

(19)



(11)

EP 4 197 961 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
21.06.2023 Bulletin 2023/25

(51) International Patent Classification (IPC):
B66F 9/18 (2006.01)

(21) Application number: **22212707.8**

(52) Cooperative Patent Classification (CPC):
B66F 9/183

(22) Date of filing: **12.12.2022**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

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(30) Priority: **14.12.2021 IT 202100031286**

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(54) AN ADJUSTABLE CLAMP FOR A LIFT TRUCK

(57) A clamp (2) for a lift truck (1) according to the invention comprises a frame (3) and two side structures (6,7) movable towards or away from each other. Each side structure (6,7) comprises a panel support (18) and a clamping panel (12,13) attached thereto through a plurality of adjustable connections, each comprising a buffer element (28) and a fixing screw (29). The buffer element (28) comprises at least a threaded cylindrical main body (28a) configured to be screwed into a threaded opening

(27) in the panel support (18), and comprising a central threaded opening (35) for receiving the fixing screw (29) therein, when the latter is inserted through a hole (36) in the clamping panel (12,13). By rotating the buffer element (28) relative to the panel support (18), the gap (A) between said panel support (18) and the clamping panel (12,13) itself can be adjusted quickly and easily, using a minimum of components.

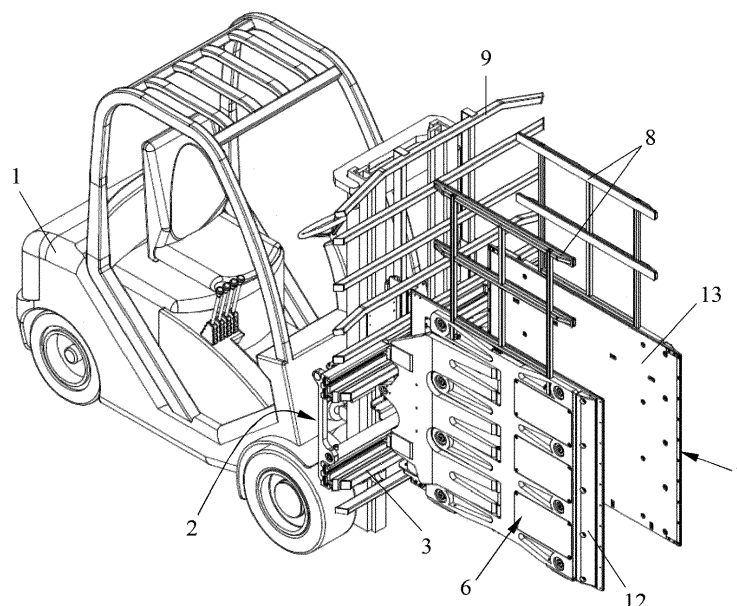


FIG. 1

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Description

[0001] The invention is related to lift trucks, in particular to a clamp that can be removably attached to a lift truck for clamping a parcel from two opposite sides. Such clamps are used for transporting certain types of parcels such as large cartons or white goods packed in polystyrene. The clamp comprises a pair of clamping panels having mutually facing, usually resilient surfaces. The panels are actuated to move away from each other or towards each other so as to be able to clamp a parcel between the panels at one location, transport the parcel, and set it down in another location, for example for moving parcels within a warehouse or loading parcels into a truck. The clamping force and the distribution thereof on the sides of the parcel must be adequate for securely holding the parcel up so that it does not slip during transport, while at the same time avoiding any damage to the parcel or to its packaging material.

[0002] In most clamps of this type, the panels are coupled to side structures which are slidable relative to a frame that is removably attached to the lift truck. The clamp further comprises actuators for moving the side structures towards or away from each other. The panels are usually pivotable relative to the frame about an upright pivot axis, which allows a degree of adjustment of the panels to non-parallel side surfaces of a parcel. However, additional adjustment means are often required in order to ensure that the clamping force is evenly distributed across the parcel's lateral surfaces.

[0003] Existing configurations include complex adjustment structures with many parts and/or providing inadequate support for the panels at the locations of the adjustment structures. Examples of such existing solutions are disclosed in patent publication documents WO2013056271 and US2018222734.

[0004] The object of the present invention is to provide a solution to the above-described problems. This object is achieved by a clamp for a lift truck in accordance with the appended claims and to a lift truck equipped with such a clamp. A clamp according to the invention comprises a frame and two side structures. Actuators are preferably provided for moving said structures towards or away from each other. Each side structure comprises a panel support and a clamping panel attached thereto through a plurality of adjustable connections, each comprising one buffer element and one fixing screw, i.e. a single buffer element and a single fixing screw. The buffer element comprises at least a threaded cylindrical element configured to be screwed into a threaded opening in the panel support, and comprising a central threaded opening for receiving the fixing screw therein, when the latter is inserted through a hole in the clamping panel. By rotating the buffer element relative to the panel support, the gap between said panel support and the panel itself can be adjusted quickly and easily, using a minimum of components. The use of a single buffer element at each location enables the implementation of buffer ele-

ments having a diameter that can be made sufficiently large so as to enable a large support surface between the buffer element and the panel when the latter is attached to the panel support. The diameter of the buffer elements is preferably between 40 mm and 200 mm.

Figure 1 is a 3D image of a lift truck equipped with a clamp according to an embodiment of the invention.

Figure 2 is a front view of the clamp illustrated in Figure 1.

Figure 3 is a 3D view of one of the side structures of the clamp illustrated in Figures 1 and 2.

Figure 4 is an exploded view of the side structure illustrated in Figure 3.

Figures 5a to 5c show a section and plane view of a clamping panel coupled to a panel support in accordance with an embodiment of the invention, and a detail of the section view.

Figures 6a and 6b are 3D images of a buffer element according to an embodiment of the invention.

Figure 7 illustrates the adjustment of the inclination of a clamping panel about a horizontal axis, in a clamp according to an embodiment of the invention.

Figure 8 illustrates the adjustment of the inclination of a clamping panel about a vertical axis, in a clamp according to an embodiment of the invention.

Figure 9a to 9c illustrates the adjustment of the inclination of both clamping panels about a horizontal axis, in a clamp according to an embodiment of the invention.

