Abstract: The invention concerns an apparatus for preventing creep of an elevator car (1) . The elevator car (1) is suspended on a set of hoisting ropes (3) and adapted to move in a substantially vertical direction along guide rails (4) in an elevator shaft as controlled by a control system (8) . The speed of the elevator car (1) is controlled by means of a speed limiter (10) , and the anti-creep apparatus is placed in conjunction with the speed limiter (10) . The anti-creep apparatus comprises at least an anti-creep disc (15) adapted to be rotatable and a solenoid (18) , which solenoid (18) is arranged to stop the anti-creep disc (15) during a creeping movement of the elevator car (1) . After the anti-creep disc (15) has stopped, it stops the speed limiter (10) by causing wabblers (23) to engage a brake disc (16) . Having stopped, the speed limiter (10) pulls the safety gear (13) into engagement with a guide rail (4) , stopping the movement of the elevator car (1) .
The present invention relates to an apparatus as defined in the preamble of claim 1 for preventing creep of an elevator car.

When an elevator car is standing at a landing, e.g. in a loading situation, it may start moving gradually downwards from the floor level if the friction between the elevator hoisting ropes and the rope grooves of the traction sheave is not sufficient to keep the elevator car stationary. Such undesirable motion, which is also known as creep, may be a consequence of e.g. overload in the elevator car, and if there is nothing to stop the creep, the elevator car may move even several meters downwards. Creep may cause dangers to passengers and is not allowed according to elevator regulations.

In prior art, to prevent downward creep of an elevator car, various anti-creeping devices have been used. In these solutions, when the elevator car is at a landing, it is locked in place by having it held e.g. by a guide rail or the hoisting ropes by means of a suitable device, such as a rail brake, cable brake, cam pawl or safety gear, thus preventing the elevator car from moving downwards. Before the elevator departs, the anti-creeping device is released and the elevator car is again free to move.

An anti-creeping device preventing creep of the elevator car can also be placed in conjunction with the speed limiter of the elevator, as is done in the solution disclosed in European patent specification no. EP10651564, which uses a mechanism locking the speed limiter cable. However, a problem with prior-art solutions like this is that they do not allow the elevator car to be accurately leveled at a landing. A further problem with the solution according to the above-mentioned patent specification no. EP1065164 is that it cannot be used while the elevator is being installed, but during installation it is necessary to use some other speed limiter and the
installation-time speed limiter is only replaced with a speed limiter according to the patent specification at the final stage of installation. Another problem with the speed limiter according to this solution is that it is expensive as well as large in size and therefore takes up plenty of space in the elevator shaft.

In addition, in prior-art elevator solutions, to be on the safe side, the elevator car is so dimensioned that the elevator car can only accommodate a maximum load such that the total weight of the elevator car and the load is not likely to exceed the overload limit for the elevator and the elevator car can thus not creep downwards. This solution has the drawback that, because the surface area of the car has been reduced due to the overload limit, elevators of this type cannot be used to transport loads of voluminous size but relatively light in weight.

The object of the present invention is to overcome the above-mentioned drawbacks and to create a reliable apparatus for preventing creep of an elevator car, and apparatus that is economical in cost, easy to install and safe in operation. The apparatus of the invention is characterized by what is presented in the characterization part of claim 1. Other embodiments of the invention are characterized by what is disclosed in the other claims. Certain other embodiments of the invention are characterized by what is presented in the other claims. Inventive embodiments are also discussed in the description part of the present application. The inventive content disclosed in the application can also be defined in other ways than is done in the claims below. The inventive content may also consist of several separate inventions, especially if the invention is considered in the light of explicit or implicit sub-tasks or with respect to advantages or sets of advantages achieved. In this case, some of the attributes contained in the claims below may be superfluous from the point of view of separate inventive concepts. Fea-
tuxes and details of different embodiments and examples of the invention can be applied in conjunction with each other.

The solution of the invention has the advantage that it allows the elevator car to be accurately leveled with the landing. After the elevator has stopped, the apparatus allows the car to move through a predetermined distance, such as e.g. 100 mm in either direction, and thus the elevator car can be brought exactly level with the landing. The solution also has the advantage that the apparatus can be used even during installation of the elevator, thus both facilitating and speeding up the installation process. A further advantage is that the apparatus is of economical cost and small in size, permitting the anti-creep device of the invention to be easily mounted even in narrow elevator shafts or other placements. Using the invention, it is also easy to prevent the elevator car from sliding off from the landing level, and in addition the invention makes it possible to use the gripping function of the safety gear to replace the anti-leak device of hydraulic elevators or to achieve a corresponding function in an elevator without counterweight. In the solution of the invention, the functional elements of the device only receive relatively small forces and can thus be designed to be light, economical and reliable. The invention is applicable for use in several speed limiter types, and it can be applied both in elevators having a safety gear gripping in only one direction and in elevators having a safety gear gripping in either direction. The device of the invention can be tripped by remote control at normal speed e.g. in situations where correct operation of the speed limiter has to be verified by testing.

