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(54) **A GUARDRAIL SYSTEM FOR ROADS**

(57) Disclosed herein is a guardrail system (1) comprising at least two poles (4) each comprising an opening (29), which poles (4) are configured to be fixedly connected to ground at a distance from each other and configured to extend above the ground, a guide beam (2) and a clamping mechanism (6), the at least two poles (4) each comprise a receiving portion (12, 12') with at least one side plate (24, 24') arranged in the opening (29). The guide beam (2) comprises a protrusion (10) extending along the guide beam (2), wherein, when the guide beam (2) is mounted on the at least two poles (4), the protrusion (10) is directed towards the at least two poles (4). The receiving portion (12, 12') is directed towards the protrusion (10) of the guide beam (2) and a cross section of the protrusion (10) is conical so that a width (d) of the cross section is decreasing in a direction away from the receiving portion (12). The guide beam (2) is further configured to be mounted on top of the poles (4) and the clamping mechanism (6) comprises at least one wedge (18) and at least one screw (16), said wedge being arranged, with the narrow side pointing downwards, in between the protrusion (10) and the side plate (24, 24'). The side plate (24, 24') further comprises a hole (26) having a thread for engaging the screw (16), so that the screw can press the wedge (18) towards the protrusion (10) and thereby press the protrusion (10) towards the opening (29) in order to clamp and fixate the protrusion (10) of the guide beam (2) in the receiving portion (12, 12').

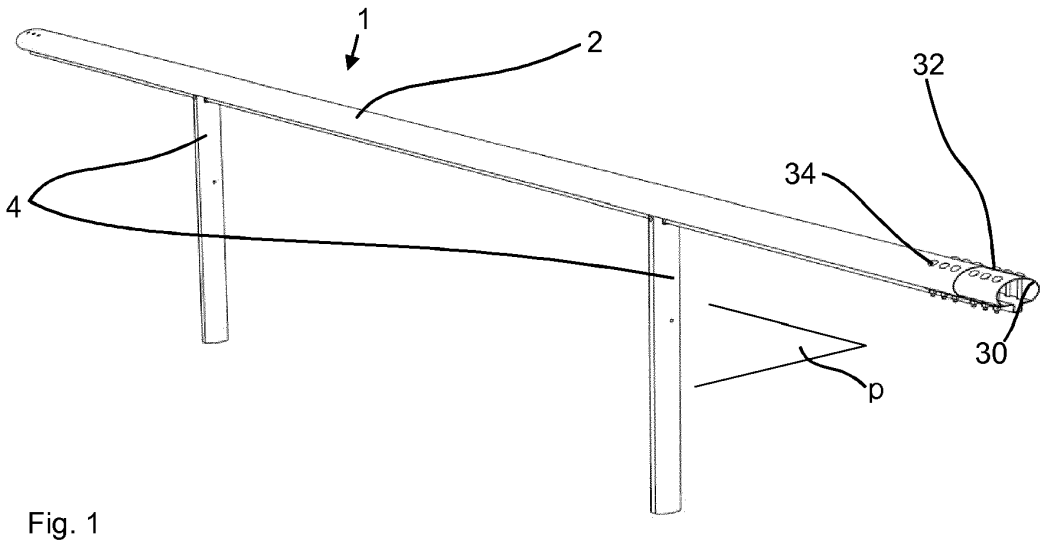

Fig. 1

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Description

Technical Field

[0001] The present invention relates to a guardrail system for all roads, which guardrail system improves the safety for all roads where people travel on their bikes or other sport gear, by foot or in vehicles as passengers and/or animals.. The guardrail system is preferably used as a center guardrail system between two roadways. A feature of the guardrail system is the comparable easy mounting of the guide beam without the direct use of screw connections between poles and guide beam, which facilitates the mounting of the guide beam onto the poles.

Background of the Invention

[0002] The requirements for guardrail systems, in particular center guide beams, are quite high in general. They have to be flexible to allow the absorption of as much energy as possible, when a vehicle crashes into them but at the same time they have to be resilient enough to avoid that a vehicle can go over across the guide beam onto the opposite lane or roadway. The poles have to be configured to bend when an impacting force is above a certain threshold and the guide beam itself has to disengage from the pole at the same time, when a threshold impact force is reached, without falling to ground so it can still guide the vehicle in the direction of the road.

