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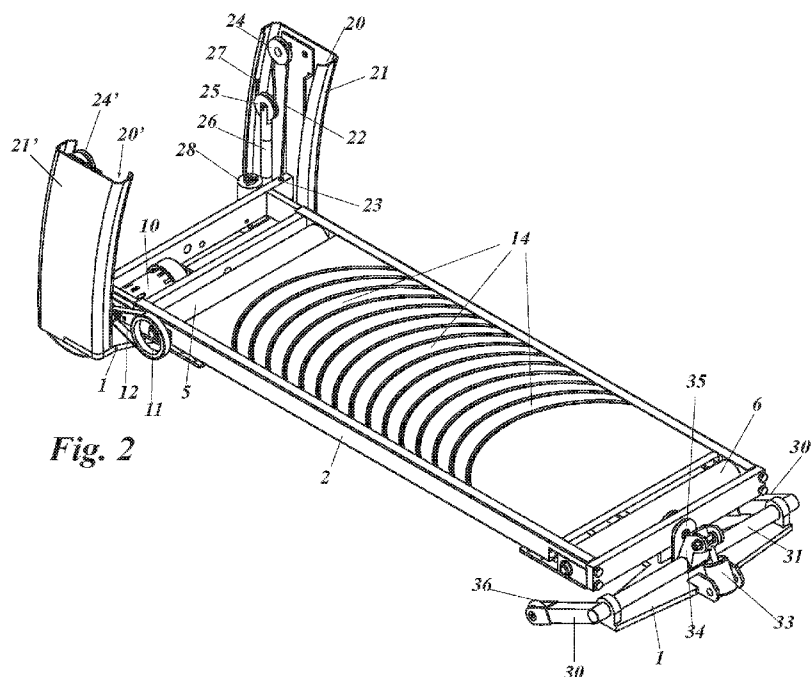


Fig. 2

(57) Abstract: The present invention provides for a training apparatus for physical exercise, preventive exercise and rehabilitation of injuries and increased balance. The apparatus is designed for running and walking exercises and comprises of a base frame (1) configured to be placed on a floor with a tread surface and endless roller belt (4) for running and walking. The apparatus has means for tilt and incline/decline motion of the tread surface which is controlled by a computer unit. The computer unit is adapted to display a graphical user interface and animation of the track or terrain which is part of a chosen training session.

A TRAINING APPARATUS

Field of the Invention

- 5 The present invention relates to an apparatus for physical exercise which is especially adapted to train the user in controlling balance. The apparatus is configured for indoor use when walking, jogging and running, the apparatus representing a type of treadmill with an uneven and unstable step surface. Exercise under controlled instability is proven to give physical benefits, both for strength and for rehabilitation after an injury.
- 10 General muscle control and balance is not stimulated when only exercising on flat and stable surfaces.

Background of the Invention

- 15 The benefits of regular aerobic exercise are well established and accepted. Because the major population in the western world lives close together in towns and cities far from the countryside and because of inclement weather, time constraints and other reasons, it is not always possible to walk, jog, or run. Various types of indoor exercise equipment have been developed for running to perform cardiovascular exercise, such equipment
- 20 being called treadmills.

- There is an ongoing development of indoor exercise apparatus aiming to simulate “natural” training environments. Many apparatus include user interfaces for input and feedback, such as consoles with button clusters and screens, often computer assisted
- 25 with programmes creating a choice of virtual environments, which the apparatus aims to simulate. Apparatus present on the market has functions, though limited, which simulate inclination (upwards tilt), speed and force to the roller base on a treadmill.

- There are some patent publications aiming at providing unique running experiences, such as for instance DE20008195 (Blöchle) and US2004/0192511 (Ein-Gal Moshe).
- 30 Different surfaces and patterns on the tread belt are also shown in publication WO 2007/061317 from the present inventor.

However, it has proven difficult to run on tread belts with uneven surfaces. On the outside of the belt there is too much wear and tear and the belt does not run smoothly.

Tilt motion as shown in the inventors' earlier publication WO 2007/061317 has not
5 proven to be practical or durable.

Brief Summary of the Invention

The present invention thus intends to solve inherent shortcomings of currently available
10 exercise apparatus and published designs. This object is achieved in a training apparatus according to the appended claims.

According to a first aspect, the inventive training apparatus includes a base frame configured to be placed on a floor, a roller belt frame suspended in said base frame, the
15 roller belt frame including an endless roller belt with a tread surface for stepping, running and walking thereon, motorized means for moving said roller belt, and actuators for controlling the position of the roller belt frame relative to the base frame. The training apparatus further includes a computer unit for controlling the motorized means and actuators according to a stored training session and displaying a
20 corresponding track or terrain on a display screen, wherein the position of the roller belt frame is controlled in both longitudinal and transversal directions. Thus, the training apparatus provides an interactive graphical user interface for fun and inspirational training, and with a step surface which aims to provide a more challenging exercise of a user and to simulate uneven terrain. The apparatus is of treadmill type, and the tread
25 base or surface which aims to simulate an uneven terrain by providing a motion which interacts with the terrain of the training program. The apparatus is able to tilt the whole step surface transverse to the running motion, simulating running on a surface with an angle relative to the horizontal, the angle being adjustable and changing constantly during a training session. The apparatus has a computer which controls the motion of
30 the apparatus according to a chosen program. There is also a screen which displays a graphical user interface for interactive communication and feedback between user and apparatus. The screen can be independent or integrated as part of an interface console of the apparatus which provides the user with easy access for input and monitoring

options. When the user has chosen a training program and track, the belt will move and create the incline/decline and tilt according to the terrain as the program is running and which is shown on the screen.

- 5 According to a second aspect, the roller belt frame is connected at the frontal end with two independent actuators for elevation and tilt motion of the said roller belt frame, the roller belt frame being suspended in its rear end in a pivot point. This is the preferred solution allowing the step surface to be tilted also in the transverse direction.
- 10 According to a third aspect, the roller belt frame includes a support structure beneath the roller belt, the structure including a number of elongated ribs that are independently suspended in the base frame and arranged perpendicular to the direction of the motion of the belt. The ribs are independently movable in a vertical fashion. This creates an uneven surface forcing the foot of a user to step on the surface at different angles and
- 15 forcing the user to "balance" the body during walking or running.

According to a fourth aspect, the ribs mentioned above are suspended in springs or elastic elements. This construction allows the support structure to provide a step surface that is both soft and elastic, thus improving the realistic behaviour of the

20 apparatus even further.

According to a fifth aspect, the ribs are straight, curved or V-shaped. The ribs will bend when the user steps on the step surface (the belt), but the bending behaviour will be different for different types of ribs, as curved or V-shaped ribs will bend more easily

25 than straight ribs.

According to a sixth aspect, the frontal end of the roller belt frame on each side is connected to a vertical track fixed on a pillar which is part of the base frame, and wherein the roller belt frame is guided vertically by a set of wires or chains and pulleys

30 on each side of the frame, each of which is connected to an actuator. This is a particular solution enabling the step surface to be tilted in both the longitudinal and transversal directions.

According to a seventh aspect, the frontal end of the roller belt frame on each side is connected to a threaded member which engages a worm gear spindle which is mounted on the base frame, and wherein the spindle is connected to a motor. This is an alternative to the solution mentioned above, which may be less complicated, easier to
5 install and more durable.

According to an eighth aspect, the rear end of the base frame has a pair of supports which are rotary connected to a transversal axle again connected to a motor driven actuator, whereupon the supports may be rotated from a horizontal position to a vertical
10 position in order to elevate the rear end of the base frame relative to the floor thus creating a decline situation of the tread base. This construction allows the inventive training apparatus to mimic a downhill surface.

According to a ninth aspect, the parts of the supports which are in contact with the floor
15 each have a wheel. This relates to the particular construction mentioned above. The wheels ease the motion of the supports along the floor, prevent the wheels from scratching the surface of the floor and allow the apparatus to be easily moved by one person alone.

