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(54) **Joint and stiffener system for a highway guardrail**

(57) Joint and stiffener system for a highway guardrail, which highway guardrail is composed of essentially vertical guardrail pillars (1) installed at a distance from one another and of essentially horizontal rails (2) fixed to them, which rails are open profiles, the open part of

which is directed towards the guardrail pillar (1), and which joint and stiffener system comprises a joint part/stiffener part (4). The invention is implemented such that the joint part/stiffener part (4) is installed at least partly inside the rail (2), and that the joint part/stiffener part (4) is a closed profile.

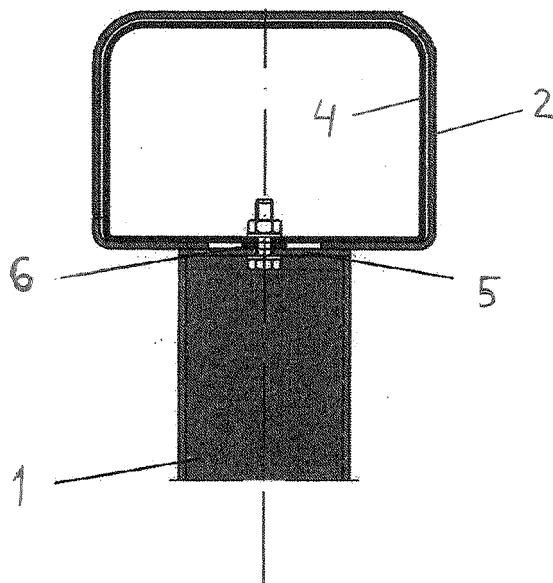


Fig. 3

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Description

[0001] The object of the present invention is a joint and stiffener system for a highway guardrail, which highway guardrail is composed of essentially vertical guardrail pillars installed at a distance from one another and of essentially horizontal rails fixed to them, which rails are open profiles, the open part of which is directed towards the guardrail pillar, and which joint and stiffener system comprises a joint part/stiffener part.

[0002] The invention relates generally to highway guardrails and more particularly to the center guardrails of traffic lanes, which have recently become rapidly more widespread. They are used for safety reasons to prevent head-on accidents of vehicles moving in opposite directions. By means of center guardrails, of course, overtaking can be prevented in places where it would be dangerous. Center guardrails have become widely adopted, particularly on highways with an overtaking lane.

[0003] Center guardrails are composed of essentially vertical metallic guardrail pillars that are embedded and/or fixed into the ground at a distance from each other, as well as of metallic guides, i.e. essentially horizontal guardrail parts, fixed to them. The terms "vertical" and "horizontal" are not, of course, mathematically precise in this context, because they vary according to the profile of the ground surface on the highway. In highway guardrails the critical points are the point of connection between the guardrail pillar and the rail and also the point of connection between two rails. In addition, it is endeavored to stiffen the rails in the section between the guardrail pillars so that the rails would withstand possible impacts better while retaining their shape.

[0004] In many prior-art guardrail solutions a joint part comprising a number of parts is used between the guardrail pillar and the rail (e.g. EP 1947245 A1) as well as oval perforations in the rail/joint part, said perforations allowing small tolerances. In addition, stiffener rods, fabricated from L-shaped steel bars, said rods to be fastened to the bottom edge of the rail by welding, are often used as a stiffener. It is also typical that completely different types of parts are used as a stiffener, as a fastener of the guardrail pillar and as a splice of a rail. Publication WO 03104568 presents a solution wherein the rail of a guardrail is formed from a C-shaped beam. At the point of connection the beam is tapered and it is installed inside the next rail and locked with bolts and nuts. This publication does not disclose in more detail how the guardrail pillars and the rails are fastened to each other.

[0005] Publication WO 9842918 presents a highway guardrail wherein the rails are also open profiles. They are joined together with a joint piece of essentially the same cross-sectional shape and of slightly smaller dimensions, on top of which joint piece the rails to be connected are installed, and which joint piece is also an open profile. Thus a joint piece is used here only in a splice joint between two rails.

