

LIFT DRIVE FOR A RAIL-GUIDED CLIMBING SYSTEM

The invention relates to a lift drive for a rail-guided climbing system, which can be used in particular as a climbing formwork, climbing frame, climbing protective wall and/or a climbing working platform, comprising climbing shoes that can be arranged on a building in a fixed manner, and at least one climbing rail which is guided by the climbing shoes and which can be integrated into a frame unit or secured to the frame unit. The invention further relates to a rail-guided climbing system with said lift drive and a method for climbing a rail-guided climbing system, which can be used in particular as a climbing formwork, climbing frame, climbing protective wall and/or a climbing working platform, with said lift drive.

Such lift drives with hydraulic cylinders are described in the German laid-open application DE 10 2016 205 956 A1 and in the international laid-open application WO 2009/117986 A1 as the prior art for a climbing system. In construction, climbing systems are used, e.g., in the construction of vertically oriented concrete structures, in particular so-called building cores, bridges, dams, and the like, as climbing formwork and/or climbing protective walls and/or in the form of climbing frames. The climbing systems are usually provided with a working platform as a frame unit and can be moved independently of a crane from a lower finished concrete wall portion of the concrete structure to be constructed or finished to a further hardened concreting portion of the concrete structure arranged above. Subsequently, a climbing rail, which can be moved upwards, i.e., climbed, via a hydraulic cylinder that is supported by a climbing shoe. Alternatively, a work console or working platform can be raised by means of climbing cylinders, which are secured by means of anchor bolts to a climbing console fastened to a concrete wall below the work console and to the work console. Crane-climbing systems that work without hydraulic cylinders are also known.

The disadvantage of the known lift drives for climbing systems is that, for the next climbing portion or concreting portion, the hydraulic cylinder has to be carried every time to the next highest floor. Depending on the lift drive used, a leading rail may also be necessary, which has to be manually attached to the building, wherein the climbing direction on the climbing system has to be switched manually during climbing in order to pull the rail. Therefore, the manual effort is high after each lifting process, wherein a continuous climbing is not possible. In addition, existing lift drives for rail-guided climbing systems can be designed so large that, when using the climbing system, due to the length of the climbing rails, a building height must first be reached that is sufficient, so that the lower free ends of the

climbing rails do not collide with the ground, on which the first concreting portion is erected, or with a floor slab that may be erected below the first concreting portion. Gear motor-driven climbing systems are expensive and susceptible to repair, so that drives with gears cannot be an adequate alternative to the lift drives designed in a significantly simpler manner.

5 Therefore, the problem addressed by the present invention is that of providing a simply designed lift drive which allows for a continuous climbing. In addition, a lift drive is supposed to be provided, with which a step-by-step continuous climbing is possible without the previously required high manual effort after each lifting process. Finally, the lift drive is supposed to have a compact design, so that it can be used in as versatile a manner as possible
10 with a rail-guided climbing system.

This problem is solved by a lift drive with the features of claim 1 and a method for climbing a rail-guided climbing system with the features of claim 18. The dependent claims disclose expedient developments.

The problem according to the invention is thus solved by a lift drive for a rail-guided
15 climbing system, which can be used in particular as a climbing formwork, climbing frame, climbing protective wall and/or a climbing working platform, comprising climbing shoes that can be arranged on a building in a fixed manner, at least one climbing rail which is guided by the climbing shoes and which can be integrated into a frame unit or secured to the frame unit, a climbing lift rail which can be moved relative to the climbing rail and is guided by the
20 climbing rail. The climbing rail and the climbing lift rail can each be mounted in at least one of the climbing shoes in one direction and removed in a direction opposite said direction, and they can be moved in relation to the at least one of the climbing shoes. The lift drive also comprises a lift device which is fixed to the climbing rail at one end and to the climbing lift rail at the other end in such a way that a length of a stroke of the lift device corresponds to a
25 movement of the climbing lift rail relative to the climbing rail. The length of the stroke of the lift device when the climbing lift rail is mounted is sufficient to mount the climbing rail such that it is offset by a mounting distance of the climbing rail.

According to the invention, a climbing lift rail is thus provided as a unit guided by the climbing rail and movable in relation to the climbing rail and connected to the climbing rail
30 via the lift device. A climbing lift rail, which is restricted in its movement by the climbing rail and moves up and down in relation to the climbing rail, is movably connected to the climbing

rail. The climbing lift rail is held or guided on the climbing rail, for example, via guide shoes of the climbing rail. A movement of the climbing lift rail in relation to the climbing rail is realized by an extendable and retractable lift device. The lift device can be releasably fixed at its upper or lower end, i.e., at one end, to the climbing rail, wherein, at its lower or upper end, i.e., at the other end, the lift device can have an engagement and fastening tab that is firmly connected to, i.e., not easily detachable from, the climbing rail.