[0003] Traditional guardrail systems comprise a conventional screw-bolt fastening between the poles and the guide beam. Such a conventional fastening is configured to break when a vehicle hits the guardrail system. Typically the screws shear off when a crash occurs. Such traditional systems are not easy to mount, since holes in the guide beam need to be matched at least more or less exactly with holes in the poles. The distances between adjacent poles may however vary due to measuring tolerances, constructional limitations etc.

[0004] Efforts have been made to avoid such screw and nut connections between poles and guide beams.

[0005] Guardrail systems that use a clamping mechanism instead of a screw-nut connection are for instance shown in SE 454 522 and SE 501 731.

[0006] The SE 501 731 illustrates a guide beam comprising a pipe-shaped part and a closed u-shaped part. The u-shaped part can be made conical. The guide beam is configured to be mounted in a side rail system, which prohibits that vehicles drive off a road on the side, for example on a bridge in order to avoid that vehicles fall into the water or a canyon.

[0007] The SE 454 522 shows a side rail system whereby the guide beam comprises a pipe-shaped part and a u-shaped part that extends from the pipe shaped part and is generally rectangular. The u-shaped part extends along the entire length of the pipe-shaped part. The u-shaped part is embedded in a receiving element, which is fixedly connected with a pole or a post. The u-shaped part is then clamped by a screw which engages the latter and which is screwed into a threaded hole formed on the receiving element. Each pole may comprise a bar or the like which interconnects two receiving elements so that an upper and a lower guide beam can be provided.

[0008] The guide beams as illustrated above are configured to be used for side rails and they are not suitable for center or middle guide beams, which are used to separate two roads or traffic lanes, for example on motorways or highly frequented roads with oncoming traffic.

The Object of the Invention

[0009] The object of the present invention is to provide a guardrail system that is suitable to be installed as a center guardrail system in order to divide two roadways configured to have traffic in opposing directions or for dividing roadways that are configured to have traffic in the same direction.

[0010] A further object of the present invention is to provide a center guardrail system that is safe and resilient in the case of a crash, even in case of a crash from either driving direction.

[0011] Another object of the present invention is to provide a center guardrail system that is easy to mount.

Summary of the Invention

[0012] The inventors of the guardrail system according to the present invention have discovered that it is possible to fasten a guide beam to poles by using a clamping mechanism comprising a receiving portion and wedges and a guide beam comprising a conical protrusion that is arranged in the receiving portion and that engages the wedges. The clamping mechanism may also be called a form-fit engagement between the pole(s) and the guide beam, such a form-fit engagement provides for enough resistance for the disengagement between pole and guide beam in case of a crash and additionally such a form-fit engagement is easy to mount since the holes in the poles do not need to match holes in the guide beam; - in fact holes in the guide beams for the connection between poles and guide beams can be completely avoided. No holes in the guide beam results in a guide beam without weakened sections or areas and thus it avoids the formation of predetermined breaking points.

[0013] The receiving portion may generally comprise a pair of side walls formed for example by side plates, said side walls or plates being configured to engage at least one wedge as explained further below.

[0014] Herein the term median guide beam may also be called center guide beam. The median guide beam or center guide beam may be installed as explained between two lanes for motorized vehicles but it can also be used between a lane for motorized vehicles and a lane for cyclists or pedestrians in order to protect the pedes-

trians and cyclists.

[0015] Disclosed herein is a guardrail system comprising at least two poles, each comprising an opening at their free ends, the poles being configured to be fixedly connected to ground at a distance from each other and extend above the ground, a guide beam and a clamping mechanism. The at least two poles each comprise a receiving portion with at least one side plate arranged in the opening. The guide beam comprises a protrusion extending along the guide beam, wherein, when the guide beam is mounted on the at least two poles, the protrusion is directed towards the at least two poles. The receiving portion directed towards the protrusion of the guide beam and a cross section of the protrusion is conical so that a width of the cross section is decreasing away from the U-shaped receiving portion of the pole. The guide beam is configured to be mounted on top of the poles and the clamping mechanism comprises at least one wedge and at least one screw, said wedge being arranged, with the narrow side pointing downwards, in between the protrusion and the side plate of the receiving portion. The side plate comprises further a hole having a thread for engaging the screw, so that the screw can press the wedge towards the protrusion and thereby press the protrusion towards one side of the opening in order to clamp and fixate the protrusion of the guardrail in the receiving portion.

[0016] The above described fastening solution provides for a safe and reliable fixation between the poles and the guide beam. At the same time it allows to release the connection between the poles and the guide beam in case of a heavy crash and the guide beam can keep its height above ground to avoid that a vehicle can go across to the opposite lane.

