

IP1394

1

Lift installation and method of arranging a drive engine of a lift installation

The present invention relates to a lift installation and to a method of arranging a drive engine of a lift installation according to the definition of the patent claims.

A lift installation in which a drive engine drives a cage and a counterweight by way of a drive cable and which lift installation does not require a separate engine room is known from Utility Model JP-50297/1992. Two vertical columns in the form of self-supporting U-shaped profile members serve as guide for cage and counterweight. The columns are closed at the upper end thereof by a horizontal crossbeam, on which the drive engine is mounted. This lift installation has the advantage of lower production costs due to the omission of the engine room.

Patent EP-1045811 shows a lift installation in which a crossbeam carrying the drive engine is fastened to a total of four guides for cage and counterweight. In this manner the entire vertical weight force of drive engine, cage and counterweight is conducted exclusively by way of these guides to the shaft floor and supported there. In that case economic, conventional guides find use. Added to that is the further advantage that the drive engine does not exert any bending moments on the supporting guides, since by virtue of this arrangement and fastening only vertical forces act on the guides. A disadvantage of this lift installation is the restriction of the arrangement of the drive engine to the lateral shaft region in which the guides extend.

The object of the present invention is to provide a lift installation with a flexible arrangement of the drive engine. The drive engine is to be arranged freely selectably substantially in the overall shaft region above cage and counterweight. The drive engine is to be arranged in space-saving manner and to be of small dimensions.

This object is fulfilled by the invention in accordance with the definition of the patent claims.

The invention relates to a lift installation with cage and counterweight and a shaft. It comprises a drive engine mounted on a crossbeam. The crossbeam is fastened by way of each of two end regions at a respective counterweight guide and it is fastened by a centre region to at least one cage guide.

The two counterweight guides and one cage guide span a substantially horizontal triangle in the shaft. The drive engine is of elongate and compact form. Advantageously the drive engine comprises two drive pulleys, which are arranged symmetrically to the left and right of a horizontal connector of the cage guides.

By virtue of this arrangement, which is symmetrical in the triangle, of the guides, weight forces of the drive engine as well as bending moments arising during operation of the drive engine are effectively absorbed and conducted by way of the crossbeam and the guides to the shaft floor. The drive engine can be arranged freely selectably on the area of this triangle substantially above the counterweight and/or substantially above the cage. This flexibility with respect to the arrangement of the drive engine is made possible by the size and shape of the crossbeam and/or the number of deflecting rollers used and/or the kind of drive means employed.

The invention is explained in detail in the following by reference to exemplary forms of embodiment in accordance with Figs. 1 to 10, in which:

- Fig. 1 shows a schematic illustration of the triangular arrangement of guides of a lift installation,
- Fig. 2 shows a perspective view of a part of a first example of embodiment of the arrangement of a gearless drive engine in 2:1 suspension and in vertical projection above the counterweight,
- Fig. 3 shows a schematic plan view of a part of the first example of embodiment of the arrangement of the drive engine according to Fig. 2,
- Fig. 4 shows a schematic view of a part of the first example of embodiment of the arrangement of the drive engine in 2:1 suspension according to Figs. 2 and 3,
- Fig. 5 shows a schematic plan view of a part of a second example of embodiment of the arrangement of a gearless drive engine in 2:1 suspension and in vertical projection above counterweight and/or cage,

- Fig. 6 shows a schematic view of a part of the second example of embodiment of the arrangement of the drive engine in 2:1 suspension according to Fig. 5,
- Fig. 7 shows a schematic plan view of a part of a third example of embodiment of the arrangement of a gearless drive engine in 2:1 suspension and in vertical projection above the cage,
- Fig. 8 shows a schematic view of a part of a third example of embodiment of the arrangement of the drive engine in 1:1 suspension according to Fig. 7,
- Fig. 9 shows a schematic plan view of a part of a fourth example of embodiment of the arrangement of a drive engine with gear in 2:1 suspension and in vertical projection above the cage and
- Fig. 10 shows a schematic plan view of a part of a fourth example of embodiment of the arrangement of a drive engine with gear in 2:1 suspension according to Fig. 9.

