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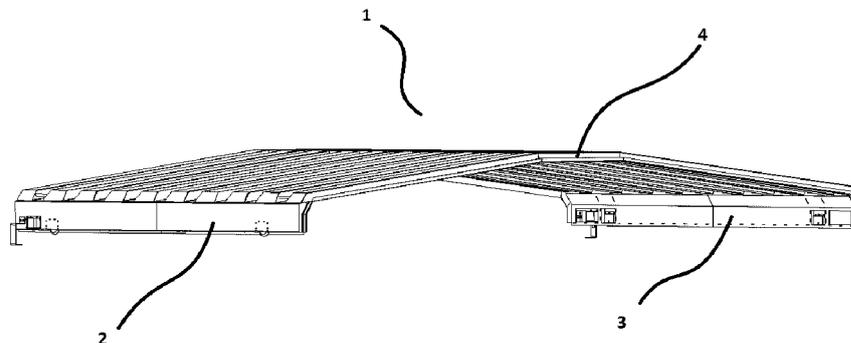
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(54) **SLIDING HATCH DEVICE AND IMPROVED SIDEWALL THEREFORE AS WELL AS A METHOD OF MANUFACTURE**

(57) The present invention relates to a sliding hatch device (1) suitable for closing off a cargo hold of a ship or more generally for closing off a space, manufactured mainly from aluminium and constructed from a horizontal top plate (4) mounted on two upright side wall sections

(2, 3), the side wall sections comprising a hollow section, which hollow section is folded according to at least one fold line, which fold line is provided with a material reduction.

**FIG.3**



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**Description****TECHNICAL FIELD**

**[0001]** The invention relates in a first aspect to a sliding hatch device for closing off a cargo hold of a ship or more generally for closing off a space, mainly made of aluminum and constructed from a lying top plate fastened to two upright side wall sections.

**[0002]** In a second aspect, the invention relates to a sliding hatch roof for closing off a cargo hold of a ship or more generally for closing off a space, composed of a set of at least 2 sliding hatch devices.

**[0003]** In a third aspect, the invention relates to a method for manufacturing a sliding hatch device for closing off a cargo hold of a ship or more generally for closing off a space.

**[0004]** In a fourth aspect, the invention relates to a pleated side wall section suitable for the construction of a sliding hatch device.

**PRIOR ART**

**[0005]** It is known to cover the cargo hold of ships with hatches which extend from one side coaming to the opposite side coaming of the cargo hold, several of which are required side by side to cover the entire hold.

**[0006]** For some time now, such cargo hatch devices have been realized mainly in aluminum in order to keep the weight as low as possible. These cargo hatch devices are essentially constructed from two upright side wall sections which are connected via a lying top plate. It is known that various welding operations and metal cutting operations are carried out for the manufacture of such cargo hatches.

**[0007]** BE 899 006 describes improved cargo hatches for ships which are made of metal, usually aluminum, and are extended upwards in the middle to rest with the ends on the so-called side coamings.

**[0008]** BE 1 013 343 describes an improved cargo hatch as is mainly used on inland vessels to close the hold. The improved cargo hatch consists of at least two parts that can be moved relative to each other according to the longitudinal direction of the cargo hatch, so that the length of the cargo hatch can be adjusted to the distance between the side coamings of a ship.

**[0009]** A problem with the known sliding hatch devices as described above is that the side wall sections of such sliding hatch devices are made up of a range of different aluminum sections. In the manufacture of such side wall sections, several welding operations and metal cutting operations must be carried out before a complete sliding hatch device can be manufactured. Welding operations and metal cutting operations are labor intensive and consequently cost intensive.

**[0010]** Moreover, each welding operation provides an extra place where the material has a certain form of freedom. This is detrimental to the wear of components and

to the functional life of a sliding hatch device.

**[0011]** The present invention aims to find a solution to at least one of the aforementioned problems.

5 **SUMMARY OF THE INVENTION**

**[0012]** For this purpose, in a first aspect, the invention provides a sliding hatch device suitable for closing off a cargo hold of a ship or more generally for closing off a space, substantially made of aluminum and constructed of a lying top plate fixed on two upright side wall sections, the side wall section comprising a hollow section, which hollow section is folded according to at least one fold line, which fold line is provided with a material reduction.

10 **[0013]** In a second aspect, the invention relates to a sliding hatch roof suitable for closing off a cargo hold of a ship or more generally for closing off a space, composed of a set of at least two sliding hatch devices, the sliding hatch devices being horizontally bearing-mounted with respect to each other.

15 **[0014]** In a third aspect, the invention relates to a method for manufacturing a sliding hatch device suitable for closing off a cargo hold of a ship or more generally for closing off a space, the method comprising the steps of:

- 25
- a. gathering a rectangular, flat aluminum plate;
  - b. applying material reductions to a flat aluminum plate;
  - 30 c. folding a flat aluminum plate into a partially folded plate;
  - d. assembling additional components to the partially folded plate;
  - 35 e. folding the partially folded plate into a closed longitudinally extended hollow section
  - 40 f. applying spot welds to the closed longitudinally extended hollow section;
  - 45 g. mounting a lying aluminum top plate on top of two upright hollow sections.

**[0015]** In a fourth aspect, the invention relates to a pleated side wall section suitable for the construction of a sliding hatch device.

**[0016]** The present invention has the advantage, among other things, that the use of welding operations and metal cutting operations can be limited. This by using folded side wall sections in the sliding hatch devices. Welding operations and metal cutting operations are a labor-intensive and time-consuming process. Therefore, by limiting welding operations, a considerable economic advantage can be gained in the manufacture of such sliding hatch devices.

**[0017]** An additional advantage of limiting welding op-

erations is that freedoms of the material are limited. In this way, the wear of components is limited, and this benefits the service life of the sliding hatch device.

**[0018]** Another additional advantage is that a closed folded side wall section provides a more defined finish to the sliding hatch device. On the one hand, this is an aesthetic advantage, but as a result, no cargo from the cargo hold of a ship can be left behind on the inside of the side wall section of a sliding hatch device. In addition, a closed folded side wall section is more uniform than a side wall section that is composed of several sections.

**[0019]** A surprising advantage of the present invention is that, through the use of a folded side wall section, substantially less customization and calculation work is required during the assembly of the components to the folded side wall section. This ensures an improved uniformity of the side wall sections since each component has a predetermined assembly location on the side wall section. In this case, no other interpretation is possible where the components have to be assembled and consequently the risk of incorrect assembly is considerably smaller. In addition, this also ensures an increased quality of the entire sliding hatch device.

**[0020]** A particular advantage is that, through the use of a folded side wall section, there is a considerably better distribution of forces over the side wall section. As a result, the forces exerted by the top plate are better distributed over the entire side wall section. In addition, the support surface of the folded side wall section provides better support for the top plate. Overall, a sturdier side wall section is thus obtained according to the present invention.

**[0021]** An advantage of the current method for manufacturing a sliding hatch device includes an advantage regarding the specific sequence of method steps c, d and e. Steps comprising, respectively, folding a flat aluminum plate into a partially folded plate, assembling additional components to the partially folded plate, and folding the partially folded plate into a closed, longitudinally extended hollow section. Because the folding of the hollow section comprises two steps, it is possible to mount the additional components via tongue and groove connections. This would be impossible if the hollow section were folded in one step. The tongue and groove connections have a considerable mechanical advantage over other mounting techniques such as welding.

## DETAILED DESCRIPTION

**[0022]** The invention relates to a sliding hatch device suitable for closing off a cargo hold of a ship or more generally for closing off a space, a sliding hatch roof composed of a set of at least two sliding hatch devices and a method for manufacturing such sliding hatch devices.

**[0023]** Unless otherwise defined, all terms used in the description of the invention, including technical and scientific terms, have the meaning as commonly understood by a person skilled in the art to which the invention per-

tains. For a better understanding of the description of the invention, the following terms are explained explicitly.

**[0024]** In this document, "a" and "the" refer to both the singular and the plural, unless the context presupposes otherwise. For example, "a segment" means one or more segments.

