Method of mounting a support means of a lift cage to a lift cage and to a lift shaft

The invention relates to a method of mounting a support means according to the introductory part of the independent patent claim 1.

A device and a method of mounting a lift installation are known from European Patent Application EP 0506323.8, in which - in departure from previous mounting methods - special scaffolding or auxiliary platforms are no longer required. According to this European patent application the support means are mounted in the lift shaft from above, wherein the lift cage is (pre-)mounted beforehand in the upper region of the lift shaft. However, this method is usable only when support rollers are arranged above the lift cage.

Currently, however, increasing use is also made of lift installations with lift cages underslung by support means. In such a configuration, cage deflecting rollers are typically seated at an underside of the lift cage, i.e. below the lift cage in the region of the cage floor. On mounting of the support means the latter have to be led below the lift cage around the cage deflecting rollers or 'threaded' into these. Use of the means and the method according to the stated European Patent Application therefore no longer comes into question. A method is illustrated for this purpose in EP 0904247 in which support means are pre-mounted at the cage side when the cage is disposed in a lower mounting position. It is disadvantageous with this method that the support means during pulling of the cage up to the upper mounting position has to be kept under tension so that the support means remains in a groove given by the deflection below the cage. This is difficult and susceptible to error.

It is therefore the object of the invention to improve the method, which is stated in the introduction, for mounting a support means in such a manner that the support means of lift installations with underslung lift cages can be mounted in simpler, more error-tolerant and more efficient manner at the time of first mounting or in conjunction with maintenance operations.

According to the invention this object is fulfilled in accordance with the features of the characterising part of the independent patent claim 1.

Advantageous developments of the method according to the invention are defined by the patent claims dependent on patent claim 1.

Whereas conventionally for mounting of a support means in the lift shaft of a lift installation an auxiliary scaffolding with work platforms has to be erected at the various required heights and subsequently removed again, in the method according to the invention use is made of a single height-adjustable work platform which is formed at the lift cage itself or is part of the lift cage. In this connection it is not necessary for the lift cage to even be completely mounted. It is sufficient if the lift cage is present in a structural form and has at least one lower surface or a lower structural part with the cage deflecting rollers as well as a form of work platform. The height adjustment of the thus-formed work platform preferably takes place with the help of an auxiliary hoist which is effective in the lift shaft. Such an auxiliary hoist can already be present in the shaft if in a previous step the guide rails were mounted according to a method such as is described in, for example, the parallel application EP 05106323.8.

The lift cage is temporarily coupled to the auxiliary hoist for the required mounting steps and after the conclusion of the mounting, i.e. when it can be supported by the support means, is decoupled from the auxiliary hoist. As support means use can advantageously be made of support belts which are substantially lighter than steel cables, so that the auxiliary hoist and the mounting point thereof are not too strongly loaded. Moreover, the light support belts are easier to handle so that the assembly personnel can, thanks to the method according to the invention, be reduced in the ideal case to only one person. This is made possible due to the fact that the track-jumping protection means effectively prevents the belt from jumping the track during pulling up of the lift cage.

A lift installation and support means mounted by way of this method are mounted in a short time and mounting can be checked in simple manner.

The invention is described in detail in the following by way of examples and with reference to the schematic drawings, in which:

Fig. 1 shows the lift installation in fully mounted state, in simplified illustration, from the side;

Fig. 2 shows the lift installation in a first mounting intermediate state, in the same illustration as Fig. 1;

Fig. 3 shows the lift installation in a second mounting intermediate state, in the same illustration as Figs. 1 and 2;

Fig. 4 shows the lift installation in a third mounting intermediate state, in the same illustration as Figs. 1 to 3;

Fig. 5 shows the lift installation in a fourth mounting intermediate state, in the same illustration as Figs. 1 to 4;

Fig. 6 shows guidance of the support means in the region of a cage deflecting roller with mounted track-jumping protection means;

Fig. 7 shows the support means, which is constructed as a support belt, in mounted state, in a simplified diagram;

Fig. 8 shows a connecting point for the support means consisting of two support belts, with a clamping device, in a diagram;

Fig. 9 shows a part of a drive pulley with two mounted, parallelly extending support belts according to the invention, in a diagram; and

Fig. 10 shows a part of the fastening/suspension means, in order to connect, in accordance with the invention, a counterweight with two parallelly extending support belts.

