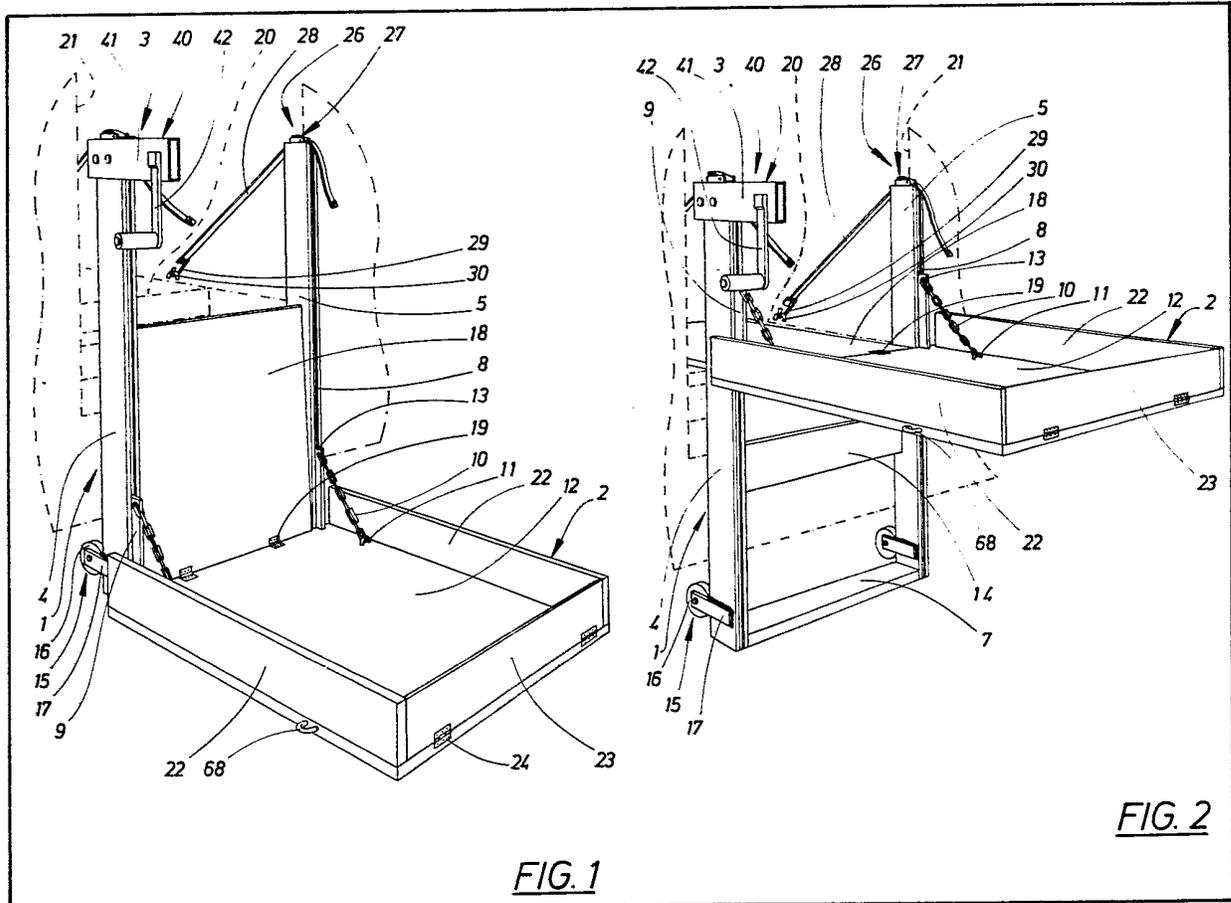


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(54) Vehicle entry aid

(57) A vehicle entry aid for a handicapped person and preferably also such auxiliary equipment as for example a wheel-chair, comprises a frame 1 and a carrying unit 2, which is provided to support the person and the auxiliary equipment and which is connected to the frame and can be moved up and down on the frame by a lifting mechanism 3. The frame is detachably attached to the vehicle adjacent to the entrance opening of the same. The frame comprises two uprights 4,5 connected to each other and the carrying unit is displaced along these uprights. The carrying unit comprises platforms 12 and 18 which are hinged together as shown. A tapered end board 23 is hinged to platform 12.



