

Description

This invention relates to a process and apparatus for fabricating honeycomb material.

U.S.-A-4,885,190 describes a process and machine for making expandable honeycomb material, the contents of which patent are hereby incorporated by reference. The underlying concept is to feed a strip of material from a continuous supply, apply lines of adhesive to the material, cut the strips into desired widths, fold the strips into flat tubular form, and then wind the tubular strips on an annular rack. The adhesive lines are located such that those on top of each tube are located below the bottom of the superposed tube. The resultant assembly of tubes after further processing is heated to activate or soften the glue and compressed to cause the stacked tubes to permanently adhere to one another. With the provision of suitable creases and pleats, an expandable honeycomb structure results of a type that has proved very popular with the public as a window covering. U.S.-A-4,450,027 and US-A-4,849,039 describe other ways of making a similar structure. One aspect of the present invention is to provide an alternative method and apparatus that offers certain advantages.

The honeycomb structure described above offers a window covering with insulating properties if the material used will block or attenuate air flow. If the material is transparent, it will allow light passage; if opaque, it will block light. But the resultant structure cannot control the passage of light in the same sense that a conventional venetian blind allows a user by tilting the slats to control the passage of light through a window into a room.

U.S.-A-3,384,519 describes a honeycomb structure that is capable of controlling the light passing through. It is made up of transparent cloth sheets interconnected by cloth strips functioning as slats. By making the cloth strips opaque, light will be blocked in one position of the cloth sheets when the strips lie flat and abut or overlap, and light can pass in another position of the cloth sheets when the strips extend in parallel planes. However, the method and apparatus described in this patent for making this structure have certain disadvantages.

According to the present invention there is provided a process for fabricating an expandable honeycomb structure comprising the steps:-

- a) feeding at least two webs of material in a downstream direction;
- b) feeding side by side between adjacent webs a plurality of strips of material;
- c) applying lines of adhesive to the webs or the strips, whereby adhesive is on or facing one face of each strip adjacent one edge thereof and on or facing the other face of each strip adjacent

the other edge thereof;

d) bringing the webs and strips into juxtaposition;

e) applying pressure or heat to cause the adhesive lines to adhere the individual strips to the at least two webs; and

f) collecting the structure resulting from step (e).

Such a process is relatively simple and capable of low cost manufacture.

A feature of this process is that a surprising number of different structures can be produced with only minor changes in the processing. Some of these structures are especially suited for use as window coverings.

In accordance with a second aspect of the invention, we provide apparatus for fabricating an expandable honeycomb structure, comprising:-

a) means for feeding at least two webs in a downstream direction;

b) means for feeding a further web between adjacent webs;

c) means for forming the or each further web into individual strips;

d) means for applying lines of adhesive to the webs or strips before or after the slitting means, whereby adhesive is on or facing one face of each strip adjacent one edge thereof and on or facing the other face of each strip adjacent the other edge thereof;

e) means downstream of the adhesive applying means for bringing said at least two webs into juxtaposition with the strips sandwiched between and for applying heat or pressure to cause the adhesive lines to adhere the individual strips to both said adjacent webs to form a unitary structure.

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 schematic side view of one form of apparatus in accordance with the present invention;

Figure 2 is a somewhat schematic cross-sectional view of the end product formed by the apparatus of Figure 1;

Figure 3 is a view of the end product of Figure 1 shown in its expanded position;

Figure 4 is an end view of the middle web of Figure 1 showing the slitting lines;

Figure 5 is a cross-sectional view similar to Figure 3 showing a modification;

Figure 6 is a view similar to Figure 5 showing a further variation;

Figure 7 is a schematic view illustrating processing of the product shown in Figure 6.

As will be clear from the following description, one of the features is a continuous process in

which material is constantly conveyed in the downstream direction of the process.

