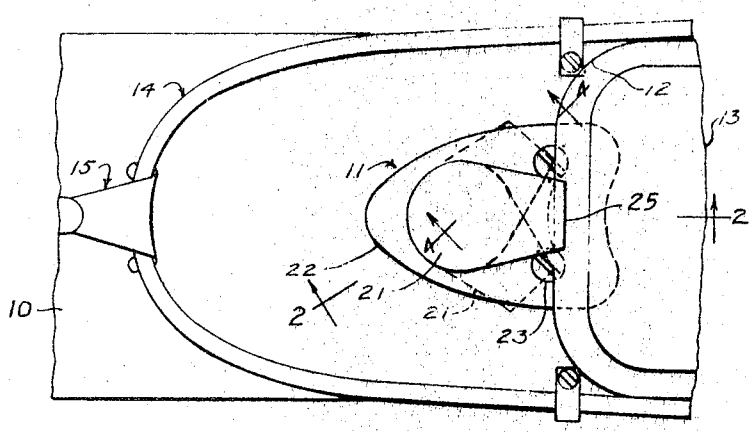
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TOE BINDING

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FIG 1



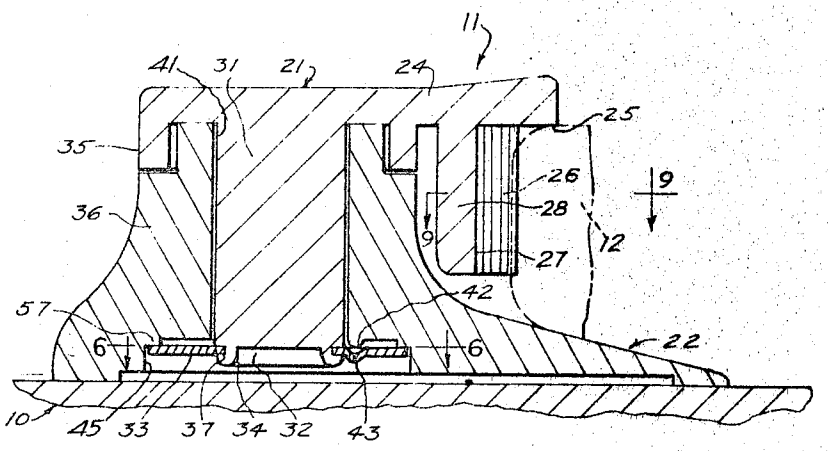


FIG 2

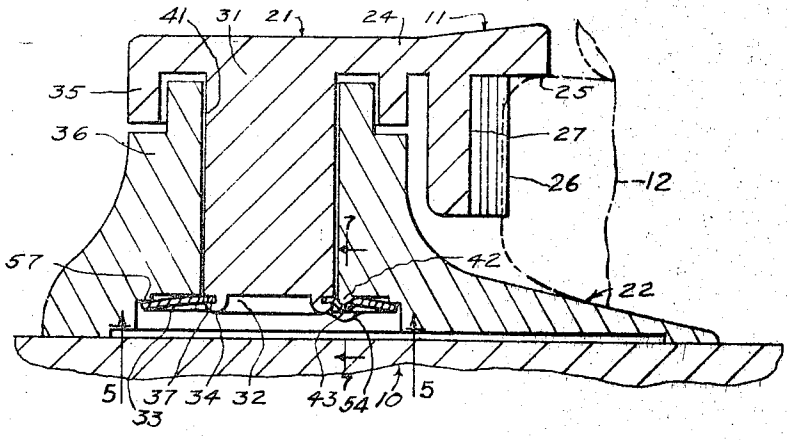


FIG 3

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TOE BINDING

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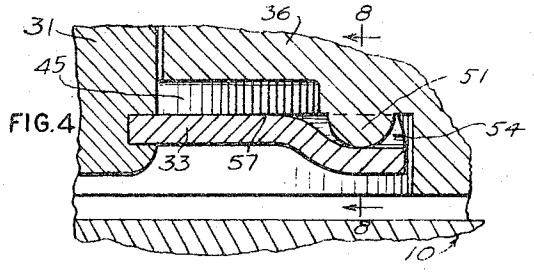


