SAFETY RELEASE SKI BOOT SYSTEM

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ABSTRACT

The safety release ski boot system comprises a ski boot having a boot upper body, a fixed upper sole attached to the upper body, a detachable lower sole releasably secured to the upper sole, and a safety release mechanism contained within the detachable lower sole which releasely secures the lower sole to the fixed upper sole of the ski boot. The safety release mechanism comprises at least two rotatable latch members one of which is pivotally mounted at the forward end and another of which is pivotally mounted at the rearward end of the lower sole. Each latch member is rotatable about its pivot axis from a lowermost ski boot release position to an uppermost ski boot engaging position and return. Separately adjustable spring means engage each rotatable latch member at a pivot point eccentric with respect to the pivot axis of the latch member. Each rotatable latch member is urged by the adjustable spring means associated therewith to its ski boot engaging position when the eccentric pivot point is positioned below the pivot axis of the latch member and is urged to its ski boot release position when the eccentric pivot point is positioned above the pivot axis of the latch member.

18 Claims, 19 Drawing Figures
SAFETY RELEASE SKI BOOT SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention
This invention relates to ski boots having a safety release device that automatically releases the ski boot from its ski in the event of an accident when skiing.

2. Prior Art
It is essential, when skiing, that a skier be able to control accurately the movement of his skis through movement of the skier’s legs. Such control is in large part made possible by the snug fit and restrictive support of the skier’s ankle and lower leg provided by the ski boots worn by the skier. In addition it is necessary that each ski boot be firmly secured to its ski in order to provide the required control of the skis. However, ski boots that are too firmly attached to the ski can cause serious injury to the skier in event of an accidental fall on the ski slopes. Therefore, skis and ski boots are ordinarily provided with elaborate safety release bindings which are intended to firmly secure the ski boot to the ski in normal use and to release the ski boot when subjected to the unusual stresses which occur when a skier falls. The design of a ski binding which firmly secures the ski boot to the ski yet releases the ski boot in event of an accidental fall present contradictory problems which are not easily resolved.

To maintain secure binding of boot to ski, the safety release binding places the sole under longitudinal and vertical compression. That is, conventional bindings generally have projections or spring loaded members that engage the toe and the heel of the sole and that strongly restrain longitudinal and vertical movement of the boot with respect to the ski. The magnitude of this longitudinal and vertical restraint is a function of the longitudinal and vertical compressive forces exerted by the binding on the toe and heel of the ski boot, and it requires careful adjustment of these compressive forces to achieve the proper balance between the security of the binding and ease of release. However, the degree of longitudinal and vertical compression will increase or decrease with small changes in the distance between toe and heel binding units caused by vertical flexing of the ski when skiing over uneven terrain. Moreover, in order to sustain this compression, ski boot soles are normally very strong and rigid.

To maintain proper release characteristics while skiing over uneven terrain the varying compression of the boot sole must be compensated for by longitudinal motion of the binding mechanism, referred to as shock absorbance, and by placing of anti-friction pads under the toe and/or heel of the boot. In order for the release mechanism to function, the longitudinal and vertical compression against the sole and the longitudinal shock absorbing movement of the mechanism must be overcome. As a result, safety release mechanisms commonly require a twisting or turning movement of the ski boot about a pivot point under the boot, usually the heel, release being initiated when sufficient torque about the pivot point is exerted by the skier’s foot and leg during an accidental fall.

In many instances the skier will find that a properly adjusted safety release binding will sometimes release during a situation where no safety release is called for, and he will adjust the binding to the maximum release force. This increases the compression of the boot sole to the point where there is no shock absorbance and the release function is severely restricted. Recent developments in “plate” type bindings overcome the boot sole compression problem by securing a plate to the bottom of the boot sole, and compression required for boot retention is borne by the plate. These bindings also have a torque-initiated release based on a pivot point at the heel or under the toe. Straight forwards and backwards release, and straight sideways release, without a strong vertical component force, are restricted due to the positioning of binding components at the toe and heel of the boot sole. Safety straps are used to connect the skier’s leg or boot very loosely to the ski to prevent loss of a ski during an accidental fall. Currently used safety straps allow the released ski to swing freely during a fall, and as a result many serious injuries have occurred due to the sharp edges of the ski hitting the falling skier.

