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(54) STAIR LIFT

(57) Stairlift comprising:
- at least one rail (1) extending along a track
- a frame (2), suspended on the at least one rail, and comprising:
- a drive, for moving the frame part along the rail;
- a support (7) for a seat (3), in particular rotatably mounted on the frame;
- a seat (3), movable, in particular pivotable, with respect to the frame (2);
- a balancing system, for keeping the seat (3) in a pre-determined orientation with respect to a fixed world;
- a lock (5, 6, 14) for locking the movement of the seat (3) with respect to the frame (2).

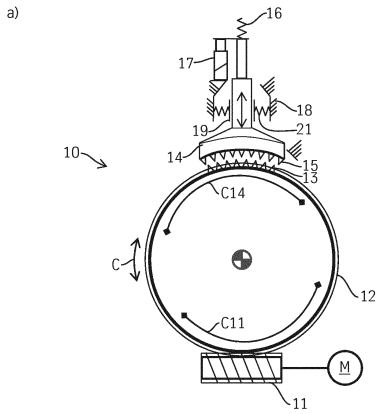

Fig. 5

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Description

[0001] The present invention relates to a stair lift, in particular chair stair lift.

[0002] These devices are known in the art, and serve to provide transportation of a person with impaired stair-climbing mobility up and down the stairs. Such stair lifts are for instance known from the international patent applications WO2014/098573, WO2014/098574 and WO2014/098575 in the name of the same applicant, but other, less refined equivalents exist too.

[0003] These particular stair lifts in general comprise a rail, which forms the track along a stair, which rail may in numerous situations be curved. The seat of the stair lift follows the curved rail, which may lead to some rocking or inclement of the seat during movement. The seat may therewith incline too, which causes the risk of a person sliding off the seat. In order to prevent such unwanted occasion, a provision may be present for balancing the seat. Such provision may be an automated balancing system, with electr(on)ic actuators. These systems are known in the art as well, and the European Patent EP 1037846 in the name of the present applicant, which is herewith incorporated by reference, gives a good overview of the state of the art.

[0004] However, these actuators may unexpectedly refuse or fail, which leads to dangerous situations. In particular the risk of failing is quite high in systems comprising a worm drive for leveling the seat. After years of operation the worm drive may be worn out, so that the worm may suddenly disengage the gear of the worm drive.

[0005] It is therefore an object of the present invention to provide a solution for the above mentioned disadvantages, or at least to provide a useful alternative to the known prior art.

[0006] The invention thereto proposes a stair lift, comprising at least one rail extending along a track, a frame, suspended on the at least one rail, and comprising a drive, for moving the frame along the rail, a support for a seat, movable, in particular pivotable with respect to the support, a balancing system, for keeping the seat in a predetermined orientation with respect to a fixed world and a lock for locking the movement of the seat with respect to the support.

[0007] The locking system prevents the seat to get in undesired angles with respect to the frame, and thus indirectly with respect to the fixed world. It is to be understood that the lock may be a separate part of the stair lift, and not - for instance - just a software routine in the balancing system. In particular, the lock may be a mechanical lock, which, at least in order to activate, does not comprise electronic actuators. In particular the brake is spring biased.

[0008] In an embodiment, the lock is configured to lock the movement of the seat with respect to the frame when the seat is moved more than a predetermined angle. The lock may comprise detection means for detecting that the predetermined angle was reached. In particular these may be mechanical detection means, such as a hole or protrusion.

[0009] The predetermined angle may be defined with respect to the frame, or with respect to the fixed world, and may for instance be 5 or in particular 10 degrees.

[0010] In an embodiment, the lock comprises a latch. Such latch may be spring-biased, and may comprise an actuator for unlocking the actuator. The spring based latch may engage with a hole, positioned such that the latch locks thanks to the spring when the predetermined angle is reached.

[0011] In a preferred embodiment, the lock comprises a brake, which may in particular be a drum brake or a disk brake.

