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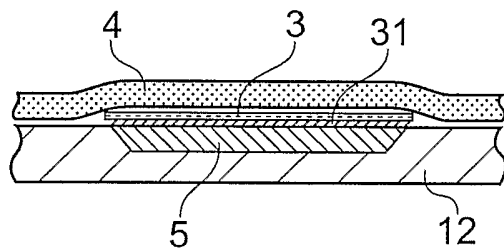
(43) International Publication Date
12 January 2006 (12.01.2006)

PCT

(10) International Publication Number
WO 2006/003462 A2

- (51) International Patent Classification⁷: B29D 31/00, B29C 70/74, 65/48
- (21) International Application Number: PCT/GB2005/002676
- (22) International Filing Date: 6 July 2005 (06.07.2005)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 0415185.8 6 July 2004 (06.07.2004) GB
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:
— without international search report and to be republished upon receipt of that report
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: RUBBER/FABRIC COMPOSITE PRODUCTS, METHODS AND APPARATUS FOR MAKING THEM



(57) Abstract: The application discloses a variety of ways of making composites, particularly mats, in which a fabric layer and an uncured rubber layer are superimposed in a mould having opposed plates, and subjected to heat and pressure between the plates to cure the rubber and join it to the fabric. The fabric layer is preferably tufted, e.g. carpet. Preferred embodiments position an array of shaped fabric pieces over a surface of the rubber layer, leaving the rubber surface partly exposed. Methods and means are disclosed for protecting the fabric against the effects of moulding heat and also for keeping fabric pieces in position. These include positioning fabric pieces in recesses of a mould plate, providing heat-shield elements between the fabric pieces and the heated mould plate, providing movable pressure plates which bring the fabric pieces into contact against the rubber only when the mould is pressurised, and the use of spiked retaining formations to engage fabric pieces. Other methods disclosed relate to providing three-dimensional configuration on the fabric-covered surface, optionally with the rubber flowing through the fabric in a predetermined pattern, or with melting or fusing of a thermoplastic fabric. Characteristic moulding apparatus and characteristic composite products are aspects of the disclosure.

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RUBBER/FABRIC COMPOSITE PRODUCTS, METHODS AND
APPARATUS FOR MAKING THEM

This application has to do with new ways of making
5 composite products, and particularly laminar products
such as mats and carpets, having a fibre-based layer such
as a woven or non-woven fabric superimposed on a
thermoset layer, particularly a rubber layer. We also
describe new processing apparatus and new composite
10 products.

BACKGROUND

In general terms, a moulded rubber mat can be made
by putting a piece of uncured thermosettable rubber
composition between upper and lower plates of a mould and
15 applying heat and pressure in a moulding press, causing
the rubber composition to flow into conformity with the
mould pattern and to cure. The upper and/or lower mould
plate may be given surface conformation features such as
shaped recesses which create corresponding ribs or other
20 protrusions in the moulded product.

A fabric-covered composite product can be made by
superimposing a fabric layer, e.g. a tufted fabric layer,
on the layer of uncured rubber in the mould. The
moulding bonds the rubber layer onto the back of the
25 textile layer as the rubber cures.

We note various respects in which the existing
techniques and products can be improved and developed.

One issue is that the moulding operation can affect the tufts or pile of a textile layer. Depending on the Tg of thermoplastic fibres in the tufts, they may lose their "shape memory" under the heat of moulding. This
5 crushes or flattens the fibres and it is difficult to raise them again, even by subsequent brushing (which is conventional). If this difficulty could be reduced, the quality of existing products could be improved and they would be easier to make. It would also become practical
10 to use fibres with lower Tg's which may have special uses. For example, a patterned mat or carpet tile may be made with white or neutral-coloured fibres and subsequently printed. Low MW thermoplastics are susceptible to printing, but they have low Tg. Also, if
15 they are flattened the printing may be spoiled because it is difficult to print onto the ends of the fibres as is desired.

Another issue addressed here is to improve the manufacture and product characteristics of laminar
20 products, such as mats or carpets, in which one or more fabric pieces e.g. of tufted textile are positioned locally e.g. in a pattern array on an otherwise exposed rubber surface.

Another issue addressed is that providing products
25 of the kind described which have novel surface conformations with special functions, for example new visual effects such as colour on the rubber, or practical

effects such as dirt removal from footwear when used as floor coverings.

A first aspect of our proposals is a method of making a composite in which a fabric layer and an uncured rubber layer are superimposed in a mould having opposed plates, and subjected to heat and pressure between the plates to cure the rubber and join it to the fabric layer. [Such a method is referred to below as a "method of the kind described".] A characteristic of this first method aspect is that, on the fabric side, a heat-shield element is positioned adjacent the fabric layer, and in particular between a metal mould plate surface and the adjacent fabric layer.

The heat-shield element may occupy only part of the mould plate surface, preferably a part corresponding in shape to a fabric layer piece which in turn only covers a part of the rubber layer. In a preferred version, plural fabric layer pieces are distributed over the rubber layer, and respective heat-shield element portions are provided for these. At other regions of that face, the metal mould plate surface may directly contact the rubber layer.

Preferably the heat-shield element is a discrete insert of thermally insulative material, e.g. a polymeric material such as PTFE. Conveniently, one or more heat-shield elements is/are removably positionable at one or more predetermined corresponding positions on the mould plate surface.

