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(54) WHEELCHAIR LIFT SAFETY BARRIER

(57) A wheelchair lift for a vehicle comprises: a base (34) for securing to a vehicle; a platform (12) for accommodating a wheelchair; a lifting arm (16) connected to the base and moveable between a raised position and a lowered position so as to move the platform between a raised position and a lowered position; and a safety barrier system; wherein the safety barrier system comprises: a safety barrier (56) moveable between a closed position and an open position; and a coupling mechanism (54) arranged to couple the safety barrier to the lifting arm so as to cause the safety barrier (56) to move from its open position to its closed position as the lifting arm (16) is moved from its raised position to its lowered position and so as to cause the safety barrier (56) to move from its closed position to its open position as the lifting arm (16) is moved from its lowered position to its raised position.

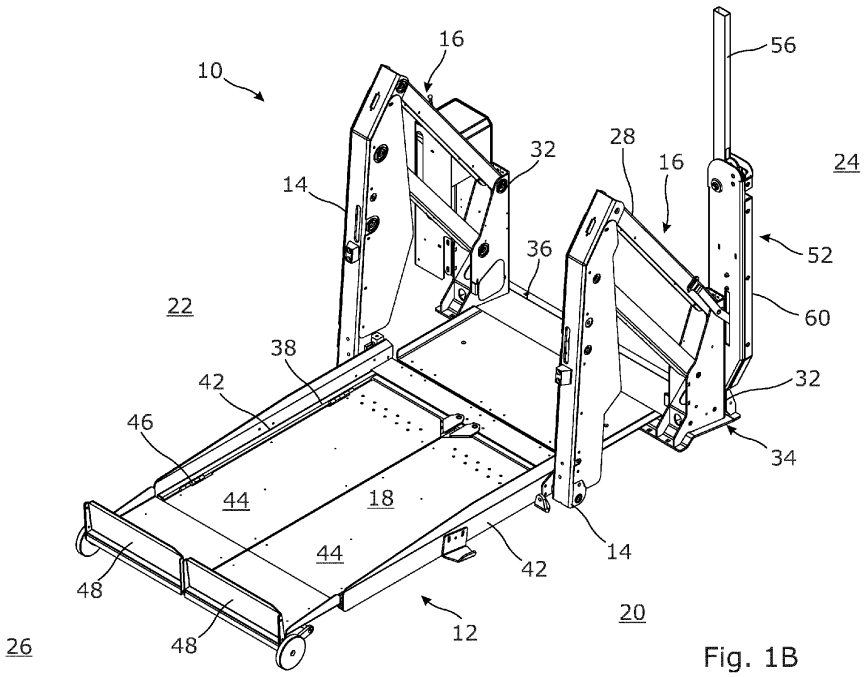

Fig. 1B

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Description

Field of the Invention

[0001] The invention relates to safety barrier systems for wheelchair lifts, in particular vehicle-mounted wheelchair lifts, and also to wheelchair lifts comprising such safety barrier systems.

Background

[0002] Foldable wheelchair lifts provide a moveable platform upon which a wheelchair may be raised and lowered between ground level and a level at which the wheelchair may be wheeled into or out from the vehicle. Such lifts are generally mounted on or inside the vehicle itself and are deployed out from a door in the side or the rear of the vehicle when needed, for example using a hydraulic actuating mechanism.

[0003] When the platform of the wheelchair lift is lowered to ground level there is the possibility that a passenger may roll or walk out from the vehicle and drop a substantial distance onto the lowered platform, potentially causing serious injury as a result. This may be accidental, or may be as a result of the passenger or operator believing the lift platform to be raised, when in fact it is lowered. For example, operators often pull wheelchairs onto the lift platform from the vehicle while walking backwards, which means that they cannot see the lift platform. Sometimes the operator believes the platform is raised, when it is in fact lowered, and they walk out of the vehicle backwards and fall.

[0004] Various systems have been developed to either indicate to passengers still on board the vehicle that the lift platform is in its lowered position or to provide barriers to prevent passengers from attempting to leave the vehicle via the lift when the platform is in its lowered position. However, such systems are often not obvious enough to be readily noticed by passengers and are generally electronically controlled or are driven by dedicated electric motors or actuators, making them complicated and potentially unreliable.

[0005] There is therefore a need for a wheelchair lift that addresses these problems.

Summary of the Invention

[0006] According to a first aspect of the invention, there is provided a wheelchair lift for a vehicle, the wheelchair lift comprising: a base for securing to a vehicle; a platform for accommodating a wheelchair; a lifting arm connected to the base and moveable between a raised position and a lowered position so as to move the platform between a raised position and a lowered position; and a safety barrier system; wherein the safety barrier system comprises: a safety barrier moveable between a closed position and an open position; and a coupling mechanism arranged to couple the safety barrier to the lifting arm so as to cause the safety barrier to move from its open position to its closed position as the lifting arm is moved from its raised position to its lowered position and so as to cause the safety barrier to move from its closed position to its open position as the lifting arm is moved from its lowered position to its raised position.

[0007] The coupling mechanism may comprise a lever arm coupled to the lifting arm and arranged to move on movement of the lifting arm. The coupling mechanism may also comprise a linkage assembly arranged to couple the safety barrier to the lever arm so as to cause the safety barrier to move from its open position to its closed position as the lifting arm is moved from its raised position to its lowered position and so as to cause the safety barrier to move from its closed position to its open position as the lifting arm is moved from its lowered position to its raised position.

[0008] The lever arm may be arranged to exert an upwards force to the linkage assembly as the lifting arm is moved from its raised position to its lowered position. The linkage assembly may be arranged to transfer at least a part of the upwards force to the safety barrier, so as to cause the safety barrier to move from its open position to its closed position.

[0009] The lever arm may be arranged to cause upward motion of the linkage assembly as the lifting arm is moved from its raised position to its lowered position. The linkage assembly may be coupled to the safety barrier such that the upward motion of the linkage assembly causes the safety barrier to move from its open position to its closed position.

[0010] The coupling mechanism may be arranged so that the safety barrier reaches its closed position before the lifting arm reaches its lowered position when the lifting arm is moved from its raised position to its lowered position.

[0011] The linkage assembly may comprise a compressible linkage arranged to be compressed when the safety barrier is in its closed position and the lifting arm moves towards its lowered position so as to allow the lifting arm to move towards its lowered position without causing movement of the safety barrier.

[0012] The compressible linkage may be arranged so that it is not fully compressed when the lifting arm is in its lowered position, thus allowing the safety barrier to move from its closed position towards its open position by pushing the safety barrier, thereby further compressing the compressible linkage.

[0013] The compressible linkage may comprise a gas strut.

[0014] The linkage assembly may comprise a slidable linkage slidable between a lowered position and a raised position. The lever arm may be arranged to push the slidable linkage upwards from its lowered position to its raised position as the lifting arm moves from its raised position to its lowered position.

[0015] The linkage assembly may be coupled to the safety barrier such that upwards motion of the slidable

linkage causes the safety barrier to move from its open position to its closed position.

[0016] The linkage assembly may comprise a guide arranged to guide and support the slidable linkage.

[0017] The slidable linkage may comprise a roller arranged to contact the lever arm.

[0018] The safety barrier may be biased into its open position by the coupling mechanism. The coupling mechanism may comprise a compressible member arranged to be compressed when the safety barrier is closed and the safety barrier may be biased into its open position by the compressible member. The compressible member may be a gas strut.

[0019] The slidable linkage may be biased into its lowered position, thereby biasing the safety barrier into its open position.

[0020] The slidable linkage may be biased into its lowered position by a compressible member which is arranged so that it is compressed as the slidable linkage slides from its lowered position to its raised position.

[0021] The compressible member may comprise a gas strut.

[0022] The coupling mechanism may be arranged so that the safety barrier reaches its closed position before the slidable linkage reaches its raised position.

[0023] The compressible linkage may be arranged to be compressed when the safety barrier is in its closed position and the slidable linkage is pushed upwards by the lever arm, thereby allowing the slidable linkage to slide upwards without causing movement of the safety barrier.

[0024] The compressible linkage may couple the slidable linkage to the safety barrier.

[0025] The compressible linkage may be pivotably connected at its lower end to the slidable linkage. The compressible linkage may be pivotably connected at its upper end to the safety barrier.

[0026] The lever arm may be connected to the lifting arm.

[0027] The lever arm may be adjustably connected to the lifting arm so that the relationship between the extent to which the lifting arm is raised or lowered and the extent to which the safety barrier is opened or closed may be adjusted.

[0028] The lever arm may be adjustably connected to the lifting arm so that the angle of the lever arm with respect to the lifting arm may be adjusted.

[0029] The lever arm may be pivotably connected to the wheelchair lift base so that it can pivot about the same axis as the lifting arm.

[0030] The safety barrier may be arranged so as to obstruct access to the platform from the inboard side of the platform when the safety barrier is in its closed position.

[0031] The safety barrier may be arranged so as to allow substantially unobstructed access to the platform from the inboard side of the platform when the safety barrier is in its open position.

[0032] The safety barrier system may comprise a housing. The linkage assembly may be supported on and housed within the housing.

[0033] The safety barrier may be mounted on the housing, for example pivotably mounted on the housing.

[0034] The housing may be mounted on the wheelchair lift base.

[0035] The safety barrier system may further comprise a latch arranged so that the safety barrier may be latched into its open position by the latch, thereby preventing the safety barrier from moving into its closed position.

[0036] The safety barrier may extend upwardly when in its open position.

[0037] The safety barrier may extend in a direction across the width of the wheelchair lift when in its closed position.

[0038] According to a second aspect of the invention, there is provided a kit of parts for a wheelchair lift as described above. The kit may comprise the base; the platform; the lifting arm; the safety barrier; the linkage assembly; and the lever arm.

[0039] According to a third aspect of the invention, there is provided a safety barrier system for a wheelchair lift as described above.

[0040] According to a fourth aspect of the invention, there is provided a kit of parts for a safety barrier system as described above. The kit may comprise the safety barrier; the linkage assembly; and the lever arm.

Brief Description of the Figures

[0041] The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1A shows a perspective view of a wheelchair lift according to an embodiment of the invention in the stowed configuration;

Figure 1B shows a perspective view of the wheelchair lift of Figure 1A in the raised configuration;

Figure 1C shows a perspective view of the wheelchair lift of Figure 1A in the lowered configuration;

Figure 2 shows a perspective view of selected parts of the wheelchair lift of Figure 1A with the lift in the raised configuration.

