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(54) **ROWING MACHINE INCLUDING A GEAR SHIFT MECHANISM**

(57) Rowing machines are described that permit a rower to adjust the rowing resistance using a gear shift mechanism. The rowing machine (200) includes a handle (237) connected to a chain (233), which passes, sequentially, over a derailleur (243) and then to the gears of the gear cassette (251). The gear cassette is coupled to a resistance unit (250), which may be similar to resistance units used in off wheel bicycle trainers. This configuration of derailleur and gear cassette permit the rower to smoothly select a gear.

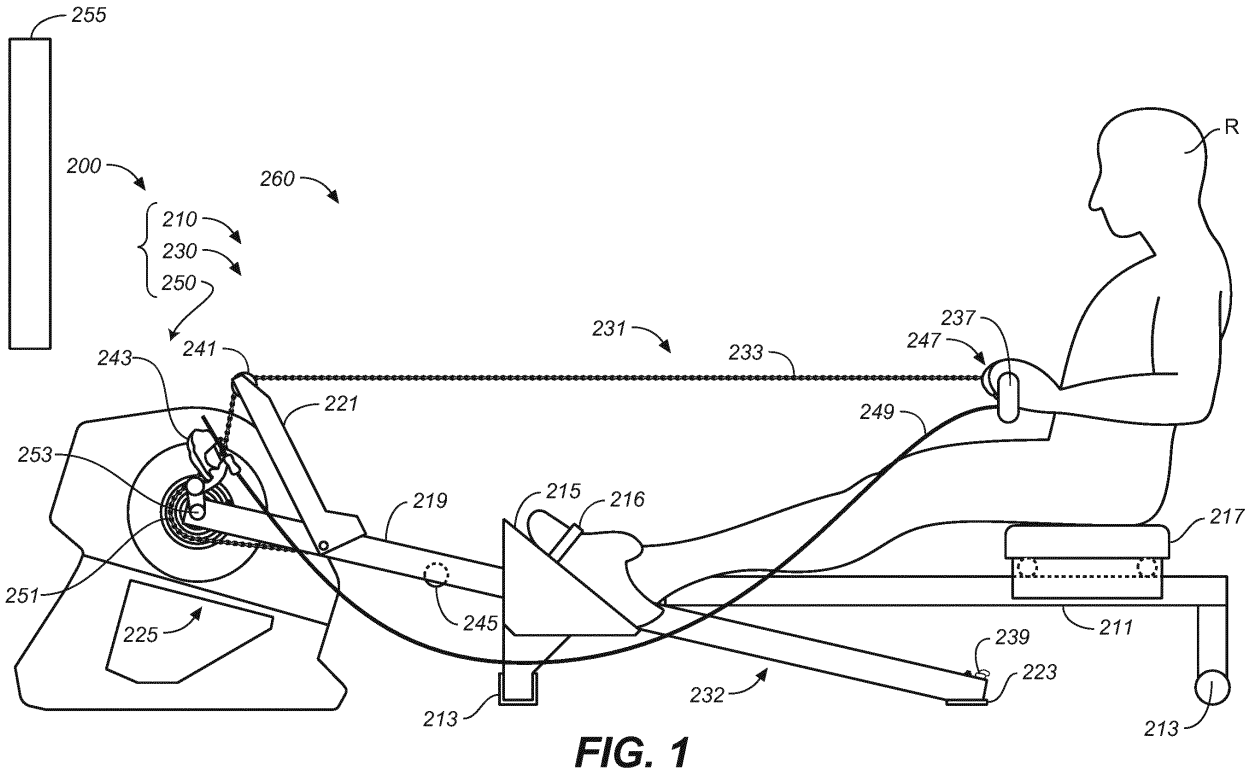

FIG. 1

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Description

[0001] The present invention generally relates to exercise equipment, and more particularly to rowing machines utilizing gear changing mechanisms.

DISCUSSION OF THE BACKGROUND

[0002] Rowing machines are stationary exercise devices that simulate the motion and forces during rowing. Rowing machines generally include a frame having a movable seat and foot rests and a handle that is connected to a resistance unit. During the drive portion of the stroke, the handle pulls on the resistance unit, which provides resistance to the motion of the handle. During the recovery portion of the stoke, there is no resistance to the motion of the handles.

[0003] In certain rowing machines, the handle is connected to the resistance unit through a chain or cord attached to the handle and a mechanism to take up slack of the chain or cord during the stroke. Resistance units for such rowing machines may include one or more of a flywheel, an air or water resistance mechanism, or a magnetic resistance mechanism which provide a resistance force to the pulling of the handle that increases with the speed of the handle. Magnetic resistance mechanisms are electronically controllable, and when used in combination a flywheels and/or an air or water resistance mechanism, can vary the resistance force to the pulling of the handle over a wide range.

[0004] One limitation of rowing machines is that they do not provide an easy way for the rower to adjust the resistance during practice. Thus, while the rowing machine may adjust the resistance through a magnetic resistance mechanism, the rower must work against this resistance and cannot, as in bicycles, for example, shift the resistance mechanism to obtain a larger or smaller resistance during rowing. There is need in the art for an rowing machine that provides the rower with a greater degree of resistance control during rowing. Such a rowing machine should be easy for the rower to operate and should be comprised of standard exercise equipment mechanisms.

[0005] The present invention overcomes some of the disadvantages of prior art by providing a rowing machine connected to a resistance unit by a chain and gear cassette/derailleur configuration in which the chain extends from a handle, through the derailleur, and though the gears. This configuration provides for a smooth operation not found in other systems.