By presenting the insulative material of the shield element to the fabric layer, flow of heat to the fabric layer is inhibited. So, where the fabric layer is vulnerable to heat e.g. because it has thermoplastic fibres, and particularly if it has upstanding pile or tuft fibres, the heat-shield element protects the fabric element against heat while still enabling moulding pressure to be applied against that portion of the article's surface.

10 The shape of the heat-shield element will depend on the shape of the mould plate and on the desired shape of the fabric-covered region of the composite article. Preferably the metal mould plate surface has one or more recesses in which the corresponding one or more heat-shield elements are received, e.g. removably as
15 mentioned. By seating in a recess, the inward face of the heat-shield element can be aligned, e.g. aligned flush, with the adjacent metal mould plate surface.

In use, the shield element blocks heat flow to the
20 article surface but its temperature nevertheless gradually approximates to that of the surrounding mould plate, especially if the moulding operation is a long one. For a thick mat, this might be about 15 minutes. So, in a preferred procedure the heat-shield element is
25 periodically removed - perhaps after each moulding operation - and replaced with a cool one.

A second characteristic proposal may be used independently, or in combination with the first proposal

above. In this second proposal the mould plate is provided with projecting retaining formations, to engage a fabric piece and hold it initially in a predetermined place on the adjacent mould plate. This can avoid
5 accidental displacement of a fabric piece as the uncured rubber piece is positioned, or as the mould plates move together. It is particularly useful where one or more smaller fabric pieces are arranged at predetermined sub-areas of a larger rubber layer. Preferred retaining
10 formations are pointed elements or spikes which engage the fabric piece within its area rather than peripherally. They need not then leave any visible trace on the moulded product. Pointed elements or spikes may merely engage the fabric surface, or they may penetrate
15 through the fabric either at the time of positioning, or subsequently when the mould plates are moved together. With rough or tufted fabric, adequate location is available by either means.

In one preferred version, location formations are
20 provided in conjunction with a heat-shield element as described above. The formations may be provided on the heat-shield element. More preferably, for reasons discussed below, they are heat-conductive (e.g. metal) spikes or pins which project through the insulative heat-
25 shield element from behind. A suitable array of retaining projections may be provided as a module, preferably mounted in a recessed area of the mould which can also receive a heat-shield element. Metal pins or

spikes may be integrated with the heat-shield element, or more preferably, project through holes in the element so that the latter can be separated.

A third independent proposal is combinable with
5 either the first or second above, and is conceptually distinct from the second proposal although they may be provided by similar technical means. When a fabric layer is applied to a rubber article (e.g. layer) and the composite is moulded, the rubber on the fabric side is to
10 some extent masked from the mould heat. Depending on the moulding conditions, the rubber type, the thickness of the rubber and the thickness of the fabric, this may lead to insufficient curing of the rubber immediately beneath the fabric. This is particularly significant if a heat-
15 shield element is used against the fabric, as in the first aspect above. Especially with a thick rubber substrate, insufficient heat may permeate to the rubber on the fabric side. Addressing this technical issue, our third proposal is that the mould plate on the fabric side
20 comprises or carries an array of plural projecting heat conductive (usually metal) pins, which penetrate the fabric and engage the rubber beneath, preferably projecting into the rubber mass. This may be useful for example when a fabric layer is itself thick and
25 insulative, irrespective of how much of the rubber surface it covers. More particularly the proposal is valuable where the mould plate carries a heat-shield element as in the first aspect, e.g. plural such elements

arranged over the mould plate in a predetermined array. Advantageously, the or each heat-shield element may then have a corresponding array of the mentioned heat-transfer pins, thermally connected to the heated element behind
5 the heat-shield element, and projecting in an array from the surface of the heat-shield element so that under pressure they penetrate a fabric piece superimposed on that heat-shield element. Conveniently the heat-shield element is separable from the heat-transfer pins, e.g.
10 they extend through holes in the element and project from its inner surface.

It will of course be appreciated that such pins can also serve the location function required in the second aspect above, although that aspect does not specifically
15 require either heat conduction nor full penetration of the fabric.

The depth of penetration and the individual thickness and array area density of pins in the array can readily be adjusted in order to achieve adequate curing
20 of the rubber beneath the fabric, based on simple tests.

From the above, it will be understood that a particularly preferred embodiment of our proposals provides/uses a mould plate having a main metal surface, for contacting rubber in the mould, optionally with
25 three-dimensional conformation for profiling that rubber surface, interrupted by recesses at locations where fabric pieces e.g. of tufted textiles are to be positioned on the rubber product. An array of metal pins

projects from the base of each recess. These may be fitted as a discrete module, with a metal base plate carrying the pins which can be rested in or fixed into the recess. Removable heat-shield elements are provided shaped to fit into the recesses, and having openings through which the heat-transfer pins extend so that they project above an inner surface of the heat-shield element. In use, fabric pieces whose shapes correspond to the recesses are positioned on them, resting on the points of the pins which keep them in place as a layer of uncured rubber is also put in the mould. A top mould plate put in place and the mould assembly put into a mould press where it is subjected to heat and pressure. The pins penetrate the fabric pieces, and heat conducted through them helps curing of the rubber immediately beneath. The heat-shield elements protect the fabric surface, and particularly a tuft or pile thereon, against the effects of heat. When the rubber is cured, the mould is opened, the product removed, the (by now hot) heat-shield elements taken out and replaced with fresh cool or cooler ones for the process to be repeated.