[0012] The lock may further be configured for disabling the balancing system when it is locked, or initiate an immediate correction of the balancing system when the predetermined angle was reached, in order to prevent a person positioned in the locked angle for a long time.

[0013] Preferably, in a locked state the latch is torque proof connected with a counterpart, in particular a gear. The latch may be connected to the frame, and the counterpart may be connected to the seat, or vice versa. Thus in the locked state the frame and the seat are torque proof connected with each other.

[0014] The lock may further be configured for disabling a drive, for moving the frame part along the rail when it is locked, so that no person is moved with the lift while sitting under an angle.

[0015] In a particular embodiment the balancing system comprises a worm drive, having a worm spidle and a worm gear engaging each other. The worm spindle is mounted at the support and driven by a motor. The worm gear is mounted to the seat. The lock comprises an anchor, which can be brought into torque proof engagement with the worm gear, in particular with the worm teeth of the worm gear. The anchor may be attached to the frame.

[0016] In a preferred embodiment the, the worm drive further comprising a worm spindle engaging the worm gear, the worm gear has a at least one first area for exclusively engaging with the worm spindle, the worm gear has at least one second area for exclusively engaging with the latch. This embodiment enables that the same ring gear is used for being engaged by the latch and being engaged by the spindle. Thus merely one standard gear can be used as the worm gear. Nevertheless the teeth of the gear, which are to be engaged by the latch, can not be worn-out by the permanent interaction between the spindle and the gear. Thus in case of emergency the latch interacts with fresh teeth of the gear, enabling a secure safety interaction between the gear and the latch even if the worm gear is worn-out. The first area may be mutually spaced in circumferential direction from the second area, and/or the first area may be mutually spaced in axial direction from the second area.

[0017] Preferably the latch mechanism may be config-

ured as a self-energizing mechanism. That means that in case of engagement of the latch, the force which keeps the latch in its locked state will increase if the seat tends to further deflect from the horizontal orientation (inclination increases).

[0018] In a preferred embodiment, in a locked state the latch is adapted to follow the movement of the counterpart and being biased by the counterpart against a biasing element, in particular a biasing face, the biasing face is adapted to additionally bias the latch into its locked position, in particular in a radial direction to the center of the gear. So the further the seat is deflected from its horizontal position, the further the latch is biased against the biasing face, the further the biasing face biases the latch in direction of the center of the gear and thus into the locked state.

[0019] The invention will now be elucidated into more detail with reference to the following figures, herein:

- Figure 1 shows a stair lift in a desired uninclined position;
- Figure 2 shows a stair lift in a undesired inclined position;
- Figure 3 shows a first embodiment of a brake for the stair lift of figures 1 and 2 in front view;
- Figure 4 shows a second embodiment of a brake for the stair lift of figures 1 and 2 in front view;
- Figure 5 shows a third embodiment of a brake for the stair lift of figures 1 and 2 in a first state of operation;

  a) in front view,
  b) in side view;

- Figure 6 shows the embodiment of figure 5 in a second state of operation;
- Figure 7 shows the embodiment of figure 5 in a third state of operation.

[0020] Figure 1 shows a stair lift in a desired uninclined position. The stair lift comprises a rail 1 extending along a track, a frame 2, suspended on the rail 1, and a drive (not visible), for moving the frame 2 along the rail; a support 7 for a seat 3, which is movable, in particular pivotable with respect to the frame 2. The stair lift 1 comprises a balancing system 4, for keeping the seat in a predetermined uninclined orientation with respect to a fixed world, provided with a lock for locking the movement of the seat with respect to the frame 2. Embodiments of the lock are depicted in figures 3 to 7.

[0021] Figure 2 shows a the stair lift from figure 1 in an undesired inclined position;

[0022] Figure 3 shows a first embodiment of a brake for the stair lift from figures 1 and 2, wherein the brake comprises a drum brake 5.