20 According to a tenth aspect, the computer unit runs a computer program directly streamed from a server on the Internet, the program providing online worldwide maps with typographical data graphically displayed on the apparatus screen. The inventive training apparatus includes an interactive user interface graphically displayed on a screen of the apparatus, the apparatus being in online communication with an internet
25 site for displaying realistic terrain models.

Brief Description of the Drawings

The features of the invention and the inherent improvements over prior art will be described with reference to the accompanying drawings, which illustrate preferred
5 embodiments of the invention by example and in which:

Fig. 1 is a perspective view of the invention,
Fig. 2 is a perspective view of the framework with mechanism for incline, decline
and tilt motion,
10 Figs. 3a and 3b show schematically the incline mechanism,
Fig. 4 shows a view of the framework from underneath the invention, Whereas Fig.
4b shows the rear end of the framework disclosing an optional decline mechanism,
Figs. 5a and 5b show details of the tread belt and ribbed step surface,
Figs. 6a, 6b and 6c show different embodiments of the step surface,
15 Figs. 7a and 7b show incline and decline positions of the invention,
Fig. 8 shows the invention in a tilted position,
Fig. 9 shows block schematic of the invention's interface system and functions,
Fig. 10 shows a screen view,
Fig. 11 shows a second perspective view of the invention disclosing a design
20 variation, and
Figs. 12a, 12b and 13 show details regarding a further embodiment of the lift and
tilt mechanism.

Detailed Description of the Invention

25

The invention aims to provide a training exercise as outside in the open terrain involving running uphill and downhill on uneven surfaces interacting with a graphical user interface.

30 With reference to Figs. 1 to 5, the invention has a base frame 1 configured to be placed on a floor surface. An elevated frame 2 with belt 4 and support structure works as a "floor" and is connected with the base frame 1 at the front in tracks on pillars 21, 21' and at the aft in a pivot point 35.

An endless belt 4 with a tread surface is running around rollers 5 and 6 located at the front and rear part of the frame 2. The front roller is connected to a motor 10 and cog wheel 11 through drive belt 12. The motor 10 is connected to and controlled by a computer unit located anywhere on the apparatus, the functions further disclosed below
5 with reference to Fig. 9. The computer is also connected to a screen 52 (Fig. 9, 11), preferably of a touchscreen type, which together with other buttons and means of control allows a user to start, stop, set the speed of the tread belt 4 or run an interactive program as shown graphically on the screen. The functions of the apparatus, its computer and programs will be further disclosed below relative to Fig 9.

10

The tread belt 4, as seen in Fig. 1, passes over a support structure with a number of ribs 14, visible in Figs. 2-6. The support structure provides for an uneven and unstable running surface. An uneven surface will challenge the balance of the user when running, as it will make the feet of the user land at different angles throughout a running
15 session. In Figs. 2-5 and 6b is shown a support structure with ribs 14 organised in a curved manner. Figs. 6a and 6c show additional embodiments where the ribs are straight or formed in a V-shape.

20

As seen in Fig. 4, the ribs 14 are suspended on springs 16 or elastic elements.

Figs. 5a and 5b show details of the apparatus. The belt 4 is shown as a top layer which is soft enough to allow the ribs 14 to move vertically as a user steps on the belt 4.

As seen in Figs. 2 and 3a-3b, each side of the frontal part of the elevated frame 2 with
25 the support structure is placed vertically in tracks 20, 20' inside two columns 21, 21'. A wire/chain and pulley arrangement is located within the columns 21, 21'. As will be described with reference to the right side of the apparatus, a wire or chain 22 is fixed at one end 23 to the frame 2. The wire 22 then runs over a pulley 24 which is fixed to the column 21 and then under a pulley 25 which is connected to an actuator 26. The wire is
30 then brought up and fixed to the column in point 27. The actuator 26 includes and is driven by an electric motor 28. When the motor is actuated, it will pull in the wire 22 and lift the frame 2. The description of this pulley arrangement applies also for the left side of the apparatus, numerals being 22', 23', 24', 25', 26', 27', 28'. Fig. 3a shows the

position of the frame 2 when at a horizontal level, as seen in Fig. 1, or at a decline position, as seen in Fig. 7b. Fig. 3b shows a situation where the actuator has pulled the wire in order to situate the frame 2 at an incline, as shown in Fig. 7a.

5 For tilting of the tread base frame 2, only one of the actuators 26, 26' is engaged. Both are engaged when the support structure is at an incline but, when a tilt motion is desired, they will not engage to pull equally. In Fig. 8 only the left actuator has been engaged, the frame tilting towards the right hand side. To allow the frame 2 to tilt in the transverse direction, the frame is suspended in a pivot point 35 at the aft end of the
10 frame.

For decline motion there is located on the rear end of base frame 1 a set of legs 30, 30' which are connected by a shaft 31 which is rotary about its longitudinal axis. A motor-driven actuator 33 is connected to a lever 34 on the shaft 31. The actuator 33 can turn
15 the shaft 31 and therefore the legs 30 in order to adjust the distance between the frame and the floor and thus the level of decline of the tread base and frame 2. At the end of each of the legs 30, 30' there are wheels 36, 36' which are in contact with a floor surface. The wheels prevent the apparatus from moving backwards and forwards when the legs are moved. Fig. 4b shows an alternative configuration of the decline mechanism
20 in which the actuator 33' is located beneath the frame and connected by a rod 32 fixed to and between both legs.

Fig. 9 shows a block schematic of the invention which includes a computer unit 50, a display unit/screen 52 and input means 53. The display unit may be of a touchscreen
25 type for user input. The input means may also be buttons, switches, joy sticks or similar for start/stop and other user input as illustrated in Figs. 1 and 10. The computer will be especially programmed for controlling the actuator motors to interact with training programs. The programs may be read from a permanently installed storage medium, such as a hard disc or flash drive, or read directly from a CD, USB memory stick or
30 other memory card, or from a portable hard drive, illustrated by numeral 54. The apparatus may also access programs from a remote server either locally or through the Internet 55, which provides for online training interactively with other users and/or for interactively training anywhere on the globe through map and GPS services online.

Numerals 60 represents the power controller which is controlled by a computer unit 51, also called input output (I/O) board, for distribution of power to the apparatus, the power being delivered from the mains 61 or from batteries 62.

5

Motor 10 is connected to a cog wheel 11 on the front roller 5 by belt 12. The tread belt 4 is endless and runs between and around rollers 5 and 6. The speed of the belt is set by the user from the interface console and through any chosen training program. The rotational speed is monitored by a sensor 67.

10

Motor-driven actuators 26 and 26' can adjust the angle of the roller belt frame 2 relative the main frame 1 and floor, both transverse the direction of roller belt motion and for elevation, simulating uphill. At the rear end an actuator 32 with motor is connected to a pair of legs 30, 30' for descent motion of the apparatus tread base, the rear part of the frame 1 being elevated.

15

Sensors 86, 87, 88 are connected with the computer 51 for monitoring and feedback of all tilt, incline and descent motions.

20

The motors are connected to the computer unit 51. The computer will run software programs for terrain simulation. The screen will show a terrain as animated graphics or film. The computer will activate the motors for moving the tread base in order to simulate the terrain.

25

As mentioned above, the computer of the apparatus will use programs or data from services on websites which have typographical data of a track or terrain, manmade or from actual geographical locations on the globe, the track or terrain being graphically shown on a screen. The invention is thus made to move according to the terrain shown graphically on the screen to provide an interactive exercise experience for the user.

30

As illustrated in Fig. 10, the screen 52 of the invention displays an example of a screen view from a training program and a chosen terrain with a choice of functions and views. Altitude data and profile of a track is gathered from map/satellite data processed and

shown on the screen in a separate section 91, the current position of the user along track shown as line 92. Another view 94 shows a bird's eye view of the terrain, as a three dimensional (3D) image or film or as a traditional map, showing the tracks and roads 95 of which to choose and follow, the position of the user being shown as dot 96. A
5 preferred view, shown as sectional view 93 which could cover the whole screen if desired, shows a 3D graphical representation of the actual terrain following the chosen road as an animated environment or representation of an actual terrain.

