(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

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

PCT

(10) International Publication Number
WO 2009/088409 A1

(51) International Patent Classification:
B29C 33/30 (2006.01)

(21) International Application Number:
PCT/US2008/012874

(22) International Filing Date:
18 November 2008 (18.11.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/972,509 10 January 2008 (10.01.2008) US

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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, 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*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(54) **Title:** SURFBOARD AND METHOD AND APPARATUS OF MANUFACTURE

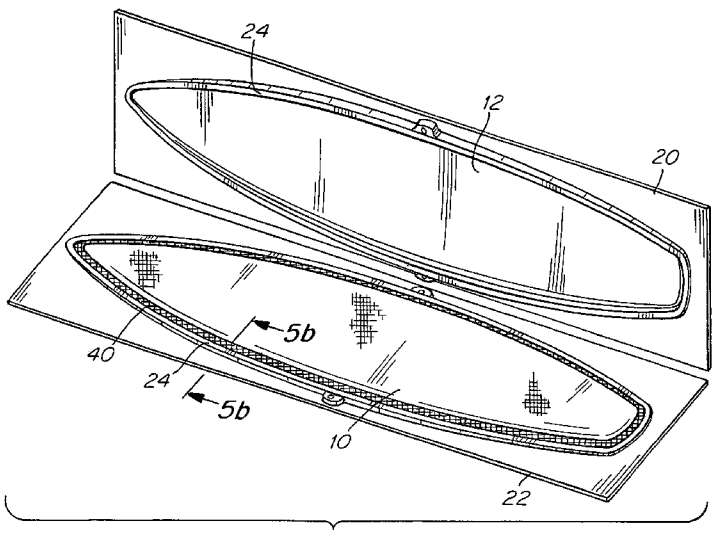

Fig. 5a

(57) **Abstract:** A method of forming a surfboard includes using a press to bend a flexible mold that contains a surfboard core, layed up with resin and reinforcing material. The layed up surfboard core is allowed to cure in the mold / press, at least partially, to set a desired degree of rocker to the surfboard. Common surfboard core blanks may be used to form surfboards with different degrees of rocker, and in this sense, may allow surfboard manufacturers to provide a greater variety of surfboard choices and/or to manufacture surfboards more efficiently. A surfboard may be formed with a core that includes a central portion and a separate rail portion. The rail portion may placed inside of a braided sleeve or reinforcing material and assembled to the central portion of the surfboard core to provide desired structure characteristics to the surfboard.

WO 2009/088409 A1

SURFBOARD AND METHOD AND APPARATUS OF MANUFACTURE

BACKGROUND

1. Field

Aspects of the invention relate to surfboard, and methods and equipment for forming surfboards.

2. Discussion of Related Art

The size and shape, among other factors, may determine ride characteristics of a surfboard, the type of waves that might be appropriate for the surfboard, and/or the size and weight of a surfer that may suitably ride the surfboard. The degree of rocker of a surfboard, which is the curvature along the bottom surface, from the nose to the tail, may determine how well a surfboard planes across the water and or turns. Generally speaking, a greater degree of rocker (i.e., more curvature from the nose to the tail) will allow a surfboard to be turned more easily, and may be more appropriate for steeper waves. A lesser degree of rocker may allow a surfboard to move faster when planing across the water.

SUMMARY

An aspect of the invention relates to a method of manufacturing a surfboard. The method comprises positioning a surfboard core and hardenable material in a mold cavity of a flexible mold. The flexible mold and surfboard core are bent to a curvature. The hardenable material is cured, fixing the surfboard to the desired curvature.

Another aspect of the invention relates to a method of forming a surfboard that comprises providing a surfboard core with a central portion and a separate rail portion. Reinforcing material is positioned about the rail portion of the surfboard core. The surfboard core, including the central portion and the separate rail portion, reinforcing material, and hardenable material are positioned together in a flexible mold. The flexible mold, the surfboard core and reinforcing material is bent to a curvature. The hardenable material is cured, fixing the surfboard core at the curvature.

Yet another aspect of the invention relates to a method of designing a flexible mold for imparting rocker to a surfboard. The method includes constructing a surfboard, at least partially that is characterized by a first shape that includes a first rocker. The first shape is measured and a model having the first shape is created. The model is bent to a second shape that includes a second rocker, different from the first of rocker. A flexible mold is constructed a mold cavity that conforms substantially to first shape when in a first position and to the second shape when in a second position.

Another aspect of the invention relates to a method of forming a surfboard that comprises providing a surfboard core with a top surface and a bottom surface. The surfboard core also has a central core portion and a rail portion, separate from the central core portion. A reinforcing sleeve is positioned about the rail portion. Hardenable material is applied to at least a portion of the reinforcing sleeve. The rail portion and reinforcing sleeve are assembled to the central core portion and the hardenable material is cured, joining the central core portion and rail portion of the surfboard core.

Yet another aspect of the invention relates to a surfboard that comprises a surfboard core that has top and bottom surfaces. The surfboard core also includes a central core portion and a separate rail portion. A sleeve of reinforcing material is positioned about the separate rail portion and one or more layers of reinforcing material are positioned over at least portions of the top and bottom surfaces.

Another aspect of the invention relates to a flexible mold for forming a surfboard having a shape that includes a degree of rocker. The flexible mold includes a first mold portion having a first parting line. A second mold portion has a second parting line configured to mate with the first parting line of the first mold portion to define a mold cavity between the first and second mold portions. At least portions of the first parting line move relative to the second parting line as the flexible mold is flexed between a first position for receiving a layed up surfboard core and a second position that conforms substantially to the shape of the surfboard with the desired degree of rocker.

BRIEF DESCRIPTION OF DRAWINGS

The accompanying drawings are not intended to be drawn to scale. In the drawings, each identical or nearly identical component that is illustrated in various figures may be represented by a like numeral. For purposes of clarity, not every component may be labeled in every drawing. In the drawings:

FIG. 1 is a perspective view of upper and lower mold halves of a flexible mold, according to one embodiment, according to one embodiment.

FIG. 2 is an exploded assembly view, showing features of a press and a flexible mold used to impart rocker to a surfboard, according to one embodiment.