After an intensive investigation into the aforesaid problem of providing an efficient ski boot and ski system while at the same time providing the system with effective safety release capabilities, we have devised a new ski boot construction in which the ski boot has a two-piece sole the upper portion of which is released from the lower portion of the sole during an accidental fall. The safety release mechanism is contained within the lower sole portion which remains secured to the ski after release of the upper sole and boot. Front and rear elastic safety straps to reduce the chance of injury caused by freely swinging released skis by maintaining the released ski nearly parallel to the skier’s foot. Our new safety release ski boot system is easy to use, provides safety release without torque or pivot points and in unlimited release angles, boot compression is eliminated when the instant release is initiated, and shock absorbance is used only to aid the skier in hard turns and to avoid unwanted releases. On release, the boot retention components are dropped instantly and completely out of the way of the boot, allowing unobstructed forward, reverse, and sideways horizontal releases. The same construction can be utilized for boot sizes ranging from the smallest children’s to that of the heaviest skier and will improve the skier’s control of his skis by allowing improved feel of the skis over present systems.

SUMMARY OF THE INVENTION
The safety release ski boot system of the invention comprises a ski boot assembly having a boot upper body, a fixed upper sole attached to the upper body, a detachable lower sole normally secured to the upper sole and a safety release mechanism contained within the detachable lower sole of the ski boot assembly. The detachable lower sole is releasably secured to the fixed upper sole of the ski boot assembly by said safety release mechanism and is adapted to be firmly secured to the upper surface of a ski by sole fastening means associated with the ski and with the lower sole of the ski boot assembly. The safety release mechanism comprises at least two rotatable latch members one of which is pivotally mounted on the lower sole at the forward end thereof and another of which is pivotally mounted on the lower sole at the rearward end thereof. Each of the latch members is rotatable about its pivot axis from a lowermost ski boot release position to an uppermost ski boot engaging position and return. Separately adjustable spring means engage each rotatable latch member at a pivot point eccentric with respect to
the pivot axis of said latch member, each adjustable spring means urging the latch member with which it is associated to its uppermost ski boot engaging position when the latch member is rotated so that the eccentric pivot point is positioned below the pivot axis and said spring means urging said latch member to its lowestmost ski boot release position when said latch member is rotated so that the eccentric pivot point is positioned above the pivot axis of the latch member.

The rotatable latch members advantageously comprise a spring, manually adjustable screw means for controlling the compression of the spring, an eccentric connecting rod linkage connecting the end of the spring to the eccentric pivot point of the rotatable latch member, and indicator means visually indicating the amount of compression of the spring. The sole fastening means advantageously comprise at least two transverse rails secured to the upper surface of the ski, at least two transverse rail-receiving slots formed in the bottom of the lower sole of the ski boot assembly, and rail retaining means mounted on the lower sole for releasably retaining said transverse rails in said transverse rail-receiving slots. Other advantageous features of the safety release ski boot system of the invention will be apparent from the following description thereof.

DESCRIPTION OF THE DRAWINGS

The safety release ski boot system of the invention will be better understood from the following description thereof in conjunction with the accompanying drawings of which:

FIG. 1 is a side elevation of an advantageous embodiment of the safety release ski boot system showing the ski boot assembly secured to a ski;

FIG. 2 is an exploded perspective view of the ski boot assembly and ski of FIG. 1;

FIG. 3 is a fragmentary sectional view along line 3—3 of FIG. 5 showing one end of the detachable lower sole of the ski boot assembly;

FIG. 4 is a sectional view similar to FIG. 3 showing the other end of lower sole;

FIG. 5 is a sectional view along line 5—5 of FIG. 3;

FIGS. 6a, b and c are successive schematic views of a rotatable latch member being rotated about its pivot axis from its ski boot engaging position to its ski boot release position;

FIGS. 7 a, b and c are successive side elevations of the ski boot assembly and ski showing the release of the upper body of the ski boot;

FIG. 8 is an exploded perspective view of a modification of the safety release ski boot system employing two rotatable latch members at the forward and rearward ends of the ski boot assembly;

FIG. 9 is a plan view, partly in section, of the detachable lower sole of the ski boot assembly of FIG. 8;

FIG. 10 is an exploded perspective view of an advantageous modification of the detachable lower sole of the ski boot assembly employing modular safety release mechanisms;

FIG. 11 is a plan view, partly in section, of a modular safety release mechanism of the type employed with the detachable lower sole of FIG. 10;

FIG. 12 is a modular safety release mechanism having the manually adjustable means for adjusting the compression of the spring means located at the end of the detachable lower sole of the ski boot assembly;

