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(71) Applicant: **Skidata GmbH**
5083 Grödig/Salzburg (AT)

(72) Inventors:
- **Wieland, Johann**
  5083 Salzburg (AT)
- **Taxer, Leo Max**
  5611 Großarl (AT)

(74) Representative: **Mewburn Ellis LLP**
Aurora Building
Counterslip
Bristol BS1 6BX (GB)

(54) **BOOM BARRIER, BARRIER COMPRISING THE BOOM BARRIER, AND METHOD FOR MANUFACTURING A BOOM BARRIER**

(57) The invention refers to a boom barrier (12) for being pivoted relative to a barrier support (14) for blocking vehicular or pedestrian access, the boom barrier (12) comprising a bar (16) extending in a longitudinal direction, wherein the bar (16) is made from wood-based material, and wherein the bar (16) includes a cavity (36) extending in the longitudinal direction.

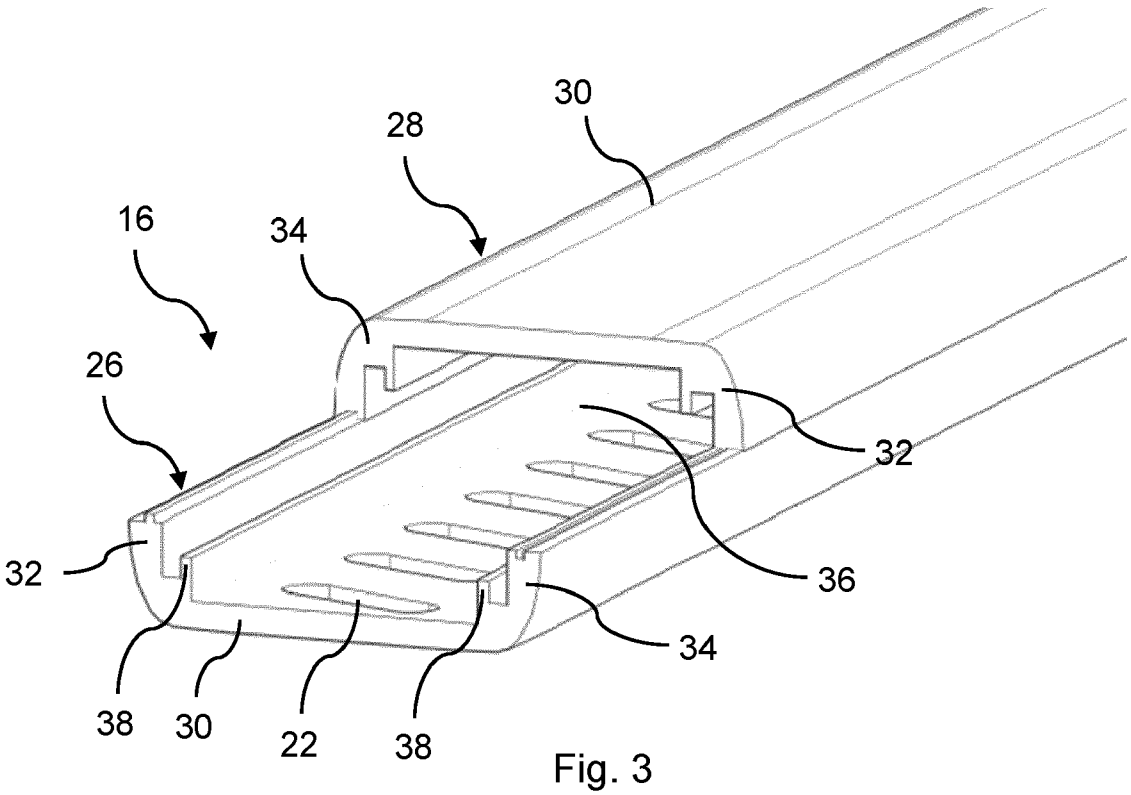

Fig. 3

EP 4 530 402 A1

Description

[0001] The present invention relates to a boom barrier for being pivoted relative to a barrier support for blocking vehicular or pedestrian access. The boom barrier comprises a bar extending in a longitudinal direction.

[0002] The invention further refers to a barrier for blocking vehicular or pedestrian access which comprises the boom barrier.

[0003] The invention also relates to a method for manufacturing the boom barrier.

[0004] Barriers are often used to control access of vehicles, for example to restricted areas (such as parking spaces). Further, barriers are also used for railway crossings with gates. Barriers can comprise a barrier support to which a boom barrier is rotatably attached. A light-weight boom barrier is preferred because this reduces the power and/or force to rotate the boom barrier.

[0005] The present invention is based on the objective of providing a light-weight boom barrier that can be recycled in a simple manner.

[0006] This objective is solved by the subject matter of the independent claims. Optional embodiments are described in the depending claims.

[0007] A first aspect of the invention refers to a boom barrier for being moved, pivoted, or rotated relative to a barrier support for blocking vehicular or pedestrian access. The boom barrier comprising a bar extending in a longitudinal direction. Optionally, the bar is made from wood-based material. Further optionally, the bar includes a cavity extending in the longitudinal direction.

[0008] A second aspect of the invention refers to a barrier for blocking vehicular or pedestrian access. The barrier comprises the boom barrier as described herein, and barrier support pivotally supporting the boom barrier.

[0009] A principal idea of this invention is to manufacture the bar of the boom barrier from a wood-based material so that it is easily recyclable. Further, the cavity within the bar reduces the weight of barrier compared to a solid boom barrier so that the wood-based bar of the boom barrier is also light-weight. In this way, the wood-based bar of the boom barrier can replace existing bars of boom barriers which are often made from an epoxy-based material. However, epoxy-based materials are difficult to recycle because various types of material are inextricably fixed to each other to form this lightweight composite material. In comparison thereto, the wood-based material is simple to recycle. For example, glass-fibre epoxy resins materials instead, which are often used for bars of boom barriers, need dedicated treatment for disposal.

[0010] The hollowness of the bar of the boom barrier provided by the cavity can ensure that the boom barrier is light-weight but still having sufficient rigidity so that elongate/long booms can be manufactured. Optionally, the outer dimensions of the bar are identical to the outer dimensions of existing epoxy-based bars so that the wood-based bar of the boom barrier of this invention can be used to replace these existing epoxy-based bars of the boom barriers. For example, the bar of the boom barrier has width (perpendicular to the longitudinal direction) between 60 mm to 100 mm, optionally between 70 mm to 90 mm, further optionally of 80 mm. The bar may have a thickness (perpendicular to the longitudinal direction and/or to the width) between 20 mm to 50 mm, optionally between 30 mm to 40 mm, further optionally of 38.4 mm. A length of the bar along the longitudinal direction may be between 0.5 m and 5 m. So, the bar may have a length of more than 2 m, 3 m, 4 m, or 5 m.

[0011] The wood-based material from which the bar is (entirely) made of can include: plywood, LVL (laminated veneer lumber), and/or solid wood (solid timber). The wood-based material may include timber or timber-based materials.

[0012] For example, planks of the wood-based material are processed to form one or more parts of the bar. Exemplary manufacturing methods will be described further below. The bar may made from one or more wood-based components that may be attached to each other. The bar may be made entirely of the wood-based material.

[0013] The bar may include a first bar section and a second bar section that are connected to each other by a hinge. So, the bar can be used for booms with a hinge which can be used in circumstances in which not sufficient height is available for rotating the bar, for example if the boom barrier is used with barriers with garages with low ceilings. The first bar section may be supported/rotated by the barrier support and the second bar section may remain in a vertical direction irrespective of the orientation of the first bar section. The first bar section and/or the second bar section may include the same features and/or characteristics as the bar described herein, except for their respective lengths.

