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(54) SUPPORTING CONTAINERS WITH LASHING SYSTEM

(57) A lashing system (1) for supporting containers (5, 8, 17) located on top of each other, wherein the lashing system (1) comprising at least an upper lashing element (19) and a lower lashing element (20), wherein the upper lashing element (19) is configured to be connected from an upper end to an upper container (5); the lower lashing element (20) is configured to be connected from an upper end to a lower container (8); at least part of at least one of the at least upper and/or lower lashing elements (19, 20) is flexible; and the at least one of the at least upper and/or lower lashing elements (19, 20) is configured to stretch lengthwise more than the other one of the at least upper and/or lower lashing elements (19, 20) when the lashing system (1) is in a tension position. Also a method is disclosed.

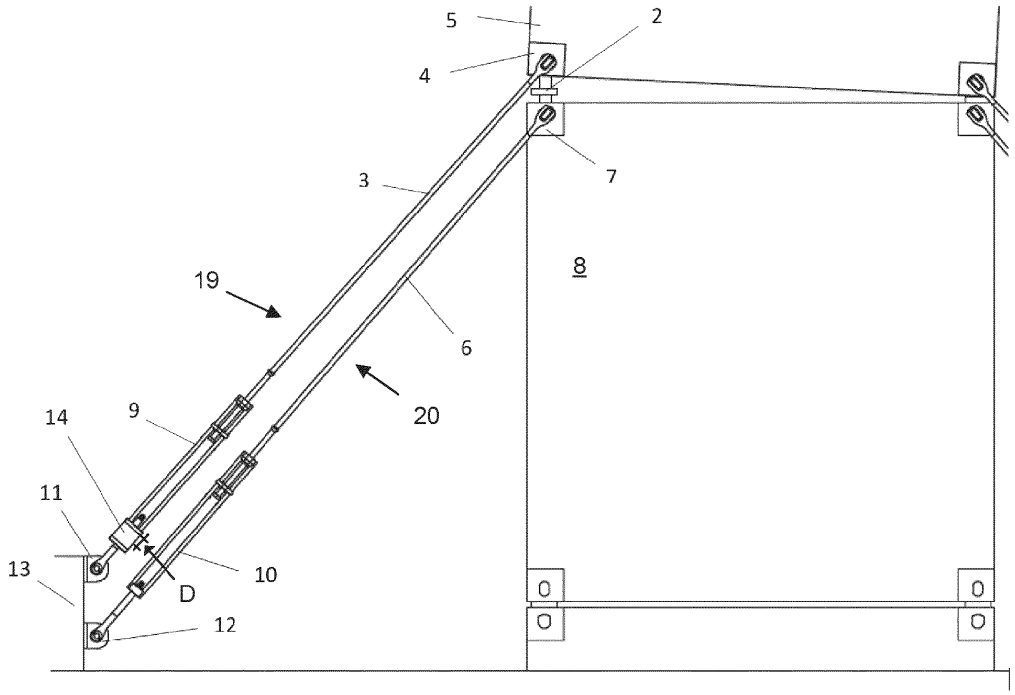

FIG. 3

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Description

FIELD OF THE INVENTION

[0001] The present application relates generally to a lashing system. More specifically, the present application relates to supporting containers located on top of each other with the lashing system.

BACKGROUND OF THE INVENTION

[0002] Container lashing bars are used in cargo ships to give additional support to stacked containers on a deck of a ship. The lashing bars give support especially when the ship is heeling at rough weather and each container stack is tilting sideways. Typically there are lashing bars connected to two containers located on top of each other in a container stack. In this situation the lashing bars and container locks are subject to heavy tension load. Function of the lashing bars may be improved to utilize their whole loading capacity.

SUMMARY

[0003] This summary is provided to introduce a selection of concepts in a simplified form that are further described below in the detailed description. This summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. The scope of protection sought for various embodiments of the present disclosure is set out by the independent claims.

[0004] Example embodiments of the present disclosure provide a lashing system for supporting containers located on top of each other, which enables distributing tension load optimally to the containers and to the lashing system that are locking and supporting the containers onboard a ship. When the ship is heeling heavily, and the container stacks are tilting sideways container locks may tie the containers together and the lashing elements may give additional support to the container stacks. Regarding the lashing elements and the container locks, which are fitted to the same containers as the lashing elements, it may be beneficial to simultaneously utilize the loading capacity of all these components instead of just one or two. It may be possible to utilize a full combined load bearing capacity of the two lashing elements and the container lock to increase weight of the containers. This means that more cargo may be carried on a similar ship because heavier containers may be allowed in the container stacks on the deck of the ship. This may have a positive impact on the productivity of the ship. Also the greenhouse gas emissions per carried cargo ton may be reduced when the container carrying capacity of the ship may be used more effectively. The required components for the presented system may be easy to produce and conventional manufacturing methods may be applicable. In addition to new ships also older existing ships may be easily modified to apply the presented lashing system.

[0005] According to a first aspect a lashing system for supporting containers located on top of each other is disclosed. The lashing system may comprise at least an upper lashing element and a lower lashing element, wherein the upper lashing element may be configured to be connected from an upper end to an upper container; the lower lashing element may be configured to be connected from an upper end to a lower container; at least part of at least one of the at least upper and/or lower lashing elements may be flexible; and the at least one of the at least upper and/or lower lashing elements may be configured to stretch lengthwise more than the other one of the at least upper and/or lower lashing elements when the lashing system is in a tension position. The economical lashing system may maximize combined strength capacity of the lashing elements and a container lock.

[0006] According to an example embodiment of the first aspect, the upper lashing element may be stretching lengthwise more than the lower lashing element. When the upper lashing element is stretching more than the lower lashing element it may allow the lower lashing element and the container lock to take part of the load.

[0007] According to an example embodiment of the first aspect, the lashing system may further comprise a container lock, an upper corner piece of the lower container, and a lower corner piece of the upper container; wherein the upper and lower containers may be connected together with the container lock, which may be configured to be located between the lower corner piece of the upper container and the upper corner piece of the lower container; and wherein a lengthwise stretching distance D in the tension position may be about equal to a slack S between the container lock and the container lower and upper corner pieces of the upper and lower containers. The lengthwise stretching difference D may be a distance between the upper and lower lashing element in the tension position. The lengthwise stretching difference D may show how much more the upper lashing element is stretching than the lower lashing element. This may allow to remove the slack S between the container lock and the container corner pieces and thus allow the load to be divided more evenly to the loading system.