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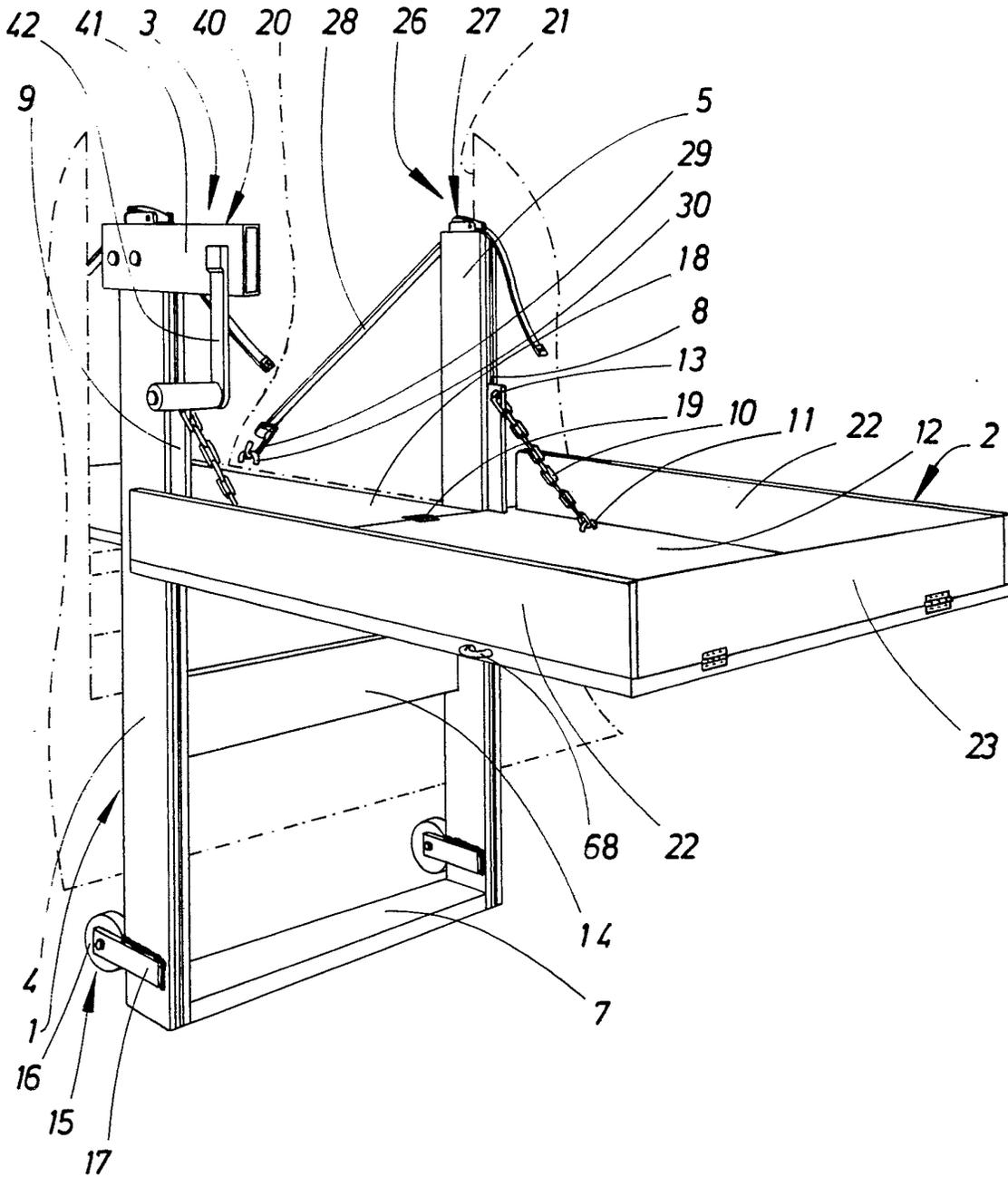