FIG. 13 is a modification of the mechanism of FIG. 12; and

FIGS. 14 and 15 are perspective views of advantageous modifications of the rotatable latch members of the safety release mechanism of the ski boot assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the interest of clarity, the safety release ski boot system of the invention will be described in connection with only one ski boot of a pair of boots and with the corresponding ski of a pair of skis. Accordingly, in the embodiment of the invention shown in FIGS. 1 and 2 of the drawings, the safety release ski boot system comprises the ski boot assembly 10 that is adapted to be secured to the upper surface of the ski 11. The ski boot assembly 10 comprises a boot upper body 12, a fixed upper sole 13 attached to the upper body 12, a detachable lower sole 14 normally secured to the upper sole 13, and a safety release mechanism contained for the most part within the detachable lower sole 14 of the ski boot assembly. The detachable lower sole 14 is releasably secured to the fixed upper sole 13 by the external latch members 16 and 17 of the safety release mechanism of the ski boot assembly, the latch member 16 being received in the latch notch 18 formed in the upper sole 13 and the adjoining portion of the boot upper body 12 at the forward end thereof and the latch member 17 being received in the latch notch 19 formed in the upper sole 13 and in the adjoining portion of the boot upper body 12 at the rearward end thereof. The lower sole 14 of the ski boot assembly is adapted to be firmly secured to the upper surface of the ski 11 by sole fastening means associated with the ski 11 and with the lower sole 14 of the ski boot assembly as hereinafter described. Safety straps 20 and 21 elastically secure the boot upper body 12 to the ski 11 as also hereinafter described.

The boot upper body 12 of the ski boot assembly is of essentially conventional construction. For example, it may comprise an outer shell of fairly rigid plastic material having an inner lining 22 of a more resilient material. The upper body 12 is provided with an opening for entry of the foot of the skier and with means (for example, buckles not shown in the drawing) for securely closing this opening. The upper body 12 is also advantageously provided with eyes 23 and 24 at the forward and rearward ends thereof for attachment of the safety straps 20 and 21 thereto. The resilient inner lining 22 may be a plastic foam or similar material well known in the art. The upper sole 12 is permanently attached to and is a part of the upper body 12. It is advantageously formed of a plastic material having the strength, toughness and flexibility characteristic of boot soles, and it may have either a non-skid or a low-friction bottom surface as hereinafter explained.

The detachable lower sole 14 is advantageously formed from a molded plastic material also having the requisite strength and toughness characteristic of boot
soles. The lower sole 14 advantageously has a top cover portion 25 the upper surface of which has low-friction characteristics to facilitate operation of the safety release mechanism in the event of an emergency, the body of the lower sole 14 being formed with various slots, recesses and openings adapted to receive the various parts of the safety release and other mechanisms as hereinafter explained. The safety release mechanism includes the two rotatable latch members 16 and 17 disposed externally at each end of the lower sole 14 of the ski boot assembly, and it also includes separately adjustable spring means 26 and 27 (FIGS. 3 and 4) associated with each latch member and disposed within the lower sole. The sole fastening means associated with the lower sole 14 and the ski 11 advantageously comprise a plurality of transverse rails 28 secured to the upper surface of the ski 11 which are adapted to be received in a corresponding number of transverse rail-receiving slots 29 formed in the bottom of the lower sole 14 of the ski boot assembly 10. Rail retaining means 30 having an external handle 31 are provided for releasably retaining the transverse rails 25 in the transverse rail-receiving slots 26 in a manner hereinafter more fully explained, the retaining means advantageously being mounted in the slot 32 formed in the lower sole 14.

As shown in FIGS. 3, 4 and 5, the rotatable latch members 16 and 17 are pivotally mounted on the lower sole 14 for rotation about their respective pivot axes 34 and 35, and the separately adjustable spring means 26 and 27 engage the latch members associated therewith at pivot points 36 and 37 eccentric with respect to the pivot axes 34 and 35 of the latch members. When the latch members 16 and 17 are rotated so that the eccentric pivot points 34 and 35 are positioned below the pivot axes 36 and 37 of the latch members (as shown in FIG. 5 and schematically in FIG. 6a,) the adjustable spring means 26 and 27 associated therewith urge the latch members toward their uppermost ski boot engagement positions; and when the latch members 16 and 17 are rotated so that eccentric pivot points 34 and 35 are positioned above the pivot axes 36 and 37 of the latch members (as shown schematically in FIG. 6c,) the adjustable spring means 26 and 27 associated therewith urge the latch members toward their lowermost ski boot release positions. When the rotatable latch members 16 and 17 are at their uppermost ski boot engagement positions, each latch member is received in and engages the corresponding latch notch 18 and 19 as shown in FIGS. 1 and 7a, the pressure of the adjustable spring means 26 and 27 associated with the latch members tending to maintain the latch members at their uppermost positions as indicated in FIG. 6a. When one or both of the latch members (for example, the latch member 16) is at its lowermost ski boot release position, the latch member is withdrawn from engagement with the corresponding latch notch 18 as shown in FIG: 7c, the pressure of the adjustable spring means 26 associated therewith tending to maintain the latch member at its lowermost position as indicated in FIG. 6c.

