

Equipment for suspension of a cage or counterweight in a lift installation and methods for mounting and for maintenance of suspension means

The invention relates to equipment for suspension of a cage or a counterweight in a lift installation and to methods for mounting and for maintenance of suspension means, according to the introductory part of the independent patent claims.

DE 2333120 illustrates such a lift installation, in which a cage and a counterweight are suspended by means of looping around of steel belts. Several deflecting rollers are in that case combined into a deflecting roller unit, which is connected with the cage or with the counterweight. The individual deflecting rollers are in that case arranged on a common axis so that the individual deflecting rollers are capable of different rotation.

However, this solution has disadvantages. The deflecting roller units have to be matched to the number of steel belts which are used and be correspondingly combined. Alignment of the deflecting roller unit to the take-off direction of the belts can take place only as a whole and an individual length compensation of the belts due to unequal load distribution, ageing and wear or imprecise mounting is not possible with this deflecting roller unit.

The object of the present invention is now to propose equipment which eliminates the aforesaid disadvantages. Compensation for different support belt elongation and adjustment of the deflecting rollers to special arrangements, for example of the counterweight, shall be made possible.

The present invention meets these objects by the features of the independent claims.

The invention relates to equipment for suspension of a cage or counterweight in a lift installation and to methods for mounting and for maintenance of suspension means, wherein the cage or the counterweight hangs at support belts and the support belts are connected with the cage or counterweight by means of several deflecting rollers.

According to the invention the equipment for suspension of a cage or a counterweight is constructed in such a manner that each deflecting roller is installed in an own deflecting roller unit, each deflecting roller unit offers space for an individual support belt and each

support belt is connected by the own deflecting roller unit with the cage or with the counterweight.

The advantage of this invention is to be seen in that an own deflecting roller unit is associated with each support belt. Preparation of the deflecting roller unit for a specific order is thereby possible in simple manner, since the number of deflecting roller units is oriented directly to the number of support belts. Moreover, the equipment is suitable for use in modernisation of existing installations. Modernisation consists in that parts of an existing lift installation are partly or entirely replaced. A typical modernisation approach consists in replacing an old drive system. Old lift installations or the drive systems thereof were often provided with direct suspension and support cables were as a rule used as support means. A new drive system preferably operates with looped suspension and with support belts. The drive system can thereby be operated with low torques and correspondingly low motor current, which enables use of more economic subassemblies. The equipment according to the invention for suspension of cage or counterweight is best suited to this purpose since it has small dimensions and is connectible in ideal manner with existing cages or counterweights. A further advantage results from the direct usability of the deflecting roller unit for mounting the support belt in a lift installation. This facilitates the mounting process.

Preferred developments of the equipment and methods according to the invention are defined in the dependent claims.

The deflecting roller unit is, in an advantageous embodiment, individually adjustable. It can accordingly be used for compensation for length change of the support belt. The use of a tie bolt for connecting the deflecting roller unit with the cage or with the counterweight enables each individual deflecting roller unit to be able to be adjusted to a required take-off direction of the support belt. By take-off direction there is understood the direction which corresponds with the resultant force line resulting from the force sum of the support belt running to and running from the deflecting roller unit.

The invention is explained in the following on the basis of examples, wherein:

Fig. 1 shows a lift installation with suspended cage and counterweight,

- Fig. 2 shows an example of embodiment of a suspension of a cage according to the invention,
- Fig. 3 shows an example of embodiment of the deflecting roller unit according to the invention,
- Fig. 4 shows an example of embodiment of a deflecting roller unit with compensating spring according to the invention,
- Fig. 5 shows a sectional illustration of a deflecting roller unit,
- Fig. 6 shows an example of mounting of a support belt and
- Fig. 7 shows an example of an arrangement of deflecting roller units in a lift installation.

Fig. 1 shows an arrangement, by way of example, of a lift installation 1 with loop-suspended cage 2 and counterweight 3. Support means 6 are in that case fastened in the region of the shaft head 8 or directly to a drive unit 4 by means of a support means end fastening 9. The support means 6 runs in a first section to a suspension 7 of the cage, which is arranged on the cage 2 and is guided in a second section from the cage 2 to a driving or deflecting pulley of the drive unit 4. A third section of the support means further leads from the drive unit 4 to a suspension 7, which is arranged at the counterweight 3, of the counterweight 3 and from the counterweight 3 in turn to a support means end fastening 9 at the counterweight side. The support means 6 is formed by a support belt 6. The cross-section of the support belt 6 is flat, wherein the surface serving for traction can be smooth or shaped. As a rule at least two support belts 6 carry the cage 2 and the counterweight 3. The support belts 6 are arranged adjacent to one another.

