Title: DUAL DENSITY FOAM CORE SPORTS BOARD

Abstract: A sports board (10) with an expanded foam core (26, 28) that has a density adapted so the core will receive a solid sheet skin (30, 32) laminated directly thereto without an adhesive layer. The sports board (10) includes a bottom solid sheet skin (30) laminated directly to a bottom surface (20) of the expanded foam core (26, 28), and a foam top skin (32) laminated to a top surface and heeled to side surfaces of the expanded foam core (26, 28).
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
DUAL DENSITY FOAM CORE SPORTS BOARD

Related Application

The present application claims priority to co-pending U.S. Provisional Patent Application Serial No. 60/274,735, filed on March 9, 2001, and entitled “FOAM SLEDDING DEVICE,” and the complete disclosure is hereby incorporated by reference.

Field of the Invention

The present invention relates generally to sports boards. More specifically, the invention relates to sports boards having two densities of foam core.

Background of the Invention

Sports boards are popular for a variety of recreational activities, such as snow sledding, body boarding, surfing, etc. Wham-O, Inc.’s BOOGIE BOARD® body boards have been used for years by children and adults for sport in ocean surf and to cool off, in an entertaining way, on warm summer days. Similarly, Wham-O, Inc.’s SNOWBOOGIE® sleds have been used for recreation on winter days. Typical sports boards use an expanded foam core, a foam skin laminated to the top and side surfaces, and a solid skin having a thin foam backing laminated along the bottom surface. An example of a typical sports board is shown in U.S. Patent No. 4,850,913 to Szabad. The sports board in Szabad includes a polyethylene film laminated to a polyethylene foam sheet to form a composite film/sheet laminate that is then laminated onto a polyethylene core. The laminated solid skin improves durability and reduces drag as the sports board slides along the snow or through the water. One problem with laminating a solid skin to the bottom of the sports board is that for proper adhesion between the solid skin and the
core a thin foam-backing layer must be laminated to the solid skin prior to laminating the skin to the core of the board. Only after the foam-backing layer has been applied can the solid skin be laminated to the bottom surface of the sports board. If a solid skin was laminated directly to the core, either the core would blister, or the skin would be too rough and lack toughness.

Another problem with typical sports boards is the stiffness requirements of the core of the board make it uncomfortably firm. Often relatively dense expanded polymer foam must be used as the core to create a sports board with the proper stiffness. Using a dense expanded foam results in an uncomfortably hard board for a user to kneel or lie on.

Yet another problem encountered in sports boards is that with a slick solid skin laminated to the bottom surface the boards are not easily steered. A sports board constructed of foam lacks hard sharp edges that can be used to carve turns in the snow or water.

It would be desirable to develop a sports board that is easy to manufacture, has the needed stiffness, while including a comfortable surface for riding, and has a structure that enables greater steering control. Greater comfort may be achieved through the use a multi-layer expanded foam core, where each layer had a different density. A top layer may have a softer density for comfort, while a lower layer may have a higher density providing needed stiffness.

Summary of the Invention

A sports board with an expanded foam core that has a density adapted so the core will receive a solid sheet skin laminated directly thereto without an adhesive layer. The sports board includes a bottom solid sheet skin laminated directly to a
bottom surface of the expanded foam core, and a foam top skin laminated to a top surface and heeled to side surfaces of the expanded foam core. The sports board may also include a dual density foam core.

**Brief Description of the Drawings**

Fig. 1 is a top plan view of a sports board according to one embodiment of the present invention.

Fig. 2 is a bottom plan view of the sports board of Fig. 1.

Fig. 3 is a cross-sectional view of the sports board of Fig. 1, taken along line 3-3.

Fig. 4 is the partial sectional view of the sports board of Fig. 1, showing a handle attached thereto.

Fig. 5 is the cross-sectional view of a runner of the sports board of Fig. 1, taken along line 5-5, showing the assembly of a snap rivet with the runner.

Fig. 6 is a schematic view of a foam core lamination process for making a sports board.

