United States Patent

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[15] **3,638,913**

[45] **Feb. 1, 1972**

[54] HIGHWAY GUARDRAIL DEVICES

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[22] Filed: **Jan. 19, 1970**

[21] Appl. No.: **3,837**

[52] **U.S. Cl.** **256/13.1**

[51] **Int. Cl.** **E01f 15/00**

[58] **Field of Search** 256/13.1, 1; 188/1; 293/84

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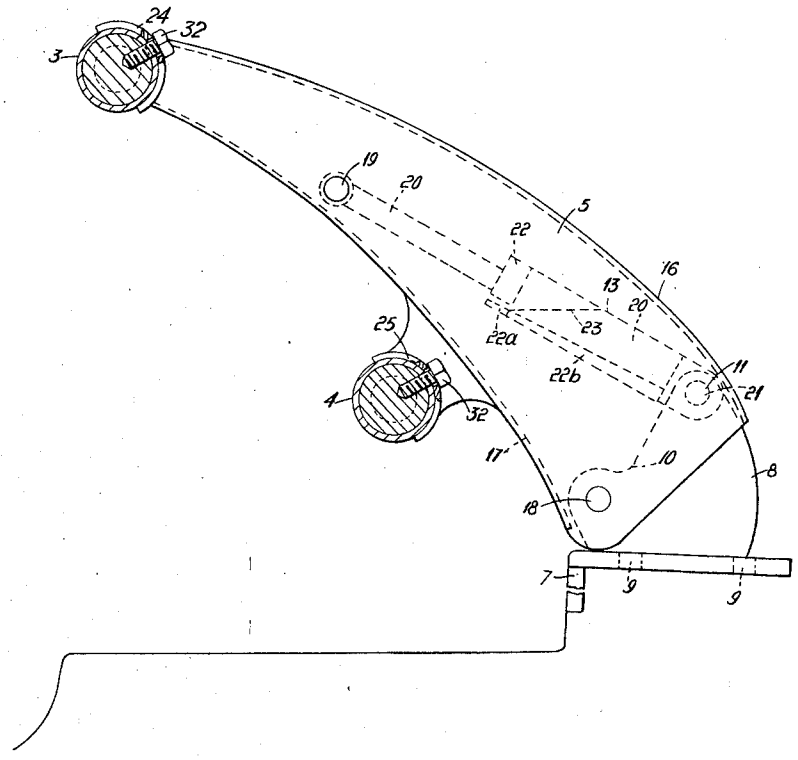
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[57] **ABSTRACT**

A guardrail support comprising a ground anchor with a bracket pivoted at one end thereto, at least two guardrail connectors secured one to the free end of the bracket and the other between the ends of the bracket, and a resilient device between the anchor and bracket to maintain the bracket at rest supporting the rails by the connectors with the upper rail closer to the highway than the lower rail and an impact of a vehicle from the highway permitting upward movement of the bracket and the rails.

9 Claims, 4 Drawing Figures

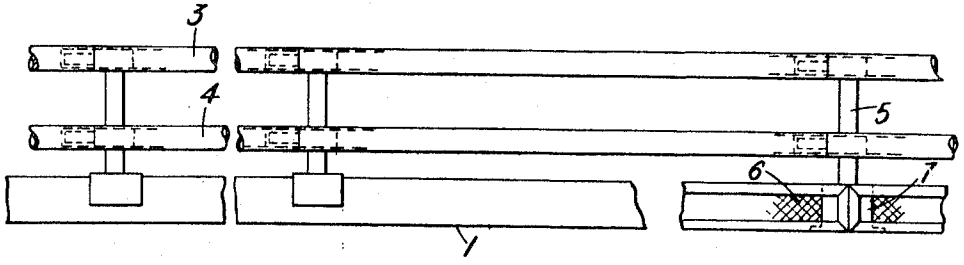


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SHEET 1 OF 3

Fig. 1.



