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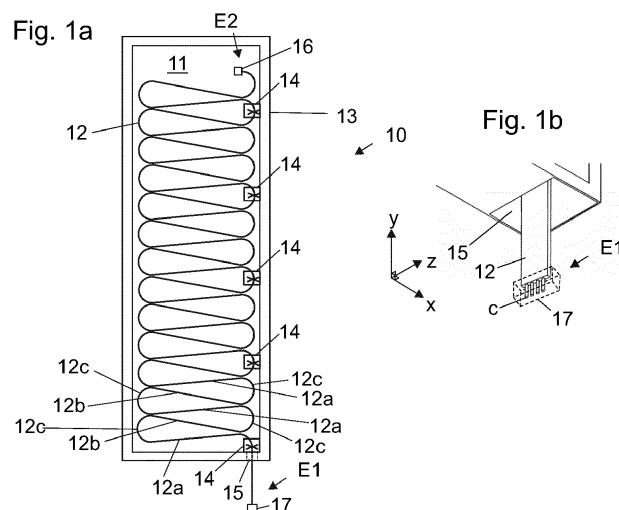
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(54) **CAR CABLE STORAGE UNIT OF ELEVATOR AND METHOD FOR CONSTRUCTING ELEVATOR**

(57) The invention relates to a car cable storage unit (10; 20) of an elevator, which is elongated and suitable for being placed in upright position, wherein the car cable storage unit (10; 20) comprises a storage space (11;21) for receiving a length of a car cable (12;22) which storage space (11;21) is vertically elongated, in particular when the car cable storage unit (10; 20) is in said upright po-

sition; and a length of a car cable (12;22) for transmitting electric power and/or signals to and/or from an elevator car (1), which length of a car cable (12;22) is bent, in particular by rolling or folding, in said storage space (11;21). The invention relates to a method for constructing an elevator implementing the car cable storage unit (10; 20).



Description

FIELD OF THE INVENTION

[0001] The invention relates to a car cable storage unit of an elevator and a method for constructing an elevator. The elevator is preferably an elevator for transporting passengers and/or goods.

BACKGROUND OF THE INVENTION

[0002] In connection with so-called jump-lifts, the bottom part of an elevator hoistway is taken into use before the building has been completed. In this case the upper parts of the building as well as the top part of the elevator hoistway can be constructed at the same time as an elevator moving in the bottom part of the elevator hoistway already serves people on the lower floors of the building under construction. Typically in jump-lifts the elevator car moving in the lower parts of the elevator hoistway is supported and moved during construction-time use with a hoisting machine supported on a vertically movable support structure in the elevator hoistway.

[0003] When the elevator hoistway under construction above the vertically movable support structure has reached a sufficient stage of completion, the completed part of the elevator hoistway can be taken into use. At this stage a "jump" is performed, wherein the vertically movable support structure is hoisted higher in the elevator hoistway. Thereafter, the car can reach a higher position than before the jump and start to serve additional floors.

[0004] The car can be suspended from the movable support structure during its use for transporting passengers and/or goods below the movable support structure with a roping hanging from the movable support structure. Moreover, during the use electricity and/or signals can be transmitted to/from the car via a car cable suitable for this purpose. For adapting the roping and cable to the change of position of the movable support structure, additional rope and/or cable often needs to be fed into the system to ensure optimal range of movement. In known solutions, the car cable has been supplied to the system by discharging from cable storage unit in the form of a reel where the cable is stored wound in round coil around a shaft.

[0005] A drawback of the known solutions has been that it has been particularly difficult to optimize the layout of the overall arrangement such that many demanding requirements of a jump lift are fulfilled at the same time. It has been noticed that this is partially due to difficulties in finding a well working position for the cable storage unit.

BRIEF DESCRIPTION OF THE INVENTION

[0006] The object of the invention is to introduce an improved car cable storage unit and a method for constructing an elevator.

An object is particularly to introduce a solution by which one or more of the above defined problems of prior art and/or drawbacks discussed or implied elsewhere in the description can be solved.

[0007] It is brought forward embodiments particularly by which a car cable storage unit is positionable flexibly to fulfil challenging, often also unique, spatial and operational needs of a construction time elevator where the elevator car is to be taken into use already during construction time of the elevator. Moreover, it is facilitated flexibility to fulfil plurality of needs of a construction time elevator at the same time, said needs particularly involving one or more of: freedom to positioning of parts of the hoisting function for their optimal operation, weight distribution of the support structure optimized for balance during movement and solid remountability thereof, sufficiency of working space on the support structure, flexibility of choosing an optimal route of the car cable from the storage to the elevator car (e.g. without excessive pulleys bringing additional weight, cost and complexity), safety, ease of transport and mounting, operational reliability and ease of use of the cable storage unit in repeated feeding of the cable into the system during the construction process.

[0008] It is brought forward a new car cable storage unit of an elevator, which is elongated and suitable for being placed in upright position, wherein the car cable storage unit comprises a storage space for receiving a length of a car cable which storage space is vertically elongated, in particular when the car cable storage unit is in said upright position; and a length of a car cable for transmitting electric power and/or signals to and/or from an elevator car, which length of a car cable is bent, in particular by rolling or folding, in said storage space. With this kind of solution one or more of the above mentioned objects can be achieved.

[0009] Preferable further details of the car cable storage unit are introduced in the following, which further details can be combined with the car cable storage unit individually or in any combination.

[0010] In a preferred embodiment, the length of car cable is bent, in particular by rolling or folding, in said storage space in a formation the height/width -ratio and height/thickness -ratio of which are at least 2, preferably more.

[0011] In a preferred embodiment, the length of car cable is at least 30 meters, preferably more.

[0012] In a preferred embodiment, when the car cable storage unit is in said upright position the height of the elongated storage space is substantially greater than the width or thickness thereof, preferably such that height/width -ratio and height/thickness -ratio of the elongated storage space are at least 2, preferably more.

[0013] In a preferred embodiment, when the car cable storage unit is in said upright position the height thereof is substantially greater than the width or thickness thereof, preferably such that height/width -ratio and height/thickness -ratio of the car cable storage unit are

at least 2, preferably more.

[0014] In a preferred embodiment, the car cable storage unit comprises a frame, which comprises walls, bottom and ceiling bordering the vertically elongated storage space.

[0015] In the preferred embodiment illustrated, the frame comprises a beam structure, in particular beam structure comprising four vertical corner beams, four upper cross beams connecting the upper ends of the vertical corner beams and four lower cross beams connecting the lower ends of the vertical corner beams.

[0016] In a preferred embodiment, the car cable storage unit comprises a locking equipment actuatable to lock the car cable from being discharged out from the storage space.

[0017] In a preferred embodiment, the locking equipment comprises at least one locking device, preferably a clamp mounted on the frame actuatable to lock at least part of the car cable from moving relative to the frame, preferably actuatable to squeeze car cable and to relieve the squeeze.

[0018] In a preferred embodiment, the locking equipment is arranged to act on plurality of points of the length of car cable, the locking of said plurality of points being openable and closable separately. For this purpose, preferably the locking equipment comprises plurality of locking devices acting on different points of the length of car cable.

[0019] In a preferred embodiment, it comprises an opening, in particular within vertical projection of the storage space, the opening forming a vertically open passage through which opening the car cable passes and/or can be discharged from the storage space downwards from the storage space.

[0020] In a preferred embodiment, the cable is arranged to be guided out from the storage space via the cable clamp and the opening, in this order or in opposite order.

[0021] In a preferred embodiment, the opening is in the bottom of the frame.

[0022] In a preferred embodiment, the car cable is belt shaped.

[0023] In a preferred embodiment, the car cable comprises one or more conductors for conducting electric current and/or electric signals and/or one or more optical fibers for transmitting light signals, which are preferably in a protective and electrically isolating sheathing preferably made of material comprising polymer, such as of rubber or polyurethane for example.

[0024] In a preferred embodiment, the car cable is provided with a terminal connectable to a terminal of the car for establishing a connection, preferably an electrically conductive connection, between the cable and the car.

