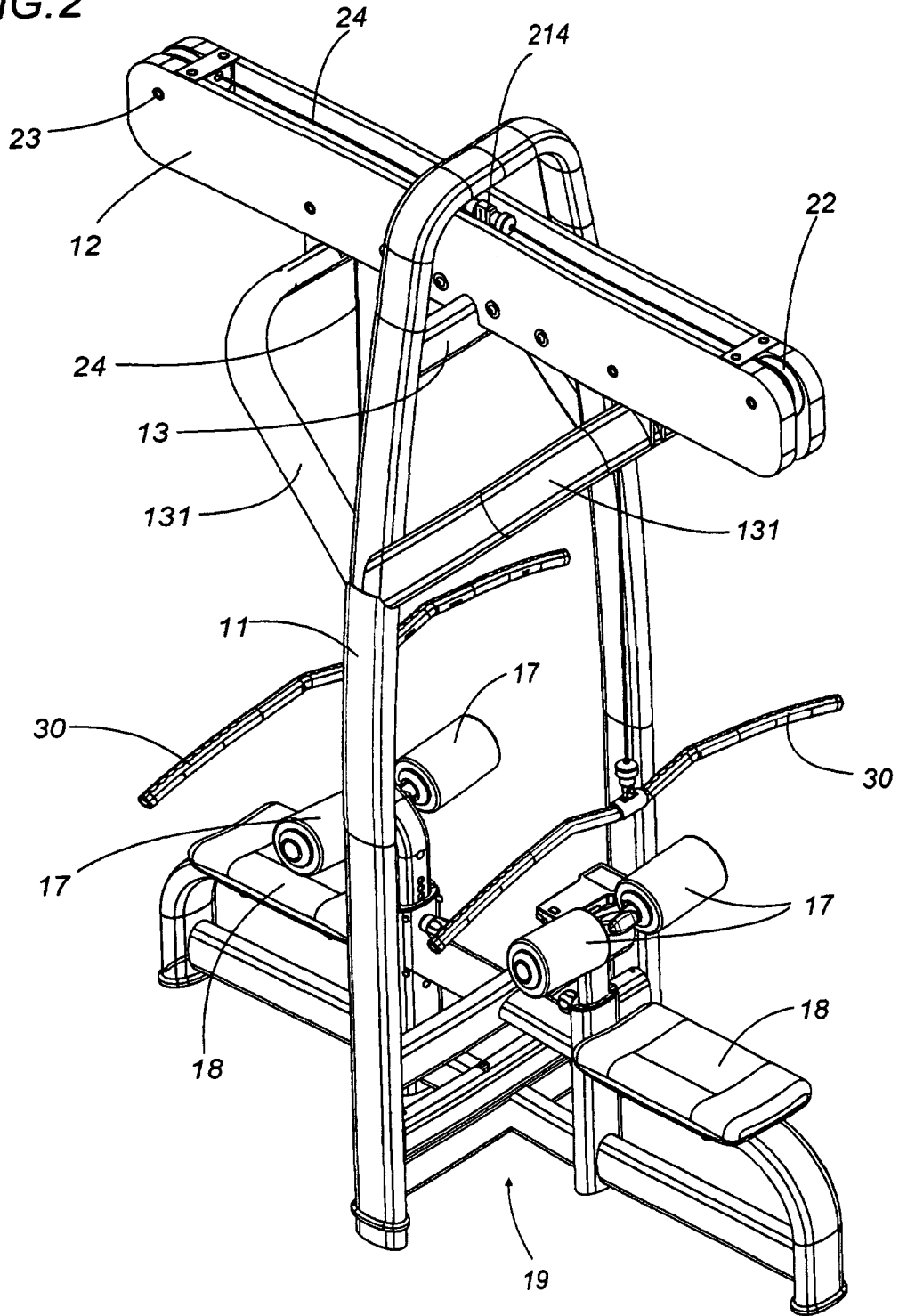


FIG. 3