[0023] Figure 4 shows a second embodiment of a brake for the stair lift from figure 1 and 2, wherein the brake comprises a disk brake 6.

[0024] Figure 5 shows a third embodiment of a brake for the stair lift form figure 1 and 2. The brake comprises a latch 14 in the form of an anchor 14.

[0025] In this embodiment the balancing system 4 comprises a worm drive 10 having a worm spindle 11 and a worm gear 12. The worm spindle 11 is driven by a balancing motor M and is mounted at the frame 2. The spindle 11 is in engagement with the worm gear, which is connected to the seat 3. The further the gear 12 is rotated against the spindle 11 the further the seat 3 is angled against the frame 2.

[0026] The latch 14 is mounted on the frame 2. When the latch 14 engages the gear 12, the seat 3 is rotationally fixed to the frame 2, only a limited turn of approx. 2° may be possible, caused by an optional linear guiding 19, which is pivotably flexible in small amount, as described later with reference to figure 7.

[0027] The latch 14 is biased by a loading spring 16 into a locked position. Figure 5 shows the latch 14 in its unlocked position. For holding the latch 14 in its unlocked position an actuator 17, in particular a solenoid actuator, is provided. In case of emergency the actuator 17 is deactivated, so that the loading spring 16 can urge the latch 14 into its locked position, as illustrated in figure 6. The deactivation can be initiated with the help of an orientation sensor system, e.g. as explained in the European patent application 16154071.1 (not published yet).

[0028] The latch 14 is supported in the housing 18 of the frame 2 by means of a linear guiding 19. The guiding 19 is supported flexibly in the housing 18 by means of centering means 21. The centering means 21 can be realized by springs or by any elastic material, which may produce an elastic counteracting force compression. In figure 7 it is shown that the linear guiding 17 can be deflected in a small amount perpendicular to the main direction (double arrow P, fig. 6) of the linear guiding 19.

[0029] During the locked state the latch 14 can follow the rotational movement of the gear 12 (see figure 7). To stop this movement after certain degrees of movement a biasing face 20 is provided, against which the latch 14 is biased during following. The biasing face 20 is inclined radially towards the center of the gear 12, so that upon contact between the latch 14 and the biasing face 20 the latch 14 is biased against the gear 12, additionally to the loading force of the loading spring 16. So the brake is in this embodiment designed self-energizing using of the weight of the seat including any load sitting on the seat.

List of reference signs

[0030]

1	rail
2	frame
3	seat
4	balancing system
5	drum brake
6	disc brake

7 support

10 worm drive
11 worm spindle
12 worm gear
13 teeth on gear
14 anchor
15 teeth on anchor
16 loading spring
17 actuator
18 housing
19 linear guiding
20 biasing face
21 centering spring

M leveling motor
C circumferential direction
C11 first circumferential area (engagement between worm and gear)
C14 second circumferential area (engagement between anchor and gear)
X11 first axial area (engagement between worm and gear)
X14 second axial area (engagement between anchor and gear)

Claims

1. Stairlift comprising:

- at least one rail (1) extending along a track
- a frame (2), suspended on the at least one rail, and comprising:
- a drive, for moving the frame part along the rail;
- a support (7) for a seat (3), in particular rotatably mounted on the frame;
- a seat (3), movable, in particular pivotable, with respect to the frame (2);
- a balancing system, for keeping the seat (3) in a predetermined orientation with respect to a fixed world;
- a lock (5, 6, 14) for locking the movement of the seat (3) with respect to the frame (2), wherein the lock comprises a latch (14), wherein in a locked state the latch (14) is torque proof connected with a counterpart (12), in particular a gear (12), wherein the latch (14) is spring-biased,

characterized in

that a latch mechanism is configured as a self-energizing mechanism,
wherein the latch mechanism is configured in a way, that in the locked state a force, which keeps the latch in its locked state, is increasing if the seat tends to further deflect from the horizontal orientation.