The adjustable spring means 26 and 27 each comprise a spring 40, a manually adjustable means for controlling the force exerted by the spring 40, and an eccentric connecting rod linkage connecting the end of the spring 40 to the eccentric pivot point 36 (or 37) of the latch member 16 (or 17). The spring 40 is preferably a coiled compression spring and is disposed in the transverse recess 41 formed in the lower sole 14. The manually adjustable means for controlling the compression of the spring 40 comprises the threaded rod 42 having a non-threaded portion 43 of somewhat reduced diameter, compression collar 44 threadably mounted on the rod 42, and thrust washer 45 mounted on the reduced diameter portion 43 of the rod 42. A lug 46 disposed on the upper surface of the compression collar 44 is received in the transverse slot 47 formed in the lower sole 14 so that the collar 44 is prevented from rotating when the threaded rod 42 is rotated. The reduced diameter portion 43 of the rod 42 extends through the opening 48 in closure plate 49 that closes the otherwise open end of the recess 41, and the compression collar 44 contacts the outboard end of the spring 40. In the embodiment shown in FIGS. 3, 4 and 5, the eccentric connecting rod linkage comprises the plunger 50 disposed in the recess 41 in contact with the inboard end of the spring 40, lever arm 51, connecting bar 52 and bell crank 53 disposed in the chamber 54, crosshead piston 55, and eccentric connecting rod 57 connected to the eccentric pivot point 36 (or 37) of the latch member 16 (or 17).

The compressive force exerted by the spring 40 is transmitted by the eccentric linkage to the eccentric pivot point 36 (or 37) of the latch member 16 (or 17). The magnitude of the force (force F) being applied at the eccentric pivot point 36 (or 37) determines the amount of counter-force (force CF) required to rotate the latch member from its uppermost position shown in FIG. 6a to its mid-position shown in FIG. 6b. The magnitude of force F is, in turn, determined by the inherent strength or stiffness of the spring 40, by the degree of compression of spring 40 and by the increase (or decrease) in mechanical advantage inherent in the design of the eccentric linkage.

The spring 40 may range in strength from relatively weak or soft to very strong and stiff, and these springs are interchangeable so as to adapt the safety release mechanism for use by skiers ranging in size from child to adult and in experience from the beginner to intermediate, expert and competition skier. Moreover, springs of slightly different strength may be installed in the spring means 26 and 27 to adapt the safety release mechanism to the specific requirements of the skier. Springs 40 of appropriate strength are installed in the mechanism when the ski boot assembly 10 is first fitted to the skier, and these springs can later be replaced by other, stronger springs as the skier grows in size and/or proficiency. This is an important advantage in that it provides great flexibility and versatility in adapting the ski boot safety release system of the invention to skiers of different and changing abilities. Fine tuning of the compressive force exerted by each of the springs 40 is obtained by manual rotation of the corresponding rod 42; for example, by means of a screwdriver inserted in a slot formed in the end of portion 43. Rotation of the rod 42 in one direction causes the compression collar 44 to travel inwardly thereby increasing the compression of the spring 40, and rotation of the rod 42 in the opposite direction causes the collar 44 to travel outwardly thereby decreasing the compression of the spring 40. The position of the compression collar 44, and hence the degree of compression of the spring 40, is indicated by the lug 46 which is visible through the indicator window 59 formed in the top portion 25 of the bottom sole 14. The eccentric linkage is normally
designed so that a relatively small movement of the crosshead piston 55 will produce a relatively large movement of the plunger 50, and this is not normally subject to much change after installation in the chamber 54 of the ski boot lower sole 14.

The compression of each of the springs 40 is separately adjusted so that the safety release mechanism will not be activated and the upper body 12 and upper sole 13 will remain securely fastened to the lower sole 14 of the assembly 10 during normal skiing operations, and so that the mechanism will be activated and the upper body and upper sole will be freed from the lower sole in the event of an accident while skiing. That is to say, the adjustment is such that the compressive force F exerted by each spring 40 against its respective latch member 16 or 17 exceeds the counter force CF exerted against the latch member by the boot upper body 12 and upper sole 13 during normal skiing operations but is such that the force F is exceeded by the counter force CF in the event of an accident while skiing. When the counter force CF exerted by the upper body 12 and the upper sole 13 against one or the other of the rotatable latch members 16 or 17 exceeds the force F exerted against the latch member by the spring 40, the latch member will be rotated from its upwardly extended position shown in FIG. 6a to its mid-position shown in FIG. 6b, whereupon the force F exerted by the spring 40 will rotate the latch member instantly to its lowest position shown in FIG. 6c. Usually, but not always, the springs 40 are adjusted so that they require slightly greater counter force CF to rotate and disengage the forward latch member 16 than is required to rotate and disengage the rearward latch member 17. Moreover, if desired either or both of the latch members can be locked in their uppermost boot engagement position merely by rotating the rod 42 until the spring 40 is fully compressed at which point the plunger 50 and hence the latch member connected thereto cannot be moved.

