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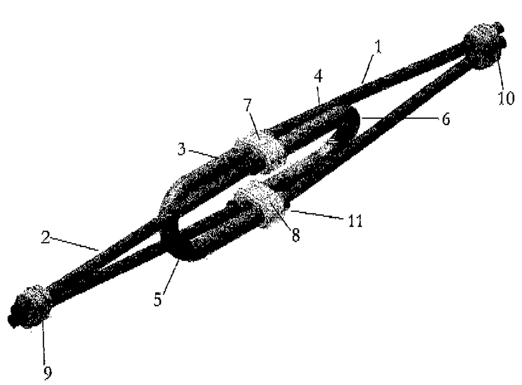
(54) IMPACT-ABSORBING DEVICE FOR USE IN EARTH-BANK-PROTECTION SYSTEMS

(57) Impact absorbing device for slope protection systems, fitted in the contention and protection screens to guard against stones or other bodies landsliding, comprising two cables arranged in the form of a lacing, each being cased in a "U" shaped tube, The cables are interlaced or arranged in parallel, the lacing being fastened together in their upper and lower part by a tightening element compressing the tubes.

These cables comprising the invention may be installed taut between the hill anchoring and the protection system, or alternatively, fitted on the mesh support cables with the posts. When an overload occurs on the contention screen, the sudden pull on the cables will force the tubes to become distorted to go between the tightening elements, such friction leading to a dissipation of energy.

Fig. 1



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Description

OBJECT OF THE INVENTION

[0001] This invention, as described in the report, is a device for absorbing impacts in slope protection systems, especially in containment screens and protection against falling stones or other bodies breaking away from hill sides to roll down the slope.

[0002] When securing land close to roads with traffic susceptible to the risk of rock landslide, defence structures are installed using cemented posts in the ground supporting a mesh net to contain any falling bodies. These structures incorporate taut anchoring cables between the hill and the fencing.

[0003] It has been verified that in the event of considerable elasticity load on this metal mesh, it is insufficient to absorb the kinetic energy, thus leading to breakage of the anchoring cables due to the sudden pull caused by large impacts, another possible effect on the mesh being considerable deformity. In order to equip these structures with a greater dynamic, anchoring cables are installed using loops or lacing with systems that allow for partial deformity of the dimensions of said loop or lacing in the event of substantial loads, thus enabling them to absorb the impact in successive stages.

[0004] The European Patent No. 91810923 shows us a loop shaped cable running inside a propeller shaped tube, being compressed on the outside of the ends of the tube by a tightening organ.

[0005] In a further European Patent, Utility Model No. 9801738, this cable applies a safety system in landslide zones, by installing cables with tubular lacing in the jackstays, made taut between the hill and the post, secured by a slack adjuster at the ends of the lacing. These cables, with identical characteristics, are also installed on the upper and lower mesh fastening.

[0006] Utility Model 9401490 presents a anti-rock slide screen with a tightening cable with no tubular coating, with loops positioned across clip devices operating with brake elements, such that the loop becomes deformed, thus reducing its size as the safety screen is subjected to overload.

[0007] The invention presented here substantially improves on these safety systems outlined above, achieving a balanced dissipation of energy in the event of considerable impacts on the safety mesh. This is achieved with a shock absorbing device comprising two cables, each forming lacing with identical dimensions. Each cable is encased in a tube, the lacing closed off by securing the cables with a ring.

[0008] The lacings are located in opposing directions, in their upper and lower parts fitted with tightening elements for a joint fastening at these points, exerting pressure on the tubes while allowing for the tubes to shift when the cables are subject to important overloads on the mesh.

[0009] Since the system is fitted with two twin sliding cables, the ability to absorb considerable pulls is greater than in previously known systems, as it distributes the energy evenly in the lacing set up in this manner.

[0010] To complement this description and in order to provide a greater understanding of the characteristics of this invention, this descriptive report is annexed by technical drawings to illustrate the recommended modus operandi, as follows:

Figure 1: Cables incorporating the device in the recommended manner.

