The invention is a device that enhances the flex capability of a ski, such that the ski’s performance is improved over prior art. With the advent of shorter shape skis being accepted in the industry there is an inherent problem with the prior art boot to ski attachment, such that a dead or flat spot in the flex is created. The invention de-couples the stiff element of the ski boot from affecting the ski’s flex. The invention comprises a novel means of providing de-coupled ski boot and binding attachment for the benefit of all stature of skiers, such as a child and adults. A substantially short (with regards to ski length) riser plate is centrally mounted to a ski. A platform plate is mounted to said riser plate, such that said platform is elevated above said ski. The invention results in said ski flexing freely to initiate smooth carve turns and dampen impacts from rough terrain. A ski binding can easily be attached to the platform using traditional methods, such that prior art ski bindings can be utilized. Further, the design can be integrated directly into the design construction of the ski to provide enhanced performance with fewer parts. The invention is clearly advancement to the existing prior art technology.
FLEX ENHANCING DEVICE

FIELD OF THE INVENTION

[0001] The present invention relates to the construction of glide boards with non-flexing members attached, in particular the interface between a skier's boot and the ski.

BACK GROUND OF THE INVENTION

[0002] In recent years the traditional profile and length of alpine downhill skis has changed from long relatively straight gliding boards to very short and non-straight profiles. A ski is made up of a few very distinct features, such as camber, side cut and stiffness. These attributes are the basic elements of what make the ski perform. The side cut of a ski is a geometric feature which enables the skis to ride on its edge for the duration of a turn. The side cut is the smooth arc between the tip and tail of the skis when looking at the top surface of a ski. Side cut is in general the varying width of the ski along the length of the ski.

[0003] The ski is further comprised of camber, which gives the ski's ability to absorb bumps and resist the centripetal forces of a turn. The camber is the smooth arc of the ski when viewed from the side. The camber is similar to that of a leaf spring, in that when weighted the curvature reduces and energy is stored in the ski structure. The typical amount of camber built into a ski is about 13 mm per ski as measured from the horizontal in the middle of the ski's length. During skiing the ski can go into a reverse curve, or reverse camber. The reverse camber of a ski in a high-speed turn could be as much as 3 times the camber.

[0004] Modern skis are constructed of composite materials such as fiberglass, carbon fiber, wood and laminates of various types of metals, aluminum, steel, titanium all suspended in a matrix of plastic polymers, such as thermoplastic or thermoset. Skis are engineered to various stiffness or flexes, as well as different turning radii for different skier abilities, i.e. racing, advanced, intermediate, and beginner.

[0005] In ski racing it is advantageous to turn the ski on its edges, such that speed is not wasted in skidding. This efficient method of turning is called carving. Essentially, a carve turn is a method of putting the ski on edge, and forcing the ski into reverse camber. When these two elements of a turn are put together the highly efficient carve turn results.

[0006] In the 1970s, a 5 ft 8 inch tall person would typically use a ski length of 205 cm long with little variation in the side cut. The side cut can be described as width measurements (in millimeters) of the tip/tail section of the ski, i.e. 80/62/75 millimeters. The camber of the ski has not changed very much in the pass 20 years.

[0007] The length of the average person's foot is about 26 cm. The typical length of a ski boot sole which would fit a 26 cm long foot is about 305 mm. The ski boot is typically attached to the top surface of the ski by a ski binding means. Said binding is made up of a spring-loaded device assembly comprising and individual toe and a heel piece. The toe piece is typically about 75 mm long and the heel piece about 95 mm long. The ski boot/binding length combined is 48 cm, which is about 25% of the total length of the prior art ski length (205 cm).

[0008] The new ski designs are called shape skis due to their very dramatic side cuts. For example the side cuts are now about 100/62/95 millimeters for a shape ski. The same 5 ft 8 inch person is now using skis of about 150 cm long or 27% shorter. The typical ski boot/binding combined length is now about 32% of the ski length.

[0009] The ski boot/binding element of the entire ski assembly, i.e. ski, binding, boot is inherently stiff and non-flexing. The ski binding and boot combination does not have the same flex characteristics as the ski. The shorter ski lengths amplify the miss match in flex of the ski assembly.

[0010] In continuation of the ski length to boot/binding disproportion, smaller youth skier are further disadvantaged by the disproportion the ski length to the boot/binding length. A youth skier of about age 10 to 12, typically is using shape skis length of about 130 cm. The toe and heel binding lengths remain the same as for adults. The statistical norm for youths skis boot size is a 23 cm length, which has a sole length of about 275 mm, yielding a boot/binding length of 45 cm. The ski length to boot/binding length ratio increases further to about 35% of the ski length.

[0011] Clearly the introduction of the shorter shape skis has made it arduous to provide a ski assembly which can freely flex and provide efficient carve turns.

[0012] Prior art ski flex enhancing devices are limited in the amount of decoupling they can accomplish. Prior art has typically attempted to integrate the ski binding into an elevated platform. The elevated platform resides on the middle length of the ski and is raised about 9 to 35 mm above the top of the ski surface. These platforms are disposed beneath the binding toe and heel piece areas. The method to decouple the platform from the ski is by inserting an elastomeric material between the platform and the ski top, typically middle distance on the platform. Other embodiments of prior art incorporates mechanical means to decouple the platform from the ski, such as distinct pivot points by attaching the platform to the side wall of the ski. Another method uses the elastomeric material in conjunction with slots and shoulder screws. The slots are disposed on the platform beneath the ski binding toe and heel piece fixation of the binding to the platform. The shoulder screws are disposed in the slots such that the platform is decoupled from the flexing motion of the ski.

[0013] In all prior art embodiments, the attempts to decouple the platform from the ski are inefficient once the ski boot is attached to the binding. A ski boot sole by design has to be a non-flexible member so that during ski flexing it does not flex out of the binding attachment. Further, the design of the ski boot sole has to be non-flexing, so that the foot inside the boot is not subjected to multiple flexing, which causes skier fatigue. When the ski boot is coupled to the prior art platform devices with said pivot points, elastomeric materials and slotted sliding devices the ski boot stiff sole limits ability of the prior art to provide efficient independent flexing of the ski.

[0014] The invention solves the problem of decoupling the stiff boot and binding combination by treating it as a separate element in the ski-boot/binding assembly.

