

Drive engine for a lift installation and method of mounting a drive engine

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

The specification WO99/43593 shows a drive engine with two drive pulleys for belts. The drive pulleys are arranged in the outer regions of the cage dimension, at least in the respective outer third of the cage dimension corresponding with the orientation of the drive axis, or outside the cage. The drive pulleys are arranged at both sides at the end of the drive engine. The illustrated embodiment has various disadvantages:

- Space requirement: The drive engine occupies a large amount of space.
- Force introduction: The bed forces have to be conducted by way of solid sub-constructions into the support structure of the lift.
- Assembly handling: The assembly and, in particular, the alignment of the drive pulley axis with respect to the running direction of the support means and drive means is costly.

An object of the present invention is the provision of a drive engine and a method of mounting the same which optimise the force flow and thus keep down the demands on the adjoining construction as well as minimise the space requirement for the drive engine. The drive engine shall, in addition, allow a flexible arrangement in the shaft. The support means and drive means train shall be divided into two strands.

This object is met by the invention according to the definition of the independent patent claims.

The invention relates to a drive engine for a lift installation with cage and counterweight and a shaft. Support means and drive means connect the cage with the counterweight. The support means and drive means are termed drive means in the following. The drive means are guided by way of the drive engine. The drive means are driven in the drive engine by a drive shaft. The zones of the drive shaft which transmit the force to the drive means are termed drive zones in the following. The cage and the counterweight are guided by means of cage guide rails and counterweight guide rails, respectively.

The drive shaft has two mutually spaced-apart drive zones. The drive zones are matched to the form of the drive means. The number of drive means is distributed symmetrically to the two drive zones, wherein each drive zone offers space for at least one drive means.

According to the invention at least one component of the drive engine, such as, for example, the motor or the brake, is arranged to the left or the right of the two drive zones. The utility of this arrangement resides in the fact that the dimensions of the drive engine are reduced. The spacing of the two drive zones can thereby be reduced in correspondence with purpose by, for example, arranging the drive means at the smallest possible distance to the left and the right of the guide rails. The space requirement of the drive engine and of the entire drive arrangement is thereby minimised. The small dimensions of the drive engine allow a compact constructional form. The compact constructional form moreover allows an optimal introduction of the bed forces into the support structure, which in turn enables simpler shapes of the sub-constructions. The assembly handling and the alignment of the drive engine is significantly improved by the compact constructional shape and the consequently possible pre-assembly of the individual sub-assemblies in an assembly-friendly environment.

The invention is explained in detail in the following by reference to forms of embodiment, by way of example, according to Figs. 1 to 8, in which:

- Fig. 1a shows a basic sketch of a drive engine according to the invention with bearings and brackets arranged to the left and right of drive zones;
- Fig. 1b shows a basic sketch of a drive engine according to the invention with central bracket, level setting means and with bearings arranged to the left and right of drive zones;
- Fig. 1c shows a basic sketch of a drive engine according to the invention with central bearing and with brackets arranged to the left and right of drive zones;
- Fig. 1d shows a basic sketch of a drive engine according to the invention with central bearing, central bracket and a level setting means with a variant;
- Fig. 1e shows a basic sketch of a drive engine according to the invention with a central bearing, central bracket and a variant of a level setting means;
- 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 according to Fig. 1;

- Fig. 3 shows a detail view of a first example of embodiment of the drive engine according to Fig. 1d;
- Fig. 4 shows a schematic plan view of a part of the first example of embodiment of the arrangement of the drive engine;
- Fig. 5 shows a schematic view of a part of the first example of embodiment of the arrangement of the drive engine in 2:1 suspension;
- Fig. 6 shows a schematic view of the example of embodiment analogous to Fig. 4, with the arrangement of the drive engine in 2:1 suspension at a shaft cover;
- Fig. 7 shows a schematic view of a further example of embodiment of the arrangement of the drive engine in 2:1 suspension; and
- Fig. 8 shows a schematic view of a further example of embodiment of the arrangement of the drive engine in 1:1 suspension.

