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(54) **Guardrail spacer**

(57) A guardrail (10) comprising a plurality of vertical posts (11) driven into the ground, for supporting a transverse rail (13) that constitutes a continuous barrier at the shoulders of a roadway, further comprising:

-- damping elements (24) interposed between each post (11) and the rail (13), which are meant to dis-

sipate part the energy transferred by the vehicle and provide a mechanical connection between each post and the rail;

-- means for connecting the damping elements and the post;

-- means for connecting the damping elements and the rail.

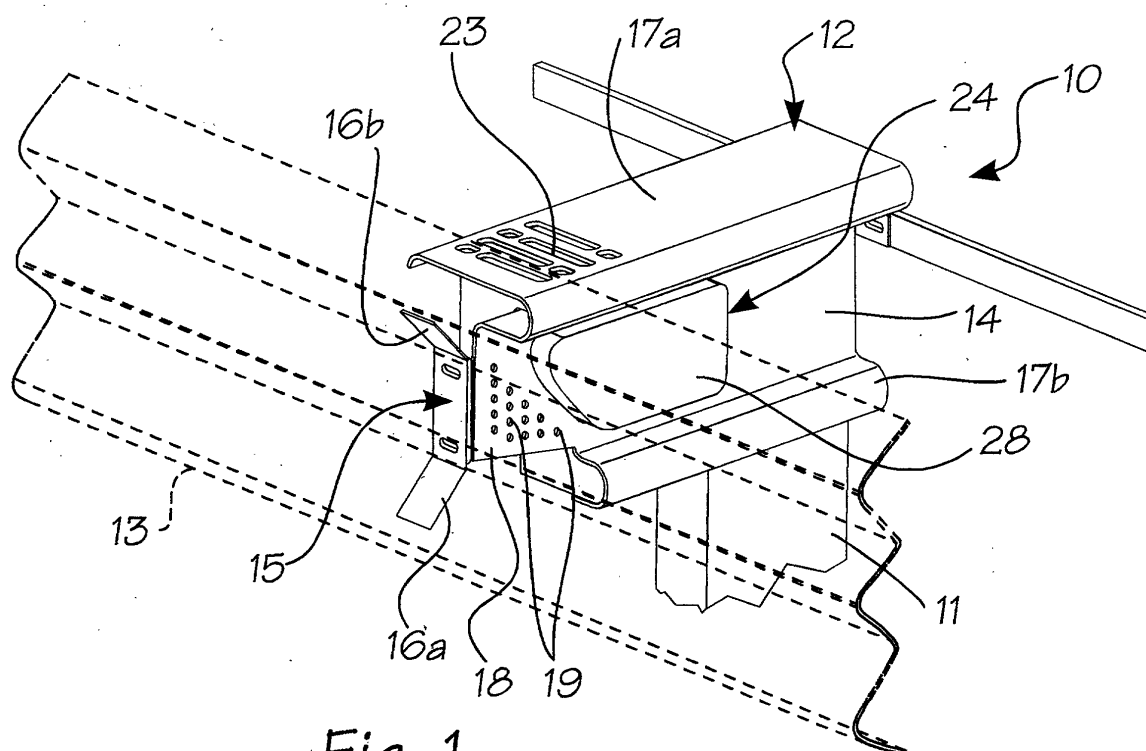


Fig. 1

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Description

[0001] The present invention relates to a guardrail.

[0002] A guardrail is substantially constituted by a plurality of vertical supporting posts driven into the ground, a horizontal rail that constitutes a continuous barrier, and a spacing support for connecting each post and the barrier.

[0003] The technology of road guardrail construction has undergone a considerable revolution over the last decades in order to combine the fundamental requirement of retaining on the roadway vehicles of which the driver has lost control with the requirement of minimizing the deformation of such vehicles in order to protect the life of the driver and passengers.

[0004] During the impact of the vehicle against the road barrier, i.e., the guardrail, the kinetic energy of the vehicle is divided into three main components, i.e., vehicle deformation work, road barrier deformation work, and residual kinetic energy of the vehicle, which changes its trajectory after impact with the barrier.

