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<p>(21) International Application Number: PCT/GB98/00065</p> <p>(22) International Filing Date: 9 January 1998 (09.01.98)</p> <p>(30) Priority Data: 9725102.9 28 November 1997 (28.11.97) GB</p> <p>(71) Applicant (for all designated States except US): GRAVUTEX LIMITED [GB/GB]; Peakdale Road, Brookfield Industrial Estate, Glossop, Derbyshire SK13 9LQ (GB).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): BROOKE, Nigel [GB/GB]; The Old Station House, Delph New Road, Delph, Oldham, Lancashire OL3 5DE (GB).</p> <p>(74) Agents: McNEIGHT, David, Leslie et al.; McNeight & Lawrence, Regent House, Heaton Lane, Stockport, Cheshire SK4 1BS (GB).</p>	<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published <i>With international search report.</i></p>	
<p>(54) Title: RAPID TEXTURE PROTOTYPING</p> <p>(57) Abstract</p> <p>There is disclosed a method for simulating a mould-imparted texture comprising applying a textured skin to a moulding from a pre-textured mould.</p> <div data-bbox="949 1243 1388 1489" style="text-align: right;"> </div>		

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RAPID TEXTURE PROTOTYPING

This invention relates to rapid texture prototyping for moulded articles.

Many moulded articles are made with a textured surface finish. Examples include interior trim parts for automobiles, knobs and handles for cooking utensils, garden furniture, casings for audio and video equipment, computers and calculators, and so on. Many of these items are made from large, expensive moulds. The moulds are first made with a smooth moulding cavity which must then be etched to produce the texture. Etching is done by applying a resist and immersing the mould in acid etchant.

Once etched, it will usually be impossible, or at best highly impracticable, to expunge the texture and apply a different texture. It is vital, therefore, for a designer to have some idea of how the product will look, textured. To this end, computer simulations are proposed in which the item can be imaged to a screen using CAD techniques and a texture superimposed. No matter to what state of excellence this type of simulation can be raised, however, it still cannot give the designer a textured component to build into a prototype assembly of, say, an automobile.

The present invention provides for rapid prototyping for textured-surface moulded articles giving authentic pre-appreciation of both appearance and feel.

The invention comprises a method for simulating a mould-imparted texture comprising applying a textured skin to a moulding from a pre-textured mould.

The skin may comprise a skin layer with relief material attached thereto as a texture. The skin layer may constitute a release backing peeled off the moulding after application of the relief material thereto. The relief material may be preferentially adhered to the moulding to enable peel off of the release backing.

However, the skin layer may be soluble and be dissolved after the relief material is adhered to the moulding. The skin layer may be soluble in a paint which is applied after application to the moulding - the skin layer then becomes absorbed into the paint layer.

The skin may be burnished on to the moulding - this may be done before and/or after removal of the skin layer; if done before, burnishing serves the purpose of improving adhesion to the moulding and helping to smooth out any imperfections in application. Burnishing may be effected by a densely-bristled brush, though other burnishing tools may be found more appropriate to specific patterns.

As to patterns, the texture may be a random pattern texture, such as the popular leather and woodgrain finishes. A textured skin suitable for such finishes is commercially available glass engraving resist, in which a resist pattern is carried on a release sheet for application to a glass surface which is then sand blasted, the glass surface being eroded except beneath the resist which is then removed. In the present application, the resist material becomes part of the textured surface of the moulding.

The method of the invention is particularly advantageous, however, with geometric patterns used as texture. Such patterns can be readily created by a CAD arrangement which can control a cutting arrangement to cut the pattern into sheet material e.g. vinyl plastics sheeting. Such sheeting may be presented (in different thickness) on a release backing from which cut sheet may be separated, by differential bonding, on to a separate release sheet - there being then 'positive' and 'negative' versions of the pattern. Either release sheet then forms the skin layer of the textured skin.

Whilst the overall effect of a random - leather, woodgrain etc - pattern may be visualizable by skilled designers, the way a regular geometric pattern texture sits on a curved surface is less easy to imagine. Indeed, difficulties are experienced in engraving

even moderately complicated moulds with geometric pattern textures as a resist-carrying backing sheet usually has to be creased to fit the mould. Often, a regular geometric texture simply cannot be applied because of the difficulties of engraving the mould, this explaining a preponderance of random textures, principally leathers.

However, for prototyping purposes as disclosed herein, the skin may be arranged to be stretchable to fit without creasing on to the moulding and the texture is imparted to the skin (as by a CAD arrangement) in distorted fashion to compensate for skin stretching to fit the moulding. Once perfected and approved, the same technique can then be used to make a stretchy resist for application to the mould from which the moulding was taken. It is possible to take several - indeed as many as may be required - mouldings from the untextured mould for perfection of a pattern and for investigation of the visual and tactile effects of different texture patterns or different orientations of a single pattern.

