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(71) Applicant: **Chesapeake Limited**
Phoenix Centre
Nottingham
Nottinghamshire NG8 6AW (GB)

(72) Inventors:
- **Turnoch, Richard**
  Leeds, West Yorkshire
  LS20 8BE (GB)
- **Davis, Nigel**
  Trowell
  Nottingham NG9 3QL (GB)

(74) Representative: **Leckey, David Herbert**
Dehns
10 Salisbury Square
London
Greater London EC4Y 8JD (GB)

(54) Forming sheet materials

(57) A method for forming an extensible sheet material comprises positioning a blank of sheet material (50) over a female forming cavity 10. The periphery of the sheet 50 is clamped around the periphery of the cavity 10. The sheet material is then pressed into the cavity by means of a male part 30. The clamping is effected by means of the periphery of the sheet material 50 being clamped between non-planar clamping surfaces 6, 22.

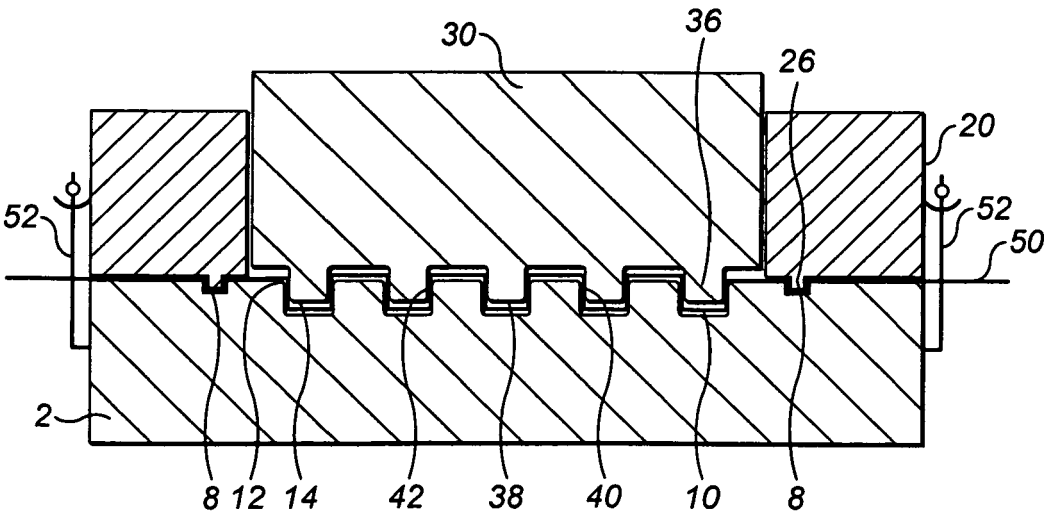

FIG. 4

EP 2 505 348 A2

Description

[0001] The present invention relates to forming a sheet material, particularly a fibre based sheet material, for example paperboard, used for example in packaging.

[0002] It is known to produce packaging such as trays from extensible sheet materials, for example extensible paperboard materials, by positioning a sheet of the material on a female form part having a cavity and pressing the sheet into the cavity in the female form part by means of a male part. Such a process is described for example in EP-A-1985437.

[0003] In EP-A-1985437, a two stage process is in fact described. In a first step, the sheet is unrestrained around its edge and is dragged into the cavity of the female part by the male part. This forms creases in the sheet. In a second step, the drawn sheet is restrained around its edge and deformed into the same or a different female mould part using the same or a different male part.

[0004] In other processes, the sheet material may simply be retained around its edges and drawn into the female part by the male part.

[0005] In such drawing processes, however, it has been found by the Applicant that it is extremely important that the sheet material is firmly retained around its edge. If this does not happen, then the sheet material may slip and be dragged into the mould (as in EP-A-1985437). This may lead to the severe creasing in the material and poor quality forming.

[0006] The present invention seeks to overcome or at least mitigate this problem.

[0007] From a first aspect the present invention provides a method for forming an extensible sheet material comprising:

positioning a blank of sheet material over a female forming cavity;
clamping the periphery of said sheet around the periphery of said cavity; and
pressing said sheet material into said cavity by means of a male part; wherein
said clamping is effected by means of said periphery of said sheet material being clamped between non-planar clamping surfaces.