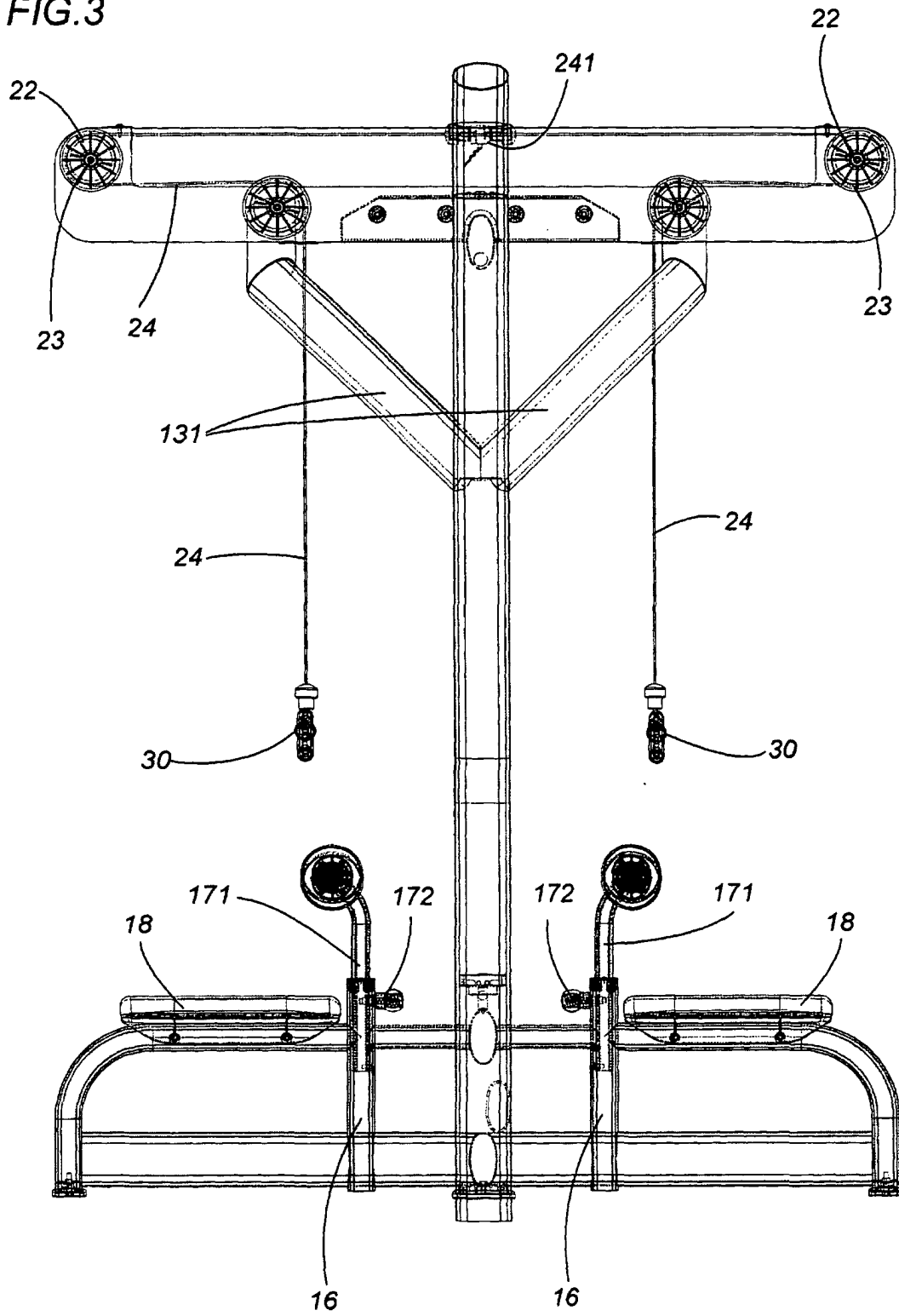
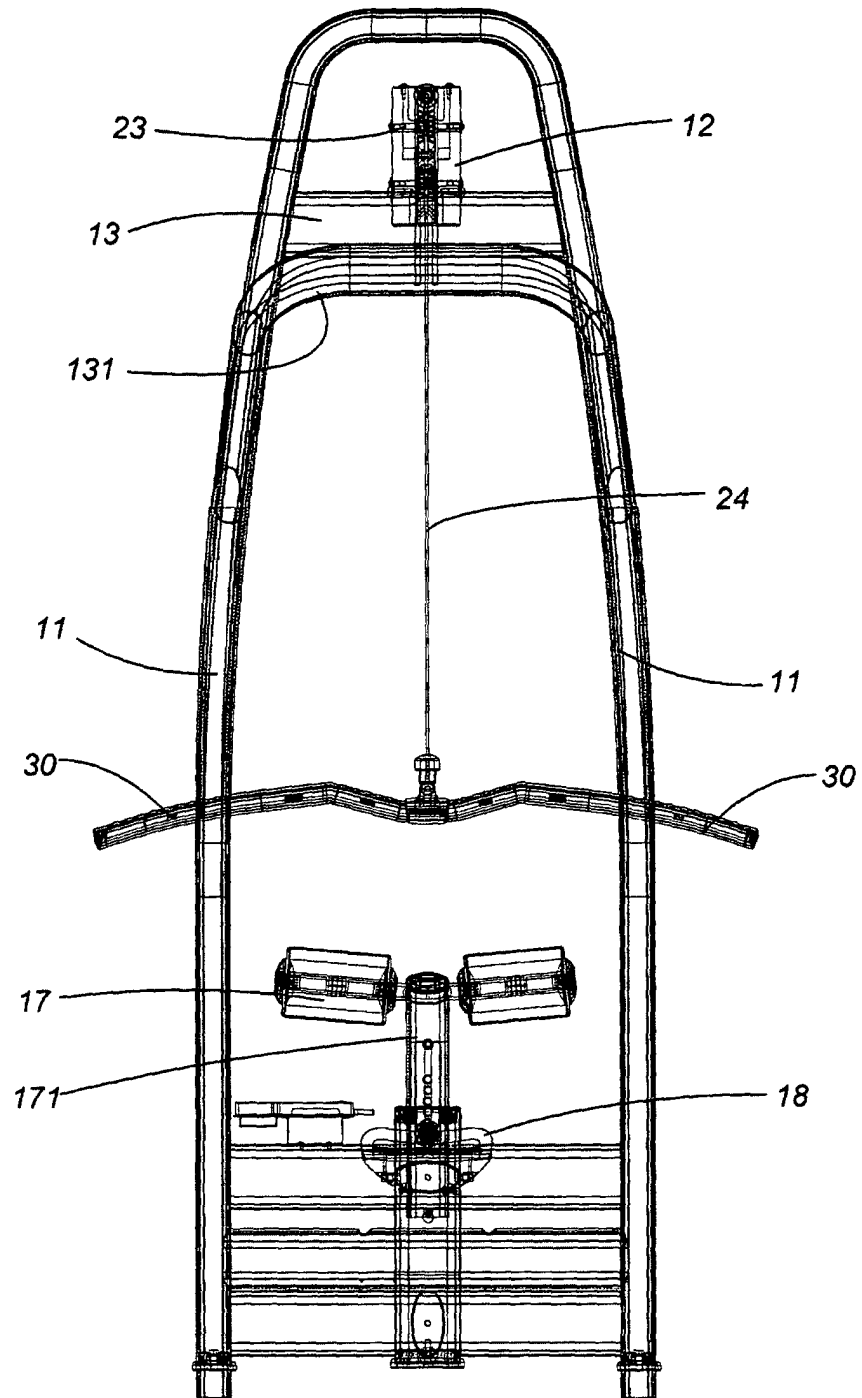