[0005] Figure 1 shows a lift truck 1 with a clamp 2 mounted at the front of the truck 1. The clamp 2 comprises a frame 3 mounted on the lift mechanism of the truck 1, so that the operator of the truck 1 can move the clamp 2 up and down. The frame 3 comprises a pair of variable length actuators 4 and 5 (see Fig. 2) which may for example be electrical or hydraulic actuators, coupled respectively to a first side structure 6 and to a second side structure 7 so as to be able to move these side structures 6,7 towards each other or away from each other relative to the frame 3, and thereby relative to the truck 1. Lateral support trellises 8 are removably attached to the top of the side structures 6 and 7. A rear support trellis 9 is attached to the frame 3. Each side structure 6,7 comprises a pair of support arms 10 which are slidably mounted in respective rails 11 so as to guide the lateral movement of the side structures 6,7 relative to the frame 3 under the influence of the actuators 4 and 5. The side structures 6 and 7 further comprise respective clamping panels 12 and 13 configured to clamp a parcel between them when the side structures 6 and 7 are actuated to move towards each other.

[0006] The left-hand side structure 6 (as seen from the front of the truck) is shown in more detail in Figures 3 and 4, without the support trellis 8. At an essentially right angle to the slidable arms 10, the side structure 6 com-

prises a support bracket 15 comprising three fork-shaped extensions 16 provided with upright tube-shaped end portions 17. A planar panel support 18 is pivotably coupled to the support bracket 15 through a pair of pins 19 inserted through holes 20 of the panel support 18 and through the tube-shaped end portions 17 of the fork-shaped extensions 16. The panel support 18 itself comprises four extensions 25 which are staggered relative to the fork-shaped extensions 16, so as to allow a pivoting motion of the panel support 18 relative to the support bracket 15, about an upright axis 26 defined by the central axis of the pins 19. Each pin 19 is secured by a screw 21 inserted through a ring 22 provided with a locking pin inserted laterally into the pin 19, and screwed respectively into the top and bottom edge of the panel support 18. The clamping panel 12 is attached to the panel support 18 and is thereby pivotable about the axis 26 (see Fig. 3), which lies approximately halfway between the front and back edges of the panel 12.

[0007] The aspects described so far are known as such and can e.g. be brought into practice according to known clamp designs. The attachment means by which the panel 12 is attached to the panel support 18 represent characteristic features of the depicted embodiment of the invention, and will now be described in more detail.

[0008] As best seen in Figure 4, the planar panel support 18 comprises eight openings 27, four of which are located at the outer ends of the extensions 25, the four others located opposite said first four openings, at the opposite side of the pins 19. The openings 27 have a cylinder-shaped inner wall and pass through the full thickness of the panel support 18. Buffer elements 28 are inserted in these openings 27. With the buffer elements 28 in place, the clamping panel 12 is attached to these eight buffer elements 28 by eight screws 29. Each of the buffer elements 28 and its accompanying screw 29 represents an adjustable connection in accordance with the invention.

[0009] One such adjustable connection is shown in more detail in Figure 5c. The connection is adjustable in the sense that the gap A between the panel support 18 and the panel 12 can be adjusted at the location of each connection, in the manner described hereafter. The buffer element 28 comprises a main body 28a and a resilient contact portion 28b. The cylindrical surface of the main body 28a is threaded between the first and second side surfaces 31 and 32 of the main body 28a. The inner wall of the opening 27 is threaded with the same thread size, enabling the insertion of the buffer element 28 into the opening 27 by screwing the buffer element 28 into said opening 27. A circumferential groove 30 (better visible in Figure 6a) having a hexagonal inner wall is present in the side surface 31 of the buffer element 28 that faces away from the clamping panel 12, so as to enable turning the buffer element 28 with the help of a socket wrench. The main body 28a of the buffer element 28 further comprises a central threaded opening 35 that is concentric with the outer cylindrical surface of the main body 28a.

The contact portion 28b is formed of a resilient material such as rubber or a material equivalent thereto. The contact portion 28b comprises a central opening 38 that is aligned with the threaded opening 35. This configuration enables the attachment of the panel 12 by inserting the screw 29 through a hole 36 provided in the panel 12 and through the opening 38 of the resilient contact portion 28b, and by turning the screw 29 thereby inserting it into the central opening 35 of the main body 28a until the screw 29 is tightly securing the panel 12 to the buffer element 28. When the clamping panel 12 is attached, the panel 12 rests against the resilient contact portion 28b, as seen in the detail shown in Figure 5c.

[0010] In a manner that is known as such, the panel 12 preferably comprises a rigid panel portion 12a and a resilient covering 12b. The holes 36 preferably have a conically shaped profile in the rigid panel portion 12 which serves as a seat for receiving the similarly cone-shaped head of the fixing screws 29. The heads of the screws 29 are thereby lying inward relative to the resilient covering 12b so as not to damage a parcel as it is picked up and clamped between the panels 12 and 13.

[0011] 3D views of the buffer element 28 are shown in Figures 6a and 6b. The main body 28a of the buffer element 28 is preferably formed of metal, for example steel or a comparable material in terms of its mechanical properties. The resilient portion 28b may be fixed to the main body 28a by a glue or similar attachment means.

[0012] As stated, the attachment of the clamping panel 12 through eight of the above-described adjustable connections enables the adjustment of the gap A indicated in Figure 5c, between the panel 12 and the panel support 18 at these eight locations. Only two components are required at each location : the buffer element 28 and the fixing screw 29. This represents a simplified structure compared to prior art clamps, as well as enabling the adjustment of the gap A by a minimum of manipulations.