[0014] The bar may be regarded as a profile made from a wood or a wood-based material.

[0015] The boom barrier may include the bar and/or a bar support. The bar support may be attached to a first end of the bar. The bar support may be slid into a cavity of the bar support and then fixed to the bar support by fastening means, such as screws. Alternatively, the bar support clamps the first end of the bar. The bar support may include an axle that protrudes perpendicular to the longitudinal direction of the bar. The bar support and/or the axle may be made from a wood-based material or a different material, such as metal and/or plastic. The bar support may remain with an existing barrier and only the bar itself may be replaced. For example, the wood-based bar may replace an epoxy-based bar.

[0016] The bar support is optional. For example, the axle may be directly fixed to the bar. Further, the axle may be fixed to the barrier support and the bar is directly fixed to the bar upon attaching the bar to the barrier support. In this case, the bar may include means for attaching the axle.

[0017] The barrier support may be fixed to the ground

and/or a wall or may stand on the ground. The barrier support may include a housing, a controller, an actuator, an interface, and/or a bearing for rotatably supporting the boom barrier. The actuator, the controller, the interface, and/or the bearing may be arranged inside and/or supported by the housing.

[0018] The bearing may rotatably support the axle of the boom barrier. The actuator may be configured to rotate the axle for rotating the boom barrier. The actuator may include a motor (e.g. an electric motor) and/or a gear or transmission. The actuator is configured to generate a movement which is directly transmitted to the axle or via the gear or transmission for rotating the axle. The rotation of the axle may include a range from 0° to 90° which may result in a rotation of the bar from a vertical orientation (in a closed position) to a vertical orientation (in an open position).

[0019] The controller may be configured to control the operation of the actuator. For example, the controller may be configured to start the operation of the actuator and/or to end the operation of the actuator when the boom barrier reaches the desired position (which may correspond to a particular orientation of the axle). To this end, the barrier support may include sensors for detecting the orientation of the boom barrier and/or of the axle.

[0020] The interface may allow wireless communication with a user or a user end device. For example the interface may include a transceiver. Further, that the interface may allow manual input of a user. For example, the interface includes one or more buttons, dials, and the like. The interface may be used for starting the operation of the actuator, for example for opening or closing barrier. The interface may be in data communication with the controller which may be configured to receive an operation signal received by the interface and convert this operation signal into a movement of the actuator. So, the barrier may be configured for automated and/or mechanical actuation of the boom barrier.

[0021] The barrier support may not include the actuator, the controller, and/or the interface. In this case, the boom barrier may be manually operated for opening and closing.

[0022] The boom barrier or the bar may be used for blocking access along a road, door, gate, and/or the like. In a closed position, the boom barrier may extend across the road, door, gate, and/or the like. In an open position, the boom barrier or bar may be rotated by 90° relative to the closed position. In the open position, a vehicle (e.g. a car, truck, motorcycle, etc.) and/or person may pass the road, door, gate, and or the like, without moving around the boom barrier or bar. For example, in the closed position, the boom barrier or bar may be horizontally arranged; in the open position, the boom barrier or bar may be inclined to the closed position, for example vertically arranged.

[0023] The bar of the boom barrier may be an elongate body and thus defining a longitudinal direction. For example, a width and/or thickness of the bar may be in the order of millimetre or centimetre whereas a length of the boom be rare is in the order of metres.

[0024] Walls of the bar may be thin in comparison to the cavity and/or to the outer dimensions of the bar. For example, a thickness of the wall of the bar (e.g. along the entire cavity) may be between 2 mm and 8 mm, optionally between 3 mm and 5 mm, further optionally 4.5 mm. In a cross-sectional view, the area of the cavity is at least 70%, 80%, or 90% of the area of the boom barrier in a cross-sectional view. It is generally known that the stability of elongate objects is not significantly reduced by an internal cavity so that, although the bar includes an elongate cavity, the bar has sufficient stability along its longitudinal direction so that the bar does not or only slightly bends. For example, a degree of bending between the first end and the second end is less than 5°, 4°, 3°, 2°, or 1°.

[0025] The thickness of the wall of the wood-based bar may be larger than the thickness of a wall of an existing epoxy-based bar. However, the thickness of the wall of the wood-based bar is sufficiently small that the cavity can house illumination (as outlined below) and/or results in a weight of the bar that is sufficiently low so that existing bar supports can move the wood-based bars. In other words, the weight of the wood-based bar of this invention can be approximately the same as the weight of the existing epoxy-based bar. For example, the power of the actuator of the existing bar support is sufficient to move the wood-based bar.

[0026] The bar may have a weight between 0.3 kg per meter (kg/m) and 1.0 kg/m, optionally 0.41 kg/m or 8.1 kg/m. The weight of the bar may depend on the type of wood that is used for the bar. Further, the weight of bar in kg/m is lower if one or more transparent or translucent portions (described further below) are provided compared if the bar does not include any transparent or translucent portions. The provision of the transparent or translucent portions may reduce the weight by approximately 15% (e.g. between 10% to 20%) compared to the weight before the transparent or translucent portions were cut into the bar. This weight reduction may depend on the number of transparent or translucent portions and/or their size.

[0027] In an optional embodiment, the bar includes a first end and a second end (can be regarded as a free end). Optionally, the cavity extends from the first end to the second end. Further optionally, the cavity is closed at the first end and the second end.

[0028] The cavity of the bar extends along the longitudinal direction. The first end may be attached to the barrier support (e.g. via the bar support and/or the axle) and the second end may be opposite to the first end along the longitudinal direction. The cavity may (completely) extend between the first end and the second end. So, in this example, the cavity may extend over the entire length of the bar except, for example, for means for closing the bar at the first end and/or the second end. The means for closing the cavity at the first end and/or the second end

may be an integral part of the bar or may be an additional component that is provided, shaped, and/or designed for closing the cavity at the first and/or second ends (e.g. similar to a plug).

[0029] In another example, the boom barrier may be solid at the first end, for example for providing sufficient support for the axle. In this case, the cavity may extend between the solid portion and the second/free end.

[0030] The cavity of the boom barrier may not be open. In other words, the cavity of the bar may be completely sealed from the surroundings of the bar so that no dirt, dust, water, and/or vapour can enter the cavity.

[0031] In an optional embodiment, the bar is made up of a first half shell and a second half shell. Optionally, the first half shell and the second half shell enclose the cavity.

[0032] With this optional embodiment, the bar can be made from two components, the first half shell and the second half shell. The first half shell and/or the second half shell may have a U-shaped in a cross-sectional view. Thus, the cavity is formed by assembling the first half shell to the second half shell or vice versa. This means that the cavity does not need to be added to the assembled first half shell and second half shell. In this way, the manufacturing of the bar including cavity can be simplified.

[0033] Of course it is also possible that the cavity in the bar is provided by drilling a hole in a solid piece of wood-based material. Other techniques for providing an elongate cavity within a wood-based material are possible for forming the cavity within the bar.

[0034] In an optional embodiment, the first half shell is symmetric to the second half shell.

[0035] The first half shell may be symmetric to the second half shell in an assembled position (e.g. after the first half shell is attached to the second half shell). Further, the first half shell may be point symmetric or line symmetric to the second half shell in the assembled position. The symmetry may exclude the surface area where the first half shell contacts the second half shell in the assembled position because, in the area of contact, slots and keys may be provided for increasing the strength of the contact. However, the slots and keys may also be manufactured so that the first half shell and the second half shell may be symmetric to each other.

