

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
16 July 2009 (16.07.2009)

PCT

(10) International Publication Number
WO 2009/086604 A1

(51) International Patent Classification:
B32B 27/10 (2006.01) **B65D 81/34** (2006.01)
B32B 27/08 (2006.01)

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(21) International Application Number:
PCT/AU2009/000024

(22) International Filing Date: 9 January 2009 (09.01.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2008200114 9 January 2008 (09.01.2008) AU

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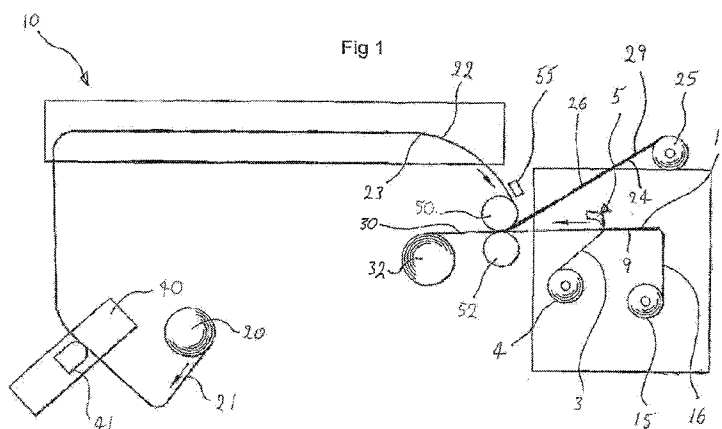
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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA,
CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE,
EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID,
IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK,
LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW,
MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT,
RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ,
TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK,
MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ,
CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN,
TD, TG).

Published:
— with international search report

(54) Title: A LAMINATED PACKAGING MATERIAL AND A METHOD AND APPARATUS FOR PRODUCTION



(57) Abstract: The invention includes a method of and apparatus (10) for producing a laminated sheet of flexible packaging material (30) for forming a package by heat bonding of the laminated sheet to another packaging component. The method includes: providing a first sheet of a flexible material (21) and a second sheet of a flexible material (16), removing a strip (3) from the second sheet (16) to form a gap (7) in the second sheet; replacing the removed strip (3) with a replacement strip (26) of a flexible material; and bonding the second sheet (16) and the replacement strip (26) to a surface (22) of the first sheet (21) to form the laminated sheet of flexible packaging material (30). The materials forming the second sheet (16) and the replacement strip (26) are such that with the application of a predetermined temperature and pressure for a predetermined time the second sheet and not the replacement strip heat bonds with the another packaging component whereby the non-heat bonded replacement strip provides a vent from the package.

A Laminated Packaging Material and a Method and Apparatus for ProductionField of the Invention

The present invention relates to laminated packaging materials and to a
5 method and apparatus for the production of laminated packaging materials. The
laminated packaging material of the present invention is suitable for use in a package
having means for releasing pressure from inside the package particularly, though not
necessarily, where the package is used to contain contents heated in a microwave
oven. However, it is to be appreciated that the present invention may have broader
10 application, for example for providing a vacuum package.

Background

It is desirable to be able to market food products in a package that can be
placed in a microwave oven and subjected to microwave energy. Thus, the food
15 products in the package can be heated or cooked without having to be removed from
the package and placed in another package or container suitable for use with a
microwave oven such as a microwave-safe container. This is attractive for
consumers as it means they do not have to clean additional packages or containers
after use, particularly if the package or container is disposable.

20

When using a microwave oven to heat or cook food in a package it is beneficial
to the taste and texture of the food if a certain amount of moisture is retained in the
package and surrounds the food. By ensuring that the food is surrounded by
moisture the food is more likely to remain moist and not dry out during the heating or
25 cooking process. This can be crucial for the food to remain palatable.

Existing microwave packages can include a plastic film formed into an open
ended package. Food, water or other liquid is added to the package through the open
end which is then sealed and the package placed in a microwave oven. Upon
30 activating the microwave some of the water in the package vaporizes which increases
the pressure inside the sealed package. Such packages are prone to rupture due to
this build up of pressure which can result in spillage of the contents, or the food
becoming dry due to the loss of moisture surrounding the food in the package.

US Patent No. 6,582,123 illustrates a bag formed of a multiply plastics film defining a containment region for food. The bag has a vent passage to allow the escape of some fluid from the containment region during heating. However, the bag disclosed in US Patent No. 6,582,123 is relatively difficult to manufacture, requires the use of a relatively complex apparatus for its manufacture and cannot be readily produced using existing film forming apparatus without significant modification.

Summary of the Invention

The present invention provides, in a first aspect, a method of producing a laminated sheet of flexible packaging material for forming a package by heat bonding of the laminated sheet to another packaging component, the method including:

providing a first sheet of a flexible material and a second sheet of a flexible material;

removing a strip from the second sheet to form a gap in the second sheet;

replacing the removed strip with a replacement strip of a flexible material;

bonding the second sheet and the replacement strip to a surface of the first sheet to form the laminated sheet of flexible packaging material;

wherein the materials forming the second sheet and the replacement strip are such that with the application of a predetermined temperature (for a given time and at a given pressure) the second sheet and not the replacement strip heat bonds with the another packaging component whereby the non-heat bonded replacement strip provides a vent from the package.

The another packaging component may include the first sheet or the second sheet or a further sheet of packaging material. The predetermined temperature of the invention may, for example, be between about 130 degrees Celcius and 180 degrees Celcius where the second sheet and the another packaging component is formed out of cast polypropylene (CPP) and the replacement strip is formed out of oriented polypropylene (OPP) material. This is because at temperatures of greater than about 130 degrees Celcius and less than about 180 degrees Celcius a sheet of OPP material will not heat bond to a sheet of material formed out of CPP. However, at temperatures of greater than about 130 degrees Celcius and less than about 180 degrees Celcius a sheet of the CPP material will heat bond to a sheet of material formed out of CPP. Thus, at temperatures of greater than about 130 degrees Celcius

and less than about 180 degrees the second sheet, when formed out of CPP, and not the replacement strip, when formed out of OPP, will heat bond to the another packaging component, when formed out of CPP, whereby the non-heat bonded replacement strip provides a vent from the package.

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In one form, the second sheet and the replacement strip are adhesively bonded to the surface of the first sheet to form the laminated sheet of flexible packaging material.

10

In another form, the first and second sheets are continuously provided from respective rolls of the sheets of material and the replacement strip is continuously provided from a roll of that material.

15

The replacement strip may have a width that is equal to the width of the removed strip. The width of the replacement strip may be 8 to 12 millimeters. The replacement strip may have a thickness less than or equal to the thickness of the second sheet.

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In one form, the step of removing a strip from the second sheet includes cutting the second sheet.

25

In another form, the step of bonding the second sheet and the replacement strip to a surface of the first sheet includes applying an adhesive to the surface of the first sheet and contacting the second sheet and the replacement strip to the adhesive applied to the surface of the first sheet.

30

In yet another form, the first sheet and the second sheet each have a width and the width of the first sheet is substantially the same as the width of the second sheet.

The method may also include providing another sheet of a flexible material as an intermediate sheet between the first and the second sheets. This intermediate sheet may be adhesively bonded to the first sheet and the second sheet adhesively bonded to the intermediate sheet.

The flexible material of the second sheet may be selected from a group of materials including cast polypropylene, and polyethylene.

5 The flexible materials of the first sheet and the replacement strip may be selected from a group of materials including oriented polypropylene, polyethylene terephthalate and nylon.

10 In embodiments involving a first, a second and an intermediate sheet, the intermediate sheet may be nylon or a paper. Alternatively the first or the second sheet may be of paper, but this is less preferred because the paper may need to be treated, for example suitably coated for waterproofing to render it fit for the purpose.

15 In another aspect, the invention provides a laminated sheet of flexible packaging material formed from the method of any one of the above forms of the invention

20 In another aspect, the invention provides an apparatus for producing a laminated sheet of flexible packaging material, the flexible packaging material for forming a package by heat bonding of the flexible packaging material to another packaging component, the flexible packaging material including a first sheet of a flexible material, a second sheet of a flexible material with a strip removed from the second sheet forming a gap in the second sheet that is replaced by a replacement strip of a flexible material that is bonded along with the second sheet to a surface of
25 the first sheet to form the laminated sheet of flexible packaging material wherein the materials forming the second sheet and the replacement strip are such that with the application of a predetermined temperature (for a given time and at a given pressure) the second sheet and not the replacement strip heat bonds with the another packaging component whereby the non-heat bonded replacement strip provides a
30 vent from the package, the apparatus including:

 a roll of the first sheet of a flexible material for continuously providing the first sheet and a roll of the second sheet of a flexible material for continuously providing the second sheet;

a device for removing the strip from the second sheet as it is continuously provided to form the gap in the second sheet;

a roll of the replacement strip for continuously replacing the removed strip; and

5 a device for enabling bonding of the second sheet and the replacement strip to the surface of the first sheet to form the laminated sheet of flexible packaging material.

10 In one form, the device for enabling bonding of the second sheet and the replacement strip to the surface of the first sheet includes a supply of adhesive for adhesively bonding the second sheet and the replacement strip to the surface of the first sheet.

In another form, the roll of the replacement strip is movable to facilitate aligning the replacement strip with the gap in the second sheet.

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In yet another form, the apparatus further includes a roll for receiving the laminated sheet of flexible packaging material.

20 The device for removing the strip from the second sheet may include at least two spaced apart cutting elements for cutting the strip for removal from the second sheet.

In one form, the apparatus further includes a roll for receiving the removed strip.

25

In yet another form, the apparatus further includes a nip roll and a ground roll for compressing the first sheet, the second sheet and the replacement strip together.

30 In apparatus for producing a three layer or three ply laminated sheet of the flexible packaging material, a roll of the intermediate sheet is included for continuously providing the intermediate sheet to the nip roll and the ground roll such that the intermediate sheet is located between the first sheet and the replacement strip. This embodiment of the apparatus may also include a further device for enabling bonding the intermediate sheet to the surface of the first sheet with the first

mentioned such device being for enabling bonding of the second sheet and the replacement strip to the surface of the intermediate sheet. The further device for enabling bonding may include a supply of adhesive.