Another aspect of the invention (independent proposal) also relates to reducing the effects of mould heat on potentially delicate fabric inserts, i.e. when making layers in which one or more fabric pieces cover only a part of a rubber layer surface. In this proposal the mould plate on the fabric side has one or more recesses to receive the corresponding fabric piece(s)

with a discrete pressure plate in the recess on which the fabric lies. This pressure plate is movable in the recess towards and away from the moulding cavity, under the influence of one or more drive means or elements acting on it from behind. Desirably the mould plate on the fabric side has inner and outer elements, the inner having the recesses housing the pressure plates and the outer, movable relative to it, connected to the pressure plates through the drive means or elements so that when the mould is pressurised and the inner and outer elements are urged together, the pressure plates are advanced in their recesses and push the fabric pieces forward against the rubber layer during moulding. This gives a very positive location of the fabric pieces, since they can lie well down in their recesses safe from disturbance by the introduction into the mould of the other component layers. It also reduces heat transfer from the back moulding plate to the pressure plates and to the fabric pieces, since the structure connecting the back moulding plate to the pressure plates can be indirect, insulative or cross-sectionally small e.g. one or more legs, and conduct less heat per unit area of mould. If desired, the pressure plates may be made from or comprise a heat-shielding material.

In all of the aspects described herein, the fabric layer may be woven or non-woven. Preferably it is tufted. The tufts may consist of or contain thermoplastic filaments. The T_g of these filaments may

be freely chosen, and may be below the moulding plate temperature where they can be protected by heat-shield elements. For example some polyamides have T_g lower than 50°C.

5 Tuft or pile on the fabric piece(s) is desirably brushed after the moulding stage.

The fabric may have an uncoloured tufting or pile which, after the moulding is coloured e.g. by printing.

10 A tufted fabric layer may or may not have the tufts anchored into the fabric (e.g. by adhesive, or by a thin backing or anchor layer of polymer or rubber, optionally uncured) before moulding together with the mentioned rubber substrate. Preferably a tufted fabric layer is moulded without an anchor coat; the bond to the rubber in
15 the mould then also anchors the tufts.

The product may be a mat or carpet tile, for example. Typical products have fabric at one face and exposed rubber at the other, and comprise only the two mentioned layers. However there is no reason why a
20 product should not have further layers or articles behind the rubber, joined on previously, simultaneously or subsequently, or indeed have fabric on both faces.

A separate proposal here is a different way of making a rubber layer product, e.g. a mat, having a
25 rubber top surface interspersed with an array of fabric zones. In the previous proposals, fabric pieces could be applied and bonded to a rubber layer in-mould. In this alternative, a rubber mat base module is formed and cured

with recesses at the intended positions of the fabric pieces. Preferably these recesses are right through the layer. They can be made by corresponding projecting blocks, e.g. discrete inserts, in the mould. The fabric pieces are joined onto separate rubber pieces and the resulting fabric-covered rubber pieces are fitted into the correspondingly-shaped recesses of the rubber base module and fixed e.g. by adhesive bonding. Desirably the outline of each fabric piece exactly matches the front surface of the rubber piece to which it is bonded, so that the fabric piece when bonded in place entirely occupies the opening of the recess. Preferably the recesses extend right through the rubber layer, and converge towards the front opening where the fabric piece is exposed. This provides for easy fitting, a very clean outline on the fabric piece, and security against the fabric-covered piece being forced out of the recess under strain. This method may be useful where in-mould bonding of smaller fabric pieces onto a larger rubber layer is found to lead to a poorly-defined outline or spoiled edge on the fabric piece. The fabric pieces may be joined to their rubber pieces in individual small moulds, e.g. by a method using proposals above, or else by adhesive bonding.

For good effect, this method is preferred for use with thicker mats, e.g. 10 mm, more preferably 15 mm or more thick at the recesses.

Further proposals now relate to creating characteristic surface conformations in methods where a fabric layer is bonded onto a rubber layer as the rubber layer is cured in a mould.

5 Generally speaking, in this set of proposals a composite comprising a fabric layer and a rubber article (usually also a layer) is made by superimposing the fabric layer on the rubber in a mould, and subjecting them to heat and pressure. In this proposal, a mould
10 surface that acts against the fabric layer has an array of recesses so that a mould region with an array of recesses is presented to a single fabric portion or region, and moulding pressure is applied causing rubber behind the fabric to deform into the recesses before
15 curing thereby creating corresponding surface projections in the cured product.

According to the choice of materials and conditions, this can create a variety of results.

In one embodiment, the rubber flows, permeates or
20 bursts through the fabric layer at the recesses so that in the article a rubber projection appears on the surrounding fabric surface. This is favoured with fabrics of relatively open structure. The shape of the recess moulds the rubber projection. Preferably the
25 projections are in a regular array. Preferred projections are in the form of localised studs or nipples. These are particularly useful where the fabric has a tufting or pile. The resulting product can have a

surface of small rubber projections interspersed in a tufted textile finish, e.g. rising to approximately the same height. This makes a very useful matting or flooring surface. The rubber projections provide a mechanical scraping effect, the fibres can wick moisture.

The recesses may be formed in a heated e.g. metal surface of the mould, if the tuft or pile can stand it, or they may be provided in a heat-shield element or layer to protect the fabric e.g. tuft/pile in between the rubber protrusions. In one preferred embodiment, metal heat-transfer pins project through holes in a heat-shield element, as referred to previously. The heat-transfer pins assist cure on the fabric side of the rubber, as described above. If a heat-transfer pin projects through a hole in a mould element and into the rubber, it tends to prevent a rubber protrusion filling that hole. This is because the heat-transfer hastens the onset of cure and so reduces flow at that point; also the pin itself presents a barrier to flow into the recess. A protrusion forms only if the hole is substantially larger than the pin. So, good cure behind the fabric can be combined with forming an array of protrusions by selectively providing heat-transfer pins through only some holes/recesses of the mould (or heat-shield element).