Equipment according to the invention for suspension of the cage 2 or the counterweight 3 is illustrated in Fig. 2. Several support belts 6 - in the illustrated example, three support belts 6 - are arranged in the immediate vicinity of one another. Each support means 6 is in that case according to the invention connected with the cage 2 or with the counterweight 3 by means of an own deflecting roller unit 10. Direct vicinity means that no other parts are arranged between the support belts 6 such as serve for guidance, holding or fastening of

the support means 6, inclusive of the necessary safety spacings. The advantage of this solution is that preparation of the deflecting roller unit 10 for a specific order is possible in simple manner. A number of deflecting roller units 10₁, 10₂, 10₃ to be supplied is oriented to the number of support belts 6 which are provided. Pre-assembly of the deflecting roller devices 10 specific to order is redundant. Moreover, the individual deflecting roller units 10 are individually rotatable and/or adjustable about an axis to a required take-off direction of the respective support belt. The spacing of the deflecting roller units 10 from the cage 2 or from the counterweight 3 is adjustable, for example by threaded rods 20. Thus, the individual deflecting roller units 10 can be used for compensation for changes in length of the support belts 6. Length changes can result during the installing, for example, by reason of different support belt lengths, or they occur in operation, for example by reason of unequal loading of the support belts 6. The deflecting roller unit according to the invention can also be used without limitation for lift installations with a divided support belt arrangement.

Fig. 3, Fig. 4 and Fig. 5 illustrate an advantageous form of embodiment of a deflecting roller unit 10 in detail. The deflecting roller unit 10 comprises a deflecting roller 11. The deflecting roller 11 is matched to the width BT of the support belt. The illustrated deflecting roller unit 10 thus offers space for exactly one support belt 6. This allows an optimum utilisation of the space, since no unnecessary space is lost. The deflecting roller 11 is mounted on an axle 12, advantageously by means of roller bearings 13, and the axle 12 is connected with a U-shaped carrier 14, which laterally retains the deflecting roller 11. The axle 12 is in that case provided, for example at one end, with securing means 15 against turning and on the other side seals with the U-shaped carrier 14. The sealing takes place in that the axle 12 is provided with a shoulder and flange 16, which is expanded to the U-shaped carrier 14. This embodiment is particularly space-saving and accordingly enables small spacings between adjacent deflecting roller units 10₁, 10₂.

The support belt 6 comprises the deflecting roller 11 usually with an angle of wrap of approximately 180°. A spacer 17 is arranged in the region of the deflecting roller 11 not embraced by the support belt 6. The spacer 17 can be of one-piece or multi-piece construction. The spacer 17 determines the spacing of the U-limbs, which are formed by the U-shaped carrier 14, at the side of the U-shaped carrier 14 which is open with respect to the U-shape and it prevents objects from dropping into the entry zone of the support belt 6.

The U-shaped carrier 14 forms a semicircular curve at its end opposite the spacer 17. This curve forms the receptacle for a cylinder 18 which has a transverse bore 19. A tie bolt 20 is plugged through the transverse bore 19 and is provided at its end facing the deflecting roller 11 with a nut 21, preferably a castle nut, and securing cotter pin 22. The tie bolt 20 represents the connection of the deflecting roller unit 10 with the cage 2 or the counterweight 3. The deflecting roller unit 10 is adjustable about an axis AV defined by the tie bolt. The cylinder 18 arranged in the U-shaped carrier 14 additionally enables adjustment of the deflecting roller unit 10 about the axis of the cylinder 18. In the illustrated embodiment the cylinder 18 is secured by means of a securing plate 23 against lateral slipping. The securing plate 23 at the same time prevents damage of the deflecting roller 11 by the tie bolt 20. The illustrated embodiment requires little space, can be manufactured economically and is appropriately adjustable to a take-off direction of the support belt 6.

The deflecting roller 10 is constructed in such a manner that the constructional width BU required by the deflecting roller unit 10 corresponds with less than 1.7 times the width BT of the support belt 6. The illustrated example offers space for a support belt 6 of approximately 30 millimetres width BT. The associated deflecting roller unit 10 requires a width BU of approximately 43 millimetres. A spacing of adjacent deflecting roller units 10 can be fixed at approximately 48 millimetres. Existing lift installations with support cables usually have a support cable spacing of approximately 48 millimetres. The embodiment according to the invention can thus be used particularly well for modernisation of existing lift installations. Existing connecting hole patterns of cage and counterweight can be taken over. This is favourable in terms of costs, since the modernisation interface is placed at an easily definable location.

