

### **Elevator system**

The invention relates to an elevator system according to the preamble of claim 1.

5        Elevator systems are used to transport persons and/or goods between floors of buildings. For this purpose, at least one elevator car accommodating a person and/or goods is moved in an elevator shaft, in particular vertically between the floors. Depending on the transport capacity required in the building, an elevator system can have only one elevator car or several elevator cars which can be moved independently of each other in adjacently ar-  
10        ranged travel paths of the elevator shaft. An elevator system with multiple travel paths for elevator cars can be called a group elevator. The aforementioned travel paths for the elevator cars of a group elevator are usually not separated from each other by walls, but by intermediate beams to which components of the elevator system, in particular guide rails for guiding the elevator cars, are attached. Guide rails are usually assembled from indi-  
15        vidual guide rail pieces placed on each other. In the following, a guide rail is understood to mean a complete guide rail and/or a guide rail piece, depending on the context.

EP 0397064 B1 describes an elevator system with an elevator shaft with a first travel path for a first elevator car of the elevator system and a second travel path for a second eleva-  
20        tor car of the elevator system. The first travel path and the second travel path are adjacently arranged in a width direction of the elevator shaft. Between the first and the second travel path, a plurality of first intermediate beams are arranged, which are spaced apart from each other in the vertical direction and run in a depth direction of the elevator shaft running perpendicular to the width direction. The first elevator car is connected to a first  
25        counterweight via a first support means, and the second elevator car is connected to a second counterweight of the elevator system via a second support means. The elevator shaft has a third travel path for the first counterweight and a fourth travel path for the second counterweight. The third travel path for the first counterweight is arranged between the first travel path for the first elevator car and a shaft wall of the elevator shaft adjacent to  
30        the first travel path for the first elevator car in the depth direction. The fourth travel path for the second counterweight is arranged between the second travel path for the second elevator car and the first intermediate beams.

JPS60178177A and CN107804767A also describe elevator systems, each having an elevator shaft, a first travel path for a first elevator car, a second travel path for a second elevator car, a third travel path for a first counterweight and a fourth travel path for a second counterweight. JPS6481782A describes a generic elevator system.

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In contrast, it is in particular the object of the invention to propose an alternative elevator system with an elevator shaft with two travel paths adjacently arranged for elevator cars of the elevator system. According to the invention, this object is achieved by an elevator system having the features of claim 1.

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The elevator system according to the invention has an elevator shaft with a first travel path for a first elevator car of the elevator system and a second travel path for a second elevator car of the elevator system. The first travel path and the second travel path are adjacently arranged in a width direction of the elevator shaft. Arranged between the first travel path and the second travel path is a plurality of first intermediate beams which are spaced apart from each other in the vertical direction and run in a depth direction of the elevator shaft running perpendicular to the width direction. Arranged between the first travel path and the second travel path is a plurality of second intermediate beams which are spaced apart from each other in the vertical direction and run in the depth direction of the elevator shaft. The second intermediate beams are arranged spaced apart from the first intermediate beams in the width direction. A third travel path for a first counterweight of the elevator system connected to the first elevator car via a first support means and a fourth travel path for a second counterweight of the elevator system connected to the second elevator car via a second support means are arranged between the first intermediate beams and the second intermediate beams. The first intermediate beams and the second intermediate beams have an elongated shape and are supported on opposite shaft walls of the elevator shaft.

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According to the invention, the third travel path for the first counterweight and the fourth travel path for the second counterweight are adjacently arranged in the width direction of the elevator shaft. In particular, the first travel path of the first elevator car is arranged next to the third travel path of the first counterweight and the second travel path of the second elevator car is arranged next to the fourth travel path of the second counterweight. In this arrangement, the first counterweight advantageously does not move directly past the second elevator car and the second counterweight does not move directly past the first

elevator car. The third travel path therefore does not directly border on the second travel path, and the fourth travel path does not directly border on the first travel path. This means that there is no risk of a fitter or service technician in one of the two elevator cars being endangered by the counterweight of the other elevator car. In addition, this accordingly results in a less complex routing of the two support means.

In particular, the first travel path of the first elevator car and the second travel path of the second elevator car are each separated from the adjacent travel path of a counterweight by a protective element. The protective element can be designed, for example, as a protective wall in the form of sheet metal or a Plexiglas wall, as a grid or as a net stretched in a frame, for example a textile net or a wire net. The protective element extends in the depth direction along the first or second travel path for the first or second elevator car. This protects a fitter or service technician on the roof of an elevator car or at the bottom of the elevator shaft from a collision with a counterweight. The above-mentioned protective elements prevent, in particular, the fitter or service technician from being able to lean out of the first or second travel path into the adjacent travel path of a counterweight. The protective element does not have to extend over the entire height of the elevator shaft. A first protective element is arranged in particular at the bottom of the elevator shaft. In particular, it has a height that is at least as great as the height of the counterweight arranged in the adjacent travel path. A second protective element is arranged in particular at the middle height of the elevator shaft, i.e., where the elevator car and the associated counterweight pass each other.

