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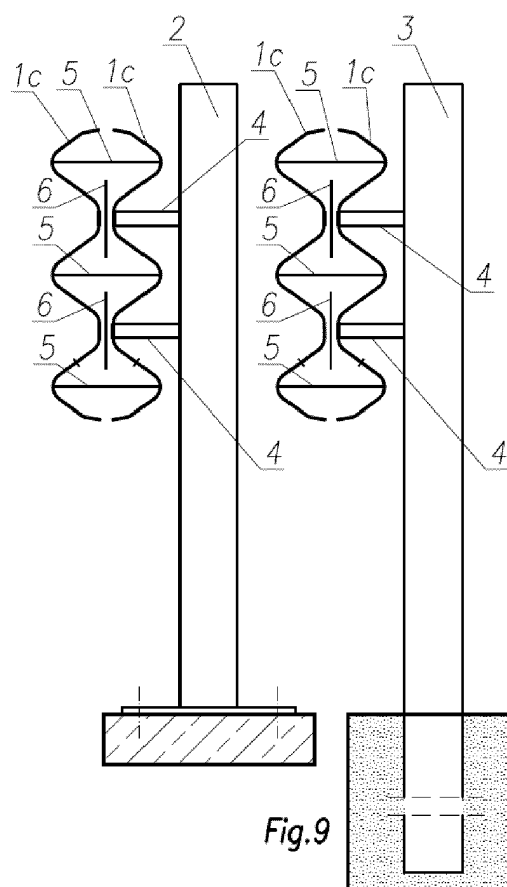
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(54) **ROAD OR BRIDGE SAFETY BARRIER**

(57) The road or bridge barrier comprising guides, characterised in that in accordance to the invention, in its basic structure, it is formed by at least two A-type or B-type or 3n-type coupled guides (1a-1c) connected back-to-back to each other. The guides are connected back-to-back to each other to form a single structure and attached to road posts (3) or bridge posts (2), forming together with the posts a safety barrier for a collision with a vehicle. Sets of connected guides can be joined over a greater length, e.g. by means of bolts.



Description

[0001] The invention relates to a safety barrier that prevents vehicles from falling off a bridge or running off the road.

[0002] The use of safety barriers known as guardrail barrier/traffic barrier/crash barrier/barricades on roadways or bridges for preventing vehicles from falling out of broadways line is common, e.g. in the case of a slippery road.

[0003] The basic factor used to determine whether a road or bridge safety barrier structure is working correctly/expectedly is a positive result of crash tests.

[0004] A typical solution for such barriers is a structure comprising of posts/stakes, one or more guides connected over a length with the posts directly or indirectly by means of additional known elements for combining guides. Other used elements are: profile strips, pipes, wire ropes, brackets.

[0005] The posts can be driven into the ground of the shoulder or attached to the supporting structure of the bridge or flyover with the use of basket anchors, adhesive anchors or bolts fixing them directly to the steel structure of the bridge or flyover.

[0006] The guides are made of Σ -shaped sheet section in particular made of metal, sinusoidal sheet, moulding, specially bent or cold-formed sections, solid bars.

[0007] The use of a single / one type guide such as A-type or B-type or 3n-type guide in safety barriers is known in the art. Said barriers have a specific/particular stiffness, strength and its flexibility that lead to lack of occurrence of excessive overloads in people present in the vehicle during a collision. All its components included in barriers impact on their level of working in expected way. Known types of guides are shown in Figs. 1, 2 and 3.

[0008] Patent description US6010275 discloses a design of a road barrier consisting of impact-absorbing elements and a barrier in the form of a row of posts connected to a guide. The absorbing elements are in the form of cylindrical elements made of a flexible material, for example rubber tires.

[0009] A road barrier for traffic routes with a large number of front-connected wall elements for absorbing kinetic energy from the impact of a car, each of which is connected to at least one anchoring element located on a surface, for example a road surface, bridge surface or another surface, with at least one fastening element is known from the Polish patent description PL192339. The at least one fastening element is sliding mounted relative to at least one anchoring element, and the wall element is, with its at least one fastening element, sliding mounted between a rest position and a position shifted by a set distance from the rest position. At least one anchoring element of the barrier is a rail element anchored to the ground, positioned approximately perpendicularly to the longitudinal dimension of the wall element and assigned to the sliding fastening element.