[0025] In a preferred embodiment, car cable is provided with a terminal connectable to a terminal connected to or comprised in the control system of the elevator for establishing a connection, preferably an electrically conductive connection, between the cable and the control

system.

[0026] In a preferred embodiment, the length of car cable is bent by rolling in said storage space.

[0027] In a preferred embodiment, the car cable storage unit comprises a first cable wheel and a second cable wheel, which are mounted on the frame, the second cable wheel being on top of the first cable wheel when the car cable storage unit is in said upright position, the length of cable being wound around said first and second cable wheels. Preferably, the length of cable is wound around said first and second cable wheels in plurality of full rounds, preferably around itself that cable of each round rests against the cable of the round on the inside of it.

[0028] In a preferred embodiment, the length of car cable is rolled in said storage space such that the length of car cable comprises plurality of upwards passing sections and downwards passing sections extending successively back and forth across the storage space in vertical direction, in particular between a ceiling and a bottom of the frame.

[0029] In a preferred embodiment, the aforementioned upwards passing sections and downwards passing sections preferably extend back and forth successively across the storage space in vertical direction along the same vertical plane.

[0030] In a preferred embodiment, each said upwards passing section and downwards passing section is untwisted.

[0031] In a preferred embodiment, the length of car cable is bent by folding in said storage space.

[0032] In a preferred embodiment, the length of car cable comprises plurality of forward passing sections and backwards passing sections extending back and forth successively across the storage space in transverse direction, in particular between two side walls of the frame.

[0033] The aforementioned forward passing sections and backwards passing sections are piled such that each forward passing sections thereof is above the backwards passing section preceding it in succession, and vice versa.

[0034] The aforementioned forward passing sections and backwards passing sections preferably extend back and forth successively across the storage space along the same vertical plane.

[0035] In a preferred embodiment, between each pair of a backwards and a forward passing section which are successive (i.e. without a backwards or a forward passing section between them) there is a bend, wherein the cable turns upwards around an axis extending in width direction of the cable. Hereby, the turning directions of the pairs alternate between clockwise and counterclockwise.

[0036] In a preferred embodiment, the distance, as measured in horizontal direction from remotest parts of the bended parts of the cable, between successive bends is at least 0.5 meters, whereby each said backwards passing section and said forward passing section is at least 0.5 meters long.

[0037] In a preferred embodiment, each said back-

wards passing section and said forward passing section is untwisted.

[0038] It is also brought forward a new method for constructing an elevator comprising providing an elevator car for being vertically moved in a hoistway; mounting stationary in the hoistway, in particular in a position above the car, a vertically movable support structure for supporting the car below it, in particular with roping hanging from the movable support structure; providing a car cable storage unit as defined anywhere above, and arranging the car cable to hang between the car and the car cable storage unit, a length of the cable being left stored in the car cable storage unit; and using (also referred to as "first using") the elevator car for transporting passengers and/or goods and during said using transmitting electricity and/or signals to/from the car via the cable; and thereafter hoisting the movable support structure higher in the hoistway; and thereafter using (also referred to as "second using") the elevator car for transporting passengers and/or goods and during said using transmitting electricity and/or signals to/from the car via the cable.

[0039] With this kind of solution one or more of the above mentioned objects can be achieved.

[0040] Preferable further details of the method are introduced earlier above and in the following, which further details can be combined with the method individually or in any combination.

[0041] In a preferred embodiment, the method comprises discharging car cable from the cable storage. Particularly preferably the method comprises during said first using or after it, but preferably before the second using, such as before during, or after said hoisting, discharging car cable from the cable storage.

[0042] In a preferred embodiment, said arranging comprises discharging (also referred to as the "first discharging") cable from the car cable storage unit such an amount that after said discharging a length of car cable is left inside the storage space, said length being preferably at least 30 meters. This length is then usable for adapting the cable configuration to changes in range of car movement resulting from future jumps.

[0043] In a preferred embodiment, in the arranging the cable is arranged to hang between the car and the car cable storage unit such that it passes from the storage space downwards through an opening forming a vertically open passage which opening is within the vertical projection of the storage space.

[0044] In a preferred embodiment, said arranging comprising connecting the car cable to the car, the connecting preferably comprising connecting a terminal of the car cable to a terminal of the car.

[0045] In a preferred embodiment, the method comprises mounting the car cable storage unit. This is preferably performed before said first using. This is also preferably performed before a first discharging comprised in the arranging.

[0046] In a preferred embodiment, in said mounting the car cable storage unit is placed in an upright position.

[0047] In a preferred embodiment, in said mounting the car cable storage unit is mounted inside the hoistway. In this context, the advantages of the cable storage unit are substantial due to space savings in the layout of the elevator.

[0048] In a preferred embodiment, in said mounting the car cable storage unit is mounted in a position higher than the lower end of the hoistway.

[0049] In a preferred embodiment, in said mounting the car cable storage unit is mounted on the movable support structure.

[0050] In a preferred embodiment, the method comprises before said discharging mounting the car immovably in the hoistway, e.g. on car guide rails; and thereafter clamping the cable passing in the hoistway past the car (the part preferably hanging from the support structure) with a clamp mounted on the car such that a part of the cable extending downwards from the clamp is suspended by the clamp mounted on the car; and thereafter releasing a clamp of the car cable storage unit; and thereafter performing said discharging; and thereafter closing the clamp of the car cable storage unit and thereafter opening the clamp mounted on the car.

[0051] In a preferred embodiment, said mounting the movable support structure is performed with releasable mounting means actuatable to mount the support structure stationary in the hoistway and to release said mounting.

[0052] In a preferred embodiment, the movable support structure comprises releasable mounting means actuatable to mount the support structure stationary in the hoistway and to release said mounting.

[0053] In a preferred embodiment, the method comprises before said hoisting the movable support structure actuating said releasable mounting means to release mounting of the movable support structure.

[0054] In a preferred embodiment, the method comprises after said hoisting the movable support structure actuating said releasable mounting means to mount the support structure stationary in the hoistway.

[0055] In a preferred embodiment, the method comprises before or during said hoisting opening a rope clamp and feeding rope via the rope clamp into the roping from a rope storage.

[0056] In a preferred embodiment, the hoisting is performed with a hoisting arrangement mounted above the movable support structure.

[0057] In a preferred embodiment, the method comprises before said first using connecting a terminal of the cable to a terminal connected to or comprised in the control system of the elevator for establishing a connection, preferably an electrically conductive connection, between the cable and the control system.

[0058] In a preferred embodiment, the method comprises before said discharging disconnecting the terminal from a terminal connected to or comprised in the control system of the elevator, and after said discharging reconnecting the terminal to a terminal connected to or com-

prised in the control system of the elevator.

[0059] In a preferred embodiment, the method comprises maintaining during said discharging the terminal connected to a terminal connected to or comprised in the control system of the elevator for maintaining a connection, preferably an electrically conductive connection, between the cable and the control system.

[0060] In a preferred embodiment, each said using the elevator car for transporting passengers and/or goods comprises automatically operating, in particular by an elevator control system, a machinery, to move the elevator car between vertically displaced landings, in particular in response to signals received from one or more interfaces, such as one or more user interfaces operable by a user.

[0061] In a preferred embodiment, the discharging comprises rotating or allowing rotation of the said first and second cable wheels.

[0062] In a preferred embodiment, the discharging comprises pulling or allowing gravity to pull cable bent by folding out from said storage space.

[0063] In a preferred embodiment, the car has an interior space suitable for receiving a passenger or passengers, and the car can be provided with a door movable between open and closed state for opening and closing the interior space.

BRIEF DESCRIPTION OF THE DRAWINGS

[0064] In the following, the present invention will be described in more detail by way of example and with reference to the attached drawings, in which

Figure 1a illustrates a first embodiment of a car cable storage unit in an upright position according to the invention as viewed in thickness direction thereof.

Figure 1b illustrates preferred details of the car cable storage unit of Figure 1a.

Figure 2 illustrates a second embodiment of a car cable storage unit in an upright position according to the invention as viewed in thickness direction thereof.

