(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 705 420 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.09.2020 Bulletin 2020/37

(51) Int Cl.:
B65D 88/14 *(2006.01)* ***B65D 88/52*** *(2006.01)*

(21) Application number: **20161509.3**

(22) Date of filing: **06.03.2020**

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **08.03.2019 NL 2022701**

(71) Applicant: **Van Riemsdijk Rotterdam B.V.**
3079 DN Rotterdam (NL)

(72) Inventor: **VAN RIEMSDIJK, Geert**
3062 LE ROTTERDAM (NL)

(74) Representative: **EP&C**
P.O. Box 3241
2280 GE Rijswijk (NL)

(54) **A COLLAPSIBLE FREIGHT CONTAINER**

(57) The invention relates to collapsible air freight container (10), comprising:
a rigid bottom plate (1),
a first side wall (2) comprising one or more first side wall elements (7, 8, 30) connected to a first edge (6) of the bottom plate (1), wherein the one or more first side wall elements are hingable relative to one another and/or the bottom plate about a first hinge line that is substantially parallel to the bottom plate, and
a second side wall (3) comprising one or more second side wall elements connected to a second edge (26) of the bottom plate (1), wherein the second edge (26) is opposite to the first edge (6) of the bottom plate, wherein the one or more second side wall elements are hingable relative to one another and/or the bottom plate about a second hinge line (15) that is substantially parallel to the bottom plate,
characterized in that the collapsible air freight container (10) comprises at least one inflatable support element (4, 5) extending between the first side wall and the second side wall, wherein the at least one inflatable support element is connected to the first side wall above the first hinge line and to the second side wall above the second hinge line,
wherein the container (10) is transformable from a collapsed state to a storage state, in which the container defines a storage space (23), by inflation of the at least one inflatable support element, and wherein the container (10) is transformable from the storage state to the collapsed state by deflation of the at least one inflatable support element.

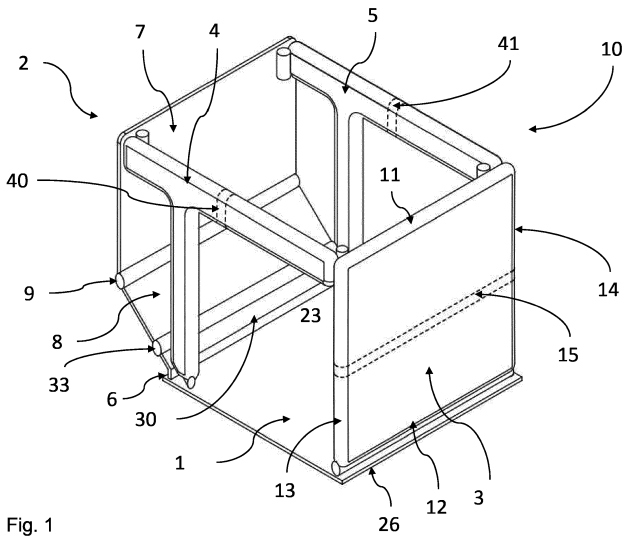

Fig. 1

EP 3 705 420 A1

Description

FIELD OF THE INVENTION

[0001] The invention relates to a collapsible freight container, for example a collapsible air freight container, and a method for using a collapsible freight container for air freight.

BACKGROUND OF THE INVENTION

[0002] The last couple of decades a steady growth in the world's population has been seen. In many parts of the world this increase has gone hand in hand with an increase in wealth. As a result, consumption has gone up and the need for transport and logistics has increased.

[0003] To be able to build on this growth, businesses in the freight sector are keen on innovations that enable them to become or stay competitive. Especially innovations that optimize the use of cargo space, facilitate faster and easier handling of cargo, and provide better protection of the cargo and/or freight vehicle are in high demand.

[0004] These trends have also observed in the world of airfreight, where a combination of globalisation, large capital investments, and the enormous costs of downtime drives businesses to do more, faster and cheaper. Typically this means reducing turnaround times of aeroplanes on the ground. To this end Unit Load Devices (ULD) have been introduced decades ago, which in turn has boosted trade flows by lowering operational costs. Using ULD's however also comes with its own set of challenges.

[0005] When unloaded at the destination airport, empty ULD's namely form an impediment on the tarmac. Another problem is the return logistics. In the probable case that there are ULD's transported back empty to the origin airport, a lot of valuable space in the cargo area is lost.

[0006] There are known examples of airfreight containers that are collapsible when unloaded. After collapsing these containers can often be stacked to take up a smaller surface area and volume during storage and/or transport.

[0007] US5941405 discloses a collapsible cargo container for aircraft, that comprises a rigid aluminium base plate and top plate and flexible fabric side walls. In erected and unlocked state, the rigid top plate is slidable up and down along support posts that extend upwards from each of the corners of the base plate. Said support posts are provided with hinges near the base plate. In the collapsed position, wherein the top plate has been moved downwards to lie substantially on top of the base plate and the side walls have been tucked away in between, the support posts are foldable to lie parallel with the bottom and top.

[0008] A drawback of the container disclosed in US5941405 is that manual intervention is required to transform the container from an erected position to a collapsed position. After unlocking the top plate at each of the support posts to allow it to move downward, a crew member should either support the top plate to be gradually lowered or let the top plate fall down abruptly. Either way there is a risk of injury by pinching of the skin or limbs getting stuck or impacted. Another drawback in this design seems to be the probable occurrence of wear and tear as a result of the transformation.

[0009] DE102014003210 discloses an airfreight container of which the side walls and bottom are inflatable. When inflated, the container defines a container shape, when deflated, the container has a substantially lower volume and can be folded.

[0010] A drawback of the container disclosed in DE102014003210 is that the inflatable elements are in no way shielded from puncture or any other kind of damage in either inflated or deflated state. For instance during deflation, the medium used for pressurizing is gradually released until a pressure equilibrium with the environment is reached. The remaining air should then be forced out either manually or for instance by means of a pump.

[0011] Another drawback is that in the deflated state the container has an undefined shape. Collapsing of the container of DE102014003210 by deflation of the inflatable elements will not result in folding of the container in a controlled manner. This makes handling difficult and therefore additional folding is required before stowing. Folding the container to a desired shape may require a substantial effort.

[0012] Finally, before the container disclosed in DE102014003210 can be neatly transformed from a folded deflated state to an erected inflated state, it should be laid out on the floor. A process that can become cumbersome for flexible elements that have been tightly packed in a cargo space. Besides, objects lying on the floor pose a risk of puncturing the bottom.

[0013] WO2008/118077 discloses a goods container for loading spaces in vehicles, comprising a bottom, a top and at least one side wall made of a non-self-supporting material. The container further comprises a loadbearing structure which maintains the side walls, bottom and top so that they define a storage space. In certain embodiments the loadbearing structure comprises flexible tubes that are filled with compressed air. The main aim of the container disclosed in WO2008/118077 is to optimally use the storage space in a vehicle, by being able to place the relatively compliant container against a side wall of said storage space without inducing excessive forces on either the wall or container during transport.

[0014] The container from WO2008/118077 does not provide any shielding of the compressed loadbearing structure. The risk of damaging the container during handling or storage therefore seems to be significant.

[0015] Further, the disclosed container is not suited to be drawn across the floor of a cargo space, but rather is designed to be put on a conveying track. This would narrow down the scope of application in airplanes and/or

airport wherein such facilities are not available.

[0016] US 3,552,466 discloses a freight container having a rigid rectangular base plate and inflatable walls connected to the base plate. The walls can be inflated to erect the container and deflated to collapse the container.

[0017] US 3,578,050 discloses a collapsible air cargo container. The container is constituted of flexible material, a cargo pallet on which cargo can rest, means for securing the container to the pallet. The container comprises air inflatable means for supporting the container in an upright expanded position on the pallet and for forming a rigid entrance for the container to provide access to the interior of the container. The container is constructed to permit the envelope of the container to hug the irregular boundary surface of the article content with a decreased air pressure, whereby the container serves to hold the individual products in firm relation with respect to one another. In the absence of any air pressure, the container is constructed to cause the container to collapse and to be constituted of only of the container material and pallet when completely empty to conserve space in returning the empty container to the point of origin.