A drive engine 20 comprises, as illustrated in Figs. 1a to 1e and Figs. 2 to Fig. 4, a drive shaft 4 which is provided with two drive zones 3, 3' arranged at a spacing from one another. A motor 1 and a brake 2 act on the drive shaft 4. The drive zones 3, 3' drive drive means 19, 19', which, as illustrated by way of example in Figs. 5 to 8, drive a cage 11 and a counterweight 12. The spacing D is advantageously selected to be as small as possible. It results from, for example, the envisaged arrangement of the drive zones or the drive means 19, 19' at both sides of the cage guide rail 5. The motor 1 and/or the brake 2 and/or other components, such as rotational speed sensors, evacuation aids or optical indicators, are arranged, according to the invention, to the left and/or right of the two drive zones 3, 3'. The best combination can be ascertained with utilisation of the arrangement possibilities of the components of the drive engine 20. The use of this arrangement results from the fact that the space requirement for the drive engine 20 can be minimised in correspondence with the requirement of the installation arrangement. The drive engine 20 is executed with a small overall length. This enables a significant degree of pre-assembly of the drive engine in a suitable working environment. The assembly is thereby simplified and sources of error are excluded.

Fig. 1a shows the arrangement of the motor 1 and a first bearing 28 on one side of the drive zones 3, 3' and the brake 2 and a second bearing 28' on the other side of the drive zones 3,

3'. Brackets 29, 29' are fastened to the support structure of the lift installation in correspondence with the arrangement of the bearings 28, 28'. This variant is advantageously used when the spacing D between the drive zones 3, 3' is selected to be small, which by way of example is rational in the case of very small guide rail dimensions.

In departure from Fig. 1a, Fig. 1b shows the use of a central bracket 22 which guides the bed forces of the drive engine 20 centrally substantially to a position in the support structure of the lift installation. The central bracket 22 is arranged at right angles to the axis of the drive engine 20 to act in a plane S of symmetry of the two drive zones 3, 3'. This enables a particularly economic embodiment of the connecting construction. In addition, this arrangement enables the use of a level setting means 27. The level setting means 27 in that case has only small force differences to overcome, which result substantially from the weight forces of the drive itself and from inaccuracies in the drive means arrangement. The level setting means 27 enables, without special cost, alignment of the axis of the drive shaft 4 to the direction of running of the drive means 19, 19'. This alignment is advantageous particularly in the case of use of belts as drive means, since the wear behaviour and noise behaviour are thereby decisively influenced. In the case of inaccurate alignment of the drive engine the wear of the drive means strongly increases, which leads to early replacement of the drive means and correspondingly to high costs. For example, in this Fig. 1b the brake 2 and the motor 1 are arranged on one side of the drive zones 3, 3'. This arrangement is advantageous if the space on the opposite side of the drive zones is otherwise occupied.

Fig. 1c shows the arrangement of a central bearing 21 which absorbs the radial force, which is produced by the tension forces present in the drive means 19, 19', of the drive shaft 4 at a central position. The central bearing 21 is arranged at right angles to the axis of the drive engine to act in a plane S of symmetry of the two drive zones 3, 3'. A support bearing 24 is arranged at the motor end of the drive shaft 4. It takes over the difference forces arising in the drive system. The different forces substantially result from the weight forces of the drive itself and from inaccuracies of the drive means arrangements. The support bearing 24 additionally guarantees an exact maintenance of the air gap between the stator and the rotor of the motor 1. The drive engine 20 is fastened by means of two brackets 29, 29' to the support structure of the lift installation. This arrangement is particularly advantageous when the spacing D between the drive zones 3, 3' allows sufficient space for the arrangement of the central bearing 21 and the demands on alignment accuracy of the drive shaft are low.

Fig. 1d shows the arrangement of a central bearing 21 and a central bracket 22, which conducts the bed forces of the drive engine 20 centrally substantially to a position in the

support structure of the lift installation. The central bracket 22 and the central bearing 12 are arranged at right angles to the axis of the drive engine 20 to act in a plane S of symmetry of the two drive zones 3, 3'. A level setting means 27 is preferably arranged at the motor end of the drive engine. A support bearing 24 is arranged as shown in Fig. 1c. The arrangement of the drive engine 20 in correspondence with Fig. 1d is particularly advantageous, since small dimensions of the drive engine 20 result, the forces are conducted in optimum manner to the support structure of the lift installation, use of only two bearing positions in the drive engine 20 enables a secure design of the drive shaft 4 and the alignment of the axis of the drive shaft 4 to the direction of running of the drive means 19, 19' can be carried out in simple manner.