Methods for simulating texture according to the invention will now be described with reference to the accompanying drawings, in which:

- Figure 1 is a diagrammatic cross-section through a mould;
- Figure 2 is a view of a moulding made using the mould of Figure 1;
- Figure 3 is a face-on-view of a textured skin layer to be applied to the moulding of Figure 2;
- Figure 4 is a cross-section through the textured skin applying layer of Figure 3, much enlarged;

- Figure 5 is a cross-section through part of the surface of the moulding of Figure 2, with the skin from Figures 3 and 4 in place, and showing burnishing;
- Figure 6 is a cross-section like Figure 5, showing peeling off a skin layer;
- Figure 7 is a cross-section like Figure 5, showing painting over a soluble skin layer; and
- Figure 8 is a face-on-view of a textured skin applying layer of a geometric texture pattern.

The drawings illustrate methods for simulating a mould-imparted texture comprising a textured skin 11 applying to a moulding 12 from a pre-textured mould 13.

The mould 13 comprises a mould cavity 13a and a cooperating former 13b. When first made the mould cavity is smooth-walled. For aesthetic reasons - as well as to conceal surface imperfections - or to provide grip (e.g. knurling on knobs, ribs on canister caps and so forth) it is usually intended that the visible surface (in the finished or assembled product of which the moulding is a component) is provided with a texture, which might be a random texture such as that of leather or woodgrain, or a regular geometric texture such as raised (or indented) cylindrical, square, diamond or other shaped areas arranged in a pattern.

The texture is applied to the mould surface by acid etching using a resist. This is a procedure that does not usually allow of second thoughts, and there is a strong desire on the part of the designers to be able to visualize the finished product before the

final step necessary to produce that product - namely the application of a textured finish to the mould wall - has been finally and irrevocably carried out.

To this end, according to the invention, a preferred texture or a selection of preferred textures is made from a library or designed from scratch using, for example, a CAD system. A moulding 12 is made from the pre-textured mould 13, or as many mouldings as there are textures to assess.

Figures 3 and 4 illustrate a commercially available product that just happens to be suitable for use in the method. This product is known as glass engraving resist and is used in engraving glass by sandblasting. It comprises a protective backing 31 covering a pattern 32 on a film 33. The pattern 32 is releasably adhered to the backing 31. With this stripped off the pattern 32 is applied to a glass surface, in its regular use, having been first sprayed with an adhesive if necessary, to adhere to the glass while the film 33 is peeled off. The pattern material 32 protects the underlying glass from erosion by the sand particles and is later washed off.

Using this product in the present invention, the backing 31 is removed and the pattern material 32 is applied to the surface of the moulding 12, if necessary spraying the moulding 12 or the pattern material with a suitable adhesive. The film 33 and pattern material may now be securely pressed on to the moulding 12 as by burnishing - a brush 51 with densely packed bristles is an effective burnishing tool.

Further, now, the film 33 is peeled off, as seen in Figure 6, for which it must be less well adhered to the pattern material 32 than the latter is to the moulding 12, or, if the material of the film is soluble in a suitable paint, such a paint is now sprayed on to the film 33 (Figure 7) which dissolves the film leaving the contours of the pattern material 32 covered with a uniform paint layer as a seemingly integral texture to the moulding 12.

It is desirable, in any event, to paint the surface now textured even if the film 33 is removed - it is a texture which is desired to be simulated, and uniformly coloured surface is appropriate.

Being a commercial product for an entirely different purpose, it cannot be expected that a full range of textures appropriate to entirely different circumstances would be available, nor that such a product could be available in bespoke designs, especially considering that, as used in the method taught herein, it is not a consumable of production, merely an adjunct to design. However, a wide, indeed practically limitless variety of designs can be readily produced using a CAD system, especially for geometric texture patterns. Basically, a CAD-produced design is used to cut a design out of sheet material, such as vinyl plastic sheet which may be supplied in roll form in a range of thicknesses, a thickness being selected according to the depth of relief required in the finished textured surface. The vinyl is cut to the required pattern while on a release backing and can be separated by the application of another release, or simply by peeling off from the backing a matrix out of which "islands" have been cut, leaving "positive" and "negative" patterns.

