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2,648,543

LAMINATED SKI

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3 Sheets-Sheet 2

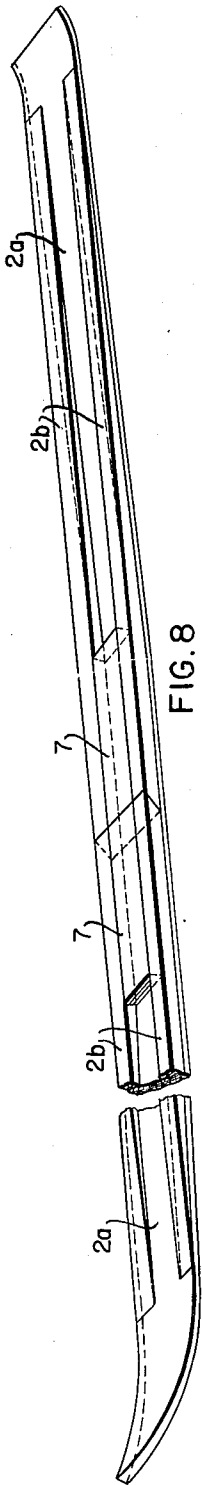


FIG. 8

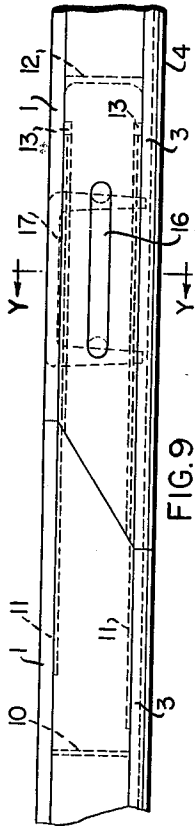


FIG. 9

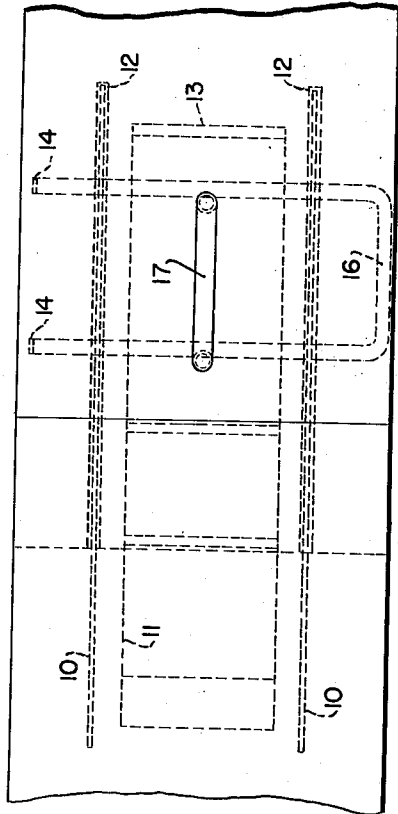


FIG. 10

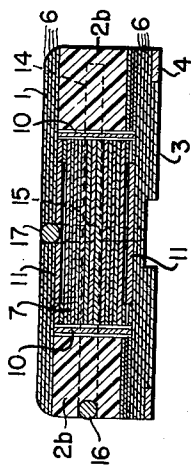


FIG. 11

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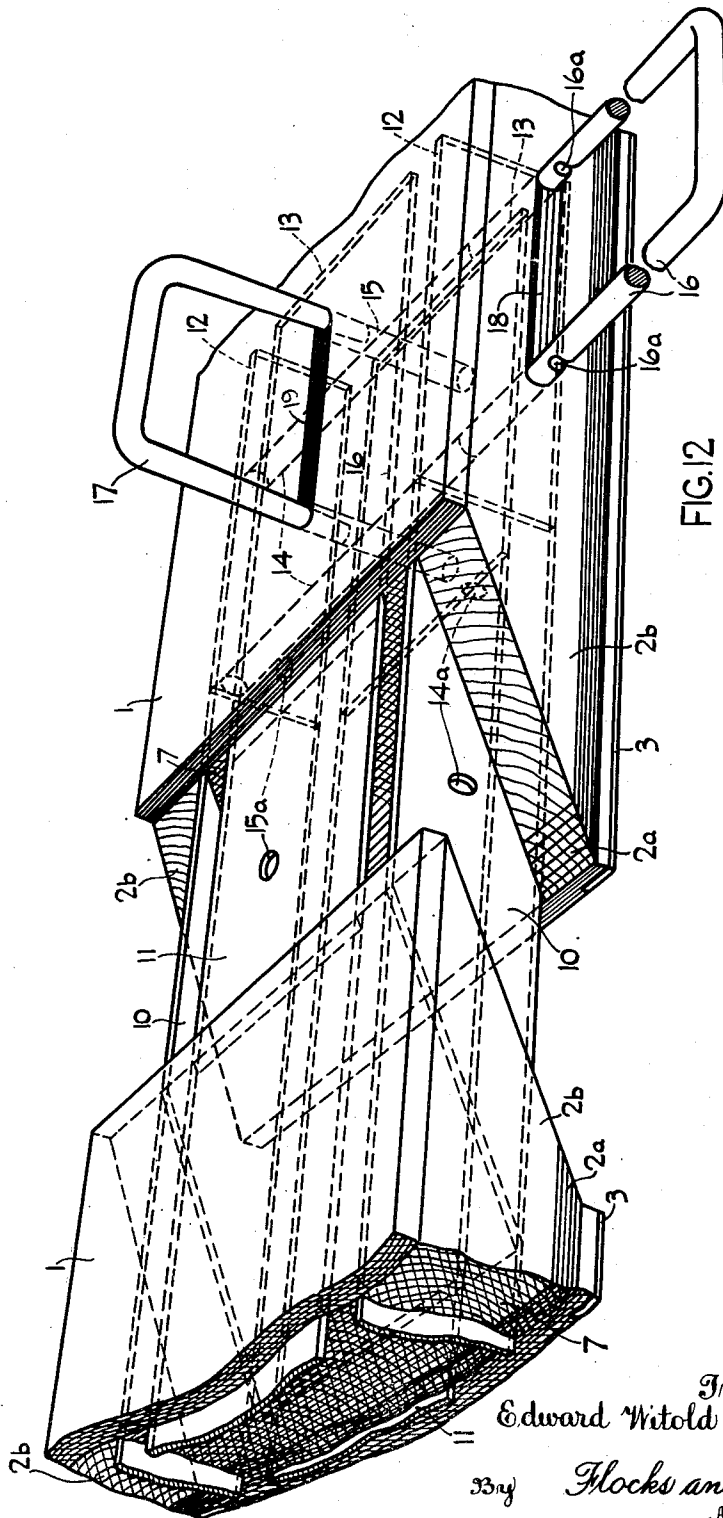
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LAMINATED SKI

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2 Claims. (Cl. 280—11.13)

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This invention relates to skis and has for its object to provide an improved relatively inexpensive ski construction which shall have the advantages over the skis hitherto used of being lighter in weight, of greater strength and of having a more uniformly graded flexibility and resilience.

The modern ski is usually made from a solid piece of wood, such as ash, oak, birch, spruce or hickory, shaped to form a long, narrow and substantially flat member tapering slightly in thickness towards both ends from the part where the binding is fitted, the forward end or toe, and the rear end, or heel, being slightly upturned, the former to a greater extent than the latter, and thickened somewhat towards the tips. The undersurface of the ski is smooth except for a central narrow longitudinally extending groove which runs for the full length of the substantially flat portion of the ski and may be machined therein or may be formed by securing two separate spaced steel or wooden runners thereto.

One disadvantage of a ski of this construction is that it is very susceptible to deterioration due to the penetration of moisture, in spite of the adoption of precautions such as waxing its surfaces after each use, and such skis are expensive because only pieces of wood free from the slightest flaw may safely be used in their production. Even so they are liable to snap when subjected to great strain as, for example, if the wearer should fall, and they gradually lose their resilience. It has already been proposed, for overcoming this disadvantage, to form a ski from strips of wood glued together with the grains of adjacent strips running in different directions. Such a construction is relatively heavy, is expensive to produce and is just as susceptible to the penetration of moisture as the one-piece skis.