2. Stairlift according to claim 1,
wherein the lock (5, 6, 14) is configured to lock the movement of the seat (3) with respect to the frame (2) when the seat is moved more than a predetermined angle.

3. Stairlift according to claim 2,

wherein the predetermined angle is defined with respect to the frame or wherein the predetermined angle is defined with respect to the fixed world,
or wherein the predetermined angle is 5 degrees, in particular 10 degrees.

4. Stairlift according to the preceding claim,
wherein the latch (14), is adapted to be brought into engagement with a gear (12) as counterpart, in particular a worm gear (12) of a worm drive (10) for balancing the seat.

5. Stairlift according to the preceding claim,

wherein the gear (12) is a worm gear of a worm drive (10), the worm drive further comprising a worm spindle (11) engaging the worm gear (12), the worm gear (12) has at least one first area (C11, X11) for exclusively engaging with the worm spindle (11),
the worm gear (12) has at least one second area (C14, X14) for exclusively engaging with the latch (14).

6. Stairlift according to the preceding claim,

wherein the first area (C11) is mutually spaced in circumferential direction from the second area (C14),
and/or
wherein the first area (X11) is mutually spaced in axial direction from the second area (X14).

7. Stairlift according to any of the preceding claims,
wherein in a locked state the latch (14) is adapted to follow the movement of the counterpart (12) and being biased by the counterpart (12) against a biasing element (20), in particular a biasing face (20), which is adapted to additionally bias the latch (14) into its locked position, in particular in a radial direction of the center of the gear (12).

8. Stairlift according to any of the preceding claims,
wherein the locking mechanism is a brake, in particular a drum brake (5) or disc brake (6).

9. Stairlift according to any of the preceding claims,
comprising an actuator (17) for unlocking the latch (14).

10. Stairlift according to any of the preceding claims, wherein the lock is configured for disabling the balancing system when it is locked.

11. Stairlift according to any of the preceding claims, wherein the lock is configured for disabling a drive, for moving the frame part along the rail when it is locked.