5 In another aspect, the present invention also provides a replacement strip for use in any of the above forms of the method of the invention and with any of the above form of the apparatus of the invention, wherein the material forming the replacement strip is such that with the application of a predetermined temperature the second sheet and not the replacement strip heat bonds with the another packaging
10 component whereby the non-heat bonded replacement strip provides a vent from the package.

In one form, the replacement strip is in the form of a roll.

15 In another form, the material forming the replacement strip is selected from a group of materials including oriented polypropylene, polyethylene terephthalate, paper and nylon.

In another form, the replacement strip may be a laminate of at least two layers.
20 One of the layers may be polyethylene (PE), which provides a particular advantage to be described below. For a replacement strip which is a laminate of three layers, the layers may be, for example, PET, PE and OPP.

In yet another form, the replacement strip has a width of 8 to 12 millimeters.

25 In yet another aspect, the invention provides a package for an item, the package including at least one wall formed from the laminated sheet of flexible packaging material formed from the method of any one of the above forms of the invention, wherein the second sheet and not the replacement strip is heat bonded
30 with another component of the package whereby the non-heat bonded replacement strip provides a vent from the package.

In one form, the another component of the package is a third sheet of a flexible packaging material.

The flexible material of the third sheet may be selected from a group of materials including cast polypropylene, and polyethylene.

5 The item may be a perishable item.

In one form, the package further includes an openable closure for enabling the placement of the item in the package or the removal of the item from the package.

10 In another form, the package is for containing the item when the item is heated in a microwave oven.

In a further aspect, the invention provides a laminated sheet of flexible packaging material including first, second and third layers of flexible material which
15 are bonded together,

 wherein the third layer includes a strip of a different material to the material of the remainder of the third layer, said different material being less heat bondable to other materials than the material of the remainder of the third layer,

 wherein at least one of the first, the second and the third layers of flexible
20 material comprises a non-permeable material.

The laminated sheet of flexible packaging material according to this further aspect of the invention can be used to manufacture a package in the form of a flexible bag, which in addition to being suitable for heating a food product therein within a
25 microwave oven, may also be used to vacuum pre-pack the food product. Such a bag may be formed by heat bonding the laminated flexible packaging material to another non-permeable packaging material wherein the strip of a different material of the third layer faces the another non-permeable packaging material and a portion of it is located along a heat bonded join between the laminated sheet and the another
30 non-permeable packaging material. Although this portion of the strip is heat bonded for the another non-permeable packaging material, the bond is less strong than that of the remainder of the third layer for the another non-permeable packaging material, but is sufficiently strong to allow a food product to be packed within the bag and for the air to be drawn out before final sealing of the bag, that is, for the food product to be

vacuum packed to preserve it for longer than would otherwise be the case. Upon microwave heating of the vacuum packed food product, the weaker heat bonding of the portion of the strip of a different material for the another non-permeable packaging material provides a rupturable join for venting the bag. The non-permeable nature of the laminated sheet and the another packaging material must be of such a degree as to adequately maintain the vacuum. An example of a suitable material is nylon (in contrast to, for example OPP or CPP which materials may not maintain the vacuum for a sufficiently long period of time).

Preferably the strip of a different material is a laminate of at least two layers and more preferably one of the layers is PE. Where the strip is not a laminate, it is preferably formed of PE. Use of PE for or in the strip provides a particular advantage to be described below.

Brief Description of the Drawings

It will be convenient to hereinafter describe the invention in detail with reference to the attached drawings that schematically illustrate a preferred embodiment of a method, an apparatus, a laminated sheet of flexible packaging material and a package in accordance with the invention. It should be appreciated, however, that the generality of the preceding portion of the specification is not to be superseded by the specifics of the following description.

Figure 1 illustrates a side view of a preferred embodiment of an apparatus in accordance with a preferred form of the invention.

Figure 2 illustrates a perspective view of a portion of the apparatus of Figure 1.

Figure 3 illustrates an exploded perspective view of the layers of a laminated sheet of flexible packaging material formed in accordance with the invention.

Figure 4 illustrates a perspective view of a package including at least one wall formed out of the laminated sheet of flexible packaging material of Figure 3.

Figure 5 illustrates a perspective view of another package which is partially formed and includes at least one wall formed out of the laminated sheet of flexible packaging material of Figure 3.

5 Figure 6 illustrates a side view of a portion of a cross section of the package of Figure 5 taken along the section line A-A wherein the layers of a laminated sheet of flexible packaging material of Figure 3 forming the package are illustrated.

10 Figure 7 illustrates a plan view of the package of Figure 5 including at least one wall formed out of the laminated sheet of flexible packaging material of Figure 3.

Figure 8 illustrates a perspective view of the package of Figure 5 including a food item inside the package.

15 Figure 9 illustrates a perspective view of a package including at least one wall formed out of the laminated sheet of flexible packaging material of Figure 3 including a food item inside the package.

20 Figure 10 illustrates an exploded perspective view of three layers of a laminated sheet of flexible packaging material in accordance with an embodiment of the invention.

Figures 11 and 12 illustrate exploded perspective views of multi-layered strips of material for use in forming the laminated sheet of Figure 10.

25

Detailed Description

Referring to Figures 1 and 2 there is shown an apparatus 10 (and thus inherently a method) for producing a laminated sheet of flexible packaging material 30 shown in Figures 3 to 9. The apparatus 10 includes a roll 20 of a first sheet of flexible material 21 having two opposite surfaces 22, 23. The first sheet of flexible material 21 is preferably formed out of either oriented polypropylene (OPP), polyethylene terephthalate (PET) or nylon. However, any other suitable material may be used.

The apparatus also includes a roll 15 of a second sheet of flexible material 16 having two spaced apart and parallel lateral edges 17, 18. The second sheet 16 includes one surface 19 and an opposite surface 9 between the lateral edges 17, 18. The material from which the second sheet 16 is formed is such that at a predetermined temperature it will form a heat bond with the materials used to form either one of the first sheet 21 or the second sheet 16, but particularly the second sheet 16. The second sheet of flexible material 16 is preferably formed out of either cast polypropylene (CPP) or polyethylene (PE). However, any other suitable material may be used.

The first sheet 21 and the second sheet 16 are provided continuously by being drawn from their respective rolls 20,15 between a nip roll 50 and a ground roll 52. Prior to reaching the nip roll 50 and the ground roll 52, a strip 3 is removed from the second sheet 16 by a device 5 for removing a strip from the second sheet 16 as the second sheet 16 is continuously provided. The device 5 includes a pair of spaced apart cutting elements 6, 8 which are fixed to a supporting structure of the apparatus 10. The cutting elements 6, 8, which are stationary and laterally spaced apart, engage the second sheet 16 intermediate the lateral edges 17, 18 of the second sheet 16. When the second sheet 16 is drawn from the roll 15, the second sheet 16 is engaged by and moves relative to the cutting elements 6, 8 such that a strip 3 of the second sheet 16 is cut therefrom. As a result of cutting the strip 3 from the second sheet 16 a gap 7 is left in the second sheet 16 intermediate the lateral edges 17, 18 of the second sheet 16.

The device 5 for removing a strip from the second sheet 16 includes a roll 4 that receives the strip 3 after it is removed from the second sheet 16. Accordingly, when the first sheet 21 and second sheet 16 are continuously drawn from their respective rolls 20,15 and the second sheet 16 moves relative to the device 5, and the cutting element 6, 8 thereof, the strip 3 is continuously removed from the second sheet 16 and received by the roll 4 so as to continuously form the gap 7 in the second sheet 16.

The apparatus 10 also includes a roll 25 of a replacement strip 26 of flexible material. The replacement strip 26 has opposite, spaced apart and parallel lateral

edges 27, 28 as well as two opposite surfaces 24, 29 between the edges 27, 28. The materials forming the second sheet 16 and the replacement strip 26 are such that with the application of a predetermined temperature the second sheet 16 and not the replacement strip 26 heat bonds with another packaging component. In some forms of the invention, the another packaging component may include the first sheet 21 or the second sheet 16. Thus, in some forms of the invention the material that forms the second sheet 16 substantially does not heat bond to the material forming the first sheet 21 or the material forming the second sheet 16 or both. The replacement strip 26 is preferably formed out of either oriented polypropylene (OPP), polyethylene terephthalate (PET) or nylon. However, any other suitable material may be used. The replacement strip 26 is also preferably less than or equal to the thickness of the second sheet 16

After removal of the strip 3 from the second sheet 16 and the formation of the gap 7 in the second sheet 16, the first sheet 21 and second sheet 16 are drawn between the nip roll 50 and the ground roll 52. Simultaneously, the replacement strip 26 is drawn from the roll 25 of the replacement strip 26, along with the first sheet 21 and the second sheet 16, between the nip roll 50 and the ground roll 52. The replacement strip 26 is aligned with the gap 7 in the second sheet such that it substantially replaces the strip 3 which has been removed from the second sheet 16. Accordingly, the opposite, spaced apart and parallel lateral edges 27, 28 of the replacement strip 26 are aligned with opposing, spaced apart and parallel lateral edges 11, 12 of the gap 7. The alignment is such that the lateral edges 27, 28 of the replacement strip 26 are contiguous with the lateral edges 11, 12 of the gap 7. The replacement strip 26 may have opposite and spaced apart lateral edges 27, 28 that are not parallel. The lateral edges 27, 28 may have portions that are non linear, converging, diverging, wavy, corrugated and the like. Similarly, the gap 7 in the second sheet 16 may have opposite and spaced apart lateral edges 11, 12 that are not parallel. The lateral edges 11, 12 may be non linear, converging, diverging, wavy, corrugated and the like. The alignment of the lateral edges 27, 28 of the replacement strip 26 need not be contiguous with the lateral edges 11, 12 of the gap 7. There could be some overlap of the lateral edges 27, 28 of the replacement strip 26 with the lateral edges 11, 12 of the gap 7.

