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LAMINATED SKI AND THE PROCESS OF MAKING THE SAME

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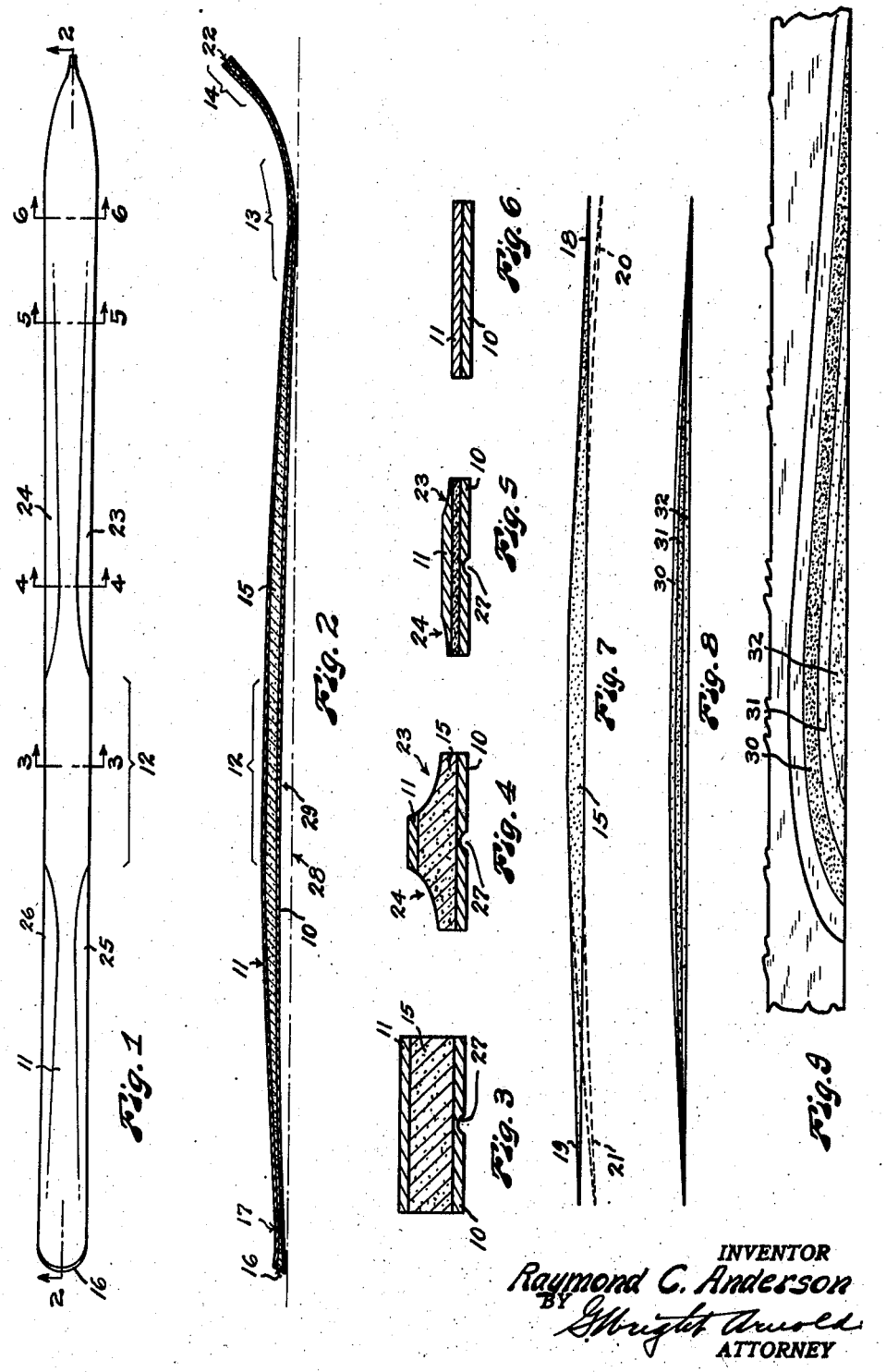

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LAMINATED SKI AND THE PROCESS OF MAKING THE SAME

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My invention relates to the art of skis, and to the process of making the same. More particularly, my invention relates to a laminated ski characterized, among other features, by the precision of magnitude and location, longitudinally considered, of the degree of spring embodied in the ski, the flexibility and capacity to resist side thrust of the upturned tip portion of the ski, and by the precision of weight of each ski, and its form retaining feature.