The arrangement of the travel paths for the counterweights between the first and second intermediate beams takes up very little space in the cross section of the elevator shaft. This means that an elevator system with such an elevator shaft can have elevator cars with very large cross sections and therefore base areas, or with given cross sections and therefore base areas of the elevator cars, the elevator shaft can have a particularly small cross section.

Guide rails for guiding the first and second counterweights, as well as the first and second elevator cars, during movement in the elevator shaft can be attached at least indirectly to the first and second intermediate beams. The first and second intermediate beams therefore fulfill several tasks so that further components can be omitted. This means that the

elevator shaft can be constructed using little material, in particular little metal. This allows for an economical and resource-efficient realization of the elevator shaft.

5 In order to be able to attach guide rails for the second counterweight and the second elevator car to the first intermediate beams, plates, rods and bolts are mounted on the first intermediate beams using nuts in the elevator shaft according to EP 0397064 B1. This assembly takes time and incurs costs. In the elevator shaft according to the invention, guide rails can be fixed directly to the intermediate beams. Installing guide rails in the elevator shaft is therefore simple, quick and economical.

10 The elevator shaft is bordered in particular by solid shaft walls which can be made of concrete or wood, for example. However, it is also possible for the elevator shaft to be bordered by a supporting structure, in particular made of metal.

15 The elevator shaft and therefore also the travel paths for the independently movable elevator cars and the counterweights of the elevator shaft connected to the elevator cars run in particular vertically, wherein minor deviations from the vertical are possible. The individual travel paths are therefore each designed as mainly cuboid-shaped, non-overlapping spaces in which an elevator car or a counterweight can be moved vertically.

20 A vertical extension of the elevator shaft can be called a height of the elevator shaft. A vertical position within the elevator shaft can be referred to as a height in the elevator shaft. In particular, the elevator shaft has a mainly cuboid basic shape. It therefore has a height extending in the vertical direction, a width extending in the width direction, and a  
25 depth extending in the depth direction.

In particular, the elevator shaft has shaft openings at different heights, wherein a shaft opening is usually assigned to a floor of the building comprising the elevator shaft. When stopping at a floor, a car door of an elevator car and a shaft door arranged in a shaft opening  
30 are aligned with each other in such a way that it is possible to enter and exit the elevator car via the car door and the shaft door.

Shaft openings assigned to a floor are adjacently arranged, in particular in the width direction of the elevator shaft. It is also possible for an elevator car to have two opposite car  
35 doors so that, at least on one floor, the elevator shaft also has opposite shaft openings.

The elevator shaft can also have more than two travel paths for elevator cars and more than two travel paths for counterweights.

5 The first and second intermediate beams run in the depth direction, wherein the depth direction does not have to run exactly perpendicular to the width direction; a small deviation is possible. The first and second intermediate beams also run in particular horizontally. In the elevator shaft, a first intermediate beam and a corresponding second intermediate beam are arranged in particular in pairs at different heights. For example, a first intermediate beam and a corresponding second intermediate beam have a distance of between 70 and 100 cm. For example, two first or second intermediate beams arranged vertically one above the other have a distance of between 200 and 400 cm.

15 The first and second intermediate beams have an elongated shape and rest against opposite shaft walls. In the case of shaft walls made of concrete, for example, they can be cast in when pouring the shaft walls. It is also possible for the shaft walls to be cast first, and the intermediate beams are then attached to the shaft walls, for example by screwing. The shaft walls can also have ledges or niches on which the intermediate beams can rest from above. Of a first and a corresponding second intermediate beam, it is also possible for 20 only one of the two intermediate beams to rest on opposite shaft walls and for the other intermediate beam to be attached to the intermediate beam resting on the shaft walls.

The first and second intermediate beams are designed in particular as metal beams, for example as hollow profiles with for example a rectangular cross section, T-beams or double-T-beams, with optional attachments. The intermediate beams in particular have attaching options for attaching guide rails of the elevator system to the intermediate beams. The attaching options can be designed, for example, as elongated holes or threaded pins.

30 The arrangement of the third travel path for the first counterweight and the fourth travel path between the first and second intermediate beams results in the first intermediate beams and the second intermediate beams being designed and arranged such that the first and second counterweights can be moved vertically between them.

