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Section 29(1)
Regulation 3.1(2)
File: 92 J 085

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AUSTRALIA

Patents Act, 1990

NOTICE OF ENTITLEMENT

I, GEOFFREY JOHN HUMBY being the applicant in respect of Application No. 20,672/92 state the following:

The person nominated for the grant of the patent is the actual inventor.

G J Humby — 24-10-94

Signature — Date

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Section 29

AUSTRALIA

Patents Act, 1990

PATENT REQUEST: STANDARD PATENT/PATENT OF ADDITION

I, being the person(s) identified below as the Applicant, request the grant of a patent to the person identified below as the Nominated Person, for an invention described in the accompanying standard complete specification. Full application details follow.

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[54]	INVENTION TITLE:	A COMPOSITE STRUCTURE
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Drawing number recommended to accompany the abstract: Fig. 3.

DATED this 23rd day of July, 1992.

GEOFFREY JOHN HUMBY
By his Patent Attorneys,
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F035868 28/07/92

AU9220672

(12) PATENT ABRIDGMENT (11) Document No. AU-B-20672/92
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 655999

(54) Title
A COMPOSITE STRUCTURE

(51)[5] International Patent Classification(s)
B32B 005/02 B32B 025/08 B32B 025/10 B32B 027/12
D06N 007/02 E04D 005/02 E04D 005/10

(21) Application No. : 20672/92 (22) Application Date : 28.07.92

(43) Publication Date : 10.02.94

(44) Publication Date of Accepted Application : 19.01.95

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(56) Prior Art Documents
AU 624268 62693/90 B32B 5/02
AU 635033 57204/90 D06N 7/00
US 4248926

(57)

Fig. 1 is a schematic view illustrating the application of a preferred adhesive to a roof substrate in the fabrication of the composite roof in accordance with one aspect of the invention;

Fig. 2 is a perspective view of the application of the composite sheet membrane according the invention over the adhesive layer;

Fig. 3 is an enlarged vertical sectional view illustrating the construction of a composite roof according to one aspect of the invention; and

Fig. 4 is a broken-away schematic side view showing a method of jointing two overlapping composite sheet membranes according to the invention.

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CLAIM

1. A method of forming a composite covering upon a substrate, comprising the steps of:

providing an initially flowable low rise foam adhesive material;

applying said initially flowable adhesive material onto said substrate and allowing it to foam so as to fill any voids on the substrate and to cover the substrate;

prior to complete solidification of said foamed adhesive material, applying a composite sheet membrane thereto and allowing the adhesive material to solidify,

said composite sheet membrane including a sheet of flexible material having a fibre or fleece-like matting secured to the underside thereof,

said membrane-applying step including the steps of placing said matting in contact with said adhesive material prior to complete solidification thereof, causing said matting to become at least partially embedded within said adhesive material, and thereafter allowing said adhesive material to solidify.

8. A composite roof structure adapted to be supported by a roof substrate and comprising:

a layer of initially flowable low rise foam adhesive material adapted to be secured to said substrate; and

a composite sheet membrane including a sheet of flexible material having a fleece-like matting secured to the underside thereof,

said membrane being attached to said adhesive material

with at least a portion of said matting being embedded within said adhesive material so as to provide a vapour venting spacing between said adhesive material and said sheet of flexible material for permitting venting of vapours from said roof structure.

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Regulation 3.2

AUSTRALIA

Patents Act, 1990

COMPLETE SPECIFICATION

FOR A STANDARD PATENT

Original

TO BE COMPLETED BY THE APPLICANT

NAME OF APPLICANT:	GEOFFREY JOHN HUMBY
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INVENTION TITLE:	A COMPOSITE STRUCTURE

The following statement is a full description of this invention, including the best method of performing it know to me:-

The present invention relates to a composite sheet membrane and particularly to a composite sheet membrane adapted to be bonded to flat roof surfaces and other functional surfaces such as road surfaces and surfaces of building excavations. The present invention also provides a composite roof structure and a method of forming same that uses the composite sheet membrane.

There is a need for a composite sheet membrane that can be intimately bonded to and protect substantially flat surfaces or building substrates subject to environmental stresses.