As noted, the sole fastening means associated with the ski 11 and the lower sole 14 advantageously comprises a plurality of transverse rails 28 secured to the upper surface of the ski 11, a corresponding number of transverse rail-receiving slots 29 formed in the bottom of the lower sole 14, and rail retaining means 30 mounted in the slot 32 formed in the lower sole 14 of the ski boot assembly. In the embodiment shown in FIGS. 1 through 5, the transverse rails 28 have a T-shaped cross-section, and they are formed with a point 61 at one end and with a wedge-shaped stop element 62 at the other end. The transverse rail-receiving slots 29 have a T-shaped cross-section corresponding to that of the rails 28, the slots 29 being formed with wedge-shaped enlarged areas each having a rail stop surface 63 corresponding to the wedge-shaped stop elements of the transverse rails 28. The points 61 of the rails 28 facilitate insertion of the rails into the slots 29, and the stop surfaces 63 of the slots 29 block further movement of the rails 28 when the rails are fully inserted in the slots with the stop elements 62 abutting the stop surfaces 63. The rails 28 and the slots 29 may, of course, have other cross-sections such, for example, as inverted L-shaped or dove-tailed cross-sections, and the stop elements 62 and stop surfaces 63 may have other configurations as will be apparent to those skilled in the art.

The rail-retaining means 30 advantageously comprises a relatively thin metal strip formed with a plurality of cutout portions 64 corresponding to each of the transverse slots 29 formed in the lower sole 14, the metal strip being capable of limited longitudinal travel in the slot 32 to move the cutout portions 64 into and out of axial alignment with the corresponding slots 29. Spring means 65 urge the rail-retaining means 30 toward its forwardmost position at which position the cutout portions 64 are out of alignment with the corresponding slots 29 as shown in FIGS. 3 and 4, the rail-retaining means being adapted to be manually moved to its rearward position by means of the handle 31 at which position the cutout portions 64 are in axial alignment with the slots 29. When the transverse rails 28 are received in the transverse slots 29, and when the rail-retaining means 30 is at its forwardmost position, the rail-retaining means partially block the open ends of the slots 29 thereby preventing withdrawal of the rails therefrom. When the rail-retaining means 30 is moved to its rearward position the cutout portions 64 thereof are moved into alignment with the slots 29 thereby permitting withdrawal of the rails 28 from the slots 29.

The safety straps 20 and 21 are formed of a stretchable elastic material and they elastically secure the ski boot assembly 10 to the ski 11 as shown in FIG. 1. In the event of an accidental fall while skiing, the safety release mechanism of the ski binding frees the skier's ski boot from the ski, and unless restrained the freed ski will get away and proceed unguided down the ski slope with the possibility of serious injury to anyone who might be struck by the runaway ski. On the other hand, if the ski is restrained by a single strap attached to the skier's ski boot or leg, the skier may become entangled with his own ski with the possibility of serious injury to himself. The provision of two elastic straps in accordance with the present invention prevents the ski from escaping while at the same time minimizing the likelihood that the skier would become entangled in his own skis.

In normal use the detachable lower sole 14 is always secured to the upper body 12 and upper sole 13 of the ski boot assembly 10, both when the wearer is on skis (i.e., skiing) or is on foot (i.e., walking). Accordingly, the lower sole 14 is advantageously somewhat flexible longitudinally to facilitate walking and increase comfort of the wearer. When a skier wearing the ski boot assembly 10 wishes to put on his skis he merely places his foot so that the rail-receiving slots 29 of the lower sole 14 are in line with the transverse rails 28 of the ski 11, and he then moves his foot sideways until the rails 28 are fully received in the slots 29. Further sideways movement is prevented by the wedge-shaped stop surface 63 of the slot 29 and the stop element 62 of the rail 28.

The points 61 of the rails 28 move the rail-retaining means 30 rearwardly when the rails are inserted in the slots 29, the rail-retaining means 30 automatically moving forward to prevent withdrawal of the rails 28 from the slots 29 when the rails are fully inserted in the slots. When the skier has finished skiing, he manually moves the rail-retaining means 30 to its rearwardmost position, and he then moves his foot sideways to withdraw the rails 28 from the slots 29.