In a further option, the mould surface between the recesses is a heating surface and softens, melts or fuses the fabric or a component of it creating a fused covering on the rubber at these portions. At the recesses, the

fabric (or its tuft/pile) may either not fuse if
sufficient clearance is provided for it in the recess, or
it may also fuse - particularly if the rubber deforms
into the recess behind it - so that a contoured surface
5 with a fused coating is created. This may have a
particular value in creating a coloured coating, since
fusible fibrous webs are available in a variety of
materials and colours, whereas rubber is notoriously
difficult to colour.

10 In these fully-fused versions the fabric need only
be sufficiently coherent to be evenly arranged over the
rubber surface. It may be for example a loose felt or
entanglement, e.g. of coloured polypropylene.

The material used for the rubber layer is not
15 critical. However preferred embodiments use rubber
materials made according to any one of the proposals in
our WO 2005/028552, which is incorporated herein by
reference. Alternatively stated, the rubber material
used may be in accordance with any of the statements of
20 invention, claims or embodiments as described in
WO 2005/028552.

Separately, it should be noted that in the
protection sought via the present application we may
exclude (disclaim) the methods using the materials of
25 WO 2005/028552 while applying a textile layer covering,
as described from page 26 line 23 to page 27 line 2 of
that document.

In addition to the methods, the moulding apparatus described and the characteristic moulded products, especially mats, are independent aspects of the invention.

5 Embodiments of the various proposals above are now described, with reference to the accompanying drawings in which:

 Fig. 1 is a schematic cross-section of a mould press for making a fabric-covered rubber mat;

10 Fig. 2 is a schematic cross-section showing a heat-shield element in a mould;

 Fig. 3 is a cross-section showing a modified heat-shield element;

 Fig. 4 is a cross-section showing a fabric-retaining and heat-transferring formation on the mould plate;

15 Fig. 5 is a cross-section showing a combination of heat-transfer pins and a heat-shield element, after moulding a composite;

 Fig. 6 is a plan view of a layout of textile patch portions for a rectangular rubber mat with a contoured rubber surface;

20 Figs. 7(a) and (b) are a plan view and side view of a metal heat-transfer pin module;

 Fig. 8 is a transverse cross-section of a lower mould plate for the mat layout of Fig. 6, including heat-transfer pin modules in situ;

25

Fig. 9(a) shows a rubber/textile composite being formed in a mould with a perforated mould plate, Fig. 9(b) shows a subsequent stage, and

Fig. 10 shows a product thereof;

5 Fig. 11 shows an initial stage for moulding a composite of a rubber layer and a tufted textile in a mould with a heat-shield element, Fig. 12 showing a subsequent processing stage;

10 Figs. 13 and 14 show first and second stages of moulding a rubber/polypropylene composite;

Fig. 15 shows a product thereof, and

Fig. 16 is a schematic cross-section showing a different mould press with adaptations for locating and protecting fabric pieces.

15 With reference to Fig. 1, a moulding press has an upper mould platen 1 and a lower platen 2 of a press, which can be pressed together (arrows F). Upper and lower mould plates 11,12 which can be pressed together in the mould - shown here separated - are steel plates with steel perimeter members 111,121. To make a rubber mat
20 with an arrangement of textile facing portions, textile pieces 3 are laid on the lower mould plate 12 and a rectangular pre-cut sheet of uncured rubber 4 is laid on top. The heated press platens 1,2 are then forced
25 together, forcing the rubber composition to flow, and form exactly to the mould plates and as it cures, bond to the rear surfaces of the textile pieces 3.

Fig. 2 shows a modification in which a PTFE heat-insulating plate 5, of shape and size corresponding to a textile piece 3 with a pile 31, seats in a recess of the lower mould plate 12. The pile 31 may be of tuft fibres having a Tg lower than the moulding temperature of the plate 12. On moulding, the insulative plate 5 restricts heat flow to the region of the textile piece, so that the shape memory of the tufts 31 is not lost and they can easily be brushed upright after moulding.

Fig. 3 shows a refinement in which the PTFE plate 5 has an array of holes 51 which provide additional clearance for the tuft fibres, further reducing crushing effect on these. At the same time, the insulative plate 5 presents enough distributed solid surface to the textile element to prevent it from deforming outwardly under moulding pressure, so that the product is not misshapen. As in Fig. 2, the inward face of the plate 5 is flush with the surrounding face of the mould plate 12.

A further feature in Fig. 3 is that the PTFE plate 5 is laid removably in the recess 122 of the metal mould plate. After a moulding operation, the PTFE plate is appreciably hot. It is taken out and replaced with a cool one for the next moulding operation.

Fig. 4 shows a different refinement in which, at the location of a fabric piece 3, a correspondingly-shaped array of metal retaining spikes is provided. In this embodiment they are mounted together on a common plate 6 to form a module which is seated in a corresponding

slight recess of the lower mould plate 12. The retaining spikes 61 catch the tufted undersurface of the fabric piece 3, preventing it from being inadvertently shifted out of place as the rubber layer 4 is laid on top.

