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Rope Traction Elevator

Description

The present invention relates to a rope traction elevator with an elevator drive, and consists of a gear with traction sheave, a motor, a brake, suspension elements which pass over the traction sheave to provide vertical motion to an elevator car which preferably has a counterweight, the motor of the elevator drive being in an upright position.

An elevator drive of the type mentioned is known from DE 37 37 773 C2. The purpose of this construction is to make it easy to assemble the gear, and to permit rapid mounting and dismounting of the motor, keeping the bearings aligned during the process. The motor, which is in an upright position on top of the gear, has a drum brake at its upper end.

With today's high level of thermal load on the motor windings, the occurrence of a fault in the windings due to an overload appears to be more probable than a mechanical defect in the gear. If a defective motor has to be replaced, the brake on top of the motor also has to be removed together with the defective motor. A prerequisite for this operation is that the car and counterweight must first be secured against unbraked movement, for example by applying clamps to the ropes and/or supporting the counterweight in the hoistway. This procedure is time-consuming and carries the risk of accidents.

The German utility model 1 918 376 discloses an elevator drive consisting of a worm gear and a motor which is also in an upright position, but in which the motor is an external

159159

rotor motor and whose cylindrical external surface simultaneously serves as a brake drum.

With this drive the brake also has to be removed when the motor is replaced, which gives rise to the same disadvantageous effect as already described above. Furthermore, the large gyrating mass resulting from the external rotor principle can have a negative effect on the acceleration and deceleration of the elevator car.

In both of the drives mentioned, the small size of the motors in relation to the size of the gear leads to the conclusion that these drives are designed only for relatively low power output. If a motor for the medium power range is used which has a higher power output and is therefore larger, the horizontal dimensions of the motor may be greater than those of the gear base, which has negative consequences for the range of possible layouts.

The objective of the present invention is therefore to create an elevator drive whose motor and gear cases have narrow dimensions, i.e. in at least one horizontal dimension they are narrow enough for the drive to be located in the side of the hoistway in such a manner as to save space, but at the same time using a normal shape of motor. Moreover, it must be possible to replace the motor rapidly and easily without the disadvantages mentioned above.

The elevator drive according to the invention is characterized by the fact that the elevator drive, including the upright motor attached to it, is slightly tilted in such a way that a vertical projection of the motor from above lies within the horizontal boundary of the gear and that this can be achieved without complex structural modifications.

Advantageous further developments and improvements are stated in the subclaims.

The inclination of the axis of the motor and gear is achieved by the mounting feet of the gear being in an inclined plane relative to the base of the gear.

The mechanical brake is positioned between the motor and the gear and does not have to be removed if the motor is replaced. As a result, movement of the drive and traction sheave after the motor has been removed is prevented by the closed brake, and no additional measures are needed to hold the elevator in position.

The mechanical brake is constructed as an integral part of the gear and is contained in a part of the gear case.

The part of the case containing the brake is constructed as a flange collar, which faces upwards and has a flange plate to receive the motor, and which together with the lower part of the gear is constructed as a single-piece casting.

The vertical cross-section of the gear case, which has an optimized shape similar to an oval for high strength and rigidity, whose curves are constructed from several different radii, and whose height is greater than its width, makes it possible for the gear case to have thin walls and compact dimensions in the horizontal direction.

By positioning a flywheel above the motor it is possible to use a flywheel which projects beyond the cross-section of the motor case without exceeding the dimensions available for installation.

A more detailed description of the invention based on an exemplary embodiment follows below and is illustrated in the drawings. These show:

Fig. 1: a three-dimensional view of the elevator drive and its position in the hoistway;

Fig. 2: a vertical cross-section of the elevator drive shown in Fig. 1;

Fig. 3: a front elevation;

Fig. 4: a side elevation; and

Fig. 5: a cross-section of the gear case along the plane V-V in Fig. 2.