Figure 3 illustrates a three-dimensional view of the car cable storage unit of Figure 2.

Figure 4 illustrates an embodiment of an elevator arrangement and a phase of a method according to the invention.

Figure 5 illustrates a phase of a method according to the invention following the phase disclosed in Figure 4.

Figure 6 illustrates a phase of a method according to the invention following the phase disclosed in Figure 5.

Figure 7 illustrates a phase of a method according to the invention following the phase disclosed in Figure 6.

Figure 8 illustrates a terminal of a car cable storage unit according to the first or second embodiment connected to a terminal of a control system of an eleva-

tor.

Figure 9 illustrates a terminal of a car cable storage unit according to the first or second embodiment connected to a terminal of a terminal of the car.

The foregoing aspects, features and advantages of the invention will be apparent from the drawings and the detailed description related thereto.

DETAILED DESCRIPTION

[0065] Figure 1a illustrates a first embodiment of a car cable storage unit 10 of an elevator, which is elongated and suitable for being placed in upright position, wherein the car cable storage unit 10 comprises a storage space 11 for receiving a length of a car cable 12 which storage space 11 is vertically elongated, in particular when the car cable storage unit 10 is in said upright position. The car cable storage unit 10 moreover comprises a length of car cable 12 for transmitting electric power and/or signals to and/or from an elevator car 1, which length of car cable 12 is bent, in particular by rolling or folding, in said storage space 11.

[0066] This configuration facilitates that the car cable storage unit 10 is space efficient in its intended use such that it can be positioned relatively freely to a desired position e.g. in cross-section of a hoistway, i.e. when viewed in vertical direction. This provides advantages such as increased freedom to position the car cable storage unit such that the cable can be guided out from the storage to pass down in the hoistway without guiding the cable horizontally from far towards the point where the cable is desired to hang vertically in the hoistway, as well as increased freedom in positioning of parts of the hoisting function for their optimal operation and increased possibilities to optimize weight distribution of a movable support structure in case where the rope storage unit is to be positioned on the movable support structure.

[0067] The length of car cable 12 is bent, in particular by rolling or folding, in said storage space 11 in a formation the height/width -ratio and height/thickness - ratio of which are at least 2, preferably more as it is the case in the illustrated case. Hereby, the space consumed by the length of the car cable is larger in vertical direction y than in horizontal direction (x or z) and the above mentioned advantages can be facilitated. The vertical direction, the width direction and thickness direction are marked in Figures 1b and 3 by y, x and z, respectively.

[0068] The car cable storage unit 10 is more particularly such that when the car cable storage unit 10 is in said upright position the height thereof is substantially greater than the width or thickness thereof, preferably such that height/width -ratio and height/thickness -ratio of the car cable storage unit 10 are at least 2, preferably more as it is the case in the illustrated case. The car cable storage unit 10 is more particularly such that when the car cable storage unit 10 is in said upright position the height of the elongated storage space 11 is substantially

greater than the width or thickness thereof, preferably such that height/width -ratio and height/thickness - ratio of the elongated storage space are at least 2, preferably more as it is the case in the illustrated case.

[0069] The car cable storage unit 10 comprises a frame 13. In the preferred embodiment illustrated, the frame 13 comprises walls, bottom and ceiling bordering the elongated storage space 11. However, it is not necessary that the walls, bottom and ceiling are closed since some or all of these may partially open, e.g. for allowing access into the storage space. In the preferred embodiment illustrated, the frame 13 comprises a beam structure, in particular a beam structure comprising four vertical corner beams, four upper cross beams connecting the upper ends of the vertical corner beams and four lower cross beams connecting the lower ends of the vertical corner beams. In the preferred embodiment, the frame 13 is elongated.

[0070] The car cable storage unit 10 moreover comprises a locking equipment 14 actuatable to lock the car cable from being discharged out from the storage space 11. The locking equipment 14 comprises at least one locking device, preferably a clamp 14 mounted on the frame 13 actuatable to lock at least part of the car cable 12 from moving relative to the frame 13, preferably actuatable to squeeze the car cable 12 and to relieve the squeeze.

[0071] In the preferred embodiment of Figure 1, the locking equipment 14 is arranged to act on plurality of points of the length of car cable 12, the locking of said plurality of points being openable and closable separately from each other (i.e. each being openable and closable without opening/closing any other locking). This provides that a desired amount of cable can be released to be discharged, thereby avoiding uncontrolled discharging, for instance due to pull by gravity. For this purpose, the locking equipment 14 comprises plurality of locking devices 14 acting on different points of the length of car cable 12. Said plurality of locking devices 14 are actuatable separately from each other (i.e. each being actuatable without actuating any other locking device).

[0072] The length of car cable 12 is bent in said storage space 11 such that the length of car cable comprises plurality of forward passing sections 12a and backwards passing sections 12b extending successively back and forth across the storage space 11 in transverse direction, in particular between two side walls of the frame 13.

[0073] The aforementioned forward passing sections 12a and backwards passing sections 12b are piled such that each backwards passing section 12b thereof covers the forward passing section 12a preceding it (if any), and vice versa.

[0074] The aforementioned forward passing sections 12a and backwards passing sections 12b preferably extend back and forth successively across the storage space 11 along the same vertical plane.

[0075] Between each pair of a backwards and a forward passing section 12a, 12b which are successive (i.e.

without a backwards or a forward passing section 12a, 12b between them) there is a bend 12c, wherein the cable turns, in particular upwards, around an axis extending in width direction of the cable. Hereby, the turning directions of the pairs alternate between clockwise and counterclockwise, meaning that the turning directions of pairs alternate in order as follows: clockwise, counterclockwise, clockwise, counterclockwise, clockwise, counterclockwise etc.

[0076] The distance, as measured in horizontal direction from remotest parts of the bended parts of the cable 12, between consecutive bends is at least 0.5 meters, whereby each said backwards passing section and said forward passing section is at least 0.5 meters long.

[0077] Each said backwards passing section 12b and said forward passing section 12a is untwisted.

[0078] Figures 2 and 3 illustrates a second embodiment of car cable storage unit 20 of an elevator, which is elongated and suitable for being placed in upright position, wherein the car cable storage unit 20 comprises a storage space 21 for receiving a length of a car cable 22 which storage space 21 is vertically elongated, in particular when the car cable storage unit 20 is in said upright position. The car cable storage unit 20 moreover comprises a length of car cable 22 for transmitting electric power and/or signals to and/or from an elevator car 1, which length of car cable 22 is bent, in particular by rolling or folding, in said storage space 21.

[0079] This configuration facilitates that the car cable storage unit 20 is space efficient in its intended use such that it can be positioned relatively freely to a desired position e.g. in cross-section of a hoistway, i.e. when viewed in vertical direction. This provides advantages such as increased freedom to position the car cable storage unit such that the cable can be guided out from the storage to pass down in the hoistway without guiding the cable horizontally from far towards the point where the cable is desired to hang vertically in the hoistway, as well as increased freedom in positioning of parts of the hoisting function for their optimal operation and increased possibilities to optimize weight distribution of a movable support structure in case where the rope storage unit is to be positioned on the movable support structure.

[0080] The length of car cable 22 is bent, in particular by rolling, in said storage space 21 in a formation the height/width -ratio and height/thickness -ratio of which are at least 2, preferably more as it is the case in the illustrated case. Hereby, the space consumed by the length of the car cable is larger in vertical direction than in horizontal direction and the above mentioned advantages can be facilitated.

[0081] The car cable storage unit 20 is more particularly such that when the car cable storage unit 20 is in said upright position the height thereof is substantially greater than the width or thickness thereof, preferably such that height/width -ratio and height/thickness -ratio of the car cable storage unit 20 are at least 2, preferably more as it is the case in the illustrated case The car cable

storage unit 20 is more particularly such that when the car cable storage unit 20 is in said upright position the height of the elongated storage space 21 is substantially greater than the width or thickness thereof, preferably such that height/width -ratio and height/thickness - ratio of the elongated storage space are at least 2, preferably more as it is the case in the illustrated case.