The tie bolt 20 is secured to the end facing the deflecting roller 11 by a securing cotter pin 22, preferably a spring clip. This enables simple mounting and demounting of the deflecting roller unit 10 in the case of need.

The tie bolt 20 is, at the end of the tie bolt 20 at the cage side or counterweight side, selectably executed with a fixed fastening or the fastening is adjustable. A fixed fastening can be a screw head, which transmits the supporting force of support belt 6 to the cage 2

or the counterweight 3. This fastening is advantageous when no space for more extensively adjustable fastenings is present.

An adjustable fastening is, as illustrated in Fig. 3, a tie bolt 20 with thread, on which a threaded nut 21 with corresponding locking means and securing cotter pin is arranged, which transmits the supporting force from the support belt 6 to the cage or the counterweight. Compensation for elongation of a support belt 6 is carried out in that the support belt 6 is tensioned or relaxed by means of the tie bolt 20 or by adjustment of the threaded nut 21 on the tie bolt 20. This is advantageous, since through this adjustment compensation can be provided for a substantial elongation of the support belt 6, as a change in length at the tie bolt 20 corresponds with twice the change in length of the support means 6. An adjustment of the tension of the support belt 6 by means of the tie bolt 20 is thus very space-saving.

Advantageously at least one support belt end fastening 9 or a deflecting roller unit 10 is executed with a spring-loaded bias. Compensation can thereby be provided for different degrees of stretching or elongation of several support belts 6 relative to one another during operation of the lift installation 1. One embodiment of the fastening of the deflecting roller unit 10 proposes, as illustrated in Fig. 4, that a spring 24 arranged on the tie bolt 20 enables compensation for different stretching or elongation of support belt 6.

In a preferred embodiment the tie bolt 20 is additionally pivotably fastened at both ends by way of a ball socket. The fastening leads at one end of the tie bolt 20 to the cage or to the counterweight and at its other end to the cylinder 18 of the deflecting roller unit 10. This is advantageous, since the deflecting roller unit 10 can be adjusted in correspondence with a take-off direction of the support means 6 and the tie bolt 10 is thus substantially free of bending stresses.

The deflecting roller 11 is shaped in correspondence with a form of construction of the support belt 6. It has a smooth deflecting surface or a structure. In the case of need it is provided with lateral shoulders. The expert defines the construction in correspondence with requirements for traction, noise or guidance accuracy.

Fig. 7 shows a further advantageous form of use of the equipment according to the invention. As a rule the centre axis AZ of the several deflecting rollers 11, which are

arranged on the cage 2 or the counterweight 3, are arranged on a vertical plane EK. This means that the axes 12 of several deflecting roller units 10 considered from above are arranged in a line. Considered from the side, the axes 12 can be set at different height levels, as is apparent in Fig. 2. In an alternative arrangement, however, the centre axes AZ of the deflecting rollers 11 are arranged on mutually parallel vertical planes EG₁, EG₂, EG₃. This means that the axes 12 of several deflecting roller units 10 considered from above are arranged to be displaced in parallel relative to one another. An inclined setting region, which in a normal case is achieved by an inclined setting of the common fastening of the deflecting roller units 10, can thereby be increased.

A deflecting roller unit 10 of the aforesaid kind can be used in particularly satisfactory manner for mounting suspension means in a lift installation. A use of the deflecting roller 10 for this purpose is illustrated, by way of example, in Fig. 6.

A support belt 6.1 is in that case provided for mounting in the region of an uppermost shaft position, for example on a cage 2, which is premounted in this region or fixed there, or in an engine room. Advantageously one end of the support belt 6.2 is placed over the drive unit.

- The end of the support belt 6.2 is now moved into the deflecting roller unit 10 and the end of the support means 6.2 is connected by means of a support belt end fastening 9 with a fixing point at the counterweight side.
- The support belt 6 is let down in the shaft, wherein the support belt 6 is moved downwardly by means of the weight of the deflecting roller unit 10 until the deflecting roller unit 10 has reached the counterweight 3 premounted in the region of the shaft pit.