[0036] The symmetry of the first half shell and the second half shell may simplify the production of the bar because only one piece needs to be manufactured. This piece may have to the same shape and two of these pieces of the same shape of assembled for forming the bar.

[0037] In an optional embodiment, the first half shell and/or the second half shell include a base portion, a first side portion, and/or a second side portion. Optionally, the first side portion and the second side portion protrude from opposing ends of the base portion for forming a U-shape in a cross-sectional view of the bar.

[0038] The base portion, the first side portion, and/or the second side portion may each have a wall thickness which is substantially the same providing a continuous wall thickness as described above.

[0039] In the assembled position, the first side portion of the first half shell may be attached to the first side portion of the second half shell. Similarly, the second side portion of the first half shell may be attached to the second side portion of the second half shell. In this case, a length of the first side portion and a length of the second side portion may equal and/or the sum thereof correspond to the thickness of the bar. Equally, a length of the base portion may correspond to the width of the bar.

[0040] In case of a line-symmetric first half shell and second half shell in the assembled position, the dimensions of the first side portion are equal to the dimensions of the second side portion.

[0041] In another example, in the assembled position, the first side portion of the first half shell may be attached to the second side portion of the second half shell. Similarly, the second side portion of the first half shell may be attached to the first side portion of the second half shell. In this case, a length of the first side portion and a length of the second side portion may equal or different and/or the sum thereof correspond to the thickness of the bar.

[0042] In a cross-sectional view, the bar may have a rectangular shape, an oval shape, a rectangular shape with rounded corners, a quadratic shape, a quadratic shape with rounded corners, or a circular shape. In case of the rectangular shape (with or without rounded corners), the base portion may define the longer side of the rectangular cross-section while the first side portion and the second side portion provide the shorter side of the rectangular cross-section.

[0043] The wall thickness of the first half shell and/or the second half shell may not be constant along the circumference (but optionally constant along the longitudinal direction) so that, in a cross-sectional view, a shape of an inner surface of the first and/or second half shells may deviate from a shape of an outer surface of the first and/or second half shells. The U-shape in a cross-sectional view of the first half shell and/or the second half shell may relate to the inner surface and/or the outer surface of the first half shell and/or the second half shell. For example, the first half shell and/or the second half shell may have an inner surface having a U-shape in a cross-sectional view, while the outer surface may have a circular, oval or ellipsoid shape. The outer surface of the first half shell and/or the second half shell defines the shape of the outer surface of the bar. The inner surface of the first half shell and/or the second half shell defines the shape of the cavity within the bar.

[0044] For example, the outer shape of the bar is chosen to correspond to the shape of the existing epoxy-based bar, while the wall thickness and/or the shape of the inner surface is chosen to provide sufficient stability for the bar. For example, reinforcement ribs and/or increased wall thickness may be provided for

(locally) increasing the stability of the bar. When forming the bar from the first half shell and the second half shell, this can be easily done because the inner surface and the outer surface half shells can be processed in a simple manner as both surfaces are outer or exposed surfaces in a non-assembled position of the first half shell and the second half shell.

[0045] In an optional embodiment, the first side portions and the second side portions of the first half shell and the second half shell, respectively, include end faces which are fixed to each other in the assembled position by means of an adhesive.

[0046] The end faces of the first side portion and/or the second side portion may include a slot and/or a key. The key may be inserted into the slot when the first half shell is attached to the second half shell, i.e. when the respective end faces are brought in contact which each other.

[0047] The fixation of the first half shell to the second half shell using an adhesive (such as glue) may contribute to the overall stability of the bar. The provision of the slot and key and/or using an adhesive may effect that tensions and/or forces acting on the first half shell may be transmitted to the second half shell and vice versa. This is thought to increase the stability of the bar because the respective other one of the first half shell of the second half shell provides support for the respective other one of the first half shell of the second half shell.

[0048] In an optional embodiment, the boom barrier further comprises an illumination source arranged in the cavity. Optionally, the illumination source includes a plurality of LEDs, optionally a stripe of LEDs.

[0049] The illumination source, e.g. the stripe of LEDs, may extend over the entire length of the cavity in the longitudinal direction. The illumination source may include a plurality of illumination points such as a single LED or another form of light generating means. The plurality of illumination points may be (equally) distributed over the length of the cavity for providing a homogeneous and/or continuous illumination of the cavity.

[0050] The illumination points may generate light of single wavelength or over the same wavelength range. In this case, the illumination source may be considered unicolor. In another example, one or more of the light points generate light of first wavelength or over a first wavelength range and one or more of the light points generate light of second wavelength or over a second wavelength range, etc. In this case, the illumination source may be considered multicolour. For example, the illumination source includes RGB-LEDs (e.g. LEDs that generate red, green, and blue light).

[0051] The illumination source may be a component separate to the bar and/or may be attached to the bar (e.g. to an internal surface of the bar forming a cavity). The illumination source may be connected to wiring for powering the illumination source. The boom barrier may include one or more electrical connectors that allow electrical connection of the boom barrier to the barrier support.

[0052] The wiring of the electrical connector may be routed through a wall of the bar, through or along the axle, and/or to the controller which may control the illumination source. For example, the controller powers the illumination source when the bar is moving or is about to be moved. Thus, the illumination source may be a visual warning that the bar is moving or is about to be moved.

[0053] It is possible that the illumination points may be arranged in one or more portions of the cavity for illuminating one or more areas of the bar. Further, the wiring for powering the illumination source may extend within the cavity.

[0054] Optionally, the illumination source is additionally or alternatively arranged on an outer surface of the bar.

[0055] In an optional embodiment, the first side portion and/or the second side portion of the first half shell and/or the second half shell each include a rib protruding towards each other in the assembled position. Optionally, the rib(s) and the side portions form a channel. Further optionally, the illumination source is arranged in the channel. In an example, the illumination source is held in the channel by positive-locking.

[0056] For example, the first side portion of the first half shell and the first side portion of the second half shell each include the rib for forming a first channel. In this case, the first side portion of the first half shell is attached to the first side portion of the second half shell. Similarly, the second side portion of the first half shell and the second side portion of the second half shell each include the rib for forming a second channel. In this case, the second side portion of the first half shell is attached to the second side portion of the second half shell. With these two optional examples, one channel (e.g. the first channel or the second channel) or two channels (e.g. the first channel and the second channel) can be formed. This may be possible if the first half shell and the second half shell are line symmetric to each other. The illumination source may be arranged in one channel or in both channels.

[0057] In an alternative example, the first side portion and the second side portion each include a rib. If the first side portion is attached to the second side portion, two channels are formed. This may be possible if the first half shell and the second half shell of point symmetric to each other. The illumination source may be arranged in one channel or in both channels.

[0058] The rib may protrude from the base portion in the direction of the first side portion and/or the second side portion. Thus, a gap is formed between the rib and the first side portion and/or the second side portion. This gap forms the channel. In other words, a portion of the first side portion and/or the second side portion extends parallel to the rib for forming the channel.

[0059] Each channel may be formed by two opposing ribs and sections of the first side portion and/or the second side portion. The channel may be open so that a slot extends along the longitudinal direction of the bar

for allowing light exiting the channel to illuminate the cavity. This may be achieved in that the ribs do not contact each other but are spaced apart when the first half shell is attached to the second half shell. The distance or gap between the ribs in the assembled position of the first half shell of the second half shell provides the slot through which the light generated by the illumination source can reach the cavity. So, the slot allows an illumination of the channel by the illumination source.

