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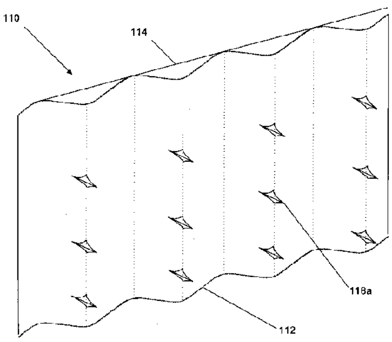

Figure 1

(57) Abstract: A flexible material, comprising a flat paper layer and a corrugated paper layer bonded to one face of the flat paper layer, wherein the corrugated paper layer comprises indentations formed across an opposite face of the corrugated layer.

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FLEXIBLE MATERIAL

TECHNICAL FIELD

The described embodiments relate to a flexible material for use in protective packaging.

BACKGROUND

Corrugated cardboard laminates are commonly used to form boxes. Such laminates are designed to be rigid rather than flexible and do not lend themselves to use in many applications as a result.

Packaging materials made of alternative materials such as plastic have been proposed but can be expensive and detrimental to the environment, either because they do not readily biodegrade or because the products or processes used for their manufacture.

It is desired to address or ameliorate one or more problems or disadvantages associated with existing cardboard laminates, or to at least provide a useful alternative.

SUMMARY

Some embodiments relate to a material, comprising:

a flat paper layer; and

a corrugated paper layer bonded to one face of the flat paper layer;

wherein the corrugated paper layer comprises indentations formed across an opposite face of the corrugated layer.

The indentations may be arranged at an angle to the corrugations and may effectively define discontinuous score or crease lines crossing the corrugations. The indentations may also be substantially parallel. The indentations may comprise a first series of indentations arranged at a first angle to a longitudinal direction of corrugations and a second series of indentations at a second angle to the longitudinal direction of the corrugations.

The magnitude of each of the first and second angles may be within a range between 0 and 90 degrees, such as between 20 and 70 degrees or between 30 and 60 degrees, for example. The magnitude of the first and the second angles may be substantially the same, but the first and second angles may be reckoned from a different reference. For example, an acute angle of 30 degrees to the longitudinal orientation of the corrugations could also be considered to be an obtuse angle of 150 degrees if reckoned from a different starting point, even though each angle effectively has the same magnitude. In some embodiments, the magnitude of the angles may be about 45 degrees.

A further series of indentations may be provided at an angle of 90 degrees to the corrugations. The indentations (or the spacings of score or crease lines) of any one series may be between about 10 mm and 15 mm apart, or even up to about 50 mm apart, for example.

A second flat paper layer may be bonded to a face of the corrugated layer opposite from the first flat paper layer.

The thickness of the first or second paper layer may be between 0.05 mm and 0.3 mm. In some embodiments, the thickness of one or both paper layers may be approximately 0.1 mm. The weight of each paper layer may be between 50 and 250 grams per square meter.

The material may further comprise an outer layer bonded to a face of the flat paper layer. The outer layer may be a protective layer comprising grease-proof or water-resistant material or may comprise an insulation of natural or cellulosic fiber material that is biodegradable.

The material may be formed into a three dimensional container. The three dimensional container may be an envelope, a carry bag, bottle bag or a rectanguloid container, for example.

The material may consist of biodegradable and/or recyclable constituent materials.

Other embodiments relate to a method of producing a flexible material for use in packaging or packing, comprising bonding a corrugated paper layer to one face of a flat paper layer, and forming indentations across an opposite face of the corrugated layer.

The step of forming indentations on the corrugated material may be performed by pressing a roller having blade portions against the surface of the corrugated material, for example. In some embodiments, the roller may be alternatively or additionally applied to the exposed face of the flat layer.

The method may further comprise the step of bonding a second flat paper layer to a surface of the corrugated layer opposite from the first flat paper layer. The method may further comprise the step of bonding at least one outer layer over one of the flat paper layers.

The step of bonding a corrugated paper layer to one face of a flat paper layer may include applying an adhesive to the corrugated surface using either a spray or roller, for example.

Other embodiments relate to a flexible packaging material, comprising:

a substantially flat first layer; and

a corrugated second layer bonded on one side to the first layer, the second layer having ridges and valleys arranged in parallel,

wherein ridges on an opposite side of the second layer are each formed to have a series of structural weakenings along a length of each ridge.

The structural weakenings may be formed by scoring, cutting or indenting the ridges. The first and second layers may be paper layers.

Other embodiments relate to a method of forming a flexible material, the method comprising:

bonding a substantially flat first layer to one face of a corrugated second layer, the second layer having ridges and valleys arranged in parallel; and

forming a series of structural weakenings along a length of each ridge on an opposite face of the second layer.

Other embodiments relate to a laminate, comprising:

a flat layer; and

a corrugated layer bonded to one face of the flat layer;

wherein the corrugated layer comprises indentations formed across an opposite face of the corrugated layer.

Other embodiments relate to a method of producing a laminate, comprising the steps of bonding a corrugated layer to one face of a flat layer, and forming indentations across an opposite face of the corrugated layer.

Other embodiments relate to a flexible material, comprising:

a flat layer; and

a corrugated layer bonded to one face of the flat layer and co-extensive therewith, the corrugated layer defining parallel ridges and valleys having a longitudinal orientation;

wherein parallel lines of structural weakening extend at an angle to the longitudinal orientation across an exposed face of at least one of the flat layer and the corrugated layer.

The parallel lines of the flexible material may comprise first and second series of differently angled lines. The first and second series may be oppositely angled at between about 30 degrees and 60 degrees to the longitudinal direction, for example. The parallel lines may be spaced apart by between about 10 mm and about 15 mm, for example. The flat and corrugated layers are continuous sheets of thin material, such as paper.

The thickness of each flat paper layer may be between about 0.05 mm and about 0.3 mm. The weight of each flat paper layer may be between about 50 and about 250 grams per square meter.

