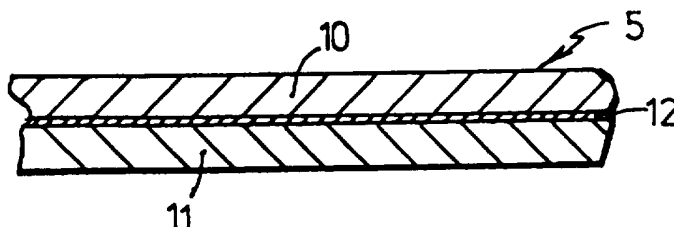




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : B32B 3/12, E04C 2/36	A1	(11) International Publication Number: WO 96/30202 (43) International Publication Date: 3 October 1996 (03.10.96)
(21) International Application Number: PCT/NL96/00124 (22) International Filing Date: 22 March 1996 (22.03.96) (30) Priority Data: 9500623 31 March 1995 (31.03.95) NL (71) Applicant (for all designated States except US): BESIN B.V. [NL/NL]; Herderlaan 4, NL-3851 BD Ermelo (NL). (72) Inventor; and (75) Inventor/Applicant (for US only): DIDERICH, Johannes, Philippus, Ludovicus, Maria [NL/NL]; Herderlaan 4, NL- 3851 BD Ermelo (NL). (74) Agent: FERGUSON, Alexander; Octrooibureau Vriesendorp & Gaade, P.O. Box 266, NL-2501 AW Den Haag (NL).		(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, ES, FI, FI (Utility model), GB, GE, HU, IS, JP, JP (Utility model), KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), 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). Published <i>With international search report.</i> <i>In English translation (filed in Dutch).</i>

(54) Title: HONEYCOMB CORE OF A MOISTURE SEALING MATERIAL



(57) Abstract

A honeycomb core is built up of strips made with a material such as cellulose material, the strength and/or the shape of which is sensitive to the action of moisture. The strips are built up in layers and comprise a layer of plastic. The plastic layer can be located between two layers of the moisture-sensitive material and be integral with this. With this honeycomb core a honeycomb panel in the shape of a sandwich construction can be built up, which comprises two cover plates made with a material such as cellulose material, the strength and/or the shape of which is sensitive to the action of moisture, which cover plates form panel faces, between which the core is glued, in which at least one of the cover plates is moisture-proof. At least one of the cover plates can be built up in layers and can comprise a layer of plastic. The cover plate concerned can comprise two layers of the moisture-sensitive material, between which the plastic layer thereof is located which is integral with this.

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HONEYCOMB CORE OF A MOISTURE SEALING MATERIAL

5 The present invention relates to a honeycomb core, built
up of strips made with a material, such as cellulose
material, the strength and/or the shape of which is sensi-
tive to the action of moisture, and to a honeycomb panel
10 in the form of a sandwich construction, comprising such a
honeycomb core and two cover plates which define panel
faces, between which the core is glued.

For many uses, for example in pallets or in interior parts
for cars it is desirable that such a honeycomb core or
15 such a honeycomb panel is moisture-proof and particularly
water-proof. Moisture resistance can be achieved by using
a plastic instead of the moisture-sensitive material. Most
plastics, however, have a much lower temperature stability
than cellulose material such as, for instance paper, and
20 they are in most cases more expensive. Moreover, plastics
have the disadvantage that an environmentally harmful
product is obtained, and that the conventional manufactu-
ring methods which are geared to paper processing, in
particular the cutting and glueing thereof, will have to
25 be completely revised.

Apart from this, moisture resistance can be achieved by
impregnating the paper with a moisture-repellant means.
The usual method for recovering paper for recycling is,
30 however, stirring the paper to pulp in water in a so-
called pulper. Since the water cannot penetrate the im-
pregnated, moisture-repellant paper, this method is not
usable for impregnated paper. Consequently, the paper can
no longer be recovered from that.

35 The invention aims at providing a material for the honey-
comb core and the honeycomb panel which is moisture-resis-
tant, easily workable in the usual paper processing pro-
duction processes and furthermore easily recoverable for
40 re-use.