[0017] The wedge(s) further reduce the likelihood of vibrations due to a comparably large contact surface between the guide beam and the wedge.

[0018] The conical cross section gives a resistance so that quite a substantial force is needed to disengage the form fit connection.

[0019] Additionally, since no screws between the guide beam and the poles are used, the mounting of the guide beam is comparably simple, first the protrusion is inserted into the receiving element and then the wedge(s) is slid in from one side of the pole and finally the screw is inserted into the hole and screwed towards the wedge so that the wedge is pressed against a side of the protrusion for safely clamping the latter.

[0020] Conical means that a cross section of the protrusion is narrowing away from the pole, when the guide beam is mounted on the pole. This narrowing of the cross section allows for the insertion of the wedge.

[0021] Due to the conical or the narrowing cross-section, the fastening of the guide beam in the pole may be according to narrowing opening whereby the conical section needs to move through a part that is narrowing in the direction of disengagement so that the guide beam needs to be torn out through the dimension reduction in case of a hit by a vehicle.

[0022] The narrowing opening is formed by the upper inner edge(s) of the wedge(s) when they are installed in the receiving portion. The narrowing opening may be formed with both either a single (asymmetric shape) wedge arranged on one side of the protrusion or two or more wedges (symmetric shape) arranged on either side of the protrusion, when the guide beam is fixed to the poles.

[0023] In another embodiment the at least one wedge comprises a recess for receiving the free end of the at least one screw, when the at least one screw is screwed into the hole.

[0024] The recess engages a free end of the screw and further ensures a secure positioning of the wedge. When a crash occurs the wedge will move together with the guide beam and the screw will most likely be sheared off since its free end is engaged in the recess or alternatively forcing the receiving portion to deform and finally release the wedges between the screw and the protrusion of the guide beam.

[0025] In a further embodiment the clamping mechanism comprises at least two wedges and at least two screws, wherein the at least two wedges are arranged with their narrow side pointing downwards on either side of the protrusion and wherein the receiving portion comprises at least two side plates, each comprising a hole having a thread.

[0026] The at least two side plates may be arranged parallel to the longitudinal direction of the guide beam and their side surfaces may be oriented vertically when the side plates are fastened into the pole(s).

[0027] The distance between the two side plates, as measured in a direction rectangular to the longitudinal direction of the guide beam, may be chosen so that the protrusion and the wedges can fit in between the at least two side plates.

[0028] The side plates may be made of thicker material than the pole and the guide beam.

[0029] Using two wedges and two screws ensures a symmetric behaviour of the guardrail system in case of a crash, no matter from which direction the vehicle is driving into the guardrail system. This may be wished when guardrail system is used as a center guardrail system, configured to be arranged in the middle between two roadways.

[0030] The wedge or wedges are configured to contact the surface of the sides of the conical protrusion and to compensate the inclination of the protrusion.

[0031] In a further embodiment the receiving portion may be a U-shaped receiving portion, whereby the at least two side plates are interconnected with a middle plate. Said at least two side plates and the middle plate preferably being integrally formed out of a single piece of material.

[0032] The U-shaped receiving portion may be made of a thicker metal than the pole and the U-shaped receiving portion may be welded into a recess or cut out formed

at a free end of the pole.

[0033] Such a thicker metal for the U-shaped receiving portion may be useful for rigidity and stability.

[0034] A further effect of the comparably thick U-shaped receiving portion is that the screw which is pressing on the wedge and engaging the wedge is held stable and that the screw is not rotated so easily around an axis that lays in a plane parallel to the side arms of the U-shaped receiving element in case of a crash. One can imagine that when using a thin metal it is quite easy to deform the metal and rotate the screw out of its rectangular orientation in view of a plane defined by a metal.

[0035] The U-shaped receiving portion may help to lower the guide beam or at least the protrusion of the guide beam into the pole. As mentioned previously, the pole may be a cut out or comprise a recess at its free end to receive the U-shaped receiving portion so that the guide beam can be lowered into the free end of the pole. This may increase rigidity and stability and also prevent screws from standing out, which is a potential hazard in particular for motorcyclists.

[0036] In another embodiment the guide beam may comprise a generally oval and tube like portion extending along the guide beam, whereby a major axis of the oval cross section is oriented parallel to the horizon and rectangular to a longitudinal direction of the guide beam.

[0037] In a further embodiment a cross section of the poles may be oval and the major axis of the oval cross section may oriented rectangular to the longitudinal direction of the guide beam.

[0038] In still a further embodiment the guide beam may be made of metal and produced by rolling and welding.