[0018] EP 3 398 869 discloses an inflatable and collapsible container having a single circumferential side wall connected to the bottom wall. The container further comprise at least two support elements arranged at the underside of the bottom wall. The bottom wall, the circumferential side wall and the support elements are all constructed as inflatable elements.

[0019] EP 0 141 429 discloses a flattened container ready for filling with bulk material, comprising a liner of impervious sheet in an outer container of strong load-carrying material. The liner and the outer container are folded length-wise in the same way such that the liner is kept in position by having its folded of gussets everywhere placed in the corresponding folds or gussets of the outer container.

SUMMARY OF THE INVENTION

[0020] The present invention aims to overcome one or more of these drawbacks and/or to provide an alternative collapsible container. According to the invention, this aim is achieved by means of the collapsible air freight container according to claim 1.

[0021] The collapsible air freight container comprises a rigid bottom plate, for example a rigid rectangular bottom plate. In an embodiment, the bottom side of the container may be provided with a second bottom plate or one or more other elements to provide in a pallet configuration with the first bottom plate. Also, the bottom side may be provided with elements and/or could comprise protrusions, recesses, and/or through holes for interfacing with the loading and restraint system of for instance an aircraft.

[0022] The container further comprises a first side wall comprising one or more first side wall elements and a second side wall comprising one or more second side wall elements. The one or more first side wall elements may be connected to a first edge of the bottom plate. The one or more first side wall elements are hingable relative to one another and/or the bottom plate about first hinge line that is substantially parallel to the bottom plate. The one or more second side wall elements may be connected to a second edge of the bottom plate, wherein the second edge is opposite to the first edge of the bottom plate. The one or more second side wall elements may be hingable relative to one another and/or the bottom plate about a second hinge line that is substantially parallel to the bottom plate.

[0023] At least one inflatable support element extends between the first side wall and the second side wall. The at least one inflatable support element is arranged to provide, when inflated, constructional support between the first side wall and the second side wall. The at least one inflatable support element is connected to the first side wall above the first hinge line and to the second side wall above the second hinge line.

[0024] When being deflated the at least one inflatable support element may be constructed to be folded at at least one fold line. The fold line may be at a predefined position in the at least one inflatable support element. The fold line may for instance be created by a weakened section in the at least one inflatable support element. The fold line may also be created by any other means that causes the at least one inflatable support element to fold at a desired location, for example a hinge. In another embodiment, the location of the at least one fold line may be determined by a manual pushing action of a person guiding the deflation of the at least one inflatable support element. An indicator may be provided on the at least one inflatable support element to indicate the desired location for such pushing action, causing the at least one inflatable support element to fold at the intended location.

[0025] The container is transformable from a collapsed state to a storage state, in which the container defines a storage space, by inflation of the at least one inflatable support element, and the container is transformable from the storage state to the collapsed state by deflation of the at least one inflatable support element.

[0026] An advantage of the container is that due to the configuration and characteristics of the different parts of the container, the container may transform from the storage state to the collapsed state in a controlled way. During the collapsing process, the at least one inflatable support element may gradually deflate while it may be folded. The first side wall may hinge at least partially in the direction of the second side wall to lie above the bottom plate. The at least one inflatable support element may, in the collapsed state, at least partially be arranged below the first side wall and/or the second side wall, where it may be protected by the first side wall and/or the second side wall, respectively.

[0027] Another advantage of this air freight container is that it will result in less take up of volume by empty

containers, either on the tarmac or during return flights. After unloading of a freight container from a freight vehicle, and unloading the goods from the storage space, instead of placing multiple freight containers side by side or stacking them on top of each other, the containers can be collapsed and efficiently stored or transported. Multiple collapsed containers may be stacked on each other, while occupying the space of only one container in storage state. In logistically demanding area's such as airfields this is advantageous.

[0028] None of the prior art documents disclose or suggest US 3,552,466, US 3,578,050, and EP3 398 869 disclose a collapsible air freight container comprising at least one inflatable support element connected between two opposite side walls, wherein inflation and deflation of the at least one inflatable support element is used to transform, in a controlled way, the air freight container from a collapsed state to a storage state and from the storage state to the collapsed state, respectively. The prior art containers require substantial manual labour to carry out such transformation in a controlled way. EP 0 141 429 discloses a different type of container constructed to be filled with bulk material.

[0029] In an embodiment, the one or more first side wall elements comprise one or more rigid side plate elements.

[0030] An advantage of the rigid side plate elements is that is that the rigid side plate elements may be used to shield the relatively vulnerable at least one inflatable support element from impact, puncture, etc. by arranging the at least one inflatable support element, in the collapsed state of the container, at least partially between rigid side plate elements and the bottom plate. The rigid side plate elements of the first side wall may also, in the collapsed state of the container, be used as a top plate of the collapsed container that provides a basis to place other collapsed containers on the collapsed container. Thus, the rigid side plate elements may improve the stackability of multiple collapsed containers.

[0031] In an embodiment, the one or more rigid side plate elements comprise a bottom rigid side plate element and at least one further rigid side plate element, wherein the bottom rigid side plate element extends from the bottom plate and is fixedly connected to the first edge of said bottom plate, and wherein the at least one further rigid side plate element is connected at the first hinge line to the bottom rigid side plate element. The fixedly connected rigid side plate is for example useful when a length of the first side wall exceeds the length of the bottom plate. The fixedly connected rigid side plate may ensure that in the collapsed state, the first side wall does not extend beyond the opposite second side of the bottom plate.

[0032] In an embodiment, the first side wall comprises one or more inflatable side wall elements that is/are hingable at the first hinge line. The first hinge line may for example be created by mechanical hinges provided in an inflatable side wall element or between two inflatable side wall elements, but also by a first wall folding line created in one inflatable side wall element. Such first wall folding line may for example be created by providing a relatively weak part in the inflatable side wall element.

[0033] In an embodiment, the second side wall comprises one or more inflatable side wall elements that is/are hingable at the second hinge line. The second hinge line may for example be created by mechanical hinges provided in an inflatable side wall element or between two inflatable side wall elements, but also by a second wall folding line created in one inflatable side wall element. Such second wall folding line may for example be created by providing a relatively weak part in the inflatable side wall element.

[0034] An advantage of having inflatable elements in the first side wall and/or the second side wall is that it makes the first side wall and/or the second side wall an active element during transformation, further facilitating self-erectability of the container. The fact that the first side wall and/or second side wall is more yielding and furthermore deflates gradually aids in gradual collapsing of the container. By creating the first hinge line and the second hinge line at a suitable location collapsing of the container in a controlled way may still be guaranteed even though inflatable side wall elements are used for the first side wall and/or the second side wall.

[0035] In an embodiment, the second side wall comprises two rigid plate elements, wherein the rigid plate elements are hingably connected to each other at the second hinge line. An advantage of plate elements in the side wall is that the second hinge line is properly defined by the hinge or hinges that are provided between the plate elements. Moreover, the collapsing of the container may also properly controlled by using rigid plate elements in the second side wall.

[0036] In an embodiment, the first side wall comprises an upper part above the first hinge line and a lower part below the first hinge line, wherein the first hinge line is provided to fold the upper part of the first side wall towards the second side wall, and wherein the second side wall comprises an upper part above the second hinge line and a lower part below the second hinge line, wherein the lower part is hingably connected to the bottom plate to fold the lower part of the second wall towards the first side wall and the second hinge line is provided to fold the upper part of the second side wall away from the first side wall, such that in the collapsed state the upper part of the second side wall will be arranged at least partially above the lower part of the second side wall, and the first side wall will be arranged at least partially above the upper part and the lower part of the second side wall.

[0037] In an embodiment, the first side wall and the second side wall each comprise a front end and a back end, wherein the back end is opposite to the front end, and wherein the container comprises a first inflatable support element extending between the front end of the first side wall and the front end of the second side wall, and a second inflatable support element extending be-

tween the back end of the first side wall and the back end of the second side wall. It is advantageous to provide a first inflatable support element between the front end of the first side wall and the front end of the second side wall to form at least partially a front wall of container, and a second inflatable support element between the back end of the first side wall and the back end of the second side wall to form at least partially a back wall of container. The storage space of the container, in storage state, may be formed between the first side wall, the second side wall, the front wall and the back wall.