[0005] It is therefore evident that for example highly rigid concrete barriers perform well the main task of retaining the vehicle on the roadway but are in practice dangerous because, by not undergoing deformation, they do not absorb energy and unfortunately cause considerable deformations to the vehicle and in practice cause severe damage to the driver and passengers.

[0006] Research into this modern barrier has therefore concentrated on the provision of barriers capable of behaving so as to retain the vehicles on the roadway but at the same time absorb energy by deforming, and capable of deforming so as to facilitate a change of trajectory of the vehicle without the vehicle remaining blocked in the impact position, so that a residual part of the initial kinetic energy remains with the vehicle, which continues its trajectory.

[0007] This ensures retention of the vehicle so as to minimize deformation and deceleration thereof, allowing to better safeguard the integrity of the driver and of the passengers.

[0008] The shapes of the components that constitute modern road barriers have undergone radical improvements and enhancements in order to offer the above-described behavior.

[0009] US-5,044,609 and US-5,286,137 provide a clear example of application.

[0010] These patents clearly show that the spacing supports have a fundamental role in contributing to such behavior, and that the shape has been the subject of in-depth studies.

[0011] Attempts are also noted to give the profile the ability to dissipate the energy originating from the impact.

[0012] However, a severe drawback is that the elements are entirely made of steel and are therefore subject to an elastoplastic behavior and thus offer limited energy absorption capabilities.

[0013] The aim of the present invention is to provide a guardrail capable of absorbing a high percentage of the energy of the vehicle that strikes it, without reducing its capacity to retain the vehicle on the roadway.

[0014] Within this aim, an object of the present invention is to provide a guardrail that can be obtained also by modifying already-installed guardrails.

[0015] Another object is to provide a guardrail that is simple.

[0016] This aim and these and other objects that will become better apparent hereinafter are achieved by a guardrail of the type that comprises a plurality of vertical posts driven into the ground, for supporting a horizontal rail that constitutes a continuous barrier at the shoulders of a roadway, characterized in that it comprises:

- damping elements interposed between each post and said rail, which are designed to dissipate part of the energy of the vehicle and provide a mechanical connection between each post and said rail;
- means for connecting said damping elements and said post;
- means for connecting said damping elements and said barrier.

[0017] Further characteristics and advantages of the present invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figures 1 and 2 are two different perspective views of a guardrail according to the invention;

Figure 3 is an exploded perspective view of the guardrail of Figures 1 and 2;

Figure 4 to 7 are transverse sectional views of respective four embodiments of a component of the guardrail.

[0018] With reference to the figures, a guardrail according to the invention is generally designated by the reference numeral 10.

[0019] The guardrail 10 is constituted by a supporting post 11, which is driven into the ground, a spacing support 12, and a continuous transverse rail 13, which is suitable to provide a protective barrier in order to keep a vehicle on the roadway during an impact.

[0020] The spacing support 12 comprises a flat central portion 14, to be arranged vertically, which is provided at the front with a substantially U-shaped coupling element 15 with mutually opposite diverging wings 16a and 16b to be fixed to the rear wall of the rail 13 by means of bolts or similar fixing means, not shown in the figure.

[0021] The longitudinal upper and lower edges of the spacing support 12, designated by the reference numerals 17a and 17b respectively, are substantially C-

shaped, so as to provide longitudinal reinforcement elements.

[0022] On the rear part of the spacing support 12, the longitudinal edges 17a and 17b end at the same imaginary vertical plane, while at the front part the lower longitudinal edge 17b is spaced with respect to the coupling element 15, so that said coupling element is connected to the lower longitudinal edge 17b by a plate-like portion 18 which is substantially triangular and protrudes downward, i.e., from the upper longitudinal edge 17a to the lower longitudinal edge 17b.

[0023] The triangular portion 18 is advantageously provided with a plurality of through holes 19.

[0024] In this manner, the triangular portion 18 is a collapsible portion of the guardrail 10.