For achieving an upward movement of the climbing rail when the lift device is both extended and retracted, the length of the stroke of the lift device is selected such that it is sufficient to mount the climbing rail offset by a mounting distance of the climbing rail.

Depending on the design of the connection between the climbing shoe and the climbing rail for mounting the climbing rail, at least one mounting distance of the climbing rail from the lift device must therefore be covered when the climbing lift rail is mounted. With the upward movement of the climbing rail in relation to the building when the lift device is extended and the upward movement of the climbing lift rail in relation to the climbing rail when the lift device is retracted, a continuous climbing of the frame unit is achieved in a simple manner. The lift drive according to the invention therefore climbs along due to its lift movements. Since the climbing rail and the climbing lift rail can each be mounted in at least one of the climbing shoes in one direction and removed in a direction opposite said direction and movable in relation to the at least one of the climbing shoes, a manual effort can be forgone for each step of extending and retracting the lift device. For the next climbing portion or concreting portion, the lift device no longer has to be carried to the next highest floor in a disassembled state.

The climbing lift rail is guided by the climbing rail when the climbing lift rail is moved relative to the climbing rail, so that it is ensured that the respective expansions of the climbing rail and the climbing lift rail in the longitudinal direction do not add up even when the lift device is fully extended, which results in a compact construction of the lift drive. Since the lift device can remain fixed at one end to the climbing rail and at the other end to the climbing lift rail both when it retracts and extends and, apart from guiding the climbing rail, the climbing lift rail is connected to the climbing rail only via the lift device, the lift drive is designed extremely simple and can be realized correspondingly inexpensively, operated with little loss and is not susceptible to repair.

In a preferred embodiment of the invention, the length of the stroke is additionally sufficient to cover a mounting stroke distance of the climbing lift rail. In this way, the climbing rail can be mounted offset by the mounting distance, even if a complete mounting stroke distance of the climbing lift rail has to be covered beforehand in order to mount the climbing lift rail. The mounting stroke distance can be selected to be smaller than the mounting distance in order to use a larger part of the full length of the stroke of the lift device for the upward movement of the climbing rail in relation to the building than for the downward movement of the climbing lift rail in relation to the climbing rail.

The climbing shoe, which guides the climbing rail when the climbing lift rail is mounted, can be arranged above or below the climbing shoe, in which the climbing lift rail is mounted. According to the embodiments described by means of the figures, the climbing shoe, which guides the climbing rail when the climbing lift rail is mounted, is arranged above the climbing shoe, in which the climbing lift rail is mounted, which is therefore not required.

The climbing shoe can be designed either for mounting the climbing rail or the climbing lift rail or for mounting both the climbing rail and the climbing lift rail. In this way, conventional climbing shoes can be used for mounting the climbing rail. On the other hand, the overall size and in particular the required number of climbing shoes can be reduced if the climbing shoe is designed for mounting both the climbing rail and the climbing lift rail.

The connection between the climbing lift rail and the climbing shoe is preferably established in such a way that the climbing lift rail is mounted in the climbing shoe designed for mounting the climbing lift rail by means of at least one latching/snap element and a plurality of retaining elements for holding the at least one latching/snap element or by means of a plurality of latching/snap elements and at least one retaining element for holding at least one latching/snap element of the plurality of latching/snap elements. In this case, the one or more latching/snap elements are located on the climbing shoe designed for mounting the climbing lift rail and the one or more retaining elements are located on the climbing lift rail, or the one or more retaining elements are located on the climbing shoe designed for mounting the climbing lift rail and the one or more latching/snap elements are located on the climbing lift rail. In this way, the climbing lift rail with the climbing shoe can be produced easily and reliably.

The latching/snap element is preferably designed as a movable element, which is designed in particular to be pivotable, foldable or moveable, in the form of a latch, in particular a locking latch or a climbing latch, a detent, in particular a snap-in nose, or a bolt, in particular a locking bolt. The latching/snap elements can be present one behind the other on the climbing lift rail in the form of climbing latches or foldable snap-in noses. Alternatively, the retaining elements can be introduced into the climbing lift rail one behind the other in the form of retaining recesses for engaging with the at least one latching/snap element of the climbing shoe, as is the case in the embodiments described below by means of the figures, or retaining knobs can be applied, for example, welded, to the climbing lift rail.

In a preferred embodiment, the climbing lift rail has the retaining recesses on at least one side in such a way that the climbing lift rail is present in the form of a profile with a hook-in contour, in particular with teeth. Alternatively, the climbing lift rail can have the retaining recesses in the form of completely edged holes, also called ears, especially if there is only one latching/snap element on the climbing shoe designed for mounting the climbing lift rail.

Completely edged holes as retaining recesses have a higher stability than not completely edged recesses between teeth, in particular if only one latching/snap element has to support the climbing system when the lift device is extended. On the other hand, teeth that are generated, for example, between rectangular or square recesses, are easier to manufacture and thus more cost-effective than hole patterns. Depending on the application, e.g., required stability and/or cost specification, the climbing lift rail can in this case be made, for example, pressed or embossed, of solid material or be present as a hollow profile, for example, in lasered form.

