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(54) SURFBOARD AND METHOD OF MANUFACTURING

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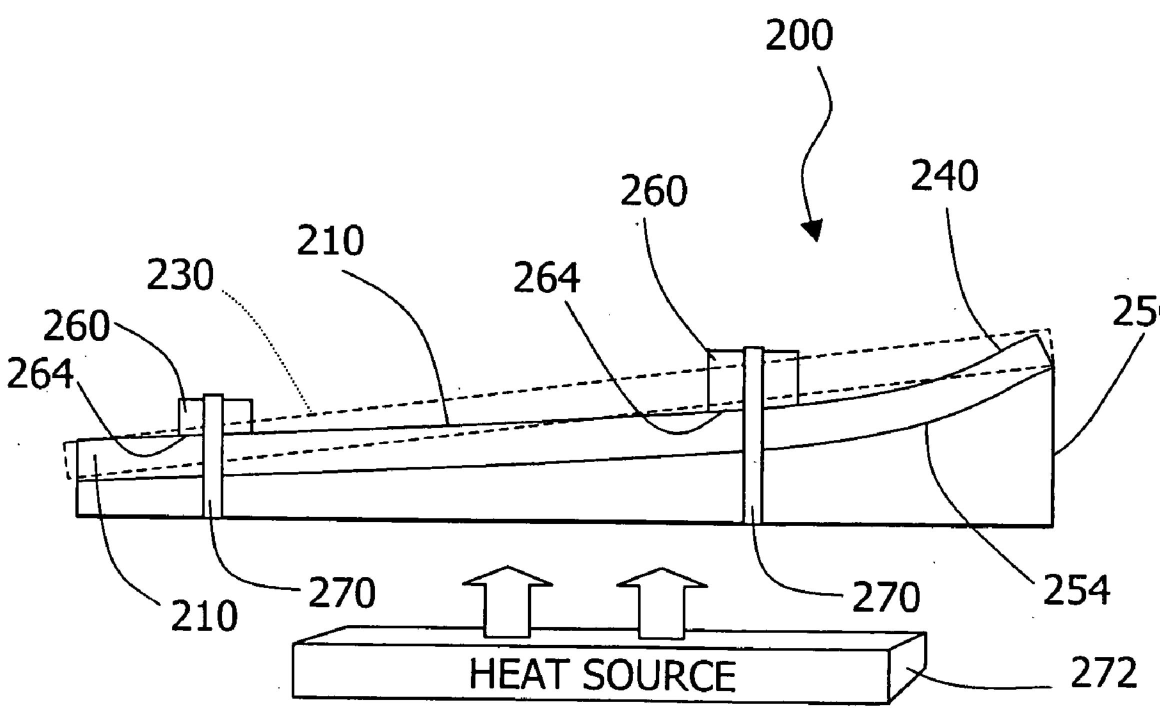
(57) ABSTRACT

A surfboard includes a core covered with a laminate and having perforations where the user places his feet, in order to prevent air blisters from forming between the core and laminate. The core is formed from an extruded closed-cell polystyrene foam block which has been shaped by restraining it against a shaped form using shaped restraining tools and straps, and heating it; and by cutting using a hot wire. The core is laminated with FIBERGLAS® and epoxy resin, and the perforations are formed using a perforating tool that has a planar or curved working surface and one or more heated needles extending perpendicularly from the working surface.