[0060] The illumination source may be attached to the channel by mechanical fastening means such as screws. However, in an optional embodiment, the channel provides a positive locking, form fit, or form locking for the illumination source. In this case, mechanical fastening means can be omitted. For example, the illumination source, e.g. a stripe of LEDs, may be slid into the channel after or during the attachment of the first half shell to the second half shell. For example, a width of the illumination source (e.g. a width of the stripe of LEDs) is smaller than a width of the channel (e.g. by one or more tenths of a millimetre) but larger that a width of the slot. In this way, the illumination source is positively locked in the channel by the ribs. The length and/or arrangement of the ribs may also provide that light generated by the illumination source can exit the channel.

[0061] The use of a positive locking or form locking (e.g. the absence of any mechanical fastening means) simplifies the recycling of the boom barrier because the illumination source can be simply removed from the channel. Further, an existing illumination source (e.g. used with a bar to be replaced) can be re-used by removing the illumination source and inserting it into the channel of the new bar.

[0062] In an optional embodiment, the boom barrier further comprises a transparent or translucent portion for providing an optical channel so that light can exit the cavity.

[0063] In this way, one or more surface areas of the bar can be illuminated. The wood-based material is optically non-transparent due to the thickness of the wall so that optical channels need to be provided for guiding the light within the cavity to the surrounding of the bar. The illumination source may be arranged in the cavity and/or illuminates the cavity (e.g. through the slot if arranged in the channel). The optical channel provides that light within the illuminated cavity can exit the cavity.

[0064] The optical channel is either transparent or translucent. Transparent or transparency can be understood as the physical property of allowing light to pass through the optical channel without appreciable scattering of light. Translucent or translucency (also called translucence or translucidity) can be understood as allowing light to pass through the optical channel but does not necessarily (on the macroscopic scale) follow Snell's law; the photons can be scattered at either of the two interfaces, or internally, where there is a change in index of refraction. In other words, the translucent optical channel is made up of components with different indices of refraction. The transparent optical channel is made up of components with a uniform index of refraction.

[0065] The optical channel may include materials in addition to the wood-based material of the bar and/or may be formed by a change of the shape of the wood-based material of the channel (e.g. a reduced thickness and/or absence of the material). For example, holes, through-holes, recesses, and/or slots in the wood-based material of the bar may form and/or provide the optical channel. The additional materials of the optical channel may be fixed in and/or arranged in or on holes, through-holes, recesses, and/or slots in the wood-based material of the bar.

[0066] The optical channel may be formed so that the cavity is sealed from the surrounding of the bar. The optical channel may prevent dirt, dust, water, and/or vapor to enter the cavity while allowing light to pass through the optical channels. In other words, the optical channel may have a configuration so that the cavity is still sealed from the surroundings so that no dirt, dust, water, and/or vapour can enter the cavity. Only light may pass through the optical channel.

[0067] In an optional embodiment, the transparent or translucent portion includes one or more optical areas that are separated from each other. Optionally, the optical areas are distributed along the longitudinal direction, and/or the base portion of the first half shell and the base portion of the second half shell include at least one optical area.

[0068] Each optical area may form a separate optical channel for guiding light from the cavity to the surroundings of the bar. The optical area may have the shape of a line, circle, arrow, and/or the like. If the illumination sources powered, the geometrical shape of the optical area is illuminated so that the shape of the optical area can be seen in contrast to the rest of the outer surface of the bar. The shape of the one or more optical areas allows to provide information. For example, each optical area has a shape of a letter so that one or more words are illuminated when the illumination source is powered.

[0069] Each optical area or each optical channel may have the same configuration and/or may be different to each other. For example, the transparency and/or translucency of each optical area is the same so that each optical area has to same degree of illumination assuming a homogeneous or continuous illumination of the cavity. Alternatively or additionally, the shapes of each optical area are the same.

[0070] The optical areas may be equally distributed along the longitudinal direction of the bar. The optical areas may be arranged on one side of the bar or on both sides of the bar. For example, the optical areas may be arranged in the base portion of the first half shell and/or in the base portion of the second half shell. The arrangement of the optical areas in the base portion allows that the optical areas can be seen by a person because the boom barrier may be attached to the barrier support in such a way that the base portions are vertically orien-

tated.

[0071] The distribution, shape, and/or arrangement of the optical areas can be adapted to the individual circumstances for providing adequate information to the person in front of the barrier.

[0072] In an optional embodiment, the transparent or translucent portion is arranged in the base portion. Optionally, the transparent or translucent portion includes a through-hole in the base portion and/or a section of reduced thickness in the base portion. Further optionally, the reduced thickness is between 100 μm and 1200 μm or between 100 μm and 1500 μm.

[0073] The translucent portion may be provided by thinning the wall of the wood-based material to such a thickness that the wood-based material becomes translucent. The wood-based material may become translucent if it has a thickness between 100μm and 1200 μm, optionally between 100 μm and 600 μm, further optionally between 100 μm and 300 μm. Thus, the translucent portion may form an optical channel in that the thickness of the wall of the bar is locally reduced. This reduction of the thickness may be provided by processing (e.g. milling) the area of the translucent portion.

[0074] Optionally, (only) the inner surface of the cavity of the bar is milled and the outer surface of the bar is not processed for providing the translucent portion. This means, that the optical channels are not visible from the outside if the illumination source is not powered. The outer surface of the bar may be a smooth surface. For example, an outer surface of the first half shell and/or the second half shell is flat (e.g. smooth and/or without edges) and their inner surface includes edges due to the reduced wall thickness of the optical area.

[0075] Only upon powering the illumination source, the optical channel (e.g. the shape of translucent portion) is visible as it is illuminated compared to the rest of the bar. In other words, with this embodiment, the presence of the optical channel is only visible if the illumination source is powered.

[0076] However, it is also possible that both sides of the wall of the bar are processed (e.g. milled) for providing translucent portion. This may make the milling more complicated since the wall of the bar needs to be processed from two sides.

[0077] The transparent portion may be a through-hole in the wall of the bar, for example in the base portion. This through-hole may be filled with an optically transparent material and/or may be covered by an optically transparent material. For example, a piece of glass or optically transparent plastic may be fixed into the through-hole for sealing the cavity. Alternatively or additionally, the through-hole may be covered by an optically transparent foil which may be wrapped around the entire bar or only covers the through-holes.

[0078] The provision of the optical area by milling is simple and/or allows to shape the optical areas in a simple manner. For example, it is very simple to shape the optical areas as letters and other geometrical shape.

[0079] A third aspect of the invention refers to a method for manufacturing a bar of a boom barrier from wood-based material, comprising the steps of (a) preparing a first half shell and a second half shell each including a base portion, a first side portion, and a second side portion, wherein the first side portions and the second side portions protrude from opposing ends of the respective base portions, and wherein the base portion, the first side portion, and the second side portion each extend in a longitudinal direction, and (b) attaching end faces of the respective first side portions and the second side portions to each other for forming the bar having a cavity.

[0080] The above optional embodiments, optional characteristics, and/or optional features may equally apply to the method.

[0081] In an optional embodiment, the step of the preparing a first half shell and the second half includes (i) providing two of a panel from a wood-based material and/or a wood plank, (ii) milling the panel and/or the wood plank using one or more milling heads, and/or (iii) providing optical areas in the base portion by using a CNC machine.

[0082] The panel from the wood-based material and/or the wood plank may have a length and/or a width which approximately corresponds to the length and the width, respectively, of the final bar. A thickness of the panel and/or the wood plank may be approximately half of the thickness of the final bar.

