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Remarks:
In accordance with Article 14(2), second sentence EPC the applicant has filed a text with which it is intended to bring the translation into conformity with the original text of the application.

(54) **Improved spacer for a road safety barrier**

(57) A spacer (51) for a road safety barrier (10), comprising at least one first region (52, 53) adapted for a fastening on an upright (21), and a second region (54) adapted for a fastening of at least one longitudinal stringer (41, 42), wherein said at least one first region (52, 53) comprises a cutout (60) open to an edge (62) of said first region (52, 53), said cutout (60) being intended for housing at least one fastening member (70).

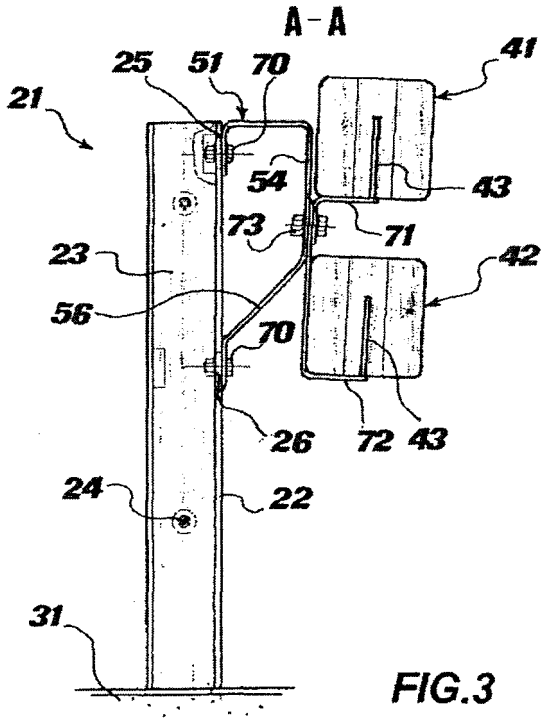

FIG.3

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Description

[0001] The present disclosure refers to an improved spacer for a road safety barrier and, more specifically, to an improved spacer for a safety barrier preferably made with wooden material.

[0002] Over the last decades, road circulation safety has been remarkably enhanced by the ever more widespread installing of guardrail barriers, which are placed on roadway sides along dangerous road stretches to prevent transiting vehicles from going off the roadway in case of side skid.

[0003] Evidently, the dynamic response of a guardrail barrier in case of impact from a vehicle is decisive to the ends of the outcome of the impact itself, and therefore of passengers' safety.

[0004] In fact, a guardrail barrier should be able to absorb as much as possible the kinetic energy of the impacting vehicle, yet in no case should it be as rigid as to compromise occupants' safety. On the other hand, too elastic a barrier would result in throwing back the vehicle towards the centre of roadway, with the risk of impact with other oncoming vehicles.

[0005] Therefore, the development of guardrail barriers meeting ever higher safety standards is the subject of continuing studies and improvements, also from the standpoint of materials employed.

[0006] Known-art guardrail barriers are comprised of an array of vertical uprights, set at regular spacing and driven in the ground along the edge of the roadway, a longitudinal stringer, and spacers interposed between each upright and said stringer. These components are usually made of metal, like e.g. steel or galvanised sheet iron.

[0007] The spacer allows to keep the longitudinal stringer at a certain distance from the upright, in order to avoid a vehicle impact against the upright itself. The spacer can be designed so as to plastically and elastically deform during the impact, facilitating the containment function of the barrier.

[0008] The known art described above entails some relevant drawbacks, discussed hereinafter.

[0009] Following an impact, the upright tends to deform by bending to the outside of the roadway, with generation of a plastic hinge at the upright bottom, and, therefore, it decreases in height; since the longitudinal stringer is constrained to it, during deformation the upright drags the stringer downward therewith and therefore reduces guardrail effectiveness in preventing the vehicle from going off the roadway, as the risk of passing over the same stringer increases.

[0010] Furthermore, it should be considered that, owing to guardrail structure constraints, deformation of upright-dragged stringer affects also the uprights subsequent to the one closest to the point of impact, in turn dragging them toward the outside.

[0011] Hence, a vehicle skidding along the stringer meets an increasingly lower stringer as uprights deflect to the outside, and therefore might go so far as to pass over the same stringer, thereby ending up off-road.