Figure 3A shows a front (or inboard) side view of the selected parts shown in Figure 2 with the lift in the raised configuration with the internals of the safety barrier system shown.

Figure 3B shows a front (or inboard) side view of the selected parts shown in Figure 2 with the lift in the lowered configuration with the internals of the safety barrier system shown.

Figure 4A shows a right side view of selected parts of the wheelchair lift of Figure 1A in the lowered configuration with the internals of the safety barrier system shown.

Figure 4B shows a right side view of the selected parts shown in Figure 4A with the wheelchair lift in the raised configuration with the internals of the safety barrier system shown.

Figure 5A shows a front (or inboard) side view of selected parts of the safety barrier system of the lift of Figure 1A with the lift in the raised configuration with the internals of the safety barrier system shown.

Figure 5B shows a front (or inboard) side view of the selected parts shown in Figure 5A with the lift part way between the raised and lowered configurations with the internals of the safety barrier system shown.

Figure 5C shows a front (or inboard) side view of the selected parts shown in Figure 5A with the lift in the lowered configuration with the internals of the safety barrier system shown, and

Figure 6 shows a front (or inboard) side view of selected parts of the safety barrier system of the lift of Figure 1A with the lift in the raised configuration with the internals of the safety barrier system shown.

[0042] Like reference numerals denote like features throughout the drawings.

Detailed Description

[0043] Referring to Figures 1A-C, a wheelchair lift 10 according to an embodiment of the invention comprises a foldable platform assembly 12, a pair of support arms 14 which are arranged substantially vertically, with the foldable platform assembly 12 supported on their lower ends, and a pair of lifting assemblies 16, each connecting the upper end of one of the support arms 14 to the floor of a vehicle.

[0044] The lifting assemblies 16 are hydraulically actuated to move the lift 10 between a stowed configuration, in which the platform assembly 12 is folded away and is stowed within the vehicle upon which the wheelchair lift 10 is mounted in a substantially vertical arrangement, and a deployed configuration, in which the platform assembly 12 is arranged to provide a substantially horizontal platform 18 upon which a wheelchair may be accommodated. In the deployed configuration, the platform assembly 12 is movable between a lowered position, as shown in Figure 1C, in which the platform assembly 12 rests on, or is in close proximity to, the ground and in which a wheelchair can be wheeled between the ground and the platform 18, and a raised position, as shown in Figure 1B, in which the platform assembly 12 is approximately level with the floor of the vehicle and in which the wheelchair may be wheeled between the platform 18 and the internal floor of the vehicle. The lift 10 therefore has three principal configurations: a stowed configuration (Figure 1A), a raised configuration (Figure 1B), and a lowered configuration (Figure 1C).

[0045] Typically, the wheelchair lift 10 will be mounted in a vehicle, such as a minibus, to raise and lower a wheelchair and its occupant between the ground and the inside of the vehicle. The most common arrangement is for the wheelchair lift 10 to be mounted at the rear of the vehicle so that it may be deployed through doors on the back of the vehicle. Accordingly, the frame of reference used in the following discussion assumes such a configuration. For example, the right 20 and left 22 sides of the lift 10 are those that face the left and right sides of the vehicle when looking forwards. Of course, other mounting configurations are possible, for example so that the lift 10 deploys out from the side of the vehicle. The "front" or "inboard" side 24 of the lift 10 is therefore the side that faces into the vehicle and the "rear" or "outboard" side 26 of the lift 10 is the side that faces out of the vehicle, i.e. in the direction in which the platform assembly 12 extends away from the support arms 14 when the lift 10 is in the deployed configurations.

[0046] The lift 10 comprises right and left lifting assemblies 16. However, it is possible for the wheelchair lift 10 to comprise only a single lifting assembly 16 and associated support arm 14. For example, only the left or right lifting assembly 16 need be present. However, having both left and right lifting assemblies 16 improves the stability of the lift 10. Each lifting assembly 16 comprises an upper lifting arm 28 and a lower lifting arm 30, which are arranged substantially parallel to each other. Each of the upper 28 and lower 30 lifting arms is pivotably connected at its lower (inboard) end to a mounting turret 32, the upper lifting arm 28 being connected to the mounting turret 32 at a point above the lower lifting arm 30. The upper (outboard) end of each of the lifting arms 28, 30 is pivotably connected to the upper end of one of the support arms 14, again with the upper lifting arm 28 being connected to the support arm at a point above the lower lifting arm 30 so as to form a parallelogram linkage. The lifting assemblies 16 generally each comprise at least one hydraulic strut arranged to actuate the parallelogram linkage, which in turn causes the lift 10 to raise and lower between the stowed, raised, and lowered configurations.

[0047] The mounting turrets 32 form part of the base 34 of the lift. The base 34 is configured to be secured to a vehicle, in particular to the floor of a vehicle. The base also comprises a baseplate 36 upon which the mounting turrets 32 are located. The baseplate 36 extends between and connects the mounting turrets 32.

[0048] The foldable platform assembly 12 is pivotably mounted on its left hand side to the lower end of the left support arm 14, and on its right hand side to the lower end of the right support arm 14. The foldable platform

assembly 12 comprises a substantially U-shaped platform frame 38. The platform frame 38 comprises a cross member 40 at its front (inboard) end, which extends between the left and right support arms 14, and left and right side members 42, which are connected to the cross member 40 at their front (inboard) ends and extend away from the cross member 40 in a substantially parallel manner. The upper surfaces of the cross member 40 and the side members 42 are generally flat and together define the platform plane. The platform frame 38 is pivotably connected towards its front (inboard) end on its left and right sides to the left and right support arms 14, respectively, so that it may pivot about a horizontal axis that extends between the two connection points with the support arms 14.

[0049] The foldable platform assembly 12 further comprises left and right foldable platform sections 44. Each foldable platform section 44 is connected to the inside edge of the respective side member 42 of the platform frame 38 by one or more hinges 46 so that the foldable platform section 44 can pivot between a deployed configuration, in which it lies in the platform plane, and a stowed configuration, in which it lies substantially perpendicular to the platform plane. When the lift 10 is raised into the stowed configuration the foldable platform sections 44 and the side members 42 extend vertically upwards to define a passageway between them. The passageway may, for example, be wide enough to allow a person to pass through, thereby allowing the door of the vehicle that the lift 10 deploys out from to be used when the lift 10 is in the stowed configuration. The inside edges of the foldable platform sections 44 abut one another when in the deployed configuration and cooperate with the cross member 40 and side members 42 of the platform frame 38 to define a platform 18 upon which a person or an object, such as a wheelchair, may be placed and lifted into or lowered from a vehicle.

[0050] Left and right roll-off ramps 48 are pivotably connected to the distal (outboard) ends of the left and right foldable platform sections 44, respectively. When the lift 10 is in the raised configuration, each of the roll-off ramps 48 extend upwards substantially perpendicularly from the platform plane to prevent the wheelchair from rolling off the rear (outboard) end of the platform 12. When in the lowered configuration the roll-off ramps 48 are lowered to allow the wheelchair to be wheeled between the ground and the platform 12.

[0051] The platform assembly also comprises a bridge plate 50, which is pivotably connected to the proximal (inboard) end of the platform frame 38 so that it can pivot about a horizontal axis adjacent to the proximal (inboard) edge of the platform 12. The bridge plate 50 bridges the gap between the floor of the vehicle and the front (inboard) edge of the platform 12 when the lift 10 is in the raised configuration, thereby allowing a wheelchair to be wheeled between the platform 12 and the floor of the vehicle. In the lowered configuration the bridge plate 50 extends upwards from the proximal edge of the platform 12 to prevent the wheelchair from rolling off the proximal (inboard) end of the platform 12.

[0052] The lift 10 also comprises a safety barrier system 52 comprising a safety barrier 56 pivotable between a closed position and an open position, and a coupling mechanism 58 arranged to couple the safety barrier 56 to one of the lifting arms 28 of the lift 10 so as to cause the safety barrier 56 to pivot from its open position to its closed position as the lifting arm 28 of the lift 10 is pivoted from its raised position to its lowered position and vice versa. The coupling mechanism 58 comprises a lever arm 54 coupled to one of the lifting arms 28 and arranged to pivot with the lifting arm 28, and a linkage assembly 59 configured to couple the lever arm 54 to the safety barrier 56. The safety barrier system 52 may also comprise a mounting panel 62, which may form part of a housing 60.

[0053] The safety barrier 56 is pivotably mounted on the mounting panel 62, and is therefore mounted on the housing 60. The mounting panel 62, and therefore also the housing 60, is in turn mounted on the wheelchair lift base 34, specifically on one of the mounting turrets 32. The mounting panel 62 may, for example, be mounted on the inboard side of one of the mounting turrets 32. The linkage assembly 59 and other elements of the safety barrier system 52, such as the safety barrier 56 may be mounted on the mounting panel 62. The mounting panel 62 may be combined with a cover 64, which attaches to the mounting panel 62 to form a housing enclosing the linkage assembly 59.

[0054] The safety barrier 56 may be in the form of a bar, as shown, or it may take any other form that provides an effective obstruction. The safety barrier 56 is pivotably mounted on the housing 60 so that it may pivot between an open (or raised) position and a closed (or lowered) position, as shown in Figures 3A and 3B respectively.

[0055] As shown best in Figure 1C, in the closed position the safety barrier 56 extends substantially horizontally in a direction across the width of the lift 10, i.e. in a transverse direction. When in its closed position the safety barrier 56 is arranged to obstruct access to the lift platform 18 from the inboard side 24 of the lift 10. For example, the safety barrier 56 may extend in a direction across the lift 10 to obstruct the passageway onto the platform 18 defined by the two lifting assemblies 16. The safety barrier 56 may, for example, extend above the baseplate 36 of the lift base 34 when closed. In its closed position, the safety barrier 56 extends from the housing 60, which is located on one side of the lift 10, towards the other side of the lift 10. The safety barrier 56 does not, however, have to extend across the entire width of the lift 10, and it does not have to provide a total obstruction to boarding the platform 18 from the inboard side 24. For example, the safety barrier 56 may extend only part way across the width of the lift 10 so as to allow a passenger to board the platform 18 from the inboard side 24 by passing to one side of the safety barrier 56. This improves the safety of the lift 10 since it allows the vehicle to be exited in an

emergency even when the safety barrier 56 cannot be opened. It also allows for more rapid entry of and exit from the vehicle without having to wait for the safety barrier 56 to open. When in its closed position the safety barrier 56 will also extend in a direction across the door of the vehicle through which the wheelchair lift 10 deploys.