In the past, in order to improve roof characteristics during renovation, flat roof surfaces of some high rise buildings have been covered first by asphalt or other adhesive substance. A synthetic rubber membrane sheet formed from EPDM rubber is then applied over the adhesive substance. However, the EPDM rubber membrane sheet, because of its substantially smooth surface, will not bond easily or intimately with the adhesive and, as a result, the sheet will be subject to wind uplifts, particularly from around the edges of the roof surface. Also, the resultant roof surface will have little, if any, vapour ventilation capacity, and therefore will be prone to excessive blistering.

It is an object of the present invention to overcome or substantially ameliorate the shortcomings of the prior art.

According to the invention, there is provided a method of forming a composite covering upon a substrate, comprising the steps of:

providing an initially flowable low rise foam adhesive material;

applying said initially flowable adhesive material onto said substrate and allowing it to foam so as to fill any voids on the substrate and to cover the substrate;

prior to complete solidification of said foamed adhesive material, applying a composite sheet membrane thereto and allowing the adhesive material to solidify,

said composite sheet membrane including a sheet of flexible material having a fibre or fleece-like matting secured to the underside thereof,

said membrane-applying step including the steps of placing said matting in contact with said adhesive material prior to complete solidification thereof, causing said matting to become at least partially embedded within said adhesive material, and thereafter allowing said adhesive material to solidify.

Although not being restricted thereto, the composite covering upon a substrate has particular application as a component of a roof structure.

Accordingly, another aspect of the invention provides a composite roof structure adapted to be supported by a roof substrate and comprising:

a layer of initially flowable low rise foam adhesive material adapted to be secured to said substrate; and

a composite sheet membrane including a sheet of flexible material having a fleece-like matting secured to the underside thereof,

said membrane being attached to said adhesive material with at least a portion of said matting being embedded within said adhesive material so as to provide a vapour venting spacing between said adhesive material and said sheet of flexible material for permitting venting of vapours from said roof structure.

Preferably, the flexible material of the said sheet comprises a synthetic rubber. The flexible material may alternatively be a thermosetting resin or thermoplastic material if desired.

It is preferred that the flexible material be waterproof, or have heat insulating properties.

The preferred synthetic rubber is ethylene propylene diene monomer (EPDM) rubber and may have a thickness of from about 0.075 mm to 2 mm. Both the thermosetting material and thermoplastic material may have a thickness of from about 0.075 mm to 4 mm, and may be polyvinylchloride, polyisobutadene, acrylic or polyurethane based products.

The preferred fleece-like matting is a polyester matting consisting of a mat of polyester fibres, and may have a thickness of from about 0.075 mm to 4 mm.

The fleece-like matting may be a polypropylene or other fibrous or filamentous matting provided that a portion of the matting can be embedded within the selected adhesive material.

In particularly preferred forms, the adhesive material is in the form of a layer of foamed, cellular synthetic resin material, most preferably polyurethane foam. The adhesive layer has a thickness after solidification of at least about 2 mm, and more preferably from about 2 mm to 20 mm.

Furthermore, in order to facilitate installation, the adhesive material is initially in the form of a liquid and has an initial solidification time in excess of about 30 seconds, and more preferably from about 30 seconds to 20 minutes. Advantageously, the polyurethane adhesive is a two-component system having polyol/diisocyanate components.

In order that the invention may be more readily understood and put into practical effect, reference will be made to the accompanying drawings, in which:-

Fig. 1 is a schematic view illustrating the application of a preferred adhesive to a roof substrate in the fabrication of the composite roof in accordance with one aspect of the invention;

Fig. 2 is a perspective view of the application of the composite sheet membrane according the

invention over the adhesive layer;

Fig. 3 is an enlarged vertical sectional view illustrating the construction of a composite roof according to one aspect of the invention; and

Fig. 4 is a broken-away schematic side view showing a method of jointing two overlapping composite sheet membranes according to the invention.

The preferred procedure for fabrication of a composite roof in accordance with one aspect of the invention is illustrated in Figs. 1 to 3. Generally the composite roof hereof is applied to an otherwise conventional roof substrate 10 which may include metal decking 12 and a layer of insulated foam 14, as shown in Fig. 3. In preparing the substrate 10, the upper surface thereof should be clean and free of grease, and any sharp edges should be repaired. Although a metal/insulated foam substrate has been illustrated, it will be appreciated that the invention is not so limited. Thus, the composite roof can be directly applied to plywood, chipboard, concrete, or smooth-surfaced or gravel surfaced built up roofs. If insulation is installed, however, it should be compatible with the adhesive system employed.