[0010] An element of a road barrier intended for inter-

operation with other segments forming a linear barrier separating two opposite traffic lanes is also known from the Polish description of the utility model No. 54951. The solution has the form of a polygonal solid, which in cross-section is a truncated, tapering upward, two-stage cone supported on a rectangular base, which in the front and rear planes has vertical recesses running parallel to the vertical axis, in which the connecting holders offset to each other are mounted. In the base of the element, a trapezoidal process opening extends longitudinally. In the upper part of the side walls mounting holes are arranged.

[0011] A road safety barrier, consisting of mounted posts and a guide, having an elastic insert placed between the stop elements of the posts and the barrier guide is known from the description of the Polish patent application PL.311384. It is equipped with guiding elements enabling the barrier guide to move.

[0012] A road safety barrier is known from the description of the Polish invention PL.347197, which has flexible load dampers arranged between the guide and the posts, each containing at least two coaxially fixed annular elements made of a material with elastic properties. There is a free space between the adjacent ring elements.

[0013] An absorbing element for a road safety barrier, having the form of a bent thin-walled metal section having a first fastening wall having connecting means adapted to be fastened to the barrier fender, a second fastening wall substantially parallel to the first fastening wall and having connecting means adapted to be attached to the barrier post, and two deformation walls connecting the first fastening wall to the second fastening wall is known from the description of the Polish invention application PL.412418. To enable the construction of road barriers with improved shock absorption capacity, each of the deformation walls of the absorbing element is inclined at an acute angle in the vertical plane, the orientation of the said angle of inclination being the same for both deformation walls, and the angle being in the range of 4 to 20°. The absorbing elements feature a simple and economical structure and allow quick installation of safety barriers.

[0014] The aim of the invention was to provide such a safety barrier structure which will have the required/expected parameters at the lowest possible weight of barriers and low price of production.

[0015] During the study on developing of the invention, it turned out that the stiffness of the guide affects/impacts on the amount of load transferred to the adjacent/connected with posts - the stiffer the guide, the more posts take the transferred external load, thus the cross-section of the posts can be reduced or their spacing increased. Locating in barrier/installing two or more guides in parallel, according to the invention, increases the stiffness of the guides significantly. On the other hand, in the known solutions, single guide in barrier is used.

[0016] The subject matter of the invention - essence of the solution - enables/allows for providing barriers with

the expected characteristics/parameters. The subject matter is presented in the claims.

[0017] The invention is a barrier, while the characteristic element of said barrier is the use of A-type, B-type or 3n-type guides connected back-to-back/dorsally - coupled/combined with known fasteners such as, e.g. bolts, rivets, welds, etc. They can be joined together by any method known in the art, e.g. with bolts, rivets or other permanent methods. The guides in the set are fixed/ arranged therefore in pairs. Between the guides, there may be additional filling element, element for stiffening or spacing elements/distance element/spacer known in the art. They can be located at a post or between posts. The barrier, according to the invention, may further comprise other guides or additional elements from the prior art. The guide sets, according to the invention, are connected to road posts. At least one set consisting of two A-type or B-type or 3n-type guides, which are coupled with bolts or other elements, is mounted/combined to the posts driven into the ground of the shoulder or fixed to the load-carrying structure of the bridge. As it turned out during the tests/evaluation, such coupling/combining of two guides increases several times the stiffness and strength of the cross-section. Thanks to the coupled guide, it is possible for example to reduce the stiffness of posts or increase their spacing. According to the invention, the guides should be connected/combined back-to-back/dorsally, but it is not required to be connected symmetrical. They can be asymmetric, i.e. a worked end/embossed of the guide connected with the non-worked end/non-embossed of the guide. However, only the guides connected back-to-back/dorsally give good results unlike the non-coupled guides but only located close to each other.

[0018] Preferably, the filling and stiffening elements are located in the guides at the post or between the posts.

[0019] Preferably, spacers are provided between the guides.

[0020] Preferably, more than one set of guides (pair) is provided.

[0021] The proposed structure of the barrier made by the back-to-back connection of the guides has a stiffness many times greater than the stiffness of two guides placed next to each other. This solution increases the stiffness of the barrier in relation to the unconnected guides, with the same mass. The embodiment shows the calculation results confirming the efficiency of the invention.

