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(54) **ELECTROMECHANICAL MECHANISM FOR CONTROLLING FRACTIONAL WEIGHT LIFTING PLATES IN WORKOUT STATIONS**

(57) "ELECTROMECHANICAL MECHANISM FOR CONTROLLING FRACTIONAL WEIGHT LIFTING PLATES IN WORKOUT STATIONS", to be installed in a weight tower of the workout station, of the kind comprised by two vertical columns, joined at the top by a crossbeam and at the bottom by a base, on which there rests a stack of unit weights that can be vertically moved by a steel cable, sliding in vertical guides mounted between the crossbeam and the base; and this tower has at its top a pulley that deflects the steel cable coming from the lower part of the tower towards the center of the tower, where it is attached to the unit weights. A pulley (8), that deflects the steel cable, is mounted in the center of a shaft (11); this shaft (11) being kept suspended and parallel to the crossbeam (2) by a pair of bearings (13) attached to the crossbeam (2) of the tower; and on this shaft (11) there is mounted on either side of the pulley (8), a pulley (15) provided with a coupling (17) in the side section, housable in a coupling (18) of an adjacent disk (19), lengthwise and slidingly mounted on the shaft (11), conducted by a rod (20) which is propelled axially by the cursor (23) of a linear actuator (24); there being fastened to each pulley (15) a steel cable (16), which passes through the tower, by a deflection pulley (29), hanging vertically down inside a tube (30) attached to the crossbeam (2) and to the base (3) of the tower, the cylindrical fractional weight (31 or 32) being held at the end.

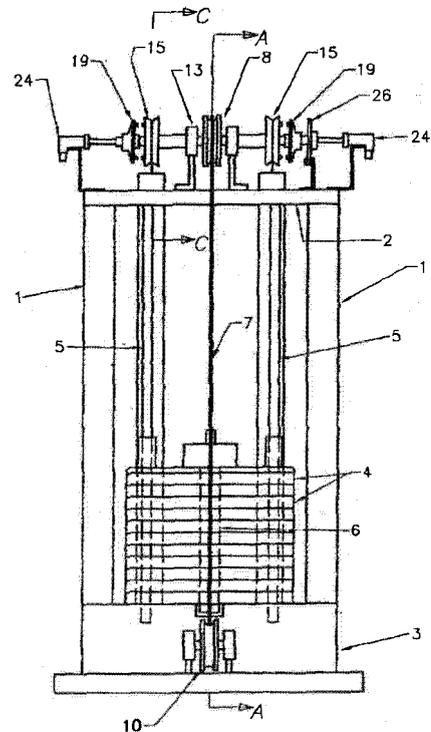


Fig. 1

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## Description

**[0001]** The present specification refers to an electro-mechanical mechanism for controlling fractional weight lifting plates in workout stations and, more specifically, to a shaft having pulleys, mounted on bearings fixed on the weight tower of the workout station to act in conjunction with a set of fractional weight lifting plates which together with the unit weights, make up the total amount selected by the user of the workout station.

**[0002]** As persons skilled in the art are aware, weight towers of workout stations have various unit weights stacked, which may, in whole or in part, be lifted inside the towers by central vertical steel cables, driven by active members of the workout station driven by the user. Selecting the weights to lift may be obtained by inserting a horizontal pin, which crosses through a hole existing in each weight in correspondence with a sequence of holes of an ear that extends to below the lower weight and attaches at the top to a steel cable. A weight selected by the pin lifts all the weights above it as well.

**[0003]** The most modern towers have electromechanical systems for selecting the weights, commanded by a panel fixed to the workout station.

**[0004]** Many conventional towers have unit weights each weighing ten kilos and extra pins for coupling, in a guide parallel to that of the unit weights, of extra fractional loads, normally weighing five kilograms and two and a half kilograms.

**[0005]** It is therefore one of the objectives of the present invention to provide an electromechanical mechanism for controlling fractional weight lifting plates in workout stations which enables the motorized selection of the fractional weight lifting plates in unit weight towers.