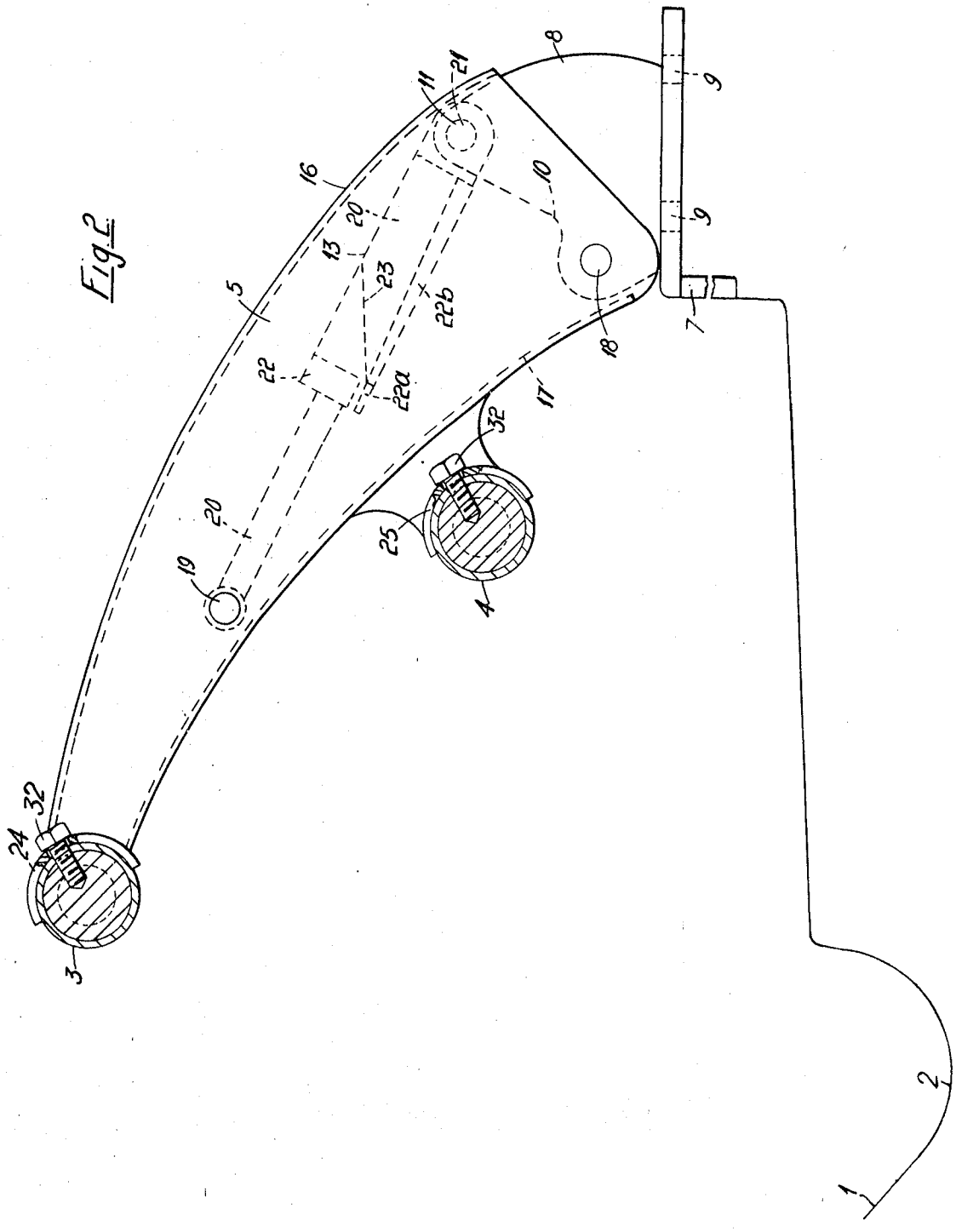
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Fig. 2