[0008] From a second aspect the invention provides a tool for forming an extensible sheet material, the tool comprising:

a first, female tool part including a forming cavity;
a second tool part mountable to said first tool part for clamping a portion of said sheet material between opposing clamping surfaces of said first and second tool parts; and
a third, male tool part for insertion into said forming cavity; and wherein
said clamping surfaces are non-planar

[0009] Thus in accordance with the invention, rather than the extensible sheet material being clamped between two planar surfaces as for example disclosed in EP-A-1985437, it is clamped between non-planar surfaces. This improves the retention of the sheet material during the drawing process.

[0010] The non-planar surfaces may take a number of forms. For example, the surfaces may be formed with interengaging clamping formations. A series of clamping formations may be provided one outside the other to improve the clamping effect.

[0011] In one example, the surfaces may be provided with one or more interengaging step formations provided around the cavity.

[0012] In another arrangement, the surfaces may be provided with one or more interengaging channel and rib formations.

[0013] Most preferably the interengaging formations deform the sheet material through at least a 90° angle, thereby improving the retention. Thus the edges of the step or channel may therefore be perpendicular to the surrounding surface. However, the step or channel may be formed at an angle to the vertical, for example within 20° of the vertical.

[0014] The clamping formation is positioned at an appropriate spacing from the mould cavity. This can be determined empirically for each application.

[0015] Similarly the optimum dimensions of the formations can be determined empirically. In one embodiment however, a channel may be 1 mm wide and the complementary rib 0.5 mm wide. The channel may typically be 2 mm deep.

[0016] The end surface of the male tool part which is pressed into the sheet material is shaped to give the desired profile to the formed sheet product. It will be understood that the shape of the formed sheet will be determined by the male tool part. The cavity in the female part does not need to closely complement the shape of the male tool part. However, depending on the intricacy of the shape being formed it may be desirable to have the male tool part bottom out in the female part cavity in order to provide the necessary definition. It is desirable that peripherally, the cavity should provide sufficient clearance with the male tool part so that it does not interfere with the deformation of the sheet material by the male tool part as it moves into the cavity.

[0017] In one example, where the tool is being used for producing blister packs for example, the end surface of the tool part may be formed with a plurality of spaced apart projections each of which will form a blister formation on the formed sheet.

[0018] The female tool part may have a plurality of forming cavities each engaged by a corresponding male tool part. The clamping may be effected around individual cavities or around the array of cavities, depending on the particular application.

[0019] The distance the male tool part is inserted into the female tool part will depend on the particular material

being formed and the desired final shape of the sheet. The skilled person will be able empirically to determine how far the male tool part can be inserted without causing rupture or unacceptable thinning of the sheet material.

[0020] The male tool part and the periphery of the female forming cavity should preferably have no sharp edges which might cause tearing of the sheet material during its deformation. Thus the forming edges in the tool parts are preferably curved.

[0021] The material used in the invention is an extensible sheet material. Preferably the material is an extensible fibre based sheet material for example a paperboard material such as a FibreForm board material produced by Billerud.

[0022] The material should preferably have an extensibility of at least 0.1 and more preferably at least 0.13. By extensibility is meant the strain at breakage of the material (as determined by IS01924-3:2005 (E) divided by 100. The extensibility may also be expressed as a percentage, namely the extensibility multiplied by 100. Thus the material preferably has an extensibility of at least 10%, more preferably at least 13%.

[0023] As stated above, the invention is preferably used in packaging. It allows shapes of package to be produced which previously could only have been produced by a plastics moulding technique. From a further aspect, therefore, the invention provides a container having a product containing pocket formed in a sheet material formed in accordance with the invention.

[0024] From a further aspect the invention provides a blister pack comprising a capsule receiving body having a plurality of capsule receiving pockets formed therein and formed from a stretched paper based board material and a film sealed over the pockets.

[0025] Some preferred embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 shows an exemplary first tool part;
Figure 2 shows an exemplary second tool parts;
Figure 3 shows an exemplary third tool part; and
Figure 4 shows a schematic vertical cross section through the assembled tool parts.

