(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 679 531 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
01.01.2014 Bulletin 2014/01

(51) Int Cl.:
B66B 7/08 *(2006.01)* ***B66B 5/02*** *(2006.01)*

(21) Application number: **12173639.1**

(22) Date of filing: **26.06.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(54) Elevator with moveable rope suspension point

(57) The invention refers to an elevator having a drive machine (14) driving a traction sheave (16) which traction sheave engages hoisting ropes (18) which support and/or move at least one elevator car (20) in an elevator shaft (12), which elevator car runs along guide rails (22) and comprises at least one gripping device (26) for locking the elevator car at the guide rails, whereby the hoisting ropes run over the traction sheave and are connected via rope suspension points (16, 37, 39; 54; 84, 86) to elevator components. At least one rope suspension point (16; 84, 86; 112) is mounted on a variable support, which variable support has a support base (38; 92; 114) fixed with respect to the elevator shaft or to the car or to the counterweight and a mounting area for the suspension point, which mounting area is movable with respect to the support base. This solution allows a fast and easy release of the elevator car from a locked position on the car guide rails after the gripping device has been activated.

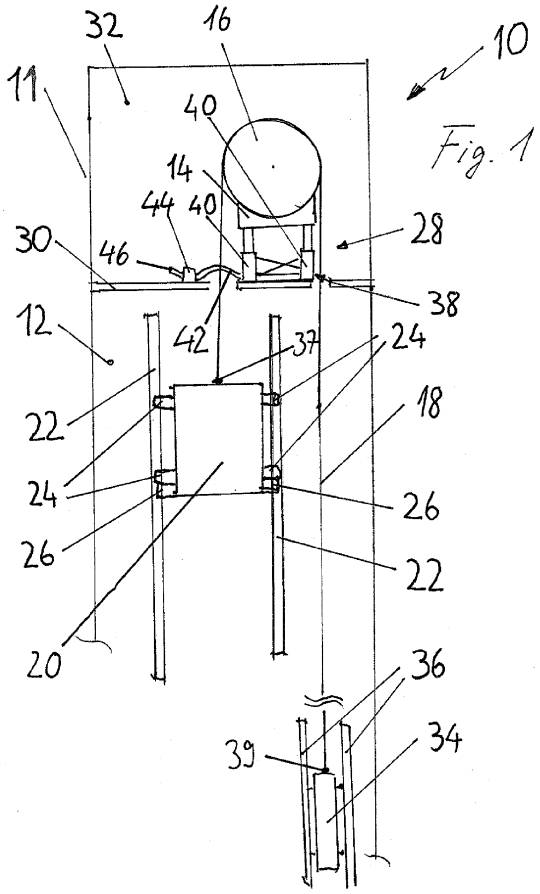

Fig. 1

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Description

[0001] The present invention relates to an elevator, particularly an elevator having a heavy or large size elevator car, an elevator having a comparably high load, e. g. more than 1000 kg or double deck elevators which also have a certain weight. Furthermore, this invention also particularly relates to elevators having a high travel velocity. The problem with all these elevators is that it is very difficult to free the elevator car after the gripping device has been activated to lock the elevator car at the guide rails, e.g. triggered by an overspeed governor or for other safety related reasons, e. g. the opening of a car or landing door during travel of the elevator car or power shut offs or severe failures in the elevator control. The gripping device of an elevator has regularly wedge shaped braking elements which are squeezed between the elevator guide rail and counter faces of the gripping device.

[0002] Particularly, if the elevator car is comparably heavy and/or if the elevator car has run into an emergency situation with a high velocity then the elevator car may stick heavily in its locked position. In this case it is often impossible by a single maintenance person to lift the elevator out of its locked position. For releasing the elevator car it is necessary to move the elevator contrary to the traveling direction in which the gripping occurred. Therefore, until now special hoists have been used to lift the stuck elevator car out of its locked position. This work necessitated a lot of special additional tool and several persons of maintenance staff to free the elevator car. Furthermore, this situation was very uncomfortable for passengers which were trapped in an elevator car for a long time during such an accident. Particularly if the release of the elevator car takes several hours this inflicts a high stress level to the trapped passengers and might be harmful for passengers with cardiac problems. Furthermore, such a rescue operation involving a lot of additional tools and several persons operating to get the elevator car free costs a high amount of money and labor.

[0003] It has to be added that the release of an elevator car in the upwards direction is always more troublesome as a downwards release as the latter is supported by the weight of the car itself. In contrast thereto an upwards release has to overcome the locking friction as well as the complete car weight.

[0004] It is object of the present invention to provide an elevator wherein the elevator car can easily be freed from a locked position after the gripping device has been activated.

[0005] This object is solved with an elevator according to claim 1. Preferred embodiments are subject matter of the dependent claims.

[0006] The inventive elevator has a drive machine driving a traction sheave. The traction sheave engages hoisting ropes which support and/or move at least one elevator car in an elevator shaft. It is possible that the hoisting ropes are used to support and move the elevator car totally but there are also solutions wherein at least a part of the elevator car is supported by a separate suspension ropes connected to a counterweight. For the invention it is not relevant to which extent the elevator car is supported or moved by the hoisting ropes. The hoisting ropes run over the traction sheave and are connected to suspension points at the shaft and/or at the car and possibly at a counterweight. For example the hoisting ropes go in a 1:1 suspension from the elevator car over the traction sheave and from there to a counterweight. Accordingly, the suspension points for the hoisting rope are the fixing points on the car and counterweight as well as the traction sheave itself. In a 2:1 suspension the hoisting ropes run for example over the traction sheave and over diverting pulleys fixed at the elevator car and the counterweight and finally to fixing points at the shaft top. Accordingly, the suspension points can be the traction sheave itself, diverting pulleys or fixing points in which for example the ends of the hoisting ropes are fixed to the car, counterweight or another fixed place in the elevator shaft or machine room (rope terminators).