The exceedingly high velocities attained while skiing, create tremendously high strains upon the ski. The velocities reach as high as sixty miles per hour, and even higher on jumping take-offs, the weight of a skier may be more than two hundred pounds, and the vertical distance through which he may drop may be fifty feet or more. In cross-country skiing, where steep slopes and inclines prevail, hidden obstacles in the snow, in the form rocks, fallen logs, or other solid obstructions may put exceptionally high strains upon the skis, and unless they are equal to the ensuing shocks, severe injury may occur to the skier.

In manufacturing skis, the common practice heretofore has been to make them of a solid piece of wood, as hickory, ash, pine or birch. It is well known that hickory forms one of the best species of wood for use as a runner. However, the grain of hickory wood is very irregular, and its density is subjected to quite wide variations. Skis made from a single billet of such woods warp, even after a little service, and as a consequence, their usefulness is very seriously impaired, if not destroyed. Such skis warp even while held in stock before selling. Such warping is due to their being subject to severe strains and extreme changes in climatic conditions, and especially to the necessary curves, bends and variation in thickness of the wood at different points. The curvatures characterizing the ski are imparted to the ski by steaming and molding or shaping the wood, and this puts the wood cells of the solid wood ski on one side under tension, and the cells on the opposite side under compression. When the ski becomes wet, the compressed cells expand, and this expansion force gradually operates to deform the ski, i. e., spiral twisting both sidewise and vertically. The top and sides of the ski may be painted, varnished, or otherwise coated to exclude water, but the bottom cannot be so protected. Its surface must be left free to function as a runner The usual waxing employed to afford snow gripping action, becomes scratched, and in general provides very little protection against the absorption of water. Hence, no substantial protection attains in the ski as heretofore commonly made.

It will be understood that the ski throughout most of its length is slightly arched, so that without any weight applied a small section of the ski touches the plane at the rear, and a small section touches the plane in front. Then when the weight of the skier is placed on the ski, the ski is depressed so that it touches continuously from front or upturn to rear or heel, thus providing a dependable even support or uniform full bearing throughout the snow contacting length of the ski. The stiffness of the spring preferably should gradually increase as the middle of the arch, or foot-rest portion, gradually approaches the plane, so that said middle portion does not pass below the horizontal plane. Any such sagging of the local section supporting the weight, i. e., the foot-rest section, creates a brake action and lessens the weight support bearing. This condition emphasizes the importance of the ski retaining the form initially imparted. It is important to eliminate heel drag.

It is highly important to control the degree of spring, and it is equally important to provide the same degree of spring in both members of a pair of skis. This is very difficult where the ski is formed from a single piece of wood. Some skiers prefer to have a greater stiffness in the arch from the foot-rest rearward, than from the foot-rest forward. Moreover, there is the further importance of having the front or tip or turned-up portion of the ski particularly springy, in order to promptly yield to a slight obstruction and move upwardly to lead the way for the rest of the ski to follow over the obstacle with the minimum of shock to the skier. While great flexibility is important, yet this tip portion must be capable of sustaining severe side thrusts without breaking, and to do this in a shock absorbing manner, i. e., the tip portion must bend or yield vertically considered.

Furthermore, it is important that in a racing ski, as compared to a cross country ski, it be made very light (seven or more pounds—the amount varying greatly) longer, and narrower, and the ski embodying my invention readily provides for the required degree of lightness, and greater arching for flexibility, as well as strength. On the other hand, a ski to be used for jumping must be broader, longer and heavy (fourteen or more pounds—the amount varying greatly) and

the ski embodying my invention provides for this.

Resort is often had in skis as heretofore made to add lead to the ski to obtain the necessary weight for the desired steadiness and precision of balance—holes being bored and molten lead run in. The holes obviously tend to reduce the strength of the ski.