The alignment of the replacement strip 26 can be manipulated manually so that the lateral edges 27, 28 of the replacement strip 26 align and are contiguous with the lateral edges 11, 12 of the gap 7. Alternatively, or additionally, the apparatus may include an electronic sensor 55 which detects the position of the replacement strip 26 to automatically adjust the alignment of the replacement strip 26. The alignment of the replacement strip 26 could be such that there is a controlled amount of overlap of the lateral edges 27, 28 of the replacement strip 26 with the lateral edges 11, 12 of the gap 7.

The replacement strip 26 in the illustrated embodiments has a width that is substantially equal to the width of the gap 7 defined by the lateral distance between the lateral edges 11, 12 of the gap 7. Preferably, the width of the gap 7 and the width of the replacement strip 26 are 8 to 12 millimeters, however, other widths of the gap 7 and replacement strip 26 of less than 8 millimeters and greater than 12 millimeters may also be adopted.

The apparatus 10 further includes a supply 40 of adhesive and an adhesive applicator 41 that coats one of the surfaces 22 of the first sheet 21 with the adhesive as the first sheet 21 is drawn from its roll 20. The coating of adhesive on the surface 22 of the first sheet 21 may be continuous or intermittent. After the surface 22 of the first sheet 21 is coated with adhesive the first sheet 21 reaches the nip roll 50 at which point one of the surfaces 29 of the replacement strip 26 and one of the surfaces 19 of the second sheet 16, with the gap 7 therein, are brought into contact with the surface 22 of the first sheet 21 that is coated with adhesive. The first sheet 21, second sheet 16 and the replacement strip 26 are drawn between the nip roll 50 and the ground roll 52 and are compressed therebetween to adhesively bond and form the laminated sheet of flexible packaging material 30 which subsequently exits from between the nip roll 50 and the ground roll 52. As the first sheet 21, the second sheet 16 and the replacement strip 26 are fed continuously from their respective rolls 20, 15, 25 the flexible packaging material 30 is formed continuously and exits from the gap between the nip roll 50 and the ground roll 52 and passes to a roll 32 of the finished flexible packaging material 30.

Figure 3 illustrates an exploded perspective view of the components of the flexible packaging material 30 produced by the apparatus 10 and the method described above. In particular, they illustrate the replacement strip 26 and the second sheet 16 which are bonded by adhesive 40 in the method and by the apparatus to the surface 22 of the first sheet 21 wherein the replacement strip 26 is located in the gap 7 in the second sheet 16.

Figures 4, 5, 7, 8 and 9 illustrate partially and completely formed packages 60 that include the flexible packaging material 30 produced by the apparatus 10 and the method described above. Figure 5 illustrates a longitudinally extending tube 61 formed out of the sheet of packaging material 30 which is then used to subsequently form a package 60. The tube 61 includes at least one wall 65 formed from the sheet of flexible packaging material 30 produced by the method and apparatus 10 of the invention described and illustrated above. Figure 6 illustrates a portion of a cross section of the tube 61 of Figure 5 taken along the section line A-A wherein the layers of a laminated sheet of flexible packaging material 30 forming the tube 61 are illustrated.

The tube 61 of Figure 5 is formed from a continuous sheet of the flexible packaging material 30. The sheet of flexible packaging material 30 forming the tube 61 has two longitudinal folds 67, 68 either side of the replacement strip 26. Longitudinally extending and laterally spaced apart free edges 66, 69 of the sheet of flexible packaging material 30 are brought together and may be bonded together by any suitable means including by being heat bonded or adhesively bonded. Bonding the free edges 66, 69 of the sheet of flexible packaging material 30 forms the sheet of packaging material 30 into the longitudinally extending tube 61 with the at least one wall 65 positioned between the two longitudinally extending folds 67, 68. Opposite the wall 65, the tube 61 has another wall 62 positioned between the two longitudinally extending folds 67, 68. The tube 61 may be cut at desirable longitudinal lengths to form the tube 61 into sections. Each section includes two open ends 63, 64 (open end 64 not shown in Figure 5).

The open ends 63, 64 may be sealed by heat bonding the wall 65 with the opposite wall 62 at one open end 63 at a predetermined temperature and pressure to

form a finished package 60 as shown in Figure 7. Otherwise, the open ends 63, 64 may be sealed by heat bonding the wall 65 with the opposite wall 62 at a predetermined temperature and pressure at both open ends 63, 64 to form a finished package 60 as shown in Figure 8. In the arrangement shown in Figure 7 the open end 64 which is not sealed by heat bonding may be sealed by a suitable means such as by adhesive. Alternatively, the open end 64 may include a reclosable zipper (not shown) which is closed by the user after the package has been filled with content. In yet another arrangement, both open ends 63, 64 may be heat bonded but at differing predetermined temperatures and pressures such that one vent portion e.g. 74 is heat bonded (but less strongly than the remainder of the join) whilst the other vent portion e.g. 72 is not heat bonded.

Any suitable means may be used for sealing one or both of the open ends 63, 64 by heat bonding the wall 65 with the opposite wall 62. One means for heat bonding the wall 65 with the opposite wall 62 utilizes a pair of linear elements that are heated to a predetermined temperature and are brought together to clamp the wall 65 and the opposite wall 62 at the open ends 63, 64 so as to at least partially fuse the wall 65 and the opposite wall 62 at the open ends 63, 64 together.

With reference to Figure 6, when the wall 65 and the opposite wall 62 are sealed by heat bonding at one or more of the open ends 63, 64, the surface 9 of the second sheet 16 of the wall 65 is heat bonded in face to face relation with the surface 9 of the second sheet 16 of the opposite wall 62 to form a seal. The materials forming the second sheet 16 and the replacement strip 26 are such that with the application of a predetermined temperature for a predetermined time at a predetermined pressure the second sheet 16 of the wall 65 and not the replacement strip 26 heat bonds with the second sheet 16 of the opposite wall 62. As will be appreciated, the application of heat at a predetermined temperature for heat bonding the second sheet 16 of the wall 65 to the second sheet 16 of the opposite wall 62 also attempts to heat bond the replacement strip 26 of the wall 65 to the second sheet 16 of the opposite wall 62. However, in the packages 60 as illustrated in Figures 5 to 8, the nature of the materials used to form, respectively, the replacement strip 26 and the second sheet 16 are such that they are substantially not heat bonded together. At certain predetermined temperatures there may be some degree of heat bond formed

between the replacement strip 26 and the second sheet 16, however, the strength of that heat bond is at least substantially less than the strength of the heat bond between the second sheet 16 of the wall 65 and the second sheet 16 of the opposite wall 62. Thus, when the package 60 contains an item 70 such as a food product, perishable item, liquid or the like and is placed in a microwave oven or any other heating apparatus in order to heat the item 70 the substantial lack of a heat bond between the replacement strip 26 and the second sheet 16 forms a vent 72 from the package 60. The vent 72 enables the release of increased pressure arising inside the package 60 as a result of the application of heat for the purpose of heating the item 70 in the package 60.

In the packages 60 of Figures 5 to 8 where the opposite wall 62 is formed from the laminated sheet of flexible material 30 produced by the method and apparatus 10 of the invention described herein, the "another packaging component" of the invention is provided by the second sheet 16 of the opposite wall 62. Where the second sheet 16 is formed out of CPP the second sheet 16 of the wall 65 can be heat sealed to another packaging component formed out of CPP, such as the second sheet 16 of the opposite wall 62, at a temperature of substantially 130 degrees Celsius or more. Where the replacement strip 26 is formed out of OPP material, however, at temperatures of less than about 180 degrees Celsius the OPP material, and hence the replacement strip 26, will not heat bond to a sheet of material formed out of OPP or to a sheet of material formed out of CPP material, such as the second sheet 16. Thus, at a temperature between about 130 degrees Celsius and about 180 degrees Celsius the second sheet 16 of the wall 65 will heat bond with the second sheet 16 of the opposite wall 62 and the replacement strip 26 will not heat bond with the second sheet 16 such that the non-heat bonded replacement strip 26 provides a vent from the package 60.

It will be appreciated that according to forms of the invention, the opposing wall 62 can be a sheet of flexible material different from the laminated sheet of flexible material 30. In particular, the opposing wall 62 does not need to include the first and the second sheets 21 and 16, but rather it can be a single sheet of material or a laminated sheet of material formed out of, for example, cast polypropylene (CPP) or polyethylene. Thus, in an alternative form such as the form as illustrated in Figure 4,

the wall 65 is formed out of the laminated sheet of flexible material 30 produced by the method and apparatus 10 of the invention described herein and the second sheet 16 of the wall 65 is heat bonded with a third sheet 85 of a flexible material at the open ends 63 and 64. As illustrated in Figure 4 the third sheet 85 may be a ply of a wall 86 that opposes the surface 9 of the second sheet 16 of the wall 65 or which may form the opposite wall 86 in its entirety. The third sheet 85 is formed out of material that at a predetermined temperature will form a heat bond with the second sheet 16 of the wall 65 but not with the replacement strip 26 whereby the non-heat bonded replacement strip 26 provides one or more vents 72, 74 from the package 60 formed therefrom. Thus, in such arrangement, the "another packaging component" of the invention is provided by the third sheet 85.

The package 60 illustrated in Figure 4 includes another two ends 87, 88 that are lateral to and extend between the open ends 63 and 64. The two ends 87, 88 may be closed by any suitable means. For example, one or both of the ends 87, 88 may be closed by heat bonding or adhesively bonding of the two walls 65 and 86. Also, one or both of the ends 87, 88 may include a reclosable zipper (not shown) which is closed by the user after the package has been filled with content.