[0082] The car cable storage unit 20 comprises a frame 23. In the preferred embodiment illustrated, the frame 23 comprises walls, bottom and ceiling bordering the elongated storage space 21. However, it is not necessary that the walls, bottom and ceiling are closed since some or all of these may partially open, e.g. for allowing access into the storage space. In the preferred embodiment illustrated, the frame 23 comprises a beam structure, in particular a beam structure comprising four vertical corner beams, four upper cross beams connecting the upper ends of the vertical corner beams and four lower cross beams connecting the lower ends of the vertical corner beams. In the preferred embodiment, the frame 23 is elongated.

[0083] The car cable storage unit 20 moreover comprises a locking equipment 24 actuatable to lock the car cable from being discharged out from the storage space 21. The locking equipment 24 comprises at least one locking device, preferably a clamp 24 mounted on the frame 23 actuatable to lock at least part of the car cable 22 from moving relative to the frame 23, preferably actuatable to squeeze the car cable 22 and to relieve the squeeze.

[0084] The car cable storage unit 20 comprises a first cable wheel 28 and a second cable wheel 29, which are mounted on the frame 23, the second rope wheel being on top of the first cable wheel 28 when the car cable storage unit 20 is in said upright position, the length of car cable 22 being wound around said first and second cable wheels 28,29.

[0085] The length of car cable 22 is rolled in said storage space 21 such that the length of car cable comprises plurality of upwards passing sections 22a and downwards passing sections 22b extending successively back and forth across the storage space 21 in vertical direction, in particular between a ceiling and a bottom of the frame 23.

[0086] The aforementioned upwards passing sections 22a and downwards passing sections 22b preferably extend back and forth successively across the storage space 11 in vertical direction along the same vertical plane.

[0087] Preferably, each said upwards passing section 22a and downwards passing section 22b is untwisted.

[0088] In the embodiments of Figures 1a-3, the car cable storage unit 10; 20 comprises an opening 15;25, in particular within vertical projection of the storage space, the opening forming a vertically open passage through which opening 15;25 the cable 12;22 passes and/or can be discharged from the storage space downwards from the storage space.

[0089] The cable 12;22 is arranged to be guided out from the storage space via the rope clamp and the opening 15, in this order or in opposite order. The opening 15 is in the bottom of the frame 13;23.

[0090] The length of car cable 12;22 bent in said storage space 11;21 is at least 30 meters, preferably more. Thus, it is sufficient for supplying substantial amount of cable so that a jump or jumps of substantial height can be performed.

[0091] The car cable 12;22 is preferably belt shaped, whereby bending direction thereof and thereby the shape and structure of the formation of the cable stored inside the storage unit can be simply controlled. This shape makes the car cable 12;22 also simple to fold or roll along such that it extends along the same vertical plane.

[0092] The car cable 12;22 preferably comprises one or more conductors c for conducting electric current and/or electric signals and/or one or more optical fibers for transmitting light signals, which are in a protective and electrically isolating sheathing preferably made of material comprising polymer, such as of rubber or polyurethane for example. An example of this type of structure of the cable is illustrated in Figures 1b and 3. The structure of the car cable 12;22 could also be different, such as of any known kind or any other kind required or desired for facilitating the function of serving as a car cable of an elevator.

[0093] The car cable 12;22 is provided with a first end E1 and a second end E2. At each end, it comprises a terminal 16,17;26,27. Each terminal 16,17;26,27 can be formed at simplest by the ends of one or more conductors c of the cable 12;22 or alternatively one or both of the terminals 16,17;26,27 can comprise a socket attached to the ends of the one or more conductors c of the cable 12;22, as illustrated in Figures 1b and 3. A socket makes use of the car cable storage unit 10; 20 quicker and safer, in particular when repeated connections and disconnections of a terminal or terminals of the car cable 12;22 need to be made.

[0094] As illustrated in Figures 1-3 and 9, the car cable 12;22 is preferably provided with a terminal 17;27 at its first end E1 connectable to a terminal 1a of the car 1 for establishing a connection, such as preferably an electrically conductive connection, between the cable 12;22 and the car 1.

[0095] As illustrated in Figures 1-3 and 8, the car cable 12;22 is preferably provided with a terminal 16;26 at its second end E2 connectable to a terminal 100a connected to or comprised in the control system 100 of the elevator for establishing a connection, such as preferably an electrically conductive connection, between the cable 12;22 and the control system 100.

[0096] Figure 8 illustrates said terminal 16;26 of the car cable 12;22 being connected to a terminal 100a connected to the control system 100 of the elevator such that a connection, such as preferably an electrically conductive connection, is established between the cable 12;22 and the control system 100. The terminal 100a and ter-

minal 16;26 are preferably disconnectable. For the embodiment of Figure 3 this is preferable so that rotation of the cable wheels 28;29 is facilitated.

[0097] A method for constructing an elevator comprises, as illustrated in Figure 4, providing an elevator car 1 for being vertically moved in a hoistway 2; mounting stationary in the hoistway 2 in a position above the car 1 a vertically movable support structure 30 for supporting the car 1 below it with a roping 3 hanging from the movable support structure 30; and providing a car cable storage unit 10;20 as described referring to any of Figures 1-3, and arranging the car cable 12;22 thereof to hang between the car 1 and the car cable storage unit 10;20, a length of the car cable 12;22 being left stored in the car cable storage unit 10;20. Said length left stored is preferably at least 30 meters.

[0098] After this, the method comprises using the elevator car 1 for transporting passengers and/or goods and during said using transmitting electricity and/or signals to/from the car 1 via the cable 12;22, as indicated by arrow in Figure 4. After this using (also referred to as "first using") the method comprises hoisting the movable support structure 30 higher in the hoistway 2 as illustrated in Figure 6. After the hoisting, the method comprises, as illustrated in Figure 7, using (also referred to as "second using") the elevator car 1 for transporting passengers and/or goods and during said using transmitting (e.g. continuously or intermittently) electricity and/or signals to/from the car 1 via the cable 12;22.

[0099] For facilitating future dischargings of the car cable, preferably before said first using, as well as preferably before said first discharging, the method comprises mounting the cable car cable storage unit 10;20 in a position higher than the lower end of the hoistway 2, most preferably on the movable support structure 30 as illustrated in Figure 4 (but alternatively on a landing on a structure of the hoistway such as wall on a guide rail).

[0100] In said mounting, the cable car cable storage unit 10;20 is placed in the upright position.

[0101] In the method, said arranging comprises connecting the car cable 12;22 to the car 1, the connecting preferably comprising connecting a terminal 17;27 of the cable to a terminal 1a of the car 1, the preferred details of which have been schematically shown in Figure 9.

[0102] Said arranging more specifically comprises discharging (also referred to as the "first discharging") cable from the car cable storage unit 10;20 such an amount that after said discharging a length is left inside the storage space 11;21. Said length being preferably at least 30 meters. Thus, discharging of additional cable to the system from the storage unit 10;20 e.g. in a later jump is facilitated.

[0103] Said arranging more specifically comprises arranging the cable to hang between the car 1 and the car cable storage unit 10;20 such that it passes from the storage space downwards through an opening 15;25 forming a vertically open passage which opening is within the vertical projection of the storage space 11;21.

[0104] The method comprises before the second using, such as before during, or after said hoisting, discharging (also referred to as the "second discharging") car cable 12;22 from the cable storage 10;20 as illustrated in Figure 5. The second discharging may be possible to perform or at least start already during said first using but for ensuring safety and easiness, e.g. due to reduced need of additional clamps, preferably second discharging is performed after the first using as illustrated in Figure 5.

[0105] For facilitating the second discharging, the method preferably comprises before said second discharging mounting the car 1 immovably in the hoistway 2 as illustrated in Figure 5, e.g. on car guide rails (not showed); and thereafter clamping the cable 12;22 passing in the hoistway past the car 1 (the part preferably hanging from the support structure 30) with a clamp 41 mounted on the car 1 such that a part of the cable 12;22 extending downwards the clamp is suspended by the clamp 41 mounted on the car 1; and thereafter releasing a clamp 14;24 of the car cable storage unit 10;20; and thereafter performing said discharging; and thereafter closing the clamp 14;24 of the car cable storage unit 10;20 and thereafter opening the clamp 41 mounted on the car 1.

