

Method for installing an elevator system

The invention relates to a method for installing an elevator system according to the preamble of claim 1.

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The installation of an elevator system during the construction of a building is complex and therefore involves considerable costs. In particular, the creation of an elevator shaft of the elevator system and the subsequent installation of elevator components in the elevator shaft is really complex. Usually, the elevator shaft is created together with the floors of the building accommodating the elevator system, and once the elevator shaft is finished, the elevator system with its elevator components such as the car, counterweight, drive machine, and guide rails is then installed in the elevator shaft. It has already been proposed to create the elevator shaft from a plurality of prefabricated shaft modules with shaft walls in which elevator components, such as guide rail pieces, are at least in some cases already pre-installed. Prefabrication and pre-installation do not take place at the construction site of the building accommodating the elevator, i.e. at the elevator system installation site, but in a factory and thus at a manufacturing location. This procedure requires less time at the installation site. In addition, this procedure has positive effects on the quality of the installation and on the working safety of the installation personnel.

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WO 2022/122364 A1 describes a method for installing an elevator system in which shaft modules are stacked on top of each other to form an elevator shaft of the elevator system. In this process, a car of the elevator system is arranged and fixed in a shaft module at the manufacturing location. The shaft module with the car is transported from the manufacturing location to the installation site of the elevator system and is set down there on a foundation of the elevator shaft. The design of the foundation is not described further. When installing the elevator system, it is necessary to carry out installation steps at the bottom of the elevator shaft and thus below the car. WO 2022/122364 A1 does not address how such installation steps are possible.

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EP 3960677 A1 and WO 2022/103795 A1 also describe methods for installing an elevator system in which shaft modules are stacked on top of each other to form an elevator shaft of the elevator system. In each of the shaft modules located at the very bottom, buffers are arranged which limit the downward movement of an elevator car. The buffers are pre-installed and are required for the operation of the elevator system.

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However, the resulting space between the floor of the elevator shaft and the elevator car is so small that it is not sufficient for a safety space during the installation of the elevator system.

5 In contrast, the object of the invention is in particular to propose a safe and efficient method for installing an elevator system. According to the invention, this object is achieved by a method having the features of claim 1.

10 In the method according to the invention for installing an elevator system, a shaft module is set down on a pit element to form an elevator shaft of the elevator system. A car of the elevator system is arranged in the shaft module. According to the invention, before the shaft module is set down on the pit element, a safety element is arranged in the shaft module or in the pit element so as to limit a downward displacement of the car if the car comes to rest on the safety element during the downward displacement. This ensures a safety space in the pit
15 element. In particular, the safety element is arranged in such a way that the said safety space is high enough for an installer to be able to stand safely in it and also to carry out installation steps from the said safety space. With the above-mentioned resting of the car on the safety element, a positive and therefore particularly secure connection between the car and the safety element is created, which reliably prevents the car from entering the safety
20 space.

The at least one safety element is removed when installation of the elevator system has reached the stage at which the car is held by a support means and buffers are arranged on the bottom of the pit element. The buffers then ensure a corresponding safety space.
25 If, after the elevator system has been put into operation, the safety space is ensured by other devices, for example by using extendable bolts on the car, the at least one safety element will be removed in particular when the said device has been put into operation.

30 In the following, directional information such as above, below, and lateral or vertical and horizontal refers to the orientation of the corresponding component during an operating state of the elevator system. In this case, the operating state of the elevator system is understood to be the state following completion of the installation and commissioning of the elevator system. In the operating state of the elevator system, people and/or goods can thus be transported in the car between floors of the building in which the elevator system is
35 located.

