

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets

(11)

Publication number:

**0 000 008  
B1**

(12)

## EUROPEAN PATENT SPECIFICATION

(45)

Date of publication of patent specification:  
**13.05.81**

(51)

Int. Cl.<sup>3</sup>: **B 66 F 19/00, A 61 G 7/10**

(21)

Application number: **78850003.1**

(22)

Date of filing: **09.06.78**

(54)

**A lifting device.**

(30)

Priority: **17.06.77 SE 7707055**

(43)

Date of publication of application:  
**20.12.78 Bulletin 78/1**

(45)

Publication of the grant of the patent:  
**13.05.81 Bulletin 81/19**

(84)

Designated Contracting States:  
**CH DE FR GB NL**

(56)

References cited:  
**FR-A-2 320 081  
US-A-2 672 620  
US-A-2 918 718**

(73)

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**EP 0 000 008 B1**

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## A lifting device

The present invention relates to a lifting device for lifting a load, comprising a rigid carrier arm to be placed over the load, means for receiving the load, the carrier arm supporting said means for receiving the load, and transfer means connected to said carrier arm for parallel movement thereof in its lateral direction.

Primarily, the lifting device is intended for lifting and/or moving a patient confined to bed between two places.

Such lifting devices, often referred to as patient lifters, are previously known for facilitating the work of the medical staff in hospitals and similar institutions for lifting and moving patients having reduced faculty of motion or being confined to their beds for other reasons. Prior art lifting devices are often bulky and difficult to handle and require for handling often more than one person. Moreover, prior art lifting devices generally are mounted on the floor or a wall and so valuable space is lost in the room where the lifting device is accommodated.

There are previously known patient lifters attached to the ceiling of a room, such lifters including a rigid carrier bar to be placed along and over a person to be lifted. The bar is supported at its both ends by two cables which over pulleys in the ceiling are connected to a telfer having two cable exits. A device for receiving and supporting a patient can be attached to the carrier bar. This type of lifting device only allows vertical movement. Therefore, when moving a patient from e.g. a stretcher to a bed, first the patient has to be lifted from the stretcher which then has to be removed whereupon the bed is brought in under the patient which is then lowered down onto the bed.

The Swedish laid-open specification 7508892-2 discloses a patient lifter including a carrier bar supported by a lever which is pivotably supported by a horizontal shaft. The carrier bar is movable in its lateral direction by rotation of said shaft. This patient lifter can be handled by one operator and allows movement of a patient between two support surfaces, e.g. a stretcher and a bed, without intermediate movement of said support surfaces. However, this patient lifter occupies a relatively large floor area.

The object of the present invention is to provide a new lifting device which obviates the above-mentioned drawbacks of prior art lifting devices and is particularly suited for operation in narrow spaces.

This object is achieved in a lifting device of the type described in which said transfer means includes two similar transfer assemblies each having a rigid link member pivotably connected to a respective end of the carrier arm, and a lever pivotably connected at one end to the associated link member and rigidly attached at its other end to a respective rotatable pivot shaft, and driving means connected with said pivot shafts, which

driving means when actuated rotate the shafts in opposite senses, thereby lifting and moving the carrier arm laterally, the shafts of said transfer means being laterally spaced in one and the same vertical plane, and extending vertically or at an inclination to the vertical.

For the purpose of elucidation the invention will be described in greater detail in the following with reference to the accompanying drawings, wherein

Fig. 1 is a simplified view showing the basic structure of a lifting device according to the invention;

Figs. 2A and 2B are partial detail views on a large scale showing portions of the lifting device in Fig. 1;

Fig. 3 illustrates a realization of the lifting device according to the invention;

Figs. 4a and 4B illustrate in two different positions in simplified manner a modified structure of the lifting device according to Fig. 1; and

Fig. 5 illustrates a stabilizing means for the lifting device according to a further embodiment of the invention, said stabilizing means being connected to the link members of the lifting device.

The following description of the lifting device according to the invention is directed to an application as a patient lifter. However, as mentioned below the lifting device provided with a suitably structured load receiving means can be used for lifting any type of load.

Referring to Fig. 1 which schematically illustrates the basis structure of a lifting device according to the invention occupying its raised position, the lifting device has a rigid carrier arm 1 with a longitudinal extension suitable for the particular application of the lifting device. Preferably, the carrier bar 1 includes a pipe or two parallel side members which are rigidly connected by means of cross members (Fig. 3).

In Figs. 1, 4A and 4B most of the components of the lifting device are illustrated in a simplified manner by means of straight lines, crossing lines showing the presence of articulations for allowing mutual movement. However, it is emphasized that the components illustrated as straight lines in practice also have a lateral extension.

A load receiving means 2 for receiving and supporting a patient is connected to the carrier arm 1 and supported thereby. Said receiving means is made releasable from the lifting device and can also include the carrier arm. In Fig. 1 said load receiving means 2 is shown as consisting of several rigid yokes 3 connected to the carrier bar 1, lifting bands 4 being releasably attached to the legs of said yokes. However, said load receiving means 2 can be embodied in various other ways, another suitable embodiment for receiving patients being shown in Fig. 3.

Rigid, preferably straight link members 5a and 5b are pivotably connected to both the ends of the carrier arm 1 which link members at their

other ends are pivotably connected to a respective lever 6a and 6b. These levers 6a and 6b are in turn pivotably supported and rigidly fixed to separate pivot shafts 7a and 7b, respectively. The pivot shafts 7a, 7b are supported in a frame 27 which is bolted to the ceiling of a room. In the embodiment of the lifting device which is described here the pivot shafts are vertical. However, as mentioned below, they can be inclined.

At their ends facing away from the levers 6a and 6b the vertical pivot shafts 7a and 7b have transmission members 8a and 8b which for transmitting a rotating movement to the pivot shafts engage corresponding transmission members 9a, 9b of a shaft 10. In the embodiment of the lifting device shown in Fig. 1, the shaft 10 includes a worm of a worm gear 12 the input shaft of which is coupled to a motor 13 which may be pneumatically or hydraulically driven, but is preferably electrically driven.

The above mentioned components 13, 12, 10, 9a, 9b, 8a, 8b, 7a, 7b, 6a, 6b and 5a, 5b constitute transfer means for parallel movement of the carrier bar 1 in its lateral direction. Said transfer means including drive means and transmission means is provided to drive said pivot shafts 7a and 7b in opposite rotational directions.