A latching/snap element arranged in or on the climbing shoe is preferably designed in the form of a climbing latch for mounting both the climbing rail and the climbing lift rail. Due to the double function of said climbing latch, the climbing shoe can be designed simpler than in the case, in which a climbing latch is to be provided for mounting the climbing rail as well as the climbing lift rail.

The climbing rail and the climbing lift rail can be arranged one inside the other or lying next to one another, depending on the case of application.

In the case of an arrangement, in which they lie one inside the other, the guidance of the climbing lift rail by the climbing rail is possibly more effective than in an arrangement, in

which they lie next to one another, which can be easier to realize than the arrangement, in which they lie one inside the other.

5 The climbing lift rail preferably has a rectangular profile or a cross-sectional profile in the form of an L, T or I, also called a double-T. As a result, a simple and stable design of the climbing lift rail is ensured.

A hydraulic cylinder, a spindle drive or a rack and pinion drive, an actuator or a linear drive come into consideration as the lift device, wherein the spindle or rack and pinion drive can be driven, for example, by an electric motor. A common standard hydraulic cylinder can therefore be used according to the invention.

10 If the climbing rail is designed to be pivotable by at least 4 degrees in relation to a vertical axis, the lift drive is also suitable for creating non-vertical designs of the outer wall or outer walls of a building without modifications.

The invention also comprises a rail-guided climbing system with the lift drive according to the invention, the frame unit, in which at least one of the climbing rails is
 15 integrated or to which the at least one climbing rail is secured, wherein a total length of the at least one climbing rail is sufficient to guide the climbing rail of at least two climbing shoes which are spaced apart from one another by a predetermined distance. By using several climbing rails at the same time, the load-bearing capacity of the climbing system can be increased. In order to fully provide a building with a climbing system, it may be necessary to
 20 provide a plurality of climbing rails for the climbing system. The heights of a plurality of climbing rails are preferably synchronized via end position compensation after each extension and retraction of the lift device.

The at least two climbing shoes are preferably spaced apart from one another by a distance which corresponds approximately to a floor height of the building or a fraction
 25 thereof. With a spacing of approximately one floor height, the climbing shoes can be placed in, or removed from, the outer wall of the building with each climbing cycle, with which the climbing system is moved upwards by one floor height. Intermediate climbing cycles only for placing or removing the climbing shoes without further work, for example, formworking, concreting, etc., can thus be avoided.

A method for climbing a rail-guided climbing system, which can be used in particular as climbing formwork, climbing frame, climbing protective wall and/or a climbing working platform, with the lift drive according to the invention is also part of the invention. The method comprises the steps:

- 5 - Extending the lift device with the mounted climbing rail, wherein the climbing lift rail is moved downwards relative to the climbing rail until the climbing lift rail is mounted,
- continuing the extension movement of the lift device, wherein a further downward movement of the climbing lift rail is prevented by the mounting of the climbing lift rail and the climbing rail is removed and moved upwards by at least one
10 mounting distance of the climbing rail relative to the climbing lift rail,
- retracting the lift device, wherein the climbing rail is moved downwards relative to the climbing lift rail until the climbing rail is mounted moving upwards by at least the one mounting distance, and
- 15 - continuing the retraction movement of the lift device, wherein a further downward movement of the climbing rail is prevented by the mounting of the climbing rail and the climbing lift rail is removed and moved upwards by at least the one mounting distance of the climbing rail relative to the climbing rail.

For example, the lift device extends until the lower of at least three climbing shoes,
20 which are capable of simultaneously guiding the climbing rail, is mounted in the climbing lift rail. A further downward movement of the climbing lift rail in relation to the building is then no longer possible and the further stroke of the lift device pushes the climbing rail, to which the frame unit is attached, over the climbing lift rail, which is now fixed in place in relation to the building and which is connected to the lift device, in the direction opposite the direction of
25 the climbing rail until it is mounted. The climbing rail is thus supported by the lift device on the climbing lift rail in order to move the climbing system upwards. As a result, the climbing rail is lifted out of the middle one of the three climbing shoes for guiding the climbing rail, which was previously responsible for the vertical load transfer, and the vertical load is transferred in the lower climbing shoe, in which the climbing lift rail is mounted. Since the
30 length of the stroke of the lift device is sufficient to mount the climbing rail offset by a mounting distance, the climbing rail runs over the upper one of the three climbing shoes. After completion of the climbing stroke, there is thus a change in the vertical load transfer from the

lower to the upper climbing shoe, in which the climbing rail is now mounted, when the lift device is retracted. Other embodiments are possible, wherein any climbing shoe of the climbing lift rail, which is located in the area of the climbing lift rail, can be used for the upward push. In the above embodiment, the climbing shoe with retaining function for holding the climbing rail is located above the climbing shoe for mounting and supporting the climbing lift rail. However, the climbing shoe with retaining function for holding the climbing rail, which can be designed as a climbing shoe with an additional latch, can be arranged at any point in relation to the climbing shoe for mounting and supporting the climbing lift rail, e.g., in the area of the middle climbing shoe or below the climbing shoe for mounting and supporting the climbing lift rail.