FIG. 3 shows, conceptually, relative movement between upper and lower flexible mold halves.

FIG. 4a shows the rail portion removed from a surfboard core blank.

FIG. 4b shows a braided tubular sleeve being advanced over the rail portion.

FIG. 4c shows the rail portion and braided tubular sleeve reunited with the core blank, according to one embodiment.

FIG. 5a shows a surfboard core with a rail portion wrapped in a braided sleeve of reinforcing material, and laminated in a flexible mold, according to one embodiment.

FIG. 5b shows a partial, cross-sectional view, taken along cut A-A of FIG. 5a.

DETAILED DESCRIPTION

An aspect of the invention relates to a method and to equipment for imparting rocker to a surfboard. A flexible mold is provided to contain a surfboard core, layed up with resin and reinforcing material. The mold is flexed by a press, or otherwise, to provide a desired rocker curvature to the surfboard. The layed up surfboard core is allowed to cure in the mold / press, at least partially, to set a rocker shape to the surfboard. This aspect of the invention allows surfboards with different degrees of rocker to be formed from similarly dimensioned surfboard core blanks, and in this sense, may allow surfboard manufacturers to provide a greater variety of surfboard choices and/or to manufacture surfboards more efficiently.

Another aspect of the invention relates to a surfboard and a method of forming a surfboard having a core that includes a central portion and a separate rail portion wrapped with a braided reinforcing sleeve.

Methods of imparting rocker to a surfboard core may begin with a surfboard core 10 that is layed up, typically with resin and reinforcing material, in the cavity 12 of the flexible mold 14. The mold cavity 12 conforms substantially to the surfaces of the layed up surfboard core 10 so that pressure may be applied evenly to the resin and reinforcing material during the curing process. A form 16, like that illustrated in FIG. 2, is configured with rocker surfaces 18 that exhibit the degree of rocker that is to be imparted to the surfboard. The flexible mold 14 and layed up core 10 are forced into conformance with the rocker surfaces. Heat is applied for an appropriate amount time to allow the resin and reinforcing material to meld together and set. The surfboard is then cooled and removed from the flexible mold after the press is released.

Surfboard core blanks may be initially foamed to conform to the shape of the cavity in the flexible mold. According to one illustrative embodiment, a foaming mold is designed to produce core blanks having a shape comparable to that of the final surfboard, except without rocker, or otherwise with less than will be provided to the ultimately produced board. Core blanks formed in such a foaming mold may be ready for positioning in the flexible mold with minimal further processing, such as light sanding, or no processing at all. Manufacturing core blanks in this manner can reduce the overall number of steps required to produce a surfboard, and may help ensure a proper fit between the flexible mold and the surfboard core, once layed up. It is to be appreciated that core blanks may also be produced through other methods, such as by hand forming or through automated machining techniques, and from a core blank that is larger than the flexible mold cavity, as aspects of the invention are not limited in this respect.

Surfboard cores may be formed of various materials, including, but not limited to polyurethane, polyethylene, polystyrene, polyether, PVC foam, and the like. According to certain embodiments, the core blank may provide a light, shape defining substrate about which a structural material, like laminate, may be positioned. Aspects of the

invention, however, are not limited in this manner, as structural core materials, like honeycomb, may also be used, with or without further laminating structure.

The flexible mold 14 shown in FIG. 1 includes upper 20 and lower 22 mold halves that, when positioned together, define a mold cavity 12. The mold cavity, in the illustrated unflexed position, conforms substantially to the final shape of the surfboard that is to be produced, except that the mold cavity lacks the rocker curvature of the final surfboard shape. The mold cavity may be sized to have a slight interference fit with a layed up surfboard core placed therein. According to some embodiments, the core blank and flexible mold cavity are designed to have about 0.001' to about 0.005" of interference, although greater interferences, such as 0.010", 0.020" or greater are also possible, as are interferences smaller than 0.001", including no interference at all, as aspects of the invention are not limited in this respect. The interference between a layed up surfboard core and the mold cavity may depend on the thickness of any reinforcing material that is used, and may average about 0.020", according to some embodiments, although other interferences are also possible. Interference between the layed up surfboard core and mold cavity may allow proper pressure to be applied against the layed surfboard core, even when the core or other components are undersized, such as might occur due to natural manufacturing variability.

The shape of the surfboard, other than the rocker, is typically built into the mold. In the illustrated embodiment, the shape of the nose, tail, and rails are defined by the mold cavity. Additionally, any curvature or other features of the surfboard surfaces, like concavities or convexities extending from between lateral sides of a board, depressions for fin boxes, leash plugs, and/or foot pads, may be built directly into the mold cavity, or may be added by mold inserts that may optionally be placed into the mold cavity when desired for a particular surfboard that is being manufactured. Alternatively, one or more other features may be formed in the surfboard post-molding

Embodiments of the flexible mold may be stiff enough to apply a substantially even pressure against a layed up surfboard core in the cavity, yet flexible enough to bend upon the application of adequate forces during the forming process. The mold is

typically made of metal, such as aluminum, although other materials are also possible, such as other metals, plastics, and the like. In the embodiment of FIG. 1, the lower mold half 22 is thinner than the upper mold half 20, allowing the lower half to bend more readily than the upper half, which may prove advantageous when releasing the surfboard from the mold, as discussed herein. Features, such as gussets or slits, may be added to portions of the mold to promote flexibility of the mold. Additionally or alternately, features, such as stiffeners, may be incorporated into portions of a mold to reduce mold flexibility.

The upper and lower halves of the mold meet one another at a positive stop, such as might be provided by opposed parting lines 24. In this respect, when the mold halves are brought together to the positive stop, the maximum pressure applied to a layed up surfboard core may be determined by the interference between the mold cavity, the layed up surfboard core, and the materials included in the layed up surfboard core – rather than the force applied by a press. Providing a positive stop in this manner may allow excessive forces/pressures to be avoided, that might otherwise crush the surfboard core material.