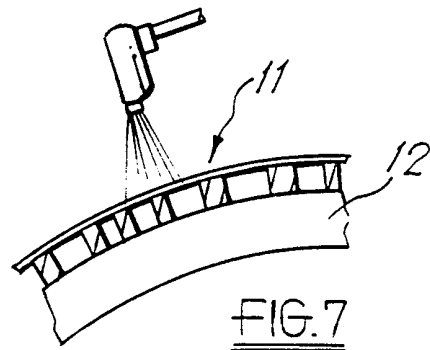
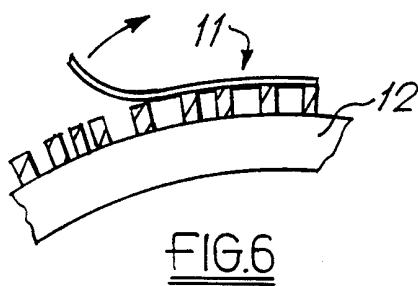
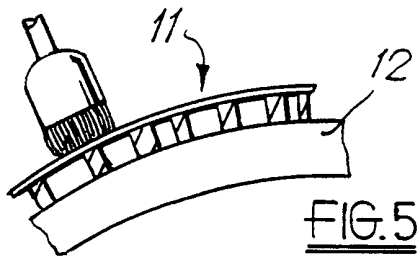
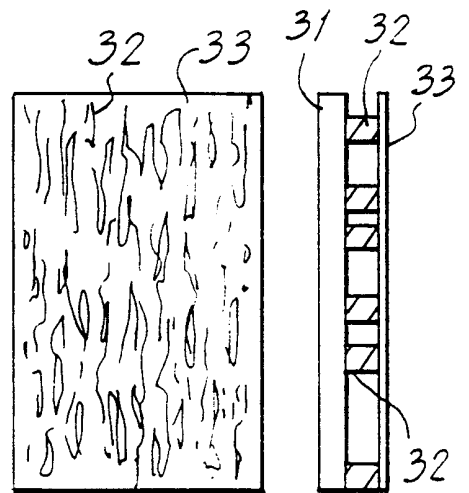
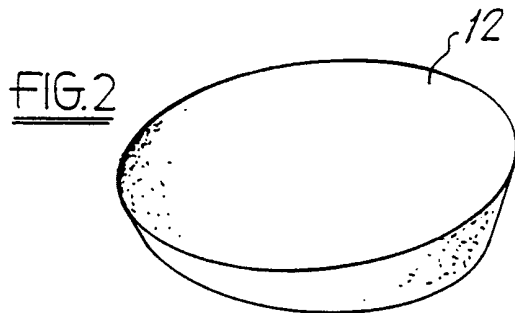
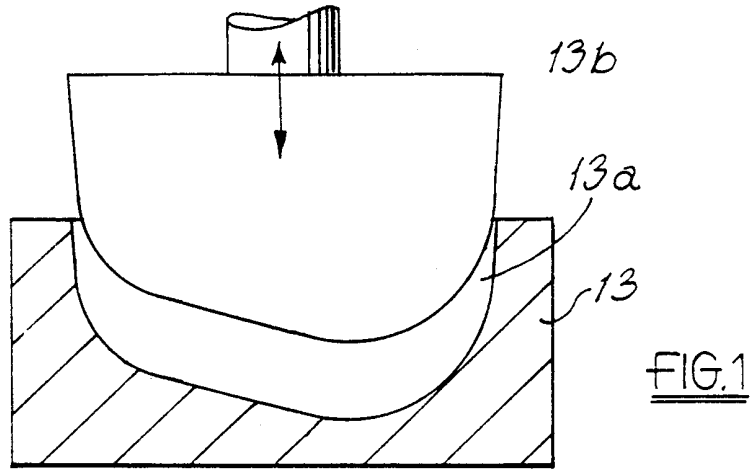
A problem with geometric pattern is that in a mould which has curvature in two directions, it is impossible to fit a pattern without cutting darts in the resist, and the same will be true of the simulation according to the invention.

Using CAD techniques, however, it will be possible to produce a distorted pattern, such as that seen in Figure 8 which can be based on biaxially orientable film and stretched appropriately to fit the moulding (when simulating) or the mould (when etching the mould) to compensate for the curvatures and yield a regular, well oriented texture pattern.

CLAIMS

1. A method for simulating a mould-imparted texture comprising applying a textured skin to a moulding from a pre-textured mould.
2. A method according to claim 1, in which the skin comprises a skin layer with relief material attached thereto as a texture.
3. A method according to claim 2, in which the skin layer constitutes a release backing peeled off the moulding after application of the relief material thereto.
4. A method according to claim 3, in which the relief material is preferentially adhered to the moulding to enable peel off of the release backing.
5. A method according to claim 2, in which the skin layer is soluble and is dissolved after the relief material is adhered to the moulding.
6. A method according to claim 5, in which the skin layer is soluble in a paint which is applied after application to the moulding.
7. A method according to any one of claims 1 to 6, in which the skin is burnished on to the moulding.
8. A method according to any one of claims 1 to 7, in which the texture is a random pattern texture.
9. A method according to claim 8, in which the texture is a leather texture.
10. A method according to claim 8, in which the texture is a woodgrain texture.

