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(54) **LIFTING ASSEMBLY**

(57) A lifting assembly for a care bed comprising a first end frame and a second end frame having a mattress platform extending longitudinally between the end frames. At least one actuator mechanism is mounted to at least one of the first and/or second end frames that is configured to provide a corresponding vertical height adjustment of the mattress platform relative to the ground that is the sum of the stroke length of respective first and second linear actuators of the actuator mechanism.

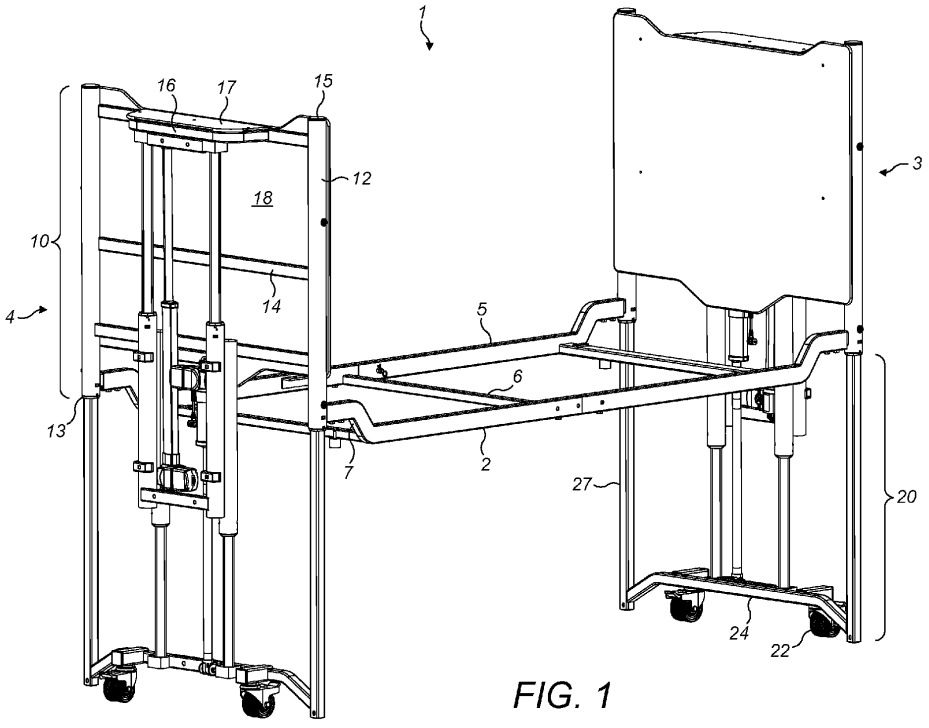


FIG. 1

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## Description

### Field of invention

**[0001]** The present invention relates to a lifting assembly for a bed, such as a care bed used in hospitals, care homes and a home care environment.

### Background art

**[0002]** Patients in hospitals, care homes and a home care environment often require treatment by medical staff whilst in bed. The height of beds may not be ideal for staff to treat patients. It may be too high for safely supporting a patient to enter or leave the bed and too low for medical staff to treat the patient safely. Beds used in hospitals and care homes are often equipped with means to adjust the height of the mattress to allow these various activities to be carried out safely. For vulnerable patients, the minimum height of the bed could present a falls hazard, where a patient could be seriously injured as a result of falling from the mattress platform to the floor. Typically, a low bed designed to place the patient as close to the floor as possible has a limited range of travel, which then presents a risk to carers due to the maximum platform height being too low/unsuitable for a carer to treat the patient.

**[0003]** Conventional care beds achieve height adjustment by a mechanism placed underneath the mattress platform. Height adjustment may be achieved by hydraulic or electronic linear actuators placed under the mattress platform such as in the system described in US3739406A. Actuators under the mattress platform in certain arrangements around a central pivot can also be used to tilt or angle the platform (see US3900906A). A main disadvantage of these mechanisms is their limited range of movement. The fixed components of the mechanism are under the platform and thus prevent lowering of the platform all the way to ground level. A greater range of movement requires longer linear actuators which increases the minimum height achievable.

**[0004]** These issues may be overcome to a limited extent by using a scissor-type lifting mechanism. However, this type of mechanism may be hazardous to children or pets, particularly in a residential care setting. Moreover, bedding and other material may become trapped and jam the mechanism.

**[0005]** US2018116884A discloses a lifting mechanism for a care bed which consists of a telescopic linear actuator mounted at an end of the bed which raises and lowers a headboard. A mattress platform is slidably mounted to the headboard and may be lifted up relative to the headboard by a pulley system. This system therefore allows the mattress platform to be lowered to ground level by retracting the telescopic linear actuator to lower the headboard and then sliding the mattress platform to the lowest point on the headboard. However bedding and other articles may jam the pulley system and over time the ingress of dirt and debris may damage the pulleys. The mattress platform changes position relative to the headboard. When the mattress is in a fully raised position there is minimal headboard available and this system does not therefore offer adequate head/back support and presents a potential risk of falls, due to the limited height of the head/foot board above the mattress.

### Summary of the Invention

**[0006]** The present invention seeks to provide a lifting assembly for a care bed which is capable of adjusting the height of a mattress platform across a wide vertical range from a fully lowered position adjacent the ground to a fully raised position. The fully raised position may be greater than 800 mm above the ground. The height of the mattress platform and the care bed can therefore be adjusted to suit requirements such as when moving patients in and out of bed or providing treatment, thus minimising the risk of falling or discomfort to patients or care staff.

**[0007]** The present invention also seeks to provide a lifting assembly which maintains the head and foot boards at the same height relative to the mattress platform over the entire range of vertical movement. This ensures that adequate safety is provided for the patient when the mattress platform is at any height.

**[0008]** Viewed from a first aspect the present invention provides a lifting assembly for a care bed comprising: a first end frame positioned at a head end of the assembly; a second end frame positioned at a foot end of the assembly, wherein each of the first end frame and the second end frame has an upper portion and a ground-engaging lower portion and is configured such that a vertical separation distance between the upper portion and the ground-engaging lower portion is adjustable; a mattress platform extending longitudinally between and connected to the upper portion of the first end frame and the upper portion of the second end frame; at least one actuator mechanism mounted on at least the first or second end frame; wherein the actuator mechanism has a first telescopic linear actuator and a second telescopic linear actuator, the first telescopic linear actuator having a first elongate housing and a first elongate rod slidably received in the first elongate housing and linearly extendable over a first stroke length between a retracted position and an extended position relative to the first elongate housing and the second telescopic linear actuator having a second elongate housing and a second elongate rod slidably received in the second elongate housing and linearly extendable over a second stroke length between a retracted position and an extended position relative to the second elongate housing; wherein the first telescopic linear actuator is connected to the upper portion and the second telescopic linear actuator is connected to the ground-engaging lower portion; such that an adjustment of the vertical separation distance between the upper portion and the ground-engaging lower portion to provide a

corresponding adjustment of the height of the mattress platform is the sum of the stoke lengths of the first telescopic linear actuator and the second telescopic linear actuator.