The 20 upper and lower 22 mold halves may slide relative to one another, typically along mating parting line 24, when flexed to impart rocker to a surfboard. This is conceptually illustrated in FIG. 3, which shows a flexible mold 14 in an unbent position 26 and a bent position 28. An arc length of the upper surfboard surface, corresponding to the upper mold half, may shorten relative to the arc length of the lower surfboard surface, when the mold is flexed (or, equivalently, the upper mold may extend relative to the lower mold). The mold cavity 12 may be designed to accommodate this relative movement, such as by having a mold cavity that conforms to the shape of the surfboard when the mold is in a bent or flexed position. For instance, when in the unflexed position, the lower portion of the mold cavity may be slightly longer, in a nose-to-tail direction of the surfboard, than the upper portion of the mold cavity. As the upper mold half moves, relative to the lower mold half, the parting line at the upper and lower mold cavities about the nose and/or tail portion of the surfboard may meet to conform to the shape of the surfboard.

Embodiments of flexible molds may include features to minimize or control relative movement between portions of the mold during flexing. By way of example, the upper and lower mold halves in the embodiment of FIG. 1 may be held, relative to one another, at a point centrally located in the nose-to-tail direction of the surfboard. This may be done in the illustrated embodiment by a pin positioned through a pair of pin slot 30, although other techniques to clamp portions of the mold together may also be used. The clamped portion of the board will experience minimal, if any, relative movement in the nose-to-tail direction as the mold is flexed. Portions of the upper and lower flexible mold that lie further from the clamped portion will typically experience greater amounts of nose-to-tail movement, relative to one another. In this respect, clamping the central portion of the board, as shown in FIG. 1, may minimize the maximum amount of relative movement experienced by any portion of the upper and lower mold halves.

According to one embodiment, the process of laying up the surfboard core begins in the lower half 22 of the flexible mold 14. A lower layer of reinforcing material, such as a sheet of 6 ounce woven fiberglass cloth, is positioned over the lower mold cavity. The lower layer is typically larger than the mold cavity to allow edges of the material to be wrapped about rails of the surfboard core. The material is wetted out with resin, and the surfboard core is positioned on top of the material in the flexible mold, with the edges of the material wrapped about the rail portions of the surfboard core. A first upper layer of reinforcing material, for example, a sheet of 4 ounce woven fiberglass, is then placed on the top surface of the surfboard core. The first layer typically extends to the parting line of the mold, and may extend further to allow the first layer to be wrapped around the bottom of the rail. A second upper layer, also typically a sheet of 4 ounce woven fiberglass cloth, is then positioned on top of the first layer. The second layer may be oversized, relative to the mold cavity, and may extend outside of the mold between the opposed parting line surfaces of the upper and lower mold halves. The first and second upper layers are wetted out with resin to complete the layup procedure, and the upper flexible mold half 20 is positioned on top of the layed up surfboard core 10.

It is to be appreciated that reinforcing materials other than fiberglass may be used, including, but not limited to aramid, kevlar, cotton, rayon, silk polypropylene, polyester, polyamide, and the like, as aspects of the invention are not limited in this respect.

According to another embodiment, the surfboard core 10 may be layed up with reinforcing material at the rail 32 of the surfboard. As shown in FIG. 4a, all or a portion of the rail 32 may be cut and separated from the central portion 34 of the surfboard core. In one embodiment, this involves cutting the core over a constant distance from the core edge 36, over the entire core perimeter. In some embodiments, the cut may be about 1-1/2", about 1-1/4", although other distances are also possible. In other embodiments, the rail may be formed separately from the central portion of the core, as aspects of the invention are not limited to the rail being separated from the central portion of the core in any one particular way.

The separated rail 32 may then be cut, typically at the nose 38 of the rail, so that reinforcing material, like a braided, tubular 'sock' or sleeve 40 of reinforcing materials, such as fiberglass, carbon fiber, aramid, kevlar, cotton, rayon, polypropylene, polyester, and/or polyamide, and the like, may be fitted over the rail, as shown in FIG. 4b. The rail portion is then reassembled to the central core, as shown in FIG. 4c, with the reinforcing material between the rail portion and central portion of the surfboard core wetted with resin.

The reassembled surfboard core may then be placed on top of a lower layer 42 of reinforcing material, such as a sheet of 6 ounce woven fiberglass cloth, that is positioned over the lower flexible mold surface 22 and wetted with resin. The lower layer may overlap, at least partially, with the braided tubular sock 40 of reinforcing material. First and second layers 44, 46 of upper reinforcing material, typically sheets of 4 ounce woven fiberglass cloth, may then be placed on the top surface of the surfboard core 10, as shown in FIGs. 5a and 5b. Like the bottom layer 42, the first 44 and second 46 upper layers may overlap, at least partially, with the braided sock 40 of reinforcing material. After the

upper layers are wetted with resin, the upper flexible mold half 20 is mated with the lower mold half 22.

According to some embodiments, other features may be incorporated into the surfboard core. In one embodiment, the surfboard core may be cut, typically in halves, from nose to tail. A stringer of reinforcing material, such as fiberglass, and resin are positioned between the halves as the halves are reassembled in the mold. In another embodiment, a box shaped portion (or other shapes) of the surfboard core may be removed, and enclosed in a braided sleeve of reinforcing material before being wetted with resin and reassembled to the other portions of the surfboard core. In one such embodiment, a central portion of the board is removed and enclosed in a braided sleeve and then reassembled to the surfboard in the position of a typical stringer. Other types of reinforcing members that may harden and take shape when the layed up surfboard core is bent and hardened may be incorporated into the surfboard core, as aspects of the invention are not limited in this respect.

A press may be configured to impart a desired degree of rocker to the layed up surfboard core in the flexible mold cavity. In the embodiment illustrated in FIG. 2, appropriate opposed upper and lower rocker forms 16 are chosen and are positioned at upper and lower portions surfaces of the press. An inflatable bladder 48, positioned between the flexible mold and the upper form surface, is then inflated, to a pressure of about 70 psi, to press and bend the flexible mold 14 into conformance with the shape of the rocker forms 16, which are held rigidly in place by supporting structure of a press. The resin in the mold is heated by running hot water and/or steam through heating layers that are positioned on either side of the flexible mold (not shown). This melds the resin, reinforcing layers, and core material together, and causes them to set, so the surfboard retains the rocker shape. The surfboard may then be cooled by running cool water through the heating layers, prior to the press being released.

