

Barrier System

This invention relates to barrier systems, and in particular but not exclusively, to security barriers that provide a perimeter protection against vehicular intrusion around airports and the like.

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Security barriers are designed to resist vehicle impacts in a direction substantially perpendicular to the security barrier. In contrast, conventional road crash barriers are designed to deflect vehicles impacting the fence an angle of 15 to 25 degrees relative to the fence (i.e. small angles) at speeds up to 110 km/h (68 mph). Security barriers may be used as anti-terrorist fences or perimeter security barriers for restraining heavy vehicles.

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According to a first aspect of the present invention, there is provided an elongate bracket comprising at least one each of a first type and a second type of mutually spaced fence member receiving channels, the or each channel of the second type having a greater width than the or each channel of the first type, as measured along a length of the bracket.

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It will be understood that, when a bracket of the present invention is used to attach (horizontal) fence members to a (vertical) support post in a security barrier system, the or each channel of the second type allows its respective fence member to slide upwardly along the support post and within the channel during an impact of a vehicle with the security barrier system. This has the advantage that the energy from the impact can be absorbed in a controlled and load shedding manner.

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In an embodiment, the bracket further comprises a plurality of non-channel regions. The non-channel regions may comprise an interconnecting region between each pair of adjacent channels. The non-channel regions may comprise a pair of end regions at the ends of the bracket.

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In an embodiment, one of more of the non-channel regions comprises an aperture. The aperture provides a means by which the bracket may be attached to a support post.

In an embodiment, the non-channel regions lie in a common plane, with the channels extending out of the common plane. The non-channel regions may be planar.

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5 In an embodiment, each of the first type of channels has a substantially semi-circular cross-section. In use, a cross-section of this shape allows the fence member to be better held against the support post, and helps to hold the fence member in place during the impact of the vehicle. Additionally, a bracket with a channel of this shape is easy to manufacture.

10 In an embodiment, each of the second type of channels has a linear central region between arcuate end regions. The linear region extends in a direction parallel to the length of the bracket. In use, a cross-section of this shape helps to hold the fence member against the support post but to slide along the support post during the impact of the vehicle. Additionally, a bracket with a channel of this shape is easy to manufacture.

15 In an embodiment, the bracket comprises one channel of the second type. In an embodiment, the bracket comprises at least two channels of the first type. In an embodiment, the bracket comprises three channels of the first type.

20 In an embodiment where more than one channel of either type is provided, the channels can be arranged in any order along the length of the bracket.

25 In an embodiment, a channel nearest to a first end of the bracket is a channel of the first type, and a channel second nearest to the first end of the bracket is a channel of the second type.

30 According to a second aspect of the present invention, there is provided a security barrier system comprising a plurality of support posts, attached to each support post at least one bracket in accordance with the first aspect, the length of the bracket orientated vertically, and a plurality of fence members orientated horizontally, each member passing through a corresponding one of the fence member receiving channels of each bracket.

35 In an embodiment, each support post has attached thereto two brackets in accordance with the first aspect. In an embodiment, the two brackets attached to the support post are substantially identical to each other.

In an embodiment, the two brackets are attached to each support post at the same position along a length of the support post.

- 5 In an embodiment, at least one bolt attaches the two brackets to each support post, each bolt extending through the aperture of a non-channel region of a first of the two brackets, an aperture of the support post, and an aperture of a non-channel region of a second of the two brackets. Using bolts to attach the support posts in this manner simplifies assembly of the security barrier system. The security barrier system may be
10 assembled in situ more easily.

- In an embodiment, the support post has a substantially rectangular cross section. A support post with this cross section is easy to manufacture. In an embodiment, the non-channel regions of the brackets are flush with the support post, and are therefore
15 planar. An advantage of this feature is that the security barrier system is more compact. The support post may be of circular cross section, in which case the non-channel regions of the brackets may be correspondingly curved.

- In an embodiment, the horizontal fence members have a circular cross-section defining
20 a fence member diameter. In an embodiment, each channel of the first type has a width substantially equal to the fence member diameter. In an embodiment, each channel of the first type has a depth substantially equal to the fence member diameter. This helps to hold the fence member in place during the impact of the vehicle.

- 25 In an embodiment, each channel of the second type has a depth substantially equal to the fence member diameter and a width greater than the fence member diameter. This helps to hold the fence member against the support post but to slide along the support post during the impact of the vehicle

- 30 The fence members may be cables or bars.