The material described herein may be used as an insulating, packaging or packing material. Further embodiments relate to apparatus comprising means for forming the material and for performing the method as described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be further described by way of example only with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a flexible material;

Figure 2 is a side view of the flexible material of Figure 1;

Figure 3 is a plan view of an alternative flexible material;

Figure 4 is a side view of an alternative flexible material;

Figure 5 is a perspective view of 1 flexible material formed into a packaging container;

Figure 6 is a perspective view of 1 flexible material formed into an alternative packaging container;

Figure 7 is a flow chart of a manufacturing process according to some embodiments;

Figure 8 is a schematic representation of a manufacturing apparatus for manufacturing a flexible material according to some embodiments;

Figure 9 is a flow chart of the manufacturing process according to the apparatus of Figure 7; and

Figure 10 is a perspective view of a face of a flexible material according to some embodiments.

DETAILED DESCRIPTION

The described embodiments relate to a flexible material, a method of manufacturing a flexible material and packages formed by a flexible material.

Referring to figures 1 to 3, there is shown a flexible material 110 having a flat paper layer 114 and a corrugated paper layer 112. Corrugated paper layer 112 is formed to have ridges and valleys extending in a longitudinal orientation. Valleys of corrugated paper layer 112 are bonded to one face of flat paper layer 114. The flat paper layer 114 and the corrugated paper layer 112 are co-extensive, in that one does not extend beyond the edge of the other. Both layers 112, 114 are continuous materials (i.e. without openings formed therein). Corrugations of the corrugated layer 112 are formed to have weakened portions arranged to weaken the longitudinal rigidity that the corrugations would otherwise provide to material 110. The weakened portions serve to reduce the resistance of the flexible material 110 to bonding in directions transverse to a plane of the material, while not appreciably altering its tensile strength in the planar directions.

In the embodiments shown in Figure 1, weakened portions are exemplified by indentations 118 which are formed on ridges of corrugations formed on the face of corrugated paper layer 112 that is opposite to the paper layer 114. The weakened portions may be formed by scoring, crushing or slitting, for example. Indentations 118 are described for convenience as only one form of structural weakening of the ridges. For the embodiments described herein, indentations 118 may be substituted for slits or other forms of structural weakening.

Flat paper layer 114 and corrugated paper layer 112 may be made from commercially available paper products, but preferably from recycled cellulosic materials. Flexible material 110 can be used as a packing or packaging material, for example. Advantageously, because it is formed of paper, flexible material 110 can be recycled more easily than plastic alternatives and degrade in land-fills at a much faster rate.

Indentations 118 may be continuous across the face of the corrugated layer, or only applied to the raised (ridge) portions of the corrugations. Indentations 118 should be sufficiently deep to weaken the longitudinal resistance to flexion of the ridge portions of each corrugation, thereby weakening the rigidity of the flexible material 110 and its resistance to folding and providing the flexible material 110 with increased flexibility in a direction across (transverse to) the corrugations. However, despite the periodic weakenings along the length of each corrugation, portions of the ridge of each corrugation positioned between indentations 118, which may generally resemble a longitudinal series of mounds, retain much of their structural integrity. Advantageously, the flexible material 110 can be readily bent, curved or folded without it significantly losing its tensile and shear strength. The flexible material 110 is therefore particularly suitable for wrapping furniture, art work and numerous other items that require protective packaging. Thus, in some embodiments, flexible material 110 may be provided in large rolls or sheets for manual application to other items as protective insulation, packaging or wrapping.

Indentations 118 are arranged such that they comprise a series of parallel indentations in the ridges, arranged at a first angle to the corrugations. In the example shown in Figure 1, the angle is about 45 degrees from the line of the corrugations. One series of indentations 118a may be provided (as shown in Figure 1) or, alternatively, a second series of indentations 118b (Figure 3) may also be provided at a second angle to the corrugations. Each series of indentations may extend across an entire face of corrugated paper layer 112 (or across flat paper layer 114 in some embodiments – see Figure 10) or, as shown in Figure 3, only across a portion of the face.

In Figure 3, a second series of indentations 118b are shown by way of example at an angle of approximately 45 degrees, however at a different orientation to the first series of indentations 118a. The first and second angles may have the same magnitude (45 degrees) but different orientations. It may also be desirable to have indentations 118a, 118b run at angles other than 45 degrees (i.e. greater than 0 and less than 180 degrees) and the magnitude of the first and second angles may also be different to each other. The first and second angles may be varied, depending on the desired structural weakening pattern to be applied to flexible material 110. For example, the first series of indentations 118a may be orientated at 35 degrees to the corrugations and the second series of indentations 118b may be orientated at -50 (or 130) degrees to the corrugations. Generally, it is envisioned that angles of between about 20 and about 70 degrees, or possibly between about 30 degrees and about 60 degrees, would be suitable to achieve the desired effect of structurally weakening the corrugations. The described magnitudes of the angles are provided by way of example only and are intended to indicate an acute angular orientation to the closest longitudinal reference line, rather than an absolute angle from a fixed Cartesian reference (0 degrees) origin. Lesser or greater angles may be employed for the first and second angles to suit a specific configuration.

As seen in Figure 3, a further series of indentations 118c may be formed at an angle of about 90 degrees, i.e. perpendicular, to the corrugations. The number of series of indentations may be altered to provide the desired bending characteristics of the flexible material.

Each series of indentations 118 are spaced apart along the corrugations. The amount of spacing can also be altered to provide the desired bending characteristics of flexible material 110. For example, a spacing between indentations (where the score or crease lines cross each ridge of the corrugations) of less than about 15 mm has been found to provide suitable bending characteristics. In particular, a spacing of about 10 mm is considered to be particularly suitable for use in packaging domestic articles. Spacings of around 7, 8, 9, 11, 12, 13 or 14 mm may be employed in some embodiments. However a spacing below a certain amount may be less effective because if the indentations are too close together, it may limit the retention of the longitudinal series of mounds between the indentations and reduce the protective characteristics of flexible material 110. A spacing above about 15mm, for example about 16, 17, 18, 19, 20, 25, 30, 35, 40, 45, up to about 50mm (or possibly greater), may be useful for industrial applications or packaging of heavy items. In some embodiments, such spacings may be measured as the shortest distance between two adjacent parallel score or crease lines 118a or 118b.