- 2 -

For this purpose the honeycomb core according to the invention is characterized in that the strips are built up in layers and comprise a layer of plastic, and the honeycomb panel according to the invention is characterized in that at least one of the cover plates is moisture-proof.

The core and the panel according to the invention are characterized in that the strips are built up in layers and comprise a layer of plastic, and the panel according to the invention is characterized in that at least one of the cover plates is moisture-proof.

The core and the panel according to the invention are thus provided with moisture-sealed layers. Moisture, and in particular water, can only affect the exposed outer surface of the core or the panel, and cannot reach the material which is closed in, for instance by further processing and mounting of the material. Apart from that the moisture-sensitive material can be recovered for re-use.

All the strips of the honeycomb core comprise the plastic layer so that the core or the panel can be cut to an arbitrary size and still remain moisture-proof.

If both cover plates of the panel are thus moisture-proof, these will cooperate with the moisture-sealing layers of the honeycomb core, so that the honeycomb cells are separated from the outside and from each other. If the panel is now damaged locally and a moisture sealing layer is broken there, the moisture can indeed penetrate the cell there, and moisten the paper layers inside it, but the moisture cannot spread any further, because the cell in question is isolated from its surroundings by moisture-sealing layers. The moisture impairment in local damage is thus localised.

The cover plates of the honeycomb panel can also be manu-

- 3 -

factured with a material such as cellulose material, the strength and/or the form of which is sensitive to the action of moisture. In that case it is preferable that at least one of the cover plates is built up in layers and comprises a layer of plastic. The material of the cover plates of such a panel, for example paper, can also be recovered for re-use.

The cover plates can, however, be made of another material which is or is made moisture-proof, such as, for instance, wood, metal, plastic, coated paper or laminates thereof, if this material is inherently moisture-resistant. For the purpose of re-use the paper should be separable from these materials.

Preferably the plastic layer of the honeycomb core is to be found between two layers of the moisture-sensitive material of the strips, and is thus integrated with it. If the plastic layer is built in in that way in the moisture-sensitive material of the core strips, the surface thereof retains the character of moisture-sensitive material. In the case of paper the strips can be processed in the usual ways as paper, for example by trimming, cutting and gluing, for the production of the honeycomb core and with that the honeycomb panel.

Preferably the cover plate concerned of the honeycomb panel comprises two layers of the moisture-sensitive material, between which the plastic layer thereof is located, which is integral with that. By building in the plastic layer here as well, the cover plate surfaces retain the character of the moisture-sensitive material, and the cover plates can be cut, glued and processed further in the usual ways for producing honeycomb panels. The principal faces of the produced panels then also retain the character of the moisture-sensitive material (for example paper) so that these panels can then be cut

- 4 -

in the usual manner to size, and so that for example paper honeycomb blocks or honeycomb panel parts can be glued against them, with the usual glueing methods. Common products such as pallets and interior parts for cars can
5 be made without radical production changes.

It is preferable that the built-in plastic layers are melted together with the paper layers resting against them. A paper product melted in that way can easily be
10 used as initial material in the usual production processes for the honeycomb core and the honeycomb panel based on paper.

The paper layers of the core material can have a surface
15 density between 50 and 125 g/m², and preferably have a surface density of about 70 g/m², whereas the cover plates of the honeycomb panel have a total surface density of between 150 and 750 g/m². In that way an optimal balance between weight and strength of the material is attained.

20 It is preferable that the plastic layers used are made of polyethene. This material can be melted easily with paper.

The polyethene layers have a surface density between 5 and
25 50 g/m² and preferably have a surface density of about 12 g/m². Layer densities like this melt well with paper and are not penetrable by moisture.

The honeycomb core can be built up by glueing the strips
30 together with a moisture-resistant glue, and the cover plates of the honeycomb panel can be glued together with the honeycomb core thereof with a moisture-resistant glue. In this way the structure of the core or the panel remains intact when becoming moist and local moisture damage to
35 the panel is fixed and located in an effective manner. A suitable moisture-resistant glue is, for example, polyvinyl acetate glue.