[0106] In the method, each mounting the movable support structure 30 is performed with releasable mounting means 31 actuatable to mount the support structure 30 stationary in the hoistway 2 and actuatable to release said mounting. For enabling this step, the movable support structure 30 comprises releasable mounting means 31 actuatable to mount the support structure 30 stationary in the hoistway and to release said mounting. In the method illustrated in Figures 5-7, the mounting means 31 include claws movable, in particular to-and-fro, between a state where they are above a stationary support face f such as for example a vertically facing support face of a concrete pocket of the building or platform of the building or a beam hoistway 2 or a guide rail bracket mounted in the hoistway 2, and a state where they are not above the stationary support face f. The mounting means 31 could alternatively be in the form of gripping means arranged to grip a guide rail mounted in the hoistway, such as an actuatable safety gear or an actuatable friction pad caliper brake, for instance.

[0107] The hoisting is prepared such that the method comprises before said hoisting the movable support structure 30 actuating said releasable mounting means 31 to release mounting of the movable support structure 30. In Figure 6, the hoisting is illustrated, and at this phase, the releasable mounting means 31 have been actuated to release mounting of the movable support structure 30 (in this case retracted towards the center of the hoistway 2).

[0108] The hoisting can be performed in different ways. In Figure 6, the hoisting is performed with a hoisting arrangement 50 mounted above the movable support structure 30. In this case, the hoisting arrangement comprises a support structure 51 as well as a hoist 52 and a

roping 53 supported by support structure 51. The hoist 52 is arranged to pull the support structure 31 upwards powered by the hoist 52. Alternatively the hoisting arrangement could be any known type. As one alternative the hoisting arrangement can be an integral part of the movable support structure 30, such that the support structure can perform self-climbing movement in the hoistway 2 in which case the hoisting arrangement would be mounted on the movable support structure 30 and comprise an up and down movable support structure.

[0109] The method comprises after said hoisting the movable support structure 30 actuating said releasable mounting means to mount the support structure 30 stationary in the hoistway 2. This is illustrated in Figure 7, where the releasable mounting means 31 have been actuated to mount the support structure (30) stationary in the hoistway 2 (in this case to extend on top of a support face f).

[0110] For facilitating preparing of the roping 3 to a jump, the method comprises before or during said hoisting opening a rope clamp 43 and feeding rope via the rope clamp 43 into the roping 3 from a rope storage 42, as illustrated in Figure 6.

[0111] Preferably, the method comprises, before said first using, connecting a terminal 16;26 of the cable 12;22 to a terminal 100a connected to or comprised in the control system 100 of the elevator for establishing a connection, preferably an electrically conductive connection, between the cable 12;22 and the control system 100 as illustrated in Figure 8.

[0112] The method can, although this is not necessary, comprise before said second discharging disconnecting the terminal 26 from a terminal connected with or comprised in the control system 100 of the elevator, and after said second discharging reconnecting the terminal 26 to a terminal 100a connected to or comprised in the control system 100 of the elevator. This facilitates particularly use of embodiment illustrated in Figure 2 where rotation of components is involved in discharging.

[0113] The method can, although this is not necessary, comprise maintaining, during said second discharging, the terminal 16 connected to a terminal 100a connected to or comprised in the control system 100 of the elevator for maintaining a connection, preferably an electrically conductive connection, between the cable 12;22 and the control system 100. This is possible and preferable particularly when the cable storage unit 10 is in accordance with the embodiment illustrated in Figure 1 where no rotation of components needs to be involved in the discharging.

[0114] Preferably, each said using the elevator car 1 for transporting passengers and/or goods comprises automatically operating, in particular by an elevator control system 100, a machinery 4, to move the elevator car 1 between vertically displaced landings F0,Fn, in particular in response to signals received from one or more interfaces 200, such as one or more user interfaces operable by a user.

[0115] Each discharging preferably comprises when the cable storage unit 10 is in accordance with the embodiment illustrated in Figure 1 pulling or allowing gravity to pull cable 12 bent by folding out from said storage space 11.

[0116] Each discharging preferably comprises when the car cable storage unit 20 is in accordance with the embodiment illustrated in Figure 2 rotating or allowing rotation of the said first and second cable wheels 28,29.

[0117] As mentioned, use of the car cable storage unit 10,20 as defined provides that the car cable storage unit 10,20 can be positioned relatively freely to a desired position in cross-section of the hoistway 2. Due to shape and formation achieved being relatively high the car cable storage unit 10,20 can be made even so thin in thickness and width direction that it fits to be positioned between counterweight guide rails effectively. Accordingly, in a further embodiment the car cable storage unit 10,20 is positioned between two guide rails adjacent a hoistway wall.

[0118] It is to be understood that the above description and the accompanying Figures are only intended to teach the best way known to the inventors to make and use the invention. It will be apparent to a person skilled in the art that the inventive concept can be implemented in various ways. The above-described embodiments of the invention may thus be modified or varied, without departing from the invention, as appreciated by those skilled in the art in light of the above teachings. It is therefore to be understood that the invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims.

Claims

1. A car cable storage unit (10; 20) of an elevator, which is elongated and suitable for being placed in an upright position, wherein the car cable storage unit (10; 20) comprises
 - a storage space (11;21) for receiving a length of a car cable (12;22) which storage space (11;21) is vertically elongated, in particular when the car cable storage unit (10; 20) is in said upright position; and
 - a length of a car cable (12;22) for transmitting electric power and/or signals to and/or from an elevator car (1), which length of a car cable (12;22) is bent, in particular by rolling or folding, in said storage space (11;21).
2. A car cable storage unit (10; 20) according to claim 1, wherein the length of car cable (12;22) is bent, in particular by rolling or folding, in said storage space (11;21) in a formation the height/width -ratio and height/thickness -ratio of which are at least 2.

