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Security Bars

- The present invention relates to security bars which may be made up into grilles or gratings eg to cover the window
- 5 openings in security buildings for protection against intrusion or escape, for use as glazing bars or mullions in security applications, or for use more generally in the field of security grilles and shutters.
- 10 An aim of the invention is to provide a security bar having high resistance to both bending and cutting and, in particular, superior resistance to attack with metal-cutting saws or files than is the case with traditional steel window bars. Accordingly the invention proposes a composite form of
- 15 bar comprising a core of a steel or other material resistant to bending surrounded by a layer which comprises elements of hard, saw-resistant material bound in a cast polymeric matrix. Most preferably the bending-resistant core is disposed within and spaced from an outer finishing skin and
- 20 the matrix which binds the hard elements is cast in situ within the space defined between the core and skin.

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These and other features of the present invention will become apparent from the ensuing description of preferred examples thereof taken in conjunction with the accompanying schematic drawings, in which:

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Figure 1 illustrates a window grating comprising bars in accordance with the invention;

Figure 2 is a horizontal cross-section through an individual
10 bar of the grating;

Figures 3a to 3c and 4a to 4c are half sections through variants of the bar of Figure 2; and

15 Figures 5 and 6 are cross-sections through further variants of the bar.

Referring to the drawings, Figure 1 shows part of a masonry wall 1 having a window opening 2, and let in to this opening
20 is a grating comprising a plurality of parallel bars 3 held in a steel frame 4. The bars 3 are designed to offer high resistance to intrusion or escape through the grating either by bending the bars apart or by cutting them through eg with carbide-coated rod- or hack-saws or files, and each one is of
25 the general form indicated in Figure 2.

With reference to Figure 2, the bar 3 is seen to be of composite construction comprising a central core 5, an outer finishing skin 6 and a hard layer 7 filling the space between
30 the core and skin. The core 5 provides most of the bar's resistance to bending and is preferably made from steel of a type which can be given a high elastic limit, it being resistance to plastic (ie permanent) deformation which is of

importance in the context of a bar provided for the above-mentioned purpose. In some embodiments the steel may be given a hard surface layer and the characteristics of the surface hardening method may influence the choice of steel.

- 5 The possibilities include a low carbon, substantially unalloyed, steel bar in which a high yield strength has been induced by "cold working"; carbon steels which can be given a high surface hardness by an induction or flame hardening method; and low alloy steels which can be through-hardened to
- 10 provide a high yield strength and this treatment combined, necessary, with a hardened surface, (the latter may be suitable for surface hardening by carburising or nitriding treatments followed by a heat treatment to impart high strength to the steel interior).

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The filling 7, which provides most of the resistance to cutting, is itself a composite material, comprising elements 8 of a very hard material (preferably in excess of 1000kg/mm², or 7 on the Moh scale) bound in a cast matrix

- 20 9. The hard material 8 will typically be an oxide, silicate or carbide whether synthetic or natural. More particularly, alumina or silicon carbide particles are presently preferred. These particles should be in the form of dense nuggets of high quality, such as may be made by fusion or sintering
- 25 processes. The matrix material 9 contains, supports and bonds the hard elements 8 in a homogeneous mass, and is formed from a rigidly-setting polymer. It is envisaged that in manufacturing the bar 3 the nuggets 8 will be placed into the space defined between the core 5 and skin 6, suitably
- 30 mounted in jigs, and then the liquid resin together with a catalytic hardener will be cast in to fill the interstices between the nuggets, core and skin. Alternatively the

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nuggets and matrix material might be pre-mixed and cast together into the space between the core and skin. A cold setting matrix material is preferred in order to avoid any thermal distortion or discolouration of the relatively thin
5 skin 6.

The material of the outer skin 6 should be corrosion resistant and readily formable to the required section, and in the finished bar should have a smooth external surface to
10 aid the detection of damage. The preferred material in this respect is a stainless steel or aluminium alloy.

Although bars in accordance with the invention may be made in a simple circular form with the outer skin concentric with
15 the core, the elongate cross-sectional form indicated in Figure 2 is considered to represent a more optimum solution to the conflicting requirements of maximum security and reasonable daylight transmission between the spaced bars. The orientation of the bars in the grating is such that from
20 the viewpoint of Figure 2 the upper part of the figure represents the inside of the building and the lower part represents the outside. The elongate form of bar increases the area of material which has to be cut through in comparison with a circular bar of the same width (that is the
25 cross-sectional dimension of the bar in the plane of the grating). Also, if a hand saw or file is used in an attempt to cut a bar, space considerations dictate that in general it will have to be worked perpendicularly to the plane of the grating, that is in the fore-and-aft direction in relation to
30 the elongate bar, which represents the longer line of required cut to the tool. Tapering the noses of the bars at the inside face of the grating, as indicated in Figure 2, further aids daylight transmission.