[0026] With reference to Figure 1, a first, female tool part 2 of a tool in accordance with the invention for producing blister packs is shown. The first toll part 2 comprises a body 4 having an upper surface 6. The upper surface 6 is formed with a channel 8 which surrounds an array of cavities 10. The channel 8 and upper surface 6 together form a first non-planar clamping surface.

[0027] In this embodiment, the first tool part 2 is of a moulded plastics material and the channel 8 may be formed by being moulded into the upper surface 6 or by being machined, e.g. milled or laser cut, into the upper surface 6 after moulding

[0028] The channel 8 is about 2 mm deep and 2 mm wide in this embodiment, but other sizes of channel 8 are contemplated within the scope of the invention. The dimensions of the channel will be determined by, amongst other things, the thickness of the sheet material being formed.

[0029] Each cavity 10 is generally racetrack shaped in this embodiment and has an upper edge 12 which is rounded or chamfered. This is to avoid tearing or damaging of the sheet material as it is deformed around this edge 12.

[0030] The inner wall 14 of each cavity tapers slightly inwardly, for example at an angle of 2 to 5° to the vertical.

[0031] The upper surface 6 is also formed with a number of locating apertures 16.

[0032] Figure 2 shows a second tool part 20. This second tool part 20 has a lower surface 22 (shown uppermost in Figure 2 for clarity purposes). A central cavity 24 extends through the second tool part 20. Arranged around the central cavity 24 is an upstanding rib 26. The rib 26 and lower surface 22 together constitute a second non-planar clamping surface.

[0033] The rib 26 may for example be about 1.5 mm high and 1.0 mm wide and project at 90° to the lower surface 22 such that it may be received in the channel 8 of the first tool part 2 with a sheet of material arranged between them. Again the dimensions of the rib 26 are determined taking into account the thickness of the sheet material being formed.

[0034] In this embodiment the rib 26 is formed integrally with the second tool part 20, which is preferably moulded but it could for example be formed as a separate element mounted thereto.

[0035] The surface 22 is also provided with a number of locating members 28 for location in the locating apertures 16 of the first tool part 2.

[0036] The central cavity 24 of the second tool part 20 slidably receives a third, male tool part 30 shown in Figure 3. The male tool part 30 has outer wall 32 which is complementary in shape to the shape of the central cavity 24 and a lower end surface 34 (shown uppermost in Figure 3 for clarity).

[0037] The lower end surface 34 of the male tool part 30 is formed with a plurality of spaced apart projections 36. As shown in Figure 4, these projections 36 are to be received in the cavities 10 of the female tool part 2 and as such are arranged in a complementary array to that of the cavities 10. The shape of the lower surface 34 corresponds to the desired shape of the sheet product to be formed by the tool.

[0038] Each projection 36 has a flat lower surface 38 and an inclined side wall 40. The edge 42 formed between the lower surface 38 and the side wall 40 is rounded or chamfered to avoid tearing of the sheet material as it is deformed about this edge 42.

[0039] The horizontal cross section of the projections 36 is generally complementary to that of the cavities 10, but the projections 36 are preferably dimensioned such that the side walls 40 of the projections 36 do not come into contact with the internal walls 14 of the cavities 10

or do not trap sheet material being formed between them. Thus typically the angle of inclination of the side walls 40 is greater than that of the internal walls 14, for example by 2° or more.

[0040] In use, a piece of extensible fibre based sheet material 50 preferably of a paper based material for example a paperboard material is positioned on the upper surface 6 of the tool part 2 so as to project outwardly of the channel 8. The sheet material should preferably have an extensibility of at least 0.10 (10%) and preferably at least 0.13 (13%). Such paper based materials are available from, for example, Billerud AS.

[0041] The second tool part 20 is then placed over the first tool part 2 with the locating members 26 locating in the locating apertures 16. This properly aligns the first and second tool parts 2, 20 so that the rib 26 of the second tool part is located over the channel 8 of the first tool part 2.

[0042] The first and second tool parts 2, 20 are then clamped together by suitable clamping means. For example, an external clamp such as a toggle clamp 52 illustrated schematically in Figure 4 may be provided between the mould parts. In another arrangement, fasteners may extend through the tool parts to clamp them together. Alternatively, external pressure may simply be applied one or both of the tool parts. Any form of clamping is contemplated within the scope of the invention

[0043] The clamping will cause the rib 26 to push the sheet material 50 into the channel 8 thereby not only clamping the sheet material 50 between the opposed clamping surfaces 6, 22 but between the rib 26 and the channel 8 to provide additional clamping.