According to some embodiments, the material thickness of each of flat paper layer 114 and corrugated paper layer 112 (prior to corrugation) may be generally between about 0.05mm and about 0.3mm, for example. In some embodiments, the thickness may be about 0.1mm. The weight of these layers may be between about 50 and about 250 grams per square meter, for example. Flat paper layer 114 may be made from the same grade of paper as corrugated paper layer 112 or from a different grade of paper. Increased material thicknesses and heavier paper weights, for example a material thickness of about 0.445mm and a paper weight of about 385 grams per square meter, may also be employed, where useful for industrial applications or packaging of heavy items. If thicker materials are required, laminates of multiple paper layers or flexible card stock may also be used.

Accordingly, the overall thickness of flexible material 110 may be varied depending on the desired application. For packaging domestic articles, the thickness of flexible material 110 may be between about 1.5 mm to about 4.0 mm. Thicknesses of about 3.0 mm may be suitable for many applications. Most of the thickness of flexible material 110 is provided by the height of the ridges relative to the valleys of corrugated paper layer 112. In some industrial applications, material 110 may be formed to have greater overall thickness, up to about 25mm, for example. If flexible material 110 is required in a different thickness, the corrugations on corrugated paper layer 112 may be formed deeper or shallower and the paper thickness of corrugated layer 112 may be thicker, for example up to about 0.5 to 1.0 mm. Alternatively or in addition, material having a different thickness, for example up to about 0.5 to 1.0 mm, may be used for flat paper layer 114.

Flexible material 110 may also be used as one layer of a multi-layered material by stacking and/or bonding layers of flexible material 110 together. For example, a material comprising two or three layers of flexible material 110 may be formed, with the flat paper layer 114 of each layer of flexible material 110 being bonded to the corrugated layer 112 of an adjacent layer of flexible material 110. The corrugations of each layer of flexible material 110 may be orientated at the same or a different angle from other layers.

Referring to Figure 4, an alternative flexible material 210 is illustrated. In addition to flat paper layer 214 bonded to a face of corrugated paper layer 212 and indentations 218 being formed on an opposite face, a further flat paper layer 216, which is sufficiently light and flexible as to not overly stiffen flexible material 210, is bonded to a face of corrugated paper layer 212 opposite from flat paper layer 214, i.e. over indentations 218. Indentations 218 may be formed in the same manner as indentations 118.

According to the some embodiments, the material thickness of each paper layer 214, 216 and corrugated paper layer 212 may be generally between about 0.05 mm and about 0.3 mm. In some embodiments, the thickness is about 0.1 mm. The weight of these layers may be between about 50 and about 250 grams per square meter. Paper layer 216 may be made from the same grade of paper as paper layer 214 and corrugated paper layer 212 or from a different grade of paper. Increased material thicknesses and heavier paper weights, for example a material thickness of about 0.445 mm and a paper weight of about 385 grams per square meter, may also be employed, where useful for industrial applications or packaging of heavy items. If thicker materials are required, laminates of multiple paper layers or flexible card stock may also be used.

The overall thickness of flexible material 210 may be varied depending on the desired application. For packaging domestic articles, the thickness of flexible material 210 may be between about 1.5 mm to about 4.0 mm. Thicknesses of about 3.0 mm may also be suitable. Most of the thickness of flexible material is provided by the height of the ridges relative to the valleys of corrugated paper layer 212. In some industrial applications, material 210 may be formed to have greater overall thickness, up to about 25 mm, for example. If flexible material 210 is required in a different thickness, the corrugations on corrugated paper layer 212 may be formed deeper or shallower. Alternatively, material having a different thickness may be used for either of flat paper layers 214, 216.

Flexible material 210 may also be used as one layer of a multi-layered material by stacking and/or bonding layers of flexible material 210 together. For example, a material comprising two or three layers or flexible material 210 may be formed, with the flat paper layer 214 of each layer of flexible material 210 being bonded to the corrugated layer 212 (or flat paper layer 216) of an adjacent layer of flexible material 210. The corrugations of each layer of flexible material 210 may be orientated at the same or a different angle from other layers. One or more layers of flexible material 110 may also be combined with one or more layers of flexible material 210 to form a multi-layered material.

Paper outer layer 220 may also be provided. Paper outer layer 220 may comprise additional sub-layers (not shown) if additional thickness is desirable, however paper outer layer 220 must be sufficiently light so as to not overly stiffen or rigidify flexible material 210. Paper outer layer 220 may be provided on one side of the flexible material, as shown in Figure 4, bonded to paper layer 216, or both sides, i.e. bonded to paper layers 214, 216 if required.

An outer layer 220 (whether applied as an internal face or an external face) may provide additional properties to flexible material 210 to make it suitable for a particular purpose. For example, paper outer layer 220 may comprise a grease-proof or water resistant material, coating or substance. Advantageously, absorption of moisture or contaminants can be reduced by application of such coatings or substances, thereby increasing the useful life of the material. Other materials, such as cotton, wool or biodegradable plastic may also be suitable for use as outer layer 220, depending on the required application. Outer layer 220 may comprise a single layer of these materials or multiple layers of such materials combined. For example, outer layer 220 may comprise two or three layers and may be made up of cotton, wool, shredded or pulped paper or biodegradable plastic.

Figure 5 illustrates a flexible material 310 that can be formed into a shape desirable for containing articles. In the example shown in Figure 5, flexible material 310 is formed into the shape of an envelope. Alternatively, flexible material 310 may be formed into the shape of a carry bag, a bottle bag or a rectanguloid container. An example of a flexible rectanguloid container 320 is shown in Figure 6. Particularly, flexible material 310 is suitable for use in transporting hot or cold goods because it has improved thermal insulation properties relative to, say, plastic or synthetic bags. Advantageously, because flexible material 310 has improved thermal insulation properties, a foil layer may be omitted from the bag or container.