[0007] According to the invention at least one of the above mentioned suspension points is mounted on a variable support.

[0008] It shall be clear that the hoisting ropes regularly consist of a set of several independent ropes or belts.

[0009] Supposed a 1:1 roping is present and the rope fixing to the elevator car is mounted on a variable support then following steps can be performed in case of the elevator car is locked at the guide rails after the gripping device has been activated:

[0010] A maintenance person gets to the building site and operates from the machine room the variable support in a way as to draw the elevator car from its locked position at the guide rails. The variable support has a drive which may be any per se known drive used to impose large forces, as e. g. electrical drives, hydraulic drives or pneumatic drives, rack and pinion arrangements.

[0011] These drives may have an electric motor or maybe manually driven, for example by a manually driven hydraulic pump or via a lever for rotating a spindle. Via the operation of this drive the variable support has sufficient force to draw the elevator car from its locked position on the guide rails. The actuating element for these drives is preferably located in a save place, e. g. in a machine room or in front of a control panel at a floor adjacent to the elevator shaft. Via this measure the maintenance person can safely draw via the variable support the elevator car from its locked position in a very short time and without needing any further persons and without needing to install an additional hoist.

[0012] The variable support has a support base and a mounting area for the suspension point, which mounting area is moveable with respect to the support base. The support base may for example comprise a scaffold holding four hydraulic posts at its corners and the mounting area is mounted to the free ends of the cylinders of the hydraulic posts. The support base is fixed to the car or

to the machine room or to the elevator shaft or to the counterweight, depending on the roping of the elevator. Of course the variable support has to be provided at a suspension point which is adapted to pull the elevator car out of its locked position. Here it has to be considered that the traction sheave is regularly locked in its position after the gripping device has been activated. Accordingly, an adapted suspension point would be the rope fixing or diverting pulley located at the elevator car or at the traction sheave or a rope fixing at the machine room or elevator shaft. An adapted suspension point would also be any diverting pulley which is in the rope section between the tractions sheave and the rope termination at the traction sheave side on which the car suspension is arranged.

[0013] The mounting area may for example be a mounting plate which is connected to the support base, e.g. to the four hydraulic posts in a moveable manner. Such kinds of variable supports with a support base and a moveable mounting area are easy to install in the elevator shaft (machine room) or on top of the elevator car or counterweight. The activation of such a variable support is easy via the already mentioned drives independent of the question whether it is a hydraulic drive, pneumatic drive or electric drive or any manual drive.

[0014] If (also) the counterweight has a gripping device, all statements made in this application relating to the release of the elevator car apply to the release of a counterweight as well.

[0015] If the drive comprises an electric motor preferably a battery or accumulator is provided as power support so that it is possible to draw the elevator car from its locked position also in case of a power off situation of the external power supply. Preferably, when a battery or accumulator is used a battery or accumulator load control means is connected with the elevator power supply to keep the battery or accumulator loaded for emergency situaitons. In case the variable support is mounted to the elevator car or counterweight the power supply could be realized by a traveling cable of the elevator car and/or by a compensation cable running between the car and counterweight and around a compensation sheave arrangement in the shaft bottom in case of larger elevators.

[0016] Preferably the drive control for actuating the drive of the variable support is located in the machine room or - in case no machine room is provided - in front of an operating panel located at a landing beside the elevator shaft. Via this measure easy operation of the drive of the variable support can be realized whereby it is not even necessary to enter the elevator shaft. The freeing of the elevator car can thus be performed fast, reliably and absolutely safely for the maintenance person.

[0017] In case the variable support has a frame with four vertical telescope posts. The telescope posts are hydraulic cylinders with which very high loads can be imposed to the elevator car to set the car free. Via this measure also loads of several tons can be applied to free the elevator car. In this case preferably at least two of the posts are hydraulic cylinders driven by a hydraulic drive, preferably all four posts.

[0018] Also, at least one scissors jack can be used as a variable support. Accordingly, a variable support may have a mounting area which is carried by two three or four scissors jacks which are driven simultaneously, e.g. via an electric spindle drives or via hydraulic cylinders. This kind of variable support is able to move several tons of weight and is thus be able to free heavy cars from their locked position, such e.g. elegant double deck cars.

[0019] The position of a variable support can vary. It is for example possible to place the complete elevator drive together with its traction sheave on a variable support in which case the whole drive machine together with the traction sheave is lifted together with the elevator car. By this measure the elevator car is reliably drawn from its locked position. The variable support may in this case also be used to facilitate mounting or maintenance or repair work at the drive machine and/or traction sheave.

[0020] If the variable support is provided e. g. on a top of the elevator car, i.e. on the rope fixing or on the diverting pulley of the elevator car there are two possibilities. Either the actuator or control of the drive of the variable support is located in the machine room or in front of an operation panel at a landing in which case the variable support can be operated remotely as to draw the elevator car up. Or the drive and its control or actuator are located on the top of the elevator car in which case the maintenance person has to enter the shaft and to climb onto the top of the elevator car to activate the variable support to free the elevator car from its locked position. Although this alternative is not as safe as the remote operated alternative, this solution allows the maintenance person to inspect the guide rails at the gripping point to evaluate whether or not maintenance of the gripping device or guide rails is necessary.