**[0025]** The terms 'comprise', 'comprising', 'consist of', 'consisting of', 'provided with', 'have', 'having', 'include', 'including', 'contain', 'containing' are synonyms and are inclusive or open terms that indicate the presence of what follows, and which do not exclude or prevent the presence of other components, characteristics, elements, members, steps, as known from or disclosed in the prior art.

**[0026]** When the term "around" or "about" is used in this document with a measurable quantity, a parameter, a duration or moment, and the like, then variations are meant of approx. 20% or less, preferably approx. 10% or less, more preferably approx. 5% or less, even more preferably approx. 1% or less, and even more preferably approx. 0.1% or less than and of the quoted value, insofar as such variations are applicable in the described invention. However, it must be understood that the value of a quantity used where the term "about" or "around" is used, is itself specifically disclosed.

**[0027]** In a first aspect, the invention relates to a sliding hatch device suitable for closing off a cargo hold of a ship or more generally for closing off a space, substantially made of aluminum and constructed of a lying top plate fixed on two upright side wall sections, characterized in that the side wall section comprises a hollow section, which hollow section is folded according to at least one fold line, which fold line is provided with a material reduction. In this context, a fold line is understood to mean a line along which one can or must easily fold; it can also be the line that has already been folded.

**[0028]** Furthermore, material reduction is understood to mean that a material, in the case of the present invention being aluminum, is weakened by means of material removal, by any technique, at a certain area of the material.

**[0029]** In an embodiment of the present invention, material reduction of a fold line will be arranged according to a line pattern. In a further embodiment, the percentage of material reduction at the level of the line pattern of a fold line will preferably be more than 50%, more preferably more than 75% and even more preferably more than 90%.

**[0030]** A preferred embodiment of this line pattern comprises a repetition of longitudinally extended and cut-out U-shapes arranged one after the other along a line. This line pattern in combination with a material reduction percentage of more than 90% has the advantage that an optimal relationship between the retention of material strength and the foldability of the aluminum along the fold line is achieved.

**[0031]** The configuration of a fold line by means of material reduction according to a line pattern has the advan-

tage, among other things, that aluminum plates can be folded in a simple manner into a folded or more closed structure, without the aluminum plates breaking or considerable pressure having to be exerted on the aluminum plate.

**[0032]** In an embodiment of the present invention, a sliding hatch device comprises a hollow section folded into a closed longitudinally extended polygon, preferably an irregular pentagon. In this case, the folded hollow section serves as a side wall section of a sliding hatch device.

**[0033]** A closed side wall section has the advantage, inter alia, that no cargo from the cargo hold can be left behind on the inside of a side wall section. In addition, a closed hollow section comprises a defined finish to the side wall section where a minimum of welds are visible, which can be seen as an aesthetic advantage.

**[0034]** A folded side wall section has the advantage, inter alia, that there is a considerably better distribution of forces over the side wall section. As a result, the forces exerted by the top plate are better distributed over the entire side wall section. In addition, the support surface of the folded side wall section provides better support for the top plate.

**[0035]** In an embodiment of the present invention, a sliding hatch device comprises the lying top plate having a height that, from the center thereof, progressively decreases toward both ends thereof.

**[0036]** In an embodiment of the present invention, a sliding hatch device comprises supporting aluminum reinforcing ribs attached to the inside of the cavity of the hollow section in the hollow section. Such reinforcing ribs provide the side wall section with additional load-bearing capacity. The attached reinforcing ribs have the advantage, among other things, that reinforcement of the side wall section can be realized as well as limiting the number of welding operations. An additional advantage of limiting welding operations is that freedoms of the material are limited. In this way, the wear of components is limited and this benefits the service life of the sliding hatch device.

**[0037]** In an embodiment of the present invention, a sliding hatch device will span the opening of the cargo hold in the transverse direction of the ship, characterized in that a sliding hatch device rests with both outer edges on the side coamings of the ship. In this case, a side coaming comprises the upright side of the ship's hold, from the deck of an inland vessel. In a further embodiment of the present invention, at least one side coaming of a ship will be provided with rails according to the longitudinal position of the ship.

**[0038]** In an embodiment of the present invention, additional material reductions will be provided in the hollow section for assembling additional components, which additional components include wheel housings, handle housings, latch housings and hatch hook housings. These additional components provide the side wall section and, by extension, a sliding hatch device with an optimal embodiment. In a further embodiment of the

present invention, wheel housings will be provided with bearing-mounted or double-bearing wheels, which are slidable over a rail on the side coamings according to the longitudinal position of the ship.

**[0039]** In a second aspect, the invention relates to a sliding hatch roof suitable for closing off a cargo hold of a ship or more generally for closing off a space, composed of a set of at least two sliding hatch devices, characterized in that the sliding hatch devices are horizontally bearing-mounted with respect to each other.

**[0040]** The horizontally bearing-mounted positioning of a set of sliding hatch devices means that the vertical height of each successive sliding hatch increases progressively. This has the advantage, among other things, that they fit on top of each other when retracted and they do not take up more space than a single sliding hatch device.

**[0041]** In an embodiment of the present invention, all sliding hatch devices of the sliding hatch roof will be slidable over a rail on the side coamings of a ship according to the longitudinal direction of the ship.

**[0042]** In an embodiment of the present invention, seals in Ethylene Propylene Diene Monomer rubber (EPDM) will be fitted between the different sliding hatch devices of a sliding hatch roof. Such seals in EPDM have the advantage, among other things, that a sliding hatch roof is made watertight. In this way, the cargo in the cargo hold of a ship is protected against moisture.

**[0043]** In a third aspect, the invention relates to a method for manufacturing a sliding hatch device for closing off a cargo hold of a ship or more generally for closing off a space, the method comprising the steps of:

- a. gathering a rectangular, flat aluminum plate;
- b. applying material reductions to a flat aluminum plate;
- c. folding a flat aluminum plate into a partially folded plate;
- d. assembling additional components to the partially folded plate;
- e. folding the partially folded plate into a closed longitudinally extended hollow section;
- f. applying spot welds to the closed longitudinally extended hollow section;
- g. mounting a lying aluminum top plate on top of two upright hollow sections.

**[0044]** In an embodiment of the present invention, the method comprises material reductions being made by one of the following techniques: punching, cutting or laser cutting, which material reductions comprise fold lines according to a line pattern and cut-outs for additional com-

ponents.

**[0045]** In this context, punching comprises a processing technique in which shapes are cut from (sheet) material or parts of a structure are removed in some other way by means of compressive force, while the structure itself is supported at the rear. The openings made in the (sheet) material are the product and not the cut-out shapes.

**[0046]** In an embodiment of the present invention, the method comprises additional components comprising wheel housings, handle housings, latch housings and hatch hook housings, which are attached to at least one side wall section of the sliding hatch device.

**[0047]** In a preferred embodiment of the present invention, the method comprises manufacturing a hollow section from a flat aluminum plate, characterized in that the flat plate has a thickness of 1-100 mm, preferably 2-20 mm and even more preferably 3-10 mm; characterized in that the flat plate has a length of 1-25 m, preferably 3-12 m and even more preferably 6-8 m and characterized in that the flat plate has a width of 1-15 m, preferably 2-8 m and even more preferably 3-5 m.

**[0048]** A preferred embodiment with a thickness between 3-10 mm has the advantage, among other things, that an optimum ratio is obtained between the retention of material strength, which is required for a side wall of a sliding hatch device, and the foldability of the aluminum along the fold line.

**[0049]** In a fourth aspect, the invention relates to a pleated side wall section suitable for the construction of a sliding hatch device.

**[0050]** The present invention as described above has the advantage, among other things, that the use of welding operations can be limited to a minimum. Welding operations are a labor intensive and time consuming process. Therefore, by limiting welding operations, a considerable economic advantage can be gained in the manufacture of such sliding hatch devices.

**[0051]** An additional advantage of the present invention is that a folded side wall section is more resistant to corrosion. On the one hand because welding is limited and on the other hand because the folded hollow section provides better drainage of condensation.

**[0052]** A surprising advantage of the present invention is that, through the use of a folded side wall section, substantially less customization and calculation work is required during the assembly of the components to the folded side wall section. This ensures an improved uniformity of the side wall sections since each component has a predetermined assembly location on the side wall section. In this case, no other interpretation is possible where the components have to be assembled and consequently the risk of incorrect assembly is considerably smaller. In addition, this also ensures an increased quality of the entire sliding hatch device.