[0025] Following the impact of a vehicle, the rail 13 rotates downward about its own longitudinal axis, absorbing part of the kinetic energy of the vehicle and at the same time helping it to remain on the roadway.

[0026] Advantageously, it is possible to provide in the central portion 14 of the spacing support 12 an opening 20 which has, on its perimeter edge, reinforcement lips 21 obtained by bending.

[0027] The opening 20 is substantially quadrangular, with a front side that is inclined downward so as to form the triangular portion 18.

[0028] The spacing support 12 is fixed to the supporting post 11 by means of two wings 22a and 22b, which are monolithic with the spacing support 12.

[0029] In particular, the wing 22a is obtained by bending a corresponding portion of metal plate obtained following the machining of the opening 20, while the wing 22b protrudes from the end portion of the support 12.

[0030] The wings 22a and 22b are provided with through holes for the engagement of bolts, not shown in the figure, for fixing to the post 11, which are also designed to provide structural weakening.

[0031] Advantageously, the upper longitudinal edge 17a of the support 12 is provided, at the front, with holes and slots, generally designated by the reference numeral 23, which are suitable to constitute a concentrated structural weakening region so that the support 12 yields when the stresses caused by the impact of a vehicle exceed a certain maximum threshold, in order to limit the deformations of the vehicle, which otherwise, especially in violent impacts, are an enormous life hazard for the driver and passengers.

[0032] As mentioned, the guardrail 10 is further provided with damping elements 24, which are interposed between each post 11 and the rail 13 and are suitable to dissipate part of the energy of the vehicle.

[0033] Each damping element 24 is substantially constituted by a parallelepipedal body 25, which can be fixed laterally to the spacing support 12 and then fixed to the supporting post 11 and to the rail 13.

[0034] In this manner, the damping element 24 and the spacing support 12 cooperate in parallel to form a support that has a high damping capacity in case of ve-

hicle impact.

[0035] At the front and rear, the body 25 of the damping element 24 has threaded holes, designated by the reference numerals 26a and 26b respectively, for the engagement of screws, not shown in the figure, for fixing respectively to the rail 13 and to the supporting post 11.

[0036] Advantageously, the body 25 can be provided with threaded holes for fixing to the spacing support 12, with which it can also be associated, however, by adhesive bonding.

[0037] If there is no spacing support 12, the damping element 24 itself can act as a support for the rail 13 on the posts 11.

[0038] In the cases shown in the above-described figures, the damping element 24 comprises a parallelepipedal body 25, whose upper and lower edges 27a and 27b are shaped so as to be inserted within the longitudinal edges 17a and 17b of the spacing support 12, which are substantially C-shaped.

[0039] The parallelepipedal body 25 is further provided with a protrusion 28, which runs transversely to the body 25 in order to enter the opening 20 of the support 12.

[0040] Moreover, the protrusion 28 has, perimetricaly with respect to its base, slots 29 for the insertion of the reinforcement lips 21 of the opening 20.

[0041] The damping element 24 can be made of a single or composite material with high damping capacity, as shown in Figures 4 to 7.

[0042] In Figure 4, the damping element 24a is constituted by an outer shell 30, made for example of composite material, and an inner body 31, which is enclosed in the shell and is constituted by a resin that is particularly suitable to dissipate energy when it is deformed.

[0043] Figure 5 illustrates a damping element 24b constituted by a structure of honeycomb composite material filled with resin.

[0044] Figure 6 illustrates a damping element 24c made of rubber with high damping capacity, while Figure 7 is a view of a layered damping element 24d.

[0045] In practice, the materials used can be wood, laminated wood, wood impregnated with resin, rubber, honeycomb structures, plastics and/or resins, and shell-type containment structures made of carbon fiber and filled with resins with high damping capacity or rubber, shell-type containment structures made of glass fiber and filled with resins with high damping capacity or rubber, and shell-type containment structures made of metal and filled with resin with high damping capacity or rubber.