**[0009]** Reference within this specification to '*a sum of the stroke length of the first telescopic linear actuator and the second telescopic linear actuator*' encompass the first and second actuators being arranged such that their stroke lengths is considered cumulative, additive, combined for example to work in-series. This provides that the stroke length of the first actuator is in combination with the stroke length of the second actuator to provide a sum total of the height adjustment of the mattress platform from the ground via a corresponding adjustment and vertical separation between the upper portion and the ground-engaging lower portion of the respective first and/or second end frames. Accordingly, reference to the *'sum'* of the stroke lengths encompasses an arrangement in which the first and second actuators are oppositely positioned such that the elongate rod of the first actuator extends upwardly from the first housing and the second elongate rod of the second actuator extends downwardly from the second housing. It also encompasses an arrangement in which the first and second actuators both extend from their respective housings in the same direction but are vertically offset.

**[0010]** By mounting the actuator mechanisms at one or both end frames of the assembly rather than underneath the mattress platform it is possible for the mattress platform to be lowered down to ground level. The use of telescopic linear actuators simplifies the actuator mechanism compared to scissor-type lifting mechanisms or pulley type lifting mechanisms. Linear actuators offer a more contained lifting system, limiting the risk of articles such as bedding becoming trapped in and damaging the mechanism, it also presents a lower risk for the patients, carers and others.

**[0011]** The telescopic linear actuators may be driven by any suitable means such as hydraulics, pneumatics or electronics. Preferably the telescopic linear actuators are electronically driven.

**[0012]** Preferably a maximum vertical separation distance between the upper portion and the ground-engaging lower portion may be the combination and sum of the first stroke length and the second stroke length. This may be achieved by orientating the first and second actuators in opposed position such that one actuator operates upwardly and the alternate actuator operates downwardly (with regard to telescopic extension). Additionally, the maximum vertical separation distance may be achieved by arranging the first and second linear actuators in a vertically offset configuration to avoid an overlap of the two elongate rods. This is advantageous as it maximises the range of vertical separation for a given size of linear actuator.

**[0013]** The upper portion may have a pair of transversely spaced apart leg housing tubes and the ground-engaging lower portion may have a pair of transversely spaced apart legs telescopically mounted respectively in the pair of leg housing tubes. Although not structurally essential (the actuator mechanisms act as the main load bearers for the upper portion) the legs provide extra support to the upper portion and prevent lateral deviation of the upper portion during vertical movement. They also define the corners of the assembly which may assist when positioning the assembly around other items of furniture and keeping the space underneath the mattress platform free from obstructions to permit lowering. Preferably, the spaced apart leg housing tubes and the spaced apart legs of the respective upper portion and ground-engaging lower portion may be parallel with respect to one another.

**[0014]** The leg housing tubes on the upper portion may provide a suitable attachment point for side rails which may run longitudinally and parallel to the mattress platform between the two end frames to provide additional protection against a patient falling from the care bed.

**[0015]** The first telescopic linear actuator may be rigidly connected to the second telescopic linear actuator by a first pair of stabilising rams and a second pair of stabilising rams. Such rams may be mounted rigidly together in an offset side-by-side arrangement. The stabilising rams reduce the load on the actuators, which may prolong the life of the actuators and reduce the risk of malfunction. The stabilising rams also limit lateral movement of the actuator mechanism during vertical displacement. Each stabilising ram may have a ram housing and a shaft received within the ram housing which is linearly extendable and retractable relative to the ram housing.

**[0016]** A distal end of each of the first pair of stabilising rams may be coupled to the upper portion and a distal end of each of the second pair of stabilising rams is coupled to the ground-engaging lower portion. In certain embodiments, the distal end is the end of the linearly extendable shaft furthest from the ram housing. In this case the ram housings of the first and second pairs are positioned adjacent each other and mounted rigidly together with the shafts extending in opposite vertical directions.

**[0017]** A lower support brace may be fixed transversely between the first pair of stabilising rams and an upper support brace may be fixed transversely between the second pair of stabilising rams. This creates a rigid structure consisting of the first and second pairs of ram housings and the lower and upper support braces.

**[0018]** A lower end of the first elongate housing of the first telescopic linear actuator may be attached to the lower support brace and an upper end of the second elongate housing of the second telescopic linear actuator may be attached to the upper support brace. The first telescopic linear actuator and the second telescopic linear actuator may be transversely spaced apart. Optionally, the first and second linear actuators may be vertically offset such that an uppermost end and/or a lowermost end of each respective housing may be to different position in the vertical height direction relative to the alternate linear actuator.

**[0019]** Preferably the first and second linear actuators are arranged to extend and retract vertically in opposite directions. This allows the first and second elongate housings to be mounted to overlap vertically without any vertical overlap of the elongate rods. This maximises the vertical range of movement of the actuator mechanism whilst minimising the length of the actuator mechanism in its fully retracted configuration.

**[0020]** Where the first and second linear actuators are arranged to extend and retract vertically in opposite directions, a distal end of the first elongate rod may be connected to the upper portion and a distal end of the second elongate rod may be connected to the ground-engaging lower portion. The distal end of the first elongate rod may be connected directly to the upper portion or may be connected to an upper transverse rail which is itself connected to the upper portion. Similarly, the distal end of the second elongate rod may be connected directly to the ground engaging lower portion or may be connected to a lower transverse rail which is itself connected to the ground engaging lower portion. The use of upper and lower transverse rails allows the entire actuator mechanism (including the distal ends of the shafts and elongate rods) to be attached and removed from the upper portion and ground engaging lower portions as a single unit. This enables easy replacement of the actuator mechanism or disassembly for transportation.

**[0021]** The first pair of ram housings may have at least one fastener for fastening a cover board to protect the actuator mechanism. The fastener may be any suitable fastener such as a clip or a threaded hole suitable for receiving a bolt or screw. The cover board advantageously prevents or limits the ingress of foreign objects into the actuator mechanism which may cause the mechanism to stick or become damaged. The cover board is preferably removable to allow servicing or replacement of the actuator mechanism.

**[0022]** Preferably the first telescopic linear actuator is operable independently from the second linear actuator. This allows a user greater control over the position of the mattress platform. For example, the second linear actuator may be temporarily disabled in a fully extended position for patients who do not require the care bed to be lowered to a fully lowered position in contact with the ground.

**[0023]** The linear actuators may be controllable with foot pedals positioned at one or both ends of the assembly. Alternatively the linear actuators may be controlled by an electronic control panel mounted on or near the assembly. The linear actuators may be controlled via a computer operating software designed to enable a user to manipulate the positions of one or multiple care beds.