In the following, the invention will be described in detail by referring to an embodiment example and the attached drawings, wherein
Fig. 1 presents a diagrammatic and simplified side view of an elevator without counterweight in which an apparatus according to the invention is used,

Fig. 2 presents a diagrammatic and partially sectioned view of the apparatus of the invention as seen in the direction of Fig. 1 when the anti-creep function is not activated,

Fig. 3 presents a diagrammatic and partially sectioned view of the apparatus of the invention as seen in the direction of Fig. 1 when the anti-creep function is activated, and

Fig. 4 presents a diagrammatic and partially sectioned view of the apparatus of the invention as seen in the direction of the plane of rotation of the speed limiter.

Fig. 1 presents a diagrammatic and simplified view of a traction sheave elevator without counterweight applying the apparatus of the invention, comprising at least an elevator hoisting machine 5 with a hoisting motor, a traction sheave 6, an elevator control system 8 and an elevator car 1 mounted inside a car frame 2 and moving along guide rails 4 in a substantially vertical direction, being suspended on a set of hoisting ropes 3. The first end of the set of hoisting ropes 3 is secured to the upper part of the car frame 2, from where the ropes are passed over the traction sheave 6 and after that under a diverting pulley 7 comprised in the hoisting machine 5 and further a second time over the traction sheave 6 and then under a diverting pulley 9 mounted on the bottom of the elevator shaft, from where the ropes are passed to the lower part of the car frame 2, to which the second end of the hoisting ropes 3 is secured. The elevator receives its hoisting power from the hoisting machine 5 by virtue of the friction between the traction sheave 6 and the hoisting ropes 3.

The suspension of the elevator car in Fig. 1 is a simplified suspension structure for an elevator without counterweight. Often the hoisting rope 3 is passed via several diverting
pulleys, a suspension ratio of desired magnitude being thus obtained.

The apparatus of the invention is integrated with the elevator's speed limiter 10, which in the embodiment presented in the example is mounted in the upper part of the elevator shaft. The speed limiter cable 11 is secured by its first end to a safety gear 13 placed in the lower part of the elevator car frame 2. From the safety gear 13, the cable 11 is passed over the pulley of the speed limiter 10 and from there under a diverting pulley 12 mounted on the bottom of the elevator shaft, from where it is further passed to the safety gear 13, to which the second end 11 of the cable 11 is likewise secured. The speed limiter 10 functions in such a way that, when the elevator car 1 is moving downwards at an excessive speed, the limiter stops the motion of the cable 11, with the result that, while the elevator car is still moving, the stopped cable 11 pulls the wedges of the safety gear 13 into engagement with the guide rail 4, the movement of the elevator car 1 being thus stopped as well. The idea of the solution of the invention is to prevent creep of the elevator car 1 by the same method. If the elevator car 1 moves downwards or upwards through a predetermined distance, e.g. 100 mm when standing at a landing, then the speed limiter 10 will stop the motion of the cable 11, causing the safety gear 13 to engage and the safety gear wedges to stop the movement of the elevator car 1.

Fig. 2 presents a diagrammatic and simplified front view of the apparatus of the invention and its most important parts in greater detail. The apparatus is integrated with the speed limiter 10, which comprises at least a central axle 21 rotating in a substantially horizontal plane and a circular carrier plate 25 adapted to revolve about the axle 21, with a two-part supporting disc 14 attached to the front side of the carrier plate. The supporting disc 14 is of circular form and it has a central opening, inside which is placed a brake disc.
16 mounted on the axle 21. Provided at the edges of the supporting disc 14 are also substantially circular openings placed symmetrically on opposite sides. Placed inside these openings are wabblers 23, which are secured to the carrier plate 25 by axles 23a so as to be rotatable about the axles 23a. These openings communicate with the opening for the brake disc 16 in the supporting disc 14 and also extend across the circumference of the supporting disc 14, thus dividing the supporting disc 14 into two substantially symmetrical parts.