A suitable adhesive may be used for bonding the layers together, for example poly vinyl acetate (PVA) glue. Alternatively, a starch-based glue or cold-water glue can be used. Preferably the adhesive is non-toxic, biodegradable and compatible with existing recycling processes.

Referring to Figure 7, a flow chart outlining a manufacturing process 400 of the flexible material 110 is described according to some embodiments. Step 410 includes the step of bonding flat paper layer 114 to the face of corrugated paper layer 112. Step 412 comprises the step of forming indentations on the face of the corrugated layer 112 opposite to the face that is bonded to the flat paper layer 114. In alternative embodiments (described below in relation to Figure 10), the flat paper layer 114 may be scored, creased or crushed instead of, or in addition to, the scoring, creasing or crushing of the corrugated layer 112 to provide further overall reduced resistance to bonding, folding or curving of the material.

The step of bonding a corrugated paper layer to one face of a flat paper layer (step 410) may include applying an adhesive to the corrugated surface using either a spray or roller application method. Application by a roller method allows only a ridge of each corrugation to be covered with adhesive, reducing the amount of adhesive used. Depending on the type of adhesive used, additional strength may be imparted to the corrugated layer 112, 212 by the adhesive (when set). Accordingly, where greater overall stiffness is called for, it may be desirable to coat most or all of one face of the corrugated layer with adhesive using a spray process, for example, to provide additional stiffness to the corrugations.

Step 412 may be performed while the adhesive is still moist. Doing this may assist with the forming of the indentations and may increase the strength of the mound formed between the indentations 118.

A schematic representation of a manufacturing apparatus 500 is shown in Figure 8. A continuous roll of corrugated material 510 is shown exiting bonding machine 512 which bonds a flat paper layer 114 to a corrugated paper layer 112. Bonding machine 512 may be a suitable commercially available machine for producing a flat paper layer bonded to a corrugated paper layer. Bonding machine 512 (or another in-line machine) may also form a corrugated layer from a flat paper layer or may simply bond an already prepared corrugated layer.

As an alternative to using bonding machine 512, single face corrugated material (i.e. already bonded in another process) may be supplied directly into the process either as sheeting or a continuous roll. Corrugated material 510 may be processed with the corrugations extending across the face of corrugated material 510 (i.e. in the cross-direction) or along the face of corrugated material 510 (i.e. in the machine direction).

Indentations, creases or scores are then formed on corrugated material 510 by contact between corrugated material 510 and rollers 514 and also by contact between one or both faces of corrugated material 510 and a further series of rollers 516, if required, to form flexible material 110. Rollers 514, 516 may comprise a series of ridges, blades or flanges which impart pressure on material 510 to form the indentations, creases or scores. Rollers 514 may form multiple series of indentations, or alternatively, each series of indentations, creases or scores may be formed by a separate roller. Accordingly, a further roller 516 positioned after roller 514 may form additional indentations if required.

According to some alternative embodiments, the flexible material may comprise a further flat paper layer bonded to a face of the corrugated layer opposite from the flat paper layer, i.e. over the indentations. To achieve this, roller 520 supports a roll of flat paper 522 that can be bonded to a face of the flexible material 110 (or 1000, Figure 10) which has already had indentations formed on it. Roller 518 allows the further flat paper layer 522 to be pressed against flexible material 110 to form material 210. Flat paper layer 522 may be bonded to flexible material 110 with a suitable commonly available adhesive, but preferably the adhesive is non-toxic, biodegradable and compatible with existing recycling processes. Once complete, the creased (and optionally double-sided) flexible material 110, 210 may be wound into a roll 524 ready to be shipped out to a customer. Alternatively, flexible material 110, 210 may be cut into lengths (if not already cut) and supplied as a stacked arrangement of sheets.

This alternative manufacturing process of a flexible material according to other embodiments is outlined in Figure 9. In these embodiments, indentations may be formed on a face of the corrugated layer in multiple steps 612, 614. In step 616, a further flat paper layer may be bonded to an opposite face of the corrugated paper layer. Additionally, an outer layer may be bonded over the indentations or over a flat paper layer in step 618.

In further embodiments, a flexible material 1000 may be formed, as illustrated in Figure 10, having indentations, scores or creases formed on the flat layer 114 rather than, or in addition to, scores, creases or indentations being formed on the corrugated layer 112. In such embodiments, processes similar to those described above may be employed to form such creases, scores or indentations across the exposed face of flat paper layer 114 (i.e. that face which is not bonded to corrugated layer 112). It is contemplated that such formation of indentations, scores or creases may involve exerting pressure along at least one series of parallel lines 1018a orientated at an angle to the longitudinal orientation of the corrugations. In some embodiments, a second series of differently angled parallel lines 1018b may be formed to cross the first series 1018a. In flexible material 1000, flat layer 114 and corrugated layer 112 are continuous and co-extensive.

The exertion of pressure to form the one or more series of lines 1018a, 1018b on the exposed face of flat paper layer 114 may also result in a partial crushing of the valleys of the corrugated layer 112 where they are bonded to the flat paper layer 114, thus achieving a dual effect of weakening the resistance of the flat paper layer 114 to bending, curving or folding, while simultaneously reducing the resistance of the corrugated layer 112 to the same manipulations. Such weakenings are, however, exerted in a manner to not pierce through the flat paper layer 114, as this may overly weaken the material and make it overly susceptible to ripping or tearing.

The series of parallel lines 1018a, 1018b are shown in Figure 10 as being approximately right-angled to each other and at about 45 degrees to the longitudinal direction of the corrugations (on the opposite side of flat paper layer 114). However, embodiments may employ variations of such angles, within a range of, say, 20 to 70 degrees or 30 to 60 degrees, and without the magnitudes of the first and second angles being equal, to similar beneficial effect. The minimum separation of adjacent parallel lines 1018a or 1018b may be around 10 to 15 mm or up to around 50 mm, as described above in relation to Figure 3. Alternatively, as in the embodiments described above, this spacing may apply to the distance along each corrugation between where adjacent parallel lines 1018a or 1018b cross that corrugation.

