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

(11) **EP 4 545 394 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
30.04.2025 Bulletin 2025/18

(21) Application number: **23206455.0**

(22) Date of filing: **27.10.2023**

(51) International Patent Classification (IPC):
B63B 25/16 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B63B 25/16

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

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(54) **PARTITION WALL FOR USE IN A VESSEL**

(57) The invention pertains to a partition wall for use in a vessel comprising:
at least a wall sheet (2);
a plurality of elongated stiffeners (3, 3a) formed of a stiffening profile; the stiffeners (3, 3a) being connected to a first surface (4) of the wall sheet (2) in a distance (d) to each other, forming a gap (10) in-between two adjacent stiffeners (3, 3a) and protruding towards a potential heat source and/or sound source (5);
and at least an insulation layer (9, 14) located on the side of the first surface (4) of the wall sheet (2), the insulation layer (9, 14) covering the stiffeners (3, 3a) and the first surface (4) of the wall sheet (2) thereby forming a heat insulation and/or an acoustic insulation of the wall sheet (2) and the stiffeners (3, 3a) towards the potential heat/-sound source (5)
whereas the insulation layer (9, 14) is fixed to protruding ends (6) of the stiffeners (3, 3a) at protruding portions of the stiffeners (3, 3a), whereas the insulation layer (9; 14) is at least partially, preferably fully bridging the distance (d) between adjacent stiffeners (3, 3a) and thereby forming a cavity (13) between the insulation layer (9, 14) and the wall sheet (2).

Fig. 1a

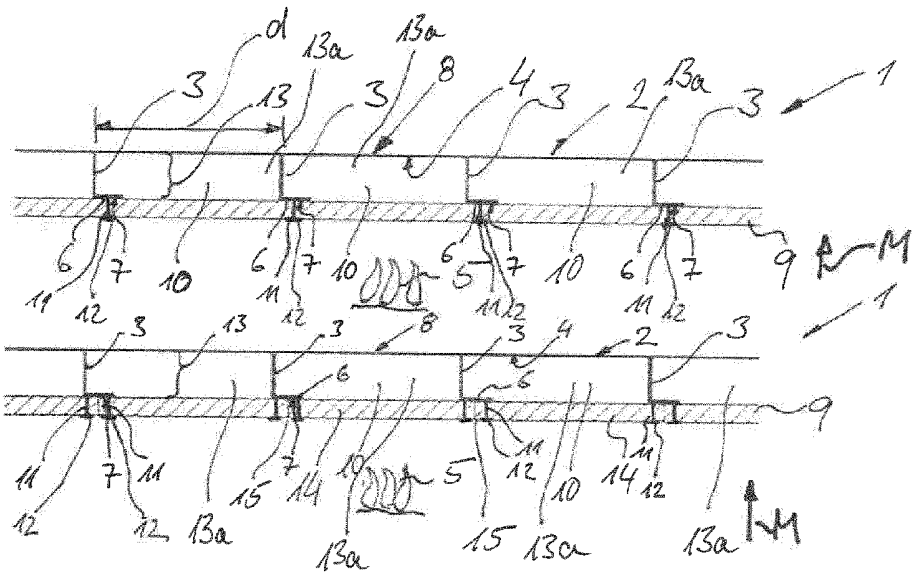

Fig. 1b

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Description

[0001] The invention pertains to a partition wall for use in a vessel according to the preamble of claim 1.

[0002] EP 1 680 561 B1 shows an insulating element consisting of mineral fibers for the construction of ships. Regarding the mounting of such an insulating element it is suggested to envelope stiffeners with a formfitting first insulation element and to fill a gap between two adjacent stiffeners with a second insulation element directly mounted to a wall sheet touching the surface of the wall sheet facing a potential heat source and/or sound source. Thus, there is a need of an individual formfitting element which has to be adapted to the geometry of the stiffeners. The production is more complicated and the amount of space necessary for transportation of the insulation elements to a shipyard is increased. A second mounting method is disclosed in that no formfitting elements are used but the stiffeners are enveloped by plate like singular elements which increases the number of insulation elements in comparison to the first method. Both methods result in good heat resistance and fire resistance properties but there is a need to simplify the mounting as well as to lower the number of different parts needed to form proper insulation. Particularly, the number of pins and washers used to fix the whole insulation of the partition wall is desirable to be minimized.

[0003] Starting from the above it is an object of the invention to reduce the effort for forming a proper insulation layer at least fulfilling, preferably exceeding heat insulation standards and fire resistance standards to provide a proper heat insulation or fire resistance or to provide reasonable acoustic insulation of partition wall of a vessel. Particularly it is intended to reduce the number of parts of the insulation elements as well as to reduce the amount of fastening elements for fixing the insulation to the partition wall.

[0004] According to the invention these objects are addressed by a partition wall defined in claim 1. Preferable embodiments are defined within the sub claims.

[0005] According to the invention a partition wall, in particular a ceiling wall, a sidewall or a separation wall, for use in a vessel comprises: at least a wall sheet, a plurality of elongated stiffeners formed of a stiffening profile, the stiffeners being connected to a first surface of the wall sheet in a distance d to each other, forming a gap between two adjacent stiffeners and protruding towards a potential heat source or a potential sound source and at least an insulation layer located on side of the first surface of the wall sheet, the insulation layer covering the stiffeners and the first surface of the wall sheet thereby forming a heat insulation and/or an acoustic insulation of the wall sheet and the stiffeners towards the potential heat source and/or the potential sound source whereas the insulation layer is fixed to protruding ends of the stiffeners at protruding portions of the stiffeners (3, 3a), whereas the insulation layer (9; 14) is at least partially, preferably fully bridging the distance d between adjacent stiffeners and thereby forming a cavity between the insulation layer and the wall sheet.