Fig. 1e shows another possibility of arrangement of a level setting means 27. The level setting means 27 is arranged directly at the bearing housing in this form of embodiment. It is identical in its effect to the form of embodiment shown under Figs. 1b, 1d. The expert can define further forms of embodiment best suited for a specific case of use.

The arrangements shown in Figs. 1a to 1e can be combined by the expert in suitable form. The brake 2 can, for example, be arranged between the drive zones 3, 3'.

Fig. 2 and Fig. 3 show a detail embodiment, by way of example, of the arrangement illustrated in Fig. 1d. The illustrated drive engine 20 comprises a drive shaft 4 with two spaced-apart drive zones 3, 3'. In this example the spacing D of the two drive zones is 100 to 250 mm. This allows the arrangement of guide rail profiles which are currently usual and which have a rail foot width of 50 to 140 mm. The drive shaft 4 is mounted in a bearing housing 7. A central bracket 22 in this case is integrated in the bearing housing 7. The central bracket 22 is arranged in a plane S of symmetry, which is at right angles to the drive axis and defined by the two drive zones, between the two drive zones 3, 3'. The drive shaft 4 is mounted in the bearing housing 7 by means of a central bearing 21 arranged between the drive zones 3, 3'. The central bearing 21 is similarly arranged to act in the plane S of symmetry. The central bearing 21 accepts the bed forces due to the drive means 19, 19' and conducts them by way of the bearing housing 7, the central bracket 22 and by way of an intermediate member to the support structure of the lift installation. The drive zones 3, 3' are machined directly into the drive shaft 4. The drive zones 3, 3' can alternatively also be mounted by means of separate elements, such as, for example, in the form of discs, on the drive shaft 4. The drive shaft 4 - or the drive zones 3, 3' - is connected with the motor 1 and a brake 2 in force-effective manner, preferably integrally and gearlessly, and thus enables drive of the drive means 19, 19' by means of the drive zones 3, 3'. The drive zones 3, 3' are,

in the illustrated embodiment, similarly integrally integrated in the drive shaft 4. This is advantageous in the case of use of belts as drive means, since these drive means enable small deflecting or drive radii. Through the arrangement of the central bearing 21 between the drive zones 3, 3' the constructional space available there is utilised efficiently and the external dimensions are reduced. Due to the reduction in the number of varying positions, costs are reduced. The quality of the drive engine 20 is significantly increased by this arrangement, since due to the reduction in the bearing positions an over-determination of the shaft mounting is redundant.

Advantageously the brake 2 and the motor 1 are arranged, as shown in the examples, at the left and the right of the two drive zones 3, 3'. The motor 1 and the brake 2 are force-effectively connected by way of the bearing housing 7. The drive moments produced by the motor 1 and/or the braking moments produced by the brake 2 are conducted into the bearing housing 7 and by way of the central bracket 22 into the support structure of the lift installation. The illustrated arrangement of the drive zones 3, 3' between the brake 2 and the motor 1 enables, together with the force-effective connection of brake 2, motor 1 and bearing housing 7, a particularly space-saving embodiment. In addition, accessibility with respect to the brake 2 and the motor 1 is ensured in ideal manner.

A support bearing 24 is arranged at the motor end of the drive shaft 4. The support bearing 24 accepts the difference forces arising in the drive system. The difference forces substantially result from the weight forces of the drive itself and from inaccuracies in the drive means arrangements. The support bearing 24 additionally ensures an exact maintenance of the air gap between the stator and the rotor of the motor 1. The support bearing 24 conducts the difference forces into the housing of the motor and the bearing housing 7. The resulting support forces are accepted by a level setting means 27 and conducted into the support structure of the lift installation. The level setting means 27 serves at the same time for accurate and simple levelling of the axis of the drive shaft 4 relative to the drive means 19, 19'. This alignment is advantageous particularly in the case of use of belts as drive means, since the wear behaviour and noise behaviour are thereby decisively influenced.

Alternatively, the level setting means 27 can be arranged, for example, horizontally as shown in Fig. 1e.