[0006] The aim of the invention is to achieve a joint and

stiffener arrangement for a highway guardrail that does not have the drawbacks occurring in prior art and that has many other advantages also compared to earlier guardrails. The highway guardrail according to the invention is **characterized in that** the guardrail pillar has a planar top end against which the open side of the rail is placed and also a joint part/stiffener part is installed at least partly inside the rail, and in that the joint part/stiffener part is a closed profile.

[0007] One preferred embodiment of the joint and stiffener arrangement according to the invention is **characterized in that** the cross-section of the joint part/stiffener part is of essentially the same shape as the cross-section of the rail, and in that the outer dimensions of the joint part/stiffener part are smaller than the inner dimensions of the rail, in which case the joint part/stiffener part can be fitted inside the rail by threading from the end of the rail.

[0008] A second preferred embodiment of the joint and stiffener arrangement according to the invention is **characterized in that** the guardrail pillar has an essentially horizontal top edge, in which is a hole for a bolt, in that inside the rail at the point of connection is a joint part/stiffener part, in which is a corresponding hole for a bolt, and in that a nut is threaded onto the bolt for tightening the joint or there is a threaded hole in the joint part/stiffener part.

[0009] Yet another preferred embodiment of the joint and stiffener arrangement according to the invention is **characterized in that** between the top edge of the guardrail pillar and the joint part/stiffener part a shim of essentially the thickness of the material of the rail is installed, through which shim a bolt is also installed.

[0010] One of the advantages of the invention that can be mentioned is that the guardrail pillar can be fixed to the rail at any point of the rail whatsoever. In addition, the tight installation tolerances in the longitudinal direction of the joint between the guardrail pillar and the rail are eliminated and installation is essentially speeded up. Separate perforations are not needed in the rail at the point of the fastener. Furthermore, stiffener parts to be fastened by welding that assist the permanence of the shape of the rail are not needed in the structure according to the invention. That being the case, fabrication of the rail is considerably facilitated and perforations in the rail at the point of the stiffener are not needed.

[0011] It can further be mentioned that the stiffener part of the rail, the fixing part of the guardrail pillar and the splice part of the rail are based on the same type of closed profile, in which case instead of the three completely different parts required earlier, only two parts of different lengths based on one closed profile are required.

[0012] In the following, the invention will be described in more detail by the aid of some preferred embodiments with reference to the attached drawings, wherein

Fig. 1 presents highway guardrail according to the invention, as viewed from the side.

Fig. 2 presents a longitudinal section of the detail A of Fig. 1.

Fig. 3 presents a cross-section of the detail A of Fig. 1.

Fig. 4 presents a cross-section of the detail C of Fig. 1.

Fig. 5 presents a longitudinal section of the detail B of Fig. 1.

[0013] The highway guardrail, in this case more particularly the center guardrail of a highway, is composed of essentially vertical guardrail pillars 1, which are fixed into the ground 3 preferably at essentially regular intervals, and of rails 2 fixed to the guardrail pillars. The detail A marked in Fig. 1 refers to the point of connection between a guardrail pillar 1 and a rail 2 and it is described in more detail in the cutaway drawing of Figs. 2 and 3.

[0014] Further, in Fig. 1 the detail B refers to the stiffening point of the rail and it is presented in more detail in the cutaway drawing of Fig. 5. The detail C of Fig. 1 refers to the splice joint point between two rails and it is presented in more detail in Fig. 4.

[0015] The guardrail pillar 1 is preferably an open profile, e.g. a C-profile or a sigma profile. On its top end is an essentially horizontal top edge 5, which is e.g. bent to be horizontal or is formed by welding a slab to the top end of the guardrail pillar or an angle bar is fixed to it with bolts. The aperture side of a rail 2 having an open profile is installed against this planar top end, as can be seen in Fig. 3.

