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(54) INSTALLATION FOR SECURE ACCESS TO AN UPPER PART OF A VEHICLE

ANLAGE FÜR SICHEREN ZUGANG ZU EINEM OBEREN TEIL EINES FAHRZEUGS

INSTALLATION POUR UN ACCÈS SÉCURISÉ À UNE PARTIE SUPÉRIEURE D'UN VÉHICULE

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(56) References cited:
EP-A1- 2 366 600 WO-A1-03/048024
CA-A1- 2 633 824 DE-A1- 10 103 021
US-A- 4 776 429

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Description

TECHNICAL FIELD

[0001] This invention relates to an installation for secure access to an upper part of a vehicle, said installation comprising, a fixed frame arranged along a line of passage for said vehicle, a vertically movable support structure, movable relative to the fixed frame, at least one longitudinal platform supported by said movable support structure, a first actuating device having one fixed part fixed relative to the fixed frame and a movable part attached to said movable support structure, to arrange for vertical movement, of the movable support structure, a second actuating device having one part attached to a first fixing means fixated to said movable support structure and another part attached to a second fixing means attached to said longitudinal platform, to arrange for horizontal movement of the longitudinal platform.

BACKGROUND

[0002] There is a general problem with existing installations of the above kind, e.g. as known from EP-2716498 and ES-2627789. One of the main problems is that they are relatively expensive and also relatively space requiring. Hence, in order to handle the loads that may be applied there is a need of a relatively large number of uprights and such uprights do take space from areas where it is inconvenient from many aspects to not have free open space.

[0003] Moreover, there is a disadvantage in that staff when using such an installation when moving from one side to the other need to first climb down to the floor and pass over to the other side and there again climb upwards to the platform on the other side.

[0004] From CN202866341 and US4776429, which discloses the preamble of claim 1, there are known installations that partly solve the above problems, but that suffers from other disadvantages, e.g. space requiring and relatively limited functionality.

SUMMARY OF THE INVENTION

[0005] It is an object of the invention to minimize the problems mentioned above which is achieved thanks to an installation in accordance with the independent claim.

[0006] Thanks to the invention there is provided an installation which provides significantly much more open space than conventional installations, better adaptation to enable efficient use and which also may be produced to lower cost than most traditional installations.

[0007] According to a preferred aspect of the invention there is also arranged at least one laterally extending platform/"bridge", which enables staff to easily move from a longitudinal platform arranged along one side of a vehicle to the other side of the vehicle without the need to first move down to the ground floor. Furthermore, such

an installation provides the possibility to merely use one stair way application instead of two as is needed with conventional installations.

[0008] According to further preferred aspects of the invention:

- there is a pair of parallel longitudinal platforms (5), wherein there preferably are arranged two transversal platforms (6), which at each end is movably supported by said longitudinal platforms, which provides the advantage that enhanced flexibility is achieved.
- said support structures (31, 35, 32, 36), include at least one longitudinal framework member (31, 35), preferably two parallel longitudinal framework members (31, 35, 32, 36) also include at least one transversal framework member (32, 36), preferably two transversal framework members (32, 36), which may provide many advantages, e.g. efficient assembly, enhanced flexibility is achieved, etc.
- said transversal platform/s (6) comprise/s two parts (6A, 6B) that interact telescopically, which provides the advantage that one or two longitudinal platforms may be used for support thereof.
- said longitudinal platform (5) has a floor (52) limited by a support wall (53) along an outer long side, which support wall (53) is arranged to provide strength and also hinder objects from falling down from said floor (52), by means of providing said support wall (53) with a substantial height (h5) and fixing said support wall (53) to have its lower edge (53B) at or below the level of said floor (52) and its upper edge (53A) well above level of said floor, which may provide the combined advantage of providing both protection and a self-supporting design, wherein preferably said height (h5) is larger at the center in between the short end walls (54) of the platform (5) than adjacent the short end walls of the platform,
- said longitudinal platform (5) at each short end wall (54) has a hollow carrying member (50) attached thereto, which hollow carrying members (50) may provide efficient support and a transversal open space for housing of said support beams (40) to cost-efficiently and safely enable transversal movement of said longitudinal platform (5), wherein preferably said hollow carrying member (50), has attached thereto said second fixing means (43) and preferably said first fixing means (44) is attached to said support beam (40).
- a pair of parallel longitudinal framework members (31, 31'), either in one installation (2) or two parallel neighboring installations (2, 2'), support a transversally arranged crane beam (9) arranged to be movable in the longitudinal direction, which may cost-efficiently and safely enable installation of a crane/hoist.
- said movable anchoring device (41) includes a car-

dan joint (46), which may increase safety and strength of the design.

- the installation includes at least one stair way arrangement (7) including a lower fixed stair way part (7A) and an upper movable stair way part (7B), which includes a top platform (72) that by means of an actuating device (70) may position said top platform (72) at different levels.

[0009] Further advantages will become apparent from the detailed description below.

BRIEF DESCRIPTION OF THE FIGURES

[0010] In the following the invention will be described in more detail with reference to the enclosed figures wherein:

Fig. 1 shows a perspective view of a bus maintenance workshop provided with two parallelly arranged installations according to a first alternative of the invention,

Fig. 2 shows the same perspective view as Fig. 1 but according to a second alternative of the invention,

Fig. 3 shows a view of an installation of Fig. 1 seen from a front view,

Fig. 4 shows the same view as Fig. 3 but in a partly cross-sectional view to present details,

Fig. 5 shows a more detailed front view of an upper part of the view presented in Fig. 3,

Fig. 6 shows a view from above, partly in cross-section of an outer end of an installation according to the invention,

Fig. 7 shows in more detail the anchoring mechanism of the movable support structure,

Fig. 8 shows a perspective view of an end part of a longitudinal platform according to the invention,

Fig. 9 shows a perspective view of a transversal platform according to the invention,

Fig. 10 shows in more detail a brake mechanism of the transversal platform,

Fig. 11 shows a perspective view of a preferred stairway according to the invention,

Fig. 12 and 13 show side views of the stairway in an upper and lower position respectively,

Fig. 14 shows a perspective view from above of an

upper part of a stairway as presented in Fig. 1,

Fig. 15 shows the cross-sectional view from below of a stairway according to the invention, as indicated in Fig. 12, and,

Figs. 16 shows an exemplary side views of a bus service workshop arranged with installations according to the invention.

DETAILED DESCRIPTION

[0011] In Fig. 1 there is shown a perspective view of a bus service workshop 1 provided with two installations 2, 2' in accordance with one embodiment of the invention. The two installations 2, 2' have the same design and are arranged parallelly in order to provide for the possibility to service two vehicles B at the same time. The installations 2, 2' are arranged with movable platforms 5, 6, 5', 6', which are shown to be positioned on different heights in the figure, to clearly show that the platforms 5, 6, 5', 6' are adjustably positioned on any desired height within a given range provided by the installation 2, 2'.

[0012] In the following merely one of the installations 2 will be described more in detail. The installation 2 includes a fixed frame structure 3. The fixed frame structure 3 comprises four uprights 30 positioned at each end of a rectangular area that is created by the frame structure of the installation 2, when seen from above. At the top of the uprights 30 there are arranged two parallel longitudinal frame works 31 and also two parallel lateral frame works 32. Accordingly, the frame works 31, 32 are interconnected via the uprights 30 to form a rectangle at the top of the uprights 30. The height h of the uprights are sufficiently high to provide for entry of a vehicle to easily pass underneath the platforms 5, 6 when the platforms 5, 6 are positioned in their uppermost position. Preferably the top end of the uprights 30 are positioned at a level within the range of 6-7 m above the ground floor GF, i.e. the ground floor for a vehicle to drive into and out of the installation along a line of passage C.

[0013] The width W of the installation 2 is defined by the outer sides of the uprights 30, which preferably positioned such that the width W is in the range of 5-6 m which provides for sufficient space for vehicles to enter into the installation 2. Further, thanks to the use of frame works 31, 32 the length L of the installation between two longitudinally uprights 30 may be relatively large, which provides for the advantage that there will be provided an open space between each pair of the longitudinal uprights. Preferably the distance L between two longitudinally uprights is at least 10 m, preferably in the range of 13-23 m. The clearance width between a pair of uprights is preferably at least 4,5 m, more preferred 4,8-5,4 m. Maximal clearance width between the two longitudinal platforms 5 is at least 3 m, preferably in the range of 3,1-3,5 m. Adjustable clearance height below the platforms 5, 6 is preferably within the range of 1-5 m, more

preferred within 1,2-4,2 m.

[0014] The movable support structure 4 includes two horizontally extending support beams 40. Each support beam 40 extends transversally in relation to the line of passage C, between a pair of uprights 30. An anchoring device 41 is arranged at each end 40A of the support beams 40 that provides for the ability to move the support beams 40 vertically along the uprights 30 and that fixates the support beams 40 in any other direction, i.e. provides a stable guidance to merely provide vertical movement.

[0015] Supported by the support beams 40 there are positioned two longitudinal platforms 5, which may be moved transversally on the support beams 40. Each platform 5 is arranged with flooring 52 for staff to move on longitudinally along the installation 2. Further there are arranged support fences 51 to safeguard staff moving on the platform 5, to not fall down. Also, there are cushioning members 83, 84 positioned at the inner edges of the longitudinal platforms 5 that enable the platforms to be positioned in contact with a vehicle B without damaging the vehicle and also closing the space between the platform and the vehicle B so that there exists no gap.

[0016] Each anchoring mechanism 41 interacts with guide rails 412, 413 (see Fig. 6) within each upright 30, such that vertical movement is facilitated at the same time as the anchoring mechanism 41 is fixed in other directions. Furthermore, preferably the anchoring mechanism 41 includes a cardanic joint 46, such that bending forces from the support beams 40 onto the anchoring mechanism 41 will not transfer any bending forces into the guiding members 411, 414, 412, 413 of the anchoring mechanism 41.

[0017] Moreover, as seen in Fig. 1 there may also be arranged upper transversal support beams 33 provided at an angle, forming V-shapes along the upper top side of the fixed support structure 3. These additional support members 33 are preferably provided in connection with having a crane beam 9 arranged within the installation 2. On the crane beam 9 there may be provided a hoist (not shown) that is movably arranged along the crane beam 9 such that the hoist may be moved from one side to the other within the installation 2. Furthermore, the crane beam 9, may be provided with low friction members 90 (e.g. rollers) at each end to be movably arranged along the longitudinal frame works 31, such that the crane beam 9 may be moved and positioned at any desired location in the longitudinal direction within the installation 2.

