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(54) **Road safety barrier structure with supporting pillar and method to install it**

(57) The invention relates to a road safety barrier structure with supporting post and to a method for installing it.

The road safety barrier structure comprises a supporting post (1) and a safety barrier (3), wherein said supporting post (1) comprises at least one open bore (2), said open bore (2) is provided with a parallel extension that corresponds to the diameter of the bore, is essentially parallel with an edge (5) of the supporting post (1) and is located between said edge (5) and an opposite edge of said supporting post (1), and wherein the supporting post (1) and the safety barrier (3) are secured together by means of a detachable connecting means (4) that passes through said parallel extension of the open bore (2) or at a bottom (13) thereof.

During installation, the open bore (2) is formed in the supporting post, at least two supporting posts (1) are secured, and then the safety barrier (3) is affixed through respective opening (10) by means of connecting means (4) passing through the parallel extension of the open bore (2) or at the bottom (13) thereof onto said at least two supporting posts (1).

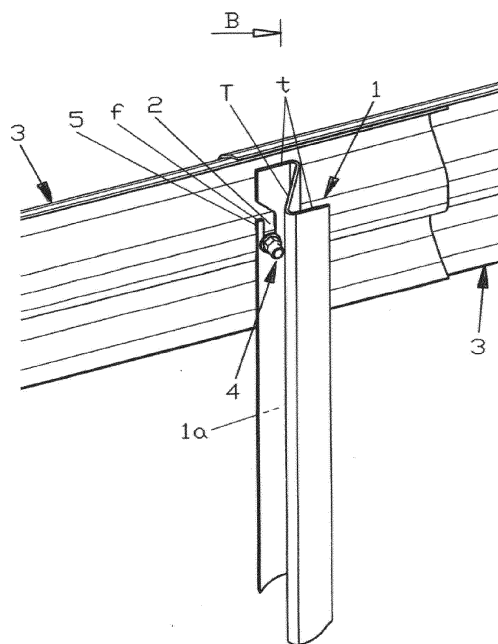


Figure 3

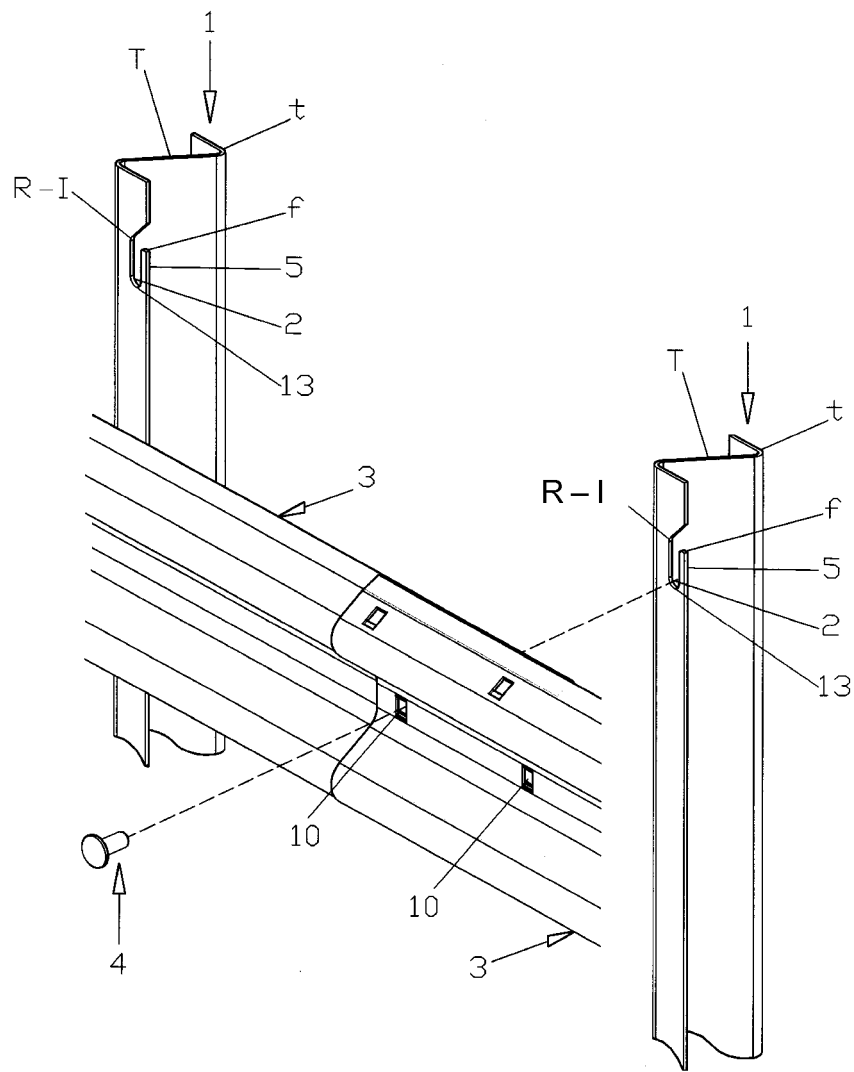


Figure 8

Description

[0001] The present invention relates to a road safety barrier structure with supporting post and a method to install it.