SUMMARY OF THE INVENTION

[0015] The invention consists of a first plate attached to a ski top surface. The first plate is disposed approximately in the middle of the skis center length. The first plate can be
either a metallic structure, and or a composite material. The first plate is composed of two distal surfaces, such that a thickness or height of said plate is established. The height of said first plate can vary depending on the intended use of the device. The first plate could be approximately 6 mm in height, measure with respect to the top surface of the ski approximately at the middle of the ski's length.

[0016] The first plate can be attached to the ski by means of fasteners, adhesives or a type of mechanical locking feature. Further, said first plate could be a simple raised feature in the ski's cross section, as an integral part of the ski's composite laminate.

[0017] The preferred embodiment's first plate's planar shape is that of a rectangle with its width slightly less (about 1 to 3 mm less on each side) than the ski's top width. The length of the first plate, as in the direction of the longest dimension of a ski, can be as small as possible to allow for adequate surface area for inserting fasteners for a second plate. The invention's first plate length can be approximately 150 mm. Further, the planar shape of said plate is not limited to a polygon of a rectangle, but could be that of a circular shape, or elliptical.

[0018] A second plate is disposed on top of the first plates top surface. The second plate is also comprised of two distal surfaces, such that a thickness or height is established. The second plate's first distal surface is adjacent to the top distal surface of the first plate. The second plate is fixed to the first plate's top distal surface by means of fasteners, adhesive or mechanical interlocking means. The second plate is preferred to be of a lightweight, inexpensive material such as plastic.

[0019] A third plate is disposed on top of the second and first plate. The length of the third plate is slightly longer than the total length of a combined ski binding assembly from front to back.

[0020] A third plate or platform can be comprised of a solid piece of metal or in the preferred embodiment a composite laminate construction. The composite laminate can be, but is not limited to a semi-isotropic lamina of fibrous materials with a matrix binding material, and a center core material with thin outer solid sheets. Said composite laminate could have a larger portion of fibers orientated in the longitudinal direction. The composite laminate can be comprised of various fibrous materials such as carbon fiber, fiberglass, Kevlar, boron, spectra or of similar high strength and modulus materials, and or combinations of said fibrous materials. Said matrix material could be but is not limited to thermo setting polymers, such as bismalimides, and high strength engineering thermoplastic resins, such as polyimides. Said core material are not limited to kiln-dried hard woods, such as a birch plywood, but synthetic materials such as polyurethane foam cores, and thermoplastic. Other cores materials would include metal honeycomb. The thin outer solid sheets could have a thickness of 1/60 of the second plates total thickness or about 0.5 to 1.5 mm thick. Said solid sheets could be aluminum, steel, titanium, plastic or a pre-cured composite laminate.

[0021] The thickness of the third plate can vary with the intended use of the device. The thickness of the third plate would vary depending on the intended use, for example a youth skier which weight 50 to 60% less than adults and has not fully developed their muscle strength, would be substantial less than an adult or an intended aggressive racer. Further, the third plate's thickness is also directly related to the lamina materials selected in its construction.

[0022] In the sport of alpine ski racing there are rules for the amount of height that a ski binding can be from the ski's bottom surface. Alpine ski racing international sports governing body, Federation of International Skiing or FIS has ski bottom to ski boot sole height requirements. For example youth ski racers are limited to a height of 50 mm and adults to 55 mm. Meeting the FIS ski bottom to boot height requirements can be accomplished by adjusting the second plates thickness and or adding thin shims to the overall stack height. It is best to optimize the stack height such that the second plate is as tall as possible. The second plate's height determines the free flexing range of the ski.

[0023] The ski has a varying cross sectional thickness in the longitudinal direction. The ski's thickness is typically thicker in the center than at the tip distal and the tail distal ends. As an example the tip and tail thickness can be about 7 mm, where as the center thickness can be about 20 mm.

[0024] The side profile of the ski with the camber and thinner from the middle to the tip and tail creates two negatively sloping surfaces. If an imaginary horizontal plane is established in the middle of the ski, there would be an increasing gap between the horizontal plane and the front and rear top surface of the ski. The gap between the horizontal plane and the top surface of the ski increases as you move further away from the center distance of the ski. This gap between the horizontal plane and the ski top is referred to as the free flex zone. Free flexing would be in regards to the ski's ability to travel in reverse camber unhindered. A free flexing ski will be very responsive and leads to highly efficient carve turns.

[0025] The free flex zone is also the gap between a rigid non-flexing plate, which is attached to the top surface of the ski. The rigid non flexing plate is generally parallel to the skis running surface, or the two points where the arched skis would contact a flat surface. These two contact points are located forward and aft of the ski's center length. The non-flexing rigid plate's length is about four distance of the front portion of the ski and med distance of the rear section of the ski. When the ski flexes into reverse camber the front and rear sections of the ski move toward the rigid horizontal plate resulting in a decreasing gap between them. The gap where the ski front and rear sections can move or flex without contacting the rigid horizontal plate is the free flex zone.

[0026] There are conditions when the ski could exhibit an extreme flex or reverse camber such that the top of the ski would make contact with the bottom of rigid horizontal plate. In such a case, the invention would provide the same function as any prior art device has in the past. However the invention is a major improvement in providing a decoupling device to attach a ski's boot-binding combination to a ski.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0027] The following drawings will show by pictorial description the non-limiting means, the advantages, and the benefits of the invention.
FIG. 1 is a perspective drawing of a ski assembly consisting of the interfacing device for decoupling the ski boot and binding elements from the ski. The ski is show both flexed and non-flexed.

FIG. 2 is a side view of FIG. 1 with the ski in the relaxed and in the flexed reverse camber condition.

FIG. 3 is a detailed cross sectional view of FIG. 2 with the ski front and end sections removed for clarity.

FIG. 4 is a cross sectional view through line IV-IV of FIG. 3.

FIG. 5 is a cross sectional view through line V-V of FIG. 3 detailing the first plate.

FIG. 6 is a planer view of the top surface of the platform plate.

FIG. 7 is a perspective view of alternate embodiment of the ski with an integrated riser plate.

FIG. 8 is a cross sectional view of FIG. 7 approximately in the middle of the ski through line VIII-VIII.

