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(54) **Safety barrier**

(57) A safety barrier comprising a beam mounted on a plurality of supports, the beam being connected to at least one support by a connector mounted in a slot.

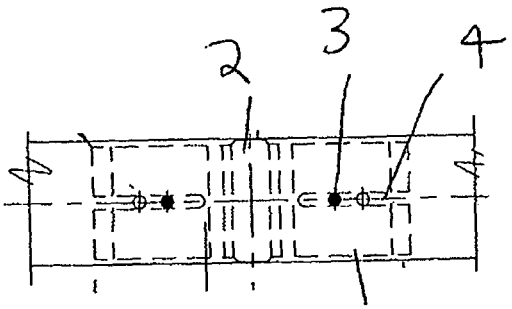

FIG. 7a

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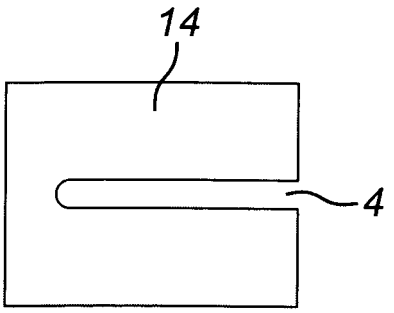
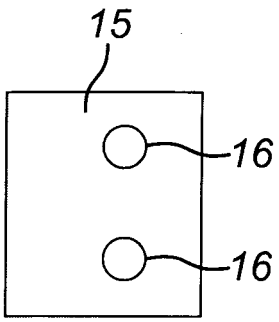


FIG. 7b



Description

[0001] The invention relates to a safety barrier (also known as a vehicle restraint system), particularly, but not exclusively, a safety barrier for a road.

[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 rail, also known as a beam, supported by posts at regular intervals. The beam is attached to the posts by bolts, which are designed to shear in the event of a severe impact, such that the posts are knocked over while the beam acts to redirect the vehicle back onto the carriageway.

[0005] A problem with the known safety barrier is that the strength of the connection between the beam and the posts is the same irrespective of the direction of loading.

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

[0007] According to a first aspect, the invention provides a safety barrier comprising a beam mounted on a plurality of supports, the beam being connected to at least one support by a connector mounted in a slot.

[0008] As the connector is mounted in a slot, it provides varying degrees of load capacity depending on the direction of loading on the connector. This provides sufficient load capacity for heavy impacts but would not be too severe for light impacts.

[0009] The slot may be such that the connector is disconnectable from the slot when the loading is in line with the axis of the beam. For example, the slot may be open at one or both ends. Alternatively, it may be closed, but shaped so that the connector can disconnect from the slot when moved in a linear direction. For example, the slot may be L-shaped, or the section which closes the slot may be of such a thickness that it may readily be sheared by the connector when it is moved in a linear direction.

[0010] This will mean that the connection is "strong" in the lateral direction of the beam in order to support the barrier on impact, but "weak" in the axial direction of the beam in order to reduce the severity of the impact and to prevent excessive damage to the vehicle. Moreover, if the connector can disconnect rather than shearing in the event of an impact, it will mean that it is possible to use stronger connectors, which will provide greater resistance in the lateral direction whilst still enabling the support to disconnect from the beam in the event of loading in line with the axis of the beam.

[0011] The slot may be substantially parallel to the axis of the beam. Alternatively, the slot may be substantially parallel to said support.

[0012] The beam may be connected to said support by one or more brackets, a slot being provided in each bracket.

[0013] The bracket(s) may be such that the connector is disconnectable from the beam irrespective of whether the beam is impacted on one side of said support or the other.

[0014] Each bracket may be substantially L-shaped.

[0015] The beam may be connected to said support by two L-shaped brackets. Each bracket may include a slot which is open at one end. The brackets may be arranged such that the slot in each bracket is open at an opposite end. Alternatively, the brackets may be arranged such that the slot in each bracket is open at the same end.

[0016] Alternatively, each bracket may be substantially planar.

[0017] Said bracket may include a slot which is open at both ends.

[0018] Said support may include a cut-out beneath the slot.

[0019] Said cut-out may be sufficiently deep to allow the connector to pass through the support and so to disconnect from the slot.

[0020] Any suitable connector may be used. For example, each connector may be a bolt.