Referring now to FIG. 7, if the ski 11 should strike something and stop or slow abruptly, the skier's momentum will cause the upper body 12 and upper sole 13 to press against the latch member 16 with sufficient
force to rotate the latch member from its boot engagement position shown in FIG. 7a to its boot release mid-position shown in FIG. 7b whereupon the spring means 26 will rotate or snap the latch member to its lowermost position shown in FIG. 7c. In like manner, if the skier should fall sideways, the twisting motion of the skier’s foot will cause the boot upper body and upper sole to rotate the latch member 17 rearwardly to its mid-position whereupon the spring means 27 will cause the latch member to snap downwardly to its lowermost position. In all cases, rotation of the latch member from its uppermost boot engagement position to its lowermost boot release position takes place almost instantaneously whenever the forces exerted by the boot upper body and upper sole exceed the predetermined critical value of force CF. Moreover, when the latch member is thus rotated to its lowermost position there is no obstruction protruding from the upper surface of the ski to interfere with the free release or “take-off” of the boot upper body and upper sole. The functioning of the safety release mechanism is greatly facilitated if at least one of the facing surfaces of the upper sole 13 and the lower sole 14 has low-friction characteristics. Accordingly, one of these facing surfaces, and preferably the upper surface of the lower sole 14, is provided with a coating of a low-friction material such as Teflon (polyfluoroethylene) or the like. When the boot upper body and upper sole are freed from the ski as shown in FIGS. 7b, c, the elastic safety straps 20 and 21 prevent the freed ski 11 from escaping and maintain the ski under elastic restraint to minimize the likelihood of dangerous entanglement of the freed ski with the fallen skier.

In the embodiment of the safety release system shown in FIGS. 8 and 9, the safety release mechanism is provided with two co-acting rotatable latch members 66a and 66b at the forward end and with two co-acting latch members 67a and 67b at the rearward end of the ski boot assembly 10. When the latch members 66 and 67 are at their uppermost positions as shown in FIG. 8, they engage corresponding latch receiving notches 68 and 69 formed in the upper body 12 and upper sole 13, thereby releasably securing the upper body and upper sole to the lower sole 14 of the assembly. When the latch members 66 and 67 are at their lowermost position as shown in FIG. 9, the latch members are withdrawn from their respective latch notches, thereby releasing the upper body and upper sole from the lower sole of the assembly.

Referring now to the mechanism at the forward end of the ski boot assembly as shown in FIG. 9, the latch members 66a and 66b are pivotally mounted on the lower sole 14 for rotation about their respective pivot axis 70a and 70b, the pivot axes 70a and 70b advantageously being disposed at an angle of about 45° with respect to the longitudinal axis of the lower sole. The adjustable spring means associated with the co-acting latch members 66a and 66b comprises the spring 71 disposed in the longitudinal recess 72 formed in the lower sole 14, manually adjustable means for controlling the force exerted by the spring 71, and eccentric connecting rod linkages connecting the end of the spring 71 to the eccentric pivot points 73a and 73b of the latch members 66a and 66b. The manually adjustable means for controlling the compression of the spring 71 comprises the threaded rod 74 having a non-threaded portion 75, compression collar 76 threadably mounted on the rod 74, and thrust washer 77 mounted on the unthreaded portion 75 of the rod 74. A lug 78 disposed on the upper surface of the compression collar 76 is received in a longitudinal slot formed in the lower sole to prevent rotation of the collar 76 when the rod 74 is rotated. The position of the lug 76 indicates the degree of compression of the spring 71 when viewed through the indicator window 80 disposed in the upper surface of the lower sole 14. The unthreaded portion 75 of the rod 74 extends through the opening 82 in the removable closure plate 83 that closes the otherwise open end of the recess 73. The compression collar 76 contacts the outboard end of the spring 71 and the plunger 84 disposed in the recess 72 contacts the inboard end of the spring 71. The eccentric connecting rod linkages for the two latch members 66a and 66b each comprise the plunger 84 disposed in the recess 73, connecting bar 86, a pivoted lever arm 87, a crosshead member 89 and an eccentric connecting rod 90 connected to each of the eccentric pivot points 73a and 73b of the latch members 66a and 66b.

The safety release mechanism shown in FIGS. 8 and 9 functions in the same manner as described in connection with the embodiment shown in FIGS. 1 through 7. That is, if the forces exerted by the boot upper body 12 and upper sole 13 against the latch members 66 and 67 do not exceed the predetermined critical value of force CF, the upper body and upper sole will remain firmly secured to the lower sole 14. However, if the force exerted by the upper body 12 and upper sole 13 against any one (or more) of the latch members exceeds the critical value of force CF, the latch member will be rotated instantaneously to its lowermost boot release position thereby freeing the boot upper body and upper sole from the lower sole of the boot assembly.

