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LAMINATED SKI AND METHOD OF MAKING SAME

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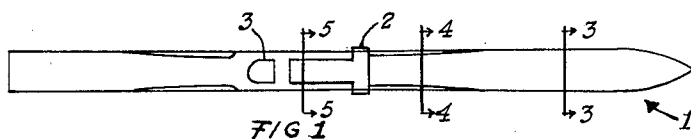


FIG 1

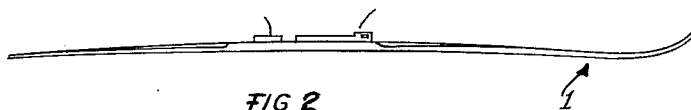


FIG 2

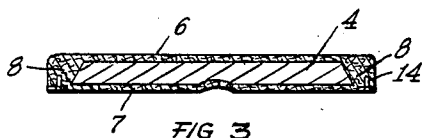


FIG 3

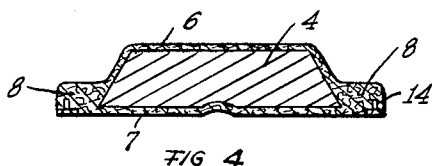


FIG 4

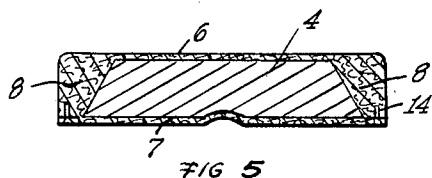


FIG 5

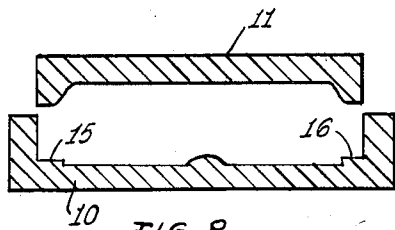


FIG 8

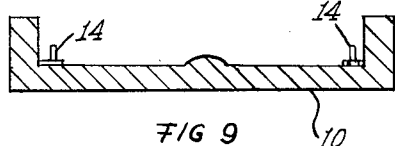


FIG 9

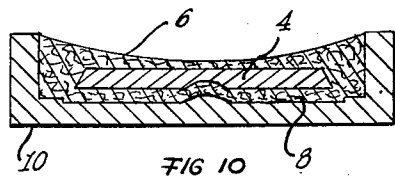


FIG 10

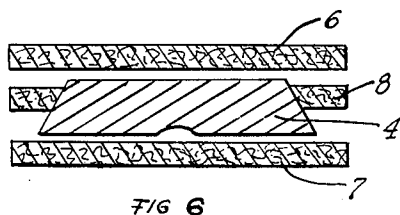


FIG 6



FIG 7

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LAMINATED SKI AND METHOD OF MAKING SAME

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2 Claims. (Cl. 280—11.13)

This invention relates to articles composed of dissimilar materials and more especially to an improved type of ski and method or process of forming same.

It has been conventional practice for many years to fashion skis from wood. By reason of its comparatively low density and low heat conductivity coupled with the factor of desirable resilience, wood has been the most used material for manufacturing skis. Wooden skis have certain inherent disadvantages and require considerable care to keep them in condition for best use. They are subject to warpage and nonuniform shrinkage resulting from changes in moisture content and temperature fluctuations, and are unstable in that they tend to become distorted and lose their shape. Furthermore, it is practically impossible to accurately match the individual skis because of the variations in the characteristics of wood. Another disadvantage is that a wooden ski is not endowed with desirable high strength characteristics and in use is often subjected to stresses approaching its ultimate strength.

It has been proposed to fashion skis of composite materials utilizing a core of low density material such as wood covered with relatively high strength fibrous material impregnated and bonded to the core through the medium of a suitable resin or plastic. This provides a stressed skin construction having several advantages over a wooden ski in that an improved wearing face is provided, the reinforced plastic or resin skin, having high strength characteristics, satisfactorily carries the bending or flexing loads while the core assists in stabilizing the faces of the ski. Skis of this character have been made embodying a core of wood generally rectangular in cross section covered with a plurality of layers of fibrous material impregnated or coated with resin. While skis of this character attained numerous advantages as compared with a wooden ski, there are certain attendant disadvantages. For example, if the sides of the skis are crossed during use, extensive wear may be encountered on the top edge of one ski near the tip through its engagement with the edge of the other ski and in some instances the skin layer may be worn through or punctured. Such condition exposes the core to the absorption of moisture which causes separation or delamination of the materials rendering the ski unfit for use. In fabricating a ski of this nature, the core must be accurately fitted on the edges to secure the proper distribution of skin thickness adjacent the edges. Moreover, a low density core such as balsa or poplar is relatively porous and is readily subject to shrinking or swelling in moisture conditions which cause its dimension to be modified. As the mold or die in which the ski is formed is of fixed dimension, a shrinkage of the core results in improper bonding of the covering, and a swelling of the core necessarily results in a nonuniform covering. Furthermore, it has been difficult to wrap the fabric plies around the core and at the same time avoid the formation of wrinkles or overlaps in the fabric when pressure is applied during the molding operation.