[0083] An outer surface of the first half shell and/or the second half shell may be provided by smoothing an outer surface of the panel or wood plank and/or by rounding the corners. An inner surface of the first half shell and/or the second half shell may be provided by milling a side surface of the panel and/or wood plank for providing an elongate and broad recess so that the panel and/or the wood plank have a U-shape in a cross-sectional view. In this way, the base portion, the first side portion, and the second side portion can be formed.

[0084] Further, an elongate slot along the longitudinal direction may be provided in the first side portion and/or the second side portion for providing the rib. Further, the end faces of the first side portion and/or the second side portion may be milled for providing the key and/or slot.

[0085] The milling and/or smoothing of the panel and/or the wood plank may be done by conventional milling machines.

[0086] The sections of reduced thickness in the wall of the bar (forming the translucent portions) may be provided by using a computer numerical control (CNC) machine because accurate control of the milling process is necessary for providing a (uniform) thickness between 100 μm and 1200 μm.

[0087] Optional aspects are described in the following: An object of the invention may be seen in replacing existing barrier boom or gate boom, which can be made from a composite of glassfibre embedded in epoxy resin, by a boom made from timber or wood with same dimension and functionality, optionally including illumination.

[0088] To implement a substitution for the affected part, the properties of natural products in comparison to synthetic products can be considered. Wood-based (W-b) materials have different strength properties than any plastic composite materials. Furthermore, the processability of wood-based products differs strongly to synthetic ones. To achieve sufficient stiffness and stability, the profile form must be recalculated and modified. Additionally, a proper illumination of the part can be made possible.

[0089] So far, a semi-transparent glassfibre reinforced epoxy resin was used to provide a barrier boom with the ability for internal illumination by RGB-LED stripes. These materials are used to get enough stability over up to 5 m length in combination to illuminate the boom from the inside. This combination is unique to booms by the applicant. Other solutions can also show illumination, but mostly as LED stripes mounted somewhere on top or outside the boom made e.g., from aluminium. From design and stability reason, the cross-section as described herein was chosen.

[0090] To substitute the glassfibre reinforced epoxy resin profile, a solution out of wood-based material has been designed. The entire profile or bar may consist of two equal parts. Static requirements have been re-calculated using the values of the tensile strength and bending properties of the wood-based material. Illumination of the profile is possible due to a "shine-through-effect" of light sources (LED) through a thin layer of wood.

[0091] The invented profile/bar can have the same outside shape dimensions than the original resin-based profile/bar. This can be an important factor as the new profile/bar has to fit to all connecting hardware parts of the barrier gate or barrier support. The inner profile contour has been adapted due to statical and process technical reasons. This re-design may lead to an increase of the material thickness and a reduction of the inner volume. However, this has no impact of the functionality as all optional internal hardware parts will fit into the profile.

[0092] An optional method for manufacturing the bar/-profile may include one or more of the following steps:

- Each half of the two-part profile/bar is cut out of a panel or a wood plank.
- The inner contour is milled out with multiple special milling heads.
- The outer contour is shaped with another inline milling head.
- The illumination slits (an example of an optical channel or translucent portion), along both sides of the long axis, and necessary holes and shape details are milled out using a CNC machine.
- The two halves are glued together and completed.

[0093] Having the same shape, the wood-based boom barrier can be 1:1 used as replacement for the original resin-based part. Also electrical connectors and existing illumination can be reused. Furthermore, the approach can also be used for a boom with a hinge - e.g., used if garage ceiling is low and only an inner section of the boom is able to be turned into vertical direction. The rest has to be kept in horizontal orientation. With the wood-based material, the disposal of this part will be unproblematic as part is considered as "standard waste wood" (Recycling concept). Thus, the boom barrier fulfils the standard functionality of a blocking element at a car entrance, can exhibit illumination and/or additionally contributes to an approach of providing easy to recycle materials.

[0094] Glass-fibre epoxy resins materials instead, is to be declared as special waste, which need dedicated treatment for disposal.

[0095] Even the overall weight of the wood-based bar, in comparison to the original part, is reduced. This will, in turn, reduce the power consumption and extend engine lifetime. Weight comparison between original resin-based profile/bar (1210 g/m) and new wood-based profile/bar indicates a weight reduction of at least 250g/m.

[0096] The invention is explained in more detail below by way of example with reference to the accompanying figures.

Fig.1 shows a schematic representation of a first example of a barrier having an illumination source that is not powered;

Fig.2 shows a schematic representation of the barrier of Fig. 1 with the illumination source being powered;

Fig. 3 shows a schematic perspective cross-sectional view of an example of a bar of the barrier of Figs. 1 and 2 in which a second half shell of the bar is partly removed;

Fig. 4 shows a schematic cross-sectional view of a further example of a bar in a preassembled state;

Fig. 5 shows a schematic cross-sectional view at the different longitudinal position of the bar of Fig. 4 in an assembled state; and

Fig. 6 shows a schematic representation of exemplary steps of a method for manufacturing a bar of a boom barrier from wood-based material.

[0097] Fig. 1 shows a barrier 10 which includes a boom barrier 12 and a barrier support 14. The barrier 10 may be used to block or provide access to a parking space or at a railroad crossing. To this end, the boom barrier 12 is rotatably supported by the barrier support 14. In this way, the boom barrier 12 can be moved between a closed position (shown in Fig. 1 by the solid lines) via an intermediate position (shown in Fig. 1 by the dashed lines) to

an open position (not shown in Fig. 1).

[0098] The boom barrier 12 includes a bar 16 and a bar support 18 which includes an axle 20. In an alternative example, the bar support 18 may be considered as being a part of the barrier support 14. In both examples, the bar support 18 may include an open cavity in which the bar 16 can be inserted and, subsequently, fixed thereto. The bar support 18 may have other shapes and/or dimensions but is configured to provide a mechanical connection between the bar 16 and the axle 20. For example, the bar support 18 may have standardised dimensions so that any bar 16 complying with standardised dimensions can be inserted into the bar support 18.

[0099] The bar 16 is made from a wood-based material or wood and may be provided for replacing commonly used epoxy-based bars. So, the bar 16 may have outer dimensions that comply with the standardised dimension of the bar support 18. Optionally, the wood-based bar 16 has the same outer dimensions as the commonly used epoxy-based bars.

[0100] The axle 20 is fixed to the bar support 18 and is rotatably supported by the barrier support 14, for example by a bearing. The barrier support 14 may include an actuator and/or gear mechanism for rotating the axle 20 which will result in a movement of the bar 16 between the open position and the closed position. The barrier support 14 may further include a controller for controlling the actuator and/or an interface for sending and/or inputting commands for opening and closing bar 16. The controller, the interface, and/or the actuator may be provided within a housing of the barrier support 14 and are not shown Figs. 1 and 2.

[0101] The bar 16 may have a smooth or flat outer surface which may be free of recesses, slots, and/or openings. The bar 16 may include optical areas 22 which may be illuminated by an illumination source 24 (see also Figs. 3 and 5). The optical areas 22 are not visible when the illumination source 24 is not powered (see Fig. 1), but only when the illumination source 24 is powered (see Fig. 2). The bar 16 optionally includes a plurality of optical areas 22 which are distributed along a longitudinal direction of the bar 16. The optical areas 22 may have an equal distance to each other and have the shape of an arrow. The illumination source 24 may be controlled by the controller and/or may be powered when the bar 16 is moving or is about to move. The illumination source 24 may thus be a warning signal for a vehicle or person passing the barrier 10.

