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(54) **STIFFENER FOR INFLATABLE DROP-STITCH STAND-UP PADDLE BOARD AND METHOD OF MANUFACTURING SAME**

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B63B 35/79 (2006.01)

(52) **U.S. Cl.**
CPC ***B63B 35/7913*** (2013.01)

(58) **Field of Classification Search**
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USPC 441/66
See application file for complete search history.

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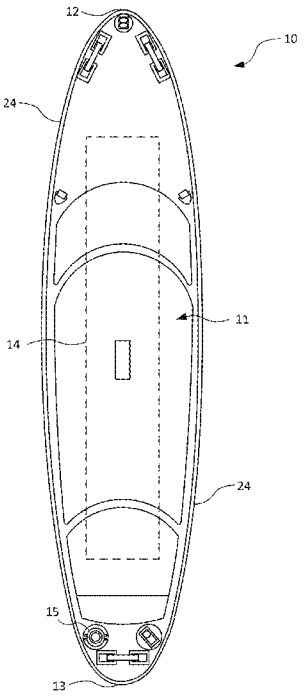
(57) **ABSTRACT**

An inflatable board, which can be used for floating or paddling on water, with a thin layer of inelastic material, such as acrylic, bonded between the layers of material forming the top or bottom surfaces of an inflatable board. The thin layer of inelastic material is bonded between the inner material and the outer material. The thin layer of inelastic material is bendable, so that the un-inflated board may be rolled-up for storage or transportation. When inflated, the thin layer of inelastic material bonded between the layers of the top or bottom surfaces of the board increases the rigidity of the board and the board's ability to resist flexing and bending.

