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Skedeleski et al.

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[54] SURFBOARD FINS WITH FLEXIBLE EDGES

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[51] Int. Cl.[5] B63B 1/00

[52] U.S. Cl. 441/79; 114/140

[58] Field of Search 441/74, 79; 114/140, 114/39.2

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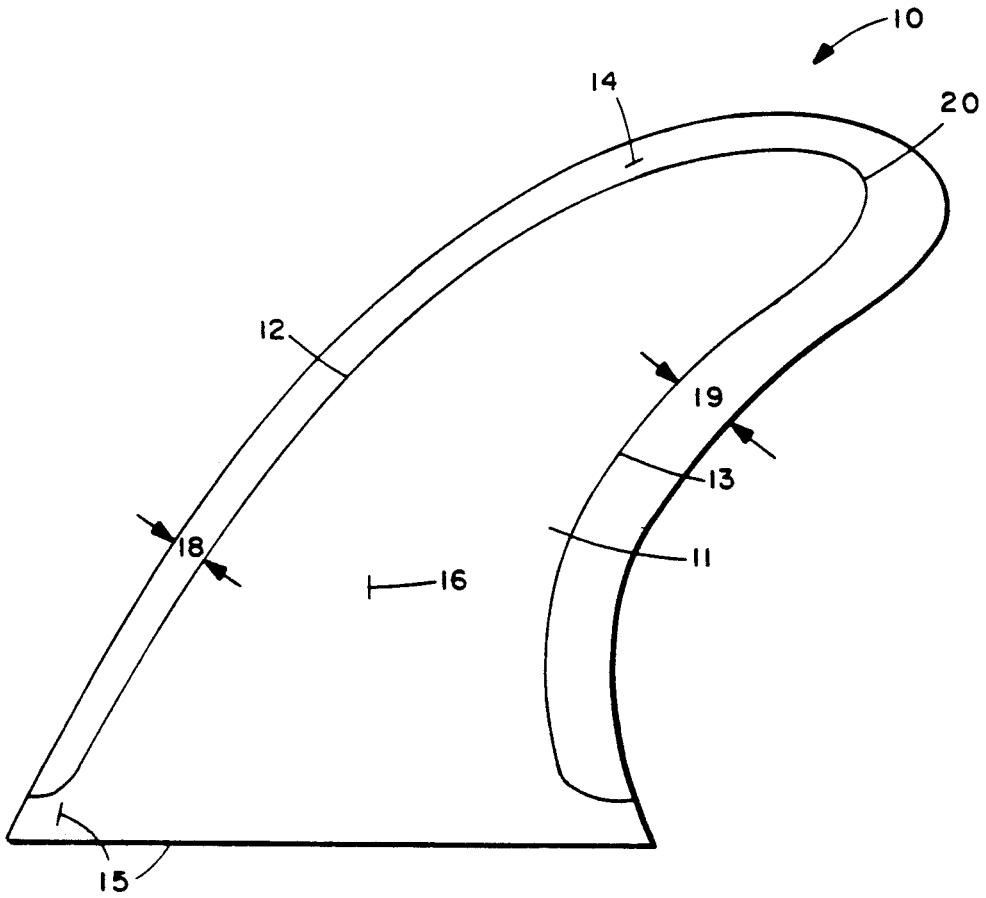
[57] ABSTRACT

A surfboard has one or more (e.g. three) fins extending from its bottom surface. Each fin is a rigid plastic body element (e.g. Shore D hardness of at least about 78) with curved leading and trailing edges, a base, and side walls. The edges intersect in a rounded tip, and the leading edge curves back toward the rear of the surfboard. The leading and trailing edges, but not the sides, of the fin rigid bodies are covered with a soft flexible material (e.g Shore A hardness of about 40–100), such as rubber, urethane, or silicone. The flexible elastomeric material has sufficient thickness, softness, and flexibility to protect a surfer impacted by a leading or trailing edge of the fin, and to act as a rudder (provide anti-cavitation action) to provide some board steerability by the surfer shifting his or her weight.