[0008] According to an example embodiment of the first aspect, the slack S = E - B = F + D3, wherein E is a vertical distance between a lower surface of the lower corner piece of the upper container and an upper surface of the upper corner piece of the lower container; B is a thickness of a flange of the container lock; D3 is a vertical distance between the bottom surface of the lower corner piece and an upper surface of the flange; and F is a vertical distance between a bottom surface of the flange and the upper surface of the upper corner piece.

[0009] According to an example embodiment of the first aspect, the upper end of the upper lashing element may be configured to be attached to the lower corner piece of the upper container; and the upper end of the

lower lashing element may be configured to be attached to the upper corner piece of the lower container or to the lower corner piece of the lower container. This may allow better attachment of the containers.

[0010] According to an example embodiment of the first aspect, at least part of the at least one of the first and the second lashing elements may comprise an elastic element, elastic material, or a design configured to cause lengthwise stretch when the lashing system is in the tension position. Advantage of this may be that the upper lashing element stretches lengthwise and at the same time the lower lashing element and/or the container lock may be subjected to higher load.

[0011] According to an example embodiment of the first aspect, the upper lashing element may comprise an upper lashing bar and an upper turnbuckle; and the lower lashing element may comprise a lower lashing bar and a lower turnbuckle. The turnbuckle may be used to connect the lashing bars to the lashing bridge or other structures and to regulate length or tension of the lashing element.

[0012] According to an example embodiment of the first aspect, the upper and/or lower turnbuckle may comprise the elastic element. The elastic element may allow length increase of the lashing element.

[0013] According to an example embodiment of the first aspect, the first lashing element comprises an upper fixing structure and the second lashing element comprises a lower fixing structure attached directly or indirectly to a lashing bridge or a deck of a ship, and wherein the upper and/or the lower fixing structure comprises an elastic element, elastic material, or a design configured to enable lengthwise stretch when the lashing system is in the tension position. This may allow the elastic element, elastic material, or a design configured to enable lengthwise stretch to be located in an alternative location.

[0014] According to an example embodiment of the first aspect, the upper fixing structure and/or the lower fixing structure may comprise a hole comprising the elastic element. The elastic element inside the hole may allow lengthwise stretch of the upper and/or lower lashing element.

[0015] According to an example embodiment of the first aspect, the elastic element may be a spring, a rubber disc, elastic material, or an elastic component. Different kind of elements may be used as the elastic element.

[0016] According to an example embodiment of the first aspect, the elastic material is steel or glass fibre composite. Different materials may be used as the elastic materials.

[0017] According to an example embodiment of the first aspect, at least part of the at least one of the at least upper and/or lower lashing elements may be flexible, which means that it is configured to return to original shape when a deforming force or pressure is removed. Advantage of the elastic element, elastic material, or a design configured to enable lengthwise stretch is that they may allow length increase but still may be able to return back to their original form after stretching.

[0018] According to a second aspect, a lashing arrangement comprising at least one lashing system according to any one of the first aspects above is disclosed. The lashing arrangement may allow one or more lashing systems to be used at the same time.

[0019] According to a third aspect a method for supporting containers located on top of each other with a lashing system is disclosed, wherein the lashing system comprising at least an upper lashing element and a lower lashing element, wherein at least part of at least one of the at least upper and/or lower lashing elements is flexible. The method may comprise connecting the upper lashing element from an upper end to an upper container; connecting the lower lashing element from an upper end to a lower container; and stretching the at least one of the at least upper and/or lower lashing elements lengthwise more than the other one of the at least upper and/or lower lashing elements when the lashing system is in a tension position. This may enable distributing tension load optimally to the containers, container lock, and to the lashing system that are locking and supporting the containers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The accompanying drawings, which are included to provide a further understanding of the invention and constitute a part of this specification, illustrate embodiments of the invention and together with the description help to explain the principles of the invention. In the drawings:

Fig. 1 shows schematically an example of a side view of a lashing arrangement according to an example embodiment;

Fig. 2 shows schematically an example of a side view of a lashing system in a resting position according to an example embodiment; and

Fig. 3 shows schematically an example of a side view of the lashing system of Fig. 2 in a tension position according to an example embodiment;

Fig. 4 shows schematically an example of a cross-sectional side view of a locking arrangement in a tension position according to an example embodiment; and

Fig.5 shows an example method according to an example embodiment.

[0021] Like references are used to designate like parts in the accompanying drawings.

DETAILED DESCRIPTION

[0022] Reference will now be made in detail to example embodiments, examples of which are illustrated in the accompanying drawings. The detailed description provided below in connection with the appended drawings

is intended as a description of the present examples and is not intended to represent the only forms in which the present example may be constructed or utilized. The description sets forth the functions of the example and the sequence of steps or operations for constructing and operating the example. However, the same or equivalent functions and sequences may be accomplished by different examples.

[0023] Container lashing elements may be used in cargo ships to give additional support to stacked containers on a deck of a ship. Especially when the ship is heeling at rough weather each stack of containers may be tilted sideways. In this situation the lashing elements and container locks may be subject to heavy tension load. There may be two lashing elements connected to two containers located on top of each other in a container stack. There may be lashing elements attached to one end of a container located, for example, in a stack of up to 11 containers one in each top corner and bottom corner. The lashing elements may be attached to the third and fourth container calculated from the bottom of the stack, but also other height options may be used. For example, the lashing elements may be attached to the containers below the third and fourth container.

[0024] According to an example embodiment the upper lashing element may be attached to the upper container and the stiffer lower lashing element may be attached to the lower container. The lower container may locate straight below the upper container or there may be one or more intermediate containers between the upper container and the lower container wherein the lower lashing element may be attached. Depending on the size, especially the length, of the container, the lashing elements may be used at both ends or just at one end of the container. The lashing element may comprise a lashing bar and a turnbuckle. An upper end of the lashing bar may be attached to the container. A lower end of the lashing bar may be attached to a turnbuckle that may be fixed to a lashing bridge on the deck of the ship. In some cases the turnbuckles may also be fixed directly on the deck of the ship.