FIG.4

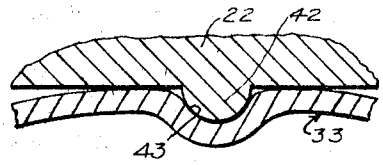


FIG 7

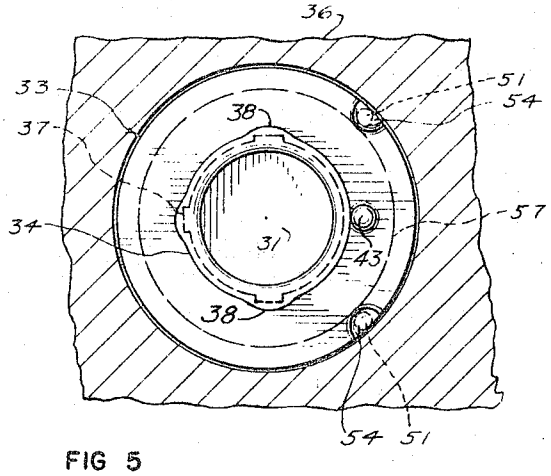


FIG 5

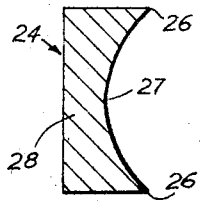


FIG 9

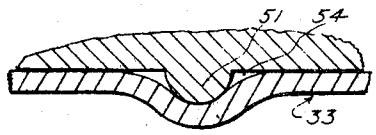


FIG 8

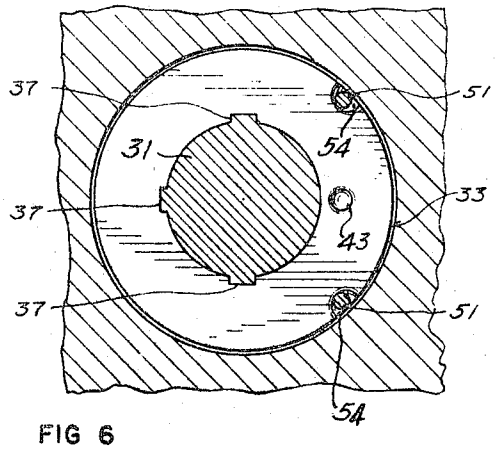


FIG 6

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FIG. 10

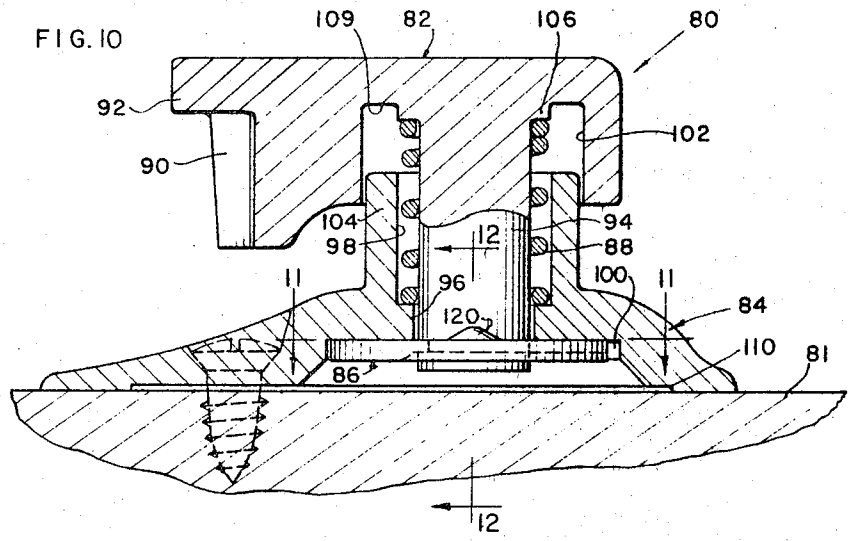


FIG. 11

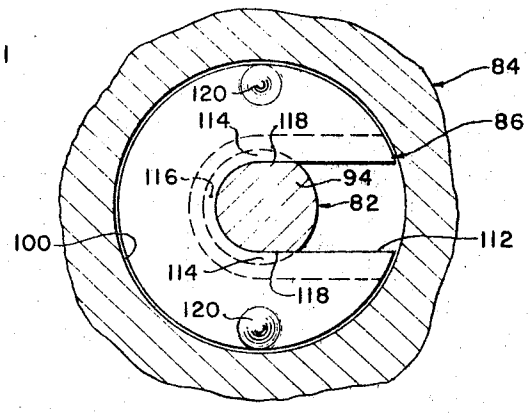
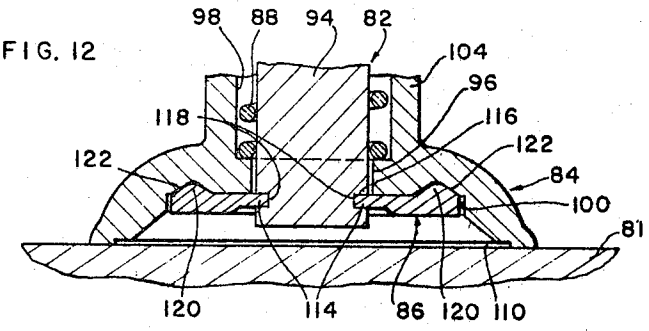


FIG. 12



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United States Patent Office 3,265,400 Patented August 9, 1966

3,265,400

TOE BINDING

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Filed Mar. 16, 1964, Ser. No. 352,197
15 Claims. (Cl. 280—11.35)

This invention relates to toe ski bindings, and more particularly to safety toe ski bindings having improved detenting means.

An object of the invention is to provide improved toe ski bindings.

Another object of the invention is to provide safety toe ski bindings having improved detenting means.

A further object of the invention is to provide a toe ski binding having releasing detent means variable in accordance with the upward force of a swivel member thereof.

A still further object of the invention is to provide safety ski bindings having a minimum number of parts.

Yet another object of the invention is to provide an improved safety toe binding for a ski in which the holding power of the binding is increased while a skier is executing a turn.

The invention provides toe ski bindings each including a base fixed to the ski and an arm provided with a jaw portion at one end thereof having means engaging a ski boot. The arm is pivotally mounted on the base for free horizontal pivotal movement relative to the base and is movable vertically relative to the base against the force of a spring. Detent means located under the base holds the arm in a holding position and applies an increased holding force to the arm when the arm is pressed upwardly relative to the base.