21 Claims, 5 Drawing Sheets



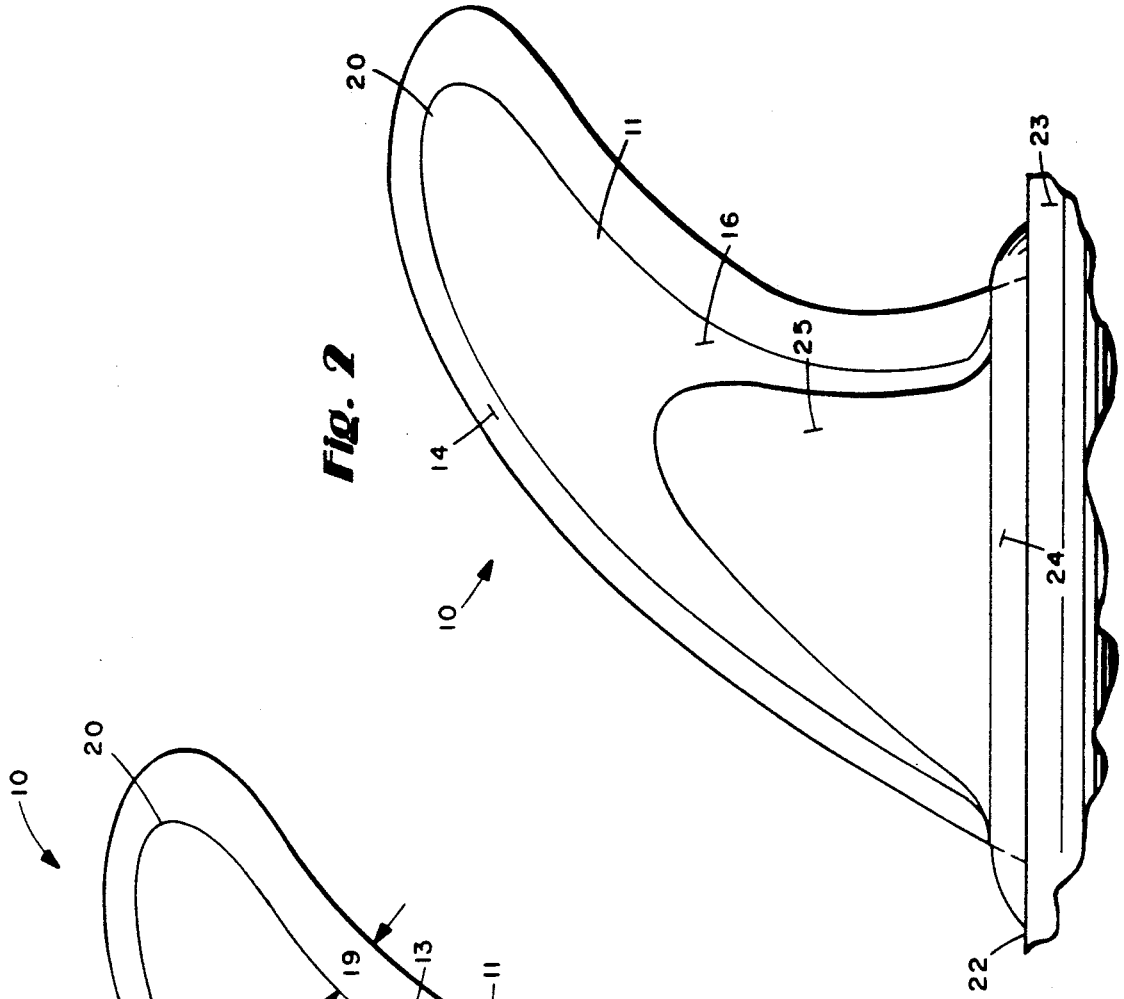


Fig. 2

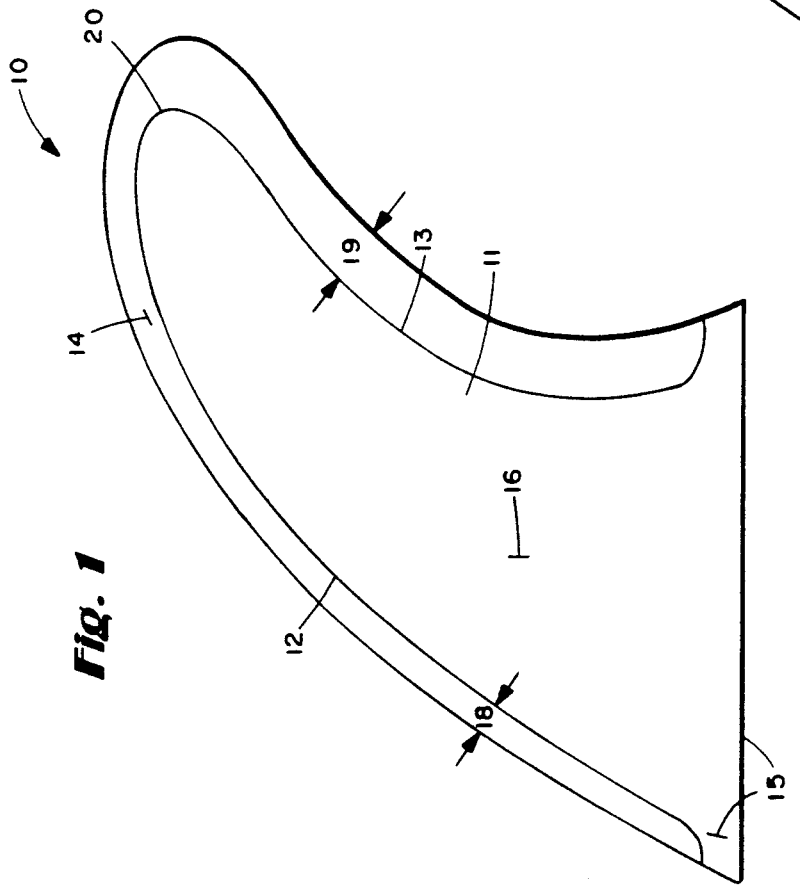


Fig. 1