Components which are the same and similar or have the same effect are provided in all figures with the same reference numerals.

Fig. 1 shows a lift installation 1. The lift installation 1 comprises a lift shaft 10 which in the illustrated example is bounded by a floor 10.1, side walls 10.2, 10.3 and a ceiling 10.4. A traction pulley 12, a schematically illustrated auxiliary hoist 14 and a first connecting point

16 and second connecting point 18 for a belt-shaped support means 30 are provided in the lift shaft 10.

The traction pulley 12 is rotatably mounted in a stationary position and is drivable in conventional manner. It is preferably integrated, as drive zone, directly in a shaft of a drive unit.

In the present example the auxiliary hoist 14 is fastened to the ceiling 10.4 of the lift shaft 10. The auxiliary hoist 14 is then used for carrying a lift cage 20 when mounting and, in a given case, maintenance operations are undertaken at the lift shaft 1 and in this connection the lift cage 20 is not (yet) supported by the support means 30. The auxiliary hoist 14 can in a given case be usefully employed beforehand to facilitate mounting of other components (for example, guide rails) of the lift installation 1. After the conclusion of the mounting the auxiliary hoist 14 can be removed, but it can also be left in the lift shaft 10 as, to a certain extent, redundant support and drive means for emergency situations. Block-and-tackle equipment mounted in the uppermost shaft region is preferably used as auxiliary hoist 14. It would also be possible to use a fluid hoist (for example, a hydraulic system) arranged in the lowermost shaft region or also a building crane.

The lift installation 1 additionally comprises the already mentioned lift cage 20. The lift cage 20 is present at least in structural form. The final completion of the lift cage 20 can take place later. The lift cage 20 has a floor plate or a lower structural part with a lower surface 22, at which first cage deflecting rollers 24.1 and second cage deflecting rollers 24.2 are arranged, as well as a roof plate (or an upper structural part), which in the present example forms a kind of work platform 26. The work platform 26 could also be formed by the floor plate of the lift cage 20 if the structural form, which is present, of the lift cage 20 still does not incorporate side walls.

The lift cage 20 can be coupled to the auxiliary hoist 14 and is displaceable upwardly and downwardly by this in the lift shaft 10. The lift cage 20 is illustrated in Fig. 1 in an upper shaft region.

The support means 20 mentioned further above, a counterweight 32 and counterweight deflecting means 34 also belong to the lift installation 1. The support means 30 is formed by one or more support belts, which are similarly denoted by 30. The support means or

each support means 30 is elongate and flexible and has a first end 30.1 which in the mounted state is attached to the first connecting point 16, as well as a second end 30.2 which in the mounted state is attached to the second connecting point 18.

The support means 30 runs, in the mounted state, from the first connecting point 16 down along the side wall 10.2 of the lift shaft 10, is deflected by the cage deflecting rollers 24.1 and guided below the lift cage 20, thereafter further deflected by the cage deflecting rollers 24.2 and guided upwardly along the side wall 10.3 of the lift shaft 20 to the traction pulley 12. From the traction pulley 12 the support means runs in a loop 30.4 to the second connecting point 18. The counterweight deflecting means 34 to which the counterweight 32 is attached is disposed in the loop 30.4.

The support means 30 substantially consists of one or more support belts, which are similarly denoted by 30. Each support belt 30 has two belt surfaces. The construction of the connecting points 16, 18, cage deflecting rollers 24.1, 24.2, traction pulley 12 and counterweight deflection means 34 corresponds with the number of support belts and the construction thereof.