FIG. 2

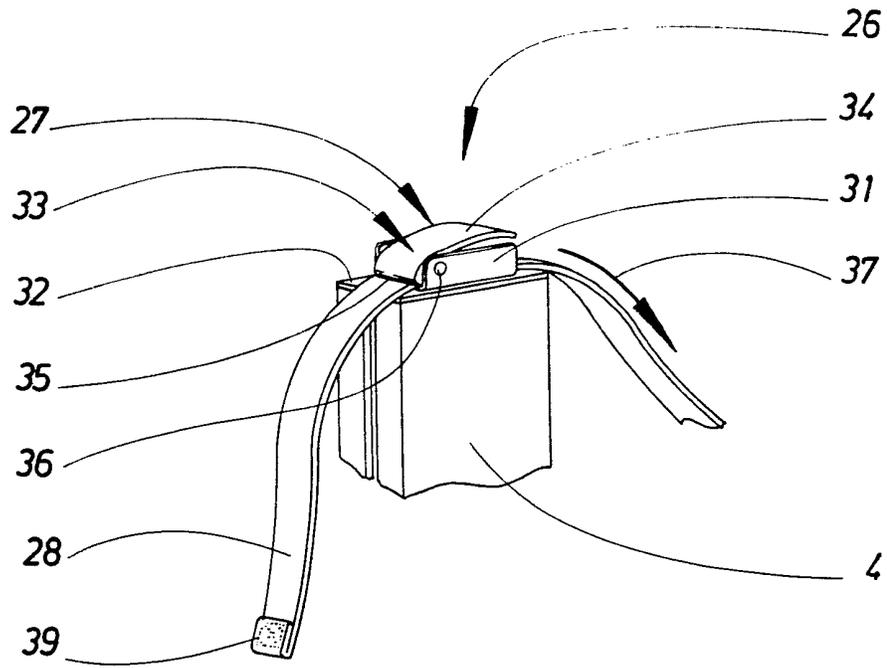


FIG. 3

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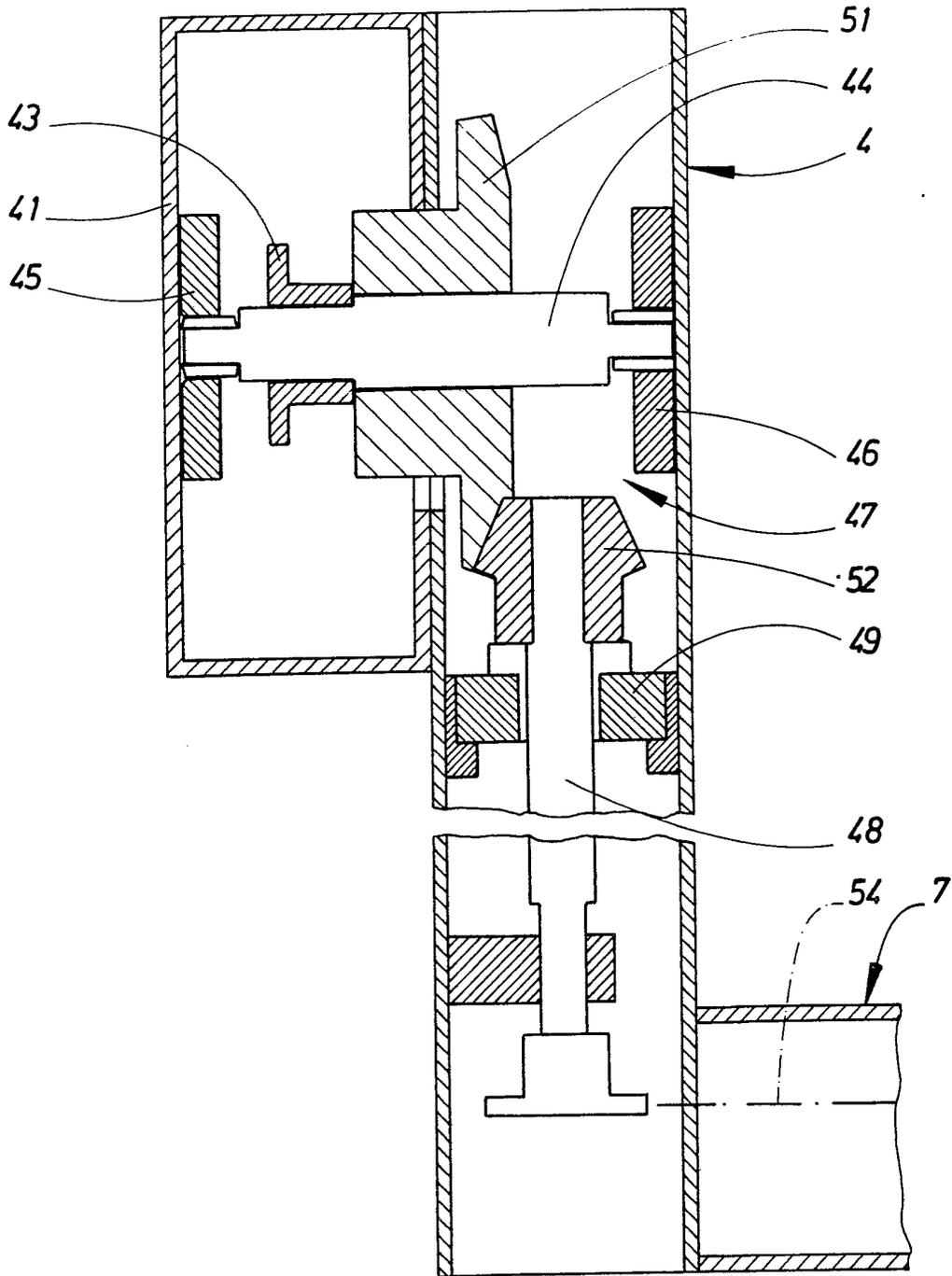