[0021] In case the counterweight has a gripping device a variable support can also be located on the top of the counterweight so that the rope fixing or diverting pulley located on the counterweight is mounted on the variable support. Of course, if the variable support is used for the mounting of the traction sheave the car as well as the counterweight can be released by lifting the tractions sheave up.

[0022] Of course it is also possible that the gripping device is activated when the elevator car runs upwards, particularly if it runs upwards empty in case of a counterweight being provided. In this case it is necessary to draw the elevator car downwards to free it from its locked position. In this case it is preferable that a variable support for the fixing of a compensation rope it located below the elevator car so that it is possible to draw the car via the compensation rope from its locked position downwards. In this case it is preferable that a lock is provided for preventing the rotation of the compensation sheave. Usually such lock is prevented for the traction sheave by the operating brakes because in any case of emergency action also the operating brakes of the drive machine are

activated in which case the traction sheave is locked in any case after the gripping device has been triggered. Anyway it has to be born in mind that the release in downwards direction is essentially easier as it is supported by the car weight.

[0023] In case of elevator cars with a very high load, for example in case of double deck cars it is also possible to provide a slipping prevention arrangement in connection with the traction sheave and/or compensation sheave. Via this measure the slipping of the ropes on the traction sheave is prevented when the variable support is activated to draw the elevator car from its locked position. Such a slipping prevention arrangement may have electrically or hydraulically activated elements pressing against the ropes in the groves which arms preferably have a high friction surface as e. g. a rubber surface.

[0024] In case a compensation rope is provided in the lower shaft part between car and counterweight, preferably two variable supports are provided at the car, one at the top and one at the bottom. By this measure it is possible to draw the car in both directions and on the other hand it is possible to operate the other variable support which is not pulling the car in the counter direction to give the necessary rope free so that with the pulling of the car the tension in the rope loop "car - hoisting rope - counterweight - compensation rope - car" is not increased. However, it is also possible to work with only one variable support. In this case - when the elevator car is pulled upwards - the increased tension in the compensation rope may be compensated by a compensation device for rope elongation, e.g. in connection with a compensation sheave arrangement. If this should not be sufficient, a rope clamp on the compensation rope has to be manually loosened for the time of the release of the elevator car to give room in the compensation rope for lifting the car.

[0025] The invention also provides for the possibility that the variable support offers the possibility of having a mounting area which is movable with respect to the support base without having an own drive for the movement. In this case the drive can be a portable device, e.g. a portable hydraulic jack or scissors jack which is fitted to the variable support only in case of an emergency action. This has the advantage that no drives have to be provided at each building site. The portable drive can easily be carried by a maintenance person and it fulfills the same requirements for a fast and safe release of the passengers in as a fixed drive mounted in the building site. Of course in this case the portable drive has to be actuated on site or has to be connected to an electric or hydraulic supply to operated it remotely.

[0026] The above mentioned embodiments can arbitrarily be combined with each other as long as this is technically possible.

[0027] The invention is described hereinafter with the aid of the enclosed drawings.

Figure 1 shows a schematic side view of a first embodiment of an inventive elevator,

Figure 2 shows a schematic side view of a variable support on top of an elevator car,

Figure 3 shows a schematic side view of another embodiment of an elevator having a compensation rope and a variable support on top and bottom of the elevator car,

Figures 4 and 5 show a variable support having a support base and a mounting area which is moveable in vertical direction with respect to the support base,

Figures 6 and 7 show the arrangement of a variable support according to figures 4 and 5 on the top of an elevator car for carrying a beam for two diverting pulleys, and

Figure 8 shows a rope fixing mounted on a variable support with two hydraulic activators.

[0028] Figure 1 shows an elevator 10 located in an elevator shaft 12 provided in a building 11. At the top of the elevator shaft a machine room 32 is provided which is separated from the shaft 12 by a machine room floor 30 carrying a drive machine 14 driving a traction sheave 16. The traction sheave 16 co-acts with hoisting ropes 18 for moving and supporting an elevator car 20 along guide rails 22, which are arranged vertically along the elevator shaft. The elevator car 20 is guided along the guide rails 22 via guide shoes 24. Furthermore, gripping devices 26 are provided for clamping or locking the elevator car 20 to the elevator guide rails 22 in case of a triggering situation of the gripping device, e. g. in case of over speed.

[0029] The drive machine 14 together with the traction sheave 16 is mounted on a variable support 28 mounted on the floor 30 of the machine room 32.

[0030] One end of the hoisting ropes 18 is connected via a car rope fixing 37 to the elevator car 20 whereas the other end is connected via a counterweight rope fixing 39 to a counterweight 34 which is traveling along counterweight guide rails 36.

[0031] The variable support 28 comprises a support base 38 carrying four hydraulic posts 40 which are hydraulic cylinders. The hydraulic posts are connected via a hydraulic tube 42 to a manual hydraulic actuator 44 (manually operated hydraulic pump) having a foot pedal 46.

[0032] In case the elevator car 20 drives with full load and over speed in direction to the shaft bottom and the gripping devices 26 are triggered the elevator car is

locked to the car guide rails 22 by per se known wedge like stopping elements of the gripping device. In this case the elevator car 20 has to be lifted up to release the car from its locked position on the guide rails 22. This releasing action is based on the self-energizing clamping effect of the wedge shaped stopping elements usually used in gripping devices 26.