[0056] Due to the obvious obstruction it causes when closed, the safety barrier 56 reduces the likelihood of a passenger attempting to board the platform 12 from the vehicle when the wheelchair lift 10 is in its lowered configuration as a result of mistakenly believing that the platform assembly 12 is raised. This reduces the chance of injuries occurring due to the large drop between the floor of the vehicle and the lift platform 18 when the lift 10, and therefore also the platform assembly 12, is in its lowered configuration.

[0057] As shown for example in Figure 1B, when in its open position the safety barrier 56 extends substantially vertically upwards, specifically upwards from the housing 60 to which it is mounted. However, the safety barrier system 52 may instead be arranged so that the safety barrier 56 extends substantially vertically downwardly when in its open position, for example if the available height within the vehicle is not sufficient to accommodate an upwardly extending safety barrier 56. Of greater importance than the actual positioning of the safety barrier 56 when in its open position is that it does not substantially obstruct access to the lift platform 18 from the inboard side 24 of the lift 10. The lift platform 18 may therefore be boarded from the inboard side 24 without significant hindrance by the barrier 56.

[0058] As best illustrated in Figures 4A and 4B, the lever arm 54 is connected to one of the lifting arms 28, 30 of the lift, generally the upper lifting arm 28 of one of the lifting assemblies 16, so that it pivots with the lifting arm 28. It is also pivotably connected to the wheelchair lift base 34, specifically to one of the mounting turrets 32, so that it may pivot about the same axis as the lifting arm 28 so as to provide additional support to the lever arm 54 and to provide a fulcrum about which the lever arm 54 may pivot. The lever arm 54 is an elongate structure and comprises a lifting portion 66, which is arranged to pivot upwards as the lifting arm 28 is moved from its raised position to its lowered position and which extends beyond the inboard side of the mounting turret 32 and into the housing 60, and a connecting portion 68 which is connected to the lifting arm 28 and which pivots in the same direction as the lifting arm 28. The connecting portion 68 extends alongside the lifting arm 28 from the pivot 70 connecting the lever arm 54 to the lift base 34. The pivot 70 is located between the lifting portion 66 and the connecting portion 68 of the lever arm 54 so that the lifting portion 66 pivots upwards as the connecting portion 68 pivots downwards, and vice versa.

[0059] The lever arm 54 is adjustably connected to the lifting arm 28 so that the angle of the lever arm 54 with respect to the lifting arm 28 may be adjusted. For this reason, the lever arm 54 has formed in it a mounting slot 72, through which a fastening 74, such as a bolt, passes to fasten the lever arm 54 to the lifting arm 28. The mounting slot 72 is arranged so that the fastening 74 is slidable within the slot 72 when it is loosened. More specifically, the mounting slot 72 extends in a direction substantially perpendicular to the longitudinal axis of the connecting portion 68 of the lever arm 54. The mounting slot 72 therefore allows the angle of the lever arm 54 with respect to the lifting arm 28 to be adjusted by varying the position of the fastening 74 within the slot 72.

[0060] The connecting portion 68 of the lever arm 54 enters the housing 60 through an opening 76 in the outboard face of the housing 60, specifically in the mounting panel 62. The opening 76 is arranged to allow the lever arm 54 to pivot upwards and downwards and is therefore in the form of a vertically extending slot.

[0061] As best illustrated in Figures 5A-5C, the linkage assembly 59 is housed within and is supported by the housing 60 and is arranged to couple the lever arm 54 to the safety barrier 56 in such a way as to cause the barrier 56 to open and close as the lifting arm 28 is raised and lowered, respectively. The linkage assembly 59 comprises a slidable linkage 78 and a compressible linkage 80, which are connected together and arranged to couple the lever arm 54 to the safety barrier 56.

[0062] The slidable linkage 78 is slidable between a lowered position (as shown in Figure 5A) and a raised position (as shown in Figure 5C), and is arranged to contact the lever arm 54, specifically the lifting portion 66 of the lever arm 54. The slidable linkage 78 is arranged so that it is pushed upwards by the lever arm 54 as the lifting arm 28 pivots downwards from its raised position to its lowered position and the lifting portion 66 of the lever arm 54 pivots upwards.

[0063] The slidable linkage 78 comprises two substantially vertically extending slide rods 82 which are slidably received by a guide 84 comprising a mounting block so that they may slide upwards and downwards, for example in a substantially vertical direction. The guide 84 is mounted on the housing 60, specifically on the mounting panel 62, thereby connecting the slidable linkage 78 to the housing 60. The two slide rods 82 are connected at their upper ends by an upper cross member 86 and at their lower ends by a lower cross member 88. Each of the cross members 86, 88 extends substantially horizontally between the slide rods 82, i.e. substantially perpendicular to the longitudinal axes of the slide rods 82.

[0064] The slidable linkage 78 further comprises a roller 90 mounted on the lower cross member 88 between the slide rods 82 and arranged to contact the lever arm 54. The lever arm 54 is coupled to the linkage assembly 59 via the roller 90, which rests on the lever arm 54. The roller 90 allows the slidable linkage 78 to roll along the top edge of the lever arm 54 as the lifting portion 66 of the lever arm 54 and the slidable linkage 78 are raised and lowered.

[0065] The linkage assembly 59 further comprises two

biasing gas struts 92 arranged either side of the slidable linkage 78. The biasing gas struts 92 are arranged substantially vertically and are connected to the slidable linkage 78 at their lower ends via the lower cross member 88. The lower cross member 88 extends sideways either side beyond the slide rods 82 to provide mounting points for the biasing gas struts 92. The biasing gas struts 92 are arranged so that they are compressed as the slidable linkage 78 moves in an upwards direction. The biasing gas struts 92 therefore bias the slidable linkage 78 into its lowered position, which in turn biases the safety barrier 56 into its open position.

[0066] The compressible linkage 80 is connected at its lower end to the upper end of the slidable linkage 78 and is connected at its upper end to the safety barrier 56. The compressible linkage 80 comprises a gas strut 94 and is connected to the upper cross member 86 of the slidable linkage 78 between the two slide rods 82. The compressible linkage 80 is connected to the safety barrier 56 such that its connection 96 to the safety barrier 56 rotates about the pivot axis 98 of the safety barrier 56 when the compressible linkage 80 is pushed upwards, thereby causing the safety barrier 56 to pivot from its open position to its closed position. In this way, the coupling mechanism 58 is arranged to impart a rotational force to the safety barrier 56 as the lifting arm 28 pivots downwards from its raised configuration to its lowered configuration. The compressible linkage 80 is pivotably connected to both the slidable linkage 78 and the safety barrier 56 so that its connection to the safety barrier 56 may rotate about the pivot axis 98 of the safety barrier 56, which changes the angle of the longitudinal axis of the compressible linkage 80.

[0067] The compressible linkage 80 is arranged so that it is not fully compressed when the lifting arm 28 is in its lowered configuration and the slidable linkage 78 is in its raised position. This allows the safety barrier 56 to be opened manually when the lift 10 is in its lowered configuration by lifting or pushing the safety barrier 56 directly, which causes the gas strut 94 to become compressed further. This is a useful safety feature as it allows the barrier 56 to be raised in an emergency. It also allows more general flexibility of access to the vehicle. For example, the barrier 56 may be raised to allow ease of access even when the lift 10 is in its lowered configuration.

[0068] As best illustrated in Figure 6, the safety barrier system 52 may also comprise a latch 100, which is arranged so that the safety barrier 56 may be latched into its open position by the latch 100. The latch 100 is mounted on the mounting panel 62, and is therefore mounted on the housing 60 and is arranged so that it may be releasably engaged with the safety barrier 56 to prevent the safety barrier 56 from pivoting from its open position to its closed position. The use of the compressible linkage 80 in the linkage assembly 59 means that the safety barrier 56 may be latched in the open configuration while still allowing the lift 10 to be raised and lowered between its raised and lowered configurations because the compressible linkage 80 is compressed as the lifting arm 28 is lowered, rather than causing the safety barrier 56 to move.

[0069] The safety barrier system 52 is arranged so that the safety barrier 56 is in its closed position when the lifting arm 28 is in its lowered position and is in its open position when the lifting arm 28 is in its raised position. The coupling mechanism 58 is in the configuration shown in Figure 5A when the lifting arm 28 is in its raised position. As the lifting arm 28 pivots from its raised to its lowered position the lever arm 54 pivots with the lifting arm 28 to push upwardly on the slidable linkage 78 of the linkage assembly 59, thereby causing the slidable linkage 78 to slide upwardly. Specifically, the lifting portion 66 of the lever arm 54 imparts an upward force to the linkage assembly 59 as the lifting arm 28 is moved from its raised position to its lowered position. The compressible linkage 80 is in turn pushed upwards by the slidable linkage 78, which causes the connection 98 of the slidable linkage 78 to the safety barrier 56 to rotate about the safety barrier 56 pivot axis, thereby causing the safety barrier 56 to pivot from its open position to its closed position. In this way, the linkage assembly 59 transfers at least a part of the upwards force applied to the linkage assembly 59 by the lever arm 54 to the safety barrier 56 in such a way as to close the safety barrier 56.

[0070] The compressible linkage 80 is connected to the safety barrier 56 sufficiently close to the safety barrier 56 pivot axis such that a relatively small upwards movement of the compressible linkage 80 causes the safety barrier 56 move from its open to its closed position. This means that the safety barrier 56 is rapidly closed and reaches its closed position before the lifting arm 28 is fully lowered into its lowered position and before the slidable linkage 78 reaches its raised position, as illustrated in Figure 5B. This is advantageous because it causes the safety barrier 56 to assume its closed position even when the lift platform 18 is only slightly lowered, thus improving the safety of the lift 10. Once the safety barrier 56 is in its closed position and the lever arm 54 continues to push the slidable linkage 78 upwards the compressible linkage 80 is compressed until the slidable linkage 78 reaches its raised position when the lift 10 is in its lowered configuration and the lifting arm 28 is in its lowered position, as illustrated in Figure 5C.

[0071] When the lift 10 is raised from its lowered configuration to its raised configuration the lifting portion 66 of the lever arm 54 pivots downwards and the biasing gas struts 92 arranged either side of the slidable linkage 78 force the slidable linkage 78 downwards. The compressible linkage 80 extends as the slidable linkage 78 slides downwards, eventually reaching its fully extended configuration. Further downwards movement of the slidable linkage 78 causes the compressible linkage 80 to be pulled downwards, therefore causing the safety barrier 56 to be opened as its connection 96 to the compressible linkage 80 is pulled downwards and is thereby rotated about the safety barrier pivot axis 98.

