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(54) **Safety barrier**

(57) A safety barrier comprising a beam and a plurality of supports, the beam being directly connected to at least one support by a first deformable element, said first deformable element comprising at least two spaced apart webs which extend between the beam and said support.

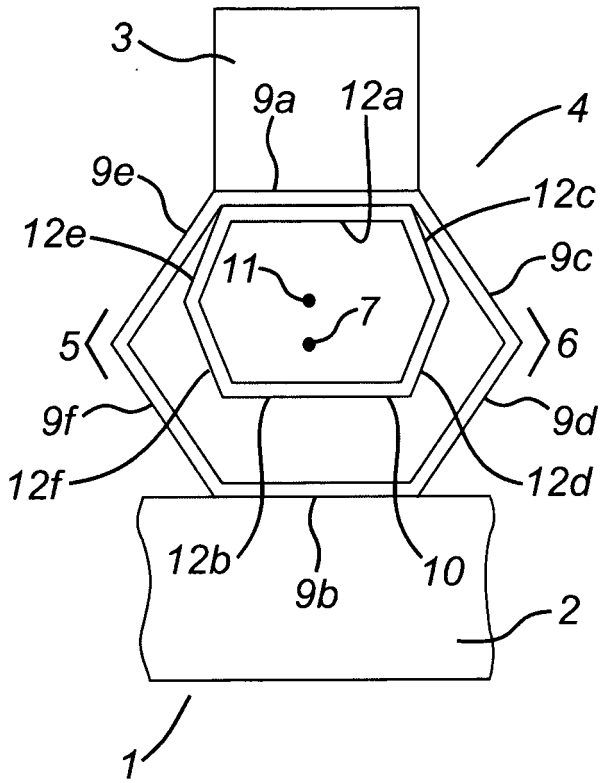

FIG. 1

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Description

[0001] The invention relates to a safety barrier (also known as a vehicle restraint system), particularly, but not exclusively a safety barrier for positioning on a road, bridge or associated with a steep downward incline.

[0002] The main purpose of a safety barrier for a road is to prevent vehicles from crossing from one carriageway to the other or from leaving the carriageway edge, hence preventing errant vehicles (that is, vehicles leaving the carriageway) from meeting with roadside features or hazards.

[0003] In general, a safety barrier achieves this objective by redirecting the vehicle along the line of the barrier. This is known as containment.

[0004] A known safety barrier comprises a continuous guard beam, also known as a beam, supported by posts at regular intervals. Rigid spacers are positioned between the beam and each post to help prevent the wheels of an errant vehicle from striking the posts. As these spacers are nominally rigid, they will absorb little or no energy from a vehicle impacting the barrier. A deformable element is thus positioned between each spacer and the beam. These deformable elements will collapse when a vehicle strikes the barrier, thereby absorbing some of the energy from the impact.

[0005] A problem with the known safety barrier is that when a large or heavy vehicle strikes it, the strength of the impact may be sufficient to cause the nominally rigid spacers to collapse. This makes it difficult to predict accurately the behaviour of the known safety barrier in the event of an impact. Predicting the behaviour of safety barriers is important as they must meet the requirements of regulations which govern the properties of such vehicle restraint systems.

[0006] It is an object of the invention to seek to mitigate this disadvantage.

[0007] Accordingly, the invention provides a safety barrier comprising a beam and a plurality of supports, the beam being directly connected to at least one support by a first deformable element, said first deformable element comprising at least two spaced apart webs which extend between the beam and said support.

[0008] Omitting the rigid spacers and directly connecting the beam to the support using a first deformable element gives a safety barrier which will have more predictable behaviour. As such, it will redirect the vehicle in a more controlled manner and make it less likely that the vehicle impacts a support.

[0009] The central axis of the first deformable element may be inclined to the central axis of the beam. Preferably, the central axis of the first deformable element is substantially perpendicular to the central axis of the beam. More preferably, the central axis of the first deformable element is, in use, substantially vertical. Having a central axis which is substantially perpendicular to the central axis of the beam increases the stiffness of the first deformable element in that direction, with the result that the beam tends to bend in the horizontal plane rather than in the vertical plane. This maintains the desired contact height with a vehicle during impact, thereby giving a more controlled and so more predictable impact performance.

[0010] Each of said webs may be non-planar.

[0011] Preferably, each of said webs may comprise two sections which are inclined to one another.

[0012] The first deformable element may comprise a hollow section of polygonal or rounded cross section.

[0013] Preferably, the hollow section is of substantially hexagonal cross section. If the hollow section is of substantially hexagonal cross section, this will result in a controllable and tuneable non-linear force displacement characteristic.