35 In an embodiment of the invention, a first intermediate beam and a corresponding second intermediate beam of the elevator shaft run parallel to each other and at the same height

in the elevator shaft. In particular, guide rails of the elevator system are attached to the intermediate beams. Due to the above-mentioned arrangement of the intermediate beams, an installation technician located on an installation platform can attach guide rails to a first and a second intermediate beam during installation of the elevator system without having to change the position of the installation platform in the vertical direction. This allows for particularly simple, fast and economical installation of the elevator system.

In an embodiment of the invention, the first intermediate beam and the corresponding second intermediate beam of the elevator shaft are connected to a cross member. Components of the elevator system, in particular guide rails, can also be attached to the cross member. The cross member, like the intermediate beams, can have corresponding attaching options. The cross member allows for particularly simple, quick and therefore economical installation of the elevator system. In addition, the cross member can contribute to a high stability of a combination of a first intermediate beam and a corresponding second intermediate beam.

The cross member runs in particular in the width direction of the elevator shaft and horizontally when the intermediate beams are arranged parallel and at the same height. More than one cross member, for example two or three cross members, can be arranged between a first intermediate beam and a corresponding second intermediate beam. For example, a cross member can be arranged between the third travel path for the first counterweight and the fourth travel path for the second counterweight. It is also alternatively or additionally possible for cross members to be arranged between the third and/or fourth travel path and a wall bordering the elevator shaft. This allows guide rails for the first and/or second counterweight to be attached to a cross member and not to the aforementioned wall of the elevator shaft. Attachment to a cross member is usually easier, faster and therefore more economical than to a wall of the elevator shaft, in particular if it is made of concrete.

In an embodiment of the invention, a first intermediate beam and a corresponding second intermediate beam of the elevator shaft run in the elevator system at the same height in the elevator shaft. The first intermediate beam and the corresponding second intermediate beam are connected to a cross member, and a guide rail for the first counterweight and/or

the second counterweight is attached to the cross member. For this embodiment of the elevator system, the above statements regarding one or more cross members of an elevator shaft accordingly apply.

Further advantages, features, and details of the invention can be found in the following description of embodiments and with reference to the drawings, in which like or functionally like elements are provided with identical reference signs. The drawings are merely schematic and are not to scale.

In the drawings:

Fig. 1 shows a side view of an elevator system with two elevator cars that can be moved independently of each other in an elevator shaft and

Fig. 2 shows a view of the elevator system from Fig. 1 from above,

According to Fig. 1 and 2, an elevator system 110 has an elevator shaft 112 extending in the vertical direction and therefore in a vertical direction 11 with a first travel path 114 for a first elevator car 116. The first elevator car 116 is connected to a first counterweight 120 via a first support means 118 in the form of a cable or a belt. The first support means 118 runs over a first drive pulley 122 arranged above the first elevator car 116 and a first deflection pulley 124 arranged above the first counterweight 120. The first drive pulley 122 can be driven by a first drive machine (not shown), whereby the first support means 118 and therefore the first elevator car 116 and the first counterweight 120 can be moved vertically in the elevator shaft 112.

The elevator shaft 112 has a second travel path 126 for a second elevator car 130 which is arranged in a width direction 32 of the elevator shaft 112 next to the first travel path 114 for the first elevator car 116. The second elevator car 130 is connected to a second counterweight 136 via a second support means 134 in the form of a cable or a belt. The second support means 134 runs over a second drive pulley 138 arranged above the second elevator car 130 and a second deflection pulley 140 arranged above the second counterweight 136. The second drive pulley 138 can be driven by a second drive machine (not shown), whereby the second support means 134 and therefore the second elevator car 130 and the second counterweight 136 can be moved vertically in the elevator shaft 112. The two drive machines can be controlled independently of each other by an elevator control

system (not shown) so that the first elevator car 116 and the second elevator car 130 can be moved independently of each other in the elevator shaft 112.

5 Arranged between the first travel path 114 for the first elevator car 116 and the second travel path 126 for the second elevator car 130 are a third travel path 142 for the first counterweight 120 and a fourth travel path 144 for the second counterweight 136, wherein in Fig. 1, the third travel path 142 is arranged to the left of the fourth travel path 144. The third travel path 142 and the fourth travel path 144 are therefore adjacently arranged in the width direction 32. The third travel path 142 is therefore arranged in the  
10 width direction 32 next to the first travel path 114, and the fourth travel path 144 in the width direction 32 next to the second travel path 126.