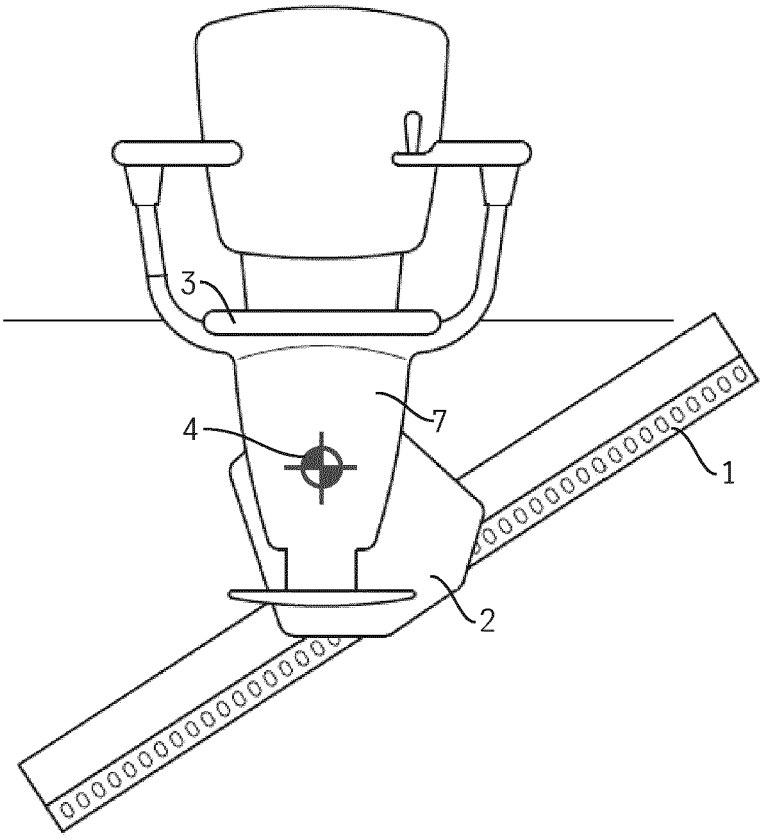


Fig. 1

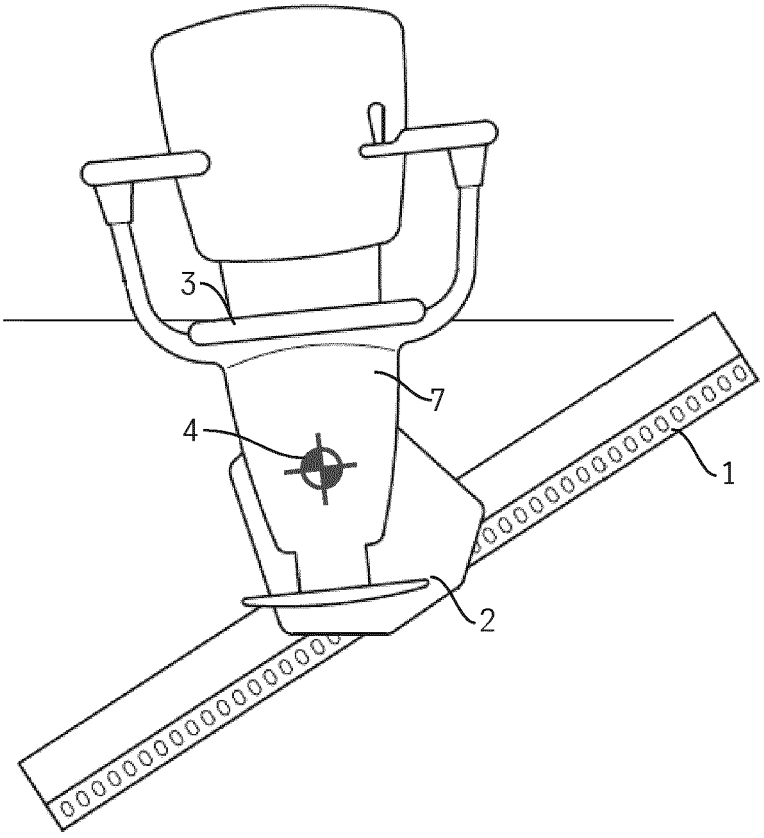


Fig. 2

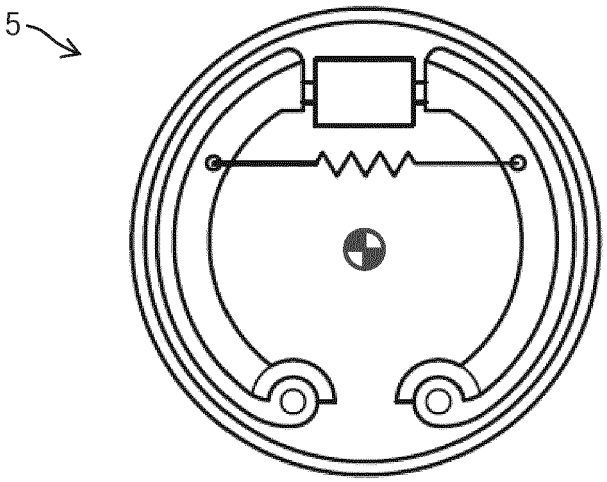