FIG.4



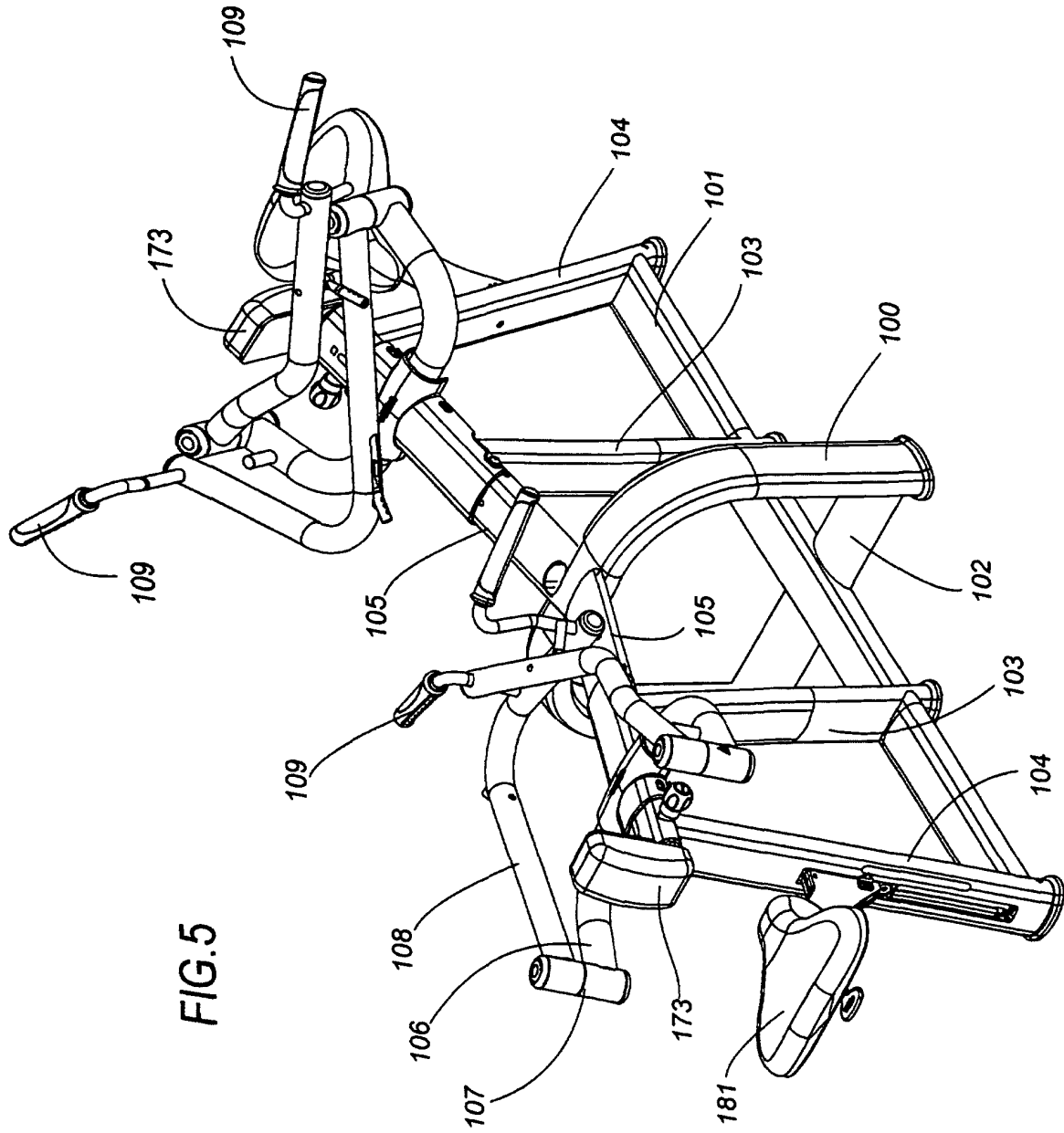


FIG.5