FIG. 4



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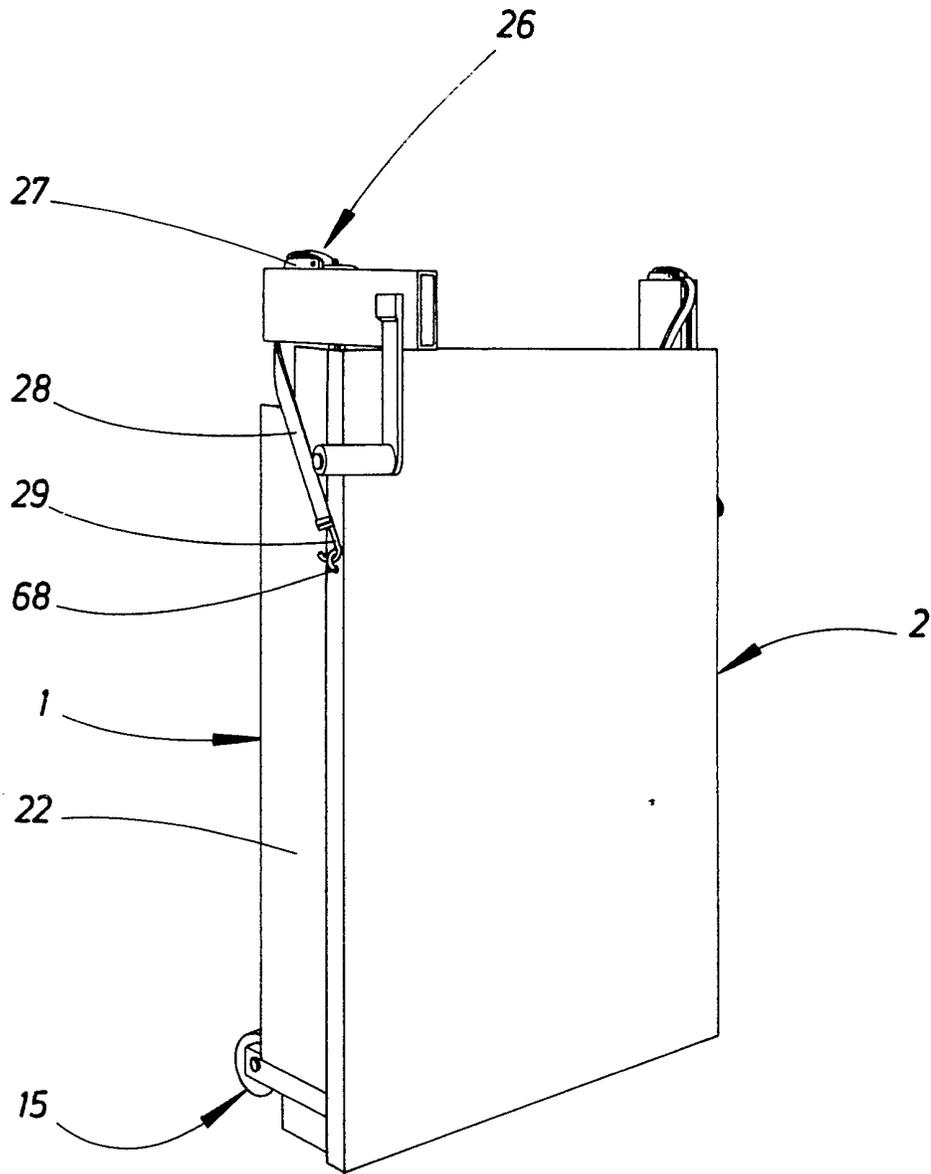


FIG. 6

## SPECIFICATION

## Lifting means

5 The present invention relates to a lifting means for the transfer of a handicapped person and preferably also such auxiliary equipment as for example a wheel-chair, between a lower level outside of a vehicle and a higher level in the vehicle. The lifting  
10 means comprises a frame and a carrying unit, which is provided to support the person and the auxiliary equipment and which is connected to the frame and provided to be displaced between said different levels, and a lifting mechanism, which is provided to  
15 displace the carrying unit between said different levels.

Lifting means serving the purpose to facilitate physically handicapped persons in a wheel-chair to enter a vehicle and to come out of the same respectively are known in the form of devices which are permanently mounted in connection to the door of the vehicle. However, such an installation is very expensive and requires that each vehicle is provided with such a means. These known devices are further  
20 relatively bulky even in folded-up condition, which leads to a fixed encroachment on the construction of a vehicle. Means according to the prior art are built in such a manner that in addition to the required vertical displacing movement a pivoting movement is  
30 also required in order to bring the wheel-chair inside the vehicle, which also means that the device will be complicated and expensive to build.

It is an object of the present invention to provide a simple lifting means, which can be stored in for example the baggage compartment of a vehicle and which is mounted at the entrance of the vehicle only at those occasions when it is needed.

It is a further object of the present invention to provide a lifting means, in which loads from oblique forces relative to the device are kept low.

According to the invention the frame is provided to be detachably attached to the vehicle adjacent to the entrance opening of the same. The frame comprises two uprights connected to each other and the carrying unit is provided to be displaced along these uprights.

The invention will be described more in detail in the following by means of an example of embodiment, reference being made to the accompanying drawings, in which Fig. 1 is a perspective view of the lifting means according to the invention in its position of use with its carrying unit in its bottom position; Fig. 2 is a corresponding view of the lifting  
55 means in its position of use with the carrying unit in an upper position; Fig. 3 is a partially broken view on an enlarged scale showing a holding device forming part of the lifting means according to the invention; Fig. 4 is a schematic view of a vertical partially  
60 broken cross-section of an upper and a lower portion respectively of the lifting means; Fig. 5 is a likewise schematic view of a vertical partially broken cross-

section through a portion of the lifting means, from which a trolley means, which forms part of the lifting  
65 means according to the invention in storage position is evident; and Fig. 6 shows the lifting means according to the invention in storage condition.

