space between the car wall plane and the hoistway wall plane, even when this space is very slim. Having two ropes facilitates safety of the elevator as in this way it is not relied on only one rope.

In a preferred embodiment said load bearing member(s) is/are embedded in a common elastomeric coating. The ropes being belt-like, they provide a large surface area enabling efficient force transmission, e.g. by frictional engagement. This can be facilitated by elastomeric coating. In a preferred embodiment, the coating forms the contoured shape for the rope.

In a preferred embodiment said rope(s) each comprise a plurality of parallel load bearing members adjacent and spaced apart in the width direction of the belt-shaped rope.

In a preferred embodiment said the width/thickness ratio(s) of the rope is at least 4, preferably at least 8. Thereby, the bending resistance of the rope is small but the load bearing total cross sectional area can be made vast.

In a preferred embodiment said the width/thickness ratio(s) of said load bearing member(s) is/are at least 8, preferably more. Thereby, the bending resistance of the rope is small but the load bearing total cross sectional area is vast with minimal non-bearing areas.

In a further refined embodiment said load bearing member(s) has/have width larger than thickness as measured in width direction of the belt-like rope. In a yet further refined embodiment each of said rope(s) comprises a small number of load bearing parts, which is enabled by the great width. In one preferred embodiment, each of said rope(s) comprise(s) exactly one of said load bearing members. Thus, non-bearing cross sectional areas are minimized. Accordingly, the width of the rope is effectively utilized and size of the rope bundle minimized. In a preferred alternative embodiment, each of said rope(s) comprises exactly two of said load bearing members adjacent in width-direction of the rope. Thus, non-bearing areas between adjacent load bearing members are minimized, yet not having to rely on only one load bearing member. Said

two load bearing members are parallel in length direction of the rope and placed on the same plane in width-direction of the rope.

In a preferred embodiment the of the elevator the thickness of each of said load bearing member(s) is from 0.8 mm to 1.5 mm, preferably from 1 mm to 1.2 mm as measured in thickness direction of the rope. In this way, the ropes as specified above, will have an optimal combination of properties with regard to compactness, traction abilities and tensile properties, which is especially important in case of an elevator where the ropes pass around a wheel is positioned in a slim space, in particular between the car wall plane and the hoistway inner wall plane as specified above. Preferably, the width of the of the single load bearing member or the total width of the two load bearing members of the same rope is from 20 mm to 30 mm. Preferably, the total width of the load bearing members of the two ropes is from 40 to 60 mm. This is the optimal combination of dimensions for obtaining an elevator with high maximum load and space efficiency.

In a further refined embodiment the load bearing member(s) of the rope cover(s) majority, preferably 70% or over, more preferably 75% or over, most preferably 80% or over, most preferably 85% or over, of the width of the rope. In this way at least majority of the width of the rope will be effectively utilized and the rope can be formed to be light and thin in the bending direction for reducing the bending resistance.

In a further refined embodiment the module of elasticity (E) of the polymer matrix is over 2 GPa, most preferably over 2.5 GPa, yet more preferably in the range 2.5-10 GPa, most preferably of all in the range 2.5-3.5 GPa. In this way a structure is achieved wherein the matrix essentially supports the reinforcing fibers, in particular from buckling. One advantage, among others, is a longer service life.

In a further refined embodiment, individual reinforcing fibers are homogeneously distributed in said polymer matrix. Preferably, over 50% of the cross-sectional square area of the load-bearing part consists of said reinforcing

same as far as possible in terms of its cross-section for the whole length of the rope. The reinforcing fibers f are preferably distributed in the aforementioned load bearing member 7,7' as evenly as possible, so that the load bearing member 7,7' would be as homogeneous as possible in the transverse direction of the rope 2,2'. An advantage of the structure presented is that the matrix m surrounding the reinforcing fibers f keeps the interpositioning of the reinforcing fibers f essentially unchanged. It equalizes with its slight elasticity the distribution of a force exerted on the fibers, reduces fiber-fiber contacts and internal wear of the rope, thus improving the service life of the rope. The reinforcing fibers being carbon fibers, a good tensile rigidity and a light structure and good thermal properties, among other things, are achieved. They possess good strength properties and rigidity properties with small cross sectional area, thus facilitating space efficiency of a roping with certain strength or rigidity requirements. They also tolerate high temperatures, thus reducing risk of ignition. Good thermal conductivity also assists the onward transfer of heat due to friction, among other things, and thus reduces the accumulation of heat in the parts of the rope. The composite matrix m, into which the individual fibers f are distributed as evenly as possible, is most preferably of epoxy resin, which has good adhesiveness to the reinforcements and which is strong to behave advantageously with carbon fiber. Alternatively, e.g. polyester or vinyl ester can be used. Alternatively some other materials could be used. Figure 7 presents a partial cross-section of the surface structure of the load bearing member 7,7' as viewed in the longitudinal direction of the rope 2,2', presented inside the circle in the figure, according to which cross-section the reinforcing fibers f of the load bearing members 7,7' are preferably organized in the polymer matrix m throughout the load bearing member 7,7' in question. As presented by Figure 7, the individual reinforcing fibers f are essentially evenly distributed in the polymer matrix m, which surrounds the fibers and which is fixed to the fibers f. The polymer matrix m fills the areas between individual reinforcing fibers f and binds essentially all the reinforcing fibers f that are inside the matrix m to each other as a uniform solid substance. In this case abrasive movement between the reinforcing fibers