Fig. 7 is a sports board foam core blank having two different foam densities.

Fig. 8 is a schematic view of a solid sheet laminating process for making a sports board.

Fig. 9 is a plan view of a sports board shape to cut out of a laminated sports board blank.

Fig. 10 is a cross-sectional view of a sports board, illustrating the heeling of a top foam skin onto the sports board.
Detailed Description and Best Mode of the Invention

A sports board according to one embodiment of the present invention is shown in Figs. 1 and 2, generally indicated at 10. Sports board 10 may be a body board, a sled, or similar recreation board for sliding along water or snow. Sports board 10 includes a body 12 having handles 14 and runners 16 connected thereto.

Body 12 includes a top surface 18, shown in Fig. 1, and a bottom surface 20, shown in Fig. 2. The top surface of the sports board includes handles 14 mounted thereto. The bottom surface of the sports board includes runners 16 mounted thereto. Handles 14 may be configured for a person to grip when using the sports board. Children, for example, may use sports board 10 for sliding on snow by gripping handles 14 with their hands and lying prone on top surface 18 of body 12. Runners 16 may be configured to aid in steering the sports board while sledding. Children, for example, may steer sports board 10, while sliding down hill on snow, by shifting their weight from side to side causing the runners to dig into the snow and carve a turn.

As shown in Figs. 1 and 2, sports board 10 includes four handles 14 and four runners 16. It should be understood that other handle configurations and runner configurations may be used with the present invention. Further, it should be understood that in some applications, such as a sports board for surfing, runners 16 may take the form of fins configured to aid in steering the sports board gliding through the water. The position of runners 16 may be moved according to the activities for which the sports board is designed.

Handles 14 are secured to body 12 using snap rivets 22 and strap 24. Each strap 24 is threaded through each handle 14 and snap rivet 22 is inserted through an aperture
(not shown) in strap 24 securing the strap to body 12 of board 10, as will be further explained below with reference to Fig. 4. It should be noted that handles 14 may be positioned on body 12 in other locations and that there may be any number of handles 14.

A cross-section of sports board 10, taken along line 3-3 of Fig. 1, is shown in Fig. 3. Body 12 of sports board 10 includes a first core section 26, a second core section 28, a solid sheet bottom skin 30, and a foam sheet top skin 32. First core section 26 has a first density $\rho^l$. Similarly, second core section 28 has a second density $\rho^h$. First density $\rho^l$ is less than second density $\rho^h$. First density $\rho^l$ may be in the range of around 1.0 pounds per cubic foot (PCF) to 1.5 PCF, and preferably first density $\rho^l$ may be around 1.2 PCF. Second density $\rho^h$ may be in the range of around 1.7 PCF to 3.0 PCF, and more preferably second density $\rho^h$ may be around 2.2 PCF. By having a density of 2.2 PCF, core section 28 may be optimized for bonding to skin 30.

Solid bottom skin 30 may be a solid polymer sheet having a low coefficient of friction to enhance the performance of the sports board. Solid bottom skin 30 may be in the range of 6 to 25 mils thick, and more preferably around 15 mils thick. Solid bottom skin 30 may be made of extruded polyethylene or other polyolefins. The thickness of skin 30 may be selected to optimize bonding to second core section 28 and durability of sports board 10.

Foam sheet top skin 32 may be a high-density polymer foam sheet having a relatively thin thickness. Skin 32 may have a density in the range of about 4 to 10 PCF, preferably 6 PCF, and a thickness in the range of about 0.100 to 0.150 inches, preferably
0.125 inches. Skin 32 may be textured and have a tackiness to prevent a rider from slipping off of sports board 10 while riding.

In Figs. 4 and 5, the coupling of handle 14 and runner 16 through body 12 is shown. Strap 24 is threaded through handle 14 and secured to body 12 by snap rivet 22. Strap 24 may be any suitable flexible material such as nylon webbing. Strap 24 includes apertures (not shown) in each end sized to enable the snap rivet 22 to pass through the end of the strap. Snap rivet 22 may be adapted to couple with a snap post 34 that extends upward from runner 16. Snap post 34 includes snap slots 36 that are configured to engage snap rivet 22 and retain the rivet after it has been inserted into the snap post.