The method steps according to the invention are preferably defined as a cycle and the cycle is repeated until the frame unit has reached a further or a plurality of further floors of the building or a concreting portion of the building to be concreted.

Further features and advantages of the invention will become apparent from the following detailed description of an embodiment of the invention, from the patent claims and from the figures of the drawings, which show details essential to the invention. The features shown in the drawings are depicted in such a way that the special features according to the invention can be made clearly visible. The different features can each be realized in isolation or as a plurality in any combination in variants of the invention. In the figures, the same reference signs denote the same or corresponding elements.

In the drawings:

Fig. 1a-1e are cross-sectional views of a sequence of climbing processes a to e of a climbing system with the lift drive according to the invention, wherein the climbing system comprises a working platform that carries an outer formwork and a frame unit that also has a trailing platform;

Fig. 2a, b show the climbing system shown in Fig. 1b in a side view (a) and in a top view (b) with two climbing rails;

Fig. 3a is a cross-sectional view of section B in Fig. 2a in an enlarged representation;

Fig. 3b is a cross-sectional view along the plane A-A in Fig. 3a of a climbing rail and a climbing lift rail with a top view of a climbing shoe according to one embodiment of the invention;

Fig. 4 is a spatial external view of a climbing lift rail with a fixed lift device
5 according to a further embodiment of the invention; and

Fig. 5 is an enlarged spatial sectional view of the climbing rail and the climbing lift rail according to the invention, which are shown in section C in Fig. 2b.

Fig. 1a shows an initial position of a climbing system 10 with the lift drive according to the invention in cross section during a sequence of climbing processes for climbing a frame unit 11 around a floor of a building 1. The building 1 comprises a plurality of floors with outer walls 40, 44, 48, 52, which are shown separated from one another in the vertical direction Y in the cross-sectional view by cutouts 41, 45, 49, 53, for example, for the installation of windows. The floors of the building 1 lying one above the other with floor heights 42, 46, 50, 54 are connected to one another by floor slabs 43, 47, 51, 55.

15 The climbing system 10 comprises a frame unit 11 with a formwork platform 12 with a formwork 13, which can be moved jointly in the horizontal direction 14 towards the building 1 and/or away from the building 1 in order to complete a concreting portion, for example, of a floor of the building 1. A working platform 16, which is fixed to the formwork platform 12, is arranged below the formwork platform 12. A control unit for operating a drive for moving the
20 formwork and/or a lift device 26 for climbing the climbing system can be arranged on the working platform 16. The lift device 26 is located on a trailing platform 22 which is arranged below the working platform 16 and is fixed to the working platform 16. In the climbing system 10 shown in Fig. 1a, the frame unit 11 thus comprises the formwork platform 12, the working platform 16 and the trailing platform 22, wherein a climbing rail 18 is integrated in
25 the frame unit 11. It is also possible to fasten the climbing rail 18 to the frame unit 11. The trailing platform 22 is used, among other things, for attaching and removing climbing shoes 32, 34, 36, 38 which are arranged on the building 1 in a fixed manner and used to guide and support the climbing rail 18 which is carried by the frame unit 11.

The climbing rail 18 has bores 19 and support bolts 19', also called spacers, which are
30 each vertically spaced apart from one another by a mounting distance 20 and which engage in each of the climbing shoes 32, 34, 36, 38 in such a way that the climbing rail 18 can be

mounted in at least one of the climbing shoes 32, 34, 36, 38 in the vertical direction, e.g., in the case of a downward movement, and in the direction opposite said direction, i.e., upwards, it can be removed and is moveable in relation to the respective climbing shoe 32, 34, 36, 38.

According to the invention, not only the climbing rail 18 is present but also a climbing lift rail 24 which is moveable relative to the climbing rail 18 and guided by the climbing rail 18, which can be mounted in at least one of the climbing shoes 32, 34, 36, 38 in one direction and in the direction opposite said direction, it can be removed and is movable in relation to the at least one of the climbing shoe 32, 34, 36, 38. In addition to being guided by the climbing rail 18, the climbing lift rail 24 is only connected to the climbing rail 18 via the lift device 26. In the present embodiment, the lift device is connected with its lower end 27 to the climbing lift rail 24 and with its upper end 28 to the climbing rail 18.

At the beginning of the climbing process, the lift device, more precisely, a lifting cylinder or ram of the lift device, is completely retracted, so that a stroke length 2 of the lift device is zero. When the lift device 26 is retracted, there is a distance 2' between a height 25 of an upper edge of the climbing lift rail 24 and a height 21 of an upper edge of the climbing rail 18. The climbing rail 18 is mounted in the climbing shoe 34, so that a vertical load is transferred via said climbing shoe.