[0021] Each connector may shear when subjected to an impact of a force above a specified level. This will enable the safety barrier to perform in a controlled manner.

[0022] The beam may be mounted above the supports. Usually, the beam in known safety barriers is mounted in front of the supports to increase the strength of the safety barrier in the lateral direction. However, because the present invention enables stronger connectors to be used, this is no longer necessary, with the result that the beam may be mounted above the supports. This allows a safety barrier to be provided which has a narrower profile than known safety barriers making it particularly suitable for use in areas where space is limited. This mounting position also acts to improve the ergonomics during assembly, in that the installer does not need to support the weight of the beam while inserting the bolts, as with the known barrier systems.

[0023] The beam may comprise a hollow member, preferably a plurality of hollow members. Usually the beam in known safety barriers has a small horizontal dimension and a large vertical dimension, but a problem with such beams is that they have sharp edges and so are not suitable for use in areas to which pedestrians may have access. Using a beam which comprises a hollow member overcomes this problem. The hollow member may be of any suitable cross section. For example it may be of square, rectangular, circular, oval, hexagonal or octagonal cross section.

[0024] Adjoining hollow members may be connected

together by a joint which is inserted between two hollow members, the hollow member and the joint being provided with one or more apertures for receiving a connector, the apertures being positioned such that the apertures in the hollow members and in the joint do not align completely when the hollow members are connected together. This reduces the amount of free play in the beam.

[0025] The hollow members may comprise equiaxed box sections.

[0026] The beam may comprise a plurality of arrays of apertures, each array being for connecting the beam to a support. By providing a linear or non-linear array of apertures, inaccuracies in the positioning of the support may be accommodated.

[0027] Each support may comprise a hollow member of rectangular cross-section.

[0028] Any suitable cross-sectional aspect ratios of the hollow member may be used.

[0029] The safety barrier may be made of any suitable material such as steel, aluminium or composites.

[0030] According to a second aspect, the invention provides a beam for use in a safety barrier, the beam comprising two hollow members which are connected together by a joint which is inserted in between the two hollow members, the hollow members and the joint being provided with one or more apertures for receiving a connector, the apertures being positioned such that the apertures in the joint and in the hollow members do not align completely when the hollow members and the joint are connected together.

[0031] According to a third aspect, the invention provides a beam for use in a safety barrier, the beam comprising a plurality of arrays of apertures, each array being for connecting the beam to a support. The arrays may be linear or non-linear.

[0032] According to a fourth aspect, the invention provides a tool for use in assembling a safety barrier, the tool comprising an elongate member for insertion between two hollow members which are being connected together to form a beam. This tool allows the hollow members to be connected together with little or no free play. This tool also ensures that a sufficient gap is provided between the hollow members to allow for expansion of the hollow members in hot weather.

[0033] The invention will now be illustrated with reference to the following drawings of which:

Figure 1 shows a side view of a first embodiment of a safety barrier according to the invention;

Figure 2 shows a plan view of a box section from the safety barrier of Figure 1;

Figure 3 shows a plan view of a joint from the safety barrier of Figure 1;

Figure 4 shows a side view of part of the beam from the safety barrier of Figure 1 during assembly;

Figure 5 shows a side view of part of the beam from the safety barrier shown in Figure 1;

Figure 6 shows a side view of part of the beam from the safety barrier shown in Figure 1;

Figure 7a shows a plan view of part of the beam from the safety barrier shown in Figure 1;

Figure 7b shows plan views of the two flanges of the bracket shown in Figure 7a.

Figure 8 shows a side view of part of the beam from a second embodiment of a safety barrier according to the invention;

Figure 9 shows a perspective view of a support and bracket from the safety barrier of Figure 8;

Figure 10 shows a perspective view of a support from the safety barrier of Figure 8; and

Figure 11 shows a perspective view of part of the beam from a third embodiment of a safety barrier according to the invention.

[0034] The safety barrier shown in Figures 1 to 7 comprises a beam 1 mounted on a plurality of supports (posts) 2, the beam 1 being connected to each support 2 by two connectors (bolts) 3, each connector being mounted in a slot 4.