[0038] The spaces of the front wall and the back wall not occupied by the first inflatable support element and the second inflatable support element, respectively, may be closed by one or more flexible sheets to provide a closed front wall and a closed back wall. Entrance openings may be provided in the one or more flexible sheets to provide entrance to the storage space.

[0039] In an embodiment, the second side wall has a top end and a bottom end, wherein the bottom end is connected to the second edge of the bottom plate and the top end is opposite to the bottom end, wherein the second hinge line is arranged substantially midway between the top end and the bottom end.

[0040] In an embodiment, the container is constructed to be substantially self-collapsing and/or substantially self-erecting by deflation and/or inflation of the inflatable support elements, respectively. Having a substantially self-erecting container allows the user to connect and activate a supply of compressed medium to the container, and subsequently move to the next task. Overall this feature has the potential to either reduce the turnaround time of a freight vehicle, to reduce the required manpower for managing the cargo space, or both. Substantially self-collapsing means that the container may be transformed from storage state to collapsed state with low effort. There may be a need for personnel to guide movable parts during transformation between the storage state and the collapsed state, and vice versa.

[0041] In an embodiment, the at least one inflatable support element comprises a beam that extends between the first and second side wall and a leg that extends between the beam and the bottom plate. The construction of beam and leg generally forms a T-shape. An advantage of having the at least one inflatable support element built as a T-shape is that the structural rigidity of the container is improved while leaving open a path to the storage space defined by the container.

[0042] In an embodiment, the leg is inflatable. An advantage hereof is that having an inflatable leg facilitates the self-erect ability by providing an additional outwardly and upwardly directed force during inflation.

[0043] In an alternative embodiment the leg is rigid. An advantage of a rigid leg is that during self-collapsing the leg may provide an additional downwardly and inwardly directed force onto the part of the inflatable support elements that resides substantially above the second hinge line of the second side wall, adding to the predictability and reliability of the collapsing process. Another advantage is the increased rigidity of the container. Yet another advantage is that, compared to an inflatable leg, less compressed medium is required for filling of the inflatable support elements.

[0044] In an embodiment, the container in the storage state has the form of an AKE airfreight container. An advantage of this form is that it fits in the hull of many (commercial) aircraft. For instance the A300, A310, A330, A340, 747, 767, 777, DC-10, MD-11 and IL9 aircraft can fit AKE containers. Due to the shape of the AKE container it facilitates an optimal loading.

[0045] In an embodiment the container further comprises a top wall. The top wall may comprise a flexible sheet, for example a tarpaulin. The main advantage of having a thin flexible sheet as a top wall is that it does not significantly hinders the movement of parts during the transformation process of the container and that it is relatively light. Another advantage of having a tarpaulin cover the top of the container is that the cargo is better shielded from external influences such as the weather.

[0046] In an embodiment, the container comprises one or more side covers arranged in a plane in which the at least one inflatable support element extends between the first side wall and the second side wall, at locations or spaces between the first side wall and the second side wall where this plane is not occupied by the at least one inflatable support element.

[0047] The structural strength and/or rigidity of the container may be increased by providing one or more side covers, for example formed by one or more flexible sheets, in the plane of the inflatable support element extending between the first side wall and the second side wall, at locations or spaces between the first side wall and the second side wall where this plane is not occupied by the at least one inflatable support element. These side covers may be connected to the first side wall, the second side wall and/or the at least one inflatable support element. The at least one inflatable support element and the side covers may together form a closed wall between the first side wall and the second side wall. Such closed wall may for example be provided at the front side and the back side of the container to form a front wall and a back wall of the container. To provide entrance to the storage space of the container, in the storage state of the container, at least one of the side covers may be provided with an entrance opening, which in its turn may be closed by a flexible sheet when no entrance to the storage space of the container is needed.

[0048] In an embodiment, the inflatable support elements and/or the one or more side wall inflatable elements are in fluid communication with each other. Having the inflatable elements, i.e. the inflatable support elements and/or the one or more side wall inflatable elements, in fluid communication with each other provides the opportunity to supply the compressed medium into the elements at a single point. This reduces the amount of parts such as valves and hoses, as well as decreases

the setup time required for the transformation process.

[0049] In an embodiment, the at least one inflatable support element comprises a first wall and a second opposite wall with a space for introducing the compressed medium therein between, wherein the first wall and the second wall are connected to each other by fibres that extend through the space. This technology is also known as dropstitch and provides relatively stiff inflatable elements. Any other inflatable element used in a collapsible container as described in this application may also be based on dropstitch technology.

[0050] The construction of the air freight container as claimed in claims 1-17 may also be applied in any other freight container, to provide a freight container which is transformable between a storage state and a collapsed state.

[0051] The invention also relates to a method of using a container according to any one of the claims 1-17.

BRIEF DESCRIPTION OF THE DRAWING

[0052] The invention will be described in more detail below with reference to the accompanying drawings, in which:

Figure 1 presents in a schematic way, in perspective view, an embodiment of the freight container in storage state,

Figure 2 presents in a schematic way, in perspective view, an embodiment of the freight container in half-collapsed state,

Figure 3 presents in a schematic way, in perspective view, an embodiment of the freight container in collapsed state,

Figure 4 presents in a schematic way, in front view, an embodiment of the freight container in an storage state,

Figure 5 presents in a schematic way, in front view, an embodiment of the freight container in half-collapsed state,

Figure 6 presents in a schematic way, in front view, an embodiment of the freight container in collapsed state, and

Figure 7 presents in a schematic way, in perspective view, an embodiment of the freight container in storage state, wherein the top and sides are covered.

DETAILED DESCRIPTION OF THE DRAWINGS

[0053] The hull of an aircraft is typically divided into an upper area, for either passengers or cargo, and a lower area for cargo, by a deck. Below the deck, there is room for one or more freight containers. In many widely used aircraft, a so-called AKE container allows a more optimal fit than a plain cubic container would.

[0054] Figure 1 shows an embodiment of the collapsible freight container 10 according to the invention in storage state, having the form of an AKE airfreight container. It comprises a bottom plate 1, a first side wall 2, a second side wall 3, a first inflatable support element 4, and a second inflatable support element 5.

[0055] The bottom plate 1 in figure 1 is made of a rigid material and is rectangular. In this embodiment the bottom plate 1 is made of an aluminium alloy. The rigid plates comprised by the container may however also be made from any other type suitable material. In an embodiment the bottom side of the container could furthermore comprise a second bottom plate in a pallet configuration with the first bottom plate and/or could comprise protrusions, recesses, and/or through holes for interfacing with a loading and restraint system of for instance an aircraft.

[0056] In the embodiment of figure 1, the first side wall comprises a first rigid side plate element 7, a second rigid side plate element 8, and a third rigid side plate element 30. The third rigid side plate element 30 is a fixed plate element that is connected to a first edge 6 of the bottom plate 1. As can be seen in figure 4, the third rigid side plate 30 comprises a first part 31 extending upwards from edge 6 and a second part 32 that extends upwards from the first part 31 and away from the bottom plate 1. The second rigid side plate element 8 is hingably connected to the third rigid side plate element 30 at a third hinge line 33, and rigid side plate elements 7 and 8 are connected to each other via a first hinge line 9. Both the first hinge line 9 and the third hinge line 33 are parallel to the bottom plate 1.

[0057] In another embodiment the first side wall 2 may comprise a single hingable rigid plate element plate element connected to fixed rigid side plate element 30. Fixed rigid side plate element 30 may also comprise another number of parts, or may have another shape. For instance three plate elements, a single plate extending upwards and away from the bottom plate, or a single curved plate could be provided. The hinges of the first side wall may for example be embodied as spring hinges, pivot hinges, or barrel hinges.

[0058] In figure 1 an embodiment of the second side wall is indicated with numeral 3 (see also figure 4). The second side wall comprises a top end 11, a bottom end 12, a front end 13 and a back end 14. The bottom end 12 is connected to edge 13 of the bottom plate, which is opposite edge 6. The second side wall 3 furthermore comprises second hinge line 15 parallel to the bottom plate 1, provided substantially midway between the top end 11 and the bottom end 12. In this embodiment, the second side wall 3 is a single inflatable element comprising a space for having the compressed medium. To improve the dimensional stability of the inflatable elements, both walls are connected by fibres that extend through the interspace. This technology is also referred to as dropstitch. The second hinge line 15 may be accomplished by locally providing a difference in wall thickness at the second hinge line 15 or by providing stiffening elements on the surfaces of the second side wall 3 except in the area of the second hinge line 15, or by any other suitable way.