It has also been proposed to impart a permanent resilience to a ski, while at the same time strengthening the same, by inserting a strip of steel in the wood. This arrangement, however, increases the weight of the ski and, in addition, there is an abrupt change in the flexibility of the ski at a point towards the toe so that the steel strip is liable to take a permanent set at this point if a great stress is applied to the ski, and the latter cannot then be readily restored to its original shape.

According to this invention, a light-weight and relatively strong ski having a flexibility progressively varying along its length comprises a hollow box-like structure consisting of upper and lower members interconnected at their marginal edges by side walls,

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The side walls may be mounted by means of a suitable adhesive on a thin layer of wood, laminated or not, or any other material which possesses vibration-damping properties, which is of even or varying thickness throughout the length of the ski and which has the shape of the ski.

The side walls with the vibration-damping layer form a channel member which may extend throughout the length of the ski or, in certain cases, only over part of the same. The rectangular or channel shape may terminate short of the toe end or the heel end of the ski, or both, depending on the purpose for which the ski is required, leaving in such cases only the vibration-damping layer to continue throughout the length of the ski.

The nature of the invention will be clearly understood from the following description of two examples of skis constructed in accordance therewith, reference being made to the accompanying drawings, wherein:

Fig. 1 is a side elevation of one construction of ski, shown in two pieces for convenience of illustrating only but actually having the upper piece in the figure joined to the lower piece in the figure so that the lines X—X coincide,

Fig. 2 is a plan view of the ski, again in two pieces, part of the upper layer of one piece being broken away,

Fig. 3 is a section taken on the line A—A of Fig. 2,

Fig. 4 is a section taken either on the line B—B or on the line B'—B' of Fig. 2,

Fig. 5 is a section taken either on the line C—C or on the line C'—C' of Fig. 2,

Fig. 6 is a section taken on the line D—D of Fig. 2,

Fig. 7 is a section taken on the line E—E of Fig. 2,

Fig. 8 is a perspective view showing the construction of the filler member sandwiched between the upper and lower layers of the ski of Figs. 1 to 7 but indicating a modification whereby it is suited for incorporation into a folding ski,

Fig. 9 is a side elevation of the central portion of a folding or collapsible ski constructed in accordance with this invention, to a somewhat larger scale than Fig. 8,

Fig. 10 is a plan view thereof,

Fig. 11 is a section taken on the line Y—Y of Fig. 9, and

Fig. 12 is a fragmentary perspective view, to a still larger scale, showing the joint between the two parts of the folding ski in the process of being made.

Referring first to Figs. 1 to 7, it will be seen

that the ski illustrated is of the conventional external shape with an up-curved toe, a slight waisting or narrowing at the center of its length, and an up-curved heel portion of lesser length than the curved portion at the toe end. In the unloaded condition, as shown, the ski is bowed upwards between its toe and heel ends in the normal fashion.

In accordance with the present invention, however, the structure of the ski is of a novel character. It comprises an upper layer 1 of sheet material shaped to the same outline in plan view as the finished ski, an intermediate filler member 2 of the same outline in plan view but of varying thickness along its length, and a lower layer 3 of sheet material corresponding in shape to the upper layer and having protective edging strips 4 secured on its underside along each of its longitudinal edges.

The required progressively varying flexibility of the ski is secured (1) by constructing the upper and lower layers of the same material or of materials which have the same density and coefficient of expansion, these materials all being characterised by a very low capacity for absorbing moisture, and (2) by constructing the intermediate filler member so that each end portion thereof presents a channel or U-shape in cross-section from a point adjacent the location at which the binding is to be attached to a point adjacent the respective tip, the side walls of the U-shape being varied in cross-section as herein-after described.