FIG. 9 is a cross sectional view through line IV-IV of FIG. 3 with the ski shown in FIG. 7 to illustrate the canting feature.

FIG. 10 is a side cross sectional profile of an alternate embodiment of FIG. 3 showing forward and aft adjusting device.

FIG. 11 is a perspective view of an alternate embodiment of the invention where by the platform plate is attached to the sides of the ski.

FIG. 12 is cross sectional view through line XIII-XII of FIG. 11, showing side attachment of the platform to the ski with an additional binding attachment feature.

FIG. 13 shows a cross sectional view of an embodiment from FIG. 8 with an additional gap-filling feature.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows an illustration of the invention consisting of a ski 1, raiser plate 2, height shim 3, platform 4 and front 5 and rear 6, ski binding assemblies and ski boot 7. The ski boot 7 is fastened into the ski binding assembly's front 5 and rear 6 pieces.

A Cartesian coordinate system 19 is shown in FIG. 1 to define a horizontal plane 20 created between the X and Z-axis. The Y-axis is shown in the positive upward direction perpendicular to the horizontal plane 20.

In FIG. 1 there are two images of a ski, super imposed on one another. Ski 1 is in a relaxed, non-flexed condition and ski 18 is the same ski in a flexed condition. This flexed condition is called reverse camber, where by the tip 8 and the tail 9 are flexed above the horizontal plane 20.

The ski 1 is comprised of an upwardly curved tip 8, which is located at the front distal portion 10 of the ski. A tail 9 is disposed in the extreme opposite direction of the tip 8. The distance between the tip 8 and the tail 9 make up the length of the ski 1. The front section 10 of the ski 1 is disposed between the ski's middle distance 12 forward toward the tip 8. A rear section 11 of the ski 1 is disposed between the middle distance 12 rearward to the tail of the ski 1.

Ski 1 is in a non-flexed condition and is resting on horizontal plane 20 by contact points of the front section 10 and the bottom portion of the tip 8 and the rear section 11 and the bottom portion of the tail 9. The ski's middle distance 12 is elevated above the horizontal plane 20 a height of about 20-mm. The ski bottom 15 running between the tip 8 and tail 9 create and curved surface, generally referred to in the ski industry as camber. Distal to the ski bottom 15 in the Y-axis is the ski top 14, which traverses the length of the ski in an arc, and is not concentric to the ski bottom 15. The space between the ski bottom and the ski top 14 establish the ski thickness 16.

In general the ski's thickness 16 varies as shown in FIG. 1, such that the middle 12 is substantially thicker than the tip 8 and the front section 10 and the tail 9 and the rear section 11. The construction of the ski 1 is such that the flex and stiffness characteristics are determined by the variation of the ski's thickness 16 along the longitudinal direction of the ski.

Looking directly down on the top of the ski 14 along the Y-axis shows that the front section 10 and middle section 12 and the rear section 11 are of varying widths. This width variation creates the side cut of the ski. The side cut is also smooth arc between the tip 8 and the tail 9. The ski industry is current producing skis with a high degree of difference in side cut. As an example the tip 8 width can be 105 mm wide and the middle 12, 62 mm wide and the tail 9, 95 mm wide. The side cut is a smooth arc of a distinct radius, in particular a side cut radius of 12 meters is used for tight radius turns as those found in an alpine slalom ski race. A side cut radius of 21 meters would be used for larger radius turns as those found in an alpine giant slalom ski race.

The side cut and the camber arcs as well as the stiffness of the ski are the three main elements of the ski design which allows the ski to carve a turn on its longitudinal edge 17.

Approximately middle distance 12 of the ski 1 is a raising plate 2 projecting above the ski top 14. The height of said raising plate 2 can vary depending on the intended use of the ski assembly. The ski industry's international governing body or the federation international of skiing (FIS) has established ski bottom to ski boot sole requirements for competition. As an example the ski bottom to ski boot sole maximum height for a youth skier is 50 mm. The maximum height requirement for an adult ski racer is 55 mm. It has been found in the ski industry that by elevating the skier's boot above the ski top surface creates increased leverage to the ski, which makes it less difficult to execute a carve turn.

A brief explanation of a carve turn is provided. The mechanics to perform a carve turn is to roll the skiers knees into the turn while putting the skis on edge. When the skis are on edge the side cut of the ski makes non-skidding contact with the snow surface. The skis travel down the ski slope on the edges, which initiates a carve turn. As the radius of the turn tighteners or the speed increases the ski flexes in a reverse arc or reverse camber. The side cut of the ski and the reverse flexing help to produce the highly efficient non-sliding carves turn.
There are a number of prior art devices for creating a raiser plate, such as a simple solid block means running the length between the front and rear binding. Said solid block raiser plate means are limiting in that they add an additional stiffness element to the ski. When attempting to perform a carve turn the additional stiffness of the solid raiser plate disrupts the skis natural arc and therefore makes it difficult to perform a carve turn.

Other such prior art raiser plate devices attempt to compensated for the skis natural flexing or reverse camber by complicated mechanical means such as springs, mechanical hinges, elastomeric materials in conjunction with mechanical fasteners in slotted holes. The entire prior art raiser plate devices fail to adequately isolate the stiff rigid ski boot sole and binding assembly from the flexing ski.

FIG. 2 illustrates how the ski 1 flexes during a carve turn. The ski 1 is the non-flexed condition and the ski 21 is in the flexed reverse camber condition. In the flexed condition 21, the ski is in reverse camber, which implies that the front section 10 and the rear section 11 of the ski 1 has moved away from the horizontal plane 20, such that a smooth arc 22 is created a long the longitudinal length of the ski. The smooth arc 22 is such that the top of the ski 14 does not contact front most distal edge 23 and 24 of the platform 4. The rear section 11 of the ski's top surface 14 does not contact the rear most distal edge 24 of the platform 4. The front bottom surface 25 of the platform 4 and rear bottom surface 26 establish a planar surface 27 which is generally parallel to the horizontal plane 20.

Further, the front ski binding boot attachment plane 28 and the rear ski binding boot attachment plane 29 are in general parallel to both the plate 4 and bottom surface 27 and the horizontal plane 20. The generally non-flexing ski boot's sole 30 is mostly parallel to horizontal plane 20 and isolated from the flexing ski 21 in the reverse camber condition.

