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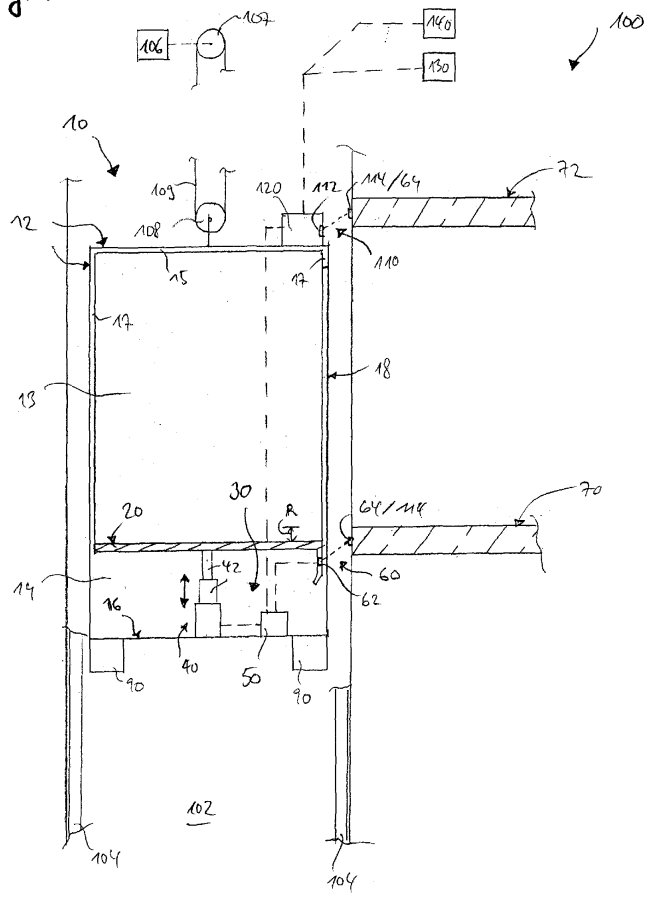
(54) Elevator car, elevator comprising such an elevator car and method for controlling an elevator car

(57) The invention relates to an elevator car (10) comprising a support (20) for a payload to be transported by the elevator car (10) and a support levelling system (30) for levelling the support (20) independently from the elevator car (10). Furthermore, the invention relates to an elevator comprising such an elevator car and a method for controlling such an elevator car.

Fig.1



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Description

[0001] The invention relates to an elevator car comprising a support for a payload to be transported by the elevator car and to an elevator comprising such an elevator car. Furthermore, the invention relates to a method for controlling such an elevator car.

[0002] A conventional traction elevator comprises a brake located in the hoisting machine in the machine room or in the shaft top. Normally, a further safety brake or safety gear is located on the elevator car. Such a brake and safety system is known from EP 0 183 616 A2. Furthermore, US 5,033,587 discloses an elevator system comprising a braking means disposed upon an elevator car for stopping the car and an auxiliary braking device disposed upon a counterweight for preventing inertial travel thereof. In detail, the braking means is mounted on the bottom of the car for stopping the car at a floor upon request or in an emergency. Furthermore, by providing an auxiliary braking device in the counterweight, overrun of the counterweight is minimized.

[0003] However, very often after landing it is necessary to open and close the main elevator brake in order to stop the elevator car exactly at a height level substantially identical to the landing floor level (due to control inaccuracies or changing car payload). Thus, it is necessary to open and close the main brake several times until the car is in the correct level. This braking procedure is laborious and jerky.

[0004] It is an object of the invention to improve the landing operation of an elevator car and the passengers' comfort.

[0005] According to the present invention an elevator car comprising a support for a payload to be transported by the elevator car is characterized by a support levelling system for levelling the support independently from the elevator car. Thus, it is not necessary to open and close the main brake several times. In this way a substantially jerk-free and safer levelling or re-levelling and almost perfect landing accuracy is achieved. Especially a platform supporting the passengers can be levelled to bring this platform within a predetermined level range.

[0006] Preferred embodiments of the elevator car according to the invention are described in claims 2 to 15.