Said transfer means includes two transfer assemblies interconnected by means of said drive means and transmission means. The two transfer assemblies are similar, the components thereof having identical lengths and structure. In this embodiment the length of the carrier arm 1 is equal to the distance between the pivot shafts 7a and 7b.

It is appreciated that the members having the same reference figures, e.g. levers 6a and 6b, have the same longitudinal extensions and so when rotating the pivot shafts 7a and 7b in opposite directions the carrier arm 1 will be transferred perpendicularly to its longitudinal extension. From an initial lifting position where the levers 6a and 6b are parallel and facing in the same direction the levers can be rotated either inwardly or outwardly thereby achieving the same lifting action on the carrier arm 1.

The connection of the link members 5a and 5b to the carrier arm 1 has such a structure that the link members can pivot around an axis essentially perpendicular to the longitudinal extension of the carrier arm which axis is horizontal when the lifting device is mounted in place. Preferably a shaft 17 (Fig. 2B) is used for this connection, thereby counter-acting the tendency of lateral swinging of the load receiving means. Another suitable articulation for this connection is a universal joint, such as a ball and socket. Such an articulation also allows movement between the link members 5a and 5b and the carrier arm around an axis parallel to the carrier arm and so lateral swinging motion of said load receiving means will not be counter-acted. The connection of the link members 5a and 5b to the respective levers 6a and 6b is constructed for allow pivoting movement around both a vertical and a horizontal axis per-

pendicular to the carrier arm. A suitable articulation in this case is a universal joint, such as a ball and socket (Fig. 3). However, as shown in Fig. 2A also a vertical pivot 19 can be pivotably mounted at the end of the respective lever 6b facing away from the associated pivot shaft which pivot at its lower end has a lateral through shaft 16 which is connected to the associated link member 5b. This latter articulation with rigid shafts counter-acts unfavourable swinging motion of said load receiving means.

Of course, the transmission between the output shaft 10 of the worm gear 12 and the two pivot shafts 7a and 7b can be constituted in any different ways. However, these transmissions are preferably embodied as bevel drives 8a, 9a and 8b, 9b respectively, the shafts 10, 7a and 7b being supported and carried in bearings in a suitable manner. The gear reduction between the shaft 10 and the pivot shafts 7a and 7b preferably is 2:1 in order that the load on the levers 6a and 6b is kept at reasonable values when operating the lifting device. The drive means and transmission means described above sometimes may be too heavy to be fixed to the ceiling of rooms in older buildings. A considerably lighter drive means and transmission means (not shown) can be made using a chain drive. In this case the transmission can include sprockets fixed at the ends of each pivot shaft 7a, 7b which sprockets are rotatable in different directions by means of an endless chain having a figure-of-eight configuration. A central sprocket fixed on an additional shaft engages the chain and said shaft is driven by a gear connected to a motor.

The levers 6a and 6b are rigidly fixed to a respective pivot shaft 7a and 7b and extend downwardly therefrom under an angle of declination which is less than 90°. However, it is appreciated that in other embodiments of the lifting device the levers can form any angle to the pivot shafts and also extend upwardly therefrom.

In Fig. 1 the transfer means of the lifting device is shown entirely over the carrier arm and is mounted to the ceiling of a room by means of the frame 27 (see also Fig. 3). However, said transfer means and the associated frame can be mounted on the floor of a room, the pivot shafts 7a and 7b thereby extending upwardly from the floor. This latter alternative embodiment is of interest only in the case of ample space in the room where the lifting device is placed.

In said alternative embodiment of the lifting device the levers can however only be rotated inwardly in order that the carrier arm 1 shall be able to pass through its top position, in which the levers are directed towards each other and located in the same vertical plane.

In this alternative embodiment the carrier arm should be somewhat shorter than the distance between the pivot shafts 7a, 7b since otherwise the latter will obstruct the carrier arm when passing through its top position.

The operation of the lifting device is described below with reference to the embodiment of

Fig. 1.

For lifting and transferring between two supporting surfaces a patient supported in said receiving means 2 the lifting device is put into a position where the levers 6a and 6b are parallel and the link members 5a and 5b are essentially vertical. The bed or similar resting place on which the patient to be lifted lies is inserted under the carrier arm 1 so that the latter takes a position along the person in question. Then the person is placed in said receiving means 2 and the lifting device can be activated. When starting the motor 13 the shafts 7a and 7b will rotate in opposite directions, e.g. so that the levers 6a and 6b are pivoted outwardly from the carrier arm as shown in Fig. 1. Since the ends of the levers 6a and 6b facing away from the pivot shafts 7a and 7b are turned outwardly the link members 5a and 5b will be carried along and so the ends of the link members connected to the carrier arm will be urged in a direction perpendicular to its longitudinal extension.

During the movement of the carrier arm from its bottom position to its top position (rotation of the pivot shafts over 90°) where the levers 6a and 6b are located in the same vertical plane, the carrier arm describes a curve. When the rotation of the shafts are continued over another 90° the carrier arm performs a reverse movement downwardly to a laterally displaced second bottom position, the carrier arm thereby describing a curve which in relation to a vertical plane through the two pivot shafts 7a and 7b is symmetrical with said first mentioned curve.

By suitable selection of the lengths of the levers 6a, 6b, the link members 5a, 5b and the carrier arm as well as the angle  $\alpha$  between the levers and the shafts 7a, 7b a desired shape of said curve is achieved. For a patient lifter said curve should have an initial steep slope upwardly which slope successively decreases. In this way a very appropriate movement is achieved for the lifting device in which movement the carrier arm in an initial stage is mainly lifted whereupon the movement in horizontal direction gradually will increase until the top position of the carrier arm is reached. From this position the reverse movement takes place and the carrier arm is lowered on to the other side of the lifting device.

In accordance with a further embodiment of the invention a biasing device 15 is provided between two members 11a, 11b fixed to the pivot shafts 7a and 7b. The biasing device 15 may be shaped as a tension spring which has its most biased or extended state when the carrier arm takes any of its bottom positions. When the biasing device 15 is a tension spring said members 11a, 11b can be either rigid arms or cables be wound around the pivot shafts. The biasing device 15 is completely unloaded when the levers 6a and 6b are situated in the same vertical plane, i.e. when the carrier arm 1 takes its top position. When operating the lifting device the biasing device will contribute to the rotation of the pivot shafts during the lifting stage while during the

lowering stage the biasing device will smooth the movement at the same time as a bias is built up in the biasing device.