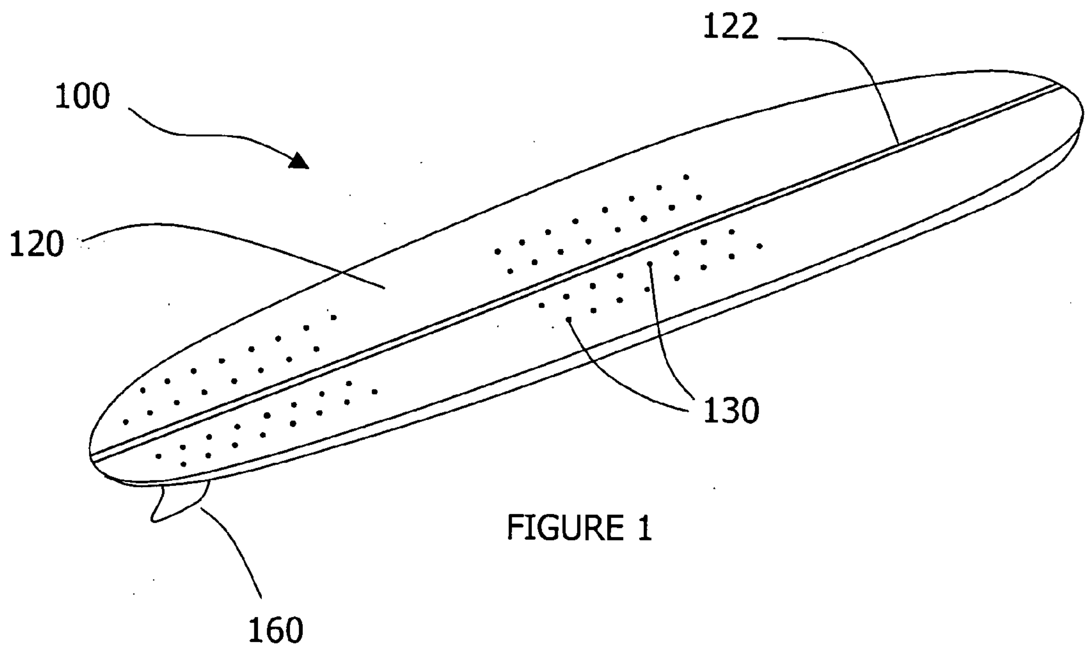


FIGURE 1

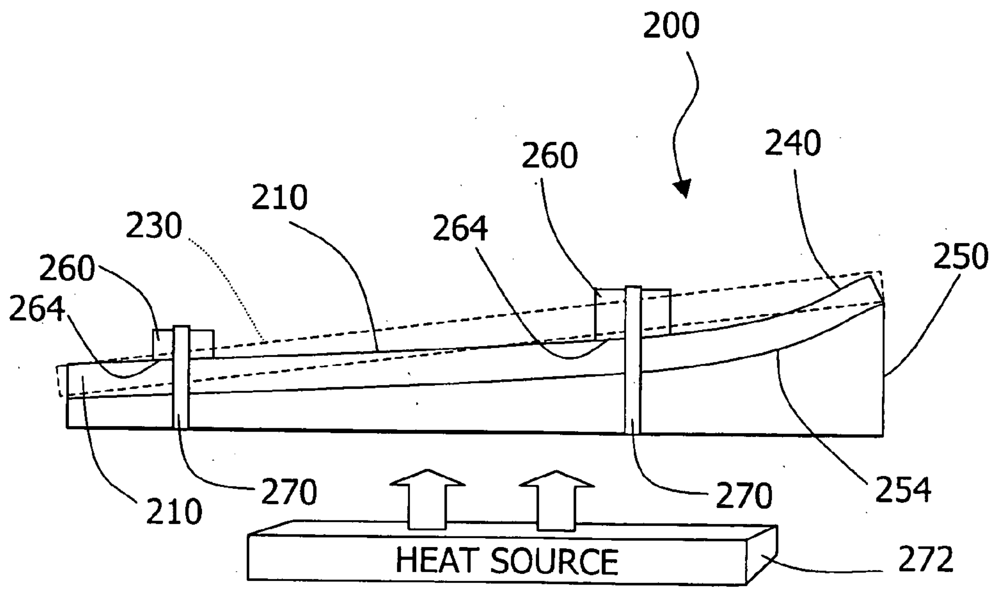


FIGURE 2A

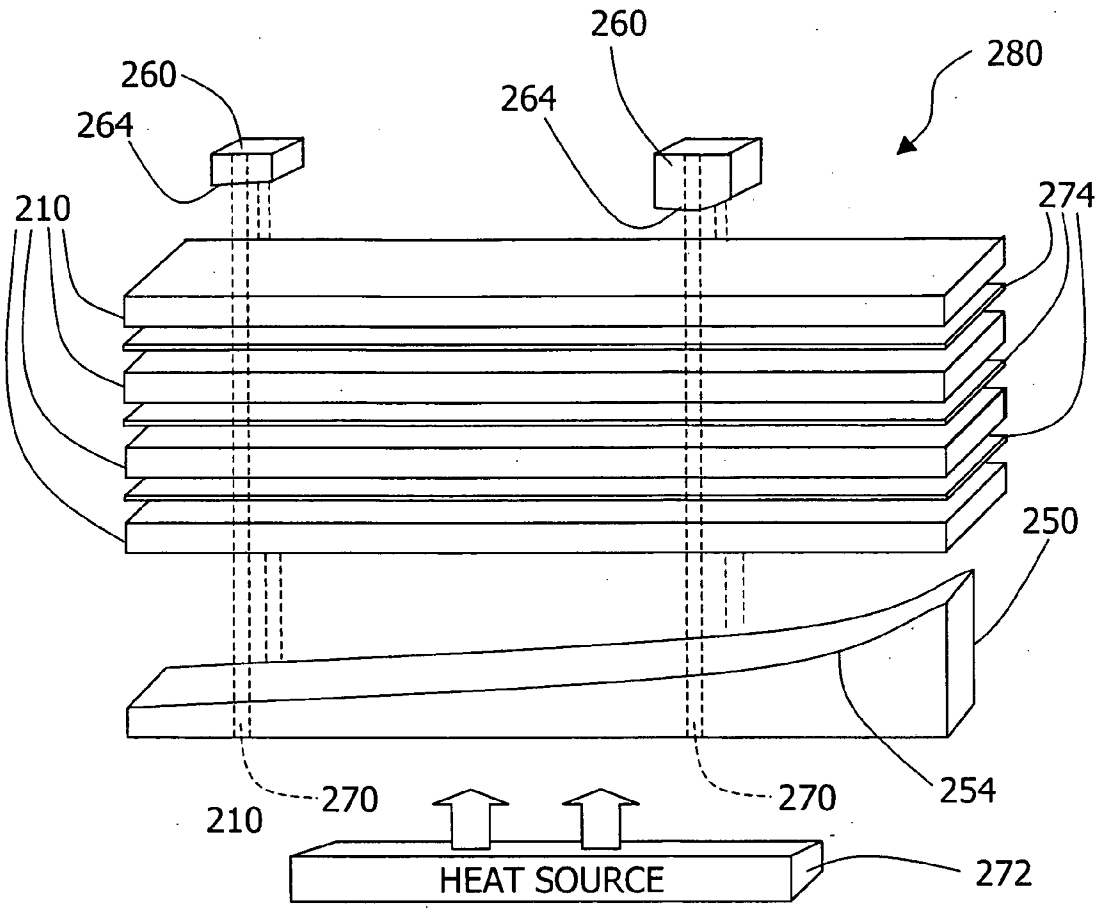


FIGURE 2B

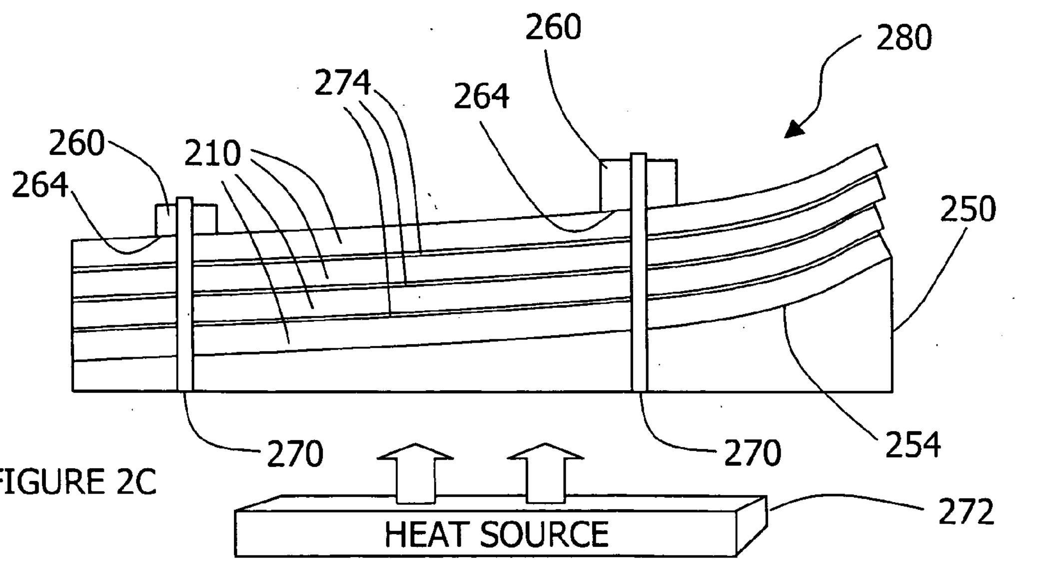


FIGURE 2C

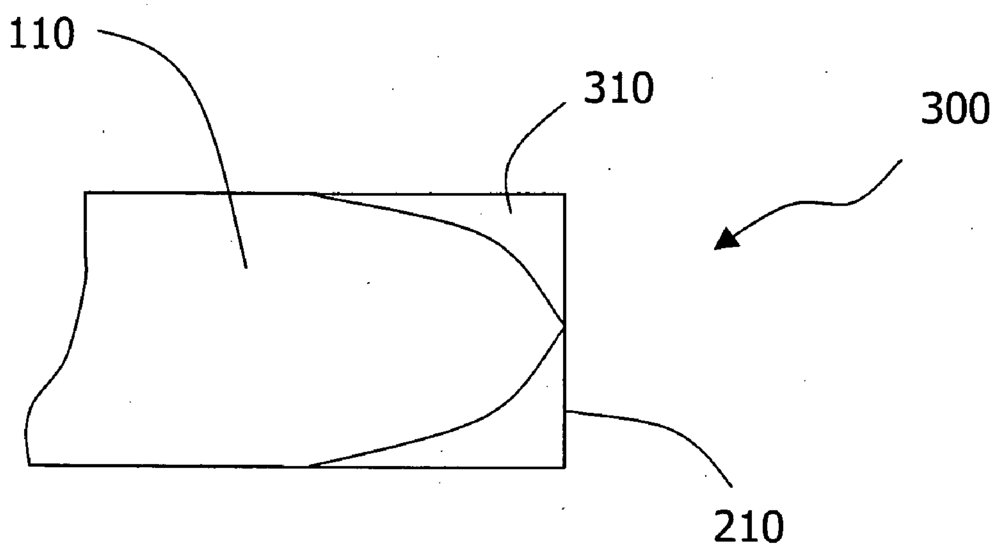


FIGURE 3

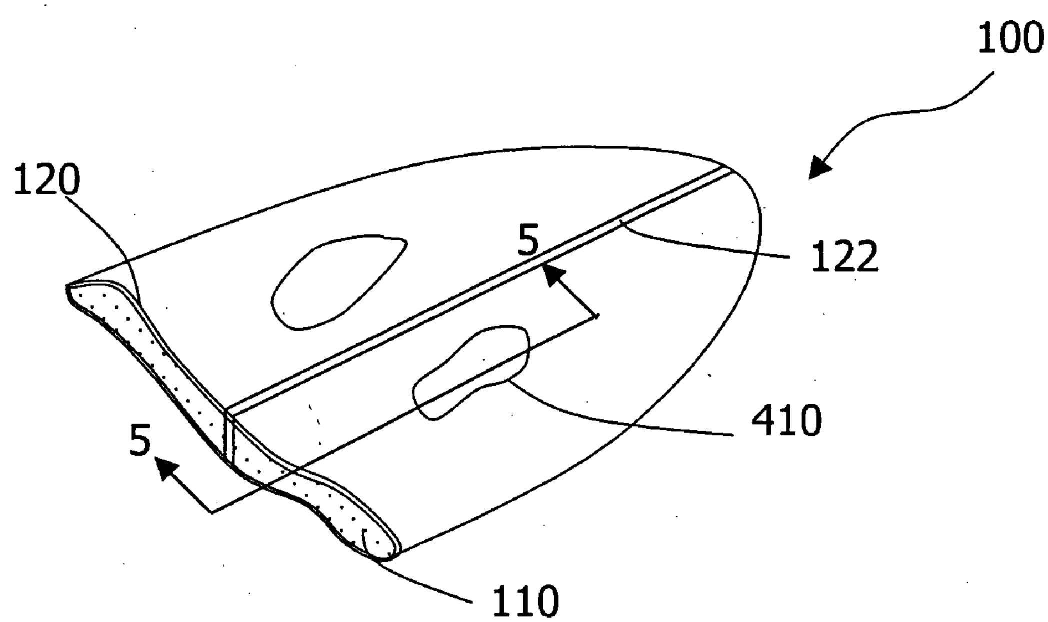


FIGURE 4

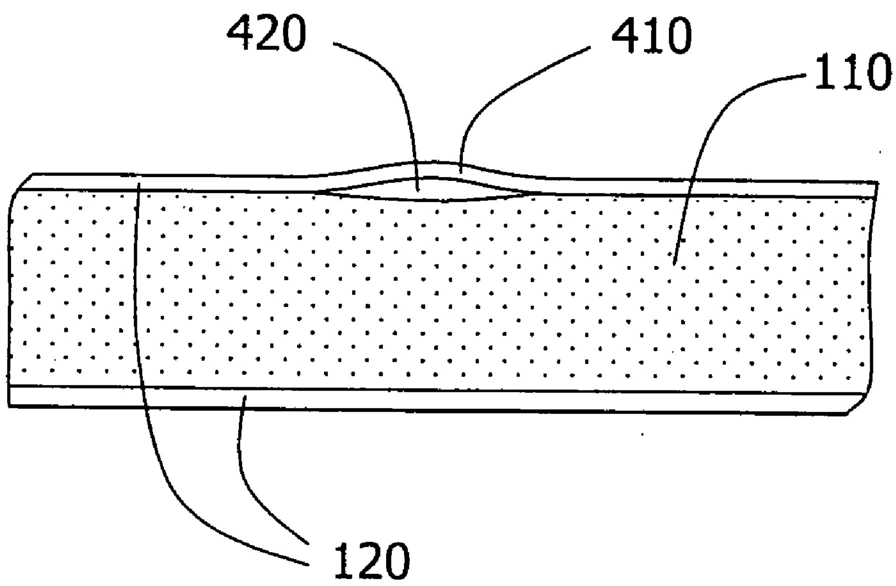


FIGURE 5

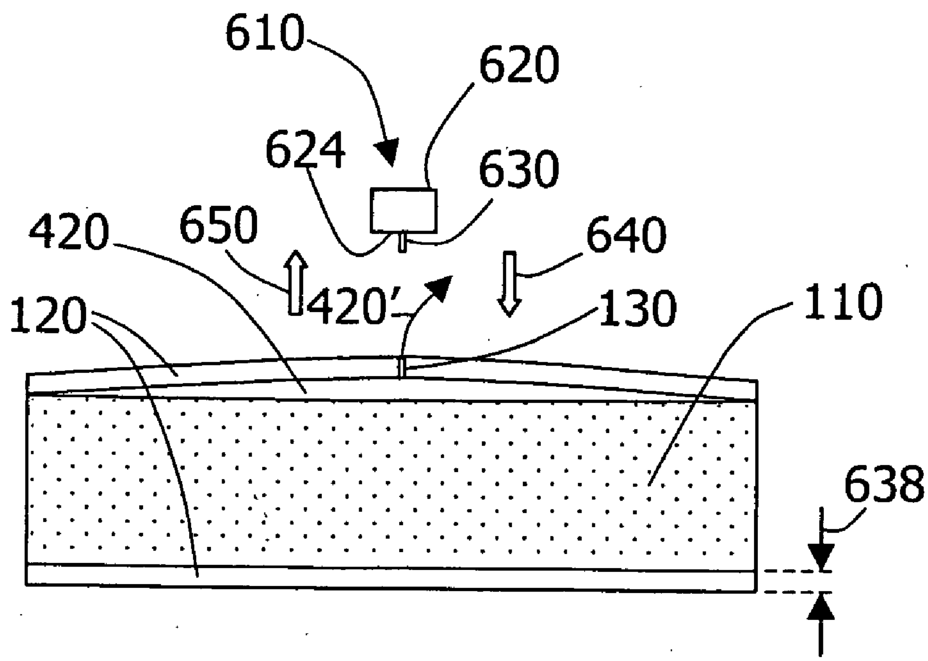


FIGURE 6

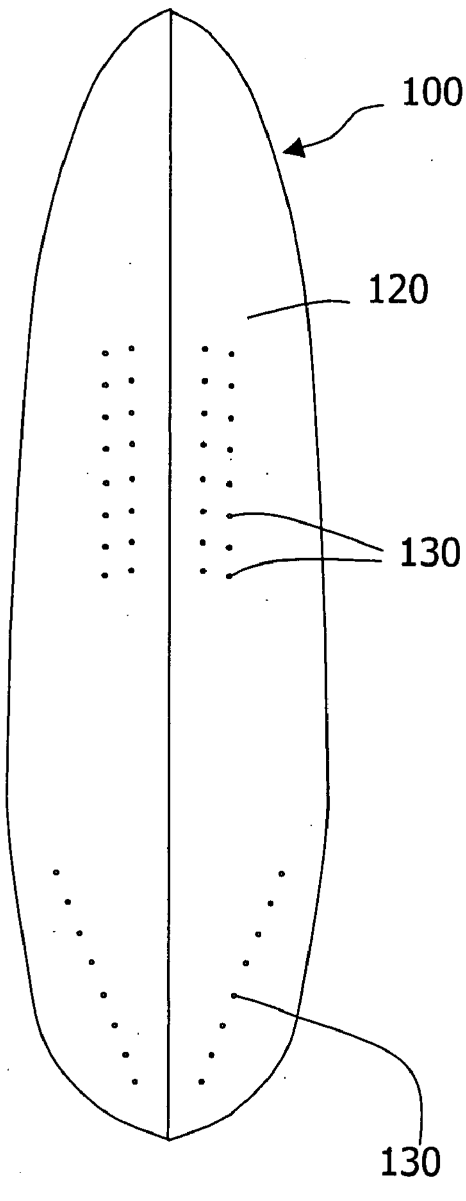


FIGURE 7

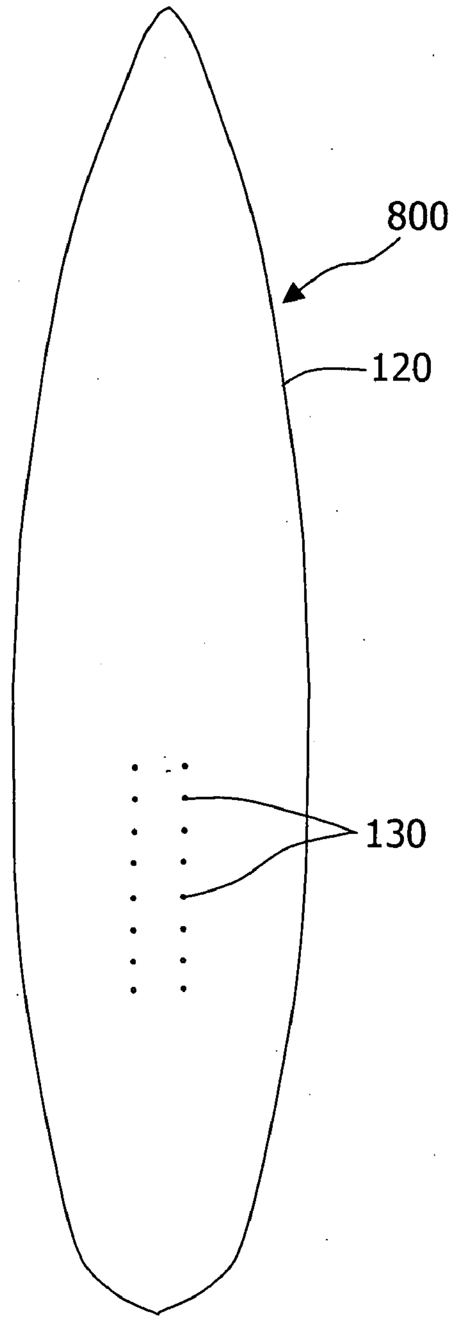


FIGURE 8

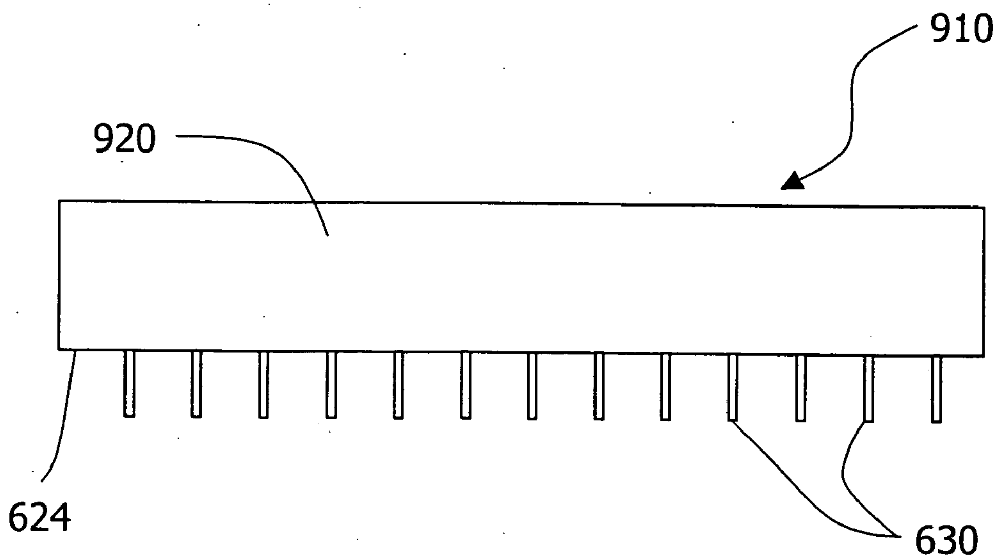


FIGURE 9

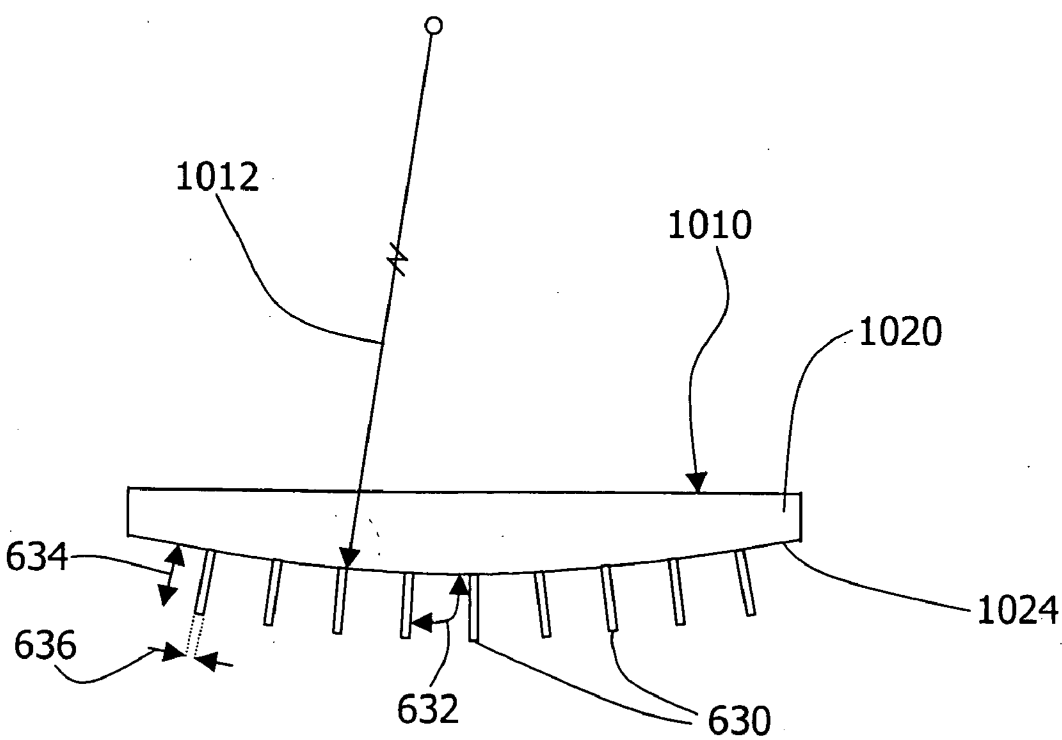


FIGURE 10

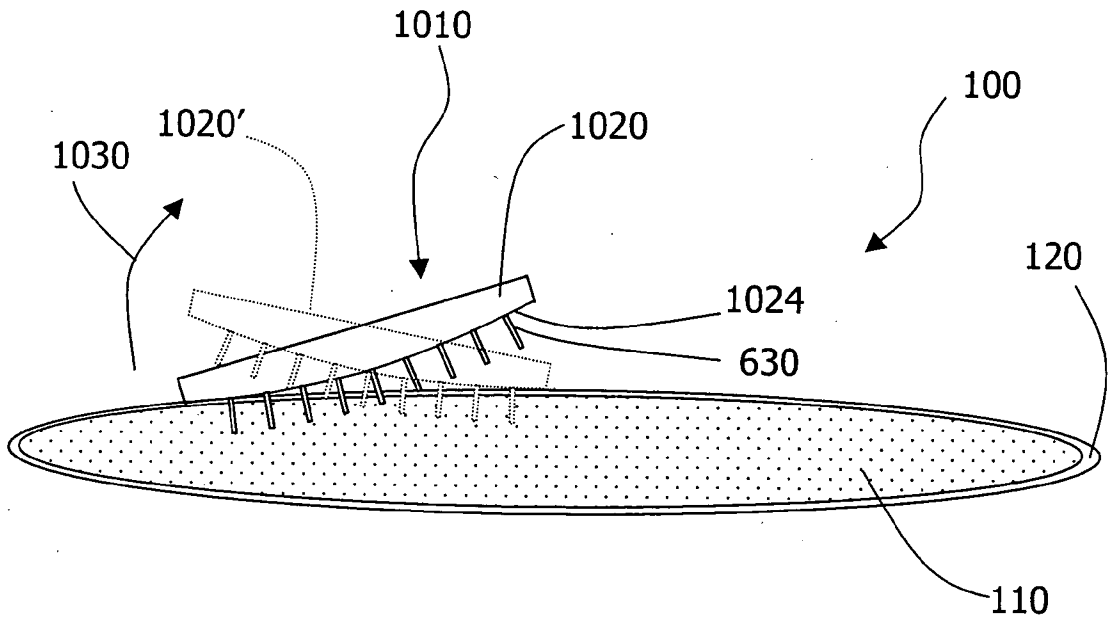


FIGURE 11

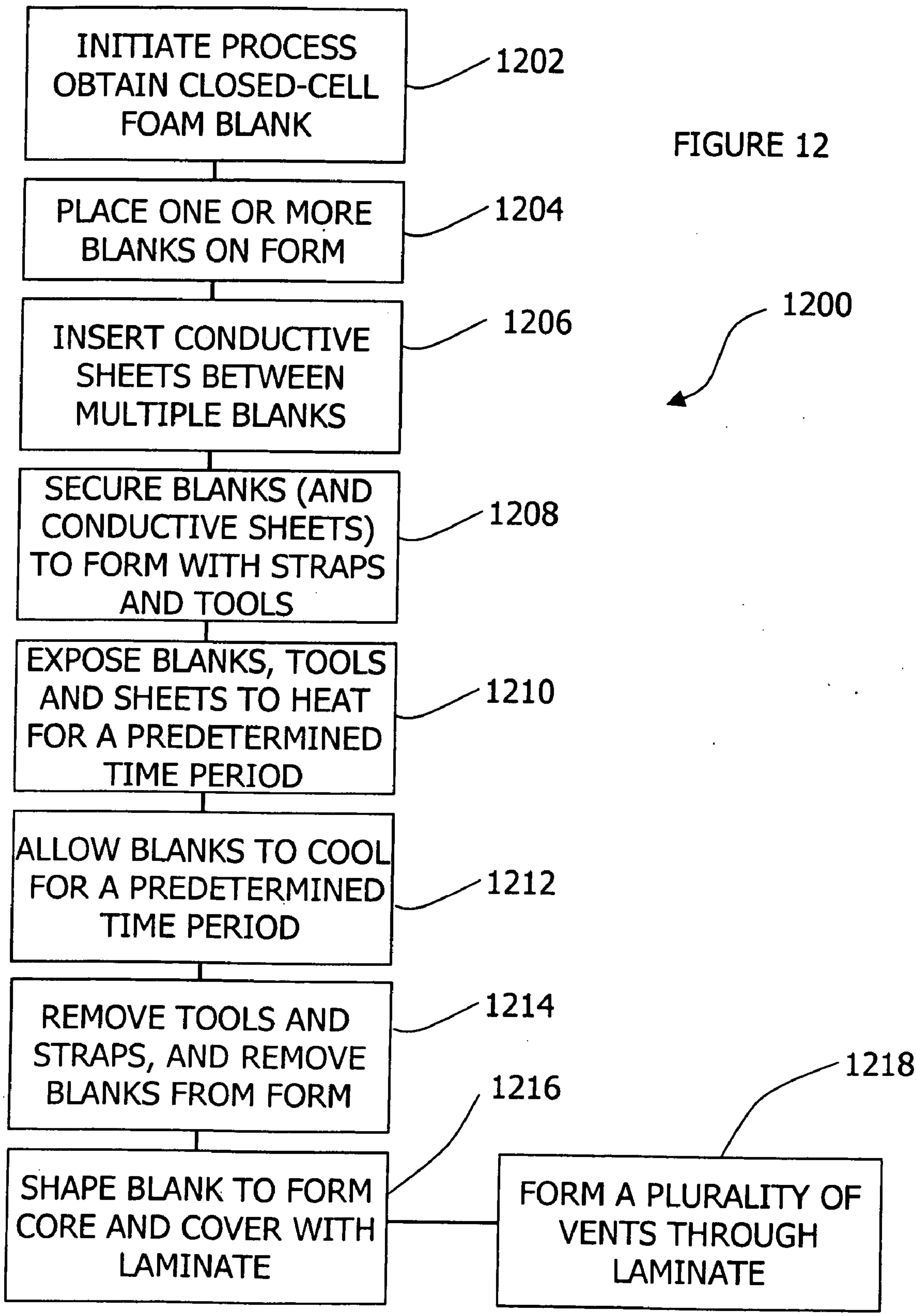

INITIATE PROCESS OBTAIN CLOSED-CELL FOAM BLANK
1202
PLACE ONE OR MORE BLANKS ON FORM
1204
INSERT CONDUCTIVE SHEETS BETWEEN MULTIPLE BLANKS
1206
SECURE BLANKS (AND CONDUCTIVE SHEETS) TO FORM WITH STRAPS AND TOOLS
1208
EXPOSE BLANKS, TOOLS AND SHEETS TO HEAT FOR A PREDETERMINED TIME PERIOD
1210
ALLOW BLANKS TO COOL FOR A PREDETERMINED TIME PERIOD
1212
REMOVE TOOLS AND STRAPS, AND REMOVE BLANKS FROM FORM
1214
SHAPE BLANK TO FORM CORE AND COVER WITH LAMINATE
1216
FORM A PLURALITY OF VENTS THROUGH LAMINATE
1218
1200

FIGURE 12

SURFBOARD AND METHOD OF MANUFACTURING

RELATED APPLICATIONS

