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(54) Title: **ROAD SAFETY BARRIER**

(57) Summary:

Road safety barrier, comprising: lower parts (1); some upper concrete pieces (2) coupled on the lower pieces (1) and some means of joining (3, 31) of the successive upper pieces (2) at their opposite ends. The lower parts (1) have an upper surface provided with a longitudinal channel (11) for coupling in the longitudinal direction and with the possibility of limited vertical displacement of a longitudinal appendage (21) protruding from a lower surface of the upper parts (2); The channel (11) and the appendix (21) have similar cross-sections and dimensions calculated so that the upper part makes a lateral rotation of a certain amplitude, in the event of a vehicle impact, and absorbs a significant part of its kinetic energy.

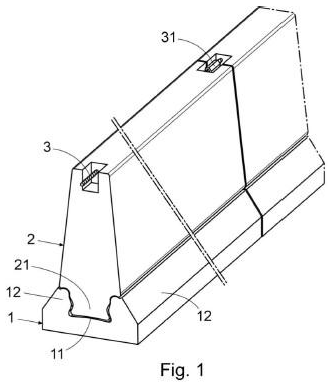

Fig. 1

DESCRIPTION

Road Safety Barrier

Technical sector.

The present invention relates to a road safety barrier comprising a series of precast concrete pieces, of constant cross-section, facing each other at their longitudinal ends, and including: lower parts conformants of a base of the barrier, and some upper pieces that make up a body of the barrier, these upper pieces being joined by means of union that relate the opposite ends of them.

This road safety barrier is located within the field dedicated to the Manufacture of protective elements intended to delimit vehicle circulation areas.

Prior art.

The barriers used to delimit areas of vehicle circulation are now widely known, consisting of pieces of concrete with a constant longitudinal section and which are fixed on the ground or simply rest on it.

Within concrete barriers, barriers are made up of a series of concrete elements that have a one-piece body, and barriers made up of lower pieces that make up a base of the barrier and upper pieces, which rest on the lower pieces, and which make up the body of the barrier itself; the latter being, formed by one piece upper and a lower one, those that are more closely related to the road safety barrier that is the subject of the invention.

In barriers formed by an upper and a lower part, the lower pieces, of constant section throughout their length, are arranged in an aligned line and comprise in their upper surface a longitudinal appendage protruding towards the upper area,

while the upper parts have a longitudinal hole on their lower surface for the reception of the longitudinal appendage of the lower pieces, which allows these upper parts to be assembled and dismantled vertically. Such a barrier can be observed, for example, in the patent document US 4 059 362. The disadvantage of this barrier, like those formed in a single piece of concrete, is that they do not have an adequate structure to deform and significantly absorb the kinetic energy of a vehicle in the event of an impact, so it does not minimise the harmful effects on the injured.

Road safety barriers also usually have means of joining the successive pieces at the longitudinal ends facing each other, which helps to maintain the alignment of the successive pieces.

For example, in the EP 1106738 A2 patent, they are used, to ensure continuity of the pieces of road safety barriers, rigid reinforcements housed in accommodations provided for in the concrete elements of the barrier.

In patent EP 0641893 A1, metal parts in the shape of an "H" are used as fasteners, the opposite ends of which are inserted vertically into the defined "C" housings at opposite ends of the concrete pieces.

These joining elements, like others on the market, have the disadvantage that, in the event of a very strong impact on the barrier, the parts constituent parts of the barrier are excessively misaligned, and the upper parts may be released from the lower parts of the barrier and these upper parts may break through the mounting areas of the joining means.

Road protection barriers are generally available, at the bottom or base, of a protruding part whose purpose is to return the vehicle to the road in the event that the vehicle's wheels impact the barrier at a reduced speed; however, when the vehicle impacts at a higher speed, the wheels exceed this ledge or protrusion of the barrier, impacting the vehicle against the body or vertical element of the barrier.

A problem with existing barriers is that, in the event of an impact, it is the vehicle that absorbs the energy, with the consequent high risk of injury to the occupants.