The package 60 illustrated in Figure 7 incorporates one vent 72 by virtue of the fact that only one open end 63 of the package is heat sealed. However, the packages 60 illustrated in Figures 4, 8 and 9 incorporate two vents 72, 74 by virtue of the fact that two open ends 63, 64 of each respective package 60 is heat sealed. The packages 60 of Figures 4, 7 and 8 are substantially flexible in that they are entirely formed from flexible packaging material. Thus the packages 60 of Figures 4, 7 and 8 are bag like packages 60 and are suitable for containing a prepackaged food product 70 or liquid for subsequent heating in a microwave oven.

On the other hand, the package 60 illustrated in Figure 9 incorporates a wall 65 formed from the sheet of the flexible packaging material 30 that is heat sealed to another packaging component which is in the form of a substantially rigid open container portion 75 of the package 60. Thus, in the package 60 of Figure 9 the "another packaging component" of the invention is provided by the substantially rigid open container portion 75 of the package 60. The package 60 of Figure 9 is a

substantially rigid open container package 60 suitable for containing a prepackaged food product 70 for subsequent heating in a microwave oven. Alternatively, the package 60 of Figure 9 may also include an openable closure (not shown) for facilitating the placement of contents in the package 60 for heating in a microwave oven and the removal of contents from the package 60 after heating.

It has been found that for a package 60 as in Figure 9, if the thickness of the wall 65 formed from the laminated sheet of flexible packaging material 30 is relatively thin (for example about 42 microns), then after opening of the vent 72 or 74, the vent may unexpectedly close (usually during cooling). Such closing of the vent or vents 72, 74 can cause the package 60 to deform in shape as a result of a difference in pressure between the interior and exterior of the package 60. Experiments have shown that such closing of the vents 72, 74 can be avoided by providing a replacement strip 26 of greater width than the normally preferred 8 to 12 mm (which normal width is satisfactory for a relatively thick wall 65), for example a replacement strip 26 having a width of about 30 mm can avoid this problem. Use of a thin wall 65 is preferred because the reduced thickness reduces costs and the weight of the package.

Use of a wider replacement strip 26 for the laminated flexible packaging material 30 may also be appropriate when the material 30 is used for making a flexible package 60 as in Figure 4, 7 or 8 that is of larger size (for example a 28 cm x 20.3 cm bag) compared to a "normal sized" package (for example a 25 cm x 17.5 cm bag). Thus for larger packages 60, a replacement strip 26 width of about 30 mm may be used instead of the preferred 8 to 12 mm for smaller sized bags 60. This wider width for strip 26 for larger bags 60 avoids a possible bursting of the bag 60 due to the rate of pressure increase inside the bag 60 exceeding the rate at which pressure is released through the vent 72 or 74.

Of course, the width of the replacement strip 26 (and thus of a vent 72 or 74) cannot be too wide, otherwise pressure may release too quickly and thus fail to build up sufficiently inside the package 60.

The laminated sheet of flexible packaging material 30, instead of comprising two layers as above described, may instead comprise three layers, that is, it may include an intermediate sheet of flexible material between the first and second sheets of flexible material. An apparatus for producing a three layer laminated sheet of the flexible packaging material 30 will be similar to the apparatus 10 of Figure 1, but additionally include a roll of the intermediate sheet (not shown) to continuously feed the intermediate sheet to the rolls 50, 52 between the first sheet 21 and the replacement strip 26. A further means for bonding the sheets may include an adhesive supply such as 40 and an adhesive applicator such as 41 located relative to the continuously feeding intermediate sheet to apply a coating of adhesive onto the surface of the intermediate strip onto which the replacement strip 26 and the second sheet 16 are to be bonded. Operation of an apparatus as so modified will be evident from the above description relative to Figures 1 and 2.

The intermediate sheet may be of any suitable material, for example it may be of nylon to provide desirable properties for the laminated sheet of flexible packaging material 30 such as substantial non-permeability.

A three layer instead of a two layer laminated sheet of flexible packaging material 30 may be used to form any of the packages 60 of Figures 4, 7, 8 or 9.

An advantageous application for a package 60, whether formed from a two or a three layer laminated sheet of flexible packaging material 30, is for food content to be vacuum packed within the package for longer preservation before the food is heated in a microwave oven. For this application the laminated sheet of flexible packaging material 30 will contain a nylon layer (or other material of suitable non-permeability) as at least one of the first sheet, the second sheet and the intermediate sheet to ensure sufficient non-permeability of the laminated sheet of flexible packaging material 30 as will sustain the vacuum.

Two additional factors may need to be addressed for a package 60 to be used for vacuum packaging a food product. The first factor is to minimise any weakness in the laminated sheet of flexible packaging material 30 along the boundaries of the lateral edges 11, 12 of the second sheet 16 and the lateral edges 27, 28 of the

replacement strip 26, which boundaries if not overlapped may define a gap and such a gap possibly being a point of failure in maintaining the vacuum. The second factor is to ensure an adequate degree of bonding between the replacement strip 26 and the "another packaging component" (as hereinbefore described), which may be another non-permeable packaging material to form the bag. That is, the vent portion should be more strongly bonded than in the case of a bag to be used as a non-vacuum package 60.

The first factor can be addressed by ensuring the presence in the replacement strip 26 of a material which will fill any gap between the lateral edges 27, 28 of the replacement strip 26 and the lateral edges 11, 12 of the gap 7 in the second sheet 16 during heat bonding of the two walls 62 and 65. Thus the replacement strip 26 may contain a layer of polyethylene (PE). Experiments have shown that during heat bonding of wall 62 to wall 65, the PE in the replacement strip 26 spreads and fills any gap between the lateral edges 27, 28 of the replacement strip 26 and the lateral edges 11, 12 of the gap 7. This is the particular advantage (mentioned hereinbefore to be described) provided by use of PE in the replacement strip 26.

Figure 10 illustrates a three layer laminated instead of a two layer laminated sheet of flexible packaging material 90 which may be used instead of flexible packaging material 30 to form any of the packages 60 of Figures 4, 7, 8 or 9. The laminated sheet of flexible packaging material 90 includes first 92, second 94 and third 96 layers of flexible material which are bonded together, for example by adhesive 98. The third layer 96 includes a strip 100 of a different material to the material of the remainder of the third layer 96. This different material of the strip 100 is less heat bondable to other materials than the material of the remainder of the third layer 96. Thus the strip 100 may be PE and the remainder of layer 96 may be RCPP (or CPP). At least one of the first layer 92, the second layer 94 and the third layer 96 comprises a material of substantial non-permeability, such as for example nylon.

When the laminated sheet of flexible packaging material 90 is heat bonded, the PE of strip 100 spreads and fills any gaps, such as indicated by 102 in Figure 10, between the lateral edges of the strip 100 and the lateral edges of the gap in the third layer 96 for the strip 100.

With reference to Figure 11, the strip 100 may comprise two layers, for example a layer 104 of PE and a layer 106 of OPP (or PET or nylon or paper) which are bonded by an adhesive 98. Alternatively, with reference to Figure 11, the strip
5 100 may comprise three layers, for example a layer 108 of PET in addition for the layers 104 of PE and 106 of OPP (or PET or nylon or paper).

Thus an example laminated sheet of flexible packaging material 90 as in Figure 10 for use in making a package for vacuum packaging a food product may
10 comprise a first layer 92 of PET, a second layer 94 of nylon, a third layer 96 of RCPP (or CPP) with a strip 100 of PE, or PE plus OPP (as in Figure 11), or PET plus PE plus OPP (as in Figure 12). Preferably the strip 100 comprises at least two layers, one of which is preferably PE to fill any gaps such as 102, although a material other than PE that is suitable for the purpose may be used. The thickness of the strip 100
15 (in case it comprises two or more layers 104, 106, 108) should not exceed the thickness of the third layer 96.

The second factor can be addressed by applying a higher temperature (for example increased by 10 to 15 per cent) and/or higher pressure (for example
20 increased by 10 to 15 per cent) for a predetermined time during the heat bonding to form a package that will be suitable for vacuum packaging a food product. Experiments have shown that, if an ordinary (i.e. non-vacuum) package 60 can withstand an internal pressure of 50 kPa (without heating the package) without the vent being burst open, then a vacuum package 60 should be able to withstand an
25 internal pressure of about 70 to 75 kPa (without heating the package) without the vent being burst open. With this increased level of bonding of the vent portion, the package is able to maintain a vacuum for an adequately long period of time.

In the example shown in Figure 3, the first sheet or the second sheet can be
30 paper. Preferably the first sheet 21 is not paper, since paper is normally not waterproof. Preferably, the flexible packaging material 30 has three sheets, with paper serving as an intermediate sheet between the first sheet 21 and the second sheet 16 (since heat bonding of paper to the "another packaging component" may be difficult). The paper is bonded to the first sheet and the second sheet by adhesives.

A suitable paper to be used is, for example, VEL 530 manufactured by Cartiera Lucchese S.p.A. in Italy, which has properties of whiteness of 86% (Elrepho 2000), substance of 18-26 gr/m², composition of 80% virgin pulp and 20% deinked pulp, food contact aptness, and neutral Ph.

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The use of paper is not only environmentally more friendly, but (compared with no use of paper) would also prolong the microwave heating period, say from 10 minutes to 20 minutes (probably because paper can distribute heat more evenly and quicker). The use of paper also enables the package 60 to be used for microwave cooking even when the food content contains some or substantial oil, sugar or salt content (which normally would cause temperature to rise).

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The paper to be used should be suitable for packaging food content. Preferably both sides of the paper are smooth, for efficient bonding to the first sheet and/or the second sheet by adhesive. Preferably the paper is of 18 to 40 micron thickness.

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An advantage of the device 5 of the apparatus of Figure 1 for continuously removing a strip from the second sheet 16 is that it can be incorporated into an existing apparatus for producing simple laminated flexible packaging material not incorporating the advantages of the laminated flexible packaging material disclosed herein. Thus, existing machinery can be modified to incorporate the invention disclosed herein at less cost than has previously been the case with existing methods and apparatus for producing more complex laminated flexible packaging material suitable for use in a microwave oven.