[0044] Once the sheet material 50 has been clamped in place, the male tool part 30 may be pressed onto the sheet material 50 such that the projections 36 enter the cavities 10. As the periphery of the sheet material 50 is firmly retained by the clamping mechanism described above, the sheet material 50 will not be dragged into the cavities 10. Rather it will be stretched and drawn into the cavities 10 by the projections 36. The rounding of the edges 12, 42 on the cavities 10 and the projections 36 will avoid tearing of the material at these points. Moreover the clearance between the walls 14, 40 of the cavities and projections will allow the sheet material to be drawn smoothly into the cavities 10 by the male tool part 30.

[0045] The sheet material 50 will therefore assume the shape of the end surface 34 the male tool part 30 and will not be crimped or otherwise deformed due to slippage of the sheet material 50 in the tool.

[0046] After forming, the tool parts 2, 14 may be separated and the formed sheet removed. The sheet may then be trimmed to remove excess material which may or may not include the deformed clamped part. In the present embodiment, the sheet 50 will be preferably be trimmed to leave a peripheral flange of an appropriate size surrounding a plurality of blister-like formed pockets. The pockets may then be filled with product and a film then sealed around the flange to close the pack.

[0047] It will be understood that the desired shape of the sheet material will depend on its final application. As discussed above, the formed sheet is advantageously used in packaging, for example in the production of blister packs. However, other packages are easily made using the described method.

[0048] In a simple embodiment, the formed sheet may simply assume a tray-like shape after forming. In this case, a single cavity and projection of the appropriate shape may be formed on the respective female and male tool parts.

[0049] Two formed sheet members may be joined together around their edges for example, to form a package. An example of this type of packaging would be a clam-shell type package.

[0050] In another example, a living hinge may be formed in the sheet during the forming process and the formed sheet then folded about the hinge to form a package.

[0051] These are just examples of possible packages using a formed sheet material and other possible constructions will be apparent to the skilled person.

[0052] Also, the invention is not limited to package production and the formed sheet may be used in any desired application.

[0053] It will be appreciated that the described tool is merely exemplary and that other tool constructions will fall within the scope of the invention.

[0054] For example the described rib/channel arrangement could be replaced by a step/step arrangement. i.e. with respective steps formed in the surfaces 6, 22. Also, the rib/channel could possibly be of other shapes e.g. V-shaped or U-shaped. Moreover, more than one set of interengaging formations may be provided. Thus there could be a series of two or more formations formed one outside the other. Also, the rib and channel may be formed on either of the first and second tool parts. The rib may be integrally formed in the respective tool part or a separate member attached to it. It is also possible that the channel could be formed as a separate member inlaid into the respective tool part.

[0055] Also, locating features such as those described may or may not be necessary and may be omitted in certain embodiments.

Claims

1. A method for forming an extensible sheet material comprising:

positioning a blank of sheet material over a female forming cavity;
clamping the periphery of said sheet around the periphery of said cavity; and
pressing said sheet material into said cavity by means of a male part; wherein
said clamping is effected by means of said pe-

riphery of said sheet material being clamped between non-planar clamping surfaces.

2. A tool for forming an extensible sheet material, the tool comprising:

a first, female tool part including a forming cavity;
a second tool part mountable to said first tool part for clamping a portion of said sheet material between opposing clamping surfaces of said first and second tool parts; and
a third, male tool part for insertion into said forming cavity; and wherein
said clamping surfaces are non-planar

3. A method or tool as claimed in claim 1 or 2 wherein the material is an extensible fibre based sheet material, for example an extensibility of at least Q.1 I and more preferably at least 0.13.

4. A method or tool as claimed in any preceding claim wherein the clamping surfaces are formed with interengaging clamping formations, for example a series of clamping formations provided one outside the other.

5. A method or tool as claimed in claim 4 wherein the clamping surfaces are provided with one or more interengaging step formations provided around the cavity.

6. A method or tool as claimed in claim 4 or 5 wherein the clamping surfaces are provided with one or more interengaging channel and rib formations.

