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[54] LAMINATED WATER SKI

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[52] **U.S. Cl.**.....**9/310 A,** 280/11.13 L

[51] **Int. Cl.**.....**A63c 15/00**

[58] **Field of Search**.....9/310 A, 310 R; 280/11.13 L, 11.13 M

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[57] **ABSTRACT**

A laminated water ski having mechanical vibration dampening surfaces in the form of unidirectional fiberglass skin layers and a neoprene rubber edging extending about the periphery of the ski. The fiberglass skin layers are bonded to the top and bottom surfaces of an extruded center core having a plurality of laterally spaced, longitudinally extending tunnels filled with a buoyant plastic foam for preventing buckling of the ski. The rubber edging includes a groove along the inner surface thereof which is filled with epoxy resin for further increasing the dampening effect of the edging.

5 Claims, 4 Drawing Figures

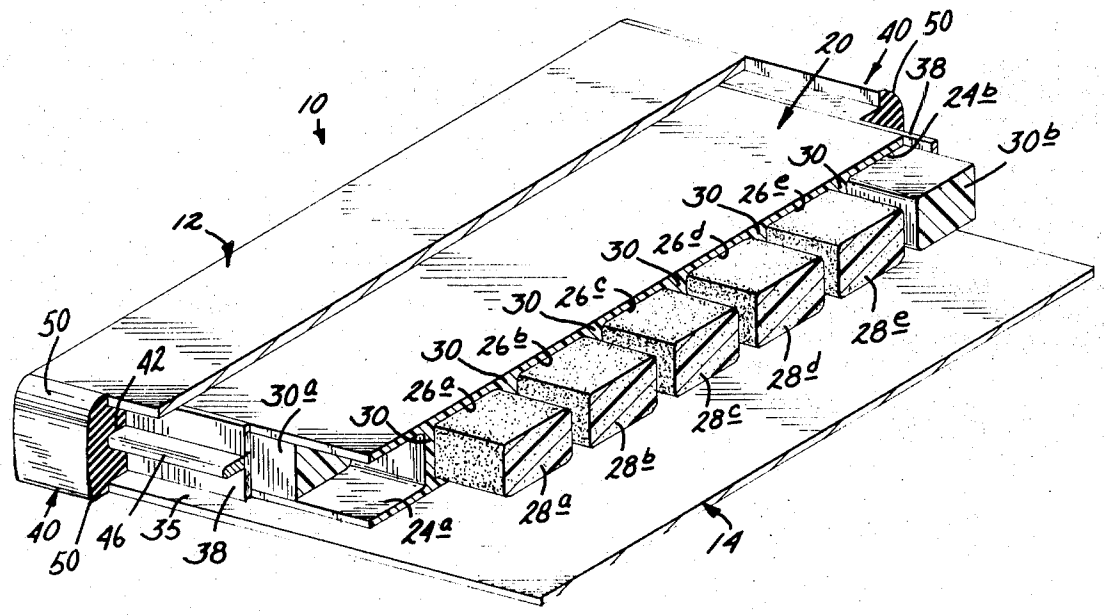


FIG. 1

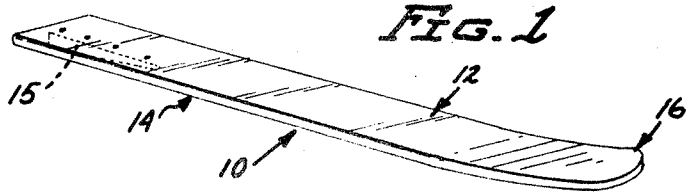
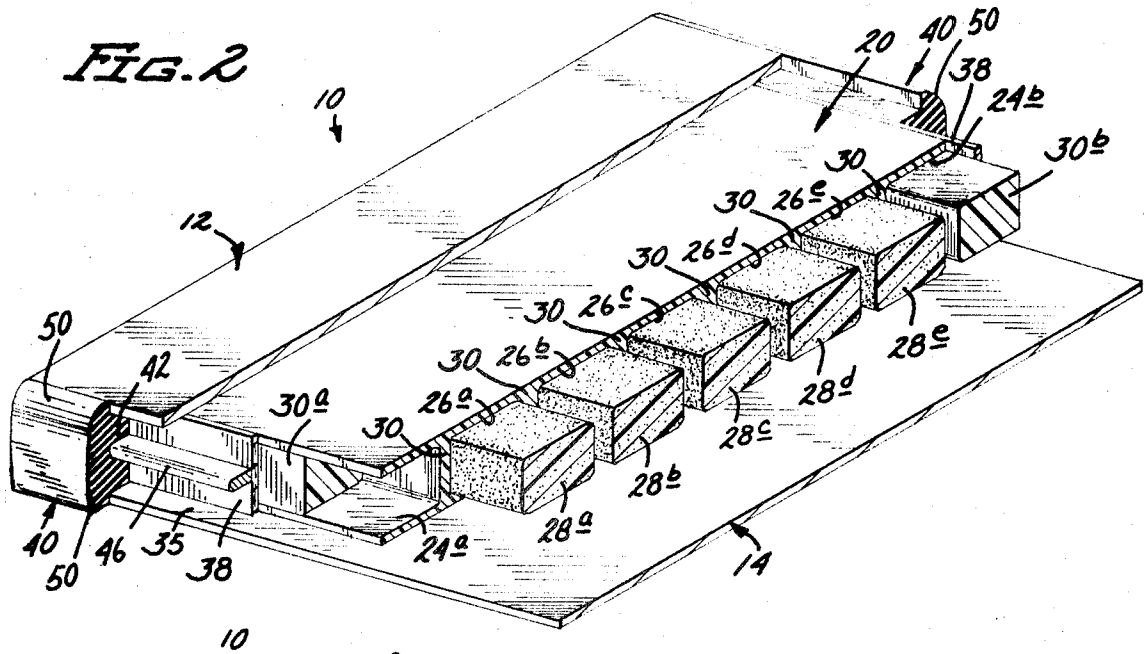