The filler member may be shaped from one piece of material, if desired, as has been indicated in Fig. 1 where the recesses 5 formed in the upper face of the member 2 leave a central solid portion of the latter at the location where the binding (not shown) is to be fixed. The recesses 5 are of substantially constant width so that two ribs or side walls are left, one along each edge of the filler member, which decrease in height but increase in width as the respective tip of the ski is approached. The recesses may be left free or empty, or alternatively, may be filled with a light-weight rigid composition having shock-absorbing and vibration-damping properties, for example, expanded vulcanised rubber or the like.

All the parts just described are secured together by means of water-insoluble adhesive compositions, preferably of the synthetic resin type.

It is preferred, however, to construct the intermediate filler member 2 in several parts, and a ski embodying this form of filler member will now be described in greater detail.

The upper and lower layers 1 and 3, which may be of different thicknesses and may each vary in thickness along the length of the ski, can be produced from synthetic resin compositions, laminated materials, steel or other metal, resin-impregnated wood or the like but it is preferred (as shown) to form these layers from a sheet of a water-impervious synthetic resin material composed of integrally united laminations 6 (Figs. 3 to 7) of synthetic resin-impregnated textile fabrics or paper bonded with the same synthetic resin. The upper and lower layers 1 and 3 are of uniform thickness throughout their lengths in the example shown and the laminations 6 each extend over the whole area thereof. The filler member 2 is built up from a base element or layer 2a, composed of laminated wood and of an outline corresponding to that of the

layers 1 and 3, and two side walls 2b. The base layer 2a is of uniform thickness throughout the length of the ski except at the zones where the heel and toe are curved upwards, being reduced in thickness at these zones.

The side walls 2b may be made of synthetic resin material, laminated or not, or they may (as shown) be of wood such as spruce, ash or hickory. They may also be made of multi-ply wood, or of synthetic resin-impregnated wood. These walls 2b are secured along the corresponding longitudinal edges of the base layer 2a by means of a synthetic resin adhesive composition, and taper towards each end from the location at which the binding is to be secured. At this location a block 7 of laminated wood or other material is positioned between and secured to the side walls 2b, to fill the space between them, before the filler member 2 is secured to the upper and lower layers 1 and 3. This block 7 is of a length approximating to that of the boot of the user and serves for the attachment of the bindings (not shown). When the filler member is secured between the upper and lower layers, which is effected with the aid of a synthetic resin adhesive composition while the parts are clamped between appropriate formers or moulding members, a space of substantially rectangular cross-section (in any plane transverse to the length of the ski) is enclosed between the upper and lower layers 1 and 3 and the side walls 2b at each side of the block 7 (see Figs. 4, 5 and 6). The box-like structure thus obtained has adequate rigidity while being light in weight and sufficiently flexible for practical purposes.

In order that the flexibility may be controlled so that it varies in the appropriate manner along the length of the ski, the side walls 2b are increased in width, or thickness, as they are reduced in height, particularly as the toe of the ski is approached, see Figs. 1 and 2.

Preferably and as shown in Figs. 2, 4 and 5, the internal space of the box-like ski structure is filled with expanded vulcanised rubber 8 or expanded plastic material or a similar natural material (balsa wood), these materials being hard vesicular products which act to damp vibrations and to increase the rigidity of the structure without materially adding to the weight of the ski.

The normal guiding groove 9 in the bottom of the ski may be formed in the lower layer 3 in any suitable manner. Alternatively, it may be formed in a separate sole plate of synthetic resin material secured to the underface of the lower layer 3, or even by two separate plates attached to this layer in such manner as to form a groove between them. The sole plate or plates may be so disposed that they leave or the lower layer 3 may itself be formed with, a rabbeted edge to be filled by the steel edging strip 4, this in common with all the other parts preferably being secured in place by a synthetic resin adhesive.

By suitably proportioning the thickness and height of each side wall 2b at the different points along its length, the curve representing deflections of the ski under equal loads applied at these different points may be given a progressively increasing slope as the toe of the ski is approached.