In the description that follows of one embodiment in accordance with the present invention, it will be appreciated that when reference is made to an optically transparent material, this is meant to cover a clear material or a translucent material which allows light directly or in diffused form to pass through, or a coarse mesh or other coarse material. Whereas, when the term optically opaque is used, this is meant to include a condition wherein light is normally blocked or diffused such that objects on the outside are not imaged on the window and therefore are not identifiable unless the user knows the structure or its access. Thus, by appropriate choice of material for the third intermediate web, any degree of darkening can be achieved, and thus the invention is not limited to a particular material. The use of a mesh or coarse material for the outer webs will enhance air flow.

The starting point is a supply from continuous rolls (not shown) of first 50, second 51, and third 52 webs or sheets of material. Suitable adhesive application means 55 are provided, to provide longitudinal lines of quick-dried or other adhesive 57 to the first and second sheets 50, 51 via a conventional heated or cooled roller 58. The middle or third sheet 52 is fed at an equal rate with sheets 50 and 51 through a conventional slitter 59, which divides the middle sheet into a plurality of longitudinal strips 60 along lines 61 extending parallel to the downstream direction of the webs. See Figure 4. Instead of applying glue lines to the outer webs, alternatively, glue lines can be applied to opposite sides of the long edges of the strips 60, or at appropriate places to opposite surfaces of the second sheet 52 before it is slitted. As still another alternative, the supply of the strips, instead of being a single sheet subsequently slit, can be a plurality of spools each supplying one of the strips. Figure 4 illustrates the subdivision of the web or sheet 52 into discrete strips 60 by slitting along the dotted lines referenced 61. A slitter similar to that employed in US-A-4,885,190 can be used for this purpose. The slit strips 60 are maintained in their adjacent planar orientation by means of a conveyor belt system referenced 64. If desired, as is known, suitable reduced pressure can be applied to perforated belts of the conveyor system 64 to ensure that the cut strips maintain their original position. The outer webs 50, 51 and the inner subdivided strips 60 are juxtaposed and joined at rollers 70, and then fed through heated rollers 71. The latter function to supply heat and pressure to activate the continuous adhesive lines 57 to cause the outer edges of each of the strips 60 to bond respectively to the upper 50 and lower 51 webs. If non-heat-activated adhesives are used, the roller 71 need

not be heated.

Figure 2 illustrates the arrangement. The adhesive lines 57 are applied continuously in the downstream direction such that each line 57 on the upper sheet 50 faces the left edge (as viewed in Figure 2) of each strip 60, and each line 57 on the lower sheet 51 faces the right edge of each strip 60. When the so arranged materials pass through the boner rolls 71, each strip left edge is bonded to the upper sheet, and each strip right edge is bonded to the lower sheet. The resultant assembly, referenced 72, can then be wound up on a roll 73 for further processing.

The process, as will be noted, is continuous and uninterrupted. The resultant structure wound up on the roll 73 has strips 60 extending lengthwise in the structure. In comparison, the intermediate strips in the rolled up structure depicted in the referenced Patent No. 3,384,519 extend transverse to its longitudinal direction. In the process according to this second aspect of the invention, the width of the outer sheets (the horizontal dimension in Figure 2) corresponds to the length of a window covering with horizontal slats. The structure resulting in the process of the invention depicted in Figure 2 can be used in the same manner as depicted in US-A-3,384,519. Assuming that the outer sheets 50, 51 are light transparent, and the strips 60 are light opaque, in the window covering position shown in Figure 6, when the strips are maintained parallel and substantially in the same plane by pulling the outer sheets in the directions indicated by the arrows, substantially all of the light incident on one of the outer sheets is blocked. For clarity, spaces have been left between adjacent edges of the sheets, but in actual practice the sheet edges would abut or overlap for maximum light blocking. If the outer sheets now are displaced in the opposite direction, as indicated by the arrows in Figure 3, until the strips 60 extend in spaced parallel planes, as illustrated in Figure 3, it will be evident that minimum blockage of light incident on one of the outer sheets occurs. Intermediate positions of the outer sheets can thus vary the light transmission between the minimum and maximum values described above. Using outer sheets that are air transparent and inner strips that are air opaque would similarly control air flow between minimum and maximum values. In the embodiment illustrated in Figure 2, the middle sheet 52 has been slit into six individual strips. It is of course evident that the invention is not limited to this number. The principal restriction of the invention is the overall width of the sheets, which determines the length of a window covering with horizontal slats. But sheets of suitable material of a width length or height are readily obtainable from material suppliers.

