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(54) Anti-ballistic material and related manufacturing process.

(57) The present invention concerns an anti-ballistic material consisting of loose fibres, one or two layers of woven or non-woven fabric impregnated with a cellulose acetate butyrate or cellulose acetate propionate resin or ethyl vinyl acetate, as such or plasticated or in a mixture with other resins the content of which is less than 50%. Said material lends itself to various uses and in particular to further processing, in that, being produced with a thermoplastic resin, it can be made plastic again by heating.

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"ANTI-BALLISTIC MATERIAL AND RELATED MANUFACTURING PROCESS"

The present invention concerns a bullet- and splinter-proof material.

Known processes use bonded layers for this purpose each layer consisting of a fabric-type structure (woven or non-woven fabric, loose fibres, for example nylon, carbon or Kevlar, a Dupont registered trademark, or other aromatic polyamides or aramides) which is impregnated or in any event coated with plastic material. With the materials thus far in use there are difficulties in achieving a homogeneous material, as far as ballistic proofing characteristics are concerned, especially when manufacturing large items. Moreover the material used up to now has a relatively high unit weight, rendering the items produced too heavy or too bulky. Normally anti-ballistic material is also difficult to form.

The aim of the present invention is to provide a material having high ballistic proofing over its entire surface, that also has a low unit weight and is preferably easy to process.

The above aims have been achieved with a material consisting of loose fibres, spun products, woven and non-woven fabrics, impregnated or coated with cellulose acetate butyrate or cellulose acetate propionate or ethyl vinyl acetate as such or plasticated or mixed with other resins the content of which is lower than 50%.

The above described material is preferably produced by immersing the base layer in a tank containing a solution or a dispersion of the above-mentioned resin and then subjecting it to heat treatment to allow the solvents or the water to evaporate.

The amount of product deposited on each layer is adjusted simply by changing the viscosity of the solution or the dispersion or by constantly squeezing the base. In this manner a high degree of evenness is easily achieved in the production of each layer. Heating is preferably carried out in a heated vertical tunnel through which the material is passed, an impregnated product being obtained that feels soft and is therefore easily shaped.

If the material is heated to a higher temperature, 120-130°C, the result is a semi-rigid impregnated product suitable for flat shapes.

The material according to the invention offers a series of advantages. As far as its characteristics are concerned, it has a lower unit weight than other known materials having the same strength, its ballistic proofing is even and remains unchanged by time. As far as its formability is concerned, being produced with a thermoplastic resin the material lends itself to re-shaping and re-forming: all that is required is heating to make the hardened product

become plastic again. As regards cost, the production cycle is economical because the process does not involve any critical step, thus it requires only limited supervision.

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Claims

1. An anti-ballistic material characterized in that it consists of fibres, spun products impregnated with cellulose acetate butyrate or cellulose acetate propionate or ethyl vinyl acetate as such or plasticated or mixed with less than 50% of other resins.
2. A material according to claim 1, characterized in that loose fibres are impregnated.
3. A material according to claim 1, characterized in that a layer of woven or non-woven fabric is impregnated.
4. A material according to the preceding claims, characterized in that a plurality of impregnated base layers are made fast with each other by hot-pressing.
5. A material according to any one of the preceding claims, characterized in that the impregnated fibres, spun products or fabrics consist of aramides, aromatic polyamides, glass, carbon or other synthetic or artificial materials.
6. Anti-ballistic products characterized in that they have been manufactured from the material according to any one of claims 1 to 5.
7. A manufacturing process for the material coated with cellulose acetate butyrate or cellulose acetate propionate or ethyl vinyl acetate, characterized in that the base layer is covered, spread, soaked, impregnated with cellulose acetate butyrate or cellulose acetate propionate or ethyl vinyl acetate.
8. A process according to claim 7, characterized in that each layer is immersed in a tank containing a solution or a dispersion of the resin, then subjected to heat treatment to allow the solvents or the water to evaporate.
9. A process according to claim 7 or 8, characterized in that each layer, after impregnation or coating with cellulose acetate butyrate or cellulose acetate propionate or ethyl vinyl acetate passes through a heated vertical tunnel.

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| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
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| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl. 4) |
| A | DE-A- 541 167 (I.G.F.) * Claim * --- | 1, 3, 7 | F 41 H 5/04 D 04 H 1/64 D 06 M 15/07 |
| A | EP-A-0 169 432 (KUHNEN & WACKER) * Claims 1,6,7 * --- | 1, 3, 4, 5 | |
| A | EP-A-0 221 794 (HUTCHINSON) * Claim 1; page 1, line 5 - page 8, line 9 * ----- | 1-5 | |
| TECHNICAL FIELDS SEARCHED (Int. Cl.4) | | | |
| F 41 H D 04 H D 06 M A 41 D D 01 F | | | |
| The present search report has been drawn up for all claims | | | |
| Place of search | Date of completion of the search | Examiner | |
| THE HAGUE | 15-07-1988 | CATTOIRE V.A. | |
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