[0033] Now a maintenance person has to get into the machine room 32 where he actuates the foot pedal 46 of the manual actuation device 44 of the hydraulic drive of the variable support 28. By this action the hydraulic cylinders of the hydraulic posts 40 are extended and the drive machine 14 together with the locked traction sheave 16 is lifted upwards which draws the elevator car from its locked position on the car guide rails 22. In this connection is has to be mentioned that always in case the gripping device is triggered also the drive machine unit 14 is locked by its operating brakes and thus the traction sheave is locked in its place and cannot rotate. Therefore, it is possible to pull the car upwards simply by lifting the drive 14 together with the traction sheave 16 upwards. To avoid slipping of the ropes 18 on the traction sheave 16 an slipping prevention arrangement may be provided which acts e. g. on the circumference of the ropes in the traction sheave 16 to avoid slipping of the ropes in the grooves. Such an arrangement can for example press the ropes into the grooves.

[0034] Accordingly, with the above solution the release of an elevator car from its locked position on the guide rails is also possible in case of very heavy elevator cars or in case of situations wherein the elevator car has run into its locked position with a very high velocity so that a very high force is necessary to free it from its locked position.

[0035] Figure 2 shows another embodiment of a rope suspension point which is here the car rope fixing 54 for fixing the hoisting ropes 18 to the elevator car 20. which can also be used in the arrangement of figure 1. In this case on top of the elevator car 20 a mounting support 50 is provided on which a car diverting pulley 52 is rotationally supported. The hoisting rope 18 is fixed via the car rope fixing 54 to the piston 56 of a hydraulic cylinder 58 which form the parts of a variable support 60 for the car side end of the hoisting ropes 18. Furthermore, a hydraulic drive 60 is provided on top of the elevator car. The hydraulic drive 60 can be actuated either manually on top of the elevator car or from the machine room 32 whereby in case of the operation of the hydraulic cylinder 58 the pistons 56 pushes the rope fixing 54 upwards and thereby draws the elevator car 20 from its locked position. In this case the drawing force is doubled up as the force is brought to the rope fixing 54 via the diverting pulley 52. This means that this variable support 60 for the rope fixing 54 has higher force but needs a longer stroke to pull the elevator car from its locked position.

[0036] Figure 3 shows an elevator 70 having a traction sheave 16, a hoisting rope 18 whereby the hoisting rope 18 runs between the elevator car 20 and the counterweight 34 over the traction sheave 16. Furthermore, a compensation sheave 72 is provided in the bottom of the elevator shaft 12 over which a compensation rope 74 is running which is connected to the bottom of the elevator car 20 via a car side compensation rope fixing 86 as well as to the bottom of the counterweight 34. The compensation rope 74 together with the compensation sheave 72 is provided for balancing out the weight of the hoisting ropes in case of high rise elevators. In this case two variable supports 76, 78 are provided comprising an upper variable support 76 at the top of the elevator car and a lower variable support 78 at the bottom of the elevator car. Both variable supports 76, 78 have a support base 80 with hydraulic cylinders as well as a mounting plate 82 which is mounted to the free end of the pistons of the hydraulic cylinders of the support base 80. On the mounting plate 82 of the upper moving support 76 the car rope fixing 84 for the hoisting ropes 18 is located whereas on the mounting plate 82 of the lower variable support 78 the car side compensation rope fixing for the compensation ropes 74 is provided. In this connection is must be emphasized that the hoisting ropes as well as the compensation ropes may comprise several separate ropes or belts which run general parallel to each other. Each variable support 76, 78 has a drive 88, whereby both drives 88 of the upper and lower variable support can be separately or commonly activated (in this case with opposite stroke direction). Thus, it is possible to keep the hydraulic cylinders of both variable supports 76, 78 in a middle position and when an emergency happens whereby the car is locked to the guide rails by the gripping devices the elevator car can be drawn upwards or downwards by simultaneously activating the upper and lower support in synchronicity. Accordingly, the embodiment of figure 3 allows the freeing of the elevator car from a locked position independent of the locking direction. In this case preferably the control of both drives 88 is located in the machine room or at a landing in front of an operating panel.

[0037] Figures 4 and 5 show a general layout for a variable support. The variable support 90 comprises a support base 92 with four posts in form of hydraulic cylinders at its corners. The pistons 94 of those hydraulic cylinders are connected at its upper end to a mounting plate 96 on which a rope fixing, a diverting pulley or the drive machine together with the traction sheave can be located. In this case only two diagonal hydraulic cylinders are actuated by means of a hydraulic distributor 98 which is connected in figure 4 via a hydraulic tube 100 to an electric hydraulic pump 102 whereas figure 5 shows a manual hydraulic pump 104 as possible alternatives of a hydraulic drive.

[0038] Figures 6 and 7 show the use of such a variable support 90 as shown in figure 4 and 5 on the roof 106 of an elevator car 20. The mounting base of the variable support 90 is mounted to the car roof 106 whereas the mounting area of the variable support 90 does not comprise a plate as shown in figures 4 and 5 but two bars

which are mounted to horizontal beams 108 which carry two diverting pulleys (not shown) for suspending the elevator car on the hoisting ropes. The figures also show an electric hydraulic pump 102 which can be operated from the car roof or from the machine room.

[0039] Finally, figure 8 shows a variable support 110 of a rope fixing 112 whereby the variable support 110 comprises a base 114 to which two hydraulic cylinders 116, 118 are mounted. In this embodiment the rope fixing 112 for six hoisting ropes are connected with the pistons of the hydraulic cylinders 116, 118. Via the activation of the hydraulic cylinders 116,118 the position of the rope fixing 112 is moved with respect to the base 114 so that the locked elevator car can be freed from its position.