It is appreciated that the biasing device 15 can be embodied in a variety of ways. Thus, it may also be hydraulic or pneumatic.

Fig. 3 illustrates a preferred embodiment of the lifting device. In this figure the same reference numerals are used as in Fig. 1 and 2 for denoting the same components.

As shown in Fig. 3 the carrier arm 1 has two side members 1a and 1b which are rigidly connected by means of cross members. One cross member at each end of the carrier arm serves as a horizontal shaft 17 for the respective link member 5a, 5b for connecting the same to the carrier bar. The link members 5a and 5b are connected at their upper ends to a respective lever 6a, 6b by a ball and socket articulation 18.

The upper-portsions of the pivot shafts 7a and 7b are accommodated in a casing 14 together with the worm gear 12, the motor 13 and the biasing device 15.

In accordance with another embodiment of the lifting device shown in Fig. 4A and 4B the carrier bar 1 is shorter than the distance between the two vertical pivot shafts 7a and 7b.

Fig. 4A illustrates the lifting device in a position where the levers 6a and 6b are rotated outwardly at a relative angle of 180° in which position the carrier arm 1 takes its top position. In Fig. 4B the lifting device is illustrated with the carrier arm 1 in its bottom position and the link members 5a and 5b are parallel and vertical. In this bottom position the two levers 6a and 6b are directed towards each other from the respective pivot shafts.

In this embodiment of the lifting device the relative lengths of the carrier arm 1 the link members 5a and 5b and the levers 6a and 6b are defined such that the link members take up a parallel position (bottom position of the carrier arm) when the two levers 6a, 6b from a mutually parallel position have been rotated inwardly towards each other by a small angle, substantially 20°.

It is appreciated that in this embodiment the lifting height will be greater than for the embodiments shown in Figs. 1 and 3. From the initial bottom position of the lifting device shown in Fig. 4B the two pivot shafts 7a and 7b are rotated counter-clockwise and clockwise, respectively (seen from above), the levers 6a and 6b thereby lifting the carrier arm 1 via of the link members 5a and 5b. In the movement of the levers from the position shown in Fig. 4B to the position where the levers are parallel, i.e. after a rotation of approximately 20° of the pivot shafts, the carrier arm 1 principally performs a movement upwardly while its movement in horizontal direction is small. Upon further rotation of the pivot shafts the movement in vertical direction will continue to dominate but gradually decreases in relation to the movement in horizontal direction until the carrier arm takes its top position where the levers are facing away from each other and located in the

same vertical plane. When the rotation of the pivot shafts are continued the levers are brought out on the other side of the lifting device, the reverse movement of carrier arm taking place and the carrier arm being lowered to its bottom position. Similar to the embodiment shown in Fig. 1 the initial lifting and the final lowering of the carrier arm, when transferring the same, will be smooth and the speed of these stages is slower than the intermediate lateral movement of the carrier arm. Thus, it is appreciated that the embodiment of the lifting device shown in Fig. 4A and 4B makes it possible to lift the carrier arm 1 higher than can be achieved by means of the embodiment shown in Fig. 1.

In the particularly preferred embodiment of the lifting device shown in Fig. 4A and 4B the distance between the pivot shafts 7a and 7b is 80 cm, the length of the levers 6a and 6b is 65 cm, the length of the link members 5a and 5b is 80 cm, the length of the carrier arm 1 between its connecting points to the link members is 60 cm and the angle  $\alpha$  between the levers and the pivot shafts is 80°. Thus, it can be seen that the lifting device occupies a very small space.

The above described embodiments of the lifting device can be modified within the scope of the invention. Thus, the carrier arm 1 can be longer than the distance between the two vertical shafts. In such an embodiment the carrier arm takes its bottom position when the two levers are turned outwardly from each other. In order to achieve the greatest lifting height by means of this embodiment the pivot shafts are first pivoted in a direction towards each other until they are parallel and after continued movement they come into the same vertical plane, in which position the carrier arm takes its top position. Then the levers are brought out on the other side of the lifting device and the reverse movement is obtained, i.e. the carrier arm is lowered.

As mentioned above the pivot shafts 7a and 7b need not be exactly parallel to each other. Thus, the pivot shafts can be arranged in the same vertical plane with their bottom ends located at a greater distance from each other than their upper ends, thus having a slight inclination to the vertical. This arrangement can be used when the carrier arm is shorter than the distance between the points on the pivot shafts from where the levers extend. On the other hand the pivot shafts can also be arranged in the same vertical plane with their bottom ends located at a smaller distance from each other than their upper ends. This arrangement can be used when the carrier arm is longer than the distance between the points on the pivot shafts from where the levers extend. When the two pivot shafts 7a and 7b are arranged at an angle a still greater lifting height can be obtained for the carrier arm. However, the bearings of the pivot shafts as well as their transmissions will be more complicated than in the embodiments of the lifting device shown in Figs. 1 to 4B.

The above described embodiments of the lifting device are relatively sensitive to unsymmetri-

cal load, namely the condition where the centre of gravity of the load is displaced from a vertical plane of symmetry across the carrier arm. Thus, if the patient is placed in said load receiving means such that the centre of gravity of the patient is displaced a considerable distance from said plane of symmetry the carrier arm will tend to incline relative the horizontal plane and the lifting device will not operate satisfactorily. In order to counteract said inclining tendency of the carrier arm a stabilizing means 20 shown in Fig. 5 is provided.

Said stabilizing means 20 includes two rigid bars 21a and 21b which at their ends are pivotably connected between the link members 5a and 5b in a crossing relation. Stabilizing means 20 shown in Fig. 5 is arranged between the bottom ends of the link members, and the carrier arm 1 is suspended between spacers 22a and 22b under said stabilizing means. However, it is appreciated that the stabilizing means 20 also can be connected to the link members at a distance from their bottom ends and so it may simply be mounted on the above described embodiments of the lifting device.

Said stabilizing means 20 comprises U-shaped clevises 23a, 23b having opposite lugs and a connecting web the latter being rigidly fixed to the respective link members 5a and 5b at the lower ends thereof such that the clevises open up towards each other. The bars 21a and 21b are disposed in parallel vertical planes and have their ends inserted between the lugs of a respective clevis 23a, 23b where they are pivotably supported by means of horizontal shafts. From Fig. 5 it is seen that the bars 21a and 21b are symmetrically arranged such that the bar 21a at one end is mounted below the bar 21b but at its other end is mounted over the bar 21b, the corresponding relation applying to the bar 21b. The upper ends of the spacers 22a and 22b which are connected to the clevises have two legs which reach around the associated clevis 23a and 23b, respectively. A horizontal shaft through the legs and the clevis allows the necessary rotation between the link members and the carrier bar 1, in this case the spacers.