[0006] Such a partition wall can be provided by a very low number of singular parts when compared to the state-of-the-art. Further the number of pins necessary for fastening the insulation layer to the partition wall is significantly reduced. Further lower weight of insulation as well as a less effort for installation of the partition wall can be achieved. Better or at least equal performance of fire resistance and of acoustic transmission when compared to the state of the art is also achieved.

[0007] The core idea of the invention is to provide a cavity between an insulation layer and a wall sheet of the partition wall which can be achieved by only fastening the elements of the insulation layer which may be self-supporting insulation plates or pliable insulation web to the free outermost edges or surfaces of the stiffeners which are facing a potential heat source and/or sound source. It was a surprising effect that by reducing the necessary number of insulation elements which can be achieved by just bridging the free ends or free surfaces of the stiffeners allow the same heat resistance or even a better heat resistance to be achieved. Of course, there is a certain amount of space between two adjacent stiffeners that are bridged by an insulation element of the insulation layer which cannot be used for storing cargo as this partial volume is between the wall sheet and the insulation layer and therefore is not available for any cargo. Compared to the whole amount of cargo space available within a vessel's department this is a very minor part of the volume which is lost for storing cargo. On the other side due to the significant lower weight of the insulation this helps to increase the storable mass of cargo which is highly appreciated. Because the stiffeners have not necessarily to be enveloped the installation is significantly simplified and the necessary parts of the insulation layer that may be an insulation web which is flexible or pliable or may be insulation plates which may be self-supporting are reduced in its number and complexity. Even the installation process is simplified as the accessibility to the locations where the pins have to be fixed is also simplified with respect to the state of the art. Further the number of pins and washers necessary for a suitable fixing of the insulation layer is significantly reduced.

[0008] Although the main goal of the invention is to fully bridge the distance between two adjacent stiffeners with only one insulation layer in order to provide a fully closed cavity there may be mounting situations in which it is necessary that one insulation layer only partially bridges the distance between two adjacent stiffeners whereas the closing of the cavity and thereby providing a full bridge of the respective distance d between the stiffeners is provided by a second adjacent insulation element. The second insulation element is mounted such that it at least touches a free edge, whereas it is preferably not only touching but pressed to a certain degree against the free edge of the partially bridging first insulation element. In this way a closed cavity is provided by the use of two or

more insulation elements touching each other or preferably to a certain degree pressed against each other respectively. In any case it is the goal of the invention to produce closed cavities between the wall sheet, the stiffeners and the insulation layer by help of the insulation layer made out of one or more insulation elements in order to improve the heat resistance, fire resistance and/or sound dampening properties.

[0009] With this partition wall of the invention the insulation elements such as insulation mats, insulation slabs or insulation rolls as well as self-supporting insulation plates or pliable insulation webs are fixed directly to protruding portions of the stiffeners preferably without any additional/auxiliary support inbetween the stiffeners and the insulation elements. The tightness of joints between the installed insulation elements, e.g., a mineral wool product which is a suitable insulation material is guaranteed by the mechanical properties of the mineral wool product itself. The insulation material, for example the mineral wool material has preferably a density that can vary between 18 kg/m^3 and 200 kg/m^3. It has a thickness that can vary between 70mm and 120mm millimeters.

[0010] The installation process is simplified by the fact that all pins necessary for fixing the insulation layer may be fixed to the stiffeners in the same mounting direction M, therefore being parallel or at least essentially parallel. This ensures very easy accessibility for pushing the insulation materials, i.e. the insulation web, the insulation plates, the insulation mats, over the pins and fixing the same with the washers.

[0011] With a preferred embodiment of the partition wall the protruding portions of the stiffeners are the protruding ends of the stiffeners more particularly the protruding portions of the stiffeners are protruding outermost surfaces or an outermost edge of the stiffeners facing away from the first surface of the wall sheet.

[0012] The mentioned areas for fixing the pins to the protruding portions of the stiffeners are preferred because of a good accessibility during the mounting/welding of the pins to the stiffeners and because of the fact that fixing the pins to the mentioned protruding portions allows to use shorter pins and therefore to save weight and material.

[0013] With the simplest embodiment with preferred insulation properties the cavity is filled with air thereby forming an airgap. this is the most cost-effective embodiment of the cavity and may be used especially in regions of a vessel where no condensation occurs. It is also the most preferred embodiment in terms of material usage.

[0014] Especially in regions of the vessel where condensation may occur during the operation of the vessel it may be preferable that the cavity is filled with non-gaseous insulation material, e.g. a solid insulation material thereby forming a 2-layer insulation structure.

[0015] The best stability properties can be expected with the partition wall in which the insulation layer is fully bridging the distance d between the adjacent stiffeners.

[0016] According to a preferable embodiment the insulation layer is a self-supporting plate or a pliable web.