**[0024]** Preferably, a length the first elongate housing and the first elongate rod is greater than a length of second elongate housing and the second elongate rod such that the first stroke length is greater than or equal to the second stroke length. In this manner, the first linear actuator may be used to adjust the position of the mattress platform across a normal range, with the second linear actuator being usable to lower the mattress platform below the normal range down to ground level. The normal range may be defined as a mattress platform height above ground of between slightly under 400 mm and slightly above 800 mm. Moreover, the present actuating mechanism and care bed arrangement is configured to lower the mattress platform towards ground level to provide a separation distance of less than 100 mm. Optionally, this minimum clearance above ground may be in a range 50 mm to 100 mm.

**[0025]** Preferably the mattress platform is connected to the upper portion of the first end frame and the upper portion of the second end frame via angled connectors. This ensures that the mattress platform can be lowered into contact with the ground.

**[0026]** Preferably, the at least one actuator mechanism comprises a first actuator mechanism mounted on the first end frame and a second actuator mechanism mounted on the second end frame. The first and second actuator mechanisms may be controlled by the same or independent control units. Preferably, both actuator mechanisms are controlled and operated in-parallel to provide a combined raising and lowering of the mattress platform in a coordinated manner.

**[0027]** Preferably, the first elongate housing of the first telescopic linear actuator is rigidly connected to the second elongate housing of the second telescopic linear actuator. The mechanical connection between the housings of the respective first and second telescopic linear actuators may be via a connecting frame arrangement and/or part of a frame connecting the stabilising rams to the respective first and second telescopic linear actuators.

## Brief description of drawings

**[0028]** A specific implementation of the present invention will now be described, by way of example only, and with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a lifting assembly for a care bed in a fully raised position;

Figure 2 is a perspective view of the lifting assembly of Figure 1 in a fully lowered position;

Figure 3 is an end view of the fully extended actuator unit and mountings of Figure 1;

Figure 4 is an end view of the fully retracted actuator unit and mountings of Figure 2;

Figure 5 is a perspective view of the fully retracted actuator unit and mountings of Figure 4;

Figure 6 is a side view of the lifting assembly of Figure 1 in a fully raised position; and

Figure 7 is a side view of the lifting assembly of Figure 2 in a fully lowered position.

Detailed description of preferred embodiment of the invention

**[0029]** Referring initially to Figures 1 and 2, a lifting assembly 1 for a care bed is shown. The lifting assembly 1 has a first end frame 3 positioned at a head end and a second end frame 4 positioned at a foot end. Extending between the first and second end frames 3, 4 is a mattress platform 2. The mattress platform 2 has two parallel, spaced apart longitudinal bars 5 connected by parallel, spaced apart transverse bars 6. The longitudinal and transverse bars 5, 6 define a substantially planar upper surface 8 (best illustrated by Figures 6 and 7) upon which a standard single mattress (width 90 cm, length 199 cm) and associated bedding is placed in use to constitute the care bed.

**[0030]** The longitudinal bars 5 of the mattress platform 2 are each connected to the first and second end frames 3, 4 via angled connectors 7 at their respective ends. The planar upper surface 8 is below the connection point between the angled connectors 7 and the first and second end frames 3, 4. This allows the mattress platform 2 to be adjacent to the ground when the assembly is in a fully lowered position as shown in Figure 2. A plurality of feet 9 are attached to the transverse bars 6. The feet 9 contact the ground when the mattress platform 2 is in the fully lowered position. The planar upper surface 8 of the mattress platform 2 is approximately 70 mm above the ground when the lifting assembly 1 is in the fully lowered position.

**[0031]** Each of the first and second end frames 3, 4 has an upper portion 10 and a ground-engaging lower portion 20. The upper portion 10 has a pair of parallel, transversely spaced apart leg housing tubes 12. The angled connectors 7 are connected near a lower end of the leg housing tubes 12. The leg housing tubes 12 are hollow cylinders and are capped at an upper end by a plastic cap 15. The pair of leg housing tubes 12 are connected by a plurality of transverse cross bars 14. Mounted on an inward facing side of the leg housing tubes 12 and the transverse cross bars 14 is a cover board 18. The cover board 18 is composed of a wood material/solid board.

**[0032]** A C-shaped mounting bar 16 protrudes from an outward facing side of an uppermost transverse cross bar 14. An upper surface of the mounting bar 16 supports a table 17 on which the user can store small items such as a cup or a book. The table 17 is composed of the same material as the cover board 18.

**[0033]** The ground-engaging lower portion 20 has a transverse mounting bar 24 extending between and connected to a pair of parallel, transversely spaced apart legs 27. The lifting assembly 1 therefore has four legs 27 disposed substantially rectangularly. Each leg 27 has a square cross-section. The transverse mounting bar 24 has a raised central portion and tapers downwardly at each end. This allows the mounting of two casters 22 underneath the transverse mounting bar 24.

**[0034]** Each leg 27 is slidably received in one of the leg housing tubes 12 of the upper portion 10. A bearing 13 is provided at the lower end of each leg housing tube 12 to prevent lateral movement of the leg 27 within the leg housing tube 12 and to prevent the leg 27 being withdrawn from the leg housing tube 12.

**[0035]** Between the upper portion 10 and the ground-engaging lower portion 20 of each end frame 3, 4 is mounted an actuator mechanism 30. Specifically, the actuator mechanism 30 is connected to the ground-engaging lower portion 20 at the transverse mounting bar 24 and to the upper portion 10 at the C-shaped mounting bar 16 as described below.

**[0036]** Referring now to Figures 3 to 5, the actuator mechanism 30 has a first telescopic linear actuator 32 and a second telescopic linear actuator 36 which are transversely and longitudinally spaced apart and vertically offset. The first and second linear actuators 32 and 36 are electronically operated and controlled by a control panel provided at or near to the lifting assembly 1. The first linear actuator 32 has an elongate housing 33 and an elongate rod 34 which is received in the elongate housing 33. The second linear actuator 36 has an elongate housing 37 and an elongate rod 38 which is received in the elongate housing 37. A lower end of the elongate housing 33 of the first linear actuator 32 is attached to a lower support brace 41a. An upper end of the elongate housing 37 of the second linear actuator 36 is attached to an upper support brace 41b.

**[0037]** The first and second linear actuators 32 and 36 are arranged to extend and retract vertically in opposite directions. The elongate rod 34 of the first linear actuator 32 extends upwardly and is fixed at a distal end to an upper transverse rail 35. As best shown in Figures 1 and 2, the upper transverse rail 35 is attached to the C-shaped mounting bar 16 of the upper portion 10. The elongate rod 38 of the second linear actuator 36 extends downwardly and is fixed at a distal end to a lower transverse rail 39. The lower transverse rail 39 is attached to the transverse mounting bar 24 of the ground-engaging lower portion 20.