[0040] It is apparent for the skilled person that the above mentioned embodiments can be combined each other where possible. Instead of hydraulic drives also electric drives or pneumatic drives may be used. The invention may vary within the scope defined by the appended patent claims.

Claims

1. Elevator having a drive machine (14) driving a traction sheave (16) which traction sheave engages hoisting ropes (18) which support and/or move at least one elevator car (20) in an elevator shaft (12), which elevator car runs along guide rails (22) and comprises at least one gripping device (26) for locking the elevator car to the guide rails, whereby the hoisting ropes run over the traction sheave and are connected via rope suspension points (16, 37, 39; 54; 84, 86) to elevator components, **characterized in that** at least one rope suspension point (16; 84, 86; 112) is mounted on a variable support, which variable support has a support base (38; 92; 114) fixed with respect to the elevator shaft or to the car or to the counterweight and a mounting area for the suspension point, which mounting area is movable with respect to the support base.

2. Elevator according to claim 1, wherein the movement of the mounting area with respect to the support base is driven by a drive (44, 46; 60; 88; 102; 104), preferably an electric or hydraulic drive.

3. Elevator according to claim 2, wherein the drive comprises a battery or accumulator as a power support.

4. Elevator according to one of claims 2 to 3, wherein a portable drive for the movement of the variable support is provided which portable drive is configured to be fitted to the variable support only in case of emergencies.

5. Elevator according to one of claims 2 to 4, wherein a drive control is located in the machine room or on top of the elevator car.

6. Elevator according to one of the preceding claims, wherein the support base (38; 92) has a frame with four vertical telescope posts (40; 94).

7. Elevator according to any of claims 2 to 5 and 6, wherein at least two of the posts (40; 94) are driven by the drive.

8. Elevator according to one of the preceding claims, wherein the suspension point is a rope fixing (54; 84, 86; 112) of the hoisting ropes or a diverting pulley (52) or traction sheave (16) over which the hoisting ropes (18) run.

9. Elevator according to one of the preceding claims, wherein the variable support (28) is connected to the elevator shaft (12).

10. Elevator according to one of the preceding claims, wherein the variable support (28) is arranged in a machine room (32) of the elevator (10).

11. Elevator according to one of the preceding claims, wherein the variable support (84, 86) is connected to the elevator car (20) and/or counterweight.

12. Elevator according to one of the preceding claims, wherein the drive machine (14) is mounted on the variable support (28) together with its traction sheave (16).

13. Elevator according to one of the preceding claims, wherein the variable support (78) is provided at the bottom of the elevator car (20), which variable support carries the compensation rope fixing (86) of a compensation rope (74).

14. Elevator according to one of the preceding claims, wherein a lock is provided for preventing rotation of the traction sheave (16) and/or of a compensation sheave (72).

15. Elevator according to one of the preceding claims, wherein a slipping prevention arrangement is provided for preventing slipping of hoisting or compensation ropes (18, 74) on the traction sheave (16) and/or compensation sheave (72).