In the embodiment shown in FIGS. 10 and 11 the lower sole 14 is of hollow core construction in order to provide the desired moderate degree of flexibility. Specifically, the lower sole is formed with a number of cavities 92 and is provided with a removable top cover 93. The lower sole 14 is also provided with transverse rail-receiving slots 94 having inverted, L-shaped cross-sections adapted to receive transverse rails (not shown) of similar cross-section, and with a longitudinal retaining means receiving slot 95 adapted to receive the rail retaining means (not shown) of the assembly. The safety release mechanism of the ski boot assembly comprises a pair of self-contained subassemblies or modules 96 and 97 that are removable mounted in the recesses 98 and 99 formed in the lower sole 14 (the modules shown in FIG. 10 have the operating parts of the mechanism moved in the interest of simplifying the drawing). The modules may be identical in order to provide complete interchangeability, or they may be “right hand” and “left hand” versions of the same mechanism as shown in FIG. 10.

As shown best in FIG. 11 each module comprises a metal or molded plastic housing 100 in which the operating parts of the mechanism are mounted. The safety release mechanism of the module shown in FIG. 11 comprises a rotatable latch member 101 pivotally mounted on one end of the housing 100 for rotation about its pivot axis 102 and adjustable spring means which engages the latch member at its eccentric pivot point 104. The adjustable spring means comprises a spring 105 disposed in the transverse recess 106 formed in the housing 100, manually adjustable means
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for controlling the force exerted by the spring, and an eccentric connecting rod linkage connecting the end of the spring 105 to the eccentric pivot point 104 of the latch member 101. The manually adjustable means for controlling the force exerted by the spring 105 comprises the threaded rod 107 having a non-threaded portion 108, compression collar 109 threadably mounted on the rod 107, and thrust washer 110 mounted on the unthreaded portion of the rod. Lug 112 disposed on the upper surface of the compression collar 109 is received in transverse slot 113 formed in the housing 100 to prevent rotation of the collar when the rod 107 is rotated. The position of the lug 112 indicates the degree of compression of the spring 105 when viewed through the indicator window 114 disposed in the top cover 93 of the lower sole 14. The unthreaded portion 108 of the rod 107 extends through an opening in the removable closure plate 116 that closes the otherwise open end of the recess 106. The compression collar 109 contacts the outboard end of the spring 105 and the plunger 117 disposed in the recess 106 contacts the inboard end of the spring. The eccentric connecting rod linkage comprises the plunger 117, pivoted lever arm 118, connecting bar 119, pivoted bell crank 120, cross head piston 121 and the eccentric connecting rod 122 connected to the eccentric pivot point 104 of the latch member 101.

In the embodiments shown in FIGS. 12 and 13 the safety release mechanism is mounted in self-contained modules 124 and 125 that are removably received in the recesses 126 and 127 formed in the lower sole 14 of the ski boot assembly. Referring now to FIG. 12, the module 126 comprises the housing 130 (shown in section to reveal the operating parts of the mechanism) on which are mounted the rotatable latch member 131 and the adjustable spring means therefor. The adjustable spring means comprises the spring 135 disposed in the longitudinal recess 136 formed in the housing 130, manually adjustable means for controlling the force exerted by the spring, and an eccentric connecting rod linkage connecting the end of the spring 135 to the eccentric pivot point 134 of the latch member 131. The manually adjustable means for controlling the compression of the spring 135 comprises the threaded rod 137, compression collar 139 and thrust washer 140. The compression collar 139 contacts the outboard end of the spring 135 and the plunger 147 disposed in the recess 136 contacts the inboard end of the spring. The eccentric connecting rod linkage comprises the plunger 147, pivoted lever arm 148, cross head member 151 and the eccentric connecting rod 152 connected to the eccentric pivot point 134 of the latch member 135. The embodiment shown in FIG. 13 is a modification of the mechanism shown in FIG. 12 in that the pivoted lever arm 148 is replaced by the two pivoted bell cranks 149 and 150.

As shown best in FIGS. 5 and 6, rotatable latch members of the safety release mechanism advantageously have an inverted L-shaped cross-section. The long leg of each L-shaped latch member is pivotally secured to the lower sole 14, and the short leg of the latch member enters and engages the corresponding latch notch formed in the upper body 12 and upper sole 13 of the ski boot assembly 10. The latch members are also advantageously provided with centering means for automatically aligning the upper sole 13 with the lower sole 14 of the ski boot assembly. In the embodiment shown in FIG. 14 (and also in FIGS. 1 and 2), the centering means comprises a pair of lateral ears 152 and 153 which are disposed at an angle with respect to the transverse axis of the latch member 16. In the embodiment shown in FIG. 15 (and also in FIG. 12), the latch member 131 is formed with a wedge-shaped portion 155 which enters a corresponding wedge-shaped recess formed in the end of the upper sole 13 of the ski boot assembly.