7. A method or tool as claimed in any of claims 4 to 6 wherein the interengaging formations deform the sheet material through at least a 90° angle, for example wherein the edges of the step or channel are perpendicular to the surrounding surface.

8. A method or tool as claimed in claim 4, 5 or 6 wherein the step or channel is formed at an angle to the vertical, for example within 20° of the vertical.

9. A method or tool as claimed in any preceding claim wherein the end surface of the male tool part which is pressed into the sheet material is shaped to give the desired profile to the formed sheet product.

10. A method or tool as claimed in any preceding claim wherein the male tool part bottoms out in the female part cavity.

11. A method or tool as claimed in any preceding claim wherein the cavity provides clearance with the male tool part so that it does not interfere with the deformation of the sheet material by the male tool part as it moves into the cavity.

12. A method or tool as claimed in any preceding claim wherein the end surface of the male tool part is formed with a plurality of spaced apart projections for forming a blister formation on the formed sheet.

13. A method or tool as claimed in claim 12 wherein the female tool part comprises a plurality of forming cavities each engaged by a corresponding male tool part, and wherein optionally clamping is effected around individual cavities or around an array of cavities.

14. A method or tool as claimed in any preceding claim wherein the forming edges in the tool parts are curved.

15. A blister pack comprising a capsule receiving body having a plurality of capsule receiving pockets formed therein and formed from a stretched paper based board material and a film sealed over the pockets.