A total of three first intermediate beams 146 run between the third travel path 142 and the first travel path 114. They run horizontally and in a depth direction 45 perpendicular to  
15 the vertical direction 11 and perpendicular to the width direction 32 and are spaced apart from each other in the vertical direction 11. In addition, a total of three second intermediate beams 148 run between the fourth travel path 144 and the second travel path 126. They are spaced apart from each other in the width direction 32 and in the vertical direction 11, wherein two corresponding first and second intermediate beams 146, 148 run parallel and at the same height in the elevator shaft 112. The first intermediate beams 146  
20 and the second intermediate beams 148 each rest on the outside on opposite shaft walls 152 of the elevator shaft 112.

The elevator cars 116, 130 and the counterweights 120, 136 are each guided by a pair of  
25 guide rails 150, wherein the guide rails 150 of the two elevator cars 116, 120 are arranged spaced apart from each other in the width direction 32, and the guide rails 150 of the two counterweights 120, 136 are arranged spaced apart from each other in the depth direction 45. The pair of guide rails 150 of the two counterweights 120, 136 are arranged spaced apart from each other in the width direction 32. With respect to the elevator  
30 shaft 112, the external guide rails 150 of the two elevator cars 116, 130 are attached to shaft walls 152 of the elevator shaft 112 by means of rail brackets and rail clamps (not shown). The second, inner guide rail 150 of the first elevator car 116 is attached to the first intermediate beams 146 by means of rail brackets and rail clamps (not shown). The second, inner guide rail 150 of the second elevator car 130 is attached to the second intermediate beams 148 by means of rail brackets and rail clamps (not shown).  
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The guide rails 150 of the two counterweights 120, 136 are attached to cross members 154 (see Fig. 2) connecting a first intermediate beam 46 and a corresponding second intermediate beam 48 by means of rail brackets and rail clamps (not shown). The elevator system 110 has two external cross members 154 per pair consisting of a first intermediate beam 146 and a second intermediate beam 148. The mentioned guide rails could also be attached to opposite walls of the elevator shaft 112 so that no cross members would be present.

Finally, it should be noted that terms such as “having,” “comprising,” etc. do not preclude other elements or steps, and terms such as “a” or “an” do not preclude a plurality. Furthermore, it should be noted that features or steps which have been described with reference to one of the above exemplary embodiments may also be used in combination with other features or steps of other exemplary embodiments described above. Reference signs in the claims should not be considered to be limiting.

Claims

1. An elevator system, comprising:

- an elevator shaft (112)
- a first elevator car (116),
- a second elevator car (30),
- a first counterweight (120) connected to the first elevator car (16) via a first support means (18), and
- a second counterweight (136) connected to the second elevator car (30) via a second support means (34),

wherein the elevator shaft (112) comprises:

- a first travel path (114) for the first elevator car (116), and
- a second travel path (126) for the second elevator car (130),

wherein

- the first travel path (114) and the second travel path (126) are adjacently arranged in a width direction (32) of the elevator shaft (112),
- arranged between the first travel path (114) and the second travel path (126) is a plurality of first intermediate beams (146) which are spaced apart from each other in the vertical direction (11) and run in a depth direction (45) of the elevator shaft (112) running perpendicular to the width direction (32),
- arranged between the first travel path (114) and the second travel path (126) is a plurality of second intermediate beams (148) which are spaced apart from each other in the vertical direction (11) and run in the depth direction (45) of the elevator shaft (112),
- the second intermediate beams (148) are arranged spaced apart from the first intermediate beams (146) in the width direction (32), and
- a third travel path (142) for a first counterweight (120) of the elevator system (110) connected to the first elevator car (116) via a first support means (118) and a fourth travel path (144) for a second counterweight (136) of the elevator system (110) connected to the second elevator car (130) via a second support means (134) are arranged between the first intermediate beams (146) and the second intermediate beams (148),

- the first intermediate beams (146) and the second intermediate beams (148) have an elongated shape and are supported on opposite shaft walls (152) of the elevator shaft (112),

**characterized in that**

5 the third travel path (142) for the first counterweight (120) and the fourth travel path (144) for the second counterweight (136) are adjacently arranged in the width direction (32) of the elevator shaft (112).

2. The elevator system according to claim 1,

10 **characterized in that**

a first intermediate beam (146) and a corresponding second intermediate beam (148) of the elevator shaft (112) run parallel to each other and at the same height in the elevator shaft (112).

15 3. The elevator system according to claim 2,

**characterized in that**

the first intermediate beam (46) and the corresponding second intermediate beam (48) of the elevator shaft (112) are connected to a cross member (154).

20 4. The elevator system according to claim 3,

**characterized in that**

a guide rail (150) for the first counterweight (120) and/or the second counterweight (136) is attached to the cross member (154).