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Accordingly, the method and apparatus of the invention may overcome one of the main drawbacks associated with existing packages for food products suitable for use in a microwave oven in that it provides the sheet of flexible packaging material 30 (or 90) that can be formed into a package 60 and provide one or more of the vents 72 for the release of excess pressure inside the package 60. The vents 72 that are enabled by the flexible sheet of packaging material 30 (or 90) also help to maintain some moisture inside the package 60 despite allowing the release of excess pressure from within the package 60. The flexible sheet of packaging material may provide

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these advantages yet be relatively inexpensive to manufacture and be readily adopted by manufacturers of laminated flexible packaging material. The method and apparatus can be incorporated into an existing apparatus for forming simple laminated flexible packaging material yet provide a more advanced product with
5 features that are not evident in such simple laminated materials.

While the package 60 described above is suitable for packaging items 70 in the form of a pre-packaged food product, the package 60 is also suitable for other uses. For example, the package 60 is suitable for a user to add food content to it before
10 closing a reclosable zipper or an openable closure and heating it in a microwave oven. The package 60 is also suitable for sterilizing items 70 using a microwave oven, such as baby care items, whereby the user would add water and the items 70 to be sterilized to the package 60 before closing the reclosable zipper or openable closure and heating it in a microwave oven. Furthermore, besides being suitable as a
15 package 60 for heating in a microwave oven, the package 60 is also suitable as a package for storing items 70 at room temperature. This is useful where the items 70 are perishable items such as fruits and vegetables. A package suitable for vacuum packaging a food product that is subsequently to be heated within the package is also a possible application when a flexible packaging material such as 90 is used to form
20 the package.

An adhesive suitable for bonding the first and second sheets and the intermediate sheet is, for example, a mixture (mixing ratio of 9:1) of SEIKABOND E-368 and SEIKABOND C-76 manufactured or distributed by Tai Chin Chemical
25 Industry Co., Ltd. in Taiwan.

Various alterations, modifications and/or additions may be introduced into the constructions and arrangements of parts previously described without departing from the spirit and/or ambit of the invention.

The claims defining the invention are as follows:

1. A method of producing a laminated sheet of flexible packaging material for forming a package by heat bonding of the laminated sheet to another packaging component, the method including:

providing a first sheet of a flexible material and a second sheet of a flexible material;

removing a strip from the second sheet to form a gap in the second sheet;

replacing the removed strip with a replacement strip of a flexible material;

bonding the second sheet and the replacement strip to a surface of the first sheet to form the laminated sheet of flexible packaging material;

wherein the materials forming the second sheet and the replacement strip are such that with the application of a predetermined temperature the second sheet and not the replacement strip heat bonds with the another packaging component whereby the non-heat bonded replacement strip provides a vent from the package.

2. The method of claim 1, wherein the second sheet and the replacement strip are adhesively bonded to the surface of the first sheet to form the laminated sheet of flexible packaging material.

3. The method of claim 1 or claim 2, wherein the first and second sheets are continuously provided from respective rolls of the sheets of material and the replacement strip is continuously provided from a roll of that material.

4. The method of any one of the preceding claims, wherein the replacement strip has a width that is equal to the width of the removed strip.

5. The method of claim 4, wherein the width of the replacement strip is 8 to 12 millimeters.

6. The method of any one of the preceding claims, wherein the replacement strip has a thickness less than or equal to the thickness of the second sheet.

7. The method of any one of the preceding claims, wherein the step of removing a strip from the second sheet includes cutting the second sheet.

8. The method of any one of the preceding claims, wherein the step of bonding the second sheet and the replacement strip to a surface of the first sheet includes applying an adhesive to the surface of the first sheet and contacting the second sheet and the replacement strip to the adhesive applied to the surface of the first sheet.

9. The method of any one of the preceding claims, wherein the first sheet and the second sheet each have a width and the width of the first sheet is substantially the same as the width of the second sheet.

10. The method of any one of the preceding claims, wherein the flexible material of the second sheet is selected from a group of materials including cast polypropylene, and polyethylene.

11. The method of any one of the preceding claims, wherein the flexible materials of the first sheet and the replacement strip are selected from a group of materials including oriented polypropylene, polyethylene terephthalate, paper and nylon.

12. The method of anyone of the preceding claims including providing another sheet of a flexible material as an intermediate sheet between the first sheet and the second sheet and adhesively bonding it to a surface of the first sheet for the second sheet to be adhesively bonded to the intermediate sheet instead of the first sheet.

13. The method of claim 12 wherein the flexible material of the intermediate sheet is selected from a group of materials including nylon and paper.

14. A laminated sheet of flexible packaging material formed from the method of any one of claims 1 to 13.

15. An apparatus for producing a laminated sheet of flexible packaging material, the flexible packaging material for forming a package by heat bonding of the flexible packaging material to another packaging component, the flexible packaging material

including a first sheet of a flexible material, a second sheet of a flexible material with a strip removed from the second sheet forming a gap in the second sheet that is replaced by a replacement strip of a flexible material that is bonded along with the second sheet to a surface of the first sheet to form the laminated sheet of flexible packaging material wherein the materials forming the second sheet and the replacement strip are such that with the application of a predetermined temperature the second sheet and not the replacement strip heat bonds with the another packaging component whereby the non-heat bonded replacement strip provides a vent from the package, the apparatus including:

10 a roll of the first sheet of a flexible material for continuously providing the first sheet and a roll of the second sheet of a flexible material for continuously providing the second sheet;

 a device for removing the strip from the second sheet as it is continuously provided to form the gap in the second sheet;

15 a roll of the replacement strip for continuously replacing the removed strip; and
 a device for enabling bonding of the second sheet and the replacement strip to the surface of the first sheet to form the laminated sheet of flexible packaging material.

20 16. The apparatus of claim 15, wherein the device for enabling bonding of the second sheet and the replacement strip to the surface of the first sheet includes a supply of adhesive for adhesively bonding the second sheet and the replacement strip to the surface of the first sheet.

25 17. The apparatus of claim 15 or claim 16, wherein the roll of the replacement strip is movable to facilitate aligning the replacement strip with the gap in the second sheet.

30 18. The apparatus of any one of claims 15 to 17, further including a roll for receiving the laminated sheet of flexible packaging material.

19. The apparatus of any one of claims 15 to 18, wherein the device for removing the strip from the second sheet includes at least two spaced apart cutting elements for cutting the strip for removal from the second sheet.

20. The apparatus of any one of claims 15 to 19, further including a roll for receiving the removed strip.

5 21. The apparatus of any one of claims 15 to 20, further including a nip roll and a ground roll for compressing the first sheet, the second sheet and the replacement strip together.

10 22. The apparatus of any of claims 15 to 21 further including a roll of an intermediate sheet of a flexible material for continuously providing the intermediate sheet to between the first sheet and the replacement strip for producing a three layer laminated sheet of the flexible packaging material.

15 23. The apparatus of claim 22 including a further device for enabling bonding of the intermediate sheet to the surface of the first sheet wherein the first defined such device is for enabling bonding of the second sheet and the replacement strip to the surface of the intermediate strip.

20 24. The apparatus of claim 23 wherein said further device includes a supply of adhesive.

25 25. A replacement strip for use in the method of any one of claims 1 to 13 and with the apparatus of any one of claims 15 to 24, wherein the material forming the replacement strip is such that with the application of a predetermined temperature the second sheet and not the replacement strip heat bonds with the another packaging component whereby the non-heat bonded replacement strip provides a vent from the package.

30 26. The replacement strip of claim 25, wherein the replacement strip is in the form of a roll.

27. The replacement strip of claim 25 or claim 26, wherein the material forming the replacement strip is selected from a group of materials including oriented polypropylene, polyethylene terephthalate and nylon.

28. The replacement strip of any one of claims 25 to 27, wherein the replacement strip has a width of 8 to 12 millimeters.

5 29. The replacement strip of any one of claims 25 to 28 which is a laminate of at least two layers.

30. The replacement strip of claim 29 wherein one of the layers is polyethylene.

10 31. A package for an item, the package including at least one wall formed from the laminated sheet of flexible packaging material of claim 14, wherein the second sheet and not the replacement strip is heat bonded with another component of the package whereby the non-heat bonded replacement strip provides a vent from the package.

15 32. The package of claim 31, wherein the another component of the package is a third sheet of a flexible packaging material.

33. The package of claim 32, wherein the flexible material of the third sheet is selected from a group of materials including cast polypropylene, and polyethylene.

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34. The package of any one of claims 31 to 33, wherein the item is a perishable item.

25 35. The package of any one of claims 31 to 34, further including an openable closure for enabling the placement of the item in the package or the removal of the item from the package.

36. The package of any one of claims 31 to 35, wherein the package is for containing the item when the item is heated in a microwave oven.

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37. A laminated sheet of flexible packaging material including first, second and third layers of flexible material which are bonded together,

wherein the third layer includes a strip of a different material to the material of the remainder of the third layer, said different material being less heat bondable to other materials than the material of the remainder of the third layer,

5 wherein at least one of the first, the second and the third layers of flexible material comprises a non-permeable material.

38. The laminated sheet of claim 37 wherein the first, second and third layers of flexible material are bonded together by adhesive.

10 39. The laminated sheet of claim 37 or claim 38 wherein the non-permeable material of the first, second or the third layer is nylon.

40. The laminated sheet of claim 37, 38 or 39 wherein the strip of a different material is a laminate of at least two layers.

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41. The laminated sheet of any of claims 37 to 40 wherein the strip of a different material comprises polyethylene.

20 42. The laminated sheet of any one of claims 37 to 41 wherein the first layer is PET, the second layer is nylon and the third layer is RCPP.

43. The laminated sheet of any one of claims 37 to 42 wherein the strip of a different material is a laminate of PE plus OPP, or a laminate of PET plus PE plus OPP.