**[0006]** These and other objectives and advantages of the present invention are achieved by way of a electro-mechanical mechanism for controlling fractional weight lifting plates in workout stations, to be installed in a weight tower of the workout station, of the kind comprised by two vertical columns, joined at the top by a crossbeam and at the bottom by a base, on which there rests a stack of unit weights that can be vertically moved by a steel cable, sliding in vertical guides mounted between the crossbeam and the base; and at the top of this tower there is a pulley that deflects the steel cable coming from the lower part of the tower towards the center of the tower, where it is fixed to the unit weights. According to the invention, the mechanism is comprised by the pulley mounted in the center of a shaft kept suspended and parallel to the crossbeam by a pair of bearings attached to the crossbeam of the tower; on this shaft there is mounted on either side of the pulley, another pulley provided with a coupling in the side section, housable in a coupling of an adjacent disk, lengthwise and slidingly mounted on the shaft, conducted by a rod which is propelled axially by the cursor of a linear actuator; fastened to each pulley is a steel cable, which passes through the tower, by a deflection pulley, hanging vertically down in-

side a tube attached to the crossbeam and to the base of the tower, the cylindrical fractional weight being held at the end.

**[0007]** Next the present invention will be described with reference to the accompanying drawings, wherein:

Figure 1 represents a front raised view of a tower having the mechanism that is the object of the present invention;

Figure 2 represents a vertical sectional view of a tower with the mechanism that is the object of the present invention;

Figure 3 represents a long cross-sectional view of the mechanism, passing through the shaft of the pulley of the top of the tower; and

Figure 4 represent a cross-sectional view of the top of the tower, crosswise to the shaft of the pulley.

**[0008]** According to these illustrations, the electromechanical mechanism for controlling fractional weight lifting plates in workout stations, the object of the present invention, is applied to weight towers comprised of two vertical columns 1, joined at the top by a crossbeam 2 and at the bottom by a base 3 supporting said columns 1, whereby forming a rectangular space between the columns 1, crossbeam 2 and base 3 where there is accommodated a plurality of unit weights 4 stacked, as can be seen in figures 1 and 2. These unit weights 4 have vertical holes that are crossed by vertical guides 5 mounted between the crossbeam 2 and the base 3, see figure 1.

**[0009]** Above the upper unit weight 4 there is a coupling plaque, with a vertical bar 6 that crosses through all the unit weights 4 by corresponding central holes therein, this plaque being attached to the end of a steel cable 7 which lifts the unit weights 4.

**[0010]** The electromechanical mechanism promotes the coupling between the vertical bar 6 and one of the unit weights 4, duly selected. The steel cable 7 then lifts, by way of the bar 6, the selected weight 4 plus all the weights above it.

**[0011]** The present invention consists of adding to the unit weights 4, fractional weight lifting plates equivalents to one half, or to one half plus one fourth of a unit weight, with an electromechanical selector for selective coupling.

**[0012]** In figures 3 and 4 the electromechanical selector for fractional weight lifting plates consists of using the central pulley 8 of the top of the tower, that deflects downwards, in the center of this tower, the steel cable 7 coming from the base 3, where there is a deflecting pulley 10 which leads the cable, horizontally, to the workout station, as schematically represented by an arrow in figure 2.

**[0013]** Accordingly, the pulley 8 has a tubular shaft 11, mounted on bushings 12 of bearings 13 attached to the crossbeam 2 of the tower. The tubular shaft 11 projects outwardly of the bushings 12 and receives, on either side of the bearings 13, the bushings 14 of two pulleys 15, which has channels for steel cables 16 having small gauge or belt.

[0014] Each pulley has a rotary coupling 17, opposite an analogous coupling 18, of a disk 19 mounted lengthwise and slidingly on the shaft 11. At each end of the same shaft 11, internally, a cylindrical 20 is housed, whereon a radial pin 21 is mounted at the end, which perpendicularly crosses oblong holes 22 provided on the walls opposite the shaft 11, so as to enable the coupling of this pin 21 on the respective disk 19. The end opposite the rod 20 leaves the hole of the shaft and connects to a cursor 23 of a linear actuator 24, by way of a rotary joint 25, each actuator 24 being attached to the crossbeam 2 of the tower. As described above, the shaft 11 has rods 20 at each end and linear actuators 24, one for each rod 20.