[0013] In order to adjust the gap A at one of the attachment locations, it is sufficient to release the screw 29, adjust the position of the buffer element 28 by turning it relative to the opening 27 with the help of a socket wrench, and re-fixing the screw 29. By adjusting the gaps appropriately at the different locations, the inclination of the clamping panels 12 and 13 relative to their respective planar panel supports 18 can thereby be adjusted. This is illustrated in Figures 7 and 8 for the case of the left-hand side structure 6 comprising the clamping panel 12. In each of these figures, the straight arrows 40 illustrate the degree to which the buffer elements 28 are to be rotated in the direction indicated by the round arrows 41 starting from a situation wherein the panel 12 is parallel to the panel support 18, using a socket wrench or any equivalent tool, in order to obtain the inclination of the panel illustrated by the slanted rectangles 42, which show the inclination angle in a somewhat exaggerated way in order to clearly visualize the effect. The panel 12 can be inclined according to inclination angles defined about a horizontal axis (Figure 7) or a vertical axis (Figure 8) or

a combination thereof. When applying the inclination about a horizontal axis symmetrically to the two panels 12,13 of the clamp 2, inclinations can be set as shown in Figures 9a to 9c. By adjusting the panels 12,13 in this way, the clamping force can be adjusted in accordance with the specific shape of a particular parcel, if the parcel requires for example a higher clamping pressure at the top than at the bottom of the parcel.

[0014] The invention is not limited to the embodiment shown in the drawings and described above. The number of buffer elements 28 can be different from 8 and could for example be 6 or 4, or more than 8 for larger sized clamps. Preferably, and as in the illustrated embodiment, a first group of adjustable connections (each connection comprising one buffer element 28 and one screw 29) is present to one side of the pivot axis 26 and a second group is present on the opposite side of said axis 26, but the adjustable connections could be more randomly distributed across the surface of the clamping panels 12,13. The adjustable connections according to the invention can also be applied on a clamp 2 having panels 12,13 which are attached to a panel support 18 that is not pivotable relative to the clamp frame 3.

[0015] Instead of the groove 30, the buffer elements 28 could be provided with equivalent means for enabling the interaction of the buffer elements 28 with a tool for rotating the elements 28 relative to the planar support 18. For example, the buffer elements 28 could be provided with a hexagonal cavity at the side surface 31 configured to interact with an Allen wrench for rotating the buffer elements 28, or the buffer elements 28 could have a hexagonal boss protruding outward from the side surface 31 enabling the interaction with a socket wrench or with a standard wrench.

[0016] The resilient contact portion 28b could be omitted. In that case, the buffer element 28 consists only of the main body 28a and the panel 12,13 rests directly against the side surface 32 of this main body 28a when the panel 12,13 is attached to the panel support 18.

[0017] Possibly, a number of adjustable connections according to the invention, i.e. comprising a buffer element 28 and a screw 29, could be combined with other connections, adjustable or not, between the panel supports 18 of the side structures 6 and 7 and the panels 12 and 13.

Claims

1. A clamp (2) for a lift truck (1), the clamp (2) comprising a frame (3) and two side structures (6,7) configured to move towards each other or away from each other relative to the frame (3), each side structure (6,7) comprising a planar panel support (18) and a clamping panel (12,13) that is attached to the panel support (18) at multiple locations through a plurality of adjustable connections (28,29) which allow adjusting a gap (A) between the clamping panel (12,13)

and the panel support (18),

characterized in that each of said adjustable connections (28,29) comprises :

- one cylinder-shaped buffer element (28) comprising at least a main body (28a) having a cylindrical outer surface, a first side surface (31) facing away from the clamping panel (12,13) and a second side surface (32) facing towards the clamping panel (12,13), wherein the main body (28a) of the buffer element (28)

- comprises a thread on its cylindrical outer surface by which the buffer element (28) is screwed into a threaded through-opening (27) in the panel support (18),

- comprises a central threaded opening (35) and

- is configured to interact at the first side surface (31) with a tool for rotating the buffer element (28) relative to the panel support (18),

- one fixing screw (29) configured to be inserted through a hole (36) in the clamping panel (12,13) and screwed into the central opening (35) of the buffer element (28) at the second side surface (32), to thereby attach the panel to the panel support (18).

2. A clamp (2) according to claim 1, wherein the buffer element (28) further comprises a resilient contact portion (28b) attached to the second side surface (32) of the main body (28a), provided with an opening (38) aligned to said threaded opening (35), and configured to be placed in contact with the clamping panel (12,13) when the latter is attached to the panel support (18).

3. A clamp (2) according to claim 1 or 2, wherein the buffer element (28) comprises a groove (30) in said first side surface (31), said groove (30) being shaped so as to enable the interaction with said tool for rotating the buffer element (28).

4. A clamp (2) according to any one of the preceding claims, wherein each side structure (6,7) comprises one or more arms (10) which are slidable relative to the frame (3) and a support bracket (15) fixed to said one or more arms (10), and wherein the panel support (18) is pivotable relative to the support bracket (15) about an upright pivot axis (26) located approximately halfway between the front and back edges of the clamping panel (12,13).

5. A clamp (2) according to claim 4, wherein a first group of one or more adjustable connections (28,29) is located to one side of the pivot axis (26) and a second

group of adjustable connections is located to the other side of the pivot axis (26).

6. A clamp (2) according to claim 5, wherein the first and second group comprise the same number of adjustable connections (28,29), and wherein the adjustable connections of one group are located directly opposite the adjustable connections of the other group. 5 10
7. A clamp (2) according to any one of the preceding claims, wherein each side structure (6,7) comprises a total of 8 adjustable connections (28,29).
8. A lift truck (1) comprising a clamp (2) according to any one of the preceding claims. 15