12 Claims, 4 Drawing Sheets



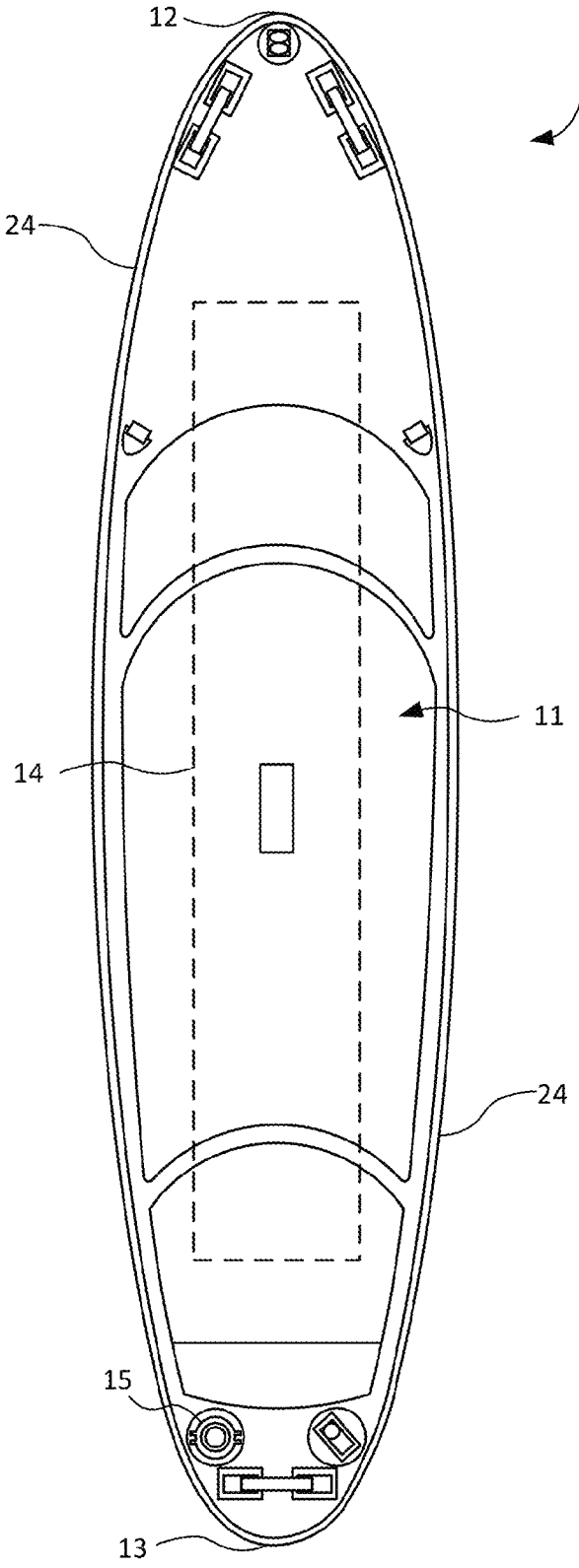


FIG. 1

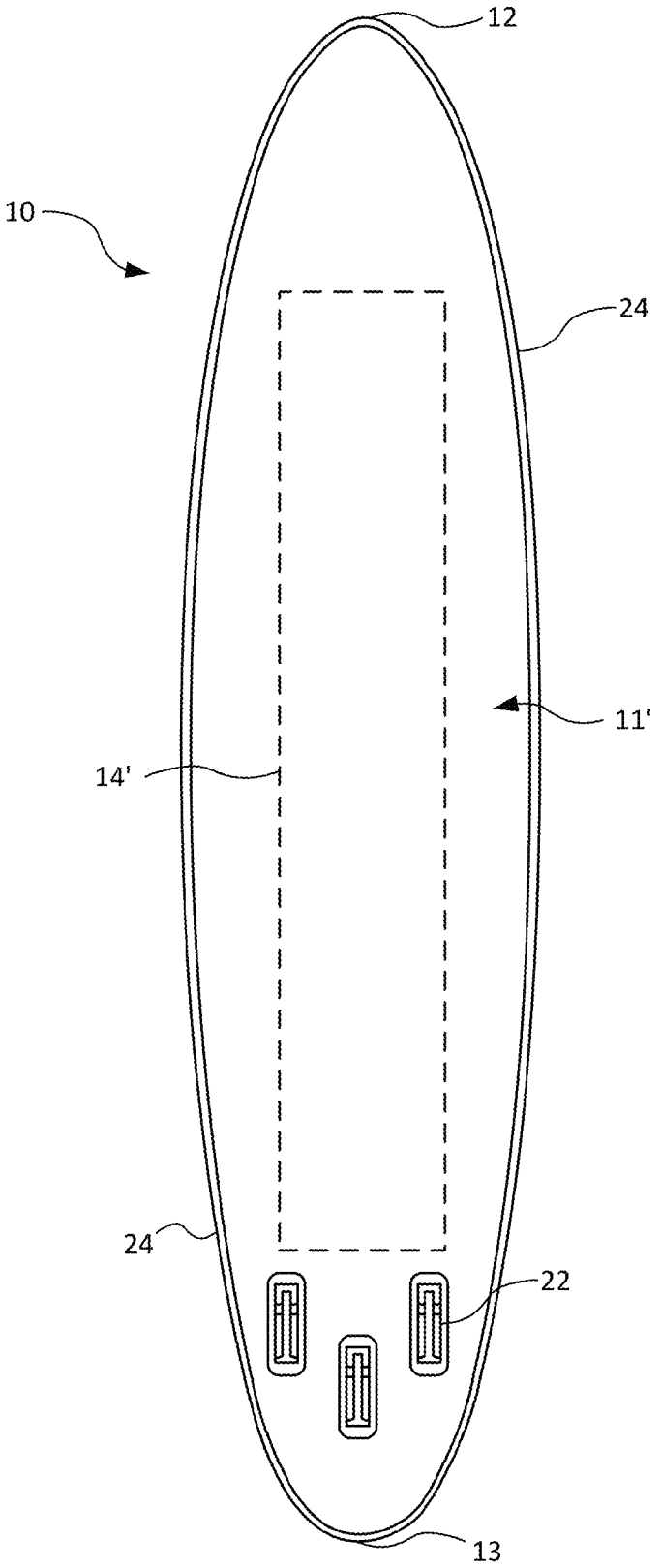


FIG. 2

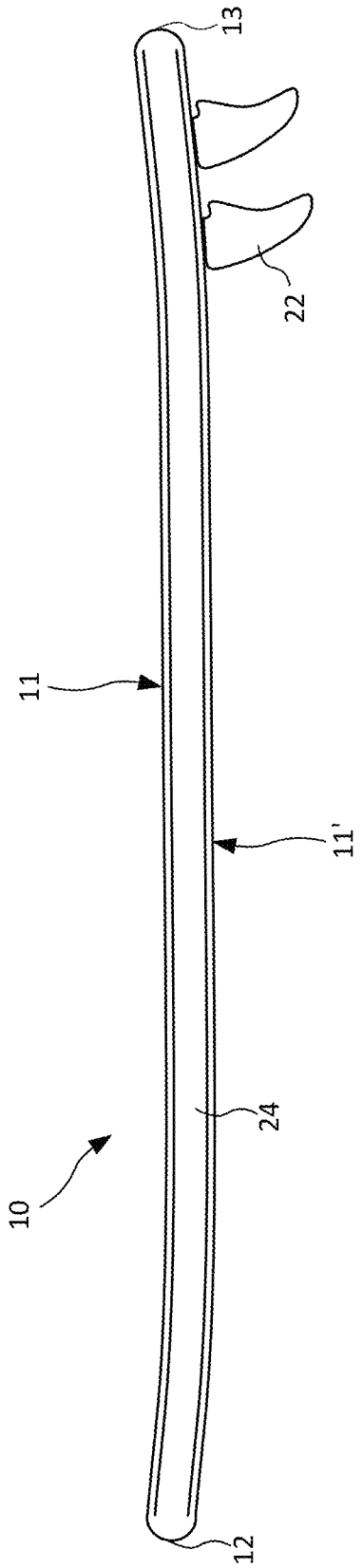


FIG. 3

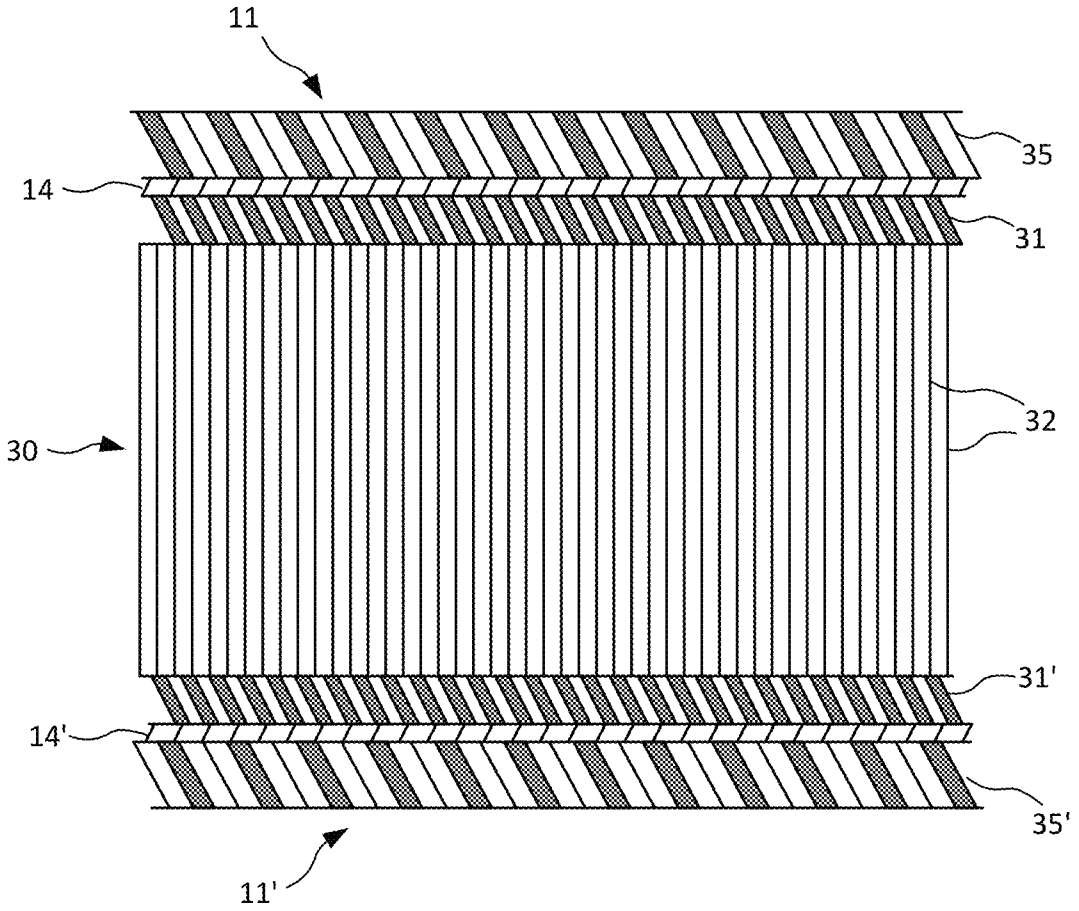


FIG. 4

STIFFENER FOR INFLATABLE DROP-STITCH STAND-UP PADDLE BOARD AND METHOD OF MANUFACTURING SAME

CLAIM OF PRIORITY TO PROVISIONAL APPLICATION (35 U.S.C. §119(e))

This application claims priority under 35 U.S.C. §119(e) from provisional patent Application No. 61/832,071, filed Jun. 6, 2013. The 61/832,071 Application is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a stiffener for an inflatable water recreation board, such as an inflatable "Stand Up Paddle" ("SUP") board, especially for such a board constructed of drop-stitch material.

2. Background