[0025] The lashing system may be an economical system that may maximize a combined strength capacity of the lashing elements and the container lock in an arrangement where two lashing elements are connected to two containers located on top of each other in a container stack. This may apply to one side of the container stack and usually the other side may have a similar arrangement as a mirror view. Often the other end of the container stack may also have the same arrangement.

[0026] According to the example embodiment the lower lashing element is stiffer than the upper lashing element.

[0027] According to an example embodiment, a commonly used lashing system have upper and lower lashing elements comprising two traditional lashing bars and turnbuckles where the structure and loading capacity of the upper and the lower lashing elements may be identical. In this kind of system the upper lashing element may carry more tension load than the lower one. In some loading cases it may be possible that the upper lashing element may carry the whole tension load while the lower lashing element and the container lock between the container corners do not have any tension load at all. The pulling force may be carried mainly by the upper lashing element only.

[0028] An example of Fig. 1 shows schematically a side view of a lashing arrangement, which may comprise one or more lashing systems 1. Purpose of the lashing system 1 is to tie and support containers on a deck 16 of a ship. The lashing system 1 may be attached to one side at one end of a container stack 15. There may be a similar lashing system 1 attached to the other side of the same container stack 15, and often also at the other end of the same container stack 15. As a total there may be hundreds or even thousands of similar lashing systems 1 onboard one ship. The lashing elements 19, 20 may comprise lashing bars 3, 6 and turnbuckles 9, 10, which may be typical lashing components, but also other type of lashing components may be used for the same purpose. The containers 5, 8, 17 may be located on top of each other in the same vertical line to form one container stack 15. There may be numerous container stacks 15 side by side and in a longitudinal direction onboard the ship.

[0029] Fig. 1 shows an example of the lashing arrangement of one bay on the deck 16 of the container ship, where a lashing bridge 13 is fixed to the deck 16 of the ship. The container stacks 15 may comprise containers 5, 8, 17 on top of each other. The container stacks may stand on hatch covers 18 resting on the deck 16. The lashing bars 3, 6 may be attached to containers 5, 8.

[0030] An example of Fig. 2 shows schematically an example of a side view of a lashing system 1 in a resting position when the ship has been loaded and the container stacks 15 are in upright vertical direction. In this position there may be very little tension forces acting in the lashing system 1 and the main force component in the container stack 15 may be the compression force caused by the weight of the containers 5, 8, 17.

[0031] An example of Fig. 3 shows schematically an example of a side view of a lashing system 1 in a tension position. This is a situation when the ship may heel, and the container stack may tilt sideways. On one side of the container stack the container lock 2 and the upper container lower corner piece 4 may pull upwards and sideways by the upper container 5 while on the opposite side of the stack 15 the container corners may be compressed downwards. This is because there may be some slack S i.e. free space around the container lock contact surfaces due to practical reasons, like manufacturing tolerances and clearance to enable manual installation. In the tension position the lashing system 1 may subject to tension force caused by the tilting container stack 15. At the same time, the lashing system 1 on the other side of the container stack 15, that may mainly be under downwards compressing force, may not carry any load. When the

ship is heeling to the other side also the loads in the lashing system 1 may shift from one side to another.

[0032] According to an example embodiment, the lashing system 1 for supporting an upper and lower container 5, 8 located on top of each other is disclosed. The lashing system 1 may comprise at least an upper lashing element 19 and a lower lashing element 20. The upper lashing element 19 may be configured to be connected from an upper end to the upper container 5 and the lower lashing element 20 may be configured to be connected from an upper end to the lower container 8. At least part of at least one of the at least upper and/or lower lashing elements 19, 20 may be flexible or resilient. According to an example embodiment flexible or resilient may mean that a material, part, or element may be configured to return to an original shape when a deforming force or pressure is removed.

[0033] According to an example embodiment, the at least one of the at least upper and/or lower lashing elements 19, 20 may be configured to stretch lengthwise more than the other one of the at least upper and/or lower lashing elements 19, 20 when the lashing system 1 is in a tension position.

[0034] According to an example embodiment, the upper lashing element 19 may be stretching lengthwise more than the lower lashing element 20. This way the lower lashing element 20 may be able to carry part of the load. In addition, also the container lock 2 may carry part of the load.

[0035] According to the example embodiment, the lashing system comprises further a container lock 2, a lower corner piece 4, and an upper corner piece 7. The upper and lower containers 5, 8 may be connected together with the container lock 2. The container lock 2 may be installed between the containers 5, 8 located one on the other. The container lock 2 may be configured to be located between the lower corner piece 4 of the upper container 5 and the upper corner piece 7 of the lower container 8. A lengthwise stretching distance D may be about equal to a stack S between a container lock 2 and the container lower and upper corner pieces 4, 7 of the upper and lower containers 5, 8.

[0036] According to an example embodiment, the lengthwise stretching difference D is a stretching distance between the upper and lower lashing element 19, 20 in the tension position. The lengthwise stretching difference D may show how much more the upper lashing element 19 may stretch than the lower lashing element 20.

[0037] According to an example embodiment, the upper end of the upper lashing element 19 may be configured to be attached to the lower corner piece 4 of the upper container 5 and the upper end of the lower lashing element 20 may be configured to be attached to the upper corner piece 7 of the lower container 8 or to a lower corner piece of the lower container 8. The lower container may have the upper corner piece 7 and the lower corner piece.

[0038] According to an example embodiment, the upper lashing element 19 comprises an upper lashing bar 3 and an upper turnbuckle 9 and the lower lashing element 20 comprises a lower lashing bar 6 and a lower turnbuckle 10. An upper end of the upper turnbuckle 9 may be attached to a lower end of the upper lashing bar 3 and respectively an upper end of the lower turnbuckle 10 may be attached to a lower end of the lower lashing bar 6. Same way a lower end of the upper turnbuckle 9 may be attached to an upper fixing structure 11 and respectively a lower end of the lower turnbuckle 10 may be attached to a lower fixing structure 12. The upper and lower fixing structures 11, 12 may be attached to a lashing bridge 13 or other fixed structures of the ship. The lashing bridge 13 may be a structure on the deck 16 of the ship that may enable fixing of the lashing bars 19, 20 to the containers 5, 8, 17 that are optimally located higher up in the container stack 15.

[0039] According to an example embodiment, at least part of at least one of the first and the second lashing elements 19, 20 comprises an elastic element 14, elastic material, or a design configured to enable length increase or to cause lengthwise stretch when the lashing system 1 is in the tension position.