[0039] Other preferred embodiments will be described further herein and they may also be derived from the detailed description of the figures.

Brief Description of the Drawings

[0040] The present invention will now be described, for exemplary purposes, in more detail by way of embodiments and with reference to the enclosed drawings, in which:

Fig. 1 schematically illustrates a perspective view onto the guardrail system according to an embodiment of the invention;
Fig. 2 illustrates a cross sectional view of the guide beam according to the invention;
Fig. 3 illustrates a top down view onto the guide beam according to the invention;
Fig. 4 illustrates a cross sectional view onto a connection between guide beam and pole;
Fig. 5 illustrates a cross sectional view of the pole;
Fig. 6a illustrates a front view onto the free end of the pole;
Fig. 6b illustrates a side view onto the free end of the pole;
Fig. 7a illustrates a side view an alternative solution for the receiving portion; and
Fig. 7b illustrate a top down view onto the alternative solution of figure 7a.

Detailed Description of Preferred Embodiments

[0041] The invention will now be described in more detail by referring to the figures 1 to 6b.

[0042] Figure 1 illustrates schematically a perspective view of a guardrail system 1 according to the invention for the use in roadways, comprising a guide beam 2 and at least two poles 4. The plane p simulates the level of the ground/roadway. The guardrail system 1 is preferably used for middle or center guide beams between two roadways having opposing traffic, thus for center guide beams for example on motorways. The poles 4 can be fastened into the ground for instance by using a concrete foundation, a socket, a footplate or an injection. The poles 4 are thus fixedly connected to ground.

[0043] Figure 1 further illustrates a joint profile 30, which joint profile comprises holes 32 so that screws/nuts 34 can be used to interconnect two adjacent guide beams 2 or guide beam segments. The joint profile can be inserted in the hollow profile of a free end of the guide beam 2 so that a next free end of another guide beam (not shown) can be connected. Figure 1 illustrates the connection segment between two guide beams 2, whereby the second guide beam is cut right after the joint profile 30.

[0044] Figure 2 illustrates a cross sectional view onto the guide beam 2 comprising a generally oval tube-like portion 8 and a protrusion 10. The oval tube-like portion 8 comprises a major axis a and a minor axis b, whereby the major axis a is longer than the minor axis b. The major axis a is oriented rectangular/transverse to the longitudinal direction D (c.f. figure 4) of the guide beam 2 and at least more or less parallel to the ground plane p (c.f. figure 1), when the guide beam 2 is connected to the poles 4. The protrusion 10 comprises a U-shaped extending portion that is conical. The protrusion has a width w that is decreasing towards the oval tube-like portion 8.

[0045] The oval tube-like portion 8 and the protrusion 10 may preferably be integrally formed, for example by rolling. Alternatively they may be rolled and welded, for example welded at an edge.

[0046] Although the invention is illustrated using an oval tube like portion 10, any other cross section with a wider extension in the direction of the major axis a than in the minor axis b may be used.

[0047] Figure 3 illustrates a top down view onto a guide beam 2 illustrating the longitudinal direction D of the guide beam 2. The longitudinal direction D is parallel to the driving directions of the vehicles on either side of the guide beam 2. Further the holes for engaging the screw nut combination 34 for fastening the joint profile 30, as illustrated in figure 1, are also good visible in figure 3.

[0048] Figure 4 illustrates a cross sectional view onto the guide beam 2 and the pole 4, illustrating a clamping

mechanism 6 that interconnects the guide beam 2 with the pole 4. For the sake of illustrating the details of the clamping mechanism 6, the screw nut combination 34 as shown in figure 1, is omitted in figure 4.

[0049] The clamping mechanism 6 comprises a screw 16 and a wedge 18, preferably on either side of the protrusion 10. The wedge(s) 18 are configured to engage the conical surface of the protrusion 10 and they are arranged with their narrow side pointing downwards towards the pole 4. The screw 16 is screwed into a hole 26 (c.f. figures 5 to 6b) comprising a thread, said hole 26 being arranged in a side arm 24 of a U-shaped receiving portion 12 arranged at a free end of each pole 4.

[0050] The fastening procedure may comprise the following steps:

- Positioning of the protrusion 10 in the U-shaped receiving portion 12
- Insertion of the wedge(s) 18 along the longitudinal direction D
- Screwing the screw(s) 16 into the holes 26 for engaging the wedge(s) 18 and thus the protrusion 10 for clamping guide beam 2 in the pole 4.