CLAIMS

1. A counterweightless elevator comprising

a hoistway;

a car vertically movable in the hoistway;

one or more suspension ropes;

a rotatable drive member engaging said suspension rope(s)

each of the suspension rope(s) being belt-like and having a first rope section on the first side of the drive member and a second rope section on the second side of the drive member, each rope section being connected to the car, said first rope section suspending the car; and

a tightening device arranged to tighten the second rope section;

wherein said second rope section is connected to a movably mounted tightening member of the tightening device of the second rope section, which tightening member is movable to tighten the second rope section, and said first rope section suspending the car is tensioned by the weight of the car, and guided to pass further to said tightening device of the second rope section and connected in a force transmitting manner to said movably mounted tightening member to pull the tightening member by effect of the rope tension of the first rope section such that the tightening member moves to tighten the second rope section,

characterized in that each of said suspension rope(s) comprises a load bearing member or a plurality of load bearing members, which load bearing member(s) is/are made of composite material comprising reinforcing fibers embedded in a polymer matrix, which reinforcing fibers are carbon fibers, and in that the first and/or second rope section passes to the tightening device turning around its longitudinal axis in the space between the vertical projection of the car and the vertical hoistway inner wall plane.

2. An elevator according to claim 1, **characterized** in that said load bearing member(s) is/are parallel with the longitudinal direction of the rope.

3. An elevator according to any of the preceding claims, **characterized** in that said reinforcing fibers are parallel with the longitudinal direction of the load bearing member.

4. An elevator according to any of the preceding claims, **characterized** in that the tightening device is mounted on the car at the side thereof, or on the stationary hoistway structures beside the vertical projection of the car, in particular beside the path of the elevator car.

5. An elevator according to any of the preceding claims, **characterized** in that the tightening device is mounted on the car at the side thereof, or on the stationary hoistway structures beside the vertical projection of the car, and the tightening member is movable along a vertical plane, which is parallel with the side wall plane of the car and/or hoistway inner wall plane to tighten the second rope section.

6. An elevator according to any of the preceding claims, **characterized** in that the tightening member is between the vertical side wall plane of the car and the vertical hoistway inner wall plane.

7. An elevator according to any of the preceding claims, **characterized** in that the tightening member is in the form of a tightening pulley around which the second rope section passes, the tightening member being movable in radial direction of the tightening pulley and/or around its axis, to tighten the second rope section.

8. An elevator according to claim 7, **characterized** in that the plane of rotation of the tightening pulley is parallel with the side wall plane of the car and/or hoistway inner wall plane.

9. An elevator according to any of the preceding claims, **characterized** in that the tightening member is in the form of a tightening pulley around which the second rope section passes, the tightening member being movable in radial direction of the tightening pulley to tighten the second rope section, the end of the first rope section being connected in a force transmitting manner to the movably mounted tightening pulley to pull the tightening pulley by effect of the rope tension of the first rope section such that the tightening pulley moves radially to tighten the second rope section.

10. An elevator according to any of the preceding claims, **characterized** in that the tightening member is in the form of a tightening pulley around which the second rope section passes and against the rim of which the second rope section is fixed, the tightening member being movable around its axis to tighten the second rope section , the end of the first rope section being connected in a force transmitting manner to the movably mounted tightening pulley to pull the tightening pulley by effect of the rope tension of the first rope section such that the tightening pulley turns to tighten the second rope section.

11. An elevator according to any one of the preceding claims, **characterized** in that each of said rope(s) has at least one contoured side provided with elongated guide rib(s) and elongated guide groove(s) oriented in the longitudinal direction of the rope, said contoured side being fitted to pass against a contoured circumference of one or more rope wheels of the elevator, said circumference being provided with elongated guide rib(s) and elongated guide groove(s) so that said

contoured circumference forms a counterpart for said contoured side(s) of the rope(s).

12. An elevator according to any one of the preceding claims, **characterized** in that that each of said rope(s) has at least one contoured side provided with elongated guide rib(s) and elongated guide groove(s) oriented in the longitudinal direction of the rope, the contoured side of at least the first or the second rope section being fitted to pass against a contoured circumference of a rope wheel of the elevator, which circumference is provided with elongated guide rib(s) and elongated guide groove(s) so that said contoured circumference forms a counterpart for said contoured side(s) of the rope(s), and in that from said rope wheel the first or the second rope section in question passes downwards or upwards to the tightening device, in particular to a pulley thereof, turning around its longitudinal axis.