[0040] According to an example embodiment, the upper and/or lower turnbuckle 3, 6 comprises the elastic element 14. The elastic element may be located at the lower end of the upper turnbuckle 3, 6. However, also other locations may be possible.

[0041] According to an example embodiment, the first lashing element 19 comprises an upper fixing structure 11 and the second lashing element 20 comprises lower fixing structure 12 configured to be attached directly or indirectly to a lashing bridge 13 or the deck 16 of the ship. The fixing structure may comprise an elastic element 14, elastic material, or a design configured to enable length increase when the lashing system 1 is in the tension position.

[0042] According to an example embodiment, the upper fixing structure 11 and/or the lower fixing structure 12 comprises a hole comprising the elastic element 14. The upper turnbuckle 9 may be attached to the hole of the upper fixing structure 11 and the lower turnbuckle 10 may be attached to the hole of the upper fixing structure 12.

[0043] According to the example embodiment, the upper fixing structure 11 has the elastic element 14 around the hole of the upper fixing structure 11. This may make the upper lashing element 19 more flexible than the lower lashing element 20 thus, it may also allow the lower lashing element 20 and the container lock 2 to carry the load. The same way the upper fixing structure 11 may have been made of the elastic material or may comprise the design to allow the upper lashing element 19 to stretch more than the lower lashing element 20.

[0044] According to an example embodiment, the elastic element 14 may be a spring, a rubber disc, elastic material, or an elastic component.

[0045] According to an example embodiment, the elas-

tic material is steel or glass fibre composite.

[0046] When containers are loaded onto the ship in a port also the lashing elements 19, 20 may be connected to the containers 5, 8, 17 and tightened with the turnbuckles 19, 20. The rigidity of the elastic element 14, elastic material, or a design configured to cause lengthwise stretch may be such that none or very little deformation may be caused by manual tightening of the turnbuckles 9, 10. When the container stacks 15 are tilting sideways, the turnbuckle 9, 10 may be exposed to high pulling force from the lashing bar 3, 6, and the elastic element 14, elastic material, or a design configured to cause lengthwise stretch may get fully deformed. Depending on the material and structure of the elastic element 14, elastic material, or a design configured to cause lengthwise stretch it may be practical to arrange a separate mechanical stop at the maximum deformation needed in the lashing system 1.

[0047] In a tension position the elastic element 14, elastic material, or a design configured to cause lengthwise stretch of the upper turnbuckle 9 may get deformed caused by the pulling force of the upper container 5. The amount of the deformation may be restricted to such magnitude that the slack S between the contact surfaces of the container lock 2 and the lower and upper corner pieces 4, 7 may be removed. The active component or mechanism that may enable the elongation of the elastic element 14, elastic material, or a design configured to cause lengthwise stretch itself may either elongate or get compressed. In other words, for example, a spring or a rubber disc may be used as the active component either to get longer or to get shorter when the lashing bar 3, 6 and the turnbuckle 9, 10 may be subjected to a pulling force.

[0048] Because of the deformation of the elastic element 14, elastic material, or a design configured to cause lengthwise stretch the pulling force from the upper container 5 may be distributed not only to the upper lashing element 19 but also to the lower lashing element 20 and the container lock 2. From the lashing bars 3, 6 the pulling force may be transferred to the lashing bridge 13 or to the other fixing structures of the ship via the turnbuckles 9, 10 and the upper and lower fixing structures 11, 12.

[0049] An example of Fig. 4 shows schematically an example of a cross-sectional side view of a locking arrangement in a tension position. The total vertical slack S is a sum of vertical clearances or distances F and D3 (F + D3). The slack S may also be a difference of E and B (E - B) in the tension position. The lengthwise stretching distance of the at least one lashing element 19, 20 may be about equal to a stack S between the container lock 2 and the container lower and upper corner pieces 4, 7 of the upper and lower containers 5, 8.

[0050] According to an example embodiment, a locking arrangement for joining together an upper and a lower container stacked on top of each other is disclosed, wherein the locking arrangement comprising a lower corner piece 4 of the upper container 5, an upper corner piece 7 of the lower container 8, and a container lock 2 for locking to each other the lower corner piece 4 of the upper container 5 and the upper corner piece 7 of the lower container 8. The lashing system 1 may comprise the locking arrangement. The container lock 2 may also comprise a flange 21. The lock arrangement in a tension position may be configured to fulfil a formula wherein the slack S = E - B = F + D3, wherein

E is a vertical distance between a lower surface of the upper corner piece 4 of the upper container 5 and an upper surface of the upper corner piece 7 of the lower container 8;

B is a thickness of the flange 21 of the container lock 2;

D3 is a vertical distance between the bottom surface of the lower corner piece 4 and an upper surface of the flange 21; and

F is a vertical distance between a bottom surface of the flange 21 and the upper surface of the upper corner piece 7.

[0051] The strength of the container 5, 8, 17 itself may set a limit for the forces acting in different directions in various parts of the container 5, 8, 17. Because of this, replacing one lashing bar, as an example, with an extra-strong lashing bar may not be possible as the present applied forces may already exceed the maximum limit. Thus, only by arranging several lashing elements 19, 20 to simultaneously carry high loads the total support force may be increased.

[0052] The presented lashing system may tolerate larger total pulling forces than a traditional lashing system. Due to this fact the weight of the containers in the stack 1 may be increased. This means that more cargo may be carried on a similar ship as heavier containers are allowed in the container stacks. This may improve efficiency of the ship.

[0053] Fig. 5 illustrates an example of a method for supporting containers 5, 8, 17 located on top of each other with a lashing system 1, wherein the lashing system 1 comprising at least an upper lashing element 19 and a lower lashing element 20, wherein at least part of at least one of the at least upper and/or lower lashing elements 19, 20 is flexible.

[0054] At operation 500, the method may comprise connecting the upper lashing element 19 from an upper end to an upper container 5.

[0055] At operation 510, the method may comprise connecting the lower lashing element 20 from an upper end to a lower container 8.

[0056] At operation 520, the method may comprise stretching the at least one of the at least upper and/or lower lashing elements 19, 20 lengthwise more than the other one of the at least upper and/or lower lashing elements 19, 20 when the lashing system 1 is in a tension position.