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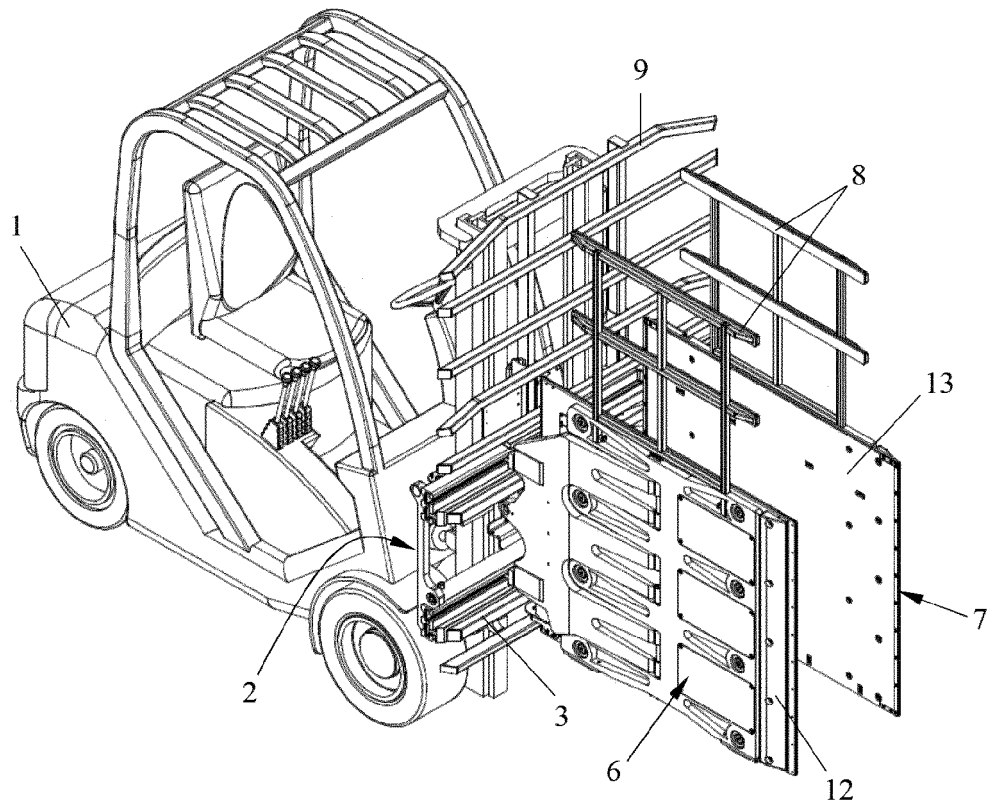