[0015] As can be seen in figure 3, at one of the ends of the shaft 11 there is also provided axially a disk 26 with perforations on the periphery, disposed with its edge accommodated in two optical sensors 27.

[0016] These two optical sensors 27 are located near each other and at a distance not multiple of the distance between the holes of the disk 26 such that the CPU of the command panel recognizes the direction in which the disk 26 is turning, besides counting the amount of holes in a lifting or lowering operation of the weights.

[0017] Figure 4 illustrates how each pulley 15 has the steel cable 16 (or belt), attached at a point snugly at the bottom of the channel, where its terminal 28 is housed, and this steel cable 16 extends behind the tower where it deflects downwards, vertically when passing by a deflection pulley 29.

[0018] At the crossbeam 2 and at the base 3 of the tower are fixed two vertical tubes 30, which receive, vertically and slidingly, two cylindrical weights, a weight 31 weighing five kilograms and the other 32 weighing two and a half kilograms, each in a tube 30 and suspended by the steel cables 16, which join at their centers.

[0019] The tubes 30 are closed at the lower ends, and may contain rubber pads 33 underneath to buffer the shock of any of the weights 31 or 32 that freefall due to rupture of the respective cable 16. Closed at the bottom, the tubes also help buffer the freefall by partial air compression with the weight acting as a piston. The weights 31 and 32 are hung by the respective steel cables 16, without touching the bottom of the tubes 30, keeping these cables driven, which will always keep their pulleys 15 in the same position when not operated.

[0020] To raise one or two fractional weight lifting plates 31 and 32, in conjunction with the selected unit weights 4 of the tower, the electronic command panel drives a linear actuator 24 or both. The actuator pushes the rod 20 axially into the shaft 11, which, by means of its pin 21 conducts the disk 19 towards the pulley 15, joining the couplings 17 and 18, such that the pulley 15 thereafter turns conducted by the shaft 11. In this condition the pulley 15 winds the cable 16, suspending the weight 31 or 32, or both. When the unit weight 4 of the tower weighs 10 kilograms, fractional weight lifting plates weighing five kilograms and two and a half kilograms are

used, such that selective operations of the two linear actuators 24 may fill the interval between 10 kilogram weights in four equal intervals.

[0021] The disk 26 and the optical sensors 27 read the angular movement of the pulley 8, which is related to the linear movement of the steel cable 7 and, therefore, to the displacement of the unit weights 4, and this data is relayed to the electronic panel of the workout station, which interprets it and adds it to the weight data informed by the sensor of the selection system and displays the energy expended in the exercise on the panel screen.

### Claims

1. "ELECTROMECHANICAL MECHANISM FOR CONTROLLING FRACTIONAL WEIGHT LIFTING PLATES IN WORKOUT STATIONS", to be installed in a weight tower of the workout station, of the kind comprised by two vertical columns, joined at the top by a crossbeam and at the bottom by a base, on which there rests a stack of unit weights that can be vertically moved by a steel cable, sliding in vertical guides mounted between the crossbeam and the base; and this tower has at its top a pulley that deflects the steel cable coming from the lower part of the tower towards the center of the tower, where it is attached to the unit weights, **characterized** wherein the pulley (8) that deflects the steel cable is mounted in the center of a shaft (11); this shaft (11) being kept suspended and parallel to the crossbeam (2) by a pair of bearings (13) attached to the crossbeam (2) of the tower; and on this shaft (11) there is mounted on either side of the pulley (8), a pulley (15) provided with a coupling (17) in the side section, housable in a coupling (18) of an adjacent disk (19), lengthwise and slidingly mounted on the shaft (11), conducted by a rod (20) which is propelled axially by the cursor (23) of a linear actuator (24); there being fastened to each pulley (15) a steel cable (16), which passes through the tower, by a deflection pulley (29), hanging vertically inside a tube (30) attached to the crossbeam (2) and to the base (3) of the tower, a cylindrical fractional weight (31 or 32) being held at the end.
2. "ELECTROMECHANICAL MECHANISM FOR CONTROLLING FRACTIONAL WEIGHT LIFTING PLATES IN WORKOUT STATIONS", according to claim 1, **characterized** wherein the pulley (8) that deflects the steel cable, is tubular, and is mounted by bushings (12) on the bearings (13) attached to the crossbeam (2) of the tower.
3. "ELECTROMECHANICAL MECHANISM FOR CONTROLLING FRACTIONAL WEIGHT LIFTING PLATES IN WORKOUT STATIONS", according to claim 2, **characterized** wherein the shaft (11)