[0102] As visible in Figs. 3 to 5, the bar 16 is made up from a first half shell 26 and a second half shell 28. The first half shell 26 and/or the second half shell 28 each include a base portion 30, a first side portion 32, and a second side portion 34. The first half shell 26 and the second half shell 28 enclose or surround a cavity 36 which extends along the longitudinal direction of the bar 16.

[0103] End faces of the first side portion 32 and/or the second side portion 34 include keys and/or slots which extend in the longitudinal direction (see Figs. 4 and 5). The end faces of the first side portion 32 and the second side portion 34 are attached to each other in an assembled position (see Figs. 3 and 5) whereby a key is inserted into a respective slot. The end faces of the first side portion 32 and the second side portion 34 are glued together. The fixation using the glue and/or the provision of the keys and slots provides stability for the bar 16 because tensions and/or other type of forces can be transmitted from the first half shell 26 to the second half shell 28 and vice versa. Optionally, the first half shell 26 and the second half shell 28 form a unitary component in the assembled position.

[0104] In more detail, the end face of the first side portion 32 of the first half shell 26 can be attached to the end face of the second side portion 34 of the second half shell 28. Further, the end face of the first side portion 32 of the second half shell 28 can be attached to the end face of the second side portion 34 of the first half shell 26. This is possible because the first half shell 26 is point symmetric to the second half shell 28.

[0105] The first side portion 32 and the second side portion 34 protrude on opposing ends from the base portion 30, thus forming a U-shaped in a cross-sectional view (see Figs. 4 and 5). The base portion 30, the first side portion 32, and the second side portion 34 extend along the longitudinal direction of the bar 16.

[0106] The base portion 30 may form a front or back surfaces of the bar 16 which are arranged in a vertical direction. The first side portion 32 and the second side portion 34 form together side surfaces of the bar 16. Thus, the length of the first side portion 32 together with the length of the second side portion 34 form a thickness of the bar 16. Further, a length of the base portion 30 forms a width of the bar 16. The base portion 30, first side portion 32, and the second side portion 34 may have a constant wall thickness in the longitudinal direction as seen in the comparison of Figs. 4 and 5 which show cross-sectionals views at different points along the longitudinal direction.

[0107] The bar 16 further includes a rib 38 that extends along the longitudinal direction. The rib 38 protrudes from the base portion 30 along the first side portion 32 and/or the second side portion 34. The rib 38 is spaced apart from the first side portion 32 and/or the second side portion 34. In the assembled position as shown in Fig. 5, the ribs 38 together with the first side portion 32 and the second side portion 34 form a channel 40, optionally two channels 40 on opposing sides of the cavity 36. The ribs 38 each have a length that is shorter than the respective length of the first side portion 32 and/or the second side portion 34 so that, in the assembled position, the ribs 38 do not contact each other. As a consequence, the channel 40 is not fully closed but open towards the cavity 36.

[0108] The illumination source 24 may include a stripe of RGB-LEDs that is inserted into the channel 40. The shape of the channel 40 provides a form fitting for the illumination source 24 so that the illumination source 24

can be held within the bar 16 without any further fastening means, such as screws or adhesive. Thus, the illumination source 24 can be easily inserted into or removed from the bar 16 when assembling/recycling the boom barrier 12. Fig. 4 shows the bar 16 without the illumination source 24 whereas Fig. 5 shows the bar 16 with the illumination source 24 arranged in the channel 40.

[0109] The illumination source 24 is configured and/or arranged to illuminate the cavity 36. The walls of the first half shell 26 and the second half shell 28 have a thickness of approximately 5 mm. As the bar 16 is made from a wood-based material, the thickness of the wall of approximately 5 mm makes the bar 16 optically non-transparent. Thus, if there were no optical areas 22, the light generated by the illumination source 24 could not exit the cavity 36. In other words, the light generated by the illumination source 24 can only exit the cavity 36 via the optical areas 22.

[0110] As seen in Figs. 3 and 5, the optical areas 22 are formed in the base portion 30 of the first half shell 26 and/or the second half shell 28. The plurality of optical areas 22 form a translucent portion. The optical areas 22 are formed by a significant reduction of the thickness of the wall of the bar 16. Over the optical areas 22, the thickness of the wall is between 100 μm and 1200 μm. Due to the reduced thickness of the wall over the optical areas 22, the wall at the optical areas 22 is translucent. Thus, the light generated by the illumination source 24 can exit the cavity 36 at the optical areas 22. At the same time, the cavity 36 is completely closed because the wall is not interrupted at the optical areas 22. Rather, the wall of the bar 16 provides a smooth outer surface (see Fig. 5).

[0111] The optical areas 22 form an optical channel through which light can exit the cavity 36. In the example shown in the figures, the optical channel is formed by a reduction of the thickness of the wall. However, the optical channel may be a through-hole to the wall of the bar 16 which may be covered by an optically transparent foil so that the cavity 36 is still sealed.

[0112] A width of the bar 16 - a distance from an outer surface of the first side portion 32 to an outer surface of the second side portion 34 of the first half shell 26 or the second half shell 28 - maybe 80 mm. A length of the first side portion 32 and/or a length of the second side portion 34 may be measured from an outer surface of the base portion 30 to the distal end face and can be 19.2 mm. Thus, the bar 16 may have a thickness of 38.4 mm. The thickness of the wall at the base portion 30 (except for the optical areas 22) may be 5.1 mm. The thickness of the wall over the optical area 22 may be reduced by 4.6 mm to 5.1 resulting of a wall thickness of the optical areas 22 between 0.1 mm to 0.6 mm.

[0113] A method for manufacturing the bar 16 of the boom barrier 12 from wood-based material is described in connection with the block diagram of Fig. 6.

[0114] In step 1, preforms of the first half shell 26 and the second half shell 28 are provided by cutting a panel of a wood-based material or a wood plank. The thickness, the width, and/or the length of the preform may be approximately the same as the first half shell 26 and/or second half shell 28.

[0115] In step 2, the inner contour surface of the first half shell 26 and/or the second half shell 28 is provided by milling a side surface of the preform. In this way, a half of the final cavity 36 may be prepared. Further, this milling step provides the key and/or the slot on the end face of the first side portion 32 and the second side portion 34, the rib 38, and an inner surface of the base portion 30. This means there may be no difference in manufacturing the first half shell 26 and the second half shell 28. After milling, the milled surfaces may be smooth or grinded.

[0116] In step 3, the outer contour surface of the first half shell 26 and/or the second half shell 28 is provided by milling the other side surface of the preform. This milling step provides the outer contour or shape of the bar 16. In particular, with this milling step, the bar 16 can be formed so that it fits within the standardised bars support 18. After milling, the milled surfaces may be smooth or grinded. Step 3 may be executed before step 2.

[0117] Steps 2 and 3 may be executed twice for manufacturing the first half shell 26 and the second half shell 28. If the first half shell 26 is point symmetric to the second half shell 28 in the assembled position, the first half shell 26 and the second half shell 28 can be manufactured in exactly the same way.

[0118] In step 4, the optical areas 22 are provided by milling out holes or recesses in the inner surface of the base portion 30 using a CNC machine. The geometrical shapes of the optical areas 22 define the shapes that are illuminated by the illumination source 24. For example, the geometrical shapes of the optical areas 22 may include arrows, letters, or the like.

[0119] In step 5, the end faces of the first half shell 26 and the second half shell 28 are glued together for assembling the bar 16. During this process or afterwards, the illumination source 24 is inserted into the channel 40 and is connected to the controller of the barrier support 14.

[0120] In step 6, the assembled bar 16 is attached to the bars support 18 and the illumination source 24 is connected to the controller of the barrier support 14.