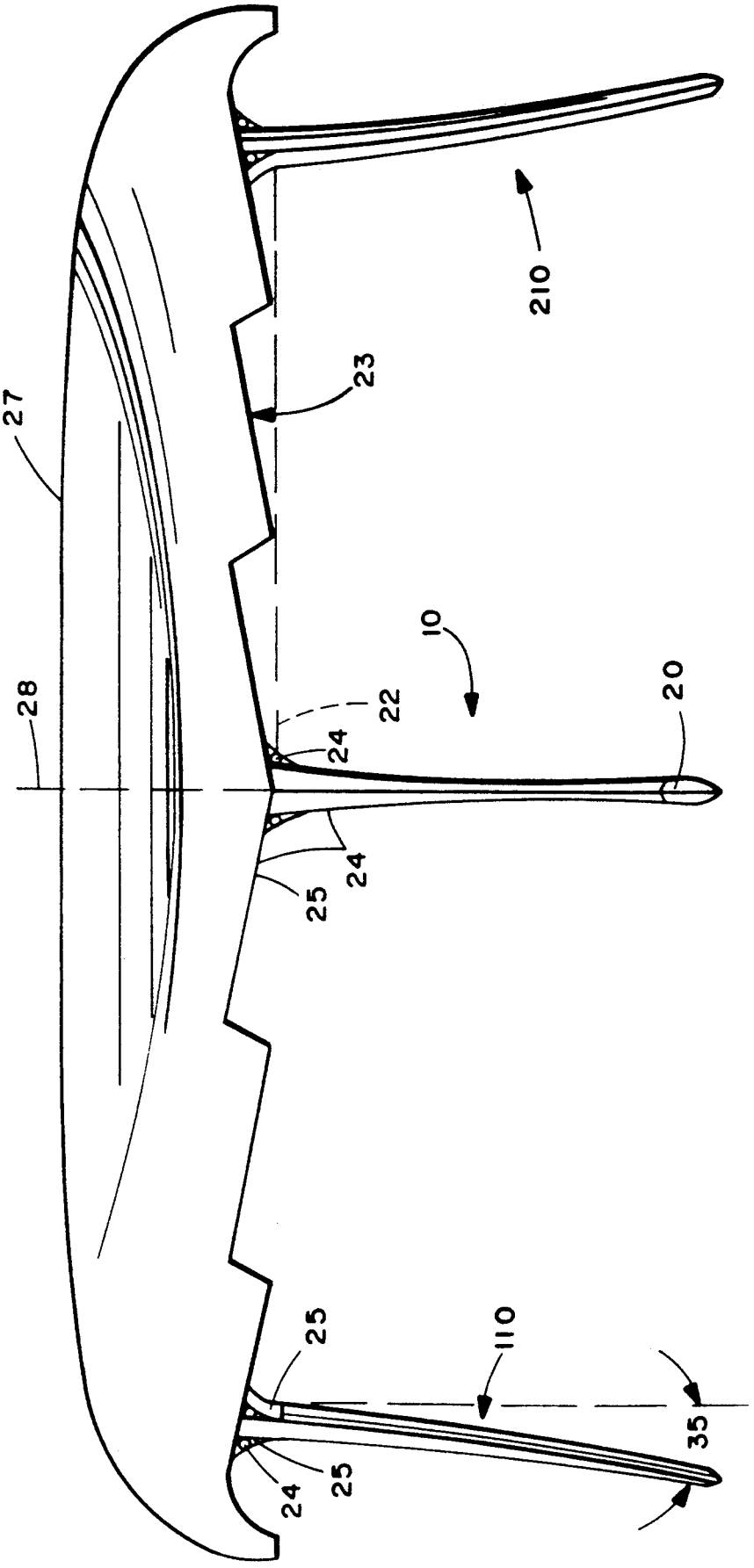


Fig. 3

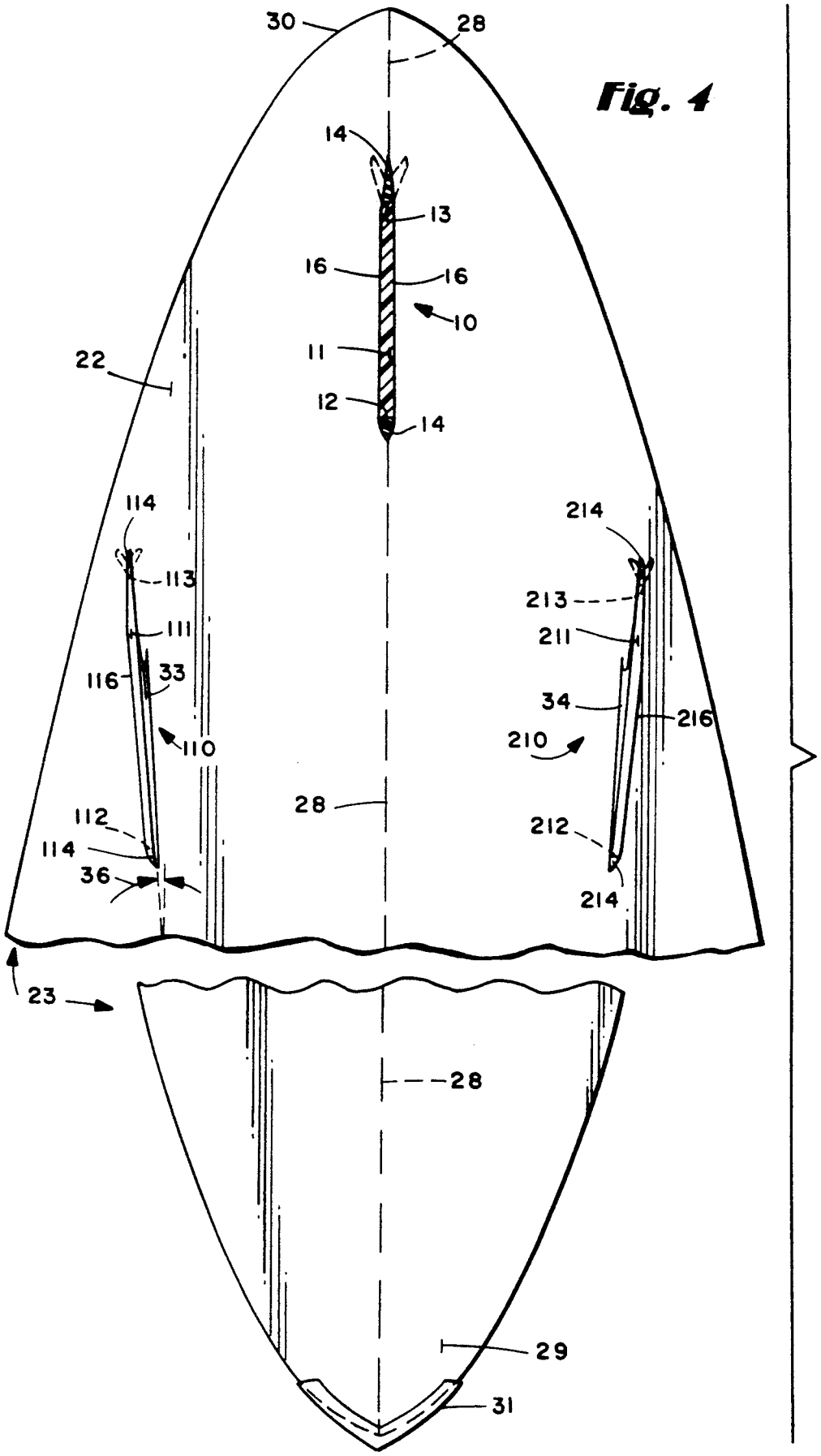

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