[0046] In practice it has been found that the present invention has achieved the intended aim and objects.

[0047] A guardrail has in fact been provided which, by virtue of the presence of the damping element, allows to dissipate a large amount of kinetic energy produced by the impact of a vehicle against said guardrail, particularly against the rail.

[0048] All the technical details may be replaced with

other technically equivalent elements.

[0049] The materials, so long as they are compatible with the contingent use, as well as the dimensions, may be any according to requirements.

[0050] The disclosures in Italian Patent Application No. PD2001A000093 from which this application claims priority are incorporated herein by reference.

[0051] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A guardrail of the type that comprises a plurality of vertical posts driven into the ground, for supporting a transverse rail that constitutes a continuous barrier at the shoulders of a roadway, **characterized in that** it comprises:

damping elements interposed between each vertical post and said rail, which are designed to dissipate part of the energy transferred by the vehicle and provide a mechanical connection between each vertical post and said rail; means for connecting said damping elements and said vertical post; and means for connecting said damping elements and said rail.

2. The guardrail according to claim 1, **characterized in that** said damping elements comprise a substantially parallelepipedal body.
3. The guardrail according to claim 2, **characterized in that** said means for connection between each damping element and the corresponding vertical post are constituted by screws that engage in corresponding holes formed at the rear of said parallelepipedal body of the damping element.
4. The guardrail according to the preceding claims, **characterized in that** said means for connection between each damping element and the corresponding barrier are constituted by screws that engage in corresponding holes formed at the front of said parallelepipedal body of the damping element.
5. The guardrail according to claim 1, **characterized in that** it comprises a spacing support for mechanical connection between each post and said rail, said damping element being shaped complementarily to said spacing support and being laterally coupled thereto so as to form a single support with high

damping capacity.

6. The guardrail according to claim 5, **characterized in that** said spacing support comprises a central flat portion to be arranged vertically and longitudinal upper and lower edges that are substantially C-shaped so as to provide longitudinal reinforcements, said damping element comprising a parallelepipedal body whose upper and lower edges are shaped so as to be inserted within said longitudinal edges of the spacing support.
7. The guardrail according to claims 5 and 6, **characterized in that** on the front part the end of said lower longitudinal edge of the spacing support is spaced with respect to the end of said lower longitudinal edge, so that the latter is connected to the lower longitudinal edge by a substantially triangular plate-like portion of said central portion of the spacing support, which protrudes downwards and forms a collapsible portion.
8. The guardrail according to claim 7, **characterized in that** said triangular portion is provided with a plurality of through holes.
9. The guardrail according to one or more of claims 5 to 8, **characterized in that** in said central portion of the spacing support there is an opening provided in the perimetric edge with reinforcement lips obtained by bending.
10. The guardrail according to claim 9, **characterized in that** said parallelepipedal body of the damping element is provided with a protrusion that lies transversely to said body in order to enter said opening of the spacing support, said protrusion having, perimetrically to the base, slots for the insertion of said reinforcement lips of the opening.
11. The guardrail according to one or more of claims 5 to 10, **characterized in that** said upper longitudinal edge of the spacing support is provided, at the front, with holes suitable to constitute a concentrated weakening region.
12. The guardrail according to one or more of claims 5 to 11, **characterized in that** said damping element is rigidly coupled to the corresponding spacing support by means of adhesives.
13. The guardrail according to one or more of claims 5 to 11, **characterized in that** said damping element is rigidly coupled to said spacing support by means of threaded couplings.
14. The guardrail according to one or more of the preceding claims, **characterized in that** said damping

element is constituted by an outer shell and an inner body enclosed therein.