[0002] Nowadays, supporting posts are fabricated for various purposes. For example, Hungarian utility model application No. U0100107 discloses supporting posts for installing informatory road-signs, Hungarian utility model application No. U9300019 teaches supporting posts installed into the soil for road-signs and/or informatory signs, while Hungarian utility model application No. U0700069 discloses supporting posts and beams for public board supporting portals and brackets. Supporting posts used to erect road safety barrier structures are also well known in the art.

[0003] The supporting posts used in road safety barrier structures are, in general, of C- or I-shaped, and there are bores formed on their side to fix/mount safety barriers thereon. The strength of said posts depends on the wall thickness, the properties of the material they are made of, the manner of installation, as well as similar other characteristics. Said supporting posts have to meet a double requirement: they have to have, on the one hand, a strength that is sufficient to bear/carry the weight of the safety barrier(s) mounted thereon and, on the other hand, to potentially keep vehicles about leaving the road on the road, as well as to lead them back into the right direction and/or - when a vehicle cannot be led back - to exert such a force upon collision that is absolutely necessary since the passengers travelling in the vehicle could be seriously damaged or even die otherwise; hence, in this latter case it is more preferred if said supporting posts e.g. simply break. That is, to satisfy the requirements of opposite nature, a compromise should be arrived at.

[0004] To fulfil the above requirements as effective as is possible, newer and newer supporting posts are developed. For example, Japanese Published Patent Application No. 2006-283523 discloses a structure of two steel tubes wherein one of the tubes is arranged within the other and the gap formed between said tubes is filled with slag or sediment. The safety barrier is mounted onto the thus obtained supporting post. This solution, however, renders the design of a supporting post, as well as the installation of a safety barrier structure comprising such post rather complicated and expensive.

[0005] U.S. Patent No. 5,069,576 teaches a road safety barrier structure wherein a pyramid shaped member projecting out to about 20 cm from the vertical supporting post is bolted onto the post, and the safety barrier is mounted onto this connection member by a detachable joint. A disadvantage of this design is that said post is not formed as a single integral piece and hence its strength is highly questionable.

[0006] U.S. Patent No. 5,219,241 suggests the use of a single piece plastic supporting post with a projecting member. The front side of said projecting member is formed to be in conformity with the inner surface of the

safety barrier. A disadvantage of the design is that both the manufacturing and the installation of the post are cumbersome due to the plastic properties. An adequate strength is also missed.

[0007] German Patent No. DE 10 2004 034 999 A1 discloses a solution wherein the supporting post is anchored to the concrete flank through a black plate after all, but a separate angled support is also required to brace it, said support is affixed to the pavement by screwing. Thus, the supporting post concerned is not a one piece element. The requisite for said angled support renders the installation of the supporting post of a road safety barrier structure complicated and expensive.

[0008] According to U.S. Patent No. 5,697,728 the supporting post is fixed by means of screw anchors to the concrete flank or to the kerbstone. This is rather complicated and hence expensive.

[0009] The supporting post fabricated along with the teachings of EP Patent Application No. 677,615 A1 is provided with a support beam, i.e. it is not formed as a one piece element either. Moreover, this essential additional element increases the costs of the post and its installation, as well as renders the installation process itself more complicated.

[0010] The supporting post of the structure disclosed in U.S. Patent No. 4,598,512 also requires bracing that increases the costs, on the one hand, and renders the installation more complicated on the other hand.

[0011] In light of the above, the present invention aims at providing a supporting post that eliminates the disadvantages mentioned previously, that is, a supporting post that does not exert too large force on a colliding vehicle, nevertheless, exhibits a strength adequate to bear the weight of the safety barrier, and that is cheap and has got a simply design together with the road safety barrier structure constructed by means of said supporting post. A further object is to provide a road safety barrier structure having the supporting post concerned that, due to its design, reduces the risk of personal injury upon collision with it. A yet further object to be achieved by the present invention is to work out a simple, rapid and cost effective method for installing a safety barrier structure.

[0012] It was found that the above objects can be achieved by making use of a supporting post with an open bore, wherein said open bore is provided with a parallel extension corresponding to the diameter of the bore in the form of a cut-out and wherein the affixing of the safety barrier takes place through said extension.