**[0053]** An advantage of the current method for manufacturing a sliding hatch device includes an advantage regarding the specific sequence of method steps c, d and

e. Steps comprising, respectively, folding a flat aluminum plate into a partially folded plate, assembling additional components to the partially folded plate, and folding the partially folded plate into a closed, longitudinally extended hollow section. Because the folding of the hollow section comprises two steps, it is possible to mount the additional components via tongue and groove connections. This would be impossible if the hollow section were folded in one step. The tongue and groove connections have a considerable mechanical advantage over other mounting techniques such as welding.

**[0054]** Furthermore, the present invention involves significantly fewer metal cutting operations since no use is made of beam-shaped and prism-shaped hollow sections for supporting the side wall. The reduction of cutting operations also results in a time saving and therefore an economic advantage in manufacturing the present invention.

**[0055]** The present invention not only offers a lower manufacturing cost for a sliding hatch device, but also a more defined finish of the side wall section so that no cargo from a ship's cargo hold can be left behind on the inside of the side wall section of a sliding hatch device.

**[0056]** The detailed description describes the preferred embodiments of the present invention wherein a sliding hatch device is adapted for closing off the cargo hold of a ship. It goes without saying that, more generally, the described sliding hatch device can also be adapted for closing off other spaces, such as, for example, storage areas of buildings.

**[0057]** In what follows, the invention is described by way of non-limiting examples and figures illustrating preferred embodiments of the invention, and which are not intended to and should not be interpreted as limiting the scope of the invention.

## DESCRIPTION OF THE FIGURES

**[0058]**

**Figure 1** illustrates a perspective schematic representation of a prior art sliding hatch device.

**Figure 2** illustrates a schematic representation of a front view of a portion of a sliding hatch device fitted with a prior art side wall section.

**Figure 3** illustrates a perspective schematic representation of a sliding hatch device with a folded side wall section according to the invention.

**Figure 4** illustrates a schematic representation of a front view of a portion of a sliding hatch device fitted with a folded side wall section according to the invention.

**Figure 5** illustrates a schematic representation of a top view of a sliding hatch device.

**Figure 6** illustrates a perspective schematic representation of a pentagonal folded hollow section.

**Figure 7** illustrates a schematic representation of a front view of a pentagonal folded hollow section belonging to a low type sliding hatch device.

**Figure 8** illustrates a schematic representation of a front view of a pentagonal folded hollow section belonging to a middle type sliding hatch device.

**Figure 9** illustrates a schematic representation of a front view of a pentagonal folded hollow section belonging to a high type sliding hatch device.

**Figure 10** illustrates a schematic representation of a flat aluminum plate with several line patterns with material reductions.

**Figure 11** illustrates a schematic detail representation of a line pattern with material reduction.

**Figure 12** illustrates a perspective schematic representation of a sliding hatch roof made up of several sliding hatch devices.

**Figure 13** illustrates a perspective schematic representation of a flat aluminum plate.

**Figure 14** illustrates a perspective schematic representation of a flat aluminum plate on which material reductions are made by laser cutting.

**Figure 15** illustrates a perspective schematic representation of a partially folded plate.

**Figure 16** illustrates a perspective schematic representation of a partially folded plate with assembled additional components.

**Figure 17** illustrates a perspective schematic representation of the inside of a closed folded hollow section.

**Figure 18** illustrates a perspective schematic representation of the inside of a closed folded hollow section.

**Figure 19** illustrates a perspective schematic representation of a sliding hatch device with a folded side wall section according to the invention.

**[0059]** In the different figures, the same reference numerals refer to the same elements.

**[0060]** A sliding hatch device 1 from the prior art is composed of a lying, sheet pile-shaped top plate 4 which is fixed via a pleated support surface 5 of, on the one hand, a left upright side wall section 2 and, on the other hand,

a right upright side wall section 3. A left side wall section 2 is constructed of aluminum beam-shaped hollow sections 6 which are fixed via welding to the inside of the outer upright side 7 of the left side wall section 2. The beam-shaped hollow sections 6 are arranged at regular intervals along the entire longitudinal direction of the left side wall section 2 and form a reinforcement that provides support between the outer upright side 7 and the support surface 5 of the left side wall section 2. Furthermore, aluminum prism-shaped hollow sections 8 are arranged that connect the support surface 5 and the beam-shaped hollow sections 6. These prism-shaped hollow sections 8 are fixed via welds and attached to all beam-shaped hollow sections 6 arranged along the entire longitudinal direction of the left side wall section 2. The support surface 5 is provided with a pleated drip lip 33. The drip lip 33 provides the side wall section with a drainage when condensation accumulates on the underside of the lying top plate 4. This drainage is designed to avoid corrosion to the welds of the prism-shaped hollow sections 8 and beam-shaped hollow sections 6. A steel beam-shaped wheel housing 9 is attached to the underside of the outer upright side 7 of the left side wall section 2. This wheel housing 9 is fixed on the one hand via welds and on the other hand via nuts 10 on the inside of the left side wall section 2. The wheel housing 9 forms a housing for a wheel 11. A sliding hatch device 1 from the prior art is mirror symmetrical with respect to the center axis of the longitudinal direction of the sliding hatch device 1, therefore a right side wall section 3 can be seen as the mirror image of a left side wall section 2.

**[0061]** Schematic representations of a sliding hatch device 1 according to the present invention are shown in Figures 3 to 12. Such a sliding hatch device 1 is composed of a lying top plate 4 which is fixed via a pleated support surface 5 of, on the one hand, a left upright side wall section 2 and, on the other hand, a right upright side wall section 3. Both the left side wall section 2 and the right side wall section 3 are constructed from a pentagonal aluminum closed and longitudinally extended folded hollow section 12. This folded hollow section 12 is fastened via the support surface 5 to the underside of the ends of the longitudinal direction of the lying top plate 4 and this for the entire length of the folded hollow section 12 and for the entire surface of the support surface 5. Such a sliding hatch device 1 is mirror symmetrical with respect to the center axis of the longitudinal direction of the sliding hatch device 1, therefore a left side wall section 2 can be seen as the mirror image of a right side wall section 3.

**[0062]** The folded hollow section 12 is pentagonal and therefore comprises five sides. The outer upright side 7 is located along the outside of the folded hollow section 12 and therefore along the outside of the sliding hatch device 1. The inner upright side 7' is arranged parallel to the outer upright side 7 and always has a shorter length than the outer upright side 7. The support surface 5 is located on the top side of the folded hollow section 12

and forms the mounting surface on which the lying top plate 4 is mounted. The lower side 15 runs horizontally and connects the outer upright side 7 with the inner upright side 7'. The sloping side 16 connects the support surface 5 with the inner upright side 7'. This sloping side 16 always has a slope beta which depends on the type of sliding hatch device 1. The angle alpha forms the angle between the outer upright side 7 and the support surface 5 and also depends on the type of sliding hatch device 1. The angle gamma is the angle along the inside of the folded hollow section 12 formed by the sloping side 16 and the inner upright side 7'.

**[0063]** The folded hollow section 12 encloses a pentagonal hollow space in which various additional components are mounted. In the hollow space enclosed by the folded hollow section 12, steel beam-shaped wheel housings 9, among other things, are mounted between the outer upright side 7 and the inner upright side 7' of the folded hollow section 12. The wheel housings 9 are closed along each side with the exception of the bottom which is open. These wheel housings 9 are attached at the level of a rectangular opening 17 in the folded hollow section 12, more specifically an opening 17 in the inner upright side 7'. The wheel housing 9 is fixed in the opening 17 via a U-shaped aluminum section 18 on the one hand and nuts 10 on the other. A folded hollow section 12 is provided with two wheel housings per side wall section, therefore a sliding hatch device 1 comprises four wheel housings in total. Each wheel housing 9 is on one end of a folded hollow section 12. The wheel housing 9 forms a housing for a wheel 11. This wheel 11 can be both a grooved wheel and a convex flat wheel. About half of the wheel 11 projects along the underside of the wheel housing 9.