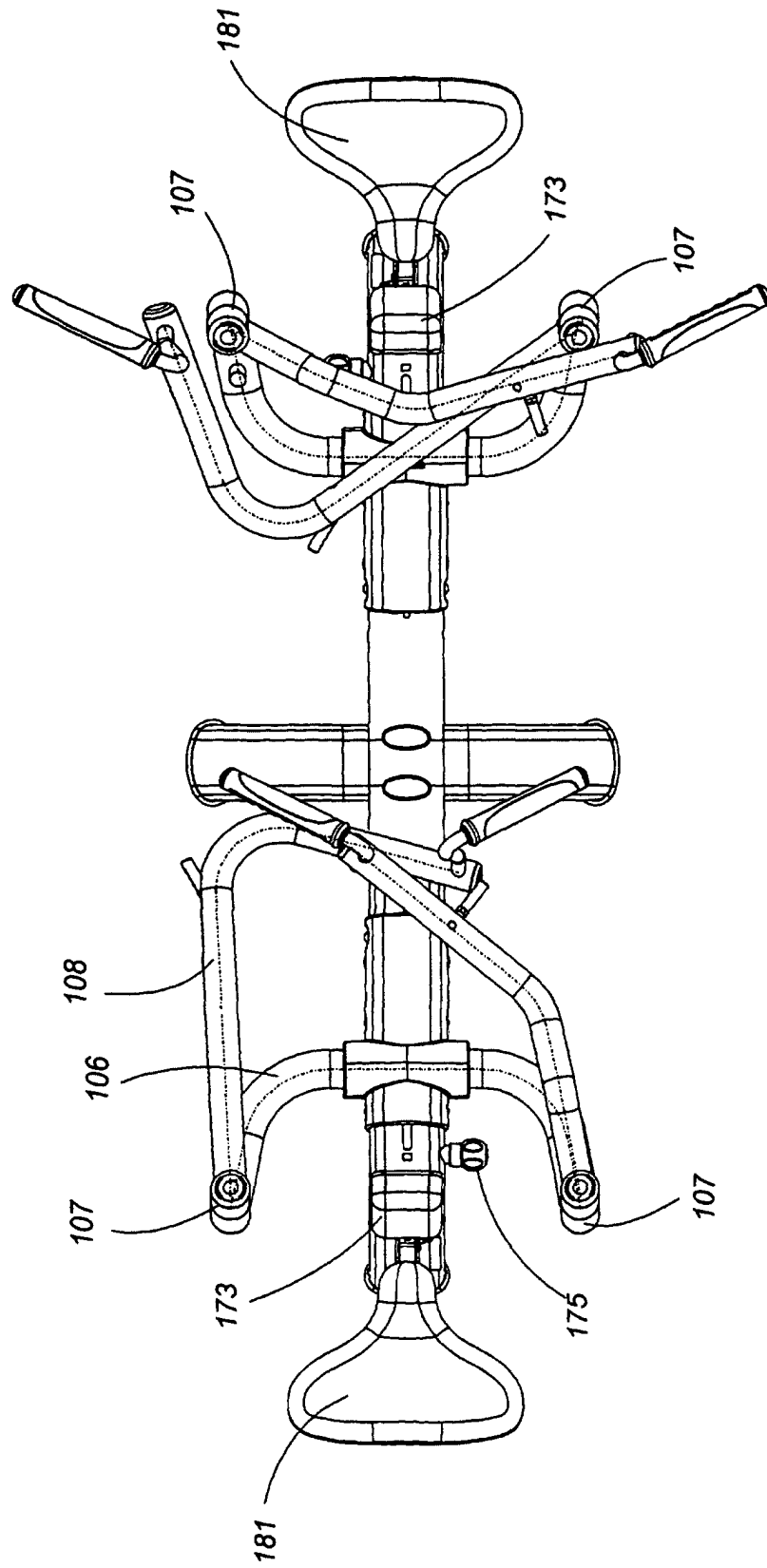
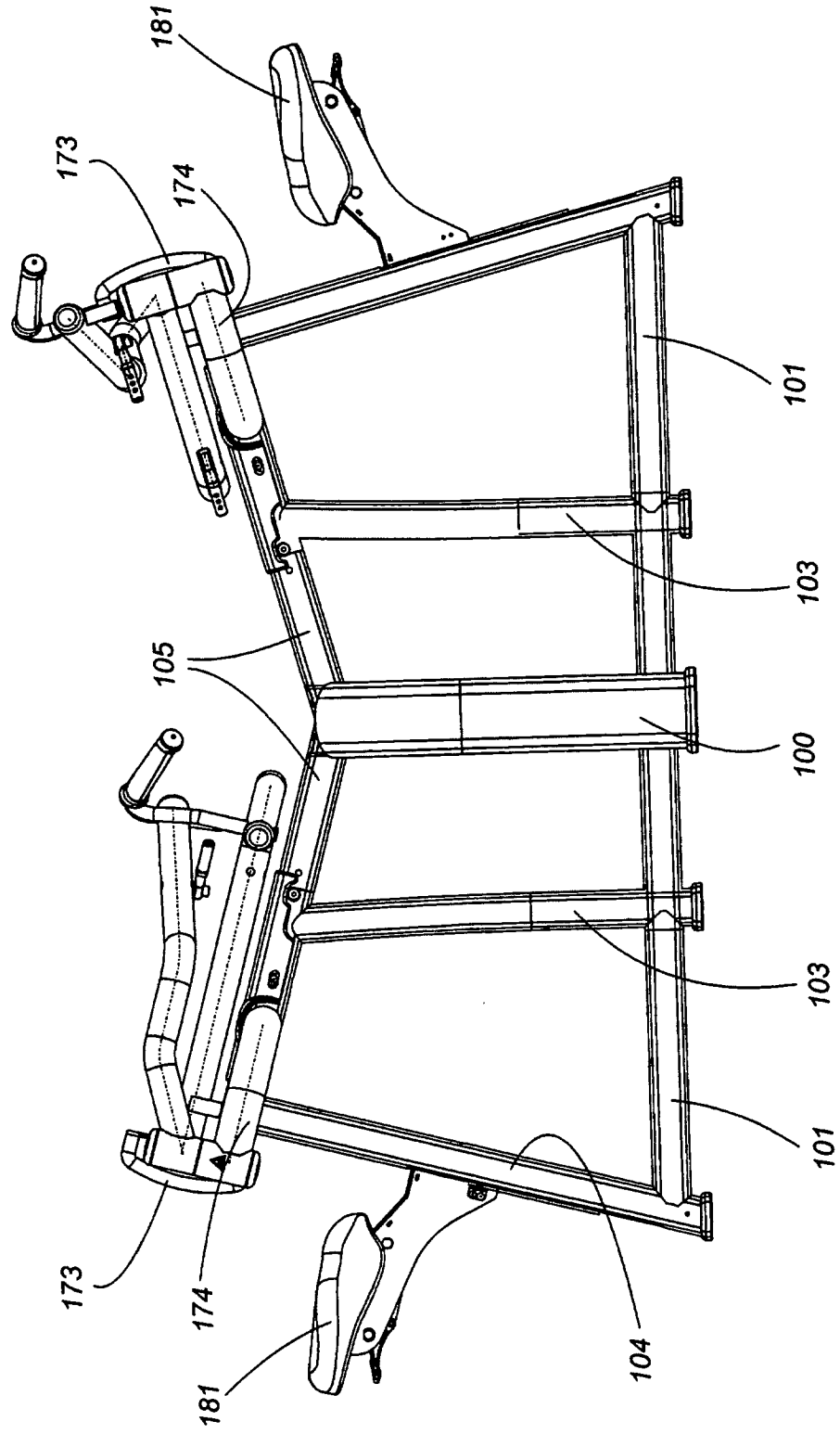