It is important to understand that platform 4 is designed to be a rigid non-flexing member of the ski assembly. The ski boot's sole 30 in general is a non-flexing element of the ski assembly. The front and rear binding elements 5, 6 are also by nature of their numerous metal parts assembly non-flexing elements of the ski assembly. The configuration of the invention isolates all the inherently rigid non-flexing elements from the ski by providing a raiser plate 2 which does not run the entire longitudinal length of the binding/boot assembly. The longitudinal length of the raiser plate 2 is typically shorter than the distance of the toe and rear contact points of the ski boot 28, 29. As an example the longitudinal length of one of the embodiments of the invention is about 150 mm for a Mondo size 26 ski boot. The longitudinal length of the raiser plate 2 is not limited to one length but can vary for the application, such as for small children or large adults.

FIG. 2 also illustrates the ability of the invention to dampen vibration from the ski to the skier's boot. The binding/boot attached to platform 4 and height shim 3 are attached to the raiser plate 2 in such a manner that the ski can flex freely between the non-flexed 1 and flexed 21 conditions without directly applying loads to the attached skier's ski boot.

The elevated position of the ski boot sole 30 in relation to the mounting location on the ski provided additional mechanical leverage. The relationship of the toe contact 28 to the center length 12 of the ski provides a front mechanical lever arm 1.1. A rear mechanical lever arm 1.2 is established between the rear of the ski boot contact point 29 and the middle of the ski 12. These front and rear mechanical lever arms, 1.1 and 1.2 make it advantageous to weight the ski during carve turns with reduced effort from the skier.

Prior art binding/ski boot to ski attachment devices with raised platforms are not able to create the front and rear lever arms 1.1 and 1.2 because the boot toe contact 28 and rear contact 29 are coupled directly into the ski tip 14.

FIG. 3 is a cross sectional view of one embodiment of the invention to illustrate the attachment means to the ski 1 and further illustrate a typical attachment means of said binding. The front and rear sections 10, 11 of the ski 1 have been omitted for clarity. The riser plate 2 is fixed to the ski 1 approximately at the ski's mid length 12. The adjacent height shim 3 is sandwiched between the platform 4 and the riser plate 2. The bottom distal surface 32 of the riser plate 2 is in direct contact with the ski's top surface 14 and fixedly attached to said top surface 14, such that a rigid attachment is achieved. There is a pattern of threaded and clearance holes which will be shown in more detail in FIG. 5 through the riser plate 2 top surface 31 and through said plates center section between distal surfaces 31 an 32. Said riser plate 2 is attached to the ski tip 14 by means of at least one high strength wood screw. In this embodiment six of said wood screws are used. The cross section visibly shows two of said wood screws 33, 34. Said wood screws 33, 34 do not protrude out of the bottom surface 15 of the ski, but are embedded into the ski core 35.

The riser plate 2 has a top surface 31, which is generally parallel to the ski's top surface 14. The riser plate 2, top surface 31 height in relation to the riser plates distal bottom surface 32 is approximately 6 to 20 mm. A shim plate 3 is found between said riser plate 2 and said platform 4. The shim plate 3 has a bottom distal surface 36 and a top distal surface 37 that creates a height for said shim plate 3. The height of the shim plate 3 can be adjustable to suit the skiers needs and stay within the FIS rules of ski boot heights. Said shim plate 3, bottom distal surface 36 is in direct contact with riser plate 2, top distal surface 31. Said shim plate 3, top distal surface 37 is in direct contact with the bottom distal surface 27 of the platform 4.

The platform 4 is rigidly attached to the riser plate 2 by means of at least one fastener. In this embodiment six of said fasteners are used. The cross section visibly shows two of said fasteners 37, 38. Said fasteners 37, 38 do not protrude out of the bottom surface 15 of the ski 1, but have threaded engagement in the riser plate 2. The threaded fasteners 37, 38 extended through the shim plates distal top and bottom surfaces 37, 36. When said fasteners are tightened the platform 4 and the shim 3 are clamped to the riser plate 2, creating a stable mount.

The threaded fasteners 37,38 are easily disassembled from the platform 4 such that other embodiments of the invention can be created such as those shown in FIGS. 9 and 10. It is not beyond the scope of this invention that the said shim plate 3 can be eliminated from the stack height of the attachment of the platform 4. It will be shown that the intermediate shim plate 3 can allow other geometric customizing features not found in prior art.
Platform 4 has a forward section 39 which projects beyond the front most edge 64 of the riser plate 2. The platform 4 has a rear section 40, which extends beyond the rear most edge 65 of the riser plate 2. The length of the platform 4 is substantially longer than the riser plate 2. The center of the platform 4 is typically aligned with the middle distance 12 of the riser plate 2. The longitudinal alignment of the riser plate 2 and platform 4 to the ski 1 longitudinal length are of a personal preference to the skier. As an example in slalom ski racing the ski binding assembly is typically mounted a few millimeters forward of the skis mid-length 12. In giant slalom the binding assembly is mounted on center of the mid-length 12. In downhill events the binding assembly is typically mounted a few millimeters behind the mid-length 12 of the ski. The length of the platform 4 can be sized according to its intended use, as for youth skiers with relatively short length feet, to adults with relatively long feet length. It is envisioned that the platform 4 element of the invention could be produced in a number of sizes, such as youth, junior, small adult, adult, and large adult.

The platform 4 has a front ski binding assembly 5 fixed mounted to the front section 39 of the platform 4. The front ski binding assembly 5 in one embodiment can be fixed mounted to the platform 4 with wood screws 42, 43. The rear ski binding assembly 6 in one embodiment of the invention can be fixed mounted to the platform 4 with wood screws 44, 45. The length between the front and rear bindings 5, 6 is based on the ski boot 7 sole length 50, such that adequate ski boot toe 48 and heel 49 clamping is provided to the toe and heel contact zones 28, 29 of the binding assembly. With varying lengths of ski boot 7, one platform 4 length could be provided and the rear distal end 24 could be cut to the required length needed. In such an embodiment where the platform 4 is cut to length after binding mounting a platform end cap 50 is provided to protect the cut end of the platform from having moisture intrude into the laminate.