**[0064]** In the hollow space enclosed by the folded hollow section 12, aluminum hatch hook housings 19 are fastened in a rectangular opening 17' at the level of the inner upright side 7' of the folded hollow section 12. The hatch hook housing 19 is fastened in the rectangular opening 17' by means of nuts 10. The hatch hook housing forms a housing for a hatch hook 20. This hatch hook 20 is U-shaped and protrudes along the underside of the folded hollow section 12. In this case, the lower leg of the U-shaped hatch hook 20 is directed toward the inside of the sliding hatch device 1. A sliding hatch device 1 is provided with two hatch hooks 20 per sliding hatch device 1 wherein one hatch hook 20 is fastened per folded hollow section 12. The hatch hook 20 is located in each case at the end of the front side of the folded hollow section 12 in the provided rectangular opening 17'.

**[0065]** In the hollow space enclosed by the folded hollow section 12, flat aluminum reinforcing ribs 21 are arranged. These reinforcing ribs 21 have the same pentagonal shape as a cross-section of the folded hollow section 12 and are attached via welds transverse to the outer upright side 7 of the folded hollow section 12. In this way, a few reinforcing ribs 21 are placed per folded hollow section 12 distributed along the entire length di-

rection of the folded hollow section 12. When the folded hollow section 12 is fully folded into a closed section, the reinforcing rib 21 is attached to each inner side of the folded hollow section 12.

**[0066]** In the hollow space enclosed by the folded hollow section 12, a rust-proof handle housing 22 and a rust-proof latch housing 23 are fastened. The handle housing 22 or latch housing 23 are fastened in the same rectangular opening 17' in which the hatch hook housing 19 is fastened. The hatch hook housing 19 is always more towards the end of the folded hollow section 12 than the handle housing 22 or latch housing 23. For each folded hollow section 12, either a handle housing 22 or a latch housing 23 is fastened in each case. Consequently, a sliding hatch device 1 comprises one handle housing 22 and one latch housing 23 in total.

**[0067]** The handle housing 22 is always located in the right side wall section 3, along the port side. The handle housing 22 is fastened via nuts 10 in the opening 17' of the right side wall section 3 along the rear end of the folded hollow section 12. The latch housing 23 is always located in the left side wall section 2, along the starboard side. The latch housing 23 is fastened via nuts 10 in the opening 17' of the left side wall section 3 along the rear end of the folded hollow section 12.

**[0068]** A sliding hatch device 1 can be positioned in a bearing-mounted manner relative to the next sliding hatch device 1. Therefore, an adapted height is provided in both the left side wall section 2 and the right side wall section 3, depending on whether the sliding hatch device 1 belongs to a sliding hatch device of the low, middle or high type. A folded hollow section 12 comprises five sides which comprise different dimensions depending on the type of sliding hatch device 1. Furthermore, a folded hollow section 12 is also characterized by three angles alpha, beta and gamma, which may differ depending on the type of sliding hatch device 1. Figures 7 to 9 illustrate these dimensions of a low, medium and high type sliding shutter device 1 respectively.

**[0069]** The low type sliding hatch device 1 comprises an angle alpha of preferably between 90°-110°, more preferably between 92°-100° and even more preferably between 95°-99°. The angle beta preferably comprises 30°-50°, more preferably between 35°-45° and even more preferably between 38°-42°. The angle gamma preferably comprises 210°-230°, more preferably between 215°-225° and even more preferably between 218°-222°. The outer upright side 7 has a length of preferably 180-250 mm, more preferably 200-220 mm and even more preferably 205-215 mm. The inner upright side 7' has a length of preferably 170-240 mm, more preferably 180-200 mm and even more preferably 185-195 mm. The support surface 5 has a length of preferably 100-170 mm, more preferably 120-140 mm and even more preferably 125-135 mm. The sloping side 16 has a length of preferably 60-130 mm, more preferably 80-100 mm and even more preferably 85-95 mm. The lower side 15 preferably has a length of about 1/3 of the length of

the support surface 5.

**[0070]** The middle type sliding hatch device 1 comprises an angle alpha of preferably between 90°-110°, more preferably between 92°-100° and even more preferably between 95°-99°. The angle beta preferably comprises 40°-60°, more preferably between 45°-55° and even more preferably between 48°-52°. The angle gamma preferably comprises 210°-230°, more preferably between 215°-225° and even more preferably between 218°-222°. The outer upright side 7 has a length of preferably 330-400 mm, more preferably 360-380 mm and even more preferably 365-375 mm. The inner upright side 7' has a length of preferably 330-400 mm, more preferably 355-375 mm and even more preferably 260-270 mm. The support surface 5 has a length of preferably 130-200 mm, more preferably 160-180 mm and even more preferably 165-175 mm. The sloping side 16 has a length of preferably 150-220 mm, more preferably 180-200 mm and even more preferably 185-195 mm. The lower side 15 preferably has a length of about 1/3 of the length of the support surface 5.

**[0071]** The high type sliding hatch device 1 comprises an angle alpha of preferably between 90°-110°, more preferably between 92°-100° and even more preferably between 95°-99°. The angle beta preferably comprises 40°-60°, more preferably between 45°-55° and even more preferably between 48°-52°. The angle gamma preferably comprises 210°-230°, more preferably between 215°-225° and even more preferably between 218°-222°. The outer upright side 7 has a length of preferably 500-570 mm, more preferably 520-540 mm and even more preferably 525-535 mm. The inner upright side 7' has a length of preferably 390-460 mm, more preferably 415-435 mm and even more preferably 420-430 mm. The support surface 5 has a length of preferably 130-200 mm, more preferably 160-180 mm and even more preferably 165-175 mm. The sloping side 16 has a length of preferably 150-220 mm, more preferably 180-200 mm and even more preferably 185-195 mm. The lower side 15 preferably has a length of about 1/3 of the length of the support surface 5.

**[0072]** A pentagonal folded hollow section 12 comprises four fold lines 13, which are arranged in the longitudinal direction of an elongated rectangular aluminum plate 14 from which the folded hollow section 12 is produced. Folding the plate 14 according to these four fold lines 13 results in a pentagonal and longitudinally extended folded hollow section 12.

**[0073]** Each fold line 13 is made up of a line pattern 24 of successively extended U-shaped material reductions 25. Figure 10 illustrates an aluminum plate 14 with several different line patterns 24 wherein different sizes of material reductions 25 are used. The legs of the U-shaped material reductions 25 are directed alternately upwards or downwards. A detail of this can be seen in Figure 11.

**[0074]** The manufacture of a sliding hatch device 1 comprises various steps:

In a first step (Figure 13), a blank rectangular aluminum plate 14 with a thickness of 4 mm is collected.

**[0075]** In a second step (Figure 14), material reductions are applied to the plate 14 by means of a machine suitable for applying these material reductions. An example of such a machine is a laser cutting machine. The first material reductions applied are the U-shaped material reductions 25. These are arranged according to a line pattern 24 which runs along the longitudinal direction of the plate 14. For example, a total of four line patterns 24 are applied to the plate 14, all of which form a fold line 13', 13", 13''' and 13'''. Furthermore, four rectangular openings are also made in the plate 14, in fact these openings can also be seen as material reductions. These openings comprise the opening for the wheel housing 17, the two openings for the hatch hook housing 17' and 17" and the opening for the wheel 26.

**[0076]** In a third step (Figure 15), the plate 14 is folded according to the applied fold lines 13 by means of a press brake. It is folded according to all fold lines 13 with the exception of fold line 13". Fold line 13''' and fold line 13'''' are folded in such a way that the folded parts form an angle of 90° with the side which will later become the outer upright side 7 of the folded hollow section 12. In this case, both folded parts are parallel to each other. Fold line 13' is folded in the opposite direction than fold line 13''' and 13'''' are folded. In this way, a partially folded plate 14' is obtained.

**[0077]** In a fourth step (Figure 16), additional components are assembled to the partially folded plate 14'. The reinforcing ribs 21 are mounted transversely on the outer upright side 7 via welds. The wheel housing 9 is also mounted on the outer upright side 7 at the level of the wheel housing opening 17 via nuts 10 and a U-section 18. Furthermore, a hatch hook housing with either a handle housing or a latch housing is attached and this at the height of the opening 17".