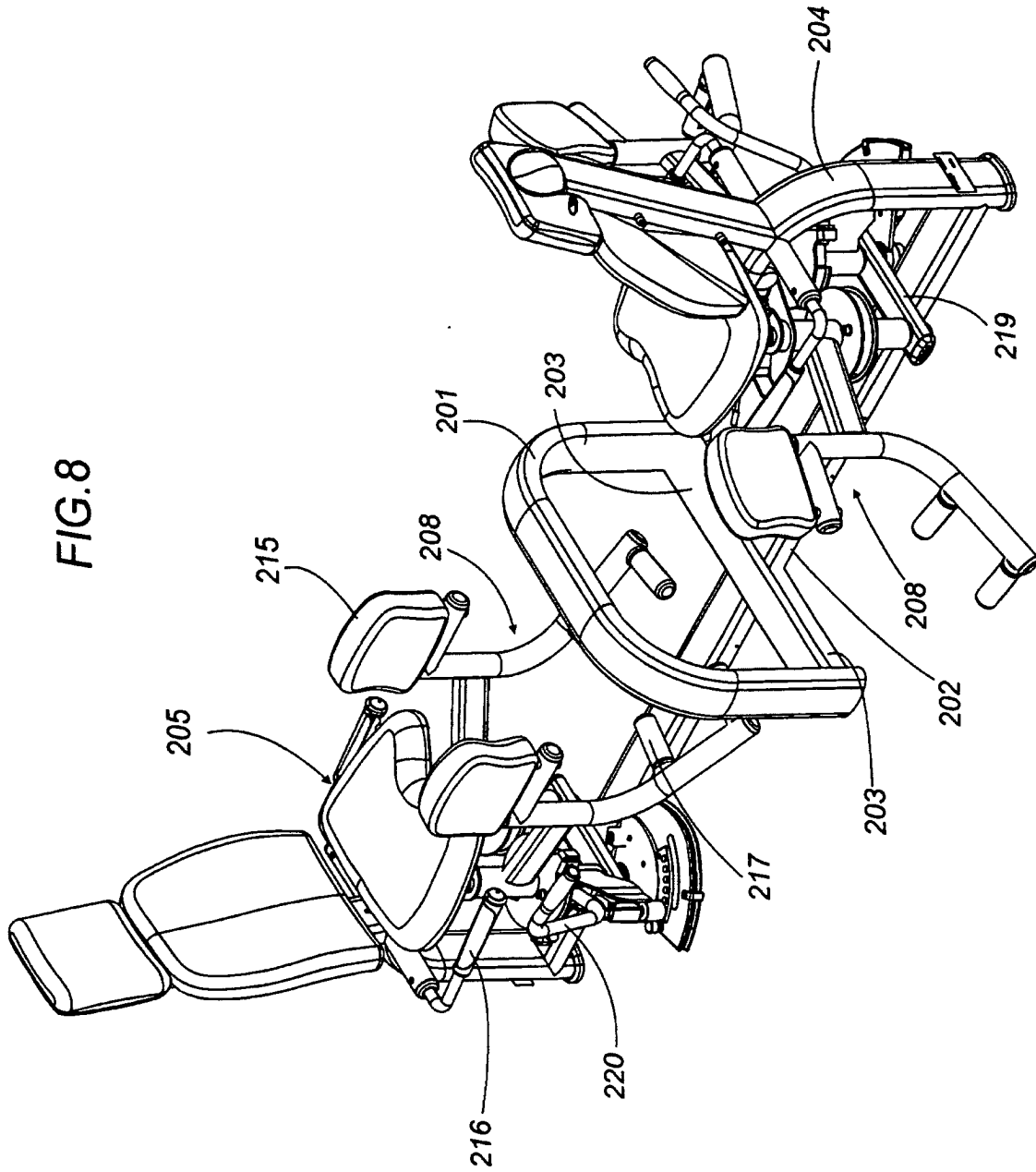