[0001] This application is a divisional of U.S. patent application Ser. No. 10/403627, filed Mar. 28, 2003, and currently co-pending.

FIELD OF THE INVENTION

[0002] The present invention relates generally to water sports equipment. The present invention relates more particularly, though not exclusively, to a water sports board made of laminated closed-cell foam with perforation vents in the laminate for preventing deformations of the surface of the board. The present invention is useful for surfboards, sailboards, wave skis and other applications requiring buoyant, rigid, and durable boards.

BACKGROUND OF THE INVENTION

[0003] Many water sports boards and craft (e.g., surfboards, sailboards, wave skis, etc.) are made of expanded open-cell rigid polymer foam. Where the discussion herein refers to a surfboard or "board", it applies to surfboards, sailboards, body boards, wave skis, and other types of water sports boards and craft as well. To make a board of open-cell foam, a "molded method" is often used. Specifically, in using the molded method, a mold of the board is filled with liquid foam, which expands to fill the mold. The foam is then allowed to harden in the mold until it is rigid. The rigid foam is made of air cells that are open to each other. The cells at the surface of the rigid foam are also open to the atmosphere. Another method of board formation is the traditional hand-shaping method wherein the board is cut, or shaped, from a block of expanded foam.

[0004] A problem with open-cell foam is that it absorbs water. To minimize this absorption of water, the open-cell foam is often coated with a water-proofing material, such as FIBERGLAS® and epoxy resin, to seal the board and make the board more durable.

[0005] Unfortunately, even though covered with a water-proofing material, in the event the board is bumped or the water-proofing materials are breached, the board absorbs water through that breach. When the open-cell foam has absorbed water, the open-cell foam is much heavier than when it is dry. A board made with open-cell foam that has absorbed water is significantly more difficult to use because of its increased weight and decreased buoyancy. Furthermore, a board that has absorbed water must be dried out before it is stored, in order to avoid deterioration of the board.

[0006] In light of the above, it would be advantageous to make a board having similar buoyancy, rigidity, and durability characteristics of a board made from open-cell foam, yet does not absorb water into the foam material if the water-proofing material is breached.

SUMMARY OF THE INVENTION

[0007] The advantages of open-cell foam can be obtained, and its disadvantages avoided, by using a closed-cell foam in its place. Closed-cell foam is extruded, and then formed into the shape of a board by hand shaping by a professional board shaper, or by using CNC machining into the desired board shape, instead of expansion into a mold as is the process used with open-cell foam. In a preferred embodiment, closed-cell foam may be made of polystyrene. An advantage of closed-cell foam is that it does not substantially absorb water. A board made of closed-cell foam does not become substantially heavier due to water absorption, and retains its physical properties, including buoyancy and ease of use for water sports and other purposes. Closed-cell foam also dries out much more quickly than open-cell foam, without yellowing or damage areas.

[0008] The present invention includes a surfboard made of laminated closed-cell foam. The laminate is perforated at places where pressure is likely to be applied to the surface of the board (e.g., where a user is likely to stand), such that air, or gas, can escape from between the laminate and foam. This avoids the formation of air blisters, thus overcoming a disadvantage to the use of laminated closed-cell foam.

[0009] Closed-cell foam extruded into a rough board shape may be referred to as a "blank" or "block". The blank may be heated, pressed and cut into a desired shape. The shaped blank may be laminated with water-proofing materials, such as FIBERGLAS® and epoxy resins, to make the board more durable.