Placed on the front side of the brake disc 16 is an anti-creep disc 15 forming a substantial part of the apparatus of the invention and likewise fitted to be rotatable about the central axle 21. The anti-creep disc 15 is also circular and substantially co-radial as well as coaxial with the brake disc 16. The outer edge of the anti-creep disc 15, near the rim, is provided with round holes 15a disposed at substantially close and even distances from each other. These holes 15a function as couplers and are each placed at an equal distance from the center of the anti-creep disc 15. Secured by their first ends to the outer edge of the anti-creep disc 15 are two levers 24 likewise placed symmetrically relative to the central axis of the anti-creep disc 15, the second ends of these levers being fastened to the wabblers 23.

On the front side of the anti-creep disc 15 is a plate-like supporting structure 17, which is fixedly attached to the supporting structures of the speed limiter 10 or to some other suitable structure. The supporting structure 17 is provided with a hole for the axle 21, the end of the axle 21 being placed in said hole. The supporting structure 17 is provided with a slot 22 of semi-circular shape and symmetrical relative to the perpendicular, the radius of this slot being substantially equal to the radius of the row of holes consisting of holes 15a from the central axle 21. The slot 22 is disposed in alignment with the anti-creep disc 15 in such
a way that some of the holes 15a in the anti-creep disc 15 are visible through the slot 22. Via dimensioning of the slot 22, it is possible to define the allowed creeping distance of the elevator car 1. A slot 22 of semi-circular length would allow the anti-creep disc 15 to turn during the locking stage through an angle of 90°, which corresponds to a certain creeping distance. In the case of the example, the slot 22 is so dimensioned that the turning angle of the anti-creep disc 15 is somewhat less than 90°. Depending on the dimensioning, the turning angle may also be larger than 90° before the speed limiter 10 becomes locked.

Placed on the front side of the supporting structure 17 is a supporting arm 20, which hangs on the axle 21 in a substantially vertical position due to the gravitational force of the earth. Secured to the lower end of the supporting arm 20 is a solenoid 18 connected to the elevator control system 8. The solenoid is so placed that the solenoid rod 19 goes in a substantially horizontal position through the slot 22 in the supporting structure 17. The length and diameter of the solenoid rod 19 are so designed that the outer end of the rod 19 can be inserted into a hole 15a in the anti-creep disc 15.

Placed on the axle 21 behind the carrier plate 25 is also the pulley of the speed limiter 10, around which the speed limiter cable 11 runs. Thus, when the elevator is moving, the cable 11 imparts rotation to at least the carrier plate 25, the supporting disc 14 and the anti-creep disc 15. During normal operation, the solenoid 18 hangs immovably on the supporting arm 20. When the elevator car stops at a landing, the solenoid 18 is activated by the elevator control system and its rod 19 comes out through the slot 22 and goes in through a hole 15a in the anti-creep disc 15 that happens to be in alignment with it. The solenoid 18 is thus coupled to move with the anti-creep disc 15. Before the elevator starts moving again in the normal manner, the solenoid rod 19 is pulled back in. However, if the elevator car 1 starts creep-
ing downwards while at the landing, then the supporting arm 20 will start turning with the anti-creep disc 15 since the solenoid rod 19 is engaged in one of the holes 15a in it. When the elevator car 1 has moved downwards through a sufficient distance, the solenoid rod 19 will meet the end 22a of the slot 22 in the supporting structure 17 which forms a back stop, stopping the rotational motion of the anti-creep disc 15. What happens after this is explained in the description of Fig. 3.

Fig. 3 presents a diagrammatic and partially sectioned front view of the apparatus of the invention and its most important parts with the anti-creep function in activated state. When the solenoid rod 19 stops at the back stop end 22a of the slot 22, the rotary motion of the anti-creep disc 15 is stopped while the other discs of the speed limiter 10 continue rotating as the elevator car 1 is creeping downwards. Since the anti-creep disc 15 is not rotating and the wabblers 23 are moving with the rotating carrier plate 25, the levers 24 fastened by their first ends to the anti-creep disc 15 cause the wabblers 23 to turn towards the brake disc 16. When the elevator car 1 has moved through the predetermined creeping distance, the wabblers 23 engage the brake disc 16 and stop the brake disc 16 as well as the speed limiter 10 pulley secured to the brake disc, with the result that the speed limiter cable 11 also stops and pulls the wedges of the safety gear 13 into engagement with the guide rail 4, the motion of the elevator car 1 being thus stopped.

