(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 230 719**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **86308418.2**

(51) Int. Cl.⁴: **B31D 3/02** , E06B 9/262

(22) Date of filing: **29.10.86**

(30) Priority: **15.01.86 US 819098**

(43) Date of publication of application:
05.08.87 Bulletin 87/32

(84) Designated Contracting States:
AT BE DE ES FR GB GR IT NL SE

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(54) Expandable honeycomb structure and a method for its manufacture.

(57) An expandible honeycomb structure such as used for window coverings made of a foldable material which, in the expanding condition, defines a plurality of longitudinal extending cells, one on top of the other. The material of each cell is adhered to the adjacent cell along at least one portion in which the material is less permeable than the remainder of the material forming the cell to prevent seeping or bleeding of the adhesive.

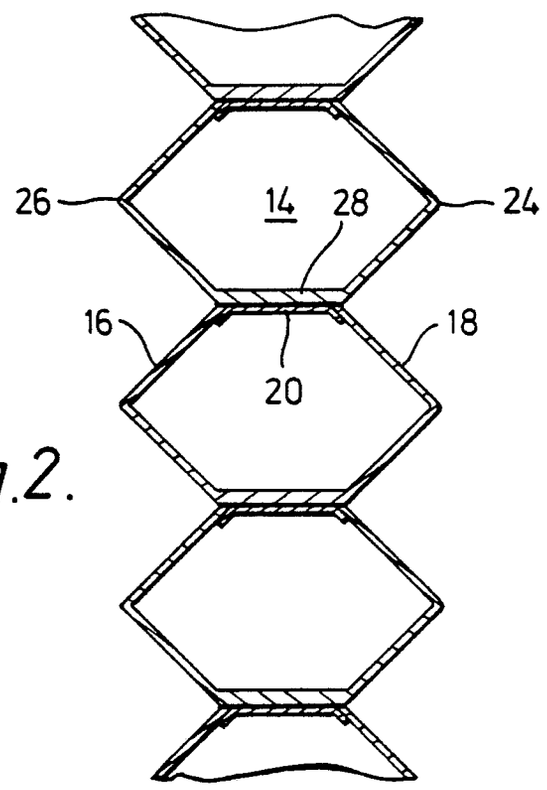


Fig.2.

EP 0 230 719 A2

EXPANDABLE HONEYCOMB STRUCTURE AND A METHOD FOR ITS MANUFACTURE

The present invention relates to an expandable honeycomb structure such as used for window coverings, and made of a foldable material which, in the expanded condition, defines a plurality of longitudinally extending cells, one on top of the other. In the retracted state of the structure, the adjacent cells are collapsed on each other. The invention also relates to a method of manufacturing such a structure.

Known structures are disclosed in US-A-4288485; 4388354; 3164507; 4450027 and GB-A-1497211 and 1460776.

US-A-4450027 discloses a method of construction in which the foldable material is folded longitudinally and wound onto a rack in overlying layers which are adhered together to form the cells of the honeycomb structure. The opposite longitudinal edges of a single length of material are progressively folded over one side of the material and adhesive is applied to the exposed longitudinal edges, whereby they adhere to the overlying layer of folded material as it is wound onto the rack. With the known structures, when adhesive is used, the application thereof must be carefully controlled in order not to interfere with the processing operation and in particular the stacking.

Where the honeycomb structure is to be used for window coverings or panels, it is often desirable to use a porous material to give a translucent effect when the honeycomb structure is in its expanded condition. With porous material there is a tendency for adhesive to bleed through which can result in opposite walls of the individual cells becoming adhered together as they are wound on the rack in overlying layers. Woven, knitted or non-woven fabrics and laminates can be used for this purpose but because of their inherent porous nature, the adhesive can bleed through and the product is either unusable or the cells must be carefully pulled to their expanded condition before the adhesive has fully set and this can be difficult during manufacture.

It is now proposed, according to the present invention, that at least those portions of the cell material to one surface of which the adhesive is applied and the opposite surface of which, in the collapsed condition of the honeycomb structure, will contact another part of the honeycomb structure, have a permeability to adhesive less than the remainder of the cell material, whereby adhesive applied to said one surface will not bleed through to said opposite surface of said portions.

With such a construction, there is less tendency for the adhesive to bleed through the less permeable portions and the problems of the walls of the cells sticking to themselves during manufacture can be substantially reduced or eliminated.