If the substrate is in the form of a ferrous metallic deck, the deck should be primed with an appropriate metallic primer. If a non-ferrous deck forms the substrate, it should be treated with a wash primer. Substrates of chromate-

treated galvanized material should be brush blasted or acid etched and neutralised before priming. Concrete and/or masonry roof substrates should have a minimum cure of 28 days at 70 degrees F and 50% relative humidity. All such surfaces should be clean, dry, free of all dust, dirt, grease and oil prior to priming. Where necessary, the concrete and/or masonry surfaces should be primed with conventional masonry primer. In the case of existing built up gravel roofs, the roofs should be power broomed in separate perpendicular passes to remove all loose gravel and, where necessary, power vacuumed. All blistered and delaminated or damaged areas should be removed and insulated foam applied until flush and smooth with the surrounding roof. All loose felts and flashings should be mechanically fastened and/or removed.

After the substrate is prepared, the adhesive 15 is applied. Referring to Fig. 1, it will be seen that use is made of a conventional spray gun apparatus 16 for this purpose. Where the preferred two-component polyurethane adhesive is used, the polyol and diisocyanate components are mixed within the body of the gun and sprayed onto the substrate 10 as illustrated. The adhesive is applied so as to obtain a final thickness, after complete solidification thereof, of from about 2 mm to 20 mm. Generally speaking, this corresponds to an application rate of 1 kilogram of adhesive per 0.5 to 4 square metres of substrate surface.

Referring to Figs. 2 and 3, immediately after application of the adhesive, the membrane 18 is placed in contact with the adhesive. It is important that the membrane

be applied prior to complete set up and solidification of the adhesive 15. Where the membrane is supplied in roll form, it can simply be unrolled behind the spray applicator.

The membrane 18 includes an upper flexible EPDM rubber layer 20 together with a non-woven polyester fleece-like layer 22 secured to the underside of the rubber layer. After the membrane 18 is unrolled and positioned on the substrate, it is gently pressed into the adhesive layer by means of a soft 350 mm roller similar to a paint roller. Preferably, rolling is done in a single pass at a 45 degree angle relative to the longitudinal axis of the unrolled membrane. After initial set of the adhesive (approximately 5-10 minutes) butt joints are rolled with a seam roller. At parapets the membrane is turned up the parapet wall and fully adhered to using the adhesive. At roof penetrations, the membrane is cut as close as possible to the base of the penetration (in the case of pipes) or "X" cut to allow membrane to turn up onto base flashings.

As particularly illustrated in Fig. 2, the membrane 18 is applied in side by side strips and thus presents, between respective strips, seam areas 24. In order to complete the roof structure, use is made of relatively narrow (e.g., 6 inch) seaming material 26 in the form of extruded black rubber tape which is factory laminated to a cured EPDM rubber membrane. The tape is soft and tacky and is covered with a release liner. The seaming material is applied to clean, dry membrane sheets which are aligned with butted edges as illustrated in Fig. 2. The seaming material is then centred

over the butt joint, making sure there are no bridging areas or wrinkles. The release paper is then stripped from the tape, and light hand pressure is applied to assure adherence to the underlying membranes. The seam is then rolled with a small steel roller (50 mm to 150 mm wide) applying in excess of 0.25 kg linear pressure with 3 passes minimum.

Finally, the edges of the applied seaming material 26 are sealed with a lap sealant in the forr of a high grade roof membrane caulk. As illustrated in Fig. 4, the jointing of membranes may be also achieved by overlaping membrane sheet edge portions 30 and 31, rather than laying the membrane sheets side by side, and then securing the overlapping portions together with an adhesive or caulking compound 32.

Finishing details around guttering, snap-on edges or the like are then completed, using conventional techniques.

As explained above, the preferred adhesive 15 is a polyurethane foam system designed for bonding the described membrane to acceptable substrates. The diisocyanate and polyol components are mixed in gun 16 in an approximately 1:1 volumetric ratio. The final adhesive, when solidified, has a free-rise core density of at least about 2.0 pounds per cubic foot, and more preferably 2.5 pounds per cubic foot and above. The polyol component consists primarily of a conventional polyol with surfactants and catalytic agents. The diisocyanate component is completely conventional.