- 5 -

5 Preferably a glue is selected which impregnates the strips and the cover plates at the glue locations. Then the strip and cover plate material cannot absorb any moisture at the glueing sites. In this way, moisture migration between adjacent honeycomb cells, parallel to the glueing bonds and the moisture-sealing layers right through the material, is blocked in an effective way.

10 Polyethene and similar polymers, just as glue residues and small paper fractions impregnated with water-resistant glue, can easily be separated from the paper in a pulper, by scooping it out of the pulp slurry. The separated pulp can thus easily be recovered for re-use in paper products.

15 The invention will be elucidated below with reference to an exemplary embodiment which is illustrated in the accompanying drawings, in which:

20 figure 1 is a perspective view of a honeycomb panel provided with a honeycomb core;

figure 2 is a top view of a honeycomb core in a folded-up position;

25 figure 3 is a top view of a honeycomb core in a partially drawn out position;

figure 4 is a top view of a honeycomb core in fully drawn out position; and

30 figure 5 is a cross sectional view of one of the paper strips of which the honeycomb core according to the invention is built up.

35 Figure 1 shows a honeycomb panel 1 which comprises a honeycomb core 2 and cover plates 3 and 4 glued to it. The honeycomb core 2 is built up of trapezoid-shaped

- 6 -

corrugated strips 5 which consist for the most part of paper. Instead of a light or heavy paper quality (cardboard) another cellulose material can be used.

5 In the figures 2, 3 and 4 top views of the honeycomb core are shown in folded-up and partially and fully drawn out positions. The strips 5 extend in longitudinal direction along each other, and parts 6 thereof are glued at least in part along their longitudinal direction, alternately to
10 the adjacent strips on both sides, for example with polyvinyl acetate glue (PVAC glue), the parts 7, of approximately the same length, located between the glued parts 6, remaining unglued. If the honeycomb core is drawn out in a direction perpendicular to the plane of the strips 5
15 (figure 3), a grid of more or less regular hexagonal cells 8 is formed, with approximately the same cell diameter D, the cell sides of which being formed by the glued parts 6 and the intermediate parts 7 (figure 4). The cells can, for instance, be 13 mm in diameter D and 50 mm in height
20 (strip width).

The strips 5 form the walls 9 of the cells 8 of the hexagonal grid and can be folded at their ends and be turned back for forming the adjacent strip. After stretching the honeycomb core a honeycomb panel can be formed
25 with it by glueing (for example with PVAC glue) the cover plates 3 and 4 to the upper and lower edges of the cell walls 9 (figure 1). It is, however, also possible to provide a honeycomb panel with a honeycomb core 2 according to the invention, in which a cover plate 3 is glued
30 to only one side of the core 2.

The cells of the honeycomb panel 1 can be empty or filled with an insulating material. The panel can be manufactured
35 cheaply of inherently flexurally slack material, but has as a whole a high resistance to compression in a direction perpendicular to the principal plane and has a high

- 7 -

flexural stiffness.

5 The structure of the material of the strip 5 is shown schematically in figure 5. The strips 5 are layered and consist of two layers of paper 10 and 11 (another cellulose material is also possible), between which there is a layer of polyethene 12, which is melted together with the paper layers. Of course another plastic, in particular a polymer, can be used. The polyethene layer 12 has a surface density between 5 and 50 g/m² and preferably has a density of approximately 12 g/m². The paper layers 10 and 11 have surface densities between 50 and 125 g/m² and preferably have a surface density of 70 g/m².

15 The polyethene layer 12 is not moisture-penetrable and the strips 5 are therefore moisture-sealed. If the material of the strips 5 is exposed on one side to moisture, only the paper layer 10 or 11 on that side will get wet and the other paper layer will stay dry.

20 If a honeycomb panel is built up of a honeycomb core of the moisture-sealed paper described, against which on one or both panel sides a cover plate is glued, then at least one of the cover plates can have the same structure as that of the strips 5 according to figure 5. The polyethene layer 12 can then have the same surface density as that of the strips 5, whereas the paper layers 10 and 11 of the cover plates can have a surface density such that the total surface density of each cover plate is between 150 and 750 g/m².