If e.g. the spacer 22a is subjected to a greater load than the spacer 22b the lower end of the link member 5a will tend to sink in relation to the lower end of the link member 5b. However, this sinking of the link member 5a is counter-acted by the stabilizing means 20 in that a couple of forces is transmitted over the clevises and the bars 21a and 21b for urging the lower end of the link member 5b down to the same level as the lower end of the link member 5a. In this way the link members 5a and 5b will be maintained at the same level of height and the carrier arm will be horizontal. Of course the corresponding conditions hold if instead the lower end of the link member 5b is subjected to a greater load than the lower end of the link member 5a.

It should be realized that said stabilizing means 20 can be constructed in several other ways as

long as it includes elements coupled to the link members which elements in response to loads on the link members transfer from each link member to the other link member a force corresponding to the difference in the load.

In the embodiment of the lifting device provided with said stabilizing means shown in Fig. 5 the distance between the link members is kept more or less constant by means of the bars 21a and 21b and so the carrier arm 1 can be supported rotatably about its axial length by the spacers 22a, 22b and displaceable through the spacers. In this case the carrier arm is cylindrical and each connecting member 24a and 24b of the spacers for connecting the respective spacer to the carrier arm consists of a cylindrical sleeve having a bearing, preferably made of tetrafluoro-ethylene, which allows the carrier arm to be rotated around its own axis.

From the two ends of the carrier arm wide bands or belts 25a and 25b, e.g. of plastic material, extend downwards for supporting said load receiving means (not shown) having a suitable structure, e.g. of that kind shown in Fig. 3 where the belts 25a and 25b also are shown. The belts 25a, 25b have a suitable length such that the individual lifting bands 4 of said load receiving means reach the desired height level when the carrier arm takes its bottom position.

The lifting device has been described above in connection with a load receiving means 2 suited for lifting a person confined to bed or having reduced faculty of motion. However, any type of load receiving means can be connected to the carrier arm in order to lift and/or transfer other types of loads.

## Claims

1. A lifting device for lifting a load, comprising a rigid horizontally extending carrier arm (1) to be placed over the load, means (2) for receiving the load, the carrier arm supporting said means for receiving the load, and transfer means connected to said carrier arm and which acts to lift and to move said carrier arm in its lateral direction, characterized in that said transfer means includes two similar transfer assemblies each having a rigid link member (5a, 5b) pivotably connected to a respective end of the carrier arm (1), and a lever (6a, 6b) pivotably connected at one end to the associated link member (5a, 5b) and rigidly attached at its other end to a respective rotatable pivot shaft (7a, 7b), and driving means (13, 12, 10, 9a, 9b, 8a, 8b) connected with said pivot shafts (7a, 7b), which driving means when actuated rotate the shafts in opposite senses, thereby lifting and moving the carrier arm (1) laterally, the shafts (7a, 7b) of said transfer means being laterally spaced in one and the same vertical plane, and extending vertically or at an inclination to the vertical.

2. Lifting device as claimed in claim 1, wherein in each transfer assembly the pivotable connection between the link member (5a, 5b) and the

carrier arm (1) is an articulation (17) permitting movement around a horizontal axis.

3. Lifting device as claimed in claim 2, wherein in each transfer assembly the articulation between the link member (5a, 5b) and the carrier arm (1) also permits movement around a vertical axis.

4. Lifting device as claimed in any one of claims 1 to 3, said device being placed in a room, and wherein the pivot shafts (7a; 7b) are supported in an overhead frame (27).

5. Lifting device as claimed in any one of claims 1 to 4, wherein in each transfer assembly the pivotable connection between the link member (5a, 5b) and the lever (6a, 6b) is an articulation (19, 16; 18) permitting movement around a horizontal and a vertical axis.

6. Lifting device as claimed in any one of claims 1 to 5, wherein the distance between the connections of the link members (5a, 5b) to the carrier arm (1) is equal to the distance between the mounting points of the levers (6a, 6b) on the pivot shafts (7a, 7b).

7. Lifting device as claimed in any one of claims 1 to 5, wherein the distance between the connections of the link members (5a, 5b) to the carrier arm (1) is less than the distance between the mounting points of said levers (6a, 6b) on the pivot shafts (7a, 7b).

8. Lifting device as claimed in any one of claims 3-7 wherein the pivot shafts (7a, 7b) are vertical.

9. Lifting device as claimed in any one of claims 1 to 8, wherein said transfer means comprises a drive shaft (10) including a worm gear (12) mounted between said pivot shafts (7a, 7b), the drive shaft at its ends being rotatably engaged to said pivot shafts (7a, 7b).

10. Lifting device as claimed in claim 9, wherein first bevel gear wheels (9a, 9b) are fixed at the ends of said drive shaft (10) and second bevel gear wheels (8a, 8b) are fixed to the pivot shafts (7a, 7b), one first and one second bevel gear wheel being rotatably engaged.

11. Lifting device as claimed in any one of claims 5 to 10, wherein in each transfer assembly the articulations between the link member (5a, 5b) and the carrier arm (1), on one hand, and the lever (6a, 6b) on the other hand are universal joints.

12. Lifting device as claimed in any one of claims 4 to 11, wherein in each transfer assembly the lever (6a, 6b) extends downwards from the associated pivot shaft (7a, 7b) and is inclined thereto at an angle less than 90°.

13. Lifting device as claimed in any one of claims 1 to 12, characterized by stabilizing means (20) mounted between the link members (5a, 5b) which transfers forces therebetween when the centre of gravity of the load in said receiving means (2) is displaced from a vertical plane of symmetry across the carrier arm (1), thereby compensating for uneven load and maintaining the carrier arm horizontally.

14. Lifting device as claimed in claim 13, wherein said stabilizing means (20) comprises two rigid

bars (21a, 21b) each of which connects the two link members (5a, 5b) the ends of said bars being pivotably connected to the link members for movement around horizontal shafts, each bar at one end being connected to one of said link members at a level below the connection of the other bar, while the other end of each bar being connected to the other link member at a level over the connection of the bar.