[0007] In one such preferred embodiment the support levelling system is equipped for moving or levelling the support in a predetermined levelling range. Preferably, this levelling range is about 200 mm, especially about 100 mm.

[0008] According to a preferred embodiment the support levelling system is mounted inside a casing of the elevator car, especially in an area between the support and the casing. However, it is also possible to mount the support levelling system in an upper area of the casing of the elevator car, for example above a ceiling of the car or on a frame of the car.

[0009] In another preferred embodiment the support levelling system comprises a support drive for moving and/or levelling the support. The support drive can be electric, hydraulic or pneumatic drive. For example, the support drive comprises at least one, preferably four, linear motors and/or at least one piston.

[0010] In order to compensate vibrations during travelling and/or landing operation of the elevator car a damping unit can be provided. This damping unit can be integrated into or linked to the support drive.

[0011] In a further embodiment the support position system for determining the support position relative to a fixed level, especially relative to a landing floor, is provided. Such a support position system can comprise at least one sensor mounted to the car, especially to the support. Furthermore, an accelerometer can be useful for sensing the acceleration or speed of the movement of the support. Preferably, the support is a platform arranged inside the elevator car.

[0012] In a further embodiment a support drive control is connected with the support drive for controlling the support drive. Hence, the support levelling system can be operated independently from the elevator car. Furthermore, the support position system can be connected with the support drive control.

[0013] Furthermore, a car brake can be mounted to, on or in the car for stopping the elevator car in normal service and/or in emergency situations, for example as a safety gear.

[0014] According to the present invention an elevator comprises an elevator car according to one of the claims 1 to 15. Preferred embodiments of the elevator according to the invention are described in claims 17 to 20.

[0015] In a preferred embodiment the elevator comprises an elevator car brake, wherein the support levelling system for levelling the support is independent from the elevator car brake. The elevator car brake can be mounted to, on or in the car for engaging or disengaging guide rails in order to stop the elevator car in normal service and/or in emergency situations. In other words, the elevator car brake has the two functions to open and close as a standard brake during normal service and to close as a standard safety gear during emergency conditions. However, no exact landing accuracy is necessary for the elevator car brake, as this fine levelling is performed by means of the support levelling system according to the invention.

[0016] In a further preferred embodiment a car position system comprises a car controller, a main electric drive or frequency converter and a main elevator controller.

[0017] According to another embodiment, the elevator comprises several landing floors and a support position system for determining the support position relative to the landing floors, wherein the support position system comprises at least one sensor mounted to the elevator car and several receivers each mounted to a landing floor. The sensor can be equipped for detecting both the support position and the car position.

[0018] In a method according to the invention for controlling an elevator car having a support for a payload to

be transported by the elevator car, a support levelling system levels the support independently from the elevator car. Preferably, the support levelling system is driven and/or stopped independently from the elevator car. Preferred embodiments of the method according to the invention are described in claims 22 to 30.

[0019] In a preferred embodiment of the method, the support levelling system is equipped for moving/levelling the support in a predetermined levelling range. The support levelling system can be moved by means of a support drive. Preferably, the support is moved within a levelling range of about 200 mm, especially within a levelling range of about 100 mm. Furthermore, the support can be moved within an area inside a casing of the elevator car, especially in an area between the support and the casing.

[0020] In a further preferred embodiment a damping unit compensates vibrations occurring during travelling and/or landing of the elevator car.

[0021] In another preferred embodiment a support position system determines the support position relative to a fixed level, especially relative to a landing floor.

[0022] Furthermore, an accelerometer can sense the acceleration or speed of the support.

[0023] According to a further embodiment a support drive control connected with the support drive controls operation of the support drive. Furthermore, the support position system can communicate with the support drive control. In another preferred embodiment an elevator car brake stops the elevator car in normal service and/or in emergency situations.

[0024] In the following the invention is further described with reference to Fig. 1, which shows an elevator 100 with an elevator car 10 movably along guide rails 104 and mounted within a shaft 102 of a building. The building comprises several landing floors, inter alia landing floors 70, 72. In a machine room on the top of the shaft 102 an elevator car drive 106 having a traction pulley 107 is mounted. Furthermore, the elevator drive system in Fig. 1 shows a guide pulley 108 and a traction belt 109.