In making skis out of a solid wood billet, it is obvious that there is considerable cutting away to do to provide for the various requirements. As a result, after the ski has been steamed and shaped as desired, and is placed in stock for sale, a great deal of further work is often necessary in rebalancing and reforming the skis in order to bring the ski back to true form, since it warps while being retained in stock for sale. This is true even in the best grade of skis. Accordingly, the manufacture of the ski is not done when the ski is offered for sale, if it is to be retained in stock for any length of time. Often there is a great deal of work involved in pairing skis to endeavor to find two that match in shape and weight and degree of springiness and flexibility of the tip portion.

Furthermore, in making skis out of a solid wood billet, serious objection obtains to the waste of material, due to the fact that a given billet may appear clear grained on the top and bottom, and yet when the necessary cutting away and channeling is done, knots will be encountered within the body of the billet. Often these are of such a size that the whole billet must be discarded. Thus, not only is the cost of the billet lost, but the work that has theretofore been performed in shaping that billet. In making the skis of my invention, we are enabled to use such portion of the billet as do have the clear grain, and thus avoid the waste of the expensive wood. As a result, we are enabled to obtain four or five times as many skis out of a given quantity of wood as is now done where a solid wood ski is made. A defective billet may provide four or five laminations, while it would be wholly disqualified for use as for making a solid wood ski.

The primary purpose of my invention is to overcome all of the various difficulties above set forth, and to provide for the various requirements mentioned, as well as to provide a ski that may be economical in construction.

The above mentioned general objects of my invention, together with others inherent in the same, are attained by the device, illustrated in the following drawing, the same being preferred exemplary forms of embodiment of my invention, throughout which drawing like reference numerals indicate like parts:

Figure 1 is a plan view of a ski embodying my invention;

Fig. 2 is a longitudinal view in vertical section on dotted line 2—2 of Figure 1;

Fig. 3 is a view in cross section on dotted line 3—3 of Figure 1;

Fig. 4 is a view in cross section on dotted line 4—4 of Figure 1;

Fig. 5 is a view in cross section on dotted line 5—5 of Figure 1;

Fig. 6 is a view in cross section on dotted line 6—6 of Figure 1;

Fig. 7 is a view in longitudinal elevation of one form of the core member of the trapezoid form;

Fig. 8 is a view in elevation of a preformed core member formed from a plurality of laminations; and

Fig. 9 is a fragmentary view in plan of a ski embodying my invention, showing different colors of wood of different laminations in the channeled out portions.

A piece of wood well suited to serve as a runner, such as hickory, is cut in two to provide two relatively thin laminations 10 and 11,—10 serving as a runner lamination, and 11 as a cover or top lamination which has a flat foot-rest section 12 and a tip portion comprising (*a*) the turned up bend and (*b*) the point sections, 13 and 14, respectively. The lines of cut of the bottom and top of the runner 10 are parallel, and are straight longitudinally of the grain. A core or centrally disposed lamination 15 is prepared relatively thick in the flat section 12, from which it tapers towards each end, preferably feathering out at 13 and 17, and preferably becoming thicker at the heel section 16. The line of the underside of the core lamination 15 is cut straight longitudinally of the grain, and the top is cut to taper as described above. The core has edges 18 and 19 cut rectilinear, so that it forms a trapezoid, Fig. 7. When bent to form in the assembly, the spring arch, the edges 18 and 19 are given a curved contour as shown in dotted lines 20 and 21, respectively. In the tip portion, a short wedged shaped core member 22 may be inserted, which strengthens the point, and as it introduces a different curvature to the top lamination, it functions to increase the mutual support of the runner and top lamination in maintaining the curved form of the tip, on the same principle as hereinafter explained, where the top surface of the core has a sharper degree of curvature than the spring arch.

Cut-out channels 23 and 24, 25 and 26, for the ridge type of ski which may feather out towards the end portions of the ski, may be provided to lighten the ski and to provide for progressively greater flexibility as the end portions of the skis are approached. These channels also function to throw off much of the snow which otherwise would pack beneath or in front of the foot-rest section 12. A central longitudinal recess 27 is cut in the runner 10 to enable the ski to grip the snow and keep the ski running true.