Fig. 3

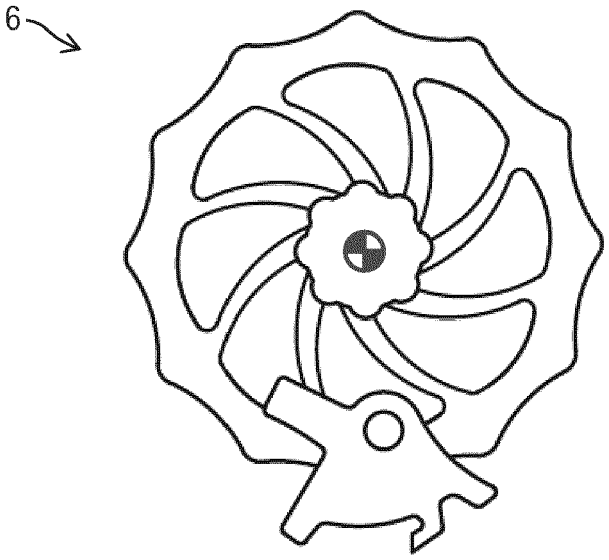
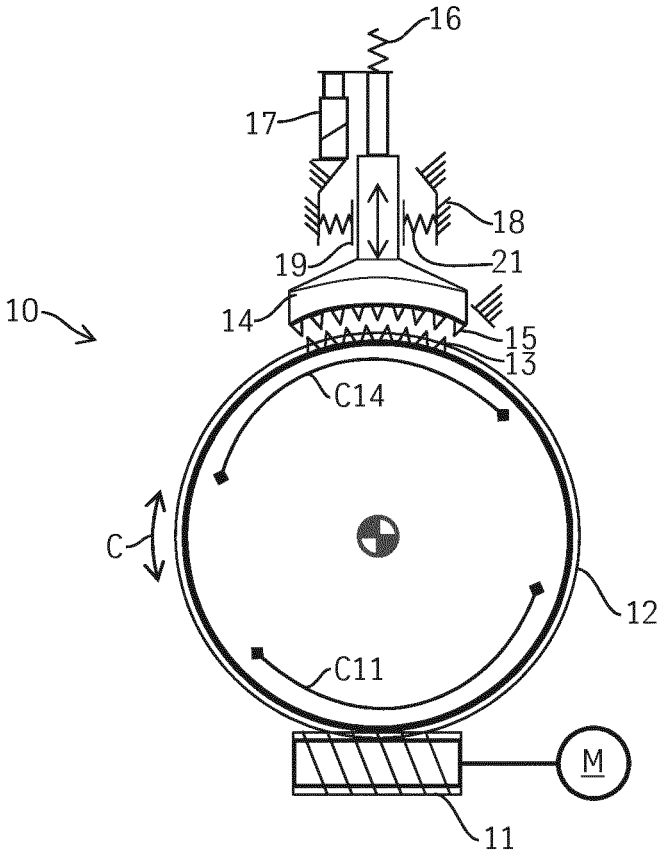


Fig. 4

a)



b)