[0006] It is one aspect to provide a rowing machine comprising: a resistance unit including a gear cassette comprising a plurality of gears coupled to a mechanism to resist the rotation of the gear cassette; a frame adapted for placing on the ground and attached to the resistance unit; a seat movable along the frame; a handle; a chain having a first end attached to the handle and a second end attached to the frame; a derailleur attached to the frame; and a gear shifter operably connected to the derailleur. The chain extends, sequentially, from the handle, through the derailleur, and engages a gear of the plurality of gears, such that the engaged gear is selectable using the gear shifter.

[0007] It is another aspect to provide a rowing machine attachment connectable to a resistance unit, where the resistance unit includes an axle and a gear cassette comprising a plurality of gears coupled to a mechanism to resist the rotation of the gear cassette. The rowing machine attachment includes: a frame adapted for placing on the ground and including a fork end adapted to accept the axle of the resistance unit; a seat movable along the frame; a handle; a chain having a first end attached to the handle and a second end attached to the frame; a derailleur attached to the frame; and a gear shifter operably connected to the derailleur. When frame is attached to the axle of the resistance unit and where the chain extends, sequentially, from the handle, through the derailleur, and engages a gear of the plurality of gears, such that the engaged gear is selectable using the gear shifter.

[0008] These features together with the various ancillary provisions and features which will become apparent to those skilled in the art from the following detailed description, are attained by the exercise equipment of the present invention, preferred embodiments thereof being shown with reference to the accompanying drawings, by way of example only, wherein:

FIGS. 1 and 2 are side and top views, respectively, of a first embodiment rowing machine with the rower at the end of a stroke;

FIG. 3 is a view of a handle and chain;

FIG. 4 is a side view illustrating one embodiment of the connection of the chain and resistance unit;

FIG. 5 is an exploded view 5-5 of showing one embodiment of a chain return mechanism; and

FIG. 6 is a side view of the first embodiment rowing attachment attached to the bicycle trainer resistance unit, with the rower at the beginning of a stroke.

[0009] Reference symbols are used in the Figures to indicate certain components, aspects or features shown therein, with reference symbols common to more than one Figure indicating like components, aspects or features shown therein.

DETAILED DESCRIPTION OF THE INVENTION

[0010] FIGURES 1 and 2 are side and top views, respectively, of a first embodiment rowing machine **200,** with a rower **R** in at the end of a stroke, FIGURE 3 is a top view of a handle **237** and chain **233;** FIGURE 4 is a side view illustrating the chain and a resistance unit 250;

and FIGURE 5 is an exploded view 5-5 of showing one embodiment of a chain return mechanism **232.**

[0011] As shown in FIGS. 1 and 2, rowing machine **200** includes a frame **210,** a resistance unit **250,** and power transmission components **230** connecting the frame and resistance unit. Frame **210** includes a first portion **211,** a second portion **219** and a third portion **221.** First portion **211** is generally horizontal. Second portion **219** is attached to first portion **211** and includes a first end **223** that extends to the ground and a second, forked end **225** attached to an axle **253** of resistance unit **250** and includes legs **213** for supporting the rowing attachment on the ground and a foot support **215** including foot straps **216.** Third portion **221** is attached to and extends above second portion **219.**

[0012] Resistance unit **250** includes a freewheel or freehub assembly including a cassette of gears **251** connected to axle **253** through a one-way clutch that engages with a resistance mechanism (both of which are not shown) within the resistance unit. Resistance unit **250** may, for example and without limitation, be generally similar to prior art resistance units of a wheel off bicycle trainer, such as the Tacx NEO (Garmin Ltd, Schaffhausen, Switzerland). Such resistance units provide a force to resist the rotation of the cassette of gears **251** in one direction and provides little force to resist the rotation of the cassette of gears in the opposite direction. Resistance unit **250** may include one or more of a flywheel, an air or water resistance mechanism, or a magnetic resistance mechanism that is electronically controllable. Resistance unit **250** also includes sensors to measure the power and cadence of the cassette of gears **251,** and electronics to accept the sensor measurements, control the resistance to the cassette of gears, and provide information for display on a screen **255.**

[0013] Power transmission components **230** include chain **233** coupled to the handle **237** with an attachment ring **301,** a first chain guide **241** attached to third frame portion **221,** a derailleur **243** attached to second end **225** in a position that is above cassette of gears **251** (as shown in FIG. 4), a second chain guide **245** attached to second portion **219,** and a chain return mechanism **232.** Power transmission components **230** also include a gear shifter **247** attached to the handle **237** and a cable **249** connecting the gear shifter and derailleur **243,** and a seat **217** including rollers to allow the seat to move along first frame portion **210.** In certain embodiments, first portion **211** is angled relative to the horizontal to aid the return of rower and at the end of the stroke.

[0014] In an alternative embodiment, derailleur **243** may be an electronic system, such as a Shimano Di2 electric drivetrain (Shimano Inc, Sakai, Japan) or Campagnolo EPS (Campagnolo Vicenza, Italy), or a wireless system, such as SRAM eTap (SRAM, Chicago, IL).