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Fig. 3

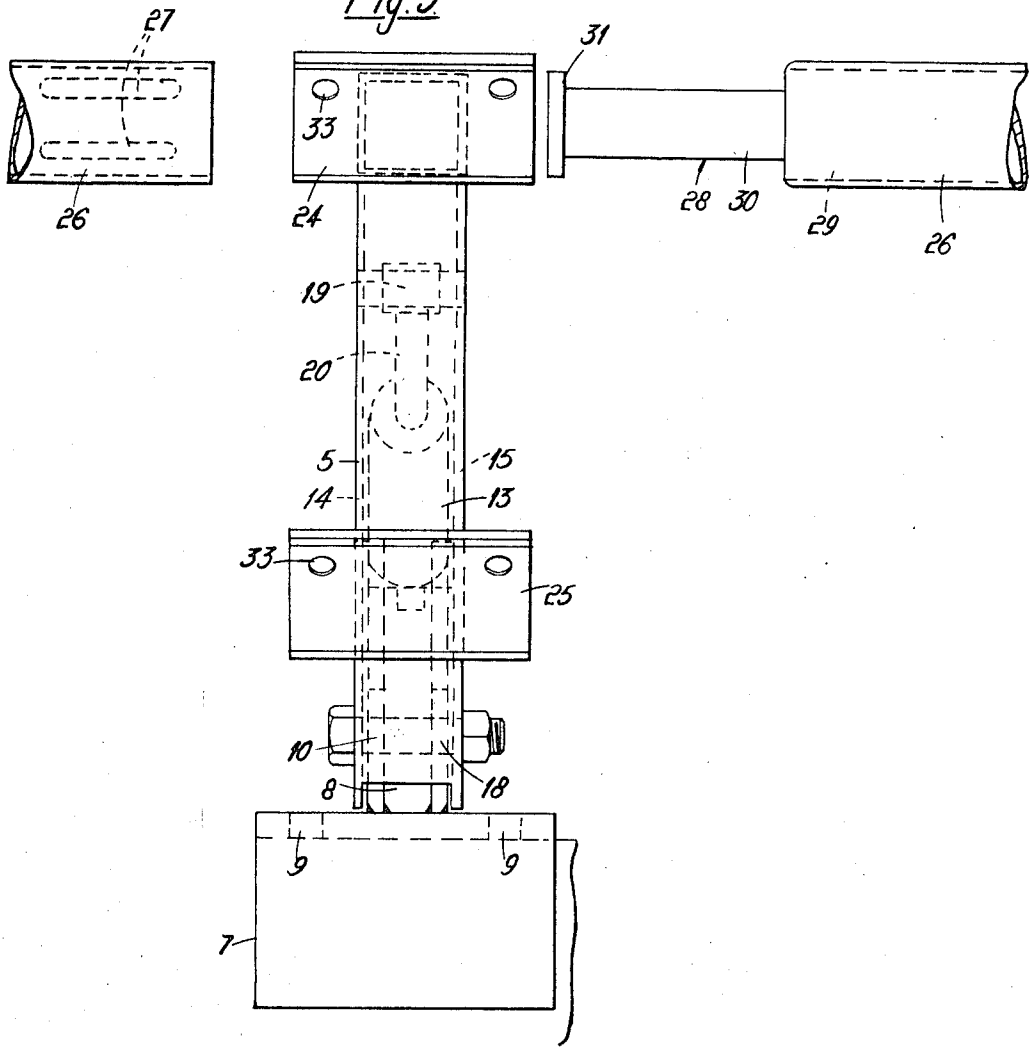
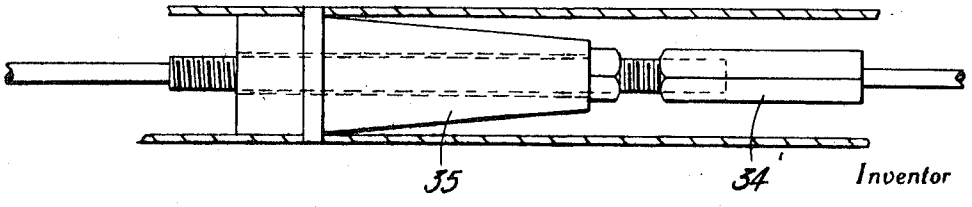


Fig. 4



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HIGHWAY GUARDRAIL DEVICES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to highway guardrail devices and more particularly to supports for highway guardrails, and to such guardrails supported thereby.