[0013] In particular, in one aspect of the invention, the above objects are achieved by a road safety barrier structure with supporting post in accordance with Claim 1. Possible further preferred embodiments of the inventive road safety barrier structure with supporting post are set forth in Claims 2 to 5.

[0014] In the inventive construction, it is the passing through connecting means that allows secure clamping of the safety barrier on both sides thereof. The stability of the road safety barrier structure is further increased

by locating said connecting means at the very bottom of the open bore with parallel extension corresponding to the diameter of the bore in the form of a cut-out. Moreover, the present design - according to which the open bore with parallel extension corresponding to the diameter of the bore in the form of a cut-out locates in parallel with the edge of the supporting post - allows that the safety barrier applied bears completely against the supporting post.

[0015] It is noted hereby that although the invention will be discussed in detail with reference to a supporting post with S-shaped cross section, any post (e.g. a C- or I-shaped one in cross-sectional view) can be used as the supporting post. Similarly, any safety barrier can be used as the safety barrier, however, the usage of a safety barrier with a sine-shaped cross-sectional profile (from now on "sine safety barrier") is highly preferred.

[0016] Furthermore, in another aspect of the invention, the above objects are achieved by providing a method to install a road safety barrier structure with supporting post, wherein the method comprises the steps of Claim 6.

[0017] In what follows, a supporting post according to the invention and the additional further components of a road safety barrier structure that includes said supporting post are discussed in detail with reference to several preferred embodiments and to drawings. For illustration purposes and with no intention to limit the scope of protection a supporting post with S-shaped cross section and a sine safety barrier will be considered. In the drawings

- Figure 1 is a front view of a supporting post with S-shaped cross section when looked from the direction of road traffic;
- Figure 2 is a cross sectional view of the supporting post shown in Figure 1, taken along the line A-A in Fig. 1;
- Figure 3 is a side view of the supporting post with the open bore and with the affixed safety barrier;
- Figure 4 is a sectional view of the supporting post shown in Figure 3, taken along the line B-B in Fig. 3;
- Figure 5 is a side view of the connecting means that is used to affix the safety barrier;
- Figure 6 is a top view of a sine safety barrier;
- Figure 7 is a sectional view of the sine safety barrier illustrated in Figure 6, taken along the line A-A in Fig. 6;
- Figure 8 is an exploded perspective elevational view of a road safety barrier structure with supporting post according to the invention;
- Figure 9 is a perspective elevational view of a road safety barrier structure with supporting post according to the invention; and
- Figure 10 is a perspective left-side rear view of a road safety barrier structure with supporting post according to the invention.

[0018] Supporting post 1 illustrated in Figure 1 comprises a longitudinally extending main wall and two side

walls, each of which is connected by a curved portion to a respective lengthwise edge of said main wall. The supporting post 1 has got an essentially S-shaped profile in a cross section perpendicular to the longitudinal direction, as it is shown in Figure 2; said cross sectional profile is defined by a main line of the main wall *T* and base lines of the respective side walls *t* connected to the main wall, said curved portions are characterized here by rounding radii R-II and R-III. Preferably, said supporting post 1 is prepared by mechanical machining/shaping of a sheet material with wall thickness *s*. Furthermore, one of the side walls of said supporting post 1 is provided with an open bore 2. Said open bore 2 has got an essentially parallel extension that corresponds to the diameter of the bore and is provided in the form of a cut-out. Due to the cut-out, a wall *f* forms between the open bore 2 and a free edge 5 of the side wall. Thus, a first edge of said open bore 2 is defined by said wall *f* itself, while the other edge of the open bore 2 that locates opposite to the wall *f* first takes the form of an arc with rounding radius R-I and then meets the free edge 5 of the side wall at a bevelled angle.

[0019] As it is shown in Figure 3, a safety barrier 3 (provided preferably in the form of a sine safety barrier) is secured/affixed by means of a connecting means 4 passing through the open bore 2 on/onto the side wall 1a of the supporting post 1. The securing of the safety barrier 3 locates preferably at the very bottom of the open bore 2. The main wall *T* and the other side wall *t*, as well as the free edge 5 of the supporting post 1 are also indicated in Figure 3.

[0020] As it is illustrated in Figure 4, the sine safety barrier 3 is directly affixed by means of said connecting means 4 onto the side wall 1a of the supporting post 1, that is, no further connection member e.g. a deforming member or any other element is inserted therebetween. The sine safety barrier 3 is secured by means of the passing through connecting means 4 at the bottom of the open bore 2 provided with a parallel extension that corresponds to the diameter of the bore. Said open bore 2 with parallel extension corresponding to the diameter of the bore is formed in one of the side walls *t*; to this, said main wall *T* is connected, to which, in turn, the other side wall *t* is connected.