[0072] The mechanical coupling between one of the lifting arms 28 of the lift 10 and the safety barrier 56 provides a simple and reliable mechanism for ensuring that the safety barrier 56 is closed as the lift 10 is lowered. Furthermore, since such lifting arms are a common feature of wheelchair lifts, the safety barrier system of the present invention may be retrofitted to existing wheelchair lifts to improve their safety.

[0073] The safety barrier system 52 may be provided as part of a lift 10, or as part of a kit of parts for a lift. Alternatively, it may be supplied on its own, for example as a kit of parts, for retrofitting to an existing lift. For example, the housing 60 may be mounted on the base of an existing lift and the lever arm 54 may be configured for mounting on the lifting arm of an existing lift. For example, the existing lift may be drilled to provide suitable mounting points, or the safety barrier system 52 may be arranged to clamp onto existing lift components.

Claims

1. A wheelchair lift for a vehicle, the wheelchair lift comprising:

a base for securing to a vehicle;
a platform for accommodating a wheelchair;
a lifting arm connected to the base and moveable between a raised position and a lowered position so as to move the platform between a raised position and a lowered position; and
a safety barrier system;

wherein the safety barrier system comprises:

a safety barrier moveable between a closed position and an open position; and
a coupling mechanism arranged to couple the safety barrier to the lifting arm so as to cause the safety barrier to move from its open position to its closed position as the lifting arm is moved from its raised position to its lowered position and so as to cause the safety barrier to move from its closed position to its open position as the lifting arm is moved from its lowered position to its raised position.

2. A wheelchair lift according to claim 1, wherein the coupling mechanism comprises a lever arm coupled to the lifting arm and arranged to move on movement of the lifting arm; and a linkage assembly arranged to couple the safety barrier to the lever arm so as to cause the safety barrier to move from its open position to its closed position as the lifting arm is moved from its raised position to its lowered position and so as to cause the safety barrier to move from its closed position to its open position as the lifting arm is moved from its lowered position to its raised position, wherein the lever arm is arranged to exert an upwards force to the linkage assembly as the lifting arm is moved from its raised position to its lowered position, and wherein the linkage assembly is arranged to transfer at least a part of the upwards force to the safety barrier, so as to cause the safety barrier to move from its open position to its closed position, and wherein the lever arm is arranged to cause upward motion of the linkage assembly as the lifting arm is moved from its raised position to its lowered position, and wherein the linkage assembly is coupled to the safety barrier such that the upward motion of the linkage assembly causes the safety barrier to move from its open position to its closed position.

3. A wheelchair lift according to claim 1 or claim 2, wherein the coupling mechanism is arranged so that the safety barrier reaches its closed position before the lifting arm reaches its lowered position when the lifting arm is moved from its raised position to its lowered position.

4. A wheelchair lift according to claim 3, wherein the linkage assembly comprises a compressible linkage arranged to be compressed when the safety barrier is in its closed position and the lifting arm moves towards its lowered position so as to allow the lifting arm to move towards its lowered position without causing movement of the safety barrier;
the compressible linkage is arranged so that it is not fully compressed when the lifting arm is in its lowered position, thus allowing the safety barrier to move from its closed position towards its open position by pushing the safety barrier, thereby further compressing the compressible linkage; and
the compressible linkage comprises a gas strut.

5. A wheelchair lift according to claim 4, wherein the linkage assembly comprises a slidable linkage slidable between a lowered position and a raised position, and wherein the lever arm is arranged to push the slidable linkage upwards from its lowered position to its raised position as the lifting arm moves from its raised position to its lowered position, and
wherein the linkage assembly is coupled to the safety barrier such that upwards motion of the slidable linkage causes the safety barrier to move from its open position to its closed position, and
wherein the linkage assembly comprises a guide arranged to guide and support the slidable linkage.

6. A wheelchair lift according to claim 5, wherein the slidable linkage comprises a roller arranged to contact the lever arm.

7. A wheelchair lift according to claim 5 or claim 6, wherein the slidable linkage is biased into its lowered position, thereby biasing the safety barrier into its

open position,
the slidable linkage is biased into its lowered position by a compressible member which is arranged so that it is compressed as the slidable linkage slides from its lowered position to its raised position, and
the compressible member comprises a gas strut.

8. A wheelchair lift according to any one of claims 5 to 7, wherein the coupling mechanism is arranged so that the safety barrier reaches its closed position before the slidable linkage reaches its raised position, and
the compressible linkage is arranged to be compressed when the safety barrier is in its closed position and the slidable linkage is pushed upwards by the lever arm, thereby allowing the slidable linkage to slide upwards without causing movement of the safety barrier.

9. A wheelchair lift according to any one of claims 5 to 8, wherein the compressible linkage couples the slidable linkage to the safety barrier, and
the compressible linkage is pivotably connected at its lower end to the slidable linkage and is pivotably connected at its upper end to the safety barrier.

10. A wheelchair lift according to any one of claims 2 to 9, wherein the lever arm is connected to the lifting arm, and
wherein the lever arm is adjustably connected to the lifting arm so that the angle of the lever arm with respect to the lifting arm may be adjusted.

11. A wheelchair lift according to any one of claims 2 to 10, wherein the lever arm is pivotably connected to the wheelchair lift base so that it may pivot about the same axis as the lifting arm.

12. A wheelchair lift according to any one of claims 2 to 11, wherein the safety barrier system further comprises a housing, the linkage assembly being supported on and housed within the housing, and
wherein the safety barrier is pivotably mounted on the housing, and
wherein the housing is mounted on the wheelchair lift base.

13. A wheelchair lift according to any preceding claim, wherein the safety barrier system further comprises a latch arranged so that the safety barrier may be latched into its open position by the latch, thereby preventing the safety barrier from moving into its closed position.

14. A wheelchair lift according to any preceding claim, wherein the safety barrier is arranged so as to obstruct access to the platform from the inboard side of the platform when the safety barrier is in its closed position, and
wherein the safety barrier is arranged so as to allow access to the platform from the inboard side of the platform when the safety barrier is in its open position.

15. A wheelchair lift according to any preceding claim, wherein the safety barrier extends upwardly when in its open position, and
wherein the safety barrier extends in a direction across the width of the wheelchair lift when in its closed position.