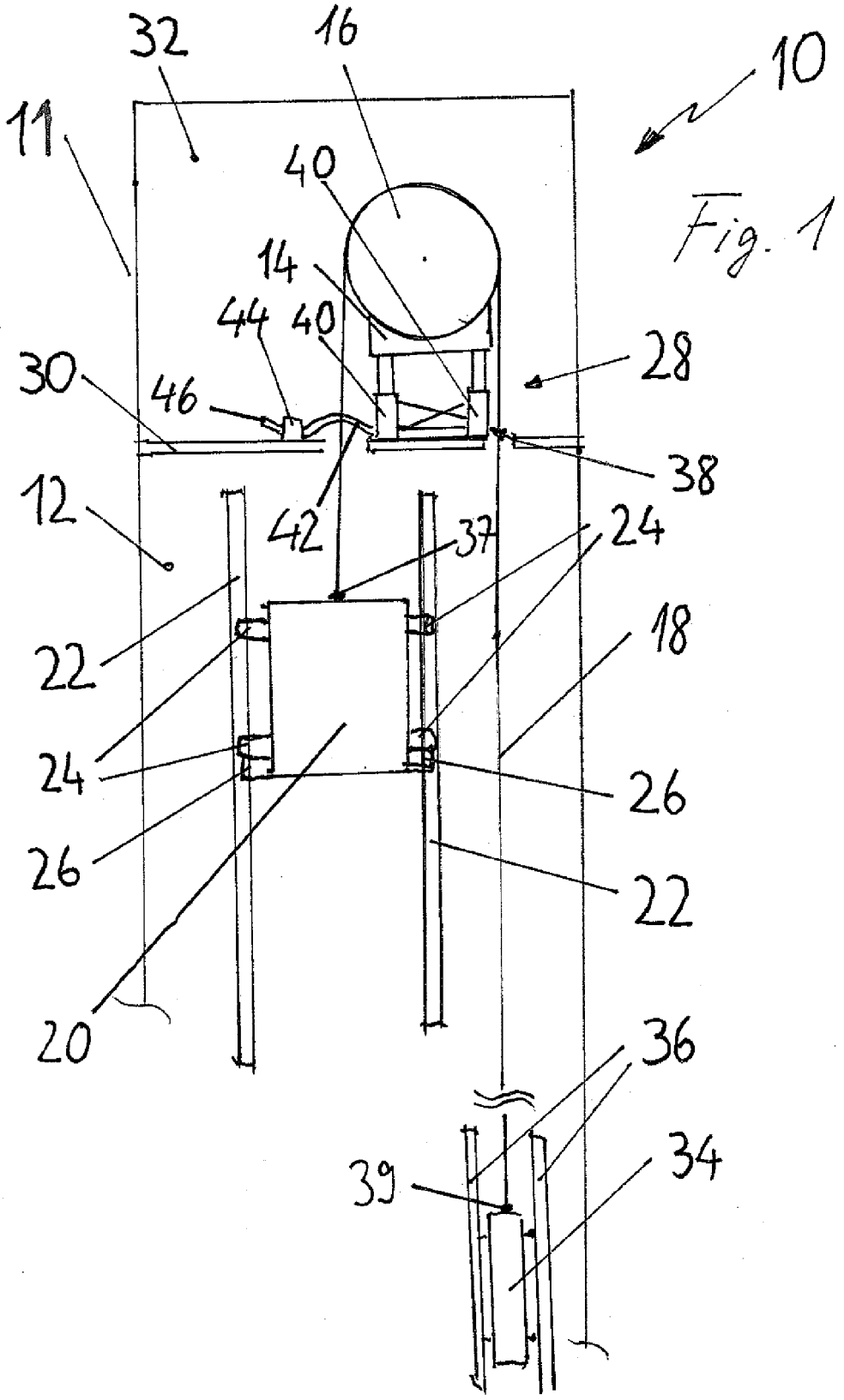
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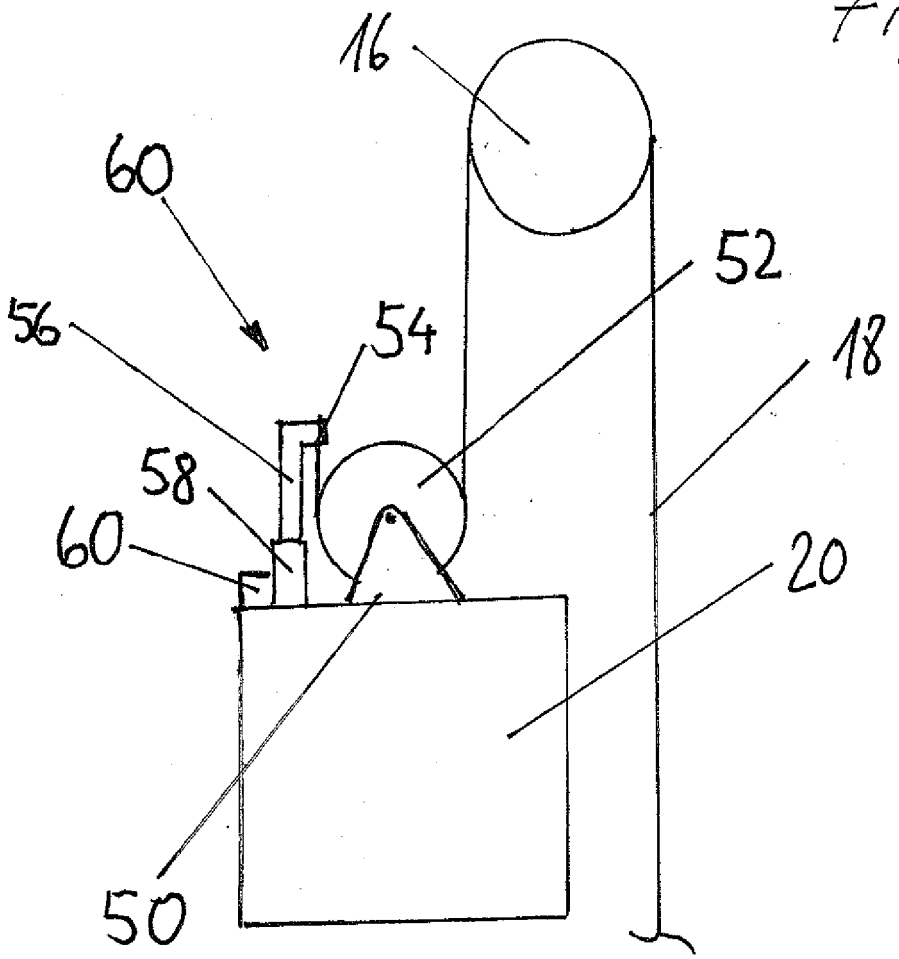
Fig. 1