[0014] The safety barrier may comprise a second deformable element, the second deformable element being smaller than the first deformable element and being positioned inside the first deformable element such that the second deformable element will not deform until the first deformable element has deformed. This will allow the safety barrier to accommodate a range of vehicle masses and speeds. In the event of a light impact, such as that caused by a small or light vehicle striking the safety barrier, only the first deformable element will collapse. In the event of a more severe impact, such as that caused by a large or heavy vehicle striking the safety barrier, the first deformable element will deform, followed by the second deformable element. As the second deformable element cannot deform until the first deformable element has deformed, it will be possible to accurately predict the collapse behaviour of both the first and second deformable elements.

[0015] The second deformable element may be more rigid than the first deformable element.

[0016] The second deformable element may comprise a hollow section.

[0017] The hollow section may be substantially the same shape as the first deformable element.

[0018] The invention will now be illustrated by way of example with reference to the following drawings:

Figure 1 shows a plan view of part of a safety barrier according to the invention;

Figure 2 shows a perspective view of the safety barrier illustrated in Figure 1; and

Figures 3a and 3b show two embodiments of deformable elements having a substantially hexagonal cross-section for use in a safety barrier according to the invention.

[0019] The safety barrier 1 shown in Figures 1 and 2 comprises a beam 2 and a plurality of supports 3, the beam 2 being directly connected to at least one support 3 by a first deformable element 4, said first deformable element 4 comprising two spaced apart webs 5, 6 which

extend between the beam 2 and the support 3, the central axis 7 of the first deformable element 4 being substantially vertical so that it is substantially perpendicular to the central axis 8 of the beam 2.

[0020] The first deformable element 4 consists of a hollow section of hexagonal cross section. Two parallel faces 9a, 9b of the hexagonal section are connected to the beam 2 and support 3 respectively, and the remaining faces 9c, 9d, 9e, 9f together form the two spaced apart webs 5, 6 which extend between the beam 2 and the support 3. The two faces 9a, 9b are connected to the beam 2 and support 3 by any suitable means such as welding.

[0021] A second deformable element 10 is positioned inside the first deformable element 4. The second deformable element 10 also consists of a hollow section of hexagonal cross section, but is smaller than the first deformable element 4. It is also more rigid than the first deformable element 4. The central axis 11 of the second deformable element 10 is also substantially vertical so that it is substantially perpendicular to the central axis 8 of the beam 2.

[0022] One face 12a of the six faces 12a, 12b, 12c, 12d, 12e, 12f of the second deformable element 10 is connected to the inside of the face 9a of the first deformable element 4 which is connected to the support 2 by any suitable means such as welding or bolting.

[0023] The beam 2, supports 3 and first and second deformable elements 4, 10 may be made from any suitable material such as steel (plain, stainless, weathering, painted or galvanized), aluminium, plastic or composite.

[0024] In the safety barrier shown in Figures 1 and 2 the beam 2 and supports 3 are rectangular box sections. However, any suitable beam and supports may be used.

[0025] In the event of a light impact, such as that caused by a small (or light) vehicle striking the safety barrier 1, only the first deformable element 4 will deform. In the event of a more severe impact, such as that caused by a large (or heavy) vehicle striking the safety barrier 1, the first deformable element 4 will deform progressively, followed by the second deformable element 10.

[0026] As the first deformable element 4 is directly connected to the beam 2 and support 3, it is possible to accurately predict the collapse behaviour of the first deformable element 4 using computer analysis and laboratory experiment.

[0027] Similarly, as the second deformable element 10 is smaller than the first deformable element 4 and is connected to the inside of the face 9a of the first deformable element 4 which is connected to the support 2, the second deformable element 4 cannot deform until the first deformable element 4 has deformed. This means that it is also possible to accurately predict the collapse behaviour of the second deformable element 10 using computer analysis and laboratory experiment.

[0028] In the event that the safety barrier is to be used in areas where severe impacts are unlikely, the second deformable element 10 may be omitted.

Figures 3a and 3b show two embodiments of deformable elements having a substantially hexagonal cross-section for use in a safety barrier according to the invention.

Although the deformable elements are preferably hexagonal in cross-section, it is not necessary for the deformable element to be a perfect hexagon. Thus, it is acceptable for the deformable element to have a shape such as that shown in Figure 3b. Such a shape may arise where the deformable element is formed from a hollow section having a square or rectangular cross-section.

Claims

1. A safety barrier comprising a beam and a plurality of supports, the beam being directly connected to at least one support by a first deformable element, said first deformable element comprising at least two spaced apart webs which extend between the beam and said support.

2. A safety barrier according to claim 1, wherein the central axis of the first deformable element is inclined to the central axis of the beam.

3. A safety barrier according to claim 2, wherein the central axis of the first deformable element is substantially perpendicular to the central axis of the beam.

4. A safety barrier according to claim 3, wherein the central axis of the first deformable element is, in use, substantially vertical.

5. A safety barrier according to any preceding claim, wherein each of said webs is non-planar.

6. A safety barrier according to claim 5, wherein each of said webs comprises two sections which are inclined to one another.