The upper and lower rocker forms 16 shown in FIG. 2 are constructed to extend the full length of the flexible mold, and define a surface 18 that has a curvature in the nose-to-tail direction of the surfboard. Although the embodiment of FIG. 2 employs

both upper and lower rocker forms, it is to be appreciated that other configurations are possible, such as embodiments with a rocker form that only lies on one side of the flexible mold. The rocker forms may include features to facilitate easy placement and removal from a press and/or for holding the forms in engagement with the press. It is to be appreciated that the illustrated forms represent but one possible embodiment, and that other constructions are possible. By way of non-limiting example, other embodiments may extend only under and/or over the nose or tail portion of a the flexible mold and layed up surfboard core, which may allow tailored rocker at the nose and tail. Still, in other embodiments, the press may include features that are selectively movable to define the rocker form that is to provided to surfboard.

In the embodiment of FIG. 2, a layer of substantially rigid bar 50, connected in series to one another with a cable, is positioned between the flexible mold 14 and the inflatable bladder 48. The layer of bars allow the flexible mold to curve about an axis that extends in the side-to-side direction of the surfboard, so that rocker may be imparted. However, the bars prevent the flexible mold from bending about an axis that extends in the nose-to-tail direction of the board, and in this sense, may prevent the flexible mold from taking on a three-dimensional curvature, like a saddle shape or a spherical shape. It is to be appreciated, however, that the layer of rigid bars, or equivalent structures, may be not used according to some embodiments, and three-dimensional curvatures may actually be desirable, according to some embodiments.

The upper flexible mold half may separate automatically from the surfboard when released from the press. The flexible mold may be biased toward the unflexed position, as shown in FIG. 1, such that when released from the press, the flexed or bent upper mold half straightens and pulls away from the surfboard. The upper flexible mold half of FIG. 1 may have a greater bias toward the unflexed position than the lower half, given the thicker configuration of the upper half. The lower flexible mold half may remain flexed, at least partially, when the press is released. This may allow an operator to remove the formed surfboard from the mold cavity without the lower half springing away from the rocker form. Additionally or alternately, one or both of the flexible mold

halves may be rigidly secured, at least temporarily, to the press or rocker forms to hold the mold halves in place as the surfboard is released.

The shape of the flexible mold cavity and/or the foaming mold, may be designed according to different approaches. In one embodiment, a surfboard may be constructed by an experienced craftsman. A digital model of the surfboard may then be created, such as by measuring the surfboard with a coordinate measuring machine. Any imperfections, like flat spots, asymmetries, and the like, may be removed from the digitized model. The digital model of the surfboard may then be 'unbent' by electronically removing or changing the degree of rocker while otherwise retaining the same shape of the surfboard. The resulting shape may be used to define the shape of the cavity in the foaming mold and/or the flexible mold, making appropriate adjustments for the thickness of any reinforcing material that is to be used, manufacturing tolerances, desired interference fits, and the like.

Aspects of the invention also relate to a system for manufacturing surfboards with a selective rocker. The system may include one or more foaming molds that define different shapes (excepting rocker) and/or lengths for surfboard core blanks. The system may also comprise flexible molds with cavities that substantially correspond to the shapes of the various surfboard core blanks. A surfer, may select a desired surfboard shape from among the available shapes of blanks, the configuration of reinforcing material to be used, and the degree of rocker that is to be imparted to the surfboard. A surfboard core blank may then be foamed, using the foaming mold that corresponds to the selected shape. The surfboard blank may then be placed in the flexible mold with the reinforcing material configured as selected by the surfer. A particular rocker form is then selected to impart the desired rocker to the surfboard. The press cycle is run, the surfboard from the mold, and any final processing steps, like trimming of excess reinforcing material, sanding, installation of fin box(es), fin(s), a leash plug, and/or the application of graphics, may be performed to complete the manufacture of the surfboard.

Having thus described several aspects of at least one embodiment of this invention, it is to be appreciated various alterations, modifications, and improvements

will readily occur to those skilled in the art. Such alterations, modifications, and improvements are intended to be part of this disclosure, and are intended to be within the spirit and scope of the invention. Accordingly, the foregoing description and drawings are by way of example only.

What is claimed is:

CLAIMS

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

positioning a surfboard core and hardenable material in a mold cavity of a flexible mold;

bending the flexible mold and surfboard core to a curvature;

curing the hardenable material to set the surfboard core and hardenable material to the curvature.

2. The method of claim 1, wherein positioning the surfboard core and hardenable material in the mold cavity comprises applying reinforcing sheets and hardenable resin to surfaces of the surfboard core.

3. The method of claim 2, wherein the reinforcing sheets comprise woven fiberglass sheets.

4. The method of claim 1, further comprising:

wrapping a rail portion of the surfboard core with the reinforcing sheets.

5. The method of claim 4, wherein wrapping the rail portion of the surfboard comprises cutting the rail portion from the surfboard core, wrapping the rail portion with the reinforcing sheets, and then reassembling the rail portion to the surfboard core.

6. The method of claim 4, wherein wrapping the rail portion comprises positioning a braided reinforcing sleeve about the rail portion.

7. The method of claim 6, wherein wrapping the rail portion comprises wrapping an entire perimeter of the surfboard rail with the braided reinforcing sleeve.

8. The method of claim 7, wherein the braided reinforcing sleeve includes carbon fiber material.

9. The method of claim 8, wherein the braided reinforcing sleeve includes fiberglass material.

10. The method of claim 1, wherein the surfboard core comprises a foam surfboard core, the method further comprising:

foaming the foam surfboard core in a foaming mold to a shape that conforms substantially to the mold cavity of the flexible mold.

11. A method of forming a surfboard, comprising:

providing a surfboard core that includes a central portion and a separate rail portion;

positioning a reinforcement about the rail portion of the surfboard core;

positioning the surfboard core, including the central portion and the separate rail portion, reinforcement, and hardenable material together in a flexible mold;

bending the flexible mold, the surfboard core, including the central portion and the separate rail portion, and reinforcement to a curvature;

curing the hardenable material so that the surfboard core retains the curvature.