[0059] In another embodiment, the second side wall may comprise several side wall inflatable elements, several hingably connected rigid plate elements, or a combination of inflatable and rigid plate elements.

[0060] Figure 1 depicts a first inflatable support element 4 and a second inflatable support element 5 comprising a material similar to that of side wall inflatable element 3. The first inflatable support element 4 extends from the front end 13 of the second side 3 wall to the front end of the first side wall 2, an therewith partially forms a front wall of the container 10. In a similar manner, the second inflatable support element 5 extends from the back end 14 of the second side wall 3 to the back end of the first side wall 2, and therewith partially forms a back wall of the container. The first inflatable support element 4 comprises a fold line 40 and the second inflatable support element 5 comprises a fold line 41.

[0061] In the embodiment depicted in figure 4, the first inflatable support element 4 and the second inflatable support element 5 each comprise a beam 16 extending from the first side wall 2 to the second side wall 3. From each of the beams 16 a leg 17 extends downwards. The leg 17 is hingably connected to the bottom plate 1. The first inflatable support element 4 and the second inflatable support element 5 thereby define a T-shape with one short arm, namely the part of beam 16 that extends beyond leg 17 to the first side wall 2, and a long arm, the part of beam 16 that extends beyond leg 17 to the second side wall 3. In another embodiment, the inflatable support elements may have another shape. For instance they may only comprise the beam 16, or they may have the shape of a carpenter's square (without the short arm). The leg 17, or every other part of an inflatable element for that matter, may also be a separate inflatable element that is physically connected to, but not in fluid communication with the rest of the inflatable element. The leg 17 may also be a rigid element.

[0062] The beam 16 and the leg 17 of each of the first inflatable support element 4 and the second inflatable support element 5 are constructed as a single inflatable element. Further, the first inflatable support element 4 and the second inflatable support element 5 are in fluid communication with the side wall inflatable element 3. This enables the collapsible container to be transformed from a collapsed state (shown in figures 3 and 6) to a storage state (shown in figures 1 and 4) by connecting and initiating a supply of compressed medium, for example compressed air, to a single valve on one of the inflatable elements 3, 4 or 5.

[0063] In some embodiments of the container 10 this transformation may need providing a manual push or pull in the vicinity of for instance fold lines 40, 41 and the first hinge line 9 and the second hinge line 15 to aid/guide the transformation of the container from the collapsed state to the storage state. The container may also be completely self-erecting, i.e. the container will transform from the collapsed state to the storage state by only the supply of compressed medium into the second side wall 3, the first inflatable support element 4 and the second inflatable support element 5.

[0064] The container according to the invention is also transformable from the storage state (as shown in figures 1 and 4) in which the container defines the storage space to the collapsed state (as shown figures 3 and 6) by deflating the second side wall 3, the first inflatable support element 4 and the second inflatable support element 5. The embodiment depicted may be to a large extent self-collapsing. This means that some guidance may be needed to collapse the container 10, but the elements and the characteristics of the container 10 are such that the container 10 will collapse in a controlled way whereby the different parts of the container 10 will be arranged, in the collapsed state, in a predetermined manner.

[0065] When the release of compressed medium from the valve is initiated, the collapsing process commences. The structural support provided by the second side wall 3, the first inflatable support element 4 and the second inflatable support element 5 decreases. Pushing the first inflatable support element 4 and the second inflatable support element 5 inwards at suitable folding positions, for example at respective folding lines 40, 41 causes them to incline inwards with respect to the container (see for example figure 2). The folding lines 40, 41 may be indicated by fold indicators that help the operators to push the first inflatable support element 4 and the second inflatable support element 5 inwards at the correct location. Deflation of the second side wall 3, the first inflatable support element 4 and the second inflatable support element 5 and/or gravity may cause the first side wall 2 to hinge at the first hinge line 9 and the third hinge line 33 and the second side wall 3 to hinge at the second hinge line 15. The operators may also guide this hinging movement of the first side wall 2 and the second side wall 3.

[0066] During the transformation, the part of the second side wall 3 below the second hinge line 15 will move towards the first side wall 2, while the part of the second side wall 3 above the second hinge line 15 will move away from the first side wall 2 until, in the collapsed state, being arranged at least partially on top of each other and substantially parallel to the bottom plate 1. Also, the rigid side plate elements 7 and 8 of the first side wall 2 will move in the direction of the second side wall 3 until, in the collapsed state, being positioned substantially parallel to bottom plate 1 (see figure 3). The first inflatable support element 4 and the second inflatable support element 5 will, in the collapsed state, also be arranged below the rigid side plate elements 7 and 8. Thus, the inflatable elements of the container, being the second side wall 3, the first inflatable support element 4 and the second inflatable support element 5 will, in the collapsed state, be arranged between the bottom plate 1 and the rigid side plate elements 7 and 8, and therefore be protected.

[0067] Further, the rigid side plate elements 7 and 8 provide, in the collapsed state, a substantially horizontal support surface for other collapsed containers or other

loads. The collapsed container 10 may therefore easily be stacked, whereby multiple stacked containers 10 in collapsed state will occupy the space of one container in storage state.

[0068] Figure 2, 5 and 6 further depict a number of hinges 43 that provide a connection between at least a single inflatable element and another element. In this embodiment, these hinges are provided as a pin and hole connection. In other embodiments however any other devices for connecting the elements may be used that allow pivoting in a similar manner to that depicted in figure 2. This could be achieved by another type of hinge, a cable connection, or for instance an adhered connection in which the inflatable element folds relatively easily at the connection points.

[0069] Figure 7 depicts the container in storage state including a top cover 24 and side covers 25 (that are not shown in Figures 1-6). The top cover 24 may cover the complete top side of the container 10. The side covers 25 may cover the spaces of the front wall and the back wall that are not occupied by the first inflatable support element 4 and the second inflatable support element 5, respectively. The side covers 25 may be placed between the first side wall 2 and the first inflatable support element 4 or the second inflatable support element 5, and between the second side wall 3 and the first inflatable support element 4 or the second inflatable support element 5

[0070] The top cover 24 and side covers 25 may be embodied by a flexible a sheet, for example a water-resistant polyester tarpaulin. The top cover 24 and side covers 25 may be connected to the first side wall 2, the second side wall 3, the first inflatable support element 4 and/or the second inflatable support element 5 in any suitable way, such as sealing, adhering or using straps or bands. The structural strength and/or rigidity of the container 10 may be substantially improved by the presence of the top cover 24 and/or side covers 25. In at least one of the side covers 25a closable opening may be provided to provide access to the storage space in the container 10. Further element such as straps or bands may be provided to increase the structural strength and/or rigidity of the container 10.

[0071] Before the arrival of an airplane that is scheduled to ship cargo to a certain destination, the tarmac or apron should be cleared according to safety regulations. Once the airplane has taxied from the runway to the scheduled apron, loading of its cargo space should commence as soon as possible, and should be executed as fast as possible. The ground crew may transport a stack of collapsible airfreight containers in deflated state, using ground support vehicles. The airfreight containers may then be loaded off the vehicles and distributed over the intended loading area alongside the airplane. Subsequently, the ground crew may connect a supply of a compressed medium to each of the valves of the respective airfreight containers, where after the supply may be initiated and the transformation of the containers may commence. In the meantime the ground crew may perform other tasks that are critical for the operation. After a time period, the container has transformed from a deflated state to an inflated state. The ground crew may now start loading freight into the storage space 23. When all cargo has been loaded into the containers, the containers may be loaded into the cargo space of the airplane. Vice versa, the containers may be unloaded at the destination. When there is no immediate logistic demand to be serviced by the containers, the release of compressed medium from the inflatable elements may be initiated. When the containers have been transformed to their deflated state, they may again be stacked onto a ground support vehicle and stored efficiently in a storage preferably close to the apron. It should be noted that the specific operational procedure may vary. For example, the containers may be loaded with freight in a remote facility, or the unloaded empty containers may be stored at the apron.