3. A car cable storage unit (10; 20) according to any of the preceding claims, wherein when the car cable storage unit (10; 20) is in said upright position the height thereof is substantially greater than the width or thickness thereof, preferably such that height/width -ratio and height/thickness -ratio of the car cable storage unit (10; 20) are at least 2 or more.
4. A car cable storage unit (10; 20) according to any of the preceding claims, wherein the car cable storage unit (10; 20) comprises a frame (13;23), which comprises walls, bottom and ceiling bordering the vertically elongated storage space (11;21).
5. A car cable storage unit (10; 20) according to any of the preceding claims, wherein the car cable storage unit (10; 20) comprises a locking equipment (14;24) actuatable to lock the car cable (12;22) from being discharged out from the storage space (11;21).
6. A car cable storage unit (10; 20) according to any of the preceding claims, wherein the locking equipment (14;24) comprises at least one locking device, preferably a clamp (14;24) mounted on the frame (13;23) actuatable to lock at least part of the car cable (12;22) from moving relative to the frame (13;23), preferably actuatable to squeeze car cable (12;22) and to relieve the squeeze.
7. A car cable storage unit (10; 20) according to claim 5 or 6, wherein the locking equipment (14;24) is arranged to act on plurality of points of the length of car cable (12;22), the lockings of said plurality of points being openable and closable separately.
8. A car cable storage unit (10; 20) according to any of the preceding claims, wherein it comprises an opening (15;25), in particular within vertical projection of the storage space (11;21), the opening (15;25) forming a vertically open passage through which opening (15;25) the car cable (12;22) passes and/or can be discharged from the storage space (11;21) downwards from the storage space (11;21).
9. A car cable storage unit (10; 20) according to any of the preceding claims, wherein the car cable (12;22) comprises one or more conductors (c) for conducting electric current and/or electric signals and/or one or more optical fibers for transmitting light signals, which conductors (c) and/or optical fibers are preferably in a protective and/or electrically isolating sheathing preferably made of material comprising polymer, such as of rubber or polyurethane for example.
10. A car cable storage unit (20) according to any of the preceding claims, wherein the length of car cable (22) is bent by rolling in said storage space (21).
11. A car cable storage unit (20) according to any of the preceding claims, wherein the car cable storage unit (20) comprises a first cable wheel (28) and a second cable wheel (29), which are mounted on a frame (23), the second cable wheel being on top of the first cable wheel (28) when the car cable storage unit (20) is in said upright position, the length of cable being wound around said first and second cable wheels (28,29).
12. A car cable storage unit (10) according to any of the preceding claims, wherein the length of car cable (12) is bent by folding in said storage space (11).
13. A car cable storage unit (10; 20) according to any of the preceding claims, wherein the length of car cable (12) comprises plurality of forward passing sections (12a) and plurality of backwards passing sections (12b) extending back and forth successively across the storage space (11) in transverse direction, in particular between two side walls of the frame (13).
14. A method for constructing an elevator comprising providing an elevator car (1) for being vertically moved in a hoistway (2); mounting stationary in the hoistway (2) a vertically movable support structure (30) for supporting the car (1) below it; providing a car cable storage unit (10;20) according to any of the preceding claims, and arranging the car cable (12;22) to hang between the car (1) and the car cable storage unit (10;20), a length of the cable (12;22) being left stored in the car cable storage unit (10;20); and thereafter using the elevator car (1) for transporting passengers and/or goods and during said using transmitting electricity and/or signals to/from the car (1) via the cable (12;22); and thereafter hoisting the movable support structure (30) higher in the hoistway (2); and thereafter using the elevator car (1) for transporting passengers and/or goods and during said using transmitting electricity and/or signals to/from the car (1) via the cable (12;22).
15. A method according to any of the preceding claims, wherein the method comprises discharging car cable (12;22) from the cable storage (10;20).
16. A method according to the preceding claim, wherein the method comprises before said discharging mounting the car immovably in the hoistway; and thereafter clamping the cable (12;22) passing in the hoistway past the car with a clamp (41) mounted on the car (1) such that a part of the cable (12;22) extending downwards from the clamp (41) is suspended by the clamp (41) mounted on the car (1); and thereafter releasing a clamp (14;24) of the car cable storage unit (10;20); and thereafter performing said

discharging; and thereafter closing the clamp (14;24) of the car cable storage unit (10;20) and thereafter opening the clamp (41) mounted on the car (1).

17. A method according to any of the preceding claims, wherein each said using the elevator car (1) for transporting passengers and/or goods comprises automatically operating, in particular by an elevator control system (100), a machinery (4), to move the elevator car (1) between vertically displaced landings (FO,Fn), in particular in response to signals received from one or more interfaces (200), such as one or more user interfaces operable by a user.