[0035] The beam 1 comprises a plurality of equiaxed box sections (i.e. box sections whose two thickness dimensions are generally the same) 5 joined end to end, with a gap between adjoining box sections 5. Each box section 5 comprises a number of linear arrays of bolt holes 6, each array being for connecting the box section 5 to a support 2. The box section 5 also comprises two further linear arrays of bolt holes 7 positioned at either end of the box section 5, each array being for connecting the box section 5 to another box section 5.

[0036] The box sections 5 are joined together by a joint 8 which comprises a smaller equiaxed box section which is dimensioned so that it will fit inside two box sections 5 positioned end-to-end. The joint 8 comprises two linear arrays of bolt holes 9 positioned at either end of the joint 8.

[0037] The beam 1, supports 2 and joints 8 are all made from galvanised steel.

[0038] The box sections 5 are connected together by positioning the joint 8 so that most of one half is inside one box section 5 and most of the other half is inside another box section 5, the two linear arrays of bolt holes 9 at either end of the joint 8 being aligned with the linear array of bolt holes 7 at the end of each box section 5. Six bolts 10 are then passed through the aligned bolt holes 7, 9 and fastened in place with six nuts 11 so that the bolts are finger tight. The box sections 5 are pulled by hand to remove any play within the joint and the nuts 11

are then fully tightened. A gap pin 12 is used to check that the gap between the two box sections 5 is at least 10mm. The bolt holes 7, 9 are positioned so that they are not completely aligned but instead overlap slightly when the joint 8 is positioned inside the box sections 5, thereby reducing the amount of play in the joint.

[0039] Each support 2 comprises a box section of rectangular cross-section, and is concreted into the ground.

[0040] The beam 1 is connected to each support 2 by two L-shaped brackets 13. Each bracket 13 comprises two flanges 14, 15, of unequal length which are substantially perpendicular to one another. The longer flange 14, includes a slot 4, which is open at one end and closed at the other end. The slot 4 extends from a position close to the joint of the two flanges 14, 15, to the opposite edge of the flange 14. The other flange 15 includes two bolt holes 16 for connecting the bracket 13 to the support 2.

[0041] The brackets 13 are positioned on either side of the support 2 so that each longer flange 14 abuts the beam 1 and each shorter flange 15 abuts the support 2. The slot 4 in each longer flange 14 is aligned with one of the linear array of bolt holes 6 in the beam 1. Two bolts 17 are passed through the bolt holes 16 in the shorter flange 15 to fix each bracket 13 to the support 2. A restrictor plate 18 is placed over the slot 4 in the bracket 13, and a bolt 3 is then passed through the restrictor plate 18, through the slot 4 and through one of the pairs of bolt holes from the linear array of bolt holes 6 in the beam 1. Having an array of bolt holes 6 means that it does not matter if the support 2 has not been accurately positioned as it will still be possible to attach the support 2 to the beam 1 to the necessary tolerance.

[0042] In the event of a light impact, one of the bolts 3 will disconnect from the beam 1 by sliding out of the slot 4 in which that bolt 3 is mounted, and one of the bolts 3 will shear, reducing the severity of the impact. In the event of a heavy impact both bolts may shear. This enables the use of stronger bolts 3 than would be used in the known safety barriers, thereby increasing the strength of the safety barrier in the lateral direction.

[0043] Disconnection will take place irrespective of whether the beam 1 impacted on one side of the support 2 or the other.

[0044] The safety barrier shown in Figures 8 to 10 differs from that shown in Figures 1 to 7 in that it uses different supports and brackets.

[0045] Each support 19 has a cut-out 20 of rectangular cross-section at its upper end.

[0046] Each bracket 21 consists of two separate strips 22 which are welded to the top of one of the supports 19 on either side of the cut-out 20 such that a gap is left between the two strips 22. The gap forms a slot 23 in the bracket 21.

[0047] The support 19 and its associated bracket 21 are attached to the beam 24 by pushing two bolts 25 through two pairs of bolt holes (not shown) from the linear array of bolt holes in the beam, and then through the slot 23. The spacing between the bolts 25 and the support 19 should not be too great otherwise the bracket 21 may become too deformed following an impact to allow the bolts 25 to slide out of the open-ended slot 23. A nut 26 is placed on the free end of each bolt 25. The cut-out 20 is sufficiently deep that the bottom of the bolt 25 and nut 26 is above the bottom of the cut-out 20.