An alternative is safety barriers that are not fixed to the ground and that can be moved, absorbing part of the vehicle's kinetic energy from the impact of the barrier, reducing the risk of damage to the vehicle's occupants. However, the problem with the use of these movable barriers is that they cannot be installed in certain areas, because they cannot be installed in certain areas.

For example, in the median of the traffic lanes, since, in the event of an impact, this barrier would invade the opposite lane; and if these barriers were installed on the sides of the traffic lane, it would be necessary to provide a space on each side for the movement of the barrier in the event of an impact.

Therefore, in view of the existing precedents in the state of the art and the existing problems with road safety barriers, the technical problem that arises is the development of a barrier with lower parts that act as a base and that do not move in the event of an impact, and that it has upper parts related to each other and to the base, so that they can absorb a part of the

of the kinetic energy of a vehicle in the event of an impact, reducing the severity of the impact, with the consequent reduction of the possible harmful effects on the injured and, consequently, improving the level of containment.

Explanation of the invention.

The road safety barrier that is the subject of this invention, comprising prefabricated concrete pieces that include: lower parts forming the base of the barrier, upper parts forming a body or vertical element of the barrier and, optionally, means of joining the successive pieces

superior, has characteristics aimed at significantly increasing the absorption of kinetic energy during the impact of a vehicle, through a deformation of the structural system of the barrier.

Therefore, one objective of the road safety barrier that is the subject of the invention is to reduce

the severity of the impact (ASI index) and improve the level of containment.

The geometric and mechanical characteristics of the complex mean that its behaviour against impact has less harmful effects on the injured parties, compared to the existing concrete barriers in the state of the art.

According to the invention, the lower parts of the barrier have an upper surface provided with a longitudinal channel for the coupling, in a longitudinal direction and with the possibility of limited vertical displacement, of a longitudinal appendage protruding from a lower surface of the upper parts;

The longitudinal channel of the lower part and the longitudinal appendage of the upper part have similar cross-sections and with calculated dimensional differences so that, in the event of an impact from a vehicle, the upper part maintains its integrity and makes a lateral rotation with respect to the vertical mid-plane of the lower part of a determined amplitude and limited by the means of

Coupling of the upper and lower parts.

In the event that the barrier incorporates means of joining the upper parts, these means of joining collaborate with the means of coupling in limiting the lateral rotation of the upper part with respect to the lower piece.

The possibility of limited vertical displacement of the upper part with respect to the lower part, together with the also limited lateral rotation of the upper part with respect to the lower piece, contributes to improving the absorption of kinetic energy from the impact.

According to the invention, the longitudinal channel of the lower part and the longitudinal appendage of the upper piece comprise at least: an upper section of general decreasing width towards the lower area, and a lower section of a width between the greater and the smaller width of that upper section.

That characteristic and the dimensional difference between the longitudinal channel of the lower part and the longitudinal appendage of the upper part allow, in the event of an impact, the lateral rotation, of limited amplitude, of the upper part with respect to the lower piece and prevents that upper piece from being released in a vertical direction from the lower part of the barrier.

Preferably, the means of joining the successive upper pieces include threaded bars, dywidag type, mounted longitudinally in a through-way on the upper parts of the barrier and which are joined to the successive threaded bars by means of threaded sleeves; or some metal pieces fitted at the ends

opposite in holes or housings defined for this purpose at the opposite ends of the aforementioned upper pieces of the barrier. In the event of an impact, these means of joining help to limit the lateral rotation of the upper pieces with respect to the lower pieces of the barrier, minimising the risk of breakage or detachment of concrete fragments from the pieces of the barrier.

In order to avoid these breaks or partial detachments of concrete, it has been planned that both the longitudinal channel of the lower piece and the longitudinal appendage of the upper piece will have their longitudinal edges rounded, also favoring the lateral rotation of the upper piece in the event of an impact.

Preferably, the lower parts of the barrier are anchored to the ground without the possibility of lateral movement, thus preventing the pieces of the barrier from invading the traffic lanes in the event of an impact.

This invention also provides that the lower parts and the upper parts are of the same length and that they can be vertically aligned in pairs, that is, superimposed; or displaced mutually in a longitudinal direction, in the form of a staggered pattern, so that the joints of the lower parts are displaced in a longitudinal direction with respect to the joints of the

the upper pieces.