[0016] A joint part/stiffener part 4 having a closed profile is pushed inside the rail 2, as can be seen more particularly in Fig. 3. The term closed profile refers here to all the embodiments in which the peripheral rigidity of the joint part/stiffener part 4 is essentially greater than that of the rails 2. Thus the term closed profile means an envelope wholly surrounding an empty space, i.e. a tubular profile, or a closed profile fabricated from completely solid material. The term closed profile also refers to profiles of all shapes, the thickness of the wall of which profiles is essentially greater than that of the rail 2, preferably at least five times the wall thickness of the rail.

[0017] The most advantageous embodiment of a joint system/stiffener system 4 is a tubular profile, which has a sufficient peripheral rigidity and at the same time a small material requirement. By using a closed profile as a joint part/stiffener part of a guardrail, surprisingly the total rigidity of the guardrail significantly increases.

[0018] The joint part/stiffener part 4 is of essentially the same cross-sectional shape as the rail 2 except for the aperture point of the rail. The joint part/stiffener part 4 is, however, smaller in its outer dimensions than the inner dimension of the rail 2, in which case it fits to move in the rail. In practice the fitting is, however, rather tight, so that the joint part/stiffener part 4 stiffens the rail 2. The length

of the joint part/stiffener part is preferably approx. 100 mm, but the invention is not, of course, limited to this.

[0019] In the joint part/stiffener part is a hole, which is placed at the same point as the hole in the horizontal top edge 5 of the guardrail pillar 1. Through these holes a bolt is pushed in the manner presented by Figs. 2 and 3. The bolt, and thereby the whole joint, is tightened with a nut. Additionally, a shim 6 of essentially the thickness of the material of the rail 2 is arranged at the point of the aperture of the rail.

[0020] The joint part/stiffener part 4 is also used to stiffen the rail 2 in the section between the guardrail pillars, in addition to at the point of a guardrail pillar. This is presented as a longitudinal section in Fig. 5. This stiffening is implemented such that a joint part/stiffener part 4, as already described, is threaded inside the rail 2 such that it is situated essentially mid-way between guardrail pillars. The joint part/stiffener part is locked into its position in the manner shown by Fig. 5 with a bolt/nut joint or alternatively with a nut and by means of a threaded hole in the joint part/stiffener part 4. In this case, also, approx. 100 mm is generally sufficient for the length of the joint part/stiffener part 4.

[0021] Fig. 4, for its part, presents a cross-section of the detail C of Fig. 1. Shown here is a splice joint of two rails 2, which is implemented by using a joint part/stiffener part of the type described earlier, which is actually longer, e.g. approx. 400 mm, when used for this purpose. At the point of a splice joint, a joint part and stiffener part 4 is pushed inside the end of each rail to be joined together and the joint is locked with bolts 7, which are pushed through the holes in the top surface and bottom surface of the rail as well as through bushings 8 inside the joint part/stiffener part 4 and/or holes in the joint part/stiffener part 4 and tightened with nuts 9. Preferably there are eight units of bolts in the whole splice joint, i.e. four at each end of the rail.

[0022] The joint part/stiffener part 4 is preferably made of steel and it can therefore also be of the same material as the rail 2.

[0023] It is obvious to the person skilled in the art that the invention is not limited to the embodiments presented above, but that it can be varied within the scope of the claims presented below.

[0024] The characteristic features possibly presented in the description in conjunction with other characteristic features can also, if necessary, be used separately to each other.

Claims

1. Joint and stiffener system for a highway guardrail, which highway guardrail is composed of essentially vertical guardrail pillars (1) installed at a distance from one another and of essentially horizontal rails (2) fixed to them, which rails are open profiles, the open part of which is directed towards the guardrail

pillar (1), and which joint and stiffener system comprises a joint part/stiffener part (4), **characterized in that** the guardrail pillar (1) has a planar top end against which the open side of the rail (2) is placed and also the joint part/stiffener part (4) is installed at least partly inside the rail (2), and **in that** the joint part/stiffener part (4) is a closed profile.

thickness of the rail (2), preferably at least five times the wall thickness of the rail.