**[0078]** In a fifth step (Figure 17), the partially folded plate 14' is further folded according to fold line 13" into the folded pentagonal hollow section 12. In this case, after the folding, a few spot welds 27 are applied to the fold line 13", this at a regular distance and along the entire length of the fold line 13".

**[0079]** In a sixth step (Figure 18), a few spot welds are attached to the underside of the folded hollow section 12 at the level of the overhanging part of the inner upright side 7' of the folded hollow section 12. The spot welds 27 are also arranged at a regular distance and over the entire length of the folded hollow section 12.

**[0080]** In a seventh step (Figure 19), the lying top plate 4 is mounted on a left side wall section 2 and a right side wall section 3. In this case, both side wall sections consist of a folded hollow section 12. The top plate 4 is fastened to the side wall sections via welds along the entire longitudinal direction of the top plate 4 and over the entire surface of the support surface 5. In this way, a complete sliding hatch device 1 is manufactured.

**[0081]** A sliding hatch device 1 is often part of a sliding

hatch roof 28. Figure 12 illustrates such a sliding hatch roof 28, which consists of a set of successive bearing-mounted sliding hatch devices 1 which are horizontally slidable relative to each other. In this way, a sliding hatch roof 28 can completely span the cargo hold of a ship.

[0082] Below is an overview of the meaning of the numbers and letters used in the figures:

1	sliding hatch device	
2	left side wall section	
3	right side wall section	
4	lying top plate	
5	support surface of side wall section	5
6	beam-shaped hollow sections	
7	outer upright side of side wall section	
7'	inner upright side of side wall section	10
8	prism-shaped hollow sections	
9	wheel housing	
10	nut	
11	wheel	15
12	folded hollow section	
13	fold line	
13'	first fold line	
13''	second fold line	
13'''	third fold line	20
13''''	fourth fold line	25
14	plate	
14'	partially folded plate	
15	lower side of side wall section	
16	sloping side of side wall section	30
17	opening for wheel housing	
17'	opening for hatch hook housing (inside side wall section)	
17''	opening for hatch hook housing (outside side wall section)	35
18	U-section	
19	hatch hook housing	
20	hatch hook	
21	reinforcement rib	
22	handle housing	40
23	latch housing	
24	line pattern	
25	U-shaped material reductions	
26	wheel opening	
27	spot welds	45
28	sliding hatch roof	
29	port side	
30	starboard side	
31	front sliding hatch device	
32	rear sliding hatch device	50
33	drip lip	
$\alpha$	angle enclosed by outer upright side of side wall section and support surface of side wall section	
$\beta$	angle enclosed by support surface of side wall section and sloping side of side wall section	55
$\gamma$	angle enclosed by sloping side of side wall section and inner upright side of side wall section	

## Claims

1. A sliding hatch device suitable for closing off a cargo hold of a ship or more generally for closing off a space, substantially made of aluminum and constructed of a lying top plate fixed on two upright side wall sections, **characterized in that** the side wall section comprises a hollow section, which hollow section is folded according to at least one fold line, which fold line is provided with a material reduction.
2. The sliding hatch device according to the preceding claim, **characterized in that** material reduction of a fold line is arranged according to a line pattern.
3. The sliding hatch device according to any of the preceding claims, **characterized in that** a hollow section is folded into a closed longitudinally extended polygon, preferably an irregular pentagon.
4. The sliding hatch device according to any of the preceding claims, **characterized in that** the lying top plate has a height which, from its center, decreases progressively towards both ends thereof.
5. The sliding hatch device according to any of the preceding claims, **characterized in that** supporting aluminum reinforcing ribs are attached to the inside of the cavity of the hollow section.
6. The sliding hatch device according to any of the preceding claims, which spans the opening of the cargo hold in the transverse direction of the ship, **characterized in that** a sliding hatch device rests with both outer edges on the ship's side coamings.
7. The sliding hatch device according to the preceding claim, **characterized in that** the at least one side coaming of a ship is provided with rails according to the longitudinal position of the ship.
8. The sliding hatch device according to any of the preceding claims, **characterized in that** additional material reductions are provided in the hollow section for assembling additional components, which additional components include wheel housings, handle housings, latch housings and hatch hook housings.
9. The sliding hatch device according to the preceding claim, **characterized in that** wheel housings are provided with bearing-mounted or double-bearing wheels, which are slidable over a rail on the side coamings according to the longitudinal position of the ship.
10. A sliding hatch roof suitable for closing off a cargo hold of a ship or more generally for closing off a space, composed of a set of at least 2 sliding hatch

devices as described according to claims 1-9, **characterized in that** the sliding hatch devices are horizontally bearing-mounted with respect to each other.

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11. The sliding hatch roof according to the preceding claim, **characterized in that** all sliding hatch devices of the sliding hatch roof are slidable over a rail on the side coamings of a ship according to the longitudinal direction of the ship. 10
12. Method for manufacturing a sliding hatch device suitable for closing off a cargo hold of a ship or more generally closing off a space, the method comprising the steps of: 15
- a. gathering a rectangular, flat aluminum plate;
  - b. applying material reductions to a flat aluminum plate;
  - c. folding a flat aluminum plate into a partially 20 folded plate;
  - d. assembling additional components to the partially folded plate;
  - e. folding the partially folded plate into a closed longitudinally extended hollow section 25
  - f. applying spot welds to the closed longitudinally extended hollow section;
  - g. mounting a lying aluminum top plate on top of two upright hollow sections. 30
13. Method according to the preceding claim, **characterized in that** material reductions are made by one of the following techniques: punching, cutting or laser cutting, which material reductions comprise fold lines according to a line pattern and cut-outs for additional 35 components.
14. Method according to any of the preceding claims, **characterized in that** additional components comprise wheel housings, handle housings, latch housings and hatch hook housings, which are attached to at least one side wall section of the sliding hatch device. 40
15. Folded side wall section suitable for the construction of an improved side wall in a sliding hatch device according to any of the preceding claims. 45