The present invention embraces the provision of an improved ski and method of producing the same which in a large measure minimizes or substantially eliminates these difficulties whereby skis of uniform character may be produced economically.

An object of the invention resides in the provision of an improved ski construction embodying an edge formation which resists wear and greatly prolongs the useful life of the ski.

Another object of this invention is to provide an im-

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proved ski embodying a stressed skin construction and having lateral edges formed of high density materials extending substantially beyond the edge of the core, said edges being fabricated of portions of the upper and lower surfaces of the facing or skin material combined with a suitable reinforcing medium.

Another object of this invention is the provision of an improved ski having a high strength, high modulus of elasticity facing material in combination with a low density core having the general contour of the finished ski with the edge walls thereof beveled or canted to present a generally trapezoidal shape in cross section.

Another object of the invention is to provide an improved ski having faces formed of high strength material bonded to a low density core the edge walls of which are configured in a manner whereby vertical pressure exerted on the ski during formation sets up a laterally acting component of force in the direction of the sides causing the high strength material adjacent the sides to establish a satisfactory bond and produce a completely formed edge in the mold.

A further object of the invention is to provide an improved ski whereby a high strength, high density material is employed as a primary stress-carrying medium suitably supported by a low density core material such that the composite construction is of low average density endowed with a relatively high strength-weight ratio, the ski having high density edges to adequately protect the core from crushing stresses should the ski be jammed against other objects.

Still another object of this invention is the provision of high density material at the edges of the ski to which metal inserts may be integrally molded therewith or secured to the ski after completion of the molding operation.

Still another object of the invention is to provide an improved laminated ski whereby a high strength facing material completely embraces and is bonded to a low density core wherein a substantial portion of this material concentrated at the edge portions which are subjected to the greatest wear.

Still another object of this invention is the provision of an improved ski having face layers formed of high strength materials bonded to a low density core fashioned to a configuration so as to eliminate the necessity of fitting the core accurately in the mold.

The improved construction, of particular use in the manufacture of skis, consists of a laminated structure the core of which is formed of a generally cellular material having substantial shear strength and the face plies of which are formed of fibers of great strength embedded in a hard adhesive. The adhesive may also be used to bond the face plies to the core material. Generally cellular materials for the core material include cellular cellulose acetate; balsa, poplar, or other varieties of low density materials. The faces of the laminated structure, similar to the face plies of plywood, may preferably be formed of glass fiber in the form of yarn, woven cloth, or mat, either used alone or in combination with fibers of other materials. The fibers are embedded in and held together by an adhesive that is capable of bonding to the surface of the glass fibers and to the core material.

If the face plies are composed chiefly of glass fiber, hardenable synthetic resins such as a polymerizable unsaturated polyester (i. e., polymerizable unsaturated polyhydric alcohol-polycarboxylic acid polyester, which is prepared by reaction of one or more polyhydric alcohols and one or more polybasic acids) or a polymerizable allyl ester (e. g., an ester or mixed ester of two alcohol molecules, each consisting of a molecule of allyl, crotyl, alpha-methyl allyl, methallyl, beta-chloro allyl or beta-methyl crotyl alcohol, with a molecule of a dibasic acid) or mixtures thereof are suitable for use to form the hard adhesive. If the fibers of the face plies consist largely of cellulosic materials, other hardenable resins such as phenol- or urea-formaldehyde or melamine-formaldehyde condensation products may be employed.

The fibers of great strength may be oriented in the face plies so that a substantial number of fibers extend generally longitudinally of the ski or other article so as to impart desired strength in bending to the article. It

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is also desirable in the construction of a ski that at least some (and in some types of construction all) of the fibers making up the face plies extend across the faces either directly or diagonally and thus provide considerable strength to resist torsional deflection of the ends of the ski.