The shaft module has in particular a cuboid basic shape with four walls, wherein in particular at least one wall has a shaft opening in which a shaft door is arranged. The shaft module can also have a different basic shape. The walls mentioned are made, for example, of concrete, wood, metal profiles or formwork for later pouring with concrete. In the shaft module, elevator components such as guide rail pieces, pulleys, a drive, switches or cabling can be installed or at least pre-installed at the manufacturing location. The shaft module mentioned is the lowest shaft module in the completed elevator shaft, which is hereinafter referred to as the “base module.” Additional shaft modules are set down on top of the base module, which are in particular designed identically except for the top shaft module, which is referred to below as the “top module.” These identical shaft modules are hereinafter referred to as “intermediate modules.” The base module is set down on the pit element and the intermediate modules are set down in particular by means of a crane, for example a tower crane or a mobile crane.

The pit element onto which the base module is set down encloses a shaft space which, if required, contains the aforementioned safety space. In particular, the shaft space mentioned is slightly higher than the safety space. The pit element can, but does not have to, have a shaft opening. In particular, it is also designed as a prefabricated element, i.e. one produced at a manufacturing location and transported to the installation site. The statements regarding the design of the shaft modules therefore apply correspondingly to the pit element. However, it is also possible for the pit element to be manufactured on site, in particular cast from concrete. The pit element can, for example, be designed as a mainly cuboid-shaped depression in the foundation of the building housing the elevator system. The pit element can also be designed in multiple parts, for example consisting of more than one shaft module or of one or more than one shaft module and a described depression.

The safety element can already be arranged at the manufacturing location or only at the installation site in the shaft module or pit element. In particular, at least two safety elements are arranged, in particular in the area of or on two opposite walls of the shaft module or of the pit element.

It is also possible to arrange at least one safety element not only in the shaft module but also in the pit element. The safety element in the shaft module thus ensures a first safety space and the safety element in the pit element ensures a second safety space, with the

first safety space being higher than the second safety space. The safety elements in the shaft module and in the pit element can be of the same design or of different designs.

5 The downward displacement of the car, limited by the safety element, can take place while the shaft module is being set down on the pit element. The displacement of the car thus takes place together with the displacement of the shaft module; in particular, there is no displacement of the car relative to the shaft module. The joint displacement of the car and shaft module ends as soon as the car is resting on the safety element. If the shaft
10 module is not yet resting on the pit element, a displacement of the car relative to the shaft module begins. This continues until the shaft module is resting on the pit element.

It is also possible for the downward displacement of the car, limited by the safety element, to take place after the shaft module has been set down on the pit element. First, the shaft module with the car is set down on the pit element and then the car is moved downward, and thus
15 relative to the shaft module and the pit element, until it rests on the safety element. The car is held in particular by the crane, by means of which the shaft modules are stacked. During the aforementioned displacement, the car can also be held by at least one chain hoist.

If the pit element is designed as a prefabricated element, the buffer can already be
20 arranged on the bottom of the pit element before the pit element is arranged. It is also possible for the buffer to be placed on the bottom of the pit element before a shaft module is placed on the pit element. It is also possible for the buffer to be arranged on the bottom of the pit element only after the shaft module has been set down on the pit element. In all cases, the safety element is in particular higher than the buffer arranged in the pit element.

25 In an embodiment of the invention, the safety element is designed as a support which rests on a bottom of the pit element and which is arranged in the pit element before the shaft module is set down on the pit element. Such supports, which are referred to for example as building props, floor props or installation props, are inexpensive and available on the market in
30 numerous designs. The installation of the elevator system is therefore particularly cost-effective.

In particular, two supports are arranged as safety elements in the pit element. The car and the support(s) are designed and arranged in relation to each other in such a way that the car
35 cannot be moved downward past the upper end of the support(s). The car and the safety

element are designed in such a way that the car can rest with its entire weight on the support(s) without sustaining damage. The support mentioned has square bearing surfaces, in particular at its two ends. This allows the support to rest securely on the bottom of the pit element. In addition, the car can rest securely on the support via the bearing surface. The support is also in particular designed in such a way that its height and thus the height of the safety space can be changed.