Fig. 11 shows a design variation of the inventive treadmill. The tread base 14, belt 4
10 and frame 2 is at an incline position simulating an uphill terrain. The treadmill has a rather large screen 52 fitted at the front end of the apparatus frame facing any user. In addition, a smaller touchscreen 8 is mounted on a frame extension positioned to the side of and easily accessible for any user, also when performing a running exercise. Also easily accessible are start/stop and speed adjustment knobs or switches 9, 9'.

15

Figs. 12a, 12b and 13 disclose a further embodiment with regards to the lift and tilt mechanism of the invention utilizing motor-driven worm gear actuators. The tread base and frame 2 is connected with members 70, 70', which run in tracks on vertical pillars 71, 71' and which are engaged with vertically oriented worm gear spindles 72, 72'. The
20 worm gear spindles are powered by motors 73, 73'. Belts 74, 74' transfer rotary motion from the motors to cog wheels 75, 75' fixed to the worm gear spindles enabling vertical motion of the members and frame. Power transmission from the motors to the spindles can also be done using gears (not shown) directly from the motors. Rods 76, 76' connect the frame 2 and members 70, 70', the rods being slideable relative to the frame
25 in order to compensate for changes in the distance between the frame and the spindles caused by the vertical motion.

Claims

1. A training apparatus, the apparatus including a base frame (1) configured to be placed on a floor,
5 a roller belt frame (2) suspended in said base frame, the roller belt frame including an endless roller belt (4) with a tread surface for stepping, running and walking thereon,
motorized means (10) for moving said roller belt, and
actuators (26, 26'; 72, 73, 72', 73'; 32) for controlling the position of the roller belt
10 frame relative to the base frame,
c h a r a c t e r i z e d i n a computer unit (50, 51, 52, 53, 54, 55) for controlling the motorized means and actuators according to a stored training session and displaying a corresponding track or terrain on a display screen (52),
wherein the position of the roller belt frame is controlled in both longitudinal and
15 transversal directions.
2. A training apparatus according to claim 1,
wherein the roller belt frame is connected at the frontal end with two independent actuators (26, 26'; 72, 73, 72', 73') for elevation and tilt motion of the said roller
20 belt frame, the roller belt frame being suspended in its rear end in a pivot point (35).
3. A training apparatus according to any of the preceding claims,
wherein the roller belt frame includes a support structure beneath the roller belt (4),
the structure including a number of elongated ribs (14) that are independently
25 suspended in the base frame and arranged perpendicular to the direction of the motion of the belt.
4. A training apparatus according to claim 3,
wherein the ribs (14) are suspended in springs or elastic elements (16).
- 30 5. A training apparatus according to claim 3 or 4,
wherein the ribs (14) are straight, curved or V-shaped.

6. A training apparatus according to any of the claims 1 - 5,
wherein the frontal end of the roller belt frame (2) on each side is connected to a
vertical track (20, 20') fixed on a pillar (21, 21') which is part of the base frame (1),
and wherein the roller belt frame (2) is guided vertically by a set of wires or chains
5 (22, 22') and pulleys (24, 25; 24', 25') on each side of the frame, each of which is
connected to an actuator (26, 26').
7. A training apparatus according to any of the claims 1 - 5,
wherein the frontal end of the roller belt frame (2) on each side is connected to a
10 threaded member (70, 70') which engages a worm gear spindle (72, 72') which is
mounted on the base frame (1), and wherein the spindle is connected to a motor (73,
73').
8. A training apparatus according to any of the preceding claims,
15 wherein the rear end of the base frame has a pair of supports (30, 30') which are
rotary connected to a transversal axle (31) again connected to a motor driven
actuator (33), whereupon the supports may be rotated from a horizontal position to a
vertical position in order to elevate the rear end of the base frame relative to the
floor thus creating a decline situation of the tread base.
20
9. A training apparatus according to claim 7, wherein the parts of the supports which
are in contact with the floor each has a wheel (36, 36').
10. A training apparatus according to any of the preceding claims,
25 wherein the computer unit runs a computer program directly streamed from a server
on the Internet, the program providing online worldwide maps with typographical
data graphically displayed on the apparatus screen.

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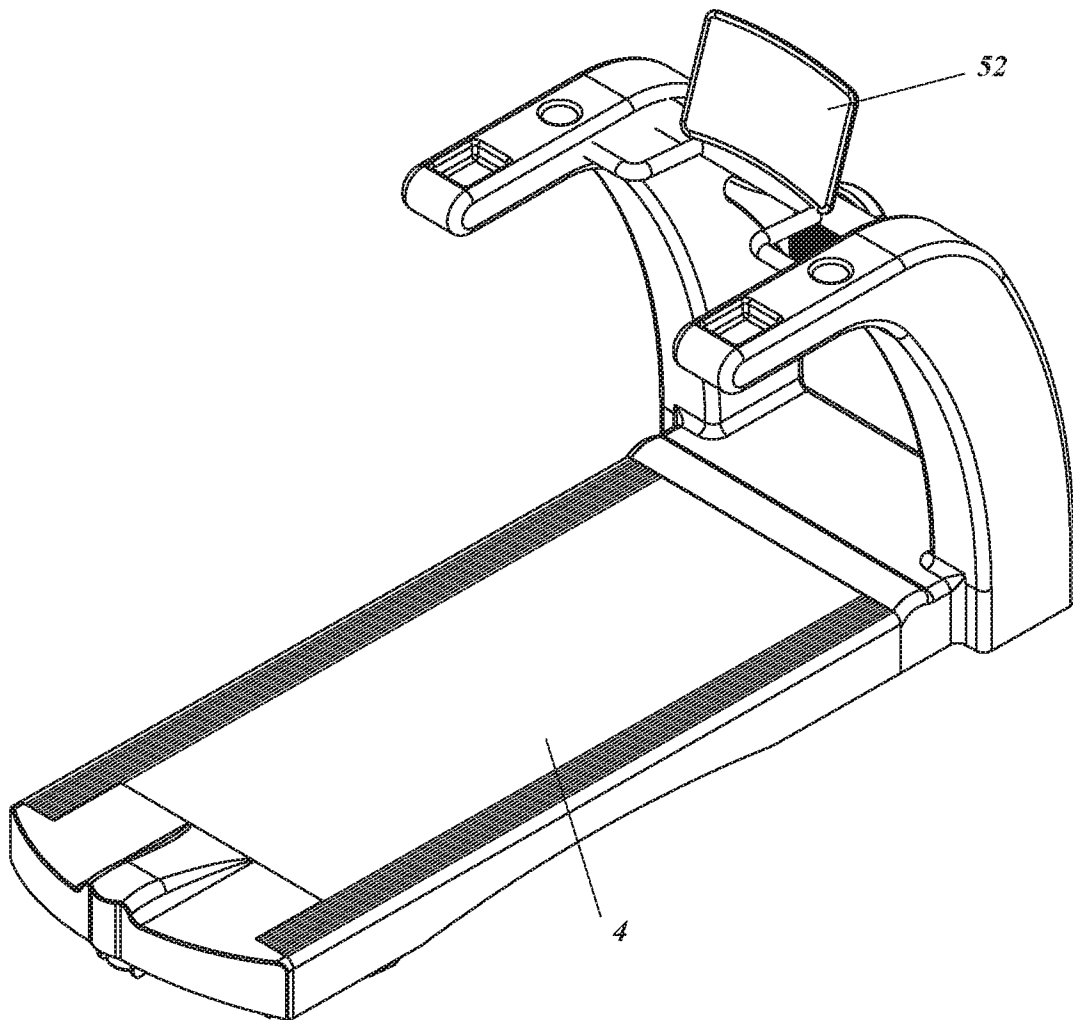