7. A safety barrier according to claim 5 or claim 6, wherein the first deformable element comprises a hollow section of polygonal or rounded cross section.

8. A safety barrier according to claim 7, wherein the hollow section is of hexagonal cross section.

9. A safety barrier according to any preceding claim, wherein the safety barrier further comprises a second deformable element, the second deformable element being smaller than the first deformable element and being positioned inside the first deformable element such that the second deformable element will not deform until the first deformable element has deformed.

10. A safety barrier according to claim 9, wherein the

second deformable element is more rigid than the first deformable element.

11. A safety barrier according to claim 9 or claim 10, wherein the second deformable element comprises a hollow section.

12. A safety barrier according to claim 11, wherein the hollow section is of the same shape as the first deformable element.

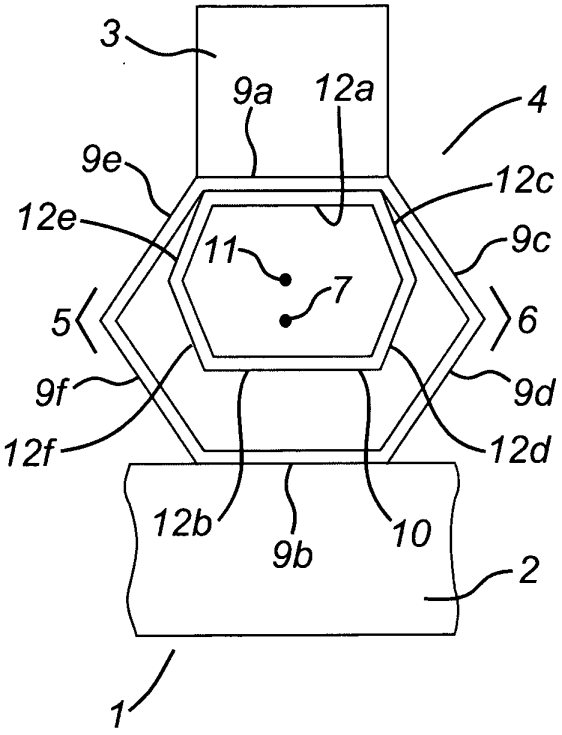


FIG. 1

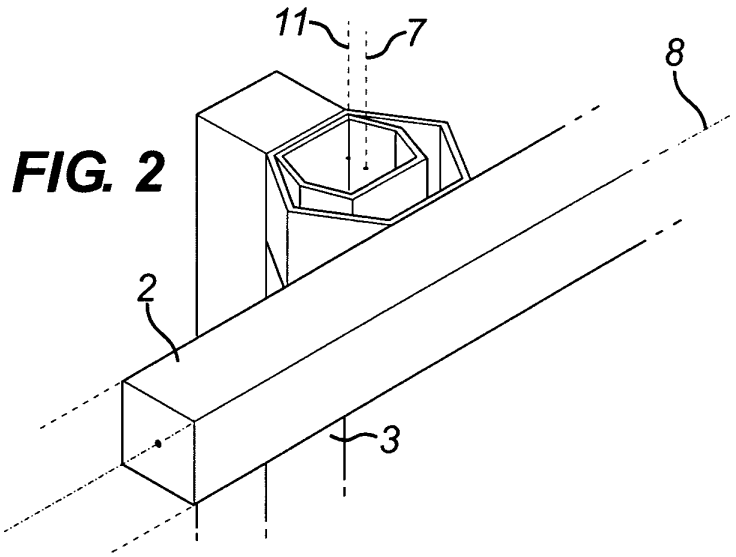


FIG. 2

FIG. 3a

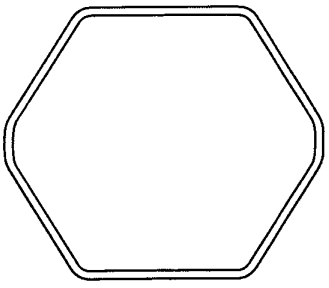
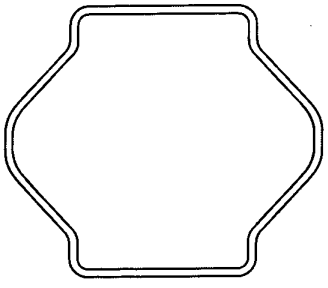


FIG. 3b



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EUROPEAN SEARCH REPORT

Application Number
EP 07 25 0321

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 161 356 A (TUBAUTO) 6 July 1973 (1973-07-06) * page 2, lines 14-34; figures 1,7-9 * -----	1-9,11, 12	INV. E01F15/04
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X	DE 20 2005 013218 U1 (SGGT STRASENAUSSTATTUNGEN GMBH [DE]) 27 October 2005 (2005-10-27) * figures 1-3 * -----	1-4	
			TECHNICAL FIELDS SEARCHED (IPC) E01F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 April 2007	Tran, Kim-Lien

CATEGORY OF CITED DOCUMENTS

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