[0025] The elevator car 10 comprises a casing 12 supported by a frame (not shown), wherein the casing 12 includes a ceiling 15, a bottom 16, walls 17 and a car door 18. Furthermore, the car 10 has a support 20 in the form of a platform for the payload to be transported by the elevator car 10. This platform divides the space enclosed by the casing 12 into an upper area 13 and a lower area 14.

[0026] Furthermore, a support levelling system 30 is provided in order to level or move the support 20 in a specific levelling range R. Thus, the support 20 can be levelled independently from the elevator car 10. To raise and lower the platform the support levelling system 30 comprises a support drive 40, for example a telescopic piston 42.

[0027] Furthermore, the elevator car 10 comprises a support drive control 50 and a support position system 60. The support position system 60 comprises a sensor 62 integrated in the support platform and a receiver 64 mounted on each landing floor 70, 72. Sensor 62 and receiver 64 communicate with each other and with the support drive control 50 in order to determine the position of the support 20 relative to the landing floor level 70.

[0028] In case that the difference between the height of the surface of the support 20 and the height of the surface of the landing floor 70 is not within the predetermined levelling range R, for example +/- 50 mm far from the receiver's height, the support drive control 50 initiates a signal to the support drive 40 in order to move the platform 20 in a direction to bring the surface of the support 20 within the levelling range, especially to the exact landing height of the landing floor 70.

[0029] In order to determine the position and/or height of the elevator car 10 within the shaft 102, the elevator system of Fig. 1 further comprises a car position system 110 having a sensor 112 mounted to the casing 12 of the car 10 and receivers 114 mounted along the shaft 102, for example at the landing floors 70, 72. As indicated in Fig. 1, it is possible to combine the functions of sensors 62 and 112 and/or of receivers 64 and 114 or to mount both to the landing floors 70, 72.

[0030] Furthermore, the car position system 110 comprises a car control unit 120, a main electric drive and/or frequency converter 130 and a main elevator controller 140. Based on this car position system 110, the "raw" car position can be derived from the main motor relative distance. The raw car positioning algorithm is distributed and achieved by a "triangulation" between car control unit 120, main electric drive or frequency converter 130 and main elevator controller 140. In other words, the car position system 110 serves as a "raw" levelling system, whereas the system 30 serves as a "fine" levelling system.

[0031] In order to stop the elevator car 10, a car brake 90 is mounted to the bottom 16 of the casing 12. The car brake 90 engages or disengages the guide rails 104. The car brake 90 opens and closes as the standard brake during normal service and also closes as a standard safety gear during emergency situations.

[0032] To coordinate the travelling and landing operation the support position system 60 is connected with the car position system 110 and/or car control unit 120, and/or main electric drive / frequency converter 130 and/or main elevator controller 140.

[0033] In order to compensate vibrations during travelling and/or landing process, for example, if linear motors are used for the support drive 40, a damping unit (not shown) can be integrated into the support levelling system 30. Furthermore, an accelerometer (not shown) can be incorporated to or linked to the support drive control 50.

[0034] The elevator system described above allows using lighter, more elastic traction belts 109 also for higher travelling heights. Furthermore, as the car brake 90 serves as main brake and as a safety gear system, further material and cost reduction is possible. Furthermore, the

levelling and relevelling of the support 20 is jerk-free and safer. The landing accuracy increases. In detail, it is not necessary to reopen and close the brake for levelling the support.

Claims

1. Elevator car (10) comprising a support (20) for a payload to be transported by the elevator car (10), **characterised by** a support levelling system (30) for levelling the support (20) independently from the elevator car (10).

2. Elevator car (10) according to claim 1, **characterised in that** the support levelling system (30) is equipped for moving the support (20) in a predetermined levelling range (R).

3. Elevator car (10) according to claim 2, **characterised in that** the levelling range (R) is about 200 mm, preferably about 100 mm.

4. Elevator car (10) according to one of the claims 1 to 3, **characterised in that** the support levelling system (30) is mounted inside a casing (12) of the elevator car (10), especially in an area (14) between the support (20) and the casing (12).