[0021] The length of the open bore 2 measured from the free edge 5 of the supporting post is preferably about 2 to 4 times, more preferably about 2,5 to 3,5 times, and even more preferably about 3 times as large as the diameter of the open bore 2. According to the studies performed, upon collision, the supporting post 1 built into the road safety barrier structure according to the invention allows tilting of the connecting means 4 from the open bore 2 with sufficient efficacy for the above given size ranges, and thus the safety barrier 3 will not be pulled down by the supporting post 1.

[0022] In particular, in a preferred embodiment of said supporting post 1 applied in the road safety barrier structure the main wall *T* is 110 ± 3 mm in width, the side walls

t are 56 ± 3 mm in width, the supporting post 1 is 1700 ± 40 mm in its total length, while its height above the ground level (that is, in its installed position) is 710 ± 40 mm. Moreover, the rounding radii at the side walls t are $R-II = 1,5s$ and $R-III = 2,5s$, the wall f is 8 ± 3 mm in width, wherein the wall thickness s of the sheet material used for the supporting post 1 is $4 \pm 0,5$ mm. The length of said open bore 2 with parallel extension corresponding to the diameter of the bore measured from the free edge 5 of the supporting post 1 is 60 mm, its width is 18 mm, and the magnitude of the rounding radius $R-I$ is 9 mm at 135° .

[0023] In Figure 5 the components of the preferred connecting means 4 can be seen: a mushroom-headed screw 6, a screw-bolt 7, a hexagonal nut 8 and a washer 9; the figure illustrates clamping of a sine safety barrier.

[0024] The sine safety barrier 3 shown in Figure 6 is provided with rectangular openings 10 for its mounting by means of the connecting means 4 passing through at the bottom of the open bore 2 with parallel extension corresponding to the diameter of the bore, and with oval openings 11 for bracing the safety barriers together. Said oval openings 11 allow a displacement of the connecting means along the longitudinal direction of the safety barrier 3 during assembling as required by the position of the safety barrier 3. Said rectangular openings 10 allow in turn the rotation free, stable securing for the connecting means.

[0025] As it can be seen in Figure 7, the preferred sine safety barrier has got a basically W-shape in cross sectional view. Here, the rectangular openings 10 are arranged within the valley portions 12 of said sine safety barrier that enable the installation of the connecting means (not shown). This design of the sine safety barrier allows a lowered arrangement of the connecting means on the road side of the barrier when installed and thus helps in decreasing the risk of being damaged by said connecting means upon collision.

[0026] Moreover, the securing by means of said connecting means 4 passing through the open bore 2 with parallel extension corresponding to the diameter of the bore or at the bottom 13 of said open bore 2 allows the easiest possible breakaway/separation of the (preferably sine) safety barrier 3 when an incidental collision occurs. In this manner, the safety barrier structures built with the above discussed supporting posts offer an increased protection on public roads and also increase safety of the vehicles and the passengers travelling in said vehicles due to their strength-related properties.

[0027] To achieve an adequate and desired surface protection, preferably both the supporting post 1 and the safety barrier 3 used in the road safety barrier structure with supporting post according to the present invention when installed are equally hot-dip galvanized.

[0028] In what follows, a possible preferred variant of the method to install a road safety barrier structure with supporting post according to the invention is outlined. The steps of installing said road safety barrier structure with supporting post according to the invention are dis-

cussed with reference to Figure 8; Figures 9 and 10 illustrate the fully installed road safety barrier structure with supporting post.

[0029] The open bore 2 (Fig. 1) with parallel extension corresponding to the diameter of the bore is formed in the supporting post 1 at a given distance, preferably at 49 ± 3 mm, from the top end thereof, and the thus obtained supporting post 1 (Fig. 1), that is ready to be installed, is transported to the place of installation. At least two supporting posts 1 are erected in a given distance apart from one another on the edge of the roadway with their front elevation view facing to the roadway. Then, the two erected supporting posts 1 are secured by beating in the soil to a desired depth t_j or by any other way. Next, a safety barrier 3 (particularly, a sine safety barrier shown in Fig. 6) with proper orientation is affixed through the rectangular opening 10 by means of connecting means 4 (Fig. 5) passing through at the bottom 13 of the open bore 2 to both of said supporting posts 1.