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Although the outer skin 6 may in itself contribute little to the structural strength or resistive properties of a bar 3 it is of value in shielding the layer 7 from attack by other (non-cutting) forms of tool to which that layer may be more vulnerable, and it is important therefore that the skin 6 should not be readily detachable from the rest of the bar. In order to strip away a portion of the skin several cuts through it would be necessary and one way in which such removal can be made very much more difficult is to configure the skin such that any anticipated line of cut with a saw or file which would achieve removal of a sizeable portion of the skin must also pass through a portion of the hard filling 7. Figures 3a and 3b show variations of the Figure 2 cross section in accordance with this concept, where portions 10 of the skin are profiled to project into the hard filling space. Figure 3c shows an example with outward projections 11 for the same purpose, and of course combinations of inward and outward projections may also be adopted.

Another measure aimed at resisting separation of the skin 6 from the filling 7, and which may be used as an addition or an alternative to profiling the skin as indicated above, is to provide the skin with anchor members extending into the mass of the cast filling 7. Figure 4a shows an example with L-shaped rod anchors 12 welded to the skin at intervals along the length of the bar; Figure 4b shows alternative hoop anchors 13 welded across internal corners of the skin; and Figure 4c shows anchors 14 integral with the skin along the whole length of the bar, where the skin and anchors are formed together in an extruded section.

Figure 5 shows a further variant of the bar where the steel core 5' in this case is tubular and contains a second hard filling 15. This filling may be similar to the composite filling 7, perhaps containing even harder elements such as

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sintered tungsten carbide. In another variation the space within a tubular core may contain rotatable bodies such as rods or balls of hardened steel or ceramics, to frustrate attempts to saw or file through the core.

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In certain circumstances it will be desirable to detect remotely any attempts to compromise a bar 3. For this purpose a wire or other form of detector may be contained within the structure of the bar, and the use of a cold
10 castable filling 7 makes it easy to incorporate a detector within the space between the core 5 and skin 6 at the time of manufacture. Figure 6 indicates a simple example with a single detector wire 16 provided in the filling 7, so that an alarm is triggered if the wire is severed by an attempt to
15 cut the bar. Wires embedded in the rigid cast matrix can also be arranged to fracture if the bar is deformed and will therefore detect bending as well as cutting. More complex detection systems may be employed with the detector elements provided within a tubular core such as 5' instead of, or as
20 well as, within the filling 7.

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CLAIMS

1. A security bar comprising a core resistant to bending surrounded by a layer which comprises elements of hard, saw-resistant material bound in a cast polymeric matrix.
2. A bar according to claim 1 wherein said core is disposed within and spaced from an outer finishing skin and said layer fills the space defined between the core and skin.
3. A bar according to claim 2 wherein said matrix is cast in situ within said space.
4. A bar according to any preceding claim wherein said elements have a hardness in excess of 1000 kg/mm².
5. A bar according to any preceding claim wherein said elements comprise nuggets of alumina or silicon carbide.
6. A bar according to any preceding claim the cross-sectional profile of which is elongate with one end of said elongation tapering to a narrower width than the opposite end thereof.
7. A bar according to claim 2 or to any other preceding claim when appended thereto wherein said skin is configured to define a series of indentations or protrusions in the cross-sectional profile of the bar, thereby to resist mechanical cutting of said skin by encounters with the hard elements in said layer adjacent to the skin.



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8. A bar according to claim 2 or to any other preceding claim when appended thereto comprising anchor means fast with said skin and extending therefrom into the mass of said layer, thereby to resist separation of said skin from said layer.

9. A bar according to any preceding claim wherein a wire adapted to form part of an alarm system for detection of attempts to sever or bend the bar is embedded within said matrix.

10. A bar according to any preceding claim wherein said core is tubular and contains further elements of hard, saw-resistant material bound in a cast matrix.

11. A bar according to any one of claims 1 to 9 wherein said core is tubular and contains rotatable bodies to resist cutting through said core.

12. A security bar substantially as hereinbefore described with reference to Figure 2, Figure 3a, Figure 3b, Figure 3c, Figure 4a, Figure 4b, Figure 4c, Figure 5 or Figure 6 of the accompanying drawings.

13. A window or like grating comprising a plurality of parallel bars each of which is in accordance with any preceding claim.

14. A grating according to claim 13 wherein each said bar is in accordance with claim 6 or with any one of claims 7-11 when appended thereto or with claim 12, wherein each said bar is arranged with the elongation of its cross-sectional profile perpendicular to the plane of the grating.