In the embodiment of the lifting means according to the invention and illustrated in Figs. 1 and 2 substantially comprises a frame 1 and carrying unit 2,  
70 which is displaceable relative to the frame and a lifting mechanism 3, by means of which a displacement of the carrying unit 2 is performed. The frame 1 substantially comprises two uprights 4, 5, which are  
75 rigidly connected to each other by means of a connecting piece 7 in the form of a box section extending between the lower ends 6 of the uprights. The uprights 4, 5 are also formed of box sections, which principally enclose the lifting mechanism, which will  
80 described in more detail below. The box sections of the uprights 4, 5 along one of their sides exhibit a longitudinally extending channel-shaped opening 8, in which a portion 9 of a trolley means is provided to run and which forms part of the lifting mechanism 3  
85 and is arranged to support the carrying unit 2. The carrying unit 2 is pivotably journalled in the portion 9 of the trolley means, as is evident from Fig. 5, and thereby pivotable between a position of use illustrated in Figs. 1 and 2, where the carrying unit  
90 extends substantially across transversal the longitudinal extension of the two uprights 4, 5, and a folded back position, which is shown in Fig. 6, where the carrying unit 2 is folded back towards the frame 1, or more exactly against the uprights 4, 5. The limitation of the movement of the carrying unit 2 in its  
95 folded down position is performed by stopping means limiting the movement, which in the example shown are two chains 10 forming pulling elements, which chains with one of their ends each are  
100 anchored to an eye 11 attached on the platform portion 12 of the carrying unit and with their other end is anchored in a hole 13 provided in the upper portion of the resp. trolley means. By means of this arrangement the pivoting moment loading the carrying  
105 unit 2 is transferred to the trolley means. This moment is caused by the weight of the carrying unit and by the load placed on the carrying unit, i.e. the weight of the person and the auxiliary equipment.

In addition to the uprights 4, 5 and the intermediate connecting piece 7 the frame 1 also exhibits a stay 14, which also extends between the two uprights and its ends is rigidly connected to them and by way of example also is formed of a box section.

115 The lifting means is further provided with wheels, a wheel assembly 15 being attached to the lower portion of each one of the uprights 4, 5 at some distance from their lower end, so that the wheels occupy a free position above a foundation, onto  
120 which the lifting means is placed in the manner illustrated in Figs. 1 and 2. Each one of the wheel assemblies is composed of a wheel 16, which is pivotably journalled in two brackets 17, one bracket on the side of each one of the uprights.

The carrying unit 2 exhibits a second platform 18, which is pivotably mounted on the platform portion 12 by means of hinges 19. This platform is arranged to form a bridge over the interspace, between the first platform of the carrying unit 2 and the floor 20 of the vehicle. As a matter of fact most vehicles at their entrance openings 21 exhibit a the level difference between the plane located outside of the vehicle, which usually is the ground plane, a station platform or similar, and the interior floor plane of the vehicle, which level difference, thus, must be bridged by means of the second platform 18. Also in those cases, if any where there are no level differences it is advantageous from a practical viewpoint with a pivotable prolonging part, to the first platform which can smooth out a slight level difference between the platform portion of the carrying unit and the floor plane of the vehicle and also bridge the small interspace, which often occurs between the platform unit and the vehicle, which by way of example is the case with a means according to the illustrated embodiment. The carrying unit 2 further exhibits two lateral pieces 22, which suitably are rigidly fixed, and an end piece 23, which is pivotably journaled in the platform portion 12 by means of hinges 24, whereby this end piece can be folded down permitting a wheel chair to be driven up onto the platform portion 12. The end piece 23, which can be folded down and which suitably is made of a relatively thin material or designed with a chamfer at its upper edge, functions as an access ramp permitting the wheel chair to be driven up onto the platform portion 12. The end piece 23 can be locked in its upright position by means of a locking means, not shown, which by way of example can be a bolt, which is displaceably mounted at each one of the ends of the end piece 23 on the inside of the same and which can be inserted into a hole in the nearest thereto located lateral piece 22.

The lifting means according to the invention further comprises a holding device 26, which in the illustrated example comprises two buckles 27 each one mounted on the top of the respective uprights 4, 5 and for each one of the buckles 27 straps 28 of woven textile material forming a flexible pulling element of long extension.

The straps at one end exhibit a hooking means 29 in the form of hooks which is arranged to be hooked on to a hooking means 30 in the form of an eye, which is rigidly attached to the vehicle, by way of example to the floor of the vehicle or to any other suitable point at the entrance of the vehicle. It is of advantage if this point is on a distance inside of the very entrance. This is especially important, if a level difference does exist between the buckle and the hooking means 30 of the vehicle.

An example of an embodiment of the buckle is shown in Fig. 3, from which is evident that the buckle is designed with a channel shaped portion 31 which in the illustrated example is rigidly mounted on an end plate 32 on each one of the uprights 4, 5, and a spring loaded locking element 33 designed as a double armed lever. The longer one of its arms forms an operating part 34, and the shorter arm forms a locking part 35. Thus, the double armed

lever is spring loaded and pivotably journaled on a shaft 36 of the channel shaped portion 31 in such a manner that the locking part 35 tends to abut against the strap 28 locking the same against a pull in the direction indicated with an arrow 37, which thus is the normal direction of pull in the position of use of the means. This buckle is dimensioned in such a manner that a self checking action will arise i.e. the locking part tends to increase its abutment, when the pulling force in the direction of the arrow 37 increases. In connection with a pull in opposite direction the strap 28 can be drawn through the buckle as it then is released by the buckle. In order to impede that the strap 28 does not completely slide out of the buckle 27, the strap at its outer end, i.e. the end, which does not exhibit the hooking means 29, is designed with an arresting means 39, which by way of example can be a double folded stitched together portion of the strap.