[0015] Chain return mechanism **232,** shown in FIGS. 3 and 5, is generally contained within second portion **219** and includes an elastic cord **235** coupled to an end of chain **233,** rollers **501, 503, 505,** and **507** supported on second frame portion **219** by bolts **511** and nuts **513.** An end **239** of elastic cord **235** is attached to first end **223.** The handle **237** also includes a mount **303** for a mobile device (not shown). The combination of chain **233** and elastic cord **235,** referred to herein as a compound cable **231,** extends from the handle **237** to first end **223,** with chain **233** being guided over first chain guide **241,** through derailleur **243,** over gears **251,** and guided over second chain guide **245.** Elastic cord **235** extend from chain **233** around rollers **501, 503, 505,** and **507** and is attached to frame **210** at first end **223.**

[0016] In an alternative embodiment, chain return mechanism **232** includes an elastic cord that pulls on an end of chain **233** as provided, for example and without limitation, by the Concept2 skewer assembly (Morrisville, Vermont) (see, for example, https://shop.concept2.com/model-b/249-skewer-assembly.html?search_query=skewer+assembly&results=6). In another alternative embodiment, chain return mechanism is a spring loaded cylinder that takes up the slack in chain **233,** or a gravity return mechanism (see, for example, US Patent Application Publication No. US20140243163A1, the content of which are incorporated by reference).

[0017] Resistance unit **250** thus provides a force that counters forces provided by a rower. The force provided by resistance unit **250** is transferred from axle **253,** to one of gears of gear cassette **251,** to chain **233** of compound cable **231,** to the handle **237.** In addition to resistance due to a flywheel or an electromagnetic or other mechanism for controlling the resistance, the gear shifter **247** and derailleurs **243** allow for rower to control the resistance. Slack in chain **233** is taken up by chain return mechanism **232.**

[0018] In another embodiment, a rowing machine attachment 260 is provided that is connectable to a resistance unit, such as resistance unit **250.** The rowing machine attachment includes the following components of rowing machine **200** described above: frame **200** adapted for placing on the ground and including a fork end adapted to accept the axle of the resistance unit; seat **217** movable along the frame; a handle **237;** chain **233** having a first end attached to the handle and a second end attached to the frame; derailleur **243** attached to the frame; and gear shifter **247** operably connected to the derailleur. When frame is attached to the axle of the resistance unit, **as illustrated in FIG. 1,** and where the chain extends, sequentially, from the handle, through the derailleur, and engages a gear of the plurality of gears, such that the engaged gear is selectable using the gear shifter.

[0019] One use of rowing machine **200** and of a rowing machine attachment 260 connected to resistance unit **250** is illustrated with reference to FIG. 1 and with FIGURE 6, which is a side view of the first embodiment rowing machine attached to the bicycle trainer resistance unit, with the rower at the beginning of a stroke.

[0020] At the beginning of a stroke, as shown in FIG.

6, the arms of rower **R** are fully extended, seat **217** is in a forward position, and elastic cord **235** retracts compound cable **231** towards first end **223.** Rower R then pulls on the handle **237** towards their body while pushing their feet against foot support **215** and extending their legs. Both seat **217** and the handle **237** then move backwards, with chain **233** being pulled through the resistance unit **250** and with elastic cord **235** elongating. During a stroke resistance unit 250 provides a resistance simulating the force during rowing.

[0021] During a stoke, as the handle **237** is pulled backwards and away from resistance unit **250,** a tension is provided to chain **233** by resistance unit **250** and while elastic cord **235** takes up any slack in compound cable **231.** The tension in chain **233** is provided by the force required to rotate gears **251,** which may be regulated by the rower using gear shifter **247** to activate derailleur **243** and thus select a gear of gears **251.** Alternatively, or in combination with gear shifter **247,** the force required to rotate gears **251** may be adjusted using software in resistance unit **250.** Thus, for example, certain embodiments of resistance unit **250** include sensors to monitor the rotation speed of gears **251** and electronics to determine power expended during rowing. In certain other embodiments, resistance unit **250** is in communication with a computer or electronic device, such as a smartphone, which can receive information from resistance unit 250 and which may also provide instructions to the resistance unit to modify the resistance provided by the resistance unit. The end of stroke is illustrated in FIG. 1.

[0022] After the end of the stroke, rower **R** moves forward to the position shown in FIG 6. The one-way clutch permits the chain to move without resistance through resistance unit **250** and return mechanism **232** takes up slack in compound chain **231.**

[0023] The inventor found that a rowing machine having a derailleur below the gears, as is generally provided on bicycles or bicycle trainers provides engagement of the one way-clutch at the beginning of a stroke that is not smooth. Thus, for example, shifting under load, as on an upstroke, can be painful for the rower. In contrast, placing the derailleur above the gears, as in FIG. 4 forces the gear shift to happen on a down stroke, when system is not under load and helps to dampen one way-clutch engagement at the beginning of a stroke, resulting in a smoother and more natural motion.

[0024] Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures or characteristics may be combined in any suitable manner, as would be apparent to one of ordinary skill in the art from this disclosure, in one or more embodiments.

[0025] Similarly, it should be appreciated that in the above description of exemplary embodiments of the invention, various features of the invention are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of one or more of the various inventive aspects. This method of disclosure, however, is not to be interpreted as reflecting an intention that the claimed invention requires more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less than all features of a single foregoing disclosed embodiment. Thus, the claims following the Detailed Description are hereby expressly incorporated into this Detailed Description, with each claim standing on its own as a separate embodiment of this invention.

[0026] Thus, while there has been described what is believed to be the preferred embodiments of the invention, those skilled in the art will recognize that other and further modifications may be made thereto without departing from the spirit of the invention, and it is intended to claim all such changes and modifications as fall within the scope of the invention. Steps may be added or deleted to methods described within the scope of the present invention.