Flexible material 1000 shown in Figure 10 may thus be considered to be a modified version of flexible material 110 and may be used to form flexible material 210, and the details of those embodiments described above are also applicable to flexible material 1000, including the manufacturing processes described above for manufacturing flexible material 110 or 210. Similarly, apparatus 500 may be used in the manner described above (for example, where the indentations, creases or scores are formed only on the exposed face of flat paper layer 114 and not the corrugated layer 112) or readily modified to allow indentations, scores or creases to be formed on both exposed faces (i.e. flat and corrugated) of the material.

In embodiments where scores, creases or indentations are formed on both exposed faces of the flexible material 110, 1000, the angled lines of such indentations, creases or scores may coincide or be offset from each other.

The embodiments have been described by way of example only and modifications are possible within the scope of the invention disclosed.

Throughout this specification and claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

CLAIMS

1. A material, comprising:
a flat paper layer; and
a corrugated paper layer bonded to one face of the flat paper layer;
wherein the corrugated paper layer comprises indentations formed across an opposite face of the corrugated layer.

2. The material as claimed in claim 1, wherein the indentations are arranged at an angle to the corrugations.

3. The material as claimed in claim 1 or claim 2, wherein the indentations are formed along substantially parallel lines.

4. The material as claimed in any one of claims 1 to 3, wherein the indentations comprise a first series of indentations arranged at a first angle to the corrugations and a second series of indentations arranged at a second angle to the corrugations.

5. The material as claimed in claim 4, wherein the magnitude of the first and second angles is between about 30 and about 60 degrees.

6. The material as claimed in claim 5, wherein the magnitude of the first and the second angles is substantially the same.

7. The material as claimed in claim 6, wherein the magnitude of the angles is about 45 degrees.

8. The material as claimed in any one of claims 1 to 7, wherein a further series of indentations are provided at an angle of about 90 degrees to the corrugations.

9. The material as claimed in any one of claims 1 to 7, wherein the distance between adjacent indentations of any one series is less than about 15mm apart.

10. The material as claimed in any one of claims 1 to 9, further comprising a second flat paper layer bonded to a face of the corrugated layer opposite from the first flat paper layer.

11. The material as claimed in any one of claims 1 to 10, wherein the thickness of each flat paper layer is between about 0.05 mm and about 0.3 mm.

12. The material as claimed in claim 11, wherein the thickness of each flat paper layer is approximately 0.1mm.

13. The material as claimed in either claim 11 or claim 12, wherein the weight of each flat paper layer is between about 50 and about 250 grams per square meter.

14. The material as claimed in any one of claims 1 to 13, further comprising an outer layer bonded to a face of the flat paper layer.

15. The material as claimed in claim 14, wherein the outer layer is a protective layer comprising grease-proof or water-resistant material.

16. The material as claimed in any one of claims 1 to 15, wherein the material is formed into a three dimensional container.

17. The material as claimed in claim 16, wherein the three dimensional container is an envelope, a carry bag, bottle bag or a rectanguloid container.

18. The material as claimed in any one of claims 1 to 17, wherein the material is recyclable.

19. A method of producing a material, comprising the steps of bonding a corrugated paper layer to one face of a flat paper layer, and forming indentations across an opposite face of the corrugated layer.

20. The method as claimed in claim 19, wherein the step of forming indentations on the corrugated material is performed by pressing a roller having blade portions against the surface of the corrugated material.

21. The method as claimed in either claim 19 or 20, further comprising the step of bonding a second flat paper layer to a surface of the corrugated layer opposite from the first flat paper layer.

22. The method as claimed in any one of claims 19 to 21, further comprising the step of bonding at least one outer layer over one of the flat paper layers.

23. The method as claimed in any one of claims 19 to 22, wherein the step of bonding a corrugated paper layer to one face of a flat paper layer includes applying an adhesive to the corrugated surface using either a spray or roller.

24. A flexible packaging material, comprising:

a substantially flat first layer; and

a corrugated second layer bonded on one side to the first layer, the second layer having ridges and valleys arranged in parallel,

wherein ridges on an opposite side of the second layer are each formed to have a series of structural weakenings along a length of each ridge.

25. The flexible packaging material as claimed in claim 24, wherein the structural weakenings are formed by scoring, cutting or indenting the ridges.

26. The flexible packaging material as claimed in claim 24 or 25, wherein the first and second layers are paper layers.

27. A method of forming a flexible material, the method comprising:

bonding a substantially flat first layer to one face of a corrugated second layer, the second layer having ridges and valleys arranged in parallel; and

forming a series of structural weakenings along a length of each ridge on an opposite face of the second layer.

28. A laminate, comprising:

a flat layer; and

a corrugated layer bonded to one face of the flat layer;

wherein the corrugated layer comprises indentations formed across an opposite face of the corrugated layer.

29. A method of producing a laminate, comprising the steps of bonding a corrugated layer to one face of a flat layer, and forming indentations across an opposite face of the corrugated layer.

30. A flexible material, comprising:

a flat layer; and

a corrugated layer bonded to one face of the flat layer and co-extensive therewith, the corrugated layer defining parallel ridges and valleys having a longitudinal orientation;

wherein parallel lines of structural weakening extend at an angle to the longitudinal orientation across an exposed face of at least one of the flat layer and the corrugated layer.

31. The material of claim 30, wherein the parallel lines comprise first and second series of differently angled lines.

32. The material of claim 31, wherein the first and second series are oppositely angled at between about 30 degrees and 60 degrees to the longitudinal direction.

33. The material of any one of claims 30 to 32, wherein the parallel lines are spaced apart by between about 10 mm and about 15 mm.

34. The material of any one of claims 30 to 33, wherein the thickness of each flat paper layer is between about 0.05 mm and about 0.3 mm.

35. The material of any one of claims 30 to 34, wherein the weight of each flat paper layer is between about 50 and about 250 grams per square meter.

36. Use of the material of any one of claims 1 to 18, 24 to 26 and 30 to 35 as an insulating packaging or packing material.

37. Apparatus comprising means for forming the material of any one of claims 1 to 18, 24 to 26, 28 and 30 to 35 or for performing the method of any one of claims 19 to 25, 27 and 29.