A toe ski binding forming one specific embodiment of the invention includes a base having a vertical bore therethrough and a counterbore at the upper end thereof in which is seated a compression spring bearing upwardly against an arm having a shaft extending through the bore. The arm has spaced ridges and an overhanging lip at a free end thereof for engaging the end of the sole of a ski boot. A slotted washer is slidable into keying grooves in the lower end of the shaft, and has detent pins fitting into detent recesses in the base when the washer is pulled up against the base by the shaft and the arm is in its normal position extending rearwardly of the base. The pins cam the washer and the arm downwardly against the lifting action of the ski boot sole to release the arm when the maximum safe lateral force is exerted by the ski boot when the skier is falling. When the skier is executing a turn where strong holding force on the ski boot is desirable, the toe of the ski boot is raised as part of the turning action, and this increases the detenting force of the detent pins and recesses.

In a toe ski binding forming an alternate embodiment of the invention, there is provided a base having a bore therethrough and a toe engaging arm which has a shaft slidable in the bore and riveted over a spring washer at the lower end of the bore to secure the arm against separation from the base while still permitting vertical movement of the arm relative to the base. The washer and the base are provided with first resilient detent means normally interengaging, and also have second, non-resilient detent means normally not in engagement but movable into engagement when the arm is pushed upwardly relative to the base, as occurs during execution of a turn with the ski.

A complete understanding of the invention may be obtained from the following detailed description of toe ski bindings forming specific embodiments thereof, when read in conjunction with the appended drawings, in which:

FIG. 1 is a fragmentary, top plan view of a ski having thereon a toe binding forming one embodiment of the invention;

FIGS. 2 and 3 are enlarged, fragmentary, vertical sectional views taken along line 2—2 of FIG. 1 and showing the toe binding in two different conditions;

FIG. 4 is an enlarged, vertical sectional view taken along line 4—4 of FIG. 1;

FIG. 5 is an enlarged, horizontal sectional view taken substantially along line 5—5 of FIG. 3;