12. The method of claim 11, further comprising:

applying reinforcing sheets and hardenable resin to surfaces of the surfboard core prior to curing the hardenable material.

13. The method of claim 12, wherein the reinforcing sheets comprise woven fiberglass sheets.

14. The method of claim 11, further comprising:

cutting the separate rail portion from the central portion of the surfboard core.

15. The method of claim 14, wherein cutting the separate rail portion comprises cutting the separate rail portion from an entire perimeter of the surfboard core.

16. The method of claim 11, wherein positioning reinforcement about the rail portion comprises positioning the rail portion in a braided sleeve of reinforcing material.

17. The method of claim 16, wherein the braided reinforcing sleeve includes carbon fiber material.

18. The method of claim 17, wherein the braided reinforcing sleeve includes fiberglass material.

19 The method of claim 11, wherein the surfboard core comprises a foam surfboard core, the method further comprising:

foaming the foam surfboard core in a foaming mold to a shape that conforms substantially to the to a mold cavity of the flexible mold.

20. A method of designing a flexible mold for imparting rocker to a surfboard, the method comprising:

constructing a surfboard, at least partially, to a first shape that includes a first rocker;

measuring the first shape;

creating a model having the first shape;

bending the model to a second shape;

constructing a flexible mold with a mold cavity that conforms substantially to the first shape when in a first flexed position and the second shape when in a second unflexed position.

21. The method of claim 20, wherein creating the model comprises creating an electronic model.

22. The method of claim 20, wherein constructing the flexible mold comprises constructing a flexible mold that includes first and second mold halves that engage one another along a parting line.

23. A method of forming a surfboard, the method comprising:

providing a surfboard core with a top surface and a bottom surface, the surfboard core including a main core portion and a rail portion, separate from the main core portion;

positioning a reinforcing sleeve about the rail portion;

applying hardenable material to at least a portion of the reinforcing sleeve;

assembling the rail portion and reinforcing sleeve to the main core portion;

curing the hardenable material to join the main core portion and rail portion of the surfboard core.

24. The method of claim 23, wherein positioning the sleeve comprises positioning a braided sleeve of fiberglass and/or carbon fiber about the rail portion.

25. The method of claim 23, wherein the rail portion of the surfboard core is cut from the main portion of the surfboard core.

26. The method of claim 23, wherein the rail portion comprises a ring that is positioned about the main portion of the surfboard core.

27. The method of claim 23, further comprising:

laminating the top surface of the surfboard core with one or more reinforcing sheets that extend partially over the rail portion.

28. The method of claim 27, further comprising:

laminating the bottom surface of the surfboard core with one or more reinforcing sheets that extend partially over the rail portion.

29. The method of claim 28, wherein laminating the top surface and laminating the bottom surface occur in a flexible mold.

30. A surfboard comprising:

a surfboard core defining top and bottom surfaces, the surfboard core including a central core portion and a separate rail portion;

a reinforcing sleeve positioned about the separate rail portion;

one or more reinforcing layers positioned over at least portions of the top and bottom surfaces.

31. The surfboard of claim 30, wherein the separate rail portion includes a complete perimeter of the surfboard core.

32. The surfboard of claim 30, wherein the surfboard core is cut to provide the separate rail portion and the central core portion.

33. The surfboard of claim 30, wherein the reinforcing sleeve comprises a braided sleeve of fiberglass and/or carbon fiber material.

34. The surfboard of claim 30, wherein the one or more reinforcing layers extend over at least a portion of the reinforcing sleeve.

35. A flexible mold for forming a surfboard with a shape that has a desired rocker, the flexible mold comprising:

a first mold portion having a first parting line;

a second mold having a second parting line configured to mate with the first parting line of the first mold portion to define a mold cavity between the first and second mold portions, wherein at least portions of the first parting line move relative to the second parting line as the flexible mold is flexed between a first position for receiving a layed up surfboard core and a second position that conforms substantially to the shape of the surfboard with the desired rocker.