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FIG.1

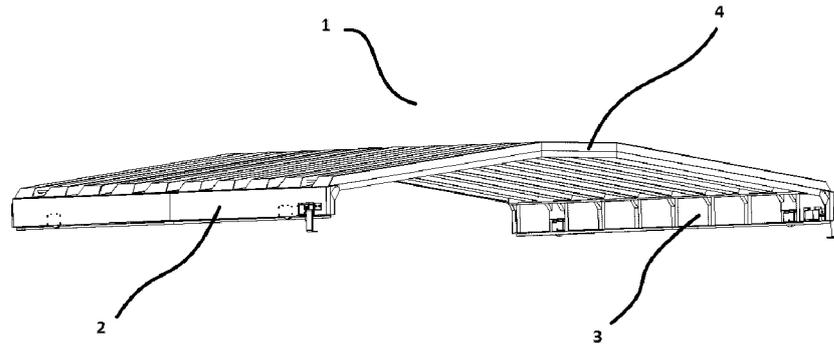


FIG.2

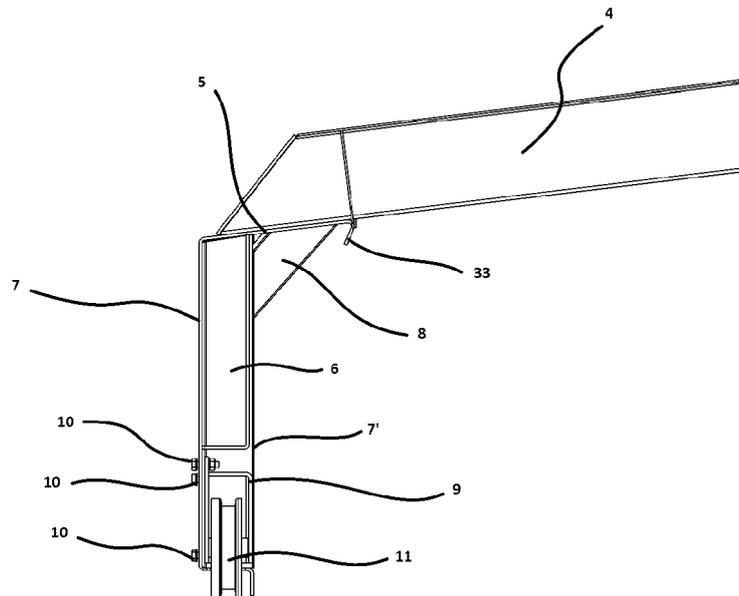




FIG.5

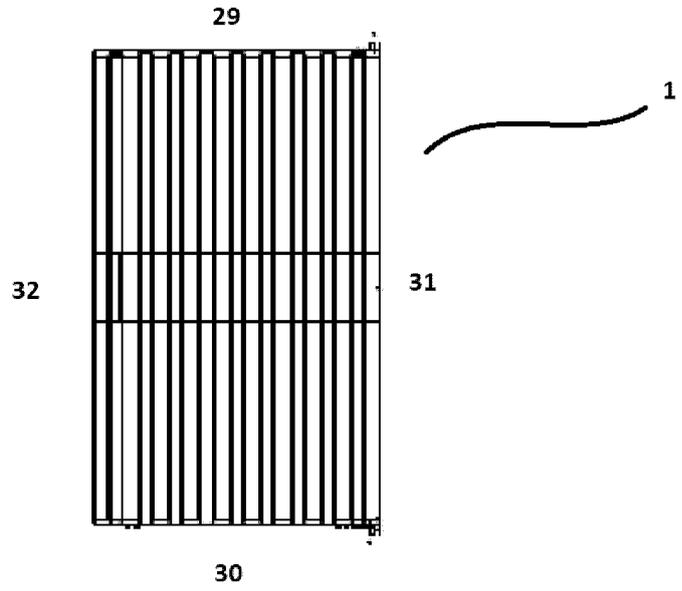


FIG.6

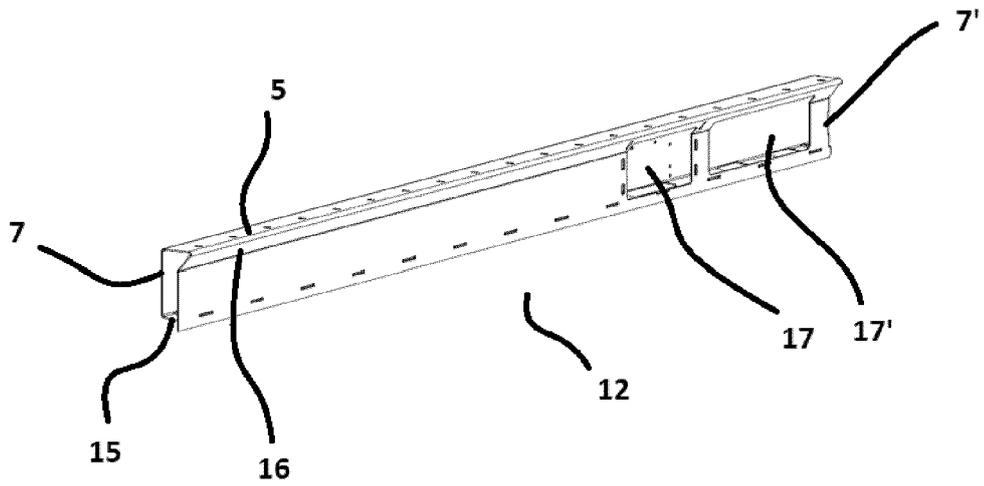


FIG.7

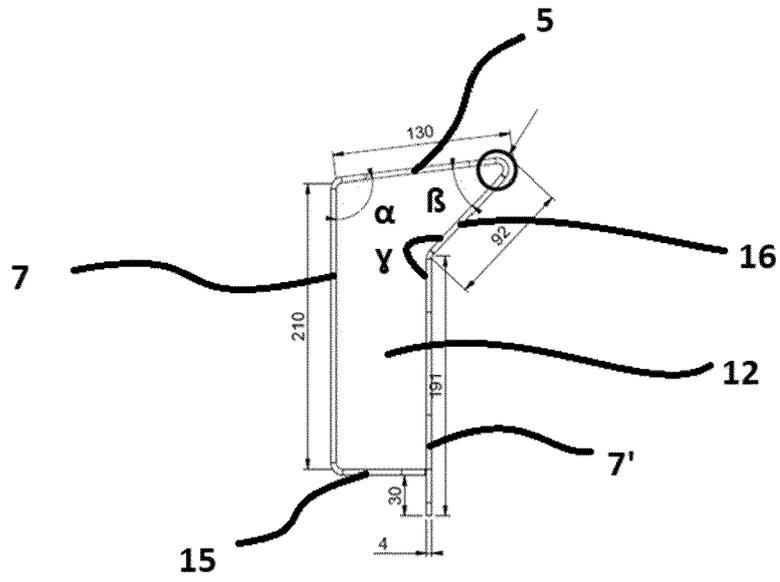


FIG.8