[0012] Moreover, known guardrail barriers are typically made of metallic material. Oft-times, it is observed that, owing to the action of atmospheric agents and inadequate maintenance, over time such barriers take on an unpleasant and unaesthetic appearance, with more or less extended dents and rusty or stained regions. This problem proves particularly relevant in hilly and mountain environments, where sensitivity to a harmonious setting of artefacts in the surrounding landscape is greater.

[0013] To take this into account, some guardrail barriers made of wooden material, or coated with wooden material, have been proposed. These however fail in exhibiting the safety requirements (from the standpoint of strength and dynamic behaviour) needed to have widespread application on all road types, or only partially mitigate the mentioned aesthetic and maintenance problems.

[0014] Object of the present disclosure is to solve at least one of the above-mentioned problems of the known art; this is attained through an improved spacer as defined in independent claim 1, inserted inside a road safety barrier, preferably of wooden material, as defined in dependent claim 10. Secondary features of the present disclosure are defined in the corresponding dependent claims thereof.

[0015] A first advantage of the present disclosure lies in providing a spacer for a road safety barrier allowing to keep longitudinal stringers at an adequate height during the impact by a vehicle; In fact, in case of a vehicle crash on the safety barrier, contingent upright oscillations or deflections towards the outside cause a relative motion of the fastening members inside the cutout with respect to the spacer, thereby reducing or even preventing a direct motion of the spacer and of the longitudinal stringer connected to the spacer. Essentially, contingent motions of the uprights determine a displacement of the fastening members, joined to the uprights, in the cutout, to a possible exiting from the cutout, thereby minimizing the risk of a displacement in height of the spacer and the longitudinal stringer connected thereto.

[0016] A second advantage of the present disclosure lies in providing a spacer allowing to produce a guardrail barrier meeting the strict safety requirements required thereto.

[0017] Another advantage of the present disclosure lies in providing a guardrail barrier comprising structural elements of wooden material.

[0018] Yet another advantage of the present disclosure lies in the capability of providing a guardrail barrier which can be installed on different types of road and respecting the surrounding landscape.

[0019] Further advantages, features and operation steps of the present disclosure will be made apparent in the following detailed description of an embodiment thereof, given by way of example and not for limitative purposes. Reference will be made to the figures of the

annexed drawings, wherein:

- Figure 1A depicts a cross-sectional view of a known-art guardrail barrier;
- Figure 1B depicts a view of an impact of a vehicle against the guardrail barrier of Figure 1A;
- Figure 2 depicts a front view of a guardrail barrier comprising a spacer according to the present disclosure;
- Figure 3 depicts a cross-sectional view of the guardrail barrier of Figure 2;
- Figure 4 depicts a cross-sectional view of the guardrail barrier of Figure 2 following an impact;
- Figure 5 depicts a front view of a spacer for a guardrail barrier according to the present disclosure;
- Figure 5A depicts a view of a detail of the spacer of Figure 5; and
- Figure 6 depicts a side view of the spacer of Figure 5.

[0020] In figure 1A it is depicted a cross-sectional view of a known-art guardrail barrier 1, comprising a plurality of uprights 2 vertically driven in ground 3 at a regular spacing to each other, a longitudinal stringer 4 and spacers 5 interposed between each upright 2 and said stringer 4. Each spacer 5 is fastened to the respective upright 2 (besides to the stringer 4) by means of bolts 6 or other fastening members.

[0021] The spacer 5 has the function of keeping the stringer 4 at a distance from the upright 2 such as to prevent as much as possible the impact of a vehicle 9 against the upright 2 itself. Said spacer 5 is designed to deform both elastically and plastically during the impact of the vehicle 9 against the stringer 4, in order to improve the containment function exerted by guardrail barrier 1.

[0022] Following an impact, as shown in Figure 1B, the upright 2 bends to the outside of the roadway, plastically deforming itself and thereby dragging therewith the longitudinal stringer 4, causing both the lowering and the outside translation of the latter.

[0023] Figures 2 and 3 show a guardrail barrier 10 according to the present disclosure, comprising a plurality of uprights 21 driven in the ground 31, an upper longitudinal stringer 41, a lower longitudinal stringer 42, and spacers 51 interposed between each of said uprights 21 and said longitudinal stringers 41 and 42.