[0017] Using a self-supporting plate structure of the insulation elements simplifies the handling of the insulation elements due to their minimized size and weight. Using a pliable web allows rolling the same to deliver insulation material rolls which simplifies the delivery process to the shipyard.

[0018] With a further preferable embodiment, the fixing is made with pins and washers, the pins being fixed to an outermost edge or an outermost surface of the stiffener relative to the first surface of the wall sheet.

[0019] As already mentioned above, this kind of location of the pins helps to simplify the accessibility for welding/spot welding the pins to the partition wall, especially to the well accessible free ends of the stiffeners.

[0020] It may be useful that at least some of the stiffeners are enveloped by a U-shaped insulation profile and a remaining gap between two adjacent insulation U-shaped insulation profiles is bridged by a plate like or by a web like insulation layer forming the cavity.

[0021] This solution is particularly applicable with stiffeners having very huge heights. This solution helps to make the space between two adjacent stiffeners of huge height accessible for cargo storing if necessary.

[0022] With another preferable embodiment two adjacent plate like insulation layers or two adjacent web like insulation layers are placed together with its respective adjacent edges in a way that the outermost surface of the stiffener overlaps the joint between the two adjacent insulation plates or the two adjacent insulation webs respectively.

[0023] This design allows to avoid separate bridging elements bridging the joint between two adjacent insulation elements as an outermost limb of a stiffening profile fulfills the bridging of joint and therefore further reducing the necessary number of insulation elements.

[0024] The partition wall of the invention can be used as a ceiling wall, a sidewall or a separation wall of the vessel.

[0025] It may appear that that the stiffeners are of at least two different heights. In this case it may be preferable to envelope the higher stiffeners by a form fitted insulation element and to bridge the lower stiffeners by a plate-like insulation element.

[0026] Useful stiffener profiles are of a L-cross-section, an I-cross-section or is a rectangular flat profile.

[0027] According to a further preferred embodiment a mounting direction M for the insulation layer and/or the longitudinal direction of all the pins used for fixing purposes of the insulation layer is the same in the case that the wall sheet is planar.

[0028] The mounting direction M is a direction along which the insulation layers are pierced onto the main fixation pins (pins used for fixing purposes of the insulation layer). This direction is parallel or at least essentially parallel to the longitudinal direction of the pins. This simplifies the installation of the insulation elements as

each insulation element can be perforated by the pins in the same direction during installation which also improves the ergonomic conditions for the workers installing the insulation.

[0029] If the partition wall, especially the partition wall sheet is not of a planar design, especially if it is a curved wall, the pins are oriented perpendicular to the first surface of the wall sheet. This allows a simplified installation as well.

[0030] With another preferred embodiment all pins used for fixing purposes are fixed to an outermost surface or an outermost edge of the stiffeners facing towards the potential heat source and/or sound source. This measurement maximizes the accessibility of the welding spots when installing the pins for fixation of the insulation layer or the respective insulation elements that form the insulation layer.

[0031] No pins used for fixing purposes (main fixation pins) are fixed directly to the first surface of the wall sheet. This first surface of the wall sheet is the least accessible area of the side of the partition wall facing a potential heat source and/or sound source. Therefore, avoiding a fixation of pins in this area facilitates the installation process. Further all the pins for fixation purposes which perform unwanted heat conducting bridges are not directly in contact with the wall sheet of the partition wall therefore minimizing the heat transfer through the fixation pins to the second surface of the partition wall. Thus, the heat resistance/fire resistance is improved.

[0032] Preferably the insulating layer is fixed directly to protruding portions of stiffeners particularly directly abutting the stiffeners without any additional/auxiliary support inbetween the stiffeners and/or inbetween adjacent insulation layers. More particularly, the insulation layer abuts the outermost surface of the stiffener facing away from the first surface of the wall sheet.

[0033] If a distance a or b between adjacent pins exceeds a certain threshold it is preferred to provide an additional auxiliary support for the insulation layer provided by auxiliary pins that are fixed to the first surface of the wall sheet fully penetrating the cavity and the insulation layer. Such auxiliary pins are especially used for stiffening edge regions of the insulation layer in order to avoid dislocation of such edge regions in the long run during the use of the partition wall in the vessel. The main characteristic for an auxiliary pin used just for stabilizing lose edge regions is that these auxiliary pins are fixed to the first surface of the wall sheet thereby penetrating the cavity in a thickness direction.

[0034] It is intended to minimize the number of auxiliary pins as much as possible as those auxiliary pins by bridging the cavity and being connected to the first surface of the wall sheet are forming additional heat bridges which should be avoided. The fastening pins however are - as defined above - all fixed to stiffeners especially to protruding portions, edges or surfaces of the stiffeners facing away from the first surface.

[0035] In order to avoid unwanted reduction of the thickness of the cavity the auxiliary pins comprise a mechanical stop defining and/or maintaining a thickness value of the cavity between the first surface and the insulation layer.

[0036] Preferably the mechanical stop is a washer or a bent part or a bulge of the auxiliary pin. In case of the mechanical stop being a washer, it is further preferred to use the same type of washer which is used for fixing the insulation layer to the fastening pins fixed to the stiffeners.