11. A method according to any one of claims 8 to 10, in which the textured skin is a glass engraving resist.
12. A method according to any one of claims 1 to 7, in which the texture is a geometric pattern texture.
13. A method according to claim 12, in which the geometric pattern is cut from sheet material, and the cut pattern transferred from a release backing of the sheet material to the skin layer.
14. A method according to any one of claims 1 to 13, in which the skin is stretchable to fit without creasing on to the moulding and the texture is imparted to the skin in distorted fashion to compensate for skin stretching to fit the moulding.
15. A method according to claim 14, also used to make a resist for application to the mould from which the moulding was taken.



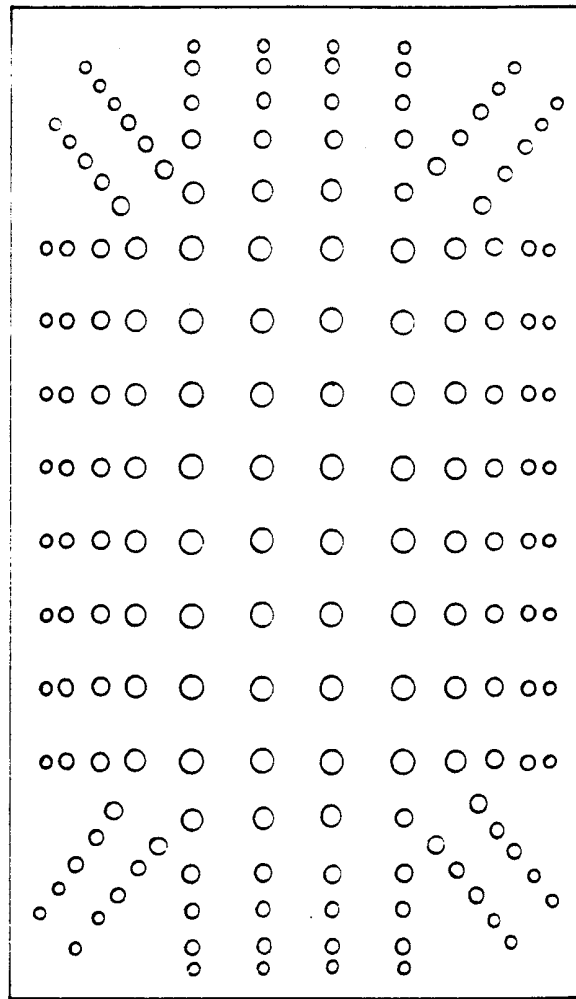


FIG. 8

INTERNATIONAL SEARCH REPORT

national Application No PCT/GB 98/00065
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A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 B29C59/00 B29C33/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
 IPC 6 B29C B05D B44C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 492 663 A (GREENWALD PAMELA S ET AL) 20 February 1996	1,8-10, 12,14,15
Y	see the whole document ---	2-7
Y	DE 94 04 567 U (KURZ LEONHARD FA) 19 May 1994	2-4
A	see the whole document ---	8,10
Y	US 3 791 905 A (MOLNER D) 12 February 1974 see the whole document ---	5-7
A	US 4 490 410 A (TAKIYAMA EIICHIRO ET AL) 25 December 1984 see the whole document ---	1-4,8,10
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Further documents are listed in the continuation of box C. Patent family members are listed in annex.

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Date of the actual completion of the international search 4 August 1998	Date of mailing of the international search report 10/08/1998
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 006, no. 242 (M-175), 30 November 1982 & JP 57 140116 A (TOUYOU CLOTH KK), 30 August 1982 see abstract ---	1-4,8,12
A	EP 0 363 111 A (HARDIE JAMES ENGRAVING) 11 April 1990 see column 3, line 28 - column 6, line 14; claims; figures ---	1-4,11
A	US 5 483 890 A (KILDUNE JOSEPH S) 16 January 1996 see column 3, line 27 - line 49 ---	1,8,12
A	DE 35 36 301 A (KOCH UDO) 16 April 1987 see claims: figures -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No PCT/GB 98/00065

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5492663	A	20-02-1996	NONE	
DE 9404567	U	19-05-1994	NONE	
US 3791905	A	12-02-1974	US 3897587 A	29-07-1975
US 4490410	A	25-12-1984	NONE	
EP 0363111	A	11-04-1990	GB 2223433 A	11-04-1990
US 5483890	A	16-01-1996	NONE	
DE 3536301	A	16-04-1987	DE 8528957 U	19-02-1987