In making the ski of my invention, the runner 10, core or holder 15, cover 11 and wedge 22 are assembled in position after suitable waterproof glue is applied to the surfaces to be glued. Top lamination 11 has its grain similar to that of lamination 10, and hence to neutralize the stresses, the piece 11 is desirably turned end for end and with the sides reversed, as compared to the grain of runner 10. This is preferably done unless a top lamination is used from a different log or billet. The assembly is then placed in a gluing form, preferably without any steaming, and sprung above the horizontal plane 28 to form the spring arch 29. While steaming is preferably omitted, however, when certain species of wood and/or thickness of wood laminations are employed, the steaming or heating may necessarily be employed. The assembly is thus held under pressure while the glue is setting.

In the modified form shown in Fig. 8, a core is made up separately of a plurality of laminations 30, 31, and 32. The various species of wood employed may be of different color, and some may have the grain running transversely of the length of the ski. Manifestly, when the cut-out channels 23, 24, 25, and 26 are formed, the edge portions (Fig. 9) of the various colors of wood would appear and would provide a very attractive appearing ski, as well as provide for great

strength. The core thus built up, with its particular degree of arch, would be preformed as a separate unit, and then the runner and top laminations would be applied thereto in the regular shaping form.

The mode of operation of the ski structure embodying my invention is as follows:

Much in this respect will be understood from the description above given.

The arch **29** is important to provide spring, so that when the weight of the operator is applied it will depress substantially to the horizontal plane **20** but not below it. By having the upper side of the runner **10** and the under side of the core **15** cut with the grain and straight longitudinally, it is manifest that the core **15** is placed under compression when the assembly is arched. The core **15** may be regarded as functioning as a spring of the arch form for the runner **10**, said runner resiliently holding the core in an arched form. The glue line between the runner **10** and the core **15** operates as an impervious barrier to moisture migrating through the thin runner lamination **10** to deform the arch. The maintaining of the spring of the ski of my invention is dependent upon the relatively thin laminations adhesively bound to the core member. By controlling the degree of tapering of core **15** rearward as compared to that forward provides for the proportion of spring to be located rearward of footrest section **12** as compared to that located forward of said section. Some prefer to have greater stiffness rearward, and my invention provides for this, so that greater flexibility forward permits the better overcoming or overriding of obstacles or unevenness of the snow surface. It will be understood that the underside of the runner **10** is unprotected, so far as a waterproof coating is concerned, i. e., has no varnish coating to keep out water. Any coating initially applied is subject to being worn off promptly in use. While the underside of the runner is waxed, this is subject to being scratched, and falls far short of preventing the runner from absorbing moisture.

While it is preferable to provide the ski with a top lamination having the same character of wood as obtains in the runner, so that thereby there may be a better neutralizing or balancing of forces or stresses which are set up in the wood laminations, such is not necessary—only two laminations, the runner and a core, may be employed, or when a top lamination is provided, it may be of a different character of wood than the runner.

Obviously, this spring arch **29** is resiliently maintained by the mutual interaction of two adjacent laminations held together by the binder means. Having been bent to form the spring arch and then bound together while so bent, two adjacent laminations cannot be deprived of their arch form without a relative movement between their adjacently disposed surfaces and this movement is prevented by the binder. The elongation of the ski, occurring when the arch is depressed, would seem to be derived from the elasticity of the wood fibers.

The lamination **15**, above the runner **10**, which ordinarily will be the core, is not subject to being softened by absorbing water, and as it, again ordinarily, will be relatively thick as compared to the runner, it may well be deemed to be the spring providing element of the runner. With the cover or superimposed lamination on the core or lamination next to the runner, the core would be further held to the arch form by the mutual position or relation of the core and this top lamination, so that then in a three ply or lamination construction, the core could be regarded wholly as an arch spring member.

Continuing this analysis, it is manifest, where three plies are present, that by providing the top surface of the core with a sharper curvature than that of the arch, that greater relative movement of the laminations, top and core, would be required than between the underside of the core and the runner which may have the spring arch degree of curvature. This difference in curvature particularly provides for a considerable augmenting of the force to depress the arch as it approaches the horizontal plane; in other words, such an arch particularly stiffens as it approaches the horizontal plane.