[0037] Further embodiments and further details of the invention are discussed and disclosed within the description of specific embodiments shown in the attached drawings. The drawings are:

Figure 1a: A simplified schematic cross-section showing a first embodiment of the invention;

Figure 1b: A simplified schematic cross-section showing a second embodiment of the invention;

Figure 2: A simplified schematic cross-section showing a third embodiment of the invention;

Figures 3: A simplified schematic cross-section showing a first further example of the embodiment of figure 2, which modifications are also applicable to all other embodiments of the invention and described herein;

Figure 4: A simplified schematic cross-section showing a second further example of the embodiment of figure 2, which modifications are also applicable to all other embodiments of the invention and described herein;

Figure 5: A diagram showing a temperature increase (°C) over the time (min) for an insulated partition wall according to a traditional design (upper curve) and according to the design of the invention (lower curve).

[0038] A first embodiment of a partition wall 1 (Fig. 1a) according to the invention is usually made of metal, for example made of steel or aluminum. The partition wall 1 comprises a wall sheet 2 and a plurality of stiffeners 3. Two adjacent stiffeners 3 are located in a distance d with respect to each other. The stiffeners 3 are L-shaped in cross-section and are fixed to a first surface 4 of the wall sheet 2. The first surface 4 of the wall sheet 2 is facing a potential heat source and/or sound source 5. The stiffeners 3 are protruding from the first surface 4 to the direction

of the potential heat source and/or sound source 5.

[0039] The stiffeners 3 each have a limb 6 having an outermost surface 7 facing the potential heat source and/or sound source 5. Opposite to the first surface 4 of the wall sheet 2 the partition wall 1 has a second surface 8 which faces to the side of the partition wall 1 which has to be protected from heat or sound. Further the partition wall 1 comprises an insulation layer 9. The insulation layer 9 is an insulation web which is fixed to the outermost surfaces 7 of the stiffeners 3 thereby bridging a gap 10 between two adjacent stiffeners 3. In order to fix the web like insulation layer 9 to the stiffeners 3 it is only necessary to provide one pin 11 at each outermost surface 7 which stitches through the insulation layer 9 after installation. The insulation layer 9 is then fixed to the pins 11 by washers 12 which is a well-known technique. During the mounting process of the insulation layer 9 to the pins 11 in a first step the insulation layer 9 is moved along a mounting direction M which is parallel, at least essentially parallel, to a longitudinal direction of the pins 11 wherein during this first step the pins 11 are piercing the insulation layer 9 thereby providing free ends of the pins 11 for receiving the washers 12. Attaching the washers 12 to the free ends of the pins 9 is the second step of the mounting process.

[0040] As a result, a cavity 13 between the first surface 4 of the wall sheet 2 and the insulation layer 9 is created. The height of the of the cavity 13, i.e. the thickness of the cavity 13 is approximately equal to the height of the stiffeners 3. The cavity 13 is filled with air thereby forming an airgap 13a. As described later in connection with other embodiments of the invention the cavity 13 of this embodiment may also be filled with a solid insulation material 18 thereby forming a 2-layer insulation structure together with the insulation layer 9; 14.

[0041] Figure 1b shows a second embodiment of the invention. The partition wall 1 of the second embodiment and the pre-described mounting process of the insulation layer 9 to the pins 11 (mounting direction M) is quite similar to the partition wall 1 of the first embodiment with the following differences. Instead of using a web like insulation layer 9 the insulation layer 9 of the second embodiment is formed by self-supporting plate like insulation elements 14 which may be stripes or plates. Each of the self-supporting plate-like insulation elements 14 is fixed to two adjacent stiffeners 3 with pins 11 and washers 12. Adjacent plate-like, self-supporting insulation elements 14 form a joint 15 with respect to an adjacent insulation element. This joint 15 is bridged by the limb 6 of the stiffener 3. With the embodiment shown in figure 1b each limb 6 of the stiffener 3 carries two rows of pins 11 whereas the first row belongs to the first insulation element 14 and the second row belongs to the second insulation element 14 forming the joint 15. The cavity 13 and the airgap 13a respectively are formed in the same way as it was described with respect to the first embodiment of figure 1a. The length of the self-supporting plate like insulation elements 14 is thus adapted to the distance d (and stiffener 3 thickness) between two adjacent stiffeners 3. If the length of the self-supporting plate like insulation elements 14 is adapted to a multiple of distance d, stiffeners 3 carry two rows of pins 11 at joints 15 as described above, while a stiffener 3 overlapped without joint 15 may carry only a single row of pins 11 (not depicted).

[0042] A third embodiment of the invention is shown in figure 2. The partition wall 1 of the third embodiment also has a wall sheet 2 and stiffeners 3. The stiffeners 3 are of an L-shaped cross-section. Within the space between two adjacent stiffeners 3 there are additional stiffeners 3a of lower height. The additional stiffeners 3a for example are of a flat rectangular profile.

[0043] Besides the pins 11 being fixed to the limb 6 of the stiffeners 3 there are pins 11 which are also provided on outermost edges 16 off the additional stiffeners 3a. Further, U-shaped insulation profiles 17 are provided which envelope the stiffeners 3 of an L-cross-section. Inbetween two of the U-shaped insulation profiles 17 an insulating plate 14 or an insulating web 9 is provided and fixed to the outermost edges 16 of the additional stiffeners 3a of lower height thereby closing and/or bridging the gap 10 between two adjacent U-shaped insulation profiles 17. The cavity 13 between the first surface 4 and the insulating plate 14 respectively the insulating web 9 corresponds to the height of the additional stiffener 3a of lower height. As described above the cavity 13 may be filled with air thereby forming the airgap 13a. Likewise it is also possible to fill the cavity 13 with a solid insulation material as described above thereby creating a 2-layer insulation structure (see embodiment according to figure 3).