FIG. 4 is a cross section of the invention seen through section line IV of FIG. 3, which illustrates the inventions internal and external composition. The ski 1 is comprised of a bottom 15, side edges 52, 53, center core 35, exterior side structure 54, 55 and top surface 32. The riser plate 2 is fixed attached to the top surface 32 with riser to ski fasteners 51. Riser to ski fasteners shown in FIGS. 3, 33, 34 are used to fix the riser plate 2 to the ski top 32. Said riser to ski fasteners 33, 34, and 50 extended through said top surface 32 into said center core 35, such that the fasteners 50, 33, 34 do not extend through the bottom 15.

Platform 4 can be constructed of a number of suitable rigid materials such as metal, as an example; aluminum, titanium, or steel. The preferred embodiment of the platform 4 is comprised of a composite construction of fibrous materials embedded in a plastic matrix material. The composite material encapsulates a core 35 material such as hard wood, plastic foam, a honey comb structure of either a metal (aluminum or steel) or plastic honeycomb structure, which are typical of the composites industry. The platform 4 is comprised of an outer skin 61 of composite material. Said skin 61 includes a top skin 57, side skin 59,60 and bottom skin 58. The outer skin 61 encapsulates the core 56.

Said outer skin 61 can be comprised of a carbon fiber material such as AS4 medium modulus material or a high modulus fiber to increase the platform’s stiffness. The fiber orientation within the skin 61 lamina is preferred to be such that the platform 4 is non-flexing along the length of the ski 1, and also providing torsion rigidity. An example of a composite lamina fiber orientation would be a zero degree, +/-30 degree and a zero degree orientation, denoted as [0/+30/-30/0]. Said zero degree orientation would be along the length of the ski 1. The fiber would be a 12 k filament in uni-direction fabric material of either a prepreg or wet lay-up resin matrix system. The resulting composite lamina would have a resin content by weight of about 33%, which is typical for the composite industry. The resulting lamina skin 61 thickness by this example would be approximately 1 to 2 millimeters.

The manufacturing method incorporated to produce the composite platform 4 can be those typical of the manufacturing methods employed in the composites industry, such as closed molding, resin infusion molding, resin injection molding, wet lay-ups, vacuum forming. The preferred method is a closed mold with a heat activated resin system with a short cure cycle of 2 to 10 minutes.

In the preferred embodiment platform 4 is attached to the riser plate 2 by means of threaded fasteners 37,38. Said platform 4 threaded fasteners 37,38 are such that the do not extend into the top surface 14 of the ski 1, thus reducing the number of stress concentrations introduced to the ski. It is not beyond the scope of the invention to eliminate the riser to ski fasteners 33, 34 and 51 and have the platform 4 to riser fasteners 37, 38 extend through the riser plate 2 and the ski top 14, and the ski core 35. In the preferred invention there are six fasteners for attaching the riser 2 to the ski 1, which would be of the type of high strength wood screw typical of the ski industry for mounting a ski binding to a ski. Further there would be a set of six fasteners for attaching the platform 4 to the riser plate 2, which would be of high strength machine screw, such that the platform 4 could easily be removed if needed.

The location of the ski binding on the ski, can drastically effect the turning performance of the ski. Typically the binding is centered to the width of the ski, in the Z direction. The binding and or ski boot position relative to the ski length or X direction is critical to good ski performance. The invention functions best when the riser plate 2 centered is aligned with the center length of the ski 12. Further the location of the ski boot 7 relative to the ski 1 should be such that the ski boots mid sole length 62 (FIG. 2) is aligned with the riser plate center and ski center 12. By locating the riser plate 2, platform 4 and ski boot 7 mid sole 62 with the center of the ski 12, the ski 1 is allow to flex in an unrestricted manner. All the skiers’ weighting and force inputs are directed to the center of the ski 12, there by being more efficient.

FIG. 5 is a plainer view of the top surface 31 of the riser plate 2, such that the mounting hole pattern is clearly shown. The riser plate 2 has a center hole 63, which has the main function of reducing the weight of the riser plate 2. The riser plate 2 dimension for this embodiment is approximately 75 mm wide x 150 mm long. The center hole 63 is approximately 35 mm in diameter. At the distal front 64 of the riser plate 2 and symmetrically to the distal rear 65 is a pattern of six mounting holes 66, 67, 68, 69, 70, 71. There is also another set of six platform 4 to riser plate 2 threaded
mounting holes consisting of holes 72, 73, 74, 75, 76, 77. The riser plate 2 to ski mounting holes 66, 67, 68, 69, 70, 71 have a through bore and a counter sunk hole such that when receiving a fastener its top surface 80, 81 is not above the top surface 31 of the riser plate 2. The riser to platform holes 72, 73, 74, 75, 76, 77 are threaded machine holes for accepting machine screws 37, 38 as an example.

FIG. 6 is a planer view of the top surface of the platform 4, such that the mounting hole pattern is clearly shown. The platform 4 similarly has a front mounting hole pattern of holes 82, 83, 84 and a rear mounting hole pattern of holes 85, 86, 87. The front mounting hole pattern of holes 82, 83, 84 are in direct alignment with riser plate 2 front holes 72, 73, 74. The rear mounting hole pattern of holes 85, 86, 87 are in direct alignment with riser plate 2, rear holes 75, 76, 77. The platform to riser plate mounting holes 82, 83, 84, 85, 86, 87 have a through bore and a counter sunk hole such that when receiving a fastener its top surface 92, 93 is not above the top surface 30 of the platform 4.

There has been a trend in the ski industry, whereby prior art binder plates are pre-drilled for accepting specific binding types. The invention can also accommodate such a desired feature as shown in FIG. 6, by toe binding mounting hole patterns 95, and rear binding mounting hole patterns 96 and 97. It may also be desirable to provide a cut line 98 if a short length boot is mounted to a generic length platform plate. Cutting the end of the said platform plate 4 and eliminating any excess platform length would allow the ski to bend in reverse camber without contacting the platform.