The ski thus presents a particular problem, one side being unprotected against the absorption of moisture, while the top side, not subject to wear, may be coated with varnish, paint or other substantial coating which will prevent the absorption of moisture to a very large degree.

The unbalanced internal strains in solid wood, which cause warping, are equalized and maintained in balance by properly gluing together two or more laminations of wood in gluing shaping forms to produce the particular shape desired, each lamination being of the particular type or species of wood designed to perform the particular function required in the ski. The various laminations provide for advantages in weight, spring, strength and water exclusion as follows:

In providing the proper weight, difficulty is experienced in the solid wood ski, because it is limited by the character of the wood used. It is quite necessary that the running surface of the ski be of a strong, hard and tough material which ordinarily is found only in the rather heavy species of wood. The laminated ski of my invention can be so constructed as to use only thin layers of the heavy material for the running surface, while the core may be of a layer of lighter or heavier material as the particular type of ski may require. One of the principal requirements of a racing ski is that it should be very light without sacrificing strength, while the jumping type of ski should be very heavy to provide steadiness, but yet have all the life or spring of a lighter ski. The element of control of weight, which is highly desirable, can primarily be accomplished by the proper selection of material used for the core. Further, a pair of skis can be more equally balanced as to weight in my type of ski, due to the fact that the core material may be a wood which does not vary in weight, to the same extent as other woods necessary in the solid type. Hickory with all its advantages, is particularly lacking in uniformity of density, and grain structure. By using a wood for a core of more uniform character, such variations are avoided.

As to providing spring.—In the solid wood type of ski, as skis are now commonly made, it is practically impossible to obtain the same degree of spring and flexibility in both members of a pair, as there is a wide variation in grain character and texture in the various billets of hickory and ash, which is not true in a number of other woods. Therefore, it is possible, with a laminated type of ski of my invention, to maintain and provide practically the same spring in the members of a given pair of skis. Inasmuch as the skis are glued to shape in gluing and shaping forms and the core may be cut to desired shape, the

degree of flexibility can be located at the most desirable point longitudinally considered of the ski.

As to strength, the laminated ski of my invention will withstand considerable more flexing and side thrust at the tip than the solid type, because the strength of wood is greatly increased when multiple layers are glued together. Thus, I am able to provide in the turned-up front portion of the ski, a considerable higher degree of flexing than ever heretofore has been possible, and at the same time with an increase of strength in said portion.

Relative water exclusion.—The absorption of water, particularly on the unprotected runner side, and the drying out of the ski, results particularly in the deforming of the solid wood type of ski, especially in flattening the arch which provides the spring. The laminated type of ski embodying my invention provides for retaining all of the advantages of the unprotected runner, and at the same time provides for overcoming the deforming effect due to the absorption of water by the interposition of water barriers in the form of the waterproof glue line, while the spring arch 29 is provided by protected laminations. In this wise, the water may be excluded, and its migration definitely limited and substantially kept away from that part of the ski which has the function of holding or maintaining the arch form.

Obviously, changes may be made in the forms, dimensions, and arrangement of the parts of my invention, without departing from the principle thereof, the above setting forth only preferred forms of embodiment.

I claim:

1. A ski embodying a runner lamination having its top surface cut with the grain substantially in a straight plane longitudinally considered, a core lamination prior to assembly cut in the form of a trapezoid longitudinally considered, a cover or top lamination, said runner, core, and cover laminations being bent to form a spring arch, and a binder between said laminations, whereby the ski is resiliently held in the arch form with respect to a horizontal plane and the degree of spring in different portions of the ski longitudinally considered may be determined.

2. A ski embodying relatively thin runner and cover laminations, and a relatively thick core lamination of a species of wood having a different specific gravity than the runner and cover laminations whereby the precise weight of a ski may be controlled, said core lamination being held in operation in a spring arch form longitudinally of the ski by said runner and cover laminations.