FIG. 2



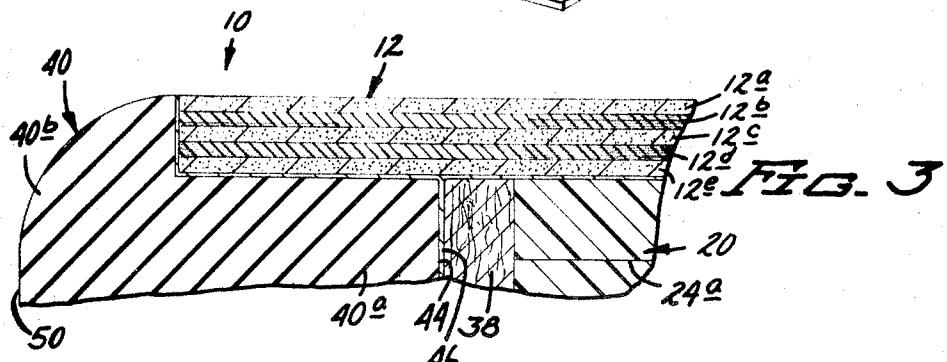


FIG. 3

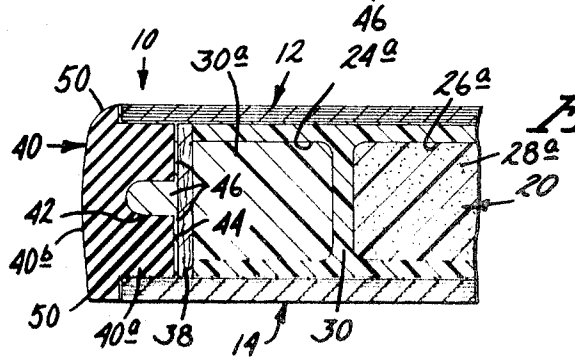


FIG. 4

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LAMINATED WATER SKI

BACKGROUND OF THE INVENTION

The present invention pertains to skis, and more particularly to water skis formed so as to dampen vibrations occurring therein.

The usage of water skis has become very popular for both competitive and recreational purposes. To meet this need, numerous different types and styles of water skis are commercially available. However, none of the presently available skis adequately dampen the mechanical vibrations which frequently occur within a water ski, particularly at high speeds. Such vibrations can reach amplitudes which cause permanent deformation of the ski or, in the extreme case, cause the ski to break. Further, even at smaller amplitudes, such vibrations can cause the skier to lose control and fall. That is, of course, extremely dangerous, especially when the skier is traveling at high speeds. Thus, a water ski which substantially reduces the mechanical vibrations occurring therein is commercially highly desirable.

Water skis used for jumping are subjected to extreme shock at the time of impact. I have often witnessed breakage of presently existing types of water skis at the time of impact. This not only causes disqualification of the jump if breakage occurs during competition, but also is extremely dangerous for the person involved.

SUMMARY OF THE INVENTION

The water ski provided by the present invention is constructed so as to dampen or dissipate the mechanical vibrations which occur within the ski, particularly at high speeds. To accomplish such dampening, the ski includes oppositely disposed top and bottom surfaces each formed preferably from several layers of oppositely oriented undirectional fiberglass. A core element is positioned between the top and bottom surfaces and has a plurality of laterally spaced, longitudinally extending tunnels therein filled with a buoyant, rigid material for preventing extreme flexing or buckling of the ski. A rubber edging having a groove along the inner surface thereof is positioned within a recess extending about the periphery of the ski. This rubber edging is bonded to the ski by a suitable adhesive material which substantially fills the groove in the inner surface thereof. In the preferred embodiment, the edging extends about the entire periphery of the ski and has a slightly convex outer surface extending between the top and bottom skin layers.