The above mentioned lifting mechanism 3 will be described in more detail by means of an example, reference being made to the Figs. 1, 4 and 5. In the illustrated example the lifting mechanism is entirely manually operated and is composed of a driving mechanism 40, which in the example shown comprises a crank mechanism, which is enclosed in a housing 41 in the form of a box section laterally projecting from the upper end of one of the uprights 4. The crank mechanism is substantially composed of a hand operated crank 42, which is mounted on a shaft not shown, said shaft being pivotably mounted in the housing 41. A chain sprocket, not shown, is mounted on this shaft and is arranged to turn a sprocket wheel by means of a chain, not shown, said sprocket wheel being journaled on a shaft 44, of which one end is pivoted in a bearing unit 45 on the inside of the housing 41, the other end of said shaft being supported in a bearing unit 46 mounted on the inside of the upright 4. The driving mechanism 40 is via a miter gear 47 in driving connection with a screw 48, which is pivoted on the upright 4 by means of a bearing unit 49 located at the top of the upright 4. By this arrangement the bearing unit 49 serves the purpose of a thrust bearing as well as a radial bearing, whereas a bearing unit 50 in the bottom portion of the upright only functions as a radial bearing. By this arrangement only tension loads will arise in the screw 48, which has turned out to be favourable from the viewpoint of load. The miter gear 47 comprises two bevel gears of which one bevel gear 51 is of larger size and rigidly mounted on the shaft 44, the other bevel gear 52 being of smaller size and rigidly mounted on the upper end of the screw 48, which two gears, thus, are in mesh with each other. The bevel gears are dimensioned in such a manner that they offer a suitable gear ratio relative to the gear ratio obtained by the driving mechanism in order to impart a suitable rotating speed to the screw 48, when the crank is operated.

A screw is in corresponding manner pivoted in the upright 5, but it is not shown, as its suspension can be made in exactly the same manner as in the upright 4, any gear, however, not being required at the upper end of the screw, but only a similar bearing unit, so that the screw will obtain a suspension at

its upper end. The drive of the screw in the upright 5 is brought about by means of a transmission mechanism, which extends in the connecting piece 7 between the bottom portions of the uprights. In the illustrated example the transmission mechanism comprises a sprocket wheel 53, which is rigidly mounted on the bottom end of each one of the screws 48, and a chain 54 extending between said two sprocket wheels 53 and forming a closed loop laid round the two sprocket wheels, which exhibit the same diameter and the same number of teeth in order to impart the same rotating speed to the two screws.

In Fig. 4 the upright 4 has been shown in a broken view and, thus, only the ends of the screw 48 have been shown. However, in Fig. 5 an intermediate portion of the uprights 4, 5, but not necessarily the entire broken out portion of Fig. 4, is shown in a partly broken cross-sectional view. As is evident from the figure 5 the representation is for the sake of space shown on a somewhat smaller scale than the one in Fig. 4. An embodiment of the above mentioned trolley means 55 is evident from Fig. 5, portion 9 of which means is running in the channel-shaped opening 8 of the uprights 4, 5. The trolley means is composed of a T-shaped profile 56, of which the portion 9 constitutes its stem, while the cross piece of the profile is indicated with 57. The carrying unit 2 is pivoted on the lower end of the portion 9 extending in said channel by means of hinges 58, one hinge at each riding carriage 56. A nut 59 further belongs to the assembly of the trolley means said nut being screwed on the threads of the screw 48. The nut 59 is held relative to the trolley means in such a manner that it cannot be turned, which in the illustrated example is arranged by means of a supporting element 60, which abuts against a plane surface of the nut. The trolley means 55 exhibits two portions 61, 62 with openings, through which the screw 48 extends with a play. These two portions are rigidly attached to the cross piece 57, the trolley means with its upper portion 61 resting relative to the nut 59 with a floating suspension, i.e. the portion 61 is not rigidly connected with the nut. In order to take up loads from oblique forces to which the trolley means is subjected, two pairs of guide rollers 63, 64 in the form of ball bearings are provided, which bear against opposite inner walls 65, 66 of the two uprights. Further plain bearings are provided in the form of blocks 67, 68 bearing against the inner walls of the uprights. Moreover additional plain bearings are provided bearing against the other opposing inner walls of the uprights, which not shown in the figure. One trolley means 55 is thus provided for each one of the uprights 4, 5.

As has been mentioned above, the lifting means can be changed over between a position of use and a position of storage. The storage position is illustrated in Fig. 6. In this position the carrying unit 2 is thus folded back against the frame 1, so that the platform portion substantially connects to the two uprights 4, 5, the lateral pieces 22 of the carrying unit being placed in close connection to the sides of the two uprights. The carrying unit 2 is then in its lowest position, so that the carrying unit does not project

above the uprights. As is evident from Fig. 2, an automatic folding-out of the second platform 18 of the carrying unit 2 and the guiding of the same in a folded-out position by means of the stay 14 is obtained. The holding device 26 can moreover be utilized to hold the carrying unit 2 in its folded-out position. For this purpose the carrying unit is provided with a hooking-up device 68 in the form of an eye on each side of the carrying unit. Thus, the hooking-up device 29 of the holding means can be hooked on to this eye, and the strap 28 can be stretched by means of the buckle 27, whereby the carrying unit is retained in folded-back position. The end piece 23 can be folded back against the platform portion.