[0022] Figs. 1-3 show individual A-type, B-type, 3n-type guides used in the invention, and Figs. 4-6 show A-type, B-type, 3n-type guides with posts. These figures illustrate the state of the art as a comparison to the structure from the invention. These guides are used in the invention as shown in the following figures. The preceding figures show the prior art as a comparison to the structure from the invention. The invention is shown in more detail in the embodiments and in the further drawings. Figs. 7-9 show A-type, B-type and 3n-type guides fixed

to the road or bridge post according to the invention, i.e. in pairs. Figs. 4-6 show the barrier with non-coupled guides, while Figs. 7-9 show the barrier with coupled guides. Figs. 10-11 show the method of testing the invention and measuring the properties of the compared structures.

Designations in the drawing:

[0023]

Fig. 1

1a - A-type guide

Fig. 4

1a - A-type guide

2 - bridge post

3 - road post

Fig. 7

1a - A-type guide

2 - bridge post

3 - road post

4 - optional intermediate element

5 - optional insert

6 - optional spacer

Fig. 8

1b - B-type guide

2 - bridge post

3 - road post

4 - optional intermediate element

5 - optional insert

6 - optional spacer

Fig. 2

1b - B-type guide

Fig. 5

1a - B-type guide

2 - bridge post

3 - road post

Fig. 3

1c - 3n-type guide

Fig. 6

1c - 3n-type guide

2 - bridge post

3 - road post

Fig. 9

1c - 3n-type guide

2 - bridge post

3 - road post

- 4 - optional intermediate element
- 5 - optional insert
- 6 - optional spacer

Fig. 12

z3 - axis passing through the centre of gravity of coupled B-type guides
 b - the distance of the outermost fibres from the axis passing through the centre of gravity of the coupled cross-section

Fig. 10

z1 - axis passing through the centre of gravity of the B-type guide
 a - distance of the outermost fibres from the axis passing through the centre of gravity of the B-type guide

Fig. 11

z2 - axis passing through the centre of gravity of non-coupled B-type guides
 a - distance of the outermost fibres from the axis passing through the centre of gravity of the B-type guide

Example 1

[0024] According to the invention, guide sets are used - of at least one pair of coupled guides. Fig. 1-3 show a single A-type guide as shown in Fig. 1, B-type guide as shown in Fig. 2, 3n-type as shown in Fig. 3.

[0025] The barrier according to the invention includes one or more A-type, B-type, 3n-type back-to-back guide sets.

[0026] The set of such guides consists of two A-type, B-type 3n-type guides.

[0027] The guides are arranged in pairs back-to-back, connected to each other in a manner known in the art, e.g. with bolts, rivets or other permanent methods.

[0028] The sets of these guides are connected to road or bridge posts in a manner known in the art to form a road or bridge for a collision with a vehicle.

[0029] The guide sets can be joined over greater lengths in a manner known in the art.

[0030] The barrier according to the invention may additionally include other guides and parts not covered by the claims of the invention.

[0031] Between the guides, there may be additional filling, stiffening or spacing elements known in the art.

[0032] As shown in Fig. 7, the A-type guides 1a are back-to-back connected to each other to form a single structure and are attached to road posts 3 or bridge posts 2, forming together with the posts a safety barrier for a collision with a vehicle.

The guides can be connected with each other or with the

posts, for example, with bolts. Between the guides and the post, an intermediate element 4 is additionally fixed, which is, for example, a flat bar bent on both sides. There is a reinforcing element between the guides to stiffen the guides internally, e.g. in the form of a properly profiled sheet 5. This element can be located at the post as well as between the posts. Between the guides there is a spacer 6, e.g. in the form of a flat bar or a profile.

[0033] Sets of connected guides can be joined over a greater length, e.g. by means of bolts.

[0034] The solution has the required parameters. The evaluation of the barrier effectiveness is presented in the following examples.

Example 2

[0035] The invention has similar features as previously described. Fig. 8 shows the B-type guides 1b connected to each other back-to-back to form a single structure and attached to road posts 3 or bridge posts 2, forming together with the posts a safety barrier for a collision with a vehicle. They can be connected with each other or with the posts, for example, with bolts.