As before, any of the materials and adhesives described in the four referenced patents can be employed in this process in accordance with the second aspect of the invention. Moreover, while this aspect of the invention has been described in connection with a light controlling window covering, it is not limited thereto. By a relatively simple modification, more complex honeycomb configurations can be produced by providing more continuous webs and/or more strips, or by varying the location of the strips relative to the webs or relative to each other.

Figure 5 is a view similar to Figure 3 of a variant employing three webs and offset strips in different planes. Figure 5 shows the end product in one intermediate position of the three webs. The webs, referenced 71, 72 and 73 would be fed in a direction extending into the plane of the drawing of Figure 5, while two intermediate webs would be slit along lines offset by one-half the strip width between each pair of sheets to form strips 74, 75. Adhesive lines 76 would be applied where shown to the strip edges or to the overlying and underlying webs to form bonds between the strip edges and the overlying and underlying webs at the adhesive lines 76 when the assembly of material is juxtaposed and passed through rollers to activate the adhesive lines and apply pressure to form the bonds. The resultant honeycomb structure would possess 4-sided cells extending in the length direction of the webs. It is evident that the structure of Figure 5 can be enhanced using 4, 5 or more webs to produce more complex cell configurations. The strips at the same level preferably abut rather than overlap to reduce overall thickness. Strips at different levels may or may not overlap.

A structure made by a process similar to that described in connection with the Figure 5 embodiment will result in a honeycomb containing the conventional 6-sided or hexagonal cells. This is illustrated in Figure 6 with eight horizontal webs, though it will be understood that less than eight or more than eight webs could be included to vary the height (vertical dimension in Figure 6) of the honeycomb core. In the case of an 8-webbed structure, each of the webs 100, 110, 111 would be supplied as sheets from rolls as described in connection with the previous embodiments. One row of cells 96 formed between two webs 110, 111 has been amplified to illustrate the bonding. The remaining rows are similarly constructed. The webs 110, 111 illustrated by the thicker lines, are interconnected by a layer of strips 112 bonded to the webs 110, 111 at junctions 96. The total width of each strip layer (if laid flat in a horizontal plane) is substantially equal to one-half the overall width of each sheet plus the small extras at each side to form the bonding junctions 95. Each layer of strips

can be slit from a common sheet and spaced apart as indicated, or the strips can each be supplied from its own strip roll. As before, at the conclusion of the bonding, a flat structure results which can be wound up on a roll, or further processed downstream. As will be observed, when the webs 100, 110, 111 of the structure are pulled as illustrated in Figure 3, the honeycomb structure illustrated in Figure 6 results. Each 6-sided cell 96 has 1 or 3 sides provided by an upper web (dark line - 110), 3 or 1 sides provided by a lower web (dark line - 111), and 2 sides provided by two adjacent strips (double lines - 112) which incline in opposite directions. (The darkened and double lines have only been shown for one row of cells.) The pitch of the strips during processing will thus equal twice the length of a hexagonal side.

While the resultant honeycomb may find use in several applications, it is preferred to use the honeycomb as shown in Figure 6 as a core by adhering sheets to the open-ended sides. As one example, illustrated in Figure 7, the Figure 6 structure is further processed by slitting (see Figure 7) with a cutter 97 transverse to its longitudinal dimension (perpendicular to the drawing plane of Figure 6 and horizontal in Figure 7) as indicated to form thin core sections 98, on opposite sides of which is bonded or laminated a thin sheet 99 of flexible or semi-rigid or rigid material. The bonding is readily achieved by laying down adhesive on the open cell edges or on the outer sheets 99. If material were chosen for the webs, the strips, and the outer sheets that was substantially air-opaque, then the now-closed honeycomb cells would form many dead air spaces. The structure that thus results, designated 115, could be used as a thermal barrier which is light weight and could be produced very economically. In this application, the honeycomb with the bonded outer sheets would not be expandable. It will thus be seen that the width of the honeycomb core is substantially equal to about two-thirds of the width of the original webs, the thickness is determined by the slitting operation with the cutter 97, and the core length would depend upon the number of webs and layers of strips chosen.