In an embodiment of the invention, before the shaft module is set down on the pit element, a guide rail piece is arranged in the pit element to guide the car during operation of the elevator system. In addition, the support mentioned is connected to the guide rail piece. This ensures that the support is held securely in its desired position and can perform its function particularly safely.

The guide rail piece is in particular fastened to a wall of the pit element. This is effected in particular by means of so-called brackets, which are already well-known. In particular, two guide rail pieces are fastened to opposite walls of the pit element and are thus arranged in the pit element. A guide rail piece can be fastened to a wall of the pit element by at least one so-called omega bracket. The omega bracket is designed such that the guide rail piece is at a distance from the wall of the pit element. In the resulting space, a counterweight travels when the elevator system is in operation. In particular, a third and a fourth guide rail piece are fixed to the omega bracket in order to guide the counterweight.

The support can be connected to the guide rail piece in different ways. The connection can be made, for example, by at least one tensioning strap. A connecting element can also be arranged between the support and the guide rail piece, which connecting element can also be fixed to the support and the guide rail piece by at least one tensioning strap or matching sleeves.

The connecting element has in particular a recess corresponding to a contour of the guide rail piece. This allows the support to be connected particularly firmly to the guide rail piece. Guide rails of elevator systems usually have a T-shaped cross-section and thus a T-shaped contour. The cross-member is called the rail foot, which is oriented in the direction of the wall to which the guide rail is fastened. The longitudinal part forms a guide surface for guiding the car. The recess of the connecting element is designed in particular to be

complementary to the part of the guide rail piece forming the running surface. The recess can therefore in particular precisely accommodate the said part of the guide rail piece.

5 The connecting element and the support can be designed as separate parts. In this case, the connecting element can have a recess corresponding to a contour of the support at its end oriented in the direction of the support. For example, the support can have a round cross-section and thus a round contour where the connecting element is supported. In this case, the connecting element could have a semicircular recess. For example, the support can be made of metal and the connecting element can be made at least mainly of wood. It is also possible for the support and the connecting element to be made in one piece.

10 In an embodiment of the invention, the safety element is designed as a console arranged on a wall of the shaft module or of the pit element and projecting inwards from said wall. This makes it possible for the method to be carried out in a particularly simple manner.

15 In particular, a console is arranged at the same height on two opposite walls. It is also possible to arrange more than one console, for example two consoles, on each of the walls mentioned. The console or consoles are designed as metal angle brackets, which are attached to the corresponding wall by screws or anchor bolts.

20 The console interacts in particular with a bolt arranged on the car, which can be extended outwards. The bolt is extended before the shaft module is set down on the pit element. Such bolts are known and are used to ensure a temporary safety space for maintenance work in the shaft pit in the case of elevator systems with no or only a small shaft pit. Such bolts and their connection to the car are designed to support the car via the bolts. When these bolts are used, no further measures need to be taken to ensure that the car is supported on the at least one safety element. The bolt can also be arranged on the car during operation of the elevator system and used as described to ensure a temporary safety space. During normal operation of the elevator system, the bolt is in a retracted position.

30 In an embodiment of the invention, a support is arranged on the shaft module before the shaft module is set down on the pit element. The car is then suspended from the support via a supporting element. This allows the car to be positioned particularly safely in the shaft module.

The support is designed in particular as a metal support, for example as a double-T support. The support is placed, for example, on two opposite walls of the shaft module and can additionally be connected to the mentioned walls using screws, for example.

5 The supporting element is designed in particular as a cable or a chain. The car is suspended from the beam via two supporting elements.

It is also possible for the car to be suspended in the shaft module from a support as described above and to additionally rest on at least one console arranged on a wall of the shaft module. The console can in particular be designed as a console as described above.
10 This means that the car is positioned particularly securely in the shaft module and can be transported from the manufacturing location to the installation site without any risk of damage.