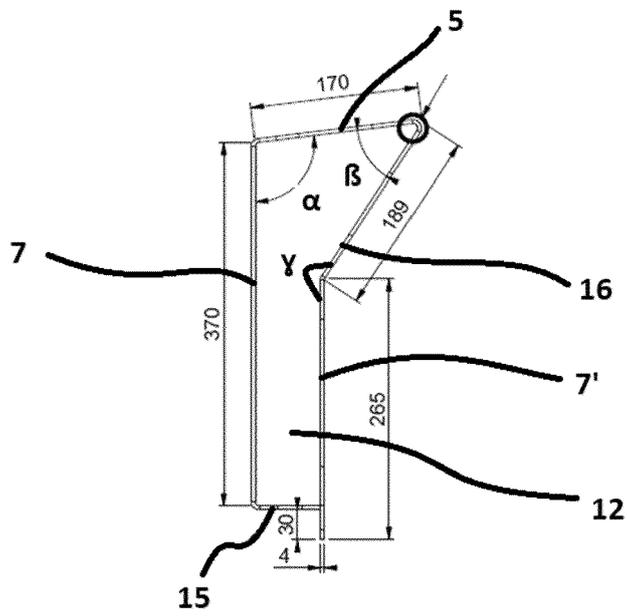


FIG.9

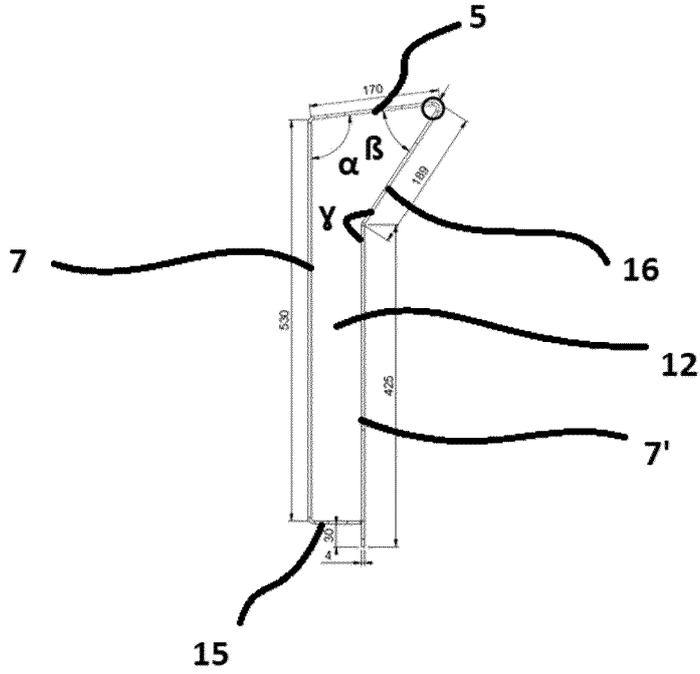


FIG.10

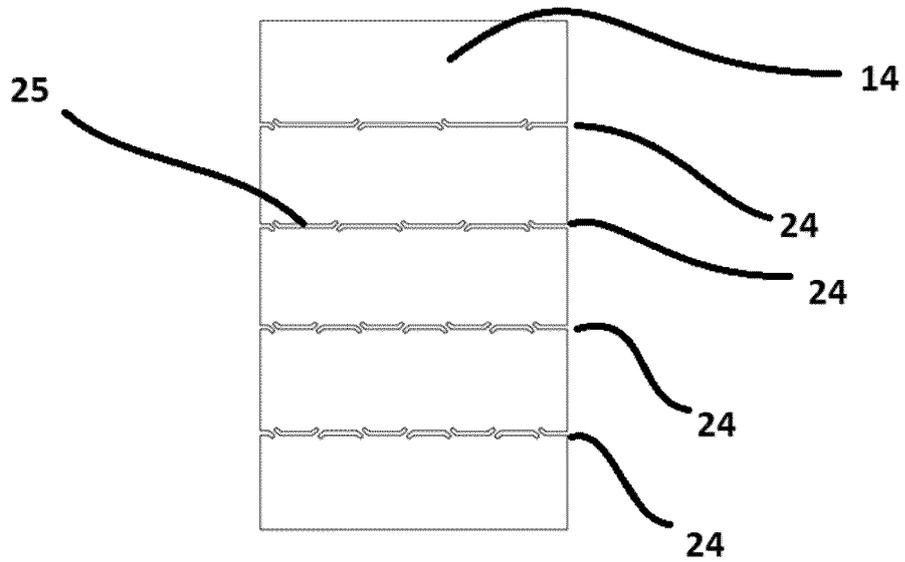


FIG.11

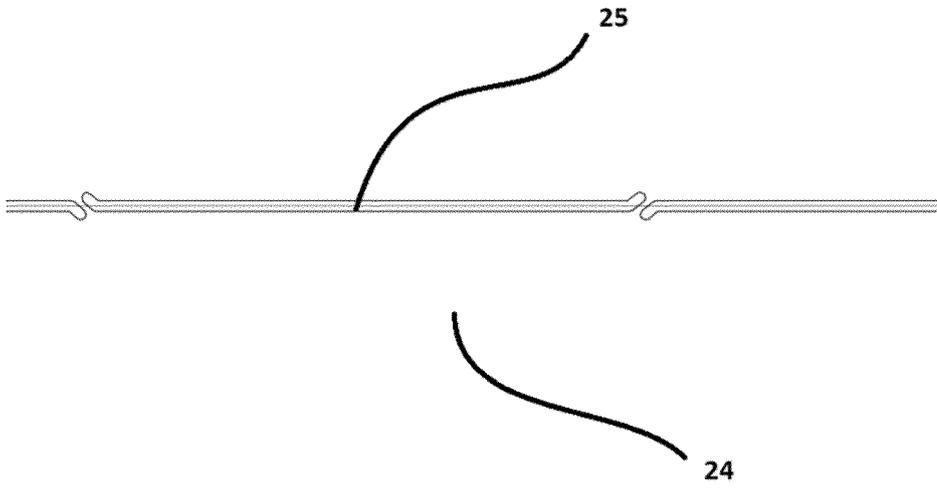


FIG.12

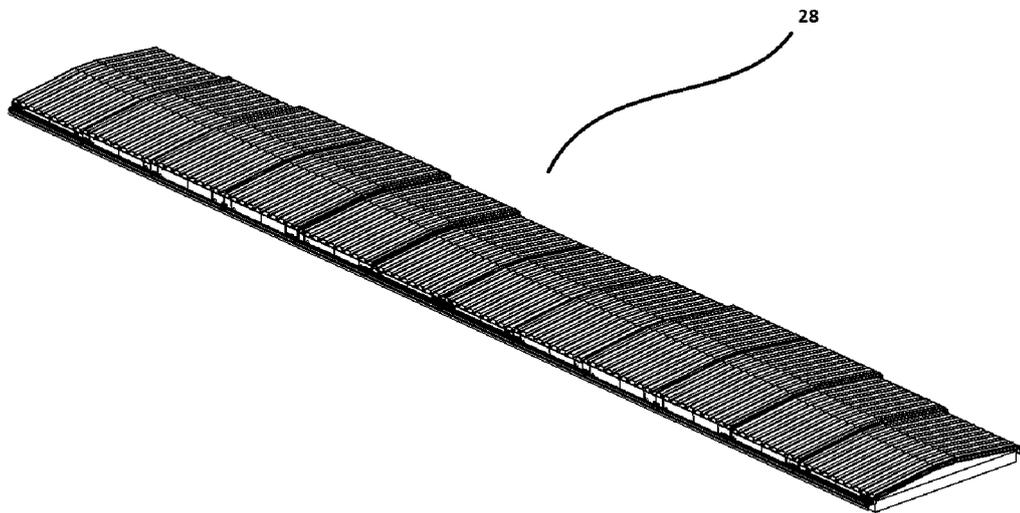


FIG.13

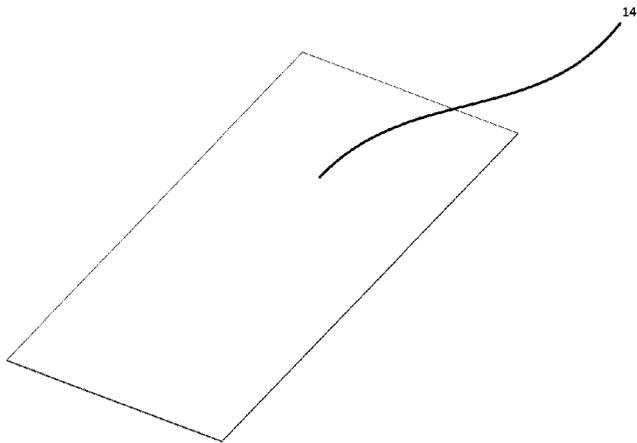


FIG.14

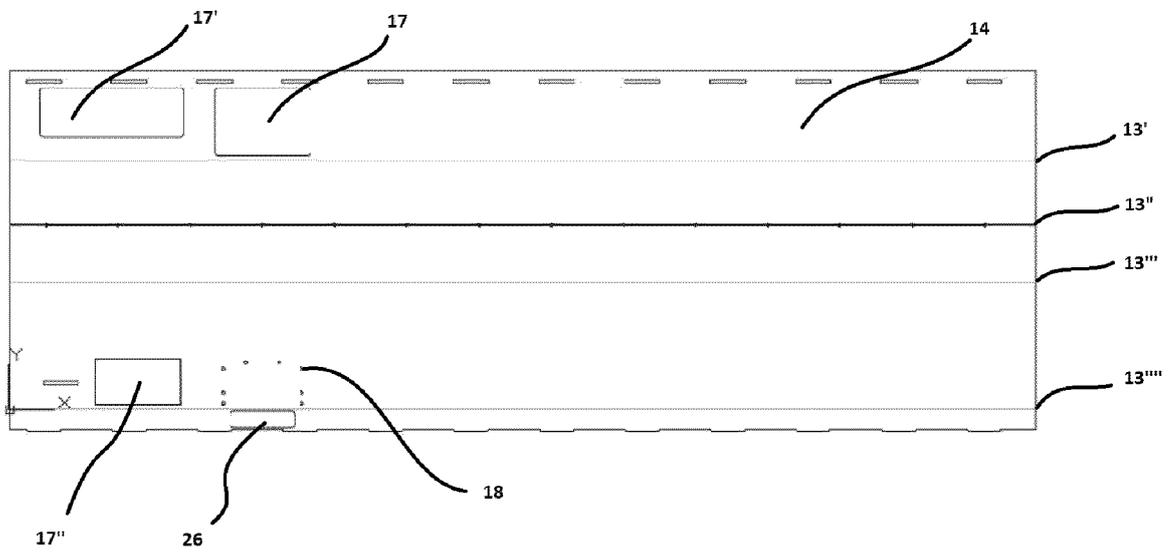