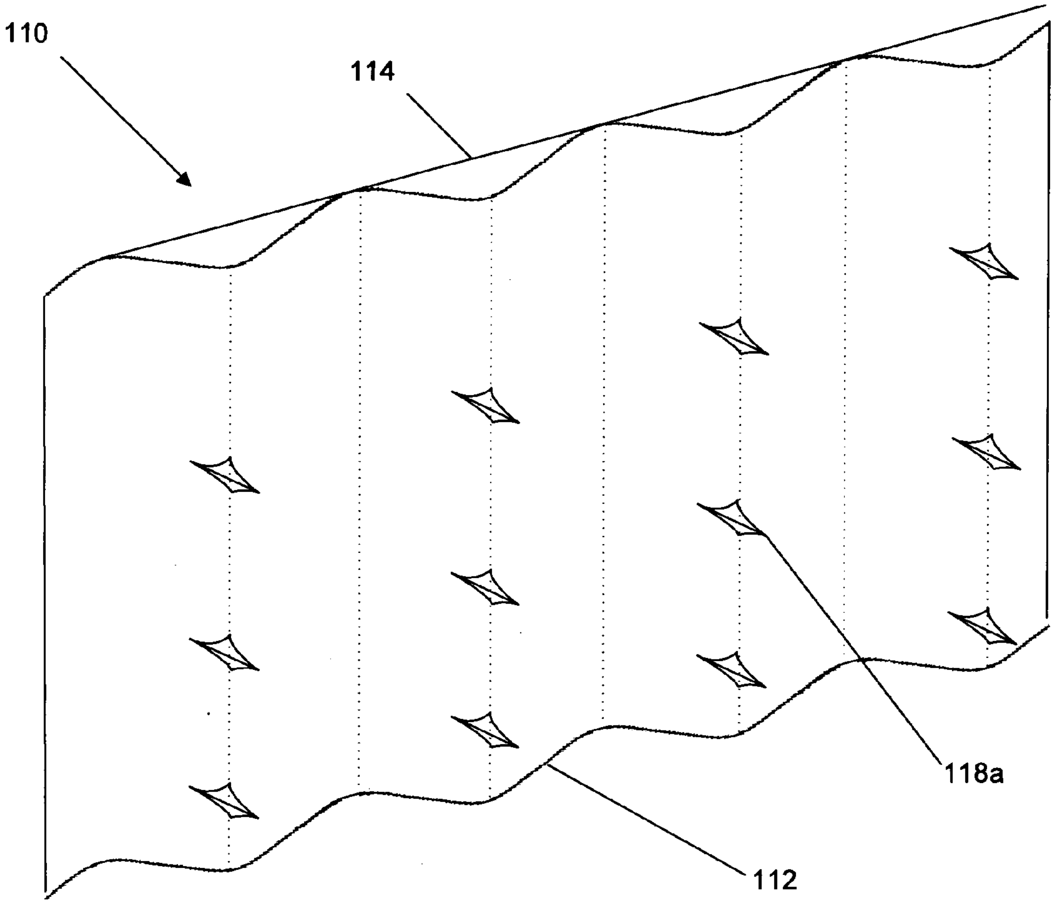


Figure 1

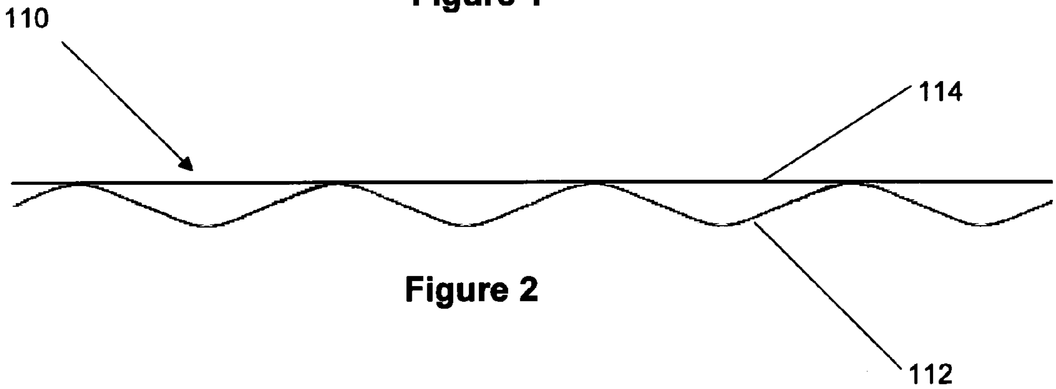


Figure 2

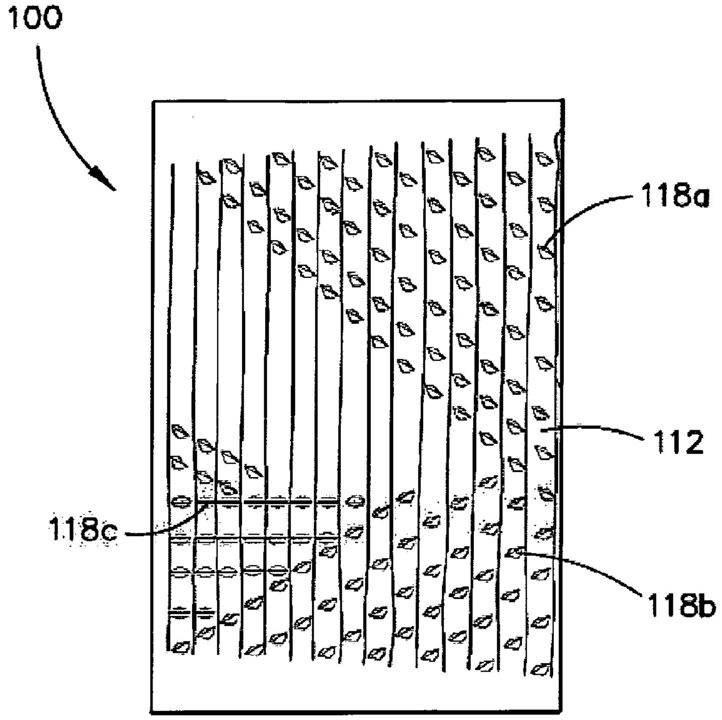
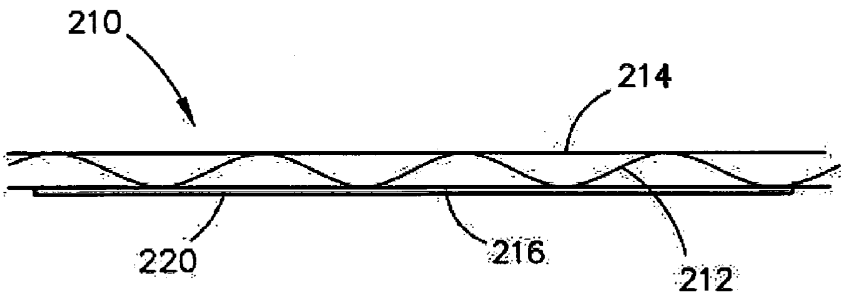