Thus, the lifting means is intended to be used in the following manner. The lifting means is extracted from a storage space, by way of example from the baggage compartment of a vehicle, and is thus in the condition shown in Fig. 6. The baggage compartment in for example busses does not exhibit any raised edge, and therefore it is a simple task to pull out the lifting means by dragging it along the floor of the baggage compartment and brought into the inclined position illustrated in Fig. 6, which operation can be performed by the driver or any other person, whereafter this person can tilt the lifting means in such a manner that the two wheel assemblies 15 reach contact with the foundation outside of the vehicle and subsequently very easily roll the lifting means as a whole unit in front of himself in tilted condition, whereby one with one's hands can get a hold of the upper ends of the uprights 4, 5 or of specially provided handles on the sides of the uprights or on any other suitable place. The lifting means can be placed in front of the actual entrance of the vehicle in the manner shown in Fig. 1. One has then to look after that the uprights 4, 5 or at least one of them will bear against a portion of the side of the vehicle, by way of example an edge portion underneath the entrance. At the same time the lifting means by means of a supporting device obtains support against the foundation outside of the entrance of the vehicle, for example the ground or a station platform or similar. In the illustrated example said supporting device is constituted by the lower ends 6 of the uprights and the underside of the connecting piece 7. The wheel assemblies 15 are thus free. By means of the holding device 26 a fixation of the uprights 4, 5 is made in such a manner that the load operating on the uprights the carrying unit 2 and its load can be taken up. The holding device 26 is anchored to the vehicle by disconnecting the straps 28 from the eyes 68 on the sides of the carrying unit 2 and stretching them to acquire the necessary length at the same time as the operating part 34 of each buckle 27 is pressed in, so that the strap can slide freely through the buckle, the hooking up means 29 of the strap being hooked on to the fixed hooking-up means 30 of the vehicle. The strap is thereafter stretched by exercising a pull until the strap is completely extended and the uprights substantially vertical and in secure manner with a portion bear against the side of the vehicle. When the hooking up means 29 of the strap has been released from the

hooking up means of the carrying unit 2 before being attached to the vehicle, the carrying unit 2 was released and could, thus, be folded down to the position illustrated in Fig. 1. The end piece 23 is then  
 5 folded out towards the foundation outside of the vehicle, which makes possible that a wheel chair or similar can be driven up onto the platform portion of the carrying unit 2. Thereafter the end piece 23 is folded back and is locked by means of a suitable  
 10 locking device.

The lifting means is thus ready for the displacement of the wheel-chair from the lower level, where the carrying unit 2 now occupies its position, and to a suitable higher level permitting the wheel-chair to  
 15 be introduced into the vehicle. The lifting of the wheel-chair by means of the carrying unit 2 is thus carried out by cranking the hand crank 42 in one direction, which operation for example is performed by the driver of the vehicle, the screw 48 thereby  
 20 being brought in rotation via the sprocket wheel 43 and the miter gear 47. Also the screw of the upright 5 is brought in rotation with the same speed via the sprocket wheels 53 and the chain 54, the nut 59 mounted on each one of the screws displacing itself  
 25 in upwards direction along the screw by cooperation between the threads of the nut and the screw. As the trolley means 55 in each upright 4, 5 is supported by the nut 59 belonging thereto, the same is consequently displaced in upwards direction, the uprights  
 30 with their inner walls forming guides for the trolley means. The carrying unit 2, which is pivotably suspended in the trolley means is in connection herewith carried along in upwards direction together with its load, i.e. the wheel chair with the handicapped  
 35 person sitting in the same. The second platform 18 is at least during a first phase in folded back condition, as the stay 14 constitutes a stop against its being folded down. By this arrangement also the prolonging part 18 together with the lateral pieces 22  
 40 and the end piece 23 functions as a protection against falling off. However, it is of advantage that the prolonging part 18 is kept in its folded back condition during the whole lifting moment by means of some form of an in itself known locking element,  
 45 which by way of example can project laterally from the portion 9 of the riding carriage or similar.

When the carrying unit 2 together with its load has reached a desired high level, suitably the level of the floor plane of the vehicle, the locking means, which  
 50 hold the prolonging part, is released, whereby said prolonging part is folded down and with its free end will arrive in contact against the floor of the vehicle in such a manner that the prolonging part bridges the stair well of the vehicle. Thus, the operation of  
 55 the lifting mechanism has now ceased, i.e. the operator relinquishes his grasp of the crank 42, a secure hold of the carrying unit 2 in the position occupied being obtained by the chosen lifting mechanism in the illustrated example, as the pitch of  
 60 the threads of the screws is chosen in such a manner that an axial load of the nuts 59 cannot bring about a rotation of the screws. The wheel-chair can now be rolled off from the carrying unit 2 over the prolonging part 18 and straight into the vehicle through the  
 65 entrance opening 21 of the same, whereafter the car-

rying unit is lowered down to its lower position shown in Fig. 1 by cranking in opposite direction. The prolonging part 18 is then automatically folded back, when the stay 14 is passed. The holding means  
 70 26 is disengaged from the vehicle and the carrying unit 2 is folded back, the hooking up means 29 of said holding means again being hooked on to the eyes 68, see Fig. 6, and the strap being clasped, so that the carrying unit is held in its folded back position. The end piece 23 has then been folded back  
 75 against the platform portion 12, whereafter the lifting means can be returned to its storage place. The displacement of a handicapped person with a wheel-chair out of the vehicle does in principle take place in the same manner but in the reverse order.