Claims

1. A rowing machine attachment connectable to a resistance unit, where the resistance unit includes an axle and a gear cassette comprising a plurality of gears coupled to a mechanism to resist the rotation of the gear cassette, said rowing machine attachment comprising:

a frame adapted for placing on the ground and including a fork end adapted to accept the axle of the resistance unit;
a seat movable along the frame;
a handle;
a chain having a first end attached to the handle and a second end attached to the frame;
a derailleur attached to the frame; and
a gear shifter operably connected to the derailleur,
where, when the fork end of the frame is attached to the axle of the resistance unit and where the chain extends, sequentially, from the handle, through the derailleur, and engages a gear of the plurality of gears,
such that the engaged gear is selectable using the gear shifter.

2. The rowing machine attachment of claim 1, where the resistance unit is an off-wheel bicycle trainer resistance unit.

3. The rowing machine attachment of claim 1 or 2, where the mechanism to resist the rotation of the gears includes a one-way clutch connecting the mechanism to the gear cassette.

4. The rowing machine attachment of any of claims 1 to 3, where the mechanism to resist the rotation of the gears includes a flywheel.

5. The rowing machine attachment of any of claims 1 to 4, where the mechanism to resist the rotation of the gears includes an electromagnet.

6. The rowing machine attachment of any of claims 1 to 5, where the rowing machine includes a return mechanism disposed between the second end of the chain and the frame.

7. The rowing machine attachment of claim 6, where the return mechanism includes an elastic cord.

8. A rowing machine comprising:

a resistance unit including a gear cassette comprising a plurality of gears coupled to a mechanism to resist the rotation of the gear cassette;
a frame adapted for placing on the ground and attached to the resistance unit;
a seat movable along the frame;
a handle;
a chain having a first end attached to the handle and a second end attached to the frame;
a derailleur attached to the frame; and
a gear shifter operably connected to the derailleur,
where the chain extends, sequentially, from the handle, through the derailleur, and engages a gear of the plurality of gears,
such that the engaged gear is selectable using the gear shifter.

9. The rowing machine of claim 8, where the resistance unit is an off-wheel bicycle trainer resistance unit.

10. The rowing machine of claim 8 or 9, where the mechanism to resist the rotation of the gears includes a one-way clutch connecting the mechanism to the gear cassette.

11. The rowing machine of any of claims 8 to 10, where the mechanism to resist the rotation of the gears includes a flywheel.

12. The rowing machine of any of claims 8 to 11, where the mechanism to resist the rotation of the gears includes an electromagnet.

13. The rowing machine of any of claims 8 to 12, where the rowing machine includes a return mechanism disposed between the second end of the chain and the frame.

14. The rowing machine of claim 13, where the return mechanism includes an elastic cord.

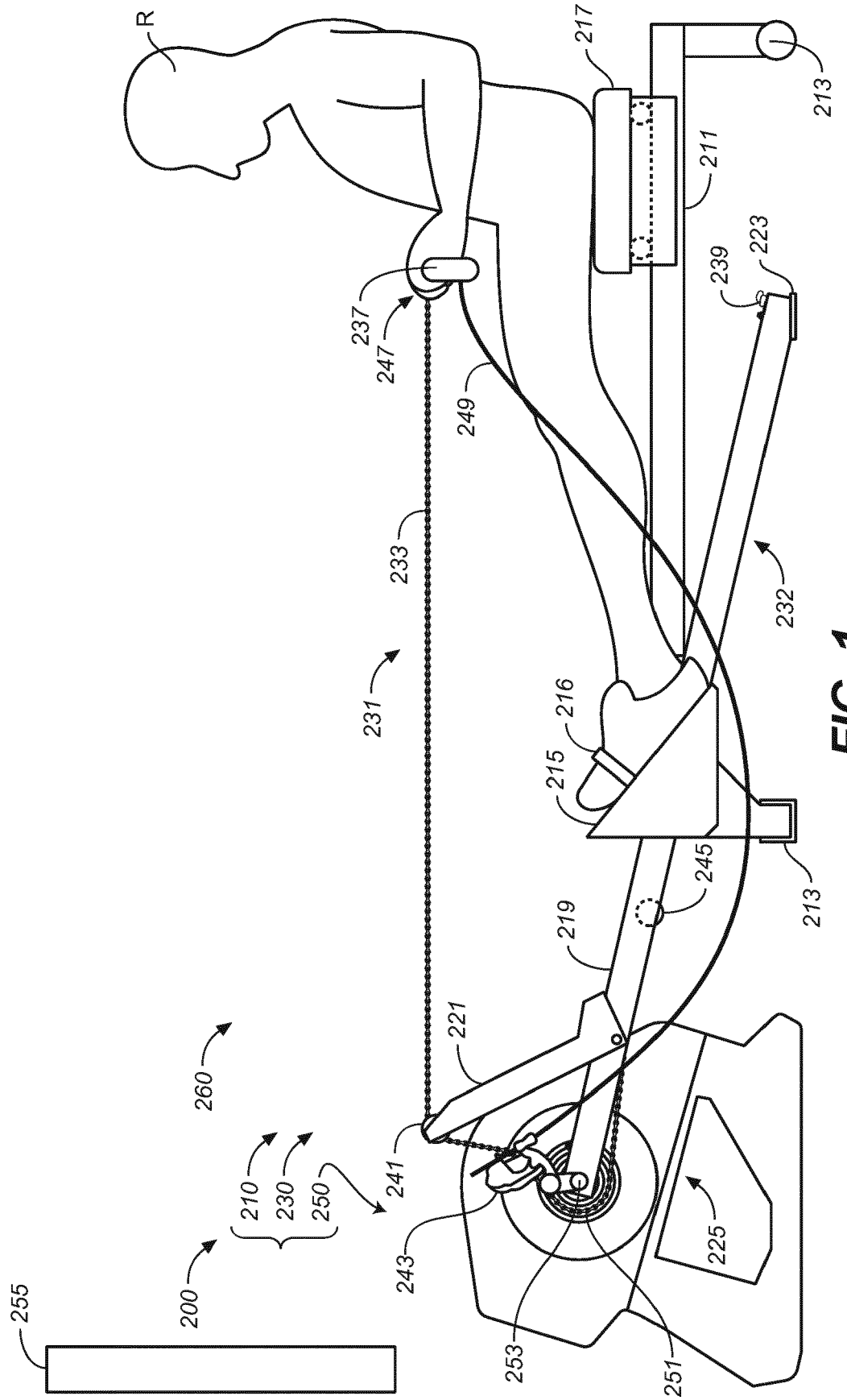
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FIG. 1