Fig. 2



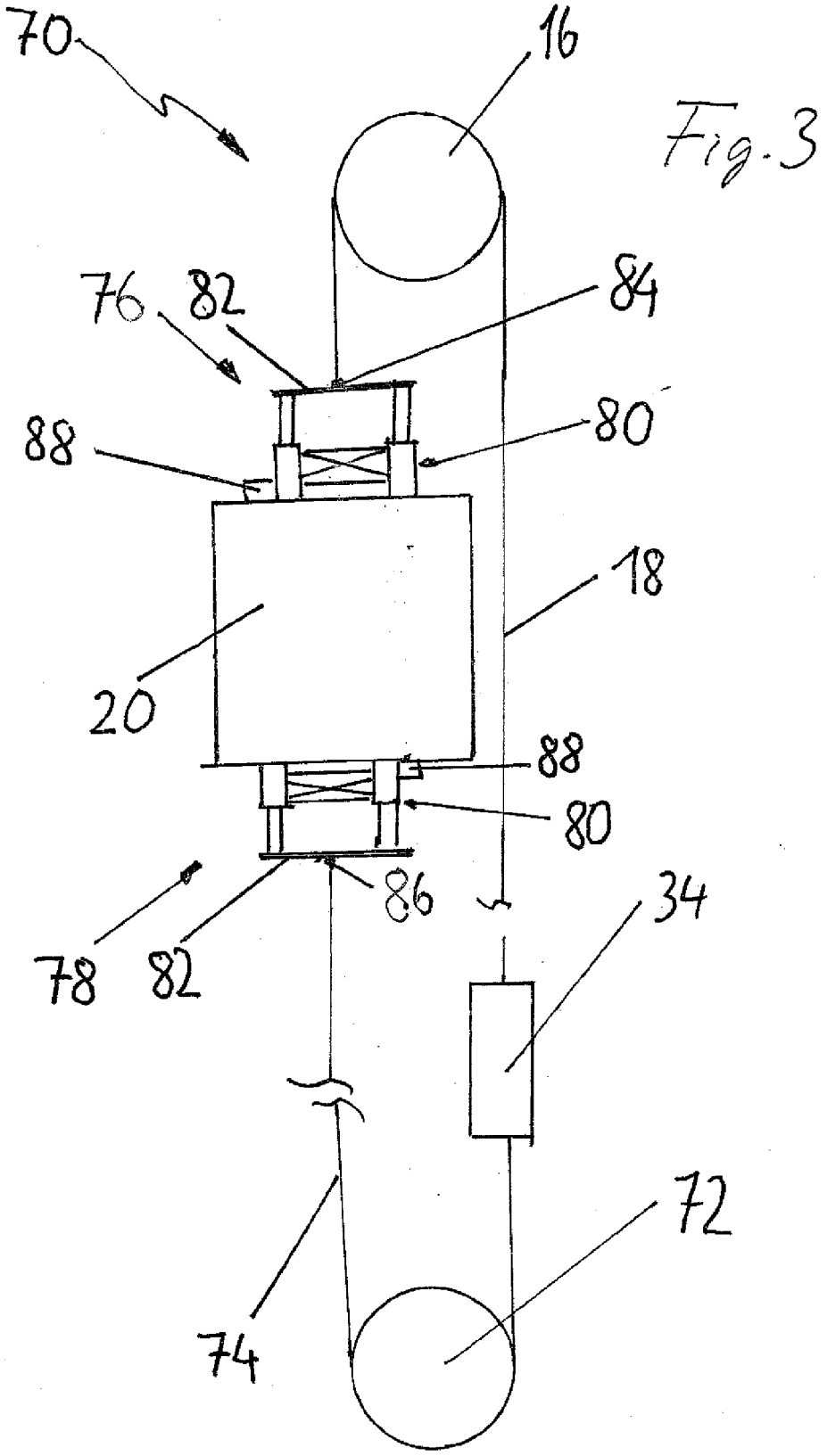


Fig. 3

Fig. 4

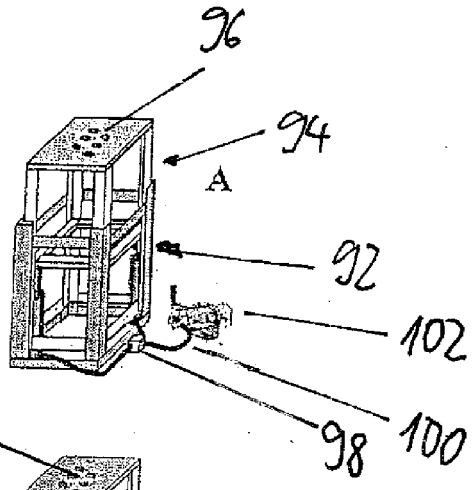


Fig. 5

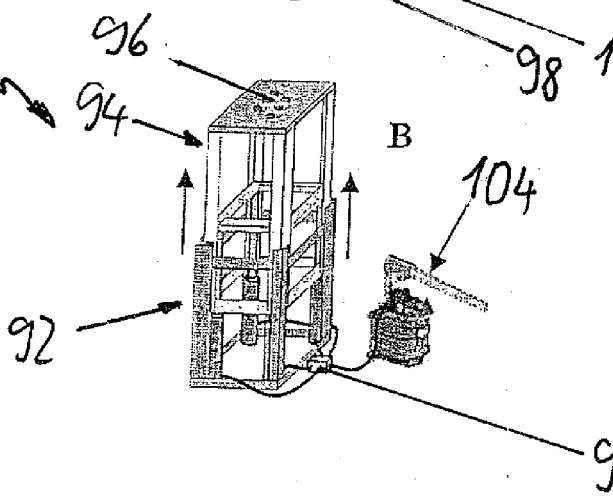


Fig. 6

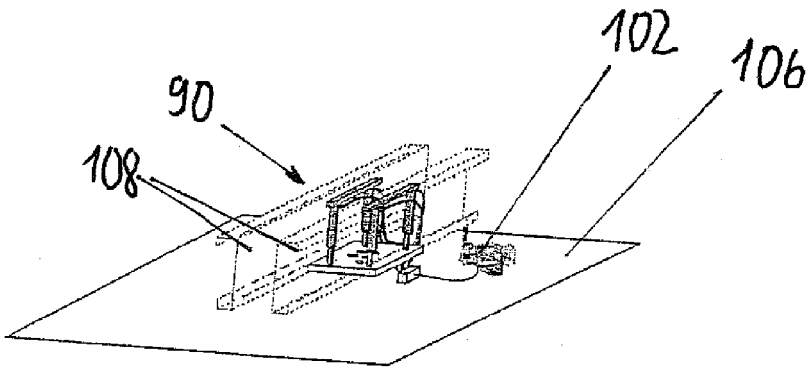


Fig. 7

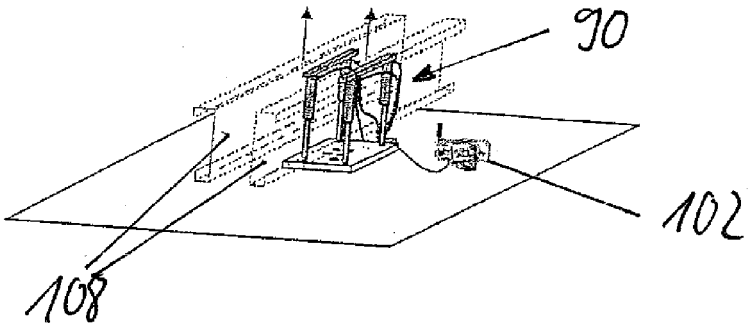
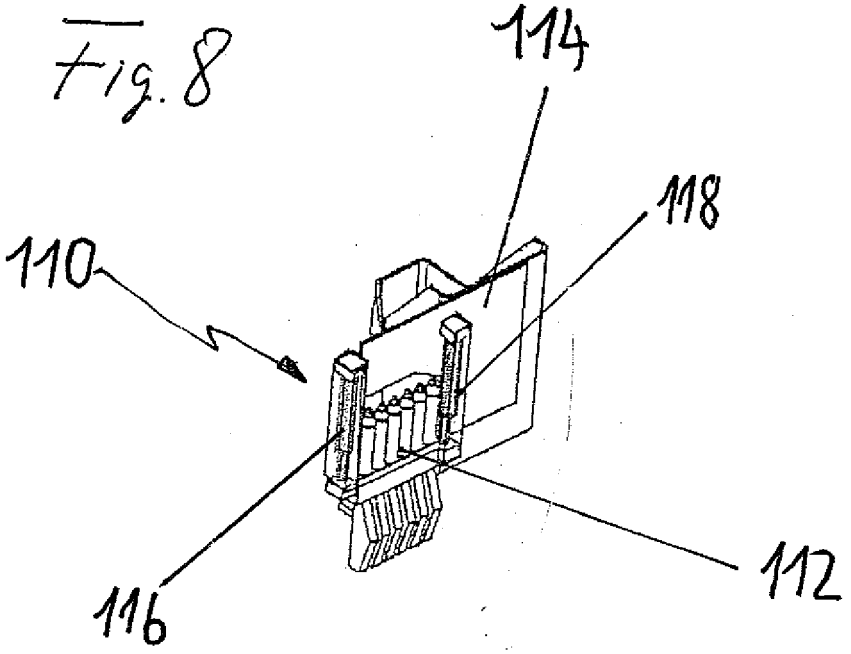


Fig. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 12 17 3639

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 6 216 824 B1 (FULLER JAMES W [US] ET AL) 17 April 2001 (2001-04-17) * abstract; figures 3,4 * -----	1-3,5-8, 11,15	INV. B66B7/08 B66B5/02
X	EP 2 457 862 A2 (CHEN YUNG-HSIN [TW]) 30 May 2012 (2012-05-30) * abstract; figures 1,3,4 * -----	1-5, 8-11, 13-15	
X	WO 2008/000886 A2 (KONE CORP [FI]; MUSTALAHTI JORMA [FI]; AULANKO ESKO [FI]) 3 January 2008 (2008-01-03) * abstract; figures 2-4 * -----	1,2,5, 8-10,13, 15	
X	CH 695 244 A5 (YUNG HSIN CHEN [TW]) 15 February 2006 (2006-02-15) * abstract; figures 3,4 * -----	1-5,8,11	
X	US 718 762 A (HISS NELSON [US]) 20 January 1903 (1903-01-20) * figure 2 * -----	1,9,10, 12-15	TECHNICAL FIELDS SEARCHED (IPC)
X	DE 12 89 969 B (STAHL R FA) 27 February 1969 (1969-02-27) * figure 2 * -----	1,2,11	B66B