FIG. 7 shows another embodiment of the invention, which would integrate the riser plate into the construction of the ski 100. The ski 100 basic construction in regards to the camber, and side cut would be similar to ski 1 previously described. The novelty of ski 100 is that in the middle length 120 of the ski 100 there is a raised section 99. Said raised section 99 has a top distal surface 101, which is above the top surface of the ski 114. There is a smooth transition from the ski top 114 to the raised section 99, top surface 101 comprising a front transition 106 and a rear transition 107. The height of said top surface 101 in relation to the ski’s top surface 114 is from 5 to 30 mm from the ski’s top surface 114.

The top distal surface 101 has a front distal edge 102 and rear distal edge 103, as well as side edges 104 and 105. The side edges 104 and 105 are in general aligned with the ski’s width at the middle length of the ski 120. The general shape of the top surface 101 is a polygon, or a rectangle with a length of about 90 to 200 mm and a width, which is approximately the same width of the ski in the middle 120 section.

The raised top surface 99 can be comprised of forward mounting hole pattern of holes 108, 109, 110 and a rear mounting hole pattern of holes 111, 112, 113. Said hole patterns 108, 109, 110, and 111, 112, 113 would be in direct alignment with the platform 4 hole pattern holes 82, 83, 84, 85, 86, 87 of FIG. 6, such that the platform 4 could be attached to said top surface 101.

FIG. 8 is similar to FIG. 4 in that it shows the cross sectional construction of the ski 100 with the platform 4 mounted. FIG. 8 depicts an embodiment of the invention, which would integrate the ski 100, cross sectional geometry into providing a raised section 99. The embodiment of FIG. 8 would eliminate two parts from the assembly shown in FIG. 1 and subsequently the additional mounting fasteners to secure the riser plate 2 to the ski 1. The construction of the ski with an integrated riser plate 99 would be such that ski core 135 profile would be increased above the typical top surface 32 (shown in FIG. 8 as a phantom line) of the ski 100. The ski sides 154, 155 would be extended to include an additional height of 114, 115 above the typical ski 1 top surface 32. The top surface 101 of the ski 100 substantially in the center of the ski’s length would be higher than the previous ski top surface 32. The height difference between the old design top surface 32 and the new design 101 would be approximately 6 to 30 mm.

In skiing the human element has many varying lower leg bone structure alignments and personal preferences. The tibia, knee joint and ankle alignment can be either pronation, or supination or straight. These various lower leg alignments affect the efficiency of how the ski can be turned, and weather the ski can be maintained flat to the snow. The ski functions best when the ski is flat to the snow surface, which provides an even snow melt layer between the ski surface and the snow for good gliding. When a person’s lower leg is out of alignment the ski boots can be adjusted such that the tibia and ankle are aligned with the ski boot, such that the ski has the tibia centered in the boot. Such an alignment is referred to in the ski industry as “canting”. Still further canting alignment is needed between the boot and the ski, because although the boot and leg can be aligned the skiier can still have a natural tendency to weight the inside or outer edge of the ski. Riding either the inside or out side edge of the ski produces uneven snow melting which results in poor ski performance.

Another embodiment of the invention is shown in FIG. 9, which is a similar cross sectional view as FIG. 4, and FIG. 8. In this embodiment the ski 100 with the integrated riser 99 is shown with a canting plate 200 which is used to adjust canting of the skier. The cant plate 200 is preferred to be the same width as the ski 112 in the Z direction. The width of the cant plate 200 has a distal edge 201 and opposing distal edge 202. The height of distal edges 201 and 202 are not equal, such that the cant plate 200 top surface 203 is non parallel to the ski 100 top surface 101. Said cant plate 200 can be produced in ½ degree angle increments. Multiple cant plates 200 can be stacked on top of one another between the ski 100 top surface 101 and the platform bottom surface 27 to achieve the desired canting angle 204. Said cant plate 200 is secured to the ski 100 by means of fastener 37, 38 which extended through a holes 205, 206 in the cant plate 200, thus clamping the cant plate 200 between the platform 4 and the ski 100. The cant plate 200 would have the same mounting hole patterns 82, 83, 84, and 85, 86, 87 as the platform 4 as described previously. It is not beyond the scope of this invention that a normal ski 1 as shown in FIG. 4 could be employed with a cant plate 200.

In skiing there are other methods of adjusting the ski position relative to the ski and boot assembly. One such method is to place a lifter plate inside the ski boot to help evaluate the ski’s heel and thus put more weight on the ski’s toe or forefoot. Another method to achieve lift is to place plates under the heel of the binding and under the ski boot heel, however these methods have problems with boot/
binding compatibility. There are standard dimensions for ski boot to ski binding interface such as DIN 7880 and ISO. When a lift is placed under the boot soles heel it is difficult to adjust the boot heel to comply with the DIN and ISO standards. Also when raising just the heel of the binding, this changes the way the boot rests in the toe and heels of the binding and could adversely affect how the binding functions.

[0081] FIG. 10 shows another embodiment of the invention with a lifter plate 300 installed in the assembly, which is similar to FIG. 3 (with out the binding shown). A cross section of the ski 1 is shown with the riser plate 2 attached to the ski top surface 14. The lifter plate 300 is preferred to be the same width as the ski 1 in the Z direction. The length of the lifter plate 300 has a front distal edge 301 and opposing rear distal edge 302. The height of distal edges 301 and 302 are not equal, such that the lifter plate 300 top surface 303 is not parallel to the ski 1 top surface 14. The height of the front distal edge 301 is less than the rear distal edge 302, such that the platform 4 is at an incline angle 305 relative to the ski top surface 14. Said incline angle 305 provides lift to the skier ski boot heel such that they tend to distribute more weight on the front section of the ski. Said lifter plate 300 can be produced in a ½-degree angle increments. Multiple lifter plates 300 can be stacked on top of one another between the ski 1 top surface 14 and the platform bottom surface 37 to achieve the desired heel lift angle 305.

[0082] Said lifter plate 300 is secured to the ski 1 by meaning of fastener 37, 38 which extended through holes 306, 307 in the lifter plate 300, thus clamping the lifter plate 300 between the platform 4 and the ski 1. The lifter plate 300 would have the same mounting hole patterns 82, 83, 84, and 85, 86, 87 as the platform 4 as described previously. It is not beyond the scope of this invention that an integrated riser plate ski 100 as shown in FIG. 7 could be employed with a lifter plate 300.