[0036] Between the guides and the post, an intermediate element 4 is additionally fixed, which is, for example, a flat bar bent on both sides. There is a reinforcing element installed between the guides to stiffen the guides internally, e.g. in the form of a properly profiled sheet 5. This element can be located at the post as well as between the posts. Between the guides there is a spacer 6 installed, e.g. in the form of a flat bar or a profile.

[0037] Sets of connected guides can be joined over a greater length, e.g. by means of bolts.

[0038] The solution has the required parameters. The evaluation of the barrier effectiveness is presented in the following examples.

Example 3

[0039] As described in the previous examples, the barrier is made of 3n-type guides attached to road posts 3 and bridge posts 2 as shown in Fig. 9.

There may be a reinforcing element between the guides to stiffen the guides internally, e.g. in the form of a properly profiled sheet 5. This element can be located at the post as well as between the posts. Between the guides there may be a spacer 6, e.g. in the form of a flat bar or a profile.

[0040] Sets of connected guides can be joined over a greater length, e.g. by means of bolts.

[0041] The solution has the required parameters. The evaluation of the barrier effectiveness is presented in the following examples.

Example 4 - Assessment of the effectiveness of the invention

[0042] Calculations of the stiffness of guides (single,

two non-coupled and coupled) constituting a component of the road and bridge barrier.

[0043] Figs. 4-6 shows the barrier with non-coupled guides, and Fig. 7-9 shows a barrier with coupled guides according to the invention, as described in example 1-3.

[0044] An additional element (5 and 6 in Figs. 7-9) may be positioned between the coupled guides in order to stiffen the guides or for structural reasons.

[0045] The coupled guides can be connected to the post directly or indirectly by means of an element 4 (Figs. 7-9). Coupled guides can be joined to obtain the length required on the site.

[0046] Calculations of the stiffness of the B-type guide (Fig. 2).

Drawing for calculations of the stiffness of the B-type guide fig. 10.

Moment of inertia of the B-type guide (fig. 2)

$J_{z1} = 108.94 \text{ cm}^4$ (moment of inertia of one B-type guide)

Section modulus of bending

$W_{z1} = 108.94/5.32 = 20.48 \text{ cm}^3$

[0047] Moment of inertia of non-coupled B-type guides - fig. 5.

[0048] Drawing for calculations - fig. 11.

$J_{z2} = 108/94 \times 2 = 217.88 \text{ cm}^4$ (moment of inertia of two non-coupled B-type guides).

[0049] Section modulus of bending:

$$W_{z2} = 20.48 \times 2 = 40.96 \text{ cm}^3.$$

[0050] Moment of inertia of the B-type coupled guides (Fig. 8 without additional elements 5 and 6). Drawing for calculations - fig. 12.

$A = 13 \text{ cm}^2$ (cross-sectional area of one B-type guide)

$J_{z1} = 108.94 \text{ cm}^4$ (moment of inertia of one B-type guide)

After considering Steiner's theorem, we get:

$J_{z3} = (108.94 + 13 \times 5.32^2) \times 2 = 953.7 \text{ cm}^4$ (moment of inertia of two coupled B-type guides)

[0051] Section modulus of bending:

$W_{z3} = 953.7/7.8 = 122.27 \text{ cm}^3.$

[0052] The above calculations show that when the sections are joined, it is possible to obtain a four-fold increase in stiffness ($\times 4.38$ to be exact) and a three-fold increase in cross-section strength.

[0053] A similar increase in stiffness and strength will occur in the case of application of A- or 3n-type guides, in accordance with the laws of physics and material strength.

2. The barrier according to claim 1, wherein the guides are combined with rivets or bolts or by welding.

3. The barrier according to claim 1, wherein between guides there is located an additional element for filling of the barrier structure or for stiffening of the barrier structure or there is a spacer .

4. The barrier according to claim 1, wherein it comprises several combined guides arranged in parallel next to each another.

Claims

1. Road or bridge safety barrier comprising guides, **characterised in that**, in its basic structure it is formed by at least two guides such as A-type or B-type or 3n-type, wherein the at least two types of guides are combined dorsally to each other.