[0051] The illustration shown in figure 4 is shown with two wedges 18 and two screws 16 the connection may however only be achieved with a single wedge and a single screw, only on one side of the protrusion. Correspondingly the protrusion may only be shaped conical on side, namely the side directed towards the wedge (not shown).

[0052] In line with the above, there may also be more than two wedges and more than two screws engaging the wedges. Further, the number of screws do not necessarily need to correspond to the number of wedges.

[0053] The wedge(s) 18 may further comprise a recess 28on the side facing the screw 16 in order to engage a free end of the screw 16 in said recess 28. Such a recess 28 may ease the positioning, mounting and the resistance of disengagement of the guide beam 2 in case of an impact/crash. The recess 28 is illustrated with dashed lines in figure 4. The recess 28 may have any shape as long as it can engage the free end of the screw 16.

[0054] As illustrated in figures 5 and 6a, the U-shaped receiving portion 12 may be made of a thicker metal than the pole 4. The U-shaped receiving portion 12 may be welded into the free end of the pole 4, which free end may be prepared accordingly as suggested in figures 5 and 6a.

[0055] Figure 5 illustrates a cross sectional view onto the pole 4 illustrating the generally oval shape of the pole's 4 cross section. A major axis a', which is longer than a minor axis b', is oriented transverse to the longitudinal direction D of the guide beam 2 and parallel to the plane p (c.f. figure 1). Again any oval or oval-like cross section may suit the purpose even rectangular.

[0056] In figure 5 the U-shaped receiving portion 12 shaped as a separate element that is welded into a corresponding recess (figure 6a) of the pole 4 is also good visible as are the two side plates 24 or side arms of the U-shaped receiving element. The two side plates 24 are interconnected by a middle plate 25, as also shown in figure 6a. The two side plates 24 and the middle plate 25 are preferably integrally formed from a single piece of metal.

[0057] Figures 6a and 6b illustrate side views onto the free end of the pole 4. In figure 6a the U-shaped receiving portion 12 is well visible, so are the holes 26 for engaging the screw 16 (not shown in figure 6a). The holes 26 comprising a thread are arranged in the side plates 24 of the U-shaped receiving portion 12, as also illustrated in figure 6b. The U-shaped receiving portion 12 is welded or fastened with screws into a corresponding opening 29 of the pole 4. The U-shaped receiving portion 12 is formed so as to receive the protrusion 10 of the guide beam 2. The opening 29 is adapted to the size of the receiving portion 12, in this case the U-shaped receiving 12 portion.

[0058] If only one wedge and only one side plate (not shown) are used, then one side of the opening will engage the protrusion, thereby allowing to clamp and fixate the protrusion.

[0059] Figures 7a and 7b illustrate an alternative solution of the receiving portion 12'. In this solution the receiving portion 12' is not a U-shaped receiving portion 12 but comprises of the two plates 24', preferably side plates 24', which are welded into the opening 29 of the pole 4. The opening 29 may be the same or similarly shaped as when using the U-shaped receiving portion 12. The side plates 24' may preferably be two side plates 24' it is however conceivable to provide only one single side plate (not shown) and adapt the clamping mechanism (not shown) accordingly. The side plates 24' are preferably made of a thicker metal than the pole 4 as indicated in figures 7a and 7b.

[0060] As illustrated in figure 7b, the side plates 7b may comprise holes 26 with thread for engaging the screws 16 (not shown in figure 7b) of the clamping mechanism 6, similar to the U-shaped receiving portion 12.

[0061] In the above the word oval describes generally a cross section that has a greater extension in a first direction than in a second direction perpendicular to the first direction, thus even rectangular, elliptic and similar shapes are herewith included.

[0062] The invention has now been described in connection with the figures. It is possible to modify the present invention within the boundaries of the knowledge of the skilled person. Such modifications, as long as they fall under the disclosed general inventive idea, are herewith included in this patent.