Inflatable SUP boards are most often used for recreational purposes, such as paddling and catching waves in the ocean and paddling and riding rapids in rivers. Inflatable SUP boards, and inflatable water sports boards in general, are useful, because they are more easily transported than traditional, rigid boards made of fiberglass or hard plastics, insofar as an inflatable board can be deflated, rolled up, and put in a car trunk or even carried by a hiker, whereas traditional boards must be carried on a car's roof rack or schlepped under a surfer's arm or the surfer's head. This advantage has long been recognized in the art, for example in U.S. Pat. No. 2,018,548 to William T. Currey, issued in 1935, for an inflatable "Surf Board", where one of the problems the invention was intended to solve was that the prior art boards could not "be readily collapsed to occupy small space for transportation." Id., at col. 1, lines 22-24, and at col. 1, lines 38-40 (the invention could "be collapsed or inflated as desired, the device when collapsed occupying a relatively small space"). Another long-recognized disadvantage of traditional rigid boards is that, owing to their rigidity, they can injure the user or other nearby persons if the board hits them. See, e.g., U.S. Pat. No. 1,206,696 to Gulbrandsen, issued in 1916, for a "Surf Coaster", at col. 1, lines 19-22. Inflatable boards, which are made of air-tight, rubbery materials, are less likely to cause injury to persons hit by them. Yet another disadvantage of rigid boards, especially when used in riding river rapids, is that they are easily damaged and dinged when they strike a rock. Inflatable boards can absorb and withstand these impacts, usually without any damage.