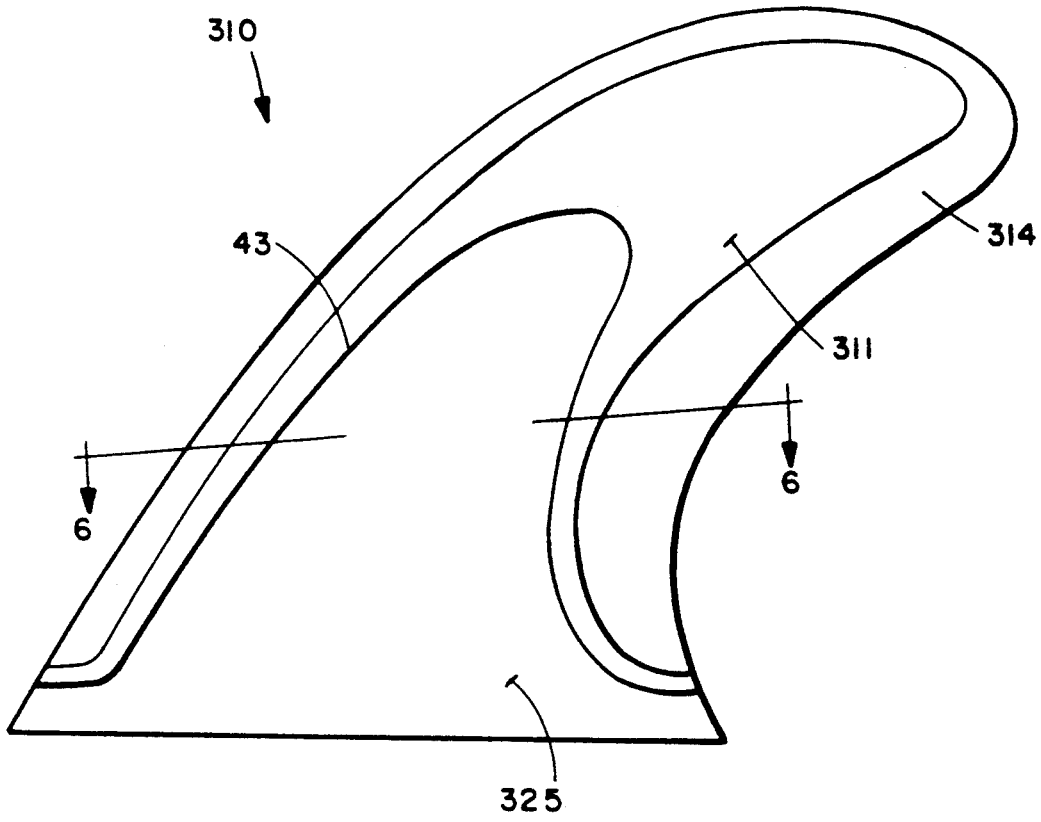
Fig. 4

Fig. 5



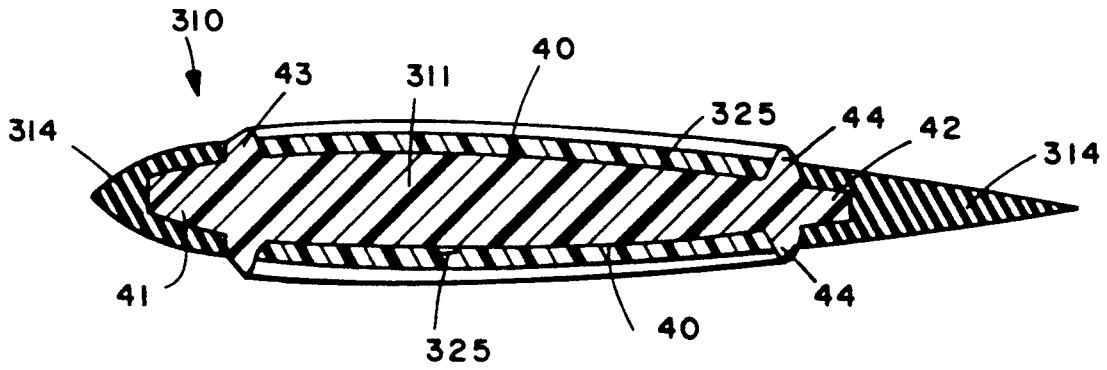
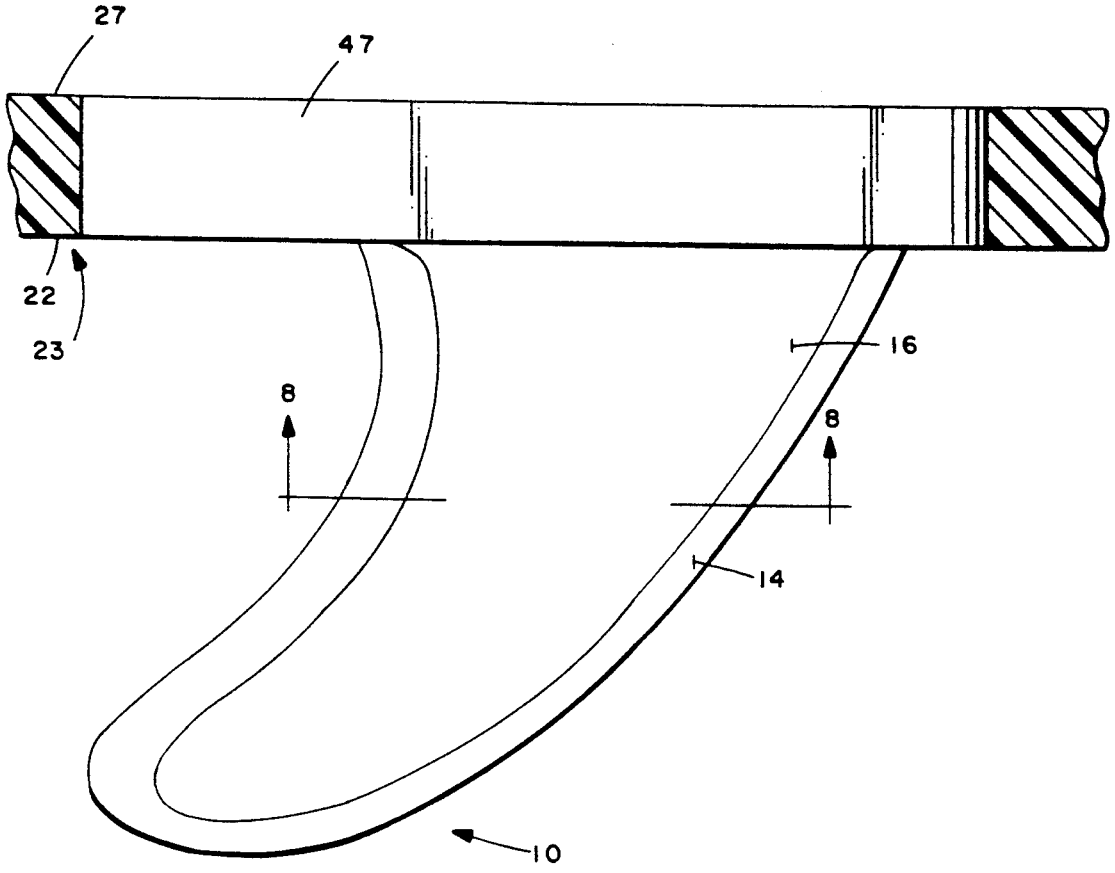