As illustrated in Fig. 5, snap rivet 22 includes snap segments 38. As shown, snap segments 38 are frusto-conical shape and are configured to snap into successive snap slots 36 until all the snap segments are completely inserted. As shown in Fig. 4, snap posts 34 are inserted from the bottom of body 12 upwardly through apertures in the body. Snap rivets 22 are then inserted from the top of body 12 downwardly through the apertures in straps 24 and into snap post 34. As snap rivet 22 inserts into snap post 34, snap segments 38 engage snap slots 36 securing handle 14 to runner 16 through the body of sports board 10.

Runner 16 may be a hard plastic or similar material adapted to keep sports board 10 tracking along in a single direction. Runners 16 further enable a rider to cause the sports board to turn by shifting the rider’s weight on the sports board enhancing the play value of the sports board. As shown in Fig. 5, runner 16 has a narrow lower end
configured to keep the sports board on track in the snow, traveling in the direction pointed by the rider.

One method of manufacturing sports boards according to the present invention is illustrated in Figs. 6-10. First, two extruded foam core materials having different densities are laminated together and cut into sports board blanks, as shown in Figs. 6 and 7. Second, bottom skin 30 is extruded and directly laminated onto the sports board blanks, as shown in Fig. 8. Third, the sports board blanks are cut into the shape of sports boards and a foam top skin is laminated onto each cut sports board, as shown in Fig. 9. Finally, the foam top skin is heeled around the sides of the core completing the sports board.

In Figs. 6 and 7, a roll 40 of foam having density $\rho^h$ is positioned above a roll 42 of foam having density $\rho^l$. Foam rolls 40, 42 may be closed cell polyethylene foam or other suitable expanded polymer closed cell foams having the required material properties, such as density, modulus of elasticity, etc. Both foam rolls 40, 42 feed foam past a heater 44 and into laminating rolls 45 and 47. The foam of roll 40 having density $\rho^h$ will become the second foam core section 28 and the foam of roll 42 having the density $\rho^l$ will become first foam core section 26. Heater 44 may be any suitable heater, for example, a radiant heater, a hot air heater, or an infrared heater, etc. Heater 44 produces a heating zone at a temperature of around 700 °F for about a 4 inches long segment between foam rolls 40 and 42 and laminating rollers 45 and 47. Traveling through the heating zone softens the two layers of foam to prepare them for laminating between laminating rollers 45 and 47. Laminating rollers 45 and 47 are heated to a temperature of 375 °F to aid in the laminating process. After the two foam layers have
been laminated together the laminated material passes over a cooling table 46 cooling table 46 allows the two laminated foam layers to harden again. Finally, once the laminated foam layers are sufficiently cooled and hardened they are cut into sports board blanks by cutter 48. Cutter 48 may be a flying cutter, or other similar cutter that may be used in a continuous manufacturing process. Sport board blank 50 is shown in Fig. 7, and may have dimensions around 1.0 inch thick, 94 inches long, and 48 inches wide. It should be understood that other dimensions for sports board blank 50 are contemplated within the scope of the present invention. Once sports board blank 50 has been formed it is ready to receive bottom skin 30.

Conventional techniques for bonding a solid skin to a foam core require the use of a sacrificial layer of thin foam to be laminated to the solid skin before the skin can be laminated to a thick foam core. The reason for the use of a sacrificial layer has to do with the heat energy carried by the solid sheet when it is at a bonding temperature and the insulating property of thick foam sheets. The solid sheet carries so much heat energy that bonding to a thick highly insulating foam causes the heat energy to build up and melt the foam, resulting in distortions in the surface of the sheet. By applying a thin sheet of foam as a sacrificial or adhesive layer to the solid skin the distortion problem is avoided.