**[0038]** In addition to the first and second linear actuators 32, 36, each actuator mechanism 30 also has a first pair of stabilising rams 40 which are transversely spaced apart and a second pair of stabilising rams 42 which are transversely spaced apart. The first pair of stabilising rams 40 and the second pair of stabilising rams 42 are mounted rigidly together in a vertically offset, longitudinally side-by-side arrangement. Each stabilising ram 40, 42 has a ram housing 43 and a shaft 44 slidably received within the ram housing 43. The shafts 44 of the first pair of stabilising rams 40 extend upwardly whereas the shafts 44 of the second pair of stabilising rams 42 extend downwardly. A bearing 45 is disposed in one end of the ram housing 43 to prevent lateral movement or over-ex-

tension of the shaft 44. The lower support brace 41a is fixed transversely between the ram housings 43 of the first pair of stabilising rams 40. Similarly the upper support brace 41b is fixed transversely between the ram housings 43 of the second pair of stabilising rams 42. The upper and lower support braces 41a, b ensure that the ram housings 43 and the elongate housings 33,37 have a rigid structure and are able to move together.

**[0039]** At a distal end of each shaft 44 is fixed a coupling block 46. The coupling blocks 46 on the respective shafts 44 of the first pair of stabilising rams 40 are fixed at each end of the upper transverse rail 35 (which itself is attached to the C-shaped mounting bar 16 of the upper portion 10). The coupling blocks 46 on the respective shafts 44 of the second pair of stabilising rams 42 are fixed at each end of the lower transverse rail 39 (which itself is attached to the transverse mounting bar 24 of the ground-engaging lower portion 20). The ram housings 43 of the first pair of stabilising rams 40 each have two fixation points 47 to allow a cover (not shown) to be secured over the actuator mechanism 30. This improves the visual appearance of the lifting assembly 1 and helps to prevent any foreign objects such as bedsheets getting caught in the actuator mechanism 30.

**[0040]** The actuator mechanisms 30 mounted at each end frame 3, 4 are operated cooperatively to raise and lower the mattress platform 2 and upper portions 10. By operating at the same speed, the actuator mechanisms 30 ensure the mattress platform 2 remains in a horizontal or nearly horizontal position during movement.

**[0041]** From when the lifting assembly 1 is in the fully lowered position shown in Figures 4 and 5, the second linear actuator 36 at each end frame 3, 4 is activated so that the elongate rod 38 extends. This pushes the elongate housing 37 upwards together with those components of the actuator mechanism 30 which are rigidly connected to the elongate housing 37, namely the support braces 41a, 41b, the elongate housing 33 of the first linear actuator 32 and the ram housings 43 of the first and second pair of stabilising rams 40, 42. As the first pair of stabilising rams 40 is connected to the upper portion 10, the upper portion 10 is caused to move upwards together with the mattress platform 2. The shafts 44 of the second pair of stabilising rams 42 are fixed to the ground-engaging lower portion 20 and therefore extend from their ram housings 43 as the elongate housing 38 of the second linear actuator 36 is driven to extend. Similarly, the legs 27 extend from the leg housing tubes 12 as the upper portion 10 is lifted.

**[0042]** The second linear actuator 36 has a stroke length (defined as the difference in the total length of the actuator between a fully extended position and a fully retracted position) of slightly less than 400 mm. The second linear actuator 36 is therefore capable of lifting the mattress platform 2 from the fully lowered position (where the planar upper surface 8 is approximately 70 mm above the ground) to a mid-height position where the planar upper surface 8 is slightly less than 400 mm above the ground. This enables the mattress to be lowered from a standard height to a position adjacent the ground to allow patients with restricted mobility to be moved on or off the mattress with a lower risk of falling.

**[0043]** When the mattress platform 2 is in the fully lowered position, the mid-height position or a height between these positions, the first linear actuators 32 remain fully retracted. The mattress platform 2 can be raised above the mid-height position by activating the first linear actuator 32 at each end frame 3, 4 to extend. The elongate rod 34 of the first linear actuator 32 pushes upwards on the C-shaped mounting bar 16 which lifts the upper portion 10 and mattress platform 2. The shafts 44 of the first pair of stabilising rams 40 are fixed to the upper portion 10 and therefore extend from their ram housings 43 as the first linear actuator 32 is driven to extend. The legs 27 extend further from the leg housing tubes 12 as the upper portion 10 is lifted.

**[0044]** The first linear actuator 32 has a stroke length of around 410 mm which is slightly longer than the stroke length of the second linear actuator 36. This advantageously allows the first linear actuator 32 to cover a range of heights for the mattress platform 2 between the mid-height position and a fully raised position where the planar upper surface 8 is greater than 800 mm above the ground. Accordingly, the first linear actuators 32 alone provide a vertical range of movement from just below 400 mm to above 800 mm. The second linear actuators 36 need only be re-activated when lowering to ground level is required.

**[0045]** The overall effect of their consecutive activation is that the stroke length of the first and second linear actuators 32, 36 is cumulative (*ie* additive or combined) allowing a desired height to be selected over a significant range.

**[0046]** By moving the upper portions 10 together with the mattress platform 2, the relative height of the cover boards 18 and the mattress platform 2 is maintained. The cover boards 18 may be used to support a sitting patient and to ensure their privacy and support is maintained when the mattress platform 2 is at any height.

## Claims

**1.** A lifting assembly for a care bed comprising:

a first end frame positioned at a head end of the assembly;
a second end frame positioned at a foot end of the assembly, wherein each of the first end frame and the second end frame has an upper portion and a ground-engaging lower portion and is configured such that a vertical separation distance between the upper portion and the ground-engaging lower portion is adjustable;
a mattress platform extending longitudinally between and connected to the upper portion of the

first end frame and the upper portion of the second end frame;
at least one actuator mechanism mounted on at least the first or second end frame;
wherein the actuator mechanism has a first telescopic linear actuator and a second telescopic linear actuator, the first telescopic linear actuator having a first elongate housing and a first elongate rod slidably received in the first elongate housing and linearly extendable over a first stroke length between a retracted position and an extended position relative to the first elongate housing, and the second telescopic linear actuator having a second elongate housing and a second elongate rod slidably received in the second elongate housing and linearly extendable over a second stroke length between a retracted position and an extended position relative to the second elongate housing;
wherein the first telescopic linear actuator is connected to the upper portion and the second telescopic linear actuator is connected to the ground-engaging lower portion such that an adjustment of the vertical separation distance between the upper portion and the ground-engaging lower portion to provide a corresponding adjustment of the height of the mattress platform is the sum of the stroke lengths of the first telescopic linear actuator and the second telescopic linear actuator.

**2.** The lifting assembly as claimed in claim 1, wherein a maximum vertical separation distance between the upper portion and the ground-engaging lower portion is the combination of each of the first stroke length and the second stroke length.