[0030] To ensure that the washer 9 and the hexagonal nut 8 (Fig. 5) could be properly tightened and that the safety barrier 3 could be clamped between the washer 9 and the hexagonal nut 8, as well as the mushroom-headed screw 6 (Fig. 5) on its both sides, within the securing step, a care should be taken that the screw-bolt 7 (Fig. 5) passes through the open bore 2 (Fig. 1) completely.

[0031] Figures 9 and 10 illustrate the finished structure in two different views with the sine safety barrier 3 being affixed by means of the connecting means 4 onto the supporting posts 1.

[0032] The advantages of the supporting post provided with an open bore 2 with parallel extension corresponding to the diameter of the bore according to the invention - and, thus, of a road safety barrier structure built with said supporting post - are as follows:

- the safety barrier 3 can be directly secured to the supporting post 1, there is no need to insert any connection members, e.g. a deforming member;
- as no connection member is required, the in-field installation of the inventive structure is much faster compared to that of structures with connection member;
- upon collision, it allows tilting of the connecting means 4 from the open bore 2, that is the supporting post 1 will not pull down said safety barrier 3;
- the replacement of a damaged supporting post poses no problem, it can be performed simply and rapidly as no connection member leading to complications is present;
- the supporting post is formed as a one-piece element, and hence it exhibits a strength that is reliable and can be precisely determined.

Claims

1. A road safety barrier structure with supporting post,

- characterized in that** it comprises a supporting post (1) and a safety barrier (3), wherein said supporting post (1) comprises at least one open bore (2), said open bore (2) is provided with a parallel extension that corresponds to the diameter of the bore, is essentially parallel with an edge (5) of the supporting post (1) and is located between said edge (5) and an opposite edge of said supporting post (1), and wherein the supporting post (1) and the safety barrier (3) are secured together by means of a detachable connecting means (4) that passes through said parallel extension of the open bore (2) or at a bottom (13) thereof.
2. The road safety barrier structure with supporting post according to Claim 1, **characterized in that** the length of the open bore (2) with parallel extension corresponding to the diameter of the bore measured from the edge (5) of the supporting post (1) is preferably about two to four times, more preferably about 2,5 to 3,5 times, and even more preferably about three times as large as the diameter of said open bore (2).
3. The road safety barrier structure with supporting post according to Claim 1 or 2, **characterized in that** the safety barrier (3) is a sine safety barrier.
4. The road safety barrier structure with supporting post according to any of Claims 1 to 3, **characterized in that** its surface is hot-dip galvanized against corrosion.
5. The road safety barrier structure with supporting post according to any of Claims 1 to 4, **characterized in that** in said supporting post (1), the length of the open bore (2) with parallel extension corresponding to the diameter of the bore is 60 mm, and its diameter is 18 mm.
6. A method to install the road safety barrier structure with supporting post according to any of Claims 1 to 5, **characterized in that** it comprises the following steps:
- said open bore (2) is formed in the supporting post (1),
 - at least two supporting posts (1) are erected on the edge of the roadway with a front elevation view facing to the roadway,
 - the two erected supporting posts (1) are secured,
 - the safety barrier (3) is affixed through respective opening (10) by means of connecting means (4) passing through the parallel extension of the open bore (2) or at the bottom (13) thereof onto said at least two supporting posts (1).
7. The installation method according to Claim 6, **characterized in that** the safety barrier (3) is provided by a sine safety barrier.