[0018] In Fig. 2 there is shown alternatively arranged installations 2, 2' in a service workshop 1 basically providing the same function as described in connection with Fig. 1. The difference compared to Fig. 1 is that the two installations 2, 2' shown in Fig. 2 may be provided with a crane beam (not shown) that extends across both installations 2, 2'. This may be achieved by not using any longitudinal frame work members 31 at the central part of the joint installations 2, 2', such that a hoist not shown may be moved in between the outer two longitudinal

frame work member 31, 31' of the two installations 2, 2'. In order to arrange for the needed strength of the fixed support structure 3 there is arranged extended uprights 36 that extend all the way up to the roof (not shown) of the workshop 1, such that it will be the roof support structure of the building that provides the strength that corresponds to the strength provided by the central longitudinal frame work members 31, as shown in Fig. 1. Hence, the installations 2 shown in Fig. 1 are self-supported, i.e. need no connections to support structures of a building, whereas the alternative in Fig. 2 uses connection to support structures of the building.

[0019] In this regard it is evident for the skilled person that indeed all uprights may be supported by the support structures (not shown) integrated in the roof of the workshop 1 and in such an installation it will be possible to eliminate any of the frame works 32, 33 shown in Fig. 1 and Fig. 2. However, longitudinal frame works are needed if crane beam/s 9 is desired. Moreover, it is foreseen that the uprights 30 may be positioned on support shelves protruding from support pillars (not shown). The advantage of using support shelves at a level above men's height is that there is thereby provided walkable space underneath the support shelves such that more free space may be available within and near the installation 2. Hence, in such an installation the lower ends of the upright 30 and cylinder 45 will be positioned well above ground floor level GF.

[0020] Further Figs. 1 and 2 shown perspective views of stairways 7 that may form a part of the concept according to the invention. It is how that the stairway comprises a lower static part 7A and an upper adjustable part 7B. At the top of the upper part 7B there is a platform 72. The platform 72 may be adjustably positioned on different vertical heights by means of a hydraulic cylinder 70 (see Fig. 11). The stairway 7 includes two stairway uprights 71 that include guiding members for controlled guided movement of the upper part 7B of the stairway 7. There is a fixed stairway part 75 leading to an intermediate platform 74. At the intermediate platform 74 there is arranged support legs 76, e.g. in the form of an up and down turned U.

[0021] In Fig. 3 there is shown a front view of an installation according to the invention as shown in Fig. 1. There is shown a preferred structure of the frame work, which includes an upper frame work beam 320, a lower frame work beam 323 and intermediate frame work members 321, 322 interconnecting the upper and lower frame work beams 321, 323. According to a preferred embodiment the height h3 of each frame work 32 is in the range of 0,4-0,7 m and each frame work beam preferably has a hollow cross-sectional shape, preferably square tube, having a maximum outer cross-sectional width within the range of 80 to 140 mm (i.e. sides of a square tube within 50-100 mm). There is shown that each upright 30 is arranged with longitudinal holes 305, which provide for the ability to securely attach guide members 412, 413 (see Fig. 6) within the uprights 30.

[0022] At each end of the longitudinal platforms 5 there are arranged hollow, carrying members 50, which provide for support and transversal movement of each platform 5 along the support beam 40 of the movable support structure 4. Each carrying member 50 is arranged with an attachment member 43 that provides attachment of one end of a hydraulic cylinder 42. The other end of the hydraulic cylinder 42 is attached to a first fixing member 44 that is fixed onto support beam 40. Hence, the actuating device 42 (here hydraulic cylinder) has one fixed part 420 and one movable part 421. (see Fig. 6)

[0023] The transversal platform 6 comprises two parts 6A, 6B, which are telescopically arranged such that when transversal movement of a longitudinal platform 5 is performed, the size of the transversal platform 6 will adapt to the transversal distance between the two platforms 5. To achieve this there is a central part 60 that is telescopically interacting with outer parts 633, 643, preferably by means of wheel/rollers (not shown) to minimize friction. Above the level of the floor 62 of the transversal platform 6 there are arranged upwardly protruding walls 632, 642 that also act telescopically, as does also the safety fence 61A, 61B.

[0024] Each longitudinal platform 5, at its outer side, is arranged with a supporting longitudinal wall 53, which fulfil more than one function. A first function is that it will provide sufficient strength to make the platform 5 self-supporting, resulting in the advantage that no external support is needed at any intermediate position between the two support beams 40 for the platform 5. To achieve this, the longitudinal wall 53 is provided with sufficient height h_5 (see Fig. 8), at least 0,3 m. Preferably the height is at least 0,35 m, more preferred in the range of 0,4 - 1 m and the thickness is preferably less than 3% in relation to the height h_5 , e.g. in the range of 8-15 mm for steel plate. More preferred the height h_5 of the side plate 53 is larger adjacent the middle of the platform 5 than adjacent the ends, which provides the advantage that sufficient strength may be achieved at a lower total weight than if a straight upper edge 53A is used. A second function of the height of the side plate 53 is that it hinders objects to fall down from the platform 5 out over the edge, which otherwise may cause injury, by having its lower end 53B at or below the level of the floor 52 of the platform 5. A similar function is achieved by the transversal side plates 54 arranged at the end of each platform 5, which also protrude above the floor area 52 of the platform 5.

[0025] In Fig. 4 there is shown a front view of an installation 2 according to the invention where one side of each upright 30 has been removed. There is shown that the vertical movement of the movable platform 4 is achieved by a hydraulic cylinder 45 positioned centrally within the open space of each tube shaped upright 30. The hydraulic cylinder 45 has a fixed cylinder part 450, which is fixedly attached in relation to the fixed frame 3. As shown in Fig. 4 this may be achieved by positioning the lower end 451 of the cylinder 450 to form the fixed part, e.g. to be positioned onto ground floor GF. The hydraulic

cylinder 45 has a movable part, i.e. a piston 452 that in a known manner may move up and down to position the movable platform 4 at a desired level. Preferably the cylinders are synchronized by a master and slave system (not shown) or by a sensor (e.g. laser) bases system (not shown) and a control unit (not shown) to achieve the same exact movement of all cylinders in real time. The hydraulic pump/s and other hardware of such a system may preferably be placed under neath a fixed part (e.g. the fixed platform 74 of the stairs 7).

[0026] In the shown view the platforms 5, 6 have been positioned at a top level within the installation 2. As shown, there is an attachment arrangement 453 for a first actuating device 45, e.g. in the form a piston 452, that connects with the anchoring device 41 to transmit vertical movement. Preferably there is a hydraulic piston 452, which at the top has an attachment arrangement 453 that fixates the upper end of the piston 452 to the anchoring device 41, which movably supports the movable support beams 40. The anchoring device 41 preferably provides both guidance for vertical movement of the support beams 40 and anchoring of the ends 40A in other directions, i.e. anchoring in all horizontal directions. Preferably the anchoring device 41 includes an anchoring frame 410, that preferably is detachably attached to each end 40A of the support beams 40. The anchoring frame 410 is suitably positioned within the hollow space of each upright 30. Preferably the anchoring frame 410 has a substantial vertical extension, e.g. about 0,5 - 1 m, to provide for rigidity. Preferably, the attachment arrangement 453 for the piston 452 is arranged at the top of the anchoring frame 410. More preferred, the movable support beam 40 is attached at the lower end of the anchoring frame 410. Preferably movable support beam 40 is attached to the anchoring frame 410 via a separate joint 46, preferably a cardan joint 46 (see Fig. 7). Suitably there are passages 301, 302 in the sides of the uprights 30, to provide space for interconnecting the separate joint 46 within the anchoring mechanism 41. Hence, the connection between the support beam 40 and the anchoring frame 410 may be arranged for via a vertically extending passage/slot 300 in each upright 30. Accordingly, the anchoring device 41 guides the support beams 4 in a controlled manner along the uprights 3. Control signals and power may be supplied via a cable arrangement 47.

[0027] In Fig. 5 there is shown a partial view of what is shown in Fig. 4. It is shown that the platforms 5, 6 are positioned in the uppermost position within the fixed frame 3 showing merely one of the uprights 30. The view presents in more detail that there may be rollers 650 arranged to enable easy telescopic action of the two parts 6A, 6B of the transversal platform 6. Moreover, it is shown a gripping member 66 which when activated activates a brake mechanism that locks the transversal platform 6 in a fixed longitudinal position such that movement of the transversal platform 6 is then not possible, which otherwise would cause a safety problem.

[0028] Further, it is shown that at the end sides of the

transversal platform 6 there are arranged low friction devices 630, preferably in the form of a pair of wheel members 630A, 630B on each side of a gap to enable easy, low friction movement in a longitudinal direction of each transversal platform 6. The gap in between the wheels 630A, 630B is used to guide the transversal platform 6 along a guide rail 55 attached to the longitudinal platform 5. The guide rail 55 preferably comprises a horizontal support part 550 attached to an inner wall of the longitudinal platform 5 which has an upwardly protruding rail member 551 extending parallelly with the direction of the longitudinal platform 5, fitting into the gap and providing support for the low friction devices 630.

[0029] In Fig. 6 there is shown partly a cross-sectional horizontal view from above of a corner of an installation according to the invention, wherein one upright 30 is shown, such that there is also shown a part of the longitudinal frame work 31, a part of one longitudinal platform 5 with bumper 83 and a part of one transversal platform 6. Here the hydraulic piston 42, for movement of the longitudinal platform in a transversal direction, is shown in more detail clearly presenting the two attachment members 43, 44. It is also shown a cross-section of the hollow carrying member 50, which exposes the positioning of the support beam 40 within the hollow space of the hollow carrying member 50. At the end of the support beam 40 it is connected to an anchoring mechanism 41, as mentioned above.

[0030] The anchoring frame 410 has connected thereto a lower (not shown) and an upper shaft 415. At each end of each shaft there are arranged rollers 414, 411 that are guided within U-shaped guide rails 412, 413 attached on each inner side of the upright 30. Accordingly, there are arranged two U-shaped guide rails 412, 413 opposing each other within the upright 30. The rollers 411, 414 fit into the U-shaped guide rails to more or less without friction guide each end of the support beam 40 vertically along a desired path. Preferably, the connection between the end of the support beam and the anchoring mechanism 41 includes a cardan joint 46 such that bending forces will not be transmitted from the support beams 40 platform to the anchoring mechanism 41, as is explained in more detail in connection with Fig. 7.