[0057] Further features of the method directly result from functionalities of, for example, the lashing system

1 and/or lashing arrangement. Different variations of the method may be also applied, as described in connection with the various example embodiments.

[0058] The lashing system 1 for supporting containers 5, 8, 17 located on top of each other may be configured to perform or cause performance of any aspect of the method(s) described herein.

[0059] Any range or device value given herein may be extended or altered without losing the effect sought. Also, any embodiment may be combined with another embodiment unless explicitly disallowed.

[0060] Although the subject matter has been described in language specific to structural features and/or acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as examples of implementing the claims and other equivalent features and acts are intended to be within the scope of the claims.

[0061] It will be understood that the benefits and advantages described above may relate to one embodiment or may relate to several embodiments. The embodiments are not limited to those that solve any or all of the stated problems or those that have any or all of the stated benefits and advantages. It will further be understood that reference to 'an' item may refer to one or more of those items.

[0062] The steps or operations of the methods described herein may be carried out in any suitable order, or simultaneously where appropriate. Additionally, individual blocks may be deleted from any of the methods without departing from the scope of the subject matter described herein. Aspects of any of the embodiments described above may be combined with aspects of any of the other embodiments described to form further embodiments without losing the effect sought.

[0063] The term 'comprising' is used herein to mean including the method, blocks, or elements identified, but that such blocks or elements do not comprise an exclusive list and a method or apparatus may contain additional blocks or elements.

[0064] Although subjects may be referred to as 'first, 'second', or 'third' subjects, this does not necessarily indicate any order or importance of the subjects. Instead, such attributes may be used solely for the purpose of making a difference between subjects.

[0065] It will be understood that the above description is given by way of example only and that various modifications may be made by those skilled in the art. The above specification, examples and data provide a complete description of the structure and use of exemplary embodiments. Although various embodiments have been described above with a certain degree of particularity, or with reference to one or more individual embodiments, those skilled in the art could make numerous alterations to the disclosed embodiments without departing from scope of this specification.

Claims

1. A lashing system for supporting containers located on top of each other, wherein the lashing system comprising
at least an upper lashing element and a lower lashing element, wherein

   the upper lashing element is configured to be connected from an upper end to an upper container;
   the lower lashing element is configured to be connected from an upper end to a lower container;
   at least part of at least one of the at least upper and/or lower lashing elements is flexible; and
   the at least one of the at least upper and/or lower lashing elements is configured to stretch lengthwise more than the other one of the at least upper and/or lower lashing elements when the lashing system is in a tension position.

2. The lashing system according to claim 1, wherein the upper lashing element is stretching lengthwise more than the lower lashing element.

3. The lashing system according to claim 1 or claim 2, wherein the lashing system comprises further a container lock, a lower corner piece of the upper container, and an upper corner piece of the lower container; wherein

   the upper and lower containers are connected together with the container lock, which is configured to be located between the lower corner piece of the upper container and the upper corner piece of the lower container; and wherein
   a lengthwise stretching distance in the tension position is about equal to a slack between the container lock and the container lower and upper corner pieces of the upper and lower containers.

4. The lashing system according to claim 3, wherein the slack S = E - B = F + D3, wherein

   E is a vertical distance between a lower surface of the lower corner piece of the upper container and an upper surface of the upper corner piece of the lower container;
   B is a thickness of a flange of the container lock;
   D3 is a vertical distance between the bottom surface of the lower corner piece and an upper surface of the flange; and
   F is a vertical distance between a bottom surface of the flange and the upper surface of the upper corner piece.

5. The lashing system according to claim 3 or claim 4,

wherein

the upper end of the upper lashing element is configured to be attached to the lower corner piece of the upper container; and
the upper end of the lower lashing element is configured to be attached to the upper corner piece of the lower container or to a lower corner piece of the lower container.

6. The lashing system according to any one of the preceding claims, wherein at least part of the at least one of the first and the second lashing elements comprise an elastic element, elastic material, or a design configured to cause lengthwise stretch when the lashing system (1) is in the tension position.

7. The lashing system according to any one of the preceding claims, wherein

the upper lashing element comprises an upper lashing bar and an upper turnbuckle; and
the lower lashing element comprises a lower lashing bar and a lower turnbuckle.

8. The lashing system according claim 7, wherein the upper and/or lower turnbuckle comprises the elastic element.

9. The lashing system according to any one of the preceding claims 1 to 7, wherein

the first lashing element comprises an upper fixing structure and the second lashing element comprises a lower fixing structure attached directly or indirectly to a lashing bridge or a deck (16) of a ship, and wherein
the upper fixing structure and/or the lower fixing structure comprises an elastic element, elastic material, or a design configured to enable lengthwise stretch when the lashing system is in the tension position.

10. The lashing system according to claim 9, wherein the upper fixing structure and/or the lower fixing structure comprises a hole comprising the elastic element.

11. The lashing system according to any one of the preceding claims 6 to 10, wherein the elastic element is a spring, a rubber disc, elastic material, or an elastic component.

12. The lashing system according to any one of the preceding claims 6 to 11, wherein the elastic material is steel or glass fibre composite.

13. The lashing system according to any one of the preceding claims, wherein at least part of the at least one of the at least upper and/or lower lashing elements is flexible, which means that it is configured to return to original shape when a deforming force or pressure is removed.

14. A lashing arrangement comprising at least one lashing system according to any one of claims 1 to 13.

15. A method for supporting containers located on top of each other with a lashing system, wherein the lashing system comprising
at least an upper lashing element and a lower lashing element, wherein at least part of at least one of the at least upper and/or lower lashing elements is flexible; wherein the method comprising

connecting the upper lashing element from an upper end to an upper container;
connecting the lower lashing element from an upper end to a lower container; and
stretching the at least one of the at least upper and/or lower lashing elements lengthwise more than the other one of the at least upper and/or lower lashing elements when the lashing system is in a tension position.

Amended claims in accordance with Rule 137(2) EPC.