Fig. 6

Fig. 7



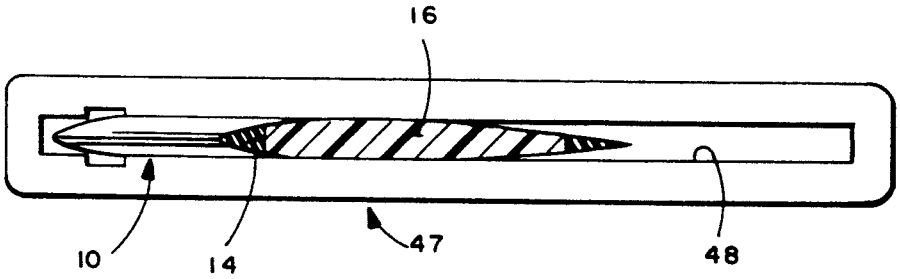


Fig. 8

SURFBOARD FINS WITH FLEXIBLE EDGES

BACKGROUND AND SUMMARY OF THE INVENTION

Modern surfboards desirably include a fin adjacent the tail thereof, and along the centerline of the board, to provide dimensional stability, to maximize board performance. While conventional fins are certainly useful for that purpose, they pose two significant problems. One is that the fin can be dangerous to surfers or nearby swimmers if the surfboard is travelling at high speed and the leading or trailing edge of the fin hits the surfer or swimmer. Also, while providing good dimensional stability, a fin may, depending upon the circumstances, restrict maneuverability.

According to the present invention a surfboard fin, and a surfboard, are provided which overcome the problems inherent in the prior art. According to the most basic aspects of the present invention, a surfboard fin or fins are provided which have soft, flexible leading and trailing edges so that if they impact a surfer or swimmer the injury will be minimized. The flexible material at the trailing edge of the fin or fins also provides a rudder action to provide maneuverability to a surfer standing on the top surface of the board and shifting his/her weight. Although numerous advantages are obtained by utilizing a single tail fin, preferably a plurality of fins are provided, e.g. three fins spaced at particular locations adjacent the tail of the board.

According to one aspect of the present invention a surfboard tail fin is provided comprising: A rigid body element having a leading edge, and a trailing edge; and a flexible material covering disposed on the leading and trailing edges of the rigid body element. The flexible material is soft enough to minimize injury to a person impacted by a leading or trailing edge of the fin, and is flexible enough to be deflected by water pressure during surfing to provide a rudder action. Preferably the rigid body element is of a hard plastic having a Shore D hardness of at least about 60 an preferably at least about 78), while the flexible material is a soft plastic (such as a urethane or silicone) having a Shore A hardness of about 40–100 (preferably about 40–94), a thickness on the trailing edge of at least about 0.25 inches, and a thickness on the leading edge of at least about 0.1 inches.

According to another aspect of the present invention a surfboard is provided having a top surface and a bottom surface, a front end (nose), and a rear end (tail). The surfboard includes at least one tail fin extending downwardly from the bottom surface adjacent the rear end. The fin comprises a rigid body element having a leading edge, and a trailing edge; and a flexible material covering disposed on the leading and trailing edges of the rigid body element, the covering material having sufficient thickness, softness and flexibility to minimize injury to a person impacted by a leading or trailing edge of the fin, and to be deflected by water pressure during surfing to provide a rudder action (anti-cavitation action) as a surfer shifts his or her weight on the top surface of the surfboard.

The surfboard according to the invention has a centerline between the front and rear ends, and preferably has three fins. A first fin is provided closest to the tail and disposed on the centerline, with the second and third fins disposed further from the tail than the first fin and off the centerline. The second and third fins are disposed approximately the same distance from the tail as each other and approximately the same distance from the centerline and on opposite sides of it, and have flat inner side faces. The leading and trailing edges of the first fin are substantially coplanar with the center plane containing the centerline. The second and third fin leading and trailing edges are in planes which makes a slight angle (e.g. about 2°–10°) to the centerline, the leading edges being slightly closer to the centerline than the trailing edges. Also the center plane is substantially vertical when the board is in use, while the planes containing the leading and trailing edges of the second and third fins are slightly off vertical (e.g. about 2° to 15°).