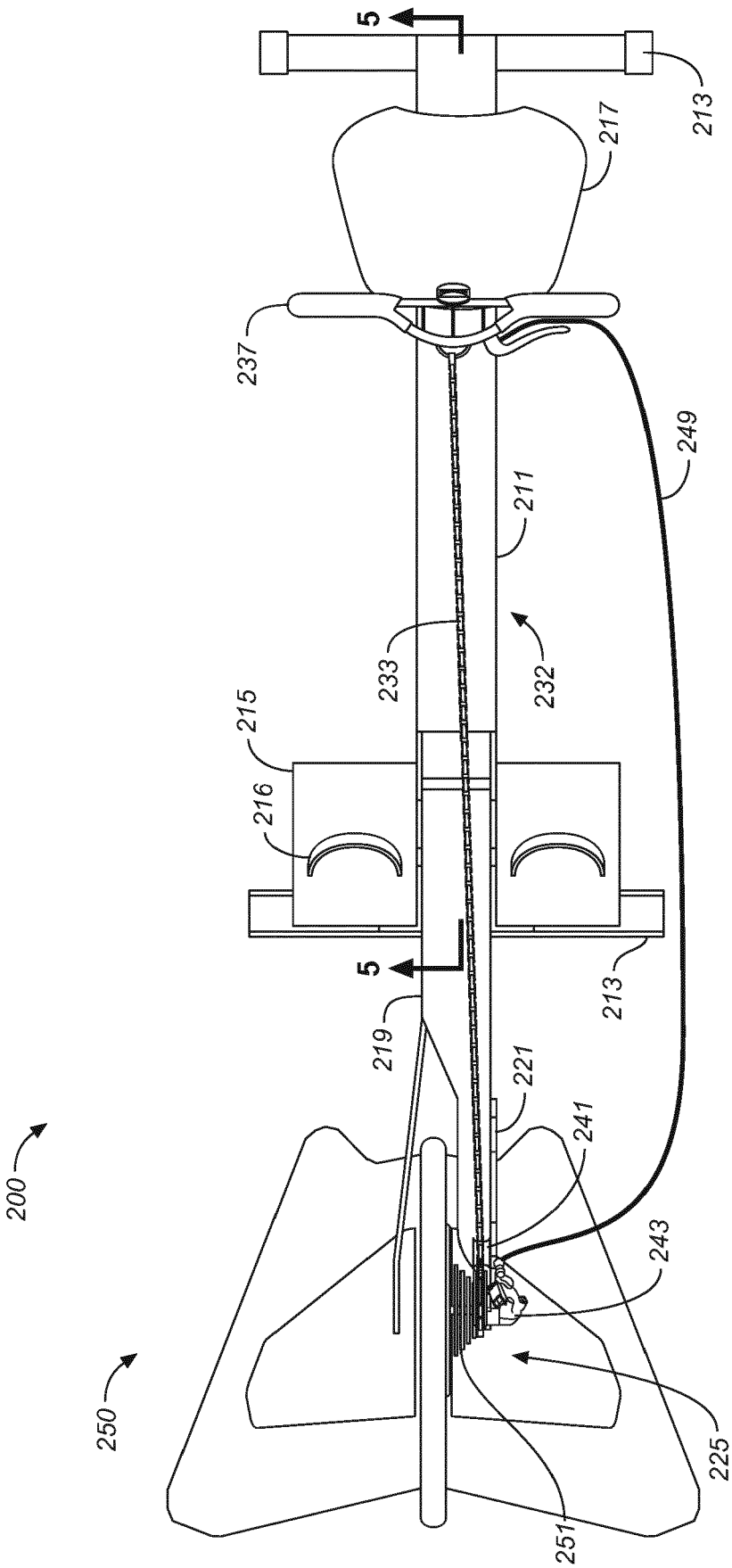
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FIG. 2