5 Furthermore, during curing and under pressure, the spikes 6 are pushed through the textile piece and penetrate into the rubber layer 4 behind. They conduct heat into that part of the rubber so that it is not unduly insulated by the presence of the textile piece in between.

10 Fig. 5 shows a combination of these concepts, in which the lower metal mould surface 12 carries a spiked metal module with a backing plate 16 and an array of upstanding spikes 161. A foraminous PTFE plate 15 has an array of holes enabling it to be fitted over the metal
15 spikes 161; it rests on the metal plate 16 with the spikes 161 projecting. For moulding, the textile layer 3 is laid on the spikes which help to hold it in position. On the application of moulding pressure, the spikes penetrate the textile layer 3 and enter the rubber layer
20 4 behind. This is the situation shown in Fig. 5. The insulative plate 15 protects most of the area of the fabric 3 against the heat of moulding. In particular, if it has a thermoplastic pile, this is protected against the effects of heat. At the same time, the conductive
25 metal pins 161 conduct heat into the rubber surface behind the textile 3, ensuring that it is cured sufficiently.

Figs. 6 to 8 show the Fig. 5 concept applied to a complete product. As shown in Fig. 6, the product is a mat 10 having a surface partly of exposed rubber, with a 3D surface pattern shown at 101, and an array of bonded-on tufted carpet pieces 3. A corresponding lower mould plate 12 is shown in Fig. 8. The main surface of the mould is a flat surface with an array of small recesses 124 corresponding to the intended rubber surface pattern 101 in the product. At areas corresponding to the carpet pieces 3 in the product, the lower mould plate has deeper recesses 122, in each of which sits a rectangular steel plate 16 carrying an array of spikes 161, shown in Fig. 7. The points of these spikes project up beyond the surrounding metal mould surface. In use, pre-cut rectangles of carpet 3 are prepared. Rectangular perforated PTFE plates 15 are laid in the recesses 122 on top of the spiked metal plates, with the spikes 161 projecting through, forming heat-insulated surfaces flushed with the surrounding metal surface. The carpet pieces 3, typically a tufted non-woven textile it may or may not have an anchor layer to hold the tufts in place, are laid tufts down on the spike arrays 161. These hold them in position while a thick layer of uncured rubber (not shown) is laid on top, the top mould plate put in place and the assembly put in the press. On the application of heat and pressure, the rubber-only portions of the mat 10 are pressed and cured at both surfaces in direct contact with the metal mould plates

11,12. At the regions of the carpet pieces 3, the behaviour is as described in relation to Fig. 5 above. So, the carpet tufts are protected against the moulding heat and the spikes 161 assist rubber cure behind the carpet piece.

Fig. 9 shows stages of a different procedure in which the lower mould plate 12 carries a mould modifier plate 7 with an array of circular through-holes 71. A textile layer 3 is laid on this, and the rubber piece 4 on top as before. The textile may or may not cover the entire area of the mould. On the application of heat and pressure, rubber from the layer behind bursts or permeates through the textile material and into the holes 71 of the modifier plate, forming rubber projections 43.

Fig. 10 shows part of the surface of the resulting product, with rubber "nibs" projecting up through a surface of textile material. Such a surface is particularly useful for a floor covering mat, since the rubber nibs 43 have a useful scraping effect whereas the textile area 3 may serve to wick away moisture.

Fig. 11 shows a related situation but with a heat-shielding plate 15 and a spiked metal heat-transfer module 6 as in Fig. 5. In this variant, some holes 152 in the insulative plate 15 do not have a heat-transfer pin i.e. are empty, and may optionally be made substantially larger than other holes 153 which have the spikes 161 projecting through them. On the application of moulding heat and pressure, as shown in Fig. 12, cure

takes place early at the points of the spikes 161, blocking the holes 153. Rubber bursts through the textile 3 and into the vacant holes 152, (but not into the holes around the spikes 161) before cure takes place, selectively forming nibs or nipples 44 rather similar to those in Fig. 10.

Finally, Figs. 13 to 15 use a mould in which the upper mould plate 11 has attached to it a mould modifier plate 8 (a metal plate) with an array of circular holes 81. An uncured rubber layer 4 is laid in the lower mould, and a layer of a coloured random polypropylene entanglement, or other coloured thermoplastic open textile, is laid on top. When the mould is closed and heated, the thermoplastic textile is fused by the heat to form a continuous coloured surface layer 9'. At the same time the uncured rubber 4 is forced up into the modifier plate holes 81, taking the covering thermoplastics 9 with it, so that the cured rubber layer 4' takes on the shape of the modifier plate. The surface conformations (upstanding discs 45 shown in Fig. 15) are covered by the same fused thermoplastics layer as the rest of the area.

Fig. 16 shows a further option for a special mould construction to protect fabric pieces e.g. carpet 103 against the effects of heat. The lower mould plate has an inner metal plate 112, optionally with a three-dimensionally configured surface 115. The upper mould plate 101 may be plain, or three-dimensionally configured if desired for the underside of the mat.

The lower mould plate 112 has a set of surface recesses 118 corresponding to the shape and disposition of the desired fabric pieces 103, and these recesses 118 are substantially deeper than the fabric pieces. In each
5 recess a pressure plate 117, of substantially corresponding shape, is operable. The pressure plate 117 is supported on legs 116 which extend slidably through holes in an intermediate support plate 113, and are connected rigidly to a rear lower plate 102 to which in
10 use moulding pressure and heating are applied. The spacing 114 (and correspondingly the length of the legs 116) is exaggerated in the drawing for clarity; in practice it approximates to the vacant height above the pressure plate and textile piece 103 in the recess 118.

