

Description

Drive Unit for an Elevator

5 The invention relates to a drive unit for an elevator comprising motors and a traction sheave wherein traction sheave and motors are supported on bearing end-plates arranged on a machine frame.

10 From EP patent application 0 565 893 a drive unit for elevators has become known which between two bearing end-plates has a traction sheave and electric motors which can be mechanically coupled in series. The rigidly series-coupled external-rotor motors are synchronized by means of a
15 multi-motor speed control. The traction sheave and the motors are supported on a rigid axle supported by the bearing end-plates.

A disadvantage of the known device is that the forces acting
20 on the rigid axle are unfavorably distributed. The main forces emanating from the traction sheave must largely be absorbed by a bearing end-plate. Also, the series-coupled electric motors make large distances between bearing end-plates necessary.

25 It is here that the invention sets out to provide a remedy. The invention as characterized in Claim 1 provides a solution to avoiding the disadvantages of the known device and creating an elevator drive which is compact.

30 The advantages achieved by the invention are essentially to be seen in that a drive unit with a short shaft and therefore a short overall length of the drive unit can be realized. It is also advantageous that the traction sheave
35 is held in bearings at both ends and the electric motors can be arranged symmetrically relative to the traction sheave, which makes the drive unit usable in the highest performance segment.

The present invention is explained in greater detail by reference to the attached figures.

Shown are in

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Fig. 1

a three-dimensional representation of the drive unit according to the invention;

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Fig. 2

a cross-section through the drive unit along its shaft;

Fig. 3 and Fig. 4

an electric power supply to the drive unit.

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Fig. 1 shows the completely assembled drive unit 1, consisting essentially of a machine frame 2, on which a first bearing end-plate 3 and a second bearing end-plate 4 are arranged. Also arranged on the machine frame 2 is a secondary-sheave mounting 5 with a secondary sheave 6. The bearing end-plates 3, 4 support a traction sheave 7, over which ropes 8 are guided, the ropes 8 being also guided over the secondary sheave 6. SA indicates the distance required between the rope-fall of an elevator car and a counterweight.

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Arranged on the first bearing end-plate 3 is a first motor 9, and on the second bearing end-plate a second motor 10. Each motor 9, 10 is provided with a terminal box 11 and with fans 12.1, 12.2. The traction sheave 7 has on each side a brake disk 13 on which two disk brakes 14 act.

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Fig. 2 shows a cross-section through the drive unit 1. The traction sheave 7 is supported by a shaft 15, the shaft 15 being held rotatably in a first bearing 16 of the first bearing end-plate 3 and in a second bearing 17 of the second bearing end-plate 4. A first free-end of the shaft 15 is indicated with 15.1, and a second free-end of the shaft 15

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is indicated with 15.2. Mounted on the first free-end 15.1 of the shaft 15 is a first rotor 9.1 of the first motor 9. Arranged on the first bearing end-plate 3 by means of a first cage-housing 9.3 is a first stator 9.2. Similar
5 applies to the second free-end 15.2, a second rotor 10.1, a second stator 10.2, and a second cage-housing 10.3 of the second motor 10. A tachogenerator 18 which can be coupled with the shaft 15 is provided to register the rotational speed.

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Fig. 3 and Fig. 4 show an electric power supply for the drive unit 1, more specifically the motors 9, 10. The motors 9, 10 are of three-phase construction, each motor having a first winding-set W1 and second winding-set W2, the windings
15 of one winding-set being mechanically connected in parallel with the corresponding windings of the other winding-set. The first winding-set W1 of the motor 9 is connected to the output of a frequency converter FU1. The second winding-set W2 of the motor 9 is connected to the output of a frequency
20 converter FU2.

The first winding-set W1 of the motor 10 is connected to the output of a frequency converter FU3. The second winding-set W2 of the motor 10 is connected to the output of a frequency
25 converter FU4. The winding-ends at one end of each winding-set W1, W2 are connected in star formation. The system requires the outputs of the frequency converters FU1, FU2, FU3, FU4 to be connected together in electrically isolated manner, which is possible by means of several winding-sets
30 W1, W2 of the motors 9, 10 which are to be supplied with electric power provided that the motors 9, 10 are rigidly coupled by means of the shaft 15.