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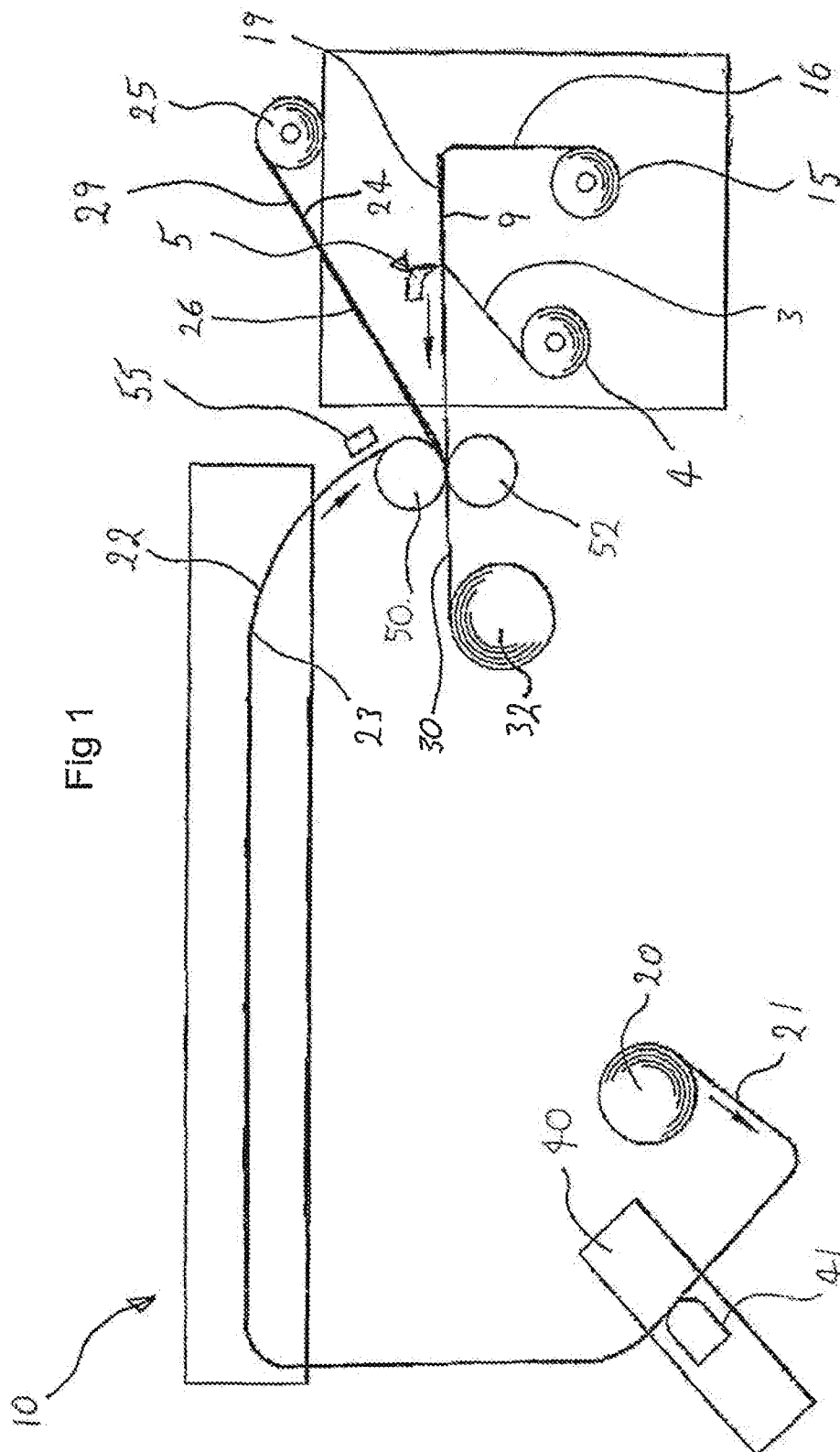
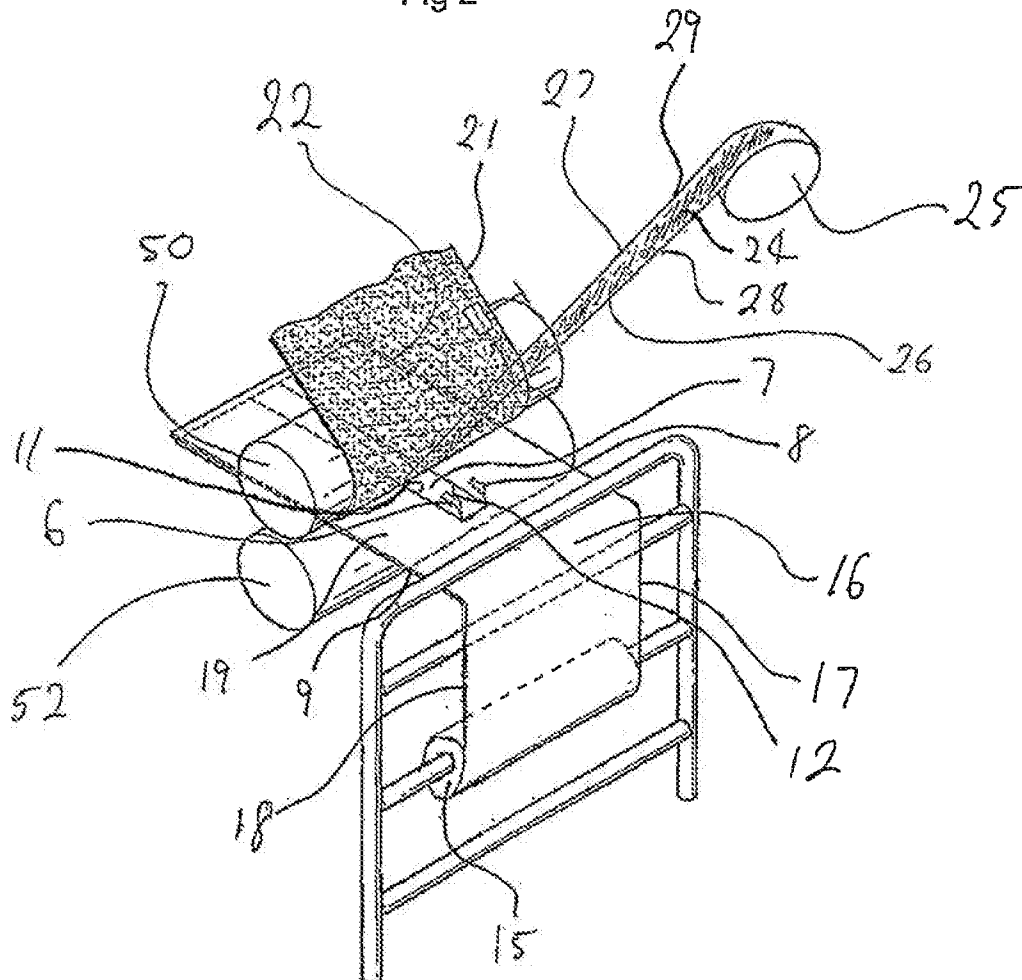


Fig 2



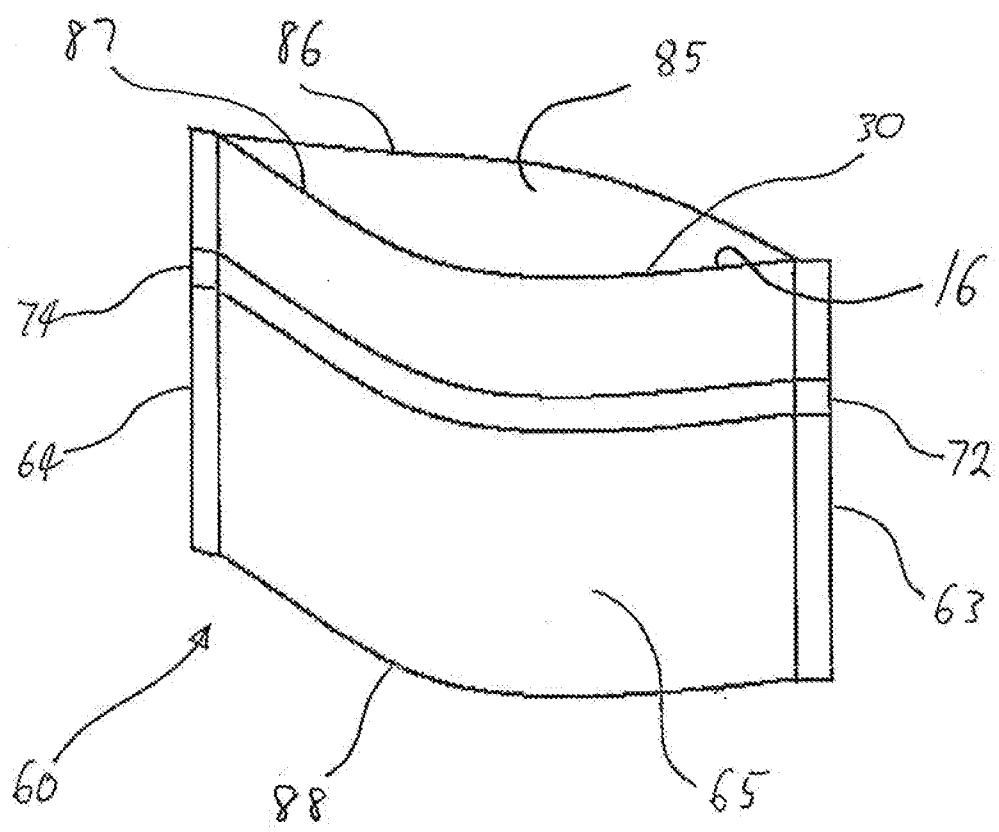
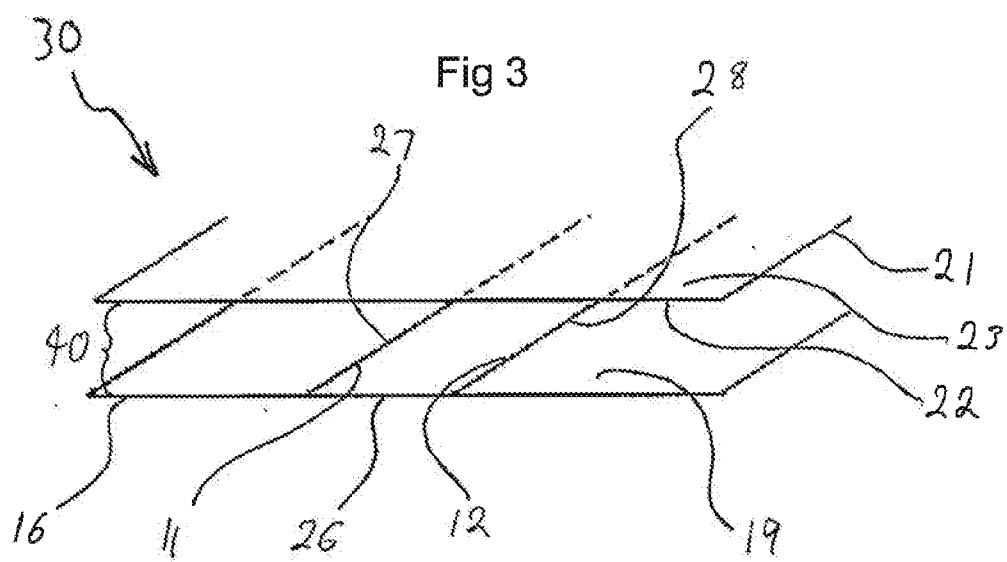