15 Biasing springs 117 (shown schematically) urge the moulding plates 113,102 apart, so that the pressure plates 117 normally lie in a retracted position, at the bottom of their recesses 118. It will be seen that the carpet pieces lie safely well down in the recesses until
20 the mould is pressurised (arrows F) whereupon the clearance between the plates 113,102 is taken up with lost motion and the carpet pieces advance with pressure to confront the uncured rubber layer at the same level as the rest of the plate face 115. Because of the small
25 cross-section of the legs 116 it is found unnecessary in many cases to take further precautions against excess heat transfer to the fabric pieces. If wished the pressure plates 117 can be made from heat-shielding

material, for which the options are as discussed above for the heat-shield elements used in other embodiments.

CLAIMS:

1. A method of making a rubber layer product, such as a mat, having a rubber top surface interspersed with an array of fabric pieces, comprising
5 forming a rubber mat base module, with recesses at intended positions for the fabric pieces;
joining fabric pieces onto respective rubber pieces to make fabric-covered rubber pieces whose shapes
10 complement the recesses of the rubber base module, and fixing the fabric-covered rubber pieces into the recesses of the rubber base module.
2. A method according to claim 1 in which the recesses
15 extend right through the rubber base module.
3. A method according to claim 1 or 2 in which the outline of each fabric piece matches the outline of the front surface of the rubber piece onto which it is
20 joined.
4. A method according to any one of claims 1 to 3 in which edge surfaces of the recesses converge towards a front opening, where the fabric piece is exposed in the
25 finished product.
5. A method according to any one of the preceding claims in which the fabric pieces are tufted.

6. A method of making a composite in which a fabric layer and an uncured rubber layer are superimposed in a mould having opposed plates, and subjected to heat and pressure between the plates to cure the rubber and join it to the fabric layer, characterised by providing a heat-shield element adjacent the fabric layer on the fabric side of the mould, between a metal mould plate surface and the adjacent fabric layer.

10

7. A method of making a composite in which a fabric layer and an uncured rubber layer are superimposed in a mould having opposed plates, and subjected to heat and pressure between the plates to cure the rubber and join it to the fabric layer, in which a mould plate is provided with projecting retaining formations to engage a fabric piece and hold it initially in a predetermined place relative to the adjacent mould plate.

8. A method of making a composite comprising a fabric layer and a rubber article, preferably a rubber layer, by superimposing the fabric layer on the rubber in a mould and subjecting them to heat and pressure, characterised in that a mould surface that acts against the fabric layer has an array of recesses so that a mould region with an array of said recesses is presented to a single fabric portion or region, and the application of moulding pressure causes rubber behind the fabric to deform into

25

the recesses before curing, thereby creating corresponding surface projections in the cured product.

9. A method of making a composite such as a mat, in
5 which a fabric layer and an uncured rubber layer are superimposed in a mould having opposed plates, and subjected to heat and pressure between the plates to cure the rubber and join it to the fabric layer, and in which composite one or more fabric pieces cover a surface of
10 the rubber layer only partially;

a mould plate on the fabric side being provided with one or more recesses to receive one or more corresponding said fabric pieces;

each said recess contains a relatively movable
15 pressure application element such as a pressure plate, on which the fabric piece lies, and

the pressure application element moves in the recess, when the mould is brought to a pressurised moulding condition, from a retracted position in the
20 recess to an advanced position in which it presses the corresponding fabric piece against the surface of the rubber layer.

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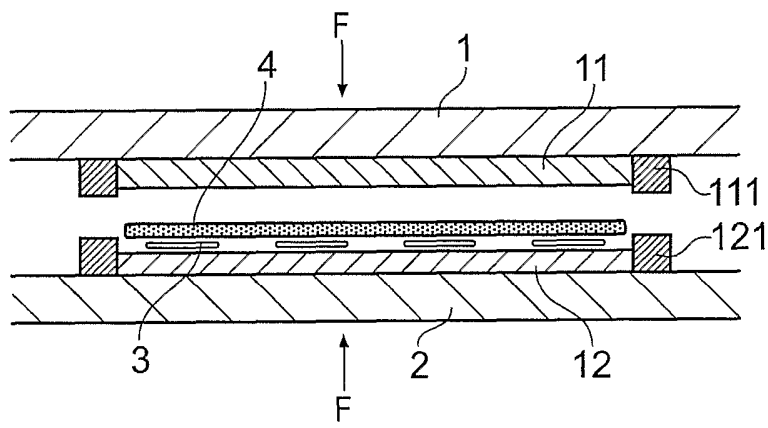