Fig. 1 shows a schematic illustration of the triangular arrangement of guides 5, 5', 9, 9' of a lift installation. The lift installation is arranged in, for example, a substantially vertical shaft 10. The shaft 10 has, for example, a rectangular cross-section with four walls. Substantially vertically arranged cage guides 5, 5' and counterweight guides 9, 9' are fastened in the shaft. Two cage guides guide a cage 11 and two counterweight guides guide a counterweight 12. The guides are fastened to next-adjacent walls. The two counterweight guides 9, 9' and a first cage guide 5 are fastened to a first wall. The second cage guide 5 is fastened to a second wall. The second wall is disposed opposite the first wall. The first cage guide 5 is arranged substantially centrally between the two counterweight guides 9, 9'. The guides are of proven materials, such as steel. The fastening of the guides to the walls is carried out by way of, for example, screw connections. With knowledge of the present invention also other shaft geometries with square, oval or round cross-section can be realised.

The two counterweight guides 9, 9' and in each instance one of the two cage guides 5, 5' span, in the shaft 10, a substantially horizontal triangle T. The horizontal connector

between the two counterweight guides forms a first side of the triangle T. The horizontal connectors between a counterweight guide and a cage guide form second and third sides of the triangle T. Advantageously, the horizontal connector of the counterweight guides is longer than a horizontal connector of the cage guides, so that a triangle T consisting of guides 9, 9', 5 of the first wall has an obtuse angle opposite the horizontal connector of the counterweight guides 9, 9' and so that a triangle T consisting of the counterweight guides 9, 9' of the first wall and a cage guide 5' of the second wall has an acute angle opposite the horizontal connector of the counterweight guides 9, 9'. Advantageously the horizontal connector of the cage guides intersects the horizontal connector of the counterweight guides substantially centrally so that the triangle T is substantially equilateral.

Figs. 2 to 10 show a drive engine 1, 2, 3, 3', 4, 40 with two drive pulleys 3, 3'. Advantageously the drive pulleys 3, 3' are operatively connected by way of a shaft 4 with a motor 1 and a brake 2. Advantageously, motor and brake are arranged at two end regions of the shaft and the drive pulleys are arranged between motor and brake in a central region of the shaft. A control and/or a transformer of the lift installation is or are arranged in a switch box 6 advantageously at a wall in the shaft 10. In the forms of embodiment according to Figs. 2 to 8 the drive engine is gearless and of elongate form, i.e. the diameter of the drive engine as seen in a plane perpendicular to the axis of the shaft 4 is smaller than the length of the drive engine. In the form of embodiment according to Figs. 9 and 10 the drive engine is provided with a gear 40. In this form of embodiment as well, the drive engine is of elongate form, i.e. the diameter of the drive engine as seen in a plane perpendicular to the axis of the gear 40 is smaller than the length of the drive engine.

Advantageously, two drive pulleys 3, 3' are arranged symmetrically to the left and right of a horizontal connector of the cage guides 5, 5'. The drive pulleys 3, 3' are advantageously smaller in diameter than the motor housing and/or the brake housing.

The drive engine arranged substantially horizontally in the shaft drives the cage and counterweight, which are interconnected by way of at least one drive means 19, 19', in the shaft. The drive means has two ends 18, 18'. The drive means is a cable and/or a belt of any form. The load-bearing regions of the drive means consist of metal, such as steel and/or plastics material, such as aramide. The cable can be a single cable or multiple cable and the cable can also have an external protective sheathing of plastics material. The belt can be flat and externally unstructured and smooth or, for example, can be

structured into wedge ribs or cogged belts. Advantageously two drive means are employed.