Figure 2: A different view of where the cables are positioned.

Figure 3: Side view of the cables with tightening elements and the retaining ring at the end of the lacing.

Figure 4: View of the cables installed in the absorbing device once the lacing is exhausted.

Figure 5: Brake cables on the device in parallel, in another set up.

Figure 6: Another view of the brake cables in parallel.

Figure 7: Side view of the cables in parallel.

Figure 8: View of the cables in parallel when the lacing has been exhausted.

Figs. 9 to 12: View of the device in an alternative set up where the tightening elements are configured to avoid any contact between the tubes, both in the interwoven mode and in parallel.

[0011] As regards the figures described, the impact absorbing device is formed from two identically sized lacing cables (1, 2) on each cable, each one being cased in a long, narrow "U" shaped tube (3, 4), its curve being formed by the curve in the lacing (5, 6).

[0012] After the cased part in the "U" shaped tube, the lacing gradually lessens in size until it joins the two cables, it being secured at this point by means of a ring (9, 10).

[0013] Each cable set up in this manner is located in opposite directions to each other. They are located in such a manner that they fasten each other together and in the same position as the two cased tubes (Figures 1 to 4). They are secured by tightening elements fitted on the ends of the "U" shaped tubes, applying pressure on the upper and lower part of the two lacing (7, 8). The tightening elements are to be clamps or pieces that cover the diameter of the cased tubes to distort them in their section, thus reducing their diameter at these points.

[0014] It is recommended to secure in this manner, with friction between the tubes from the two lacing (Figures 1 to 8).

[0015] As the shape of this tube is distorted due to the pressure from the tightening elements, a gap is left at the end in order to avoid the tightening element getting jammed at the edge of the cased tube (11).

[0016] The cables are presented as recommended, mutually interlaced (Figures 1 to 4), so that the curve on each lacing is fitted on the inside perimeter of the other lacing. In this set up, when the size of the lacing is used up (Fig. 4), the tubes remain jammed at the mid point of the lacing, evenly transferring the shock forces along this point to the rest of the structure.

[0017] In an alternative set up, the cables are fitted in parallel and superimposed on top of each other, with no variations in the rest of the invention (Figures 5 to 8).

[0018] The invention may be modified with tightening elements that allow for a gap between the tubes, either by fastening them in parallel or interlacing them (Figures 9 to 12).

[0019] A further variation involves applying bare cables without inserting them into the tubes, in direct contact with the tightening elements.

[0020] The set up presented for the invention can be configured on the cables fitted on the safety screen, made taut between the hill anchoring and the protection mesh. Depending on the expected loads that a safety net will have to withstand, support cables for the mesh net may also be installed, between the posts.

[0021] In the event of shock to the protection mesh from bodies causing an overload on the cables, the shock absorbing device will allow for movement of the tubes with cased cable, forcing them to become distorted in section as they go between the tightening elements cavity, causing energy to be given off during friction. The structure of the lacing is resized until causing the total exhaustion of the same when the tightening elements reach the curve in the lacing (Fig. 4 and 8), at which point they must be replaced.

[0022] Depending on the expected loads to be withstood, the materials of the "U" shaped tubes may vary. Likewise, and for the same reasons, the diameters may also be changed. A prediction study will determine the most appropriate tightening elements for each case.

[0023] It should be understood that the invention has been described in terms of the recommended set up. Therefore, it may be subject to changes in form, size and materials, on the condition that said alterations involve no substantial variation on the characteristics of the invention as detailed below.

Claims

1. Impact absorbing device in slope protection systems, designed to dissipate the considerable energy loads to which the protection mesh may be subjected, which may be installed taut between the hill anchoring and the protection system, or fitted on the mesh support cables with the posts, **characterized by** comprising two cables forming independent, identical lacing that are each cased in a "U" shaped tube the curve of which forming the curve in the lacing, positioned in opposing and interlaced directions, the lacing being fitted together in the upper and lower part by tightening elements located at the ends of the "U" shaped tube, which compress the tubes, distorting them in their section and which, in the event of overloads in the protection system, allow for the tubes to move with a resizing of the lacing.