15 In an embodiment of the invention, the safety element is designed and arranged in such a way that the car rests on the safety element while the shaft module is being set down on the pit element. This means that the fixation of the car in the shaft module is relieved as soon as the shaft module is set down on the pit element, in particular the suspension of the car via the holding element on the above-mentioned support. The support can then be
20 removed after the shaft module has been set down without any further measures being necessary. An otherwise necessary measure would be for example to lift the car using a crane to relieve the suspension load, i.e. to move it upwards and then lower it in a controlled manner after the suspension has been released. Alternatively, the car could first be lifted by at least one chain hoist and then lowered in a controlled manner, thus moving
25 it downward until it rests on the safety element. Each additional measure means additional effort, so that the described design of the method, in which the fixation is already relieved when the shaft module is set down on the pit element, is particularly effective.

30 If, as described above, the car rests on at least one console arranged in the shaft module in addition to being suspended from the support, the consoles will be removed before the shaft module is set down on the pit element.

It is also possible for the shaft module to be set down on the pit element without the car
35 coming to rest on the safety element. Only after the aforementioned setting down is the

car moved downward until it rests on the safety element. The downward displacement can for example be take place as described above.

5 In an embodiment of the invention, before the shaft module is set down on the pit element in the shaft module a guide rail piece is arranged on each of two opposite walls. The car is then positioned between the guide rails in such a way that the car is fixed horizontally by the guide rail pieces. This makes it possible a particularly stable and secure arrangement of the cabin in the shaft module.

10 The arrangement of the guide rail pieces takes place in particular at the manufacturing location and thus before the shaft module with the car is transported to the installation site. The arrangement of the guide rail pieces is analogous to the arrangement of the guide rail pieces in the pit element as described above. In particular, the car has guide elements, for example in the form of guide shoes, each of which interacts with a guide rail piece.

15 When the elevator system is in operation, the guide rail pieces are each part of a continuous guide rail along which the car is guided when it is moved in the elevator shaft. The guide shoes, in particular like the connecting element described above, have a recess corresponding to a contour of the guide rail piece. Such guide shoes are commercially available in various designs. Fixing the car in the horizontal direction is understood here
20 to mean that the car cannot move, or can only move minimally, in the horizontal direction, i.e. transversely to a vertically running main direction of extent of the guide rail pieces.

Further advantages, features, and details of the invention can be found in the following
25 description of exemplary 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:

- 30 Fig. 1 shows an elevator system with a car in an elevator shaft composed of elevator shaft modules,
- Fig. 2 shows a snapshot during the setting down of a base module on a pit element,
- Fig. 3 shows a snapshot during the setting down of an intermediate module
35 on the base module from Fig. 2,

Fig. 4 shows an enlarged section through a safety element designed as a support, which is connected to a guide rail piece via a connecting element,

Fig. 5 shows an enlarged detail of a car resting on a console arranged in a shaft module via an extendable bolt, and

Fig. 6 shows an enlarged detail of a car with an extended bolt before resting on a console arranged in a pit element.

According to Fig. 1, an elevator system 10 has an elevator shaft 12 for a three-story building, which shaft in the present exemplary embodiment is composed of a pit element 13, a base module 14, an intermediate module 16, and a top module 18. The elevator shaft 12 can comprise further intermediate modules 16, depending on the number of floors. The pit element 13 and the aforementioned shaft modules 14, 16, 18 are pre-produced in a factory and thus at a manufacturing location and are provided with elevator components. They are then transported to the construction site of the building housing the elevator system 10, and thus to an installation site, and stacked on top of each other. It is also possible for the pit element to be manufactured at the installation site and provided with elevator components.

Fig. 2 shows how the base module 14 is set down on the pit element 13 from above by a crane 20. The pit element 13 was previously placed on a shaft floor 17 in the same way and thus arranged on the shaft floor 17. Fig. 3 shows how the intermediate module 16 is set down on the base module 14 from above by the crane 20. The top module 18 is set down on the intermediate module 16 in the same way, thus closing off the elevator shaft 12 at the top.