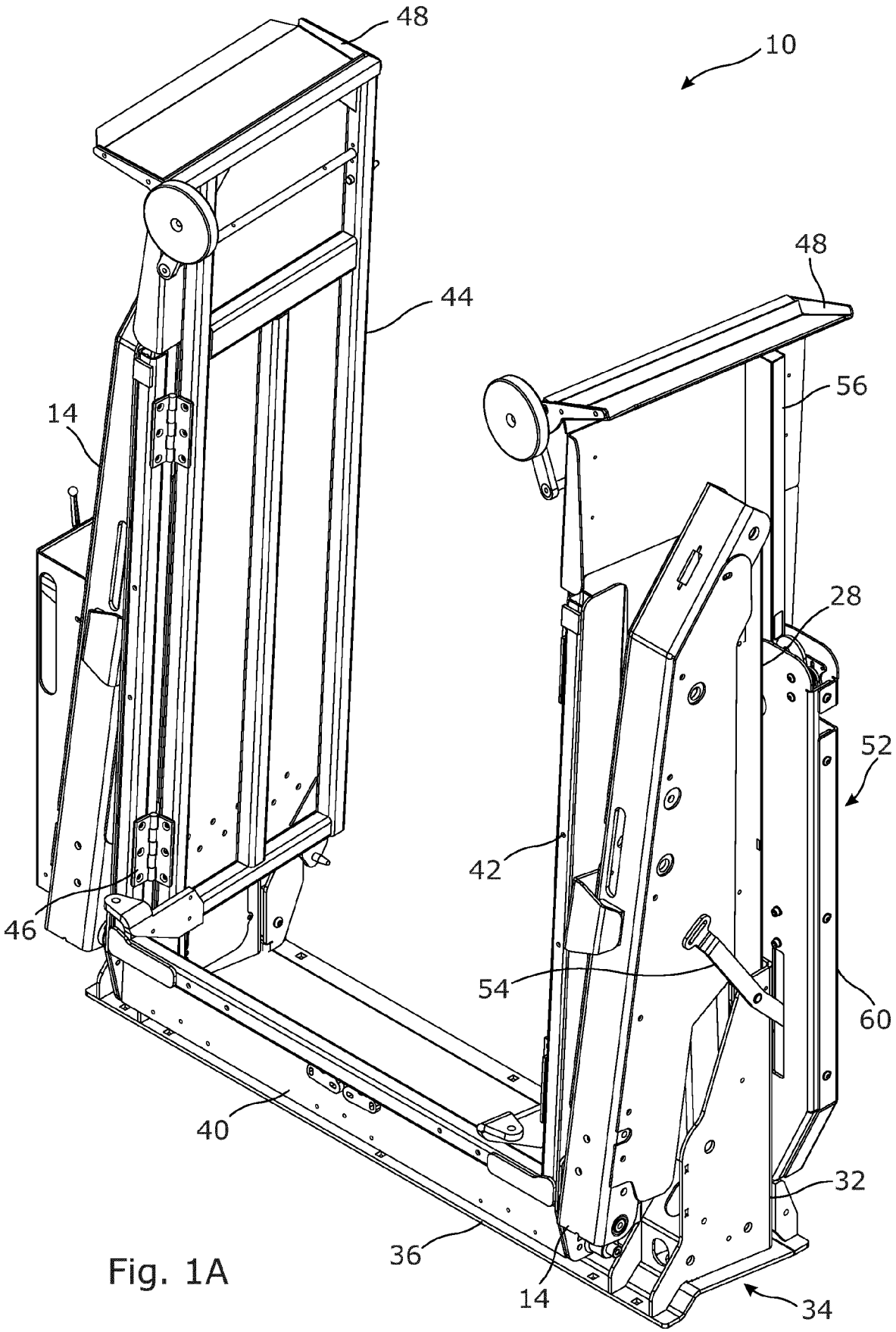

Fig. 1A

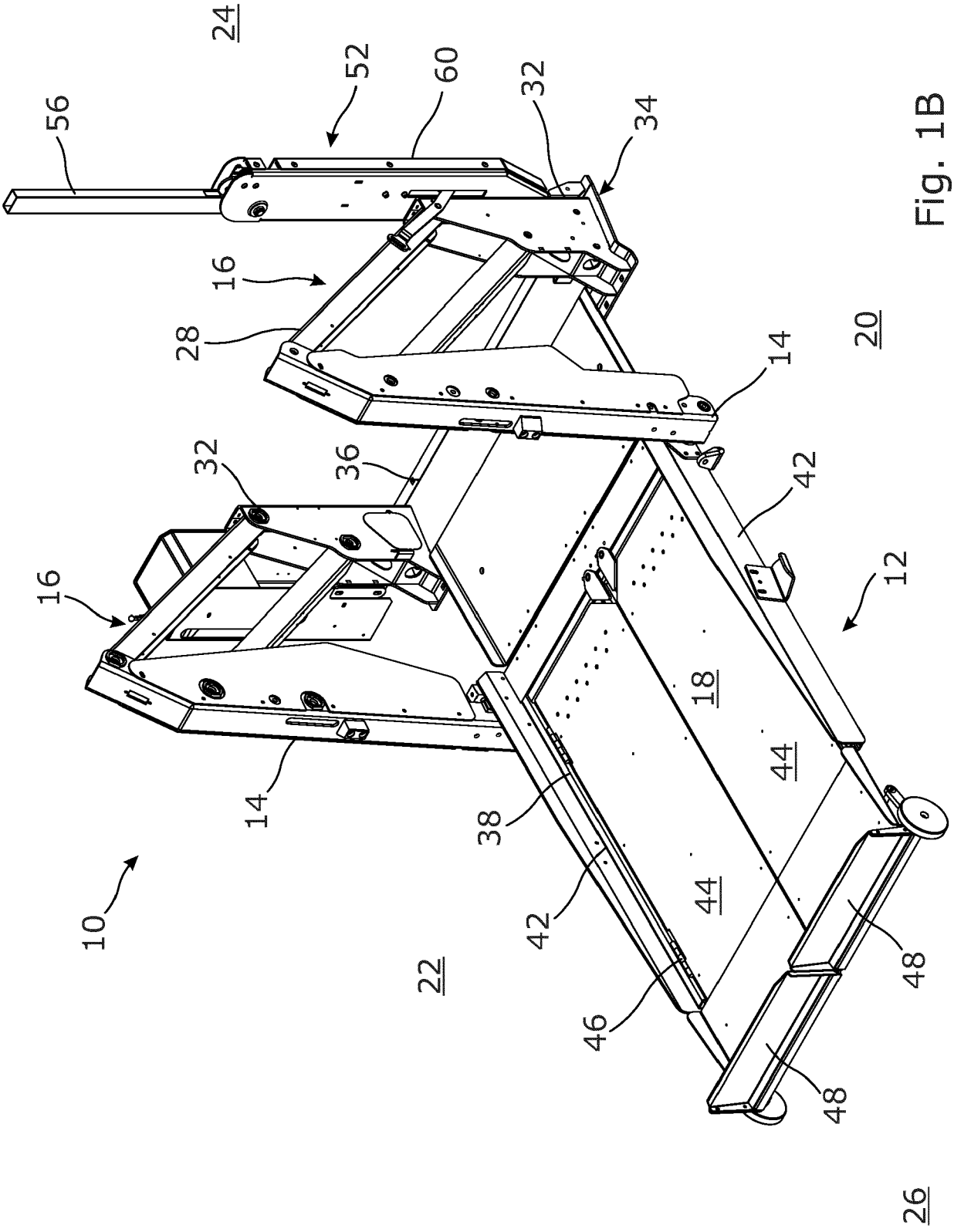
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Fig. 1B

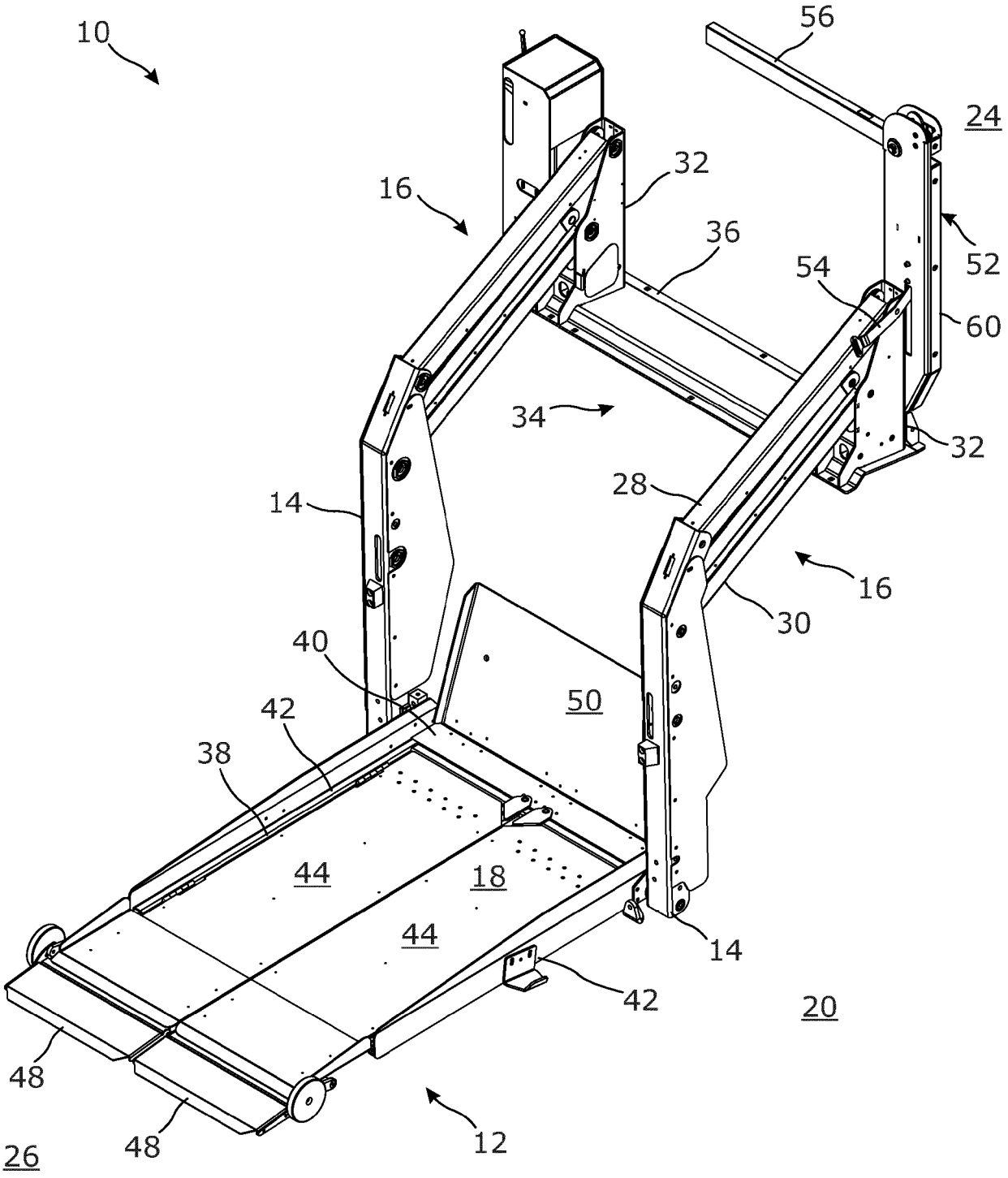
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Fig. 1C