Claims

1. A guardrail system (1) comprising at least two poles (4) each comprising an opening (29) arranged at their free ends, the poles (4) being configured to be

fixedly connected to ground at a distance from each other and which poles (4) are configured to extend above the ground, a guide beam (2) and a clamping mechanism (6), the at least two poles (4) each comprising a receiving portion (12, 12') with at least one side plate (24, 24') being arranged within the opening (29), the guide beam (2) comprising a protrusion (10) extending along the guide beam (2), wherein, when the guide beam (2) is mounted on the at least two poles (4), the protrusion (10) is directed towards the at least two poles (4) and positioned in the opening (29), the receiving portion (12, 12') being directed towards the protrusion (10) of the guide beam (2) and whereby a cross section of the protrusion (10) is conical so that a width (d) of the cross section is decreasing in a direction away from the receiving portion (12), **characterized in that** the guide beam (2) is configured to be mounted on top of the poles (4) and **in that** the clamping mechanism (6) comprises at least one wedge (18) and at least one screw (16), said wedge being arranged, with the narrow side pointing downwards, in between the protrusion (10) and the side plate (24, 24'), said side plate (24, 24') further comprising a hole (26) having a thread for engaging the screw (16), so that the screw can press the wedge (18) towards the protrusion (10) and thereby the protrusion (10) towards one side of the opening (29) in order to clamp and fixate the protrusion (10) of the guide beam (2) in the receiving portion (12, 12').

2. The guardrail system according to claim 1, wherein the at least one wedge (18) comprises a recess (28) for receiving the free end of the at least one screw (16), when the at least one screw (16) is screwed into the hole (26).

3. The guardrail system according to claim 1 or 2, wherein the guardrail system is a center guardrail system, configured to be arranged in the middle between two roadways.

4. The guardrail system according to any of the previous claims, wherein the clamping mechanism (6) comprises at least two wedges (18) and at least two screws (16), wherein the at least two wedges (18) are arranged with their narrow side pointing downwards on either side of the protrusion (10) and wherein the receiving portion (12, 12') comprises at least two the side plates (24, 24'),each comprises a hole (26) having a thread.

5. The guardrail system according to any of the previous claims, wherein the at least two side plates (24, 24') are connected at the free end of to the pole (4), at least partially in the opening (29) of the pole, for example by welding.

6. The guardrail system according to claim 5, wherein the side plates(s) (24) are made of a thicker metal than the pole (4).

7. The guardrail system according to any of the previous claims 1 to 4, wherein the receiving portion (12) is a U-shaped receiving portion (12), and wherein the at least two side plates (24) are interconnected by a middle plate (25), said U-shaped receiving portion (12) being fastened at the free end of the pole (4) for example by welding, gluing or mechanical fastening.

8. The guardrail system according to claim 7, wherein the at least two side plates (24) and the middle plate (25) are integrally formed by a single piece of material and in a U-shape.

9. The guardrail system according to claims 7 or 8, wherein the U-shaped receiving portion (12) is made of a thicker metal than the pole (4) and/or the guide beam (2).

10. The guardrail system according to any of the previous claims, wherein the guide beam (2) comprises an oval tube-like portion (8) extending along the guide beam (2), whereby a major axis (a) of the oval cross section is oriented parallel to the horizon and rectangular to a longitudinal direction (D) of the guide beam (2).

11. The guardrail system according to any of the previous claims, wherein a cross section of the poles (4) is oval and wherein the major axis (a') of the oval cross section is oriented rectangular to the longitudinal direction (D) of the guide beam (2).

12. The guardrail system according to any of the previous claims, wherein the guide beam (2) is made of metal and produced by rolling and welding.