FIG. 1

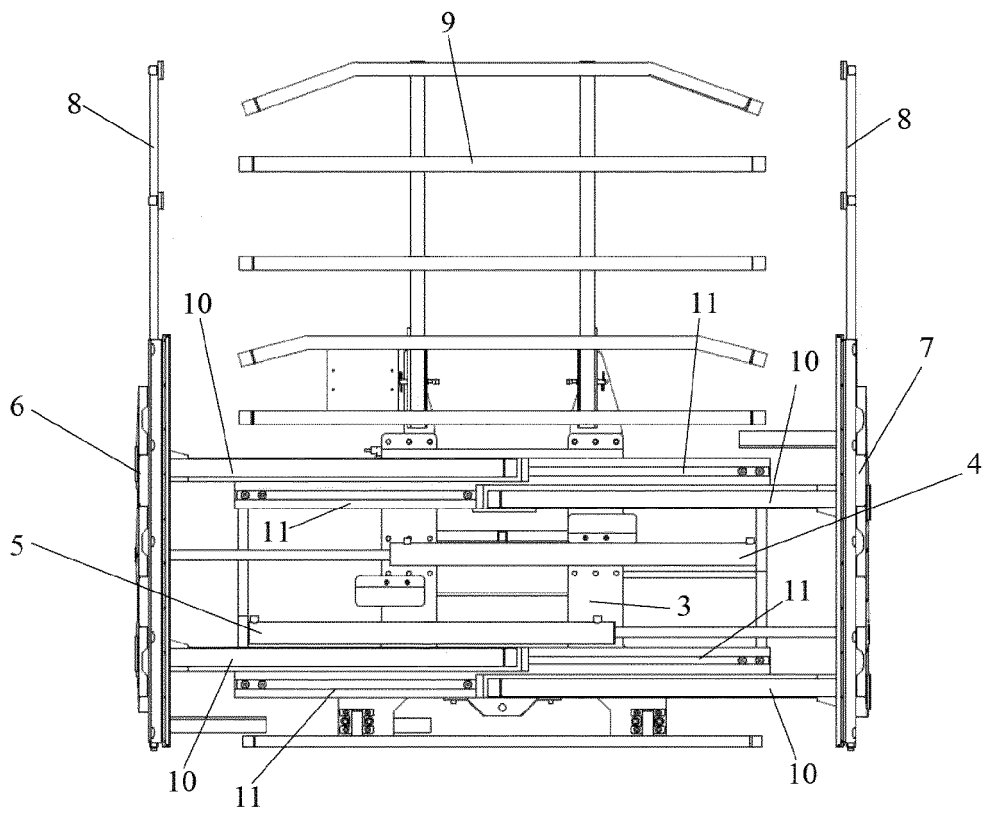


FIG. 2

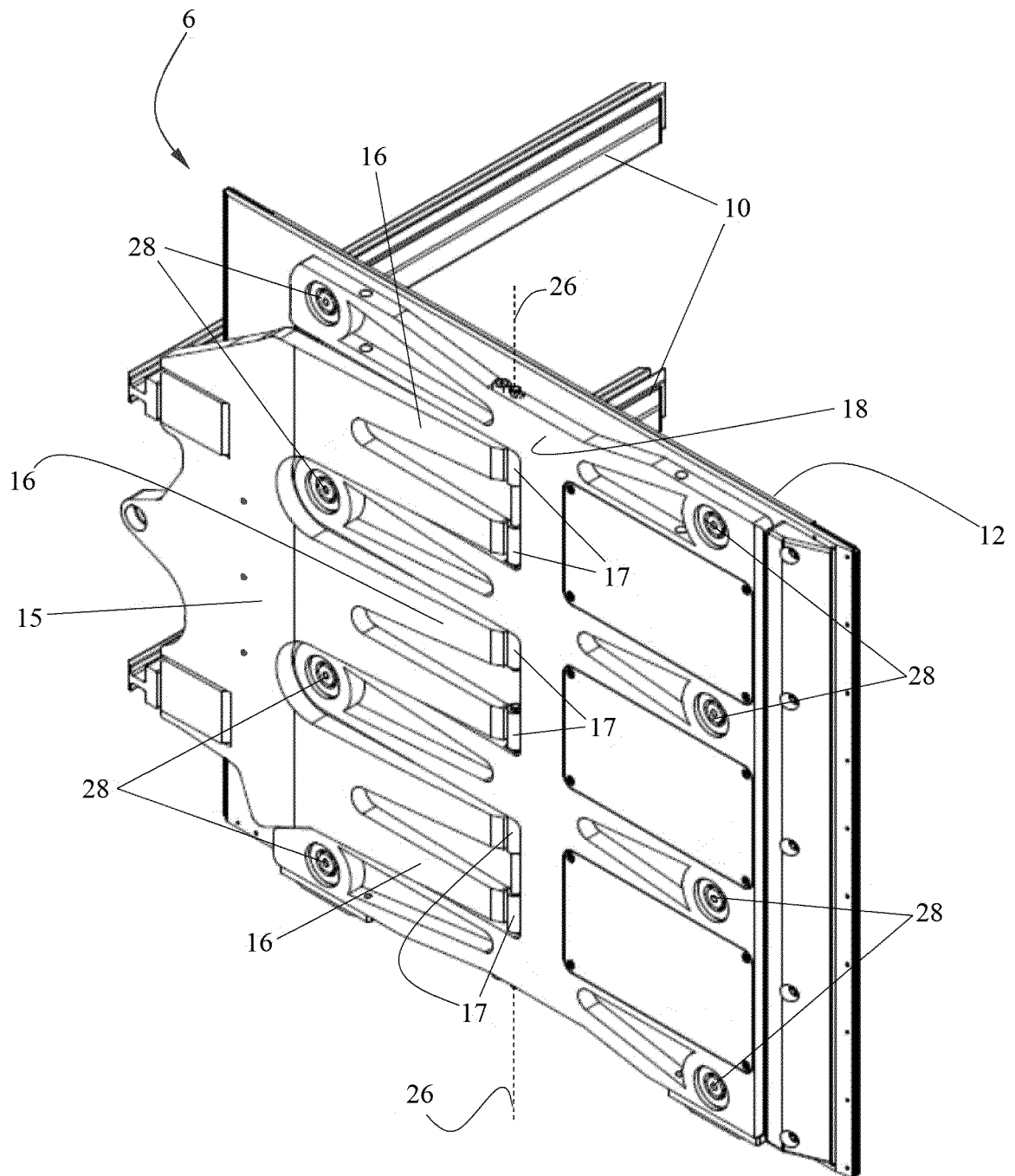


FIG. 3