Fig 4

Fig 5

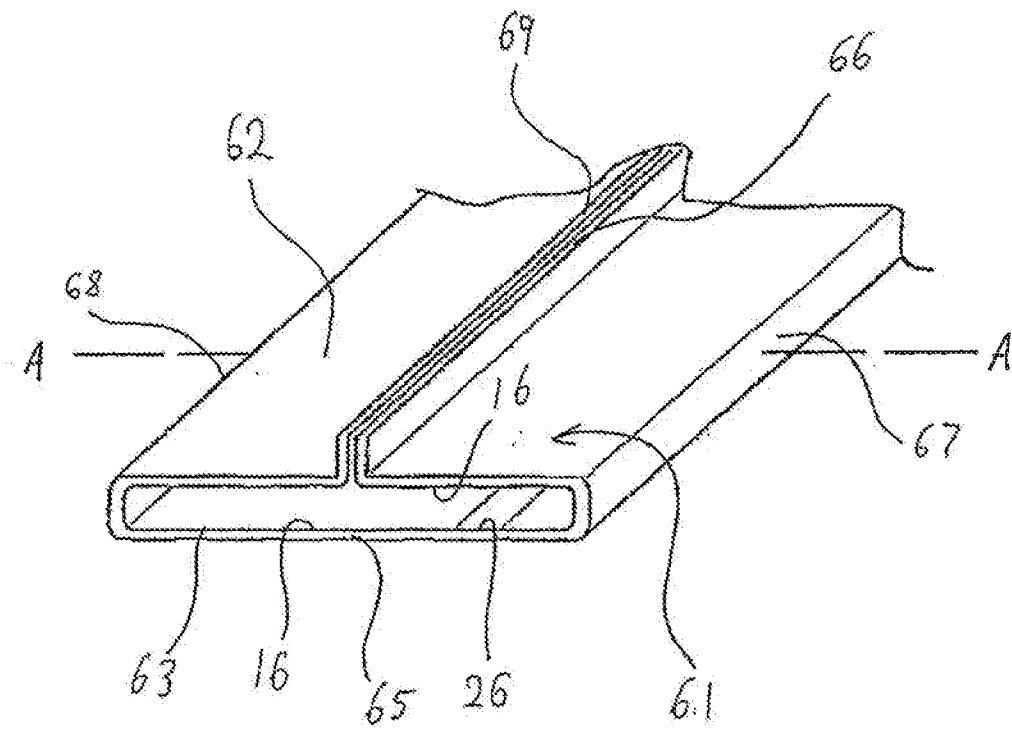


Fig 6

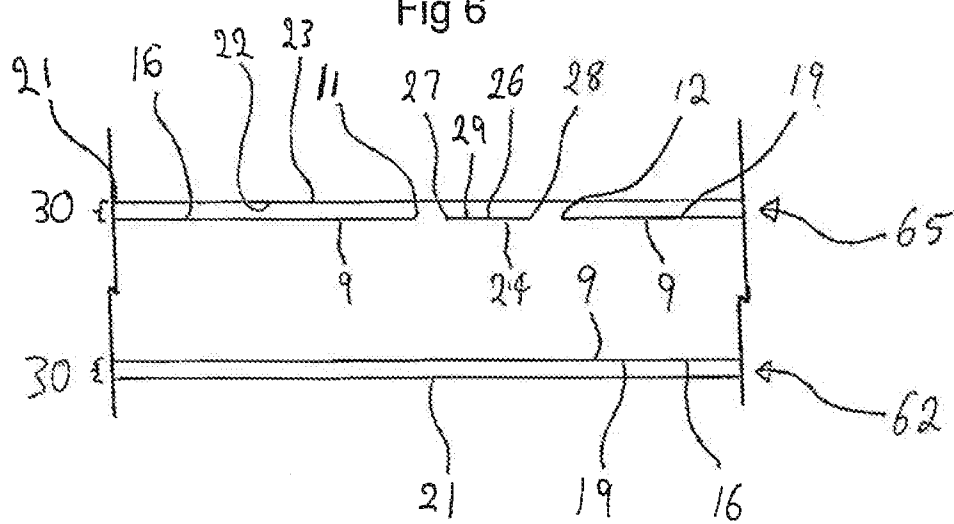


Fig 7

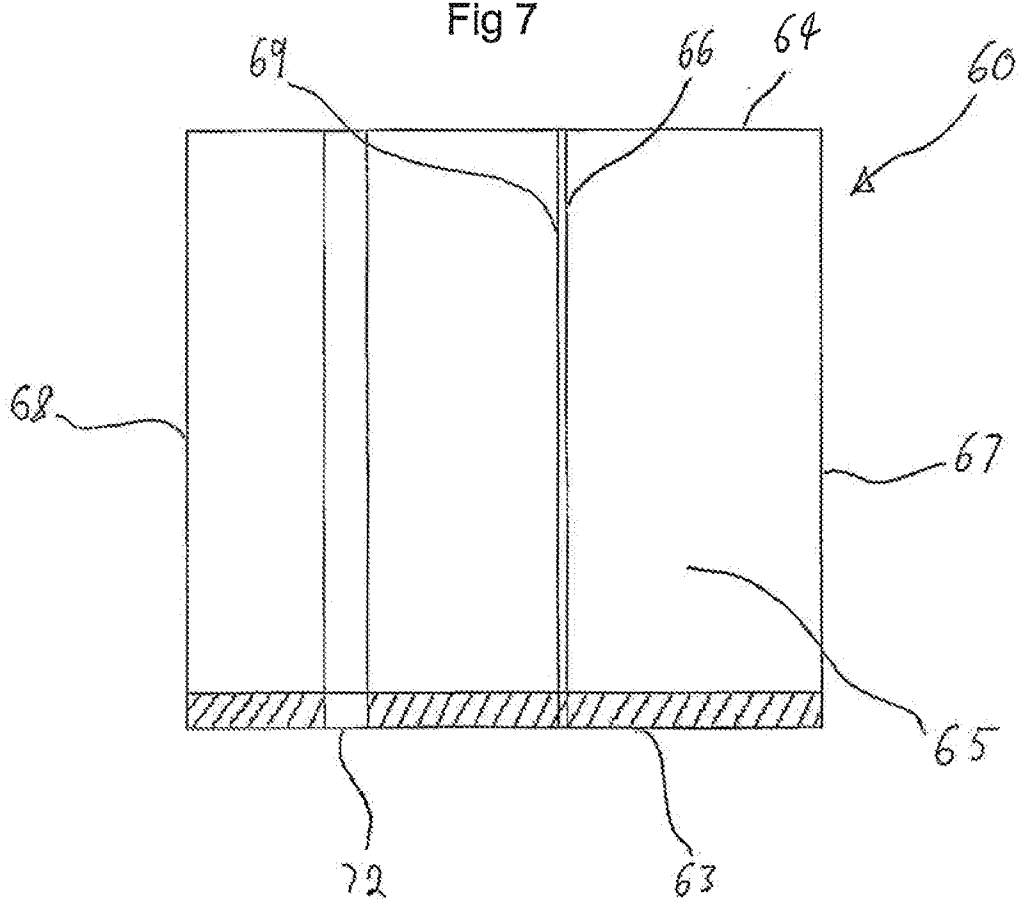


Fig 8

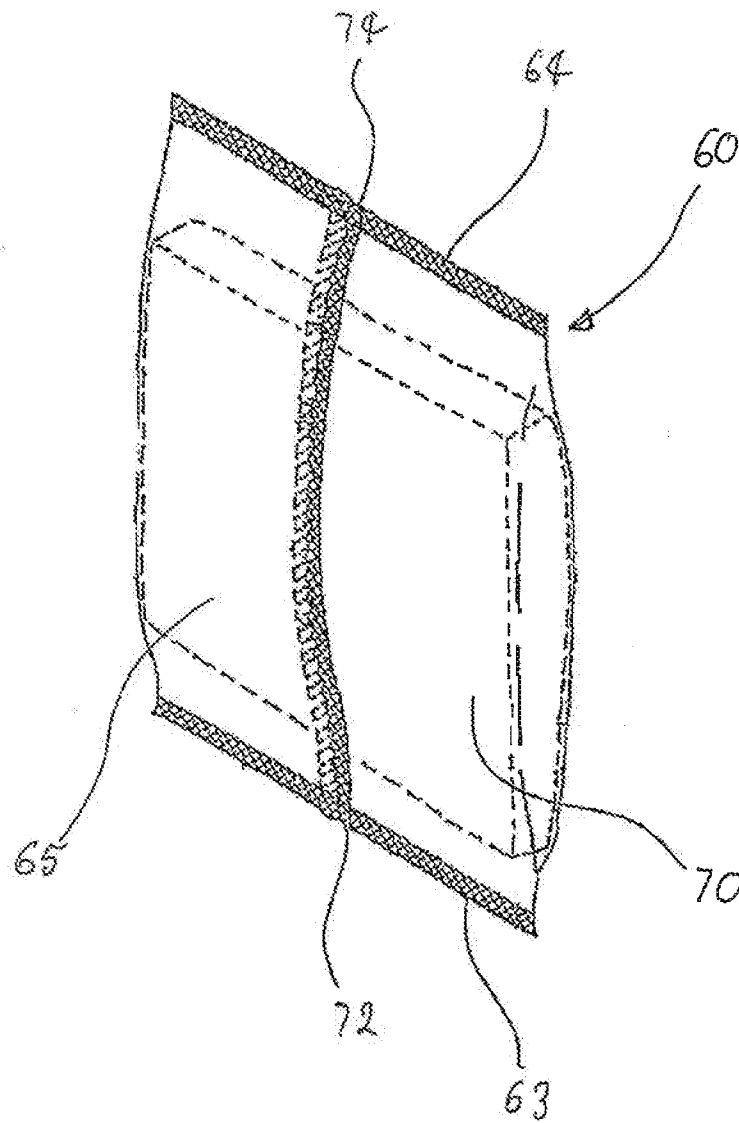
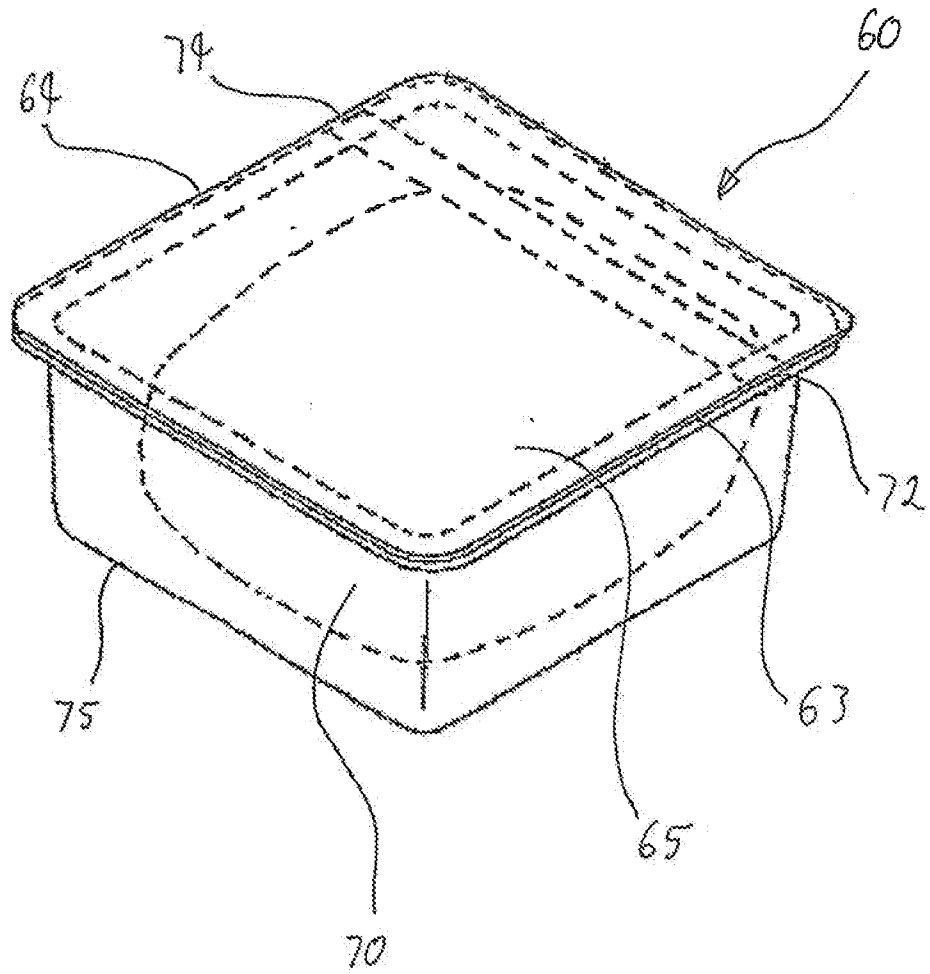
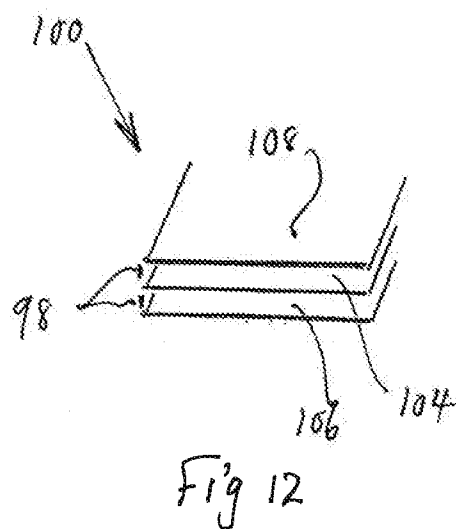
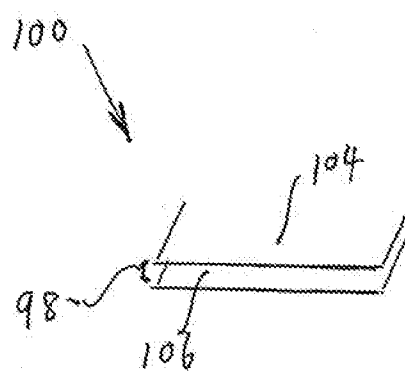
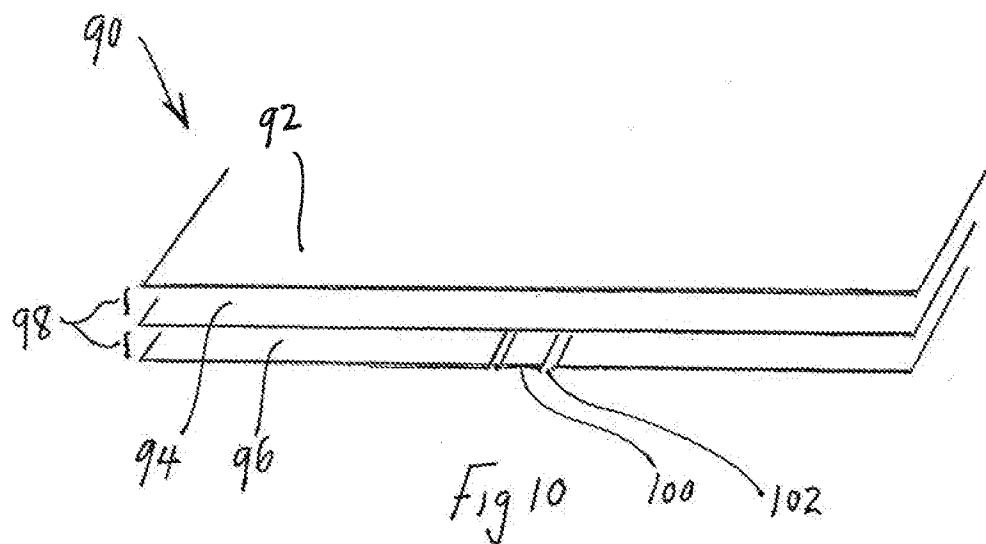


Fig 9





INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2009/000024

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

B32B 27/10 (2006.01)

B32B 27/08 (2006.01)

B65D 81/34 (2006.01)

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)

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 practicable, search terms used)

WPI & EPODOC: IPC: B32B 27/08; 27/10, 3/14, 3/16, 31/08, 31/10, 37/12, B29C 7/01, 9/00, B65D 81/00, 75/00, 65/00, 30/00, 33/00, 43/00, 51/00, B65B 25/00, 9/00 & keywords (laminate, multi layer, slit, strip, heat-weld, adhe+): Google Patents: Keywords (multi-layer, multiple, laminate, sheet, venting system, heat bond)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2007/0215610 A1 (SU et al.) 20 September 2007 Abstract; para 0007-0020, 0034, 0040, 0051, 0054-0056, 0060-0079; figs. 1, 4-10 Patent Abstracts of Japan JP 2003-285848 A (DAINIPPON PRINTING CO LTD) 7 October 2003 (Machine translation retrieved on 3 March 2009 from internet) http://www19.ipdl.inpit.go.jp/PA1/cgi-bin/PA1DETAIL	1-43