Embodiments of the present invention will now be described with reference to the accompanying figures, in which:

- 35 Figure 1 is an exploded side view of a security barrier system, according to an embodiment of the present invention;

Figure 2a is a plan view of a security barrier system, according to an embodiment of the present invention;

Figure 2b is a side view of a security barrier system, according to an embodiment of the present invention; and

5 Figure 2c is a front view of a security barrier system, according to an embodiment of the present invention.

Figure 1 shows an exploded side view of a security barrier system 1, which includes a pair of brackets 2a, 2b according to an embodiment of the first aspect of the present invention. Each bracket 2a, 2b is elongate, and each includes three fence member receiving channels of a first type 10a-10f and one fence member receiving channel of a second type 8a, 8b. The fence member receiving channels are mutually spaced along the bracket. The channel of the second type 8a, 8b has a greater width than the channels of the first type 10a-10f, as measured along the length of the bracket (which is shown vertically).

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Each bracket 2a, 2b comprises a plurality of non-channel regions 15a, 15b, 20a, 20b. The non-channel regions comprise interconnecting regions 15a, 15b between each pair of adjacent channels 8a, 8b, 10a-10f, and a pair of end regions 20a, 20b, at respective opposite ends of the bracket 2a, 2b.

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Each non-channel region 15a, 15b, 20a, 20b comprises an aperture, which provides a means by which the brackets 2a, 2b are fixed to a support post 4. This is described in more detail below. It will be appreciated that in other embodiments (not shown), only some (one or more) of the non-channel regions 15a, 15b, 20a, 20b comprise an aperture.

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The non-channel regions 15a, 15b, 20a, 20b lie in a common plane, while the channels 8a, 8b, 10a-10f extend out of the common plane. The non-channel regions 15a, 15b, 20a, 20b are planar.

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The channel 10a, 10d nearest to a first (lower) end of each bracket 2a, 2b is a channel of the first type, while the channel 8a, 8b, second nearest to the first end of each bracket 2a, 2b is a channel of the second type.

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The bracket may be constructed from any suitable material. In the present embodiment, the bracket is constructed from steel.

5 In use, the brackets 2a, 2b are fixed to a support post 4, in a manner described in more detail below, to form the security barrier system 1. Each of the channels 8a, 8b, 10a-10f supports one of a series of horizontal fence members 12a-12h, and each of the channels of the second type 8a, 8b allows its respective fence member 12b, 12f to slide upwardly along the support post 4 during an impact of a vehicle with the security barrier system 1.

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Referring to figures 2a to 2c, there are shown three views of an assembled security barrier system 1, according to an embodiment of the second aspect of the present invention. Figure 2a shows a plan view of the security barrier system, figure 2b shows a side view and figure 2c shows a front view.

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The security barrier system 1 comprises a plurality of support posts 4 (only one is shown in figures 2a to 2c). Attached to each support post is a pair of brackets 2a, 2b, as described above with reference to figure 1. The support posts 4 and the lengths of the brackets 2a, 2b are orientated vertically. The security barrier system 1 comprises a plurality of steel cables which serve as horizontal fence members 12a-12h, with each cable passing through a corresponding one of the fence member receiving channels 8a, 8b, 10a-10f of each bracket 2a, 2b.

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The non-channel regions 15a, 15b, 20a, 20b are flush with the support post 4. The support post 4 has an approximately rectangular cross section. In other embodiments (not shown), the support post has an approximately square cross-section.

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One of the brackets 2a is attached to a front face 14a of the support post 4, and the other bracket 2b is attached to a rear face 14b of the support post 4. The first and second brackets 2a, 2b are attached to the support post 4 at the same position along a length of the support post 4.

In other embodiments (not shown), the fence members 12a-12h are bars.

The channels of the first type 10a-10f have a width (in a direction parallel to a longitudinal axis of the support post 4) and depth (in a direction perpendicular to the longitudinal axes of the support post 4 and the fence members 12a-12h), both approximately equal to the diameter of the cables. In this case, this is achieved by the
5 channels of the first type 10a-10f having a semi-circular cross-section.

The channels of the second type 8a, 8b have a depth approximately equal to the cable diameter, but have a width greater than the cable diameter. This is achieved by the channels of the second type 8a, 8b having a linear central region between arcuate end
10 regions, with the linear portion extending in a direction parallel to the length of the bracket. In the present embodiment, the arcuate end regions are quarter circles.

The brackets 2a, 2b are fixed to the support post 4 by a series of bolts 16. Each bolt 16 extends through the aperture of a non-channel region 15b, 20b of the second bracket
15 2b, an aperture of the support post 4, and the corresponding aperture of a non-channel region 15a, 20a of the first bracket 2a. The bolts 16 are held in place by a series of nuts 18. It will be appreciated that in some embodiments, bolts 16 will only extend through only some (one or more) of the non-channel regions 15a, 15b, 20a, 20b.

20 The support post may be constructed from any suitable material. In the present embodiment, the support post is constructed from steel.