The material can be made less permeable in the portion or portions to which the adhesive is to be applied in a number of different ways. For example if it is a woven, knitted or non-woven fabric, then the density of the fibres can be made greater in these portions so that the interstices between the fibres is significantly less. Additionally, or alternatively, the material can be made to be thicker in these portions zone thereby rendering it less permeable to adhesive.

It is also possible to have an arrangement in which the thickness of the material is greater than twice the thickness of the cell material in the remaining part of the cell and it may be as much as four times the thickness. This may be achieved by having four layers disposed in the zone of the adhesive and the cells may be joined with the adhesive disposed centrally between the four layers of material, with two layers on either side thereof.

In order that the present invention may more readily be understood, the following description is given, merely by way of example, reference being made to the accompanying drawings in which:-

Figure 1 is a perspective view of one embodiment of window blind constructed using a honeycomb structure according to the invention;

Figure 2 is an enlarged cross-sectional view of the structure of Figure 1;

Figure 3 is a plan view of one form of material from which the structure can be made.

Figure 4 is a view similar to Figure 1 of a modification;

Figure 5 is a view similar to Figures 2 and 4 of a further modification; and

Referring first to Figure 1 there is illustrated a window blind comprising a upper rail 10 and a lower rail 12 and a number of generally hexagonal cells 14 are formed from a rear face 16 and a front face 18 which are pre-creased for example as taught by US-A-4450027, and are secured together by adhesive using connecting strips 20.

It will be noted more clearly from Figure 1 that the material used is folded up on each side to form the front face 16 and the rear face 18 with the creased fold lines 24 and 26. A portion of the material which is to be secured using the adhesive and the connecting strips 20 is indicated by the reference numeral 28 and it will be seen that this is

made significantly thicker, for example at least twice as thick, as the remainder of the material. This prevents the adhesive from seeping or bleeding through.

In the construction of Figure 4, like parts have been indicated by like reference numerals. The front sheet I6 is slightly overlapped with the rear sheet I8 at the zones 28, where the two sheets are secured together by adhesive. It will be seen that the portions 28, 30 are formed of a thicker material than the remainder.

Figure 5 shows a further construction in which instead of having simply front and rear sheets, alternate sheets I6, I8 zig-zag in interleaved relation. Thickened portions 28 are provided at the centre and further thickened portions 30 at the ends of these sheets at the zone when the adhesive is to be applied.

In order to provide suitable material for the other structures illustrated in Figures 4 and 5, it may be necessary to provide different form of weave from that shown in Figure 3, although the Figure 3 arrangement would be perfectly adequate for the construction of Figures I and 2.

Figure 3 illustrates a suitable sheet for this purpose which, as can be seen, is made of a woven or knitted fabric and the weave or knit at 28 or 30 are far more dense than the remainder of the fabric.

This fabric may or may not actually be thicker in this more dense portion. It will normally be more practical to produce a relatively wide fabric and to cut this up to form elongate strips bordered by the thickened portions 30. It will be seen that these are approximately half the width of the thickened portions 28 so that the fabric can be manufactured with a series of more dense zones similar to the zones 28, and alternate ones of these can be cut centrally to provide the thickened portions 28.

Instead of cutting the wider thickened portion 28 centrally, it could be woven so as to have a line of weakness at its center, so that the main fabric can be readily torn along this line of weakness to produce the elongate strips having the format shown in Figure 3.

While the cell material has been shown as originally flat and formed in to the cell formation during the manufacture of the honeycomb structure, it is comtemplated that the cells could be preformed, e.g. of tubular material. In this case the zones where adhesive is applied to join the cells will be formed of less permeable material than the remainder.

Claims

I. A unitary honeycomb structure constructed of foldable material and defining a plurality of longitudinally extending cells (I4) in overlying expandable-collapsible relationship, enabling collapsing of each cell against the adjacent cell, each cell having a longitudinally extending foldable or pliable front face (I6) and back face (I8), the adjacent cells being formed and/or joined together by adhesive attachment (20,28) of cell material to cell material, the adhesive for joining the cells together being applied on at least one surface of cell material of each cell in the area of attachment, characterised in that at least those portions (28,30) of the cell material to one surface of which the adhesive is applied and the opposite surface of which, in the collapsed condition of the honeycomb structure, will contact another part of the honeycomb structure, have a permeability to adhesive less than the remainder of the cell material, whereby adhesive applied to said one surface will not bleed through to said opposite surface of said portions.

2. A honeycomb structure according to claim I, characterised in that said portions (28,30) are more dense than the remainder.

3. A honeycomb structure according to claim I or 2, characterised in that said portions (28,30) are thicker than the remainder of the material.

4. A honeycomb structure according to claim 3, characterised in that said portions include more than one layer of material.