The characteristics of the invention will be more easily understood in view of the example of realization shown in the attached figures described below.

Brief description of the content of the drawings.

To complement the description that is being made and in order to facilitate the understanding of the characteristics of the invention, this is attached

descriptive memory a set of drawings in which, illustrative and not

limiting, the following has been represented:

- Figure 1 shows a perspective view of an example of the realization of the road safety barrier, according to the invention.

- Figure 2 shows an elevation view of a section of barrier in which the upper parts have been partially sectioned to allow the visualization of the means of joining them, which, in this example of construction, comprise threaded bars joined at their ends by threaded sleeves.

- Figure 3 shows an exploded, profile view of a lower piece and an upper piece of the barrier.

- Figure 4 shows a profile view of the barrier shown in Figures 1 and 2, and in which an upper piece coupled with a lower piece of the barrier can be seen.

- Figures 5 and 6 show profile views in which the limited rotation of the upper pieces towards one or the other side with respect to the midplane can be observed vertical of the lower parts in the event of an impact.

- Figure 7 shows a detail in lateral-upper perspective of the ends of two consecutive upper pieces, and in which it can be seen that they are fastened by the joining means when one of them rotates laterally, as as shown in Figures 5 and 6, due to a side impact.

- Figures 8 and 9 show elevation views of a barrier according to the invention, in which the upper pieces are respectively aligned and misaligned in a longitudinal direction with respect to the lower pieces of the barrier.

Detailed exposition of the ways in which the invention is realized.

As can be seen in Figure 1, the road safety barrier of the invention comprises lower parts (1) and upper pieces (2) of concrete, prefabricated and with a constant cross-section in the longitudinal direction.

As can be seen in figures 1 and 2, both the lower pieces (1) and the upper pieces (2) are facing each other at their longitudinal ends, forming alignments.

The successive upper parts (2) are related by means of connection, consisting of threaded rods (3), *dywidag* type, which pass through the interior of these upper parts (2) and which are fixed at their ends by means of threaded sleeves (31). These means of union collaborate with the coupling of the appendix (21) and channel (11) in limiting the lateral rotation of the upper parts (2) in the event of a vehicle impacting the barrier.

Each of the lower parts (1) has a longitudinal channel (11) on its upper surface for coupling in the longitudinal direction, like a slide, of a longitudinal appendage (21) protruding from the lower surface of the upper pieces (2).

The channel (11) and the appendix (21) have similar cross-sections and dimensional differences that facilitate their coupling in the direction longitudinal and that limit its possibility of relative displacement in a vertical direction.

Figure 3 shows that both the channel (11) of the lower piece and the appendix (21) of the upper piece have an upper section, referenced as (a) in the Appendix (21), with a general width decreasing towards the lower area; and a lower section (b) with a width between the greater and the smaller width of the upper section (a).

Once the appendage (21) has been coupled in the longitudinal direction in the channel (11), the part upper (2) is arranged vertically aligned with the longitudinal midplane (P) of the lower piece (3), as shown in Figure 4.

Due to the shape and dimensional difference between the channel (11) of the lower pieces (1) and the longitudinal appendage (21) of the upper pieces (2), when the barrier receives a side impact from a vehicle, the top piece (2) makes a turn

towards one or the other side with respect to the vertical midplane (P) of the lower piece (1), as represented in figures 5 and 6, which contributes to improving the absorption of kinetic energy from the impact and reducing the harmful effects on the injured parties.

The lateral rotation of the upper parts (2) with respect to the lower parts (1) is limited by the geometry of the channel (11) of the lower parts and by the longitudinal appendage (21) of the upper parts, the possibility of rotation being also limited by the action of the joining means, in this case the threaded bar (3), as shown in Figure 7.

Through the calculations and tests carried out during the development of this road safety barrier of the present invention, it has been found that, with the characteristics indicated, this barrier absorbs up to 25% of the total kinetic energy of the impact of a vehicle, which far exceeds the energy absorption capacity of the concrete barriers existing on the market.