Glass fiber, either in the form of yarn, cloth or mat, is particularly well adapted for use as the surface layer of a ski because of its unusual strength in tension, its resistance to abrasion and its resistance to deterioration by water. Furthermore, the layer of glass fibers embedded in a hard resin adhesive has a low coefficient of heat conductivity so that the finished ski is comparable in this respect to a ski constructed entirely of wood.

The use of fibers embedded in a hard adhesive, and glass fibers in particular, provides a finished article in which the resiliency and strength characteristics may be precisely controlled. It is thus possible to provide exactly matched skis or skis designed to particular specifications as far as strength and resiliency are concerned.

Another advantage in the use of glass fibers embedded in a hard adhesive is that the yield strength and the ultimate strength of the finished article are nearly the same in magnitude and both are higher than the strength obtainable in other suitable materials so that the article withstands normal use without danger of failure either in fracture or permanent deformation. The high yield strength plus the permanency of glass provides a finished ski that retains its camber, strength, and damping characteristics without requiring special care.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

Figure 1 is a plan view illustrating a form of ski constructed according to the invention;

Figure 2 is a side elevational view of the ski construction;

Figure 3 is a transverse sectional view taken substantially on the line 3—3 of Figure 1;

Figure 4 is a transverse sectional view taken substantially on the line 4—4 of Figure 1;

Figure 5 is a transverse sectional view taken substantially on the line 5—5 of Figure 1;

Figure 6 is a semidiagrammatic illustration showing the orientation of the core, face layers and edge reinforcing material prior to the molding operation;

Figure 7 is a sectional view illustrating a modified configuration of core structure;

Figure 8 is a transverse section of a mold construction suitable for use in forming the ski of my invention;

Figure 9 is a sectional view of a mold adapted to accommodate metal inserts or strips for integration with the ski during the molding operation, and

Figure 10 is a sectional view of the female section of a mold with the materials of Figure 6 assembled therein preparatory to a molding operation.

These specific figures and the accompanying description are intended to merely illustrate the invention and are not intended to impose limitations upon the claims.

Referring to the accompanying drawings, an improved ski 1 constructed according to the invention, is similar in size and shape to a conventional ski. The length and width of the ski may be varied according to the preference of the user and the thickness may vary along the length of the ski so as to achieve as nearly as possible a uniform load distribution to the snow beneath the ski. The uniform load distribution is affected both by the resiliency of the ski and the amount of camber or bend that it has in its unloaded condition. Thus a ski with a large amount of camber must be made relatively weak to allow it to straighten out under normal load while a ski having little camber must be relatively much stronger to carry the same load when deflected to a straight condition.

The improved ski 1 is provided with customary fittings 2 and heel pad 3 to fit the usual type of harness.

It will be noticed in Figure 2 that the thickness of the ski varies along its length and is greatest at the center where the bending moments are normally the greatest when the ski is in use. For an average ski the thickness

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of the core may vary from one-eighth of an inch at the toe to approximately three-quarters of an inch at and slightly forward of the harness fittings 2 and then taper to approximately five-sixteenths of an inch near the heel of the ski. These dimensions are illustrative only and may be varied to modify the characteristics of the ski. Thus the core of a ski intended for a light-weight person is relatively thinner than a ski intended for a heavy person.

As particularly shown in Figures 3, 4 and 5, the sides or side walls of the core 4 are beveled or canted to provide adequate space between the edge of the core and the adjacent side wall of the mold to facilitate the formation of high density sides formed by layers 6 and 7 of material comprising the upper and lower surfaces of the ski and additional reinforcing material 8. It is pointed out that skis of conventional size made according to the invention are fashioned with the height of the high density edge portion approximately one-quarter of an inch in all sections of the ski as shown in Figures 3 and 4 with the exception of the foot plate section. At the foot plate section as shown in Figure 5 the sides are substantially vertical to accommodate the ski binding or fitting 2. By forming the edge of the ski in this manner the weight of the ski is reduced to a minimum yet providing the ski with tough, dense strong edges throughout the length thereof. By beveling or canting the sides or side walls of the core in the manner shown in Figures 3, 4 and 5, the core does not have to be accurately fitted in the mold as the edges of the ski are formed by portions of the facing material and the reinforcing material disposed adjacent the sides of the core. It will be apparent that by forming the core with slanting sides, sufficient pressure applied in a vertical direction upon the mold causes the skin materials to bond with the core as well as to completely form the edges of the ski. The center core section 4 of the ski extends substantially the full length of the ski and is formed of material that is light in weight and has good shear strength properties. Balsa, Basswood and Poplar are found to be suitable for this purpose. The side walls of the core may be of any desired configuration to fulfill the purposes as herein set forth.