Fig. 1

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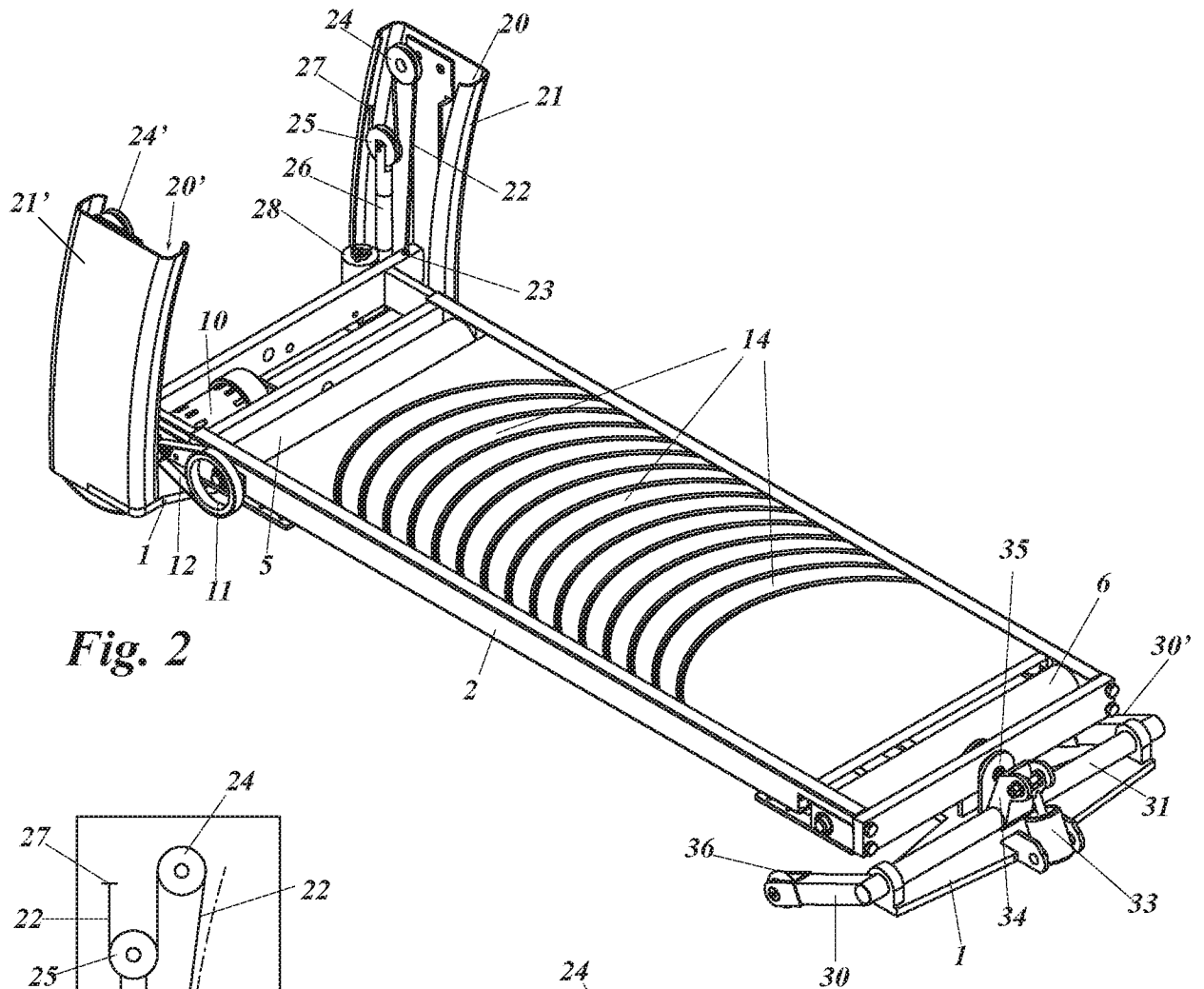


Fig. 2

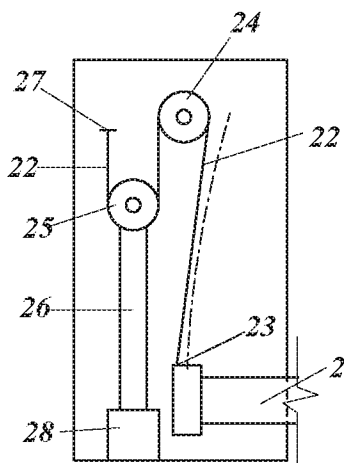


Fig 3a

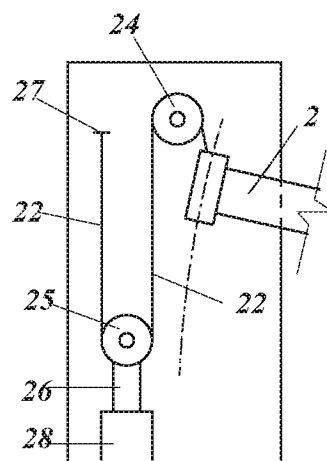


Fig 3b

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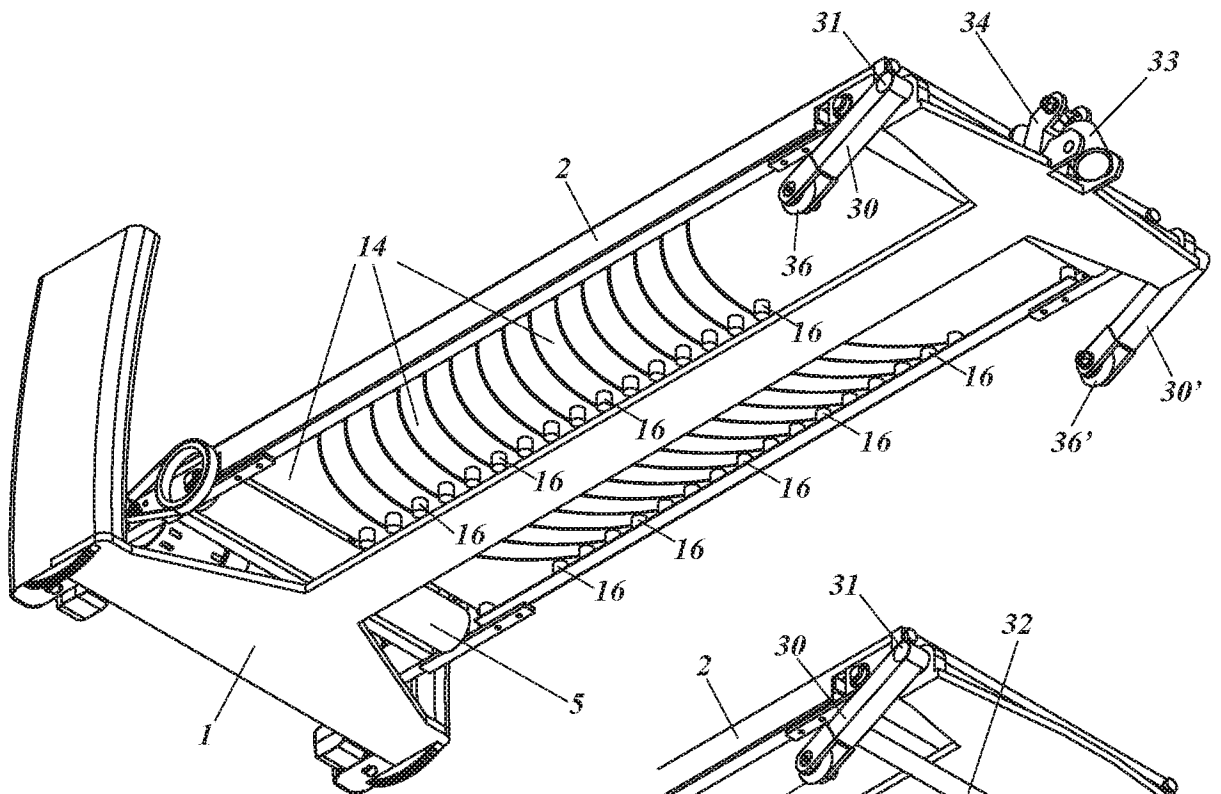


