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(54) **Improvements in, or relating to, exercise equipment**

(57) An exercise apparatus 1 for a user, comprising or including,
A chassis member 2 comprised of at least one partially hollow body,
A gear box 5 at least in part contained inside said chassis member, said gearbox 5 having an input shaft 7 to drive a metallic member in a sweeping motion opposite at least one set of permanent magnets, a distance between said metallic member and at least one of said set of opposed permanent magnets being variable, wherein said input shaft can be driven by an input member or members actuated by said user,
Wherein said user can use said apparatus 1 for exercise and said gearbox can provide any one or more of, varied resistance for exercise of said user, and varied damping of return of said input member or members.

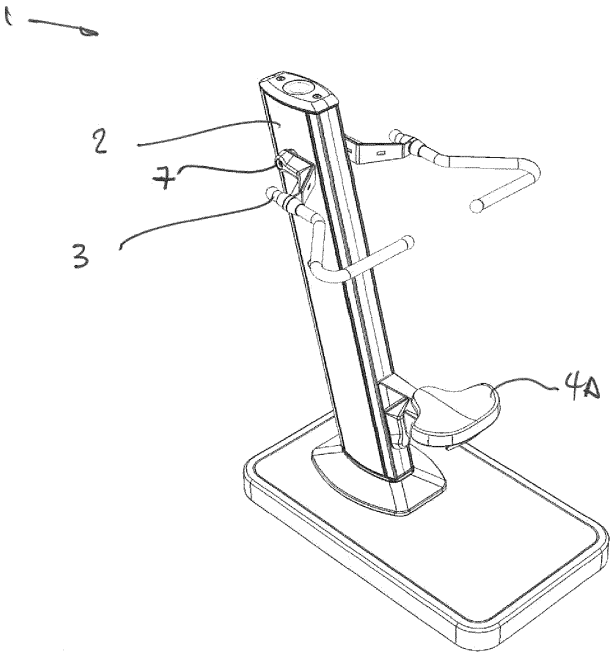


Figure 1

EP 2 801 394 A1

Description

[0001] The present invention relates to exercise equipment.

[0002] In particular, though not solely, the present invention is directed to exercise equipment that can be used in a wide range of settings by a wide range of users of varying strengths and abilities to gain strength, fitness and mobility using an internally variable resistance.

[0003] The human body reacts to exercise. To reach full potential, and to exercise some muscle groups it is often more convenient to exercise with the aid of weights and resistance. Such weights and resistance have increasingly become part of machines that enable a user to easily vary the resistance and allow one machine to provide a number of different exercises.

[0004] Such complex machines are often expensive. When resistance is provided purely by mass, for example weight plates the machines are naturally very heavy.

[0005] The nature of such machines is they are often specialised and cannot easily perform a wide range of exercises, or be adapted to forma a wide range of exercises.

[0006] Increasingly to avoid the sheer mass of weight based machines other forms of resistance are used. These for example use electricity or pneumatics or hydraulics to provide the resistance. Such machines require connection generally to a power source for example electricity to generate and control the resistance. With pneumatic and hydraulic resistance there is the issue of sealing of the resistance components and the need for specialised personal when they fail.

[0007] Still other machines use electromagnets to vary the resistance. Again such machines require an electrical source to energise the magnets to thus produce the resistance. This is seen for example in patent document US 2005/0239602.

[0008] There is increasing demand for free use of exercise equipment, for example in public spaces such as parks, domains and similar. There is also a need for such equipment in other locations such as prisons, hospitals and homes for the aged.

[0009] Such equipment must by its very nature be very sturdy to withstand mistreatment and also the environment. Such equipment must also be widely adjustable to provide the wide range of resistance for the wide range of users. The equipment must also be simple to operate, preferably intuitively with little or no instruction needed. From an equipment owners perspective such equipment would also preferably allow for a degree of change from one exercise form to the next over time to provide users variation.

[0010] To date such public space equipment has relied on the self-weight of the individual. However this has the dis-advantage if not damped of being dangerous when the user is tired and the machine slams back to its rest position under the user's weight. When damped such damping provides complexity as it is normally hydraulic or gas operated.

[0011] In this specification where reference has been made to patent specifications, other external documents, or other sources of information, this is generally for the purpose of providing a context for discussing the features of the invention. Unless specifically stated otherwise, reference to such external documents is not to be construed as an admission that such documents, or such sources of information, in any jurisdiction, are prior art, or form part of the common general knowledge in the art.

[0012] It is an object of the present invention to provide improved exercise equipment, or to overcome the above shortcomings or address the above desiderata, or to at least provide the public with a useful choice.

[0013] In a first aspect the present invention consists in an **exercise apparatus** for a user, comprising or including,

A chassis member comprised of at least one partially hollow body,

A gear box at least in part contained inside said chassis member, said gearbox having an input shaft to drive a metallic member in a sweeping motion opposite at least one set of permanent magnets, a distance between said metallic member and at least one of said set of opposed permanent magnets being variable, wherein said input shaft can be driven by an input member or members actuated by said user,

Wherein said user can use said apparatus for exercise and said gearbox can provide any one or more of,

varied resistance for exercise of said user, and

varied damping of return of said input member or members.

[0014] Apparatus as claimed in claim 1 wherein said apparatus is modular such that said chassis members, gearbox or gearboxes, and input member(s) can be varied to turn said apparatus into various forms of exercise apparatus, including, but not limited to,

An overhead arm press,

A dead lift,

A rowing machine,

A walker,

A cross trainer,

A stepper,

A hip swinger,

A grinder,

A seated leg press and,

A bicycle.

[0015] Preferably said gear box is encased by said chassis member, another said chassis member or a casing panel or panels.

[0016] Preferably said distance is variable externally of said chassis member, or said casing panel(s).

[0017] Preferably said metallic member is planar and is a disc or portion thereof.

[0018] Preferably said metallic member is made from aluminium or an aluminium alloy.

[0019] Preferably there is a geared connection between said input shaft and said metallic member.

[0020] Preferably said geared connection can be changed to vary the speed and/or resistance of said sweeping motion.

[0021] Preferably said permanent magnets can be added or removed to vary said resistance or damping.

[0022] Preferably said apparatus has an internal adjustment or externally accessible adjustment to vary said distance.

[0023] Preferably said apparatus is mounted or mountable to a base via said chassis.

[0024] Preferably said gearbox has a plurality of metallic members driven from a same input shaft or separate input shafts, whose motions are resisted by one or more sets of opposing said permanent magnets.

[0025] Preferably said metallic members move in the same or opposite directions, and said input shafts move in the same or opposite directions.

[0026] Preferably said chassis is oriented vertically, horizontally, or any angle therebetween.

[0027] Preferably a range of rotation of said sweeping motion is infinite.

[0028] Preferably a range of rotation of said sweeping motion is limited.

[0029] Preferably said gearbox has said input shaft extending through a one or both of a side(s) of said gearbox.

[0030] In another aspect the present invention may be said to consist in an **exercise apparatus** for a user, comprising or including

A chassis member comprised of at least one partially hollow body,

A gear box at least in part contained inside said chassis member, said gearbox having an input shaft to drive a metallic member in a sweeping motion between at least one pair of opposed permanent magnets, a distance between said metallic member and at least one of said pair of magnets being variable, wherein said input shaft can be driven by a input member or members actuated by said user,

Wherein said user can use said apparatus for exercise and said gearbox can provide any one or more of

varied resistance for exercise of said user, and

varied damping of return of said input member or members.

[0031] Preferably said gear box is encased by said chassis member, another said chassis member or a casing panel or panels.

[0032] Preferably said distance is variable from externally of said gearbox.

[0033] Preferably said metallic member is planar.

[0034] Preferably said metallic member is made from aluminium or an aluminium alloy.

[0035] Preferably there is a geared connection between said input shaft and said metallic member.

[0036] Preferably said geared connection can be changed to vary the speed of said sweeping motion.

[0037] Preferably more magnet pairs can be added or removed to vary said resistance or damping.

[0038] Preferably said apparatus is modular such that varying gearboxes and appendages can be used to turn said apparatus into various forms of exercise apparatus, including

An overhead arm press,

A dead lift,

A rowing machine,

A walker,

A cross trainer,

A stepper,

A hip swinger,

A grinder,

A seated leg press and,

A bicycle.

[0039] Preferably said apparatus has an external adjustment of said distance.

[0040] Alternatively said apparatus has an internal adjustment of said distance.

[0041] In another aspect the present invention may be said to broadly consist in a modular **exercise equipment,** comprising or including,

A main substantially vertical chassis member or members,

At least one or more of an arm or arms configured to interact with said chassis to allow one or more exercises to be undertaken,

And wherein said main chassis member is capable of receiving a gearbox to provide resistance and or damping to said arms or arms,

To provide an exercise equipment that can be reconfigured from one form of exercise equipment to another easily and quickly.

[0042] In another aspect the present invention may be said to broadly consist in **a gearbox** for an exercise apparatus, comprising or including,

At least one input shaft,

At least one metallic member to be driven in a sweeping motion by said input shaft

At least one pair of permanent magnets, one each either side of said metallic member,

Wherein a distance of at least one of said magnets to said metallic member can be varied to alter a resistance or damping applied to said input shaft.

[0043] Preferably said gearbox has said input shaft extending through a one or both of a sides of said gearbox.

[0044] Preferably said gearbox is infinitely rotational.

[0045] Alternatively said gearbox has stops to limit its range of rotation.

[0046] Preferably said gearbox can have one or more said pairs of magnets added or retracted to vary a base resistance of said gearbox.

[0047] Preferably said gearbox has an external adjustment of said distance.

[0048] Alternatively adjustment of said distance is internal.

[0049] Preferably said gearbox has a plurality of metallic members driven from a same input shaft or separate input shafts, whose motions are resisted by one or more sets of opposing said permanent magnets.

[0050] Preferably said metallic members move in the same or opposite directions, and said input shafts move in the same or opposite directions.

Same direction of driving

Opposing direction of driving

[0051] In another aspect the present invention may be said to broadly consist in an **exercise apparatus** as described herein with reference to any one or more of the accompanying drawings.

[0052] In another aspect the present invention may be said to broadly consist in an **gearbox** as described herein with reference to any one or more of the accompanying drawings.

[0053] In another aspect the present invention may be said to broadly consist in a modular exercise equipment as described herein with reference to any one or more of the accompanying drawings.

[0054] As used herein the term "and/or" means "and" or "or", or both.

[0055] As used herein "(s)" following a noun means the plural and/or singular forms of the noun.

[0056] The term "comprising" as used in this specification means "consisting at least in part of". When interpreting statements in this specification which include that term, the features, prefaced by that term in each statement, all need to be present, but other features can also be present. Related terms such as "comprise" and "comprised" are to be interpreted in the same manner.

[0057] It is intended that reference to a range of numbers disclosed herein (for example, 1 to 10) also incorporates reference to all rational numbers within that range (for example, 1, 1.1, 2, 3, 3.9, 4, 5, 6, 6.5, 7, 8, 9 and 10) and also any range of rational numbers within that range (for example, 2 to 8, 1.5 to 5.5 and 3.1 to 4.7).

[0058] The entire disclosures of all applications, patents and publications, cited above and below, if any, are hereby incorporated by reference.

[0059] To those skilled in the art to which the invention relates, many changes in construction and widely differing embodiments and application of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the descriptions herein are purely illustrative and are not intended to be in any sense limiting.

[0060] Other aspects of the invention may become apparent from the following description which is given by way of example only and with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0061] Preferred forms of the present invention will now be described with reference to the accompanying drawings in which;

Figure 1 Shows an isometric view of one form of the present invention as an arm press, with a seat, mounted on a plinth,

Figure 2 Shows a left hand elevation of Figure 1,

Figure 3 Shows a plan view of Figure 1,

Figure 4 Shows a sectional view of Figure 1 along line AA of Figure 3,

Figure 5 Shows an isometric view of a gearbox of part of the present invention, for example for use in the arm press shown in Figure 1, of rowing machine of Figure 8,

Figure 6 Shows an end elevation of the gearbox of Figure 5,

Figure 7 Shows an exploded view of the gearbox of Figure 5,

Figure 8 Shows a further embodiment of the present invention as a rowing machine,

Figure 9 Shows a top view of Figure 8,

Figure 10 Shows a cross sectional view along line BB of Figure 9,

Figure 11 Shows a further embodiment of the present invention in isometric as a walker,

Figure 12 Shows a plan view of Figure 11,

Figure 13 Shows a cross section along line CC of Figure 12,

Figure 14 Shows a further variation of the walker of Figure 11, configured as a cross-trainer, or Nordic walker/skier,

Figure 15 Shows the gearbox in isometric that can be used in the embodiment of Figure 14,

Figure 16 Shows an end elevation of the gearbox of Figure 15,

Figure 17 Shows an exploded view of the gearbox of Figure 15,

Figure 18 Shows a further embodiment of the exercise apparatus as a stepper machine,

Figure 19 Shows a plan view of Figure 18,

Figure 20 Shows a cross section along line DD of Figure 19,

Figure 21 Shows another embodiment as a hip swinger in isometric,

Figure 22 Shows a plan view of Figure 21,

Figure 23 Shows a cross sectional view along line EE of Figure 22,

Figure 24 Shows a gearbox in end elevation suitable for the stepper and swinger of Figures 18 and 21,

Figure 25 Shows an exploded view of the gearbox of Figure 24,

Figure 26 Shows another embodiment as a grinder exercise machine in isometric,

Figure 27 Shows an exploded view of the grinder of Figure 26,

Figure 28 Shows a further embodiment as a bicycle,

Figure 29 Shows an exploded view of the bicycle of Figure 28,

Figure 30 Shows a gearbox in end view suitable for the grinder or bicycle,

Figure 31 Shows the gearbox of Figure 30 in exploded view, and

Figure 32 Shows a static piece of exercise equipment using the modularity of the present invention as a leg raise.

DETAILED DESCRIPTION OF THE INVENTION

[0062] Preferred embodiments will now be described with reference to Figures 1 through 32.

[0063] The exercise apparatus 1 is modular and through a single or several common chassis 2 it can form a number of varying exercise machines by changing in or out various input members or arms 3, additional support members 17, and varying the configuration of a gearbox 5 or gearboxes in the apparatus. In some forms there may also additional support members 4. The apparatus 1 is typically mounted or mountable to a base 14 as shown. The base 14 may be in-ground mounted for example when used in a public area, or may be sufficiently robust and heavy to support and balance the apparatus in use, but can be moved about as needed. For example, when in ground the base may be poured in situ with reinforcing and the apparatus bolted to the base 14.

[0064] The apparatus can be configured in a number of different configurations. For example when configured as an overhead press shown in Figures 1 through 4 there is as a seat 4A to support the user. The arms 3 are then used to drive the input shaft 7 of the gearbox 5 contained substantially within the chassis 2. In Figure 1 the apparatus is shown mounted to the base 14.