[0044] A first distance between a stiffener 3 and an adjacent additional stiffener 3a is defined being the distance a. A second distance between 2 adjacent additional stiffeners 3a is defined being the distance b.

[0045] In case that the distance a is smaller than a maximum distance a_{max} and/or the distance b is smaller than a maximum distance b_{max}, it is sufficient for a reliable and long-lasting fixation of the insulation layer 9 to fix it only with the fixation pins 11 and the washers 12 which according to the invention are located on the outermost edges or surfaces of the stiffeners 3 and/or the auxiliary stiffeners 3a.

[0046] If the distances a and/or b exceed their respective maximum values a_{max} and/or b_{max} it may be necessary or at least useful to provide an improved fixation of the insulation layers 9 by using auxiliary pins 19 and washers 12 as shown within a second example of the embodiment of figure 2 which is shown in figure 4.

[0047] To distinguish auxiliary pins 19 from the main fixation pins 11 which are fixed to outermost edges or surfaces of stiffeners 3 or auxiliary stiffeners 3a the auxiliary pins 19 are fixed to the first surface 4 thereby completely penetrating the cavity 13. The auxiliary pins 19 also have a mechanical stop 19a which serves as a support for the insulation layers 9. This is to ensure that

the insulation layer 9 keeps the intended distance from the first surface in order to maintain the cavity 13 in any case.

[0048] The values of the distances a_{max} and b_{max} up to which no auxiliary pin 19 is needed depend for example on the stiffness/flexibility of the material of the insulation layer 9. It also may be influenced by a friction coefficient between platelike or web like insulation layers 9 and the U-shaped insulation profiles 17 in their contact zone. Another reason for using an auxiliary pin 19 may be to avoid a local bulging or a local sagging of certain parts of the insulation layer 9. These auxiliary pins which are only used on a certain demand are not to be defined as being fastening pins in the sense of the invention. The fastening pins in the sense of the invention are at least mainly holding the weight of the elements of the insulation layer 9 and the insulation profiles 17.

[0049] The mounting process of the insulation layer 9 of this embodiment corresponds to the pre-described mounting process of the insulation layer 9 with all the other embodiments (mounting direction M).

[0050] This embodiment according to figure 2 as well as the following embodiments according to figures 3 and 4 which will be described later show a case of the insulation layer 9 only partly bridging the distance between 1 of the additional stiffeners 3a and an adjacent stiffener 3. The remaining rest of the space between the additional stiffener 3a and the stiffener 3 is closed and/or filled by a certain portion of the insulation profile 17. As a result, according to the main goal of the invention a closed cavity 13 is provided although the insulation layer 9 only partially bridges the distance d between the additional stiffener 3a and the stiffener 3.

[0051] Figure 3 shows a first modified example of the embodiment of figure 2 in which the cavity 13 is filled with a non-gaseous insulation medium for example the cavity 13 is filled with a solid insulation material 18 thereby forming a 2-layer insulation structure. Such a 2-layer insulation structure avoiding cavities between the insulation layer 9 and the wall sheet 2 are very useful in areas of a vessel where a risk of condensation and therefore a risk of generation of liquid water exists. As already mentioned above the measurements according to the example of figure 3 namely filling the cavity 13 with a non-gaseous insulation material for example a solid insulation material 18 is applicable to all the described embodiments and examples of the invention where an airgap 13a a should be avoided.

[0052] Suitable values of the maximum distance a_{max} are 180mm to 250mm, preferably 200mm depending on the local stiffnesses of the used materials. A suitable value for a_{max} can be found by a person skilled in the art.

[0053] Suitable values for the maximum distance b_{max} are 300mm to 400mm, preferably 350mm depending on the local stiffnesses of the used materials. A suitable value for b_{max} can be found by a person skilled in the art.

[0054] To confirm the improved heat resistance the applicant conducted some experiments comparing a traditional partition wall design and a partition wall design according to the invention with respect to the fire resistance properties. Within the experiment the metal parts of the partition wall 1 were made of aluminum. Figure 5 shows two different curves whereas the upper curve 20 is related to the traditional design and the lower curve 21 is related to the new partition wall design according to the invention. Figure 5 shows a diagram of temperature increase in degrees Celsius over the time in minutes under the test conditions of an M484M test. The temperature increase has been measured on the second surface 8 of the wall sheet 2.

[0055] A comparison of the two curves 20, 21 shows that the new design of the invention reaches a certain temperature increase of the second surface 8 later than a second surface 8 of the partition wall of the traditional design. For example, a temperature increase of 100°C is reached after approximately 48 minutes with the traditional design and after 64 minutes with the design of the invention. Vice versa at a certain time the respective temperature increase of the second surface 8 of the wall sheet 2 of the invention is significantly lower than the respective temperature increase of the traditional designed partition wall. For example, after a time of 50 minutes the new design shows a temperature increase of 80°C whereas the traditional design shows a temperature increase of about 108°C. Further, it has to be mentioned that at the beginning of the experiment both designs (the traditional and the new design) have almost the same characteristics due to the temperature increase over time, whereas in the longer run, i.e., in a time span between 20 and 70 minutes the new design offers a significantly lower increase of the temperature increase when compared to a partition wall of a traditional design.