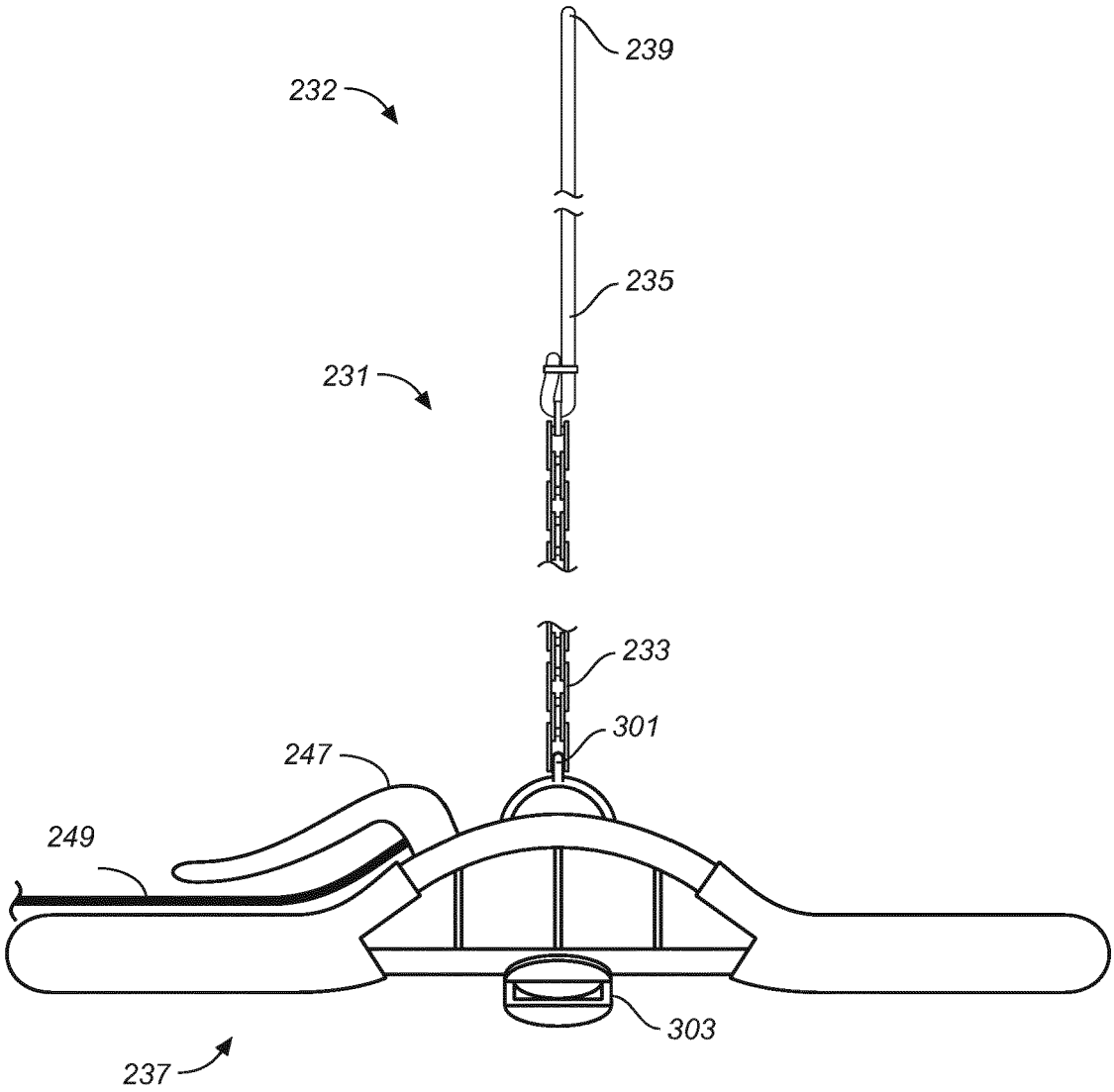

FIG. 3

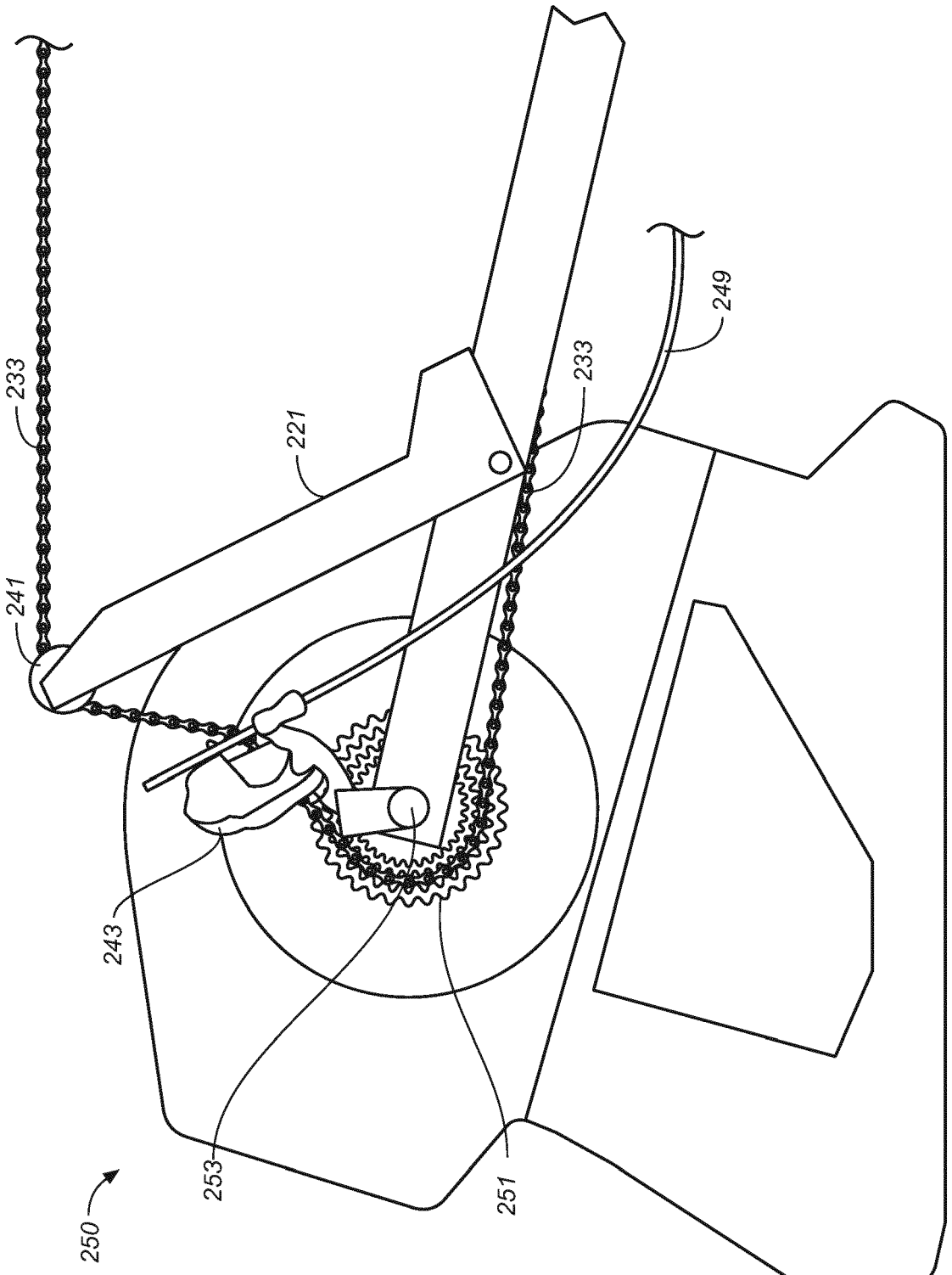

FIG. 4