Figure 6 shows a general arrangement or orientation of the materials making up the skin or face plies of the improved ski. The cross section of the ski comprises the central core material 4, a plurality of layers 6 and 7 of the skin material respectively applied to the upper and lower faces of the core material, and additional layers 8 at the edges of the ski as a reinforcement therefor. The layers 6 and 7 include a substantial number of longitudinally extending fibers either in the form of yarn, cords or longitudinal threads of cloth, or a mat of fibers such as glass fibers in which many of the individual fibers are oriented along the length of the ski.

Prior to assembly or molding operations, the materials forming layers 6 and 7 and edge reinforcement 8 may be coated or saturated with a hardenable resin, adhesive or plastic, the amount of the resin being from 35% to 70% by weight of the saturated or coated materials. The skin layers, particularly the outermost one, may also include some longitudinally extending abrasion resistant fibers to improve the running surface of the ski. These fibers may be of rayon, cotton, fibers formed from linear fiber forming polyamides or other synthetic organic fibers.

Figure 8 illustrates a mold suitable for use in constructing the improved ski. The mold is inclusive of a female member 10, the interior dimensions and contour of which conform to the lower surface and edge formation of the finished ski. A male mold 11 is adapted to fit into the upper surface configuration of the ski. The raised portions 15 and 16 in the female mold 10 are for forming the rabbets or recesses along the edge of the ski to receive the metal strips 12 which may be of steel or other suitable metal or alloy. As shown in Figure 11, it may be desirable to dispose the steel edge strips 12 in the female mold in lieu of the raised portions 15 and 16 and mold these strips integrally into the skis. The strips 12 may be held to the ski body by means of screws 14 or other securing means.

The procedure in constructing the ski, assuming that the skin layers have been preimpregnated or coated with resin, consists of disposing the outer layers 7 in the female mold 10. Next the core 4 is placed over the skin layers 7. The edge reinforcing material 8 is then laid adjacent the sides of the core and lastly the upper skin layers

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6 comprising the upper surface of the ski are placed over the core. The male section 11 of the mold is then brought into cooperative relation with the female section 10 forcing the skin layers and edge reinforcement into intimate contact with each other and with the core. The mold is then placed in a suitable press (not shown) and the entire assembly maintained at elevated temperature for a period of time sufficient to harden or cure the resin.

It is sometimes desirable, particularly when custom building skis according to specified characteristics, that the characteristics of the ski, such as its resilience and strength, may be varied without changing its outside dimensions. As long as the outside dimensions remain unchanged the molds used to hold the ski during the hardening of the resin may be used without alteration. To satisfy this condition and still provide selection of finished ski characteristics it is possible to vary the number of layers of skin material in the face plies of the ski as well as to vary orientation of the high-strength fibers with respect to the long axis of the ski. Thus, if one desires to increase the strength and stiffness of the ski a number of layers of fibers having high strength such as the layers 6 and 7 are laid on the faces of the core material with the high-strength fibers extending longitudinally of the ski. If it is desired to decrease the stiffness of the ski, this may be accomplished without change in dimension by orienting the high-strength fibers diagonally on the ski some in one direction and some in the other and at angles with respect to the center line of the ski such that the resulting components of stress parallel to the axis of the ski provide the desired strength characteristics.

The improved ski is representative of improved laminated articles that may be constructed according to the invention. By using glass fiber and a suitable hard adhesive it is possible to construct a replacement ski the characteristics of which will exactly match those of the ski it is to replace.

Various substitutions of materials and numbers of layers of skin material or substitutions in core material

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may be made without departing from the spirit and scope of the invention.

Having described the invention, I claim:

1. A ski comprising a core of low density material having its cross section of substantially trapezoidal shape, layers of high density, resinous, fibrous material encompassing said core and bonded to said core, said layers including a first series bonded to the top and bottom portions of said core having its edges extending transversely beyond the lateral walls of said core and a second series parallel to said first series and bonded to the lateral walls of said core and to said first series, each of said layers having its fibrous material oriented in a single direction.

2. A ski comprising a core of low density material having its cross section of substantially trapezoidal shape, layers of high density, resinous, glass fibered material encompassing said core and bonded to said core, said layers including a first series bonded to the top and bottom portions of said core and having its edges extending transversely beyond the lateral walls of said core and a second series parallel to said first series and bonded to the lateral walls of said core and to said first series, each of said layers having its glass fibered material oriented in a single direction.

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