35 In a honeycomb panel according to figure 1 in which the strips 5 of the core 2 as well as both the cover plates 3 and 4 are provided with a moisture-sealed polyethene layer 12 built into the paper as described above, the cells 8 of the hexagonal grid are separated by moisture-sealed polyethene layers 12 from each other and from the outside.

- 8 -

Thus moisture cannot penetrate through the panel surfaces or through the cell walls 9 at one of the circumferential edges of the panel, and can only moisten a paper layer on an outer side of the panel. If the panel is damaged locally, and the moisture-sealed polyethene layer 12 is broken there, moisture can penetrate into the respective cell or cells 8 and moisten the paper layers exposed therein. However, the other moisture-sealed polyethene layers 12 of those cells 8 prevent the moisture from spreading further in the panel 1, thus limiting the moisture damage to the damaged cells 8.

A water-resistant glue is used for glueing, which impregnates the paper. The relatively slow migration of moisture through the paper, parallel to a glueing bond and the moisture-sealed layers, or in between two strips, or across a strip edge through the paper of a cover plate, to an adjacent, undamaged cell, is effectively blocked by the local paper impregnations.

Honeycomb panels 1 according to the invention can, for instance, be used in pallets, which are almost completely made up of paper, with decks and foot blocks formed from honeycomb panels according to the invention. Such pallets can stand in a puddle of water without any problem, since they are not sensitive to weakening by the penetration of moisture therein.

Honeycomb panels according to the invention can, in addition, be used as filling material in car doors, for insulating and for cushioning the impact in sideward collisions. For that purpose suitable packs of such honeycomb panels 1 are formed, which are arranged vertically in the car door. Because of fluctuations in the relative air humidity and the temperature, water can condense in the inside of the door, as a result of which the panel pack will get wet through direct condensation thereon or indi-

- 9 -

rectly. Moreover, on account of ageing of the rubber seals of the door window, rain water can leak into the inside of the door, so that the panel pack, initially the edges thereof, will get wet. The polyethene layers 12 in the strips 5 of the honeycomb core 2 and also those in the cover plates 3 and 4 provide an effective seal against this moisture.

By building in the moisture-sealing polyethene layer 12 in the paper, the material retains the character of paper. The material can be processed using the usual methods and materials in the production process for honeycomb cores and honeycomb panels (and further for pallets and car door fillings), among others by the usual cutting and glueing actions. In addition, the material has the thermal stability and the mechanical strength of paper, that is to say, for example, that at 150° C it retains its shape and strength which is not the case with a material built up entirely of polyethene, polypropene or another cheap plastic.

The material of the honeycomb core and the honeycomb panel according to the invention can easily be recovered for re-use by shredding it and stirring it into water in a so-called pulper. The water then penetrates the paper and because of the stirring the paper is mechanically separated from the polyethene, so that a paper slurry, the pulp, is formed. The polyethene can then be scooped out of the paper slurry after which the latter can be reused for producing paper products. This method for recovery does not work in the case of impregnated paper, in view of the fact that the water cannot penetrate it. Water-resistant glue residues and small paper fractions impregnated with water-resistant glue can, however, also be easily scooped up out of the paper slurry.

C L A I M S

1. Honeycomb core, built up of strips made with a material, such as cellulose material, the strength and/or the shape of which is sensitive to the action of moisture, **characterized in that**

5 the strips are built up in layers and comprise a layer of plastic.

2. Honeycomb core according to claim 1, **characterized in that** the plastic layer is located between two layers of
10 the moisture-sensitive material and is integral with this.

3. Honeycomb core according to claim 2, in which the moisture-sensitive material is paper, **characterized in that** the plastic layer is melted together with the paper
15 layers.

4. Honeycomb core according to claim 3, **characterized in that** the paper layers have a surface density between 50 and 125 g/m².
20

5. Honeycomb core according to claim 4, **characterized in that** the paper layers have a surface density of about 70 g/m².