A	US 2003/015379 A1 (WANG JIUN JYH [TW]) 23 January 2003 (2003-01-23) * abstract; figure 1 * -----	1,3	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 November 2012	Nelis, Yves

CATEGORY OF CITED DOCUMENTS

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15-11-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6216824 B1	17-04-2001	CN 1259480 A	12-07-2000
		JP 2000219441 A	08-08-2000
		US 6216824 B1	17-04-2001
EP 2457862 A2	30-05-2012	AU 2011101553 A4	12-01-2012
		CA 2760558 A1	30-05-2012
		CN 102476769 A	30-05-2012
		EP 2457862 A2	30-05-2012
		JP 2012116602 A	21-06-2012
		SG 181269 A1	28-06-2012
		US 2012132486 A1	31-05-2012
WO 2008000886 A2	03-01-2008	CN 101506083 A	12-08-2009
		EA 200802393 A1	30-06-2009
		EP 2032490 A2	11-03-2009
		FI 20060627 A	29-12-2007
		JP 2009541180 A	26-11-2009
		KR 20090034820 A	08-04-2009
		US 2009120733 A1	14-05-2009
		WO 2008000886 A2	03-01-2008
CH 695244 A5	15-02-2006	NONE	
US 718762 A	20-01-1903	NONE	
DE 1289969 B	27-02-1969	NONE	
US 2003015379 A1	23-01-2003	NONE	

EPO FORM P0459

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