1. A lashing system (1) for supporting containers (5, 8, 17) located on top of each other, wherein the lashing system (1) comprising

at least an upper lashing element (19) and a lower lashing element (20), wherein

the upper lashing element (19) is configured to be connected from an upper end to an upper container (5);
the lower lashing element (20) is configured to be connected from an upper end to a lower container (8);
at least part of at least one of the at least upper and/or lower lashing elements (19, 20) is flexible; and
the at least one of the at least upper and/or lower lashing elements (19, 20) is configured to stretch lengthwise more than the other one of the at least upper and/or lower lashing elements (19, 20) when the lashing system (1) is in a tension position; and

a container lock (2), a lower corner piece (4) of the upper container (5), and an upper corner piece (7) of the lower container (8); wherein
the upper and lower containers (5, 8) are con-

nected together with the container lock (2), which is configured to be located between the lower corner piece (4) of the upper container (5) and the upper corner piece (7) of the lower container (8);
a lengthwise stretching distance (D) in the tension position is about equal to a slack (S) between the container lock (2) and the container lower and upper corner pieces (4,7) of the upper and lower containers (5,8); and
the slack S = E - B = F + D3, wherein

E is a vertical distance between a lower surface of the lower corner piece of the upper container and an upper surface of the upper corner piece of the lower container;
B is a thickness of a flange of the container lock;
D3 is a vertical distance between the bottom surface of the lower corner piece and an upper surface of the flange; and
F is a vertical distance between a bottom surface of the flange and the upper surface of the upper corner piece.

2. The lashing system (1) according to claim 1, wherein the upper lashing element (19) is stretching lengthwise more than the lower lashing element (20).

3. The lashing system (1) according to claim 1, wherein

the upper end of the upper lashing element (19) is configured to be attached to the lower corner piece (4) of the upper container (5); and
the upper end of the lower lashing element (20) is configured to be attached to the upper corner piece (7) of the lower container (8) or to a lower corner piece of the lower container (8).

4. The lashing system (1) according to any one of the preceding claims, wherein at least part of the at least one of the upper and the lower lashing elements (19,20) comprise an elastic element (14), elastic material, or a design configured to cause lengthwise stretch when the lashing system (1) is in the tension position.

5. The lashing system (1) according to any one of the preceding claims, wherein

the upper lashing element (19) comprises an upper lashing bar (3) and an upper turnbuckle (9); and
the lower lashing element (20) comprises a lower lashing bar (6) and a lower turnbuckle (10).

6. The lashing system (1) according claim 4, wherein the upper and/or lower turnbuckle (3,6) comprises the elastic element (14).

7. The lashing system (1) according to any one of the preceding claims 1 to 5, wherein

the upper lashing element (19) comprises an upper fixing structure (11) and the lower lashing element (20) comprises a lower fixing structure (12) attached directly or indirectly to a lashing bridge (13) or a deck (16) of a ship, and wherein the upper fixing structure (11) and/or the lower fixing structure (12) comprises an elastic element (14), elastic material, or a design configured to enable lengthwise stretch when the lashing system (1) is in the tension position.

8. The lashing system (1) according to claim 7, wherein the upper fixing structure (11) and/or the lower fixing structure (12) comprises a hole comprising the elastic element (14).

9. The lashing system (1) according to any one of the preceding claims 4 to 8, wherein the elastic element (14) is a spring, a rubber disc, elastic material, or an elastic component.

10. The lashing system (1) according to any one of the preceding claims 4 to 9, wherein the elastic material is steel or glass fibre composite.

11. The lashing system (1) according to any one of the preceding claims, wherein at least part of the at least one of the at least upper and/or lower lashing elements (19, 20) is flexible, which means that it is configured to return to original shape when a deforming force or pressure is removed.

12. A lashing arrangement comprising at least one lashing system (1) according to any one of claims 1 to 11.

13. A method for supporting containers (5, 8, 17) located on top of each other with a lashing system (1), wherein the lashing system (1) comprising

at least an upper lashing element (19) and a lower lashing element (20), wherein at least part of at least one of the at least upper and/or lower lashing elements (19, 20) is flexible; and
a container lock (2), a lower corner piece (4) of the upper container (5), and an upper corner piece (7) of the lower container (8); wherein the method comprising

connecting the upper lashing element (19) from an upper end to an upper container (5) ;
connecting the lower lashing element (20) from an upper end to a lower container (8);

and

stretching the at least one of the at least upper and/or lower lashing elements (19, 20) lengthwise more than the other one of the at least upper and/or lower lashing elements (19, 20) when the lashing system (1) is in a tension position, and

connected together the upper and lower containers (5, 8) with the container lock (2), which is configured to be located between the lower corner piece (4) of the upper container (5) and the upper corner piece (7) of the lower container (8); and wherein

a lengthwise stretching distance (D) in the tension position is about equal to a slack (S) between the container lock (2) and the container lower and upper corner pieces (4,7) of the upper and lower containers (5,8); and

the slack S = E - B = F + D3, wherein

E is a vertical distance between a lower surface of the lower corner piece of the upper container and an upper surface of the upper corner piece of the lower container;

B is a thickness of a flange of the container lock;

D3 is a vertical distance between the bottom surface of the lower corner piece and an upper surface of the flange; and

F is a vertical distance between a bottom surface of the flange and the upper surface of the upper corner piece.

the slack S = E - B = F + D3, wherein

E is a vertical distance between a lower surface of the lower corner piece of the upper container and an upper surface of the upper corner piece of the lower container;

B is a thickness of a flange of the container lock;

D3 is a vertical distance between the bottom surface of the lower corner piece and an upper surface of the flange; and

F is a vertical distance between a bottom surface of the flange and the upper surface of the upper corner piece.