[0024] Note that in the present disclosure the terms "upper" and "lower" are to be construed by taking into account an installed guardrail barrier 10; therefore, by "lower" it is denoted what, in the installed barrier 10, is closer to ground 31, whereas by "upper" it is denoted what is farther from ground 31. More specifically, in Figures 5, 5a and 6 the spacer 51 is depicted so that its "upper" portion faces the top edge of the sheet, whereas its "lower" portion faces the bottom edge of the sheet.

[0025] Each of said uprights 21 preferably comprises a section bar 22 of steel or metal and a covering 23 of wooden material fastened thereto, e.g., by means of bolts 24. One face of the upright 21 facing the roadway has two slots 25 and 26, set at different heights and obtained in an arrangement staggered therebetween with respect to a longitudinal direction 27 of said face.

[0026] Said longitudinal stringers 41 and 42 are arranged parallel to each other, and each one of them preferably comprises thereinto a laminar structure 43, or core, of metal or steel, covered by wooden material. Said laminar structure 43, which is fastened to the wooden material covering, e.g., by means of bolts 44, allows greater strength to lateral forces developing on the stringer following an impact.

[0027] More specifically, each of said stringers may comprise more longitudinal layers of wooden material (e.g., three, as depicted in Figure 3) fastened thereamong by means of glue or screws or bolts.

[0028] The connection between successive modules 45 and 46 of longitudinal stringer 41, 42 may be of male/female type, or tenon-and-mortise, and produced, e.g., by providing for the ends of each module 45 and 46 to have a length of said laminar structure 43 projecting longitudinally from the wooden material covering, and a housing, obtained in the wooden material, apt to receive said projecting length of laminar structure into the successive module. Therefore, said connection is obtained by inserting said projecting length of laminar structure 43 of a first module 45 into said housing of a second module 46 (and vice versa) and blocking the system by means of bolts 47, into suitable holes made both in the wooden material and the laminar structures.

[0029] Referring to Figures 3, 4, 5, 5a, and 6, each spacer 51, preferably made of shaped sheet steel, comprises two first regions 52 and 53 for a fastening on an upright 21, a second region 54 for a fastening to the stringers 41 and 42, a first spacing region 55 and a second spacing region 56.

[0030] Said two first fastening regions 52 and 53 are aligned therebetween with respect to a longitudinal direction 59 of the spacer 51 and lie substantially on a same plane.

[0031] Each of said first fastening regions 52 and 53 comprises a cutout 60, open to an edge 62 of the respective region, said edge being the bottom one when the spacer is installed; in other words, the cutout 60 opens to a bottom portion of the respective first fastening region 52, 53. The cutout 60 comprises a seat 61, a first edge 63 substantially parallel to the longitudinal direction 59 of said spacer 51, and a second edge 64 tilted with respect to said longitudinal direction 59. Therefore, said seat 61 is formed in the cutout 60, preferably between the first edge 63 and the second edge 64, and it is apt to house fastening members 70, and may have a semicircular (as depicted), semielliptical, triangular shape, or other suitable shapes consistent with the fastening members 70 housed therein, which will be described hereinafter.

[0032] Said second fastening region 54 has a central slot 57 for fastening to the stringers 41 and 42, as will be described hereinafter. Said second fastening region 54

lies on a plane which is distinct with respect to that containing said first fastening regions 52 and 53, preferably substantially parallel or slightly tilted to that of the first fastening regions 52 and 53, and, even more preferably, tilted of a few degrees (e.g., 3°) with respect thereto.

[0033] Said second fastening region 54 is jointed topside to the top end of the first upper fastening region 52 by means of the first spacing region 55, which is substantially orthogonal to the first fastening region 52 itself; in addition, the same second fastening region 54 is jointed bottom-side to the top end of the first lower fastening region 53 by means of the second spacing region 56, which is tilted with respect to said first fastening regions 52 and 53, and said second fastening region 54. Therefore, the spacer 51 has a substantially "G"-shaped longitudinal section.

[0034] Note that the cutouts 60, and in particular the seats 61, on said first fastening regions 52 and 53, though having analogous shapes, are obtained in an arrangement staggered therebetween with respect to said longitudinal direction 59 of said spacer 51.

[0035] The fastening of the spacer 51 to the respective upright 21 is attained with the fastening members 70 inserted in said seats 61 of the spacer and in said slots 25 and 26 of the upright 21. Said fastening members 70 could be bolts, rivets, screws, nails or other equivalent fastening members.