2. Impact absorbing device, according to Claim 1, **characterized by** the lacing closing when securing the cables by means of a ring.

3. Impact absorbing device, according to Claim 1, **characterized by** the tightening elements that exert pressure on the tubes, there being contact between the same.

4. Impact absorbing device, according to Claim 1, **characterized by** the fact that a further variation of the same entails the tightening elements keeping the two lacing separate, with no friction between the tubes.

5. Impact absorbing device, according to the previous claims, **characterized by** the fact that a further variation entails arranging the lacing in parallel and superimposed.

6. Impact absorbing device, according to the previous claims, **characterized by** the cables being able to come into direct contact with the tightening elements that are fitted in the mid, upper and lower part of the lacing.

Fig. 1

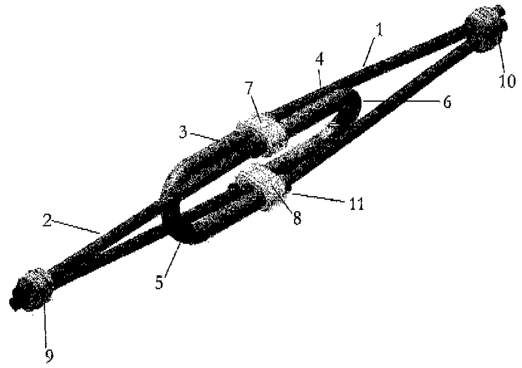
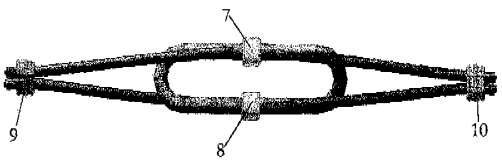


Fig. 2



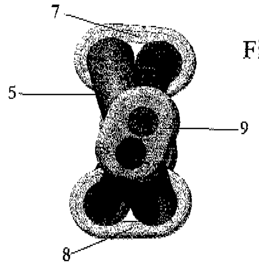


Fig. 3

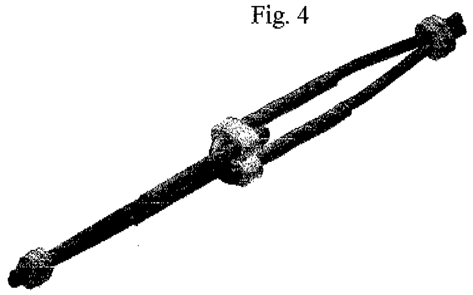
Fig. 4


Fig. 5

Fig. 6

Fig. 7

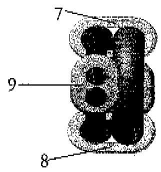


Fig. 8

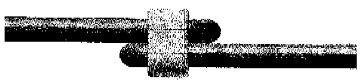


Fig. 9

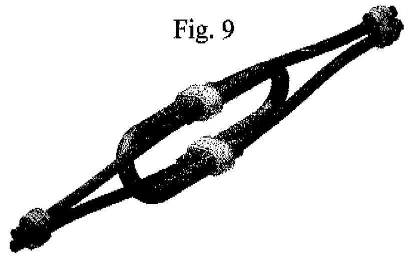


Fig. 10

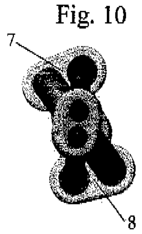


Fig. 11

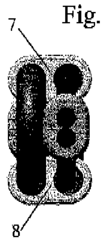
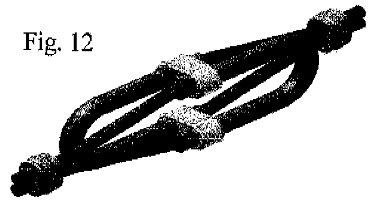


Fig. 12



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 91810923 A **[0004]**
- EP 9801738 A **[0005]**