FIG.6

FIG.7





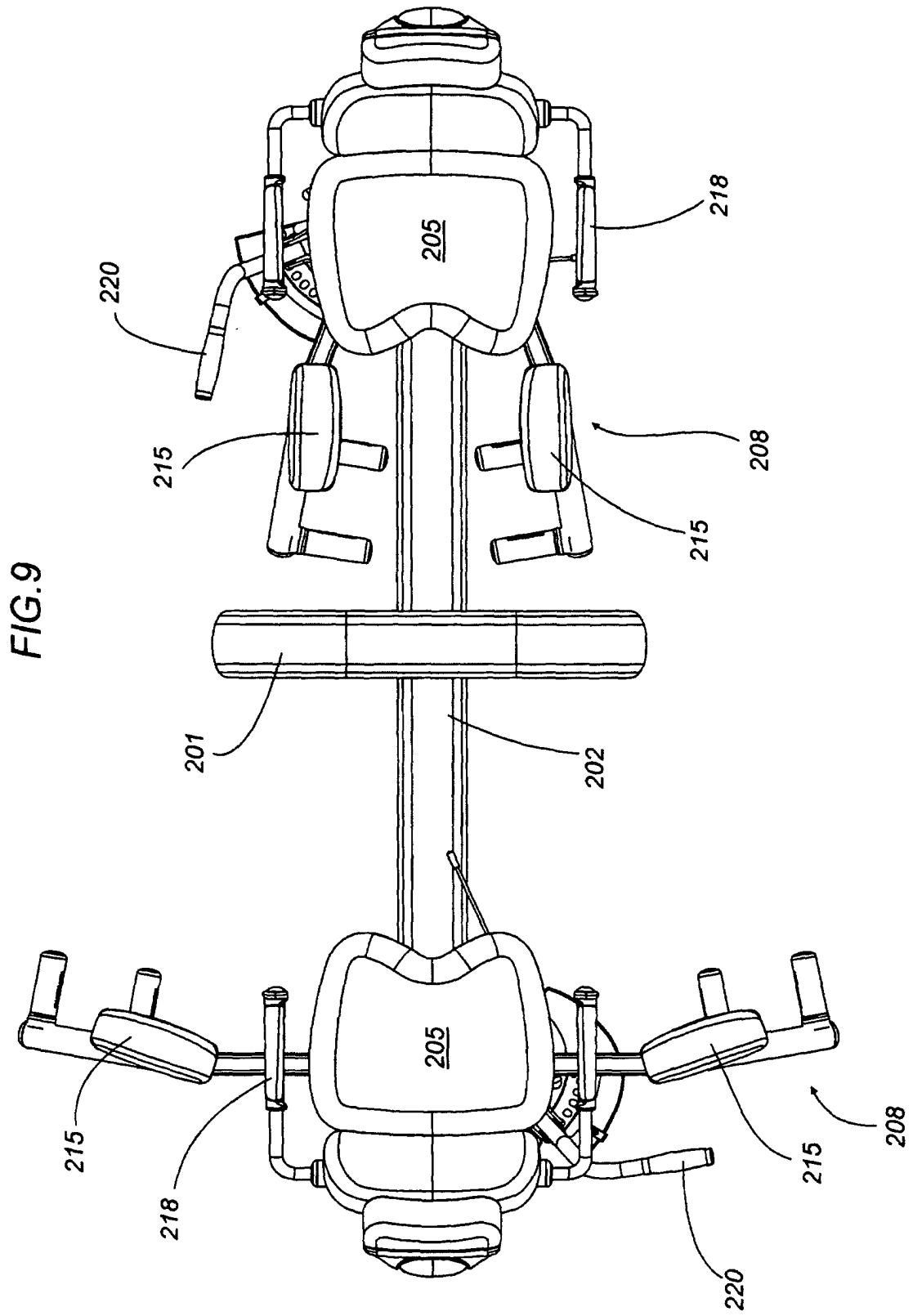
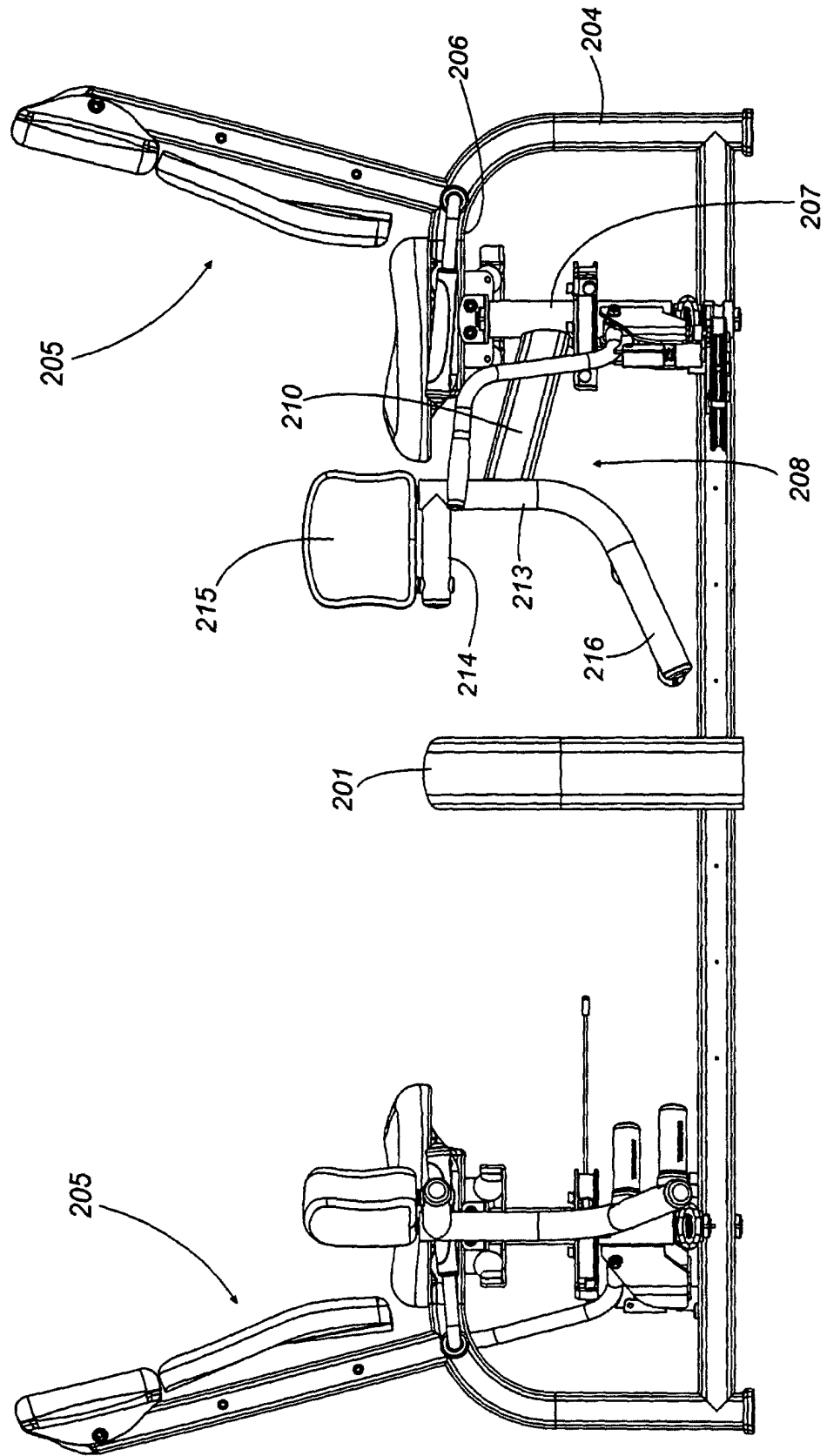