Fig. 4a

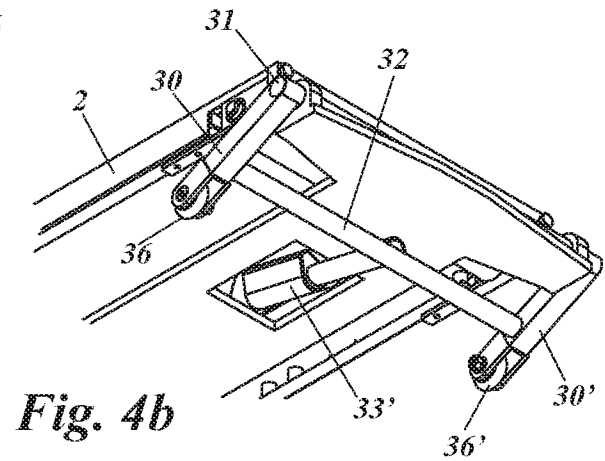


Fig. 4b

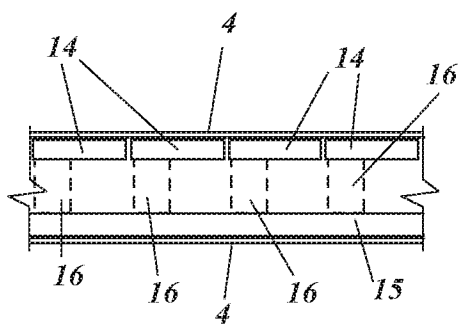


Fig. 5a

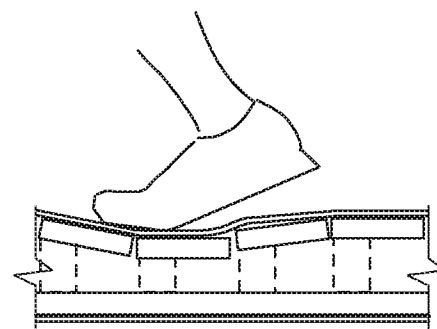


Fig. 5b

4/10

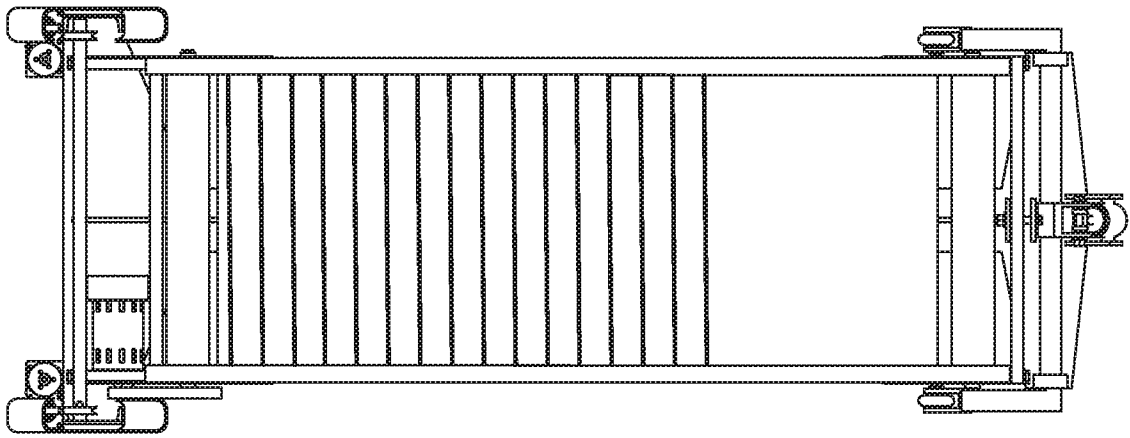


Fig. 6a

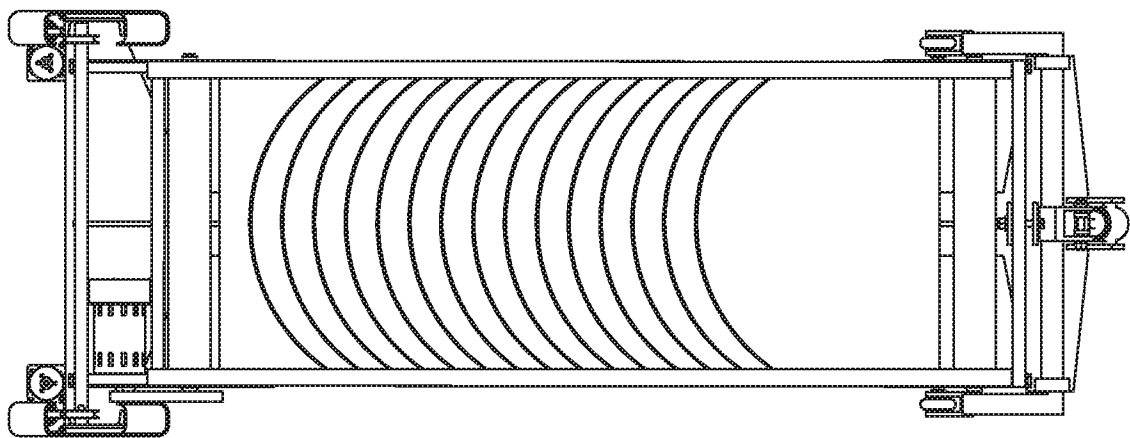