In Fig. 1b, the lift device 26 is extended by a stroke length 3 which is non-zero. The climbing rail 18 is still mounted in the climbing shoe 34 and the climbing lift rail 24 moves downwards in such a way that the height 25a of the upper edge of the climbing lift rail 24 is moved downwards by the distance 3' in relation to the height 25 of the climbing lift rail 24 which is shown in Fig. 1a. Since the climbing rail 18 has not moved in relation to its height in Fig. 1a, the length 3 of the stroke of the lift device 26 corresponds to the movement 3' of the climbing lift rail 24 relative to the climbing rail 18. The lift device 26 extends until the climbing lift rail 24 is mounted in the climbing shoe 32, which, however, is not yet the case in Fig. 1b.

In Fig. 1c, the lift device 26 is extended by the stroke length 4, which is greater than the stroke length 3, so that the climbing lift rail 24 is now mounted in the climbing shoe 32. Since the climbing lift rail 24 cannot move further downwards due to its mounting in the climbing shoe 32, the climbing rail 18 is now moved upwards instead of the climbing lift rail 24. The entire climbing system 10 including the frame unit 11 is thus raised upwards. In

relation to the height 21 of the upper edge of the climbing rail 18 in Fig. 1a and Fig. 1b, the height 21a of the upper edge of the climbing rail in Fig. 1c is moved upwards by the distance 4'. The length 4 of the stroke of the lift device 26 is thus composed of the distance 3', by which the climbing lift rail 24 has moved downwards in relation to its height in Fig. 1a, and the distance 4', by which the climbing rail 18 has moved upwards in relation to its height in Fig. 1a. In this case, the length 4 of the stroke of the lift device 26 when the climbing lift rail 24 is mounted is sufficient to mount the climbing rail 18 in the climbing shoe 36 such that it is offset by the mounting distance 20. At least the mounting distance 20 is covered. The lift device 26 thus pushes the climbing rail 18, supported on the climbing lift rail 24 which is supported on the lower climbing shoe 32, upwards by at least the mounting distance 20. In the case of Fig. 1c, the climbing rail 18 is offset by the mounting distance 20 and, in addition, by a retaining point distance that is required in order to mount the climbing rail 18 in the climbing shoe 36. The retaining point of the climbing shoe 36 from the climbing rail 18 is climbed over in order to be able to mount the climbing rail 18 in said climbing shoe. The support bolt 19' of the climbing rail 18 is therefore located above a mounting height 36' of the climbing shoe 36. The retaining point distance is approximately the vertical distance between two adjacent bores 19 in the climbing rail 18. In other designs, the retaining point distance can be smaller or reduced to zero. In this case, it is sufficient if the stroke length 4 can cover the mounting distance 20 of the climbing rail 18 when the climbing lift rail 24 is mounted. Since the climbing rail can be moved upwards by the mounting distance 20, it is not necessary to provide a longer stroke length than the stroke length 4. In the present embodiment, the stroke length 4 is therefore the maximum stroke length. However, higher maximum stroke lengths are possible.

In Fig. 1d, the lift device 26 is retracted, so that the stroke length 5 is smaller than the stroke length 4 in Fig. 1c. In relation to the height 21 of the upper edge of the climbing rail 18 in Fig. 1a and 1b, the height 21b of the upper edge of the climbing rail is moved upwards by the distance 5'. Said distance is smaller by the retaining point distance than the distance 4' in Fig. 1c and equals the mounting distance 20, so that the climbing rail 18 is mounted in the climbing shoe 36. This can be seen from the fact that the support bolt 19' is located at the height of the mounting height 36' of the climbing shoe 35. Since the lift device 26 with the stroke length 5 is retracted by more than the retaining point distance in relation to the stroke length 4, and the climbing rail 18 cannot move further downwards due to its mounting in the climbing shoe 36, the climbing lift rail 24 is now moved upwards instead of the climbing rail

18. In relation to the height 25 of the upper edge of the climbing lift rail 24 in Fig. 1a, the height 25b of the upper edge of the climbing lift rail is only the distance 5'' downwards, wherein said distance is smaller than the distance 3' in Fig. 1b and Fig. 1c. The length 5 of the stroke of the lift device 26 is composed of the distance 5'', by which the climbing lift rail 24 has moved downwards in relation to its height in Fig. 1a and the distance 5', by which the climbing rail 18 has moved upwards in relation to its height in Fig. 1a. Without a movement of the frame unit 11, which is mounted in the climbing shoe 36 via the climbing rail 18, the climbing lift rail 24 is therefore pulled upwards.