[0048] In the event of an impact, both bolts 25 will disconnect from the beam 24 by sliding out of the open-ended slot 20. Neither bolt 25 will shear as in the embodiment shown in Figures 1 to 7.

[0049] Again, disconnection will take place irrespective of whether the beam 1 is impacted on one side of the support 2 or the other.

[0050] The safety barrier shown in Figure 11 differs from that shown in Figures 1 to 7 in that it uses different brackets.

[0051] The beam 1 is connected to each support 2 by two L-shaped brackets 27, each of which comprises two flanges 28, 29 of unequal length as in the safety barrier of Figures 1 to 7. However, the bracket 27 differs from the bracket 13 of Figures 1 to 7 in that there are two slots 30. Moreover, these slots 30 are positioned in the shorter flange 29, not the longer flange 28. The two slots 30 are parallel to one another and extend from the central region of the shorter flange 29 to the edge of the shorter flange 29. Thus, the slots 30 are closed at one end and open at the other end.

[0052] The brackets 27 are positioned on either side of the support 2 so that each longer flange 28 abuts the beam and each shorter flange 29 abuts the support 2. Thus, the slots 30 are parallel to the support 2, not parallel to the beam 1 as in the safety barrier of Figures 1 to 7. A restrictor plate 32 is positioned beneath each of the longer flanges 28 such that it abuts the longer flange 28.

[0053] The longer flange 28 is connected to the beam 1 by a bolt 31, which first passes through one of the restrictor plates 32. The shorter flange 29 is connected to the support 2 by two bolts 33, each of which passes through one of the slots 30.

[0054] In the event of an impact, the bolts 33 will disconnect from the support 2 by sliding out of the slots 30 in which the bolts 33 are mounted.

Claims

1. A safety barrier comprising a beam mounted on a plurality of supports, the beam being connected to at least one support by a connector mounted in a slot.

2. A safety barrier according to claim 1, wherein the slot is such that the connector is disconnectable from the slot when the loading is in line with the axis of the beam.

3. A safety barrier according to claim 2, wherein the slot is substantially parallel to the axis of the beam.

4. A safety barrier according to claim 2, wherein the slot is substantially parallel to said support.

5. A safety barrier according to any preceding claim, wherein the slot is open at at least one end.

6. A safety barrier according to claim 5, wherein the slot is open at both ends.

7. A safety barrier according to any preceding claim, wherein the beam is connected to said support by one or more brackets, a slot being provided in each bracket.

8. A safety barrier according to claim 7, wherein each bracket is substantially L-shaped.

9. A safety barrier according to claim 8, wherein the beam is connected to said support by two L-shaped brackets, each including a slot which is open at one end.

10. A safety barrier according to claim 7, wherein each bracket is substantially planar.

11. A safety barrier according to claim 10, wherein said bracket includes a slot which is open at both ends.

12. A safety barrier according to claim 10 or claim 11, wherein said support includes a cut-out at its upper end, beneath the slot.

13. A safety barrier according to claim 12, wherein said cut-out is sufficiently deep to allow the connector to pass through the support and so to disconnect from the slot.

14. A safety barrier according to any preceding claim, wherein each connector shears when subjected to an impact of a force above a specified level.

15. A safety barrier according to any preceding claim, wherein each connector is a bolt.

16. A safety barrier according to any preceding claim, wherein the beam is mounted above the supports.

17. A safety barrier according to any preceding claim, wherein the beam comprises a hollow member.

18. A safety barrier according to claim 17, wherein the beam comprises a plurality of hollow members.

19. A safety barrier according to claim 18, wherein adjoining hollow members are joined together by a joint which is inserted between the two hollow members, the hollow members and the joint being provided with one or more apertures for receiving a connector, the apertures being positioned such that the apertures in the hollow members and in the joint do not align completely when the hollow members and the joint are joined together.

20. A safety barrier according to any of claims 17 to 19 wherein the hollow members are equiaxed box sections.

21. A safety barrier according to any preceding claim, wherein the beam comprises a plurality of arrays of apertures, each array being for connecting the beam to a support.