As described above, for each bracket 2a, 2b, the lowest of the channels (at the lowest height on the support post 4) is a channel of the first type 10a, 10e, while a second
25 lowest is a channel of the second type 8a, 8b. The channels of the second type 8a, 8b are located at a critical loading point, determined based on the type of vehicle which is expected to impact the barrier. Positioning the channels of the second type 8a, 8b at a critical loading point means that they are located at the height of the stiffest area of the vehicle which is expected to impact the barrier (i.e. at the height of the vehicle's
30 bumper). The effect of positioning the channels of the second type 8a, 8b at a critical loading point is described below.

On impact of a vehicle with the security barrier system 1, the channels of the second type 8a, 8b allow their respective cables 12b, 12f to slide upwardly along the support

post 4. This allows the energy from the vehicle impact to be absorbed and shed, the energy transferring along the cables to posts adjacent to the impact zone.

5 In some cases, when the channels of the second type 8a, 8b are located at the critical loading point, on vehicle impact, the upward sliding of the cables 12b, 12f shifts them away from the stiffest areas of the vehicle.

10 In other cases, when the channels of the second type 8a, 8b are located at the critical loading point, on vehicle impact, the cables 12b, 12f slide upwardly, keeping their position on the vehicle, with the vehicle moving upwardly with the cables 12b, 12f.

15 In either of the cases described above, positioning the channels of the second type 8a, 8b at the critical loading point further improves the dissipation of energy, as this helps to spread the load from the vehicle into all of the fence members 12a-12f as evenly as possible.

List of Reference Numerals

	1	Security barrier system
	2a, 2b	Bracket
	4	Support post
5	8a, 8b	Extended slot
	10a, 10b, 10c, 10d, 10e, 10f	Unextended slot
	12a, 12b, 12c, 12d, 12e, 12f, 12g, 12h	Fence member
	14a	Front face
	14b	Rear face
10	15a, 15b	Interconnecting region
	16	Bolt
	18	Nut
	20a, 20b	End region

CLAIMS:

1. A security barrier system comprising:
 - a plurality of support posts, attached to each support post at least one
 - 5 bracket, the bracket comprising at least one each of a first type and a second type of mutually spaced fence member receiving channels, the or each channel of the second type having a greater width than the or each channel of the first type, as measured along a length of the bracket, the length of the bracket orientated vertically; and
 - 10 a plurality of fence members orientated horizontally, each member passing through a corresponding one of the fence member receiving channels of each bracket;
 - wherein the or each channel of the second type allows its respective fence member to slide upwardly along the support post and within the channel
 - 15 during an impact of a vehicle with the security barrier system.
2. The security barrier system of claim 1, the at least one bracket further comprising a plurality of non-channel regions.
- 20 3. The security barrier system of claim 2, wherein each support post has attached thereto two brackets, the lengths of the brackets orientated vertically.
4. The security barrier system of claim 3, wherein the two brackets attached to each support post are identical to each other.
- 25 5. The security barrier system of claim 4, wherein the two brackets are attached to each support post at the same position along a length of the support post, and optionally, wherein at least one bolt attaches the two brackets to each support post, each bolt extending through:
 - 30 an aperture of a non-channel region of a first of the two brackets;
 - an aperture of the support post; and
 - an aperture of a non-channel region of a second of the two brackets.

6. The security barrier system of any of preceding claim, wherein the support posts have substantially rectangular cross sections.
- 5 7. The security barrier systems of any of claims 2 to 6, wherein the non-channel regions of the brackets are flush with the support posts.
8. The security barrier system of any preceding claim, wherein each fence member has a circular cross-section, the circular cross-section having a fence member diameter, and optionally, wherein each channel of the first type has a
10 member diameter, and optionally, wherein each channel of the first type has a width and depth substantially equal to the fence member diameter.
9. The security barrier system of claim 8, wherein each channel of the second type has a depth substantially equal to the fence member diameter and
15 a width greater than the fence member diameter.
10. The security barrier system of any preceding claim, wherein the fence members are cables and/or bars.
- 20 11. The security barrier system of any of claims 2 to 10, wherein the non-channel regions comprise an interconnecting region between each pair of adjacent channels, and/or wherein the non-channel regions comprise a pair of end regions at the ends of the bracket, and/or wherein at least one of the non-channel regions comprises an aperture.
- 25 12. The security barrier system of any of claims 2 to 11, wherein the non-channel regions lie in a common plane, the channels extending out of the common plane, and optionally, wherein the non-channel regions are planar.
- 30 13. The security barrier system of any preceding claim, wherein each of the first type of channels has a substantially semi-circular cross-section, and

optionally, wherein the at least one bracket comprises three channels of the first type.

14. The security barrier system of any preceding claim, wherein each of the
5 second type of channels has a linear central region between arcuate end regions, and/or wherein the at least one bracket comprises one channel of the second type, and/or wherein a channel nearest to a first end of the bracket is a channel of the first type, and a channel second nearest to the first end of the bracket is a channel of the second type.