FIG. 6 is an enlarged, horizontal sectional view taken along line 6—6 of FIG. 2;

FIG. 7 is an enlarged, vertical sectional view taken along line 7—7 of FIG. 3;

FIG. 8 is an enlarged, vertical sectional view taken along line 8—8 of FIG. 4;

FIG. 9 is an enlarged, horizontal sectional view taken along line 9—9 of FIG. 2;

FIG. 10 is an enlarged, fragmentary, vertical sectional view of a toe ski binding forming an alternate embodiment of the invention mounted on a ski;

FIG. 11 is an enlarged, fragmentary, horizontal sectional view taken along line 11—11 of FIG. 10; and

FIG. 12 is an enlarged, fragmentary, vertical sectional view taken along line 12—12 of FIG. 10.

Referring now in detail to the drawings, there is shown in FIGS. 1 to 9 a ski 10 having thereon a safety toe ski binding 11 against which the forward edge of a sole 12 of a ski boot 13 is urged by a cable 14 of a heel binding 15. The heel binding 15 is one of the type in which the tension of the heel binding cable 14 may be manually adjusted, one excellent ski binding for this purpose being that disclosed and claimed in my copending application, Serial No. 198,821, filed May 31, 1962, now Patent No. 3,147,986 issued September 8, 1964, which will release the tension of the cable 14 when there is a maximum safe stress on the cable 14. The toe binding 11 includes an arm or swivel 21 which normally occupies a directly rearwardly extending position, as illustrated in full lines in FIG. 1, and when maximum safe lateral thrust is applied to the free end of the arm 21, will swing to one of the broken line positions of the arm 21 to release the ski boot. The arm 21 is pivoted on a base 22 fastened to the ski by screws 23, and is detented relative to the base in its normal or full line position as shown in FIG. 1 as is described in detail hereinbelow. The detenting power holding the arm 21 in its normal, rearwardly extending position is increased when the arm is in a slightly raised position relative to the base 22 as illustrated in FIG. 3.

The arm 21 (FIGS. 2 and 3) includes an elongated arm body 24 having at one end thereof a lip 25 for engaging the top of the front end of the sole 12 of the ski boot 13, together with a pair of sharp vertical ribs or ridges 26 (FIG. 9) formed on a depending portion 28. The ridges 26, when the arm 21 is in its normal, rearwardly extending position, are substantially equidistantly spaced from the centerline of the ski 10 on opposite sides of the centerline of the ski. The rear end of the arm has an arcuate recess 27 defining with the sides of the arm the rather sharp ridges 26. The ridges 26 are adapted to engage the end of the sole 12 of the ski boot 13. The arm also includes adjacent its forward end an integral post or shaft 31. The shaft 31 has a reduced portion 32 near the lower end thereof on which is mounted a spring washer 33 which is secured to the shaft by a rivet head

portion 34 of the shaft and is keyed to the shaft by three key portions 37 (FIG. 6) positioned at the front and sides of the reduced portion 32. Enlarged rivet head portions 38 (FIG. 5) are formed from three key portions 37 (FIG. 6). The washer serves as a retainer or stop.

The arm body 24 (FIGS. 2 and 3) extends laterally beyond the shaft 31 to form, in effect, a head on the shaft. An annular skirt 35 concentric with the shaft and integral with the arm body 24 loosely surrounds a boss 36 of the base 22. The shaft 31 projects slidably through a bore 41 formed in the boss 36 to mount the arm 21 for unlimited horizontal pivotal movement of the arm 21 relative to the base 22, and also to permit vertical movement of the arm 21 relative to the base 22. Directly behind the shaft 31, when the arm is in its normal, rearwardly extending position, the base has a rounded detent pin or projection 42 directly over a camming socket or recess 43 in the spring washer 33. The recess 43 is positioned near the inner periphery of the washer 33. The washer 33 and rivet head portion 34 of the shaft 31 are positioned in a coutnerbore 45 formed in the base 22. Each of a pair of rounded detent pins or projections 51 (FIGS. 5 and 6) similar to the detent pin 42 is spaced around the boss 36 about 45° from the detent pin 42. The detent pins 51 are adapted to fully enter camming sockets or slots 54 (FIGS. 6 and 8) in the washer 33 when the arm 21 is in its normal position, and the camming sockets 54 are positioned near the outer periphery of the washer. Because of the elasticity of the washer the outer periphery thereof may flex relatively freely contrasted with the restriction of movement of the inner portion of the washer having the socket 43, which inner portion of the washer is held firmly against any appreciable flexing by the rivet head portion 34.