[0031] In Fig. 7 there is shown in more detail a perspective view of an exemplary arrangement of the anchoring mechanism 41. In a preferred embodiment, as shown, it includes a cardan joint 46, between the end of each support beam 40 and the guide frame member 410. The cardan joint 46 comprises an inner attachment body 460 that is fixated within the hollow support beam 40. A first pivot shaft 461 is mounted with an inner end in the inner attachment body 460 and an outer end in a first pivot member 462. Hence, this facilitates pivoting of the support beam 40 about the axis of the first pivot shaft 461. Further, the first pivot member 462 is pivotally arranged about a second pivot shaft 463. Hence, this facilitates pivoting of the support beam 40 about the axis of the second pivot shaft 463, i.e. providing a cardan joint 46.

The second pivot shaft 463 is attached to lugs 464 that are fixated to the anchoring frame 410. Further Fig. 7 shows that preferably there is arranged a limit stop switch 416, that may assist in controlling that the movable structure 4 does not pass by a set end position and also that a bracket 417 for a cable guide 418 may be arranged below the support beam 40.

[0032] In Fig. 8 there is shown a perspective view of an end part of a longitudinal platform. It is shown that the hollow carrying member 50 is fixedly attached to an end face plate 54. The end face plate 54 protrudes a distance above the actual platform floor 52. Also the rear wall 53 of the longitudinal platform 5 extends a distance h_5 above the floor of the platform 5, as has been described above to both eliminate the risk of tools falling down from the platform and to provide sufficient strength to make the longitudinal platform self-supporting.

[0033] In Fig. 9 there is shown a perspective view of a transversal platform 6. It is shown that the transversal platform 6 is arranged with a pair of wheel members 630 at each outer end, which provides for precise guiding of the platform in a longitudinal direction along the rails 55 on the longitudinal platforms 5. Further, it is shown in more detail that there is an intermediate part 60 that may telescopically move into the fixed parts 633, 643 arranged with space for occupying the intermediate part 60 when the transversal platform 6 is telescoping to be shorter. To provide for extra guidance and also eliminate objects to fall down from the floor surface 62 of the platform there are arranged upwardly protruding telescoping wall parts 642, 632. Preferably a first wall part 642 presents a flat plate shape and the other part 632 presenting a bent plate 63 with a U-shaped upper portion that may ride on top of the first wall part 642.

[0034] In Fig. 10 there is shown a view from above of a transversal platform 6 according to the invention, wherein the brake mechanism 66, is shown in more detail. It is shown that there is arranged a long telescopic pivot rod 662 that extends along the whole back side of the platform 6 that is pivotally supported by brackets 663. The brake gripping member 660 is fixedly attached to the pivot rod 662. At each end of the pivot rod 662 it connects with a movable brake part 664, which at its outer end is arranged with a brake member 665. The movable brake part 664 is arranged with a radially protruding shaft device (e.g. screw) 665, that fits into an angled groove 666 in a fixed tube formed body 667 that is attached to the outer side of the platform 6. Hence, when the brake gripping member 660 is actuated/pivoted, from a release position to a braking position the, the pivot rod 662 will pivot/rotate and the shaft device 665 move along the groove 666, which will make the movable brake part 664 move outwards to finally get in clamping contact with a wall part of the longitudinal platform 5, such that the transversal platform 6 is locked in that position and cannot be moved from that position until the brake mechanism 66 is again actuated in the other direction.

[0035] In Fig. 11 there is shown a perspective view of a

stairway 7 that may form a part of the concept according to the invention. It is how that the stairway comprises a lower static part 7A and an upper adjustable part 7B. At the top of the upper part 7B there is a platform 72. The platform 72 may be adjustably positioned on different vertical heights by means of a hydraulic cylinder 70 that can move the upper part 7B from the lowermost position to the uppermost position. The stairway 7 includes two stairway uprights 71 that include guiding members for controlled guided movement of the upper part 7B of the stairway 7. The upper part includes a stairway portion 73 that includes two parallel attachment members 730, 731 for adapted positioning of each step 732 in the stairway 73 to be positioned horizontally in every position. At the top of the fixed stairway part 7A there is an intermediate platform 74A. Fixed stairway part 75 lead to the intermediate platform 74. There are safety fences 728, 748 arranged to provide for safe climbing of the stairway, (in Figs 11-13 the safety fence part along the upper stairway portion 73 is not shown but merely in Fig. 14). The piston 70 is arranged centrally between the uprights 71 of the stairway 7. At the intermediate platform 74 there is arranged support legs 76, preferably in the form of an up and down turned U. There is a guiding arrangement 78 attached to the platform and extending along a side support 79 that is attached underneath the upper platform 72. There may be arranged a separate platform (not shown) to have the hydraulic pump/machinery for the stairway positioned at a level above the ground floor GF to provide sufficient space to enable walking underneath it or it may also be positioned together with the other hydraulic devices, e.g. under the fixed platform 74.

[0036] In Fig. 12 and 13 there are shown side views of a stairway shown in Fig. 11 wherein it is shown in an upper position in Fig. 12 and in a lower position in Fig. 13.

[0037] In Fig. 14 there is a perspective view from above showing a part of a workshop 1 in between two installations 2, 2' with focus on the upper part of a stairway 7 according to the invention. There is shown that the upper platform 72 of the stairway is in level with a platform 52 of the closest installation 2 and also a platform 52' of an installation 2' further away. As can be seen in the figure there are telescopic side platforms 720, 721 that may be extended to be in contact with each one of the longitudinal platforms 52, 52'. Accordingly, a person may move from the platform 72 via a side platform 720, 721 to enter onto any of the platforms 52, 52'. In accordance herewith the safety fence 728 around the platform 72 is arranged with two doors 77A, 77B, each one providing opening to one of the side platforms 720, 721. It should be noted that in the shown figure the framework parts 31 have been omitted, such that there is shown a gap in between the upper angled lateral support beams 33 and the rest of the structure.

[0038] In Fig. 15 there is shown a cross-sectional view from below of an upper part of a stairway 7 according to the invention. Centrally there is shown a piston part 70 of the hydraulic cylinder that may move the upper platform

72 up and down. Further it is shown that the side platforms 720, 721 have been extended sideways and that there may be rollers 722 arranged to provide for low friction movement of the side platforms 720, 720. Moreover, it is shown that each stairway upright 71 is arranged with protruding ruler 710 that acts as a guide element for the upper platform 72, by means of having gripping members 720 that guide along the rulers 710 on both sides. There is also shown that the platform may be equipped with a flexible cable support 723. Finally, it is shown that there may be arranged chains 730 on each side at the top of the upper the safety fence 728 of the upper platform 72 which chains will extend and form safety fences when the stairway is in its upper position, and which chains in the lower position of the upper platform 72 will merely flex and hang down along each side.

[0039] In Fig. 16 there is shown a further possible embodiment of a part of a workshop 1 having two installations 2, 2', arranged in series, i.e. along the same path of passage C, where two vehicles B, B' may be serviced simultaneously according to the invention. It is shown that the installation 2 may advantageously be used in connection with lifters 100, that may lift the vehicle B up into a higher level, such that service may be performed from the underside of the vehicle B. At the same time, service may also be performed on the roof by means of positioning the platforms 5, 6 at an appropriate level for simultaneous service at that level. As is evident, this also indicates, that the invention may be combined with using equipment installed below the ground floor level GF, e.g. lifters 100, service pits, etc. Moreover, the figure shows that in some workshops 1 it may be an advantage to use two installations of different length, e.g. a longer one 2' followed by a shorter one 2, such that simultaneously a first vehicle of a first size may be serviced in the front installation and a second vehicle of a shorter kind may be serviced in the rear installation. In other regards the installation is basically similar to what has been described above.

[0040] The invention is not limited by the examples described above but may be varied within the scope of the appended claims. For instance, it is evident for the skilled person that the invention may be used in connection with numerous, various stabilizing structures for the fixed structure. The installations use the basic structure as suggested by means of having two parallel longitudinal frame works 31, in order to provide for an easy installation of crane beam 9. Moreover, it is foreseen that many different guiding arrangements may be used both for guiding of the vertical anchoring members 41 and for guidance of the transversal platforms in a longitudinal direction and also for the longitudinal platforms for guidance in a transversal direction. Moreover, it is foreseen that different materials may be used for instance that the stabilizing rear wall 53 of the longitudinal platform 5 may be made in many different materials that can provide sufficient strength and also sufficient hinder for larger objects not to fall outside from the floor 52 of the platform 5. Further, it is evident for the skilled person that different

kind of actuating devices, other than hydraulic cylinders may be used, e.g. linear actuator, rack and pinion devices, which for instance may be powered by electric motors. Finally, it is foreseen that separate parts of the invention may be the subject for divisional applications, e.g. the configuration of the stairways 7, the arrangement of a self-supporting longitudinal platform, etc.

Claims

1. Installation (2) for secure access to an upper part of a vehicle (B), said installation comprising:

a fixed frame (3) arranged along a line (C) of passage for said vehicle (B),

said fixed frame (3) including at least four, preferably merely four, uprights (30) interconnected at their top ends by longitudinally and transversally extending support structures (31, 35, 32, 36),

a vertically movable support structure (4), movable relative to the fixed frame (3), and by said vertically movable support structure (4) including a pair of transversal support beams (40) extending transversally between a pair of said uprights (30) positioned on each side of said line of passage (C),

at least one longitudinal platform (5) supported by said movable support structure (4),

a first actuating device (45) having one fixed part (450) fixed relative to the fixed frame (3) and a movable part (452) attached to said movable support structure (4), to arrange for vertical movement, of the movable support structure (4), wherein

adjacent each end of said transversal support beams (40) there is arranged a movable anchoring device (41) guided by said uprights (30) to enable vertical movement but fixed positioning in other directions,

characterized by a second actuating device (42) having one part (420) attached to a first fixing member (44) fixated to said movable support structure (4) and another part (421) attached to a second fixing member (43) attached to said longitudinal platform (5), to arrange for horizontal movement of the longitudinal platform (5) on the support beams (40).