[0065] Within the chassis 2 is a gearbox 5, shown in Figures 4 through 7, for the overhead press embodiment. The form of the gearbox 5 can be varied dependent on the exercise the machine is to perform. Various gearboxes are shown in the Figures for various applications. Some of these, for example that for the overhead press in Figure 1 have the gearbox 5 as shown in Figure 7 with stops 6 in it to limit its movement.

[0066] The arms 3 in their various forms engage directly or otherwise the input shaft 7 of the gearbox. The input shaft is rotationally mounted (in the preferred form on low friction bearings) through two gear box sides 16A and 16B. IN the form shown these sides 16A and 16B are held by fasteners 17. The input shaft 7 then indirectly (in this case) or otherwise (in embodiments to be described) drives a planar member 8 to sweep via one or more gears (four in the case shown here). A partial gear 13A used as the movement here is finite as the input shaft is moved in an oscillating motion (that is up and down movement of the arms moves the input shaft 7 clockwise and then anticlockwise over a limited range of motion). In the form shown in the exploded diagram of Figure 7 the motion of the planar member 8 is limited in rotation as there is a stop 6 mounted from the gear box sides 16A and 16B that co-operates with the gear 13A to limit its movement over only a certain range. This range can be varied as needed by varying the gear 13A or the size or location of the stop 6. In other forms of the gearbox the sweeping motion can be continuous or infinite, for example continuous for a bicycle as shown in Figures 28 and 29. Each of the gears 13 is in the preferred form mounted on a low friction bearing, which in the form shown are bearings 18 mounted in or from the sides 16A and 16B, .

[0067] Permanent magnets 9 sit either side of the planar member 8 (a disc in Figure 7) and produce resistance on the disc when it is in motion due to eddy currents induced in the disc by the magnets. The permanent magnets may be arranged in opposing pairs, or in sets that do not necessarily lie immediate opposite each other, but nonetheless are arranged to create eddy currents in the member 8. A carrier 10A and 10B holds the permanent magnets 9. Carrie 10A can be adjusted to vary the distance toward and away of one set of the permanent magnets from the planar member and other magnets on carrier 10B to decrease or increase the resistance. In other forms both carriers 10A and 10B may move, or the distance of the member 8 may be varied relative the carriers 10A and 10B.

[0068] The variation is achieved by an adjuster 11 which may be external such as shown in Figure 2 or may be internal. The adjuster 11 may be actuated by a user engagable portion 12, such as a knob as shown, or may be remotely actuated for example by a cable or similar. As shown there is an adjuster 11 which varies the resistance, and in the embodiment shown in Figure 7 this is adjustable by the user as it is accessible externally of the chassis 2 and casing panels 12 as shown. In other forms where it is not desirable for a user to adjust the adjuster may not be accessible, for example it may be covered. In other forms the adjustment may be achieved remotely, by electrical for example a remotely controlled motor, or by mechanical means, for example by a cable. In other forms there may be external adjustment by the user that uses a cable to remotely adjust the resistance.

[0069] The adjuster 11 shown uses a cam and complimentary part of the carrier 10A to move it toward and away from the member 8 and other carrier 10B. In other forms a threaded interface between the adjuster and carrier may be used.

[0070] A further form of the present invention is shown as a rower in Figures 8 through 10. In this configuration there is support for the user as a footrest 4A (in the form shown stationary) and seat 4A, where the seat 4B can slide to replicate a rowing motion and is inclined to slide toward the chassis 2. The size of the gears 13 in the gearbox 5 can be varied as can their ratio depending on the force and resistance required. As significant force can be generated by a user in the rowing configuration the gears 13 as shown and their ratio to sweep or spin the member 8 are larger than those shown earlier for the overhead rower. Also it may be desirable for some exercise configurations even when they are back and forth (such as rowing here) to keep the member 8 nevertheless spinning in the same direction. In this configuration the

shaft 7 or gearbox 5 may use a ratchet or other such one way mechanism to allow the arms 3 (for example as here) to rotate the member 8 in the pulling back stroke, and allows more or less free wheel (possibly some resistance provided by a secondary smaller gearbox, itself on the opposite one way mechanism) of the arms as they are pushed back to recover back to start another pull stroke. The one way mechanism may be chosen from any known, such as a ratchet, Spragg clutch or other means known in the art.

[0071] In Figures 11 through 13 there is shown strider and in Figure 14 a Nordic strider configuration of the apparatus. The arms 3 (duplicated on either side of the chassis 2 as seen on Figure 12) are driven by supports 4A for the feet of a user. There is a parallel driving mechanism as shown to translate the back and forth movement of such a strider into rotation movement of the arms 3. In this configuration there are supports 4C for the hands of the user. In the case of the Nordic strider shown in Figure 14 the supports 4C also help drive the arms 3.

[0072] In this configuration there may be a gearbox as shown in Figures 15 through 17 which utilises a concentric input shaft 7 which is split into a left hand input shaft 7A and right hand input shaft 7B, which each in turn drive their own gears 13A and 13B respectively as two sides of the gearbox 5. In a way similar to the overhead press described above the sweeping motion is limited by stops 6 which co-operate with the first gear 13A and 13B in each respective gear train. An intermediate support 19 supports both sides of the two gear box sides. Again the moving parts are supported and mounted on bearings 18.

[0073] In the embodiment shown there are only permanent magnets on one side of each of the planar members 8A and 8B to induce eddy currents in each and oppose the sweeping motion. In the embodiment shown here there is no external adjustment to vary resistance, but this can be achieved in the ways described for this invention by varying the distance between the members 8A and 8B and their permanent magnets 9A and 9B respectively.

[0074] In another form of this gear box 5 the input shafts may drive only the one member 8 via opposing one way mechanisms so one side is driving and the other is recovering forward (or backward) or vice versa.

[0075] For all embodiments described and shown permanent magnets 9 can be added and removed to increase or decrease the base level of resistance to motion of the member 8.

[0076] A stepper apparatus is shown in Figures 18 through 20 which again has single limited motion gearbox similar to that described for the overhead press. Again an adjuster 11 allows variation of the gearbox 5 on the chassis 2 enclosed by casing panels 12. A circular arm 3 drives input shaft 7 from the foot supports 4A which pivot from the arm 3. The user stands on the on the foot supports and steps up and down, the arm 3 rocking clockwise and anticlockwise, the motion resisted by the gearbox 5. The user can support themselves from the hand supports 4C. The gearbox is shown in Figures 24 and 25.

[0077] A similar variation to the stepper is shown in Figures 21 through 23 for a hip swing. Again the user stands on foot supports 4A, holds the hand supports 4C and swings then feet and legs to drive an arm 3 which in turn rotates input shaft 7 clockwise and anticlockwise. Resistance in this case is internally set, but could equally have an external adjuster to vary the resistance. The base platform 14A is of the style that may be bolted and mounted to an in situ base 14.

[0078] Shown in Figures 23 through 25 is the gear box for the stepper and hip swinger. In these Figures and in others like numbers refer to like features of the invention.

[0079] Figures 26 and 27 shown the apparatus 1 as a grinder for arm and upper body exercise, and 28 and 29 show a seated cycle, both use a similar gearbox 5 as shown in Figures 30 and 31. In the grinder the user can sit as shown on the seat 4A (or optionally stand from the other side and not sit) and spin arm 3 in a continuous rotating motion, which in turn drives input shaft 7 into gearbox 5. Again resistance can be varied using adjuster 11 in the ways earlier described. Access to the gearbox is easily afforded through removal off the casing panels 12 on the sides and top.

[0080] Seated cycle 1 shown in Figures 28 and 29 had the user seated on seat 4A, supporting themselves as needed using supports 4C and using their feet to drive foot supports 4B to drive circular arm 3 to rotate the input shaft 7 of the gearbox 5. Again resistance may be varied using adjuster 11.

[0081] The continuous rotation gearbox 5 is for both the grinder and cycle 1 is shown in Figures 30 and 31. No stops are needed here as the rotation of the input shaft 7 and gears 13 drives the member 8 in a continuous rotation. Again rotation is supported on bearings 18. The member's 8 rotation (sweeping) is opposed by permanent magnets 9 in ways earlier described. The magnets 9 are on a carrier 10A (though no magnets are shown on this part) and 10B movement of the permanent magnets to and away from the member 8 varies the eddy currents that oppose its rotation. Again adjustment is done via adjuster 11 in the way earlier described.

[0082] The apparatus may have additional items connected to or driven from, directly or otherwise, the input shaft for example a generator for lights on the apparatus 1 or to light other aspects, or for other electrical usage. There may also be solar power panels or equivalent to run electrical systems in the apparatus.

[0083] A chassis with arms not having a gearbox is also shown in Figure 32 as an extension of the modularity of the present invention.

[0084] The foregoing description of the invention includes preferred forms thereof. Modifications may be made thereto without departing from the scope of the invention.

Claims

1. An **exercise apparatus** for a user, comprising or including,
A chassis member comprised of at least one partially hollow body,
A gear box at least in part contained inside said chassis member, said gearbox having an input shaft to drive a metallic member in a sweeping motion opposite at least one set of permanent magnets, a distance between said metallic member and at least one of said set of opposed permanent magnets being variable, wherein said input shaft can be driven by an input member or members actuated by said user,
Wherein said user can use said apparatus for exercise and said gearbox can provide any one or more of,
varied resistance for exercise of said user, and
varied damping of return of said input member or members.

2. Apparatus as claimed in claim 1 wherein said apparatus is modular such that said chassis members, gearbox or gearboxes, and input member(s) can be varied to turn said apparatus into various forms of exercise apparatus, including, but not limited to,
An overhead arm press,
A dead lift,
A rowing machine,
A walker,
A cross trainer,
A stepper,
A hip swinger,
A grinder,
A seated leg press and,
A bicycle.

3. Apparatus as claimed in either of claims 1 or 2 wherein said gear box is encased by said chassis member, another said chassis member or a casing panel or panels.

4. Apparatus as claimed in any one of claims 1 to 3 wherein said distance is variable externally of said chassis member, or said casing panel(s).

5. Apparatus as claimed in any one of claims 1 to 4 wherein said metallic member is planar and is a disc or portion thereof.

6. Apparatus as claimed in any one of claims 1 to 5 wherein said metallic member is made from aluminium or an aluminium alloy.

7. Apparatus as claimed in any one of claims 1 to 6 wherein there is a geared connection between said input shaft and said metallic member.

8. Apparatus as claimed in any one of claims 1 to 7 wherein said geared connection can be changed to vary the speed and/or resistance of said sweeping motion.

9. Apparatus as claimed in any one of claims 1 to 8 wherein said permanent magnets can be added or removed to vary said resistance or damping.

10. Apparatus as claimed in any one of claims 1 to 9, wherein said apparatus has an internal adjustment or externally accessible adjustment to vary said distance.

11. Apparatus as claimed in any one of claims 1 to 10, wherein said apparatus is mounted or mountable to a base via said chassis.

12. Apparatus as claimed in any one of claims 1 to 11 wherein said gearbox has a plurality of metallic members driven from a same input shaft or separate input shafts, whose motions are resisted by one or more sets of opposing said permanent magnets.

13. Apparatus as claimed in claim 12 wherein said metallic members move in the same or opposite directions, and said input shafts move in the same or opposite directions.

14. Apparatus as claimed in any one of claims 1 to 13 wherein said chassis is oriented vertically, horizontally, or any angle therebetween.

15. Apparatus as claimed in any one of claims 1 to 14 wherein a range of rotation of said sweeping motion is infinite.

16. Apparatus as claimed in any one of claims 1 to 14 wherein a range of rotation of said sweeping motion is limited.

17. Apparatus as claimed in any one of claims 1 to 16 wherein said gearbox has said input shaft extending through a one or both of a side(s) of said gearbox.