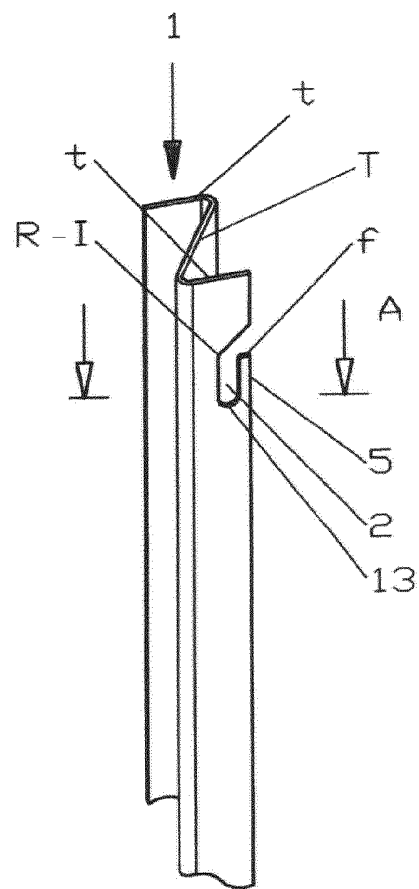


Figure 1

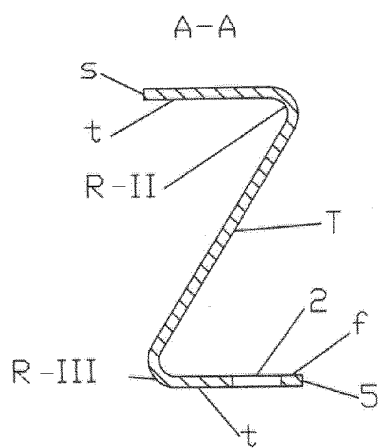


Figure 2

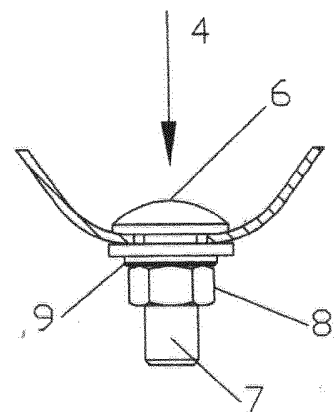


Figure 5

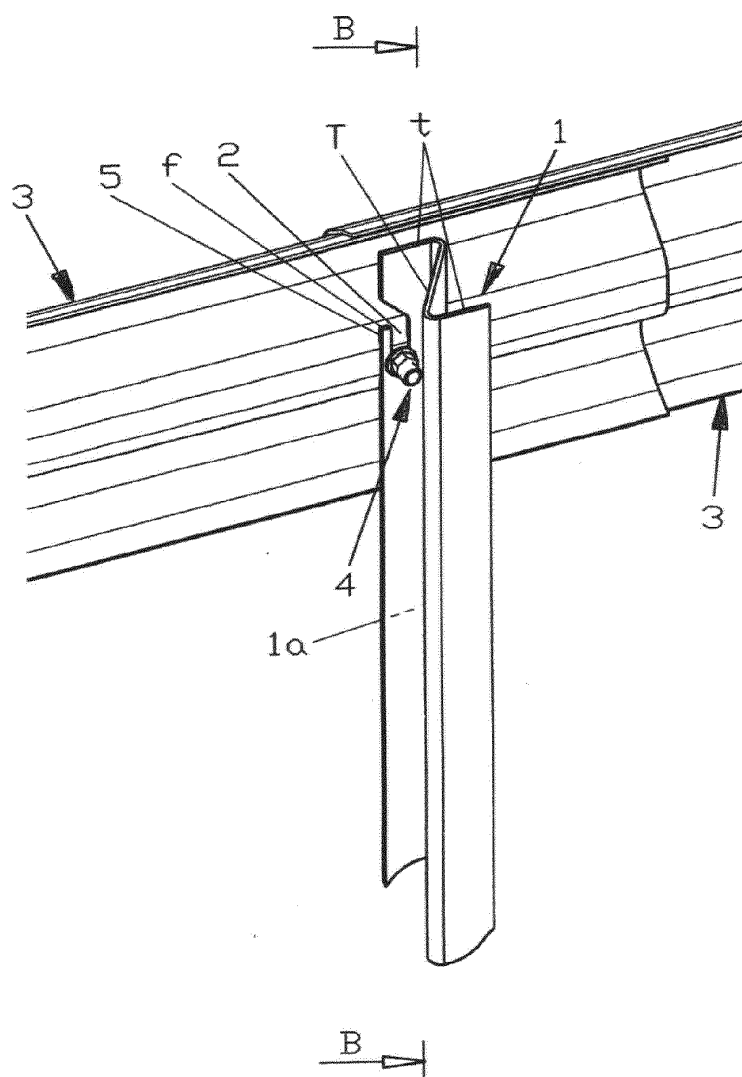