However, inflatable surfboards have always had a nagging defect, in that they are not rigid and, as a result, tend to bend and distort when used. This defect makes inflatable boards much less desirable, especially when they are used for riding waves or rapids. Various attempts at overcoming this problem have been proposed. For example, U.S. Pat. No. 3,657,753 to Le Blanc., Sr., issued in 1972, for a "Folding Inflatable Surfboard", disclosed an inflatable surfboard that resisted longitudinal bowing by use of a flexible, but substantially non-elastic, convex panel placed over the top surface of the un-inflated board. Id., Abstract. When the board is inflated, the panel is held in a bowed condition, which secures the panel and prevents the board from flexing. Id.

In the years following World War II, efforts were made to develop an inflatable material with increased rigidity and from this work "drop-stitch" construction was created. See, e.g., U.S. Pat. No. 2,753,573 to Barker, issued in 1951, for an "Inflatable Mattress", U.S., Pat. No. 4,251,573 to McCrory et al., issued in 1981, for "Inflatable Boat For High Speed Use". This use of drop-stitch construction was adapted to inflatable rescue boards (see e.g., U.S. Pat. No. 3,775,782 to Rice et al., issued in 1973, for an "Inflatable Aquatic Rescue Board And Method Of Rescue"), and has in recent years found success in inflatable SUP boards. Yet, while drop-stitch construction substantially increases an inflatable board's rigidity when compared to earlier inflatable water craft, the problem has not been fully solved and the flexing problem persists.

What is needed is an inflatable board that overcomes the problem of flexing. More particularly, needed is an inflatable board of drop-stitch construction, which retains the advantages of being easily transported and posing less risk of injury to the user or others, yet provides increased rigidity and a resistance to bowing and flexing.

SUMMARY OF THE INVENTION

The present invention is an inflatable board, which can be used for floating or paddling on water, with a thin layer of inelastic material, such as acrylic, bonded between the layers of material forming the top or bottom surfaces of an inflatable board. For example, in an inflatable SUP board employing drop-stitch construction, the thin layer of inelastic material is bonded between the inner, fabric material and the outer, PVC material. The thin layer of inelastic material is bendable to a degree, so that the un-inflated board may be rolled-up for storage or transportation. When inflated, the drop-stitch construction forms a hard, flat board. The thin layer of inelastic material bonded between the layers of the top or bottom surfaces of the board increases the rigidity of the board and the board's ability to resist flexing and bending.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top view of an inflatable stand-up paddleboard with a stiffener incorporated into the top layer.

FIG. **2** is a bottom view of the inflatable stand-up paddleboard with a stiffener incorporated into the bottom layer.

FIG. **3** is a side view of an inflatable stand-up paddleboard.

FIG. **4** is a side view of a cross-section of the drop-stitch construction of an inflatable drop-stitch stand-up paddleboard, showing stiffening film layers incorporated into the top and bottom surfaces.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** shows a top view of an inflatable SUP board **10**, indicating the front **12**, rear **13**, and top surface **11** of the board **10**, as well as the inflation valve **15**, near the rear **13**. As seen in FIG. **4**, the inelastic stiffening film layer **14** in the top surface **11** of the board **10** is sandwiched between the top substrate **31** of the drop-stitch core **30** and the outer PVC layer **35**. The drop-stitch threads **32** are interwoven with a base cloth layer incorporated into substrate **31**. One side of the top stiffening film **14** is bonded to the top drop-stitch substrate **31**, and the other side of the top stiffening film **14** is bonded to the top PVC layer **35**. Referring again to FIG. **1**, the inelastic stiffening film layer **14** occupies a portion of the central part of the top surface **11** of the elongated board **10**, but the inelastic stiffening film layer **14** can occupy a larger or smaller area.