It will be understood that the skis are produced with an initial concave curvature on the underside, so that they will straighten under the weight of the user when he is standing thereon, in the usual manner. It is important, however, that the central portion of the ski, corresponding

to the location of the block 7, shall remain flat whether the ski be loaded or not.

The general appearance of the intermediate filler member can be appreciated by reference to Fig. 8 which shows the equivalent filler member for a ski which is adapted to be separated into two parts for ease of transport. It will be seen clearly from Fig. 8 how the base layer 2a co-operates with the side walls 2b in constituting an element which is of U-shape in cross-section for the greater part of its length, the central portion at which the binding is to be located having the space between the side walls filled with the block 7 as already described.

The foldable ski is constructed in exactly the same manner as the ski already described with reference to Figs. 1 to 7 with the exception that the several layers are cut through at approximately the centre of length of the ski to separate the latter into two readily connectable and disconnectable parts. Corresponding parts in Figs. 8 to 12 are given the same reference numerals as have been employed for those parts in Figs. 1 to 7.

The face at which the two parts of the ski abut when assembled together, is directed normal to the upper face of the ski for the thickness of the upper layer 1 and is then inclined forwards and downwards through the thickness of the filler member to terminate in another portion extending normal to the lower face of the lower layer 3. This formation will be clearly appreciated from Figs. 9 and 12.

In order that the two parts may be firmly and rigidly connected together when the ski is to be put into use, the front part of the ski, i. e. that portion shown on the left in Figs. 9, 10 and 12 has firmly secured therein four metal tongues adapted to fit closely into a corresponding set of slots formed in the rear part of the ski. The set of tongues comprises two tongues 10 which are set edgewise in relation to the top and bottom faces of the ski and two tongues 11 disposed parallel with and closely adjacent the inner faces of the upper and lower layers 1 and 3. The tongues 10 and 11 are disposed so that they constitute a box-like structure and are of such a length that their one ends may be securely anchored in the front portion of the ski while their other ends project freely so that they may be engaged slidably in corresponding slots formed in the rear portion of the ski. There are two slots 12 each adapted to accommodate as a close fit one of the tongues 10 and two slots 13, each adapted to accommodate as a close fit, one of the tongues 11.

In the manufacture of the ski the two parts are assembled in correct abutting relation by sliding the tongues 10 and 11 into the slots 12 and 13 whereupon two transverse bores indicated at 14 in Fig. 12 are formed almost completely through the width of the ski from the external face of one of the side walls 2b, the blind ends of the bores being disposed within the thickness of the opposite side wall 2b (see Fig. 10). It will be appreciated that these bores will penetrate the tongues 10 so that apertures 14a will be formed therein. As a second step, two bores disposed at right-angles to those just mentioned are formed through the thickness of the ski from the upper face thereof to terminate in the thickness of the lower layer 3. These bores, which are indicated by the reference 15 in Fig. 12, are so disposed that they pass through one side of the bores 14. Since the bores 15 are

formed while the two parts of the ski are fully assembled, the tongues 11 will be perforated in the appropriate locations as indicated at 15a. Locking members in the form of U-shaped metal elements are provided one, marked 16 having two parallel limbs each adapted to pass into one of the bores 14, and the other marked 17, having two substantially parallel limbs each adapted to pass into one of the bores 15. The limbs of the element 17 are formed with a slight taper and the limbs of the element 16 are formed with a notch or groove 16a at the points which will register with the bores 15 when the element 16 is pressed right home. In order to accommodate the yoke portions of the elements 16 and 17, appropriate grooves 18 and 19 respectively are formed in the appropriate face of the ski to connect the ends of the bores 14 or 15 respectively.

The locking of the two parts of the ski in correct assembled relationship is effected by sliding the limbs of the element 16 into the bores 14 and thereupon inserting the limbs of the element 17 into the bores 15 and driving this element home so that the tapered limbs thereof will wedge in the grooves 16a formed in the limbs of the element 16. It will be appreciated that the two parts of the ski are firmly interlocked by the means provided and further, that the yoke portion of the element 17 is so disposed that it will be located beneath the foot of the user while the ski is in use so that there can be no possibility of the connection becoming loose due to displacement of the elements 16 or 17.