**3.** The lifting assembly as claimed claim 1 or 2 wherein the upper portion of each of the end frames has a pair of transversely spaced apart leg housing tubes and the ground-engaging lower portion of each of the end frames has a pair of transversely spaced apart legs telescopically mounted respectively in the pair of leg housing tubes.

**4.** The lifting assembly as claimed in any preceding claim wherein the first telescopic linear actuator is rigidly connected to the second telescopic linear actuator by a first pair of stabilising rams and a second pair of stabilising rams.

**5.** The lifting assembly as claimed in claim 4 wherein each stabilising ram has a ram housing and a shaft received within the ram housing which is linearly extendable and retractable relative to the ram housing.

**6.** The assembly as claimed in claim 4 or 5 wherein the first pair of stabilising rams and the second pair of stabilising rams are mounted rigidly in a side-by-side arrangement.

**7.** The lifting assembly as claimed in claim 5 or 6 wherein a distal end of each of the first pair of stabilising rams is coupled to the upper portion and a distal end of each of the second pair of stabilising rams is coupled to the ground-engaging lower portion.

**8.** The lifting assembly as claimed in any of claims 4 to 7 wherein a lower support brace is fixed transversely between the first pair of stabilising rams and an upper support brace is fixed transversely between the second pair of stabilising rams.

**9.** The lifting assembly as claimed in claim 8 wherein a lower end of the first elongate housing of the first linear actuator is attached to the lower support brace and an upper end of the second elongate housing of the second linear actuator is attached to the upper support brace.

**10.** The lifting assembly as claimed in any preceding claim wherein the first telescopic linear actuator and the second telescopic linear actuator are transversely spaced apart and vertically offset.

**11.** The lifting assembly as claimed in any preceding claim wherein the first and second linear actuators are arranged to extend and retract vertically in opposite directions.

**12.** The assembly as claimed in claim 11 wherein a distal end of the first elongate rod is connected to the upper portion and a distal end of the second elongate rod is connected to the ground-engaging lower portion.

**13.** The lifting assembly as claimed in any preceding claim wherein the first telescopic linear actuator is operable independently from the second linear actuator.

**14.** The lifting assembly as claimed in any preceding claim, wherein a length of first elongate housing and the first elongate rod is greater than a length of second elongate housing and the second elongate rod such that the first stroke length is greater than or equal to the second stroke length.

**15.** The assembly as claimed in any preceding claim, wherein the at least one actuator mechanism comprises a first actuator mechanism mounted on the first end frame and a second actuator mechanism mounted on the second end frame.