2. Installation (2) according to claim 1, **characterized in that** there is arranged at least one in a longitudinal direction movable transversal platform (6), wherein preferably at least at one end is movably supported by said longitudinal platform (5).

3. Installation (2) according to claim 2, **characterized in that** there is arranged a pair of parallelly arranged

longitudinal platforms (5), wherein there preferably are arranged two transversal platforms (6), which at each end is movably supported by said pair of longitudinal platforms (5).

4. Installation (2) according to any of claims 1 -3, **characterized in that** said support structures (31, 35, 32, 36), include at least one longitudinal framework member (31, 35), preferably two parallel longitudinal framework members (31, 35).

5. Installation (2) according to claim 4, **characterized in that** said support structures (31, 35, 32, 36) include at least one transversal framework member (32, 36), preferably two transversal framework members (32, 36).

6. Installation (2) according to any of claim 2-3, **characterized in that** said transversal platform/s (6) comprise/s two parts (6A, 6B) that interact telescopically.

7. Installation (2) according to any of claims 1 - 6, **characterized in that** said longitudinal platform (5) has a floor (52) limited by a support wall (53) along an outer long side, which support wall (53) is arranged to provide strength and also hinder objects from falling down from said floor (52), by means of providing said support wall (53) with a substantial height (h5) and fixing said support wall (53) to have its lower edge (53B) at or below the level of said floor (52) and its upper edge (53A) well above level of said floor (52).

8. Installation (2) according to any of claims 7, **characterized in that** said height (h5) is at least 250 mm, preferably within the range of 300-1000, and more preferred that said height (h5) is larger at the center in between short end walls (54) of the platform (5) than adjacent the short end walls of the platform.

9. Installation (2) according to any of claims 1 - 8, **characterized in that** said longitudinal platform (5) has short end walls (54) and at each short end wall (54) has a hollow carrying member (50) attached thereto, which hollow carrying members (50) provide support and a transversal open space for housing of said support beams (40) to enable transversal movement of said longitudinal platform (5).

10. Installation (2) according to claim 9, **characterized in that** said hollow carrying member (50), preferably at its outside, has attached thereto said second fixing means (43), wherein preferably said first fixing means (44) is attached to said support beam (40).

11. Installation (2) according to any of claims 4 - 10, **characterized in that** a pair of parallel longitudinal

framework members (31, 31'), either in one installation (2) or two parallel neighboring installations (2, 2'), support a transversally arranged crane beam (9) arranged to be movable in the longitudinal direction.

12. Installation (2) according to any of claims 1 - 11, first actuating device (45) is attached to said movable anchoring device (41), wherein preferably said movable anchoring device (41) includes an anchoring frame (410),
13. Installation (2) according to 12, **characterized in that** said movable anchoring device (41) is connected to said support beam (40) via a cardan joint (46), preferably adjacent or at each end (40A) of each support beam (40) and a guide frame member (410).
14. Installation (2) according to any of claims 1 - 13, **characterized by** comprising at least one stair way arrangement (7) including a lower fixed stair way part (7A) and an upper movable stair way part (7B), which includes a top platform (72) that by means of an actuating device (70) may position said top platform (72) at different levels.
15. Installation (2) according to claim 14, **characterized in that** said top platform (72) includes at least one, preferably two, telescopic side platform/s (720, 721) arranged to provide extended flooring at one side or both sides of said top platform (72).

Patentansprüche

1. Vorrichtung (2) für einen sicheren Zugang zu einem oberen Teil eines Fahrzeugs (B), wobei die Vorrichtung umfasst:

einen befestigten Rahmen (3), der entlang einer Durchgangslinie (C) für das Fahrzeug (B) angeordnet ist, wobei der befestigte Rahmen (3) wenigstens vier, bevorzugt lediglich vier, Ständer (30) umfasst, die an ihren oberen Enden durch sich längs und quer erstreckende Stützstrukturen (31, 35, 32, 36) miteinander verbunden sind,

eine vertikal bewegliche Stützstruktur (4), die relativ zu dem befestigten Rahmen (3) beweglich ist, und wobei die vertikal bewegliche Stützstruktur (4) ein Paar von Querstützbalken (40) umfasst, die sich quer zwischen einem Paar der Ständer (30) erstrecken, die auf jeder Seite der Durchgangslinie (C) positioniert sind, wenigstens eine Längsplattform (5), die von der beweglichen Stützstruktur (4) gestützt ist, eine erste Betätigungsvorrichtung (45) mit einem befestigten Teil (450), das relativ zu dem

befestigten Rahmen (3) befestigt ist, und einem beweglichen Teil (452), das an der beweglichen Stützstruktur (4) angebracht ist, um eine vertikale Bewegung der beweglichen Stützstruktur (4) zu ermöglichen, wobei

angrenzend an jedes Ende der Querstützbalken (40) eine bewegliche Verankerungsvorrichtung (41) angeordnet ist, die durch die Ständer (30) geführt ist, um eine vertikale Bewegung, aber in anderen Richtungen eine feste Positionierung zu ermöglichen,

gekennzeichnet durch eine zweite Betätigungsvorrichtung (42), die ein Teil (420) aufweist, das an einem ersten Befestigungselement (44) angebracht ist, das an der beweglichen Stützstruktur (4) befestigt ist, und ein anderes Teil (421), das an einem zweiten Befestigungselement (43) angebracht ist, das an der Längsplattform (5) angebracht ist, um eine horizontale Bewegung der Längsplattform (5) auf den Stützbalken (40) zu ermöglichen.

2. Vorrichtung (2) nach Anspruch 1, **dadurch gekennzeichnet, dass** wenigstens eine in einer Längsrichtung bewegliche Querplattform (6) angeordnet ist, wobei bevorzugt wenigstens ein Ende von der Längsplattform (5) beweglich gestützt ist.
3. Vorrichtung (2) nach Anspruch 2, **dadurch gekennzeichnet, dass** ein Paar parallel angeordneter Längsplattformen (5) vorhanden ist, wobei bevorzugt zwei Querplattformen (6) vorhanden sind, die an jedem Ende beweglich von dem Paar Längsplattformen (5) gestützt ist.
4. Vorrichtung (2) nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Stützstrukturen (31, 35, 32, 36) wenigstens ein längs verlaufendes Rahmenelement (31, 35), bevorzugt zwei parallele längs verlaufende Rahmenelemente (31, 35), umfassen.
5. Vorrichtung (2) nach Anspruch 4, **dadurch gekennzeichnet, dass** die Stützstrukturen (31, 35, 32, 36) wenigstens ein Querrahmenelement (32, 36), bevorzugt zwei Querrahmenelemente (32, 36), umfassen.
6. Vorrichtung (2) nach einem der Ansprüche 2-3, **dadurch gekennzeichnet, dass** die Querplattform/en (6) zwei Teile (6A, 6B) umfasst/en, die teleskopartig zusammenwirken.
7. Vorrichtung (2) nach einem der Ansprüche 1-6, **dadurch gekennzeichnet, dass** die Längsplattform (5) einen Boden (52) aufweist, der entlang einer äußeren Längsseite durch eine Stützwand (53) begrenzt ist, wobei die Stützwand (53) dazu angeordnet ist, für Festigkeit zu sorgen und auch zu ver-

hindern, dass Gegenstände von dem Boden (52) herunterfallen, indem die Stützwand (53) eine beträchtliche Höhe (h5) aufweist und die Stützwand (53) so befestigt ist, dass ihre Unterkante (53B) auf oder unter dem Niveau des Bodens (52) liegt und ihre Oberkante (53A) deutlich über dem Niveau des Bodens (52) liegt.

8. Vorrichtung (2) nach Anspruch 7, **dadurch gekennzeichnet, dass** die Höhe (h5) wenigstens 250 mm beträgt, bevorzugt im Bereich von 300 bis 1000 liegt, und mehr bevorzugt, dass die Höhe (h5) in der Mitte zwischen den kurzen Endwänden (54) der Plattform (5) größer ist als angrenzend an die kurzen Endwände der Plattform. 5 10 15
9. Vorrichtung (2) nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** die Längsplattform (5) kurze Endwände (54) aufweist und an jeder kurzen Endwand (54) ein hohles Trägerelement (50) angebracht ist, wobei die hohlen Trägerelemente (50) eine Stütze und einen quer verlaufenden offenen Raum zur Aufnahme der Stützbalken (40) bereitstellen, um eine Querbewegung der Längsplattform (5) zu ermöglichen. 20 25
10. Vorrichtung (2) nach Anspruch 9, **dadurch gekennzeichnet, dass** an dem hohlen Stützelement (50), bevorzugt an seiner Außenseite, das zweite Befestigungselement (43) angebracht ist, wobei bevorzugt das erste Befestigungselement (44) an dem Stützbalken (40) angebracht ist. 30
11. Vorrichtung (2) nach einem der Ansprüche 4 bis 10, **dadurch gekennzeichnet, dass** ein Paar paralleler Längsrahmenelemente (31, 31'), entweder in einer Vorrichtung (2) oder in zwei parallelen benachbarten Vorrichtungen (2, 2'), einen quer angeordneten Kranbalken (9) stützen, der dazu angeordnet ist, in Längsrichtung beweglich zu sein. 35 40
12. Vorrichtung (2) nach einem der Ansprüche 1 bis 11, wobei eine erste Betätigungsvorrichtung (45) an der beweglichen Verankerungsvorrichtung (41) angebracht ist, wobei bevorzugt die bewegliche Verankerungsvorrichtung (41) einen Verankerungsrahmen (410) umfasst. 45
13. Vorrichtung (2) nach Anspruch 12, **dadurch gekennzeichnet, dass** die bewegliche Verankerungsvorrichtung (41) mit dem Stützbalken (40) über ein Kardangelenk (46) verbunden ist, bevorzugt angrenzend an oder an jedem Ende (40A) jedes Stützbalkens (40) und an einem Führungsrahmenelement (410). 50 55
14. Vorrichtung (2) nach einem der Ansprüche 1 bis 13, **dadurch gekennzeichnet, dass** sie wenigstens

eine Treppenanordnung (7) mit einem unteren festen Treppenteil (7A) und einem oberen beweglichen Treppenteil (7B) umfasst, der eine obere Plattform (72) umfasst, die mittels einer Betätigungsvorrichtung (70) auf verschiedenen Ebenen positioniert werden kann.