One belt surface of the support belt 30 is, according to Fig. 8, preferably a structured belt surface 30.1, usually with grooves which extend transversely or longitudinally with respect to the direction of movement of the support belt 30. The support belt 30 is so arranged that its structured belt surface 30.1 at the deflecting rotation devices, i.e. at the cage deflecting rollers 24.1, 24.2 and at the drive action pulley 12 (and in a given case at the counterweight deflecting means 34) always faces the respective deflecting rotation device and bears against or is in engagement with it. This is due to the fact that the support belt 30 between two deflecting rotation devices, which on movement of the support belt 30 rotate in the opposite sense of rotation, is twisted through 180° about its longitudinal centre axis, as illustrated in Fig. 7. A belt of that kind can be simple to mount, since it is light and the structured belt surface 30.1 enables simple checking of a belt alignment.

The lift installation 1 moreover comprises a tensioning device 40 for tensioning the support means 30. The tensioning device 40 is provided in the region of the first connecting point and/or the second connecting point 18. Fig. 8 shows an example of a connecting point 16, 18 with tensioning device 40 for and with two support belts 30. Tensioning is carried out with the help of a screw device (for example, by means of a spindle and counter-nut).

Fig. 9 shows a part of the drive pulley 12, which is constructed for driving two support belts 30. Of these support means 30, only one is illustrated in Fig. 9. The run 30.5 of the support belt 30 extends upwardly from the cage deflecting roller 24.2 to the drive pulley 12 and then from the drive pulley 12 as run 30.6 to the counterweight deflecting means 34. It is apparent from Fig. 9 that the structured belt surface 30.1 is in engagement with the drive pulley 12.

The individual steps of the mounting method are described in detail in the following. The sequence of some of the steps is not absolutely as described, since, depending on the respective constellation, certain mounting steps can be carried out in a different sequence or simultaneously.

Initially the lift cage 20 is brought into the lift shaft 10 or assembled there and temporarily suspended at the auxiliary hoist 14. The lift cage 20 is, for the succeeding method steps, located in a lower shaft region, but not entirely at the bottom, rather at a height position (spacing A in Fig. 2) at which there is the required access to the cage deflecting rollers 24.1, 24.2. The axes of the cage deflecting rollers 24.1, 24.2 can in this connection be, for example, approximately A = 1700 millimetres above the floor 10.1 of the lift shaft 10.

Next, the support means 30 is brought into the lift shaft 10 and stored on the work platform 26 of the lift cage 20 or in the region thereof. The support means 30 is then led around the cage deflecting rollers 24.1, 24.2. It is also possible to initially lead the support means 30 around the cage deflecting rollers 24.1, 24.2 and then store the support means 30 on or at the lift cage 20. The remaining part of the support means 30 then provisionally remains stored at the lift cage 20 particularly with the first end 30.1 and the second end 30.2 at or on the work platform 26 or reachable from this. The mounting intermediate state after performance of the previously described method steps is apparent from Fig. 2.

The previously described method steps are carried out for all the support means 30, i.e. for each of the support belts.

A track-jumping protection means 25, which prevents the support means 30 from jumping the track while the support means is slack, is mounted at the cage deflecting rollers 24.1, 24.2 as illustrated in Fig. 6 by way of the example of the cage deflecting roller 24.1. The

track-jumping protection means 25 is advantageously mounted to be stationary, i.e. at a housing of the deflecting roller. It comprises a lateral guide 25.1 which prevents lateral slipping of the support means 30 and a radial guide 25.2 which prevents support means slack in radial direction. Support means slack inevitably results during installation of the support means 30, since the support means is not (yet) tensioned. Support means slack can, however, also result in operation if, for example, in the case of collision of the lift cage 20 with end collision buffers, which are usually present, a temporary unloading of support means 30 takes place. In Fig. 6 the track-jumping protection means 25 is shown on the righthand side in a mounting setting and on the lefthand side the end setting 25a with concluded mounting is apparent. The track-jumping protection means can be realised in particularly simple manner if use is made of support means with longitudinally grooved surfaces disposed in engagement with the deflecting rollers 24.1, 24.2. In this connection the track-jumping protection means merely prevents support means slack in radial direction. A lateral displacement is thereby prevented, since the longitudinal grooves of the belt, which are in engagement with corresponding counter-grooves of the deflecting rollers, prevent this.