Normally, when unstressed, the spring washer 33 (FIGS. 2, 3 and 6) is flat, but, when the washer is assembled on the shaft and the rivet head portion 34 is formed, the central portion of the washer is drawn slightly upwardly to bell the washer slightly, the outer peripheral portion of the washer engaging annular land or shoulder 57. This slight belling of the washer, which is so slight that it is impractical to show it in the drawing, is caused because the distance between the top of the boss 36 and the land 57 is slightly greater than the distance from the top of the shaft 31 to the reduced portion 32 of the shaft. During normal stresses of skiing, the detent pin 42 does not enter the recess or socket 43 while the detent pins 51 fully enter the sockets 54. In this position, the detent pins 51 hold the arm 21 against releasing movement until a maximum safe lateral falling force occurs and then the arm pivots, the detent pins 51 camming the portions of the washer engaged thereby downwardly to releasing positions. However, in executing a turn, the skier tends to twist his ski boot about a generally horizontal axis generally parallel to the longitudinal axis of the ski. This applies a strong lifting force to the lip 25 of the arm and lifts the arm to the position thereof shown in FIG. 3 until the inner portion of the spring washer 33 bottoms on the bottom of the counterbore 45, and the camming recess or socket 43 moves up over the detent pin 42. The sloping camming walls of the socket 43 (FIG. 7) are much steeper than those of the sloping camming walls of the recesses 54 (FIG. 8), and the detenting force of the pin 42 is much greater than the combined detenting force of the pins 51. Also, the inner portion of the washer 33 (FIGS. 2 and 3) in which the recess 43 is formed is held substantially rigid due to the backing of the rivet head portion 34 as compared to the outer peripheral portions of the washer in which the recesses 54 are positioned, which can move downwardly as the washer is flexed. Thus, the arm is detented against releasing movement with one force when there is no appreciable upward force on the lip 25, which is the condition during falling, and is held against such releasing movement with a much stronger force when there is a substantial upward force on the lip 25 as is needed during execution of a turn. Stated in other words, during execution of a turn, there is a high force urging the ski boot laterally of the ski and the toe binding, and also there is a high force from the ski boot sole pressing the arm 21 upwardly. This upward force results from the tendency of the ski boot to twist generally about its longitudinal axis during execution of the turn. These forces are not dangerous to the skier, and it is desirable that the ski boot be held strongly by the toe binding at this time, and the toe binding does this by making the strong detenting power of the detent pin 43 effective during turning. However, whenever the skier is falling, it is essential that the ski boot be released before the highest non-dangerous or maximum safe force is exceeded. During falling there is no great upward thrust on the arm 21 and only the detent pins 51 and recesses 54 are effective and they release before a dangerously high force is reached.

When the maximum safe lateral force is applied to the arm 21, the detent pins 51 or the pins 42 and 51 are cammed out of the corresponding sockets 54 and 43, and the arm 21 swings until one of the ridges 26 is overcenter relative to the centerline of the ski. Then the arm 21 swings freely onwardly to release the ski boot.

A toe ski binding 80 (FIGS. 10 to 12) forming an alternate embodiment of the invention mounted on ski 81 includes an arm 82, a base 84, a rigid locking and detenting washer 86 and a compression spring 88. The arm 82 is generally similar to arm 21, and includes a pair of vertical ridges 90 and an overhanging lip 92 at the free end thereof which are substantially identical in structure and function with the ridges 26 and lip 25 of the arm 21. The arm 82 has a shaft 94 extending loosely through bore 96 and upper counterbore 98 into lower counterbore 100 in the base 84. The arm has an elongated cylindrical bore 102, fits closely on the exterior of elongated cylindrical sleeve portion 104 of the base, and is freely slidable along and freely rotatable on the sleeve portion 104. The bore 102 is concentric to the shaft 94, and a boss portion 106 in the central part of the bore forms a springseat, joins the shaft to the arm 82 and is spaced inwardly from the wall of the bore 102 to provide an annular clearance recess 109 for the upper end of the sleeve portion 104 during assembly of the components of the binding 80. The base 84 has a bottom recess 110.