[0121] While the invention has been described in conjunction with the exemplary embodiments described above, many equivalent modifications and variations will be apparent to those skilled in the art when given this disclosure. Accordingly, the exemplary embodiments of the invention set forth above are considered to be illustrative and not limiting. Various changes to the described embodiments may be made without departing from the spirit and scope of the invention.

Claims

1. A boom barrier for being pivoted relative to a barrier support (14) for blocking vehicular or pedestrian

access, the boom barrier (12) comprising a bar (16) extending in a longitudinal direction,

wherein the bar (16) is made from wood-based material, and
wherein the bar (16) includes a cavity (36) extending in the longitudinal direction.

2. The boom barrier of claim 1, wherein the bar (16) includes a first end and a second end,

wherein the cavity (36) extends from the first end to the second end, and
wherein the cavity (36) is closed at the first end and the second end.

3. The boom barrier of claims 1 and 2, wherein the bar (16) is made up of a first half shell (26) and a second half shell (28),
wherein the first half shell (26) and the second half shell (28) enclose the cavity (36).

4. The boom barrier of claim 3, wherein the first half shell (26) is symmetric to the second half shell (28).

5. The boom barrier of claims 3 or 4, wherein the first half shell (26) and/or the second half shell (28) include a base portion (30), a first side portion (32), and a second side portion (34),
wherein the first side portion (32) and the second side portion (34) protrude from opposing ends of the base portion (30) for forming a U-shape in a cross-sectional view of the bar.

6. The boom barrier of claim 5, wherein the first side portions (32) and the second side portions (34) of the first half shell (26) and the second half shell (28), respectively, include end faces which are fixed to each other in an assembled position by means of an adhesive.

7. The boom barrier of any preceding claims, further comprising an illumination source (24) arranged in the cavity (36).

8. The boom barrier of claim 7, wherein the illumination source (24) extends along the cavity (36),
wherein optionally the illumination source (24) includes a plurality of LEDs, optionally a stripe of LEDs.

9. The boom barrier of claims 7 or 8 when depending on claims 5 or 6, wherein the first side portion (32) and/or the second side portion (34) of the first half shell (26) and/or the second half shell (28) each include a rib (38) protruding towards each other in the assembled position,

wherein the ribs (38) and the side portions (34, 36) form a channel (40), and
wherein the illumination source (24) is arranged in the channel (40),
wherein optionally the illumination source (24) is held in the channel (40) by positive-locking.

10. The boom barrier of any preceding claims, further comprising a transparent or translucent portion for providing an optical channel (40) so that light can exit the cavity (36).

11. The boom barrier of claim 10, wherein the transparent or translucent portion includes a plurality of optical areas (22) that are separated from each other, wherein optionally

the optical areas (22) are distributed along the longitudinal direction, and/or
the base portion (30) of the first half shell (26) and the base portion (30) of the second half (28) shell include at least one optical area (22).

12. The boom barrier of claims 10 or 11, wherein the transparent or translucent portion is arranged in the base portion (30),

wherein optionally the transparent or translucent portion includes a through-hole in the base portion (30) and/or a section of reduced thickness in the base portion (30),
wherein further optionally, the reduced thickness is between 100 μm and 1200 μm.

13. A barrier for blocking vehicular or pedestrian access, comprising

the boom barrier (12) according to any preceding claim, and
barrier support (14) pivotally supporting the boom barrier (12).

14. A method for manufacturing a bar (16) of a boom barrier (12) from wood-based material, comprising the steps of

preparing a first half shell (26) and a second half shell (28) each including a base portion (30), a first side portion (32), and a second side portion (34), wherein the first side portions (32) and the second side portions (34) protrude from opposing ends of the respective base portions (30), and wherein the base portion (30), the first side portion (32), and the second side portion (34) each extend in a longitudinal direction, and
attaching end faces of the respective first side portions (32) and the second side portions (34) to each other for forming a bar (16) having a cavity (36).

15. The method of claim 14, wherein the step of the preparing a first half shell (26) and the second half includes

providing two of a panel from a wood-based material and/or a wood plank, and
milling the panel and/or the wood plank using one or more milling heads,
optionally providing optical areas (22) in the base portion (30) by using a CNC machine.