3. A ski embodying an arched runner and a core member lamination, a waterproof glue line therebetween, said core member lamination being under compression longitudinally considered while resiliently held by said runner lamination in an arched position with respect to the horizontal plane.

4. A ski embodying an arched runner lamination having an upturned front portion, a core and a cover lamination, the runner and cover laminations being relatively thin and of a length extending from tip to tip, the core being relatively thick and tapering towards its end portions, said core terminating about at the point of upturn, a waterproof adhesive means holding said laminations in assembled form, whereby a relatively highly flexible vertically upturned portion is provided and at the same time one capable of sustaining severe side thrusts.

5. A ski embodying an arched runner lamination having an upturned front portion, a core and a cover lamination, the runner and cover laminations being relatively thin and of substantially the same length, the core being relatively thick and tapering towards the tip and heel portions of the ski, the heel end portion becoming thicker after tapering to provide a strong heel portion, the tip portion of which core terminates about at the point of upturn, thereby providing for the upturned portion to consist of the runner and cover laminations; and a wedge shaped member in the top part of the upturned portion.

6. A ski embodying a runner lamination having its top surface cut substantially in a straight plane longitudinally considered; a core lamination with its under surface cut substantially in a straight plane longitudinally considered and its top side cut in an arc convexly curved with respect to said underside; a cover lamination for said core, said runner, core and cover lamination being bent to form a spring arch, the top surface of the core when bent having a sharper degree of curvature than the degree of curvature of the spring arch; and a waterproof glue means operatively disposed between said laminations, whereby the spring is substantially stiffened when the arch upon being depressed approaches the horizontal plane.

7. The process of making a ski comprising the steps of cutting a relatively thin runner lamination; cutting a core member relatively thick in its central portion in comparison to the thickness of the runner lamination member; assembling said core member in superimposed position upon said runner lamination member with a layer of water-proof adhesive therebetween, said assembling being done while the said laminations are bent in an arch form with the runner lamination member being disposed in an arc of shorter length than the arc of the top of the core member; and subjecting said assembly to pressure while the veneer is setting.

8. A ski embodying a runner member lamination and a core member lamination, said laminations being adhesively bound together, said core lamination being relatively thick in the central portion longitudinally considered and tapering towards the end portions, said runner lamination being relatively thin in comparison to the central portion of said core member, the mutual interaction of the core member and runner laminations through the adhesive operating to provide and maintain a spring arch form in the ski longitudinally thereof.

9. In a ski, a core member distortedly held to form an arch spring longitudinally of the ski by a lamination adhesively bound to said core member.

10. A ski embodying a spring core member having an arch form longitudinally considered; a relatively thin runner lamination having a portion disposed in an arc paralleling the arc of the under side of the core member; and a water resisting binder means adhesively uniting the under side of said spring core member to the upper side of said runner lamination, whereby said runner lamination operates through said binder means to prevent deformation of the arch of said spring core member and the binder means prevents moisture reaching the core member through the runner lamination.

11. A ski embodying a spring core member hav-

ing an arch form longitudinally considered, the radius of the arc of the under side of the core member being longer than the radius of the arc of the top side of the core member; a relatively thin runner lamination having a portion disposed in an arc concentric to the arc of the under side of the core member; and a water resisting binder means adhesively uniting the under side of said core member to the upper side of said runner lamination, whereby said runner lamination operates through said binder means to resist deformation of the arch of said spring core member and the binder means prevents moisture reaching the core member through the runner lamination.

12. A ski embodying a spring core member having an arch form, the radius of the arc of the under side of the core member being longer than the radius of the arc of the top side of the core member; a relatively thin runner lamination having a portion disposed in an arc concentric to the arc of the under side of the core member; a relatively thin cover lamination having a portion disposed in superimposed position with respect to the core member in an arc paralleling the arc of the top side of the core member, a water resisting binder means adhesively uniting the under side of said core member to the upper side of said runner lamination; and a binder means adhesively uniting the upper side of said core member to the under side of said top lamination, whereby said runner and top laminations operate through said binder means to resist deformation of the spring arch of said core member and the said water resisting binder means prevents moisture reaching the core member through said runner lamination.

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