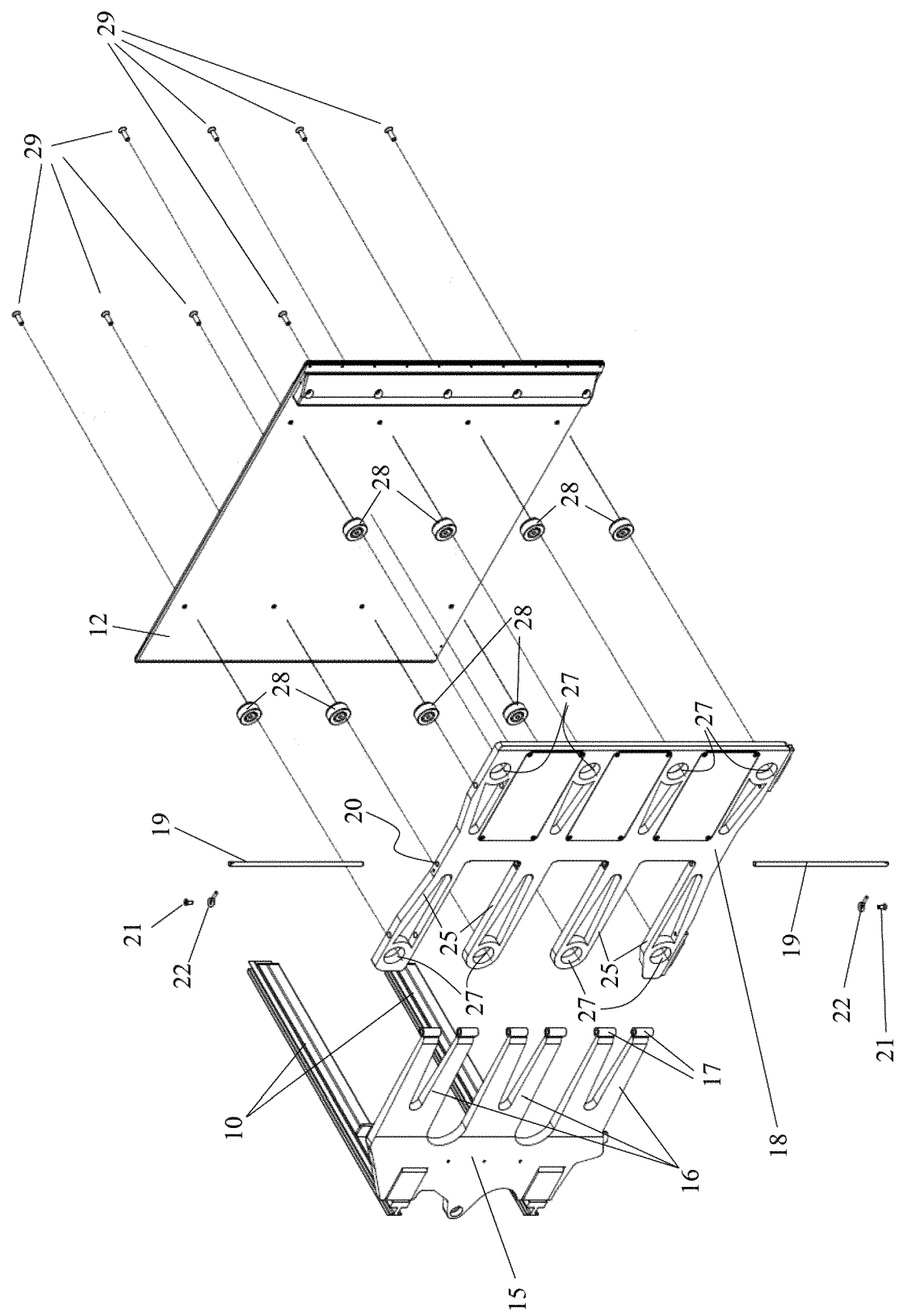


FIG. 4

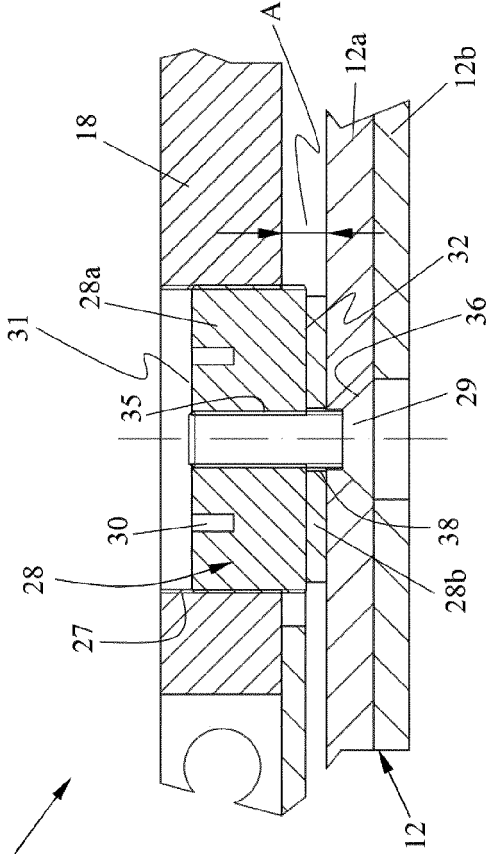
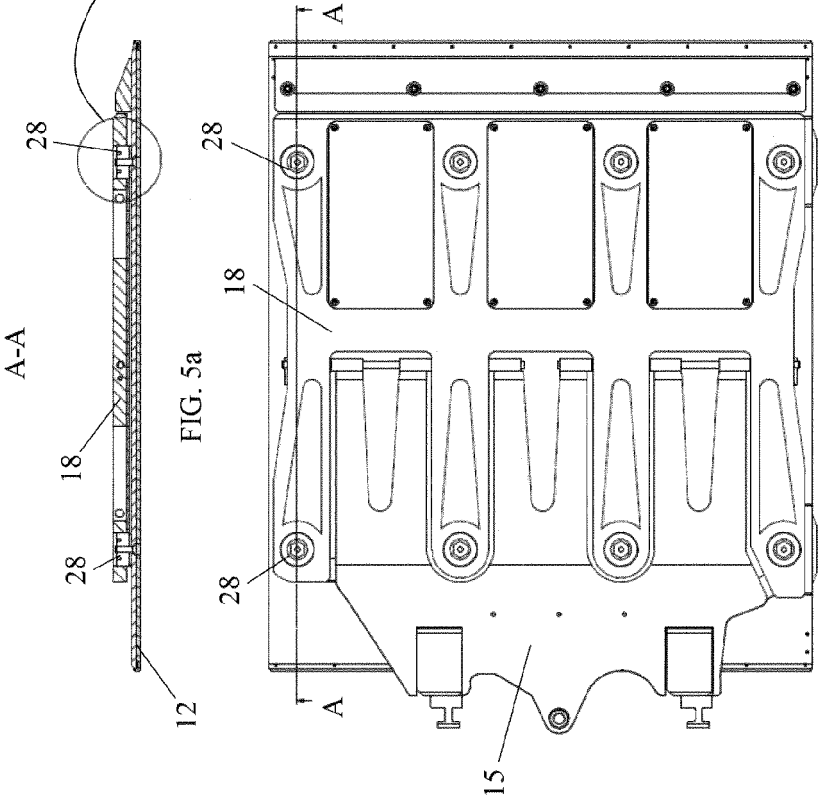