15. Vorrichtung (2) nach Anspruch 14, **dadurch gekennzeichnet, dass** die obere Plattform (72) wenigstens eine, bevorzugt zwei, teleskopische Seitenplattform/en (720, 721) umfasst, die dazu angeordnet ist/sind, einen erweiterten Boden an einer Seite oder an beiden Seiten der oberen Plattform (72) bereitzustellen.

Revendications

1. Installation (2) pour un accès sécurisé à une partie supérieure d'un véhicule (B), ladite installation comprenant :

un cadre fixe (3) agencé le long d'une ligne (C) de passage pour ledit véhicule (B), ledit cadre fixe (3) comportant au moins quatre, de préférence seulement quatre, montants (30) reliés entre eux au niveau de leurs extrémités hautes par des structures de support s'étendant longitudinalement et transversalement (31, 35, 32, 36),

une structure de support mobile verticalement (4), mobile par rapport au cadre fixe (3), et par ladite structure de support mobile verticalement (4) comportant une paire de poutres de support transversales (40) s'étendant transversalement entre une paire desdits montants (30) positionnés de chaque côté de ladite ligne de passage (C), au moins une plateforme longitudinale (5) étant supportée par ladite structure de support mobile (4),

un premier dispositif d'actionnement (45) ayant une partie fixe (450) fixe par rapport au cadre fixe (3) et une partie mobile (452) attachée à ladite structure de support mobile (4), pour permettre un mouvement vertical, de la structure de support mobile (4), dans laquelle quel adjacent à chaque extrémité desdites poutres de support transversales (40) est agencé un dispositif d'ancrage mobile (41) guidé par lesdits montants (30) pour permettre un mouvement vertical mais un positionnement fixe dans d'autres directions, **caractérisée par** un deuxième dispositif d'actionnement (42) ayant une partie (420) attachée à un premier organe de fixation (44) fixé à ladite structure de support mobile (4) et une autre partie (421) attachée à un deuxième organe de fixation (43) attaché à ladite plateforme longitudinale (5), afin de permettre un mouvement

horizontal de la plateforme longitudinale (5) sur les poutres de support (40).

2. Installation (2) selon la revendication 1, **caractérisée en ce qu'il** est agencé au moins une plateforme transversale mobile dans une direction longitudinale (6), dans laquelle de préférence au moins à une extrémité est supportée de manière mobile par ladite plateforme longitudinale (5).
3. Installation (2) selon la revendication 2, **caractérisée en ce qu'il** est agencé une paire de plateformes longitudinales (5) agencées parallèlement, dans laquelle il est de préférence agencé deux plateformes transversales (6), qui à chaque extrémité est supportée de manière mobile par ladite paire de plateformes longitudinales (5).
4. Installation (2) selon l'une quelconque des revendications 1 à 3, **caractérisée en ce que** lesdites structures de support (31, 35, 32, 36) comportent au moins un organe d'ossature longitudinal (31, 35), de préférence deux éléments d'ossature longitudinaux (31, 35) parallèles.
5. Installation (2) selon la revendication 4, **caractérisée en ce que** lesdites structures de support (31, 35, 32, 36) comportent au moins un organe d'ossature transversal (32, 36), de préférence deux éléments d'ossature transversaux (32, 36).
6. Installation (2) selon l'une quelconque des revendications 2 à 3, **caractérisée en ce que** ladite ou lesdites plateformes transversales (6) comprennent deux parties (6A, 6B) qui interagissent de manière télescopique.
7. Installation (2) selon l'une quelconque des revendications 1 à 6, **caractérisée en ce que** ladite plateforme longitudinale (5) a un plancher (52) limité par une paroi de support (53) le long d'un côté long extérieur, laquelle paroi de support (53) est agencée pour fournir une résistance et également empêcher des objets de tomber dudit plancher (52), au moyen de la fourniture de ladite paroi de support (53) avec une hauteur substantielle (h5) et de la fixation de ladite paroi de support (53) pour avoir son bord inférieur (53B) au niveau ou en dessous du niveau dudit plancher (52) et son bord supérieur (53A) bien au-dessus du niveau dudit plancher (52).
8. Installation (2) selon l'une quelconque des revendications 7, **caractérisée en ce que** ladite hauteur (h5) est d'au moins 250 mm, de préférence dans la plage de 300-1000, et plus préférablement **en ce que** ladite hauteur (h5) est plus grande au niveau du centre entre les parois d'extrémité courtes (54) de la plateforme (5) qu'adjacente aux parois d'extrémité

courtes de la plateforme.

9. Installation (2) selon l'une quelconque des revendications 1 à 8, **caractérisée en ce que** ladite plateforme longitudinale (5) a des parois d'extrémité courtes (54) et à chaque paroi d'extrémité courte (54) a un organe porteur creux (50) attaché à celle-ci, lesquels organes porteurs creux (50) fournissent un support et un espace ouvert transversal pour loger lesdites poutres de support (40) pour permettre un mouvement transversal de ladite plateforme longitudinale (5).
10. Installation (2) selon la revendication 9, **caractérisée en ce que** ledit organe porteur creux (50), de préférence à son extérieur, a attaché à celui-ci ledit deuxième moyen de fixation (43), dans laquelle de préférence ledit premier moyen de fixation (44) est attaché à ladite poutre de support (40).
11. Installation (2) selon l'une quelconque des revendications 4 à 10, **caractérisée en ce qu'une** paire d'organes d'ossature longitudinaux parallèles (31, 31'), soit dans une installation (2), soit dans deux installations voisines parallèles (2, 2'), supportent une poutre de grue (9) agencée transversalement et agencée pour être mobile dans la direction longitudinale.
12. Installation (2) selon l'une quelconque des revendications 1 à 11, dans laquelle un premier dispositif d'actionnement (45) est attaché audit dispositif d'ancrage mobile (41), dans laquelle, de préférence, ledit dispositif d'ancrage mobile (41) comporte un cadre d'ancrage (410).
13. Installation (2) selon la revendication 12, **caractérisée en ce que** ledit dispositif d'ancrage mobile (41) est relié à ladite poutre de support (40) par l'intermédiaire d'un joint de cardan (46), de préférence adjacent à, ou au niveau de chaque extrémité (40A) de chaque poutre de support (40) et d'un organe de cadre de guidage (410).
14. Installation (2) selon l'une quelconque des revendications 1 à 13, **caractérisée en ce qu'elle** comprend au moins un agencement d'escalier (7) comportant une partie d'escalier fixe inférieure (7A) et une partie d'escalier mobile supérieure (7B), qui comporte une plateforme haute (72) qui, au moyen d'un dispositif d'actionnement (70), peut positionner ladite plateforme haute (72) à différents niveaux.
15. Installation (2) selon la revendication 14, **caractérisée en ce que** ladite plateforme haute (72) comporte au moins une, de préférence deux plateformes latérales télescopiques (720, 721) agencées pour fournir un plancher étendu au niveau d'un côté ou

des deux côtés de ladite plateforme haute (72).

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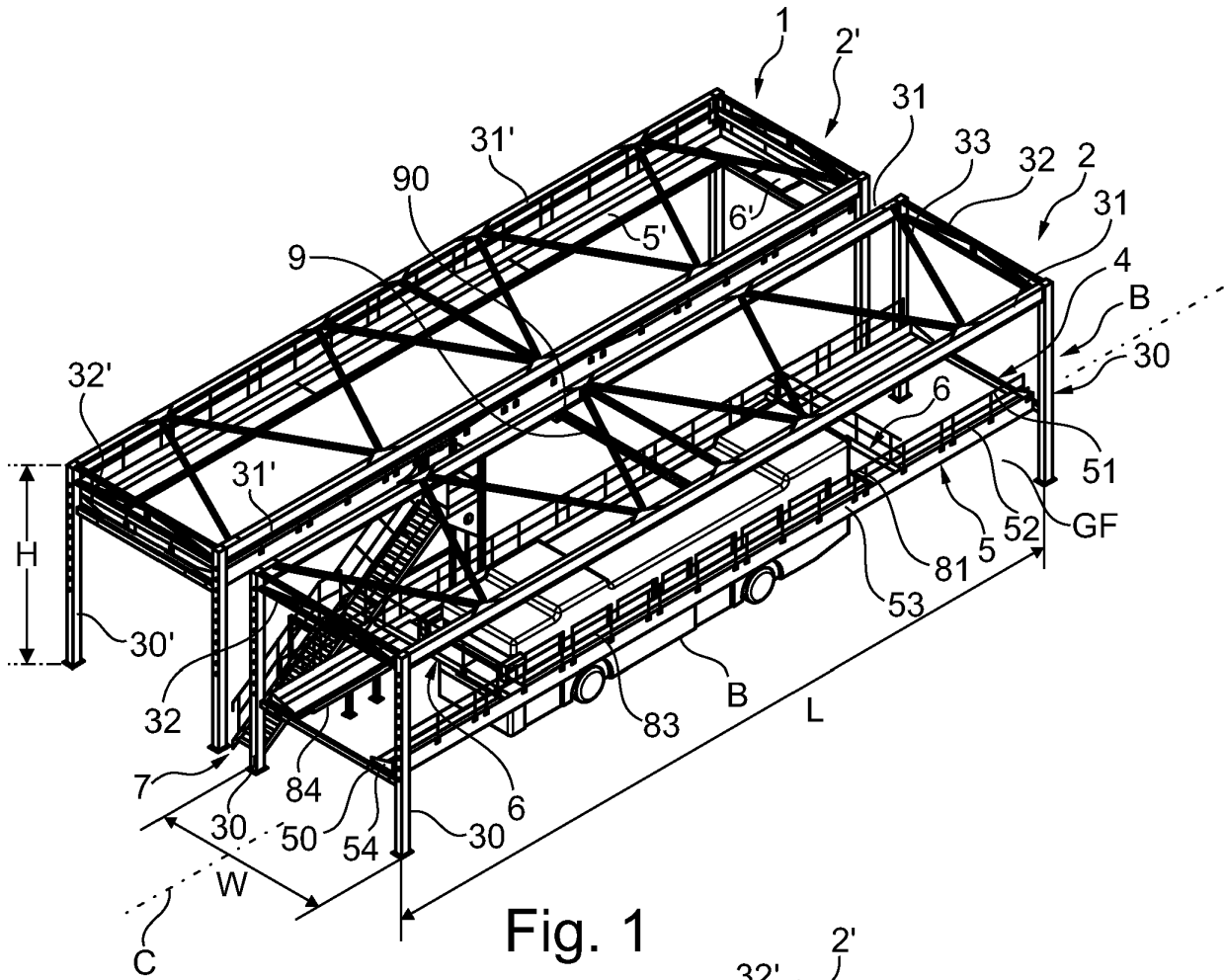