[0036] Both longitudinal stringers 41 and 42 are fastened to the spacer 51 by means of "L"-shaped brackets 71 and 72, which have a first flange fastened to the bottom face of the respective stringer and a second flange fastened to said spacer by means of a bolt 73 or the like inserted in said slot 57 of the second fastening region 54.

[0037] More specifically, the bracket 72 for supporting said lower stringer 42 extends at said second spacing region 56 of the spacer 51.

[0038] As it is shown in Figure 3, when the guardrail barrier 1 is installed, the upper stringer 41 has a face substantially adjacent and parallel to said second fastening region 54 of the spacer; the corresponding face of the lower stringer 42, though being parallel to said region 54 as well, extends instead in correspondence of said second spacing region 56, which, by being tilted, exhibits a tilt also with respect to the stringer 42 itself.

[0039] The spacers 51 according to the present disclosure carry out the usual function of keeping the stringers 41 and 42 spaced from the uprights 21 to prevent the impact of a vehicle against the uprights themselves, and of absorbing, by deforming, part of the kinetic energy of the impacting vehicle.

[0040] Moreover, the presence of said cutouts 60 and preferably of the seats 61, in particular having the described shape, allows a yielding connection of the spacers 51 with the uprights 21.

[0041] In fact, following an impact the upright 21 close to the impact region starts bending toward the roadway outside, dragging therewith the stringers 41 and 42, which are anyhow constrained also to the other uprights uninvolved by the impact, and therefore resist such dragging. Upon reaching a certain angle of bending of the upright 21, such opposite actions cause the fastening members 70 to get extracted from the seats 61 and therefore the stringers 41 and 42 to free themselves from the constraint with the upright 21. Thanks to this, said stringers 41 and 42 are no more dragged downward and remain at a proper height, being however supported by the remaining uprights. Accordingly, the impacting vehicle is not in danger of passing over the stringers themselves.

[0042] This is further fostered by what is disclosed below. During the impact the stringers 41 and 42 transmit to said second fastening region 54 a force substantially orthogonal to the upright 21, and therefore the spacer 51 is subjected to an action of deformation by crushing. In particular, the second spacing region 56, by being tilted with respect to said second fastening region 54, is subjected to a torque that tends to rotate it with respect to the second fastening region 54 itself, thereby increasing the magnitude of the angle between said regions 54 and 56. Moreover, since said second spacing region 56 is constrained to the upright 21 through said first lower fastening region 53, such a rotation substantially entails an upward thrust of the second fastening region 54 with respect to the upright 21. Evidently, said deformation transmits also to said first spacing region 55.

[0043] Therefore, the stringers 41 and 42 keep a position higher than the one they would have if they would rigidly follow the upright 21 itself. Moreover, the described deformation mode fosters the extraction of the fastening means 70 from the respective seats 61 upon reaching a certain degree of deformation of the spacer 51, as shown in Figure 4, and therefore fosters the release of the spacer 51 from the upright 21.

[0044] Ultimately, the cutouts 60 allow an easy release of the spacer 51, and therefore of the stringers 41 and 42, from the upright 21.

[0045] A person skilled in the art will appreciate that the spacer 51 for guardrail barrier 10 according to the present disclosure enhances the effectiveness of the barrier itself in case of impact. Moreover, the described technical contrivances allow a wide use of wooden material as constructive material, with an improvement of the aesthetic aspect but without compromising overall safety.

[0046] In addition, a person skilled in the art will note that optionally there might be only one stringer (or even more than two), as the ability of the spacer 51 to release from the upright 21 is independent of the number of stringers fastened thereto.

[0047] As a further embodiment, the spacer 51 might comprise only one of said first fastening regions 52 or 53 on the upright 21, said region comprising a cutout 60 and a seat 61 as aforedescribed. E.g., the first upper fastening region 52 might be fastened according to the above-disclosed modes, whereas the first lower fastening region 53 might be replaced by a mere support plane for supporting the spacer 51 onto the upright 21.

[0048] The present disclosure has hereto been de-

scribed according to a preferred embodiment thereof, given by way of example and not for limitative purposes.

[0049] It is understood that other embodiments might be envisaged, all to be construed as falling within the protective scope thereof, as defined by the claims hereinafter.

Claims

1. A spacer (51) for a road safety barrier (10), comprising at least one first region (52, 53) adapted for a fastening on an upright (21), and a second region (54) adapted for a fastening of at least one longitudinal stringer (41, 42), wherein said at least one first region (52, 53) comprises a cutout (60) open to an edge (62) of said first region (52, 53), said cutout (60) being intended for housing at least one fastening member (70).