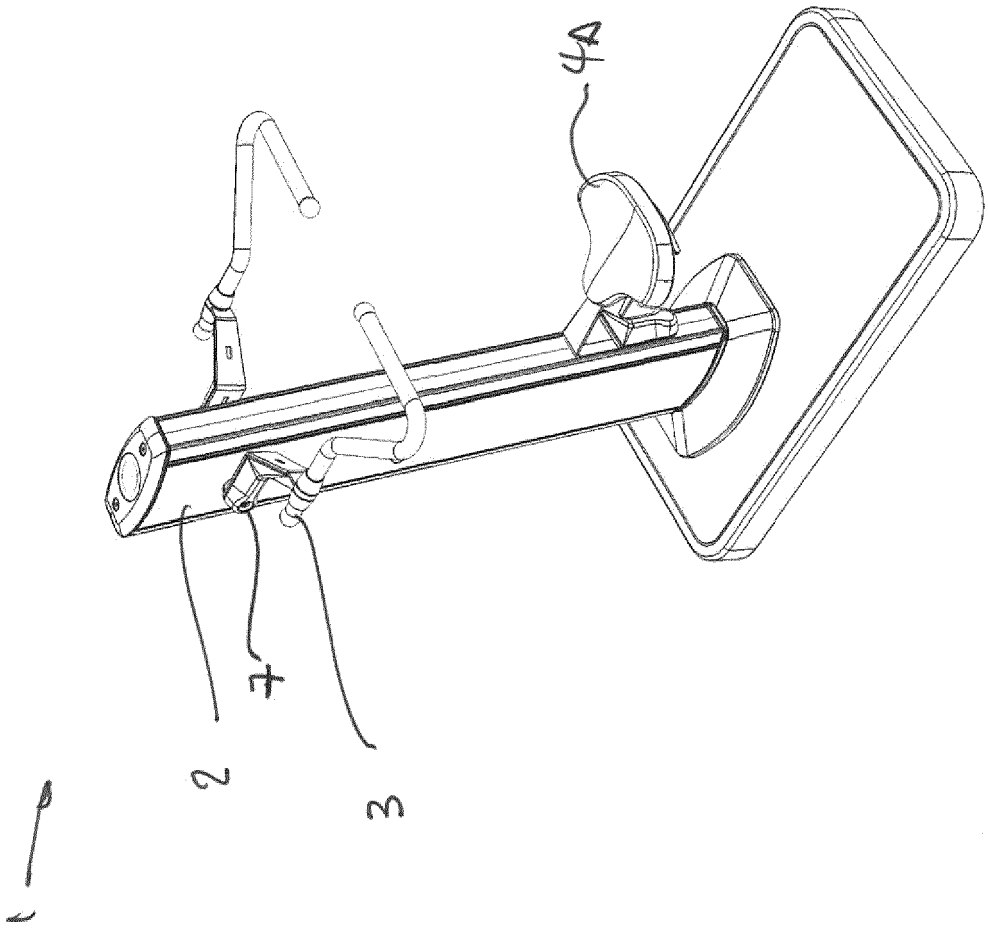


Figure 1

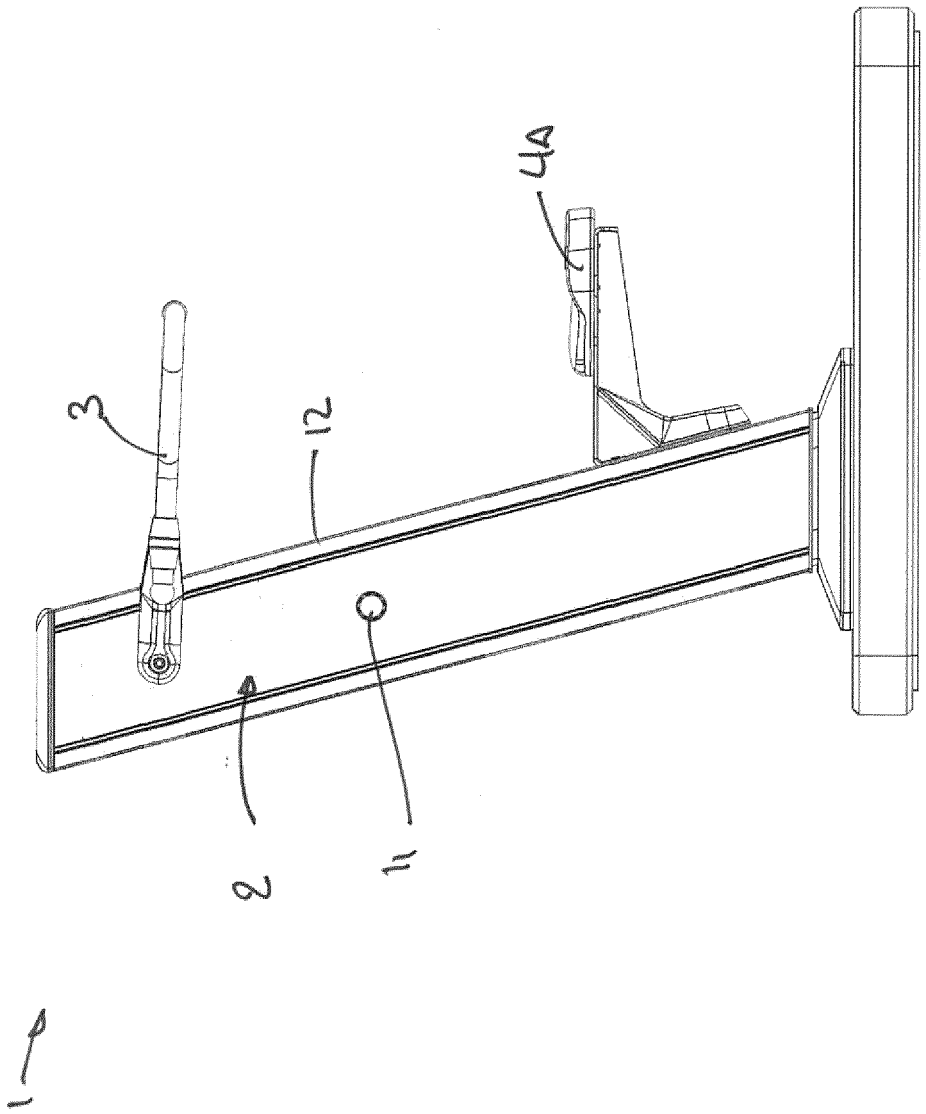


FIGURE 2

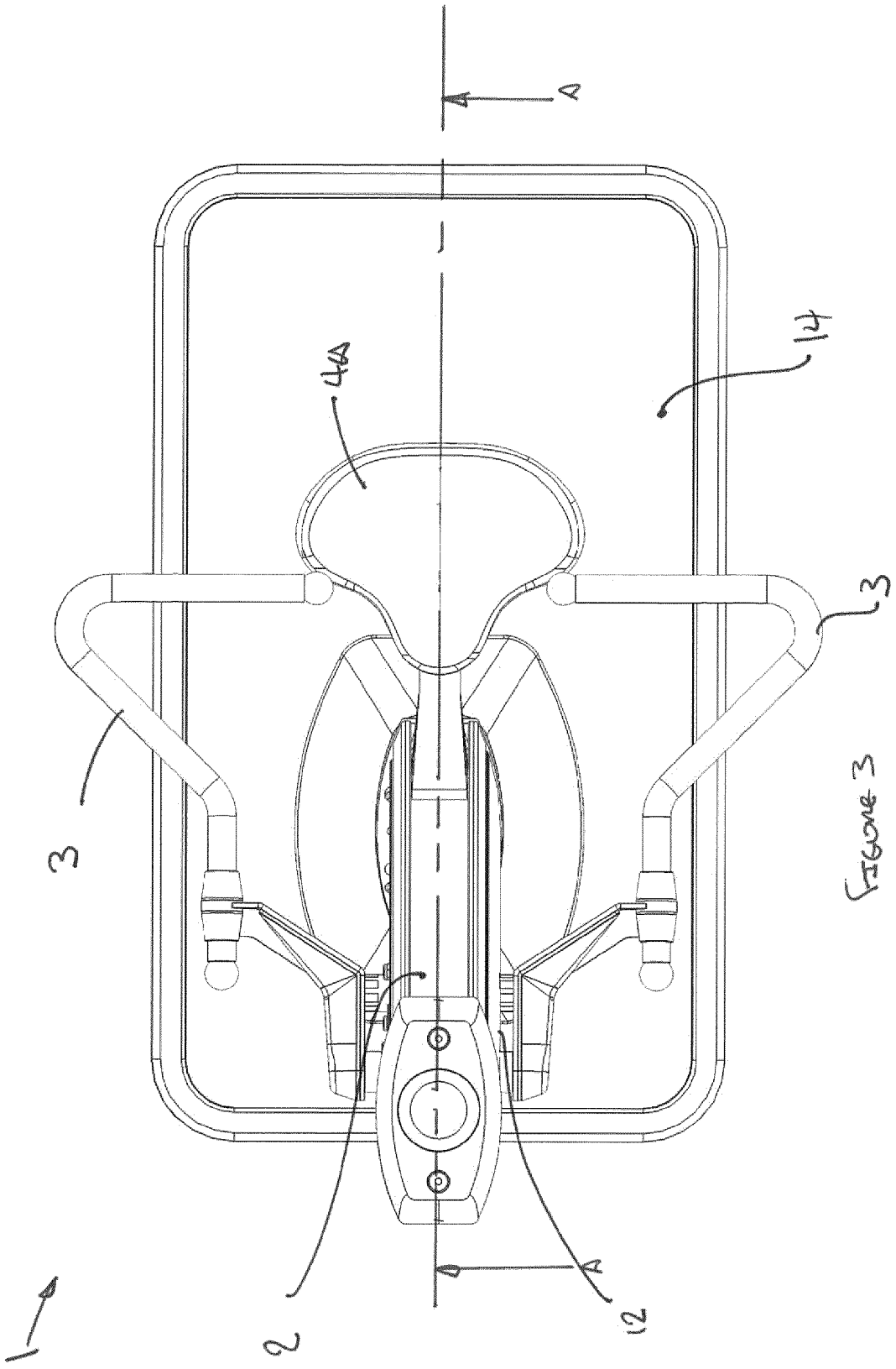
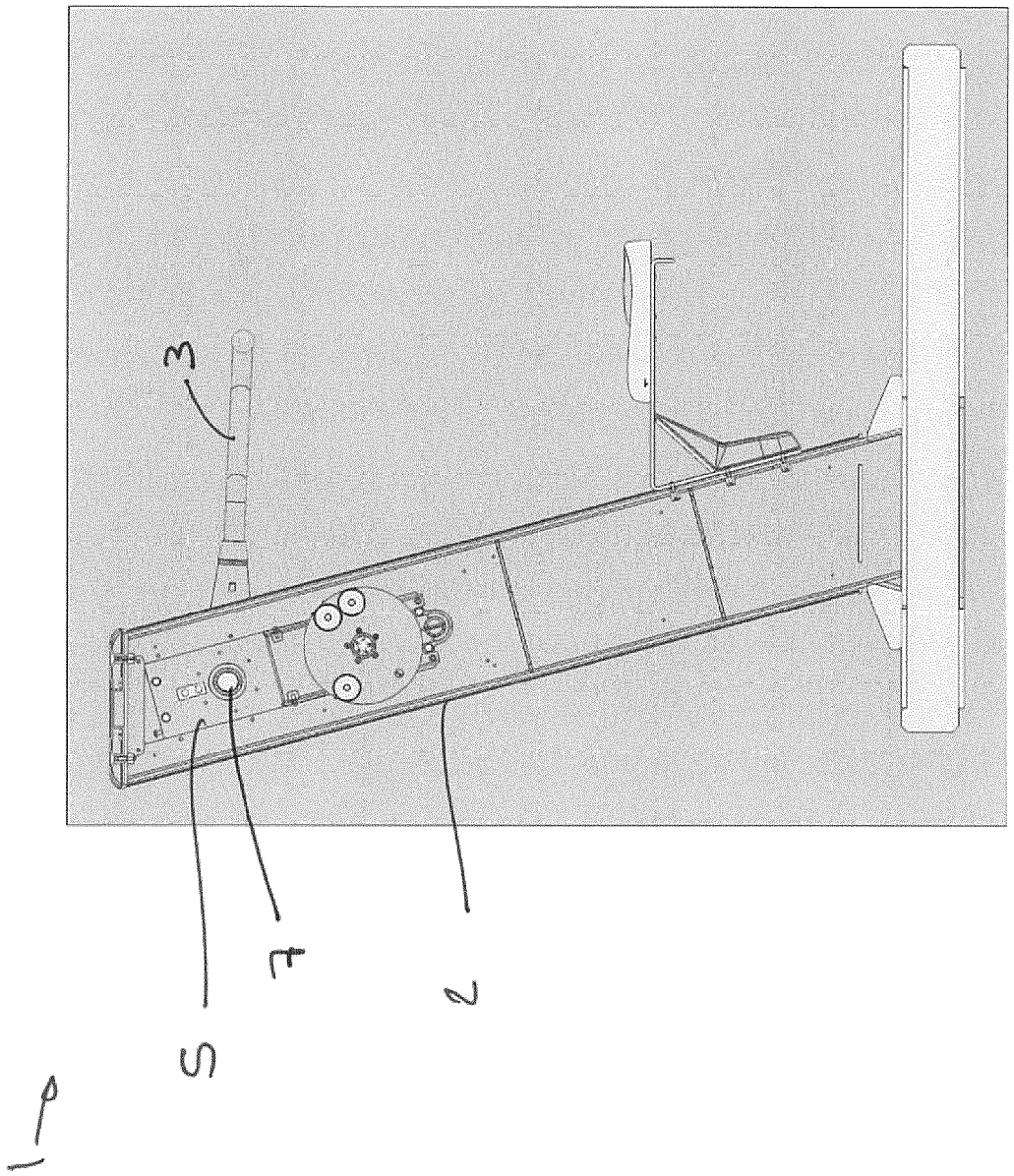


FIGURE 3



SECTION A-A

FIGURE 4

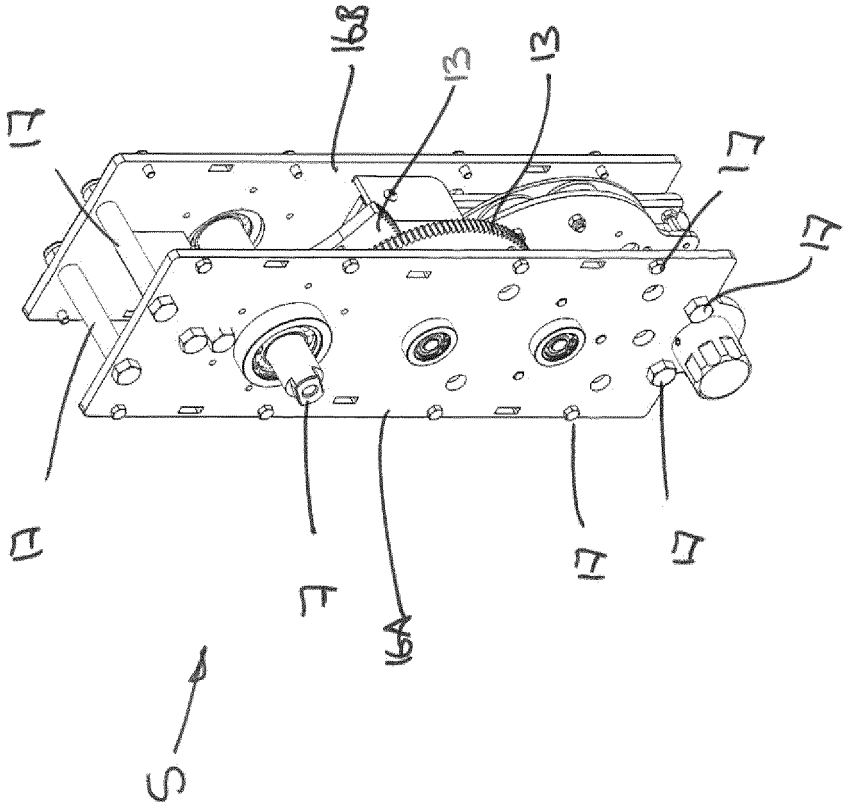
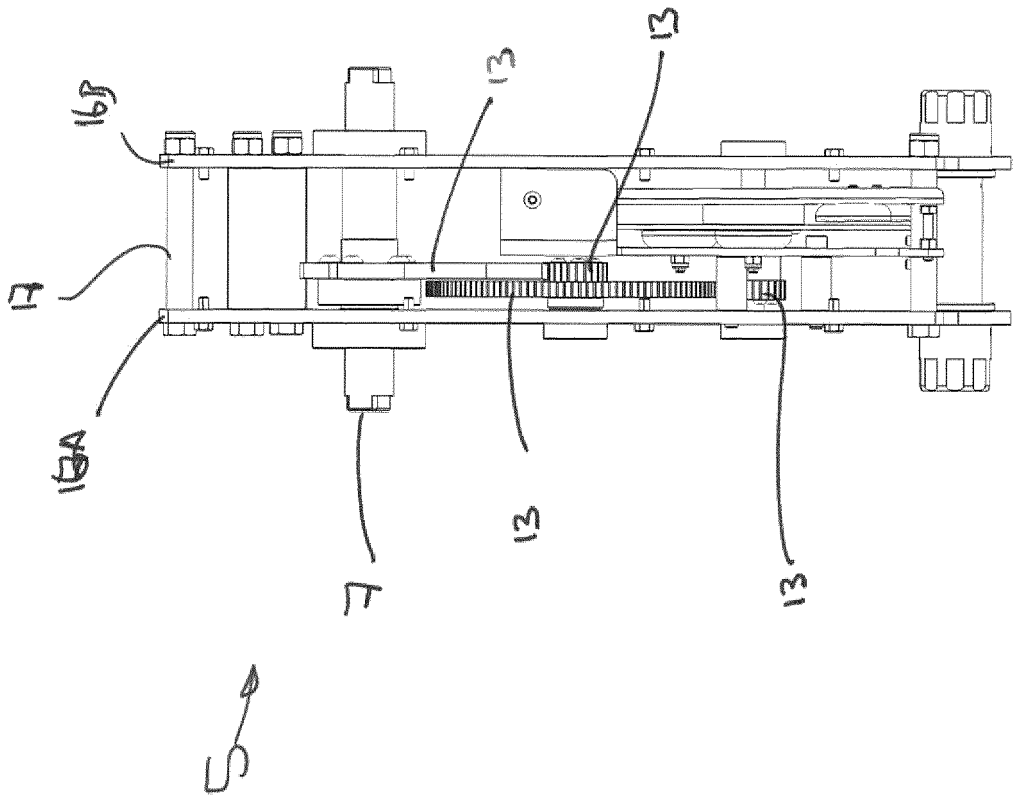