The frequency converter FU1 is determinant for the other
35 frequency converters FU2, FU3, FU4, the frequency converters operating in master/slave mode. The frequency converter FU1 determines based on the actual value of the rotational speed V_{ACT} of the tachogenerator 18, and based on the reference

value of the rotational speed V_{REF} of the elevator control CONTROL, the references for the inverter regulation. The frequency converter FU1 also produces the references for the converter regulation. The converter CONVERTER is connected to the power supply POWER SUPPLY and, depending on the converter regulation, generates the voltage of the DC link DC to which the inverter INVERTER is connected. The actual value of the rotational speed V_{ACT} and the reference value of the rotational speed V_{REF} are supplied to a rotational-speed regulator ROTATIONAL-SPEED REGULATOR which determines the reference value for the current i_{REF} of the motors 9, 10. The current of the three-phase winding-sets W1, W2 is registered for each phase and fed as actual current value I_{ACT} to the current regulator CURRENT REGULATOR, which generates from the reference value of the current (portion of the reference value of the current i_{REF}) and the actual value of the current I_{ACT} the regulator signals PWM for the switch of the inverter INVERTER which is connected to the voltage of the DC link DC. With regard to structure and function, the current regulator CURRENT REGULATOR and inverter INVERTER of the other frequency converters FU2, FU3, FU4 are comparable to the master frequency converter FU1. The specification of the amplitude of the reference value of current for the current regulator CURRENT REGULATOR of the frequency converters FU2, FU3, FU4 takes place via the bidirectional bus BUS. All other communication between the frequency converters FU1, FU2, FU3, FU4 (error handling, internal monitoring, identification of the frequency converters, etc.) also takes place via this bus BUS.

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The master frequency converter FU1 determines by means of the rotational-speed regulator ROTATIONAL SPEED REGULATOR the total current i_{REF} which is distributed to all the frequency converters FU1, FU2, FU3, FU4. The underlying current regulator CURRENT REGULATOR operates on, for example, the principle of vector regulation, transmission of the transformation angle of the reference value of the current from the master frequency converter FU1 to the slave

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frequency converter FU2, FU3, FU4 taking place via the unidirectional bus SSM.

5 The voltage of the DC link DC is generated by the converter
CONVERTER, which is connected to the three-phase power
supply POWER SUPPLY. The switch of the converter CONVERTER
is controlled by means of control signals PWML which are
generated by the converter regulator DC REGULATOR. With
10 regard to structure and function, the converter regulator DC
REGULATOR and converter CONVERTER of the other frequency
converters FU2, FU3, FU4 are comparable to the master
frequency converter FU1, synchronization of the converter
CONVERTER of the frequency converter FU2, FU3, FU4 taking
15 place by means of a timing signal of the frequency converter
FU1 via the unidirectional bus SSL.

Patent Claims

1.

5 Drive unit (1) for an elevator comprising motors (9, 10) and
a traction sheave (7) wherein traction sheave (7) and motors
(9, 10) are supported on bearing end-plates (3, 4) arranged
on a machine frame (2),
characterized in that
10 the traction sheave (7) is supported by means of a shaft
(15), the shaft (15) being held rotatably in a first bearing
(16) of a first bearing end-plate (3) and in a second
bearing (17) of a second bearing end-plate (4) and having
free ends (15.1, 15.2) on which the motors (9, 10) are
arranged.

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2.

Drive unit according to Claim 1,
characterized in that

20 arranged on the first free-end (15.1) of the shaft (15) is a
first rotor (9.1) of a first motor (9) and arranged on the
first bearing end-plate (3) by means of a first cage-housing
(9.3) is a first stator (9.2)
and in that
arranged on the second free-end (15.2) of the shaft (15) is
25 a second rotor (10.1) of a second motor (10) and arranged on
the second bearing end-plate of the second motor (10) by
means of a second cage-housing (10.3) is a second stator
(10.2).

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3.

Drive unit according to Claim 1 or 2,
characterized in that

arranged on the traction sheave (7) are brake disks (13) on
which disk brakes (14) act.

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4.

Drive unit according to one of the foregoing claims,
characterized in that

the motors (9, 10) are connected to frequency converters (FU1, FU2, FU3, FU4) which operate in master/slave mode.

5.

5 Drive unit according to Claim 4,
characterized in that

the master frequency converter (FU1) specifies a total
current (i_{REF}) which is distributed between all the frequency
converters (FU1, FU2, FU3, FU4), a current regulator
10 (CURRENT REGULATOR) regulating the current of each frequency
converter based on the reference current value and the
actual current value (i_{ACT}).

6.

15 Drive unit according to one of Claims 4 or 5,
characterized in that

provided for communication between the frequency converters
(FU1, FU2, FU3, FU4) is at least one bus system (SSL, BUS,
SSM) via which reference-current signals, synchronization
20 signals, identification signals, etc. can be exchanged
between the frequency converters (FU1, FU2, FU3, FU4).