FIG.10



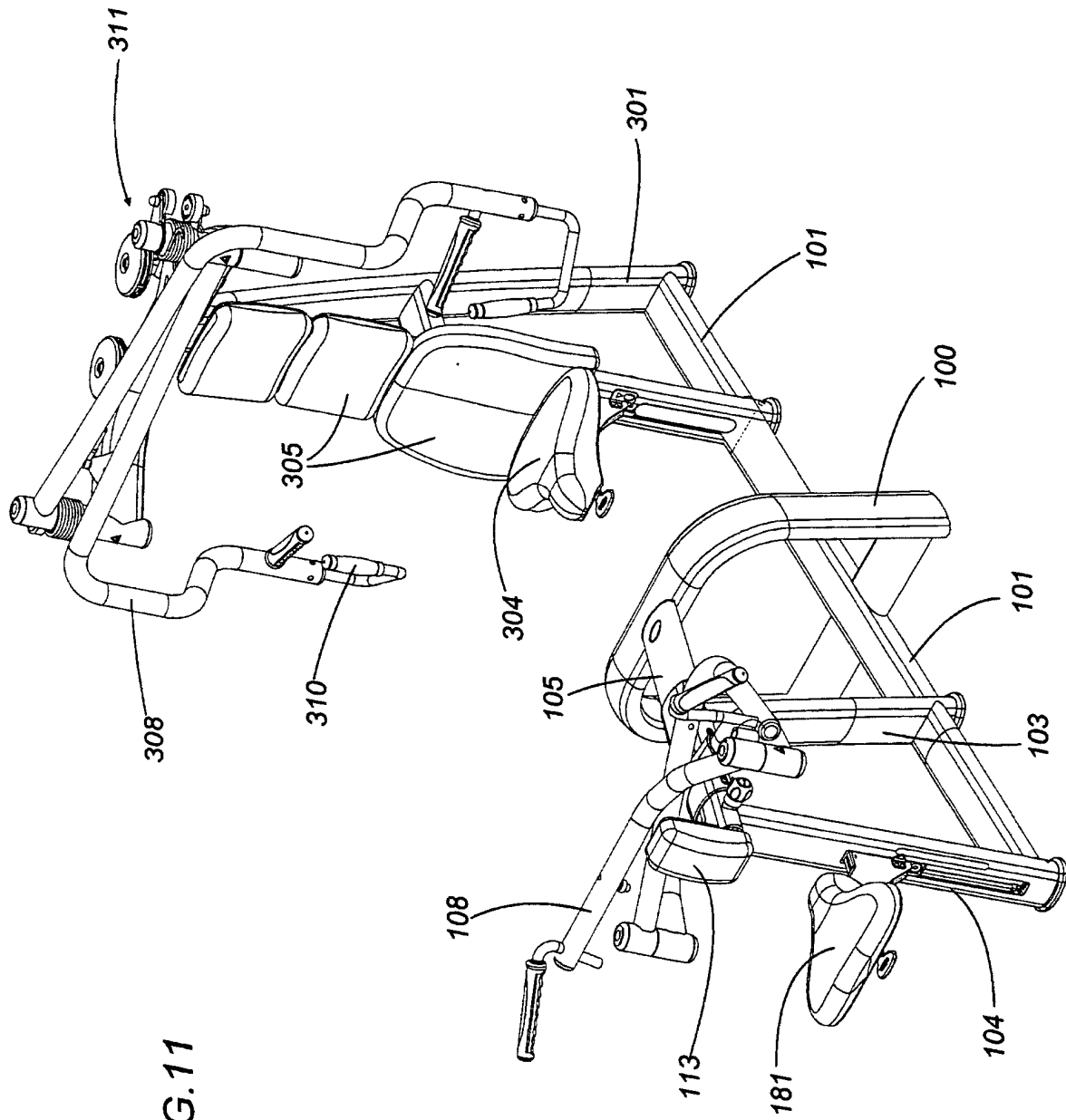


FIG.11

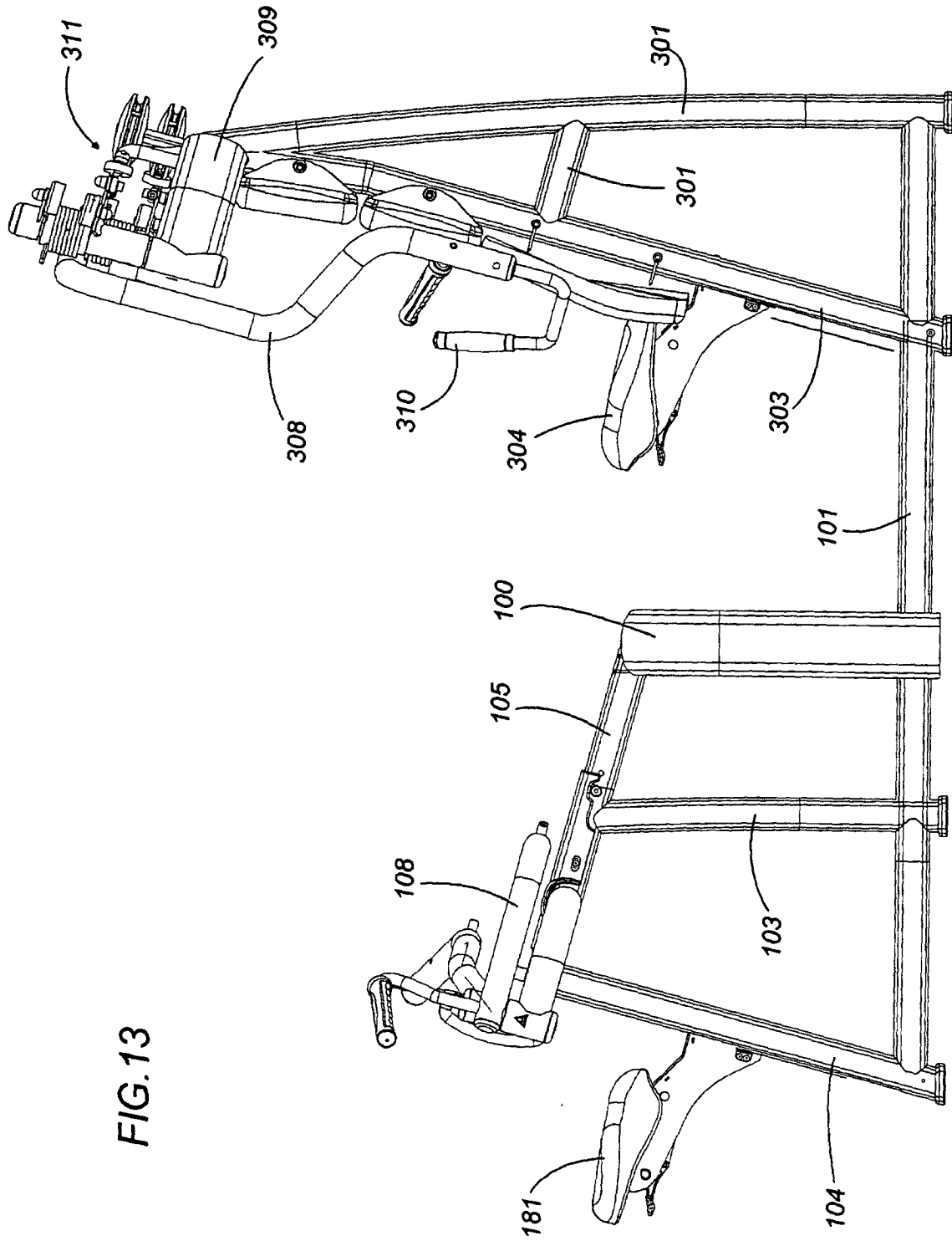


FIG. 13