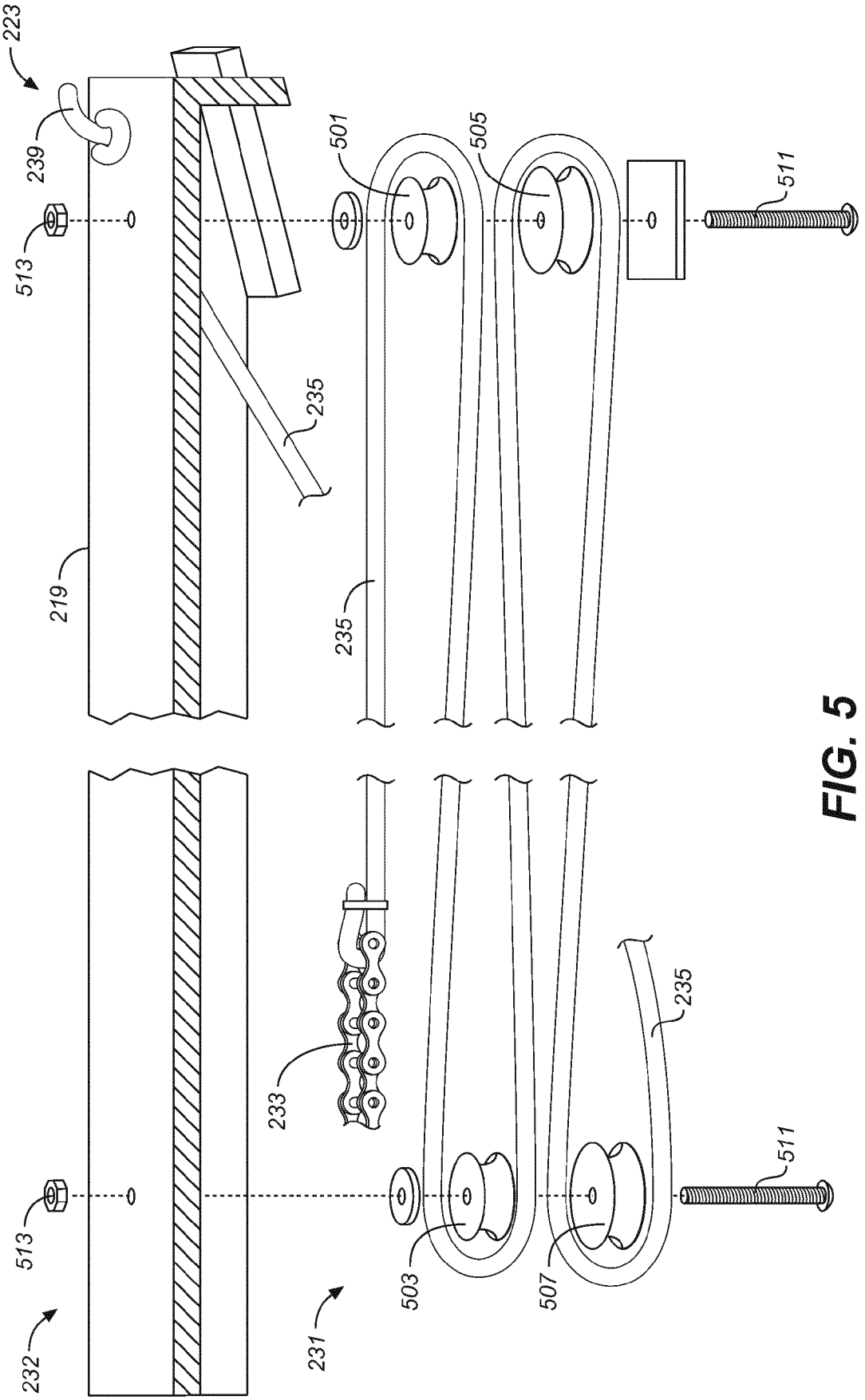
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FIG. 5