projects outwardly from the bearings (12) where it receives, on either side, a pulley (15) mounted thereon by bearing (14); and the disk (19), lengthwise and slidingly mounted on the shaft (11), is conducted by a rod (20) which perpendicularly provides a radial pin (21), which passes through a hole (22) of the shaft (11), and the rod (20) is propelled axially by the cursor (23) of a linear actuator (24), by way of a rotary joint (25).

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4. "ELECTROMECHANICAL MECHANISM FOR CONTROLLING FRACTIONAL WEIGHT LIFTING PLATES IN WORKOUT STATIONS", according to claim 1, **characterized** wherein the guide tubes (30) of the fractional weight lifting plates (31 and 32) have their bases closed and allow little internal clearance with these weights, and at the bottom have rubber pads (33).

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5. "ELECTROMECHANICAL MECHANISM FOR CONTROLLING FRACTIONAL WEIGHT LIFTING PLATES IN WORKOUT STATIONS", according to claim 1, **characterized** wherein the tip of the shaft (11) has a disk (26) with perforations at the periphery, and with the edge accommodated in two optical sensors (27), with distance there between not multiple of the distance between holes of the disk (26), designed to count the pulses when the disk turns, in addition to the sensors together enabling the electronic system to interpret the turning direction.

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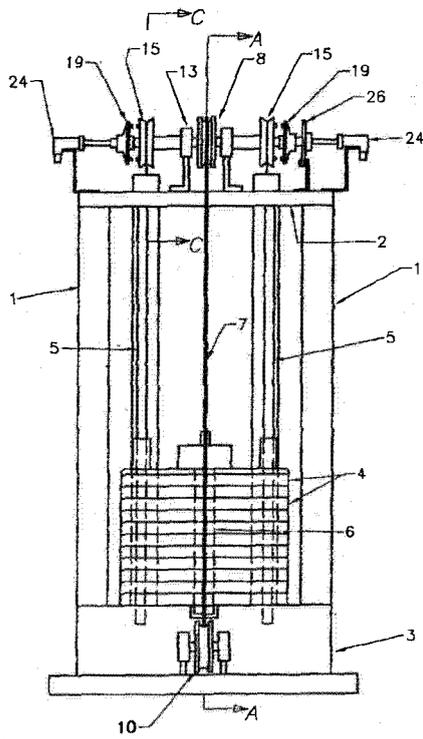