Fig. 1

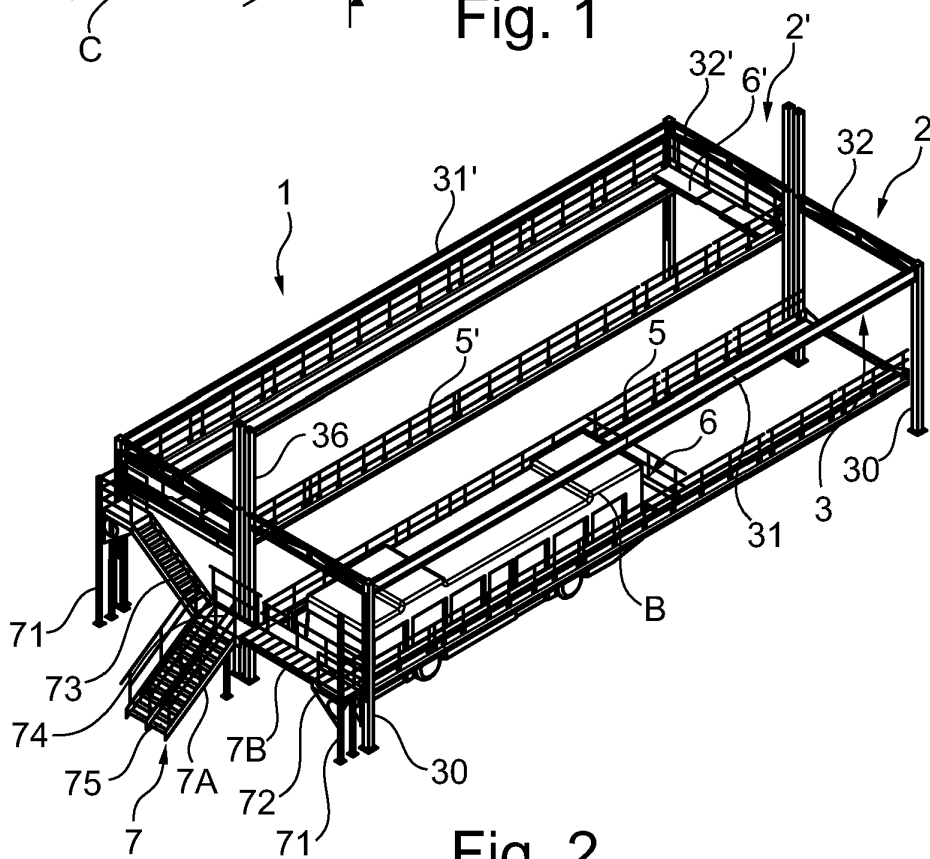


Fig. 2

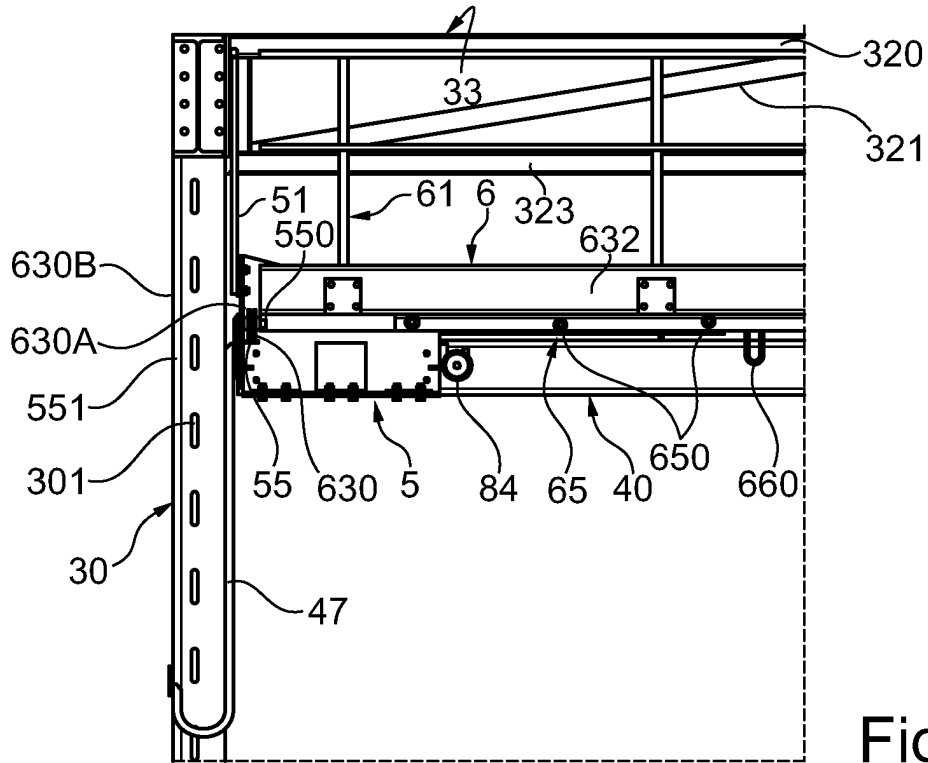


Fig. 5

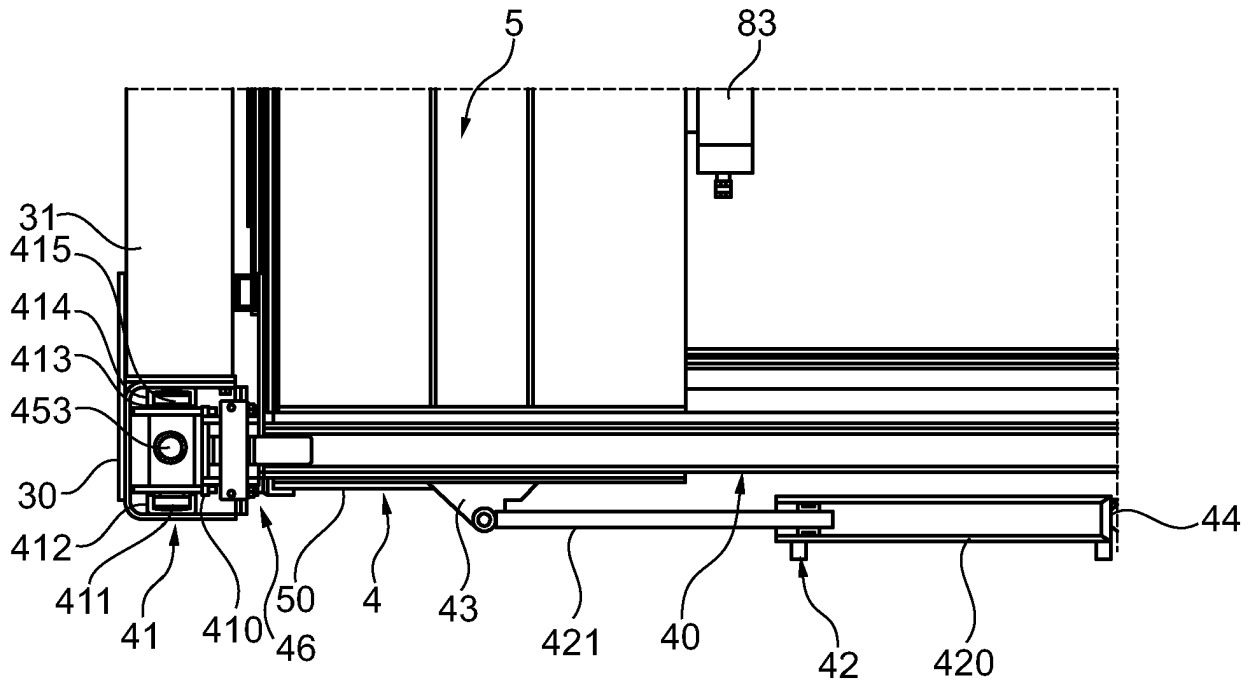
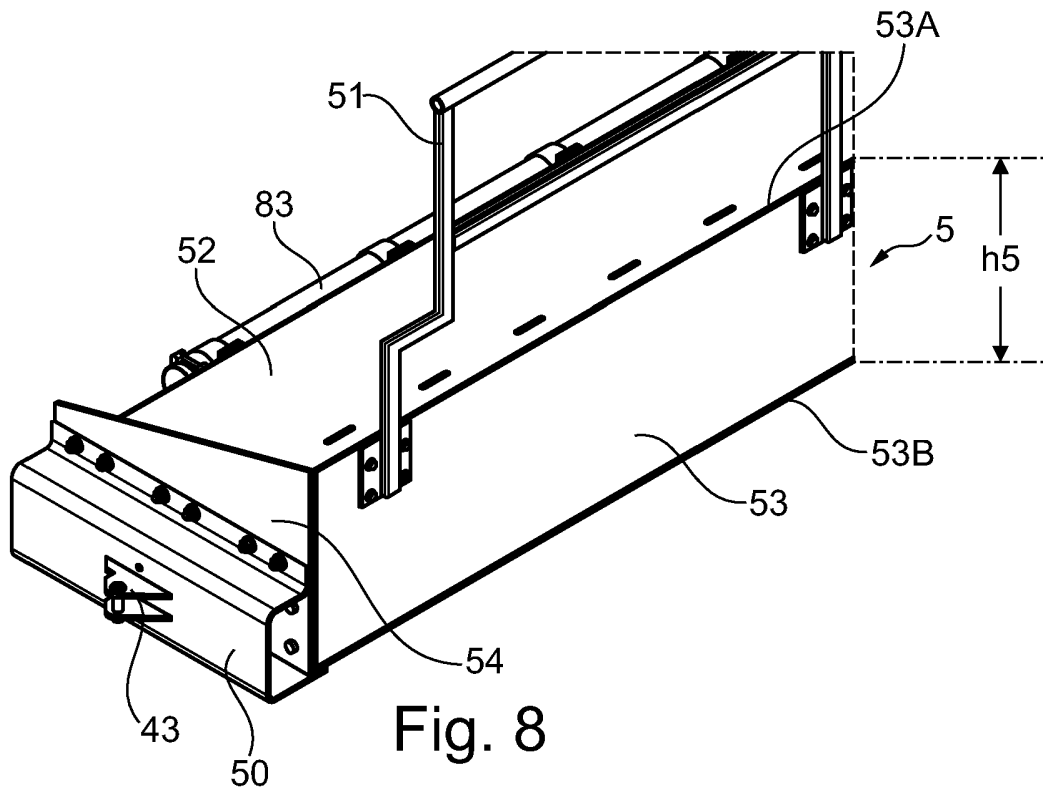
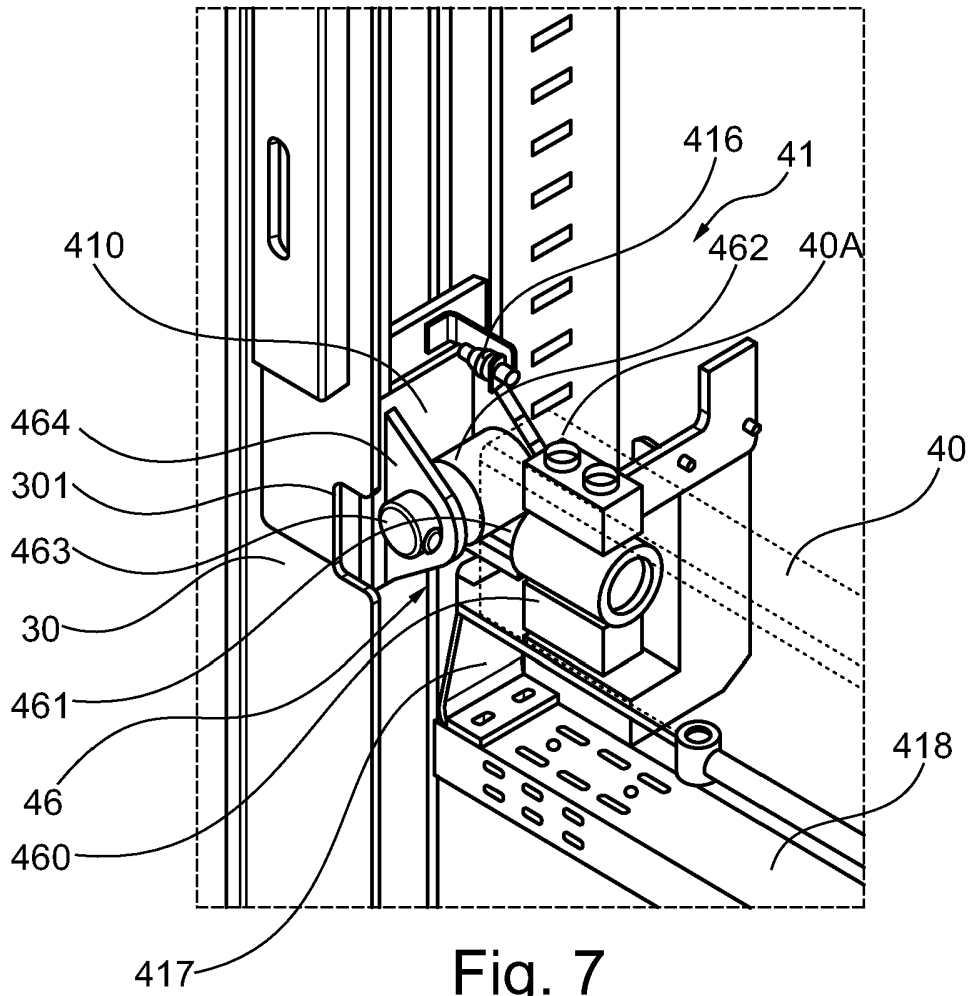