2. The spacer (51) according to the preceding claim, further comprising a seat (61) for said at least one fastening member (70), said seat (61) being formed in said cutout (60).

3. The spacer (51) according to the preceding claim, wherein said cutout (60) comprises a first edge (63) substantially parallel to a longitudinal direction (59) of said spacer (51) and a second edge (64) tilted with respect to said longitudinal direction (59).

4. The spacer (51) according to any one of the preceding claims, wherein said cutout (60) opens to a bottom portion of said first region (52, 53).

5. The spacer (51) according to any one of the preceding claims, comprising at least two first regions (52, 53), said second region (54) being interposed between said two first regions (52, 53).

6. The spacer (51) according to claim 5, wherein said two first regions (52, 53) are aligned along a longitudinal direction (59) of the spacer (51).

7. The spacer (51) according to claims 2 and 6, wherein the seats (61) of said two first regions (52, 53) are obtained in an arrangement staggered therebetween with respect to said longitudinal direction (59) of said spacer (51).

8. The spacer (51) according to claim 5, 6 or 7, wherein said second region (54) is jointed to the one of said two first regions (52, 53) by means of a first spacing region (55) and wherein said second region (54) is jointed to the other one of said two first regions by means of a second spacing region (56) arranged tilted with respect to said second region (54).

9. The spacer (51) according to any one of the claims 5 to 8, wherein said two first regions (52, 53) lie on a same plane distinct from a plane onto which said second region (54) lies.

10. A road safety barrier (10), comprising a plurality of uprights (21), at least one longitudinal stringer (41, 42), and a plurality of spacers (51) according to any one of the preceding claims, each of said spacers (51) being interposed between one of said uprights (21) and said at least one longitudinal stringer (41, 42).

11. The road safety barrier (10) according to claim 10, when claim 10 is dependent on claim 8, comprising at least one bracket (72) for supporting one of said stringers (42), said bracket (72) extending at said second spacing region (56).

12. The road safety barrier (10) according to the preceding claim, wherein said bracket (72) and said second spacing region (56) are arranged tilted to each other.

13. The road safety barrier (10) according to any one of the claims 10 to 12, wherein said at least one longitudinal stringer (41, 42) comprises a metallic core (43).

14. The road safety barrier (10) according to the preceding claim, comprising a wooden material in which said metallic core (43) is included.

15. The road safety barrier (10) according to the preceding claim, wherein said at least one longitudinal stringer (41, 42) comprises at least three layers of wooden material.

16. The road safety barrier (10) according to any one of the claims 10 to 15, comprising at least two of said longitudinal stringers (41, 42) arranged parallelly to each other.

17. The road safety barrier (10) according to any one of the claims 10 to 16, wherein said uprights (21) comprise a section bar (22) of metal and a covering (23) of wooden material.