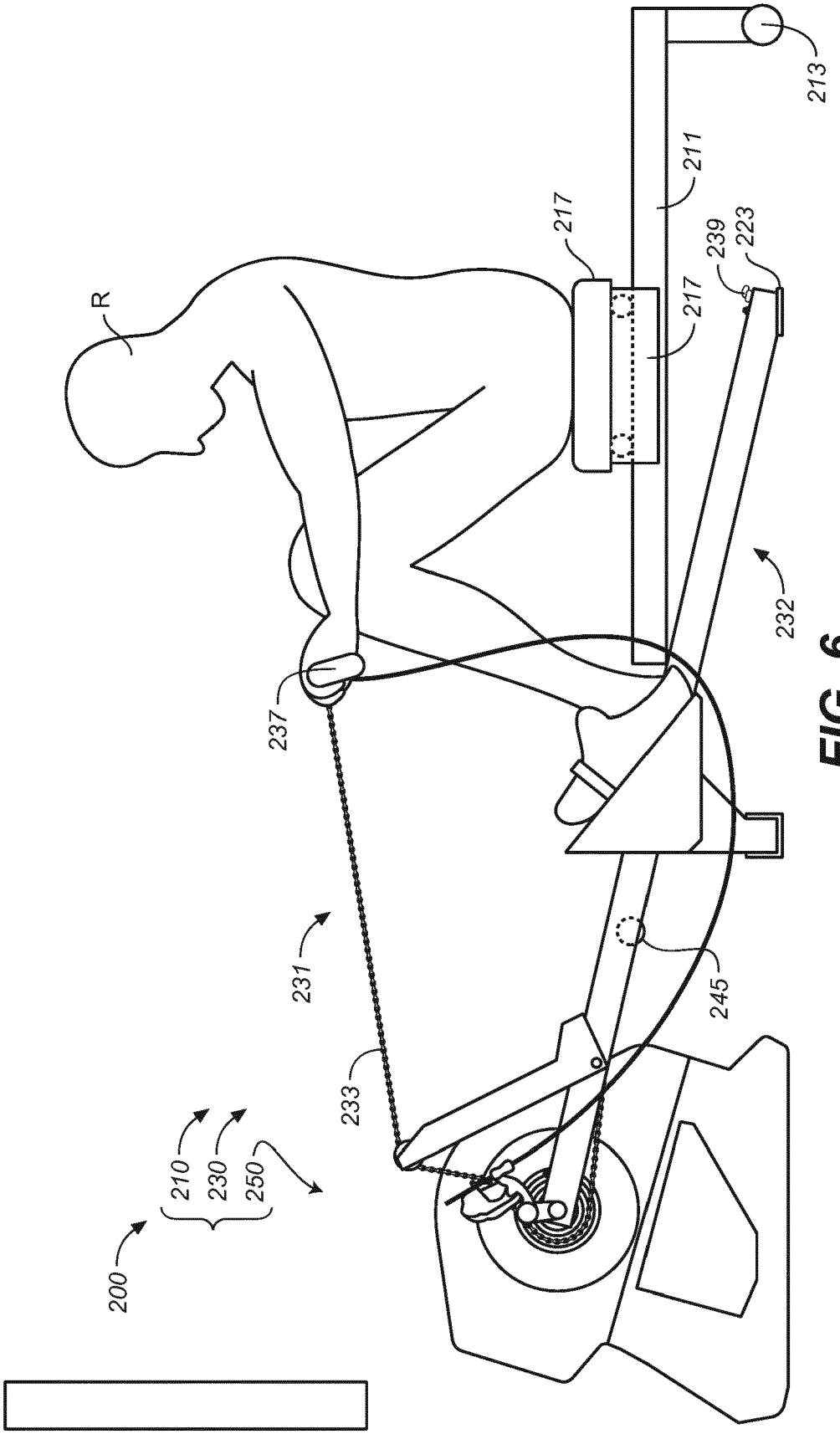

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 2936

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 357 544 A1 (RP3 ROWING B V [NL]) 8 August 2018 (2018-08-08)	1-4,8-11	INV. A63B21/005
Y	* columns 7-9; claims; figures *	5-7, 12-14	A63B21/008 A63B21/00 A63B21/22
Y	US 4 396 188 A (DREISSIGACKER PETER D [US] ET AL) 2 August 1983 (1983-08-02)	6,7,13, 14	A63B22/00 A63B71/06
A	* columns 1-2; claims; figures *	1-4,8-11	
Y	CA 1 183 559 A (TERPENNING MICHAEL) 5 March 1985 (1985-03-05)	6,7,13, 14	
A	* pages 1-3; claims; figures *	1-4,8-11	
Y	US 4 772 013 A (TARLOW JR ELLIOT S [US]) 20 September 1988 (1988-09-20)	5,6,12, 13	
A	* columns 2-3; claims; figures *	1-4,8-11	

TECHNICAL FIELDS SEARCHED (IPC)

A63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	28 September 2022	Herry, Manuel

CATEGORY OF CITED DOCUMENTS

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28-09-2022

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20140243163 A1 **[0016]**