FIGURE 5



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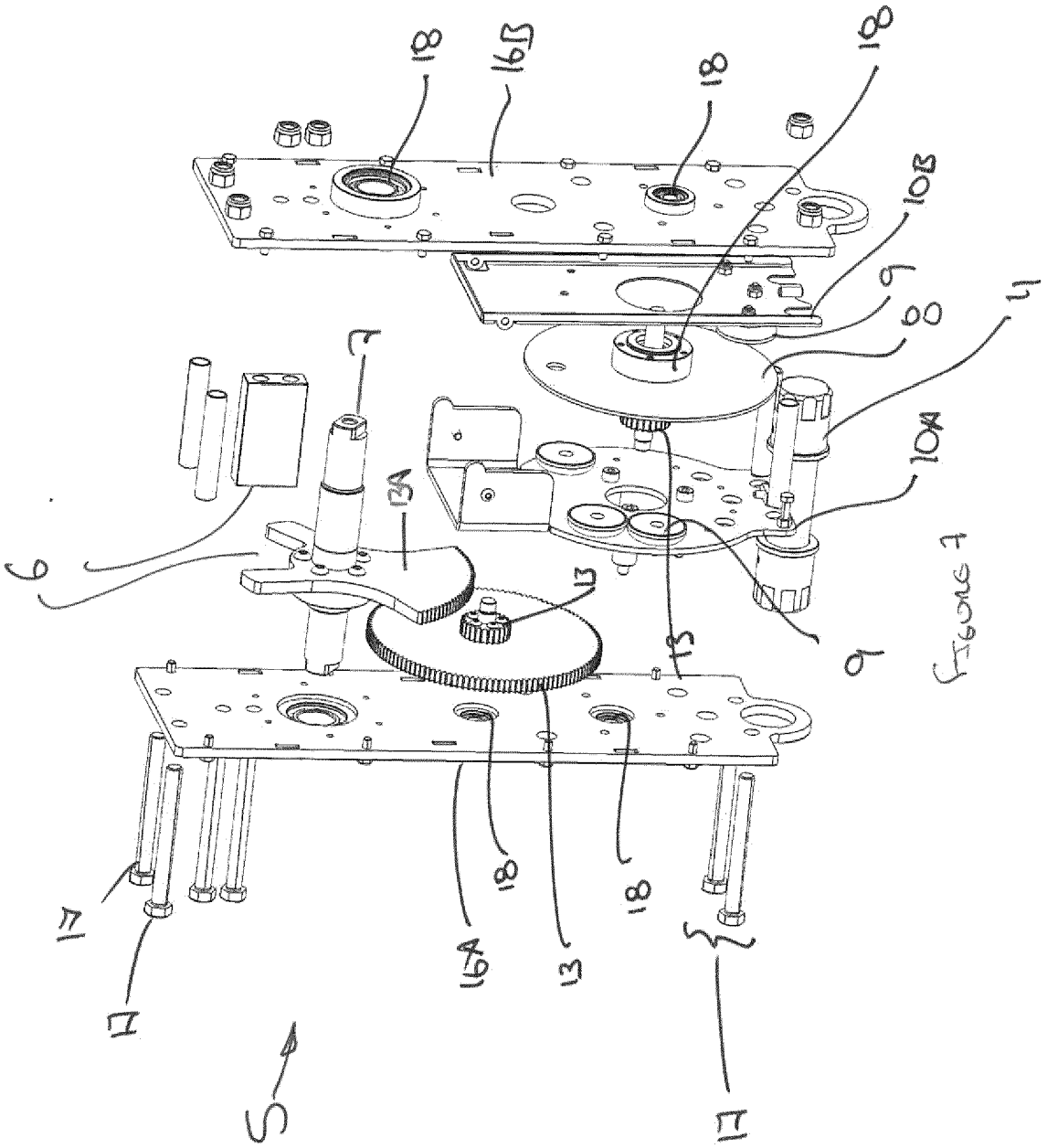

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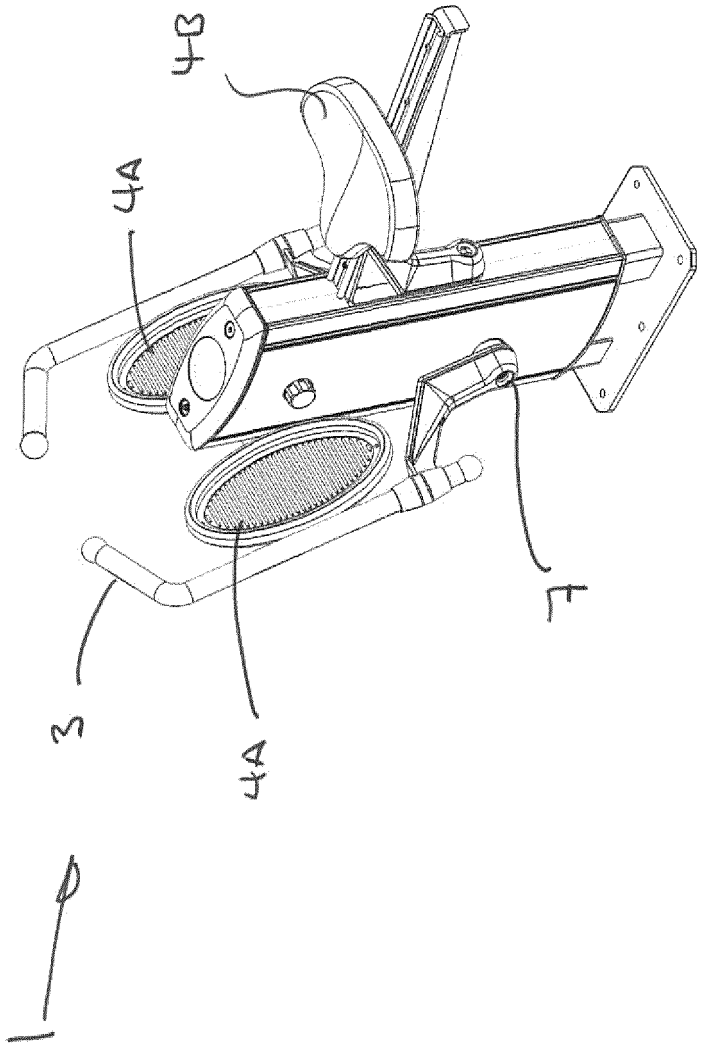

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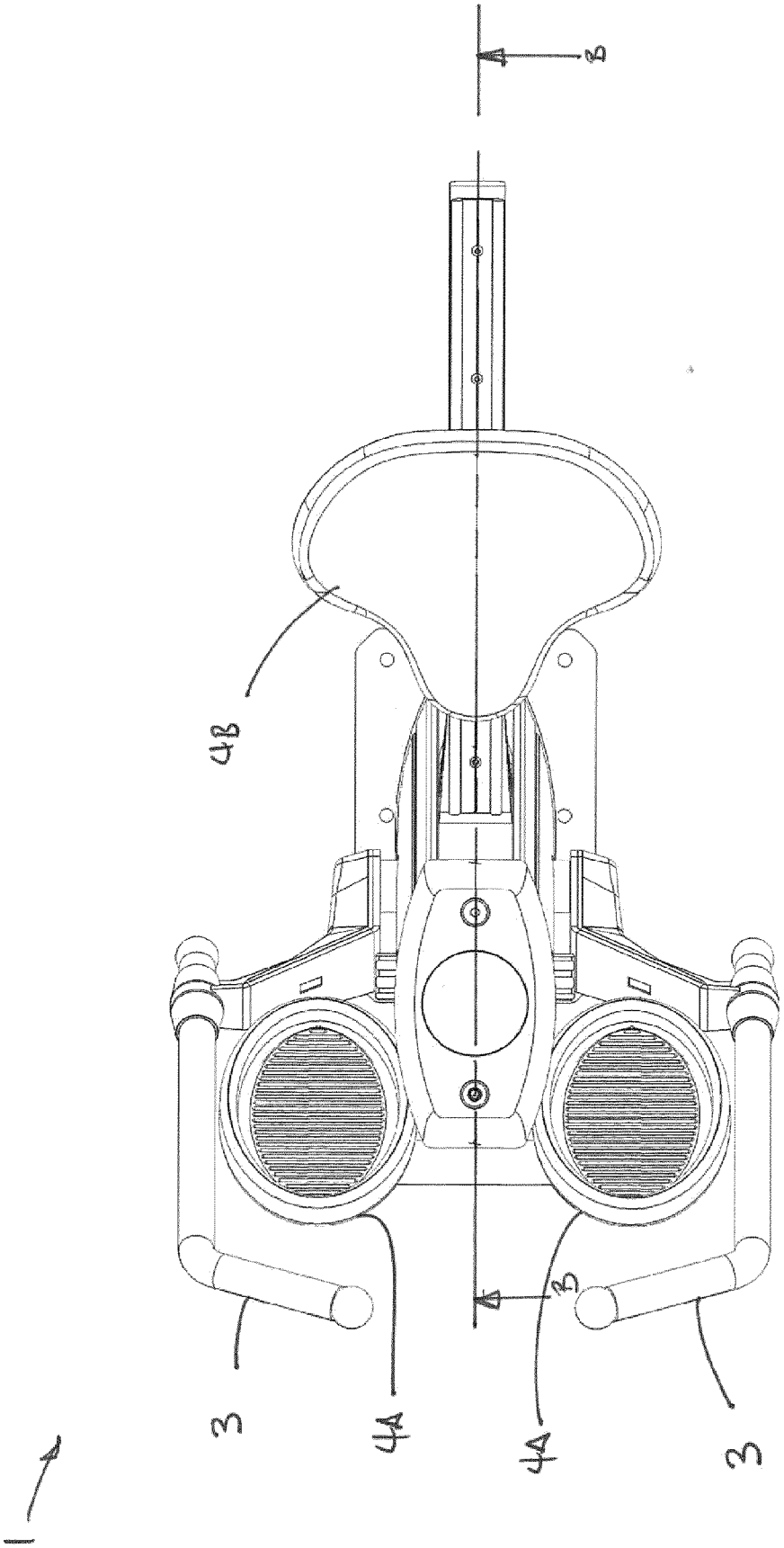

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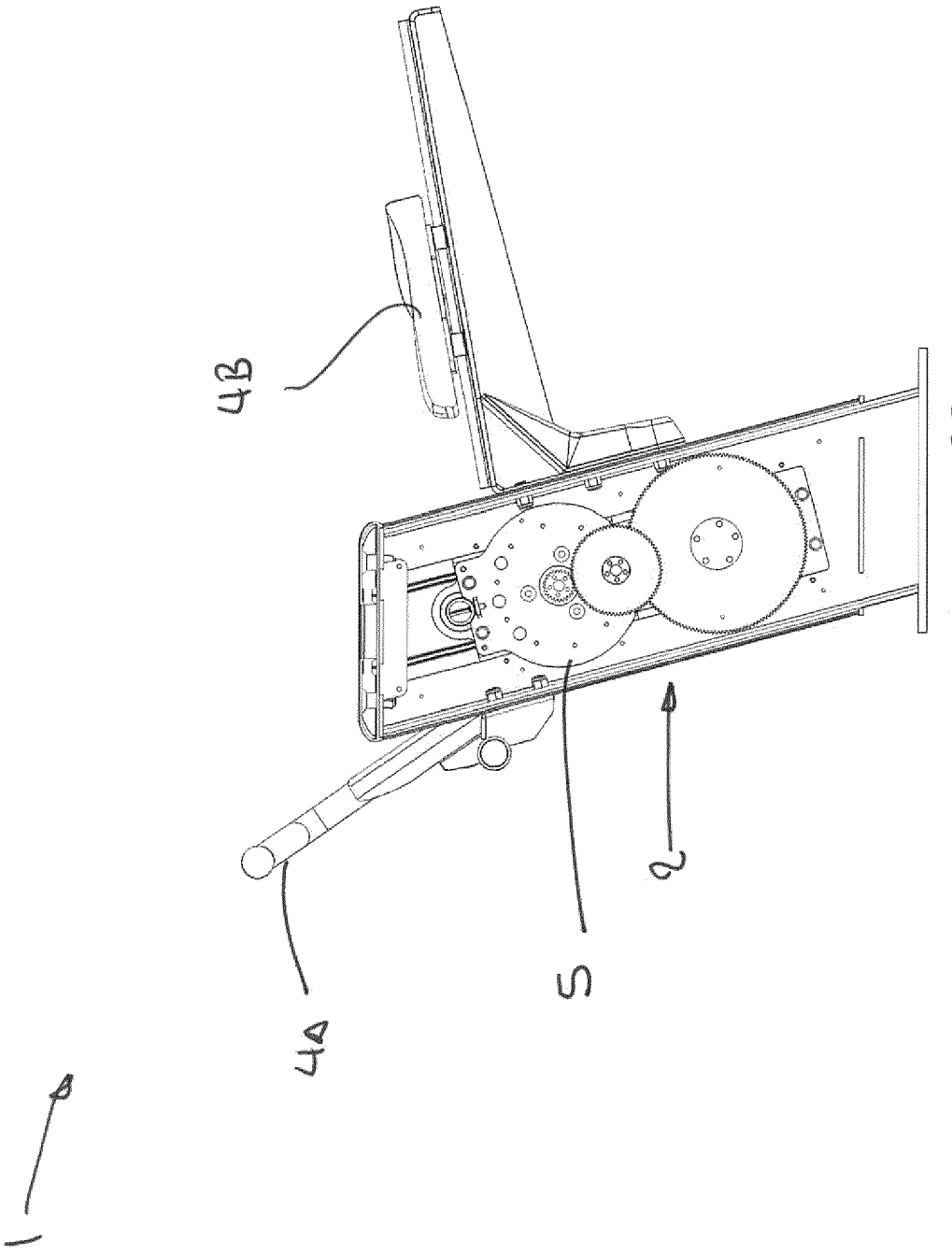