15. The guardrail according to claim 14, **characterized in that** said outer shell is made of carbon fiber. 5
16. The guardrail according to claim 14, **characterized in that** said outer shell is made of glass fibers.
17. The guardrail according to claim 14, **characterized in that** said outer shell is made of metallic material. 10
18. The guardrail according to claim 14, **characterized in that** said inner body is made of resin with high damping capacity. 15
19. The guardrail according to claim 14, **characterized in that** said inner body is made of rubber.
20. The guardrail according to one or more of claims 1 to 13, **characterized in that** said damping element is constituted by a structure made of honeycomb composite material filled with resin. 20
21. The guardrail according to one or more of claims 1 to 13, **characterized in that** said damping element is made of rubber with high damping capacity. 25
22. The guardrail according to one or more of claims 1 to 13, **characterized in that** said damping element is made of wood and/or laminated wood and/or wood impregnated with resin and/or rubber and/or plastic and/or resin or materials that are similar in terms of damping capacity. 30
23. The guardrail according to one or more of the preceding claims, **characterized in that** said damping element is made of layered material. 35

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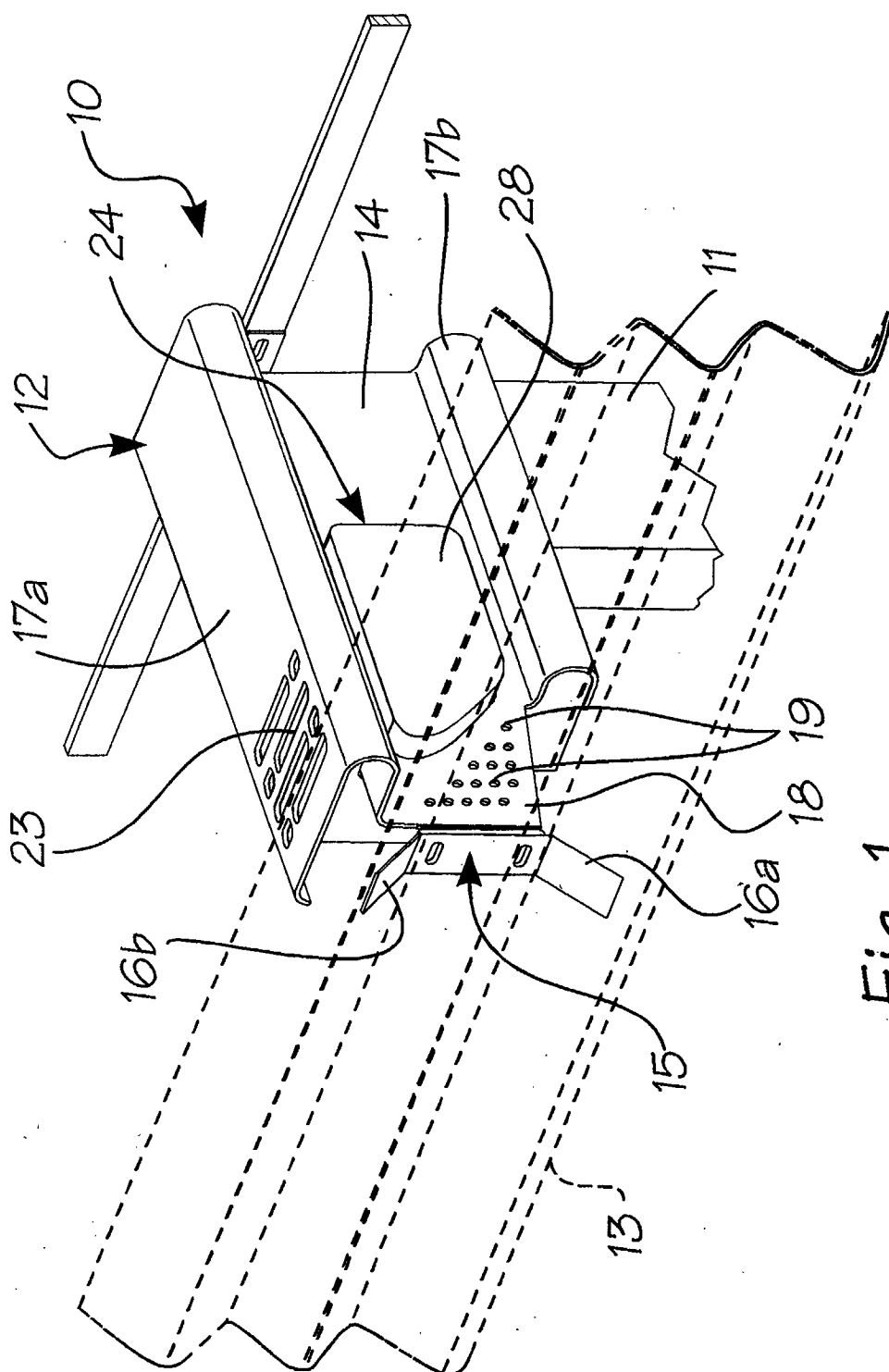
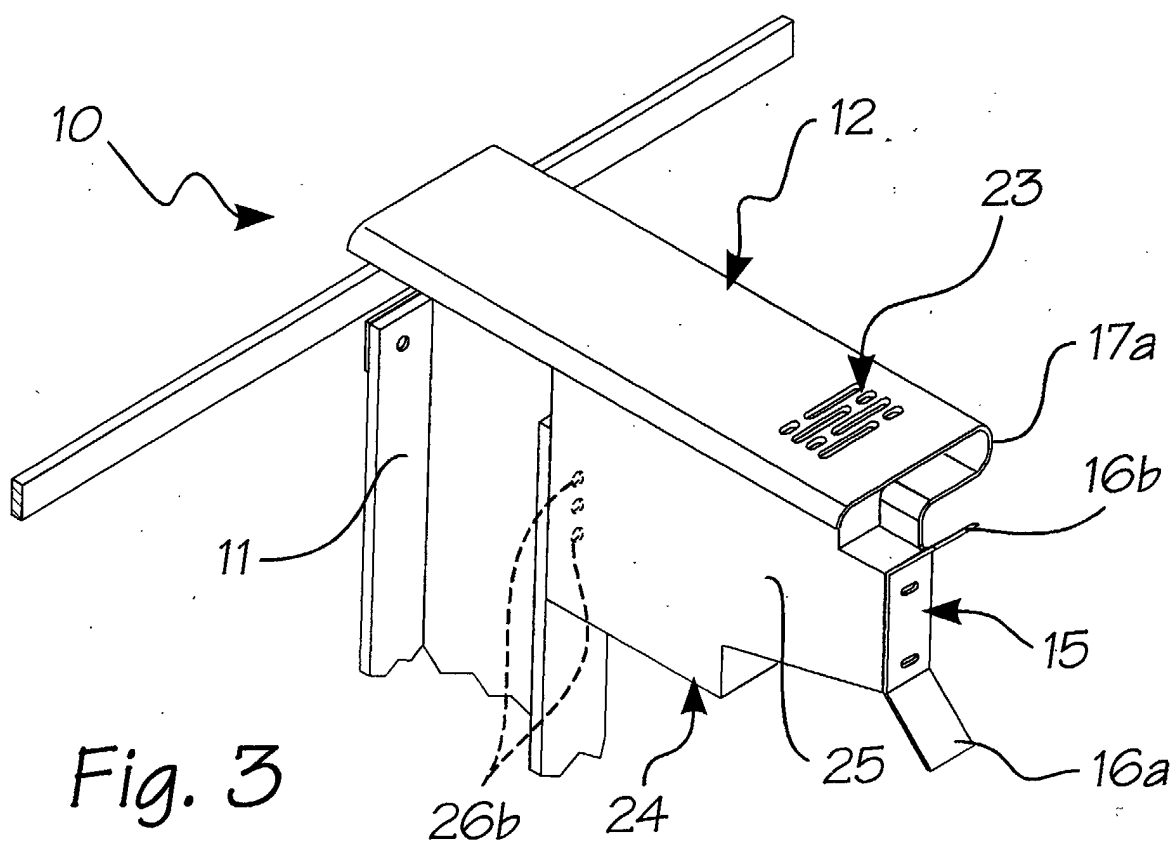
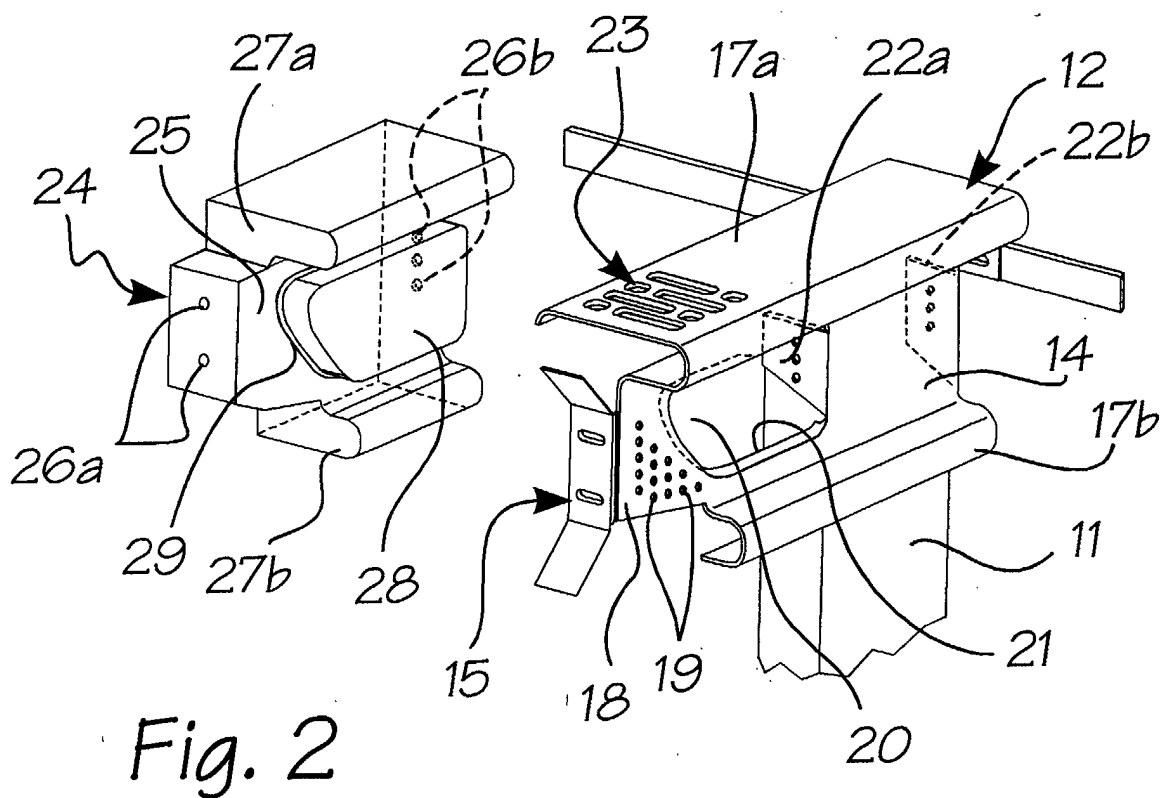