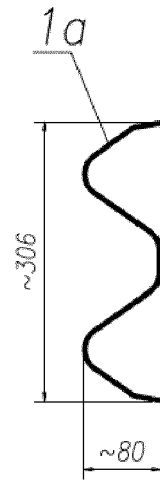


Fig.1

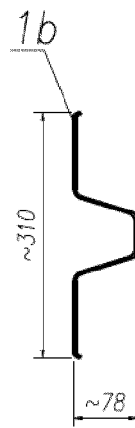


Fig.2

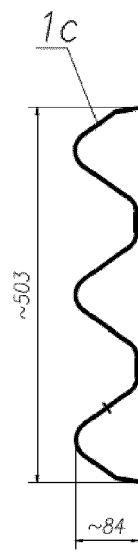
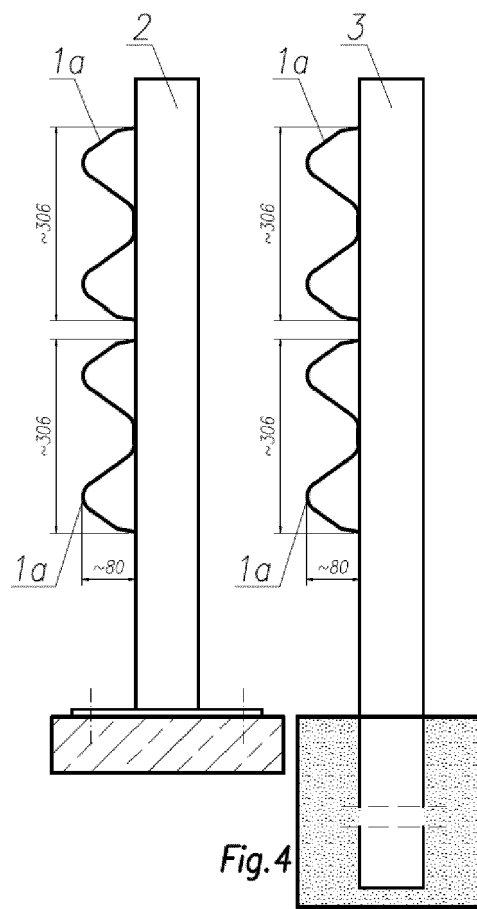
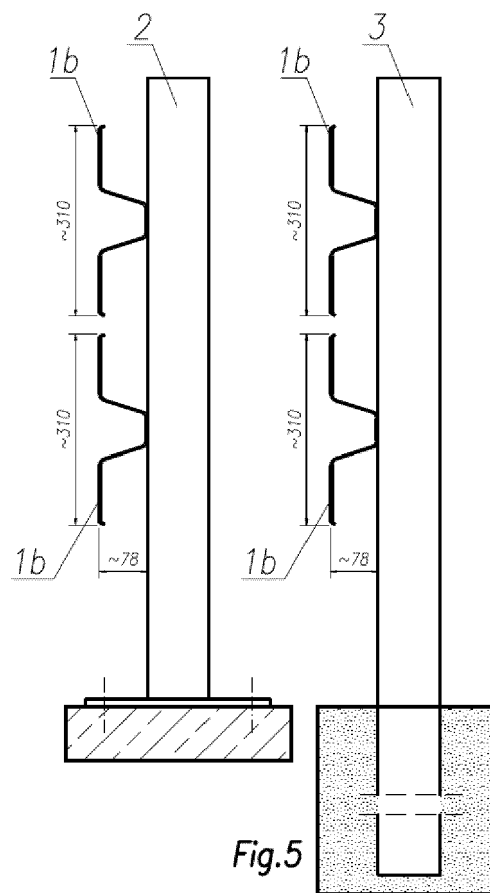
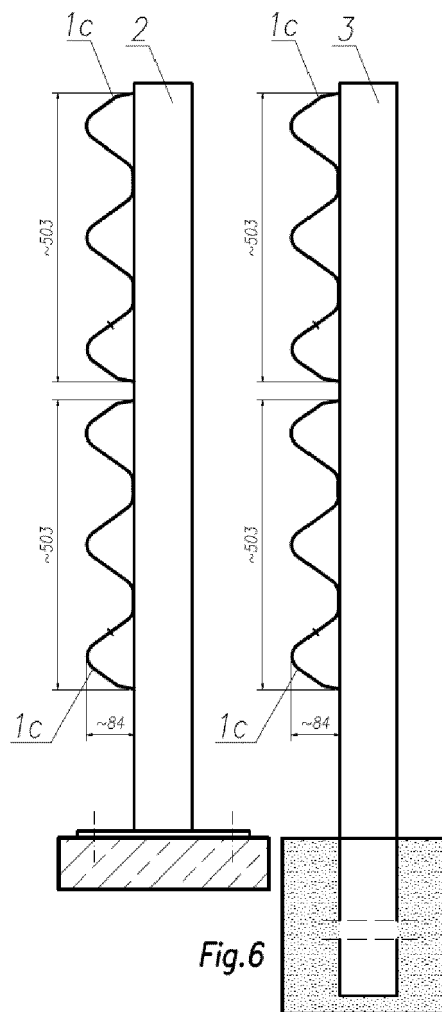