It has been found that the present water ski construction is extremely strong and also significantly dampens the physical vibrations which normally occur within a water ski. Dampening is accomplished primarily by the rubber edging and unidirectional skin layers which act generally as shear surfaces for preventing or reducing deformation of the ski. These surfaces also act to return the ski to its undeformed shape when the ski is deformed by some physical force. The inclusion of the bonded peripheral groove within the rubber edging provides two additional shear surfaces for dampening vibrations. Moreover, the slightly convex outer surface of the rubber edging serves to stabilize the ski during turns. Numerous additional advantages, such as the sturdiness and relatively light weight of the present ski, will become apparent from reading the detailed description which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the water ski provided by the present invention;

FIG. 2 is an enlarged perspective view of the ski illustrated in FIG. 1 having portions broken away to show the construction thereof;

FIG. 3 is an enlarged, cross-sectional view of a portion of the top skin layer or surface and the rubber edging extending about the ski; and

FIG. 4 is an axial cross-sectional view of one edge of the water ski shown in FIG. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring specifically to FIG. 1, a water ski generally designated **10**, is shown having an upper horizontal surface or skin layer **12** and an oppositely disposed lower surface or skin layer **14**. Water ski **10** further includes a keel **15** attached to the heel of bottom surface **14** and an up-turned toe portion **16**. Conventional bindings (not shown) can be attached to upper skin layer **12** by any one of a number of well known techniques.

To understand more fully the structure of ski **10**, reference should be had to FIGS. **2–4**.

With particular reference to FIG. **3**, it can be seen that in the preferred embodiment, the top skin layer **12** is composed of five unidirectional fiberglass layers **12*a*–12*e*** of generally equal thickness bonded together by a suitable epoxy resin. In this embodiment, alternate layers **12*a***, **12*c***, and **12*e*** are formed from unidirectional fiberglass extending entirely along the longitudinal axis of ski **10**, whereas the intermediate fiberglass layers **12*b*** and **12*d*** extend entirely in a transverse direction. The construction of bottom skin layer **14** (not shown in enlargement) is similar to skin **12**. This laminated, undirectional fiberglass construction provides stronger stress carrying surfaces and has been found to significantly dampen the physical vibrations occurring within ski **10**, particularly at high speeds.

Ski **10** includes a center core element **20** formed from a plastic material (e.g. a high impact acrylonitrile-butadiene-styrene (ABS) resin) in accordance with well known extrusion techniques. As shown, core **20** has two outer rectangular cross section tunnels **24*a*** and **24*b*** and five transversely spaced inner tunnels **26*a*–26*e*** of similar construction extending longitudinally therein. Six vertical support or divider members **30**, each similar to the member **30** shown particularly well in FIG. **4**, separate the tunnels **24*a***, **24*b*** and **26*a*–26*e***.

Inner tunnels **26*a*–26*e*** are filled with a light weight, rigid polyurethane material **28*a*–28*e*** tack bonded to the respective tunnels **26*a*–26*e*** so as to prevent movement of the material therein. Such material, typically having a density of about 1.5 lb/ft^3, can be commercially obtained. This foam material provides buoyancy or floatation to ski **10** and it also sustains shear stresses and prevents buckling of the skin layers **12** and **14** under axial compressive loading. The two outside tunnels **24*a*** and **24*b*** have open side edges and are filled with a closed cell, rigid polyvinyl chloride (PVC) material **30*a*** and **30*b***, respectively, having a density of about 5 lb/ft^3. This material is preferably more rigid and heavier than the polyurethane material within tunnels **26*a*–26*e*** so as to provide structural strength to the side edges of the ski.

Core **20** is positioned between the top and bottom skin layers **12** and **14** and bonded thereto by a suitable adhesive such as an epoxy resin. The resulting beam is exceptionally strong and resilient with the two bonds between the skins and core providing shear surfaces tending to exert a restoring force to the ski when flexed.