25 6. Honeycomb core according to any one of the preceding claims, **characterized in that** the plastic layer is made of polyethene.

7. Honeycomb core according to claim 6, **characterized**

in that the polyethene layer has a surface density between 5 and 50 g/m².

8. Honeycomb core according to claim 7, **characterized**
5 in that the polyethene layer has a surface density of about 12 g/m².

9. Honeycomb core according to any one of the preceding claims, **characterized in that** it is built up by
10 gluing the strips together with a moisture-proof glue.

10. Honeycomb core according to claim 9, **characterized in that** the strips are impregnated by the glue at the locations where they are glued together.
15

11. Honeycomb panel in the form of a sandwich construction, comprising a honeycomb core according to any one of the preceding claims or any one of the claims 21-27, and two cover plates which define panel faces, between
20 which the core is glued,

characterized in that

at least one of the cover plates is moisture-proof.

12. Honeycomb panel according to claim 11, of which
25 the cover plates are made with a material, such as cellulose material, the strength and/or the shape of which is sensitive to the action of moisture,

characterized in that

at least one of the cover plates is built up in
30 layers and comprises a layer of plastic.

13. Honeycomb panel according to claim 12, **characterized in that** the cover plate concerned comprises two layers of the moisture-sensitive material, between which
35 the plastic layer thereof is located which is integral with this.

14. Honeycomb panel according to claim 13, in which the moisture-sensitive material of the cover plates is paper, **characterized in that** the plastic layer of the cover plate concerned is melted together with the paper layers thereof.

15. Honeycomb panel according to claim 14, **characterized in that** the plastic layer of the cover plate concerned is made of polyethene.

10

16. Honeycomb panel according to claim 15, **characterized in that** the polyethene layer of the cover plate concerned has a surface density between 5 and 50 g/m².

17. Honeycomb panel according to claim 16, **characterized in that** the polyethene layer of the cover plate concerned has a surface density of about 12 g/m².

18. Honeycomb panel according to any one of the claims 11-17, **characterized in that** the cover plates have a surface density between 150 and 750 g/m².

19. Honeycomb panel according any one of the claims 11-18, **characterized in that** the cover plates and the core are glued together with a moisture-proof glue.

20. Honeycomb panel according to claim 19, **characterized in that** the cover plates and the strip edges are impregnated by the glue at the locations where they are glued together.

21. Honeycomb core, built up of strips made with a material, such as cellulose material, the strength and/or the shape of which is sensitive to the action of moisture, **characterized in that**

the strips are built up in layers and comprise a layer of plastic, located between two layers of the mois-

ture-sensitive material and being integral with this,
that the honeycomb core is built up by gluing the
strips together with a moisture-proof glue, and
that the strips are impregnated by the glue at the
5 locations where they are glued together.

22. Honeycomb core, built up of strips made with a
material, such as cellulose material, the strength and/or
the shape of which is sensitive to the action of moisture,
10 **characterized in that**

the strips are built up in layers and comprise a
layer of plastic, located between two layers of the mois-
ture-sensitive material and being integral with this, and
that the plastic layer is melted together with the
15 moisture-sensitive layers.

23. Honeycomb core, built up of strips made with a
material, such as cellulose material, the strength and/or
the shape of which is sensitive to the action of moisture,
20 **characterized in that**

the strips are built up in layers and comprise a
layer of plastic, located between two layers of the mois-
ture-sensitive material and being integral with this, and
that the plastic layer is made of polyethene.
25

24. Honeycomb core according to claim 23, **charac-
terized in that** the polyethene layer has a surface density
of between 5 and 50 g/m².

30 25. Honeycomb core according to claim 24, **charac-
terized in that** the polyethene layer has a surface density
of about 12 g/m².

26. Honeycomb core according to any one of the claims
35 21 - 25, in which the moisture-sensitive material is
paper, **characterized in that** the paper layers have a
surface density between 50 and 125 g/m².

27. Honeycomb core according to claim 26, **characterized in that** the paper layers have a surface density of about 70 g/m².