SECTION BB

FIGURE 10

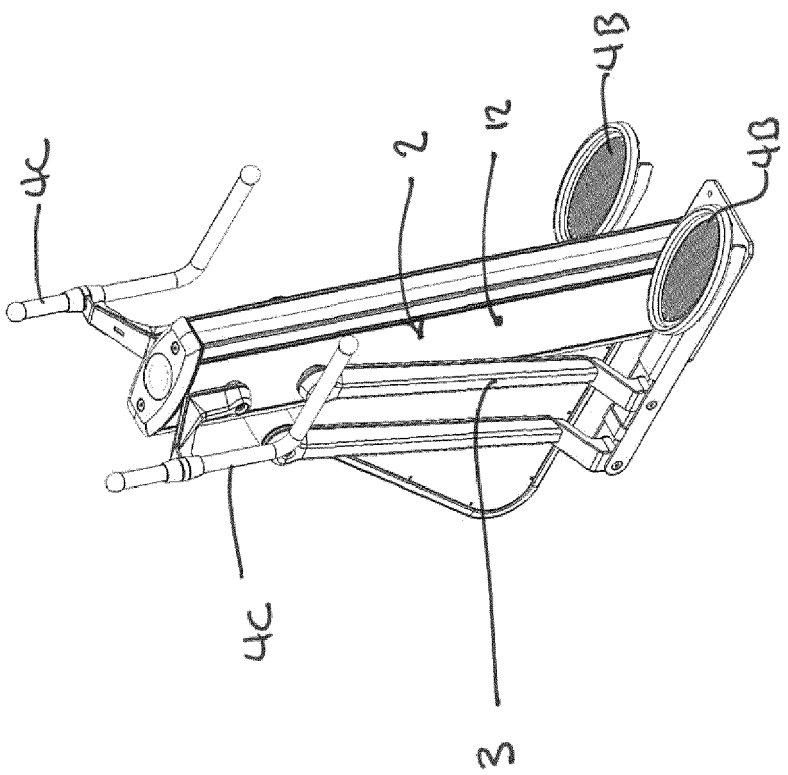
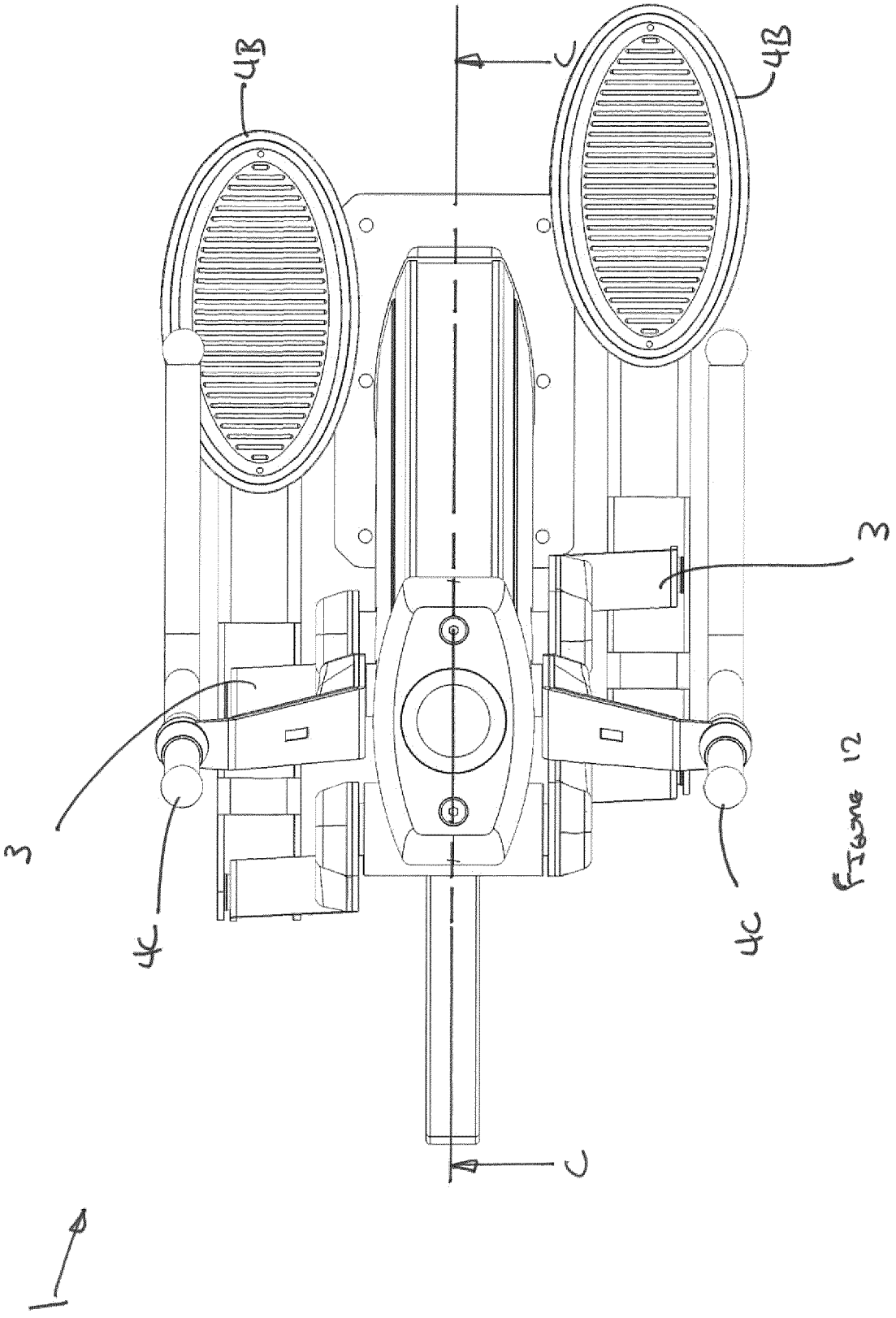


FIGURE 11



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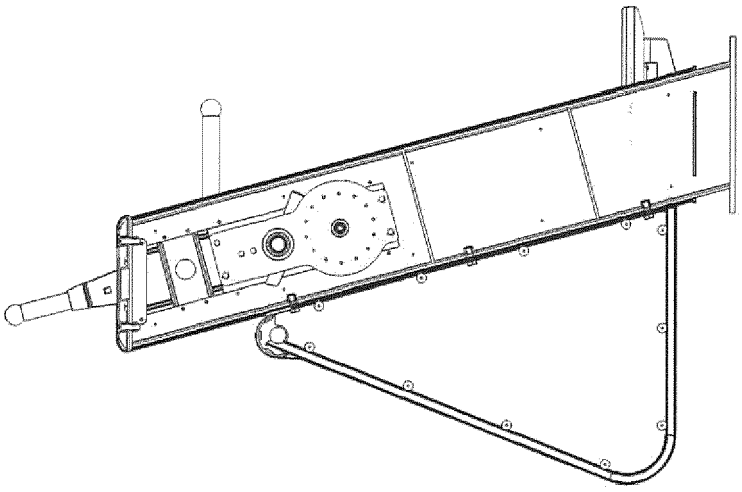