[0010] To make a board of the present invention, a blank is treated with heat and pressure to shape it, if desired, and to anneal the surface (close any open cells). The board is shaped by placing the blank against a shaped form, pressing the blank against the form by use of tension devices (e.g., restraining tools and straps), heating the blank using heated water vapor, then cooling it until it holds its new shape. The heated and pressed blank may be further shaped by cutting it with a hot wire. The cut and shaped blank or "core" is laminated with FIBERGLAS® and epoxy resin. Once laminated, the laminate is perforated in multiple locations using a tool that has a substantially planar or curved surface with multiple perforation needles extending therefrom. The perforations are formed by pressing or rolling the needled surface of the tool against the laminate thereby penetrating the laminate. The board may have one or more optional fins.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The novel features of this invention, as well as the invention itself, both as to its structure and its operation, will be best understood from the accompanying drawings, taken in conjunction with the accompanying description, in which similar reference characters refer to similar parts, and in which:

[0012] **FIG. 1** is a perspective view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing a finished board;

[0013] **FIG. 2A** is a side view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing how a blank is curved by restraining it against a form with restraining tools and straps, and subjected to a heat source;

[0014] **FIG. 2B** is an exploded side view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing how multiple blanks are simultaneously curved by stacking them vertically, separated by a flexible metal heat-conducting sheet, and restraining the stack against a form with restraining tools and straps, and subjecting the stack to a heat source;

[0015] FIG. 2C is a side view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing how multiple blanks are simultaneously curved by stacking them vertically, separated by a metal flexible heat-conducting sheet, and restraining the stack against a form with restraining tools and straps, and subjecting the stack to a heat source;

[0016] FIG. 3 is a top view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing how the blank is cut into a surfboard shape using a hot wire;

[0017] FIG. 4 is a perspective view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing a cut-away view of the interior of the board and showing how blisters are formed in the surface of the board without perforations formed in the laminate;

[0018] FIG. 5 is a cross-sectional view of the Improved Surfboard And Method Of Manufacturing of the present invention, taken across line 5-5 of FIG. 4, showing an air, or gas, blister;

[0019] FIG. 6 is a top view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing how perforations formed in the laminate by a perforation tool, prevent formation of blisters by allowing any air or gas to escape through the perforation;

[0020] FIG. 7 is a top view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing a pattern of perforations in the surface of a short board;

[0021] FIG. 8 is a top view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing a pattern of perforations in the surface of a long board;

[0022] FIG. 9 is a side view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing a perforating tool having a substantially planar working surface, and a number of perforating needles extending perpendicularly from the planar working surface;

[0023] FIG. 10 is a side view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing a perforating tool having a curved working surface and a number of perforating needles extending perpendicularly from the curved working surface;

[0024] FIG. 11 is a side view of the Improved Surfboard And Method Of Manufacturing of the present invention, showing a cross-section of a board with a curved perforating tool perforating the laminate of the board; and

[0025] FIG. 12 is a flow chart representing an exemplary process of the present invention for manufacturing the Improved Surfboard of the present invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0026] A preferred embodiment of the Improved Surfboard And Method Of Manufacturing of the present invention is shown in **FIG. 1** and is generally designated **100**. Board **100** has a foam core **110** (shown in **FIG. 4**), a laminate **120** covering core **110** having a stringer **122**, and is formed with a number of perforations **130** in laminate **120**. Core **110** of board **100** is formed by shaping a "blank". A blank is a substantially rectangular block of closed-cell foam.

[0027] Board **100** may have one or more optional fins **160**. Board **100** shown in **FIG. 1** is in the style of a short board. Perforations **130** are shown placed where a user would place his or her feet on board **100**. Perforations **130** may alternatively be placed elsewhere on board **100**.

[0028] Referring to **FIG. 2A**, an apparatus for shaping a blank is shown and generally designated **200**. **FIG. 2A** shows a blank (or foam body or block) **210**. Blank **210** may be made of closed-cell extruded polystyrene foam. Such a blank **210** is made by extruding closed-cell polystyrene foam into a foam body of the desired shape. Blank **210** may alternatively be made of other materials having strength similar to closed-cell foam.

[0029] **FIG. 2** shows two positions for blank **210**, an initial position **230** (shown in dashed lines) and a shaped position **240**. **FIG. 2** also shows a form (or form tool or mold) **250** having a shaped form surface **254**. Shaped form surface **254** has a shape in which blank **210** is desired to be shaped. **FIG. 2** also shows restraining tools **260** each having a restraining tool surface **264** corresponding to shaped form surface **254** in the manner in which blank **210** is desired to be shaped. Straps **270** extend from form **250** to tools **260** and are tightened to bring tools **260** toward form **250** to capture blank **210** between the tools **260** and the form **250**.

[0030] Blank **210** may be shaped in the following manner. Blank **210** is initially placed in initial position **230** (shown in dashed lines) upon shaped form surface **254** of form **250**. Restraining tool surface **264** of each restraining tool **260** is placed upon blank **210**. Straps **270** are attached to restraining tools **260** and to form **250**. Tension is applied to straps **270** such that each restraining tool surface **264** is pressed against blank **210**, and blank **210** is pulled toward and pressed against shaped form surface **254** of tool **250**. At the same time, heat may be applied to blank **210** from heat source **272**.

[0031] The application of heat and tension to blank **210** causes blank **210** to be conformed to shaped form surface **254** of form **250** and to restraining tool surfaces **264**. In a preferred embodiment, the heat provided by heat source **272** may not exceed 180 degrees Fahrenheit, and for an exposure period of less than 30 minutes. Outside temperature variations and humidity may affect the heat levels and duration applied to form the blank **210**. Other heating periods and temperatures may be used, however, without departing from the present invention. Rather, the specific temperature and time periods are merely exemplary of a preferred embodiment, and no limitation is intended.

[0032] Once heated, blank **210** is then allowed to cool until it holds the shape of shaped form surface **254** of form **250** and restraining tool surfaces **264** in shaped position **240** without being pressed against shaped form surface **254** or restraining tool surfaces **264**. Restraining tools **260** and straps **270** are then removed from blank **210**, and blank **210** is removed from form **250**. Form **250** and restraining tools **260** are made of one or more materials that can withstand pressure and heat required to shape blank **210**. In a preferred embodiment, form **250** may be made from wood or metal, and restraining tools **260** may be made from wood or metal, however, other materials having suitable strength and resistance to moisture may be used.

[**0033**] While two tools **260** have been shown in **FIG. 2A**, it is to be appreciated that any number of tools may be used without departing from the present invention. Additionally, tool **260** may extend the length of form **250** such that a single tool **260** is used to capture the entire blank **210**.

[**0034**] Referring now to **FIG. 2B**, an exploded side view of the Improved Surfboard And Method Of Manufacturing of the present invention is shown and generally designated **280**. In apparatus **280**, multiple blanks **210** that are substantially rectangular blocks, are vertically stacked together, separated by a flexible metal heat-conducting sheet **274**. The stack of blanks **210** and sheets **274** are positioned over form **250**.

[**0035**] Once in position, restraining straps **270** are attached to tools **260** and the straps **270** are tightened such that the stack of blanks **210** and sheets **274** are brought tightly against form **250**. As the straps **270** are tightened, the blanks **210** and sheets **274** are deformed to match the curvature of tools surfaces **264** and form **250**. When the blanks **210** are in the proper form against form **250**, heat is supplied by heat source **272** for a predetermined period of time. At the end of that heating time period, the heat source is removed, and the straps are removed, yielding several blanks **210** having the curvature of curved surface **254** of form **250**.

[**0036**] Flexible metal heat-conducting sheet **274**, in a preferred embodiment, is made from aluminum, however, it is to be appreciated that other materials having similar flexibility and heat transfer characteristics may be used. The sheet **274** provides for separation between blanks **210** as well as conducts heat from heat source **272**. The conduction of heat between blanks **210** is important because blanks **210**, by their nature, are good heat insulators. By providing a heat conduction path between blanks **210** in the stacked configuration, each blank is exposed to sufficient heat across its entire surface during the heating period to provide for the formation of blank **210** into the curved form **240** (shown in **FIG. 2A**).

[**0037**] Referring now to **FIG. 2C**, a side view of the Improved Surfboard And Method Of Manufacturing of the present invention **280** is shown. This figure depicts the process by which multiple blanks **210** are simultaneously curved by stacking them vertically, separated by a metal flexible heat-conducting sheet **274**, and restraining the stack against a form **250** with restraining tools **260** and straps **270**. Once blanks **210** are in the proper position against curve **254** of form **250**, the entire stack of blanks **210** and sheets **274** is subjecting to a heat from heat source **272**, such as steam.