In Fig. 8, the process for extruding bottom skin 30 and laminating it onto sports board blank 50 is shown. By using a higher density foam core and carefully controlling the temperature of the solid skin a direct lamination process is possible without the above described distortion problems. Bottom skin 30 may be extruded out of extruder 52 and feed around tension roller 54 and around laminating roller 56. Laminating roller 56 may
be temperature controlled to ensure that bottom skin 30 reaches the laminating point at a temperature of approximately 375 °F. Skin 30 may have a temperature higher than 375 °F when it exits extruder 52, and therefore laminating roller 56 may have to be chilled to ensure skin 30 contacts sports board blank 50 at the correct temperature. The density $p^h$ of the second core section is optimized to bond directly with bottom skin 30 without distortions. Tension roller 54 may move to collect and release slack in extruded skin 30 to maintain an efficient laminating process. Sports board blank 50 should be fed into the laminating roller 56 with second core section facing upward to receive skin 30. It should be noted that laminating skin 30 to sports board blank 50 may be done prior to cutting the blank. For example, extruder 52 and laminating roller 56 may be used downstream of laminating rollers 45 and 47 prior to the step of cutting the composite core material with cutter 48 into sports board blank 50.

Sports board blank 50 is cut to the size and shape of sports board 10 and has foam top skin 32 laminated thereto, as shown in Fig. 9. Blank 50 may be cut using a die cut process or similar method of shaping the blank to the desired shape of the sports board. Foam top skin 32 may be laminated using conventional laminating techniques directly to core section 26 of body 12.

The last step in the manufacture of body 12 is heeling foam top skin 32 to the sides and edges of body 12, as shown in Fig. 10. Heeling may be done by hand application of pressure and heat using irons, or a similar operation. When the heeling process is complete the handles and runners are attached, as discussed above, and the sports board is ready for use.
It is believed that the disclosure set forth above encompasses multiple distinct inventions with independent utility. While each of these inventions has been disclosed in its preferred form, the specific embodiments thereof, as disclosed and illustrated herein, are not to be considered in a limiting sense as numerous variations are possible. The subject matter of the inventions include all novel and non-obvious combinations and sub-combinations of the various elements, features, functions and/or properties disclosed herein. Where claims recite "a" or "a first" element or equivalent thereof, such claims should be understood to include incorporation of one or more such elements, neither requiring, nor excluding two or more such elements.

It is believed that the following claims particularly point out certain combinations and sub-combinations that are directed to one of the disclosed inventions and are novel and non-obvious. Inventions embodied in other combinations and sub-combinations of features, functions, elements and/or properties may be claimed through amendment of those claims or presentation of new claims in this or a related application. Such amended or new claims, whether they are directed to a different invention or directed to the same invention, whether different, broader, narrower or equal in scope to the original claims, are also regarded as included within the subject matter of the inventions of the present disclosure.
I Claim:

1. A sports board comprising:

an expanded foam core having a density adapted so the core will receive a solid sheet skin laminated directly thereto without an adhesive layer; and

a bottom solid sheet skin laminated directly to a bottom surface of the expanded foam core.

2. The sports board of claim 1, wherein the expanded foam core includes a first section having a first density and a second section having a second density, and wherein the second density is adapted to receive a solid sheet skin laminated directly thereto without an adhesive layer.

3. The sports board of claim 2, wherein the second density is in the range of 1.7 to 3.0 pounds per cubic foot.

4. The sports board of claim 2, wherein the second density is around 2.2 pounds per cubic foot.

5. The sports board of claim 1, wherein the bottom solid sheet skin has a thickness in the range of 6-25 mils.
6. The sports board of claim 1, wherein the bottom solid sheet skin has a thickness of about 15 mils.

7. The sports board of claim 2, wherein the sports board further includes a handle attached to a top surface of the board.

8. The sports board of claim 2, further including a set of runners attached to the bottom surface of the board.

9. The sports board of claim 2, further including a handle attached to the top surface through the sports board to a runner attached to the bottom surface of the sports board.