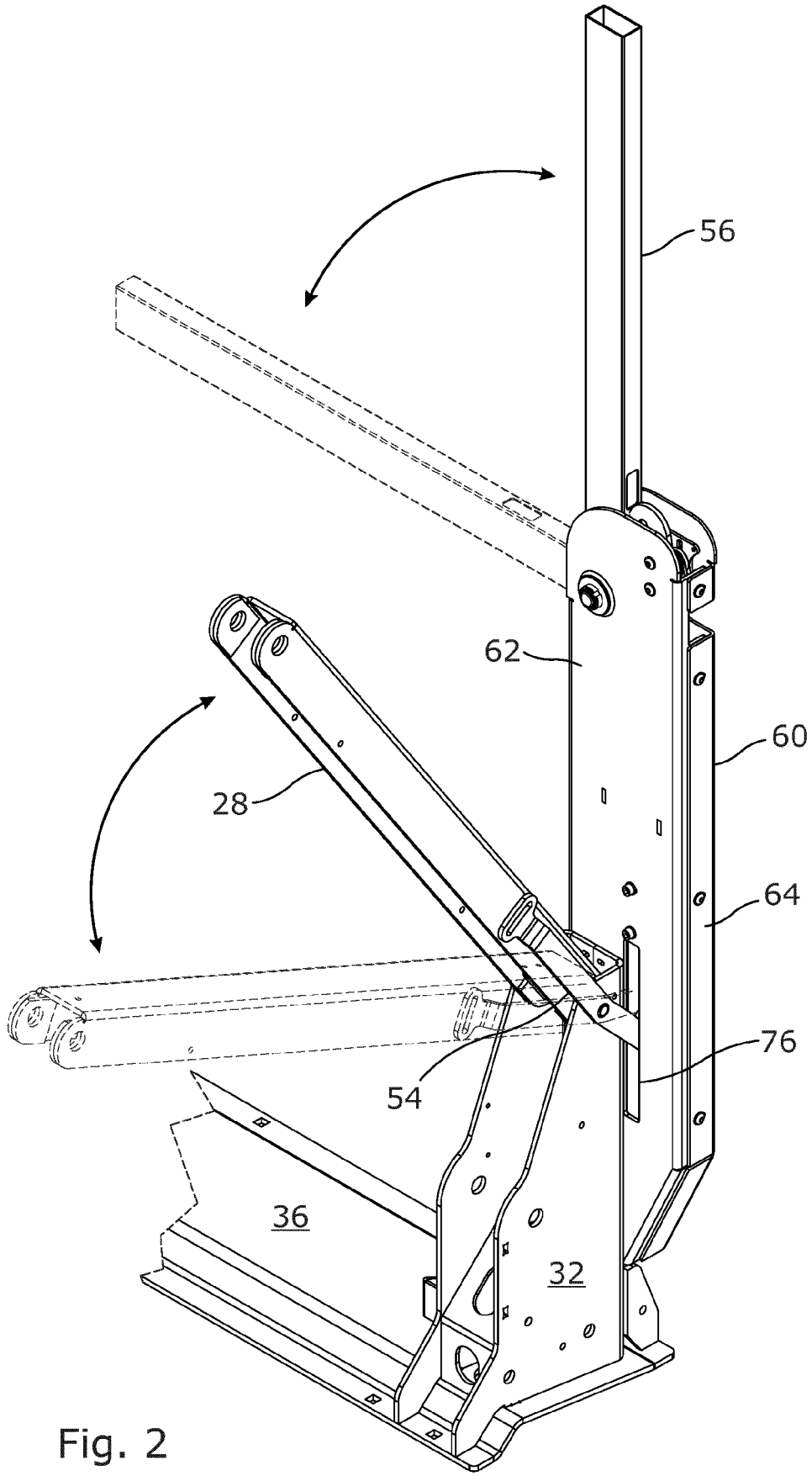

Fig. 2

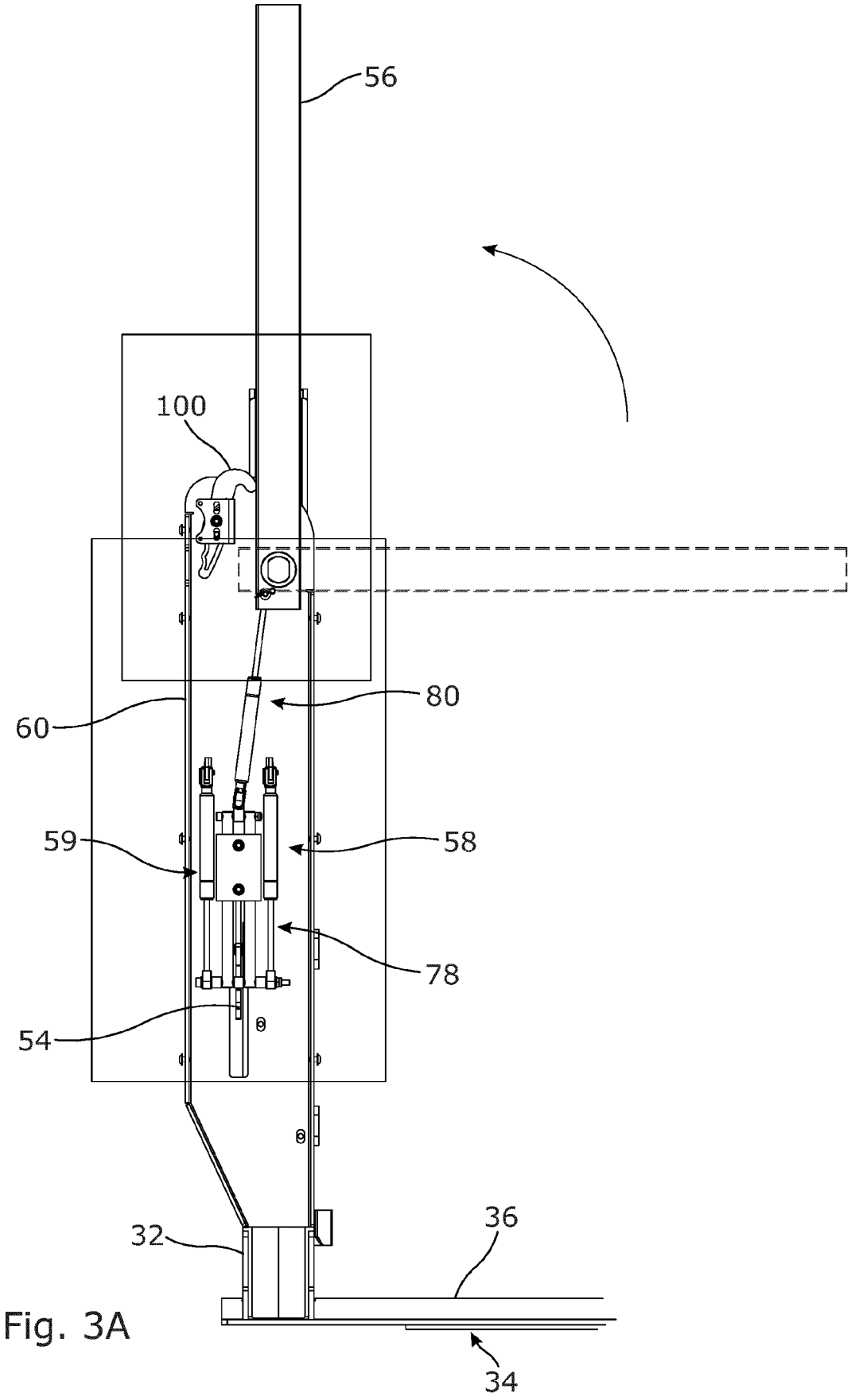

Fig. 3A

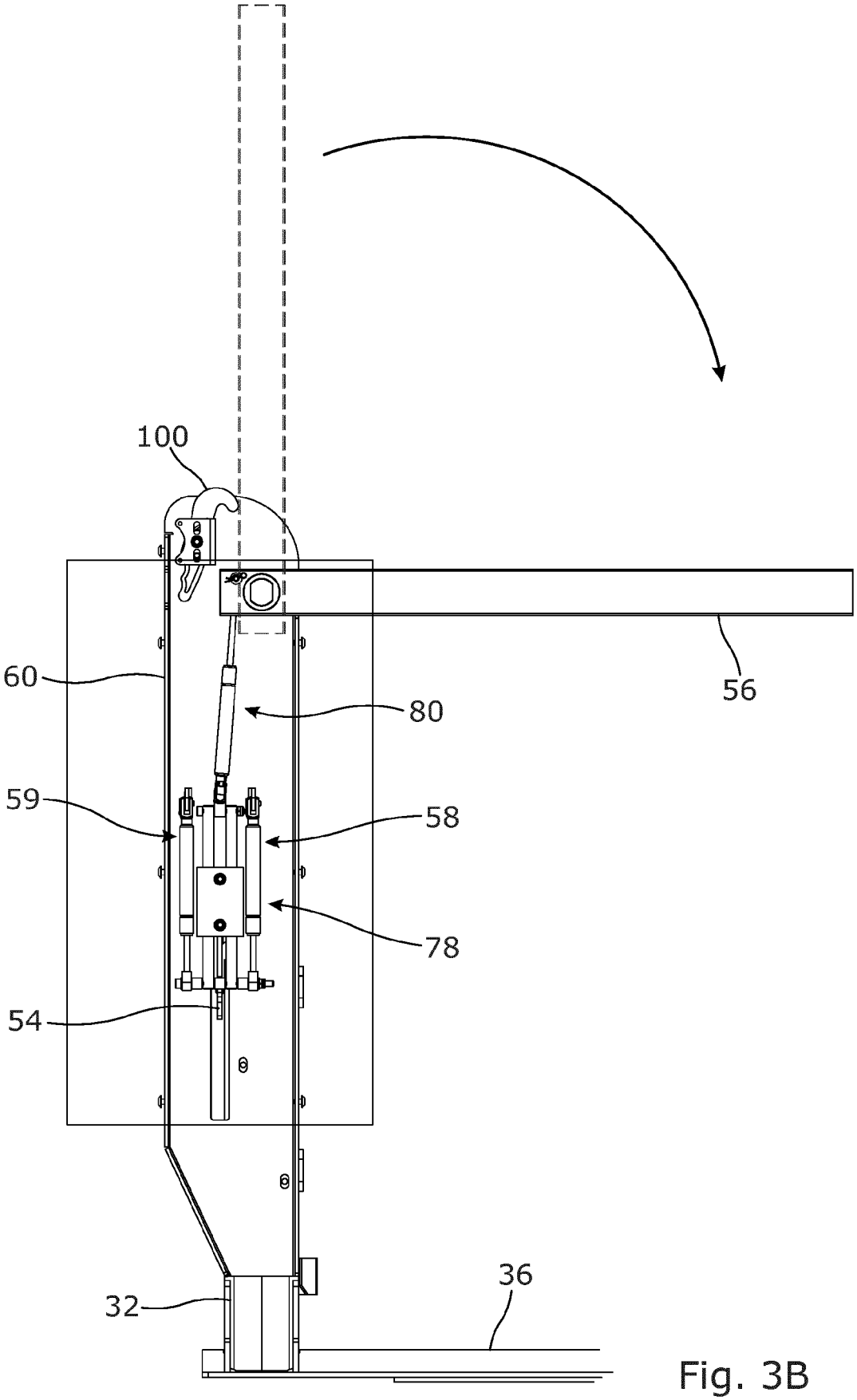

Fig. 3B

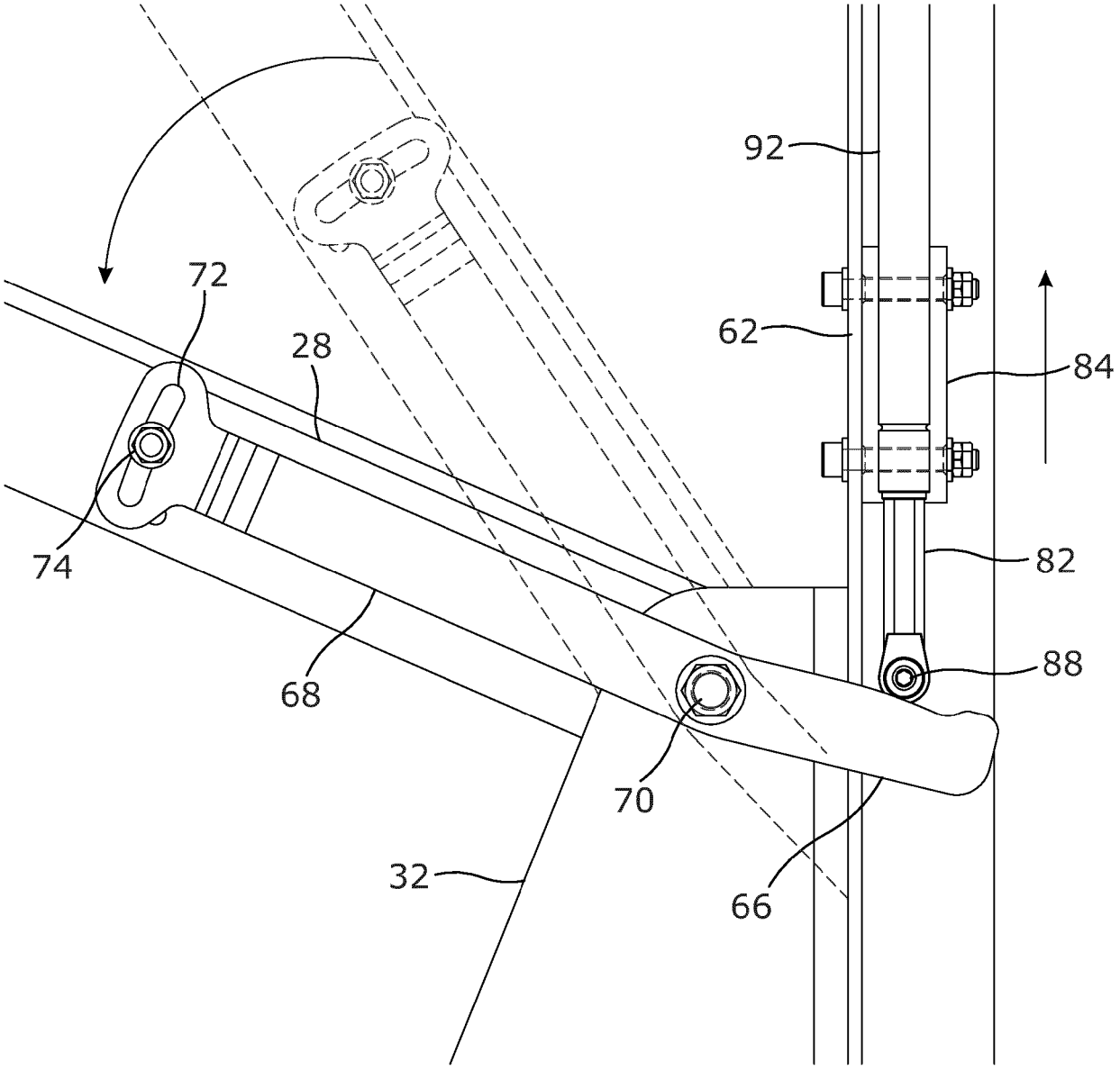

Fig. 4A

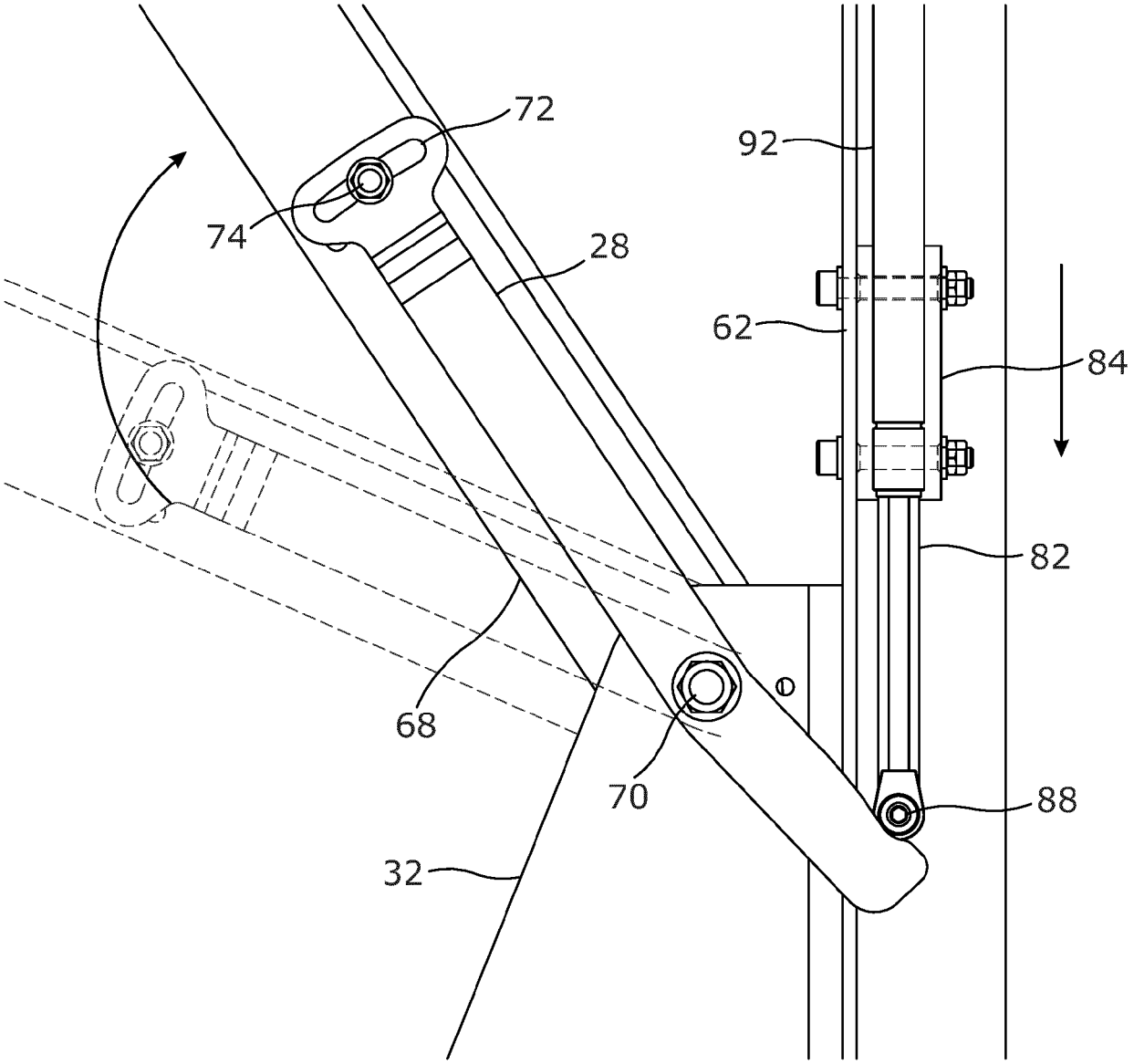