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Fig. 1a

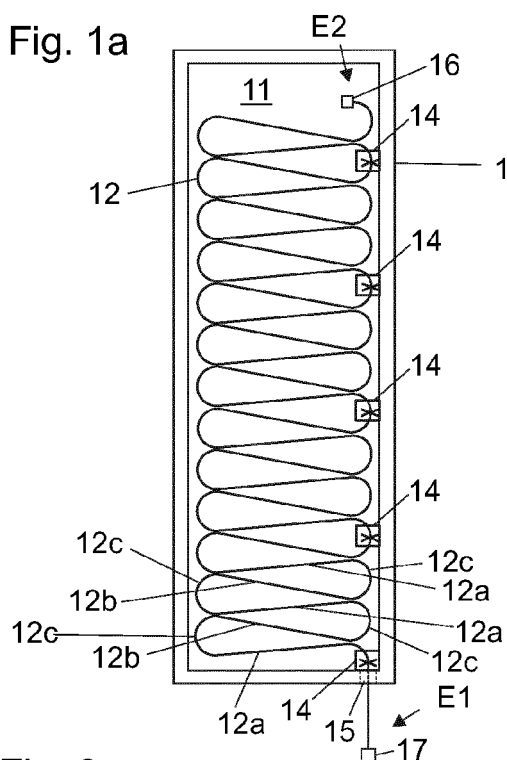


Fig. 1b

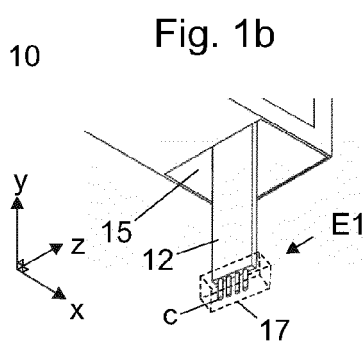


Fig. 2

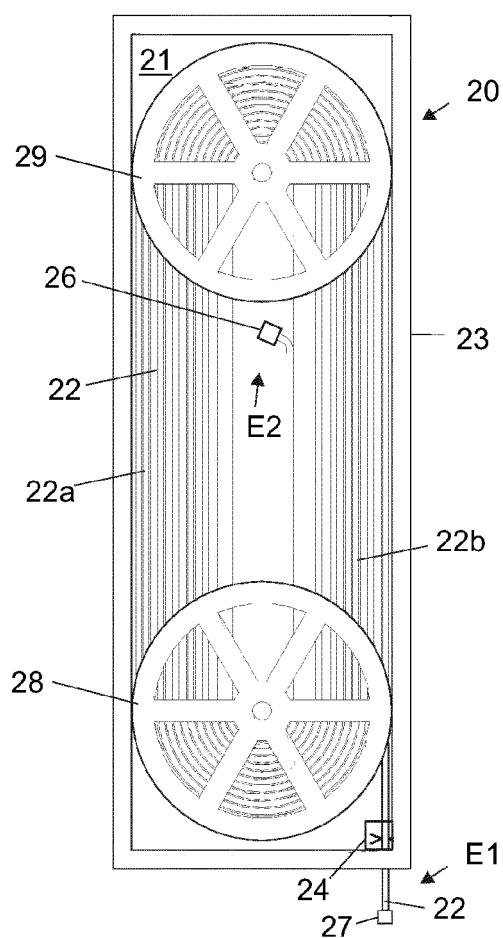


Fig. 3

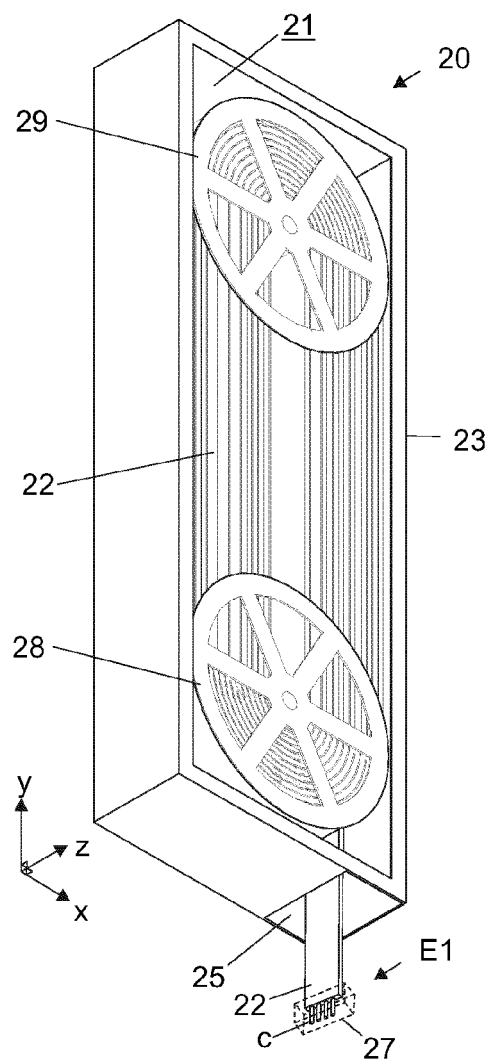


Fig. 4

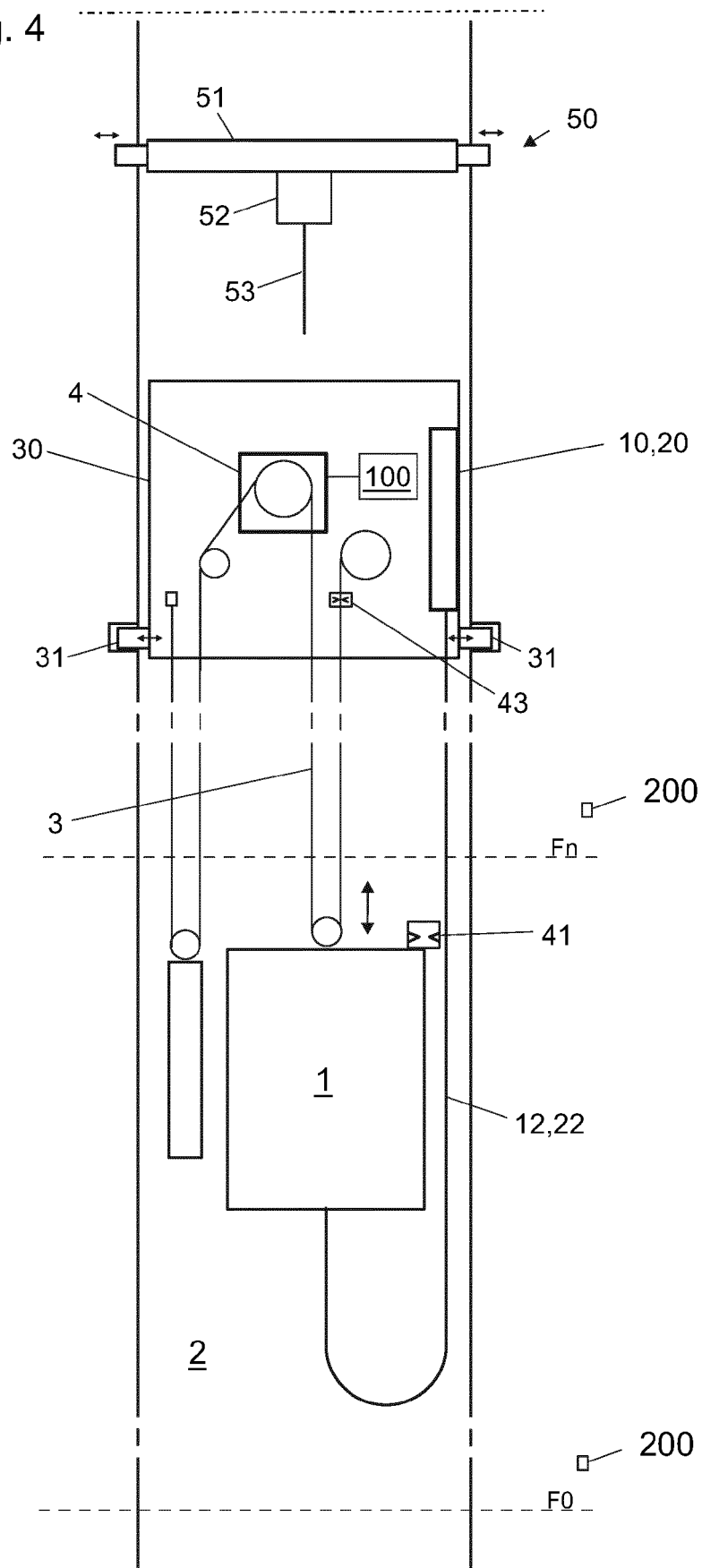


Fig. 5

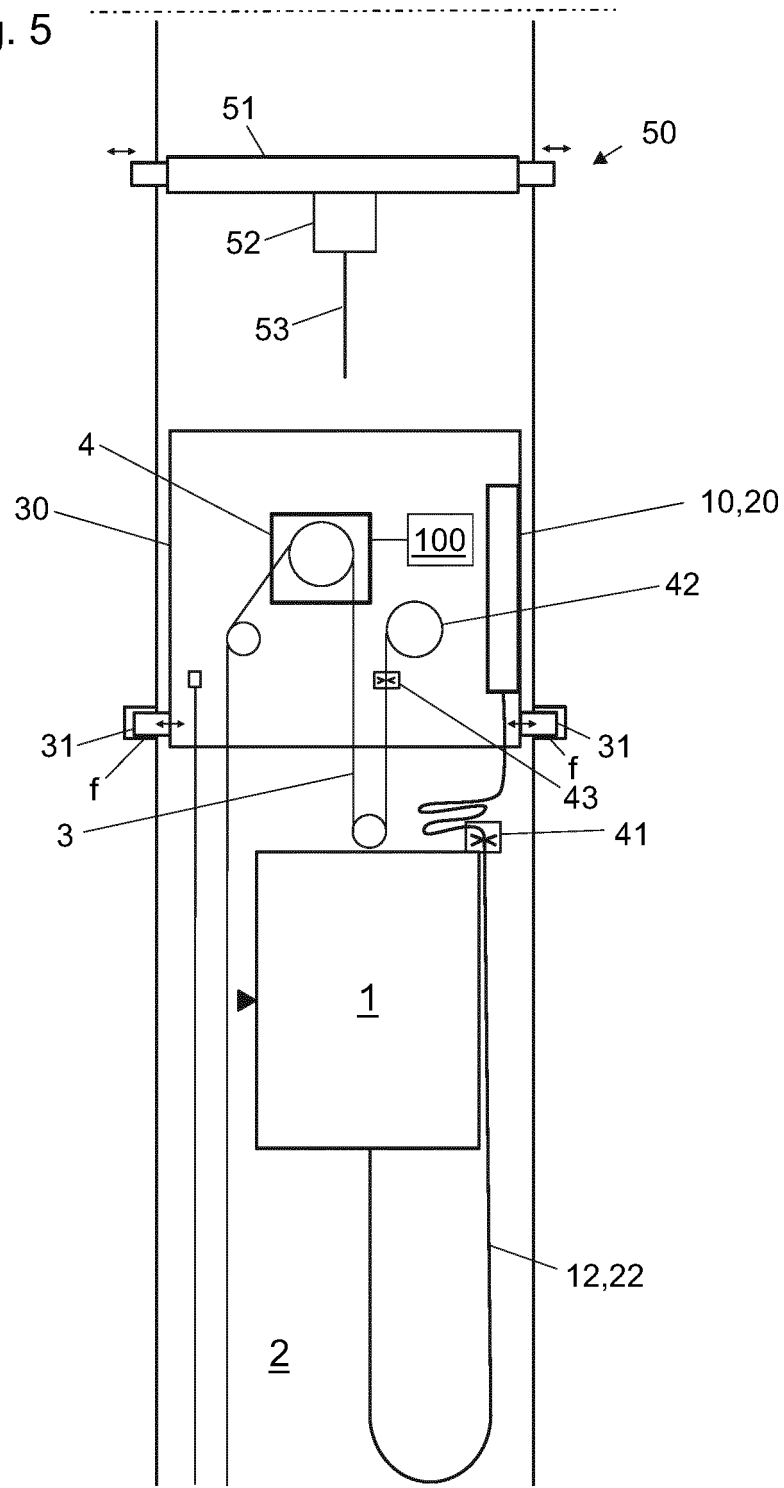


Fig. 6

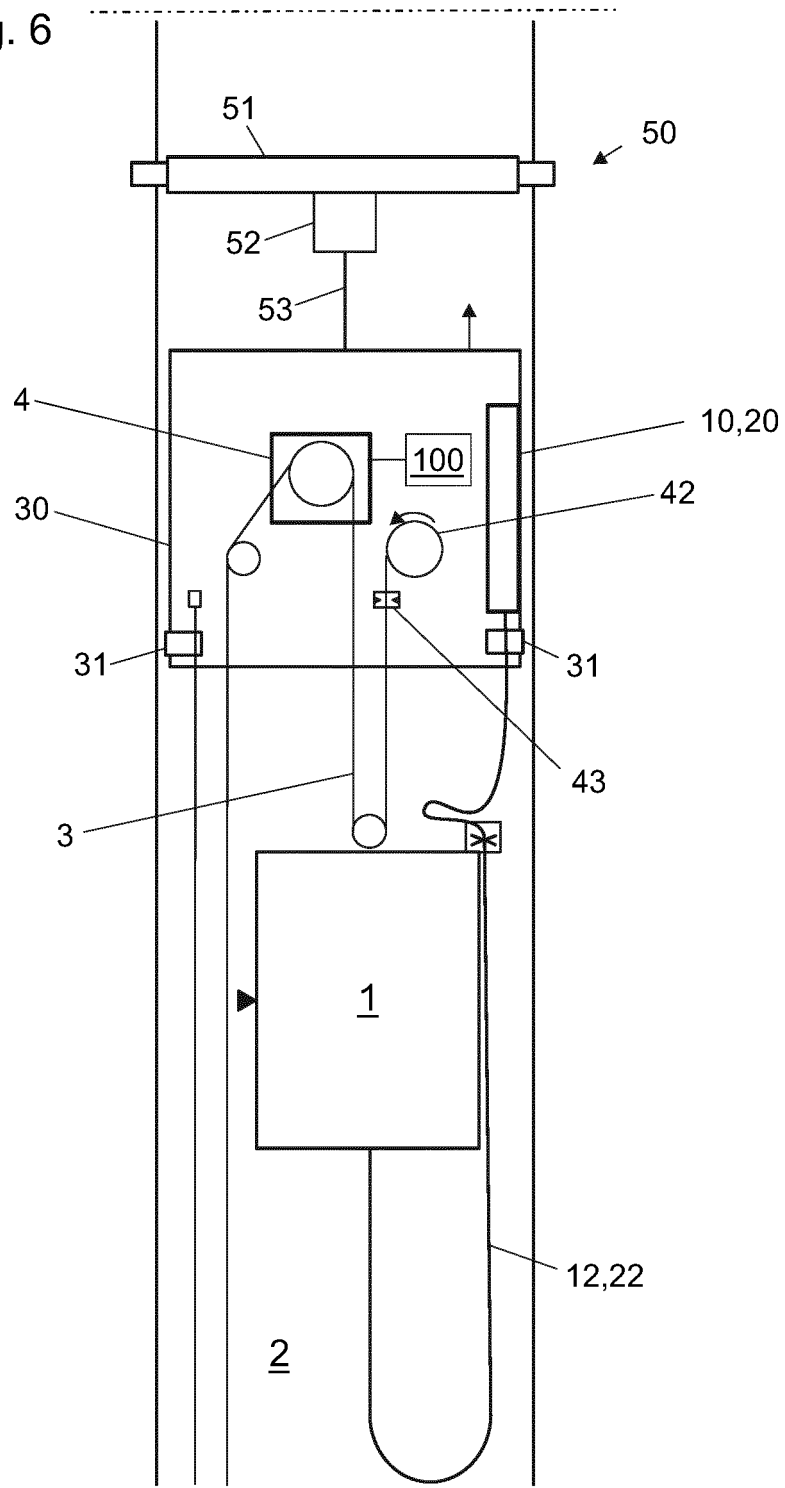


Fig. 7

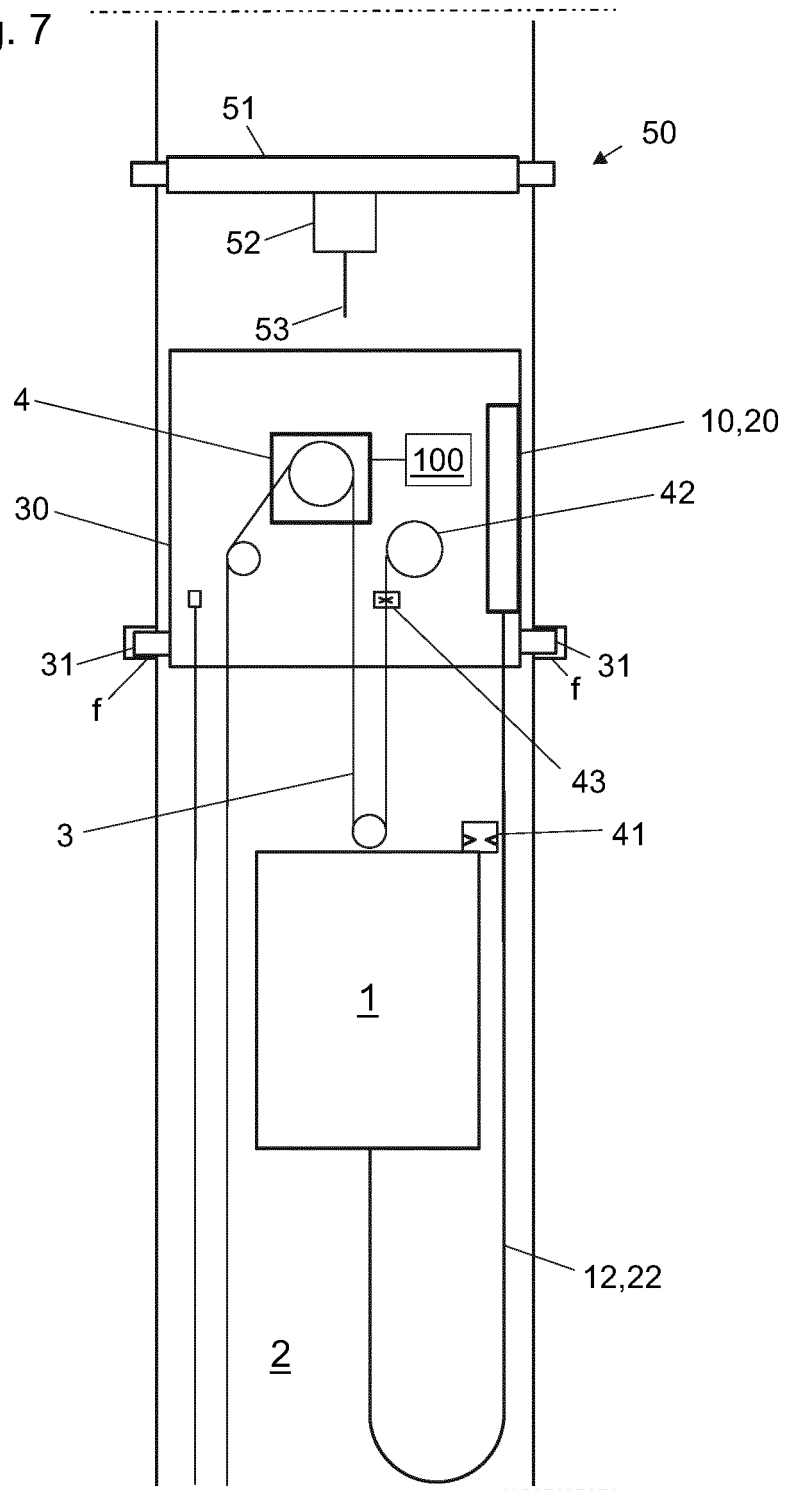


Fig. 8

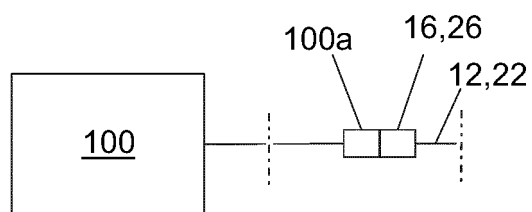
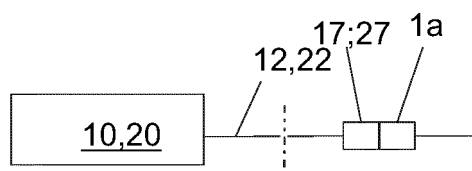


Fig. 9





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Application Number
EP 20 15 8542

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X	JP S53 70054 U (UNKNOWN) 12 June 1978 (1978-06-12) * paragraph [0002]; figures 1-3 *	1,5-11,14-17	
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			B66B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 5 August 2020	Examiner Janssens, Gerd
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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