15. Lifting device as claimed in any one of claims 1 to 14, characterized by biasing means (15) provided to cooperate with said pivot shafts (7a, 7b) via members (1a, 11b) fixed to each pivot shaft (7a, 7b) said biasing means being non-actuated when the carrier arm (1) takes its top position, rotation of the pivot shafts for lowering the carrier arm resulting in biasing of said biasing means.

### Patentansprüche

1. Hebevorrichtung zum Anheben einer Last, welche einen festen, sich horizontal erstreckenden Tragarm (1) umfasst, der über die Last anzu- bringen ist, eine vom Tragarm getragene Vorrich- tung (2) zur Aufnahme der Last, und eine mit dem Tragarm verbundene Übertragungsvorrichtung, welche den Tragarm in dessen lateraler Richtung hebt und bewegt, dadurch gekennzeichnet, dass die Übertragungsvorrichtung zwei ähnliche Übertragungsbaugruppen umfasst, wobei jede dieser Baugruppen ein mit einem respektiven Ende des Tragarms (1) schwenkbar verbundenes Gelenkglied (5a, 5b) hat und einen Hebel (6a, 6b), der an einem Ende schwenkbar mit dem entspre- chenden Gelenkglied (5a, 5b) verbunden ist und am anderen Ende mit einer Drehachse (7a, 7b) fest verbunden ist, und Antriebsglieder (13, 12, 10, 9a, 8a, 8b) welche mit den Drehachsen (7a, 7b) verbunden sind und welche bei Betätigung die Drehachsen in entgegengesetzten Richtungen drehen dadurch für seitliches Anheben und Be- wegung des Tragarms (1), und dass die Drehach- sen (7a, 7b) der Übertragungsvorrichtung in einer und derselben Vertikalebene seitlich getrennt sind und sich vertikal erstrecken oder neigen zur Vertikale.

2. Hebevorrichtung gemäss Anspruch 1, da- durch gekennzeichnet, dass in jeder Übertra- gungsbaugruppe die schwenkbare Verbindung zwischen dem Gelenkglied (5a, 5b) und dem Tragarm (1) ein Gelenk (17) ist, das Bewegung um eine horizontale Achse erlaubt.

3. Hebevorrichtung gemäss Anspruch 2, da- durch gekennzeichnet, dass in jeder Übertra- gungsbaugruppe das Gelenk zwischen dem Ge- lenkglied (5a, 5b) und dem Tragarm (1) auch Be- wegung um eine vertikale Achse erlaubt.

4. Hebevorrichtung gemäss einem der Ansprü- che 1-3, dadurch gekennzeichnet, dass die Vor- richtung in einem Raum angebracht ist, und dass die Drehachsen (7a, 7b) in einem über Kopf lau- fenden Gestell (27) getragen sind.

5. Hebevorrichtung gemäss einem der Ansprü- che 1-4, dadurch gekennzeichnet, dass in jeder

Übertragungsbaugruppe die schwenkbare Ver- bindung zwischen dem Gelenkglied (5a, 5b) und dem Hebel (6a, 6b) ein Gelenk (19, 16, 18) ist, das Bewegung um eine horizontale und eine vertikale Achse erlaubt.

6. Hebevorrichtung gemäss einem der Ansprü- che 1-5, dadurch gekennzeichnet, dass der Ab- stand zwischen den Verbindungen der Gelenk- glieder (5a, 5b) mit dem Tragarm (1) gleichgross ist wie der Abstand zwischen den Befestigungs- punkten der Hebel (6a, 6b) an den Drehachsen (7a, 7b).

7. Hebevorrichtung gemäss einem der Ansprü- che 1-5, dadurch gekennzeichnet, dass der Ab- stand zwischen den Verbindungen der Gelenk- glieder (5a, 5b) mit dem Tragarm (1) weniger ist als der Abstand zwischen den Befestigungspun- kten der Hebel (6a, 6b) an den Drehachsen (7a, 7b).

8. Hebevorrichtung gemäss einem der Ansprü- che 3-7, dadurch gekennzeichnet, dass die Drehachsen (7a, 7b) vertikal sind.

9. Hebevorrichtung gemäss einem der Ansprü- che 1-8, dadurch gekennzeichnet, dass die Über- tragungsvorrichtung eine Getriebachse (10) um- fasst, welche eine Getriebschnecke (12) auf- weist, welche zwischen den Drehachsen (7a, 7b) angebracht ist, und dass die Getriebeachse an ih- ren Enden in schwenkbarem Eingriff mit den Drehachsen (7a, 7b) ist.

10. Hebevorrichtung gemäss Anspruch 9, da- durch gekennzeichnet, dass erste Kegelräder (9a, 9b) an den Enden der Getriebeachse (10) befe- stigt sind und zweite Kegelräder (8a, 8b) an den Drehachsen (7a, 7b) befestigt sind, und dass ein erstes und ein zweites Kegelrad in drehbarem Eingriff sind.

11. Hebevorrichtung gemäss einem der An- sprüche 5-10, dadurch gekennzeichnet, dass in jeder Übertragungsbaugruppe die Gelenke zwis- chen dem Gelenkglied (5a, 5b) und dem Tragarm (1) einerseits, und dem Hebel (6a, 6b) anderer- seits Kardan-Gelenke sind.

12. Hebevorrichtung gemäss einem der An- sprüche 4-11, dadurch gekennzeichnet, dass in jeder Übertragungsbaugruppe der Hebel (6a, 6b) sich nach unten von der entsprechenden Dreh- achse (7a, 7b) erstreckt und dazu in einem Win- kel, der weniger als 90° ist, geneigt ist.

13. Hebevorrichtung gemäss einem der An- sprüche 1-12, gekennzeichnet durch eine Stabili- sierungsvorrichtung (20), die zwischen den Ge- lenkgliedern (5a, 5b) befestigt ist und die Kräfte dazwischen vermittelt, wenn der Schwerpunkt der Last in der Aufnahmevorrichtung von einer Ebenmassfläche quer über den Tragarm (1) ver- schoben ist, wobei ungleiche Last ausgeglichen ist und der Tragarm horizontal gehalten ist.