Each of the ends of the drive means is fixed to a shaft wall / shaft ceiling and/or to a cage guide and/or to a counterweight guide and/or to a crossbeam 8 and/or to the cage and/or to the counterweight. Advantageously, the ends of the drive means are fixed by way of resilient intermediate elements for damping of solid-borne sound. The intermediate elements are, for example, spring elements which prevent transmission of vibrations, which are perceived to be unpleasant, from the drive means to the shaft wall / shaft ceiling and/or cage guide and/or counterweight guide and/or crossbeam and/or cage and/or counterweight. Several exemplary forms of embodiment of fixings of ends of the drive means can be distinguished:

- in the form of embodiment according to Figs. 3 and 4, a first end 18 of the drive means is fastened to the shaft wall / shaft ceiling and/or to the cage guide 5' and a second end 18' of the drive means is fastened to the shaft wall / shaft ceiling and/or to the crossbeam 8 and/or to the cage guide 5.
- in the forms of embodiment according to Figs. 5 and 6 as well as 9 and 10 one or both ends 18, 18' of the drive means is or are fastened to the shaft wall / shaft ceiling and/or to the cage guide and/or to the crossbeam.
- in the form of embodiment according to Figs. 7 and 8, a first end 18 of the drive means is fastened to the cage 11 and a second end 18 of the drive means is fastened to the counterweight 12.

According to the examples of embodiment, two drive pulleys move two drive means by way of friction couple. With knowledge of the present invention the expert can also use drive engines as well as drive means different from the examples. Thus, the expert can use a drive engine with only one drive pulley or with more than two drive pulleys. In addition, the expert can use a drive pinion, which drive pinion is in mechanically positive engagement with a cogged belt as drive means.

Several exemplary forms of embodiment of suspensions can be distinguished:

- In the first example of embodiment according to Figs. 2 to 4, in the second example of embodiment according to Figs. 5 and 6 and in the fourth example of embodiment according to Figs. 9 and 10 the cage and counterweight are suspended 2:1. In the case of the 2:1 suspension of the cage 11, several deflecting rollers 13, 13', 14, 14' are mounted at the cage 11. In the case of the 2:1 suspension of the counterweight 12 at least one deflecting roller 17, 17' is mounted at the counterweight 12. Advantageously, the drive engine is arranged in a region substantially above the travel path of the counterweight, i.e. in the vertical projection above the counterweight. The drive engine is advantageously arranged in a region substantially completely above the travel path of the cage. Advantageously, the drive engine is arranged in a region substantially above the travel path of the counterweight and the cage, i.e. in the vertical projection above the counterweight and the cage.
- In the third example of embodiment according to Figs. 7 and 8, cage and counterweight are suspended 1:1. Advantageously, the drive engine in the third example of embodiment is arranged in a region substantially above the travel path of the cage, i.e. in the vertical projection above the cage. The drive engine in the third example of embodiment is advantageously arranged completely above the travel path of the cage.

Fig. 2 shows a perspective view of a part of a first example of embodiment of the arrangement of a gearless drive engine 1, 2, 3, 3', 4. The drive engine is mounted on the crossbeam arranged substantially horizontally in the shaft 10. The crossbeam is, for example, an elongate rectangle of proven materials, such as steel. In this first example of embodiment the crossbeam is fastened to the counterweight guides 9, 9' and to the cage guide 5 of the first wall. Advantageously the crossbeam is fastened by way of two end regions to the counterweight guides and by way of a centre region to a cage guide. The fastening of the crossbeam to these three guides takes place in the three fastening regions by way of, for example, screw connections.