[**0038**] **FIG. 3** shows a configuration for cutting blank **210** into a desired shape, generally designated **300**. More specifically, **FIG. 3** shows blank **210** with portions **310** cut away from blank **210** to shape a nose of a board of the present invention. In a preferred embodiment, cut **310** is formed by a hot wire (not shown in **FIG. 3**) that is known in the art. **FIG. 3** shows cut **310** as being in a surfboard shape. Blank **210** may also be shaped by various methods including, without limitation, further heating, further pressing, further cutting,.sanding, grinding, smoothing, and other shaping techniques known in the art. After blank **210** has been finally shaped, it may be referred to as a core **110** as discussed in conjunction with **FIG. 1**.

[**0039**] Referring now to **FIG. 4**, a cut-away view of board **100** is shown and reveals core **110** having a stringer **122**. Stringer **122** is typically made of wood, extends the length of core **110** and provides stiffening to the board **100**. After core **110** has been formed, it is covered with a sealing material, such as FIBERGLAS® and epoxy resin, which form laminate **120**. This sealing material makes board **100** more durable, and provides a water-proof covering. **FIG. 4** also shows bubbles, or blisters, **410** caused by air, or gas, pockets **420** that can form between core **110** and laminate **120** following use of the board.

[**0040**] Referring to **FIG. 5**, a cross-sectional view of board **100** taken across line **5-5** of **FIG. 4** is shown. Specifically, **FIG. 5** shows air blister or bubble **410** caused by air pocket **420** between core **110** and laminate **120**. For instance, when a user stands on board **100**, the pressure of his feet upon board **100** can cause localized deformation to the foam at that place. This deformation causes air pockets **420** to form between core **110** and laminate **120** in that location. Each air pocket **420** causes the area of laminate **120** adjacent to air pocket **420** to be raised away from core **110**, causing a raised area or "blister"**410** in laminate **120**.

[**0041**] Air blisters **410** may form where the user places his feet on board **100**, however, blisters **410** can also be caused by other sources of pressure upon board **100** at other places on board **100**. Each air blister **410** causes a deformation of laminate **120**, which can damage laminate **120** and decrease the strength of board **100** and make it more difficult to use. Additionally, exposure of the board **100** to heat sources, such as the sun, may cause the formation of air blisters **410** between the core **110** and the laminate **120** when the board is not properly vented.

[**0042**] **FIG. 6** shows another cross-sectional view of board **100** similar to **FIG. 5**, but with at least one perforation vent **130** now formed in laminate **120** to allow air in air pocket **420** to escape, thus reducing the size of air pocket **420** and in turn reducing or eliminating blister **410**. The perforation vents **130** help avoid deformation and damage to laminate **120**, and helps maintain the utility of board **100**. Each perforation vent **130** is large enough to allow air to pass through it, and small enough to allow little water or no water to pass through it. Thus, each perforation **130** allows air to get out from between laminate **120** and core **110**, but allows little water or no water to get in between laminate **120** and core **110**.

[**0043**] In a preferred embodiment, perforations **130** are formed through laminate **120** of board **100** at the time of manufacturing and prior to use, and thus, prior to the formation of any bubbles or blisters **420**. As a result, there is little or no chance for a blister to form, because any air or gas that develops between laminate **120** and core **110** escapes through perforation **130** before it can develop into a blister **410**.

[**0044**] As used herein, it is to be understood that "little water" comprises the meanings of "no water" and "substantially no water" as well as the meaning of "a very small amount of water more than no water." No measurable or significant weight change is caused by any moisture absorption into the surfboard or surf craft.

[0045] Each perforation vent **130** is formed by a perforating tool **610** which has a perforating tool body **620** having a working surface **624**, and at least one perforation needle **630** extending from working surface **624**. Each perforation vent **130** is formed as follows. Working surface **624** is placed adjacent laminate **120** and perforating tool **610** is manipulated such that at least one needle **630** is translated in the direction **640** toward board **100** until needle **630** penetrates (or perforates) laminate **120** to form an airway, or vent **130**, through the laminate **120**.

[0046] Perforating tool **610** is then manipulated such that each at least one needle **630** is then translated in the direction **650** opposite the direction **640** in which needle **630** points, and needle **630** is withdrawn from laminate **120**, leaving a perforation, or vent, **130** formed in laminate **120** by each needle **630** that penetrates laminate **120**. In a preferred embodiment of the present invention, each needle **630** does not penetrate core **110**. In an alternative embodiment of the present invention, at least one needle **630** at least partially penetrates core **110**.

[0047] Needles **630** may be made of stainless steel. Needles **630** may alternatively be made of any other material having sufficient strength to perforate laminate **120**. In a preferred embodiment of the present invention, at least one needle **630** is heated to facilitate penetration of laminate **120**. If needles **630** are heated, they may be heated to a range of 200 to 250 degrees F. Alternatively, needles **630** may be heated to a temperature in the range from zero degrees Kelvin to the melting point temperature of the material of which the needles **360** are made. In an alternative embodiment of the present invention, each needle **630** is not heated.

[0048] In an alternative embodiment, needles **630** may be formed with grooves or threads **635** like a traditional drill bit having a small diameter. In such an embodiment, perforating tool **610** may be capable of rotating needle **630** in direction **633** to bore a perforation vent **130** through laminate **120**.

[0049] **FIG. 7** is a top view of board **100**. Board **100** shown in **FIG. 7** is a short board. An array of perforations **130** are placed where a user would likely place his or her feet on board **100**. Perforations **130** may alternatively be placed in any other location on board **100**, such as next to the rails of the surfboard.

[0050] Referring now to **FIG. 8**, a top view of another embodiment of the Improved Surfboard And Method Of Manufacturing of the present invention is shown and generally designated **800**. This embodiment is a typical long board and has perforations **130** in locations where a user is likely to place his or her feet on this type of board **800**. Perforations **130** may alternatively be placed in any other location on board **800**.

[0051] **FIG. 9** is a side view of another embodiment of a perforating tool generally designated **910**. Tool **910** includes a flat body **920** having a flat working surface **624** and multiple perforating needles **630**. **FIG. 9** shows needles **630** as substantially parallel to each other, and extending from working surface **624** at an angle substantially perpendicular to working surface **624** at the point where needle **630** intersects working surface **624**. In an alternative embodiment, each needle **630** may extend from working surface **624** at an angle other than perpendicular to working surface **624** at the point where needle **630** intersects working surface **624**.

[0052] Referring now to **FIG. 10**, a side view of another embodiment of a perforating tool is shown and generally designated **1010**. Tool **1010** includes a body **1020** having a curved working surface **1024** with a radius **1012**, and multiple perforation needles **630** extending radially away from the curved working surface **1024**.

[0053] **FIG. 10** shows each perforation needle **630** as being at an angle **632** to body **1020**. In a preferred embodiment, this angle **632** is ninety degrees (90°) as dictated by its radial placement on the curved working surface **1024**. **FIG. 10** also shows each needle **630** as being substantially perpendicular to curved working surface **1024** at the point where needle **630** intersects curved working surface **1024**. In an alternative embodiment, each needle **630** may be at an angle **632** other than perpendicular to curved working surface **1024** at the point where needle **630** intersects curved working surface **1024**.

[0054] As shown in **FIG. 10**, each perforation needle **630** has a length **634** and a diameter **636**. In a preferred embodiment, length **634** is slightly longer than the thickness **638** of laminate **120** (as shown in **FIG. 6**). Also, in a preferred embodiment, thickness **638** may be ⅛ to 3/16 inch or more, and length **634** may be 3/16 inch (0.1875") or more, so long as the length **634** is equal to or greater than thickness **638**.