The washer 86 (FIG. 11) has a U-shaped slot 112 therein and has straight, parallel, keying portions 114 slidable into and complementary to a U-shaped groove 116 in the lower end of the shaft 94. Sides 118 of the groove 116 are straight, and key the washer to the shaft. Detent pins 120 formed integrally on the washer and having rounded ends normally extend upwardly into detent or camming recesses or sockets 122 in the end of the lower counter bore 100 when the arm 82 is in its normal position in which it is held in its uppermost position by the spring 88 and extends directly rearwardly along the ski.

When the condition approaching danger arises during skiing, as in a fall, for example, the ski boot is twisted with a sufficient force to turn the arm 82, which causes the detent pins 120 to cam out of the recess 122. This moves the arm 82 downwardly toward the ski 81 against the actions of the spring and the upward force of the sole of the ski boot against the lip 92. Then the detent pins ride on the plane end face of the counterbore 100 as further turning of the arm 82 occurs, and when one of the ridges 90 goes over-center relative to the centerline of the ski, the arm 82 swings freely to a collapsed or non-holding position extending laterally of the ski. However, in the execution of a turn where high holding power is needed, the sole of the ski boot tends to twist about the longitudinal axis of the sole to exert a strong lifting force on the lip 92 of the arm 82. This holds the detent pins

120 upwardly in the detent recesses 122 with sufficient force to prevent turning of the arm despite the strong turning force exerted on the arm by the ski boot during the execution of the turn by the skier.

To assemble the toe ski binding 80, with the base 84 removed from the ski 81, the shaft 94 is inserted through the spring 88 and bore 96. The arm 82 then is pushed downwardly relative to the base until the sleeve portion 104 bottoms against the bottom of the groove 109, and the arm 82 and base 84 are held in these relative positions in which the U-shaped groove 116 in the lower end of the shaft is entirely below the bottom end of the counterbore 100 in the base 84. The assembler then slides the washer 86 onto the shaft 94 to the position thereof shown in FIG. 11 in which the keying portions 114 engage the straight sides 118 of the groove 116, and the washer 86 is aligned with the counterbore 100. The arm 82 then is released and the spring 88 pulls the washer into the counterbore 100 and against the end of the counterbore 100. The counterbore 100 has a diameter slightly larger than that of the washer 86 to permit free facewise and turning movements of the washer in the counterbore but is sufficiently small to retain the washer in a substantially centered position on the shaft 94.

The above described toe ski bindings 11 and 80 provide one holding force for skiing without turning and provide a much stronger holder force while turning occurs. They also inherently increase the detenting force while any lifting force is applied to the lips 25 and 92 of the arms 21 and 82. The bindings are very rugged and durable, and have minimum numbers of parts, the binding 11 having only three parts and the binding 80 four.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. In a toe-holding clamp for a ski,
arm means extending generally horizontally and having a ski boot engaging means on one end thereof and having a shaft rigid therewith adjacent the other end,
pivot means secured to the ski mounting the shaft pivotally on the ski to mount the arm means for generally horizontal pivotal movement of the arm means relative to the ski and also permitting limited vertical movement of the arm means relative to the ski,
and detent means positioned at the lower ends of the shaft and the pivot means normally holding the arm means with a predetermined force against horizontal pivotal movement relative to the ski and holding the arm means against such horizontal pivotal movement with a substantially greater force than said predetermined force when the lip member is pressed upwardly by the ski boot.

2. In a toe-holding clamp for a ski,
arm means extending generally horizontally and having ski boot engaging means at one end thereof,
the arm means having a shaft extending downwardly from the other end of the arm means,
pivot means secured to the ski mounting the arm means on the ski and having a vertical bore receiving the shaft and a counterbore at the lower end of the bore,
retaining means keyed to the lower end of the shaft and positioned in the counterbore and limiting upward movement of the shaft relative to the pivot means and permitting downward movement thereof,
means urging the retaining means upwardly into engagement with the end of the counterbore,
first detent means on the retaining means,
a second detent means on the pivot means and engaged by the first detent means when the arm is in a normal position extending rearwardly of the ski and the retaining means is in engagement with the bottom of the counterbore for holding the arm means with a predetermined force against horizontal pivotal movement relative to the ski when no appreciable upward force is applied to the arm means and holding the arm means with a substantially greater force than said predetermined force when a substantial upward force is applied to the arm means.