Fig. 4 presents a diagrammatic and partially sectioned view of the apparatus of the invention as seen in the direction of the plane of rotation of the speed limiter 10. On the left-hand side of the figure one can see the carrier plate 25, with the supporting disc 14 and wabblers 23 mounted on its front side. The brake disc 16 is placed inside the supporting disc 14 on the axle 21 and fastened to the carrier plate 25, the brake disc 16 thus rotating with the carrier plate 25.
Placed likewise on the axle 21 on the front side of the brake disc 16 is the anti-creep disc 15, to which are fastened the levers 24, whose second ends are secured to the wabblers 23. Placed on the front side of the anti-creep disc 15 is the solenoid 18 hanging on the supporting arm 20. In the situation illustrated in Fig. 4, the solenoid 18 is in an activated state and its rod 19 has moved in through one of the holes in the anti-creep disc 15.

It is obvious to a person skilled in the art that the invention is not exclusively limited to the example described above, but that it may vary within the scope of the scope of the claims presented below. Thus, for example, instead of being used in an elevator without counterweight, the apparatus of the invention may just as well be used in an elevator with counterweight.

It is also obvious to a person skilled in the art that the holes 15a serving as couplers of the anti-creep disc 15 can be replaced with couplers of other types. The couplers may be e.g. radial openings or rod-like protrusions or other corresponding elements functioning as couplers in the anti-creep disc 15, in which case the end of the solenoid rod is shaped correspondingly.

It is further obvious to a skilled person that the plate-like supporting structure may be different from the structure described in the example. Likewise, a slot 22 of expressly semi-circular form is not necessarily needed, but it is sufficient to have a back stop provided for the solenoid rod 19 to stop the rod. It is also obvious to a person skilled in the art that the solenoid 18 may be any electric device applicable for the purpose.
CLAIMS

1. Apparatus for preventing creep of an elevator car (1), said elevator car (1) being suspended on a set of hoisting ropes (3) and adapted to move in a substantially vertical direction along guide rails (4) in an elevator shaft as controlled by a control system (8), the speed of the elevator car (1) being controlled by means of a speed limiter (10) provided with a pulley, and said anti-creep apparatus being placed in conjunction with the speed limiter (10), characterized in that the apparatus comprises at least an anti-creep disc (15) adapted to be rotatable and a solenoid (18), which solenoid (18) is arranged to stop the anti-creep disc (15) during a creeping movement of the elevator car (1), and which anti-creep disc (15) is arranged to stop the pulley of the speed limiter (10) after it has itself stopped.

2. Apparatus according to claim 1, characterized in that the anti-creep disc (15) is provided with couplers (15a) revolving with the anti-creep disc (15), and that the rod (19) of the solenoid (18) is adapted to engage one of the couplers (15a) when the elevator car is at a landing, said solenoid (18) being thus coupled to move with the anti-creep disc (15).

3. Apparatus according to claim 1 or 2, characterized in that the couplers (15a) are a set of equally spaced holes of equal size radially fitted in the anti-creep disc (15) at substantially the same distance from the center of the anti-creep disc (15).

4. Apparatus according to claim 1, 2 or 3, characterized in that the apparatus comprises at least one back stop (22a), against which the solenoid (18) rod (19) engaged in the hole (15a) of the anti-creep disc (15) has been arranged to stop during the creeping movement of the elevator car (1).
5. Apparatus according to any one of the preceding claims, characterized in that the apparatus comprises a speed limiter (10) provided with at least wabblers (23) and a brake disc (16), and that the apparatus comprises levers (24) arranged as transmitting elements actuated by the anti-creep disc (15) after it has itself stopped to bring the wabblers (23) into engagement with the brake disc (16) and to stop the said brake disc (16).

6. Apparatus according to any one of the preceding claims, characterized in that the levers (24) are secured by their first ends to the anti-creep disc (15) and by their second ends to the wabblers (23).

7. Apparatus according to any one of the preceding claims, characterized in that the solenoid (18) is suspended by an arm (20) on the central axle (21) of the speed limiter (10) so as to be turnable relative to the central axle (21).

8. Apparatus according to any one of the preceding claims, characterized in that the apparatus comprises a plate-like supporting structure (17), which is provided with a semi-circular slot (22) in which the rod (19) of the solenoid (18) is arranged to move, the ends of said slot (22) being arranged to serve as back stops (22a) to stop the turning movement of the rod (19) of the solenoid (18) about the central axle (21).

9. Apparatus according to any one of the preceding claims, characterized in that the solenoid (18) is connected to the control system of the elevator and arranged to be activated when the elevator car (1) stops at a landing.
A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC 8 : B66B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Fl, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.

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* Special categories of cited documents:
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Date of the actual completion of the international search


Date of mailing of the international search report

15 January 2007 (15.01.2007)

Name and mailing address of the ISA/FI

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