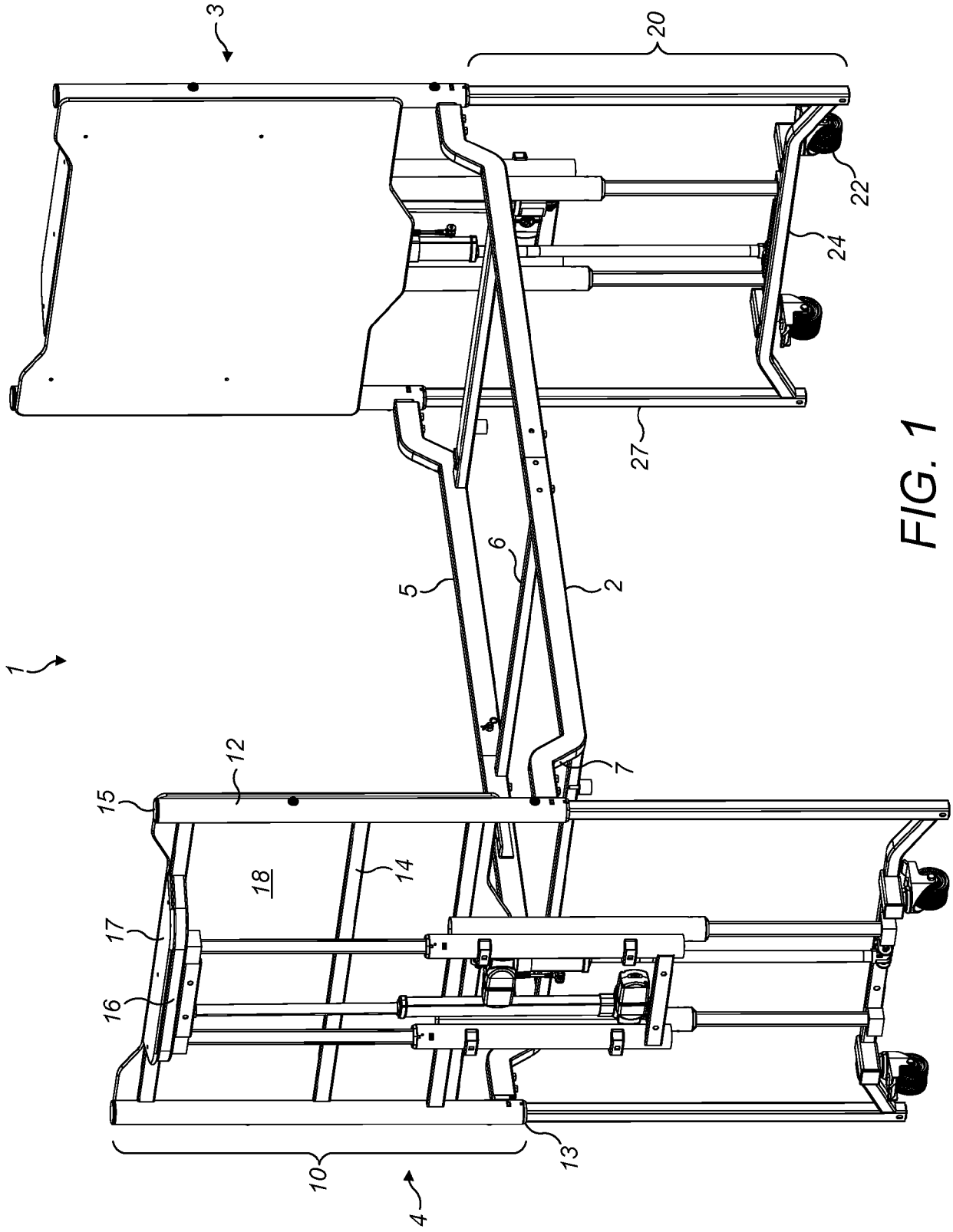


FIG. 1

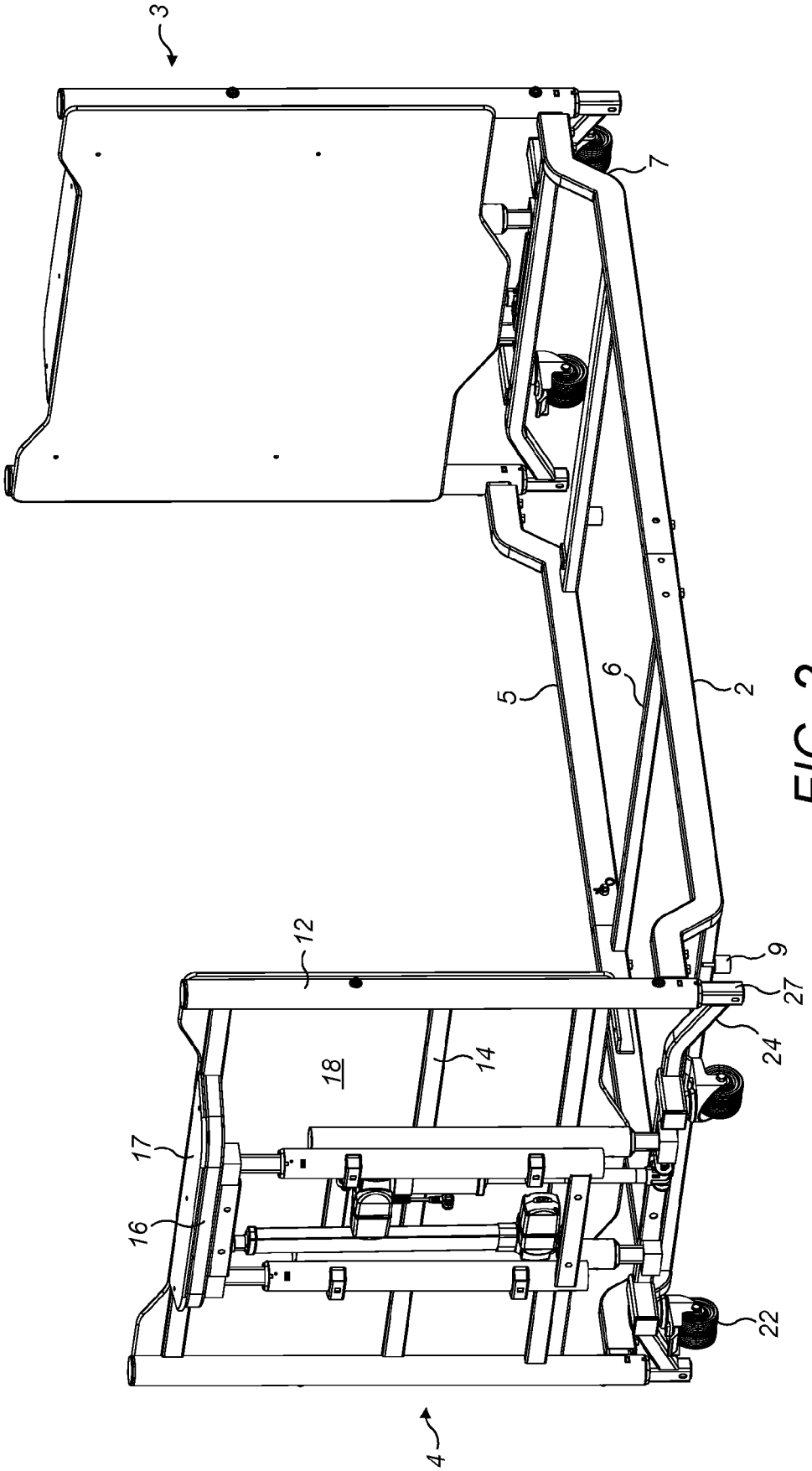


FIG. 2

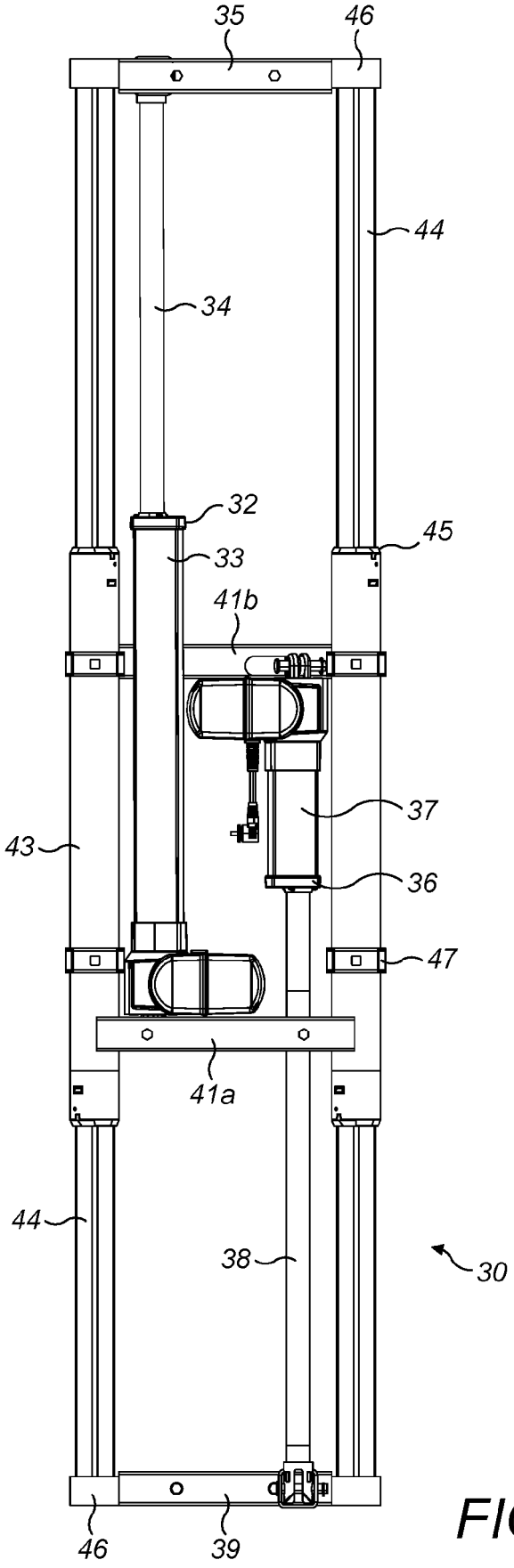


FIG. 3