The fins according to the invention may be manufactured by a wide variety of techniques, including by molding both the rigid and the flexible plastics together at the same time; injection molding the flexible plastic onto the rigid plastic once it has been formed (the preferred manner); or cutting and contouring sheets or strips of flexible material and adhesively connecting them to the edges of the rigid material. The fins may be connected to the surfboard by conventional techniques utilizing fiberglass rope and fiberglass cloth impregnated in resin, the fiberglass rope extending along all portions of the enlarged base of the rigid plastic element of the fin, while the fiberglass cloth extends up along the sides of the rigid plastic portion of the fins. The fin sides can be concave where they receive the fiberglass, and have ridges which protect the flexible material edges of the fin.

Alternatively, the fin can be removable, e.g. mounted in a conventional fin box.

It is the primary object of the present invention to provide a surfboard fin, and surfboard containing at least one fin, having enhanced safety and maneuverability characteristics. This and other objects of the invention will become clear from an inspection of the detailed description of the invention and from the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view, essentially actual size in scale, of an exemplary fin according to the present invention;

FIG. **2** is a side view of the fin of FIG. **1** shown connected to the bottom of a surfboard;

FIG. **3** is a rear cross-sectional view of a surfboard having three fins similar to those of FIGS. **1** and **2**, during construction;

FIG. **4** is a bottom view of a final surfboard like that of FIG. **3** with the fins sectioned along horizontal planes, and showing the flexible trailing edges in dotted line position, illustrating a rudder effect;

FIG. **5** is a side view of a second embodiment of an exemplary fin according to the invention;

FIG. **6** is a cross-sectional view taken along lines **6**—**6** of FIG. **5**;

FIG. **7** is a side elevational view of the fin of FIG. **1** in a fin box mounted within a surfboard, the surfboard being shown in cross-section; and

FIG. **8** is a bottom plan view of the fin and fin box of FIG. **7** with the fin sectioned along lines **8**—**8**.

DETAILED DESCRIPTION OF THE DRAWINGS

An exemplary fin according to the present invention is shown generally by reference numeral **10** in the drawings. The fin preferably consists essentially of two basic

components, a rigid plastic body element **11** having a curved leading edge **12**, and a curved trailing edge **13**, and a soft, flexible elastomeric material covering **14** disposed on the edges **12**, **13**, except at the enlarged width base **15** of the rigid element **11**. The element **11** has a pair of side faces **16** (see FIGS. **1** and **4**), which are slightly convex (i.e. foil shaped) and it is preferred that the soft flexible material **14** not cover substantial (or even any) portions of the side faces **16**.

The rigid, hard plastic element **11** may be made of a wide variety of materials, but it is highly desirable that the material be entirely compatible with fiberglass cloth and rope, which preferably are used to secure the fin **10** on a surfboard. The material of element **11** also preferably is compatible with the soft flexible plastic forming the material **14** so that the two do not have a tendency to separate in use. Preferably the hard plastic element **11** has a Shore D hardness of at least about 60, and preferably at least about **78**. For example it may be a 2102 series (e.g. 2102–80D) polyester polycaprolactone such as sold under the trademark Pellethane ®.

The soft flexible material **14** preferably is rubber, or a plastic such as a silicone or a urethane, but regardless of the material it has sufficient softness so as to minimize injury to a person impacted by a leading or trailing edge of the fin **10**, and it is flexible enough to be deflected by water pressure during surfing to provide a rudder action (anti-cavitating action). That is, it has a thickness, softness, and flexibility to perform these functions, the rudder action being provided as a surfer shifts his or her weight on the top surface of the surfboard with which the fin **10** is associated. While a wide variety of materials may be utilized, preferably the flexible elastomeric material **14** has a Shore A hardness of about 40–100 (preferably about 40–94), such as provided by a class of polyurethane elastomers sold under the Pellethane ® trademark, comprising **2102** series polyester polycaprolactones, designations **2102–75A**, **80A**, **80AE**, **85A**, **90A**, and **90AB**.

In a preferred embodiment, the thickness **18** of the material **14** along the leading edge **12** is at least about 0.1 inches, and preferably about 0.3 inches, while the thickness **19** along the trailing edge **13** is at least about 0.25 inches (and may vary along the length of edge **13**), and preferably is at least about 0.5 inches.

While the shape of the fin **10** may vary, a particularly useful shape is that illustrated in the drawings, wherein the leading edge **12** curves back toward the trailing edge **13**, and the edges **12**, **13** intersect at a rounded tip **20** remote from the surfboard. The tip **20** also is covered by the flexible material **14**, as illustrated.

The fin **10** according to the invention may be constructed in a number of different ways. For example depending upon the equipment and the materials utilized and available, the hard plastic element **11** and the soft plastic edges **14** can be injection molded at the same time. Alternatively, a hard plastic element **11** may be inserted in a mold disposed along the edges thereof, and the flexible material **14** molded in place. Still further, sheets or strips of urethane or silicone can be cut and shaped so that they correspond to the edges **12**, **13** of the element **11**, and they may be attached in place on the edges **12**, **13** with a compatible adhesive.

FIGS. **2** and **3** illustrate a preferred way in which the fin (or fins) **10** is attached to a bottom surface **22** of a surfboard **23**. It is to be understood that in the present specification and claims that the term "surfboard" is to be interpreted broadly to encompass what are colloquially known as surfboards, windsurfing boards, water ski boards, and the like; that is the term "surfboard" encompasses all water sport boards which may use a fin.