3. In a toe binding for a ski,
an arm having at one end thereof a ski boot engaging means and at the other end thereof a downwardly depending shaft,
a base having a shaft-receiving vertical bore of a predetermined diameter and a counterbore at the bottom of the bore,
a retaining member larger than the diameter of the bore keyed to the shaft and positioned in the counterbore,
the retaining member and the base being provided with detent portions interlocking when the retaining member is in an uppermost position and the arm extends directly rearwardly relative to the base and adapted to cam the retaining member downwardly and release the retaining member when the arm is pivoted relative to the base,
and resilient means urging the retaining member toward the uppermost position thereof.

4. In a toe binding for a ski,
an arm having at one end thereof a downwardly depending shaft and at the other end thereof a lip and a pair of spaced vertical ridges,
the arm also having a downwardly facing cylindrical hole concentric with the shaft,
a base having a shaft-receiving vertical bore and a counterbore at the bottom of the bore,
the base having a sleeve projecting upwardly therefrom and adapted to fit into the hole and journal the arm on the base with the inner wall of the sleeve spaced radially outwardly from the shaft,
a compression spring positioned in the sleeve and bearing against the base and the arm,
and stop means keyed to the lower end of the shaft and overhanging the upper end of the counterbore to limit upward movement of the arm relative to the base,
the stop means and the base being provided with detent portions interlocking when the stop means is in an uppermost position and the arm extends directly rearwardly relative to the base and adapted to cam the stop means downwardly and release the stop means when the arm is pivoted relative to the base.

5. In a toe binding for a ski,
an arm having at one end thereof a downwardly depending shaft and at the other end thereof a lip and a pair of spaced vertical ridges,
a base having a shaft-receiving vertical bore and a counterbore at the bottom of the bore,
and a washer keyed to the shaft and positioned in the counterbore,
the washer and the base being provided with normally interlocking, releasable detent portions

6. The toe binding of claim 5 wherein the washer is resilient.

7. In a toe ski binding,
base means attachable to a ski,
arm means extending generally horizontally rearwardly relative to the base means and pivotal on a vertical axis at the forward end thereof to the base means and having at the other end thereof an overhanging lip and a pair of vertical ridges positioned on opposite sides of the centerline of the ski when the arm means is in a normal position extending directly rearwardly from the base means,
and a spring washer keyed to one of the base means and the arm means and pressing the arm means down-

wardly relative to the base means and having detent means,
the other of the base means and the arm means being provided with detent means normally interengaging the detent means of the spring washer.

8. In a toe-holding clamp for a ski,
a base having a plate portion adapted to be fastened to the upper surface of a ski and also provided with a generally frustoconical boss portion projecting upwardly from the plate portion,
the boss portion having an axial bore therethrough and having a counterbore at the bottom of the bore and an annular land spaced radially outwardly from the bore,
the boss portion also having a first pair of angularly spaced detent pins extending downwardly from the annular land,
the boss portion also having a third downwardly extending detent pin positioned inwardly from the annular land,
an arm having a jaw portion at a first end thereof including an overhanging lip and a pair of spaced, generally parallel ridges extending at right angles to the lip,
the arm having at the other end thereof a shaft fitting slidably in the bore,
and a flat washer keyed to the shaft and having a pair of detent recesses adapted to receive the first pair of detent pins and also having a third detent recess adapted to receive the third detent pin,
the third detent pin being of a length adapted to enter the third recess only when the inner portion of the washer is pushed upwardly relative to the outer portion of the washer.