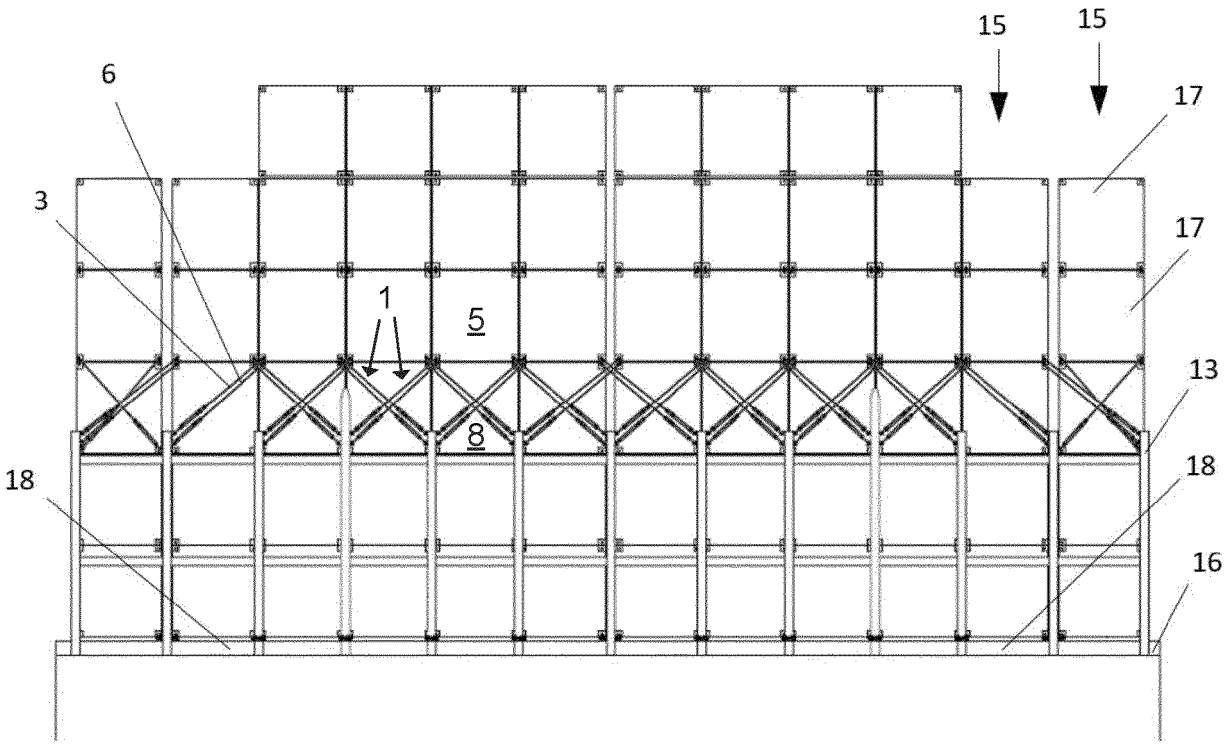

FIG. 1

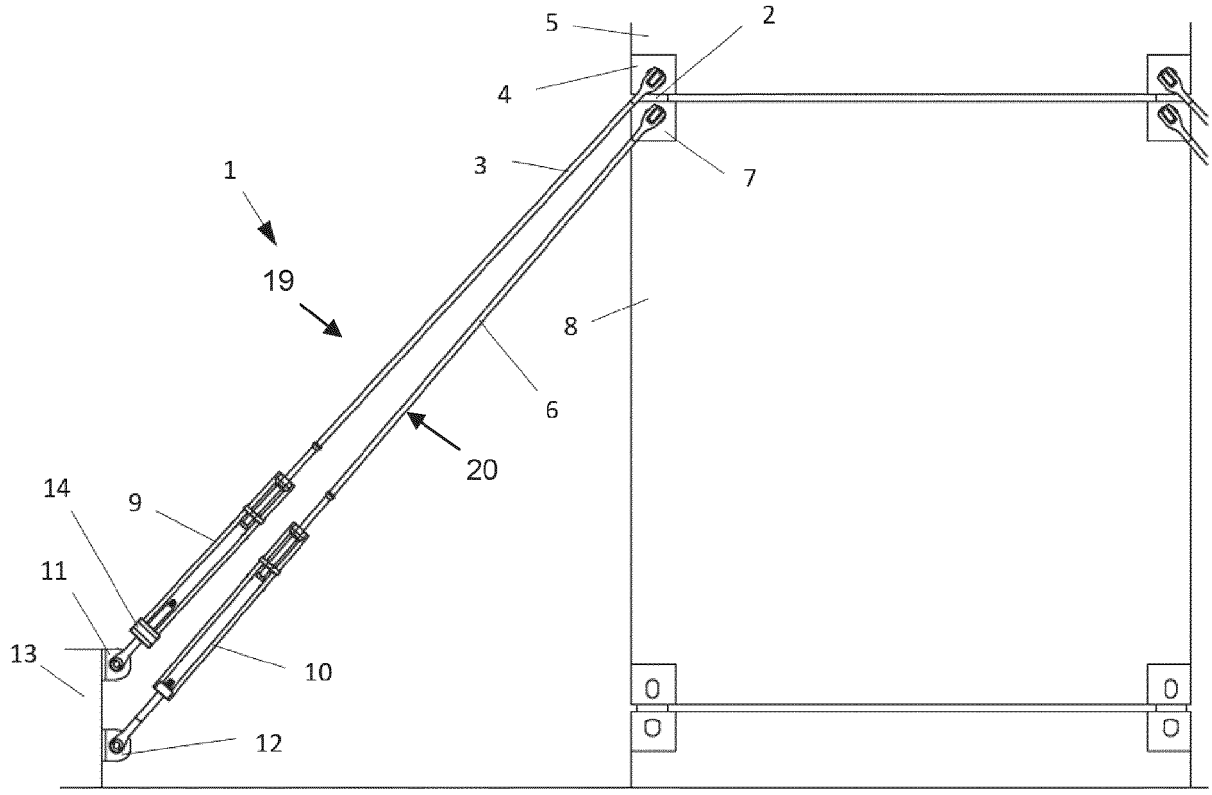

FIG. 2

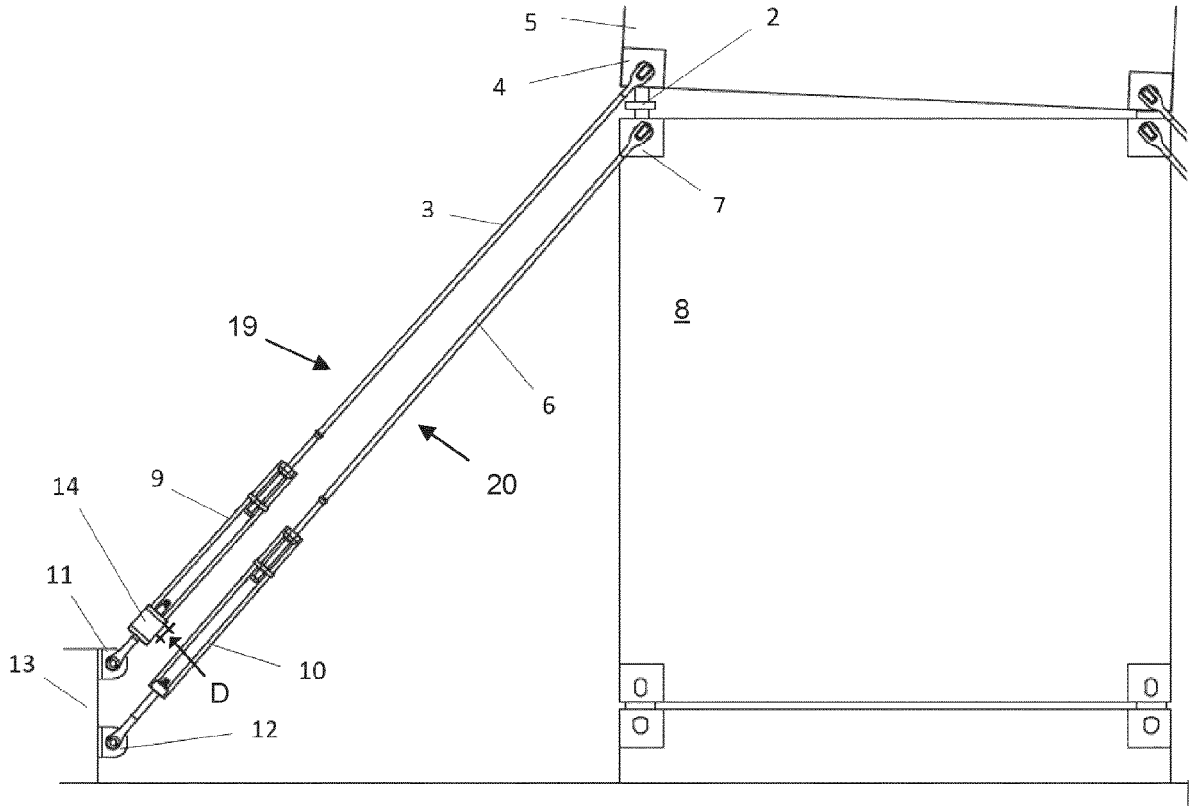

FIG. 3

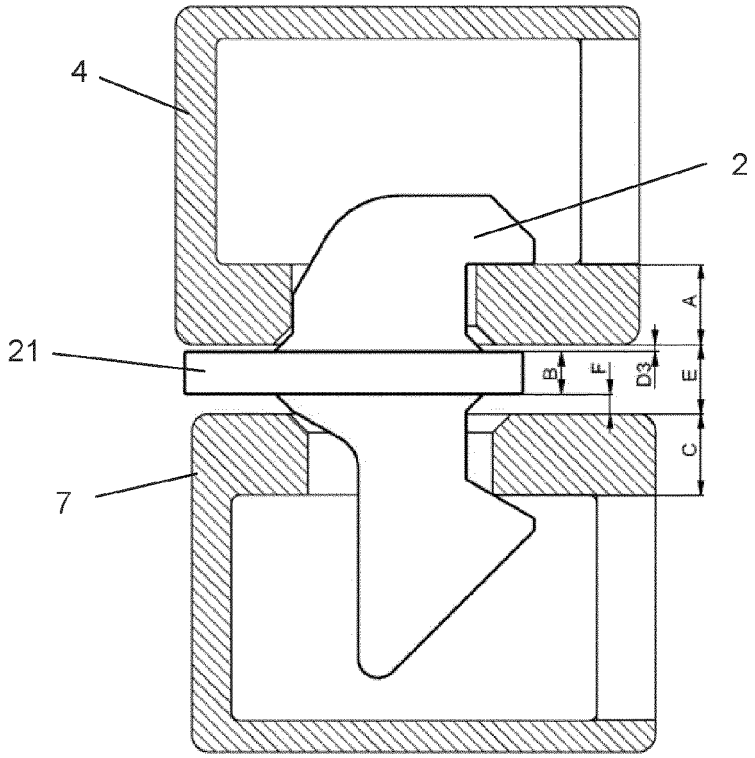

FIG. 4

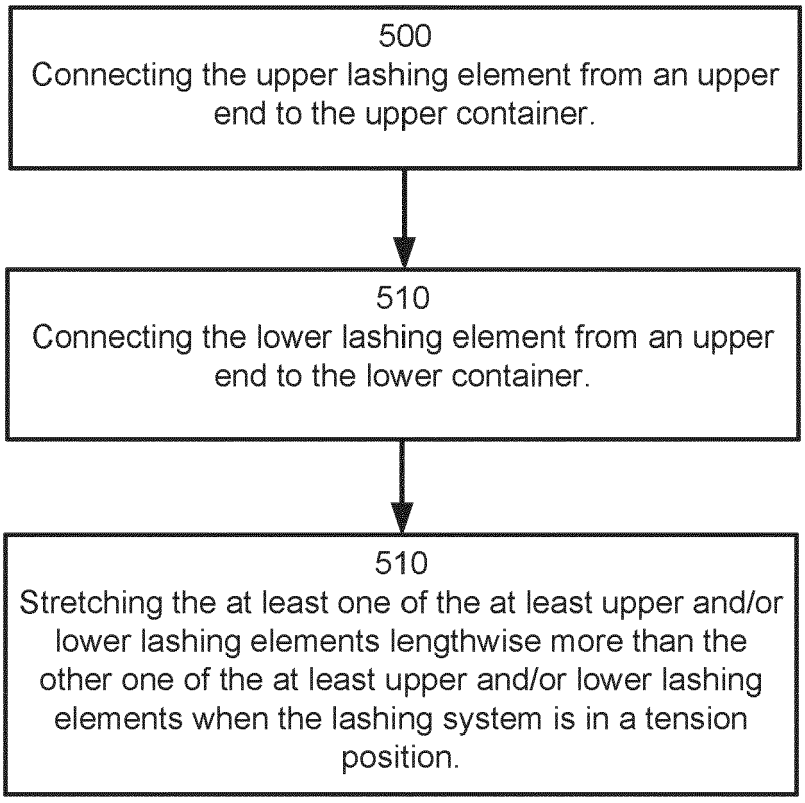
500
Connecting the upper lashing element from an upper end to the upper container.
510
Connecting the lower lashing element from an upper end to the lower container.
510
Stretching the at least one of the at least upper and/or lower lashing elements lengthwise more than the other one of the at least upper and/or lower lashing elements when the lashing system is in a tension position.

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 22 19 3212

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 February 2023	Freire Gomez, Jon

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