In the construction shown, and as can be seen for example in Figure 1, the lower parts have the typical cross-section of a general trapezoidal shape, with side ramps (12) that tend to return the vehicle to the track of circulation in the event of a low-speed impact.

Finally, and as shown in figures 8 and 9, it has been expected that the lower parts (1) and the upper pieces (2) will have the same length, in this example of about 6 meters, and that in the assembly position the upper pieces will be (2) and the lower pieces (1) can be found vertically aligned in pairs, i.e. with their longitudinal ends vertically aligned, as shown in Figure 8; or moved in a longitudinal direction, in a staggered pattern, as shown in Figure 9.

DEMANDS

1.- Road safety barrier, which comprises a series of prefabricated concrete pieces, with a constant cross-section, facing each other at their ends longitudinal, which include: lower pieces (1), forming a base of the barrier, and upper pieces (2), forming a body of the barrier, supported and coupled on the lower pieces (1); **characterized** by the fact that the lower parts (1) have an upper surface provided with a longitudinal channel (11) for coupling in the longitudinal direction and with the possibility of displacement of a longitudinal appendix (21) protruding from a lower surface of the upper parts (2); the longitudinal channel (11) of the lower part (1) and the longitudinal appendix (21) of the upper part (2) have similar cross-sections, and with dimensional differences calculated so that, in the event of a vehicle impact, Top piece maintain its integrity and performs, with respect to the vertical mid-plane (P) of the lower piece (1), a lateral rotation of a determined amplitude and limited by the means of coupling of the upper and lower parts; comprising the longitudinal channel (11) of the lower piece (1) and the longitudinal appendage (21) of the upper piece (2), at least: an upper section (a) of general width decreasing towards the lower area, and a lower section (b) of a width between the largest and the smallest width of the upper section (a).

2. Barrera, according to any of the previous demands, **characterized** by the fact that the successive upper pieces (2) are related by means of joining (3, 31) which assist in the coupling of the appendage (21) and the channel (11) in limiting the lateral rotation of the upper parts (2) in the event of an impact of a vehicle against the barrier.

3. Barrier, according to a Any of the Demands above, **characterized** because the longitudinal channel (11) of the lower piece (1) and the appendix (21) of the upper part (2) have rounded longitudinal edges.

4.- Barrier, according to a Any of the Demands above, **characterized** because the lower pieces (1) are anchored to the ground, without

possibility of travel.

5.- Barrier, according to a Any of the Demands above,

characterized by the fact that the lower pieces (1) and the upper pieces (2) have the the same length and are: vertically aligned in pairs; or moved mutually in a longitudinal direction, in a staggered pattern.