Fig. 1

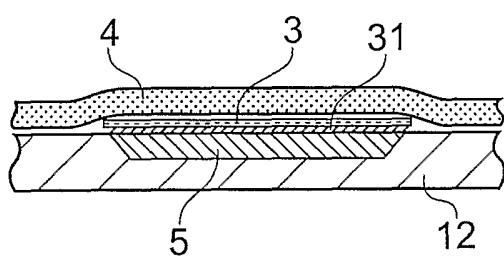


Fig. 2

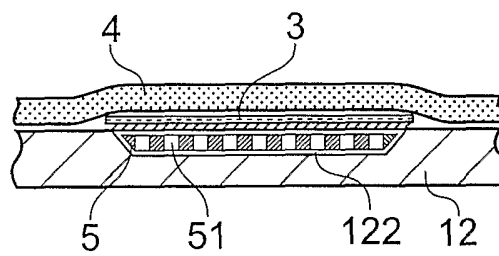


Fig. 3

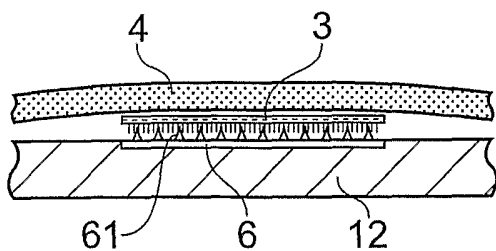


Fig. 4

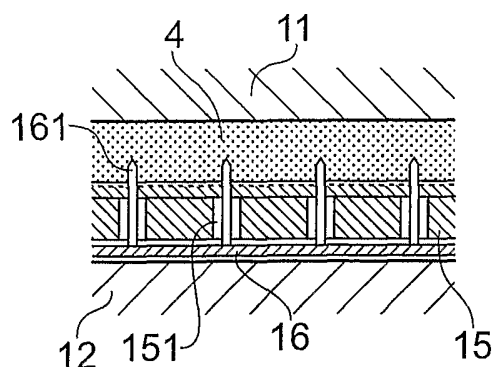


Fig. 5

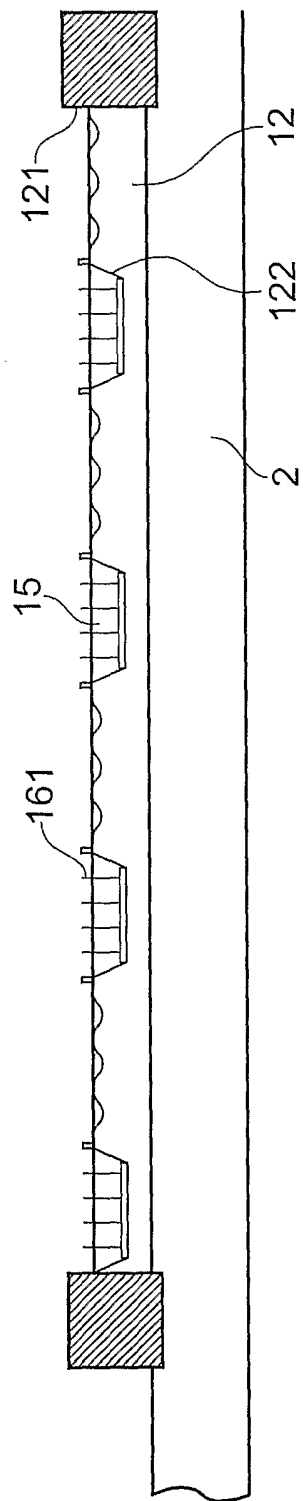


Fig. 8

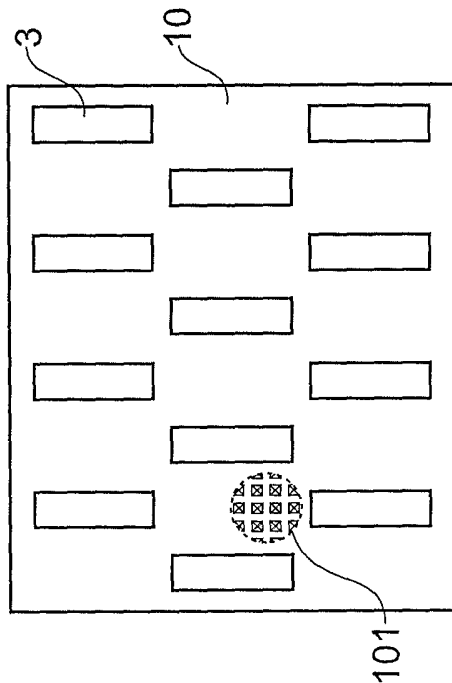


Fig. 6

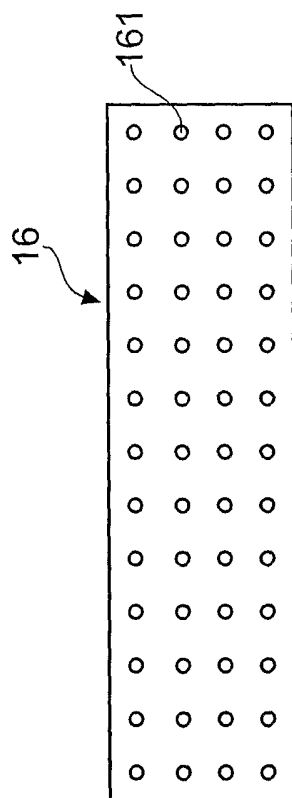


Fig. 7a

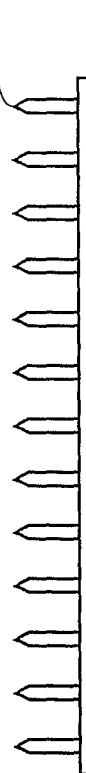


Fig. 7b

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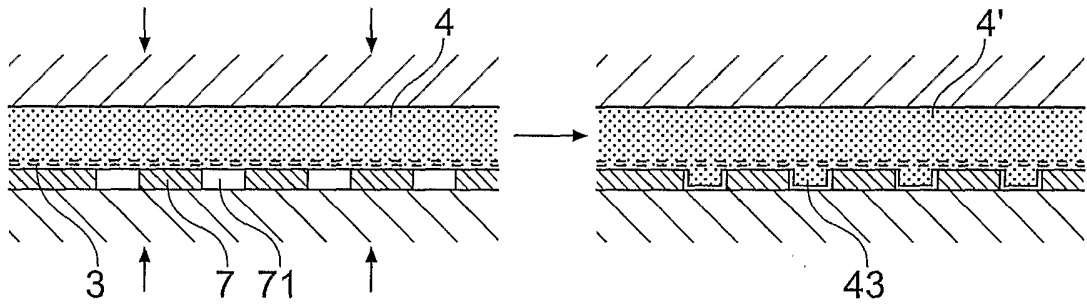