As illustrated, skin layers **12** and **14** extend laterally outward beyond core **20** so as to define a recess **35** extending about the entire periphery of ski **10.** A woven fiberglass strip **38** bonded to the vertical edges of center core **20** and core filling elements **30***a* and **30***b* defines the rear surface of recess **35.**

A neoprene rubber edging **40** is mounted in the peripheral recess **35** as can be seen particularly well in FIGS. **2** and **4.** Edging **40** is in the form of an endless member and includes an inner portion **40***a* having a laterally extending groove **42** in an inner vertical surface **44.** Prior to fitting edging **40** within recess **35,** an excessive amount of an epoxy resin **46** is positioned within the recess so as to completely fill groove **42** with resin **46** and to bond the inner surfaces of edging **40** to the surface **38** and to the lower and side surfaces of skins **12** and **14.** The resin squeezed out of recess **35** by the fitting of edging **40** therein is then removed from ski **10.**

The rubber edging **40** serves several purposes. First, an outer portion **40**b of edging **40** includes a surface **50** extending between the top and bottom fiberglass skins **12** and **14.** This outer surface **50** protects the fiberglass skins from damage which would otherwise be caused by physical blows to the side edges of ski **10.** Secondly, edging **40** provides two shear surfaces bonded to the skins which act to return ski **10** to its undeformed shape. This shock absorber effect rapidly dampens out vibrations which occur within ski **10.** The inclusion of groove **42** further increases this effect because the upper and lower bonded surfaces of the groove provided two additional shear surfaces for dampening vibrations within ski **10.** Finally, as shown, the outer surface **50** has a slightly convex shape with respect to core **20,** and has a rounded upper corner and a sharp separation corner at the bottom. This design serves to stabilize the ski during turns (extreme edging) by providing a minimal side area in contact with the water. If the bottom corner were square, there would be no water contact with the side during extreme ski edging, leading to instability. The slightly convex outer surface **50** allows for a small amount of water contact with the edge to provide stability during extreme edging.

Thus, in the embodiment illustrated, the vibrations which occur within ski **10** are substantially dampened by the inclusion of unidirectional skin layers **12** and **14** and the rubber edging **40** extending about the periphery of ski **10.** This provides a substantially stronger and safer water ski.

What is claimed is:

1. A ski comprising:

a. oppositely disposed top and bottom skins each having side edges;

b. buoyant core element means positioned between said top and bottom skins defining a peripheral recess between said skins;

c. a rubber edging member positioned within said peripheral recess between said top and bottom skins, said edging member having an outer portion covering said side edges and a deep groove formed in an inner surface thereof facing said core element means; and

d. adhesive bonding means filling and adhering to said groove to provide two shear surfaces for dampening ski vibrations and for affixing said edging member to said skins and said core element.

2. The ski of claim **1** wherein said edging member includes an outer surface extending between and covering the edges of said top and bottom skins, said outer surface having a slightly convex shape with respect to the ski, a rounded upper corner and a sharp separation corner at the bottom.

3. A ski comprising:

a. oppositely disposed top and bottom skin layers each having a peripheral edge;

b. a core element positioned between said top and bottom skin layers, said core element having a plurality of laterally spaced, longitudinally extending tunnels therein and defining a recess between said skin layers extending about a substantial portion of the periphery thereof;

c. a buoyant, generally rigid material positioned within each of said plurality of tunnels;

d. a rubber-like edging member having an inner portion positioned within said peripheral recess and an outer portion extending between said top and bottom skin layers, covering said peripheral edges; said inner portion defining a deep groove extending along the inner surface thereof; and

e. adhesive bonding means for affixing said edging member to said skin layers and said core element and for substantially filling said groove along said inner surface of said inner edging portion to thereby provide with the sides of said groove two shear surfaces for dampening ski vibrations.

4. A water ski comprising:

a. oppositely disposed, generally horizontal top and bottom skins each having a peripheral edge, said skins being formed from a plurality of unidirectional fiberglass layers of generally equal thickness extending alternately longitudinally and transversely with respect to the ski;

b. a core element positioned between said top and bottom skins, said core element including:

1. oppositely disposed upper and lower surfaces bonded to said respective top and bottom skins; and

2. a plurality of generally vertical support members extending between said surfaces so as to define a plurality of longitudinally extending tunnels in said core;

c. said skins being larger than said core element to define a recess between said skins extending about the periphery of said core element, the outer tunnels of said core element being open to said recess;

d. a buoyant, generally rigid material positioned within each of said plurality of tunnels;

e. a fiberglass strip bonded to said core element and said outermost tunnel filling material in said recess;

f. a resilient edging member mounted within said recess having an essentially horizontal, deep groove in an inner surface thereof and an outer surface extending convexly between said skins, covering said edges thereof; and

g. an adhesive resin material for affixing said edging member to said skins and said fiberglass strips and for filling said groove in said inner edging surface.

5. The ski of claim 4 wherein:

a. said core element is extruded from an acrylonitrile-butadiene-styrene resin; and

b. the material positioned within the two outermost ones of said plurality of tunnels is a polyvinyl chloride material and the material positioned within the remaining inner tunnels of said plurality is a polyurethane material.

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