Fig. 6



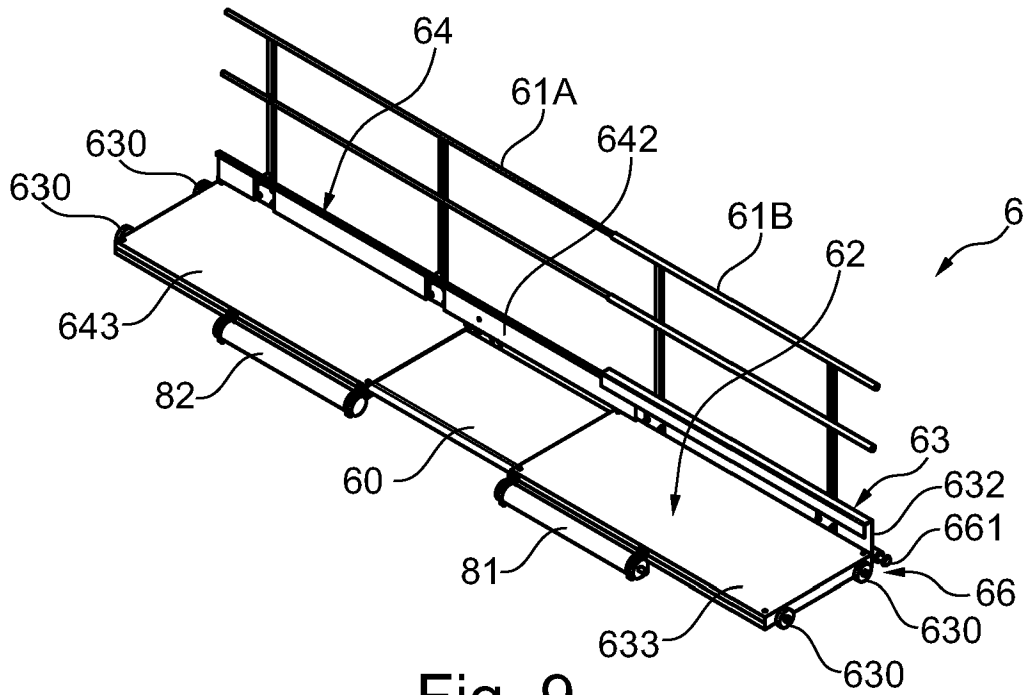


Fig. 9

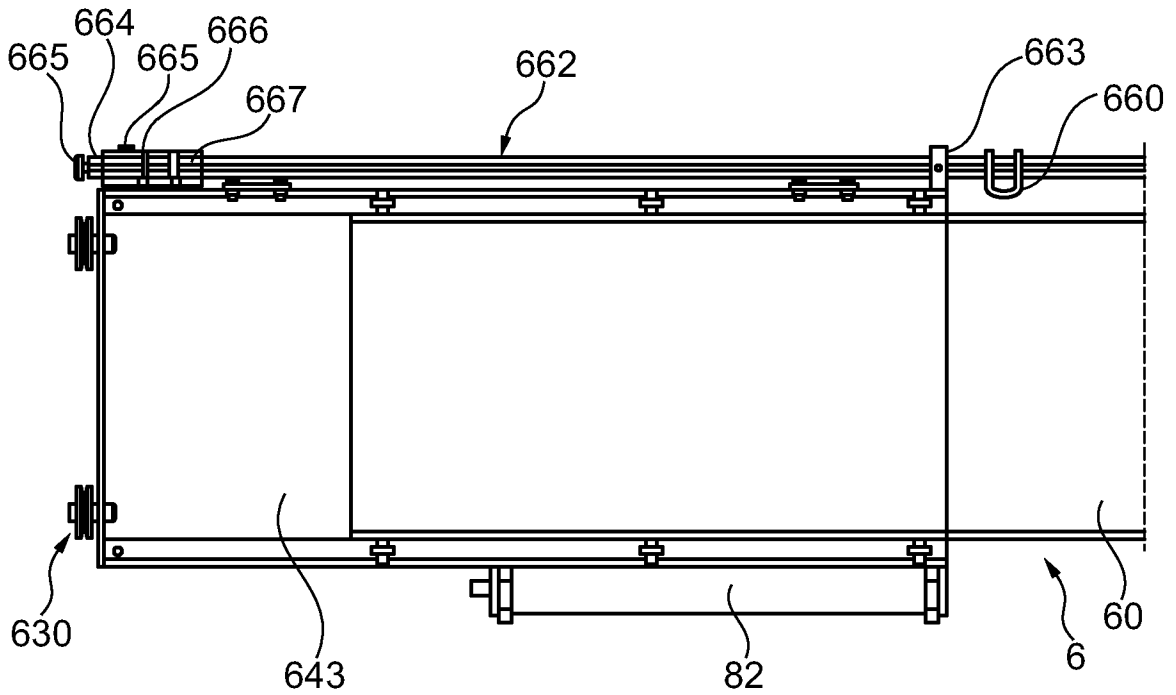


Fig. 10

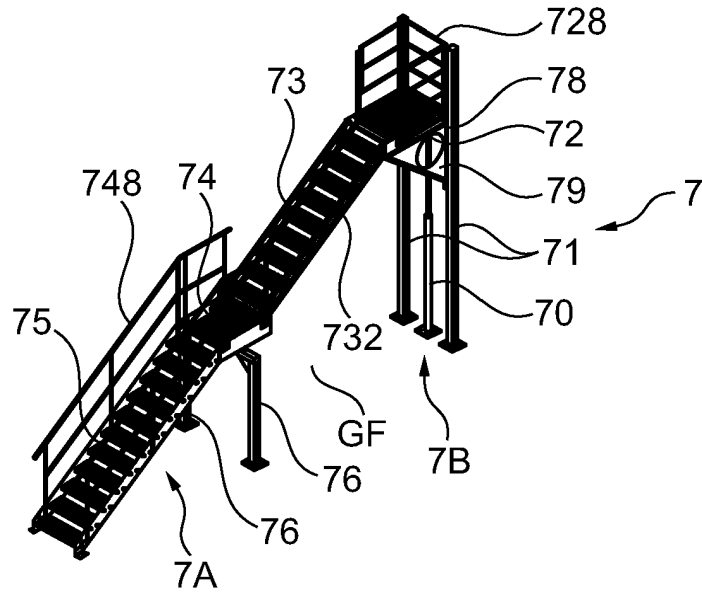


Fig. 11

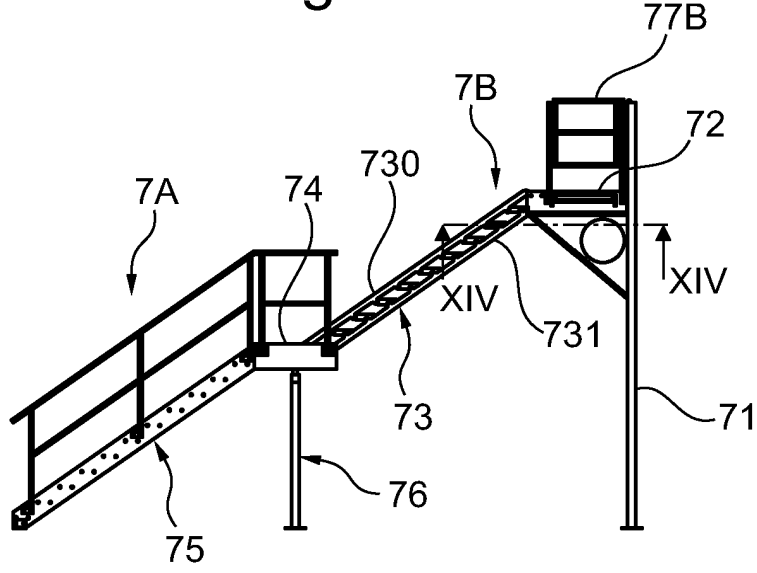


Fig. 12

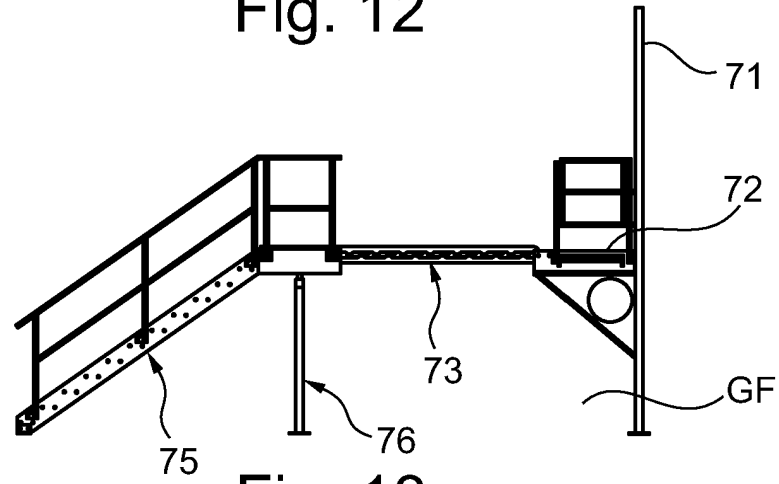


Fig. 13