Fig. 9a

Fig. 9b

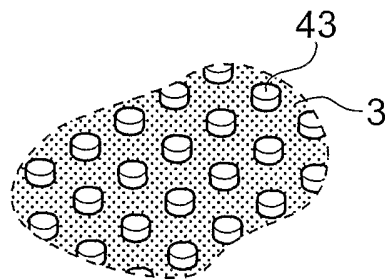


Fig. 10

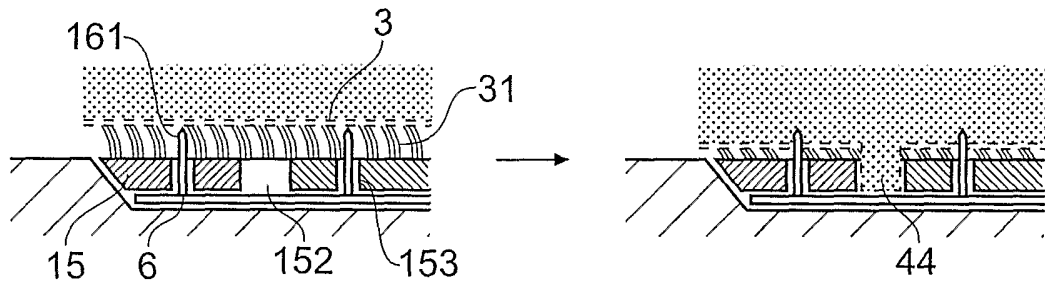


Fig. 11

Fig. 12

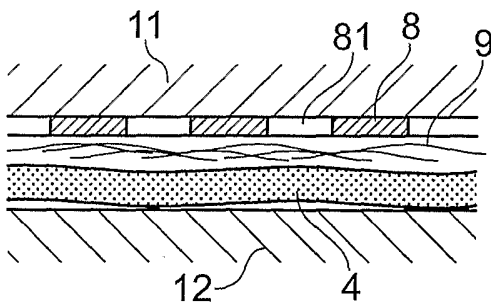


Fig. 13

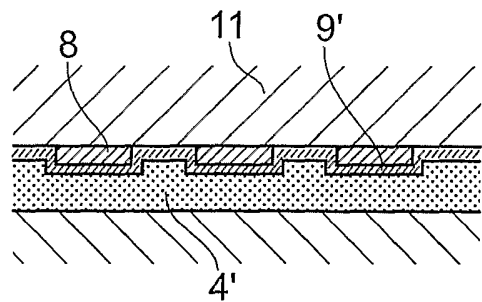


Fig. 14

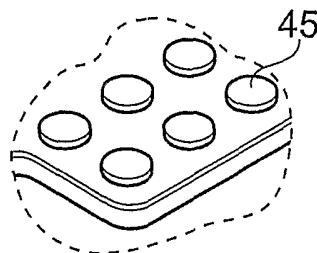


Fig. 15

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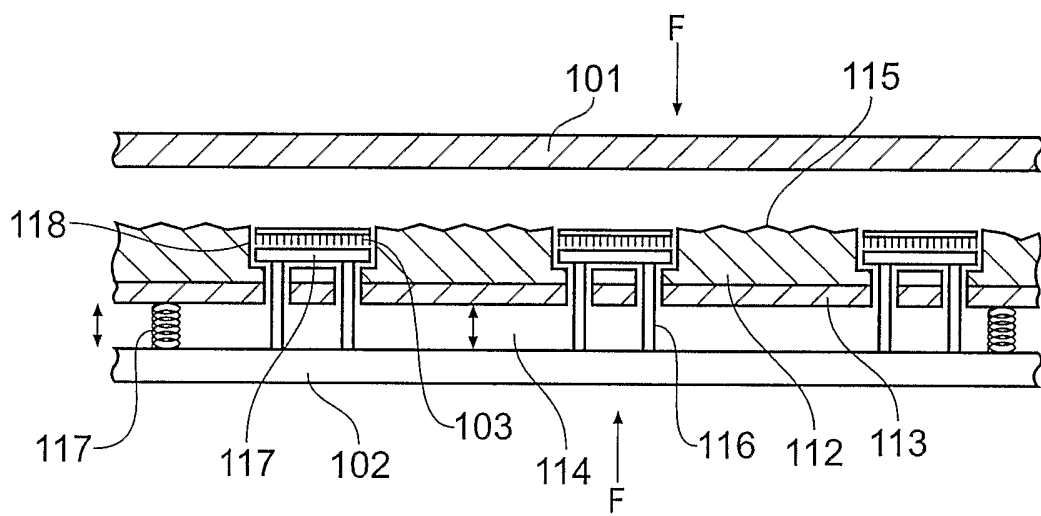


Fig. 16