Advantageously the drive engine is mounted on the crossbeam indirectly by way of a bracket 7. The bracket is advantageously mounted at the centre region of the crossbeam. For example, the bracket is mounted on the crossbeam 8 by way of feet 7.5, 7.6. The bracket consists of, for example, a flat-edge or square member of proven materials, such

IP1394

7

as steel, and is mounted on the crossbeam by way of, for example, screw connections. Advantageously the drive engine is fastened to the bracket by way of a motor housing and a brake housing. The motor housing is advantageously fastened to a first bracket mount 7.1 and the brake housing to a second bracket mount 7.2. The two bracket mounts 7.1, 7.2 are connected together by way of, for example, struts 7.3, 7.4 to be stiff in bending with respect to the axis of the shaft 4. Advantageously, the bracket mounts 7.1, 7.2 embrace, at least regionally, boundaries of the motor housing or the brake housing. For example, the bracket mounts 7.1, 7.2 embrace end faces of the motor housing or the brake housing. Advantageously, motor 1 and brake 2 are arranged in a region substantially outside an enclosure of the bracket 7, whilst the drive pulleys 3, 3' are arranged in a region substantially within the enclosure of the bracket 7.

The crossbeam is fastened at least to the apices of the triangle T. Advantageously, the crossbeam 8 rests by two end regions on the counterweight guides 9, 9' and it bears by the centre region laterally against at least one cage guide 5, 5'.

Distinction can be made between several exemplary forms of embodiment of crossbeam fastenings:

- in the example of embodiment according to Figs. 2 to 4 - where the drive engine is arranged in a region substantially above the travel path of the counterweight - the crossbeam is fastened to the counterweight guides 9, 9' and to the cage guide 5 of the first wall, which lies closest to the counterweight guides 9, 9' as well as the cage guide 5. The crossbeam has the form of a rectangle.
- in the example of embodiment of Figs. 2 to 10 - where the drive engine is arranged in a region substantially above the travel path of counterweight and/or cage - the crossbeam 8 is fastened to the counterweight guides 9, 9', to the cage guide 5 of the first wall and/or to the cage guide 5' of the second wall. The crossbeam has, in the examples of embodiment according to Figs. 5 to 8, a triangular form with straight or curved sides and in the example of embodiment according to Figs. 9 and 10 a T-shape.

The bracket 7 and the drive pulleys 3, 3' are advantageously arranged in a central region of the triangle T. Advantageously, the bracket is mounted at the centre region of the

crossbeam. For example, in the first example of embodiment according to Fig. 2 the feet 7.5, 7.6 of the console 7 are mounted at the crossbeam 8 on both sides of the cage guide 5, 5' and substantially equally spaced from the cage guide 5, 5'. For example, the drive pulleys 3, 3' are arranged on the shaft 4 on both sides of the cage guide 5, 5' and substantially equally spaced from the cage guide 5, 5'.

The drive engine can thus be freely selectably arranged on the area of the triangle T substantially above the counterweight and/or substantially above the cage. By virtue of this arrangement, which is symmetrical in the triangle T, of the guides, weight forces of the drive engine as well as bending moments arising during operation of the drive engine are effectively absorbed by, for example, the bracket and conducted by way of the crossbeam and the guides to the shaft floor. The guides are supported, for example, by way of foot plates on the shaft floor.

For example, in the example of embodiment according to Fig. 2 the first bracket mount 7.1 absorbs drive forces emanating from the motor 1 and the second bracket mount 7.2 absorbs braking forces emanating from the brake 2. In addition, the two bracket mounts 7.1, 7.2, absorb forces emanating from the drive pulleys 3, 3'. Advantageously, the two drive pulleys 3, 3' are arranged symmetrically to the left and right of the horizontal connector of the cage guides 5, 5'.