Figure 3

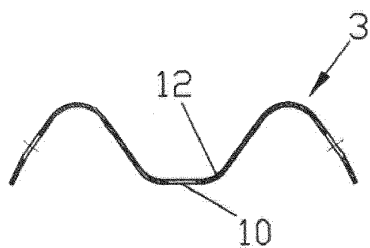


Figure 7

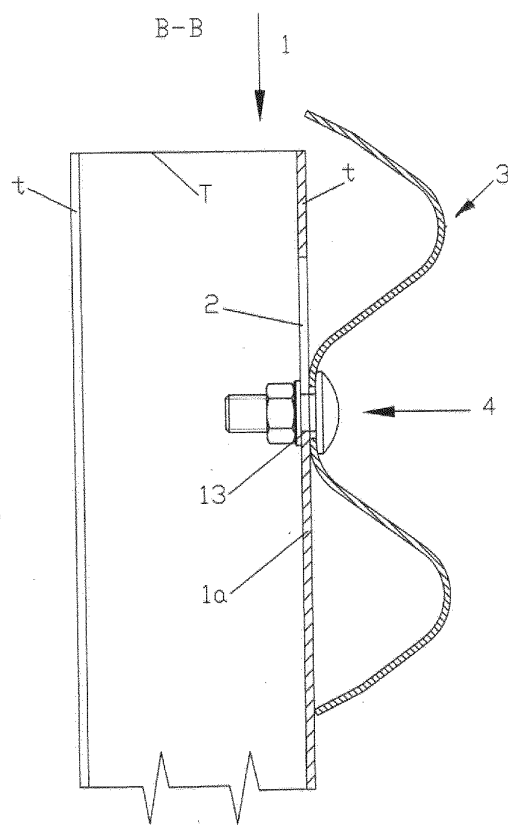


Figure 4

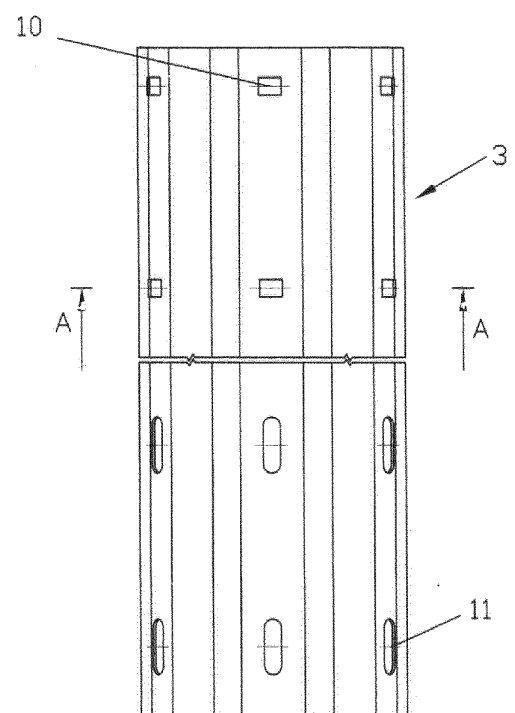


Figure 6

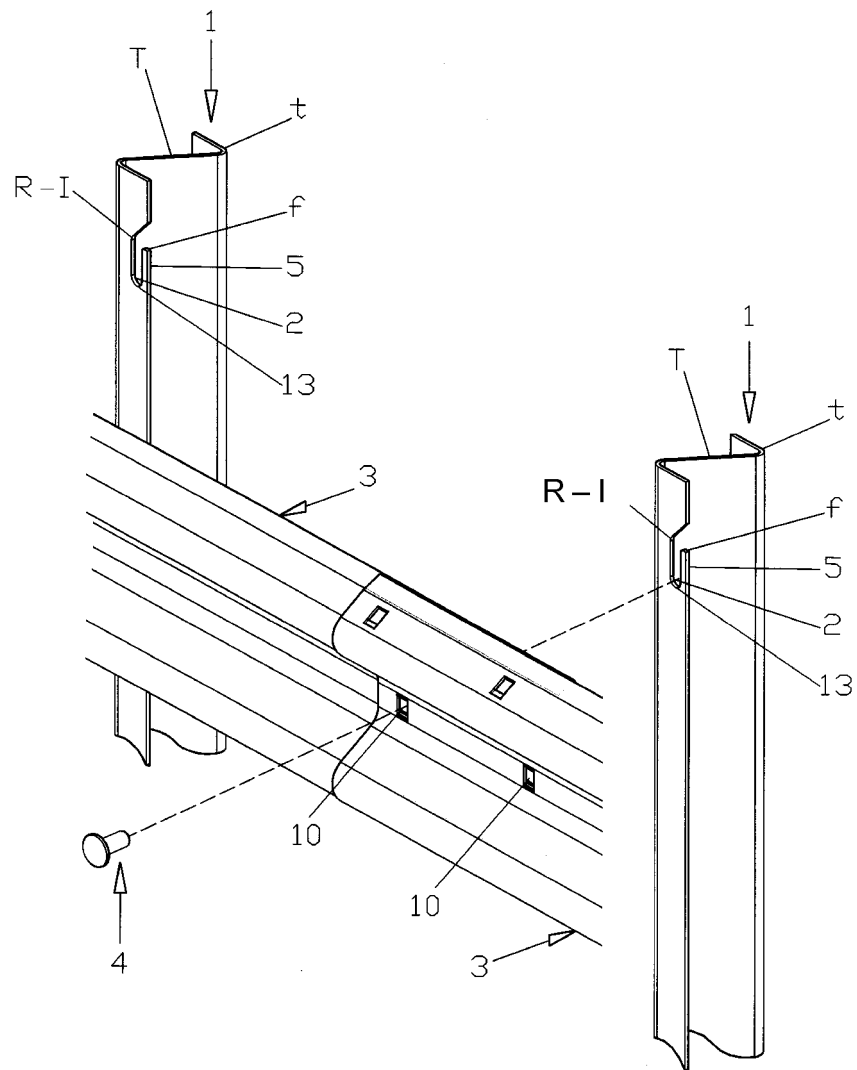