Though not shown in Figure 1, with certain materials it may be desirable to score the strips 60 before they are assembled and adhered to the outer webs 50, 51. The scoring preferably is provided at the strip locations where the strips bend when the finished shade is opened as shown in Figure 3. Score lines are readily formed in the strips 60 at such fold locations indicated by the arrows 80 in Figure 3 to assist in defining the strip shape, to simplify folding, or to enhance its appearance. This improvement can also be included for the embodiment of Figure 5.



It will be understood from the description given that the invention is not limited to webs of the same colour. In the second aspect of the invention, the front and back sheets can be of colours different from one another as well as different from the intermediate strips. Moreover, if the strips are supplied from separate spools, even they can be of different colours. Also, the invention is not limited to varying colours, but could also include other attributes of the material, such as texture and degree of transparency or porosity.

The typical sheet material or webs used for such structures are usually stretched in their long direction to improve their strength and reduce stretching during use. In the structures made according to the invention, if hung horizontally, depending upon the width of the window, some stretching may occur. This can be avoided by using blown sheets of material, which have uniform strength properties in all directions. Alternatively, the honeycomb structure can be arranged so that the strips corresponding to the slats in a conventional venetian type blind are hung vertically in the direction in which the material is normally stretched.

Claims

1. A process for fabricating an expandable honeycomb structure comprising the steps:-
 - a) feeding at least two webs (50, 51, 71-73, 100, 110, 111) of material in a downstream direction;
 - b) feeding side by side between adjacent webs a plurality of strips (60, 74, 75, 112) of material;
 - c) applying lines of adhesive (57, 76) to the webs or the strips, whereby adhesive is on or facing one face of each strip adjacent one edge thereof and on or facing the other face of each strip adjacent the other edge thereof;
 - d) bringing the webs and strips into juxtaposition;
 - e) applying pressure or heat to cause the adhesive lines to adhere the individual strips to the at least two webs; and
 - f) collecting the structure resulting from step (e).
2. A process according to claim 1, wherein the lines of adhesive (57) applied at step (c) are applied to the webs.
3. A process according to claim 1 or 2, wherein the webs are optically or air transparent, and the strips are optically or air opaque.
4. A process according to claim 4, wherein the strips are fed side by side.
5. A process according to claim 4, wherein the strips of step (b) are formed by slitting a further web of material.
6. A process according to claim 5, wherein the lines of adhesive applied in step (c) are applied to the further web before the slitting step.
7. A process according to claim 5, wherein the lines of adhesive applied in step (c) are applied to the strips after carrying out the slitting step.
8. A process according to any preceding claim, wherein step (f) is carried out by moving the resulting structure in the longitudinal direction of the strips.
9. A process according to claim 8, wherein the step (f) is carried out by winding the resulting structure onto a roll.
10. A process according to any preceding claim, wherein the combined width of the strips is substantially equal to one half of the width of the web.
11. A process according to any preceding claim, wherein the resultant structure is opened up to form a honeycomb of open ended cells, and to opposite ends of the honeycomb cells is laminated a sheet.
12. A process according to claim 11, wherein the said resultant structure is divided up into thin sections before laminating the sheets.
13. Apparatus for fabricating an expandable honeycomb structure, comprising:-
 - a) means for feeding at least two webs (50, 51, 71-73, 100, 110, 111) in a downstream direction;
 - b) means for feeding a further web (52) between adjacent webs;
 - c) means (59) for forming the or each further web (52) into individual strips;
 - d) means (55) for applying lines of adhesive (57) to the webs or strips before or after the slitting means, whereby adhesive is on or facing one face of each strip adjacent one edge thereof and on or facing the other face of each strip adjacent the other edge thereof;
 - e) means (70) downstream of the adhesive applying means for bringing said at least



two webs into juxtaposition with the strips sandwiched between and for applying heat or pressure to cause the adhesive lines to adhere the individual strips to both said adjacent webs to form a unitary structure.