A	Abstract; para, 0004-0017; figs.1-7 Patent Abstracts of Japan JP 2006-298467 A (DIC PLASTICS INC) 2 November 2006 (Machine translation retrieved on 3 March 2009 from internet) http://www19.ipdl.inpit.go.jp/PA1/cgi-bin/PA1DETAIL	1-43
A	abstract; para 0009-0021; figs.1-4 US 6054698 A (Mast) 25 April 2000	1-43
A	Abstract; col 4, line 39 to col 8, line 34; example, claim 1; figs.1-2	1-43

☒ Further documents are listed in the continuation of Box C

☒ See patent family annex

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
03 March 2009

Date of mailing of the international search report
13 MAR 2009

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2009/000024

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1488924 B1 (BOREALIS AS et al.) 22 December 2004 Abstract; para 0001-0010	1-43
A	US 5226735 A (BELIVEAU) 13 July 1993 Abstract; col 2, line 22 to col 6, line 20; fig.3	15-43

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2009/000024

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
US	2007215610	CA 2642278	EP 1993835
		WO 2007106171	WO 2008086294
JP	2003285848	NONE	
JP	2006298467	NONE	
US	6054698	EP	0839737
EP	1488924	AU 2004249491	BR PI0411457
		CN 1805848	EP 1736310
		NO 20042582	NZ 544375
		WO 2004113072	US 2007166436
US	5226735	CA	2050145
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.			
END OF ANNEX			