FIGURE 13

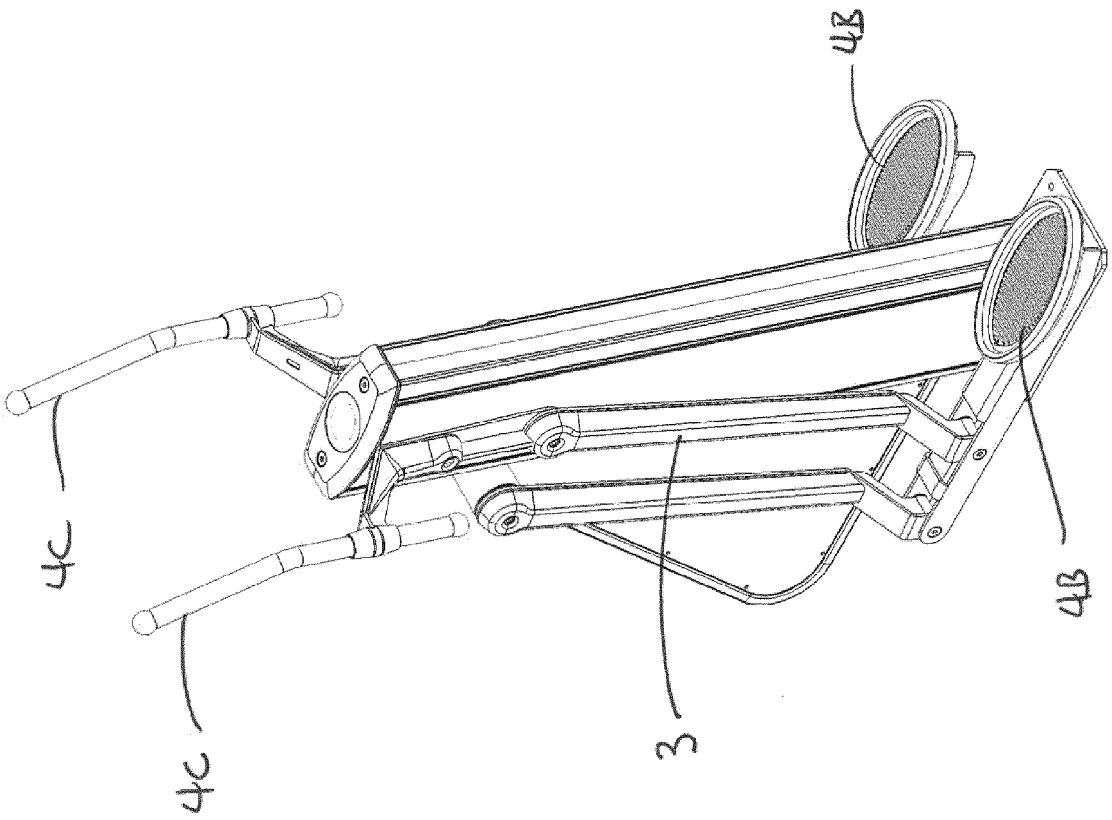


Figure 14

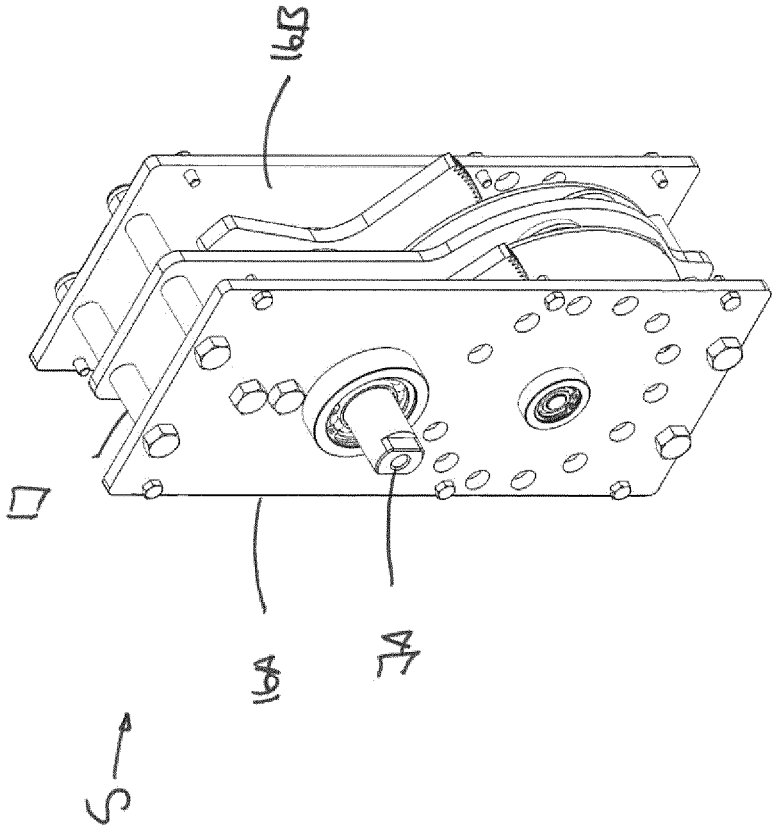


Figure 1S

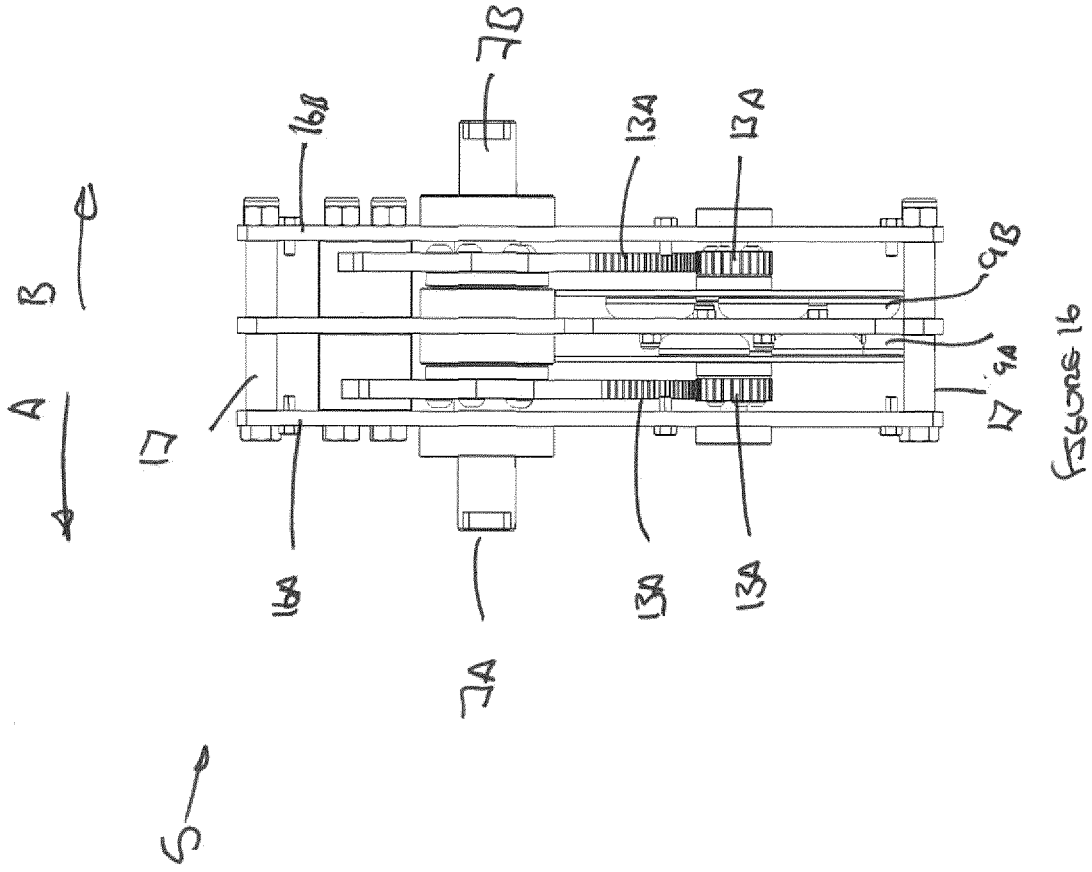


FIGURE 16

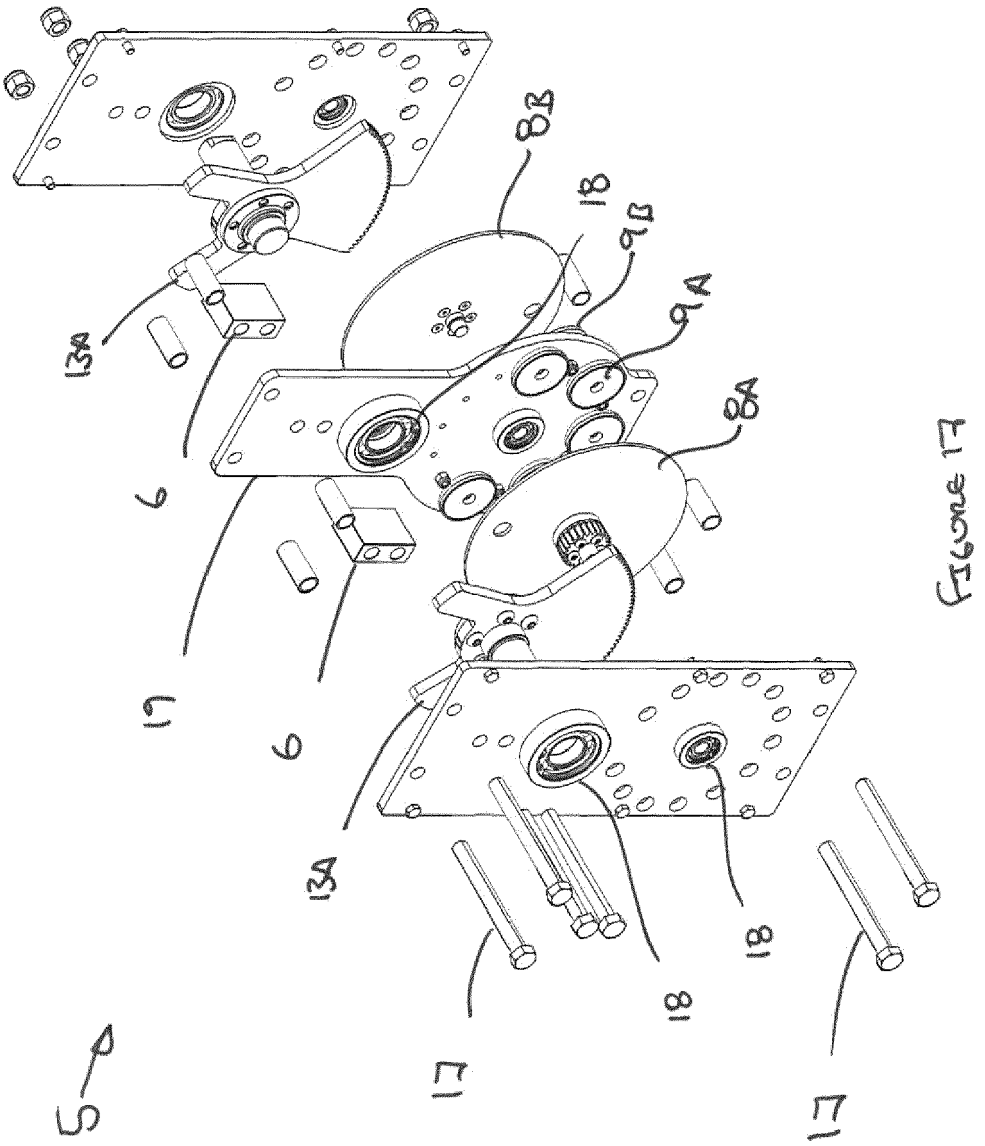


Figure 17

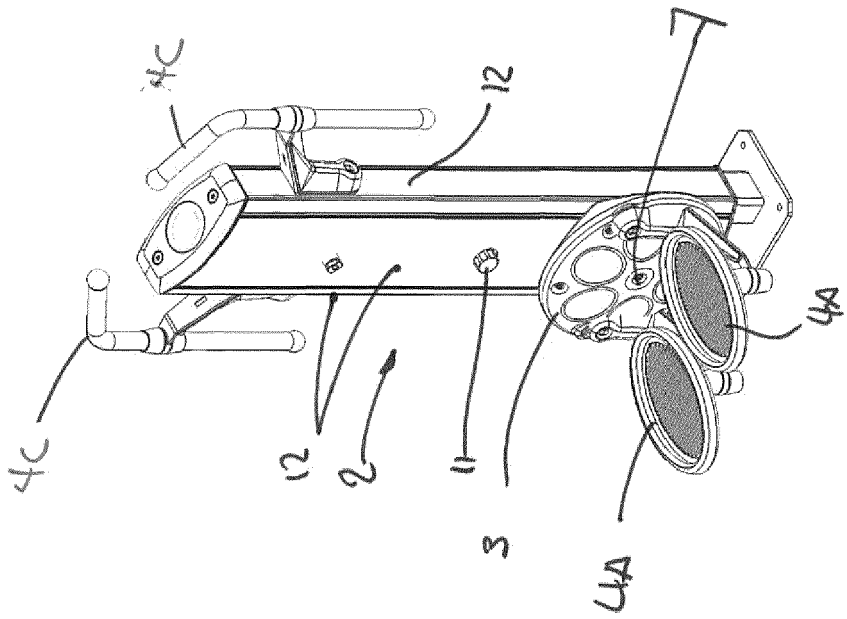


FIGURE 1B

1

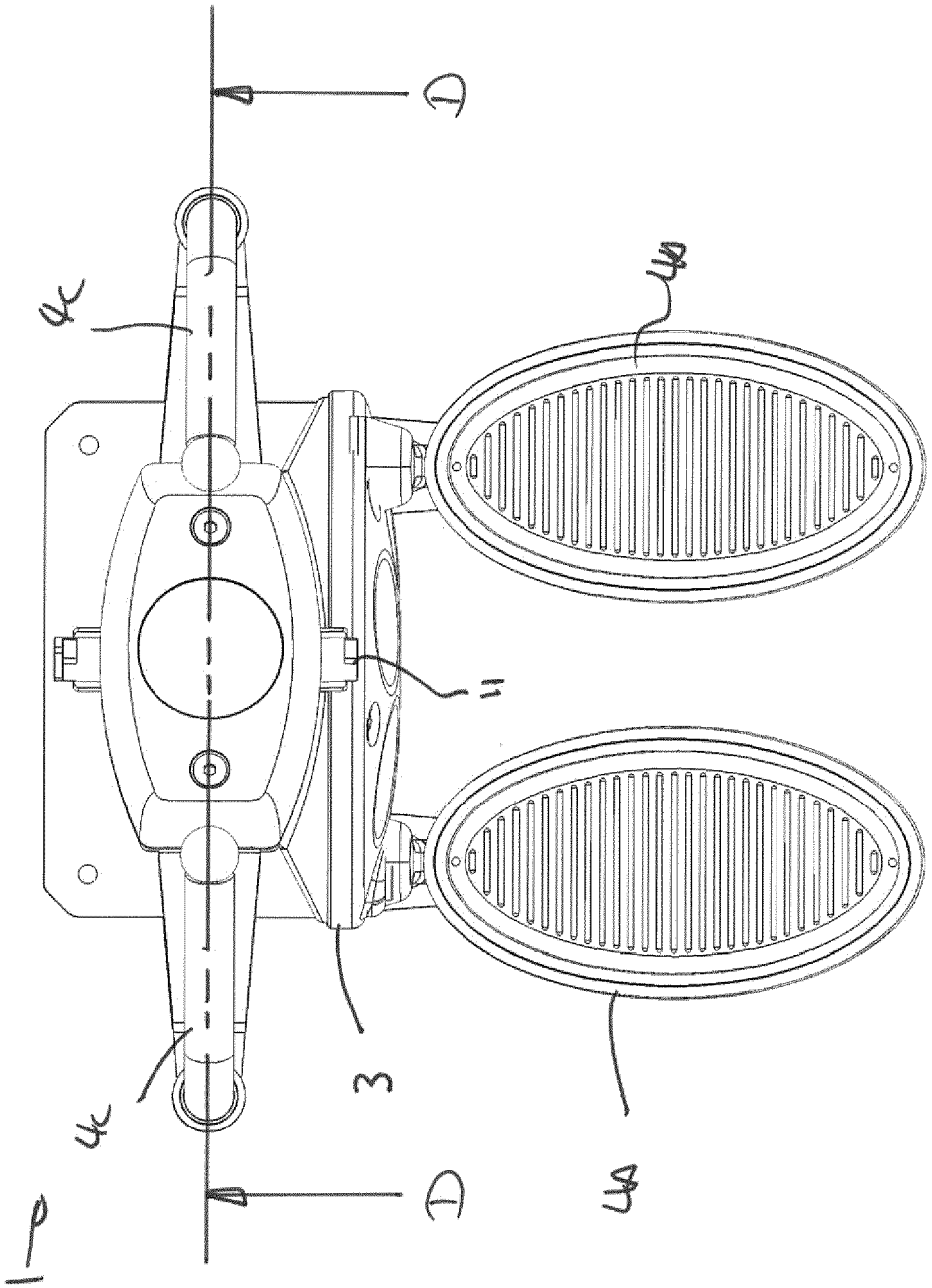


Figure 19

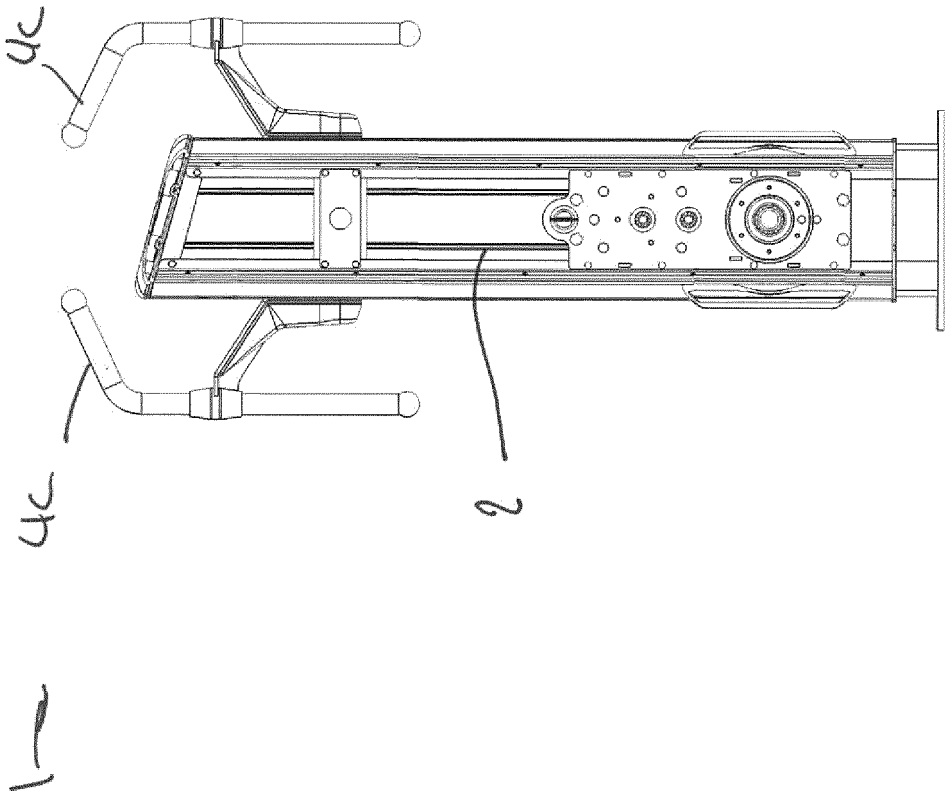


FIGURE 20