In Fig. 1d, the lift device 26 is completely retracted. Therefore, the stroke length 2 is zero. As shown in Fig. 1c, the height 21b of the upper edge of the climbing rail 18 is moved upwards by the distance 5' which corresponds to the mounting distance 20. The support bolt 19' is located at the height of the mounting height 36' of the climbing shoe 35 and the climbing rail 18 is offset upwards by the mounting distance 20 in relation to its height in Fig. 1a, as can be seen from a comparison of the heights 21 and 21b of the upper edges in Fig. 1a and Fig. 1d. The height 25c of the upper edge of the climbing lift rail 24 is also offset upwards by the mounting distance 20 in relation to its height 25 in Fig. 1a, which is shown as distance 5''' in Fig. 1d, so that the distance 2'' of the upper edges 21b and 25c of the climbing rail from the climbing lift rail corresponds to the distance 2' in Fig. 1a. When the lift device 26 in Fig. 1d is retracted, the climbing rail 18 is mounted in the climbing shoe 36. In Fig. 1a, the climbing rail 18 was mounted in the climbing shoe 34 with the lift device 26 retracted.

Fig. 2 is a side view of the climbing system 10 shown in Fig. 1b. The climbing lift rail 24 lies in the climbing rail 18 in such a way that the climbing lift rail cannot be seen. The formwork 13 is mounted on a vertical beam 13' for the formwork. A railing 13'' is attached to the upper end of the vertical beam 13' in order to ensure safe working in this area.

Fig. 2b is a top view of the climbing system 10 shown in Fig. 1b and 2a with two climbing rails 18 arranged parallel to one another. In addition to the formwork platform 12, the working platform 16 and the trailing platform 22, the formwork 13 with the vertical beam 13' and the railing 13'' as well as the cutouts 41, 45, 49 in the outer wall 44 of the building 1 are shown.

Fig. 3a shows section B of the lower area in Fig. 2a as an enlarged depiction in cross section. In this respect, Fig. 3 shows the section already shown in Fig. 1b with guide shoes 19''

of the climbing rail 18, in which the climbing lift rail 24 is guided. The climbing rail 18 is mounted in the climbing shoe 34, wherein the support bolt 19' is mounted in the climbing shoe 34 approximately centrally in the vertical direction to the climbing shoe 34.

Fig. 3b shows a cross section along the plane A-A in Fig. 3a of the climbing rail 18, which comprises two opposing U-shaped elements, and of the climbing lift rail 24, which has an I-shaped cross section, also called a double-T-shaped cross section. The climbing lift rail 24 is arranged in the climbing rail 18 between the U-shaped elements of the climbing rail 18 and guided by guide shoes 19" which are also arranged between the U-shaped elements of the climbing rail 18. The guide shoe 19" only guides the side of the climbing lift rail 24 facing away from the outer wall 40, wherein the side of the climbing lift rail 24 facing the outer wall 40 can engage in a climbing latch 32", which can be seen in Fig. 3b, because, in addition to the cross section of the climbing rail and the climbing lift rail, a top view of the climbing shoe 32 is shown. The climbing latch 32" has two lugs which are arranged parallel to one another and which can engage in the side of the climbing lift rail 24 facing the outer wall. The climbing shoe 32 has two limbs 32', with which the side of the climbing rail 18 facing the outer wall 40 is guided. The limbs 32" are each pivotable about the vertical axis y and can be fixed in their position with locking pins. Other limbs that are not pivotable and/or can be used without locking pins are possible. The climbing latch 32" can engage both in the climbing lift rail 24 and in the climbing rail 18 in order to enable both the climbing lift rail and the climbing rail to be mounted in the climbing shoe 32. However, designs of climbing shoes, in which different climbing latches are available in order to be able to mount either the climbing rail or the climbing lift rail, are also conceivable.

Fig. 4 shows the climbing lift rail 24 with a fixed lift device 26 at its lower end 27 in a spatial external view with a stroke length 3, which is already shown in Fig. 1b and 3a. The lower end 27 of the lift device 26 is screwed to the climbing lift rail 24, wherein the upper end 28 is open for a connection to the climbing rail 18. At the upper end of Fig. 4, the cross section of the climbing lift rail 24 can be seen, wherein the side facing the outer wall 40 according to Fig. 3b is wider than the side opposite said side, which is guided by the guide shoes 19" according to Fig. 3b. The wider side has a toothed profile with rectangular recesses 61, which lead to a mounting stroke distance 60 of the climbing lift rail 24. Instead of the rectangular recesses 61 leading to a toothed profile, retaining recesses in the form of completely edged holes, also called ears, can be present in the climbing lift rail 24, which can

accommodate a higher vertical load per recess than the recesses 61 which are not completely closed.