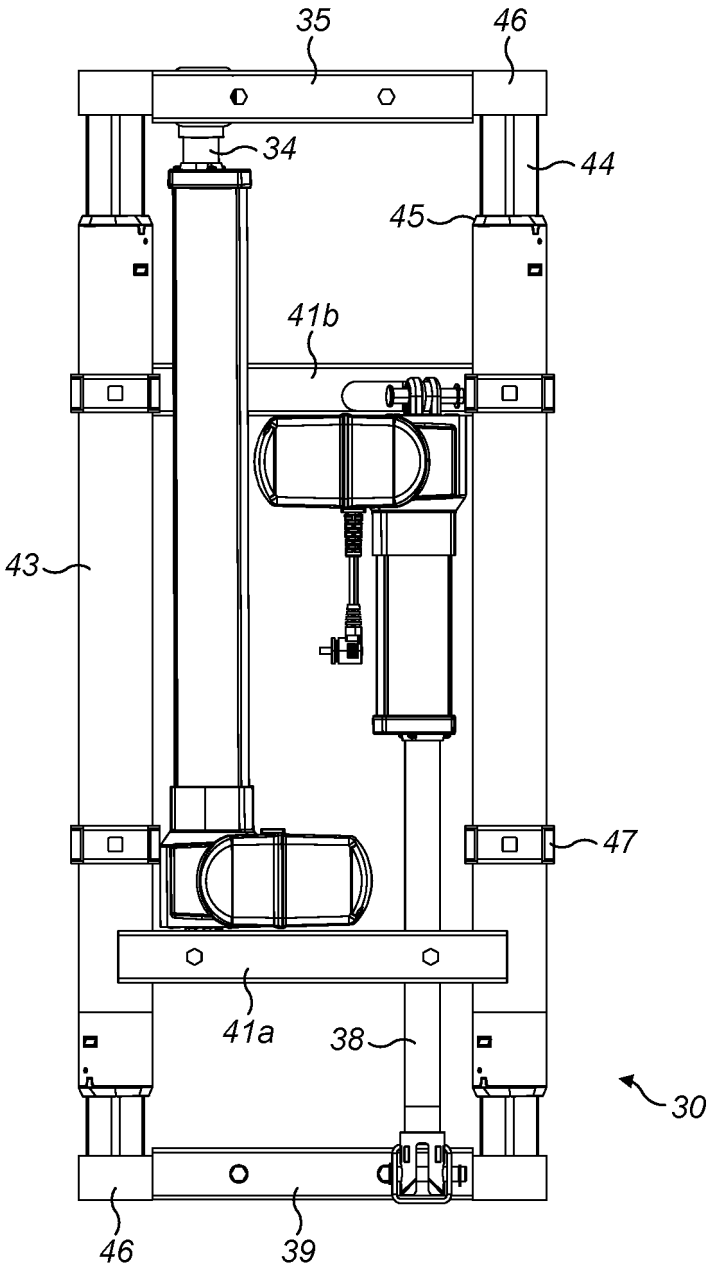


FIG. 4

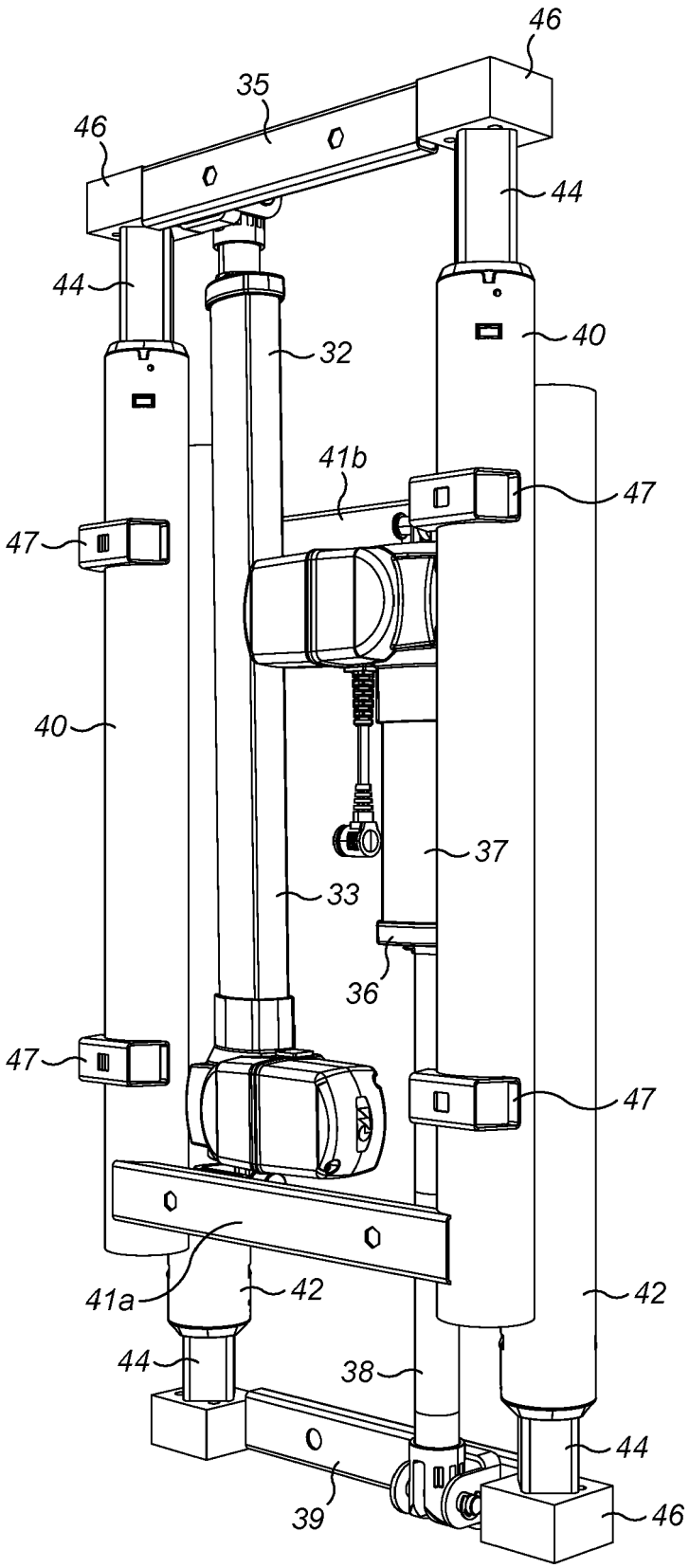
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FIG. 5