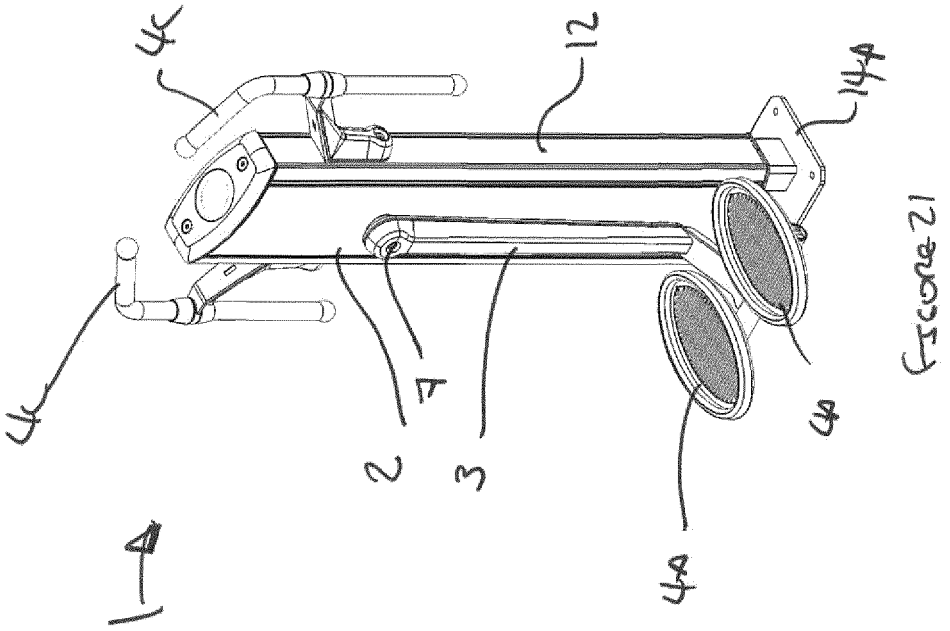


Figure 21

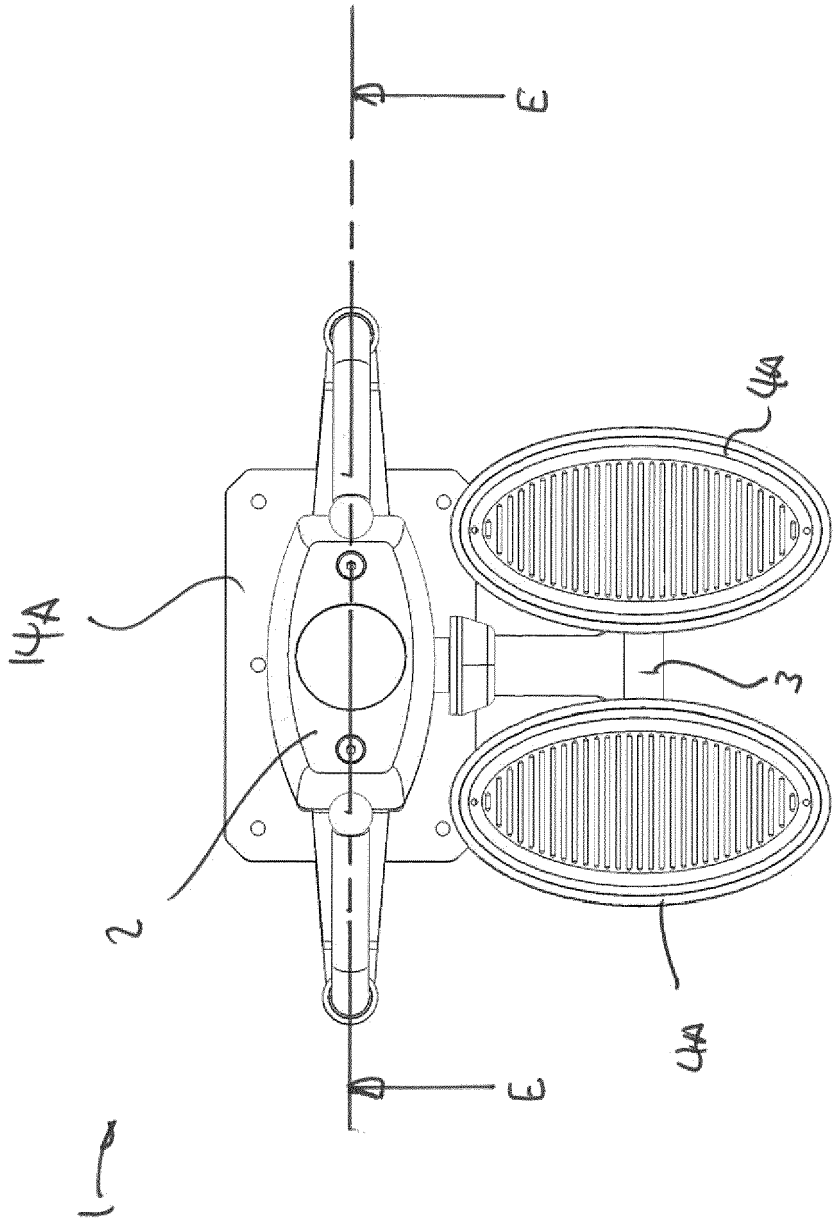


FIGURE 22

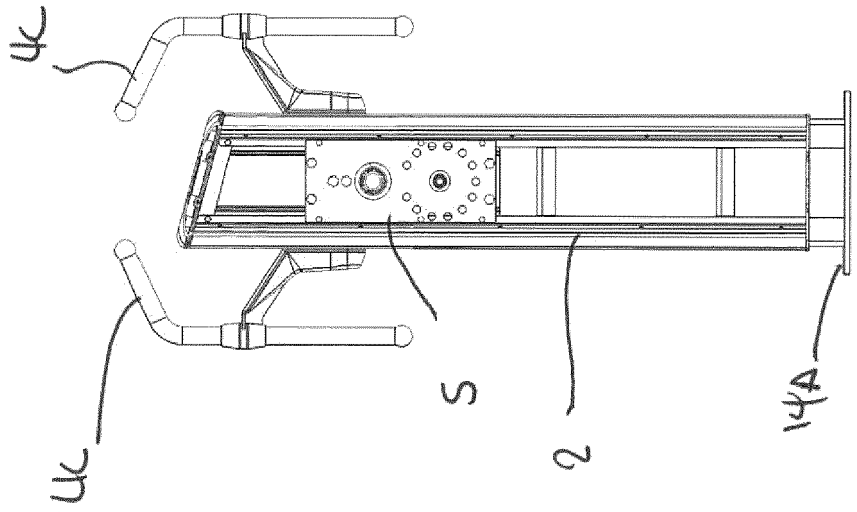


FIGURE 23

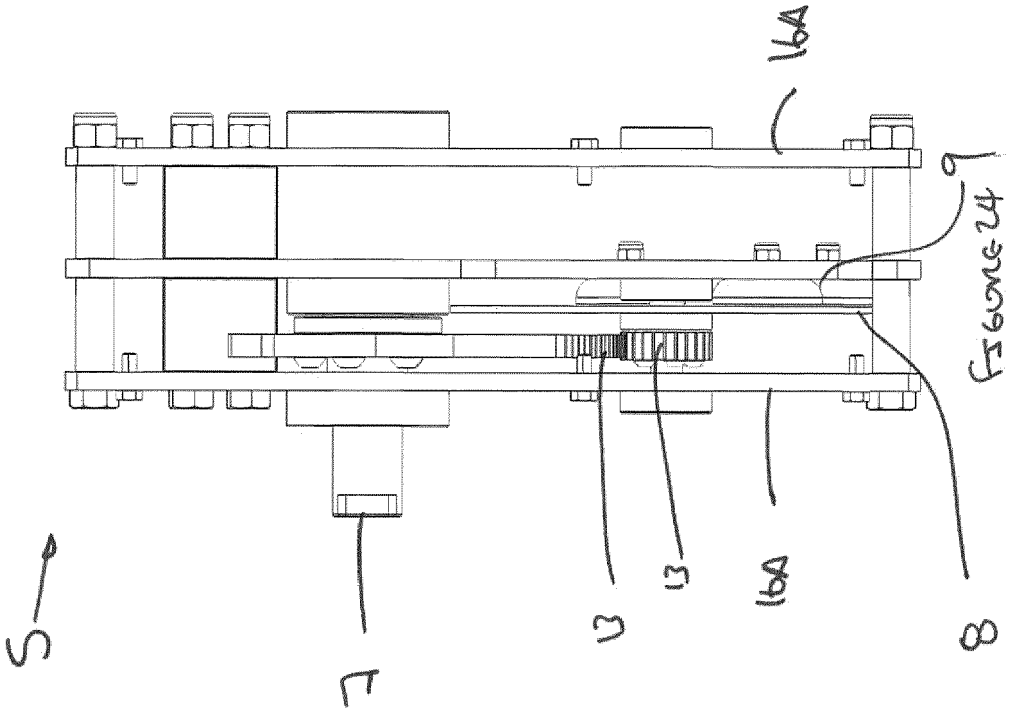


FIGURE 24

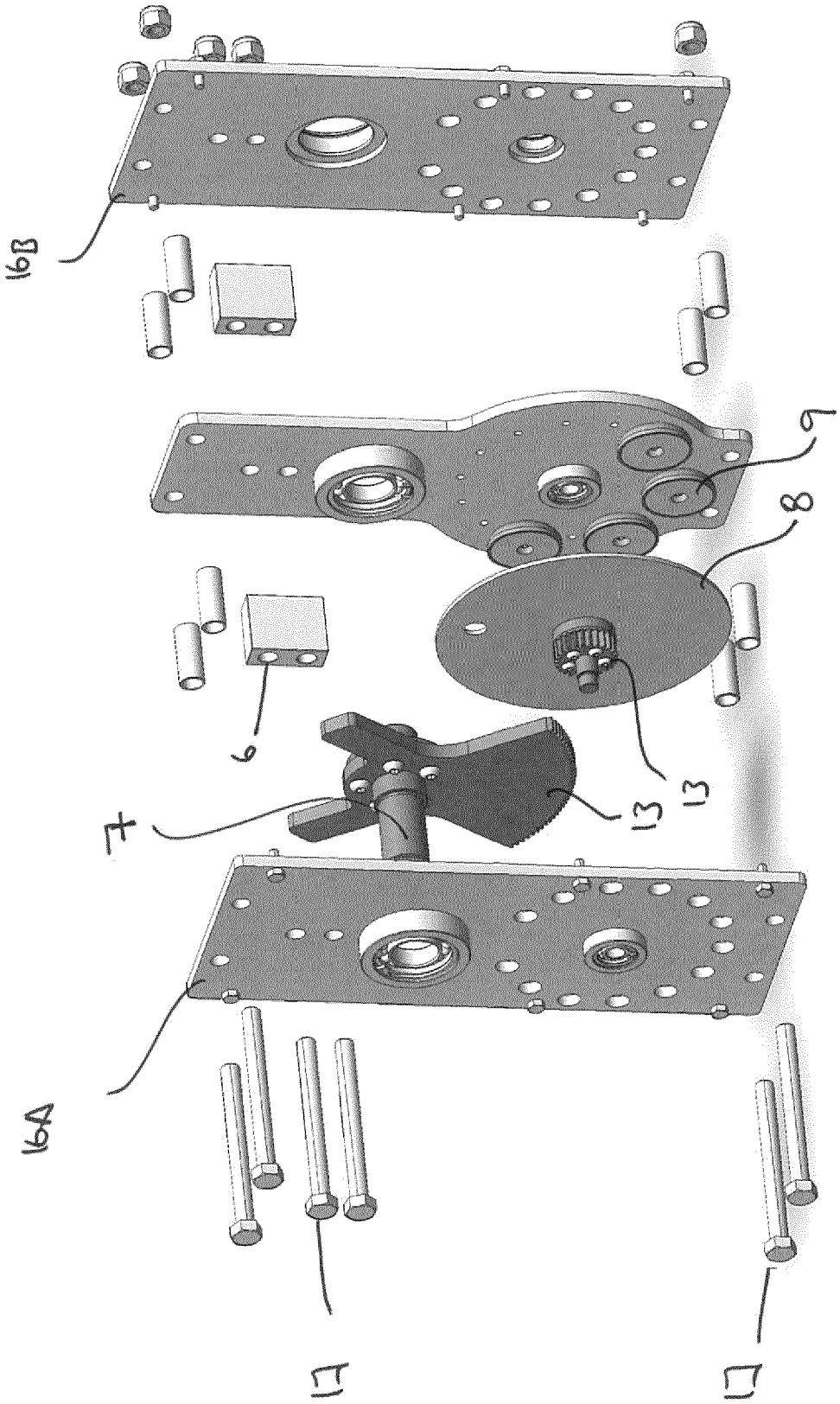
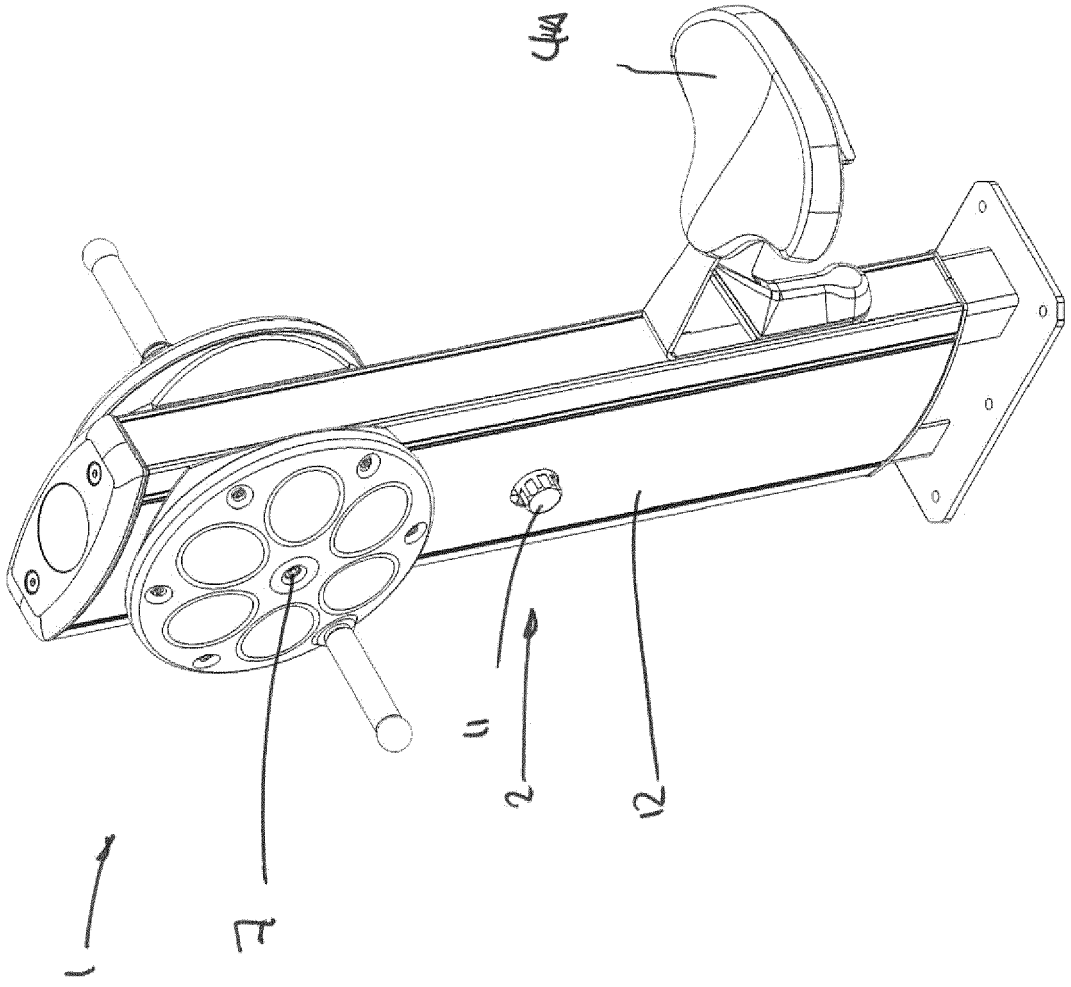


FIGURE 25



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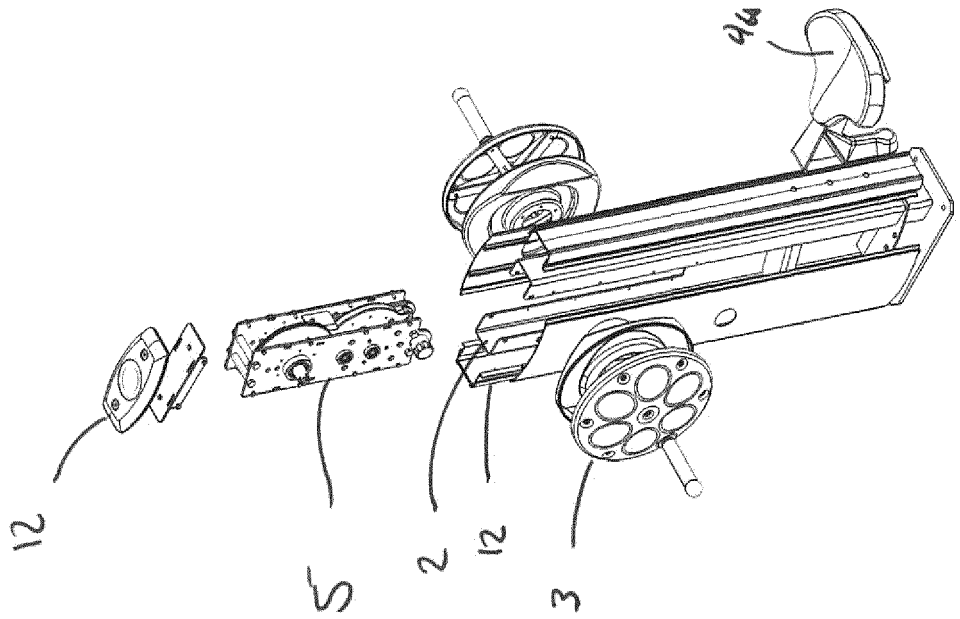