Fig. 1 shows an example of the elevator drive according to the invention installed in the hoistway. The elevator drive consists of a gear 2 with a flange collar 8, which faces upwards and has in its sides openings containing the mechanical brake, and a motor 1 mounted above the brake and having a flywheel 9. The mechanical brake consists of a brake drum 5, a brake magnet 3, and brake shoes 4. Through openings in the sides of the flange collar 8 the brake shoes 4 act from outside on the brake drum 5. The flange collar 8 is closed on its upper side with a flange plate 38 onto which the motor 1 is fastened with screws. The gear 2 is detachably fastened by means of mounting feet 10 at the sides to horizontal supports 11, 12 for the gear. A traction sheave 6 with a cover 7 is located to the side of the gear 2. Suspension elements 18 are slung over the traction sheave 6 and support a car and a counterweight, neither of which is shown. The gear supports 11 and 12 are positioned on a horizontal transverse beam 13 which is itself connected via

elastic supporting pads 14 to the car guide rails 17 and the counterweight guide rails 16. The parts 11-14 thereby form a supporting framework for the elevator drive machine. It can also be seen from Fig. 1 that the motor 1 is not exactly vertical, but at a slight inclination to the vertical and tilting towards the back.

Further details of the elevator drive are explained below with reference to Fig. 2. The active parts of the gear, a worm 20 and a worm wheel 27 which is enmeshed with the worm 20, are installed in an enclosed, oiltight and approximately rectangular hollow space in the lower part of the gear case 28. The worm 20 is part of a motor/worm shaft 19 which is held radially at its lower end in a fixed bearing 30 and axially in the gear case 28 and guided by a movable bearing 29 at the point where it emerges from this part of the gear case 28. The worm wheel 27 is connected to a traction sheave shaft 35 in such a way that they cannot rotate relative to each other. This part of the gear case 28 is closed at the right-hand side with a gear cover 31, has an oil drainage screw 32 at its lowest point, and is filled with gear oil 34 up to the level 33. Together with the upward facing flange collar 8 and the flange plate 38, this part of the gear case 28 is constructed as a single-piece cast case.

On a flat part of the right-hand side of the gear case 28, and adjacent to the flange collar 8, the brake magnet 3 is mounted. A manual brake release lever for opening the brake by hand is shown on the drawing with number 37. The brake drum 5, which is located above the movable bearing 29 and inside the flange collar 8, is non-detachably fastened to the motor/worm shaft 19. A motor case 24 of the motor 1 is detachably fastened to the flange plate 38, preferably by means of screws. The motor case 24 surrounds a laminated stator core 23 with a stator winding 22 whose winding ends

project at the lower end into the flange collar 8. A rotor 21 with a laminated core and a short-circuited winding of a type typical for alternating current motors is located on the motor/worm shaft 19 adjacent to the stator laminations 23.

A fan wheel 25 and a flywheel 9 are attached to the motor/worm shaft 19 close to its upper end in such a way that they cannot turn relative to it and axially secured with a screw 40. Number 36 shows a bevel gear ring which is screwed onto the flywheel 9. The air ventilation opening on the circumference of the fan wheel 25 is covered with a ventilation grille 26. The angle β is the angle of inclination relative to the vertical. The angle of inclination β can be any number of angular degrees that allows the advantages previously mentioned to be obtained. In the example shown, the angle β is approximately 10°. The plane of the bottom of the gear case, shown as number 39, is inclined by the same angle β to the horizontal plane.

In Figure 3 the front elevation shows additional parts of a manually operated evacuation device consisting of a manual operation shaft 44, pivoting clutch mechanism 43, bevel gear pinion 42, and the bevel gear ring 36 mentioned above. The oval-like shape of the gear with the gear cover 31 is also visible.

Fig. 4 shows clearly the advantage of the axis of the motor 1 being inclined at an angle β to the vertical. Because the motor 1 does not project anywhere along its length beyond the base of the gear case, this elevator drive can be placed correspondingly close to a hoistway wall 41, as the extent perpendicular to the plane of the guide rails, and therefore the horizontal dimension of the drive between the hoistway

wall and the path of the car, is correspondingly narrow. Furthermore, an elevator car having suspension ropes fastened to its lower part can travel along the car guide rails 17 upwards and to the right of the elevator drive as depicted in Fig. 4 and past the motor 1 of the elevator drive.