22. A beam for use in a safety barrier, the beam comprising two hollow members which are joined together by a joint which is inserted in between the two hollow members, the hollow members and the joint being provided with one or more apertures for receiving a connector, the apertures being positioned such that the apertures in the joint and in the hollow members do not align completely when the hollow members and the joint are joined together.

23. A beam for use in a safety barrier, the beam comprising a plurality of arrays of apertures, each array being for connecting the beam to a support.

24. A tool for use in assembling a safety barrier, the tool comprising an elongate member for insertion between two hollow members which are being connected together to form a beam.

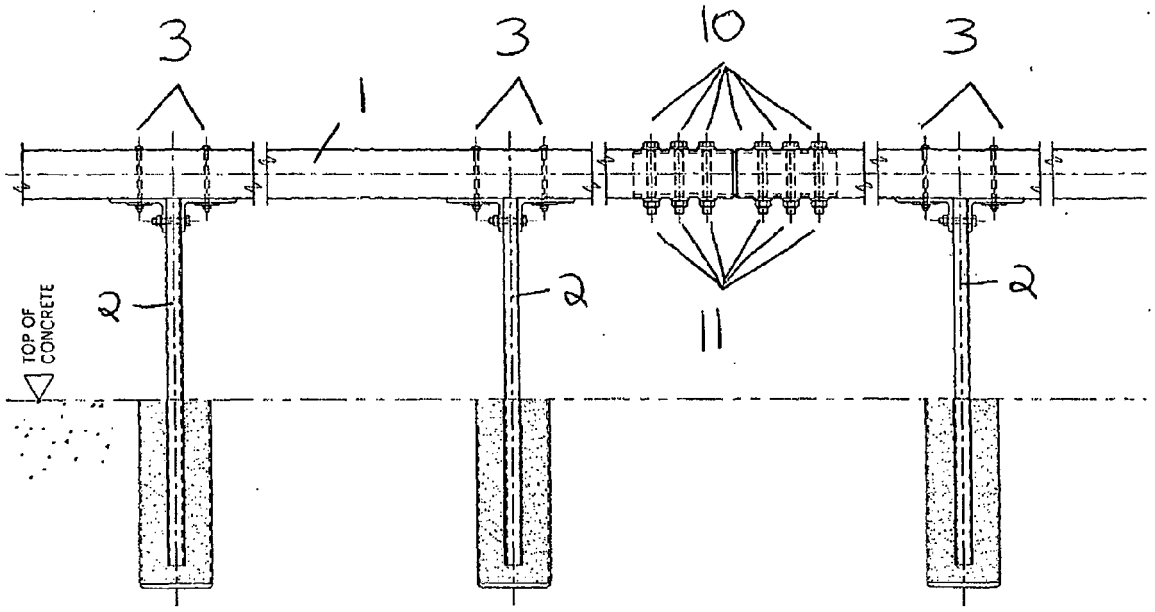


FIG. 1