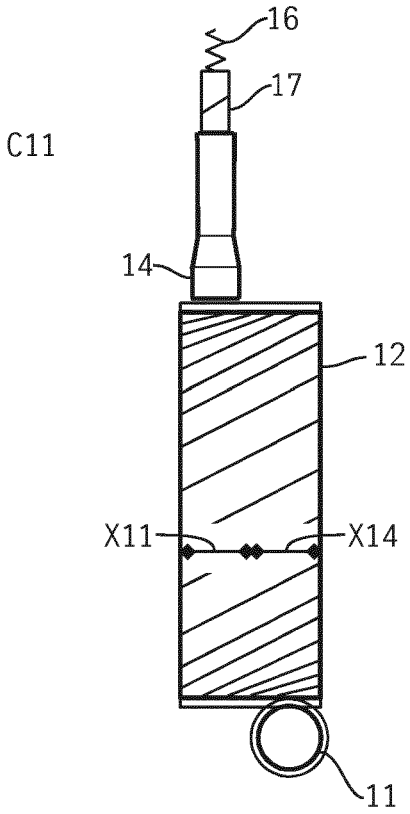


Fig. 5

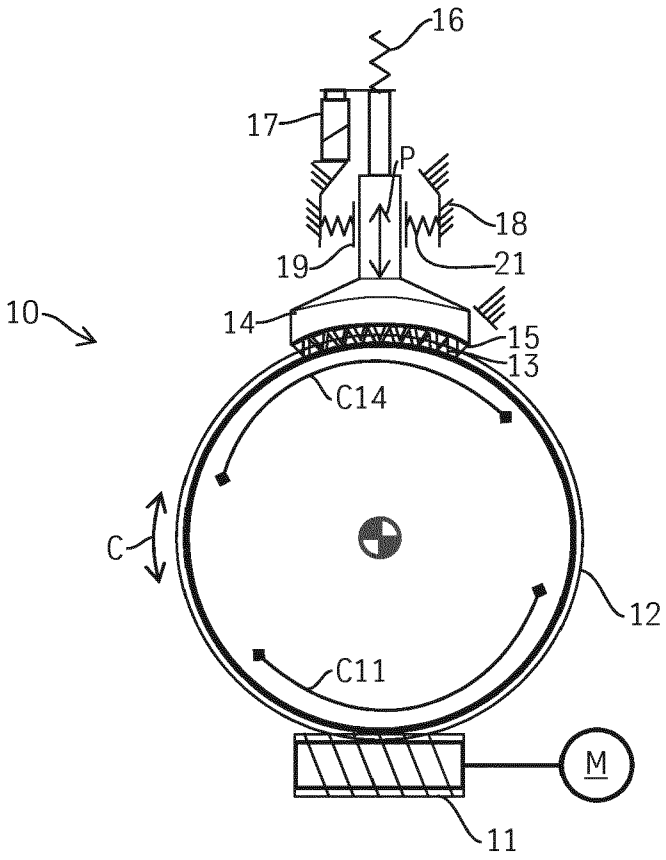


Fig. 6

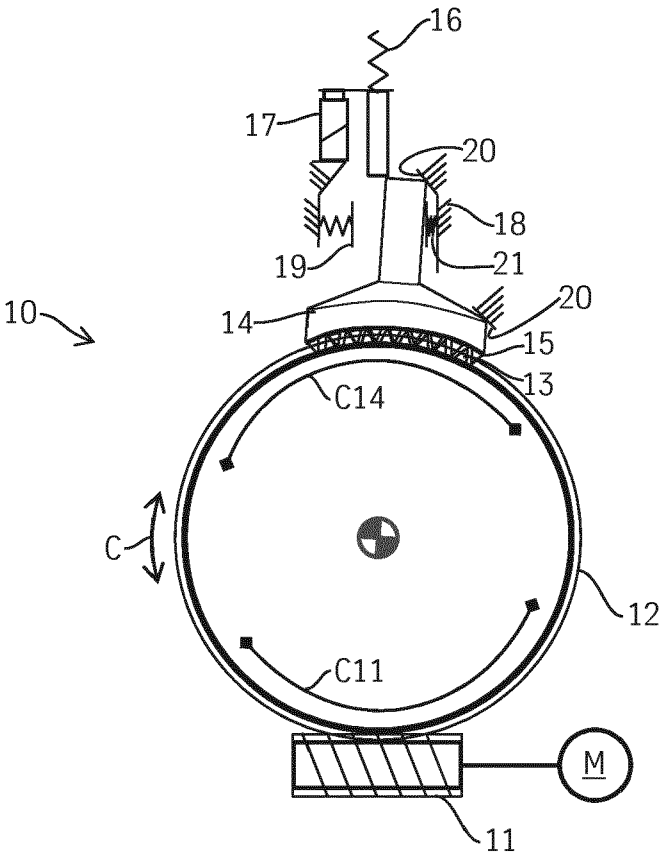


Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2014098573 A **[0002]**
- WO 2014098574 A **[0002]**
- WO 2014098575 A **[0002]**
- EP 1037846 A **[0003]**
- EP 16154071 **[0027]**