14. Hebevorrichtung gemäss Anspruch 13, da- durch gekennzeichnet, dass die Stabilisierungs- vorrichtung zwei steife Stangen (21a, 21b) um- fasst, wobei jede der Stangen die zwei Gelenk- glieder (5a, 5b) verbindet, dass die Enden der Stangen schwenkbar mit den Gelenkgliedern verbunden sind zur Bewegung um horizontale

Achsen, und jede Stange an einem Ende mit einem der Gelenkglieder in einer Höhe unter der Verbindung der anderen Stange verbunden ist und das andere Ende jeder Stange mit dem anderen Gelenkglied in einer Höhe über der Verbindung der Stange verbunden ist.

15. Hebevorrichtung gemäss einem der Ansprüche 1–14, gekennzeichnet durch eine Vorspannungsvorrichtung (15), welche mit den Drehachsen (7a, 7b) über an jeder Drehachse (7a, 7b) befestigte Glieder (11a, 11b) zusammenwirkt, und welche unbetätigt ist, wenn der Tragarm (1) in seiner Oberlage ist, und Drehung der Drehachsen, um den Tragarm zu senken, führt dazu, dass die Vorspannungsvorrichtung vorgespannt wird.

### Revendications

1. Appareil de levage pour soulever une charge, comprenant un bras porteur (1) s'étendant horizontalement et destiné à être placé au-dessus de la charge, un dispositif (2) de réception de charge, le bras porteur supportant ledit dispositif de réception de charge, et un dispositif de transfert relié au bras porteur et qui sert à soulever et à déplacer le bras porteur dans sa direction latérale, caractérisé par que le dispositif de transfert comprend deux ensembles de transfert semblables comportant chacun une bielle rigide (5a, 5b) qui est reliée à pivotement à une extrémité respective du bras porteur (1), et un levier (6a, 6b) relié à pivotement par une extrémité à la bielle associée (5a, 5b) et fixé rigidement par son autre extrémité sur un arbre de pivotement respectif (7a, 7b), ainsi que par des organes d'entraînement (13, 12, 10, 9a, 9b, 8a, 8b) reliés auxdits arbres de pivotement (7a, 7b) lesdits organes d'entraînement, lorsqu'ils sont actionnés, faisant tourner les arbres dans des sens opposés de façon à soulever et à déplacer latéralement le bras porteur (1), les arbres (7a, 7b) du dispositif de transfert étant espacés latéralement dans le même plan vertical et étant orientés verticalement ou bien inclinés par rapport à la verticale.

2. Appareil de levage selon la revendication 1, caractérisé par que, dans chaque ensemble de transfert, la liaison pivotante entre la bielle (5a, 5b) et le bras porteur (1) est constituée par une articulation (17) permettant un mouvement autour d'un axe horizontal.

3. Appareil de levage selon la revendication 2, caractérisé par que, dans chaque ensemble de transfert, l'articulation entre la bielle (5a, 5b) et le bras porteur (1) permet également un mouvement autour d'un axe vertical.

4. Appareil de levage selon l'une quelconque des revendications 1 à 3, qui est placé dans une pièce et caractérisé par que les arbres de pivotement (7a, 7b) sont supportés par un châssis supérieur (27).

5. Appareil de levage selon l'une quelconque des revendications 1 à 4, caractérisé par que, dans chaque ensemble de transfert, la liaison pivotante existant entre la bielle (5a, 5b) et le levier (6a, 6b) est constituée par une articulation (19, 16; 18)

permettant un mouvement autour d'une axe horizontal et autour d'un axe vertical.

6. Appareil de levage selon l'une quelconque des revendications 1 à 5, caractérisé par que la distance entre les liaisons des bielles (5a, 5b) avec le bras porteur (1) est égale à la distance entre les points de montage des leviers (6a, 6b) sur les arbres de pivotement (7a, 7b).

7. Appareil de levage selon l'une quelconque des revendications 1 à 5, caractérisé par que la distance entre les liaisons des bielles (5a, 5b) avec le bras porteur (1) est inférieure à la distance entre les points de montage desdits leviers (6a, 6b) sur les arbres de pivotement (7a, 7b).

8. Appareil de levage selon l'une quelconque des revendications 3 à 7, caractérisé par que les arbres de pivotement (7a, 7b) sont orientés verticalement.

9. Appareil de levage selon l'une quelconque des revendications 1 à 8, caractérisé par que ledit dispositif de transfert comprend un arbre d'entraînement (10) pourvu d'une vis sans fin faisant partie d'un couple (12) monté entre les arbres de pivotement (7a, 7b), ledit arbre d'entraînement étant relié à rotation par ses extrémités avec lesdits arbres de pivotement (7a, 7b).

10. Appareil de levage selon la revendication 9, caractérisé par que des premiers pignons coniques (9a, 9b) sont fixés aux extrémités dudit arbre d'entraînement (10) tandis que des seconds pignons coniques (8a, 8b) sont fixés sur les arbres de pivotement (7a, 7b), un premier pignon conique étant en prise avec un second pignon conique correspondant.

11. Appareil de levage selon l'une quelconque des revendications 5 à 10, caractérisé par que, dans chaque ensemble de transfert, les articulations entre la bielle (5a, 5b) et le bras porteur (1) d'une part, et le levier (6a, 6b) d'autre part, sont constituées par des joints universels.

12. Appareil de levage selon l'une quelconque des revendications 4 à 11, caractérisé par que, dans chaque ensemble de transfert, le levier (6a, 6b) s'étend vers le bas à partir de l'arbre de pivotement associé (7a, 7b) est incliné par rapport à celui-ci d'un angle inférieur à 90°.

13. Appareil de levage selon l'une quelconque des revendications 1 à 12, caractérisé par qu'il est prévu un dispositif stabilisateur (20), monté entre les bielles (5a, 5b) de façon à transmettre entre elles des forces quand le centre de gravité de la charge placée dans le dispositif récepteur (2) est décalé par rapport à un plan vertical de symétrie passant par le bras porteur (1), en vue de compenser ainsi des charges inégales et de maintenir le bras porteur horizontalement.

14. Appareil de levage selon la revendication 13, caractérisé par que ledit dispositif stabilisateur (20) comprend deux barres rigides (21a, 21b) qui sont chacune reliées aux deux bielles (5a, 5b), les extrémités desdites barres étant reliées à pivotement aux bielles de façon à se déplacer autour d'axes horizontaux, chaque barre étant accouplée par une extrémité avec une des bielles à un niveau situé en-dessous de la liaison avec



l'autre barre tandis que l'autre extrémité de chaque barre est reliée à l'autre bielle à un niveau situé au-dessus de la liaison avec la barre.