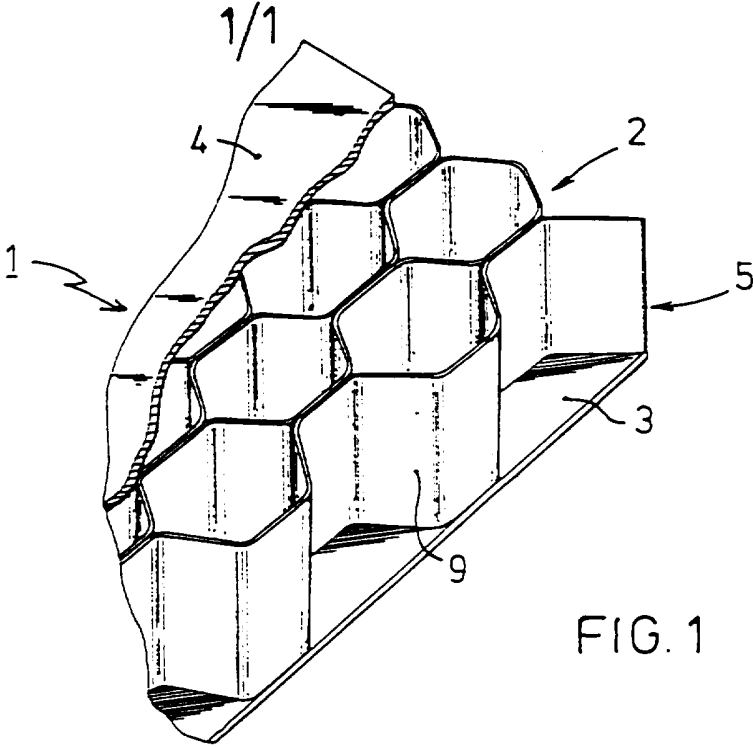


FIG. 1



FIG. 2

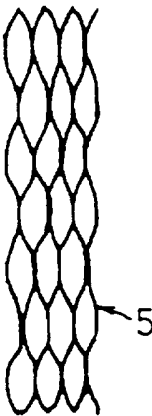


FIG. 3

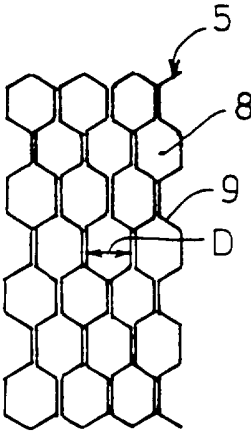


FIG. 4

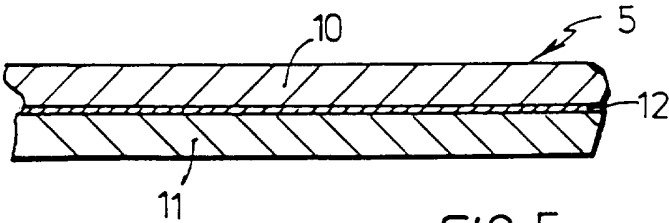


FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No

PCT/NL 96/00124

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 B32B3/12 E04C2/36

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 B32B E04C B31D

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	GB,A,803 259 (DUFAYLITE DEVELOPMENTS LIMITED) 22 October 1958 see page 1, line 1 - line 39 see page 2, line 46 - line 57 see page 4, line 39 - line 59 see page 6, line 93 - page 7, line 5 see figures 8,9 ---	1,2,4,5, 9-11, 18-21, 26,27
A	EP,A,0 474 161 (MITSUBISHI RAYON CO) 11 March 1992 see page 3, line 14 - page 4, line 38 ---	1,4,5,9, 10,21-23
A	US,A,3 673 058 (JACKSON WENDELL T ET AL) 27 June 1972 see column 2, line 18 - line 24; claims; figures 2,3 ---	1,11
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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

28 May 1996

Date of mailing of the international search report

12 -06- 1996

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

Int onal Application No
PCT/NL 96/00124

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,4 247 583 (ROY PAUL D) 27 January 1981 see column 4, line 31 - line 65; claims; figures 5,6	1,11
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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