Figure 8

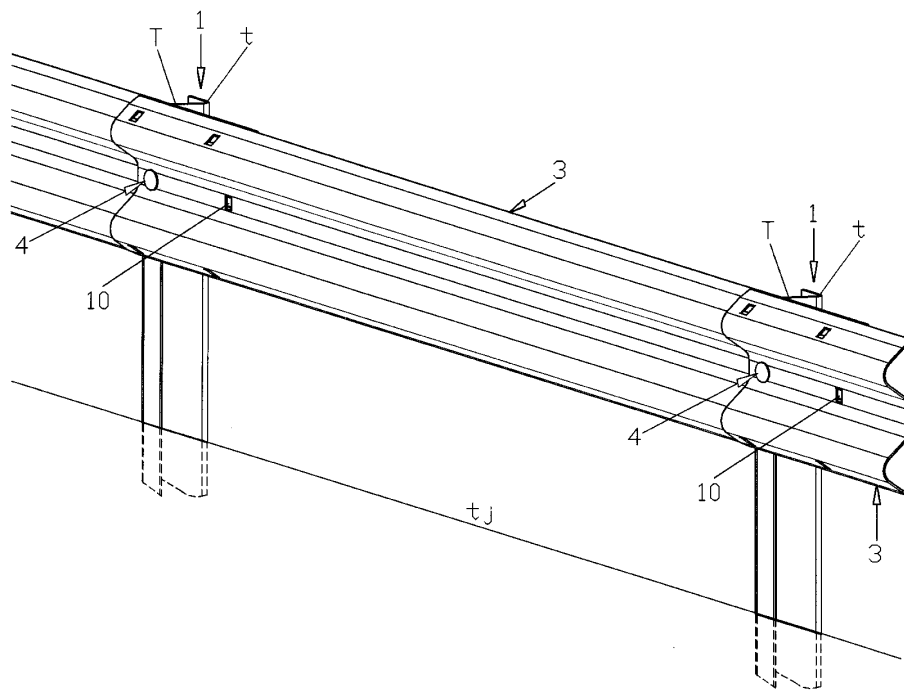


Figure 9

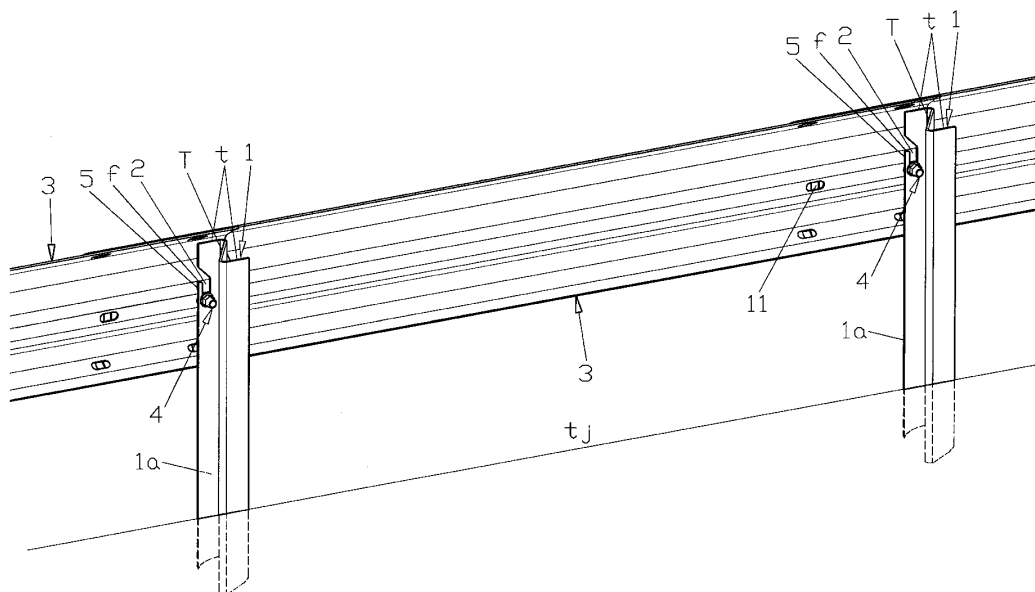


Figure 10

REFERENCES CITED IN THE DESCRIPTION

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