Claims

1. A collapsible air freight container (10), comprising:

a rigid bottom plate (1),

a first side wall (2) comprising one or more first side wall elements (7, 8, 30) connected to a first edge (6) of the bottom plate (1), wherein the one or more first side wall elements are hingable relative to one another and/or the bottom plate about a first hinge line that is substantially parallel to the bottom plate, and

a second side wall (3) comprising one or more second side wall elements connected to a second edge (26) of the bottom plate (1), wherein the second edge (26) is opposite to the first edge (6) of the bottom plate, wherein the one or more second side wall elements are hingable relative to one another and/or the bottom plate about a second hinge line (15) that is substantially parallel to the bottom plate,

characterized in that the collapsible air freight container (10) comprises at least one inflatable support element (4, 5) extending between the first side wall and the second side wall, wherein the at least one inflatable support element is connected to the first side wall above the first hinge line and to the second side wall above the second hinge line,

wherein the container (10) is transformable from a collapsed state to a storage state, in which the container defines a storage space (23), by inflation of the at least one inflatable support element, and wherein the container (10) is transformable from the storage state to the collapsed state by deflation of the at least one inflatable support element.

2. Container according to claim 1, wherein the one or

more first side wall elements comprise one or more rigid side plate elements (7, 8, 30).

3. Container according to claim 2, wherein the one or more rigid side plate elements (7, 8, 30) comprise a bottom rigid side plate element and at least one further rigid side plate element, wherein the bottom rigid side plate element extends from the bottom plate (1) and is fixedly connected to the first edge (6) of said bottom plate, and wherein the at least one further rigid side plate element is connected at the first hinge line to the bottom rigid side plate element.

4. Container according to any of the preceding claims, wherein the first side wall (2) comprises one or more inflatable side wall elements that is/are hingable at the first hinge line and/or wherein the second side wall (3) comprises one or more inflatable side wall elements that is/are hingable at the second hinge line.

5. Container according to any of the preceding claims, wherein the second side wall (3) comprises two rigid plate elements, wherein the two rigid plate elements are hingably connected to each other at the second hinge line.

6. Container according to any of the preceding claims, wherein the first side wall (2) and the second side wall (3) each comprise a front end and a back end, wherein the back end is opposite to the front end, and wherein the container comprises a first inflatable support element (4) extending between the front end of the first side wall and the front end of the second side wall, and a second inflatable support element (5) extending between the back end of the first side wall and the back end of the second side wall.

7. Container according to any of the preceding claims, wherein the second side wall (3) has a top end (11) and a bottom end (12), wherein the bottom end is connected to the second edge (26) of the bottom plate (1) and the top end is opposite to the bottom end, wherein the second hinge line (15) is arranged substantially midway between the top end and the bottom end.

8. Container according to any of the preceding claims, wherein the container is constructed to be self-collapsing and/or self-erecting by deflation and inflation of the at least one inflatable support element, respectively.

9. Container according to any of the preceding claims, wherein the at least one inflatable support element (4, 5) comprises a beam that extends between the first (2) and second side wall (3) and a leg that extends between the beam and the bottom plate.

10. Container according to claim 10, wherein the leg is inflatable or wherein the leg is rigid.

11. Container according to any of the preceding claims, wherein the container in the storage state has the form of a AKE airfreight container.

12. Container according to any of the preceding claims, wherein the container further comprises a top wall (24), wherein the top wall is a thin flexible sheet.

13. Container according to any of the preceding claims, wherein the container comprises one or more side covers (25) arranged in a plane in which the at least one inflatable support element extends between the first side wall and the second side wall, at locations or spaces between the first side wall and the second side wall where this plane is not occupied by the at least one inflatable support element.

14. Container according to any of the preceding claims, wherein the inflatable support elements and/or the one or more inflatable side wall elements are in fluid communication with each other.

15. Method of servicing a logistic demand, comprising the steps:

- providing an air freight container according to any of the claims 1-17;
- connecting a supply of compressed medium to the at least one inflatable support element;
- supplying compressed medium into the at least one inflatable support element to transform the container from the collapsed state to the storage state,
- loading freight into the storage space (23); and
- servicing a logistic demand by loading, storing, transporting and/or unloading of the container into/in/from a freight vehicle, wherein the method may for example comprise the step of releasing compressed medium from the at least one inflatable support element to transform the container from the storage state to the collapsed state.