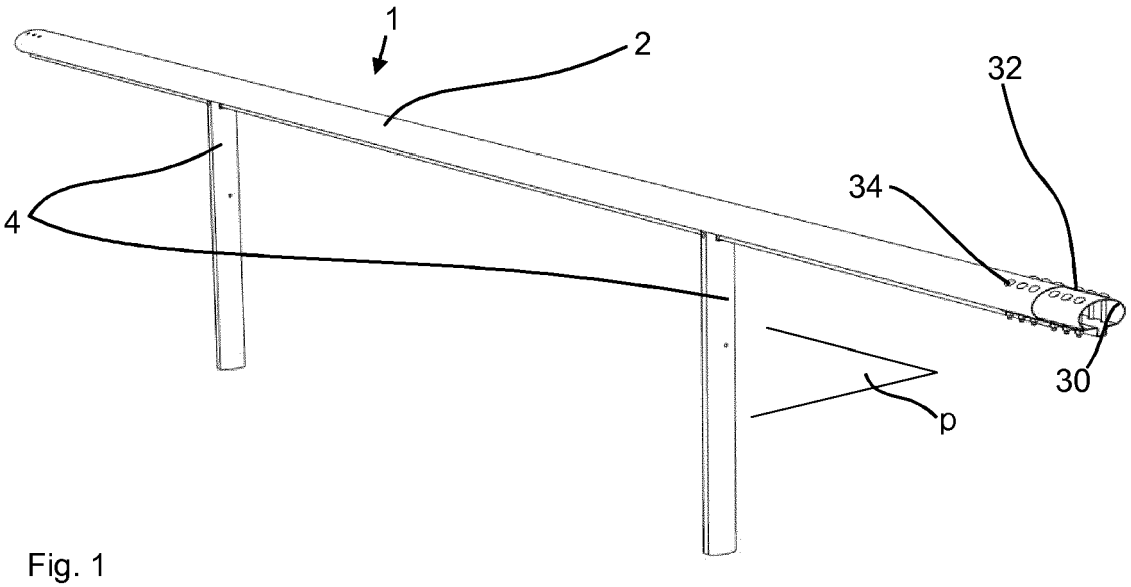

Fig. 1

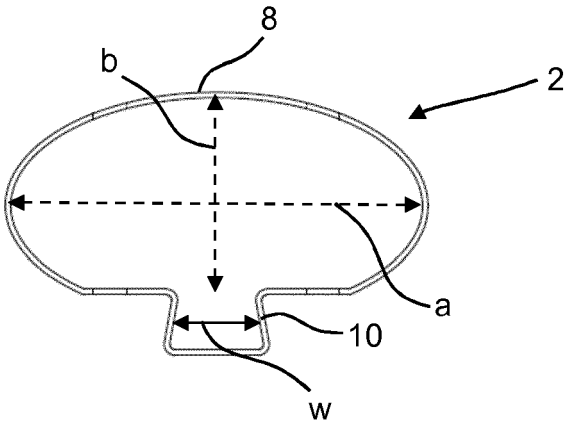

Fig. 2

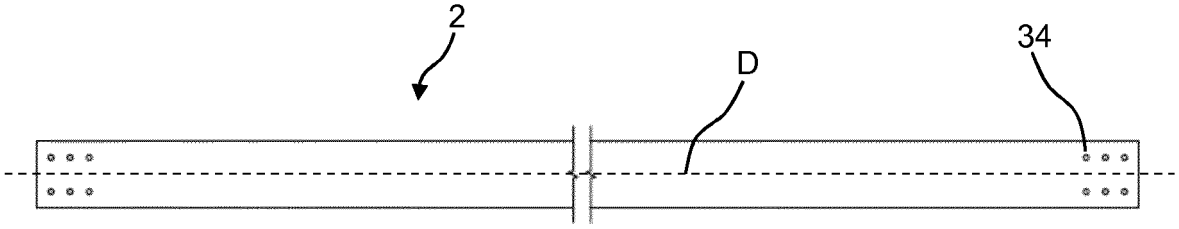

Fig. 3

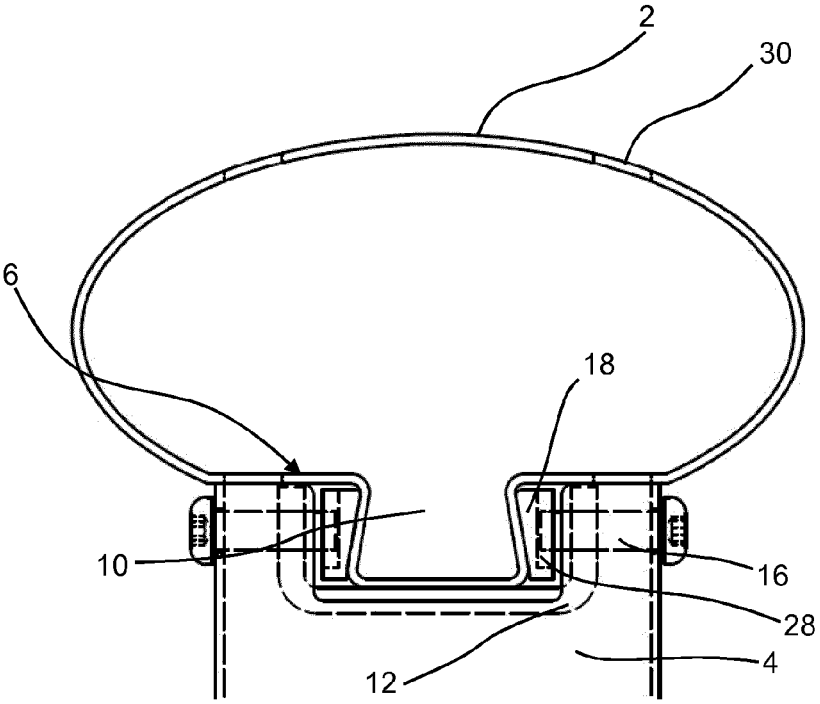

Fig. 4

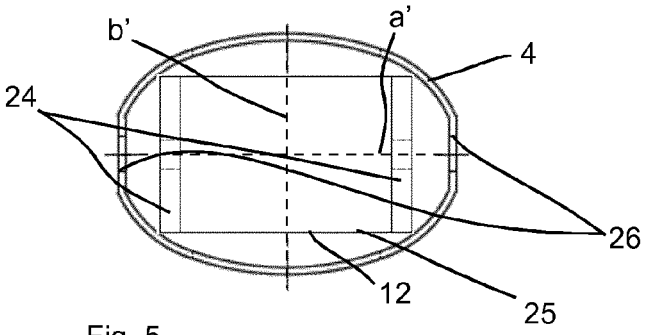

Fig. 5

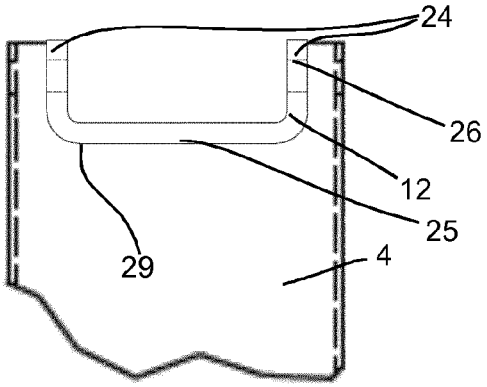

Fig. 6a

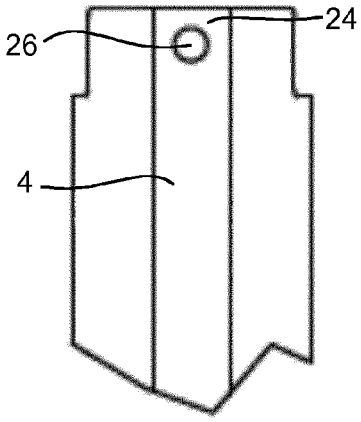

Fig. 6b