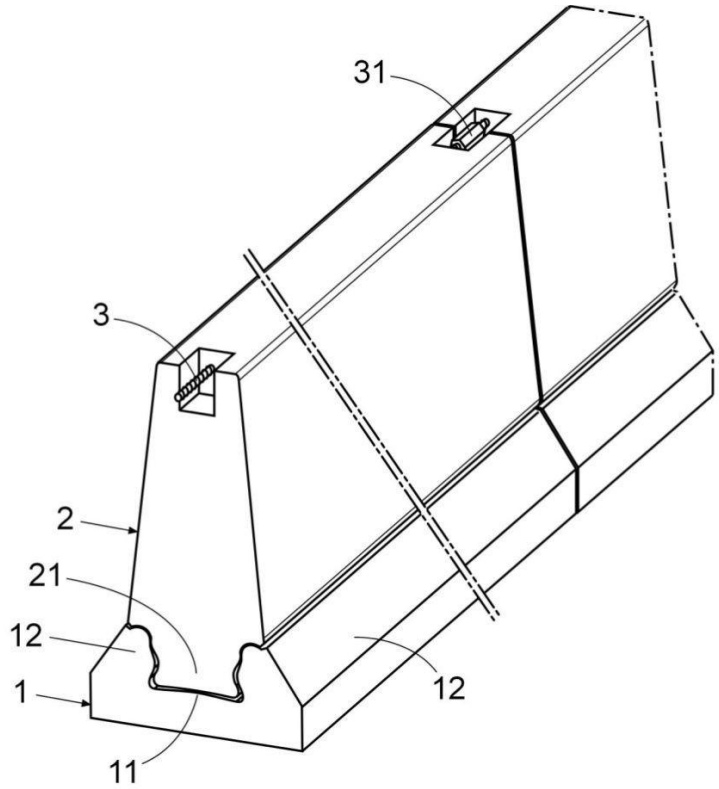

Fig. 1

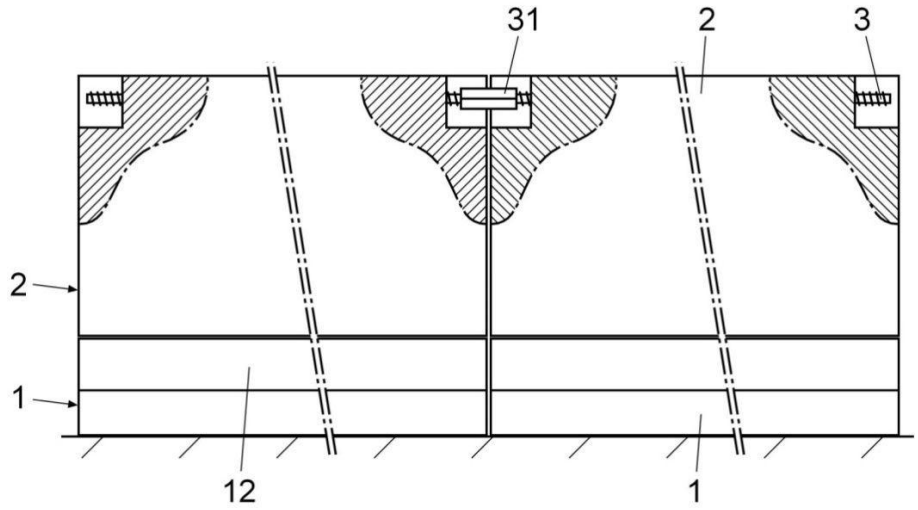

Fig. 2

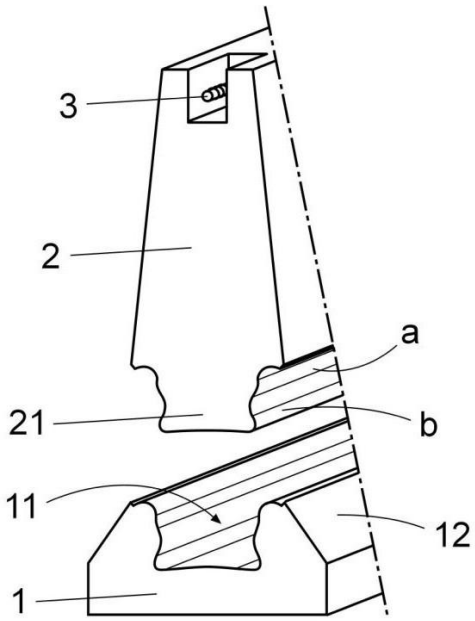

Fig. 3

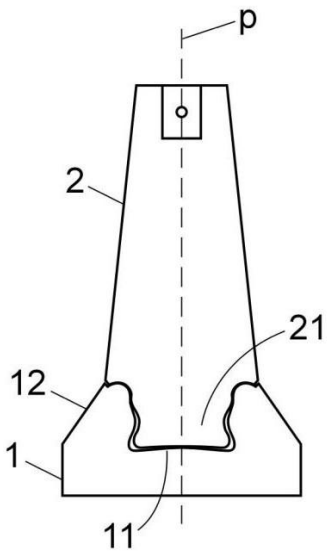

Fig. 4

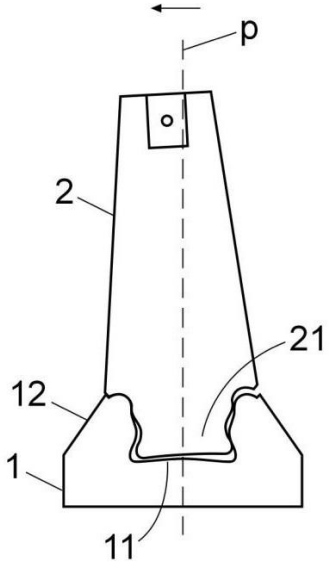