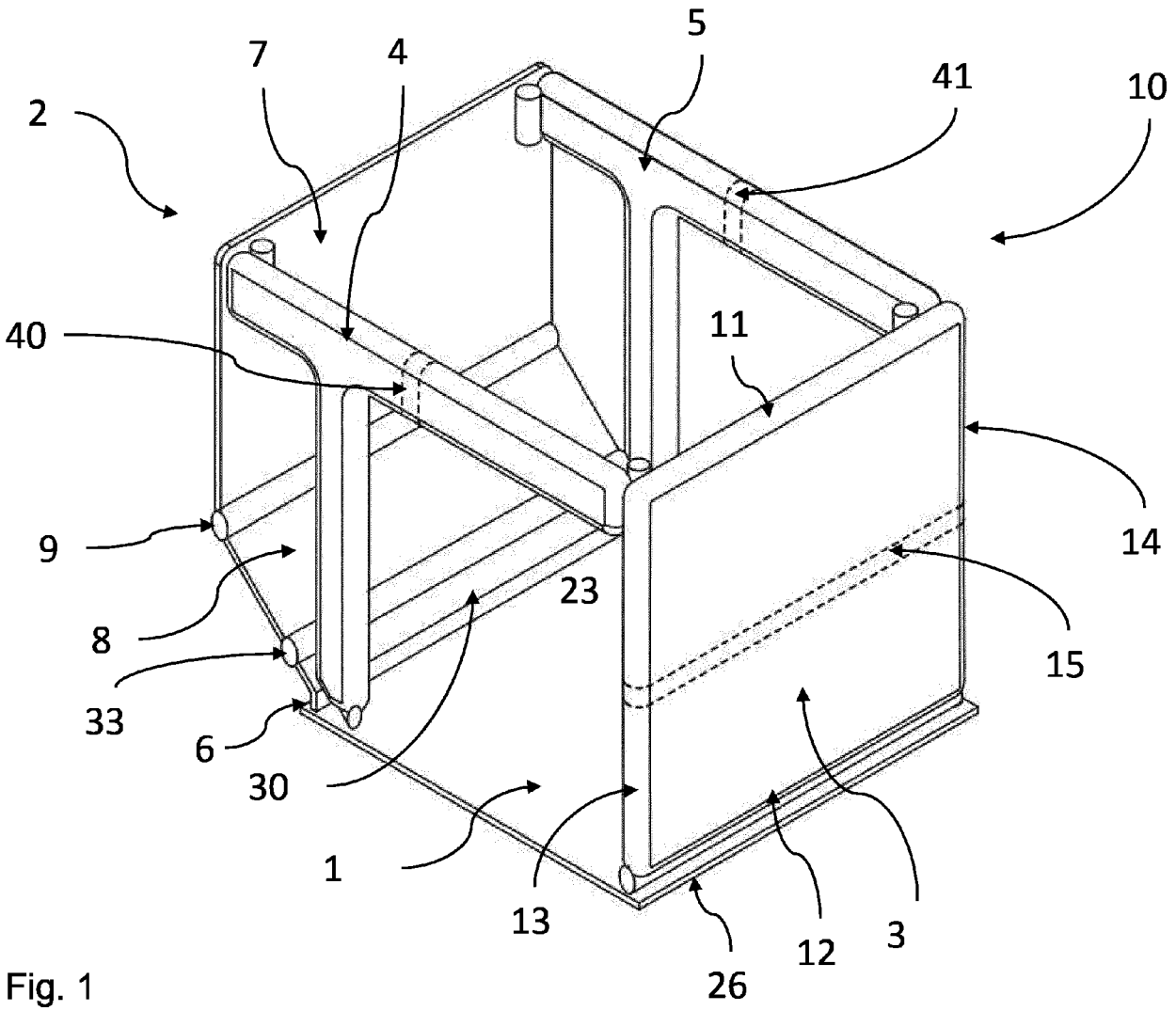

Fig. 1

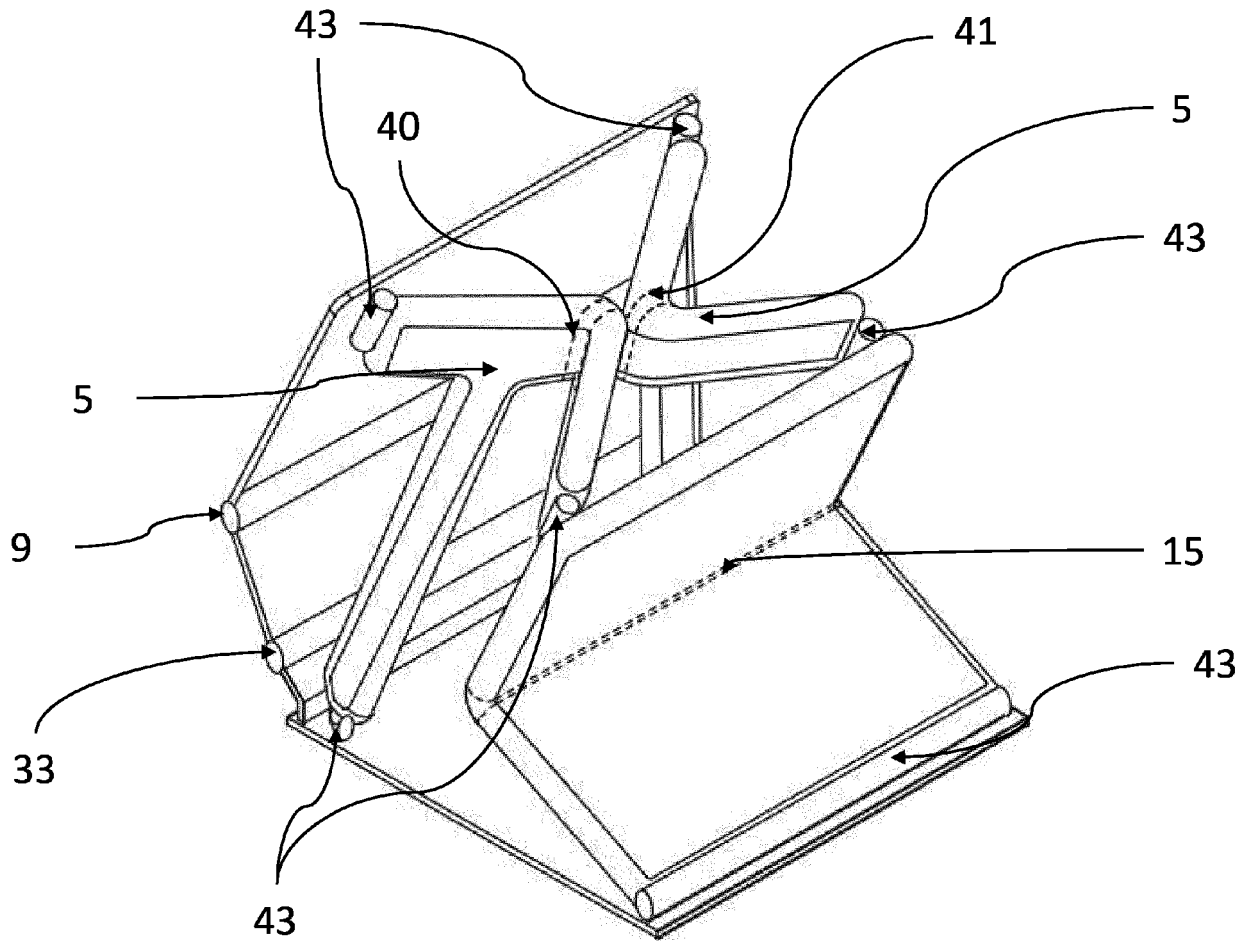

Fig. 2

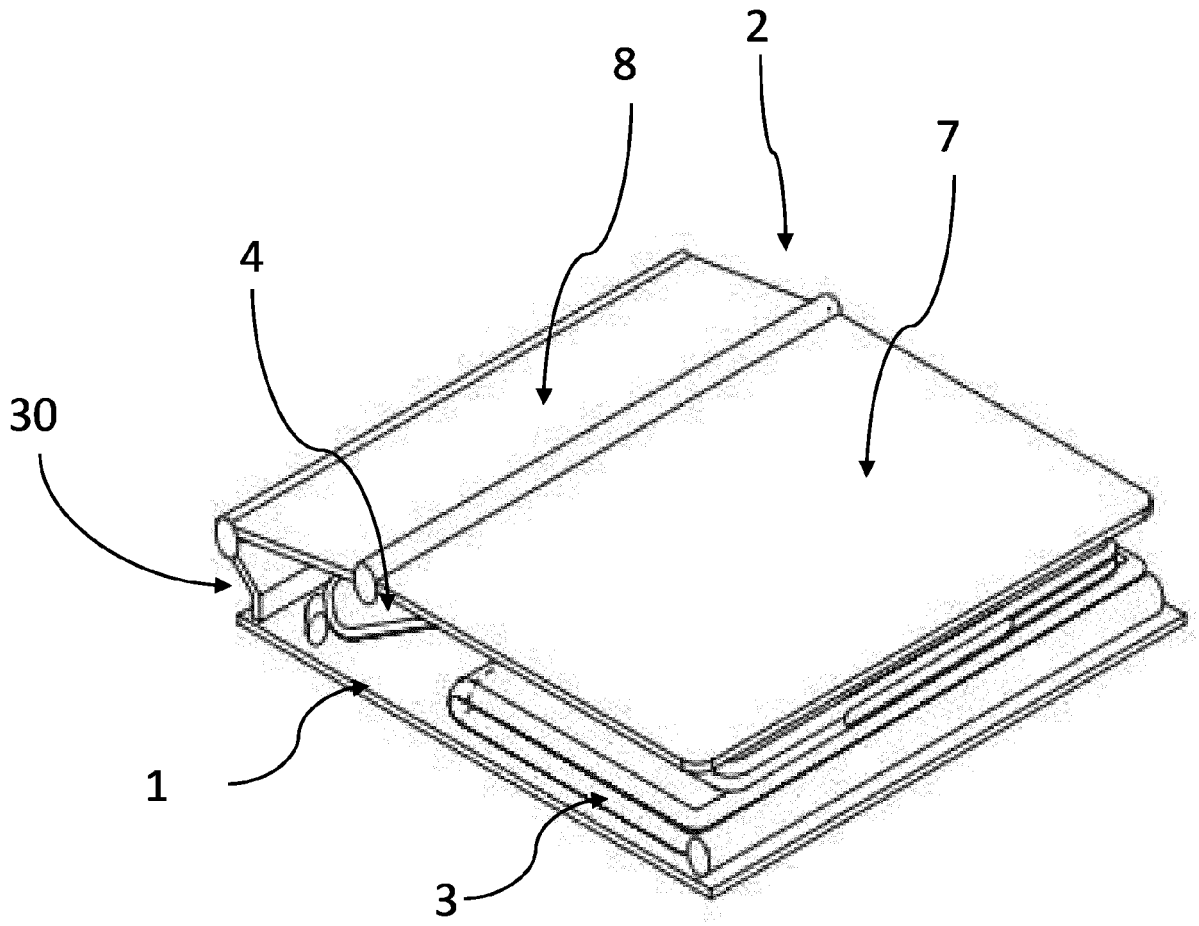

Fig. 3

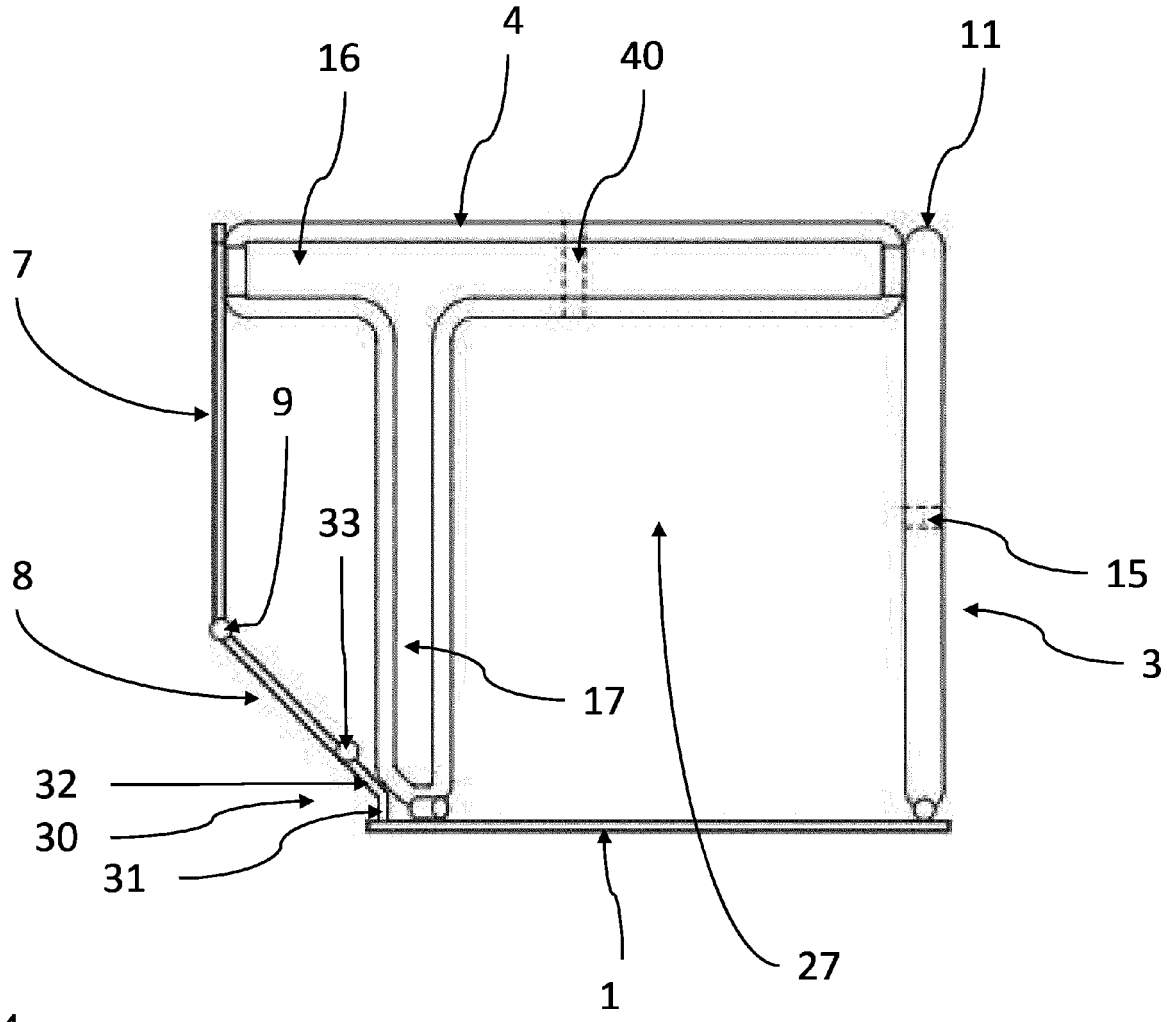

Fig. 4

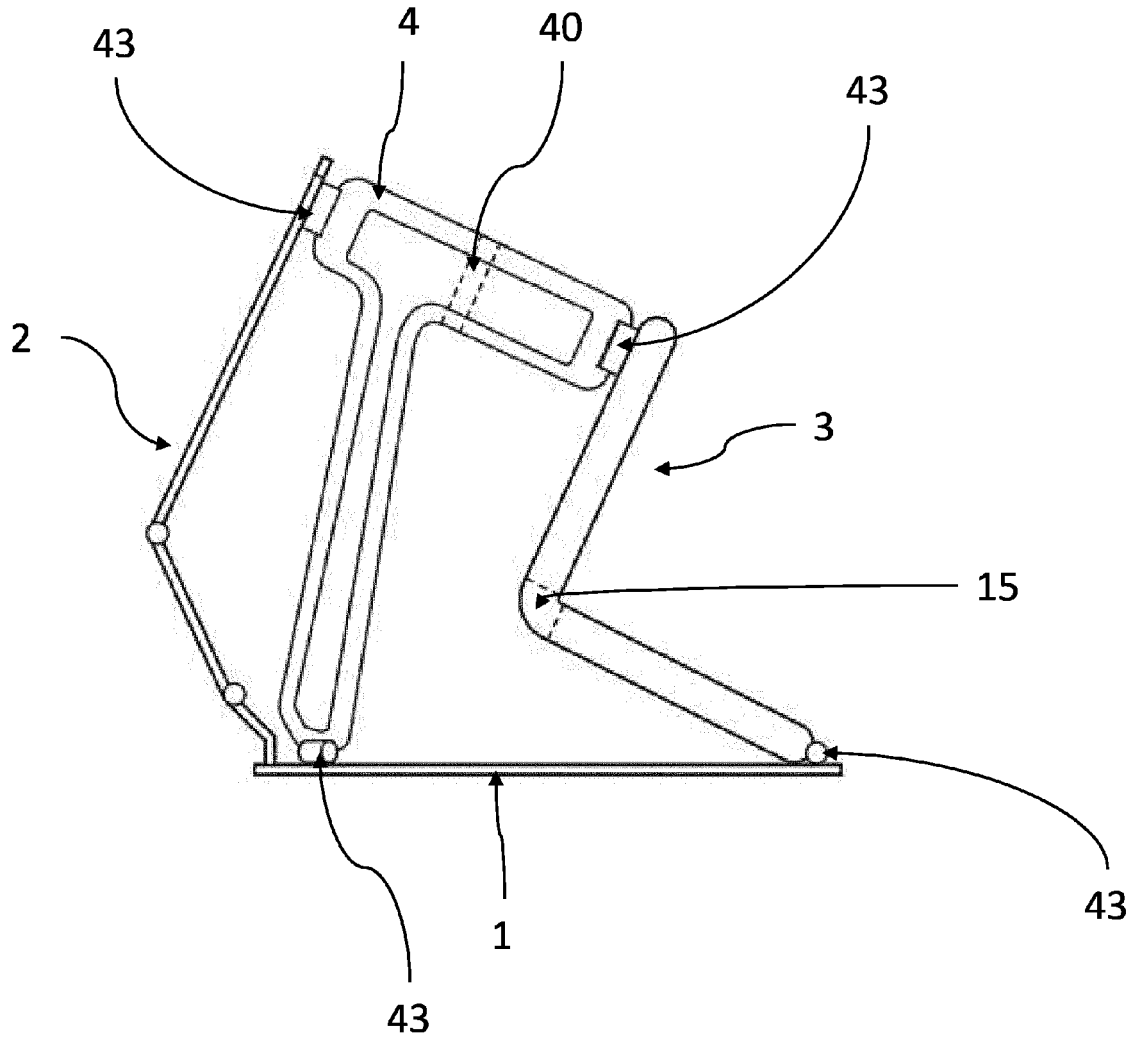

Fig. 5

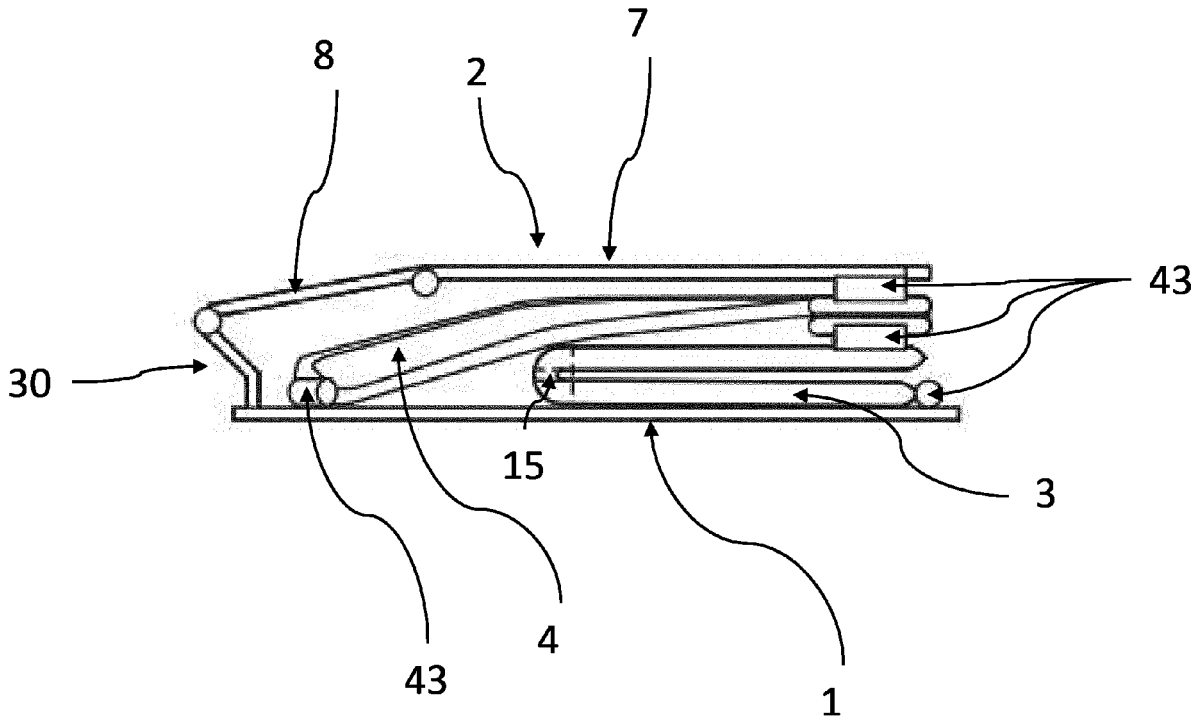

Fig. 6

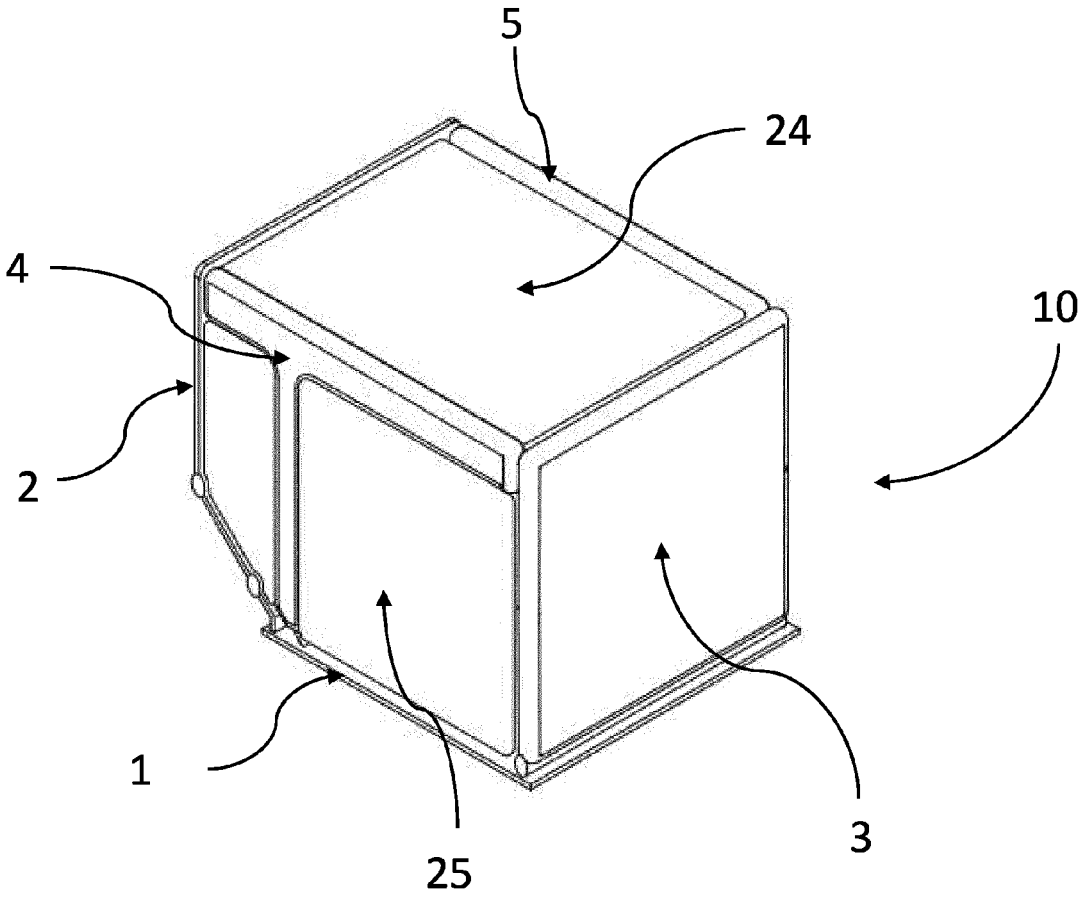

Fig. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 16 1509

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	US 3 552 466 A (FAIRCHILDS BERT S) 5 January 1971 (1971-01-05) * column 1, line 65 - column 4, line 66; figures 1-12 *	1-15	INV. B65D88/14 B65D88/52
A,D	US 3 578 050 A (WEINGARTEN JOSEPH L ET AL) 11 May 1971 (1971-05-11) * column 1, lines 34-60 * * column 2, line 24 - column 5, line 65; figures 1-9 *	1-15	
A,D	EP 3 398 869 A1 (LEUTERT RUEDI [CH]) 7 November 2018 (2018-11-07) * paragraphs [0006] - [0010], [0022] - [0045]; figures 1-12 *	1-15	
A,D	EP 0 141 429 A2 (NORSK HYDRO AS [NO]) 15 May 1985 (1985-05-15) * page 1, paragraph 1 * * page 4, paragraph 3 * * page 5, paragraph 8 - page 6, paragraph 4; figures 1-4 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) B65D