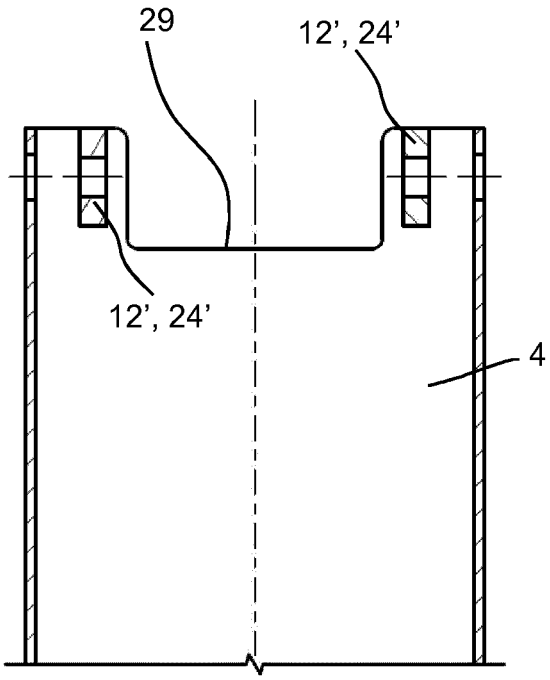

Fig. 7a

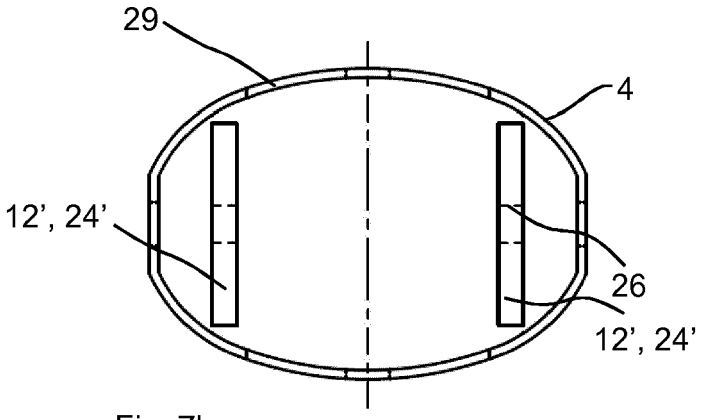

Fig. 7b

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 16 18 8031

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search	Date of completion of the search	Examiner
Munich	8 March 2017	Flores Hokkanen, P

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