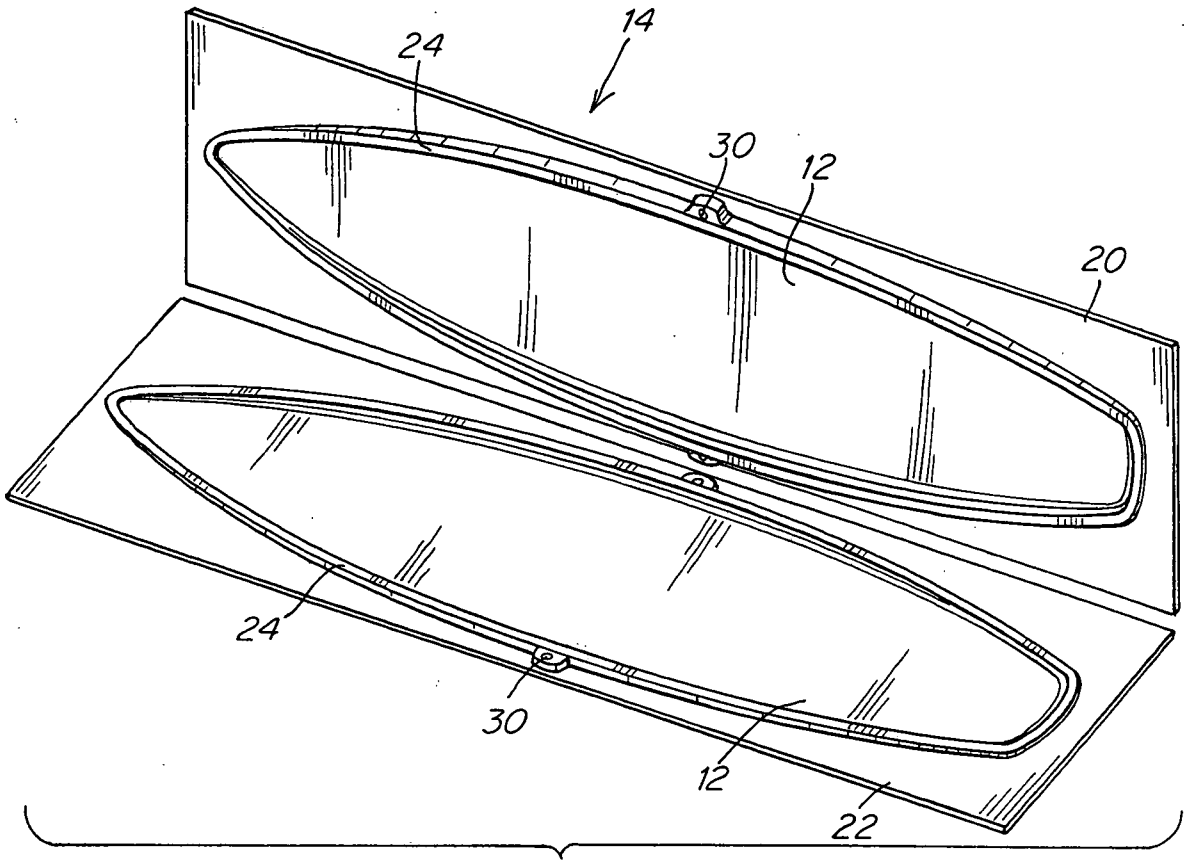

Fig. 1

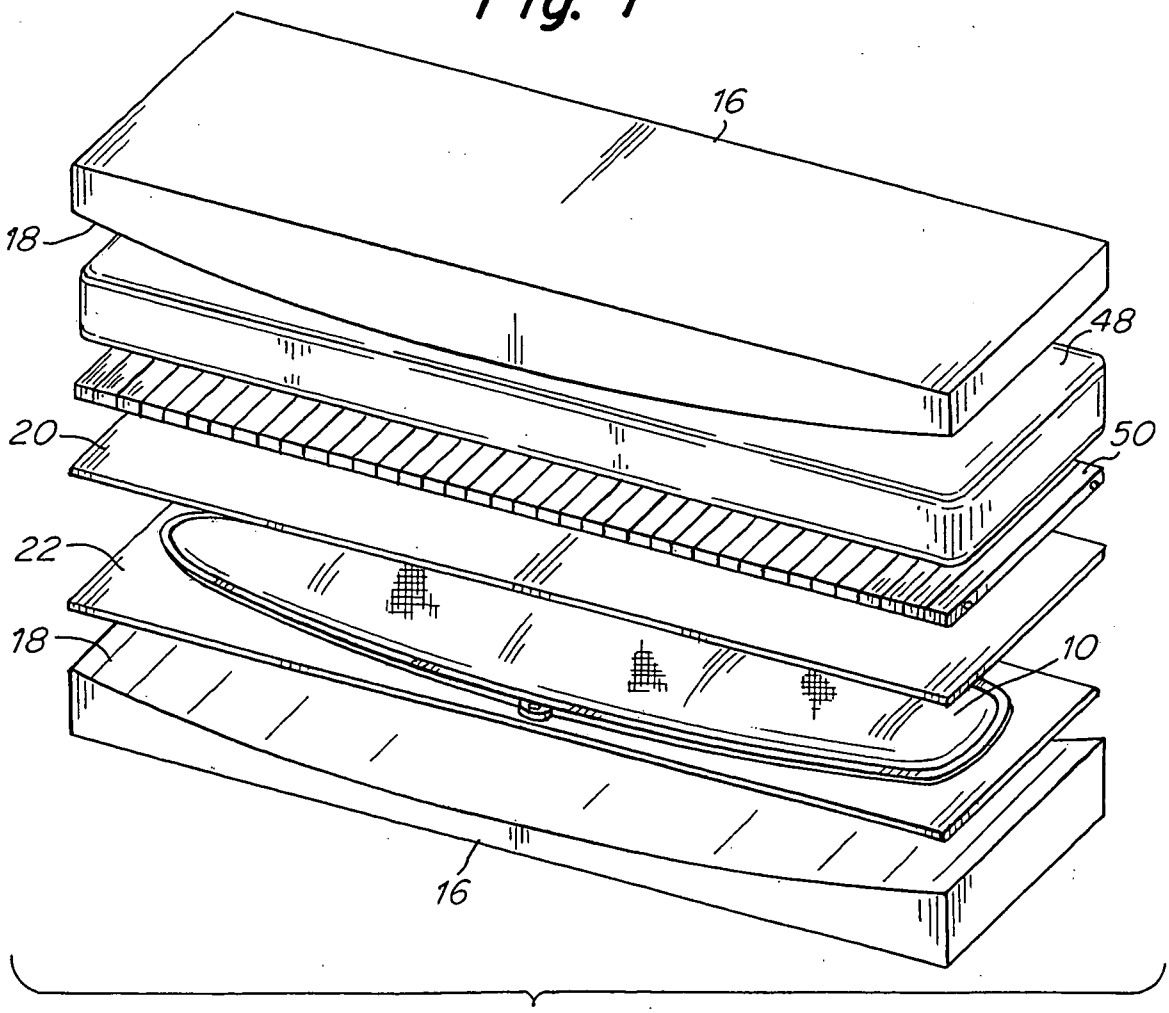

Fig. 2

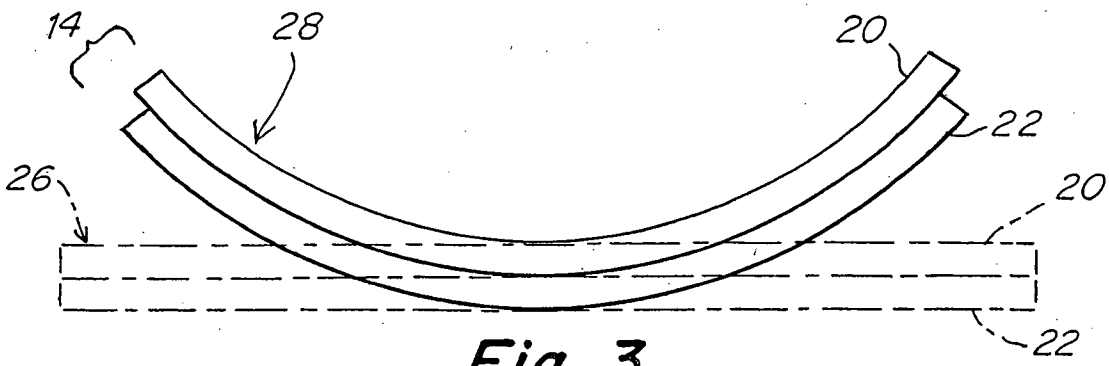

Fig. 3

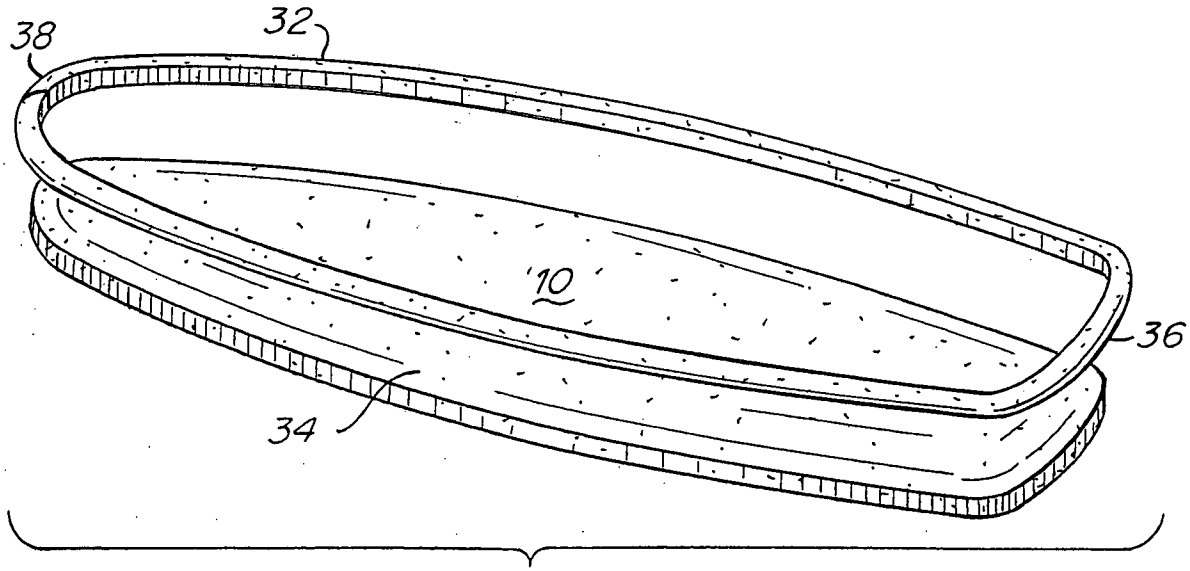

Fig. 4a

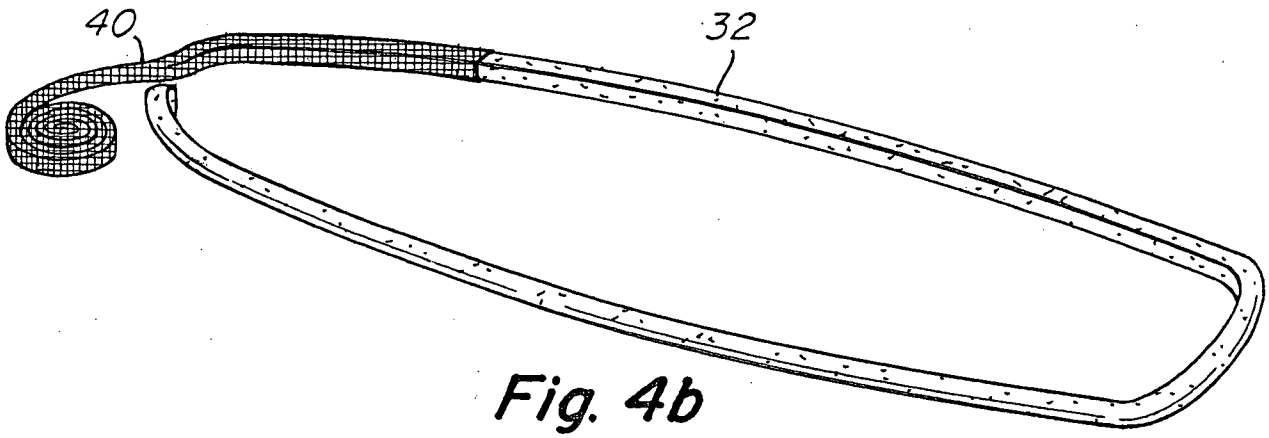

Fig. 4b

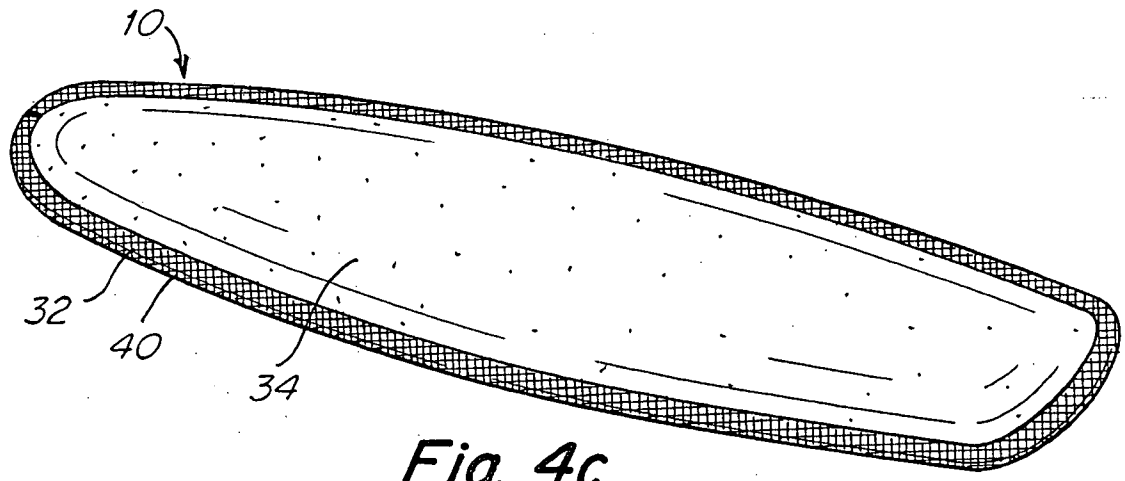

Fig. 4c

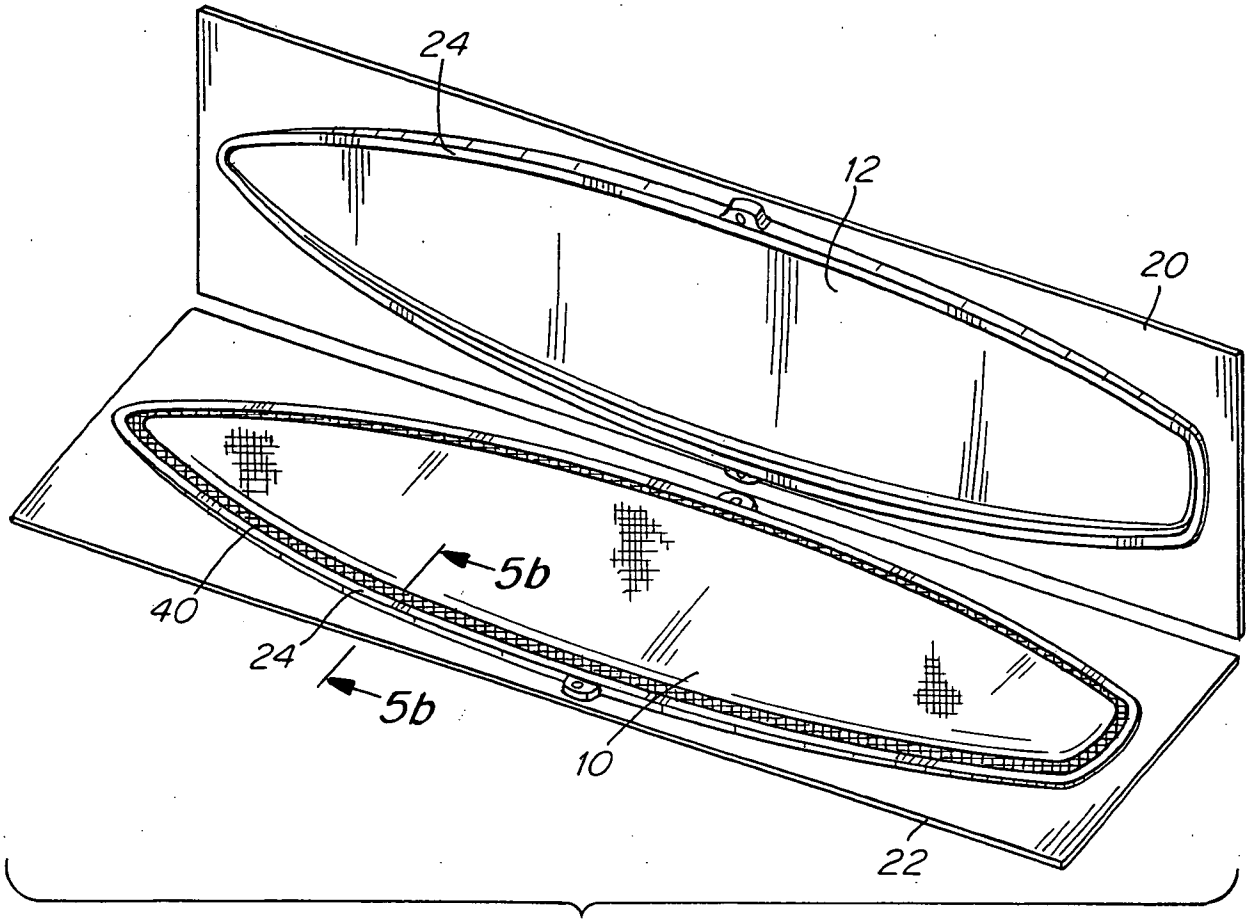

Fig. 5a

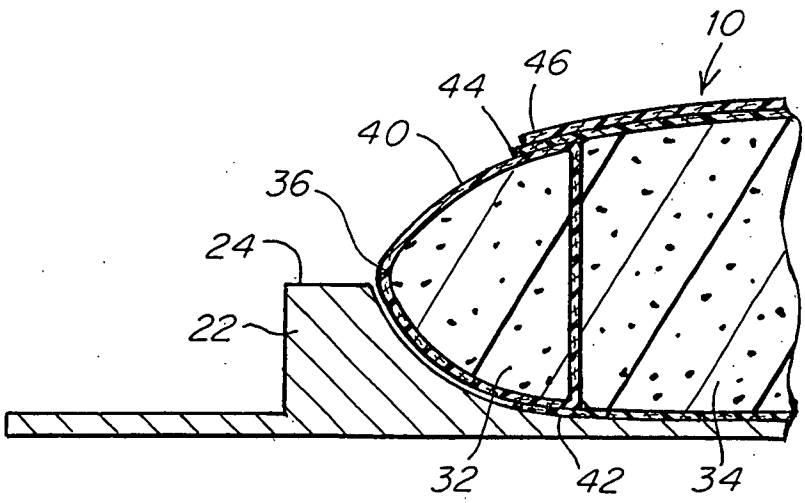

Fig. 5b

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/012874

A. CLASSIFICATION OF SUBJECT MATTER
INV. B29C33/30

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)
B29C

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 623 323 B1 (MEAD KIRBY J [US]) 23 September 2003 (2003-09-23) abstract figures 2A,2B,8-10,13 column 3, line 54 - column 5, line 28 column 8, line 20 - line 34 column 9, line 51 - column 10, line 2 column 11, line 8 - line 31 column 12, line 35 - line 49 column 13, line 45 - line 62	1-4, 10-13, 19,20, 22,35

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"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)

"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

"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

"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

"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.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 April 2009	13/05/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Lozza, Monica

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2008/012874

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6623323 B1	23-09-2003	US 2004043680 A1	04-03-2004
		US 2002031963 A1	14-03-2002