A	GB 2 351 068 A (TRELOAR GEOFFREY JAMES [GB]) 20 December 2000 (2000-12-20) * figures 1-3 *	1-15	
A	US 5 890 612 A (COPPI PAOLO [IT]) 6 April 1999 (1999-04-06) * abstract; figures 1-3 *	1-15	
A,D	DE 10 2014 003210 B3 (KAYA AYKUT [DE]) 28 May 2015 (2015-05-28) * paragraphs [0016], [0022], [0023], [0053] - [0062]; claim 1; figures 1-5 *	1-15	
A,D	US 5 941 405 A (SCALES PETER BRUCE [CA] ET AL) 24 August 1999 (1999-08-24) * the whole document *	1-15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 May 2020	Leijten, René

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 16 1509

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-05-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3552466 A	05-01-1971	NONE	
US 3578050 A	11-05-1971	NONE	
EP 3398869 A1	07-11-2018	NONE	
EP 0141429 A2	15-05-1985	AT 49566 T	15-02-1990
		AU 571903 B2	28-04-1988
		BR 8405699 A	10-09-1985
		CA 1221923 A	19-05-1987
		DE 3481050 D1	22-02-1990
		DK 531584 A	10-05-1985
		EP 0141429 A2	15-05-1985
		ES 286213 U	01-12-1985
		ES 8603774 A1	01-01-1986
		FI 76761 B	31-08-1988
		GR 80866 B	08-03-1985
		HU 192497 B	29-06-1987
		IE 55762 B1	02-01-1991
		IN 161708 B	16-01-1988
		JP H0220510 B2	09-05-1990
		JP S60123383 A	02-07-1985
		MA 20261 A1	01-07-1985
		NO 153250 B	04-11-1985
		PL 250368 A1	16-07-1985
		PT 79430 A	01-11-1984
		RO 90879 B	31-01-1987
		SU 1604150 A3	30-10-1990
		TR 23173 A	02-06-1989
		ZA 8408306 B	26-06-1985
GB 2351068 A	20-12-2000	NONE	
US 5890612 A	06-04-1999	AT 195484 T	15-09-2000
		DE 69702821 D1	21-09-2000
		DE 69702821 T2	05-04-2001
		EP 0822152 A1	04-02-1998
		ES 2151236 T3	16-12-2000
		IT AN960020 U1	30-01-1998
		US 5890612 A	06-04-1999
DE 102014003210 B3	28-05-2015	NONE	
US 5941405 A	24-08-1999	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 5941405 A **[0007] [0008]**
- DE 102014003210 **[0009] [0010] [0011] [0012]**
- WO 2008118077 A **[0013] [0014]**
- US 3552466 A **[0016] [0028]**
- US 3578050 A **[0017] [0028]**
- EP 3398869 A **[0018] [0028]**
- EP 0141429 A **[0019] [0028]**