5. Elevator car (10) according to one of the claims 1 to 4, **characterised in that** the support levelling system (30) comprises a support drive (40) for moving the support (20).

6. Elevator car (10) according to claim 5, **characterised in that** the support drive (40) is a hydraulic or pneumatic drive.

7. Elevator car (10) according to one of the claims 5 or 6, **characterised in that** the support drive (40) comprises at least one, preferably four, linear motors and/or at least one piston (42).

8. Elevator car (10) according to one of the claims 1 to 7, **characterised by** a damping unit for compensating vibrations during travelling and/or landing of the elevator car (10).

9. Elevator car (10) according to claim 8, **characterised in that** the damping unit is integrated into or linked to the support drive (40).

10. Elevator car (10) according to one of the claims 1 to 9, **characterised by** a support position system (60) for determining the support position relative to a fixed level, especially relative to a landing floor (70, 72).

11. Elevator car (10) according to claim 10, **characterised in that** the support position system (60) comprises at least one sensor (62) mounted to the elevator car (10), especially to the support (20).

12. Elevator car (10) according to one of the claims 1 to 11, **characterised by** an accelerometer for sensing the acceleration or speed of the movement of the support (20).

13. Elevator car (10) according to one of the claims 1 to 12, **characterised by** a support drive control (50) connected with the support drive (40) for controlling the support drive (40).

14. Elevator car (10) according to one of the claims 1 to 13, **characterised in that** the support (20) is a platform arranged inside the elevator car (10).

15. Elevator car (10) according to one of the claims 1 to 14, **characterised by** a car brake (90) mounted to, on or in the car (10) for stopping the elevator car (10) in normal service and/or in emergency situations.

16. Elevator (100) **characterised by** an elevator car (10) according to one of the claims 1 to 15.

17. Elevator (100) according to claim 16, **characterised by** an elevator car brake (90), wherein the support levelling system (30) for levelling the support (20) is independent from the elevator car brake (90).

18. Elevator (100) according to claim 16 or 17, **characterised in that** the elevator car brake (90) is mounted to, on or in the elevator car (10) for engaging or disengaging guide rails (104) in order to stop the elevator car (10) in normal service and/or in emergency situations.

19. Elevator (100) according to one of the claims 16 to 18, **characterised by** a car position system (110) comprising a car controller (120), a main electric drive or frequency converter (130) and a main elevator controller (140).

20. Elevator (100) according to one of the claims 16 to 19, **characterised by** landing floors (70, 72) and a support position system (60) for determining the support position relative to the landing floors (70, 72), wherein the support position system (60) comprises at least one sensor (62) mounted to the elevator car (10) and several receivers (64) each mounted to a landing floor (70, 72).

21. Method for controlling an elevator car (10) comprising a support (20) for a payload to be transported by the elevator car (10), **characterised in that** a support levelling system (30) levels the support (20) independently from the elevator car (10).

22. Method according to claim 21, **characterised in that** the support levelling system (30) is equipped for moving the support (20) in a predetermined levelling range (R).

23. Method according to one of the claims 21 or 22, **characterised in that** the support levelling system (30) is moved by means of a support drive (40).

24. Method according to one of the claims 21 to 23, **characterised in that** the support (20) is moved within a levelling range (R) of about 200 mm, preferably of about 100 mm.

25. Method according to one of the claims 21 to 24, **characterised in that** the support (20) is moved within an area inside a casing of the elevator car (10), especially in an area (14) between the support (20) and the casing (12).

26. Method according to one of the claims 21 to 25, **characterised in that** a damping unit compensates vibrations occurring during travelling and/or landing of the elevator car (10).