If desired, the lower layer 3 of each of the skis referred to may be covered with a synthetic resin graphite mixture applied while the resin component is in an intermediate stage of condensation or polymerisation and cured after application to cause completion of condensation or polymerisation of the resin, whereby a self-lubricating surface having a low coefficient of friction under varying temperature conditions, will be secured.

The edging strips 4 are preferably of steel and most suitably are fixed in position by means of a suitable synthetic resin adhesive. It is preferred to construct them each in one piece extending for the whole length of one longitudinal edge of the ski, but if desired each of the metal edging strips may be interrupted at a point on the line indicated at Z-Z in Fig. 2. The free extremities of the edging strips or the sections thereof may suitably be secured to the lower layer 3 by means of rivets, screws or other fixing devices.

In some cases, the longitudinal edges of the upper layer 1 may also require protection. An edging strip, similar to that employed on the running face of the ski, may be secured on the top face and may be constructed from a suitable hard synthetic material or metal. It is preferred to secure the protective edges in position by means of a synthetic adhesive and also to attach the ends thereof by means of rivets or screws.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. A lightweight and relatively strong ski having a flexibility progressively varying along its length comprising an upper member and a lower member each formed from water-impervious material composed of integrally united laminations of synthetic resin impregnated sheet material bonded with the same synthetic resin, said upper

member and lower member increasing in width from a location near the centre of length of the ski towards the respective ends of the latter, a pair of spaced side walls interposed between longitudinal marginal edges of the said upper and lower members, one side wall at each longitudinal edge, the outer faces of the said side walls diverging towards the respective ends of the ski in register with the corresponding edges of the upper and lower members, the inner faces of the said side walls diverging less than the outer faces thereof, a waterproof synthetic resin binder means adhesively uniting the side walls to the upper and lower members to constitute a box-like structure, a solid block within the box-like structure filling the space at the location where a binding is to be secured on the ski, a unitary piece of hard vesicular material within the box-like structure extending between the solid block and the toe of the ski and a second unitary piece of hard vesicular material within the box-like structure extending between the solid block and the heel of the ski.

2. A lightweight and relatively strong ski having a flexibility progressively varying along its length comprising an upper member and a lower member each formed from water-impervious material composed of integrally united laminations of synthetic resin impregnated sheet material bonded with the same synthetic resin, said upper member and lower member increasing in width from a location near the centre of length of the ski towards the respective ends of the latter, an intermediate member adhesively united to the said lower member by a waterproof synthetic resin binder means and increasing in width with the lower member towards the respective ends of the ski, a pair of spaced side walls interposed between longitudinal marginal edges of the said

upper and intermediate members, one side wall at each longitudinal edge, the outer faces of the said side walls diverging towards the respective ends of the ski in register with the corresponding edges of the upper and lower members, the inner faces of the said side walls diverging less than the outer faces thereof, a waterproof synthetic resin binder means adhesively uniting the side walls to the upper and intermediate members to constitute a box-like structure, a solid block within the box-like structure filling the space at the location where a binding is to be secured on the ski, a unitary piece of hard vesicular material filling the space within the box-like structure between the solid block and the toe of the ski and a second unitary piece of hard vesicular material filling the space within the box-like structure between the solid block and the heel of the ski.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
25 2,038,530	Anderson	Apr. 28, 1936
2,184,791	Broome	Dec. 26, 1939
2,213,903	Davidson	Sept. 3, 1940
2,356,809	Andreef	Aug. 29, 1944
2,362,380	Kallstrom et al.	Nov. 7, 1944
30 2,433,596	Carrier	Dec. 30, 1947
2,450,538	Beaudin	Oct. 5, 1948
2,470,227	Wheeler	May 17, 1949
2,525,618	Pierce, Jr.	Oct. 10, 1950
35 2,550,002	Chorney	Apr. 24, 1951

FOREIGN PATENTS

Number	Country	Date
701,889	Germany	Jan. 25, 1941