14. Apparatus according to claim 13, wherein the means of element (c) comprise a means for slitting the or each further web into individual strips.

15. Apparatus according to claim 13 or 14, wherein the adhesive applying means of element (d) is located to apply adhesive lines to said at least two webs.

16. Apparatus according to any one of claims 13 to 15, wherein the feeding means cause the webs to feed in the same direction.

17. Apparatus according to any one of claims 13 to 16, wherein means are provided, downstream of the means of element (e), for slitting the unitary structure into thin sections to form a honeycomb core.

18. Apparatus according to claim 17, wherein means are provided, downstream of the means for slitting the unitary structure into thin sections, for laminating opposite sides of the resultant thin sections.

Patentansprüche

1. Verfahren zur Herstellung eines auseinanderziehbaren Wabenmaterials, das folgende Schritte umfaßt:

a) Zufuhr von mindestens zwei Materialbahnen (50, 51, 71-73, 100, 110, 111) in einer Bandlaufrichtung;

b) Zufuhr mehrerer nebeneinanderliegender Materialstreifen (60, 74, 75, 112) zwischen diesen Bahnen;

c) Aufbringung von Klebstofflinien (57, 76) auf die Bahnen oder Streifen, und zwar dergestalt, daß sich Klebstoff jeweils auf oder gegenüber einer Seite des Streifens nahe dessen einer Kante sowie auf oder gegenüber der anderen Seite des Streifens nahe dessen anderer Kante befindet;

d) Zusammenführung der Streifen und Bahnen in eine Position, in der diese nebeneinanderliegen;

e) Einsatz von Druck oder Wärme dergestalt, daß die einzelnen Streifen mit den mindestens zwei Materialbahnen verklebt werden;

f) Entnahme des sich aus Schritt e) ergebenden Produktes.

2. Verfahren gemäß Anspruch 1, wobei die in Schritt (c) aufgetragenen Klebstofflinien (57) auf die Materialbahnen aufgebracht werden.

3. Verfahren gemäß Anspruch 1 oder 2, wobei die Materialbahnen licht- oder luftdurchlässig und die Streifen licht- oder luftundurchlässig sind.

4. Verfahren gemäß Anspruch 4, wobei die Streifen nebeneinanderliegend zugeführt werden.

5. Verfahren gemäß Anspruch 4, wobei die in Schritt (b) zugeführten Streifen durch Längsteilung einer weiteren Materialbahn hergestellt werden.

6. Verfahren gemäß Anspruch 5, wobei die in Schritt (c) aufgetragenen Klebstofflinien auf die weitere Materialbahn vor deren Längsteilung aufgebracht werden.

7. Verfahren gemäß Anspruch 5, wobei die in Schritt (c) aufgetragenen Klebstofflinien auf die Streifen nach dem Längsteilungsschritt aufgebracht werden.

8. Verfahren gemäß einem der vorstehenden Ansprüche, wobei Schritt (f) dadurch ausgeführt wird, daß das sich auf diese Weise ergebende Material in Längsrichtung der Streifen bewegt wird.

9. Verfahren gemäß Anspruch 8, wobei Schritt (f) dadurch ausgeführt wird, daß das sich auf diese Weise ergebende Material auf eine Rolle gewickelt wird.

10. Verfahren gemäß einem der vorstehenden Ansprüche, wobei die addierte Breite der Streifen im wesentlichen gleich der halben Breite der Materialbahn ist.