[0083] It is not beyond the scope of this invention to have both canting plates 200 and lifting plates 300 stacked between said riser plate 2 and platform 4 to achieve both a canting and lifting combination.

[0084] There is some concern that for extreme reverse camber flexes 21 that the platform 4 could contact the top surface 14 of the ski 1 and thus putting high tension loads on all of the mounting screws, for both the riser plate 2 and the platform 4. These high-tension loads would have a tendency to strip or rip the fasteners out of the ski core 35 and top surface 14 of the ski 1. By building the ski with an integrated riser plate 99 the high tension loads, which could pull the riser plate 2 off the ski can be eliminated which is presented in FIG. 11.

[0085] FIG. 11 shows an alternate embodiment of the invention, such that the high-tension loads to the platform mounting fasteners is configured into a shear load. FIG. 11 is a isometric view similar to FIG. 3. Also FIG. 12 is provided, which is a cross sectional view through line XII of FIG. 11. The ski 100 is the type with the integrated riser plate 99, however the width between the integrated riser plate vertical walls 114, 115 would be less than the ski 100 width from side wall 155 to side wall 154. The platform 400 for this embodiment would have two vertical tangs 401 and 402. The inside width of said tangs 401 and 402 would be slightly larger than the width of the integrated riser vertical walls 154, 155. The vertical tangs 401, 402 extend downward from the bottom surface 403 of the platform 400. The platform 400 would be made of a composite material, as previously discussed in regards to platform 4. Said vertical tangs 401, 402 of this embodiment is made of a composite lamina extending from the bottom surface 403 of the platform 400. It is not beyond the scope of this invention to use alternate materials for said platform 400 and vertical tangs 401, 402 such as a metal (aluminum, steel, titanium). The vertical tangs 401, 402 have a pair of through holes for accepting fasteners 404, 405 and 409. It can be appreciated that there is a total of four-platform tang fasteners in the assembly. There would be two fasteners 405, and 409 per vertical tang 401, and another pair of fasteners for vertical tang 402. The fasteners 404, 405 and 409 and a fourth not shown, which extend through the vertical tangs 401, 402 and into the ski 100 integrated riser walls 114, 115 and further into the core 135 of the ski 100.

[0086] The length of said tangs 401, 402 would be approximately the same length as the integrated riser 99, established by distal edges 102 and 103. Attaching the platform 400 in such a described manner creates a stable non-pivoting attachment.

[0087] In this embodiment, if the ski 100 goes into extreme reverse camber 21 and contacts the distal ends of the platform 407, 408 the load on the fasteners 404, 405, 409 (and a fourth fastener not shown) are perpendicular to the length of the fastener. The resulting load on the fasteners 404, 405, 409 (and a fourth fastener not shown) is a shear load through the cross section of the screw, as opposed to a tension load, which would act only on the threaded engagement of the fastener to the parent material.

[0088] FIG. 11 shows an alternate embodiment for attachment of said ski bindings 5, 6, by means of sliding channel and a track. A front sliding channel is established by fixing side plates 410, 411 to the sides 416, 417 of the platform 400 with fasteners 418, and 419 and an opposing set of two fasteners on the opposite side 417 of platform 400. The side plates 410, 411 have an elongated section 423, and 425, which extend above the platform top surface 457. The side plates 423, and 425 have another elongated section 426, and 427, which extend toward the middle width of the platform 400. Side plates 423, and 425 further have a vertical edge 428, 429 extending toward the top surface 457 of the platform 400. The above-described geometry creates two sliding channels 430 and 431 for accepting a front ski binding 5. Said channels 430 and 431 would restrict the vertical movement of said bindings in the Y direction.

[0089] Tracks, 414 and 415, which are recessed below the top, surface 457 of platform 400 to create a means to restrict any motion of bindings in the forward and aft direction of the platform 400 in the X direction. The tracks 414 and 415 would have a number of indentations of about 1.5 mm deep and 2 mm wide by 10 mm long, evenly spaced about 2 mm apart. Said indentations would create a female type thread pattern. The ski bindings would have threaded engagement to said tracks 414 and 415. Ski bindings with a means to have threaded engagement in the X direction is well know to those skilled in the art of ski binding design and will not be elaborated here.

[0090] It can be appreciated in FIG. 12 that said side plates 410, and 411 and front track 414 would create a front
binding attachment assembly and similarly said plates 412 and 413 and rear track 415 would create a rear binding attachment assembly. Said front and rear binding assemblies would have sufficient length in the X direction to securely fasten front and rear ski binding assemblies 5 and 6. Further the length of said front and rear binding assemblies 5 and 6 would be sufficient enough to accommodate a range of ski boot sizes, as an example mondo size 24 through 28.

Another embodiment of the conceived invention is shown in side profile cross section of FIG. 13, which is a similar view as FIG. 3, however in this embodiment shows ski 500. Ski 500 is of a monocoque composite lamina construction and would consist of a riser 501 and platform 502. The embodiment would only require fasteners to attach the binding 5, 6.

Typically a ski is molded in a two-part mold with a split line near the bottom surface 503 of a ski. In this embodiment of FIG. 13 a three part mold would have to be employed, such that the riser 501 rear distal end 508 could be molded above rear ski top surface 504, by means of a removable insert between the rear top surface 504 and the rear bottom surface 505 of the platform 500. The molded riser 501 and platform 502 would be centered about the ski center 510. The riser 501 front distal end 509 could be molded above ski top surface 506, by means of a removable insert between the front top surface 506 and the front bottom surface 507 of the platform 500. The geometry of the riser 501, and platform 502 would be the same as described in the previous embodiments.

It may also be preferred to fill the front gap 157 and rear gap 158 between the platform bottom surface 505, 507 and the ski top surface 504 and 506, of the ski 500. The filler material would add little to no stiffness to the ski 500. It is not beyond the scope of this invention that fillers 155 and 156 could be employed to fine-tune the stiffness and damping of the ski, by designing said fillers stiffness such that they contribute to the overall flex of the ski 500. Said fillers 155, 156 could be made of low-density plastic foam, and or an injection molded part, and or a composite lamina.