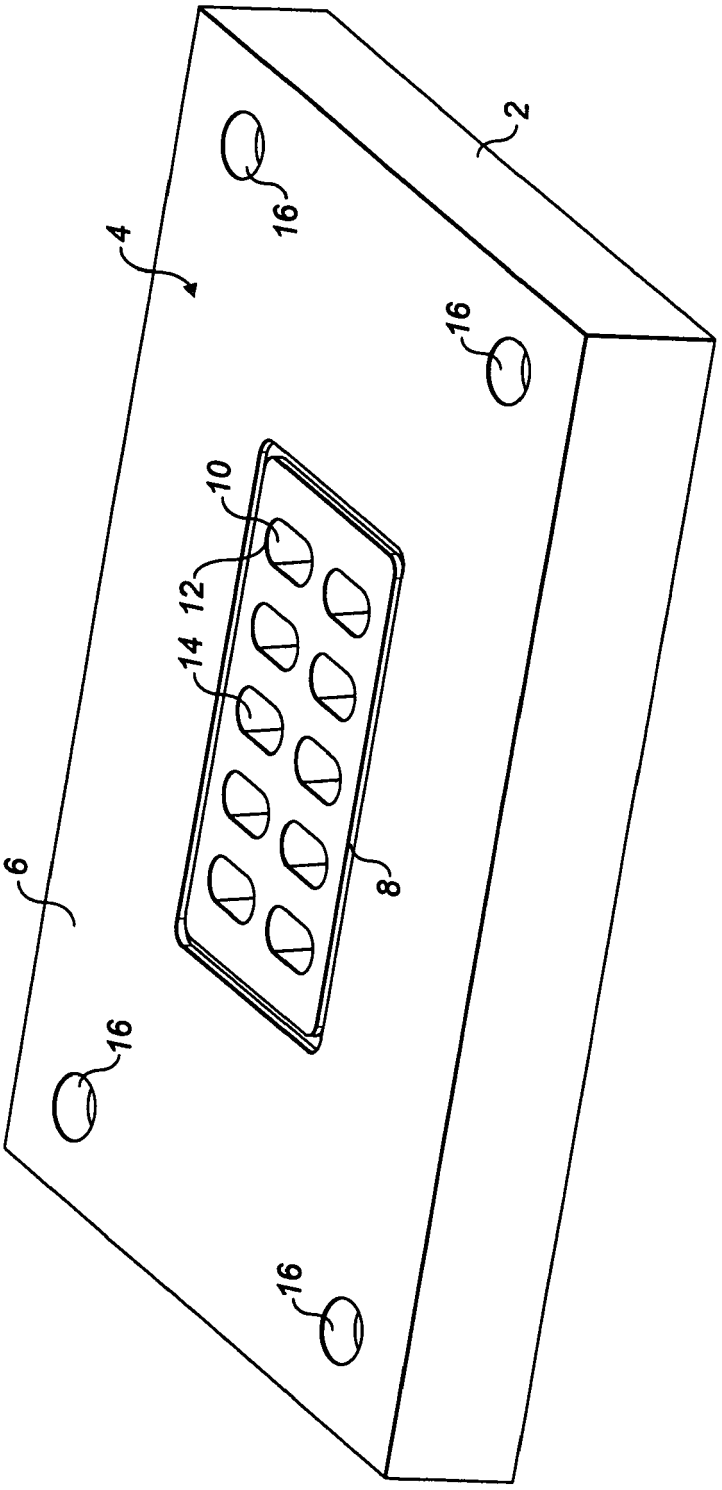

FIG. 1

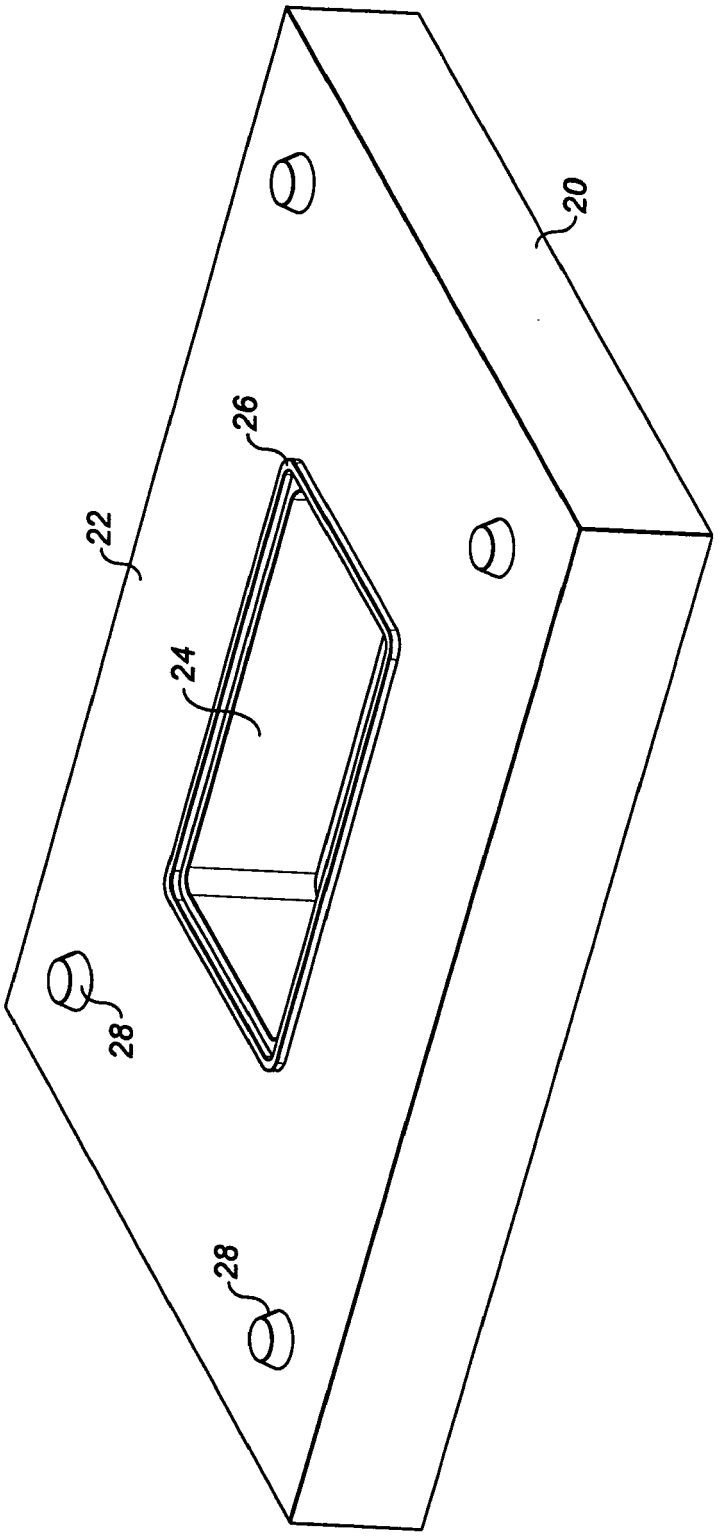

FIG. 2

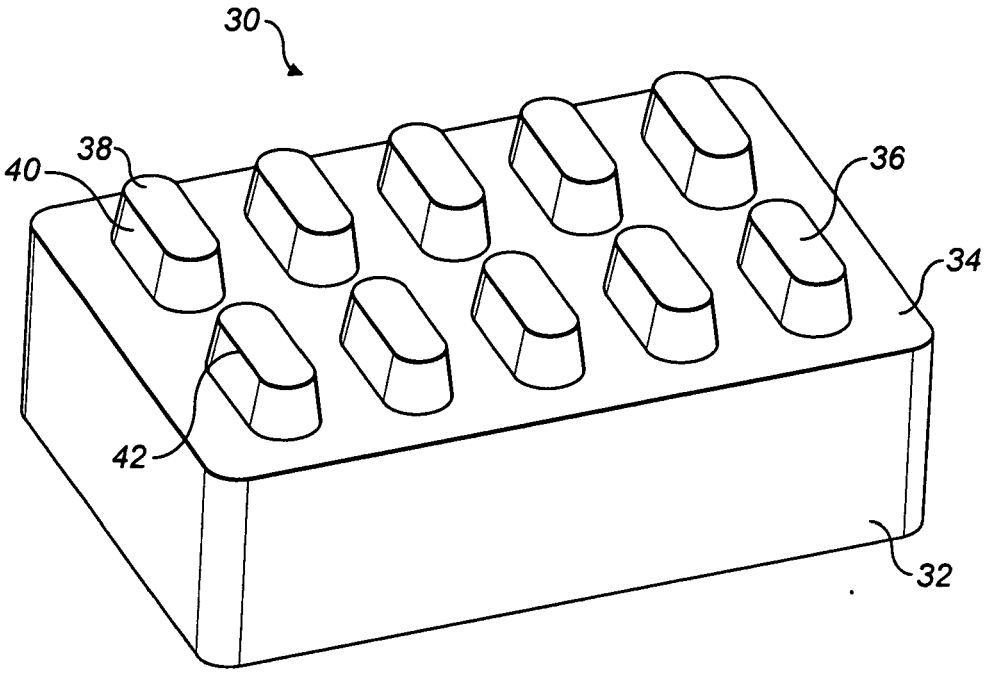