Finally, the lift cage 20 according to Fig. 3 is brought by means of the auxiliary hoist 14 into an upper shaft region, but not entirely to the top, rather in a height position allowing assembly personnel to be active on the work platform 26 and the lift cage 20. The lift cage 20 is in this connection brought to, for example, a height position in which its floor is disposed approximately 1050 millimetres below an uppermost reachable station (spacing B in Fig. 3). The first end 30.1 of the support means 30 is then attached to the first connecting point 16. Fixing of the mentioned spacings A and B is carried out with consideration of the actual construction and dimensions of a lift installation 1. The details given in conjunction with the present patent application are examples of a concrete form of embodiment.

Thereupon, according to Fig. 4 the second end 30.2 is fixed, a part of the support means 30, which lies between the cage deflecting rollers 24.2 and the second end 30.2 of the support means 30, is advantageously let down in a loop 30.3 in the lift shaft 10, since during this procedure an undesired twisting of the support means can more easily arise, and subsequently the second end 30.2 is led around the traction pulley 12. The support means 30 or the support belt 30 is in this connection twisted between the cage deflecting rollers 24.2 and the traction pulley 12 in targeted manner preferably through 180°. The

second end 30.2 of the support means 30 can be temporarily fixed to the second connecting point 18 or to the cage 20.

The support means mounted in that manner can be mounted in simple manner by one person.

A second loop 30.4 is now let down, as seen from the lift cage 20, on either side of the traction pulley 12 into the lower shaft region of the lift shaft 10 and, in particular, so that its runs 30.6 and 30.7 closer to the side wall 10.3 of the lift shaft 10 (see, also, Fig. 9 and Fig. 10) are guided within possible mounting structures of this side wall 10. This loop 30.4 is formed between the drive pulley 12 and the second end 30.2 of the support means 30, as shown in Fig. 5. Mounting structures of the side wall 10 are, for example, brackets which are led around the counterweight 32 so as to enable fastening of the cage guide.

The first loop 30.3 is obviously pulled up with the letting down of the second loop 30.4.

A track-jumping protection means is advantageously mounted at the drive pulley 12 in the region of the support means deflection as previously explained for the mounting of the support means 30 at the cage deflecting rollers 24.1, 24.2. This track-jumping protection means (not illustrated) prevents the support means 30 from jumping the track in the case of support means slack. A guidance function of the support means 30 is taken over, in normal operation of the lift installation 1, by the structured belt surface 30.1 disposed in engagement with the drive pulley 12 or a drive zone. If, for example due to jumping of the counterweight 32 or the lift cage 30, support means slack occurs then the structured belt surface 30.1 is then temporarily no longer in engagement with the drive pulley 12. At this instant the track-jumping protection means prevents displacement of the support means 30. It is particularly advantageous if this track-jumping support means is mounted in stationary position as illustrated by way of example of the cage deflecting rollers 24.1 in Fig. 6. The drive pulley 12 or a deflecting roller can be executed with small dimensions if such a track-jumping protection means is used. A drive pulley can then be directly integrated, for example without protruding shoulders, in a shaft or roller.

The lift cage 20 is now preferably left in the upper shaft region, whilst in the lower shaft region the counterweight deflecting means 34 is installed in the second loop 30.4 and the counterweight 32 is suspended. Since the lift cage 20 is disposed in the upper shaft

region the loop 30.4 with the counterweight 32 and the counterweight deflecting means 34 hangs in the lower shaft region. This mounting intermediate state is apparent from Fig. 5. A possible track-jumping protection means is preferably mounted at the counterweight deflecting means 34 in the same working step.

During letting down of the loop 30.4 in the lift shaft 10 it is possible to temporarily fasten a small weight to the support means 30 so as to ensure that the support means 30 hangs down sufficiently far in the lift shaft 10. This step is optional.

Next, attachment of the second end 30.2 of the support means 30 to the second connecting point 18 disposed in the upper shaft region and tensioning of the support means 30 take place. The connecting points 16, 18 introduce a load-bearing force of the support means (30) into a surrounding building. The connecting points 16, 18 are, for example, fastened to a wall of the lift shaft or they are arranged at guide rails or they are connected with structures of a drive.