Fig. 1



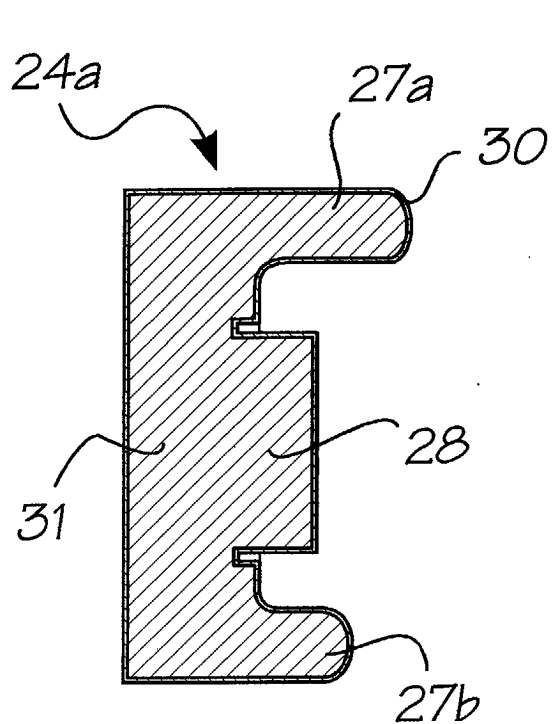


Fig. 4

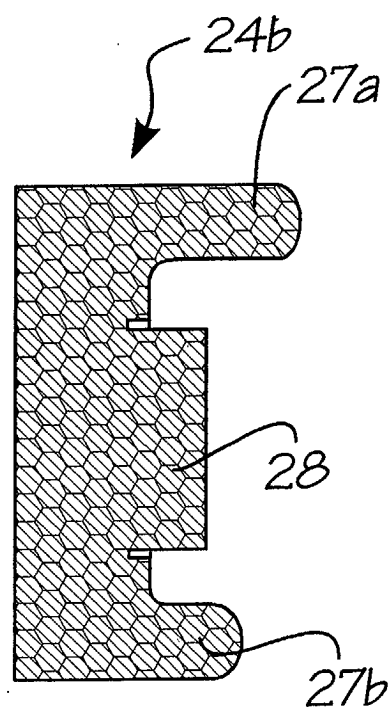


Fig. 5

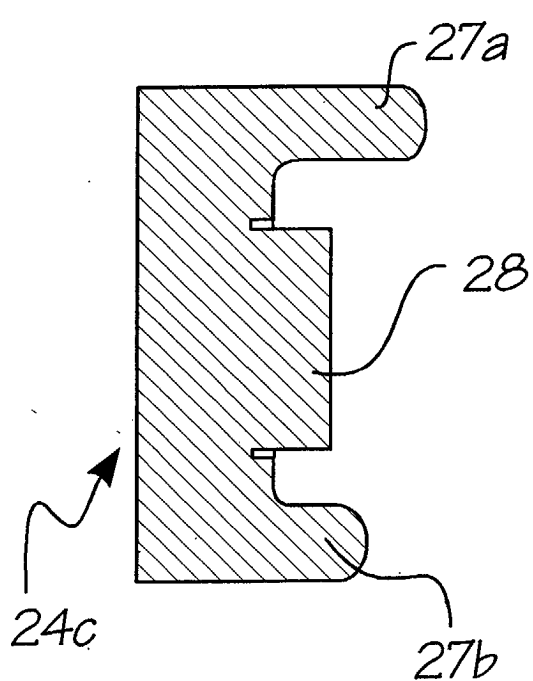


Fig. 6

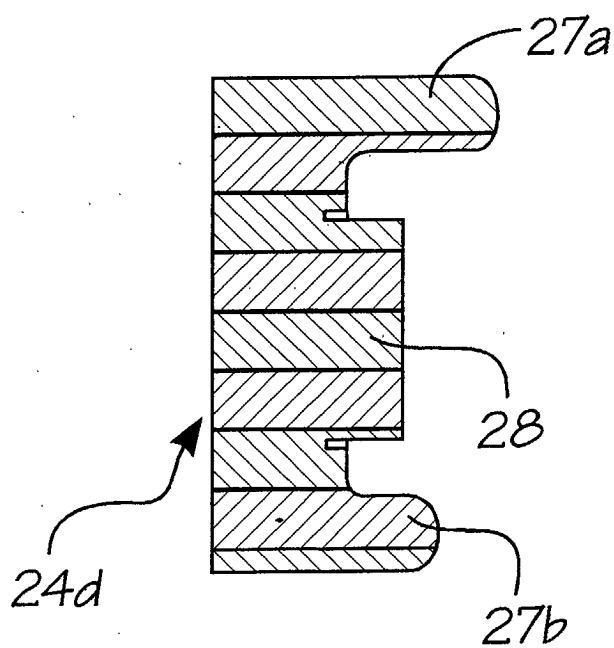


Fig. 7