11. Verfahren gemäß einem der vorstehenden Ansprüche, wobei das sich auf diese Weise ergebende Material zu einer Wabe aus endseitig offenen Zellen geöffnet und an den gegenüberliegenden Enden der Wabenzellen ein Flächengebilde aufkaschiert wird.

12. Verfahren gemäß Anspruch 11, wobei das sich auf diese Weise ergebende Material vor dem Aufkaschieren der Flächengebilde in dünne Abschnitte geteilt wird.



13. Vorrichtung zur Herstellung einer auseinanderziehbaren Wabenstruktur, ausgestattet mit

- a) Mitteln zur Zufuhr von mindestens zwei Materialbahnen (50, 51, 71-73, 100, 110, 111) in einer Bandlaufrichtung;
- b) Mitteln zur Zufuhr einer weiteren Bahn (52) zwischen nebeneinanderliegenden Bahnen;
- c) Mittel (59) zur Herstellung einzelner Streifen aus der bzw. jeder weiteren Materialbahn (52);
- d) Mittel (55) zur Aufbringung von Klebstofflinien (57) auf die Materialbahnen oder Streifen vor oder nach der Längsteilvorrichtung, und zwar dergestalt, daß sich Klebstoff jeweils auf oder gegenüber einer Seite des Streifens nahe dessen einer Kante sowie auf oder gegenüber der anderen Seite des Streifens nahe dessen anderer Kante befindet;
- e) der Klebstoffauftragsvorrichtung nachgeschaltete Mittel (70) die dem Zweck dienen, mindestens zwei Materialbahnen mit dazwischenliegenden Streifen nebeneinanderzuführen und durch Erzeugung von Wärme oder Druck die einzelnen Streifen so mit den beiden angrenzenden Materialbahnen zu verkleben, daß sich ein zusammenhängender Aufbau ergibt.

14. Vorrichtung gemäß Anspruch 13, wobei das unter (c) genannte Mittel eine Vorrichtung zur Längsteilung der bzw. jeder weiteren Materialbahn in einzelne Streifen aufweist.

15. Vorrichtung gemäß Anspruch 13 oder 14, wobei das unter (d) genannte Klebstoffauftragsmittel so plaziert ist, das es Klebstofflinien auf die genannten mindestens zwei Materialbahnen aufträgt.

16. Vorrichtung gemäß einem der Ansprüche 13 - 15, wobei das Zufuhrmittel die Materialbahnen in dieselbe Richtung fördert.

17. Vorrichtung gemäß einem der Ansprüche 13 - 16, wobei dem unter (e) genannten Mittel ein Mittel nachgeschaltet ist, das den zusammenhängenden Aufbau zwecks Herstellung eines Wabenkerns in dünne Abschnitte teilt.

18. Vorrichtung gemäß Anspruch 17, wobei dem Mittel, das den zusammenhängenden Aufbau zwecks Herstellung eines Wabenkerns in dünne Abschnitte teilt, ein Mittel zum Aufkaschieren eines Flächengebildes auf den gegenüberliegenden Seiten der sich so ergebenden dünnen Abschnitte nachgeschaltet ist.

Revendications

1. Procédé pour fabriquer une structure en nid d'abeilles extensible comprenant les étapes consistant à :

- a) faire avancer au moins deux feuilles (50, 51, 71 à 73, 100, 110, 111) de matériau vers l'aval,
- b) faire avancer côte-à-côte entre des feuilles adjacentes une pluralité de rubans (60, 74, 75, 112) de matériau,
- c) appliquer des cordons d'adhésif (57, 76) sur les feuilles ou les rubans, d'où il résulte que de l'adhésif se trouve sur une première face ou fait face à une première face de chaque ruban à proximité d'un premier bord de celui-ci et se trouve sur l'autre face ou fait face à l'autre face de chaque ruban à proximité de l'autre bord de celui-ci,
- d) amener les feuilles et rubans en juxtaposition,
- e) appliquer une pression ou de la chaleur afin d'amener les cordons d'adhésif à coller les rubans individuels aux au moins deux bandes, et
- f) recueillir la structure résultant de l'étape (e).