List of reference signs

[0056]

1	partition wall
2	wall sheet
3	**stiffener**
3a	additional stiffener
4	first surface
5	potential heat source and/or sound source
6	limb/protruding ends
7	outermost surface
8	second surface
9	insulation layer
10	gap
11	pin
12	washer
13	cavity
13a	airgap
14	self-supporting plate/insulating plate
15	joint
16	outermost edge
17	U-shaped insulation profile

18	solid insulation material
19	auxiliary pin
19a	mechanical stop/washer
20	upper curve
21	lower curve
M	mounting direction
d	distance
a	distance
b	distance
a_{max}	maximum distance value
b_{max}	maximum distance value

Claims

1. Partition wall, in particular a ceiling wall, a sidewall or a separation wall, for use in a vessel comprising:

- at least a wall sheet (2);
- a plurality of elongated stiffeners (3, 3a) formed of a stiffening profile;
- the stiffeners (3, 3a) being connected to a first surface (4) of the wall sheet (2) in a distance (d) to each other, forming a gap (10) in-between two adjacent stiffeners (3, 3a) and protruding towards a potential heat source and/or sound source (5);
- and at least an insulation layer (9, 14) located on the side of the first surface (4) of the wall sheet (2), the insulation layer (9, 14) covering the stiffeners (3, 3a) and the first surface (4) of the wall sheet (2) thereby forming a heat insulation and/or an acoustic insulation of the wall sheet (2) and the stiffeners (3, 3a) towards the potential heat/sound source (5)

characterized in that the insulation layer (9, 14) is fixed to protruding ends (6) of the stiffeners (3, 3a) at protruding portions of the stiffeners (3, 3a), whereas the insulation layer (9; 14) is at least partially, preferably fully bridging the distance (d) between adjacent stiffeners (3, 3a) and thereby forming a cavity (13) between the insulation layer (9, 14) and the wall sheet (2).

2. Partition wall according to claim 1, **characterized in that** the protruding portions of the stiffeners (3, 3a) are the protruding ends (6) of the stiffeners (3, 3a) more particularly the protruding portions of the stiffeners (3,3a) are protruding outermost surfaces (7) or an outermost edge (16) of the stiffeners (3;3a) facing away from the first surface (4) of the wall sheet (2).

3. Partition wall according to claim 1 or 2, **characterized in that** the cavity (13) is filled with air thereby forming an airgap (13a) or **in that** the cavity (13) is filled with a non-gaseous insulation material, e.g., a solid insulation material (18), thereby forming a 2-layer insulation structure.

4. Partition wall according to claim 1, **characterized in that** the insulation layer (9, 14) is a self-supporting plate or a pliable web.

5. Partition wall according to claim 1 or 2, **characterized in that** the fixing of the insulating layer (9, 14) is achieved by pins (11) and washers (12), the pins (11) being fixed to the outermost edge (16) or the outermost surface (7) of the stiffener (3, 3a).

6. Partition wall according to one of the preceding claims, **characterized in that** at least some of the stiffeners (3, 3a) are enveloped by a U-shaped insulation profile (17) and a remaining gap (6) between two adjacent insulation U-shaped insulation profiles (17) is bridged by a plate like or by a web like insulation layer (9, 14) forming the cavity (13).

7. Partition wall according to one of the preceding claims, **characterized in that** two adjacent plate like insulation layers (14) or two adjacent web like insulation layers (9) are placed together with its respective adjacent edges in a way that the outermost surface (7) of the stiffener (3, 3a) overlaps a joint (15) between the two adjacent plate like insulation layers (14) or the two adjacent web like insulation layers (9) respectively.

8. Partition wall according to one of the preceding claims, **characterized in that** the stiffeners (3, 3a) are of at least two different heights.

9. Partition wall according to one of the preceding claims, **characterized in that** the stiffener profile has a L-cross-section, an I-cross-section or is a rectangular flat profile.

10. Partition wall according to one of the preceding claims, **characterized in that** a mounting direction (M) for the insulation layer (9, 14) and/or the longitudinal direction of all the pins (11) used for fixing purposes of the insulation layer (9, 14) is the same in the case that the wall sheet (2) is planar.

11. Partition wall according to one of the preceding claims, **characterized in that** all the pins (11) are oriented perpendicular to the first surface (4) of the wall sheet (2), in particular that all pins (11) used for fixing purposes are fixed to an outermost surface (7) or an outermost edge (16) of the stiffeners (3, 3a) oriented in parallel to the first surface (4) of the wall sheet (2), i.e. facing towards the potential heat source and/or sound source (5).

12. Partition wall according to one of the preceding claims, **characterized in that** no pins (11) used for

fixing purposes are fixed directly to the first surface (4) of the wall sheet (2).

13. Partition wall according to one of the preceding claims, **characterized in that** the insulating layer (9, 14) is fixed directly over the stiffeners (3, 3a) without any auxiliary support in-between the stiffeners (3, 3a) and/or in-between adjacent insulation layers (9, 14).

14. Partition wall according to claims 1 to 12 of the preceding claims, **characterized in that** an auxiliary support is provided by auxiliary pins (19) that are fixed to the first surface (4) of the wall sheet (2) fully penetrating the cavity (13).