The manner in which the fin **10** according to the invention is applied to the surfboard bottom surface **22** is basically conventional. That is fiberglass rope **24** (see FIG. **2**) soaked in resin is applied along both sides of the fin **10** at the base **15**, while fiberglass cloth **25**, soaked in resin, is applied upwardly along the sides **16**. Such a construction essentially ensures that the fin **11** is integral with the board, and forms a part of it, with no unnecessary drag as a result of connection of the fin **10** to the board **23**.

The particular orientation of one or more fins according to the present invention with respect to a surfboard **23** is illustrated in FIGS. **3** and **4**. The surfboard **23** has a bottom surface **22** (FIGS. **2** through **4**), and a top surface **27** (see FIG. **3**). The surfer stands or kneels or lays on the top surface **27**. The board **23** also has a centerline **28**, (see FIG. **4**). Preferably the pointed tip of the nose **29** has a protective tip **31**, such as shown in U.S. Pat. No. 4,792,316, the disclosure of which is hereby incorporated by reference herein.

As can be seen in both FIGS. **3** and **4**, preferably the fin **10**, comprising a first fin, is disposed along the centerline **28** of the surfboard **23**, and is in substantially a vertical plane in use, that is a plane containing edges **12**, **13** is substantially perpendicular to the bottom surface **22** of the surfboard **23**.

According to the invention, the soft flexible material **14** does not adversely affect the performance characteristics of the board to any significant extent, while providing a surfer-protecting function. As a matter of fact, the maneuverability of the board is increased according to the invention. While the soft flexible material **14** along the leading edge **12** (see FIG. **4**) provides a substantial protective function, minimizing the injury to surfers or swimmers impacted by the leading edge of the fin **10**, the material **14** on the trailing edge **13** not only provides this protecting function but also provides a rudder action (anti-cavitation action). When the water pressure acts on the material **14** along the trailing edge **13** during surfing, the material **14** may flex to the dotted line positions illustrated in FIG. **4**. Thus a surfer standing on the top surface **27** of the surfboard **23** can utilize this rudder action to steer/maneuver the surfboard **23** by shifting his or her weight on the surfboard **23**.

While the utilization of one fin **10** according to the invention is highly advantageous, some surfers—depending upon skill level—will obtain optimum results by utilizing a plurality of fins (e.g. two, three, four, or five), such as the fins **110** and **210** in addition to the fin **10**. The arrangement of three fins in FIG. **4** is known per se (for conventional rigid fins).

As seen in FIGS. **3** and **4**, the fins **110**, **210** —comprising second and third fins—have the same basic construction as the fin **10** as far as the rigid plastic element **111** and **211** is concerned, and the soft flexible material **114**, **214** on the leading edges **112**, **212**, respectively, and additional flexible material **114**, **214** on the trailing edges **113**, **213**, respectively. The only things different about the fins **110**, **210** are their flat (water release) inner faces **33**, **34**, respectively, and their placement on the bottom surface **22** of a surfboard **23**.

The fin **10** is closer to the tail **30** than the fins **110**, **210**, and preferably the fins **110**, **210** are spaced the same distance from the tail **30**, and are disposed on opposite sides of the centerline **28**, spaced equidistance from it.

The fins **110, 210** are also preferably tilted slightly about both vertical and horizontal axes. That is they make a slight angle **35** (see FIG. **3**) with respect to the vertical when the board is in use, the angle **35** preferably being about 2°–15°. Also, they make a slight angle **36** (see FIG. **4**) with respect to the centerline **28** so that the trailing edges **113, 213** of each are spaced slightly further from the center line **28** than the leading edges **112, 212** thereof. The angle **36** preferably is about 2°–10°. That is, the fins **110, 210** are toed in for better performance (typically increased speed).

FIGS. **5** and **6** illustrate another embodiment of fin according to the invention, designed to readily accommodate "glassing" of the fin onto a surfboard. In the FIGS. **5** and **6** embodiment structures comparable to those in the FIG. **1** embodiment are illustrated by the same two digit reference numeral only preceded by a "3".

In the FIGS. **5** and **6** embodiment, the rigid plastic body element **311** of the fin **310** has concave side faces **40**, a front portion **41**, and a rear portion **42**. The concave faces **40** are defined by the leading ridges **43** and trailing ridges **44**, each set of ridges **43, 44** meeting at a top portion, as illustrated in FIG. **5**. The flexible elastomeric material **314** is received by the front and rear portions **41, 42** as indicated in FIG. **6**.

The slight ridges **43, 44** on the perimeter of the concave faces **40** of the fin **310** direct the resin impregnated fiberglass **35** away from the soft outer edges of the fin **310** defined by the material **314**. When the fin **310** is sanded, the excess glass will be lifted away from the outer edges, making it easier to remove. The material **314** also may be coated with a releasing agent during construction to prevent the resin associated with the fiberglass **325** from adhering to it, therefore enhancing the ease of removal of excess glass and resin. The glass **325** of course attaches the fin **310** to the surfboard in the same manner as the glass **25**, and may also be associated with fiberglass rope, or the like.

In the previous embodiments, the fins **10, 310**, etc. have been shown as permanently affixed to a surfboard **23**. Alternatively, the fins may be removable. As seen in FIGS. **7** and **8**, the fin **10** is mounted in a conventional fin box **47**, so that it is removable from the surfboard **23**. The conventional fin box **47** has a channel **48** formed in the bottom thereof for receipt of the fin **10**. The manner in which the fin **10** is removably held within the channel **48** is conventional, and may vary, and may be such as shown in U.S. Pat. No. 3,564,632 or U.S. Pat. No. 4,421,492.

It will thus be seen that according to the present invention a surfboard fin, and a surfboard with one or more fins, having enhanced safety and maneuverability, are provided. While the invention has been herein shown and described in what is presently conceived to be the most practical and preferred embodiment thereof it will be apparent to those of ordinary skill in the art that many modifications may be made thereof within the scope of the invention, which scope is to be accorded the broadest interpretation of the appended claims so as to encompass all equivalent structures and devices.