10. A dual density foam core sports board comprising:

   a first core section having a first density;

   a second core section having a second density laminated to the first core section forming a composite core;

   a bottom skin directly laminated to a surface of the second core section forming the bottom of the sports board; and

   a top foam skin laminated to a surface of the first core section and healed onto sides of the composite core.
11. The sports board of claim 10, wherein the second density is in the range of 1.7 to 3.0 pounds per cubic foot.

12. The sports board of claim 10, wherein the second density is around 2.2 pounds per cubic foot.

13. The sports board of claim 10, wherein the bottom solid sheet skin has a thickness in the range of 6-25 mils.

14. The sports board of claim 10, wherein the bottom solid sheet skin has a thickness of about 15 mils.

15. The sports board of claim 10, wherein the sports board further includes a handle attached to the sports board on the top foam skin side of the board.

16. The sports board of claim 15, wherein the sports board further includes a runner attached to the bottom skin side of the board.

17. The sports board of claim 16, wherein the runner and the handles are attached to the sports board by snap-rivets and snap-posts passing through apertures in the sports board.
18. A sports board comprising:

a body having an expanded foam core covered on a bottom surface by a solid skin and covered on a top and on side surfaces by a thin foam skin;

a handle coupled with the body through a flexible strap member; and

a runner coupled with the body, wherein the handle and the runner couple together though the body of the sports board by a snap rivet passing through the flexible strap member and a snap post receiving the snap rivet.

19. The sports board of claim 18, wherein the snap rivet includes snap segments configured to engage snap slots in the snap post, and wherein the engagement of the snap segments with the snap slots prevents the snap rivet from being removed from the snap post.

20. A method of manufacturing a dual density foam core sports board comprising:

providing a first foam sheet of a first density;

providing a second foam sheet of a second density;

laminating the first foam sheet to the second foam sheet by applying heat and pressure to form a dual density laminated sheet;

cutting the dual density laminated sheet into a blank;

extruding a polymer sheet and laminating it to the blank to form a bottom skin on a bottom surface of the blank;

cutting a sports board shape from the blank; and
laminating a foam top skin to a top surface of the sports board shape and
heeling the top skin to sides of the sports board shape.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B62B 13/00
US CL : 280/28

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)

U.S. : 280/28, 28.16, 18, 845, 610, 14.27, 14.28; 441/65, 74, 79

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

East Text

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>US 4,708,675 A (SHOEFFLER et al) 24 November 1987 (24.11.1987), figure 2.</td>
<td>7-9,15-19</td>
</tr>
<tr>
<td>Y</td>
<td>US 5,137,483 A (NEALY) 11 August 1992 (11.08.1992), figures 1-3.</td>
<td>18-19</td>
</tr>
<tr>
<td>Y</td>
<td>US 5,275,860 A (D'LUZANSKY et al) 04 January 1994 (04.01.1994), column 4, lines 42-45 and 60-62.</td>
<td>3-6,11-14</td>
</tr>
<tr>
<td>X</td>
<td>US 6,106,345 A (YEH) 22 August 2000 (22.08.2000), column 2, lines 45-49.</td>
<td>1,2,10</td>
</tr>
<tr>
<td>Y</td>
<td></td>
<td>3-9,11-17</td>
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Further documents are listed in the continuation of Box C. See patent family annex.

Date of the actual completion of the international search

05 May 2003 (05.05.2003)

Date of mailing of the international search report

30 MAY 2003

Name and mailing address of the ISA/US

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Form PCT/ISA/210 (second sheet) (July 1998)
# International Search Report

**Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)**

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. □ Claim Nos.:
   - because they relate to subject matter not required to be searched by this Authority, namely:

2. □ Claim Nos.:
   - because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. □ Claim Nos.:
   - because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

*Please See Continuation Sheet*

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. □ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. X No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-19

**Remark on Protest**

- □ The additional search fees were accompanied by the applicant’s protest.
- □ No protest accompanied the payment of additional search fees.
BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claim(s) 1-19, drawn to a sports board.

Group II, claim(s) 20, drawn to a method of manufacturing a sports board.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: The sports board of claims 1-19 can be manufactured by a method other than that recited in claim 20.