We claim:

1. Safety release ski boot system comprising a ski boot assembly having a boot upper body, a fixed upper sole attached to the upper body, a detachable lower sole normally secured to the upper sole and a safety release mechanism contained within the detachable lower sole of the ski boot assembly, said detachable lower sole being releasably secured to the fixed upper sole of the ski boot assembly by said safety release mechanism, said safety release mechanism comprising:

at least two rotatable latch members one of which is pivotally mounted on the lower sole at the forward end thereof and another of which is pivotally mounted on the lower sole at the rearward end thereof, each of said latch members being rotatable about its pivot axis from a lowermost ski boot release position to an uppermost ski boot engaging position and return, and

separately adjustable spring means engaging each rotatable latch member at a pivot point eccentric with respect to the pivot axis of said latch member, each adjustable spring means urging the latch member with which it is associated to its uppermost ski boot engaging position when the latch member is rotated so that the eccentric pivot point is positioned below the pivot axis and said spring means urging said latch member to its lowermost ski boot release position when said latch means is rotated so that the eccentric pivot point is positioned above the pivot axis of the latch member.

2. The safety release ski boot system according to claim 1 in which the lower sole of the ski boot assembly is adapted to be firmly secured to the upper surface of a ski by coacting sole fastening means associated with the ski and with said lower sole.

3. The safety release ski boot system according to claim 1 in which the rotatable latch members have an inverted L-shaped cross-section, the lower end of the long leg of each L-shaped latch member being pivotally secured to the lower sole and the short leg of said latch member entering and engaging a latch notch formed in the upper sole of the ski boot assembly when the latch member is at its ski boot engaging position.

4. The safety release ski boot system according to claim 1 in which the safety release mechanism is mounted in recesses formed in the lower sole of the ski boot assembly.

5. The safety release ski boot system according to claim 1 in which each safety release mechanism is mounted in a frame that is removably mounted in a recess formed in the lower sole of the ski boot assembly.

6. The safety release ski boot system according to claim 1 in which the adjustable spring means engaging each rotatable latch member comprises a spring, manually adjustable screw means for controlling the compression of the spring, and an eccentric connecting rod
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13 linkage connecting the end of the spring to the eccentric pivot point of the latch member.

7. The safety release ski boot system according to claim 6 in which indicator means visually indicate the amount of compression of the spring.

8. The safety release ski boot system according to claim 6 in which the manually adjustable screw means is disposed transversely with respect to the longitudinal axis of the lower sole and is accessible through an opening formed in the side of the lower sole of the ski boot assembly.

9. The safety release ski boot system according to claim 6 in which the manually adjustable screw means is disposed longitudinally with respect to the longitudinal axis of the lower sole and is accessible through an opening formed in the end of the lower sole of the ski boot assembly.

10. The safety release ski boot system according to claim 1 in which the lower sole has a low friction upper surface in contact with the fixed upper sole of the ski boot assembly, in which said lower sole has a non-skid bottom surface, and in which the interior of said lower sole is formed with at least one transverse cavity whereby said lower sole is longitudinally flexible.

11. The safety release ski boot system according to claim 10 in which each safety release mechanism is mounted in a frame that is removably mounted in a cavity formed in the lower sole between the upper and bottom surfaces of said lower sole.

12. The safety release ski boot system according to claim 2 in which the coacting sole fastening means comprise at least two transverse rails secured to the upper surface of the ski, at least two transverse rail-receiving slots formed in the bottom of the lower sole of the ski boot assembly, and rail retaining means mounted on the lower sole for releasably retaining said transverse rails in said transverse rail-receiving slots.

13. The safety release ski boot system according to claim 12 in which the transverse rails and the transverse rail-receiving slots have matching T-shaped cross sections.

14. The safety release system according to claim 12 in which the transverse rails and the transverse rail-receiving slots have matching inverted L-shaped cross sections.

15. The safety release ski boot system according to claim 12 in which the transverse rail retaining means comprises a spring loaded member slidably mounted in the lower sole.

16. The safety release ski boot system according to claim 1 in which at least two rotatable latch members are pivotally mounted on the lower sole at the forward end thereof.

17. The safety release ski boot system according to claim 1 in which at least two rotatable latch members are pivotally mounted on the lower sole at the rearward end thereof.

18. The safety release ski boot system according to claim 1 in which the upper body of the ski boot assembly is elastically secured to the ski with which it is associated by means of a front elastic safety strap and a rear elastic safety strap.

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