The bearing housing 7 illustrated in Figs. 2 and 3 partly encloses the drive shaft 4 together with the drive zones 3, 3'. This forms a direct protection of the drive zones 3, 3' against unintended contact and risk of assembly or service personnel being caught, but also

prevents damage of the drive zone or the drive means by objects dropping down. At the same time the bearing housing thereby gains the requisite strength in order to accept the forces and moments from the motor and the brake 2.

The drive engine 20 is fastened by means of vibration insulation means 23, 26. This enables a significant degree of vibration decoupling of the drive engine 20 from the support structure of the lift installation. Noises in the lift installation and/or in the building are thereby reduced.

For simple design of the central bearing the internal diameter of the central bearing 21 is selected to be greater than the diameter of the drive zone 3, 3' in the illustrated embodiment.

A drive form optimal in terms of cost and space is offered by the illustrated form of construction. In particular, the assembly and alignment of the drive engine can take place simply and quickly. The layout of the drive components is simplified, since the loading of the drive shaft 4 and the bearing housing 7 is defined in ideal manner by the achieved two-point mounting.

Fig. 2 shows a perspective view of an example of embodiment of an arrangement of a gearless drive engine 20. The drive engine 20 is mounted on a crossbeam 8 arranged substantially horizontally in the shaft 10. The crossbeam 8 is, for example, an elongate square member of proven materials such as steel. In this first example of embodiment the crossbeam 8 is fastened to counterweight guides 9, 9' and to a cage guide 5 of the first wall. Advantageously the crossbeam is fastened by way of two end regions to the counterweight guides 9, 9' and by way of a centre region to a cage guide. The fastening of the crossbeam 8 to these three guides is carried out in the three fastening regions by way of, for example, screw connections. The illustrated form of embodiment results in an optimum utilisation of the constructional space and enables a significant degree of preparation of the assembly unit in cost-optimal manner in construction works or in a corresponding environment.

A control and/or a transformer 6 of the lift installation is, as shown in Fig. 2, fastened in the vicinity of the drive engine, advantageously similarly on the crossbeam 8. This fastening is, if necessary, insulated against vibration. The drive engine can thus be delivered and assembled together with the associated converter with prefinished cabling. Possible changes in position, which can result due to construction contraction, cannot have any effect and the entire unit can be produced particularly economically. If appropriate, the control and/or transformer can additionally be supported relative to the wall.

A levelling balance 25 is advantageously arranged at the drive engine 20, as shown in Fig. 3. The levelling balance 25 is, for example, realised as a water balance, which indicates the horizontal position of the drive engine 20. The levelling balance 25 allows a simple check of correct levelling and accordingly enables a quick correction of the alignment of the drive engine 20.

The use of the drive engine 20 shown by way of example is universally possible for many types of installation. The arrangement shown in Fig. 2 refers to a lift without a separate engine room. However, the use is not limited to lift installations without an engine room. If an engine room is present the drive can, for example, be equally mounted on the shaft roof as shown in Fig. 6.

With the illustrated possibilities the arrangement of the drive engine can be flexibly adapted, for example in the case of modernisations, to predetermined shaft conditions, which flexibility thus enables use of standard parts and avoids costly special solutions.

Different possibilities of arrangement are illustrated, by way of example, in the following.

Figs. 4 and 5 show a preferred use of the drive engine according to the invention as is used, for example, in the case of new installations. The figures show 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 arranged in the shaft. Two cage guides guide a cage 11 and two counterweight guides guide a counterweight 12. The guides are fastened to 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 consist of proven materials, such as steel. The fastening of guides to the walls takes place 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 a respective one of the two cage guides 5, 5' span a substantially horizontal triangle T in the shaft 10. The horizontal connector between the two counterweight guides forms a first side of the triangle T. The horizontal connectors between one counterweight guide and one cage guide form second and third sides of the triangle T.

Advantageously the horizontal connector of the cage guides H intersects the horizontal connector of the counterweight guides substantially centrally so that the triangle T is substantially equilateral.

Advantageously the two drive zones 3, 3' of the drive engine 20 are arranged symmetrically to the left and right of a horizontal connector H of the cage guides 5, 5'.