FIG.15

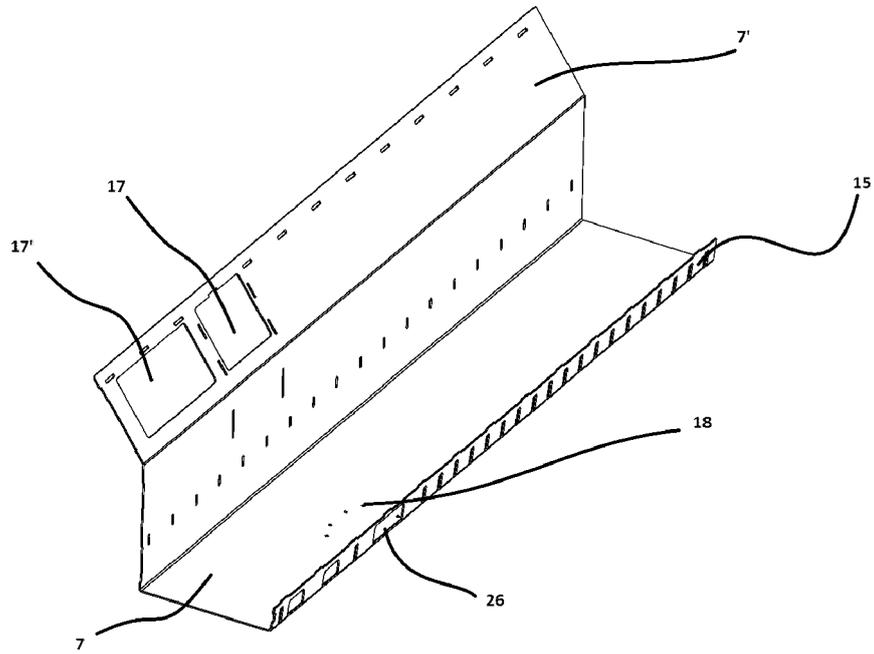


FIG.16

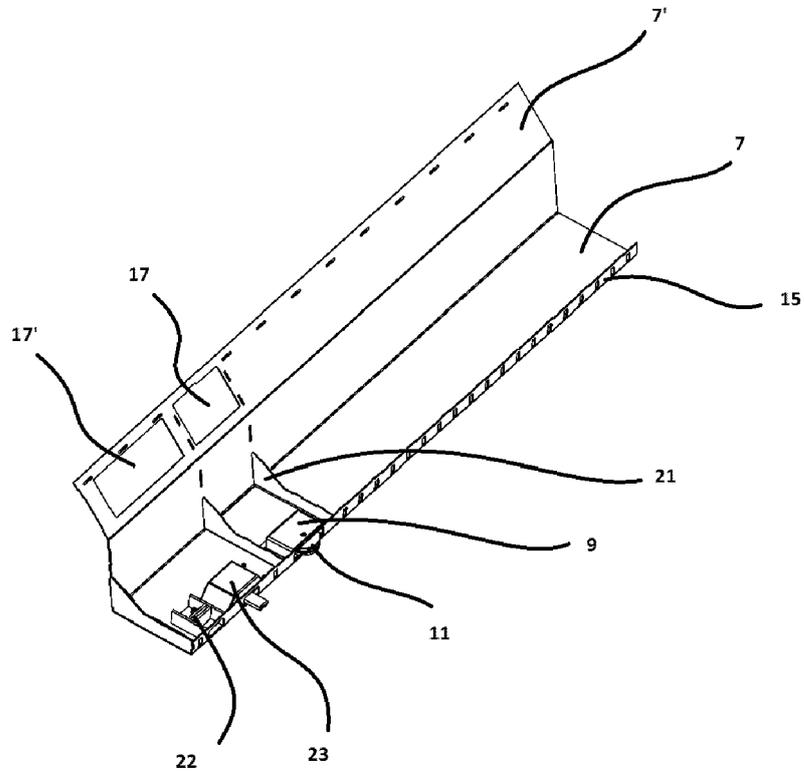


FIG.17

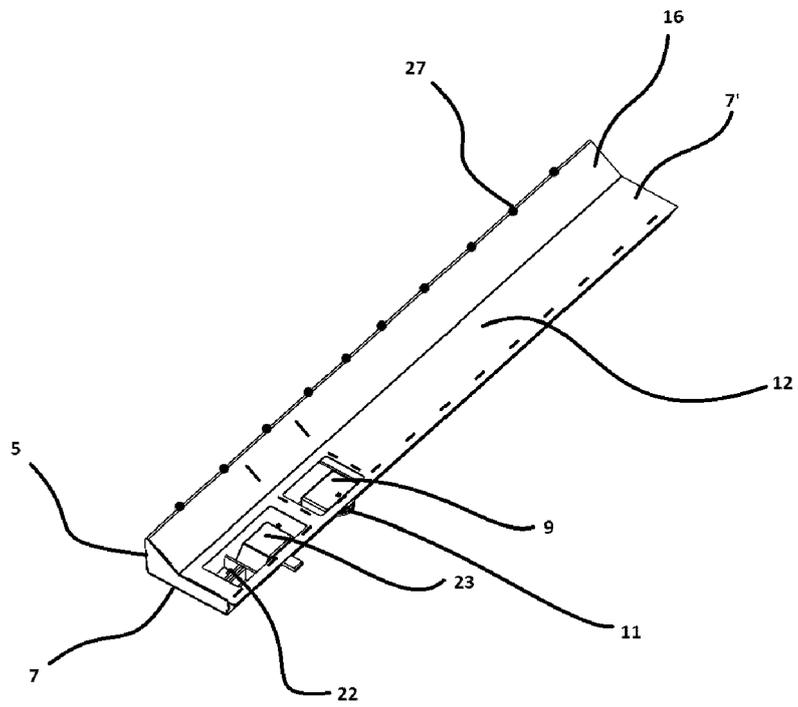


FIG.18

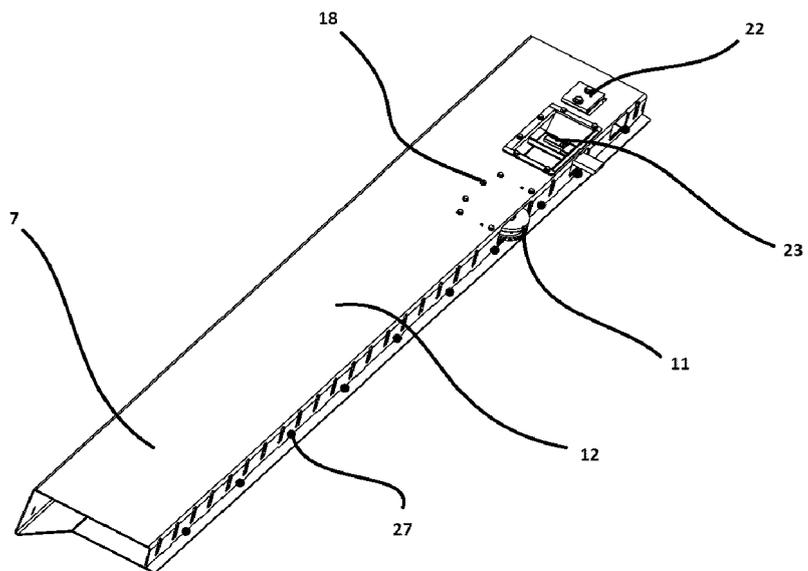
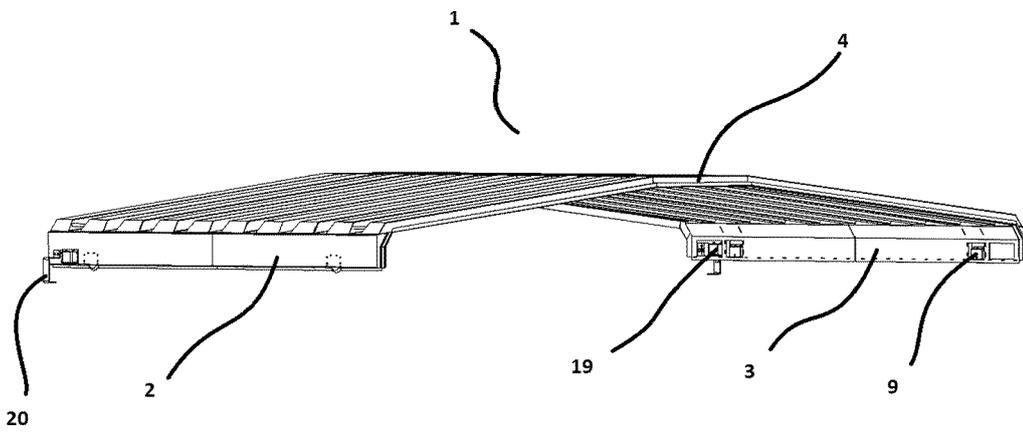


FIG.19





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