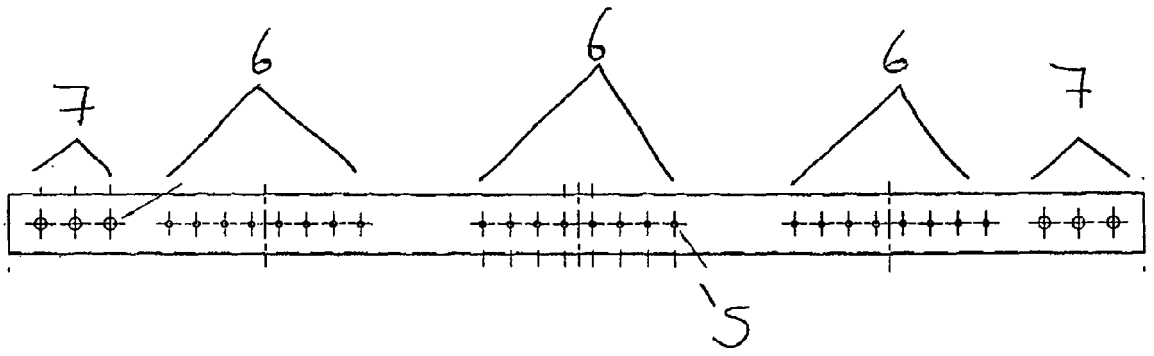


FIG. 2

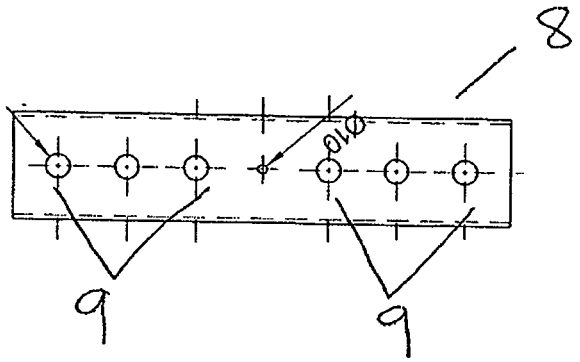


FIG. 3

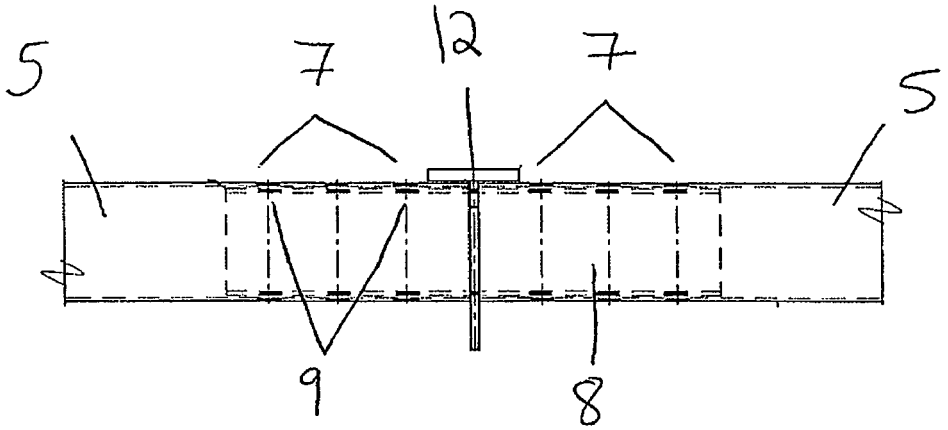


FIG. 4

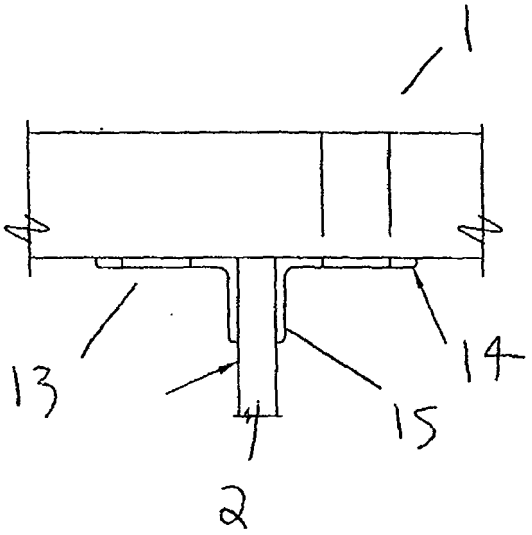


FIG. 5

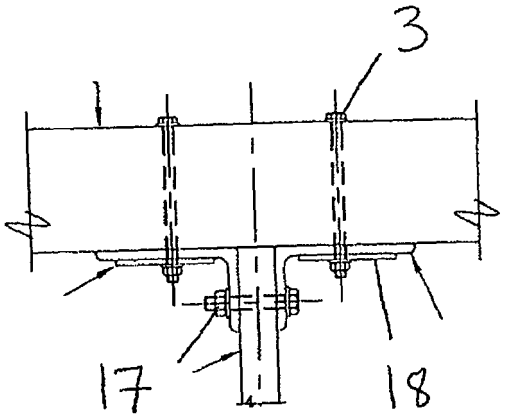


FIG. 6

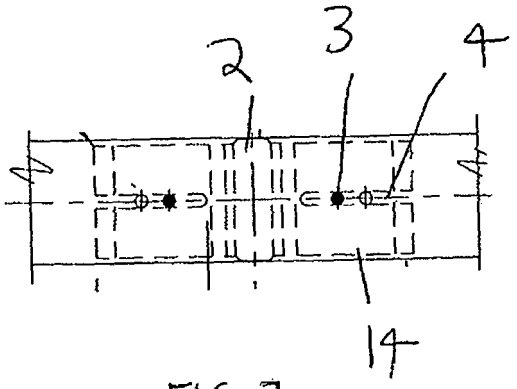


FIG. 7a

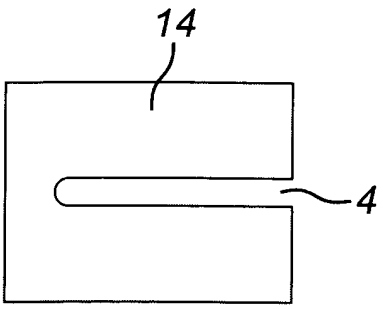


FIG. 7b

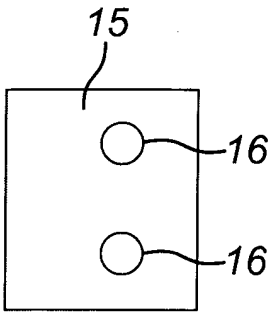
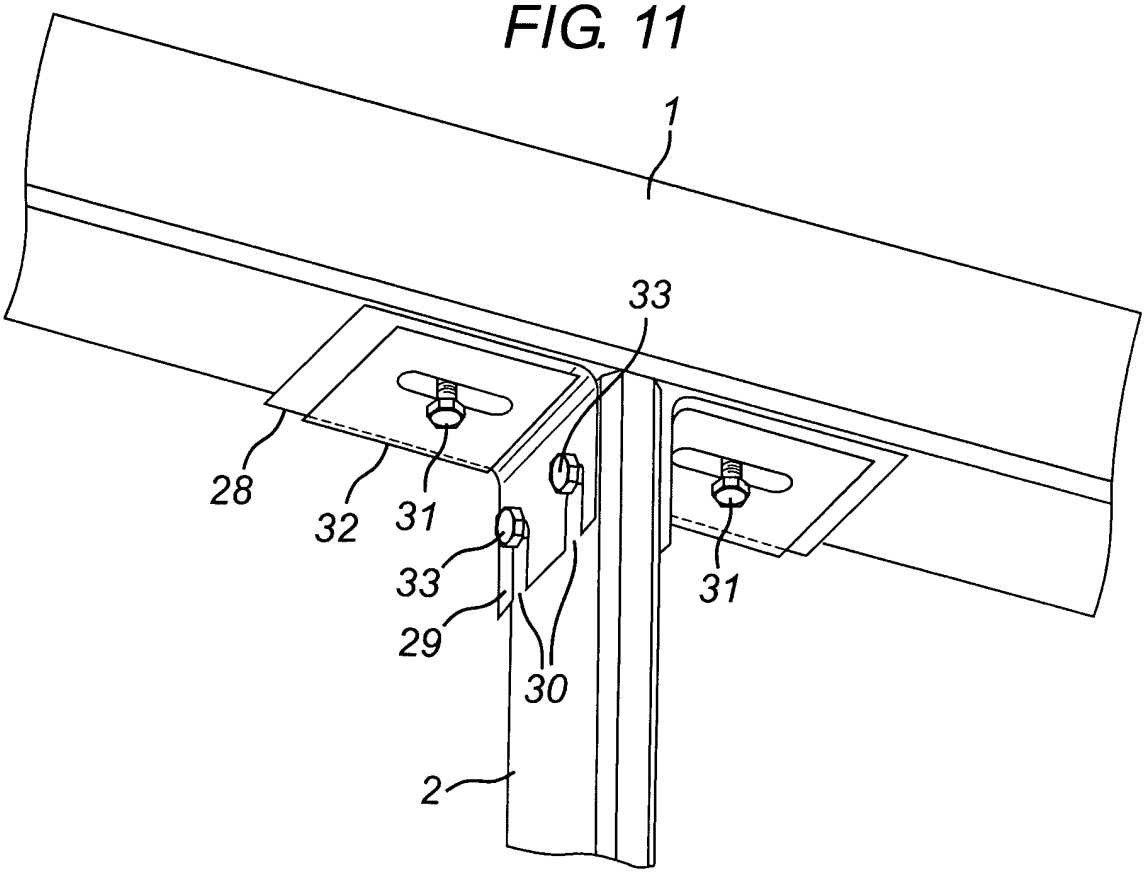