15. Partition wall according to claim 14, **characterized in that** the auxiliary pins (19) comprise a mechanical stop (19a) defining and/or maintaining a thickness value of the cavity (13) between the first surface (4) and the insulation layer (9; 14), in particular that the mechanical stop (19a) is a washer or a bent part or a bulge of the auxiliary pin (19).

Fig. 1a

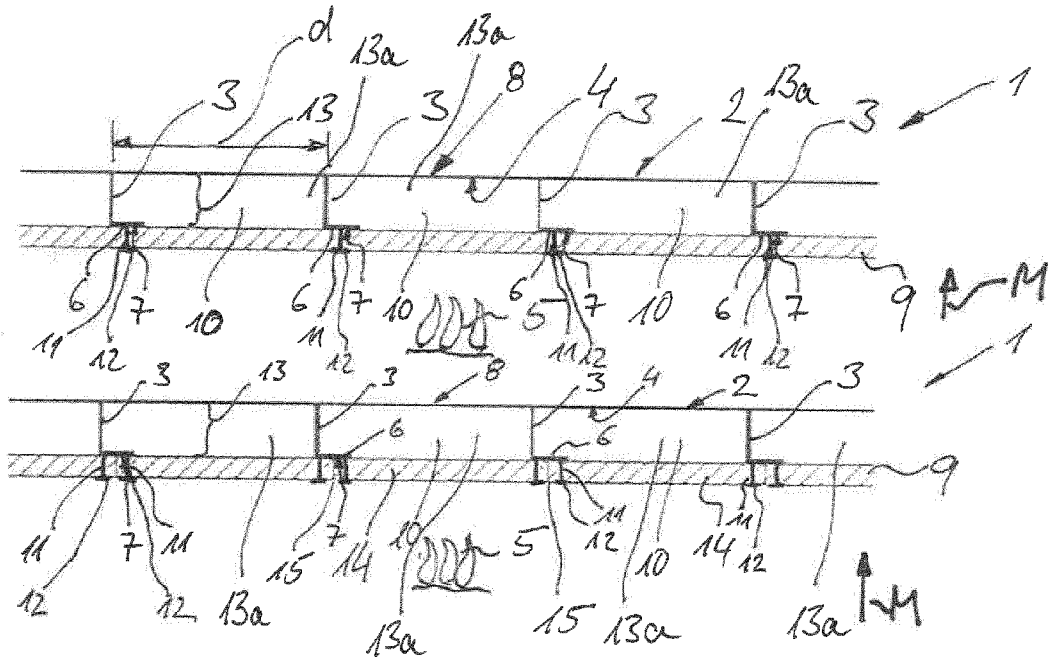

Fig. 1b

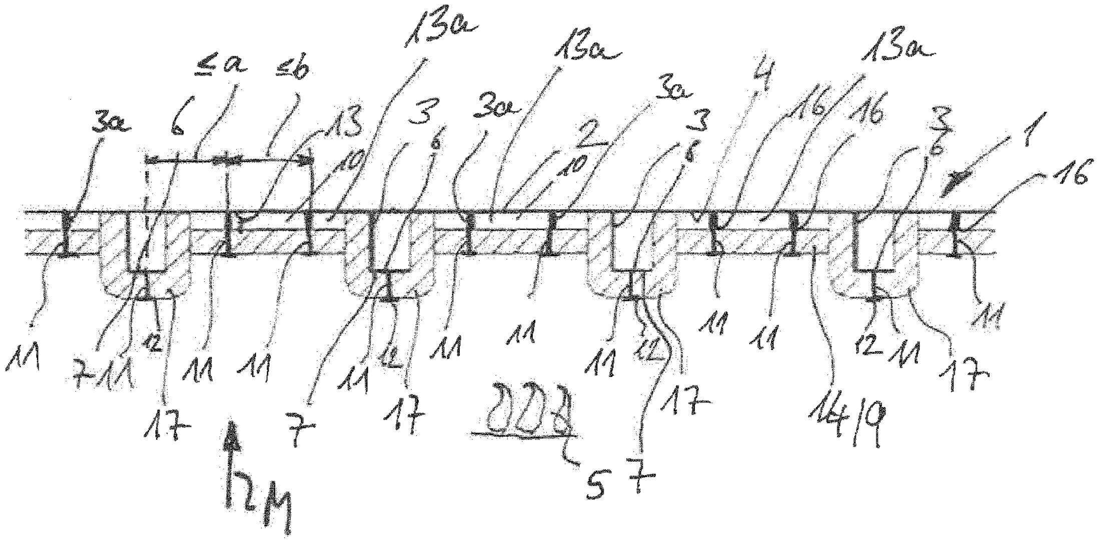
≤a
≤b
13a
13a
13a
3a
6
13
10
3
6
3a
2
10
3a
3
6
4
16
16
3
6
1
16
11
7
11
12
17
7
17
5
7
14/9
RM