5. A method of manufacturing a unitary expandable-collapsible honeycomb structure defining a plurality of longitudinally extending cells in overlying parallel relationship, each cell having a longitudinally extending foldable or pliable front face (I6) and back face (I8), said method comprising the steps of joining cell forming material, at least part of which is permeable, together by adhesive attachment over longitudinal areas, characterised in that at least those portions (28,30) of the cell material to one surface of which adhesive is applied and the opposite surface of which, in the collapsed condition of the honeycomb structure, contacts another part of the honeycomb structure, have a permeability which is less than the remainder of the cell material, whereby adhesive applied to said one surface will not bleed through to said opposite surface of said portions.

6. A method according to claim 5, characterised in that said portions (28,30) are more dense than the remainder of the cell forming material.

7. A method according to claim 5 or 6, characterised in that said portions (28,30) are thicker than the remainder of the cell forming material.

8. A method according to claim 7, characterised in that said portions include more than one layer of cell forming material.

9. A method according to claim 8, characterised in that the cell forming material is folded on itself to form said more than one layer.

10. A window blind including a unitary honeycomb structure according to any one of claims 1 to 4 or manufactured by the method of any one of claims 5 to 9.

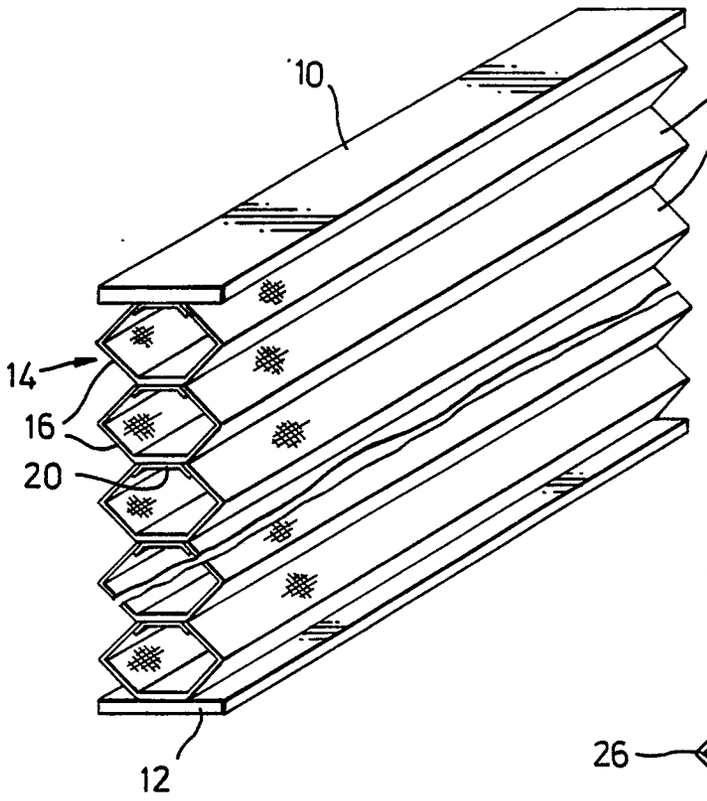


Fig.1.