2. Joint and stiffener system according to claim 1, **characterized in that** the cross-section of the joint part/stiffener part (4) is of essentially the same shape as the cross-section of the rail (2), and **in that** the outer dimensions of the joint part/stiffener part (4) are smaller than the inner dimensions of the rail (2), in which case the joint part/stiffener part (4) can be fitted inside the rail (2) by threading from the end of the rail.

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3. Joint and stiffener system according to claim 1 or 2, **characterized in that** the guardrail pillar (1) has an essentially horizontal top edge (5), in which is a hole for a bolt, and that inside the rail (2) at the point of connection is a joint part/stiffener part (4), in which is a corresponding hole for a bolt, and **in that** a nut is threaded onto the bolt for tightening the joint or there is a threaded hole in the joint part/stiffener part.

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4. Joint and stiffener system according to claim 3, **characterized in that** between the top edge (5) of the guardrail pillar (1) and the joint part/stiffener part (4) a shim (6) of essentially the thickness of the material of the rail is installed, through which shim a bolt is also installed.

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5. Joint and stiffener system according to any of claims 1-4, **characterized in that** the length of the joint part/stiffener part (4) is approx. 100 mm.

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6. Joint and stiffener system according to claim 1 or 2, **characterized in that** the joint part/stiffener part (4) can be used in forming a splice joint between two rails (2), in which case the joint part/stiffener part (4) is pushed inside the end of each rail (2), and **in that** the splice joint is locked with bolts (7) extending through the rail and the joint part/stiffener part.

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7. Joint and stiffener system according to claim 6, **characterized in that** the length of the joint part/stiffener part (4) is approx. 400 mm, and **in that** in it are formed bushings (8) or holes for bolts.

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8. Joint and stiffener system according to claim 7, **characterized in that** there are eight units of bolts (7) and bushings (8), four at each end of a rail (2) to be joined together.

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9. Joint and stiffener system according to any of claims 1-8, **characterized in that** the wall thickness of the joint part/stiffener part (4) is greater than the wall