Fig. 4B

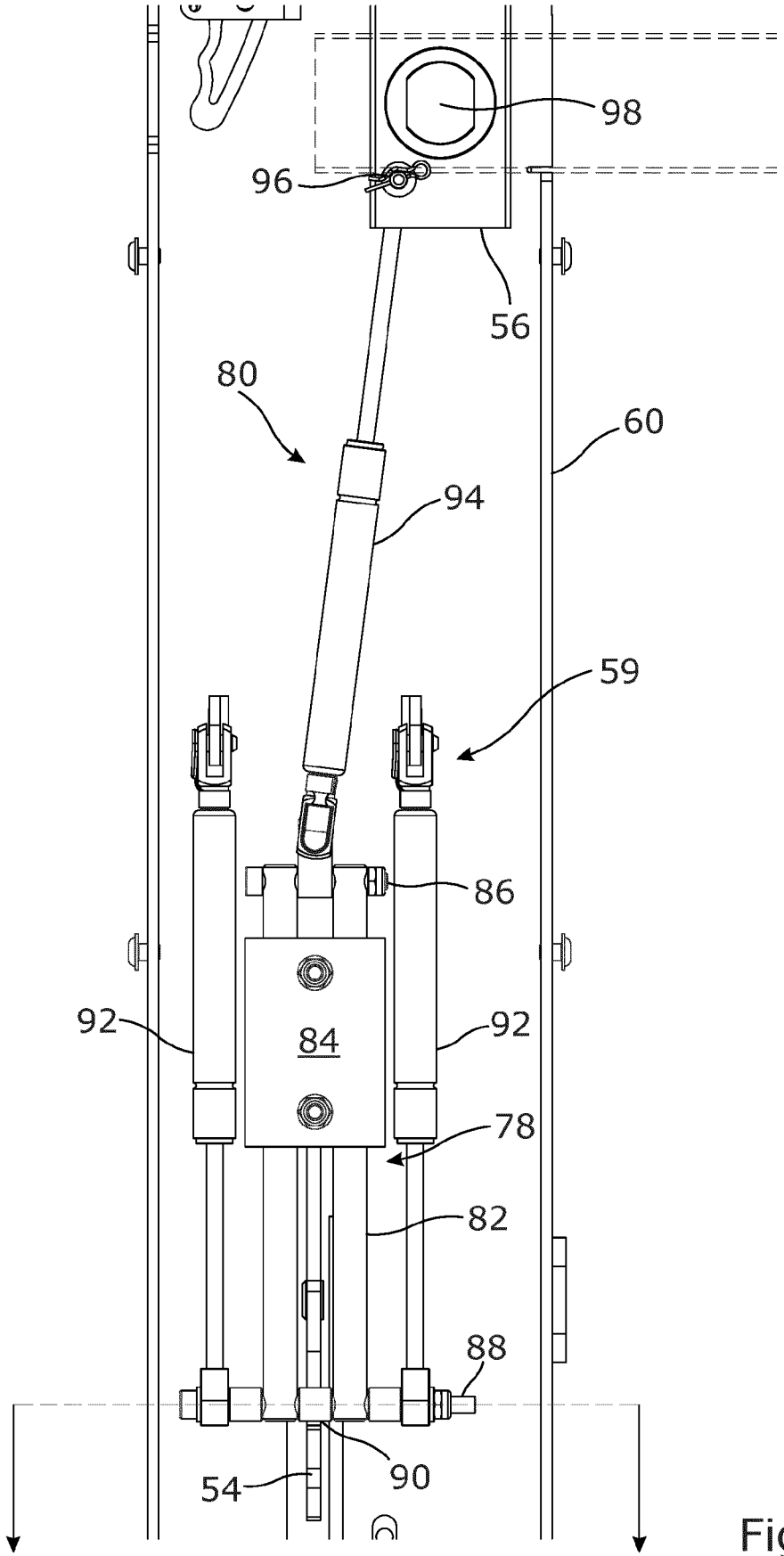

Fig. 5A

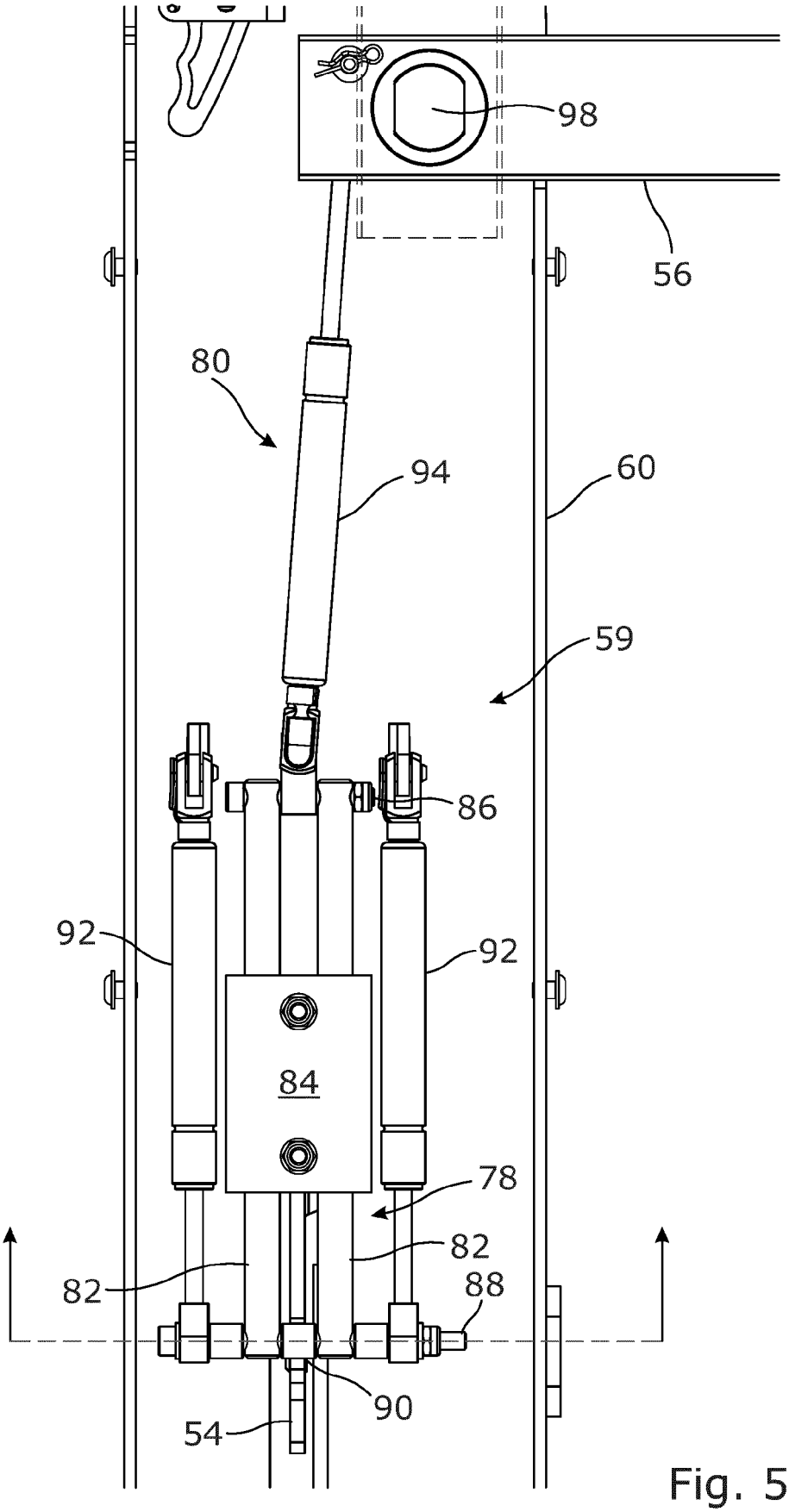

Fig. 5B

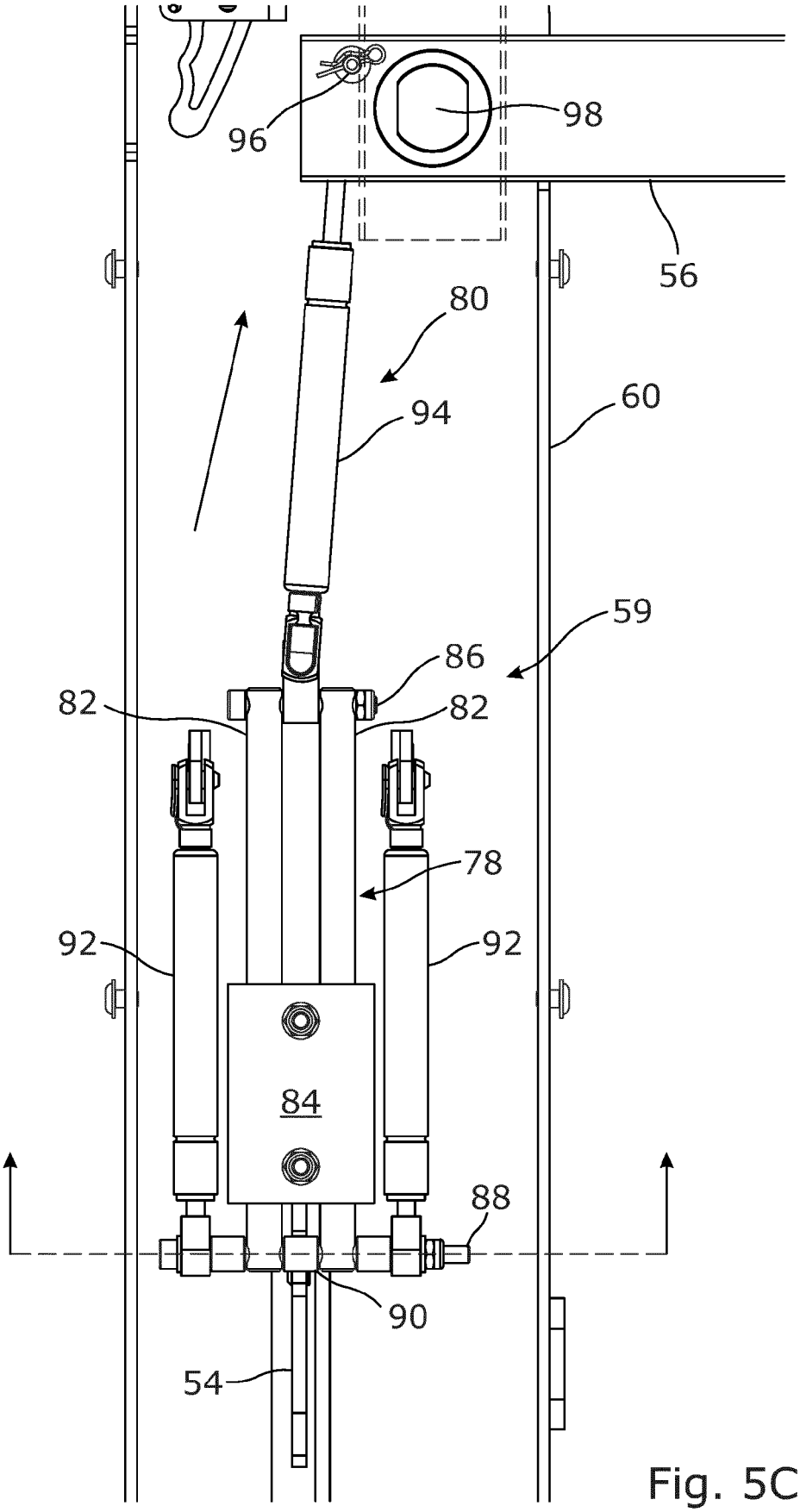

Fig. 5C

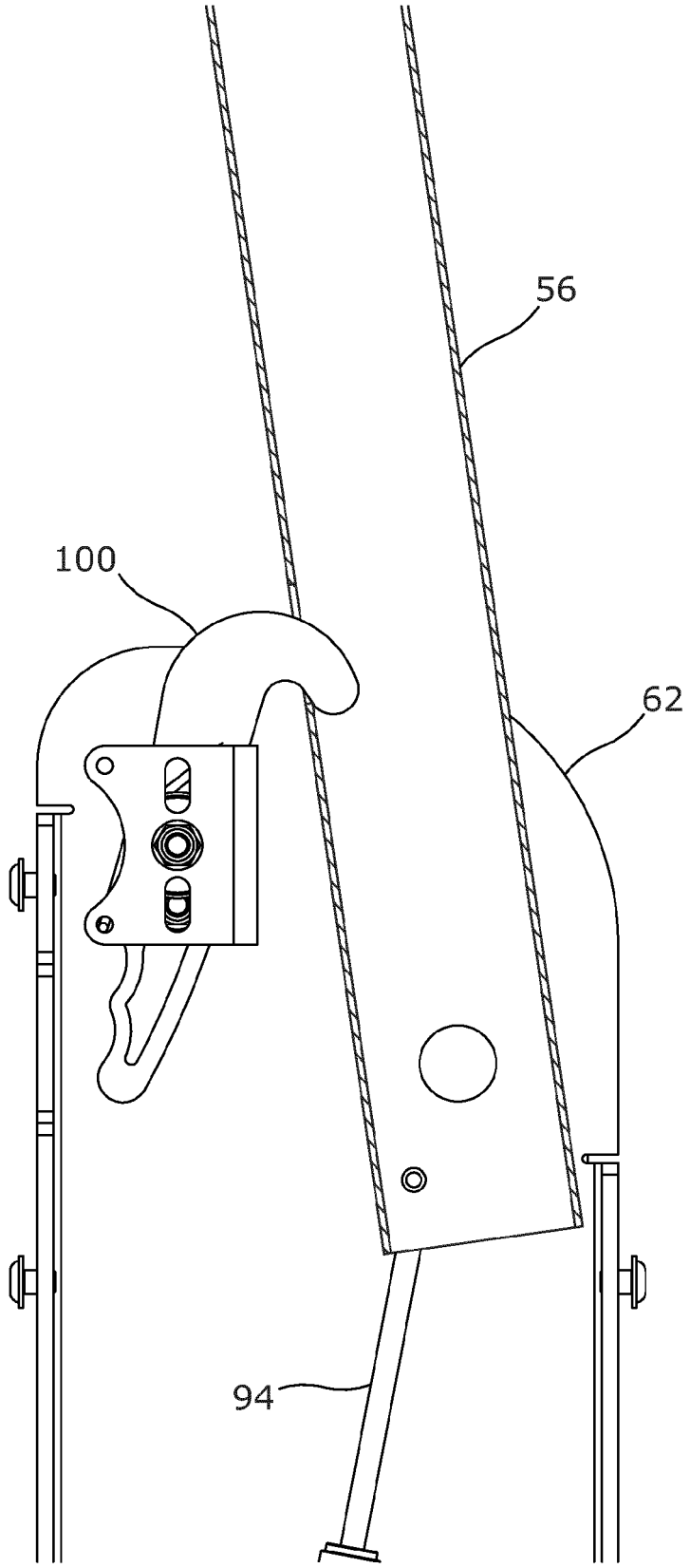

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 0631

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A61G
B60P

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 August 2019	Mammeri, Damya

CATEGORY OF CITED DOCUMENTS

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