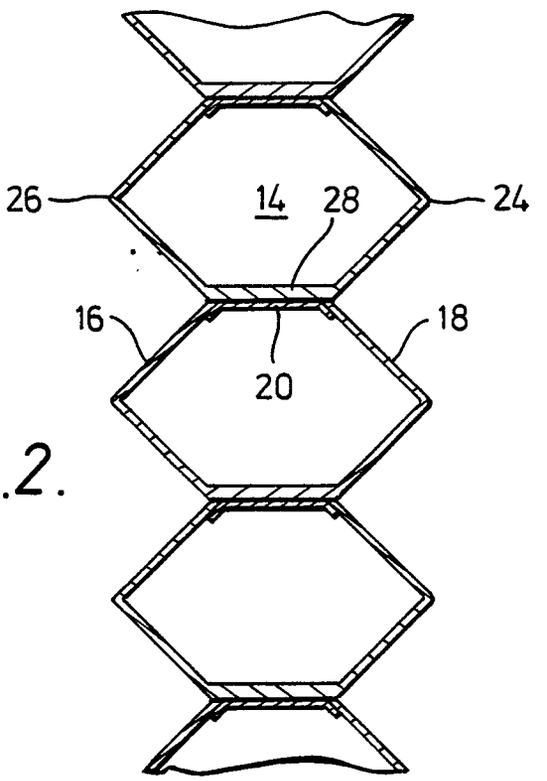
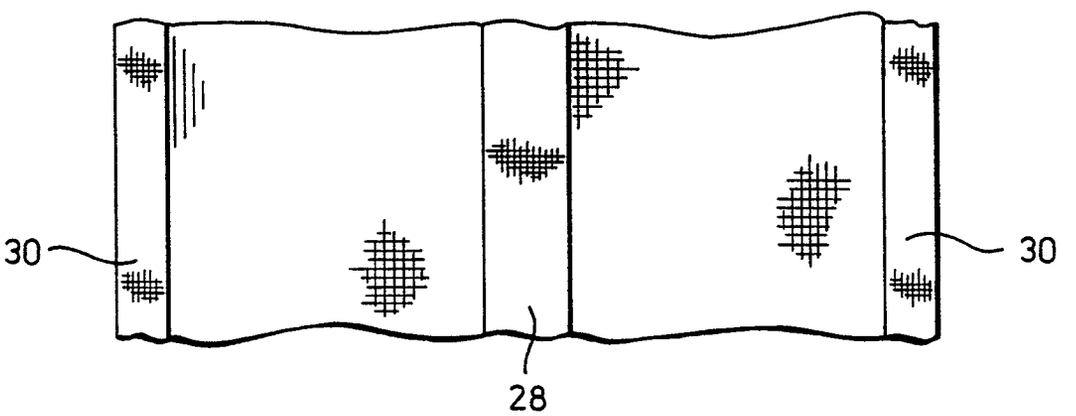


Fig.2.

Fig.3.



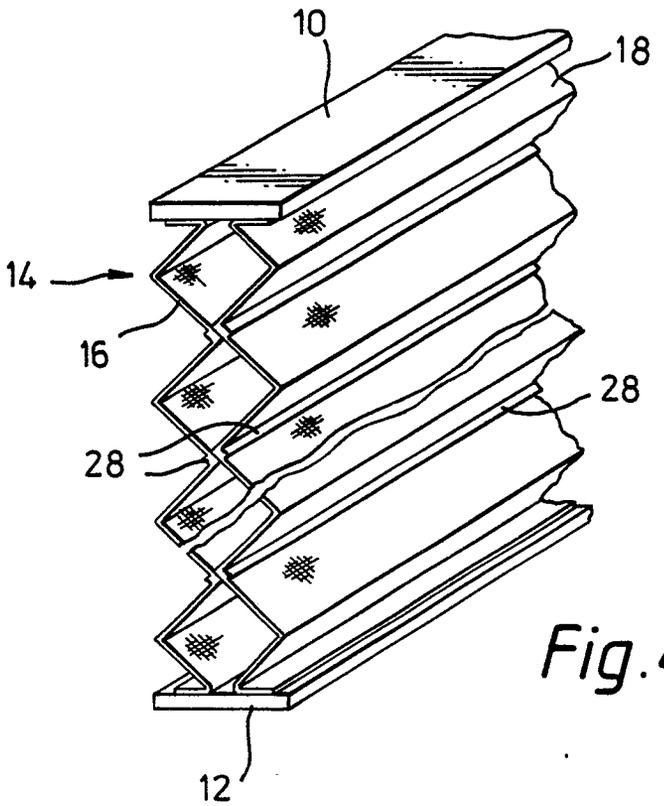


Fig.4.

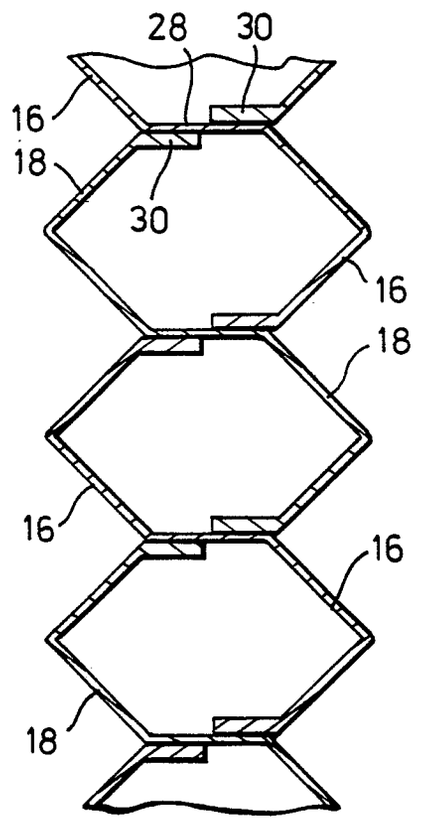


Fig.5.