[0055] The diameter **636** of perforation needle **630** may vary between 0.005 inches and 0.05 inches, and in a preferred embodiment, is 0.008 inches. It is to be appreciated that although perforation needle **630** has been depicted in the Figures as a cylindrical needle, no limitation as to the cross-sectional shape is intended. To the contrary, the cross-sectional shape of the perforation needle **630** may vary, including but not limited to, oval, rectangular, square, or other shapes. Regardless of the cross-sectional shape of perforation needle **630**, the cross-sectional area of vent **130** remains small enough to allow the exit of gasses collecting between material **120** and core **110**.

[0056] **FIG. 11** shows how curved perforating tool **1010** is used to make a row of perforations **130**. **FIG. 11** shows a cross section of a surfboard of the present invention, with curved perforating tool **1010** positioned adjacent board **100**. In use, curved working surface **1024** is placed adjacent laminate **120** such that at least one needle **630** penetrates laminate **120**. Curved working surface **1024** is then "rolled" clockwise in direction **1030** across laminate **120** to a second position (shown by **1020**' in dashed lines) such that each perforation needle **630** successively penetrates and is then withdrawn from laminate **120**, leaving a perforation vent where each needle **630** has penetrated laminate **120**. **FIG. 11** shows curved working surface **1024** as contacting laminate **120**.

[0057] Alternatively, curved perforating tool **1010** can be manipulated such that curved working surface **1024** does not actually contact laminate **120** thereby avoiding any damage to laminate **120** from perforating tool **1010**. For instance, as curved perforating tool **1010** is rolled clockwise above laminate **120**, each needle **630** rotates as the tool **1010** is translated, such that each needle **630** remains substantially perpendicular to laminate **120** as it forms perforation vent

130. This is particularly useful when tool **1010** is heated, and contact between tool **1010** and laminate **120** may cause marks or blemishes to form.

[**0058**] In **FIG. 11**, curved working surface **1024** is curved in at least one dimension of curved working surface **1024**. **FIG. 11** shows curved working surface **1024** as substantially convex. Alternatively, curved working surface **1024** can be at least partially concave without departing from the present invention. In a preferred embodiment, the curve of curved working surface **1024** is substantially an arc of a circle that has a radius **1012**, in at least one dimension of curved working surface **1024**. Alternatively, curved working surface **1024** can have a curve that is other than circular, including, without limitation, parabolic, hyperbolic, or any combination thereof.

[**0059**] Referring now to **FIG. 12**, a flow chart representing a preferred method of manufacturing an Improved Surfboard of the present invention, and is generally designated **1200**. Method **1200** includes a first step **1202** in which one or more closed-cell foam blanks is obtained, and then placed on the form in step **1204**. Once on the form, conductive sheets are inserted between the blanks in step **1206**, and the blanks and conductive sheets are secured to the form using tools and straps in step **1208**.

[**0060**] The assembly of tools, blanks separated by sheets, and secured to the form, is then exposed to heat from a heat source for a predetermined time period in step **1210**. At the expiration of that time period, the assembly is cooled for a second predetermined time period in step **1212**.

[**0061**] Once cooled, the tools and straps are removed, and the blanks are removed from the form and separated from the conductive sheets in step **1214**.

[**0062**] Once thoroughly cooled, the now-formed blanks are shaped to form a core and covered with sealing material in step **1216**. Once the sealing material is dry, a number of vents are formed through the sealing material in final step **1218** to yield an Improved Surfboard of the present invention.

[**0063**] While the particular Improved Surfboard And Method Of Manufacturing as herein shown and disclosed in detail is fully capable of obtaining the objects and providing the advantages herein before stated, it is to be understood that it is merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended to the details of construction or design herein shown other than as described in the appended claims.

I claim:

1. A method of manufacturing a surfboard, comprising the steps of:

providing a core covered by a laminate; and

forming at least one perforation in said laminate.

2. A method of manufacturing as in claim 1, wherein:

said step of forming at least one perforation in said laminate, comprises the steps of

providing a perforating tool having a working surface and at least one needle extending from said working surface at an angle substantially perpendicular to said working surface at the point where said at least one needle intersects said working surface;

manipulating said perforating tool such that said at least one needle is translated substantially in the direction that said at least one needle points, such that said at least one needle penetrates said laminate; and

manipulating said perforating tool such that said at least one needle is translated substantially opposite the direction that said at least one needle points, such that said at least one needle is withdrawn from said laminate.

3. A method of manufacturing as in claim 2, wherein:

said at least one needle is heated.

4. A method of manufacturing as in claim 2, wherein:

said working surface is substantially planar.

5. A method of manufacturing as in claim 1, wherein:

said step of forming at least one perforation in said laminate, comprises the steps of

providing a perforating tool having a working surface curved in at least one dimension, and at least one needle extending from said working surface at an angle substantially perpendicular to said working surface at the point where said at least one needle intersects said working surface;

rolling said working surface along said laminate such that each said at least one needle successively penetrates and is then withdrawn from said laminate.

6. A method of manufacturing as in claim 5, wherein:

said at least one needle is heated.

7. A method of manufacturing as in claim 1, wherein:

said step of forming at least one perforation in said laminate, comprises the steps of

providing a perforating tool having a working surface having substantially the shape of an arc of a circle in at least one dimension, and at least one needle extending from said working surface at an angle substantially perpendicular to said working surface at the point where said at least one needle intersects said working surface;

rolling said working surface along said laminate such that each said at least one needle successively penetrates and is then withdrawn from said laminate.

8. A method of manufacturing as in claim 7, wherein:

said at least one needle is heated.

9. A method of manufacturing as in claim 1, wherein:

said step of providing a core covered by a laminate, comprises the steps of:

extruding closed-cell foam into a blank;

shaping said blank into a core; and

covering said core with a laminate.

10. A method of manufacturing as in claim 9, wherein:

said step of covering said core with a laminate, comprises the steps of

covering said core with FIBERGLAS®; and

covering said core with epoxy resin.

11. A method of perforating a laminate, comprising the steps of:

providing a laminate;

providing a perforating tool having at least one needle; and

manipulating said perforating tool such that said at least one needle perforates said laminate.

12. A method as in claim 11, wherein:

said at least one needle is heated.

13. A method as in claim 11, wherein:

said step of providing a perforating tool having at least one needle, comprises the step of

providing a perforating tool having a working surface and at least one needle extending from said working surface at an angle substantially perpendicular to said working surface at the point where

said at least one needle intersects said working surface.

14. A method as in claim 11, wherein:

said step of manipulating said perforating tool such that said at least one needle perforates said laminate, comprises the steps of

manipulating said perforating tool such that said at least one needle is translated in the direction that said at least one needle points, such that said at least one needle perforates said laminate; and

manipulating said perforating tool such that said at least one needle is translated opposite the direction that said at least one needle points, such that said at least one needle is withdrawn from said laminate.

15. A method as in claim 11, wherein:

said step of forming at least one perforation in said laminate, comprises the steps of:

providing a perforating tool having a working surface having substantially the shape of an arc of a circle in at least one dimension, and at least one needle extending from said working surface at an angle substantially perpendicular to said working surface at the point where said at least one needle intersects said working surface;

rolling said working surface along said laminate such that each said at least one needle successively penetrates and is then withdrawn from said laminate.

16. A perforating tool, comprising:

a perforating tool body having a working surface; and

at least one needle extending from said working surface.

17. A perforating tool as in claim 16, wherein:

said working surface is substantially planar.

18. A perforating tool as in claim 16, wherein:

said working surface is substantially curved in at least one dimension of said working surface.

19. A perforating tool as in claim 16, wherein:

said working surface substantially has the shape of an arc of a circle in at least one dimension of said working surface.

20. A perforating tool as in claim 16, wherein:

each said at least one needle is substantially parallel to each other said at least one needle.

21. A perforating tool as in claim 16, wherein:

each said at least one needle is substantially at an angle to each other said at least one needle.

22. A perforating tool as in claim 16, wherein:

said at least one needle is substantially perpendicular to said working surface at the point where said at least one needle extends from said working surface.

23. A perforating tool as in claim 16, wherein:

said at least one needle can be heated.

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