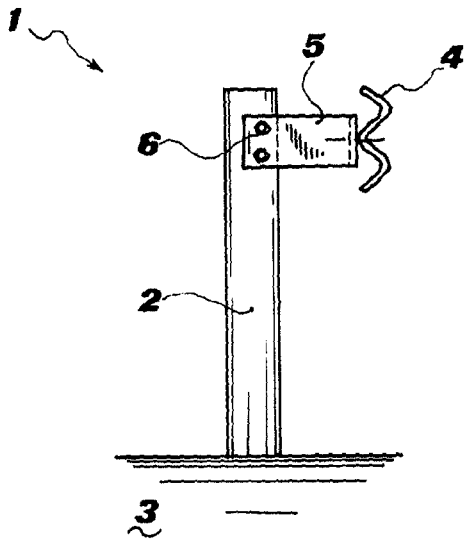

FIG.1A

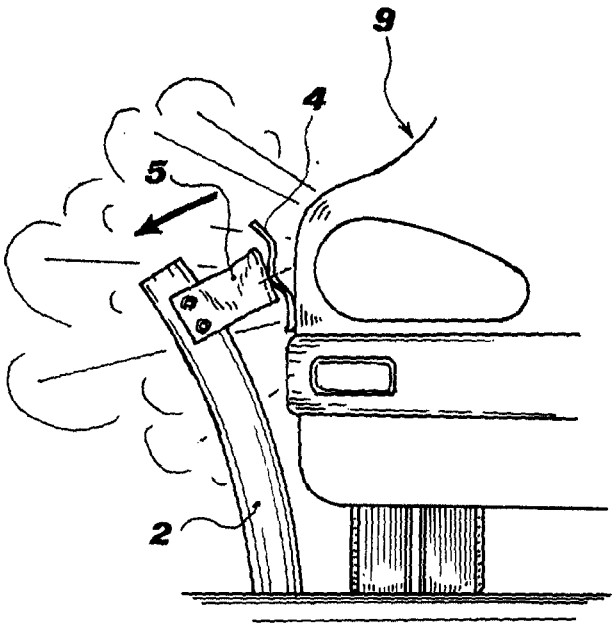

FIG.1B

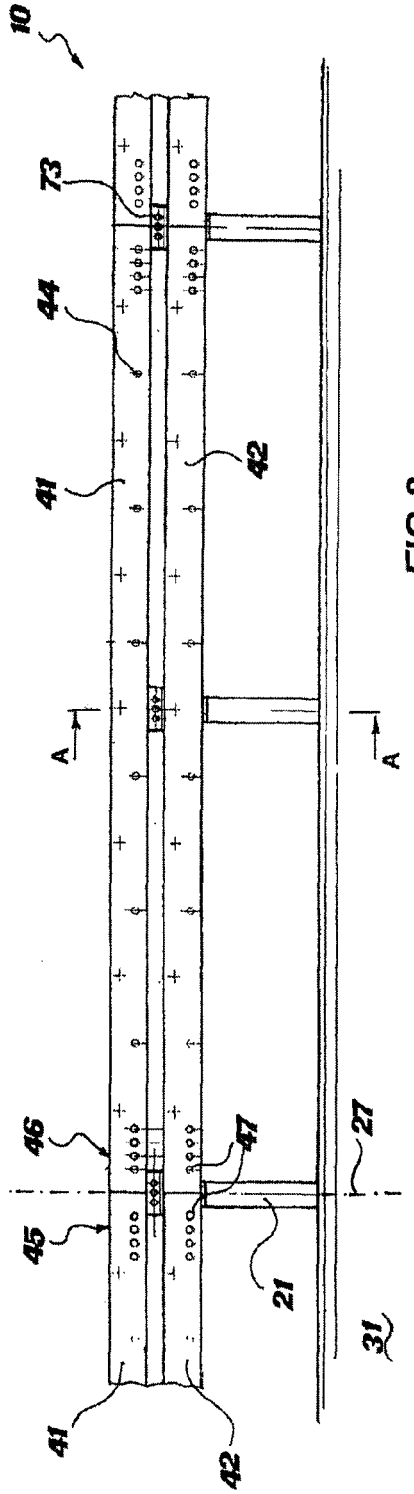

FIG.2

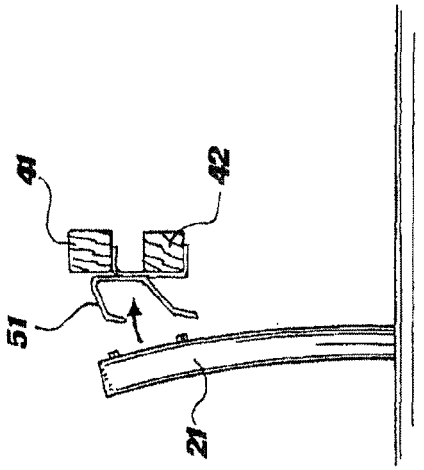

FIG.4

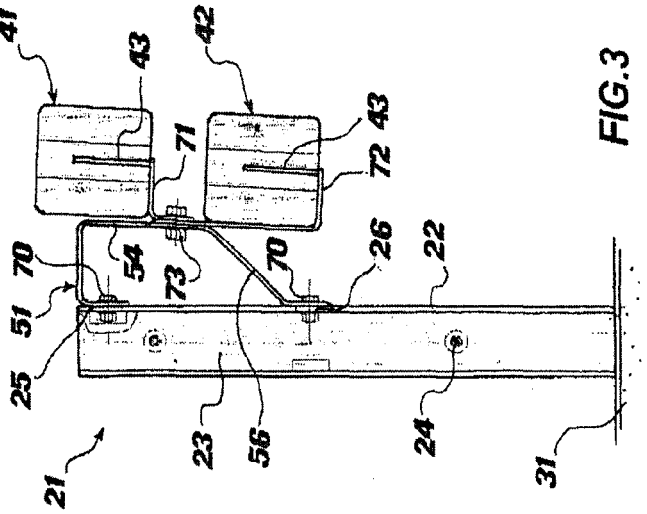

FIG.3

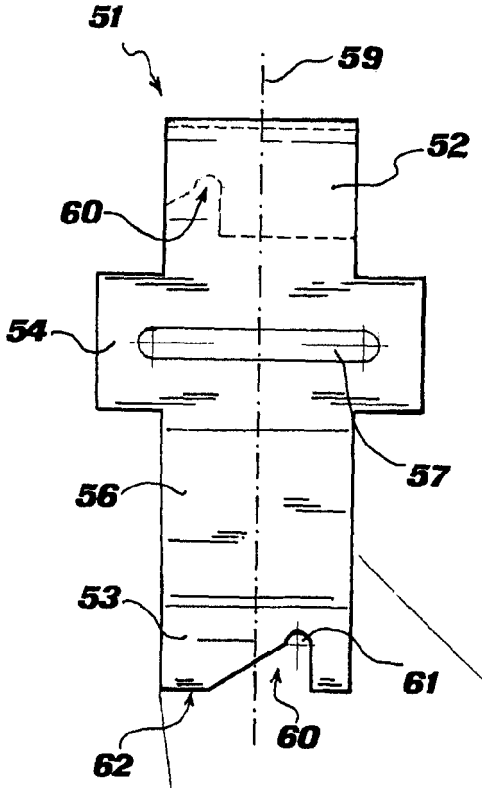

FIG.5

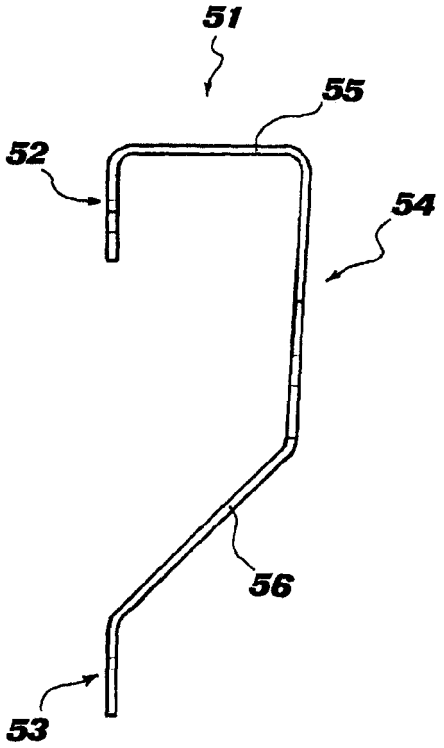

FIG.6

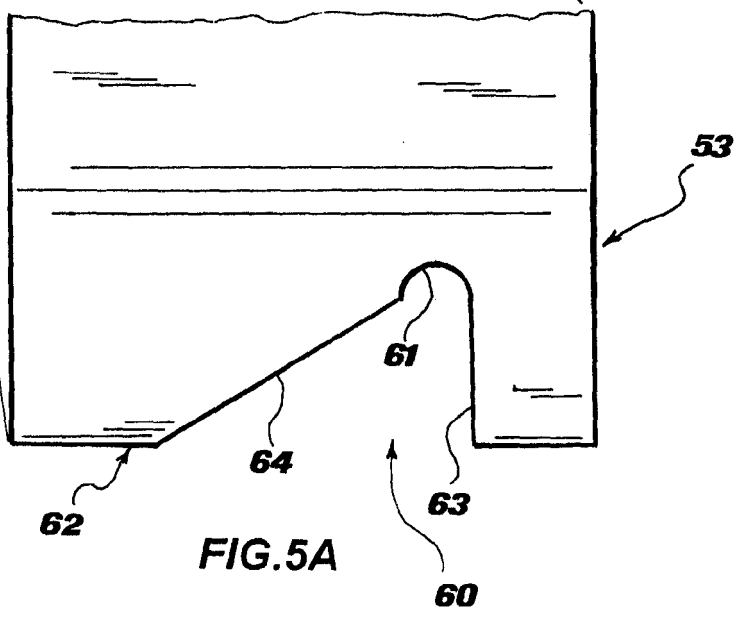

FIG.5A

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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 5180

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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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 February 2009	Tran, Kim-Lien

CATEGORY OF CITED DOCUMENTS

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