FIG. 5c

FIG. 5b

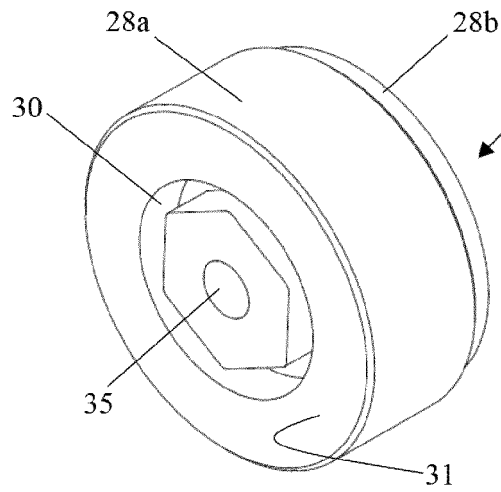


FIG. 6a

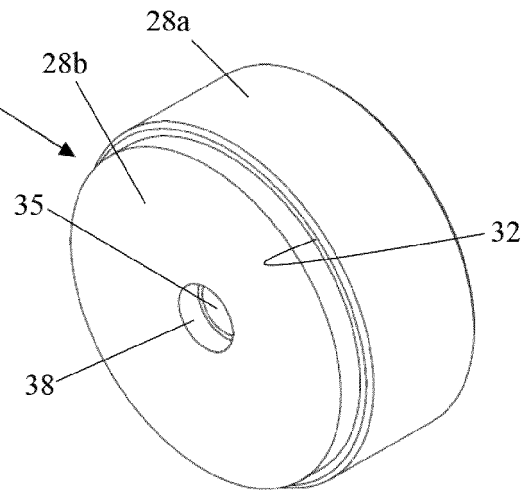


FIG. 6b

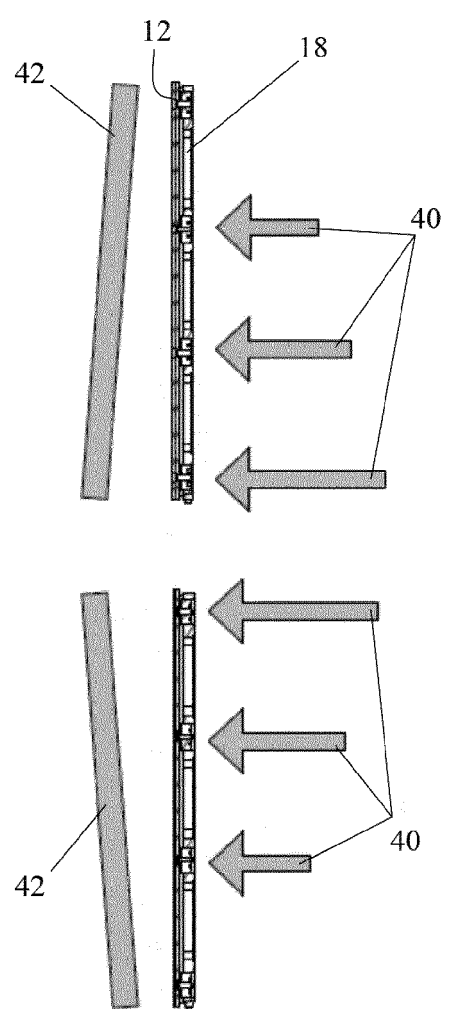
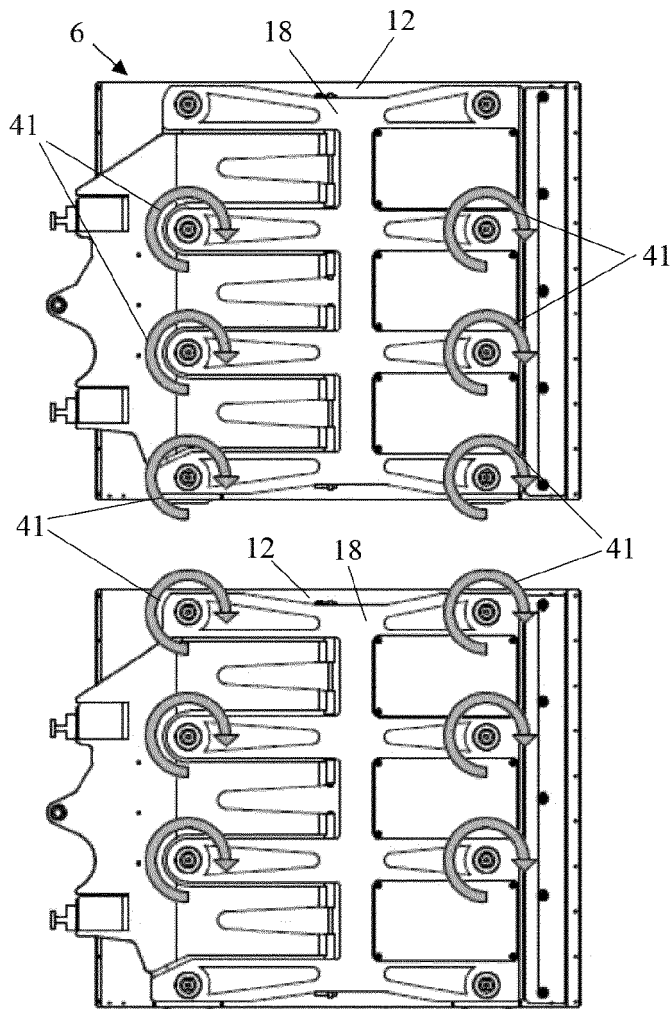