The invention is not limited to the example of embodiment described above and illustrated in the drawings, but can be varied within the scope of the following claims. The lifting mechanism can be of an  
 85 entirely different type than the illustrated one. It can for example be of hydraulic or pneumatic type and by way of example be composed of piston cylinders, which actuate the trolley means. An already existing hydraulic or pneumatic system of the vehicle can  
 90 possibly be utilized for the drive of the lifting mechanism. The crank mechanism can also be substituted by an electric motor connected with the shaft 44. The crank mechanism in the illustrated example can also be designed as a unit, which can  
 95 be displaced or swung sidewise, so that the over all dimensions of the lifting means will be reduced. The housing 41 can for example be pivoted on the shaft 44 and permit to be locked in its swung out and possibly also swung back position. The swung back position is then suitably a position, in which the housing  
 100 extends in the longitudinal direction of the upright 4 folded down from its swung out position.

It can further be imagined that the lifting means is suspended in the vehicle without reaching a supporting  
 105 position on the foundation outside of the vehicle. However, the holding means shall in the first place take up downwards directed forces and forces directed outwards from the portion of the vehicle against which the frame abuts.

It can further be imagined that the lifting means is placed in a different manner, by way of example in  
 110 such a manner that one upright will occupy a position outside of the other one. In connection with sedan type doors, i.e. doors of the type used in passenger cars, the uprights can be held to the inside of the swung-out door, the handicapped person thus not passing between the uprights. This is also the case, when the uprights are no longer than the maximum lifting height, the transfer then taking place  
 120 above the uprights or between their prolongation. It can moreover of course be imagined to make minor modifications of the holding means. The straps may for example be firmly anchored to the vehicle and permit being totally removed from the buckles.

The buckle can further be mounted in the vehicle, while the straps are fixedly or detachably anchored to the stand. The fact that the lifting means in the first place is intended for handicapped persons does not exclude its utilization of other kind, for example  
 130 loading and unloading of goods as parcels etc., in

busses or serving trolleys in trains etc.

#### CLAIMS

1. Lifting means intended to facilitate the transfer of a handicapped person and preferably also such auxiliary equipment as for example a wheel-chair, between a lower level outside of a vehicle and a higher level inside a vehicle, the lifting means substantially being composed of a frame, a carrying unit which is arranged to support the person and the auxiliary equipment and which is connected to the frame and provided to be displaced between said different levels, and a lifting mechanism, which is provided to displace the carrying unit between said different levels, in which the frame is provided to be detachably attached to the vehicle adjacent to the entrance opening of the same and comprises preferably two uprights, connected to each other, and the carrying unit is provided to be displaced along the uprights, which are provided to guide the carrying unit.

2. Lifting means according to claim 1, in which the uprights are located at such a distance from each other that the handicapped person and the auxiliary equipment can pass between the uprights in order to be displaced between the carrying unit and the vehicle.

3. Lifting means according to claim 1, in which the carrying unit comprising a platform with a carrying plane, which is arranged in its position of use to extend transverse to the longitudinal axes of the uprights and in a storage position to be folded back against the uprights, with said plane substantially parallel to said axes.

4. Lifting means according to claim 3, in which the platform being arranged in its position of use to project laterally in one direction from the uprights and being connected to a second platform, provided to be changed over between a position of use, in which it projects from the uprights in a direction opposite to the direction, in which the first platform projects, and a storage position, in which the second platform is folded towards the uprights with a main plane substantially parallel to the longitudinal axes of the same.

5. Lifting means according to any one of the preceding claims which comprises at least one lower supporting means from which the uprights in upwards direction, and provided in the position of use to rest on a foundation outside of the vehicle thereby supporting the lifting means, and a holding device, positioned at a distance from said supporting means and provided to detachably attach the frame to the vehicle.

6. Lifting means according to claim 5, in which the holding device comprises a buckle, rigidly mounted on preferably one of the uprights and a pulling element like a strap or similar extending through the buckle, which strap is provided to extend through the buckle and with one of its ends being anchored to the vehicle.

7. Lifting means according to any one of the preceding claims, in which the lifting mechanism comprising in each one of the uprights a screw spindle, pivotably mounted and a trolley means including supporting nuts, provided to be displaced by means

of the screw spindle, to which trolley means the carrying unit is attached.

8. Lifting means according to claim 7, in which the lifting mechanism comprising a driving device, which is in driving connection with one of the screw spindles and a transmission mechanism extending between the screw spindles and being arranged to transmit the rotating movement of first said screw spindle to the other screw spindle.

9. Lifting means according to claim 7, in which each screw spindle being suspended in the respective upright, in which it is mounted, by means of axial bearings at its upper end only so that the screw spindles are subjected substantially only to tensional forces.

10. Lifting means as previously described and shown on the accompanying drawings.

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