Fig. 5 shows an enlarged spatial sectional view of the climbing rail 18 and the climbing lift rail 24, which are shown in section C in Fig. 2b. The lower end 27 of the lift device with stroke length 3 is fixed on the side of the climbing lift rail 24 facing away from the outer wall 40 by means of a screw connection, wherein the upper end 28 of the lift device 26 is fixed by means of a screw connection on a side of the guide shoe 19" of the climbing rail 18 facing away from the outer wall 44. In the lower area of Fig. 5, the climbing shoe 32 attached in a fixed manner to the outer wall 40 has the limbs 32' which guide the side of the climbing rail 18 facing the outer wall 40. The climbing latch 32" can engage both in the support bolts 19' of the climbing rail 18 and in the recesses 61 on the side of the climbing lift rail 24 facing the outer wall 40. The mounting distance 20 of the climbing rail 18 shown in Fig. 3 between two support bolts 19' comprises four distances between adjacent bores 19. The mounting stroke distance 60 of the climbing lift rail 24 shown in Fig. 5 is smaller than the mounting distance 20 and is approximately two distances between adjacent bores 19. Therefore, when extending the lift device, two thirds of the stroke length required to move the climbing rail by the mounting distance 20 can be used to move the climbing rail 18, while only a maximum of one third of the stroke length is required to mount the climbing lift rail 24.

The features of the invention described with reference to the depicted embodiment, such as the toothed profile of the climbing rail 24 according to Fig. 4, can also be present in other embodiments of the invention, for example, the climbing lift rail 24 not being arranged in the climbing rail 18 but lying next to the climbing rail 24, unless otherwise stated or if it is inherently forbidden for technical reasons.

List of reference signs

1	Building
2, 3, 4, 5	Stroke length lift device
2', 2"	Distance upper edge climbing rail to upper edge climbing lift rail
3', 5", 5"	Movement climbing lift rail
4', 5'	Movement climbing rail
10	Climbing system
11	Frame unit
12	Formwork platform
13	Formwork
13'	Vertical beam formwork
13"	Railing formwork platform
14	Horizontal directions
16	Working platform
18	Climbing rail
19	Bore in climbing rail
19'	Support bolt climbing rail
19"	Guide shoe climbing rail for climbing lift rail
20	Mounting distance climbing rail
21, 21a, 21b	Height upper edge climbing rail
22	Trailing platform

24	Climbing lift rail
25, 25a, 25b, 25c	Height upper edge climbing lift rail
26	Lift device
27	Lower end lift device
28	Upper end lift device
32, 34, 36, 38	Climbing shoe
32'	Limb climbing shoe
32"	Climbing latch
36'	Mounting height climbing shoe
40, 44, 48, 52	Outer wall building
41, 45, 49, 53	Cutout in outer wall building
42, 46, 50, 54	Floor slab
43, 47, 51, 55	Floor height building
60	Mounting stroke distance climbing lift rail
61	Retaining recesses
A-A	Cross-sectional view Fig. 3a
B	Section Fig. 2a
C	Section Fig. 2b
Y	Vertical direction upwards

CLAIMS

1. A lift drive for a rail-guided climbing system (10), which can be used, in particular, as a climbing formwork, climbing frame, climbing protective wall and/or a climbing working platform, comprising climbing shoes (32, 34, 36, 38) that can be arranged on a building (1) in a fixed manner, at least one climbing rail (18) which is guided by the climbing shoes (32, 34, 36, 38) and which can be integrated into a frame unit (11) or secured to the frame unit (11), a climbing lift rail (24) which can be moved relative to the climbing rail (18) and is guided by the climbing rail (18), in which the climbing rail (18) and the climbing lift rail (24) can each be mounted in at least one of the climbing shoes (32, 34, 36, 38) in one direction and removed in a direction opposite said direction, and they can be moved in relation to the at least one of the climbing shoes (32, 34, 36, 38), and comprising a lift device (26) which is fixed to the climbing rail (18) at one end and to the climbing lift rail (24) at the other end in such a way that a length (3, 4, 5) of a stroke of the lift device (26) corresponds to a movement (3'; 3', 4'; 5', 5'') of the climbing lift rail (24) relative to the climbing rail (18), in which the length (4) of the stroke when the climbing lift rail (24) is mounted is sufficient to mount the climbing rail (18) such that it is offset by a mounting distance (20) of the climbing rail (18), in which the climbing lift rail (24) is mounted in the climbing shoe (32, 34, 36, 38) designed for mounting the climbing lift rail (24) by means of at least one latching/snap element and a plurality of retaining elements for holding the at least one latching/snap element or by means of a plurality of latching/snap elements and at least one retaining element for holding at least one latching/snap element of the plurality of latching/snap elements, in which the one or more latching/snap elements are located on the climbing shoe (32, 34, 36, 38) designed for mounting the climbing lift rail (24) and the one or more retaining elements are located on the climbing lift rail (24), or the one or more retaining elements are located on the climbing shoe (32, 34, 36, 38) designed for mounting the climbing lift rail (24) and the one or more latching/snap elements are located on the climbing lift rail (24).
2. A lift drive according to Claim 1, in which the length (4) of a stroke of the lift is additionally sufficient to cover a mounting stroke distance (60) of the climbing lift rail (24).
3. A lift drive according to Claim 1 or 2, in which the climbing shoe (34, 36), which guides the climbing rail (18) when the climbing lift rail (24) is mounted, is arranged above or below the climbing shoe (32), in which the climbing lift rail (24) is mounted.