In the case that the front filler 155 and rear filler 156 has some structural stiffness, then the ski 500 could be manufactured in the traditional method of a two part mold, whereby fillers 155, 156 are simply left in the lamina. One advantage of having the fillers 155 and 156 is that snow and ice would not accumulate in the gaps 157, 158 between the platform 502 and the ski 500. Another advantage of the fillers 155 and 156 is that the ski 500 is more aerodynamic. Said fillers 155, 156 if functioning as a structural member of the composite lamina could be adhesive bonded in place. Further if the fillers 155, 156 function is mainly for cosmetic appearance or for aerodynamic improvements, the fillers, 155, 156 could be fastened to the platform 502 and the ski 500 by means of screws and or a type of plastic mechanical snap in method.

It will be apparent to those skilled in the art that several modifications and variations not mentioned exist. Accordingly the previous descriptions are only meant for the purposes of illustration, and are not meant to limit the scope of the invention.

What is claimed is:

1. A ski with a raised section and a platform above said ski top, such that said platform extends from said raised section in the front distal and rear distal direction of said ski, and said platform distal ends are not contacting the ski top in the ski's non flexed condition.
2. A ski as described in claim 1, wherein said raised section and said platform and said ski are one composite lamina.
3. A ski as described in claim 1, wherein said raised section elevates said platform substantially above said ski top surface, such that said ski can freely flex.
4. A ski as described in claim 3, wherein said ski can freely go into reverse camber flexing.
5. A ski as described in claim 3, wherein said elevated platform is substantially stiff to support a skiers weight with little flexing.
6. A ski as described in claim 1, in which said space between said platform and said ski top is filled with a filling element.
7. A ski as described in claim 6, wherein said filling element is a foam material of little stiffness.
8. A ski as described in claim 6, wherein said filling element is of a material of substantially stiffness to affect the overall flex of the ski.
9. A ski with a raised section, such that a platform can be attached to said raised section, wherein said platform extends from said raised section in the front distal and rear distal direction of said raised section, such that said platform distal ends are not contacting the ski top in the ski's non flexed condition.
10. A ski as described in claim 9, wherein said raised section and said ski are one composite lamina.
11. A ski as described in claim 9, wherein said platform is fastened to said raised section of said ski.
12. A ski as described in claim 9, wherein said raised section elevates said platform substantially above said ski top surface, such that said ski can freely flex.
13. A ski as described in claim 9, wherein said ski can freely go into reverse camber flexing.
14. A ski as described in claim 9, wherein said elevated platform creates a space between said ski top and the platform.
15. A ski as described in claim 9, in which said space is filled with a filling element.
16. A ski as described in claim 15, wherein said filling element is of a material of little stiffness.
17. A ski as described in claim 15, wherein said filling element is of a material of substantially stiffness to affect the overall flex of the ski.
18. A ski as described in claim 12, wherein said platform is a composite lamina.
19. A ski as described in claim 12, wherein said platform is a metal material.
20. A ski as described in claim 11, wherein said platform is attached with fastener means to the top surface of said raised section, such that said fasteners are loaded in tension.
21. A ski as described in claim 11, wherein said platform is attached with fastener means to the sides surface of said raised section, such that said fasteners are loaded in shear.
22. A ski as described in claim 1, wherein said platform has side plates attached to the sides of said platform creating a channel in which ski binding elements can be attached within said channel.
23. A ski as described in claim 11, wherein said platform has side plates attached to the sides of said platform creating a channel in which ski binding elements can be attached within said channel.

24. A ski as described in claim 9, wherein said platform has an intermediate shim between said platform and said raised sections top surface, such that said platform is fastened to said raised section and clamping said shim securely.

25. A ski as described in claim 24, wherein said platform is attached with fastener means to the top surface of said raised section, such that said fasteners are loaded in tension.

26. A ski as described in claim 24, wherein said platform is attached with fastener means to the sides surface of said raised section, such that said fasteners are loaded in shear.

27. A ski as described in claim 24 wherein said shim has an incline angle between said front and rear sections of said ski.

28. A ski as described in claim 24 wherein said shim has an incline angle between said sides of said ski.

29. A ski lifter plate assembly comprising a riser plate, said riser plate being relatively short in length in comparison to said ski's length, and having a height which evaluates said riser plate top surface above said ski surface, such that a platform substantially longer than said riser plate length and substantially shorter than said ski length is on the riser plate's top surface, such that said assembly is attached to said ski.

30. A ski lifter plate assembly as described in claim 29, wherein said riser plate elevates said platform substantially above said ski top surface such that said ski can freely flex.

31. A ski lifter plate as described in claim 29, wherein said ski can freely go into reverse camber flexing.

32. A ski lifter plate assembly as described in claim 29, wherein said platform creates a space between said ski top and the platform.

33. A ski lifter plate assembly as described in claim 29, wherein said space is filled with a filling element.

34. A ski lifter plate assembly as described in claim 33, wherein said filling element is of a material of little stiffness.

35. A ski lifter plate assembly as described in claim 33, wherein said filling element is of substantially stiffness to affect the overall flex of the ski.

36. A ski lifter plate assembly as described in claim 29, wherein said platform is a composite lamina.

37. A ski lifter plate assembly as described in claim 29, wherein said platform is a metal material.

38. A ski lifter plate assembly as described in claim 29, wherein said platform is attached with fastener means to the top surface of said riser plate, such that said fasteners are loaded in tension.

39. A ski lifter plate assembly as described in claim 29, wherein said platform is attached with fastener means to the sides surface of said riser plate, such that said fasteners are loaded in shear.

40. A ski lifter plate assembly as described in claim 29, wherein said platform has side plates attached to the sides of said platform creating a channel in which ski binding elements can be attached within said channel.

41. A ski lifter plate assembly as described in claim 29, wherein said platform has an intermediate shim between said platform and said raised sections top surface, such that said platform is fastened to said raised section and clamping said shim securely.

42. A ski lifter plate assembly as described in claim 41, wherein said platform is attached with fastener means to the top surface of said riser plate, such that said fasteners are loaded in tension.

43. A ski lifter plate assembly as described in claim 41, wherein said platform is attached with fastener means to the sides surface of said riser plate, such that said fasteners are loaded in shear.

44. A ski lifter plate assembly as described in claim 41, wherein said shim has an incline angle between said front and rear sections of said ski.

45. A ski lifter plate assembly as described in claim 41, wherein said shim has an incline angle between said sides of said ski.

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