15. Appareil de levage selon l'une quelconque des revendications 1 à 14, caractérisé par qu'il est prévu un dispositif de poussée (15) coopérant avec lesdits arbres de pivotement (7a, 7b) par l'intermédiaire d'éléments (11a, 11b) qui sont

fixés sur chaque arbre de pivotement (7a, 7b), ledit dispositif de poussée n'étant pas actionné quand le bras porteur (1) arrive dans sa position haute et une rotation des arbres de pivotement pour faire descendre le bras porteur provoquant la génération d'une poussée par ledit dispositif de poussée.

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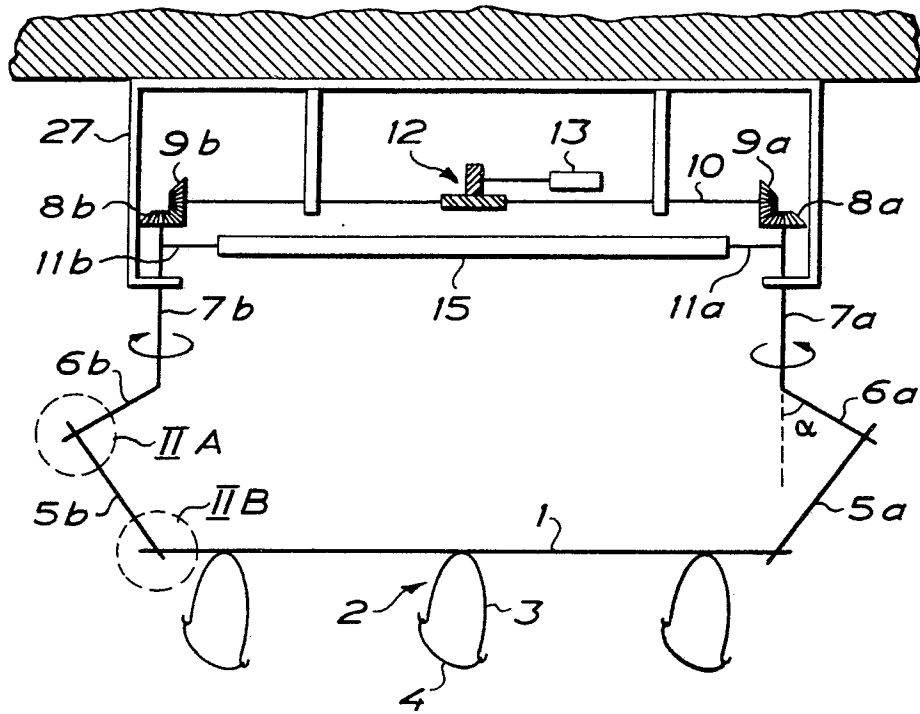