9. In a toe-holding clamp for a ski,
a base having a plate portion adapted to be fastened to the upper surface of a ski and also provided with a boss portion projecting upwardly from the plate portion,
the boss portion having an axial bore therethrough and having a counterbore portion at the bottom of the bore,
the boss portion also having a first detent pin positioned on the inner portion of the bottom of the counterbore and being provided with a second detent pin positioned on the outer portion of the bottom of the counterbore,
an arm having a jaw portion at a first end thereof including an overhanging lip and a pair of spaced, generally parallel ridges extending at right angles to the lip,
the arm having at the other end thereof a shaft slidable in the bore in the boss portion,
and a spring washer keyed to the lower end of the shaft and having detent recesses positioned in alignment with the detent pins when the arm extends directly rearwardly from the boss portion,
the first pin being of a length such as to enter one of the detent recesses only when the arm is lifted relative to the boss portion and the second pin being of a length such as to enter the other detent recess regardless of whether or not the arm is lifted relative to the boss portion.

10. In a toe binding for a ski,
a base having a first vertical pivot portion,
an arm having at one end thereof a second pivot portion pivotal on and slidable along the first vertical pivot portion and having at the other end thereof a lip and a pair of spaced vertical ridges,
means urging the arm downwardly on the base,
stop means limiting downward movement of the arm relative to the base to an extreme lower position of the arm,
first detent means on the arm and base operably engaged when the arm is in said extreme lower position, and
second detent means on the arm and base operably engaged only when the arm is moved upwardly from said extreme lower position.

11. In a toe ski binding,
base means attachable to a ski,
arm means extending generally horizontally rearwardly relative to the base means and pivotal on a vertical axis at the forward end thereof to the base means and having at the other end thereof an overhanging lip and a pair of vertical ridges positioned on opposite sides of the centerline of the ski when the arm means is in a normal position extending directly rearwardly from the base means,
first detent means normally operable to hold the arm means in said normal position, and
second detent means operable only when the arm means is urged upwardly relative to the base with a force greater than a predetermined force.

12. In a toe ski binding,
base means attachable to a ski,
arm means extending generally horizontally rearwardly relative to the base means and pivotal on a vertical axis at the forward end thereof to the base means and having at the other end thereof an overhanging lip and a pair of vertical ridges positioned on opposite sides of the centerline of the ski when the arm means is in a normal position extending directly rearwardly from the base means,
resilient detent means normally operable to hold the arm means in said normal position, and
rigid detent means operable only when the arm means is urged upwardly relative to the base with a force greater than a predetermined force.

13. In a toe binding for a ski,
a base having a first vertical pivot portion,
an arm having at one end thereof a second pivot portion pivotal on and slidable along the first vertical pivot portion and having at the other end thereof ski boot engaging means,
means urging the arm upwardly on the base,
stop means rigid on the lower end of the pivot portion of the arm for limiting movement of the arm relative to the base to an extreme upper position of the arm, and
detent means on the stop means and the base operably engaged when the arm is in said extreme upper position and releasing the arm when the arm is moved downwardly from said extreme upper position.

14. In a toe binding for a ski,
an arm having at one end thereof a downwardly depending shaft and at the other end thereof a lip and a pair of spaced vertical ridges,
a base having a shaft-receiving vertical bore and a counterbore at the bottom of the bore,
a washer keyed to the shaft and positioned in the counterbore,
the washer and the base being provided with detent portions interlocking when the washer is in an uppermost position and the arm extends directly rearwardly relative to the base and adapted to cam the washer downwardly and release the washer when the arm is pivoted relative to the base, and
a compression spring positioned between the top of the base and the bottom of the arm and urging the arm upwardly to urge the washer toward the uppermost position thereof.

15. In a toe binding for a ski,
an arm having at one end thereof a downwardly depending shaft and at the other end thereof a lip and a pair of spaced vertical ridges,
the lower end of the arm having a pair of parallel

groove portions positioned on opposite sides of the shaft and extending transversely of the shaft,

a base having a shaft-receiving vertical bore and a counterbore at the bottom of the bore, and

a washer fitting into the counterbore and having a U-shaped, slotted portion adapted to slide keyingly into the groove portions to key the shaft thereto,

the washer and the base being provided with detent portions interlocking when the washer is in an uppermost position in the counterbore and the arm extends directly rearwardly relative to the base and adapted to cam the washer downwardly and release the washer when the arm is pivoted relative to the base, and

a compression spring engaging an upper portion of the base and a lower portion of the arm to urge the arm upwardly to urge the washer toward the uppermost position thereof,

the arm being movable downwardly relative to the base

sufficiently to move the washer out of the counterbore to permit assembling the washer on the shaft.

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