FIG. 3

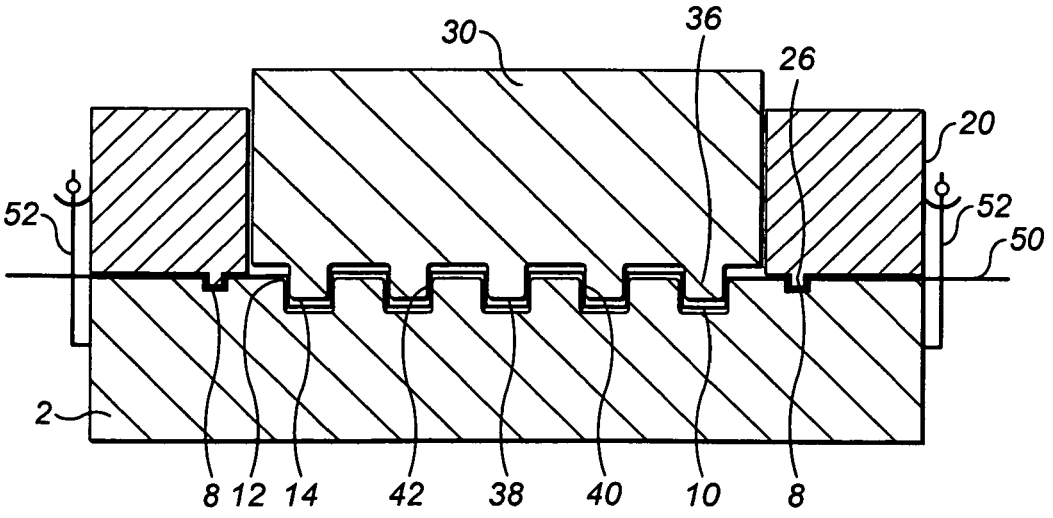

FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1985437 A **[0002] [0003] [0005] [0009]**