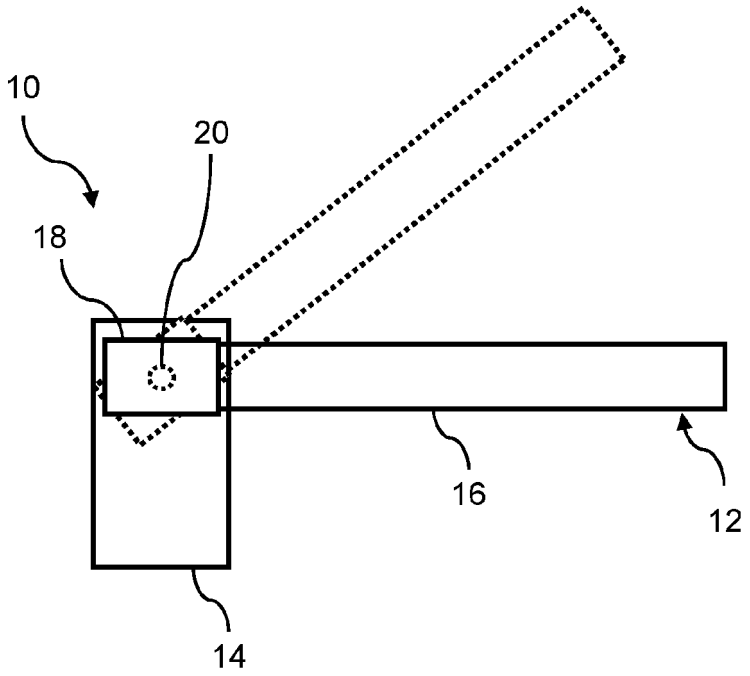

Fig. 1

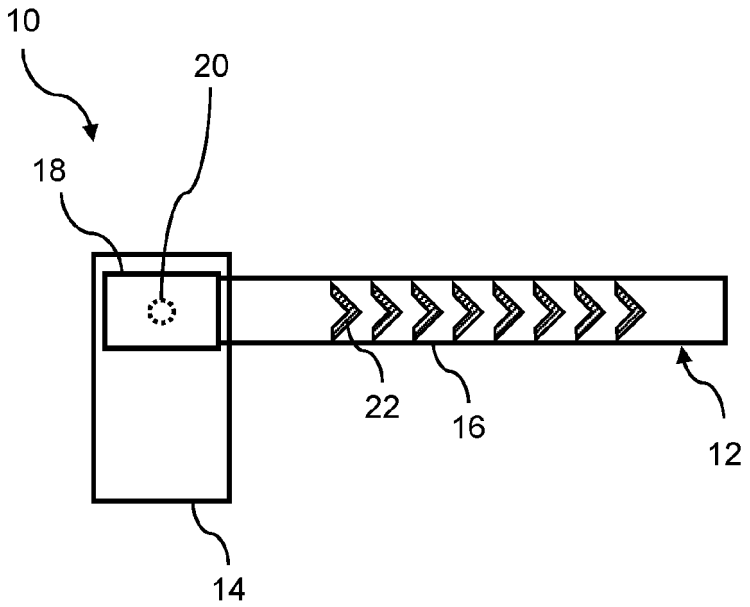

Fig. 2

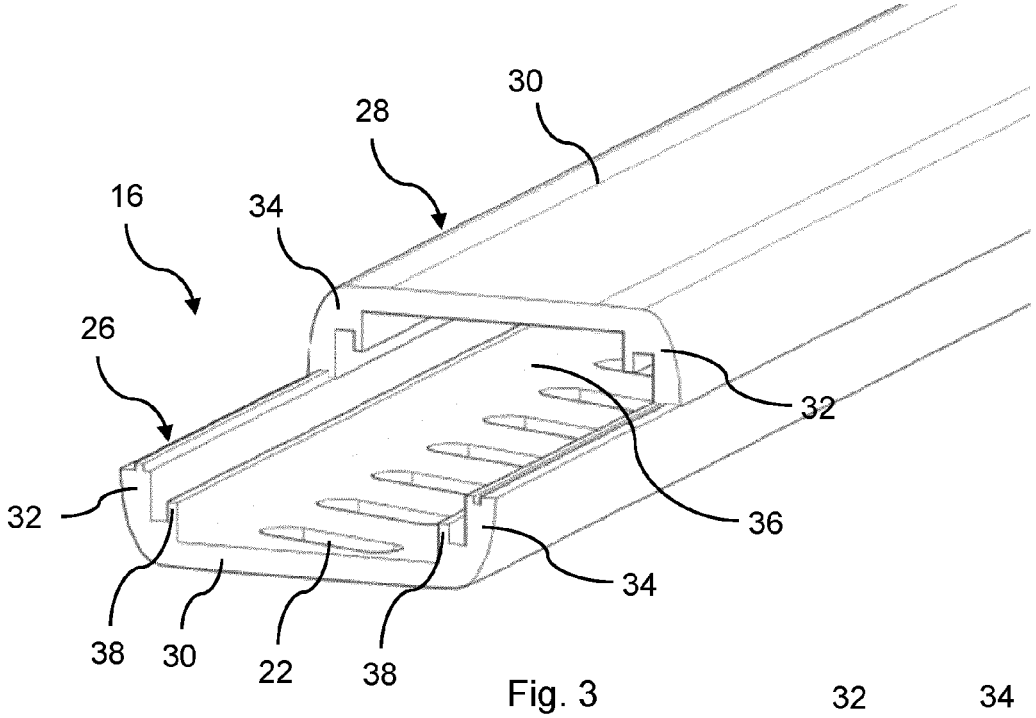

Fig. 3

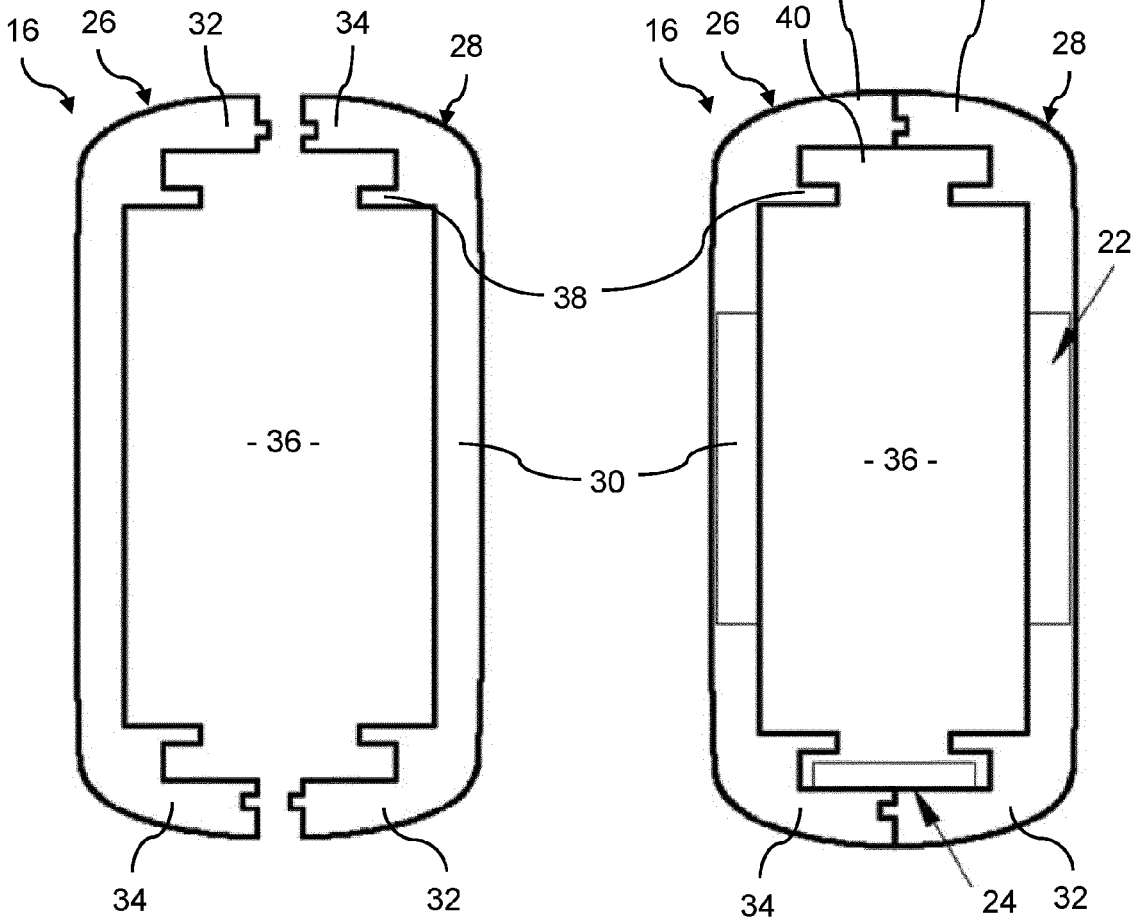

Fig. 4

Fig. 5

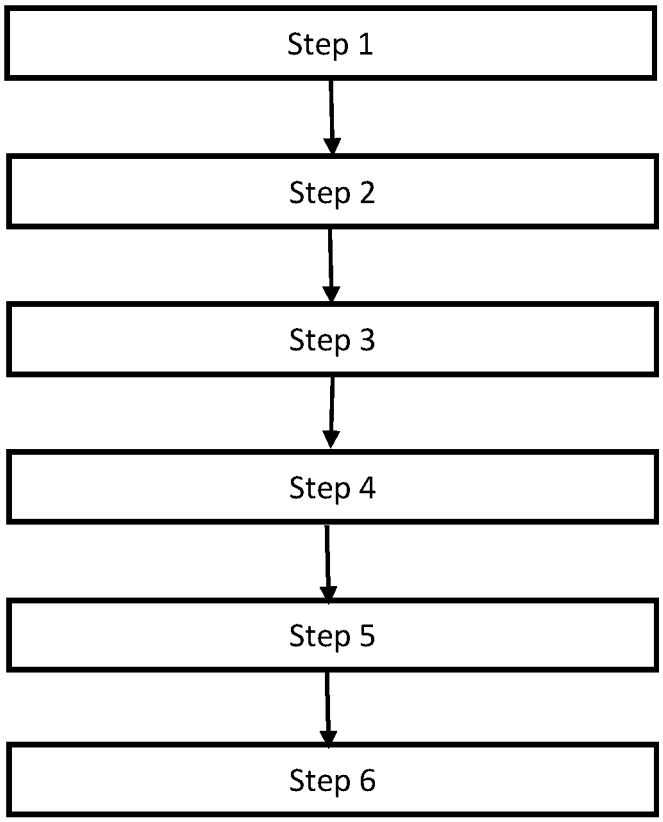

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 23 20 0559

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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
Munich	22 February 2024	Giannakou, Evangelia

CATEGORY OF CITED DOCUMENTS

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