Fig. 5 shows a cross-section of the gear case 28 on the plane cutting the gear case 28 marked in Fig. 2. Fig. 5 shows an ideal contour for the case wall in relation to strength and torsional rigidity for this gear 2. The height h of the external case contour is greater than the width b. In the example shown, the contour of the gear case, which was calculated using the method of finite elements, has four different radii R1-R4 along its perimeter, although the number of radii which flow into each other can be greater or less than four. This results in the wall of the gear case having a cross-section with a shape similar to an oval. The case wall can also be kept relatively thin, which also has a positive effect on the external dimensions and the weight of the gear 2.

The detailed manner of constructing the elevator drive is not limited to the example shown. The mechanical brake, for example, can also be implemented as a disk brake with the corresponding mounting parts.

The size and shape of the motor 1 can deviate from the embodiment shown.

Patent Claims

1. Gear casing for an elevator drive unit in which a drive shaft (35) is held horizontally in a bearing and a motor/worm shaft (19) is held at a right angle to the drive shaft (35) in inserted bearings (29, 30) lying on a common axis, one end of the worm shaft (19) being held in a first bearing (30) in the base area of the gear casing (28) and a second bearing (29) being arranged in a further position,
characterized in
that the first bearing (30) is a dismountable fixed bearing (30) accessible from the outside of the gear casing (28) and the second bearing is a movable bearing (29).

2. Gear casing according to Claim 1,
characterized in
that the movable bearing (29) can be inserted from an upper side of the gear casing (28).

3. Gear casing according to Claim 1 or 2,
characterized in
that a worm (20) is non-rotatably fastened to the motor/worm shaft (19) and a worm gear (27) meshing with the worm (20) is non-rotatably fastened to the drive shaft (35) and/or that the gear casing (28) is formed essentially as a monolithic cast casing, and/or that the gear casing (28) has an access opening for inserting the worm wheel.

4. Gear casing according to one or several of Claims 1 to 3,
characterized in
that the gear casing (28) has a height (h) which is greater than the width (b), and has an essentially oval cross-section in a plane parallel to the drive shaft (35).

5. Gear casing according to one or several of Claims 1 to 4,
characterized in
that formed monolithically on an upper side of the gear casing (28) in the vicinity of the movable bearing (29) is an upwardly extending

6. Gear casing according to one or several of Claims 1 to 5, characterized in
that in a plane perpendicular to the drive shaft (35) the gear casing (28) has an approximately rectangular cross-section.

7. Gear casing according to one or several of Claims 1 to 6, characterized in
that in a plane perpendicular to the drive shaft (35) the common axis of the mutually aligned bearings (29; 30) is inclined at an acute angle (ß) relative to the vertical.

8. Method of assembling an elevator gear unit in which
a) a gear shaft (35) on which a worm wheel (27) is non-rotatably held is inserted horizontally into a gear casing (28),
b) a movable bearing (29) is pressed onto the monolithic motor/worm shaft (19) of a pre-assembled motor assembly,
c) the motor assembly is placed on the gear casing from above, the motor/worm shaft (19) being inserted at a right angle to the drive shaft (35) through a first bored bearing hole in the gear casing (28) and into a second bored hole in the gear casing (28) situated opposite and on a common axis, and the movable bearing (29) is inserted into the first bored bearing hole from above the gear casing (28),
d) the motor casing (24) is bolted to the gear casing,
e) a dismountable fixed bearing (30) is pressed from the outside of the gear casing (28) onto the end of the worm shaft (19) and inserted into a second bored bearing hole and held axially with an end-cap bolted to the gear casing (28).

9. Assembly method according to Claim 8,
characterized in
that in step b) when pre-assembling the motor assembly, a brake drum (5) is fastened on the motor/worm shaft (19) between between the rotor (21) and the movable bearing (29).