Fig. 2

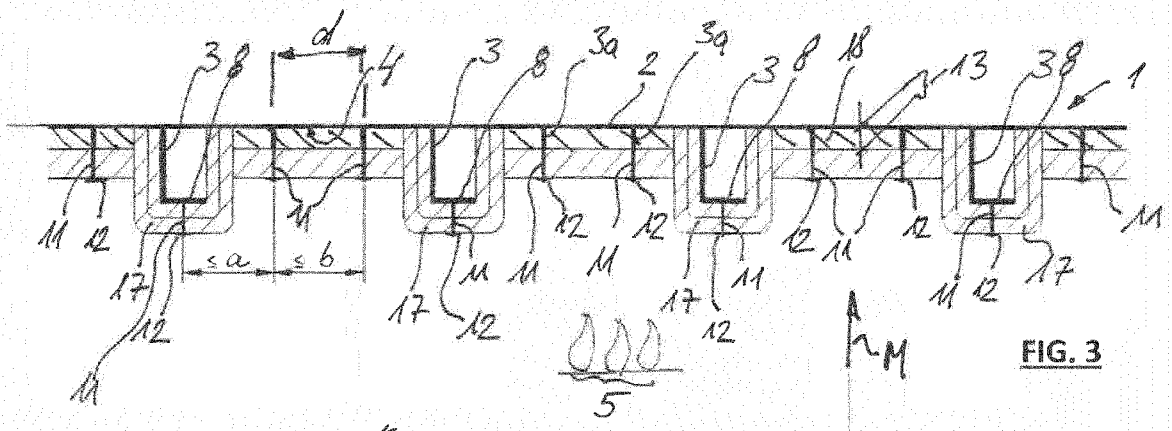

FIG. 3

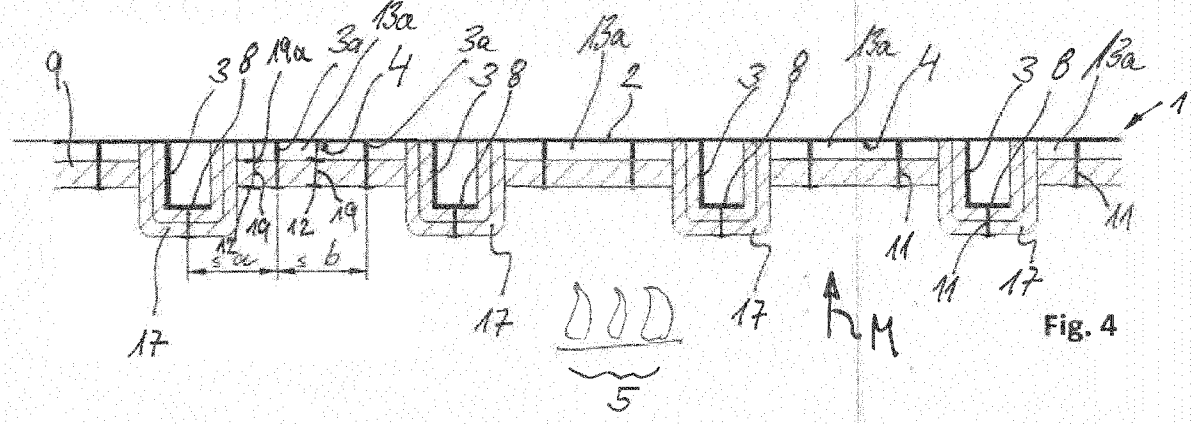

Fig. 4

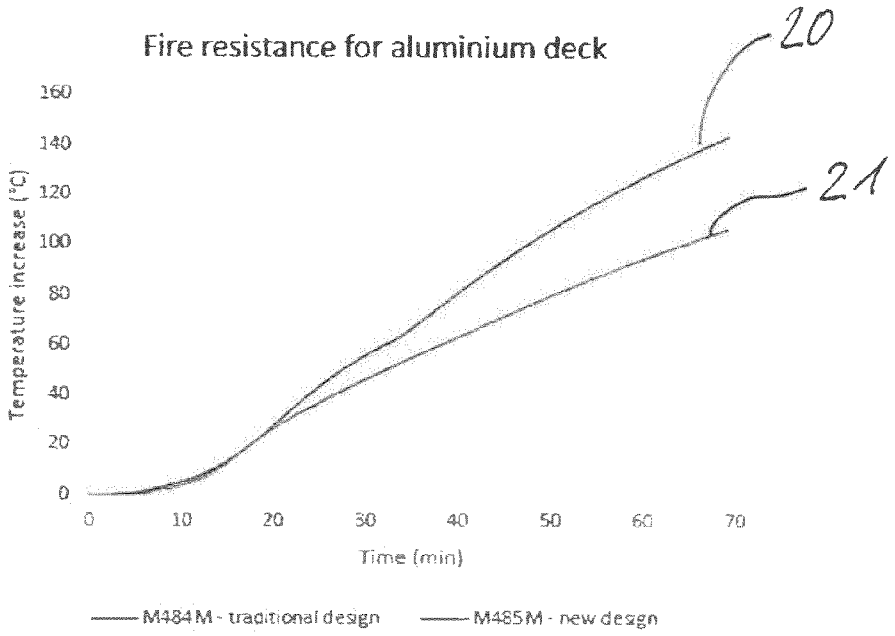
Fire resistance for aluminium deck
20
21
160
140
120
100
80
60
40
20
0
Temperature increase (°C)
0
10
20
30
40
50
60
70
Time (min)
M484M - traditional design
M485M - new design

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 23 20 6455

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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	12 April 2024	Balzer, Ralf

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KR 101669532 B1	26-10-2016	NONE	

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