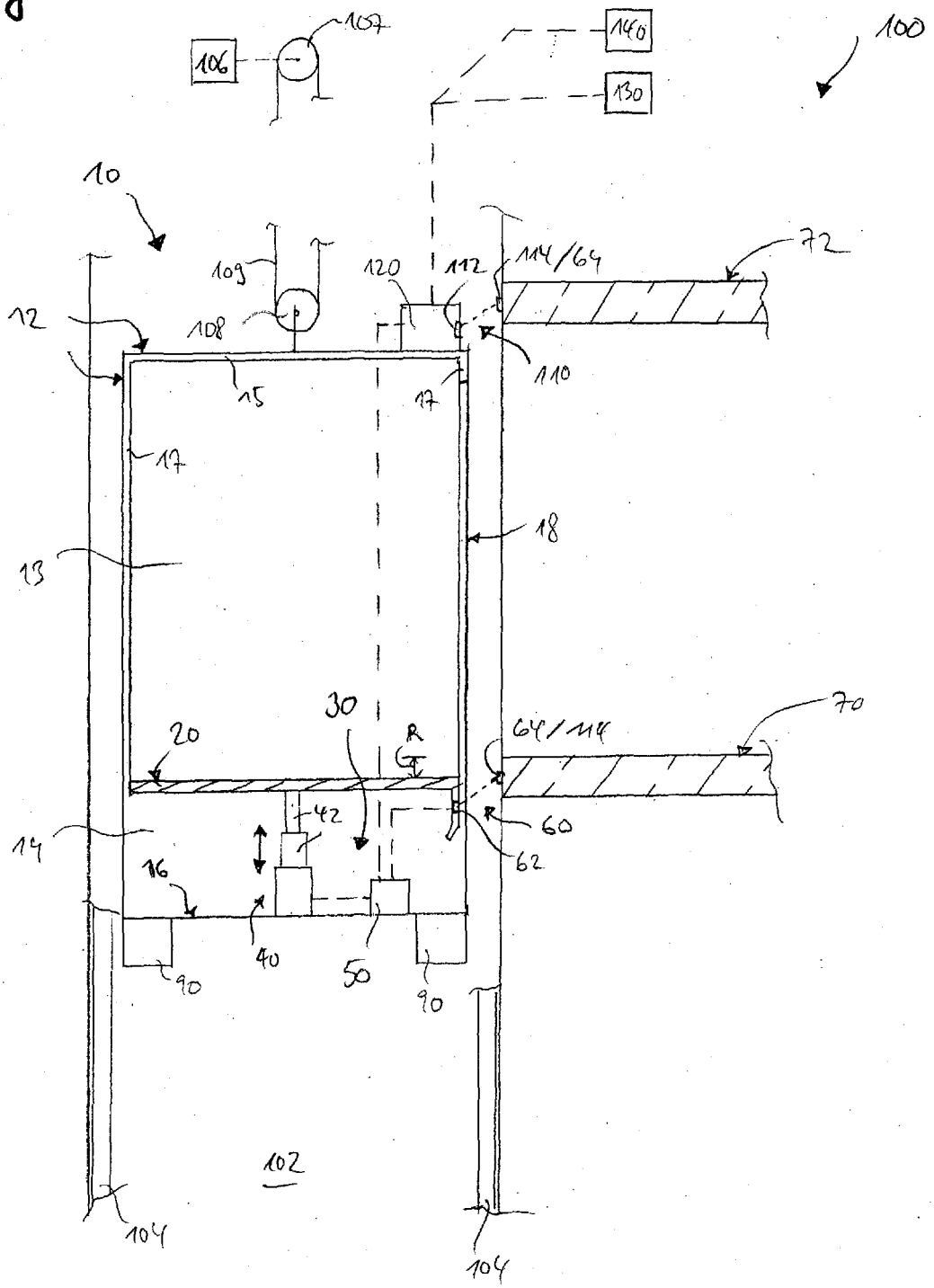
27. Method according to one of the claims 21 to 26, **characterised in that** a support position system (60) determines the support position relative to a fixed level, especially relative to a landing floor (70, 72).

28. Method according to one of the claims 21 to 27, **characterised in that** a accelerometer senses the acceleration or speed of the support (20).

29. Method according to one of the claims 21 to 28, **characterised in that** a support drive control (50) connected with the support drive (40) controls operation of the support drive (40).

30. Method according to one of the claims 21 to 29, **characterised in that** a car brake (90) stops the elevator car (10) in normal service and/or in emergency situations.

Fig.1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EUROPEAN SEARCH REPORT

Application Number
EP 07 11 5165

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 February 2008	ECKENSCHWILLER, A

CATEGORY OF CITED DOCUMENTS

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

REFERENCES CITED IN THE DESCRIPTION

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