Fig. 6b

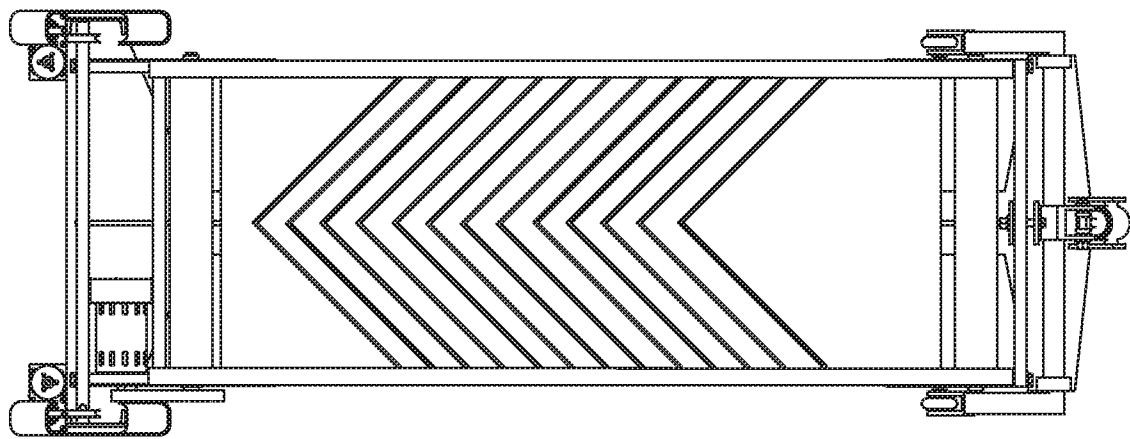
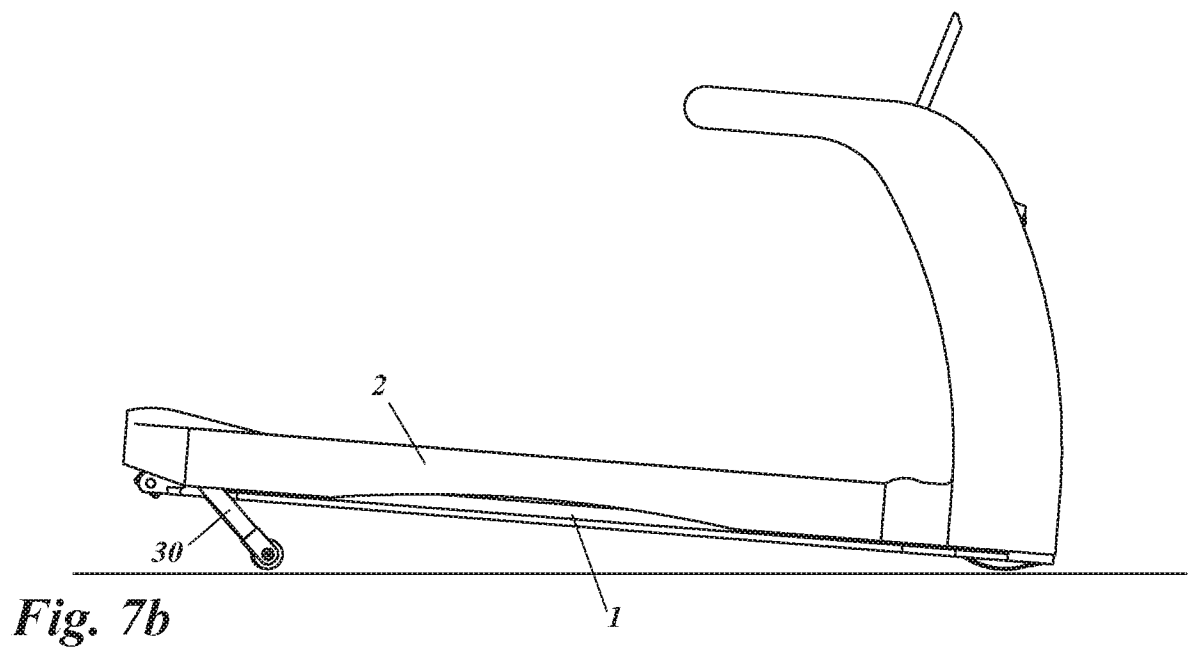
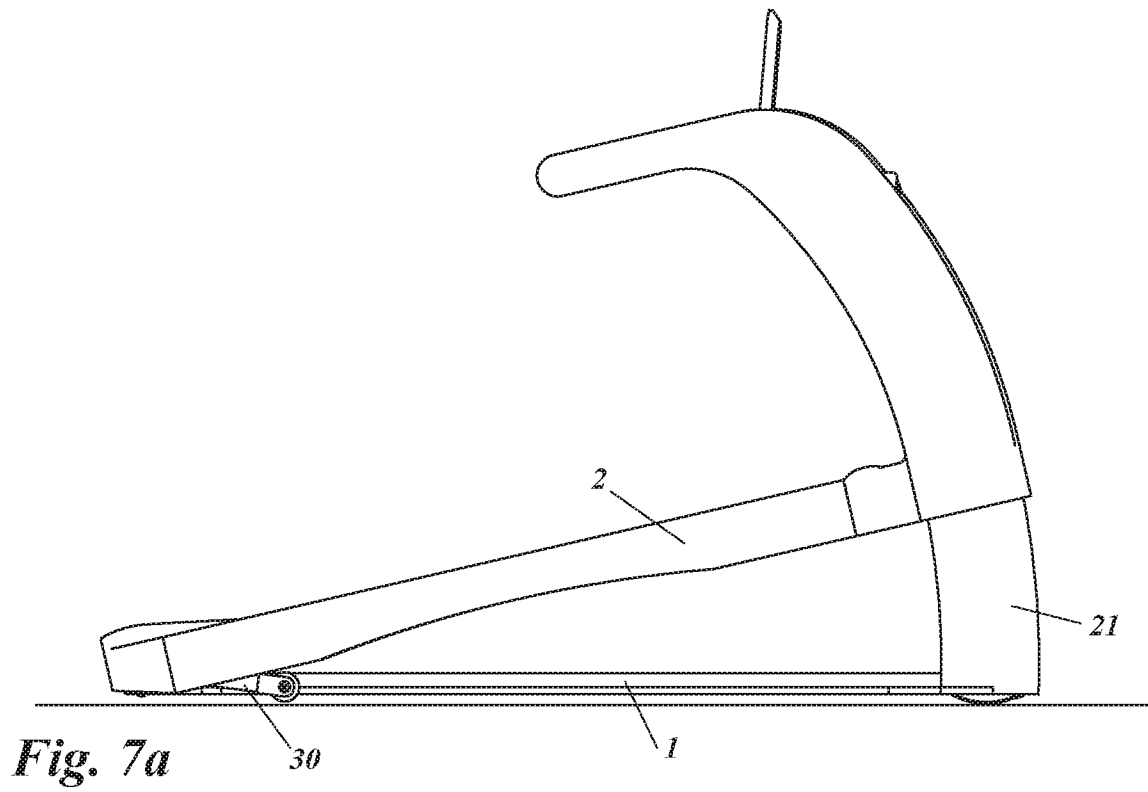


Fig. 6c

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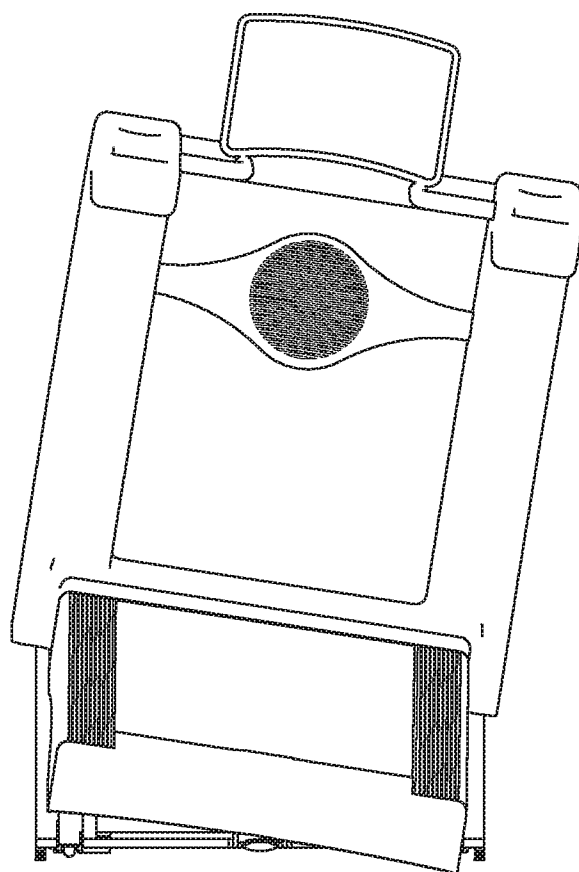