While a two component polyurethane system can be used to good effect, the invention is not so limited. Thus, use

can also be made of a single component polyurethane adhesive if desired.

A completed roof structure in accordance with the invention provides many advantages heretofore unachievable. First, the overall cost of the roof is substantially less than prior roofs of this type. This cost reduction stems from the fact that the amount of labour required is drastically reduced, as compared with other roofing systems. With the present invention, it is possible to apply 3,000 to 5,000 square feet of roofing per hour, which is many times the rate of conventional systems. Accordingly, overall costs are reduced, even though the EPDM rubber/polyester matting membrane is itself more expensive than presently used membranes. Furthermore, the foamed, cellular adhesive has good "breathing" properties, and this, combined with the vapour venting spacing provided between the adhesive and EPDM rubber, provides excellent venting of vapours. As a consequence, blistering is all but eliminated in the roofs of the present invention. The use of a synthetic rubber membrane of the type described give excellent resistance to puncture and long roof life. Finally, the adhesive bond established between the foamed adhesive and polyester matting is extremely strong, to the point that the adherence of the membrane can and often does exceed the wind uplift capabilities of the substrate.

Various modifications may be made in details of design and construction without departing from the scope and ambit of the invention.

THE CLAIMS DEFINING THE INVENTION ARE FOLLOWS:

1. A method of forming a composite covering upon a substrate, comprising the steps of:

providing an initially flowable low rise foam adhesive material;

applying said initially flowable adhesive material onto said substrate and allowing it to foam so as to fill any voids on the substrate and to cover the substrate;

prior to complete solidification of said foamed adhesive material, applying a composite sheet membrane thereto and allowing the adhesive material to solidify,

said composite sheet membrane including a sheet of flexible material having a fibre or fleece-like matting secured to the underside thereof,

said membrane-applying step including the steps of placing said matting in contact with said adhesive material prior to complete solidification thereof, causing said matting to become at least partially embedded within said adhesive material, and thereafter allowing said adhesive material to solidify.

2. The method of claim 1 wherein the flexible material of said sheet is selected from the group comprising a synthetic rubber, a thermosetting resin or a thermoplastic material.

3. The method of claim 1 wherein the adhesive material is polyurethane foam.

4. The method of claim 2 wherein said synthetic rubber comprises ethylene propylene diene monomer rubber.

5. The method of claim 2 wherein said synthetic rubber

sheet has a thickness of from about 0.075 mm to 2 mm, and both said thermoplastic material and said thermosetting material have a thickness of from about 0.075 mm to 4 mm.

6. The method of claim 1 wherein said fibre or fleece-like matting comprises polyester matting.

7. The method of claim 6 wherein said polyester matting has a thickness of from about 0.075 mm to 4 mm.

8. A composite roof structure adapted to be supported by a roof substrate and comprising:

a layer of initially flowable low rise foam adhesive material adapted to be secured to said substrate; and

a composite sheet membrane including a sheet of flexible material having a fleece-like matting secured to the underside thereof,

said membrane being attached to said adhesive material with at least a portion of said matting being embedded within said adhesive material so as to provide a vapour venting spacing between said adhesive material and said sheet of flexible material for permitting venting of vapours from said roof structure.

9. The roof structure of claim 8 wherein said adhesive material comprises a layer of foamed, cellular synthetic resin material.

10. The roof structure of claim 8 wherein said adhesive material comprises a layer of polyurethane foam material.

11. The roof structure of claim 9 wherein said layer has a thickness of at least 2 mm.

12. The roof structure of claim 11 wherein said thickness is from 2 mm to 20 mm.

13. The roof structure of claim 8 wherein said adhesive material is initially in the form of a liquid and has a solidification time of from about 30 seconds to 20 minutes.

14. The roof structure of claim 8 wherein said adhesive material comprises a two-component polyurethane adhesive including a polyol and an isocyanate component.

Dated this 2nd day of November, 1994.