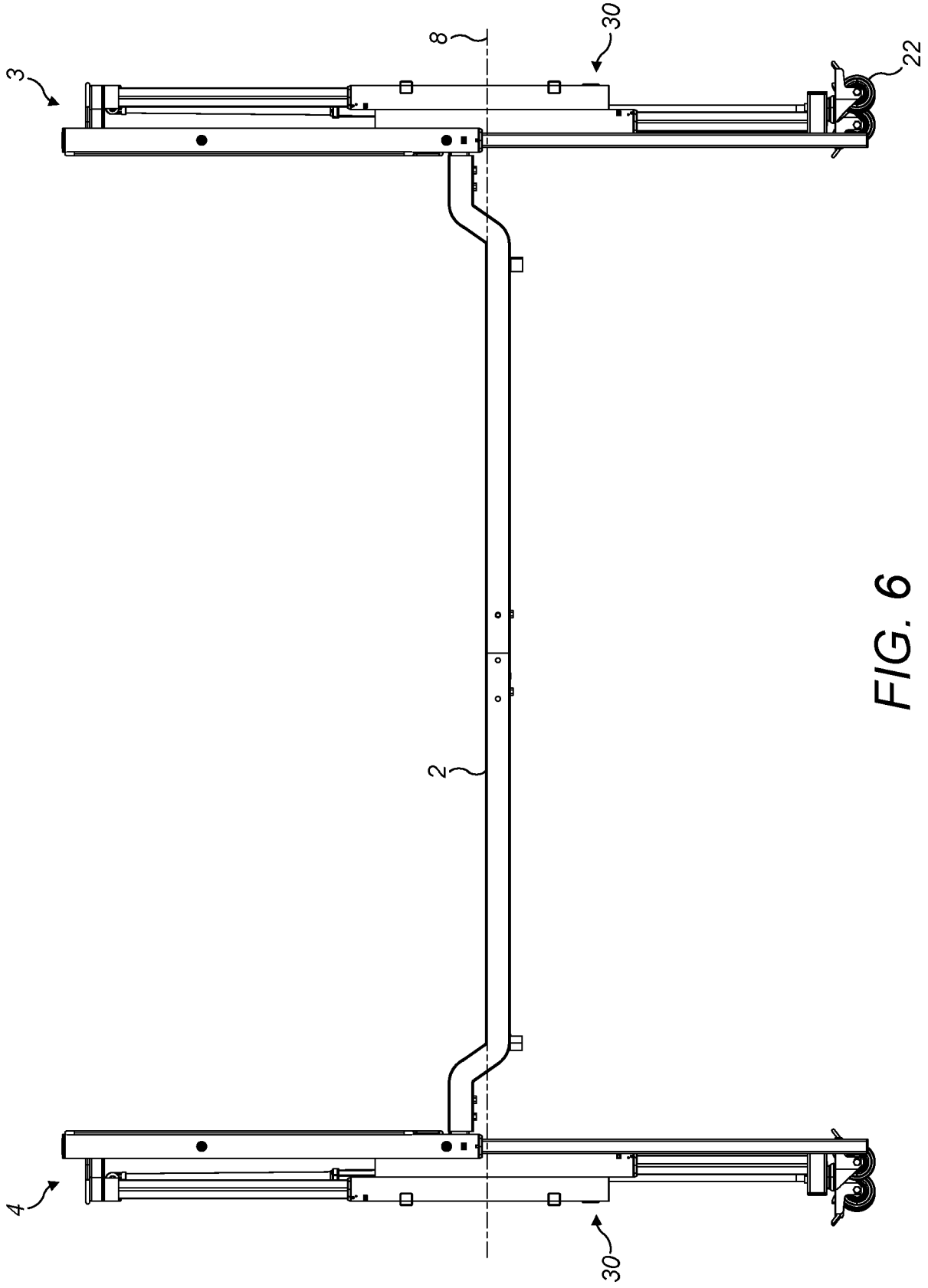


FIG. 6

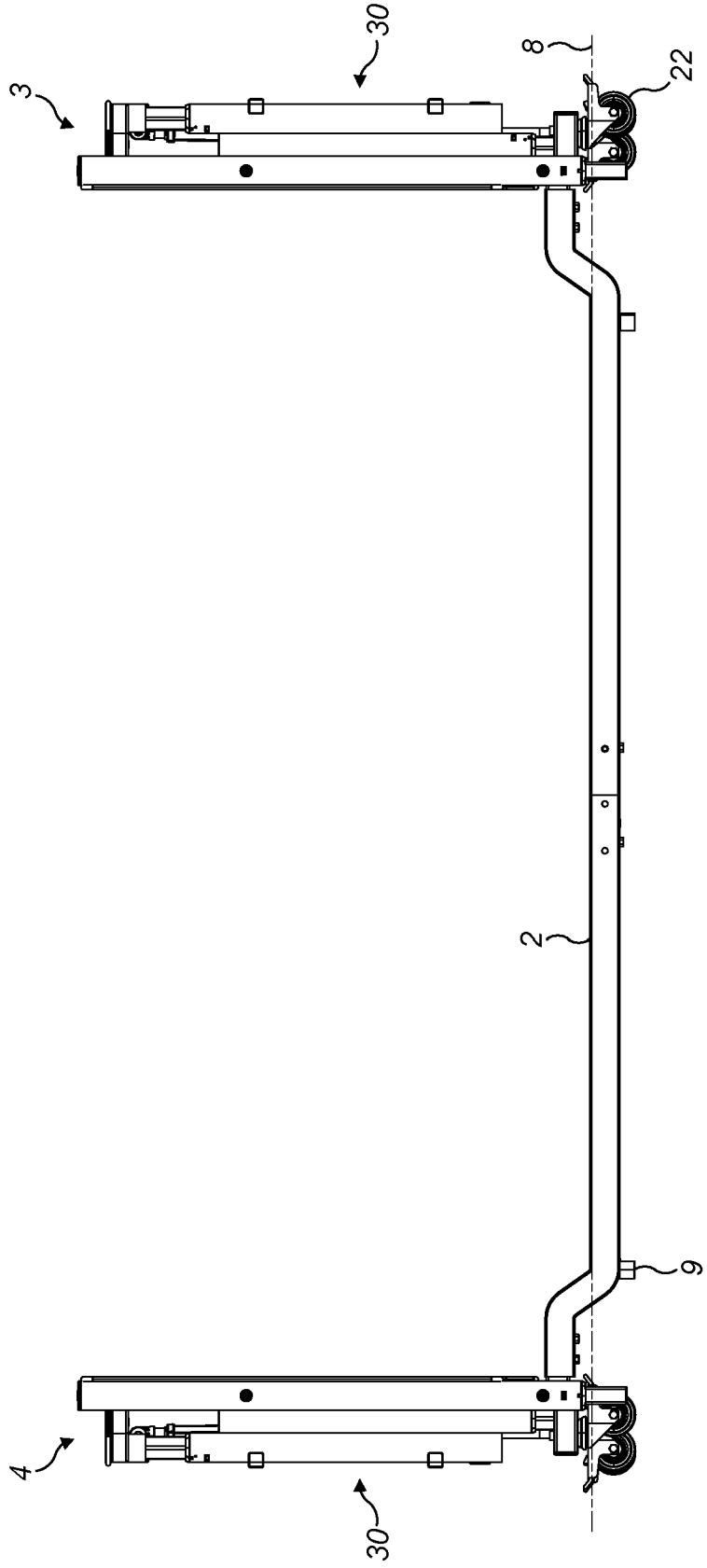


FIG. 7

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Application Number
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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
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| The Hague | 19 February 2021 | Koszewski, Adam |

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