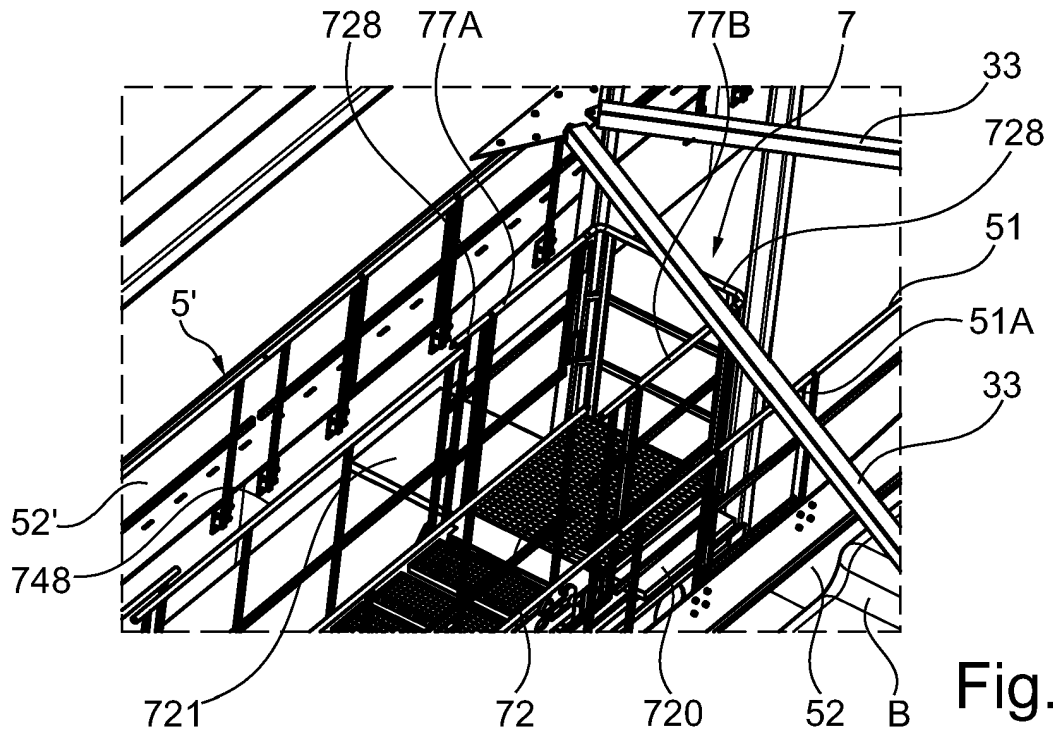


Fig. 14

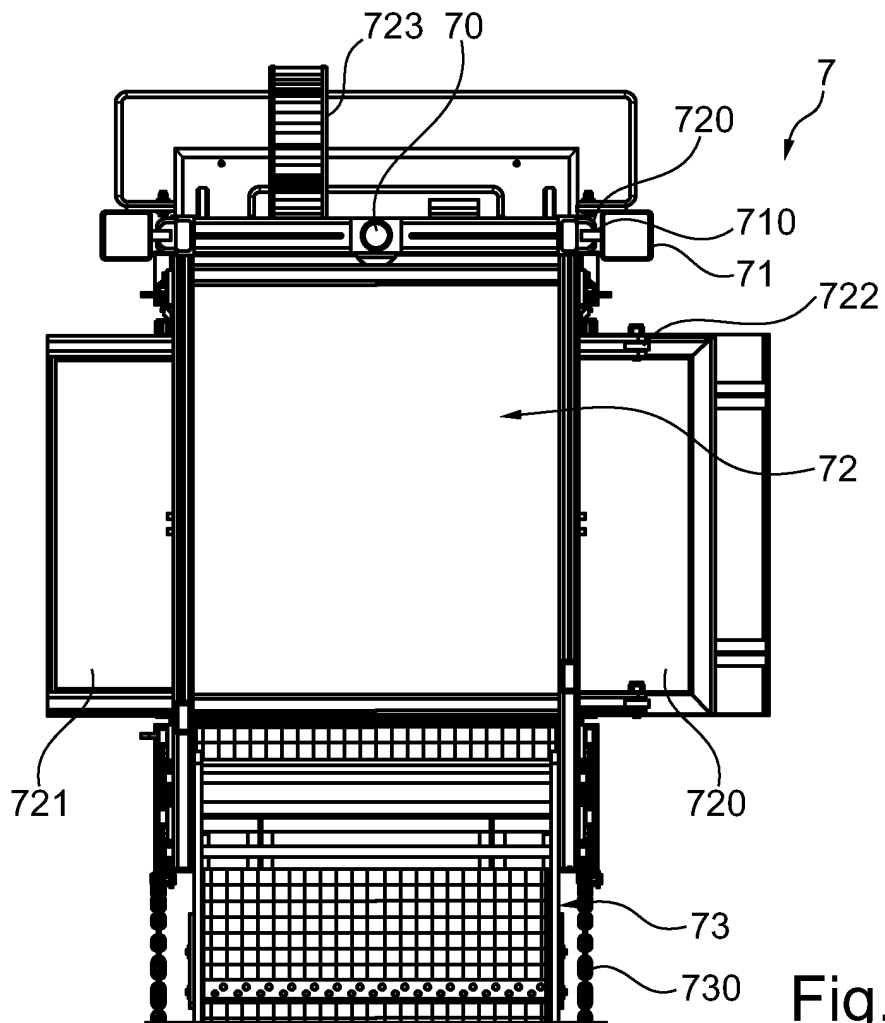


Fig. 15

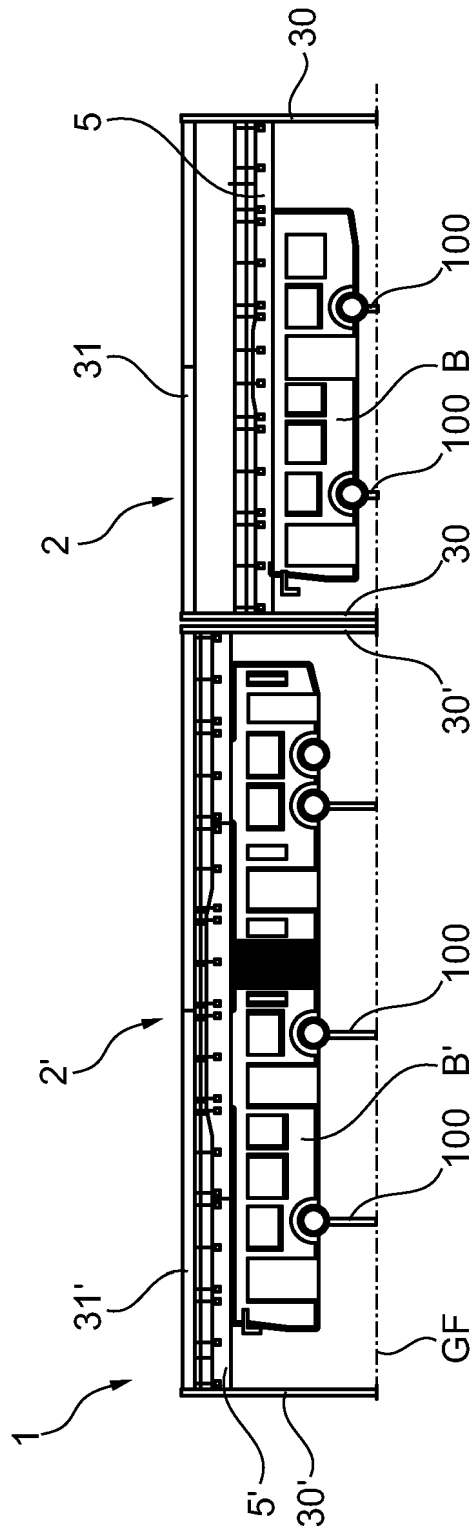


Fig. 16

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2716498 A [0002]
- ES 2627789 [0002]
- CN 202866341 [0004]
- US 4776429 A [0004]