FIG. 7

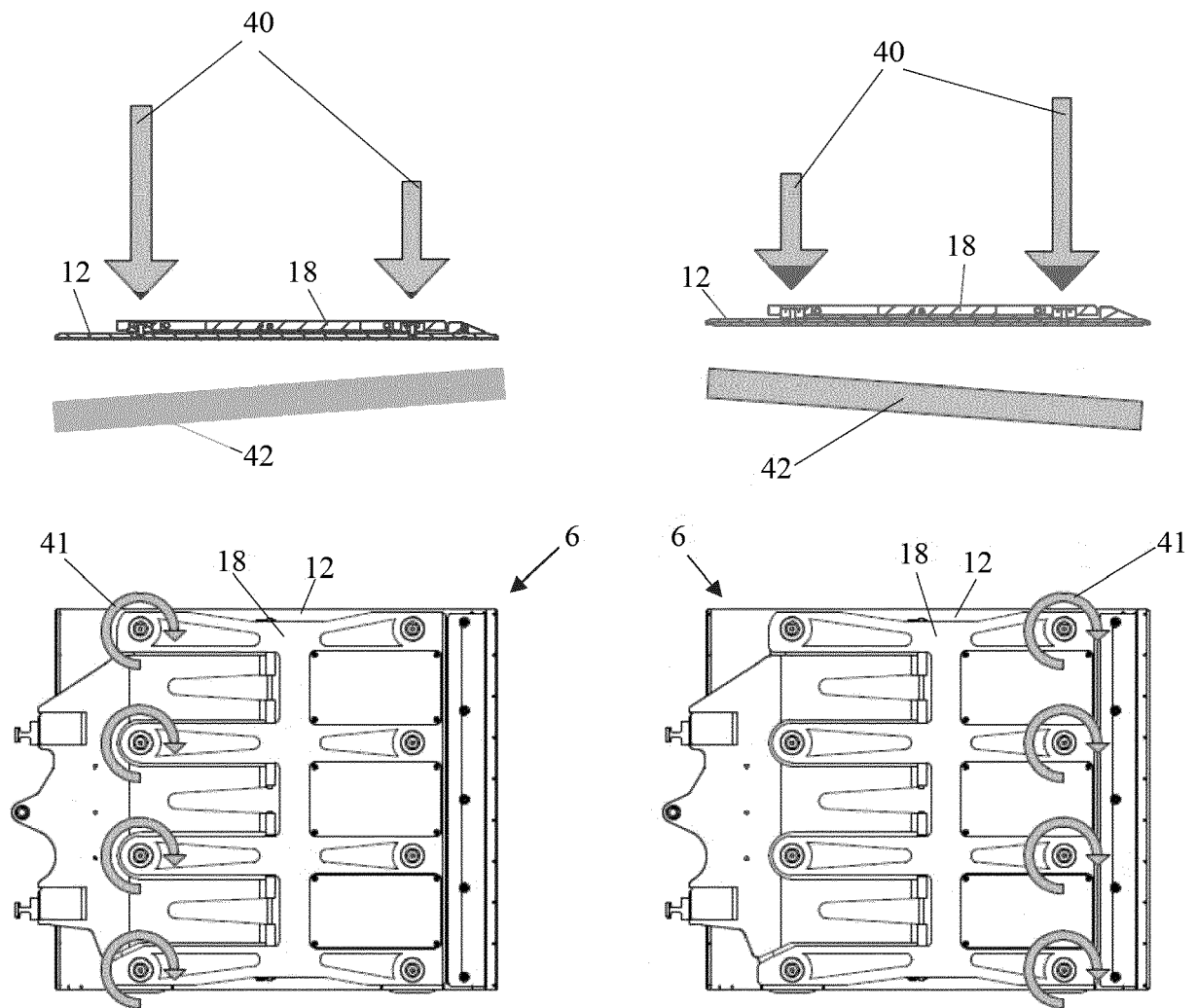


FIG. 8

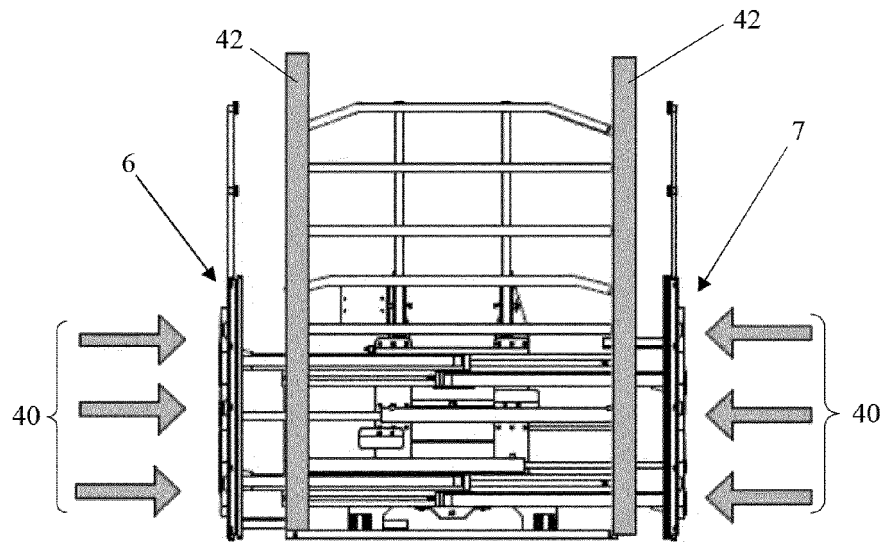


FIG. 9a

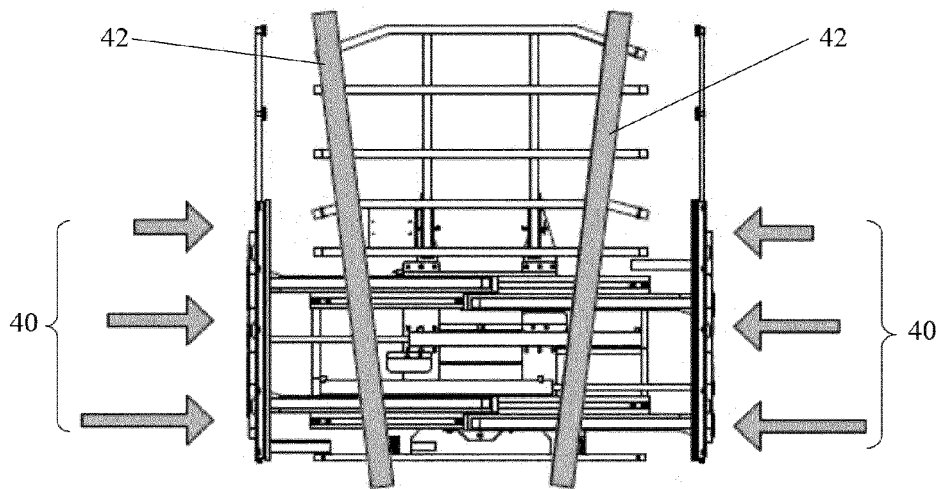


FIG. 9b

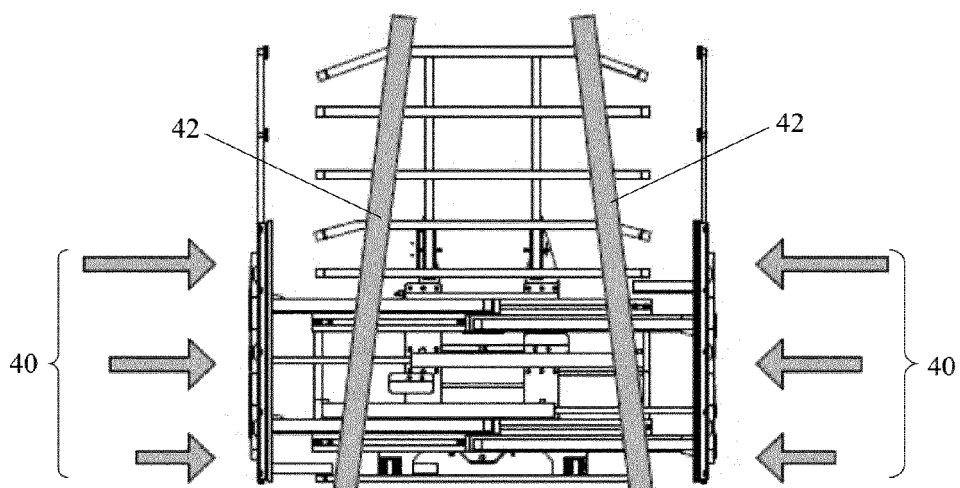


FIG. 9c



EUROPEAN SEARCH REPORT

Application Number

EP 22 21 2707

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A, D	WO 2013/056271 A1 (CASCADE CORP AN OREGON CORP [US]) 18 April 2013 (2013-04-18) * paragraph [0017]; figures 3, 4 * -----	1-8	INV. B66F9/18
			TECHNICAL FIELDS SEARCHED (IPC)
			B66F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		20 April 2023	Serôdio, Renato
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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REFERENCES CITED IN THE DESCRIPTION

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