FIG. 16

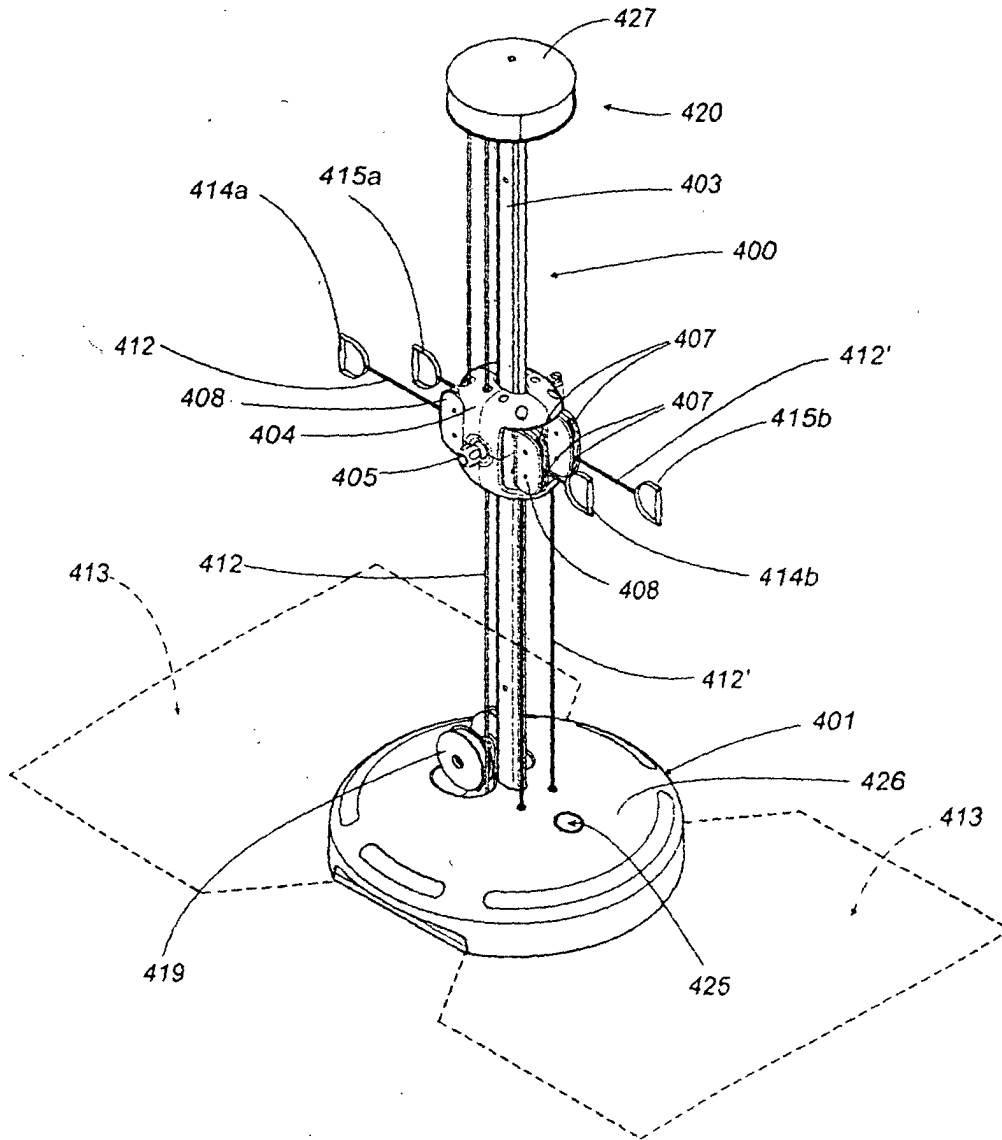


FIG. 15a

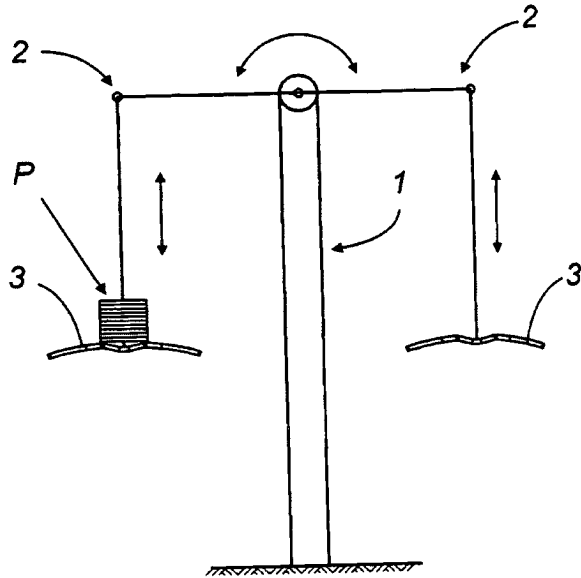


FIG. 15b