Figure 3



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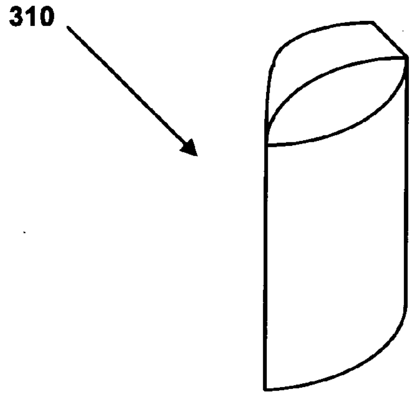

Figure 5

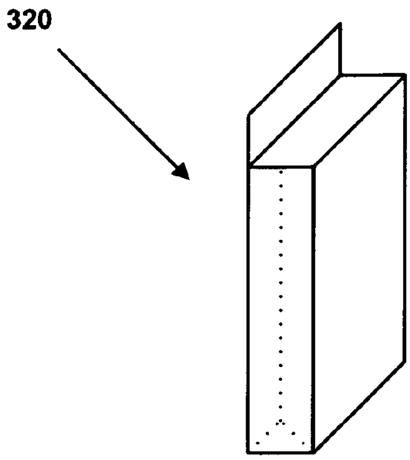

Figure 6

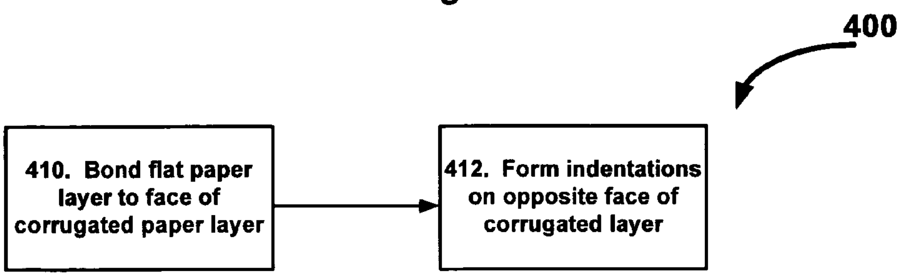

Figure 7

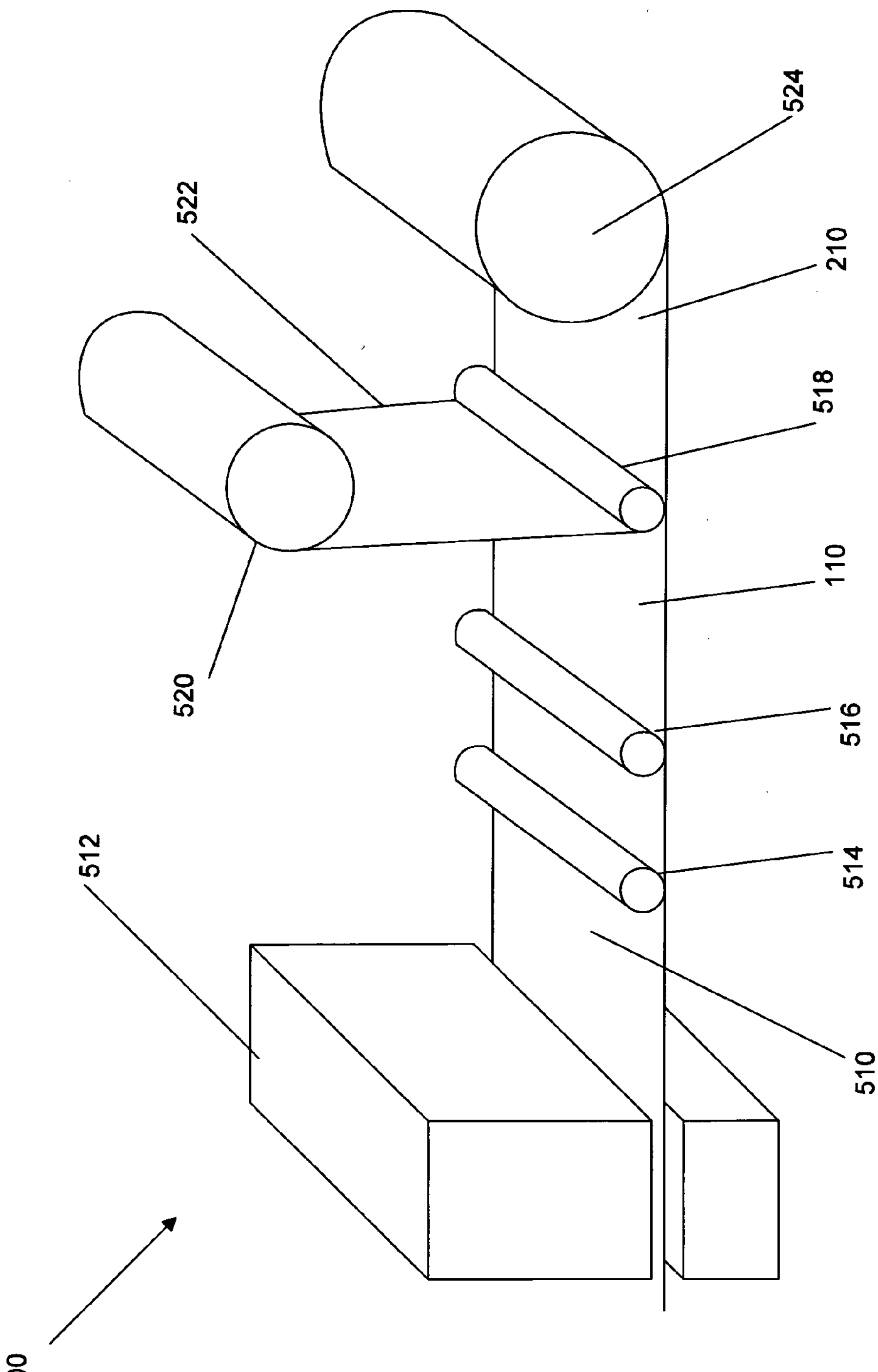

Figure 8

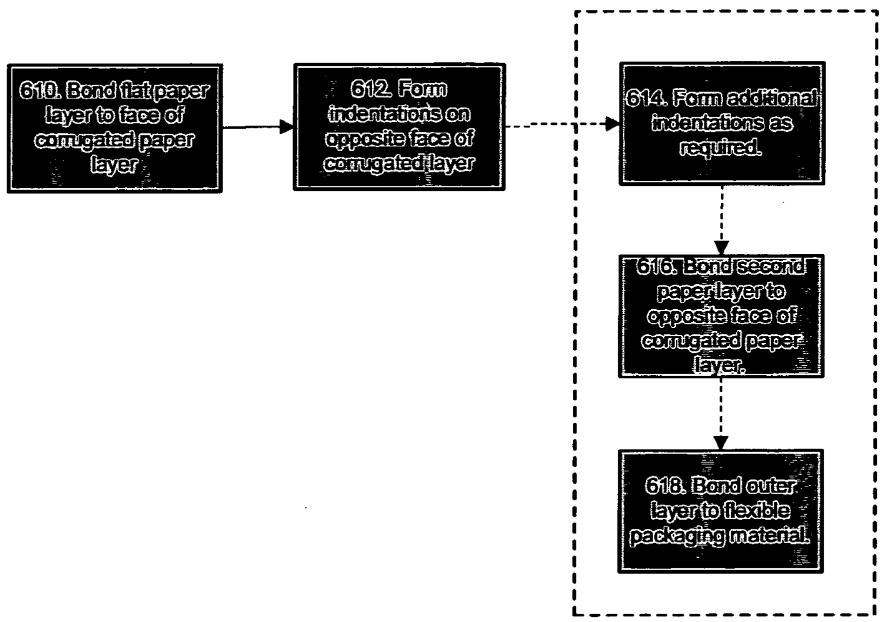