In addition, in the examples of embodiment according to Figs. 5 to 8 - where at least one deflecting roller 15, 15' 16, 16' is provided in the region above the counterweight and/or substantially above the cage - forces emanating from this deflecting roller can be absorbed by the crossbeam 8. Advantageously, this deflecting roller is fastened to the crossbeam 8 or to the bracket 7. Pairs of deflecting rollers 15, 15', 16, 16' are advantageously arranged symmetrically to the left and right of the horizontal connector of the cage guides 5, 5'. Due to the number and position of the deflecting rollers a flexibility in the arrangement of the drive engine on the area of the triangle is made possible. In particular, a high degree of utilisation of the shaft volume can be realised, wherein a dead volume is largely avoided. In addition, the arrangement of the drive engine can be flexibly adapted to predetermined shaft relationships even in the case of modernising operations, which flexibility thus enables use of standard parts and avoids costly special solutions.

Patent Claims

1. Lift installation with cage (11) and counterweight (12) in a shaft (10), with a drive engine (1, 2, 3, 3', 4, 40) mounted on a crossbeam (8), which crossbeam (8) is fastened to a respective counterweight guide (9, 9') and to a cage guide (5, 5'), characterised in that the drive engine comprises two drive pulleys (3, 3') and that the drive engine is gearless.
2. Lift installation according to claim 1, characterised in that the pulleys are operatively connected by way of a shaft (4) with a motor (1) and a brake (2) and/or that the drive pulleys are arranged at the left and right of a horizontal connector of the cage guides.
3. Lift installation according to claim 2, characterised in that the drive pulleys are arranged between motor and brake on the shaft and/or that the drive engine is fastened by way of a motor housing and a brake housing to the bracket and/or that the drive pulleys are arranged substantially in a region within an enclosure of a bracket.
4. Lift installation according to one of claims 1 to 3, characterised in that the counterweight guides and the cage guide span a substantially horizontal triangle (T) and the crossbeam is fastened at the apices of the triangle and/or that the crossbeam is fastened by way of each of two end regions to a respective counterweight guide and by a centre region to the cage guide.
5. Lift installation according to one of claims 1 to 4, characterised in that the cage guides and counterweight guides are arranged substantially vertically in the shaft and/or that the crossbeam is arranged substantially horizontally in the shaft and/or that the drive engine is arranged substantially horizontally in the shaft.
6. Lift installation according to one of claims 1 to 5, characterised in that the drive engine is mounted by way of a bracket (7) at the crossbeam and that the bracket is mounted at the centre region of the crossbeam.
7. Lift installation according to one of claims 1 to 6, characterised in that at least two drive means move the cage and the counterweight, that each drive means has two ends

IP1394

10

and that each of the ends of the drive means is fixed to a shaft wall or shaft ceiling, to the counterweight guide, to the cage guide, to the crossbeam, to the counterweight or to the cage.

8. Lift installation according to one of claims 1 to 7, characterised in that at least two drive means move the cage and the counterweight and that the drive means are belts.

9. Lift installation according to one of claims 1 to 8, characterised in that the cage is suspended 2:1 and the drive engine is arranged in a region above the travel path of the counterweight, that the cage is suspended 2:1 and the drive engine is arranged in a region substantially above the travel path of the cage, that the cage is suspended 2:1 and the drive engine is arranged in a region above the travel path of the counterweight and the cage or that the cage suspended 1:1 and the drive engine is arranged in a region substantially above the travel path of the cage.

10. Method of arranging a drive engine (1, 2, 3, 3', 4, 40) of a lift installation, with a cage (11) and a counterweight (12) in a shaft (10), which drive engine is fastened on a crossbeam (8) to two counterweight guides (9, 9') and to at least one cage guide (5, 5'), characterised in that a drive engine with two drive pulleys (3, 3') is arranged to the left and right of a horizontal connector of the cage guides.

11. Method according to claim 10, characterised in that a substantially horizontal triangle (T) is spanned by the counterweight guides and the cage guide and the crossbeam is fastened at apices of the triangle and/or that the crossbeam is fastened by way of each of two end regions to a respective counterweight guide and by a centre region to the cage guide.

12. Method according to claim 11, characterised in that the drive engine is arranged freely selectably on the area of this triangle (T) substantially above the counterweight and/or substantially above the cage.