Fig.3







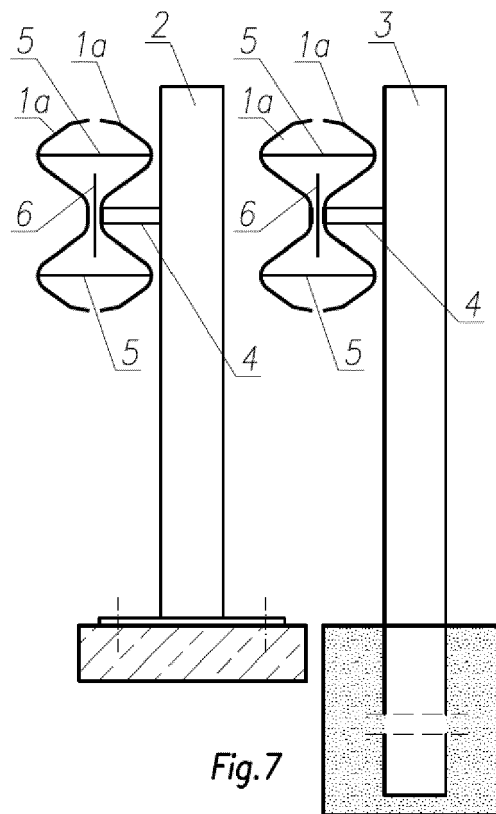


Fig.7

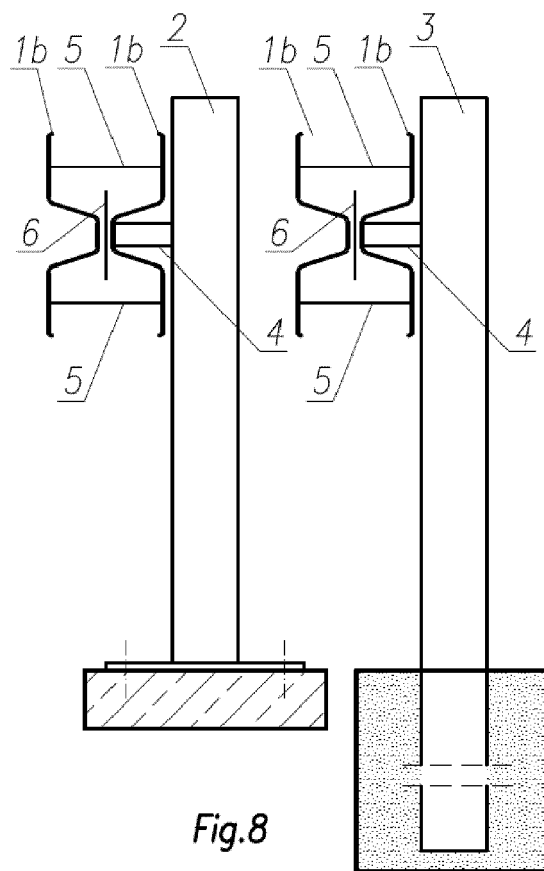


Fig.8

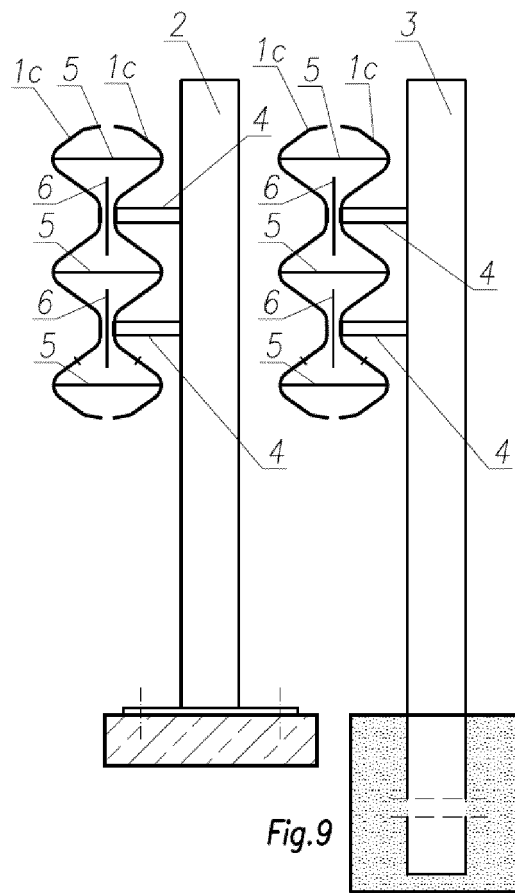


Fig.9

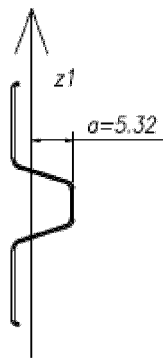


Fig. 10

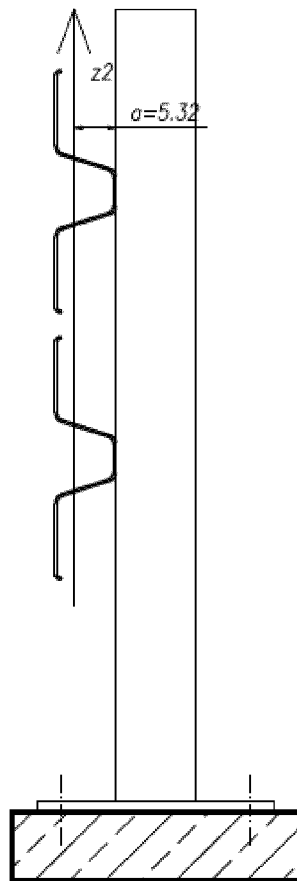


Fig. 11

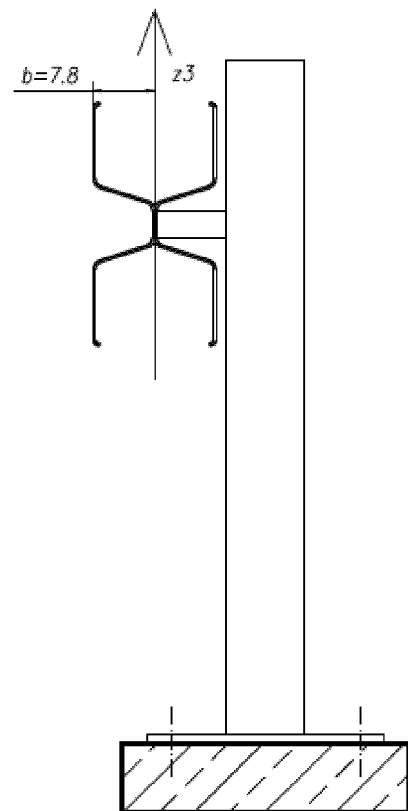


Fig. 12



EUROPEAN SEARCH REPORT

Application Number
EP 21 15 9113

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 810 325 A2 (AUTOSTRADA DEL BRENNERO S P A [IT]) 3 December 1997 (1997-12-03) * column 2, line 50 - column 3, line 32 * * column 4, lines 22-34; figures 1-7,15 *	1-4	INV. E01F15/04
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X	CH 489 669 A (MORTEO SOPREFIN SPA [IT]) 30 April 1970 (1970-04-30) * column 3, line 11 - column 4, line 20; figures 1-8 *	1-3	
			TECHNICAL FIELDS SEARCHED (IPC)
			E01F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 May 2021	Examiner Flores Hokkanen, P
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EP 21 15 9113

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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20-05-2021

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REFERENCES CITED IN THE DESCRIPTION

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