4. A lift drive according to Claim 1, 2 or 3, in which the climbing shoe (32, 34, 36, 38) is designed for mounting either the climbing rail (18) or the climbing lift rail (24) or for mounting both the climbing rail (18) and the climbing lift rail (24).

5. A lift drive according to any preceding claim, in which the latching/snap element is designed as a movable element, which is designed in particular to be pivotable, foldable or moveable, in the form of a latch, in particular a locking latch or a climbing latch (32"), a detent, in particular a snap-in nose, or a bolt, in particular a locking bolt.

6. A lift drive according to Claim 5, in which the latching/snap elements are present one behind the other on the climbing lift rail (24) in the form of climbing latches (32") or foldable snap-in noses.

7. A lift drive according to Claim 5, in which the retaining elements are introduced into the climbing lift rail (24) one behind the other in the form of retaining recesses (61) for engaging with the at least one latching/snap element of the climbing shoe (32, 34, 36, 38), or retaining knobs can be applied, for example, welded, to the climbing lift rail (24).

8. A lift drive according to Claim 7, in which the climbing lift rail (24) has the retaining recesses (61) on at least one side in such a way that the climbing lift rail (24) is present in the form of a profile with a hook-in contour, in particular with teeth, or, in particular, if there is only one latching/snap element on the climbing shoe (32, 34, 36, 38) designed for mounting the climbing lift rail (24), the climbing lift rail (24) can have the retaining recesses (61) in the form of completely edged holes, also called ears.

9. A lift drive according to Claim 7 or 8, in which the climbing lift rail (24) is made, for example, pressed or embossed, of solid material or is present as a hollow profile, for example, in lasered form.

10. A lift drive according to any of Claims 5, 7, 8 or 9, in which a latching/snap element in the form of a climbing latch (32") arranged in or on the climbing shoe (32, 34, 36, 38) is designed for mounting both the climbing rail (18) and the climbing lift rail (24).

11. A lift drive according to any preceding claim, in which the climbing rail (18) and the climbing lift rail (24) are arranged one inside the other or lying next to one another.

12. A lift drive according to any preceding claim, in which the climbing lift rail (24) has a rectangular profile or a cross-sectional profile in the form of an L, T or I, also called a double T.

13. A lift drive according to any preceding claim, in which the lift device (26) is designed as a hydraulic cylinder, a spindle drive or a rack and pinion drive, an actuator or a linear drive, in which the spindle or rack and pinion drive can be driven, for example, by an electric motor.

14. A lift drive according to any preceding claim, in which the climbing rail (18) is designed to be pivotable by at least 4 degrees in relation to a vertical axis.

15. A rail-guided climbing system (10) with a lift drive according to any preceding claim, the frame unit (11), in which at least one of the climbing rails (18) is integrated or to which the at least one climbing rail (18) is secured, in which a total length of the at least one climbing rail (18) is sufficient to guide the or each climbing rail (18) of at least two climbing shoes (32, 34, 36, 38) which are spaced apart from one another at a predetermined distance.

16. A rail-guided climbing system (10) according to Claim 15, in which the at least two climbing shoes (32, 34, 36, 38) are spaced apart from one another by a distance which corresponds approximately to a floor height (43, 47, 51, 55) of the building (1) or a fraction thereof.

17. A method for climbing a rail-guided climbing system (10), which can be used in particular as climbing formwork, climbing frame, climbing protective wall and/or a climbing working platform, with a lift drive according to any of Claims 1 to 14 and the following steps:

- extending the lift device (26) with the mounted climbing rail (18), in which the climbing lift rail (24) is moved downwards relative to the climbing rail (18) until the climbing lift rail (24) is mounted,
- continuing the extension movement of the lift device (26), in which a further downward movement of the climbing lift rail (24) is prevented by the mounting of the climbing lift rail (24) and the climbing rail (18) is removed and moved upwards by at least one mounting distance (20) of the climbing rail (20) relative to the climbing lift rail (24),

- retracting the lift device (26), in which the climbing rail (18) is moved downwards relative to the climbing lift rail (24) until the climbing rail (18) is mounted moving upwards by at least the one mounting distance (20), and

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- continuing the retraction movement of the lift device (26), in which a further downward movement of the climbing rail (18) is prevented by the mounting of the climbing rail (18) and the climbing lift rail (24) is removed and moved upwards by at least the one mounting distance (20) of the climbing rail (18) relative to the climbing rail (18).

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18. A method according to Claim 17, in which the method steps according to Claim 17 are defined as a cycle and the cycle is repeated until the frame unit (11) has reached a further or a plurality of further floors (43, 47, 51, 55) of the building (1) or a concreting portion of the building (1) to be concreted.