610. Bond flat paper layer to face of corrugated paper layer
612. Form indentations on opposite face of corrugated layer
614. Form additional indentations as required.
616. Bond second paper layer to opposite face of corrugated paper layer.
618. Bond outer layer to flexible packaging material.

Figure 9

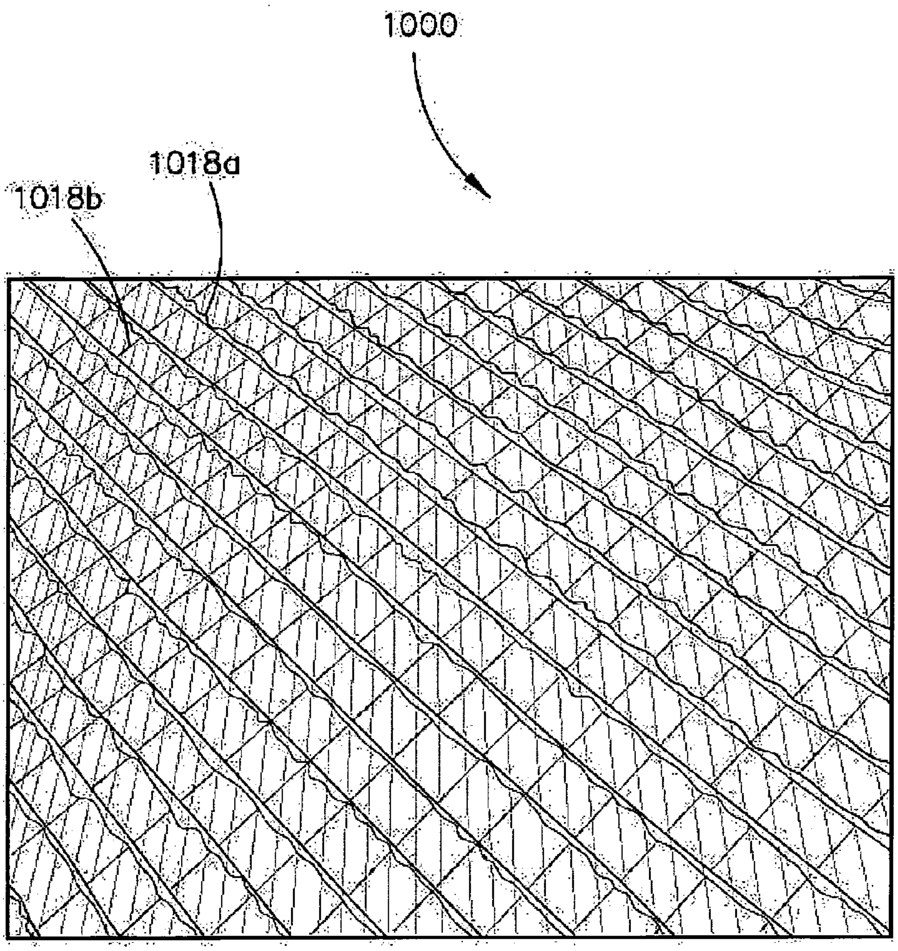

Figure 10