GEOFFREY JOHN HUMBY
Patent Attorneys for the Applicant
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ABSTRACT

A composite sheet membrane including a first layer of a flexible material and a second layer of a fleece-like matting secured to the first layer. The flexible material is selected so as to provide substantial resistance to environmental stresses. In use, a portion of the matting is adapted to be embedded within a layer of adhesive material that is applied on a roof surface or like surface so that the membrane attaches thereto and provides an intimate covering to the surface.

A composite roof structure so formed is also disclosed.

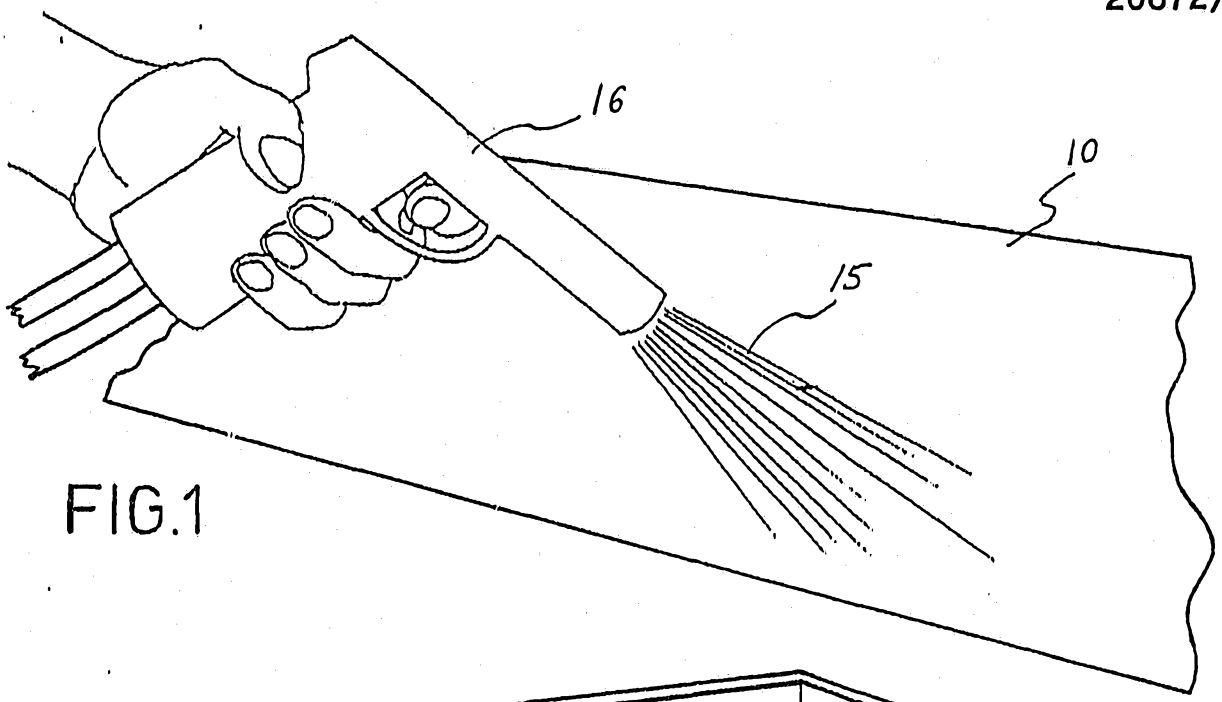

FIG.1

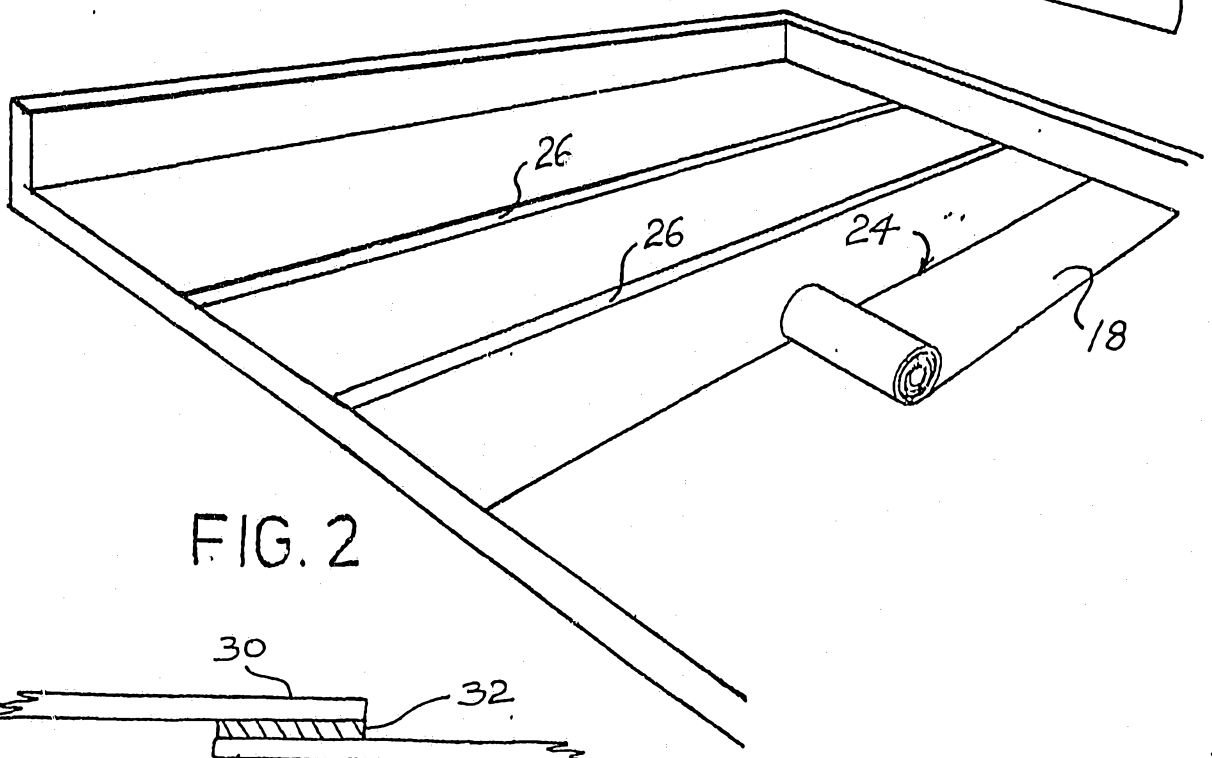

FIG. 2

FIG. 4

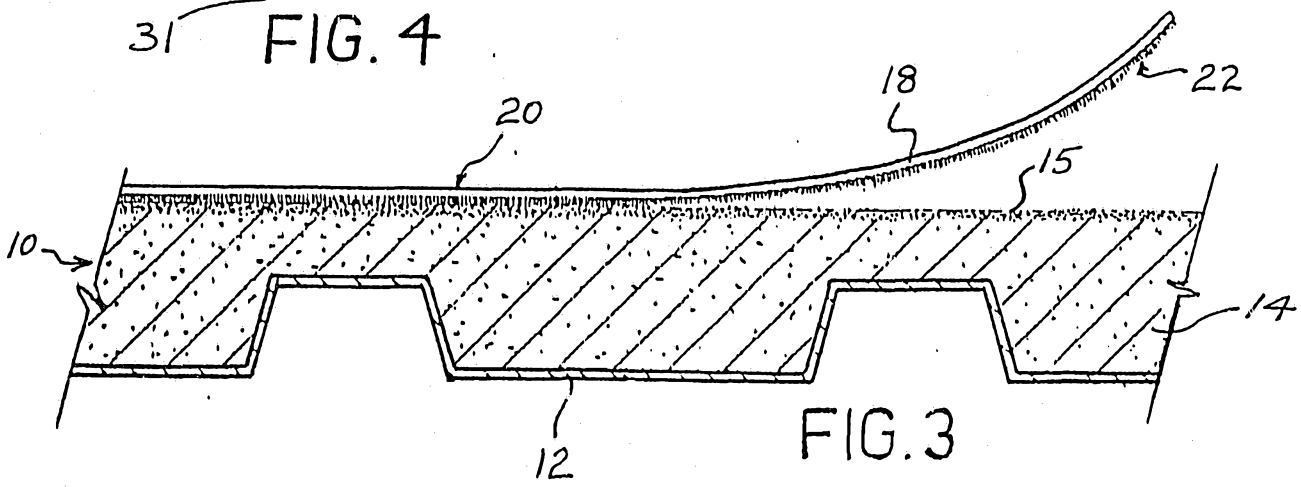

FIG. 3