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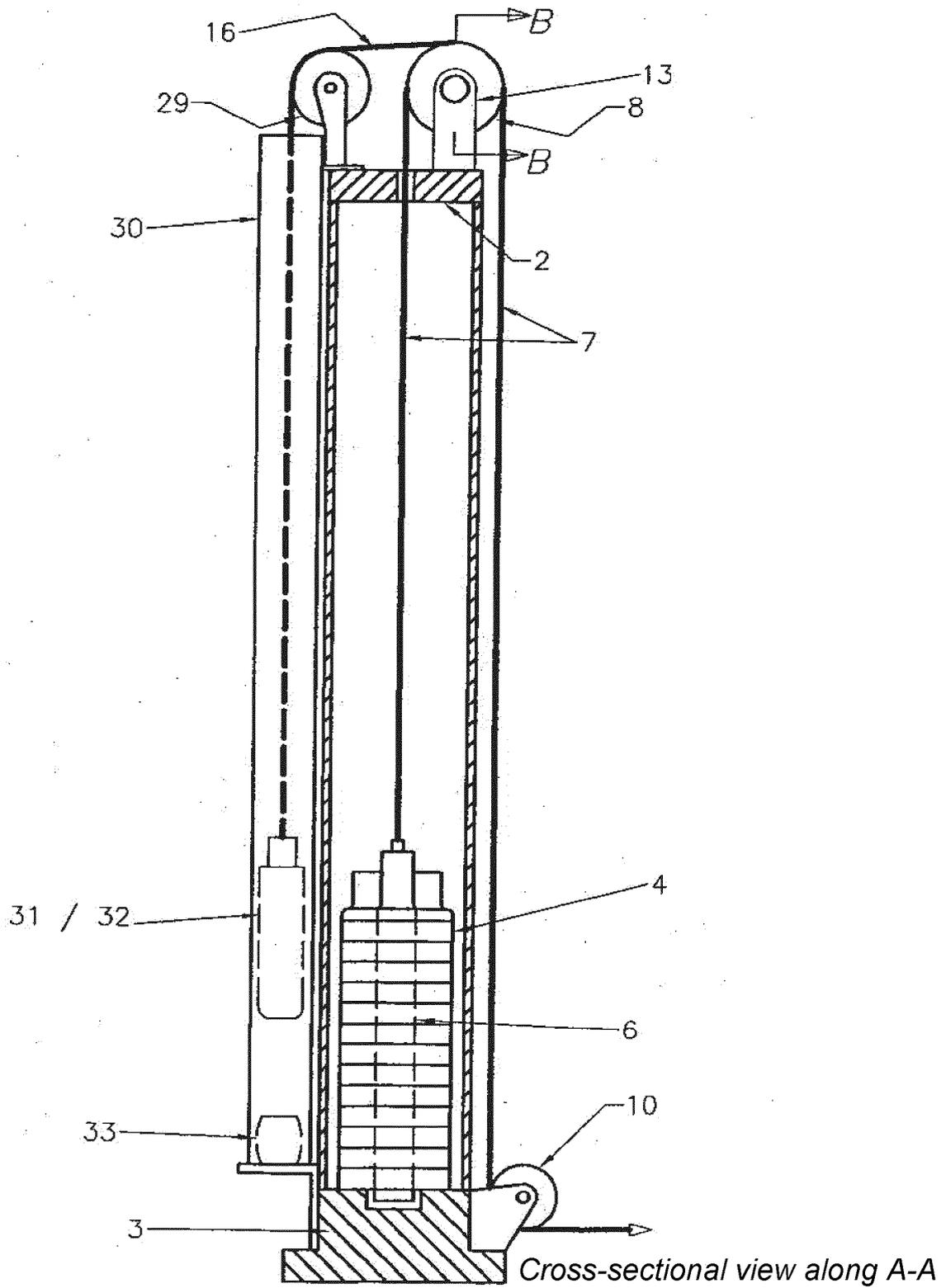
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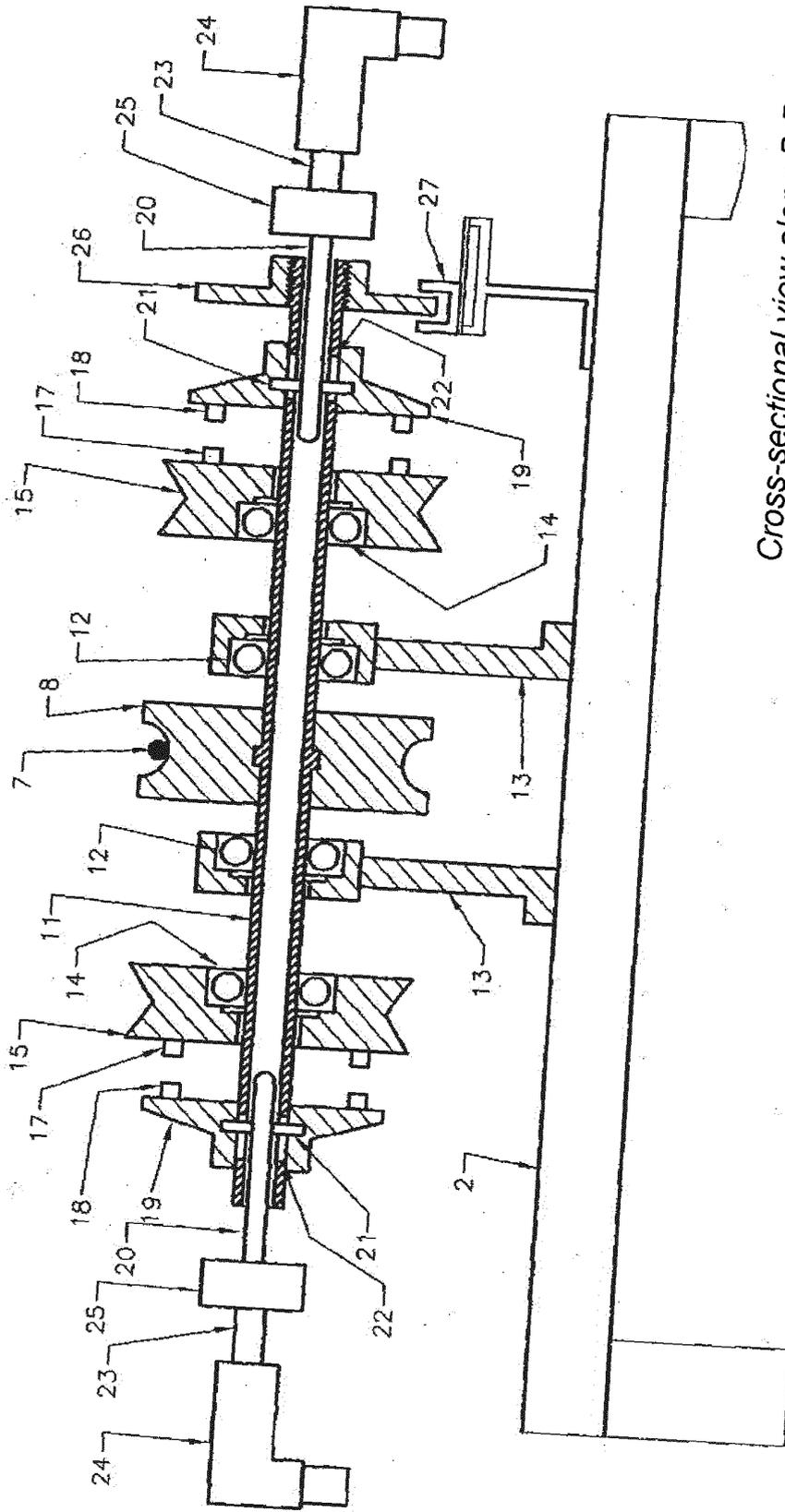
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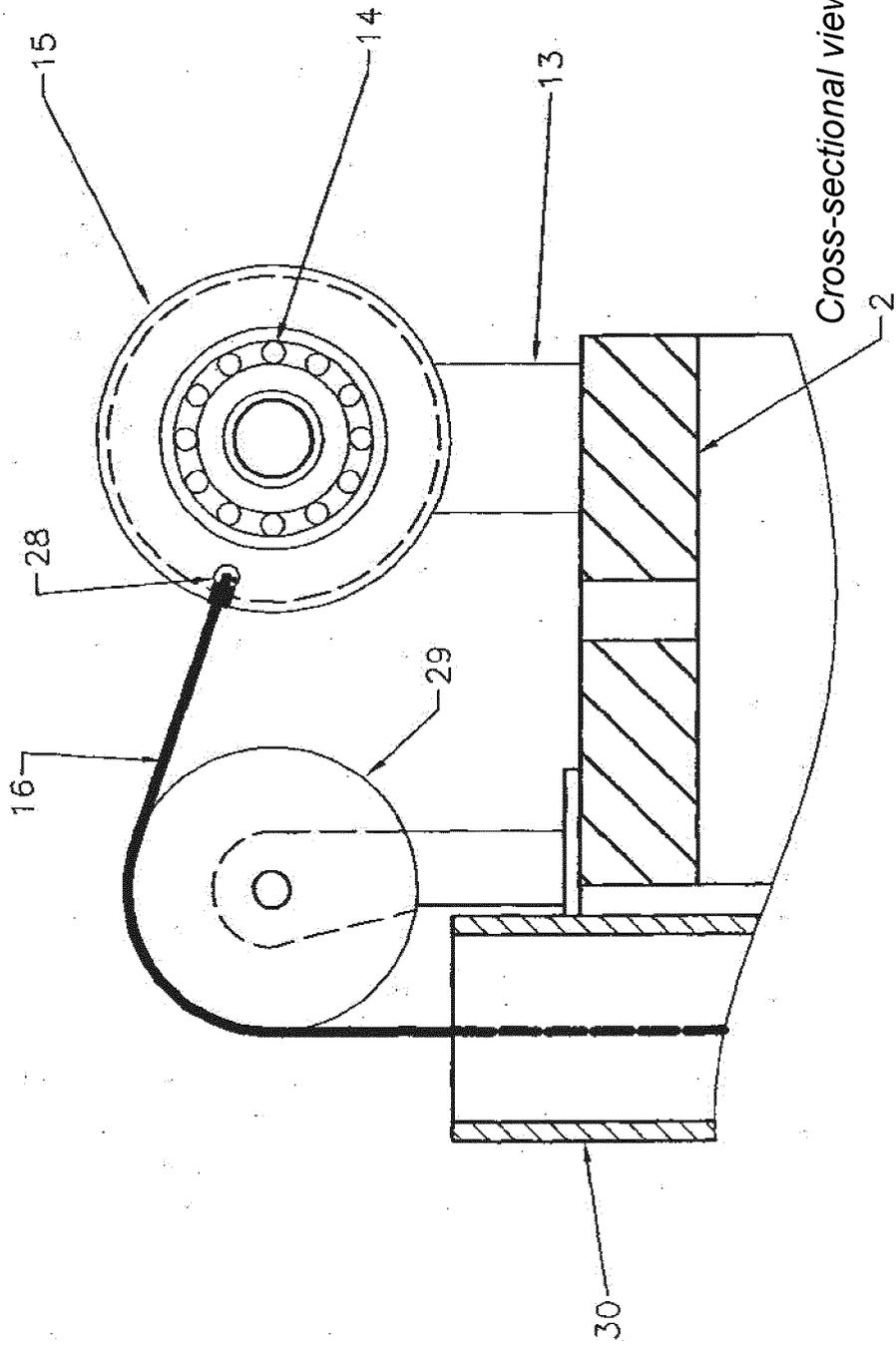
Cross-sectional view along A-A

Fig. 2



Cross-sectional view along B-B

Fig. 3



Cross-sectional view along C-C  
Fig. 4

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/BR2010/000133

A. CLASSIFICATION OF SUBJECT MATTER <b>IPC (2010.01) A63B 21/075 A63B 21/00 A63B 24/00</b> According to International Patent Classification (IPC) or to both national classification and IPC	
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) <b>IPC (2010.01) A63B</b> Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) <b>EPODOC, ESPACENET, INTRANET, SINPI</b>	
C. DOCUMENTS CONSIDERED TO BE RELEVANT	
Category*	Citation of document, with indication, where appropriate, of the relevant passages Relevant to claim No.
A	WO 2009145421 A2 (CHA CHUNG HWAN [KR]) 03 <b>December</b> 2009 (2009-12-03)
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<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.	
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Date of the actual completion of the international search <b>11 August 2010 (11.08.2010)</b>	Date of mailing of the international search report <b>23 August 2010 (23.08.2010)</b>
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Information on patent family members

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