FIG. **2** shows a bottom view of the inflatable SUP board **10**, indicating the front **12**, rear **13**, and bottom surface **11'** of the board **10**, as well as the skegs **22**, near the rear **13**. Referring again to FIG. **4**, as with the upper stiffening film **14**, the

bottom stiffening film **14'** is bonded between the drop-stitch bottom substrate **31'** of the drop-stitch core **30** and the outer PVC layer **35'**. The drop-stitch threads **32** are interwoven with a base cloth layer incorporated into bottom substrate **31'**. One side of the bottom stiffening film **14'** is bonded to the bottom drop-stitch substrate **31'**, and the other side of the bottom stiffening film **14'** is bonded to the bottom PVC layer **35'**. As with the top surface stiffening film **14**, the bottom stiffening film **14'** can occupy substantially all or only a portion of the bottom surface **11'**

It has been found that, for an average sized inflatable SUP board that is about 10 feet long by 30 inches wide by 4 inches thick, top and bottom stiffening films (**14** and **14'**) of about 6.5 feet long by 12 inches wide by 188 micrometers (0.188 mm) thick are effective in increasing stiffness up to 20% over the same board without the stiffening films. Increasing the thickness of the stiffening films can further increase stiffness, but at the expense of increased inflexibility in the deflated state. Thinner stiffening films make the board easier to roll-up for storage, but the stiffening effect drops off quickly. Increasing the portion of the area of the top or bottom surfaces (**11** and **11'**) covered by the stiffening films (**14** and **14'**) adds some incremental stiffness. The dimensions of the average sized inflatable SUP board (about 10×2.5 feet) and stiffening film **14** (6.5×1 feet), stated above, results in a top or bottom stiffening film (**14** or **14'**) that occupies about 30% of the central surface area of the top or bottom surface (**11** or **11'**) of the board **10**. Increasing the area of the surface (**11** or **11'**) covered by the stiffening film (**14** or **14'**) will provide some incremental stiffness, but as the inelastic stiffening films (**14** and **14'**) reach the rails **24** of the board **10**, undesired creasing of the inelastic film **14** material may occur where the flat surface of the drop-stitch material meets the curving area at the rails **24**. Because the stiffening film is inelastic, as discussed below, it will resist stretching and bending to conform to complex contours, thereby degrading the integrity of the layers in the inflatable board. Reducing the area of the portions of the top or bottom surfaces (**11** or **11'**) covered by the stiffening films (**14** or **14'**) decreases the stiffness and this decreased stiffness drops quickly as less surface area is covered. It is possible to increase the stiffness of an inflatable drop-stitch board by using a stiffening film (**14** or **14'**) in only one of the top or bottom surfaces (**11** or **11'**) of a board **10**, but it has been found that the effectiveness is greatest when used in both top **11** and bottom **11'** surfaces.

Drop-Stitch material **30** allows structures to be inflated to high pressures by joining the surfaces by tens of thousands of fine threads **32**. The process starts by joining two pieces of polyester woven support fabric (**31** and **31'**) with thousands of fine polyester thread lengths **32**. This base material (**31** and **31'**) is made in strips from five to ten feet in width, and up to 400 needle heads may be used in the manufacture. Each needle sews a continuous, evenly spaced thread **32**, back and forth between the two pieces of woven fabric base material (**31** and **31'**). Polyester thread is used throughout because it is strong, durable and has very little stretch. The polyester threads **32** are substantially inelastic and the thousands of threads **32** lock the base substrates (**31** and **31'**) together to form an exceptionally strong unit. In conventional drop-stitch construction, air-tight PVC coating layers (**35** and **35'**) are applied to the outer surfaces of both base substrates (**31** and **31'**). In the present invention, a stiffening film layer (**14** or **14'**) is disposed between at least one of the top or bottom drop-stitch base substrates (**31** or **31'**) and the outer layers (**35** or **35'**), by bonding the stiffening film (**14** or **14'**) to the base substrate (**31** or **31'**) and bonding the outer layer (**35** or **35'**) to the stiffening film (**14** or **14'**). Sidewall material (not shown), usually made of a polyester base fabric with a non-breathable coating on both sides, is then glued between the top and bottom surfaces (**35** and **35'**) to form the edges, or rails, **24** of the board **10** and create an airtight drop-stitch core **30**. This construction can be inflated to pressures up to 15 pounds per square inch (psi). The inelastic stiffening films (**14** and **14'**) are supported by the rigid drop-stitch core **30** and provide reinforcement against flexing, thereby decreasing the tendency of the inflatable board to deform or bend. This construction makes the inflatable board **10** more like the rigid fiberglass or hard plastic boards, although the resulting board is still less likely to cause injury to the user or persons nearby, because the outer PVC construction is still relatively soft and the rails **24**, which are the part most likely to strike someone, remain soft. Yet, when deflated, the stiffening films (**14** and **14'**) can be bent enough such that the board **10** can rolled-up for storage.