When the deflecting roller unit 10 has reached the associated counterweight 3 the deflecting roller unit 10 is fastened at the corresponding fastening point. The loose end of the support belt 6 is moved into the associated deflecting roller unit 10, the deflecting roller unit 10 is fastened to the cage 2 and is fastened by means of a further support belt end fastening 9 to the fixing point at the cage side. The support belt 6 can in that case be shortened to the required support means length.

After mounting of all support belts 6 the support means tension can be set with the help of the tie bolt 20 or can be balanced between the support means 6.

The illustrated method is simple to manage, since no support means ends have to be pulled up through the lift shaft, but the support belt 6 can always be mounted from above to below.

If the cage 2 is, as illustrated in Figure 6, premounted in the vicinity of an uppermost stopping point or is fixed there within the scope of a modernisation, the roof of the cage 2 can be used as an excellent working platform. Mounting of auxiliary platforms is in that case redundant.

The expert recognises further advantageous refinements of the outlined examples. Thus, for example, the expert uses individual side plates instead of the illustrated U-shaped carrier 14, changes the illustrated sequence when mounting the support belts or adapts the illustrated 2:1 looping suspension to multiple looping suspension, which obliges for each support belt 6 several deflecting roller units 10 at the cage 2 or at the counterweight 3. The equipment according to the invention can obviously also be used as an individual deflecting roller unit at a desired location in the shaft.

Patent Claims:

1. Equipment for suspension of a cage or a counterweight in a lift installation, wherein the cage (2) or the counterweight (3) hangs at at least two support belts (6) and each support belt (6) is connected with the cage (2) or the counterweight (3) by means of at least one deflecting roller (11), characterised in that each deflecting roller (11) is incorporated in an own deflecting roller unit (10), each deflecting roller unit (10) offers space for a respective individual support belt (6) and each support belt (6) is connected with the cage (2) or the counterweight (3) by means of the own deflecting roller unit (10).
2. Equipment according to claim 1, characterised in that the deflecting roller units (10) are individually adjustable to, in particular, enable setting of the tension of the support belt (6).
3. Equipment according to one of the preceding claims, characterised in that the deflecting roller unit (10) is rotatable about an axis.
4. Equipment according to one of the preceding claims, characterised in that several support belts (6) are arranged in the immediate vicinity of one another.
5. Equipment according to one of the preceding claims, characterised in that the connection of the deflecting roller unit (10) with the cage (2) or with the counterweight (3) is effected by means of a tie bolt (20) and the deflecting roller unit (10) is adjustable about a longitudinal axial axis (AV) defined by the tie bolt (20).
6. Equipment according to one of the preceding claims, characterised in that the deflecting roller unit (10) comprises a deflecting roller (11) which is arranged on an axle (12) by means of roller bearings (13) and the axle (12) is incorporated in a U-shaped carrier (14) and the U-shaped carrier (14) is connected with the tie bolt (20) by means of a cylinder (18) and the tie bolt (20) is secured by means of a securing cotter pin (22).
7. Equipment according to one of the preceding claims, characterised in that the centre axes (AZ) of several deflecting rollers (11) arranged on the cage or the counterweight are arranged on a vertical plane (EK) or that the centre axes (AZ) of the

deflecting rollers (11) are arranged on vertical planes (EG_1 , EG_2 , EG_3) parallel to one another.

8. Method of mounting suspension means in a lift installation, wherein a cage (2) is connected with a counterweight (3) by means of at least two support belts (6) via a driving or supporting roller unit (4) and the connection of each support belt (6) with the cage (2) or with the counterweight (3) is effected by means of a respective own deflecting roller unit (10) and for mounting of the support belts (6) one end of each support belt (6.2) is moved into the associated deflecting roller unit (10) and the end of the support belt (6.2) is connected with a fastening point by means of a support belt end fastening (9) and the support belt (6) is let down in the shaft, wherein each support belt (6) is drawn downwardly by means of the weight of the own deflecting roller unit (10).

9. Method according to claim 8, characterised in that the cage (2) is fixed in the region of an uppermost stopping point and the roof of the cage (2) is used as a work platform for mounting the support belt (6) and that the counterweight (3) is fixed in the region of its lowermost travel position and the deflecting roller unit (10) is connected with the counterweight (3).

10. Method for maintenance of suspension means in a lift installation, wherein at least two support belts (6) connect a cage (2) with a counterweight (3) by way of a driving or supporting roller unit (4), wherein the connection of each support belt (6) with the cage (2) or with the counterweight (3) is effected by means of an own deflecting roller unit (10), characterised in that for compensation for elongation of a support belt (6) the support belt (6) is tightened or relaxed by means of the deflecting roller unit (10).