The drive engine 20 arranged substantially horizontally in the shaft moves the cage and counterweight, which are connected together by means of at least two drive means 19, 19', in the shaft. The drive means have two ends 18, 18'. The drive means is a cable and/or a belt of any nature. The load-bearing regions of the drive means usually 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 casing of plastics material. The belt can be flat and externally unstructured to be smooth or, for example, structured in wedge ribs or as a cogged belt. The force transmission takes place, in correspondence with the form of embodiment of the drive means, by way of friction couple or mechanically positive connection. The drive zones 3, 3' of the drive shaft 4 are executed in correspondence with the drive means. According to the invention at least two drive means are used. The individual drive means can in case of need also be provided with several drive means.

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

- In the forms of embodiment according to Figs. 5, 6 and 7 one or both of the ends 18, 18' of the drive means is or are fastened to the shaft wall or shaft ceiling, to the cage guide and/or to the crossbeam.
- In the form of embodiment according to Fig. 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 zones move at least two drive means by way of static friction. With knowledge of the present invention the expert can also use drive methods different from those illustrated in the examples. Thus, the expert can use a drive engine with more than two drive zones. The expert can also use a drive pinion, which drive pinion is disposed in mechanically positive engagement with a cogged belt as drive means.

The method of mounting is significantly simplified by the illustrated drive engine and, in particular, by the characterising arrangement of a central bracket 22 between the drive zones, in the axis of symmetry of the resultant force traction of the drive means 19, 19', and the arrangement of a level setting means 27 at the motor end of the drive engine 20. The orientation of the drive axis relative to the traction axis of the drive means can be carried out in simple, rapid and precise manner by means of the provided level setting means 27. Otherwise-usual, costly methods such as placement underneath of underlying members, wedges, etc., can be eliminated.

With knowledge of the present invention the expert in the field of lifts can vary the set forms and arrangements as desired. For example, he or she can construct the central bracket 22 separately from the bearing housing 7.

CLAIMS:

1. Lift installation with cage (11) and counterweight (12) in a shaft (10) and with a drive engine (20), which drives the cage (11) and the counterweight (12) by way of at least
5 two drive means (3, 3'), wherein the drive engine (20) comprises a drive shaft (4), at least two mutually spaced-apart drive zones (3, 3') and components such as a motor (1) and a brake (2), and the support and drive means (19, 19') are arranged in correspondence with the spacing of the drive zone (3, 3'), characterised in that the drive zones (3, 3') are integrally integrated in the drive shaft (4) and directly machined therein.
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2. Lift installation according to claim 1, characterised in that the drive shaft (4) is mounted by way of at least one central bearing (21) which acts in a plane (S) of symmetry of the two drive zones (3, 3').
- 15 3. Lift installation according to claim 2, characterised in that an inner diameter of the central bearing (21) is greater than an outer diameter of the drive zone (3, 3').
4. Lift installation according to claim 2 or 3, characterised in that the central bearing (21) is arranged in a bearing housing (7) and the bearing housing (7) encloses the majority
20 of the drive shaft (4) with the drive zones (3, 3').
5. Lift installation according to any one of the preceding claims, characterised in that the drive zones (3, 3') are arranged symmetrical on the left and right of a horizontal connecting line H of cage guides (5, 5').
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6. Lift installation according to any one of the preceding claims, characterised in that a spacing (D) of the two drive zones (3, 3') or of the support and drive means (19, 19') from one another corresponds with at least the width of a rail foot of a cage guide rail (5).
- 30 7. Lift installation according to any one of the preceding claims, characterised in that the spacing (D) of the two drive zones (3, 3') or of the support and the drive means (19, 19') from one another corresponds with at most three times the width of the rail foot of the cage guide rail (5).

8. Lift installation according to any one of the preceding claims, characterised in that the spacing (D) of the two drive zones (3, 3') or of the support and drive means (19, 19') from one another is 100 to 250 millimetres.
- 5 9. Lift installation according to any one of the preceding claims, characterised in that the drive means (19, 19') is a belt, preferably a belt with wedge ribs.
10. Lift installation according to any one of the preceding claims, characterised in that the fastening of the drive engine (20) to a crossbeam (8) is effected by means of vibration
- 10 insulation means (23, 26) and that the crossbeam (8) is fastened respectively to a counterweight guide (9, 9') and to a cage guide (5, 5').