After this step the lift cage 20 is supported by the support means 30 and can therefore be decoupled from the auxiliary hoist 14. The now-achieved final mounting state corresponds with the state illustrated in Fig. 1.

Fig. 10 shows the support means, which is formed by two support belts 30, in the region of the loops 30.4, which are intended for reception of the counterweight deflecting means 34. In Fig. 10 this counterweight deflecting means 34 is still not disposed within the loops 30.4. It is introduced into the loops 30.4 prior to mounting at the counterweight 32; see Fig. 10.

The new method substantially simplifies mounting, because the lift cage 20 itself is used as work platform so that work platforms or scaffolding, to be temporarily installed, are not required. In this connection, however, the necessary safety measures have to be undertaken, i.e. railings or anti-fall protection means have to be provided in the region of the height-adjustable work platform 26. The new method is made possible particularly in that use is made, as support means 30, of support belts which are substantially lighter and therefore also simpler to handle than steel cables, wherein only one person is needed for mounting the support belts.

A lift installation mounted in that way can, moreover, be checked in simple manner. A support means in the form of a support belt is light and an arrangement in the shaft can be checked in simple manner, so that, for example, turning over of support belts can be easily detected and thus avoided. This enables, overall, assembly of the lift installation in short time and without expensive auxiliary structures in the lift shaft or building.

Patent Claims

1. Method of mounting a support belt (30) in a lift installation (1), wherein mounting steps are carried out in several shaft regions from a work platform (26), wherein

- cage deflecting rollers (24.1, 24.2) with the work platform (26) are provided in a lower shaft region and the support belt (30) is led around the cage deflecting rollers (24.1, 24.2) and stored in the region of the work platform (26),
- the support belt (30) is fastened by a first end (30.1) to a first connecting point (16), led by a second end (30.2) around a traction pulley (12), left as a loop (30.4) in the lower shaft region and connected there by a counterweight deflecting means (34) with a counterweight (32), and attached by the second end (30.2) to a second connecting point (18),

characterised in that a track-jumping protection means (25) is mounted in the region of the cage deflecting roller (24), this track-jumping protection means (25) protects the support belt (30) not only in radial direction, but also in lateral direction against jumping the track and the track-jumping protection means (25) is mounted when the work platform (26) is located in the lower shaft region for the purpose of support belt installation.

2. Method according to claim 1, characterised in that the work platform (26) comprises at least one structure of a lift cage (20) and the cage deflecting roller (24) is arranged in the lower region of the lift cage (20).

3. Method according to claim 1 or 2, characterised in that a surface of the support belt (30) is formed as a grooved surface (30.1) with grooves running transversely or longitudinally with respect to the movement direction, and the support belt (30) is so twisted about its longitudinal centre axis between the traction pulley (12) and the adjacent cage deflecting roller (24) that the grooved surface (30.1) comes into engagement not only with the traction pulley (12), but also with the cage deflecting roller (24).

4. Method according to one of the preceding claims, characterised in that a further track-jumping protection means (25) is mounted in the region of the counterweight deflecting means (34) and/or the drive pulley (12) and that the support belt (30) is protected by means of the track-jumping protection means (25) against jumping off the track not only in radial direction, but also in lateral direction.

5. Method according to claim 4, characterised in that the track-jumping protection means (25) is arranged in stationary position at the lift cage (20) and/or the counterweight deflecting means (34) and/or the drive pulley (12).

6. Method according to one of the preceding claims, characterised in that the work platform (26) is, for movement in the shaft, coupled with an auxiliary hoist (14), the work platform (26), after storage of the support belt (30) in the region of the work platform (26) is brought by means of the auxiliary hoist (14) into an upper shaft region and after mounting of the support means (30) the work platform (26) is decoupled from the auxiliary hoist (14) and thus supported by the support belt (30).

7. Method according to one of the preceding claims, characterised in that the traction pulley (12), the connecting points (16, 18) and preferably the auxiliary hoist (14) are arranged in the upper shaft region and the support belt (30) is tightened by means of the first connecting point (16) and/or by means of the second connecting point (18).

8. Method according to one of the preceding claims, characterised in that further support belts (30) extending substantially parallel in the mounted state are mounted together.