The elevator system 10 in Fig. 1 has a car 22 which can be moved vertically in the elevator shaft 12 along guide rails which are not shown in Fig. 1. For this purpose, the elevator system 10 has a support means 24, the first end 26 of which is fixed in the top module 18. It then extends downward and around the car 22 it and is guided via a drive machine 28 arranged in the top module 18 opposite the first end 26 of the support means 24. From there, it runs through a suspension of a counterweight 30 to its second end 32, which is fixed in the region of the drive machine 28. The drive machine 28 can move the support means 24 and thus the car 22 in the elevator shaft 12. The car 22 is connected via a suspension cable 34 to an elevator controller 36 arranged in the top module 18. The

suspension cable 34 makes possible a power supply to and a communication with the car 22.

5 The elevator system 10 has two buffers 19, which are arranged on the shaft floor 17 and thus also on the bottom 42 (see Fig. 2) of the pit element 13. The buffers 19 are positioned so that the car 22 is stopped by the buffers 19 if it moves too far downward.

10 As can be seen from Fig. 2, before the base module 14 is set down on the pit element 13, two safety elements in the form of supports 40 are arranged in the pit element 13. The supports 40 stand on the bottom 42 of the pit element 13 and are thus supported on the bottom 42. The supports 40 have square, horizontally extending bearing surfaces 44 at their ends. The supports 40 are each connected to a guide rail piece 48 via an elongated connecting element 46. The connection mentioned is secured with tensioning straps (not shown).

15 Fig. 4 shows an enlarged section through the support 40, the connecting element 46 and the guide rail piece 48. The guide rail piece 48 is fastened to a wall 52 of the pit element 13 by means of a rail bracket 50. The guide rail piece 48 has a T-shaped cross-section and thus a T-shaped contour. The cross-member 54 is oriented in the direction of the wall 52. The longitudinal part 56 forms a guide surface for guiding the car 22. In the direction of the guide rail piece 48 the connecting element 46 has a recess 58 which is complementary to the part of the guide rail piece 48 forming the running surface and thus complementary to the longitudinal part 56. A part of the longitudinal part 56 of the guide rail piece 48 is arranged in the recess 58. At the opposite end, oriented in the direction of the support 40, the connecting element 46 has a semicircular recess 60 which corresponds to a contour of the support 40. It is also possible for the support and the connecting element to be made in one piece.

20 In Fig. 2, the elevator car 22 of the elevator system 10 is arranged in the base module 14 suspended from the crane 20. For this purpose, a support 62 was placed transversely on the base module 14 at the manufacturing location and the car 22 suspended via two support elements in the form of chains 64. In addition, two guide rail pieces 48 were arranged on two opposite walls of the base module 14, analogously to the pit element 13. The guide rail pieces 48 of the base module 14 interact with two guide shoes (not

shown) of the car 22, so that the car 22 is arranged between the guide rail pieces 48 in such a way that it is fixed in the horizontal direction by the guide rail pieces 48.

5 The supports 40 are arranged in the pit element 13 in such a way that when the base module 14 is being set down on the pit element 13, the car 22 comes to rest on the bearing surfaces 44 of the supports 40. The car 22 is thus resting on the supports 40 before the base module 14 is standing on the pit element 13. This relieves the suspension load of the car 22 on the support 62 when the base module 14 is being set down on the pit element 13, and the support 62 can be removed without further measures being required. The displacement of
10 the car 22 together with the base module 14 is thus limited by the support 40 and a safety space 66 extending between the floor 42 of the pit element 13 and the car 22 is ensured. In this safety space 66, an installer can stand and carry out work under the car 22.

15 Not until completion of the placement of the base module on the pit element is also possible for the car to be moved downward until it rests on the supports. This can be done in a controlled manner, for example with the aid of the crane or at least of a chain hoist. With the aid of the crane or chain hoist, the car can also be lifted first, thus relieving and removing the suspension load on the support.