2. Description of the Prior Art

With modern high-speed highways such as trunk roads it is increasingly desirable to provide along each side of the metalled highway a guardrail which in the event of a vehicle leaving the highway, e.g., due to failure of the vehicle or to impact with another vehicle, will restrain the movement of the vehicle and bring it to a halt with the minimum risk to the vehicle driver or passengers or other road users. This necessity becomes increasingly important on bridges and viaducts to minimize the risk of the vehicle leaving the bridge or viaduct and plunging into the depth therebeneath.

The cost of such rails is substantial due to the fact that the rails on heavy impact are frequently distorted beyond restoration and the supporting uprights have to be replaced. It is desirable to provide adequate guardrails which while halting the vehicles can be restored to the position before impact for future use.

The main object of the present invention is to provide a guardrail support and a guardrail incorporating such supports which minimizes the aforesaid disadvantages and which after distortion on impact can be restored easily and inexpensively to the use position.

SUMMARY

According to the present invention a guardrail support comprises an anchor for securing to the ground, a bracket pivotally mounted with respect to the anchor, at least two guardrail connectors secured to the bracket one at the free end portion thereof and the other between said free end portion and the pivotal connection to the anchor, and a resilient device interposed between the bracket and the anchor to maintain the bracket at rest with said guardrail connectors one above the other with the upper closer to the highway, whereby on the impact of a vehicle leaving the highway and engaging at least the uppermost rail the resilient device will permit movement of the bracket to absorb the shock of the impact and increase the height of the rails as they resist the force of the impacting vehicle.

Preferably the resilient device comprises a piston sliding within a cylinder and having a fluid flow path between the opposite sides of the piston and variable in area as the piston moves within the cylinder, the cylinder being partially filled with hydraulic liquid whereby during the initial movement of the piston air moves through the flow path and on the subsequent movement the liquid moves through the flow path.

The guardrail connectors preferably include a lost motion connection between the connectors and the rails and the rails are extensible at or near the connectors whereby when the rails are subjected to impact the rails will move upwardly away from the highway and increase temporarily in length.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation of a guardrail as seen from the highway at ground level,

FIG. 2 shows an enlarged scale a support for the guardrail of FIG. 1 seen looking along the side of the highway,

FIG. 3 is a view of the support looking from the left in FIG. 2, the guardrail being shown in part with its connections to the support exploded, and,

FIG. 4 shows an alternative connector for the rails to the support.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, these show the highway **1** having a gutter **2** which will allow surface water to run away to a drain

and should a vehicle driver on the highway run towards the side verge the wheels will enter the gutter which will reduce the height of the vehicle. The highway may have a footpath, cycle track or the like along the side thereof (not shown but to the right of the highway in FIG. **2**). The guardrail to be described is disposed along the verge of the highway and where a path or cycle track is provided the guardrail is between it and the highway. The construction is particularly suitable on bridges or viaducts or other raised highways as on embankments where it is highly desirable to prevent the vehicles, leaving the highway against the intention of the drivers, plunging off the bridge or embankment. The guardrail may however be used on highways on the level ground or elsewhere.

As seen in the drawings two guardrails **3, 4** are provided one above the other, the upper one **3** being closer to the highway metalled surface than the lower one **4**, the rails being supported by brackets **5** to be described, and the spaces extending along the highway between the brackets are masked by suitable means such as grills **6** which permit water and dirt to be removed.

Referring to FIGS. **2** and **3** these show one support for the guardrails where two rails **3, 4** are employed, but additional rails may be connected to the supports if desired.