Fig. 5

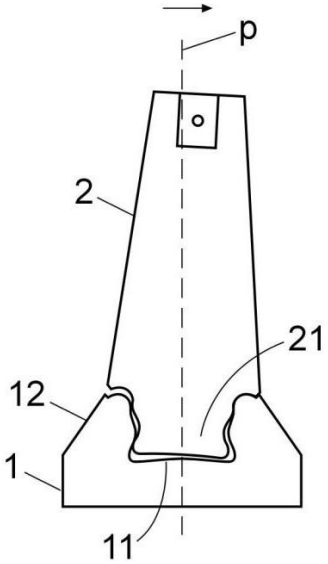

Fig. 6

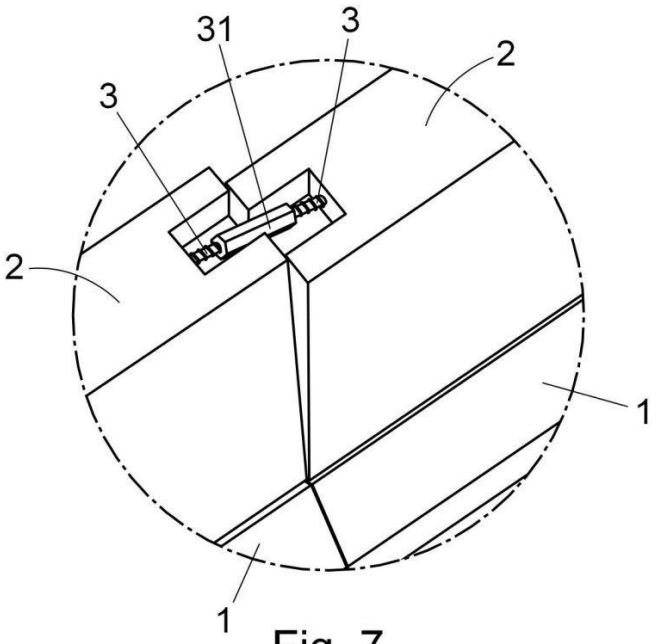

Fig. 7

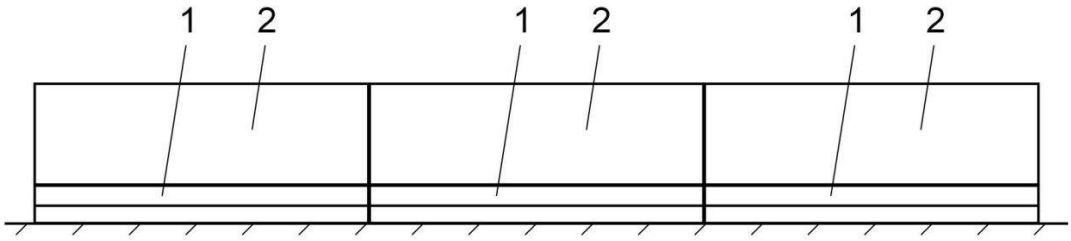

Fig. 8

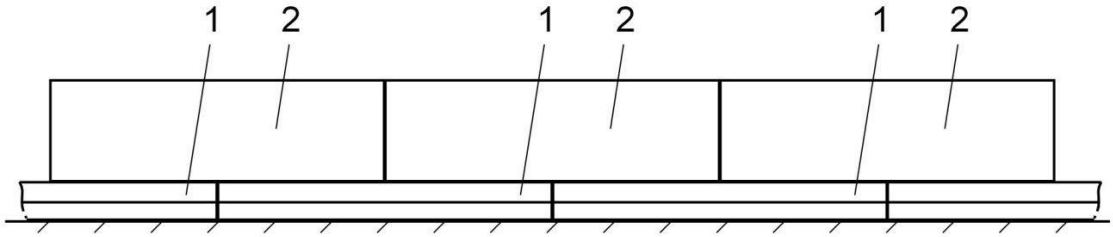

Fig. 9