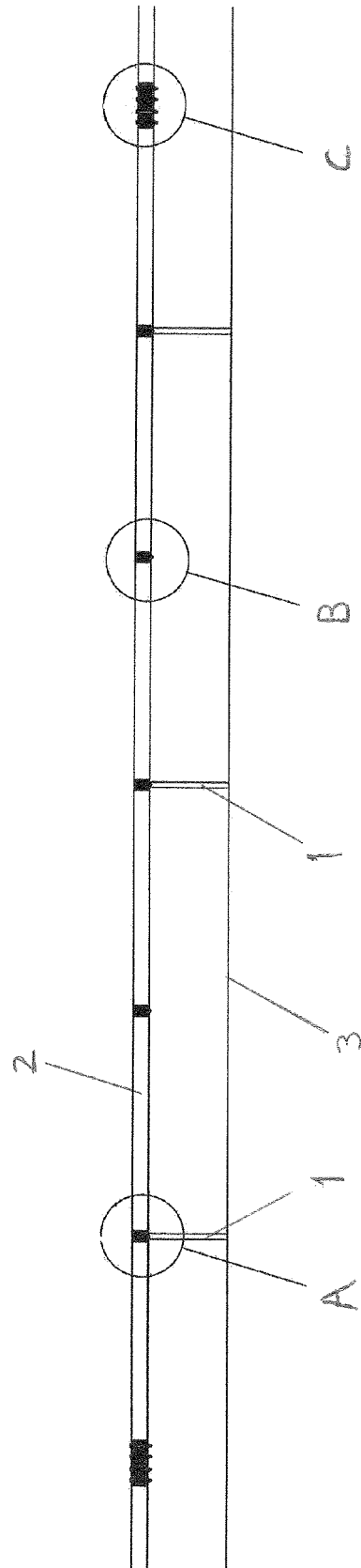


Fig.1

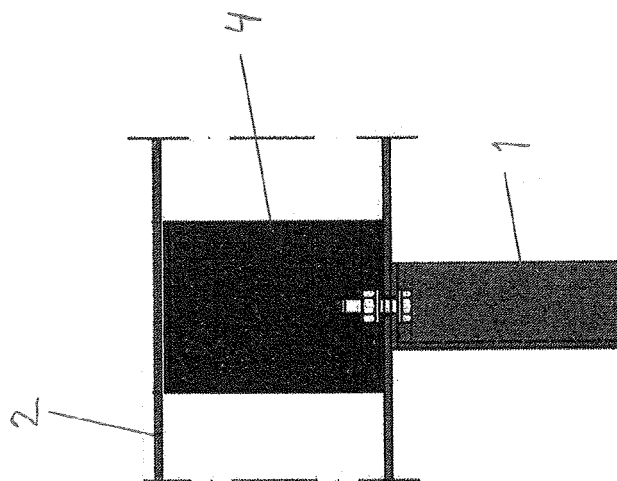


Fig. 2

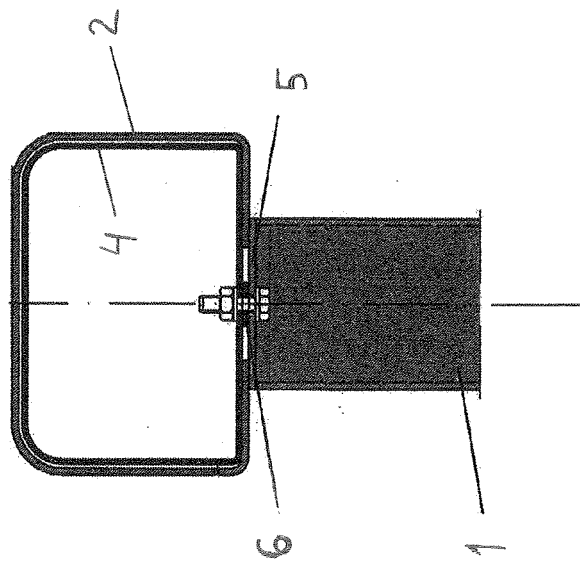
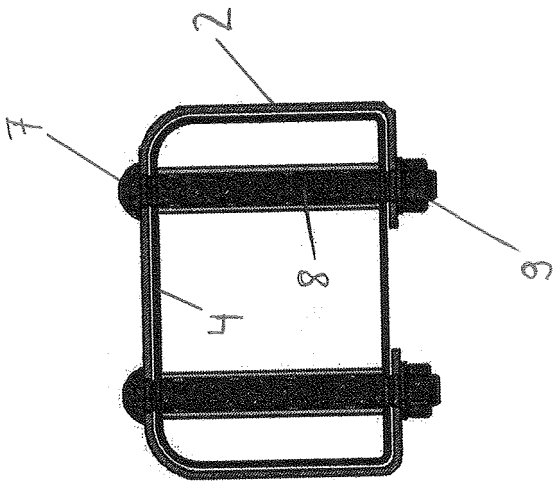
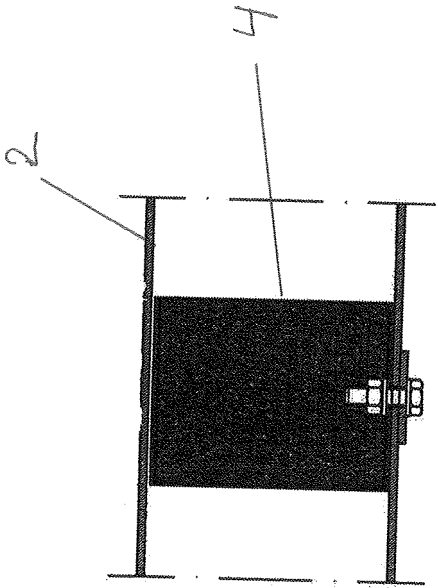


Fig. 3



REFERENCES CITED IN THE DESCRIPTION

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