20 In Fig. 5, a safety element in the form of a console 68 is shown. The console 68 is designed as a metal angle bracket which is screwed to a wall 70 of the base module 14 and projects inwards into the base module 14. Another console is attached in a similar manner to an opposite wall (not shown). At the bottom of the car 22 there is arranged an outwardly extendable bolt 72 which, in the state shown in Fig. 5, is extended so far in the direction of
25 the wall 70 that it rests on the console 68. The console 68 thus limits a downward displacement of the car 22. The console 68 is fastened to the wall 70 in particular at the manufacturing location and can thus hold the car 22 in addition to the support 62 in the base module.

30 Guide rail pieces arranged in the shaft module are not shown in Fig. 5. It is also possible for the car not to have an extendable bolt. In this case, the console is designed and arranged so that the car rests directly on the console.

35 Instead of in the base module 14 as in Fig. 5, a console 74 can also be fastened to the wall 52 of the pit element 13 as shown in Fig. 6. The statements regarding the console

68 in Fig. 5 apply correspondingly to the console 74 in Fig. 6. The console 74 then takes over the function of the support surface 44 of the support 40 from Fig. 2, so that the statements regarding the function of the support 40 in connection with Fig. 2 apply correspondingly to the console 74 in Fig. 6.

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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.

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Claims

1. A method for installing an elevator system, in which a shaft module (14) is set down on a pit element (13) to form an elevator shaft (12) of the elevator system (10), wherein a car (22) of the elevator system (10) is arranged in the shaft module (14), and before the shaft module (14) is set down on the pit element (13), a safety element (40, 68, 74) is arranged in the shaft module (14) or in the pit element (13) so as to limit a downward displacement of the car (22) when the car (22) comes to rest on the safety element (40, 68, 74) during the downward displacement, thus ensuring a safety space (66) in the pit element (13), characterized in that the safety element (40, 68, 74) is removed when installation of the elevator system has reached the stage at which the car (22) is held by a support means (24) and a buffer (19) is arranged on the bottom (42) of the pit element (13).
2. The method according to claim 1, characterized in that the safety element (40) is designed as a support (40) which is supported on a bottom (42) of the pit element (13) and which is arranged in the pit element (13) before the shaft module (14) is set down on the pit element (13).
3. The method according to claim 2, characterized in that before the shaft module (14) is set down on the pit element (13), a guide rail piece (48) for guiding the car (22) during operation of the elevator system (10) is arranged in the pit element (13) and the said support (40) is connected to the guide rail piece (48).
4. The method according to claim 3, characterized in that said support (40) is connected to the guide rail piece (48) via a connecting element (46) and the connecting element (46) has a recess (58) corresponding to a contour of the guide rail piece (48).
5. The method according to claim 1, characterized in that

the safety element (68, 74) is designed as a console (68, 74) arranged on a wall (70, 52) of the shaft module (14) or of the pit element (13) and projecting inwards from said wall (70, 52).

6. The method according to claim 5,

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characterized in that

an outwardly extendable bolt (72) is arranged on the car (22), which bolt is extended before the shaft module (14) is set down on the pit element (13), and cooperates with the said console (68, 74).

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7. The method according to one of claims 1 to 6,

characterized in that

before the shaft module (14) is set down on the pit element (13), a support (62) is arranged on the shaft module (14) and the car (22) is suspended from the support (62) via a support element (64).

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8. The method according to one of claims 1 to 7,

characterized in that

the safety element (40, 74), the pit element (13) and the shaft module (14) are designed and arranged in such a way that the car (22) comes to rest on the safety element (40, 74) while the shaft module (14) is being set down on the pit element (13).

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9. The method according to one of claims 1 to 8,

characterized in that

before the shaft module (14) is set down on the pit element (13) in the shaft module (14), a guide rail piece (48) is arranged on each of two opposite walls (70) and the car (22) is arranged between the guide rail pieces (48) in such a way that the car (22) is fixed in the horizontal direction by the guide rail pieces (48).

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