FIG. 11



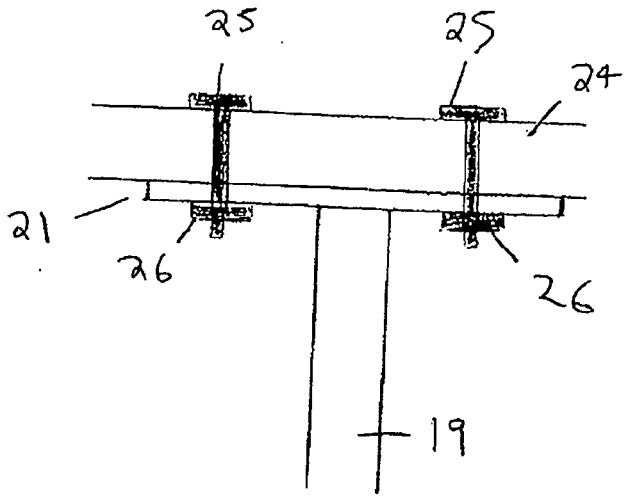


FIG 8

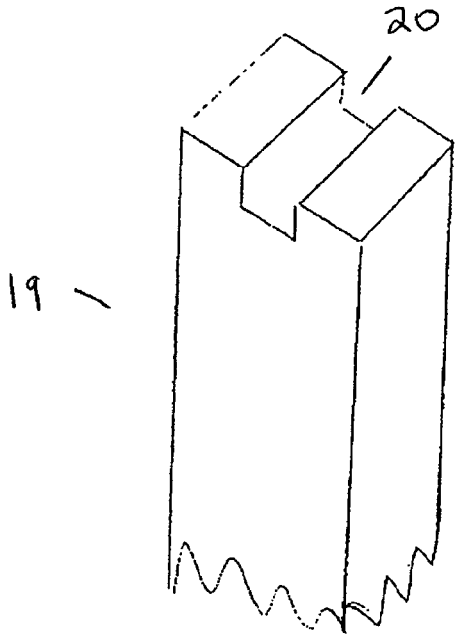


FIG 10

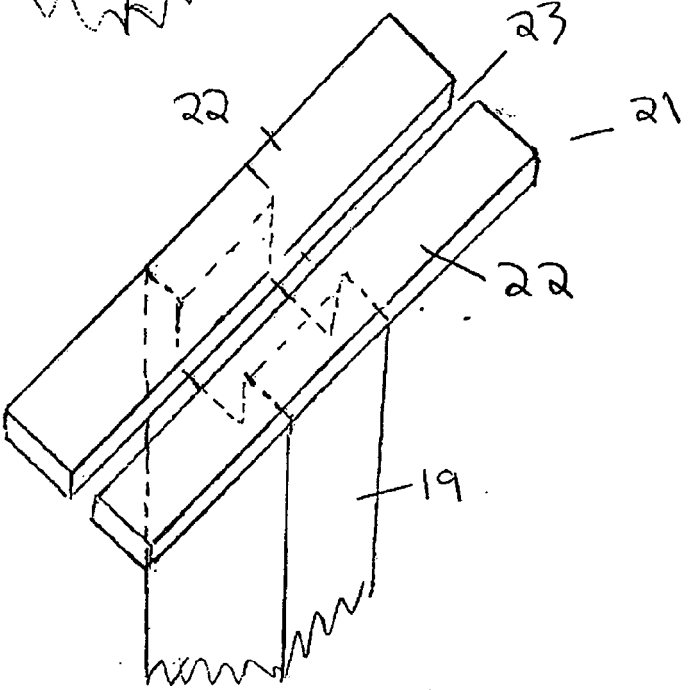


FIG 9

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EUROPEAN SEARCH REPORT

Application Number
EP 07 25 0320

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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X	EP 1 612 333 A (VARMFOERZINKNING AB [SE]) 4 January 2006 (2006-01-04) * figure 4 * -----	1,2,5-7, 11-18, 23,24	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	24 April 2007	Tran, Kim-Lien

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 25 0320

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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24-04-2007

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82