2. Procédé selon la revendication 1, dans lequel les cordons d'adhésif (57) appliqués à l'étape (c) sont appliqués sur les feuilles.

3. Procédé selon la revendication 1 ou 2, dans lequel les feuilles sont optiquement transparentes ou transparentes à l'air, et les rubans sont optiquement opaques ou opaques à l'air.

4. Procédé selon la revendication 4, dans lequel les rubans sont fournis côte-à-côte.

5. Procédé selon la revendication 4, dans lequel les rubans de l'étape (b) sont formés en refendage une feuille supplémentaire de matériau.

6. Procédé selon la revendication 5, dans lequel les cordons d'adhésif appliqués à l'étape (c) sont appliqués sur la feuille supplémentaire avant l'étape de refendage.

7. Procédé selon la revendication 5, dans lequel les cordons d'adhésif appliqués à l'étape (c) sont appliqués sur les rubans après avoir effectué l'étape de refendage.

8. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'étape (f) est effectuée en déplaçant la structure résultante dans la direction longitudinale des rubans.



9. Procédé selon la revendication 8, dans lequel l'étape (f) est effectuée en enroulant la structure résultante sur un rouleau.
10. Procédé selon l'une quelconque des revendications précédentes, dans lequel la largeur combinée des rubans est sensiblement égale à la moitié de la largeur de la feuille. 5
11. Procédé selon l'une quelconque des revendications précédentes, dans lequel la structure résultante est ouverte afin de former un nid d'abeilles à alvéoles à extrémités ouvertes, et dans lequel une feuille est laminée sur les extrémités opposées des alvéoles de nid d'abeilles. 10
12. Procédé selon la revendication 11, dans lequel ladite structure résultante est divisée en fines sections avant de laminer les feuilles. 15
13. Dispositif pour fabriquer une structure en nid d'abeilles extensibles, comprenant :
 - a) des moyens pour faire avancer au moins deux feuilles (50, 51, 71 à 73, 100, 110, 111) vers l'aval, 25
 - b) des moyens pour faire avancer une feuille supplémentaire (52) entre des bandes adjacentes,
 - c) des moyens (59) pour former la ou chaque feuille supplémentaire (52) en rubans individuels, 30
 - d) des moyens (55) pour appliquer des cordons d'adhésif (57) sur les feuilles ou rubans avant ou après le moyen de refendage, d'où il résulte que de l'adhésif se trouve sur une première face ou fait face à une première face de chaque ruban à proximité d'un premier bord de celui-ci et se trouve sur l'autre face ou fait face à l'autre face de chaque ruban à proximité de l'autre bord de celui-ci, 35
 - e) des moyens (70) en aval du moyen d'application d'adhésif pour amener lesdites au moins deux bandes en juxtaposition avec les rubans pris en sandwich entre elles et pour appliquer de la chaleur ou une pression afin d'amener les cordons d'adhésif à coller les rubans individuels auxdites deux feuilles adjacentes pour former une structure unitaire. 40
14. Dispositif selon la revendication 13, dans lequel les moyens de l'élément (c) comprennent un moyen pour refendre la ou chaque bande supplémentaire en rubans individuels. 45
15. Dispositif selon la revendication 13 ou 14, dans lequel le moyen d'application d'adhésif de l'élément (d) est positionné de manière à appliquer des cordons d'adhésif sur lesdites au moins deux feuilles. 50
16. Dispositif selon l'une quelconque des revendications 13 à 15, dans lequel les moyens d'avance amènent les feuilles à avancer dans la même direction.
17. Dispositif selon l'une quelconque des revendications 13 à 16, dans lequel des moyens sont prévus, en aval des moyens de l'élément (e), pour refendre la structure unitaire en sections fines afin de former une âme en nid d'abeilles.
18. Dispositif selon la revendication 17, dans lequel des moyens sont prévus, en aval du moyen pour refendre la structure unitaire en sections fines, pour laminer des côtés opposés des sections fines résultantes.