The stiffening films (**14** and **14'**) of the present invention are, preferably, made of an inelastic material that allows little stretching or bending, such as acrylic. When supported by an inflated drop-stitch core **30**, an acrylic stiffening film layer (**14** and **14'**) provides significant added stiffness when a user is standing on the top **11** of the board **10**. Tests of the present invention have shown that an inflatable drop-stitch SUP board **10** with acrylic stiffening film layers (**14** and **14'**) will have up to 20% more resistance to bending in response to pressure exerted against the center of the board **10**, where a SUP rider stands, as compared to the same board without the stiffening films (**14** and **14'**).

While the inflatable water board stiffener of the present invention has been described as being applied to a drop-stitch SUP board, it will be obvious to a person skilled in the art that it may also be applied in other situations where a corresponding stiffening need exists.

I claim:

1. An inflatable board capable of floating in water, comprising:

a drop-stitch core having a top substrate with an inner top substrate surface and an outer top substrate surface, and a bottom substrate with an inner bottom substrate surface and an outer bottom substrate surface, the inner top substrate surface joined to the inner bottom substrate surface by a plurality of threads, wherein the top substrate surface forms a substantially planar top surface held by the plurality of threads at a fixed distance from the bottom substrate surface which forms a substantially planar bottom surface when the board is inflated, wherein the core has a length and a width, wherein the core length is longer than the core width, and wherein the top substrate surface has a top substrate periphery and the bottom substrate surface has a bottom substrate periphery,

an edge material joining the top and bottom substrate peripheries to form a rail, wherein the rail forms a top rail curve at the top substrate periphery and a bottom rail curve at the bottom substrate periphery, and

a stiffening layer, formed of an inelastic film, disposed over at least one of the substantially planar top surface or substantially planar bottom surface, wherein the stiffening layer has a layer length smaller than the core length and a layer width smaller than the core width, wherein the layer length and width form a layer periphery, and wherein the layer periphery does not extend beyond the substantially planar top or bottom surfaces to the top or bottom rail curves.

2. The inflatable board of claim 1, further comprising an airtight material disposed over the outer top and bottom substrate surfaces.

3. The inflatable board of claim 2, wherein the airtight material is further disposed over the edge material.

4. The inflatable board of claim 2, wherein the edge material is airtight.

5. The inflatable board of claim 2, wherein the stiffening layer is disposed between the outer top or bottom substrate surfaces and the airtight material.

6. The inflatable board of claim 2, wherein the stiffening layer is disposed over the airtight material.

7. The inflatable board of claim 1, wherein the core length and width define a core area, wherein the layer length and width define a layer area, and wherein the layer area is not more than 40 percent of the core area.

8. The inflatable board of claim 7, wherein the layer area is between 25 percent and 35 percent of the core area.

9. The inflatable board of claim 1, wherein the stiffening layer has a thickness and said thickness is not more than 0.250 mm.

10. The inflatable board of claim 9, wherein the stiffening layer thickness is between 0.200 mm and 0.150 mm.

11. The inflatable board of claim 1, wherein the inelastic film is acrylic.

12. The inflatable board of claim 1, wherein the stiffening layer is disposed over both of the substantially planar top surface and the substantially planar bottom surface.

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