FIGURE 27

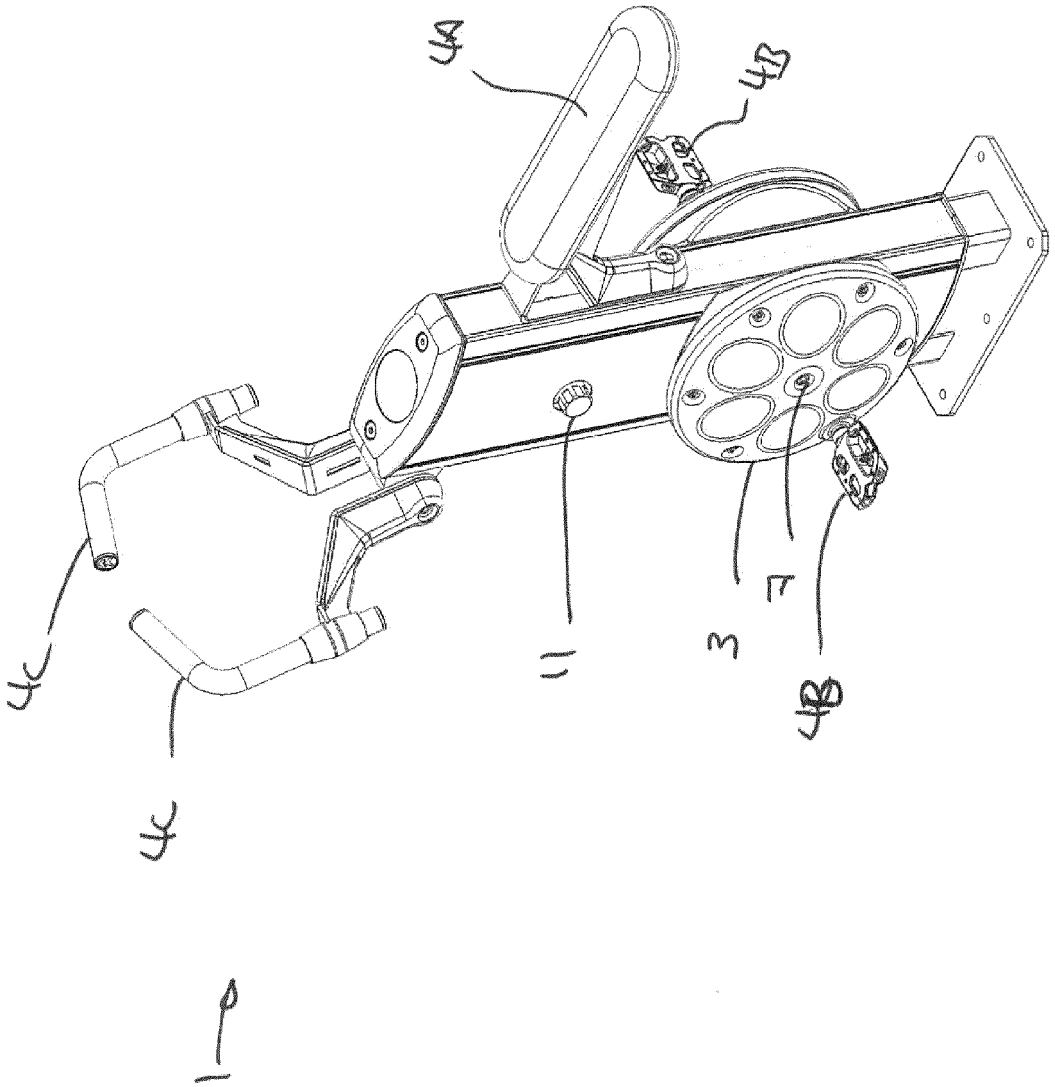
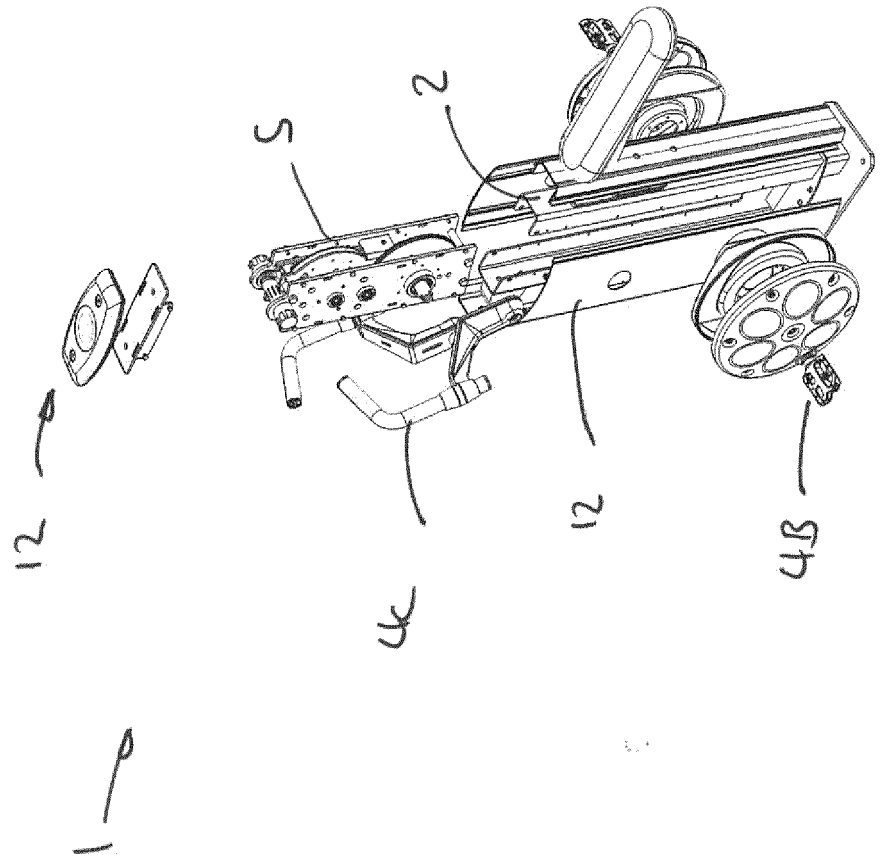


FIGURE 2B



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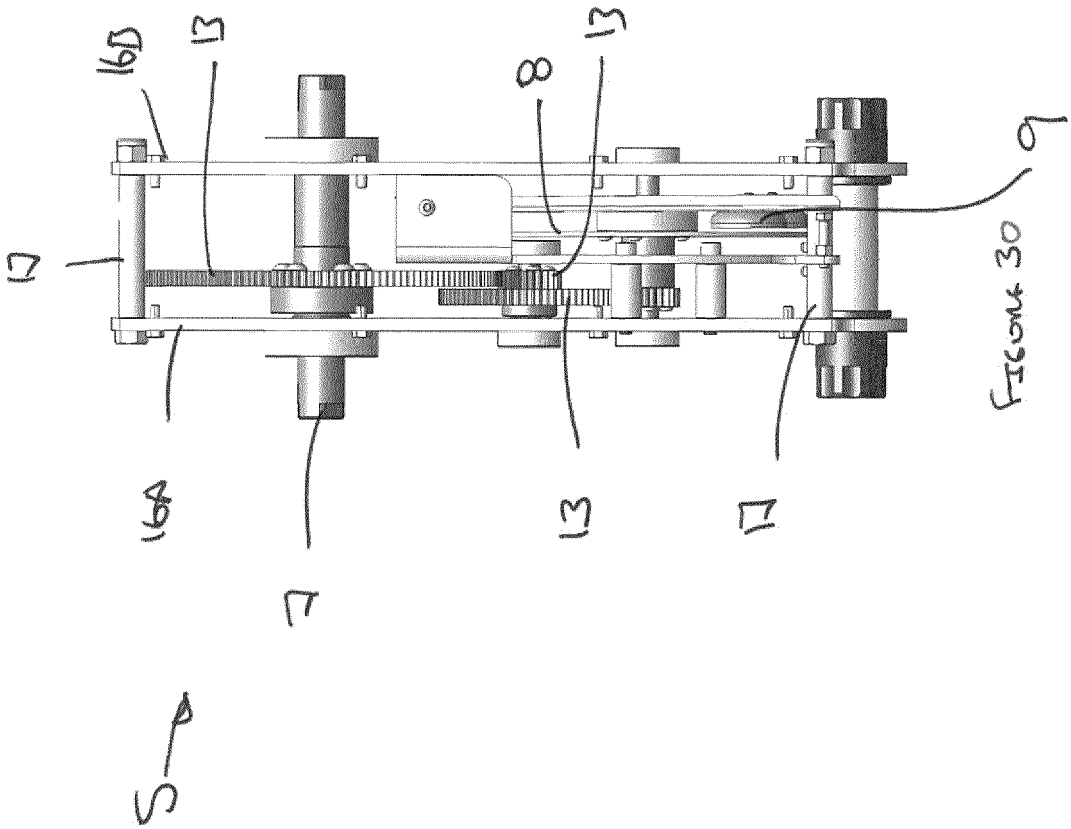
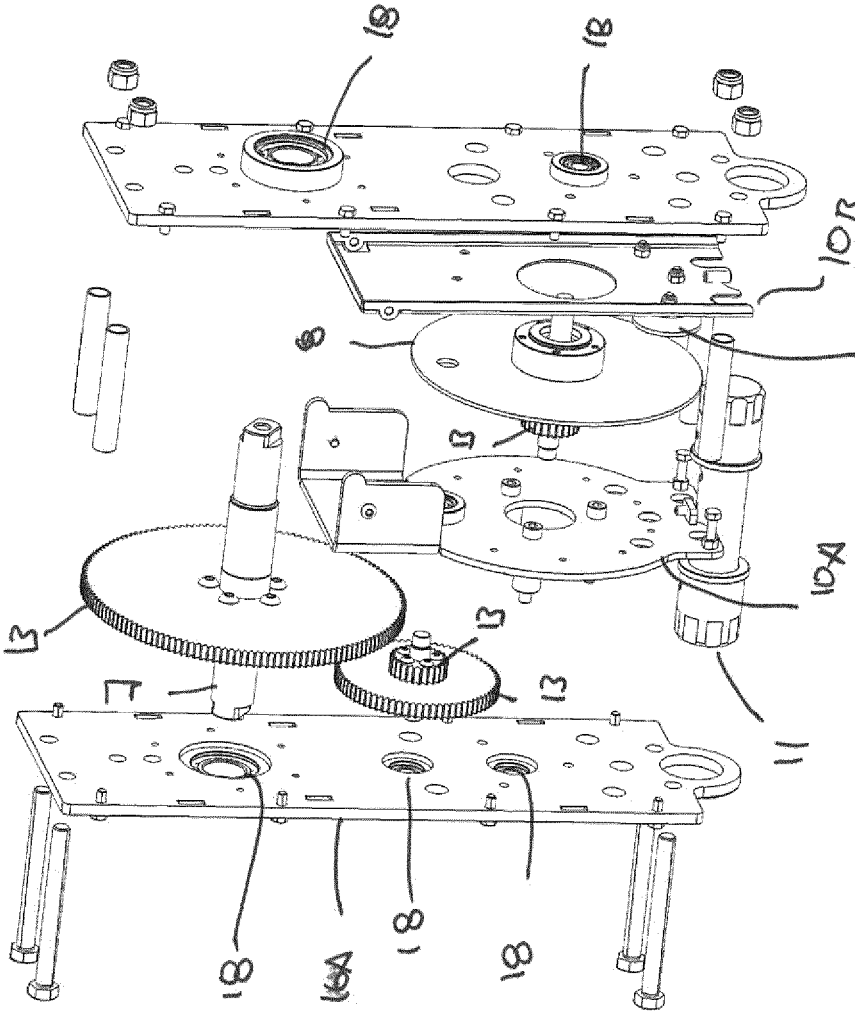


FIGURA 30



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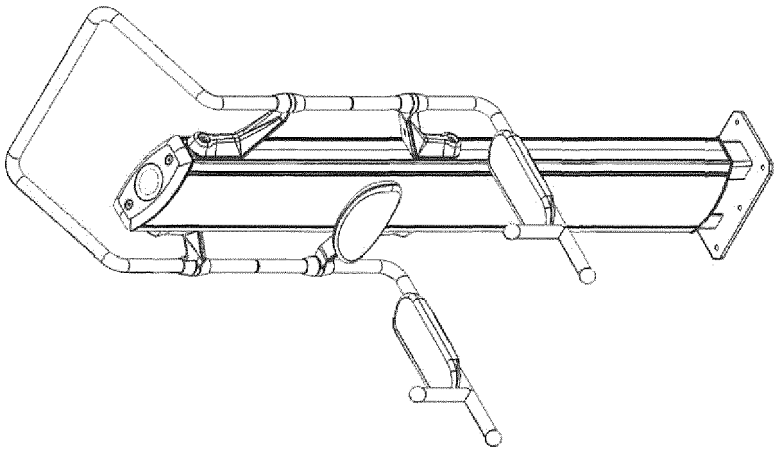

FIGURE 32

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EUROPEAN SEARCH REPORT

Application Number
EP 14 16 7761

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	US 7 077 789 B1 (CHEN MING NAN [TW]) 18 July 2006 (2006-07-18) * paragraph [0014] - paragraph [0019]; figures 1-7 *	1-17	INV. A63B21/005 A63B21/00 A63B22/00 A63B23/035
Y	US 5 749 807 A (WEBB GREGORY M [US]) 12 May 1998 (1998-05-12) * claims 1-12; figures 1-11 *	1-17	
Y	US 2002/155927 A1 (CORBALIS KEVIN P [US] ET AL) 24 October 2002 (2002-10-24) * paragraph [0137] - paragraph [0159]; figures 1-26 *	1-17	
Y	US 4 989 861 A (HALPERN ALAN A [US]) 5 February 1991 (1991-02-05) * claims 1-27; figures 1-17 *	1-17	
			TECHNICAL FIELDS SEARCHED (IPC)
			A63B A61H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 September 2014	Shmonin, Vladimir

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25-09-2014

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