FIG. 1

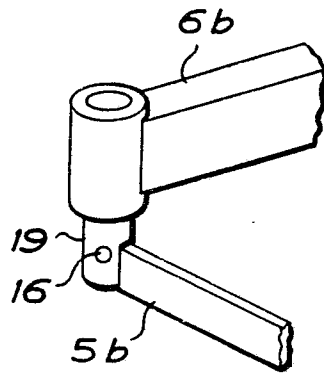


FIG. 2 A

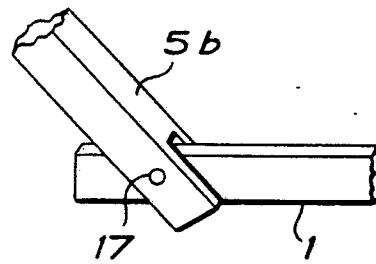


FIG. 2 B

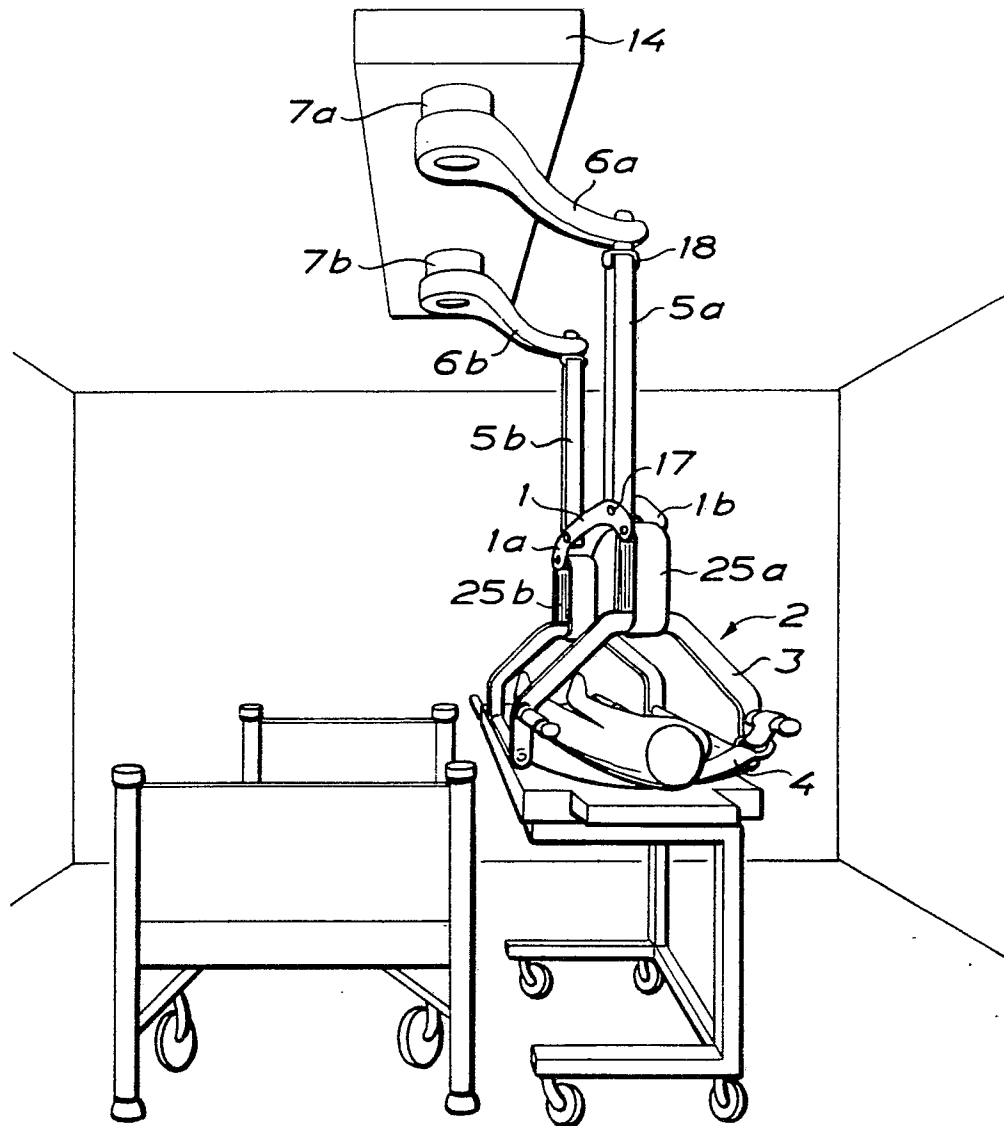
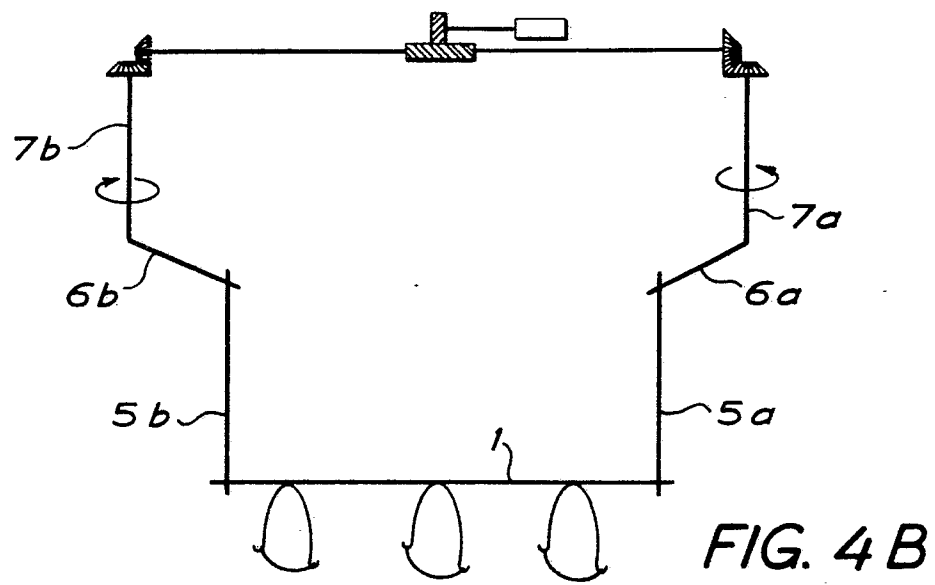
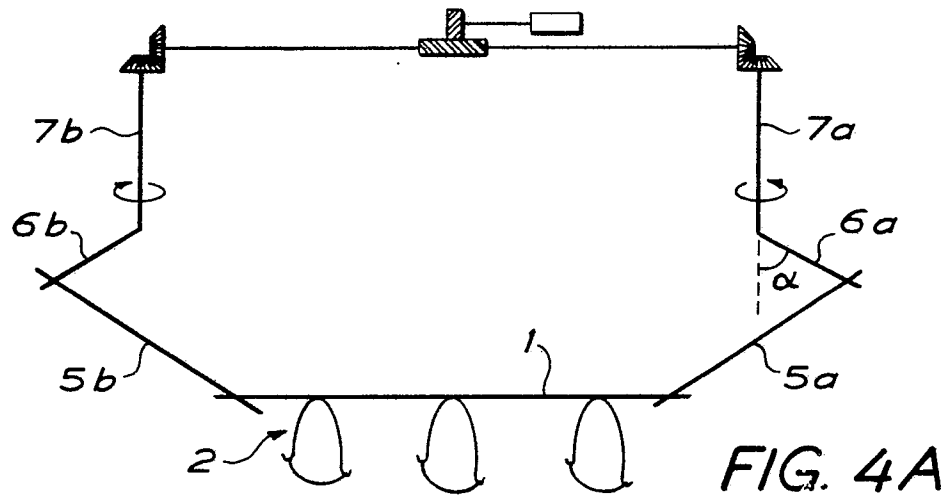


FIG. 3



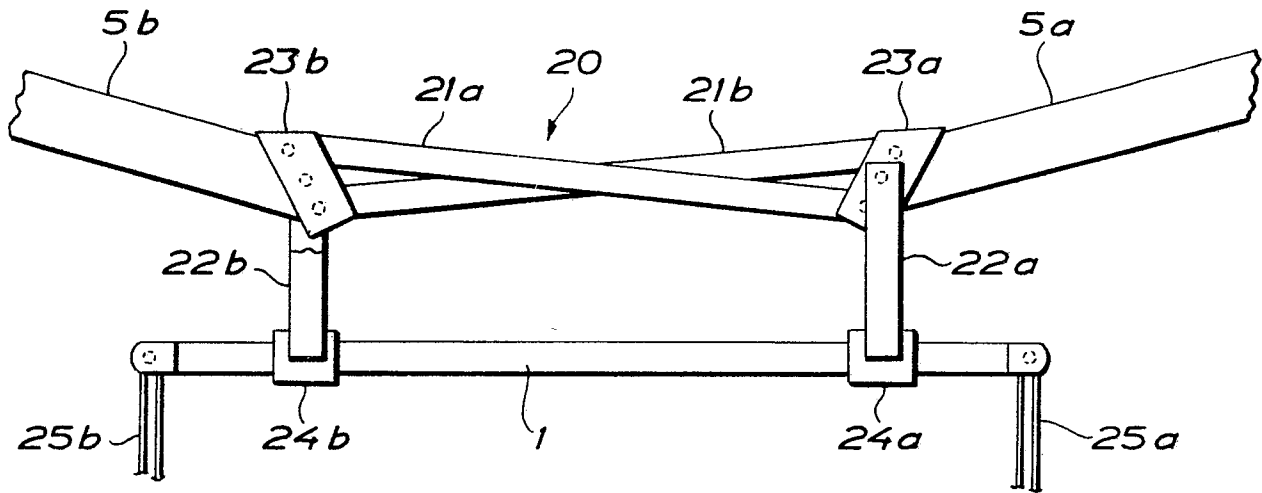


FIG. 5