What is claimed is:

1. A surfboard fin comprising:

a rigid body element having a leading edge, and a trailing edge, and

a flexible material covering disposed on said leading and trailing edges of said rigid body element, said flexible material being soft enough to minimize injury to a person impacted by a leading or trailing edge of said fin, and being flexible enough to be deflected by water pressure during surfing to provide a rudder, anti-cavitation, action;

wherein said rigid body element has a base and side faces, said flexible material not disposed on said side faces; and

wherein said base has a width much greater than the width of the rest of said rigid body element.

2. A fin as recited in claim **1** wherein said flexible material is selected from the group consisting essentially of rubber, silicones, and urethanes.

3. A fin as recited in claim **1** wherein said rigid body element has a rounded tip at an intersection between said leading and trailing edges, and both said leading and trailing edges are curved, said leading edge curved toward said trailing edge.

4. A surfboard fin consisting of:

a rigid plastic body element having a leading edge, and a trailing edge, and having a Shore D hardness of at least about 60; and

a flexible elastomeric material covering, having a Shore A hardness of about 40–100, disposed on said leading and trailing edges of said rigid plastic body element, but not disposed on significant portions of said rigid plastic body element except said leading and trailing edges, said covering having a thickness on said trailing edge of at least about 0.25 inches, and a thickness on said leading edge of at least about 0.1 inches.

5. A fin as recited in claim **4** wherein said flexible material is selected from the group consisting essentially of rubber, silicones, and urethanes.

6. A fin as recited in claim **5** wherein said flexible material has a Shore A hardness of about 50–94, and said rigid plastic body has a Shore D hardness of at least about 78.

7. A fin as recited in claim **4** wherein said rigid body element has a base and side faces, said flexible material not disposed on said side faces; and wherein said base has a width much greater than the width of the rest of said rigid body element.

8. A fin as recited in claim **7** wherein said rigid body element has a rounded tip at an intersection between said leading and trailing edges, and both said leading and trailing edges are curved, said leading edge curved toward said trailing edge.

9. A surfboard having a top surface and a bottom surface, a front end, and rear end; and

at least one fin extending downwardly from said bottom surface adjacent said rear end, said fin comprising: a rigid body element having a leading edge, and a trailing edge; and a flexible material covering disposed on said leading and trailing edges of said rigid body element, said covering material having sufficient thickness, softness and flexibility to minimize injury to a person impacted by a leading or trailing edge of said fin, and to be deflected by water pressure during surfing to provide a rudder, anti-cavitation, action as a surfer shifts his or her weight on the top surface of the surfboard; and

wherein said rigid body element of said fin has a base, and sides, and is connected to said bottom surface of said surfboard by resin impregnated fiberglass rope at said base, and resin impregnated fiberglass cloth along said sides.

10. A surfboard as recited in claim 9 wherein said surfboard has a centerline between said front end and said rear end, and has three of said fins, a first fin closest to said rear end of said surfboard and disposed on said centerline, and second and third fins disposed further from said rear end than said first fin, and off said centerline.

11. A surfboard as recited in claim 10 wherein said second and third fins are disposed approximately the same distance from said rear end as each other, and approximately the same distance from said centerline and on opposite sides thereof.

12. A surfboard as recited in claim 11 wherein said first fin leading and trailing edges are substantially coplanar with a center plane containing said centerline, while said second and third fin leading and trailing edges are in planes which make a slight angle with respect to said center plane, the leading edges of said second and third fins being slightly closer to said centerline than the trailing edges thereof.

13. A surfboard as recited in claim 12 wherein said planes containing said leading and trailing edges of said second and third fins are slightly off vertical in use, while said center plane is substantially vertical in use.

14. A surfboard as recited in claim 10 wherein each fin consists of a rigid plastic body element having a leading edge, and a trailing edge, and having a Shore D hardness of at least about 60; and a flexible elastomeric material covering, having a Shore A hardness of about 40–100, disposed on said leading and trailing edges of said rigid plastic body element, but not disposed on significant portions of said rigid plastic body element except said leading and trailing edges, said covering having a thickness on said trailing edge of at least about 0.25 inches, and a thickness on said leading edge of at least about 0.1 inches.

15. A surfboard as recited in claim 10 wherein each of said fin rigid body elements has a rounded tip at an intersection between said leading and trailing edges, and both said leading and trailing edges are curved, said leading edge curved toward said rear end of said surfboard.

16. A surfboard as recited in claim 9 wherein said base of said rigid body element is not covered by said flexible material covering.

17. A surfboard as recited in claim 9 wherein said fin rigid body element has concave side surfaces receiving fiberglass cloth thereon.

18. A surfboard as recited in claim 9 further comprising a fin box removably mounting said fin.

19. A surfboard as recited in claim 9 wherein said flexible material is selected from the group consisting essentially of rubber, silicones, and urethanes.

20. A surfboard having a top surface and a bottom surface, a front end, and a rear end;

at least one fin extending downwardly from said bottom surface adjacent said rear end, said fin comprising: a rigid body element having a leading edge, and a trailing edge; and a flexible material covering disposed on said leading and trailing edges of said rigid body element, said covering material having sufficient thickness, softness and flexibility to minimize injury to a person impacted by a leading or trailing edge of said fin, and to be deflected by water pressure during surfing to provide a rudder, anti-cavitation, action as a surfer shifts his or her weight on the top surface of the surfboard; and

said fin rigid body element having a Shore D hardness of at least about 60; and said flexible elastomeric material covering, having a Shore A hardness of about 40–100, and disposed on said leading and trailing edges of said rigid body element, but not disposed on significant portions of said rigid body element except said leading and trailing edges.

21. A surfboard as recited in claim 20 wherein said flexible material is selected from the group consisting essentially of rubber, silicones, and urethanes.

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