Fig. 8

7/10

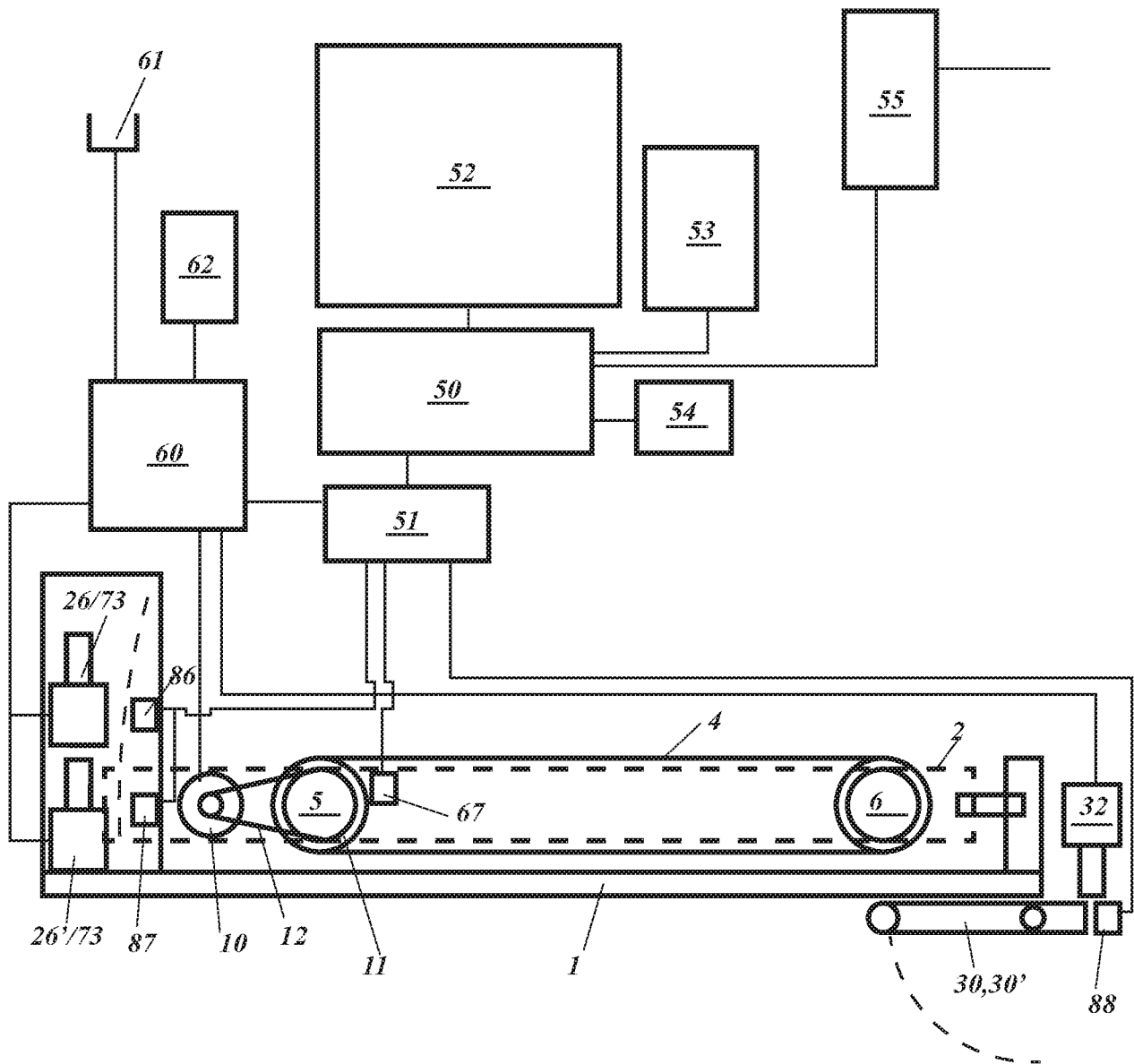


Fig. 9

8/10

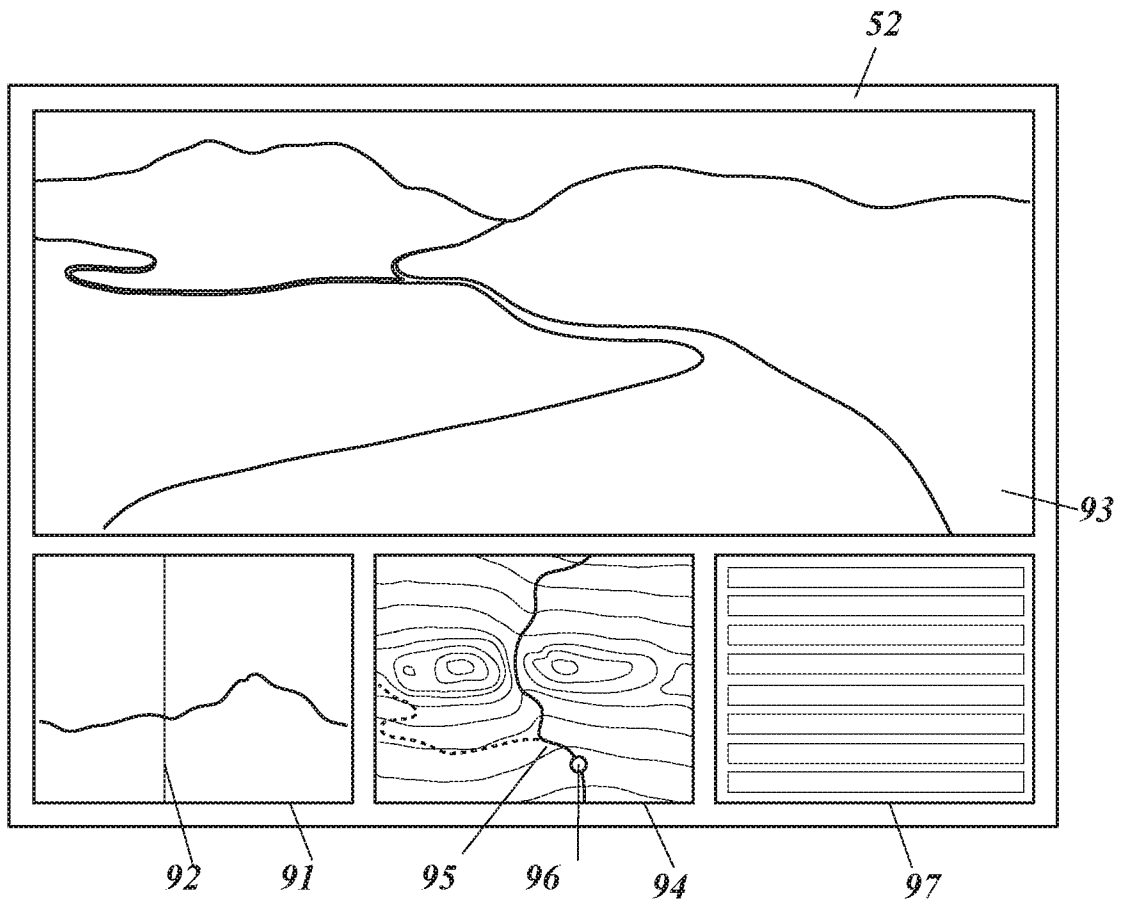


Fig. 10

9/10

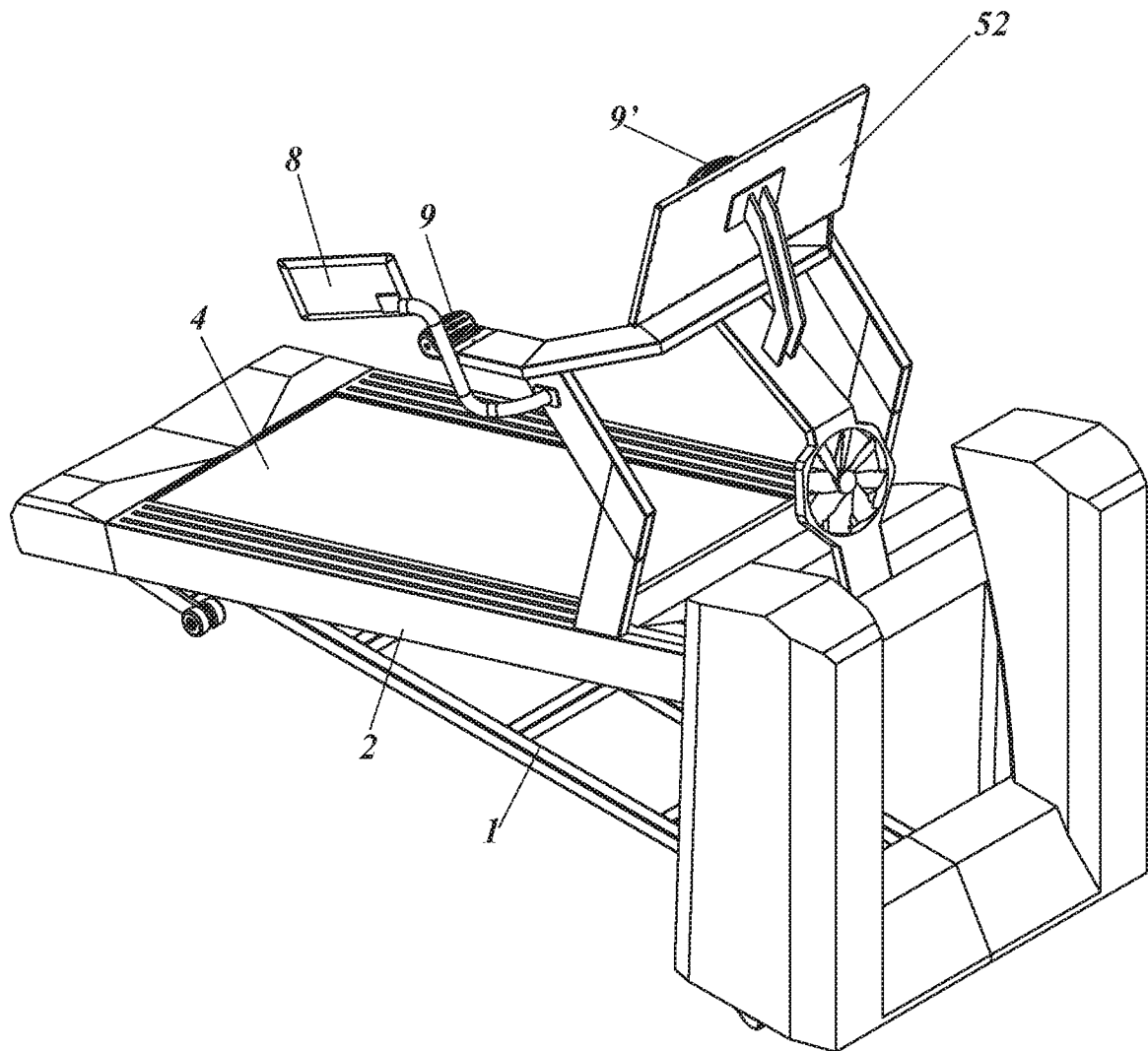
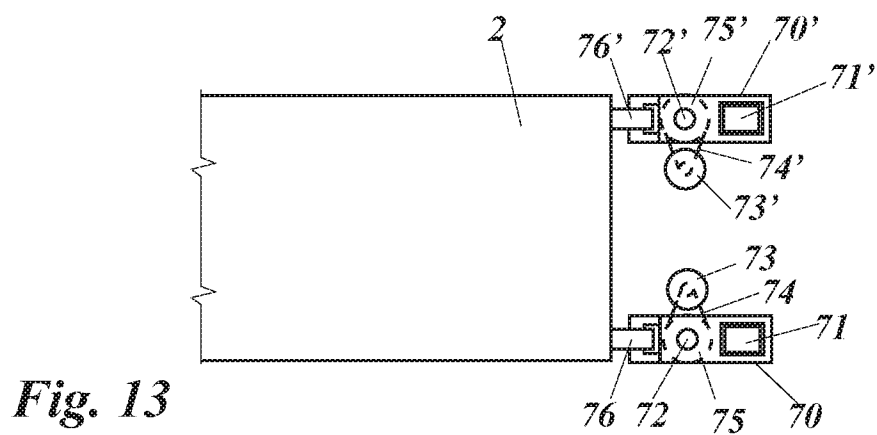
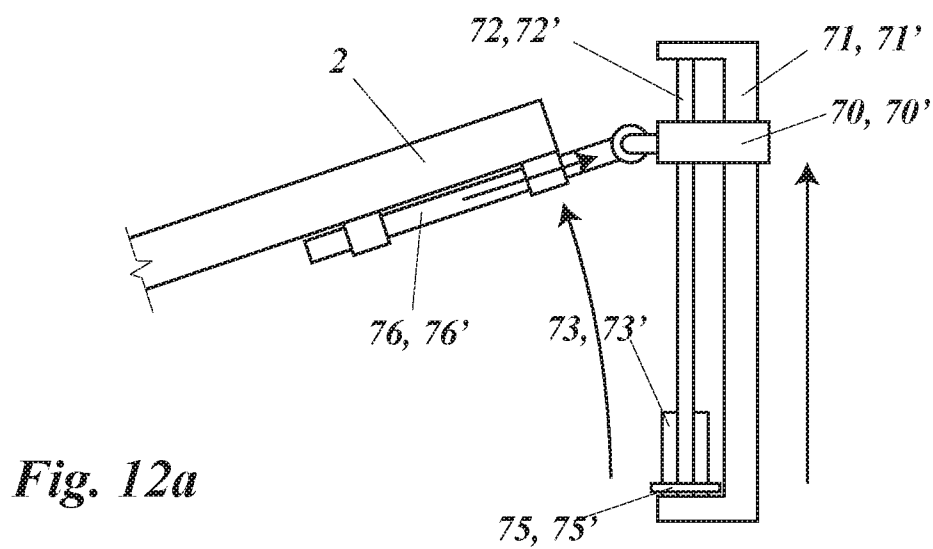
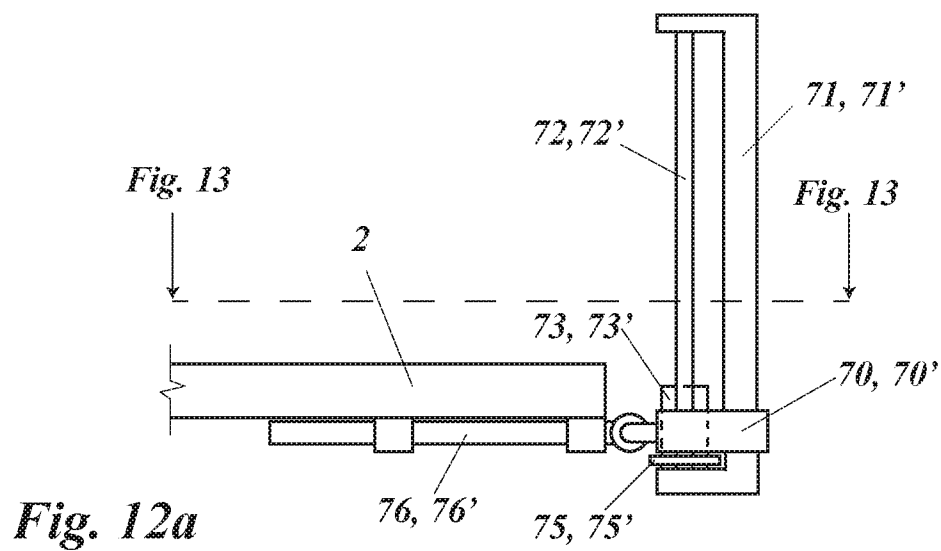


Fig. 11

10/10



INTERNATIONAL SEARCH REPORT

International application No
PCT/N02014/050028

A. CLASSIFICATION OF SUBJECT MATTER
INV. A63B71/06 A63B22/00 A63B22/02 A63B24/00
ADD.

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)
A63B

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)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/248900 A1 (ASHBY DARREN C [US] ET AL) 30 September 2010 (2010-09-30) paragraphs [0035], [0036], [0040] - [0042], [0048] - [0060]; figures 1-9 -----	1,2,7,10
X	WO 2007/061317 A2 (BADARNEH ZIAD [NO]; ELLIS CAMPBELL [NO]; HANSEN BENEDICT J M [NO]) 31 May 2007 (2007-05-31) cited in the application	1,3,5,7-10
A	page 8, lines 15-31 - page 9, lines 1-32 page 10, lines 1-26; figures 13-17 -----	2,4,6
X	US 5 385 519 A (HSU CHI-HSUEH [TW] ET AL) 31 January 1995 (1995-01-31) column 1, lines 66-68 - column 2, lines 1-46; figures -----	1,7,8



Further documents are listed in the continuation of Box C.



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Information on patent family members

International application No

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