The support has an anchor shown as a bracket **7** which is secured to the ground. The ground referred to herein can be the verge earth or a firm base such as a concrete block embedded therein, and the anchor can be a post driven into the ground. Or the ground may be the structure of a bridge or viaduct such as a reinforced concrete, iron or like structure.

The bracket **7** has mounted thereon or integral therewith a mount **8**. Where the mount **8** is separate from and secured to the bracket **7**, it is preferably secured thereto by bolts, rivets or the like passing through holes **9** in the bracket and through a contiguous part of the mount: such bolts or the like may be made of a material such as mild steel which will withstand a substantial impact on the guardrails, but if the impact is such as to be likely to cause permanent damage to the rails or supports, will fracture or yield thus reducing this possible damage.

The mount **8** has two bores **10, 11** therein and as shown in FIG. **2** the lower bore **10** forms a pivotal axis for the bracket **5** and the upper bore **11** forms the connection to the mount of one part of a resilient device **13** to be described.

The bracket **5** is generally curved in shape but it may be of any desirable shape, and is formed of two spaced elements **14, 15** which are interconnected by bridge elements **16, 17** (or one such element) and straddle the mount **8**: a pivot pin **18** passes through the bore **10** in the mount and in the elements **14, 15**; the pin **18** is shown as a replaceable bolt and may itself be of material such as mild steel which will shear if the impact on the rails is beyond a predetermined value.

The bracket **5** has pivoted to it at **19** the rod **20** of the resilient device **13** the cylinder of which is pivoted by a pin **21** to the bore **11** of the mount **8**. The device **13** is shown as an hydraulic cylinder acting in compression and normally operates to maintain the bracket **5** in a position of rest upwardly inclined towards the highway. The rod **20** carries a piston **22** in the cylinder **20** and is normally at the top end of the cylinder as seen in FIG. **2** where it is maintained by fluid pressure as will be described. The piston has a fluid flow passage **22***a* therethrough so that as the piston moves down the cylinder **20** the fluid will flow past the piston thus offering resistance to the force of impact of a vehicle on the guardrail or rails tending to displace them to the right in FIG. **2**. The fluid flow passage may be a slot in the side of the piston and a land **22***b* is provided in the cylinder which increases in cross-sectional area so that as the piston moves along the cylinder the flow passage is reduced in area to increase the fluid flow resistance.

Preferably the cylinder is only partly filled with hydraulic liquid, e.g., oil as to the level **23** in FIG. **2** so that in the initial stage as the piston moves in the cylinder air flows through the flow passage offering little resistance and after the liquid is dis-

placed to fill the cylinder behind the piston the liquid then begins to flow through the passage increasing the resistance to piston movement.

The bracket **5** is shown as having upper and lower guardrail connectors **24, 25** each of which is a half cylindrical cup into which the rails **3, 4** fit snugly. Each rail **3, 4** is formed of a tubular element **26**, e.g., of steel, on one side of the bracket **5** having two longitudinal slots **27** therein. The rail **3, 4** at the other side of the bracket **5** has a connecting piece **28** one part **29** of which is secured in a tubular element **26** as by screws or bolts with a sliding connection such as the slots **27**, and a reduced diameter portion **30** with a head **31**. The portion **26** is fitted snugly into the cup **24** or **25** so that the portion **30** extends into the other element **26** at the left of FIG. **3**. The bolts **32** securing the portion **26** to the cup **24** or **25** pass through holes **33** in the cup and into tapped and threaded holes in the part **29**. Other bolts similar to **31** pass through the slots **27** and engage the portion **30** thereby securing the rails **26** to the cup **24** or **25** with a lost motion in a direction longitudinally of the rails.

In an alternative construction the rails are tubular as seen in FIG. **4** and an elongated steel rod or cable **34** passes therethrough and at the bracket **5** a conventional connector device **35** is provided which is fixed to the cup **24** or **25** by the bolts **32** as in FIGS. **2** and **3**.

In use the resilient device **13** maintains the guardrails by the bracket **5** in the position of rest in FIG. **2**. Should a vehicle strike the rails the bracket **5** yields with only slight resistance from the device **13** and from the yield of the said lost motion of the rails and connectors so that the rails bend within their elastic limit and lengthen. The continued force of impact if maintained will further increase said displacements against increasing fluid flow resistance in the device **13** and this movement will cause the rails to rise as they move away from the highway, thus resisting the impact and increasing the height of the point of application of the impact on the vehicle so as to decrease the tendency of the vehicle to overturn over the rails. As the brackets **5** approach the vertical the lower rail **25** will accept some of the impact thus adding further resistance to the impact.

While the device **13** has been described as acting in compression it may be mounted to act in tension in which case the role of the pivots **10, 11** is reversed, the bracket being pivoted on the upper and rearward one **11**, and the device **13** being pivoted at the lower pivot **10**. While the device **13** is described as hydraulic it may be a spring or a resilient block, e.g., of rubber suitably mounted to resist the impact as the bracket **5** is displaced.

When the impact has been wholly absorbed and the impacting vehicle is removed from the site, the whole support and rails may be restored to their in-rest positions usually without any necessity to apply force to straighten the rails or brackets.

We claim:

1. A highway crash barrier comprising two substantially horizontal guardrails supported by a series of brackets, an anchor for securing each bracket to the ground, each bracket being pivotally connected at one end to its anchor and in a rest position being upwardly inclined from the ground, two guardrail connectors on each bracket, one at the midlength portion of the bracket and the other at the free end of the bracket for connection of the guardrails to the bracket, and a shock-absorbing device between each anchor and a point on the respective bracket remote from the anchor, the guardrails being supported on said brackets one above the other with the upper guardrail at a greater horizontal distance from the pivotal axes of said brackets than the lower guardrail, each guardrail being composed of at least two sections extensibly connected end to end, so that when a vehicle strikes the rail or rails the bracket adjacent the impact will swing upwardly about its axis to carry the guardrails upwardly against the resistance of the respective shock absorber, while the guardrails temporarily increase in length.

2. A highway crash barrier according to claim **1**, wherein said shock-absorbing device is a hydraulic piston and cylinder assembly acting in compression and normally operating to maintain its respective bracket in a position of rest upwardly inclined towards the highway.

3. A highway crash barrier according to claim **2**, wherein the piston rod of the hydraulic piston and cylinder assembly is pivotally connected to the upper part of the bracket and the lower end of the cylinder is pivotally connected to the anchor.

4. A highway crash barrier according to claim **3**, wherein a liquid flow passage in the form of a slot is formed in the piston and said slot engages with a land disposed longitudinally in the cylinder, the cross section of the land increasing along its length to increase the resistance to movement of the piston as it slides longitudinally in the cylinder.

5. A highway crash barrier according to claim **4**, wherein the cylinder is only partially filled with hydraulic liquid so that the initial stage as the piston moves in the cylinder air flows through the flow passage offering little resistance, and after the liquid is displaced to fill the cylinder behind the piston the liquid then begins to flow through the passage increasing the resistance to piston movement.

6. A highway crash barrier according to claim **1**, wherein the anchor is provided with a mount which has two bores therein, one higher than the other, and the lower bore forms a pivotal axis for the bracket and the upper bore forms a connection to the mount of one part of the shock absorber.

7. A highway crash barrier according to claim **6**, wherein the bracket is generally curved in shape and is formed of two spaced elements which are interconnected by bridge elements and which straddle the mount, a pivot pin passing through the lower bore in the mount and through bores in the elements and being of a material which will shear if the impact on the rail is greater than a predetermined value.

8. A highway crash barrier according to claim **1**, wherein each of the guardrail connectors comprises a half-cylindrical cup into which the rails fit snugly, and each rail is formed of a tubular element having longitudinal slots therein, the rail being secured to its cup by a sliding connection.

9. A highway crash barrier according to claim **1**, wherein the rails are tubular elements and an elongated steel member passes therethrough and is fixed at the bracket to the cup of the connector.

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