June 6, 1972 J. S. LAWRENCE 3,667,770

SKI-BINDING TOE MECHANISM

Filed Oct. 6, 1970 2 Sheets-Sheet 1

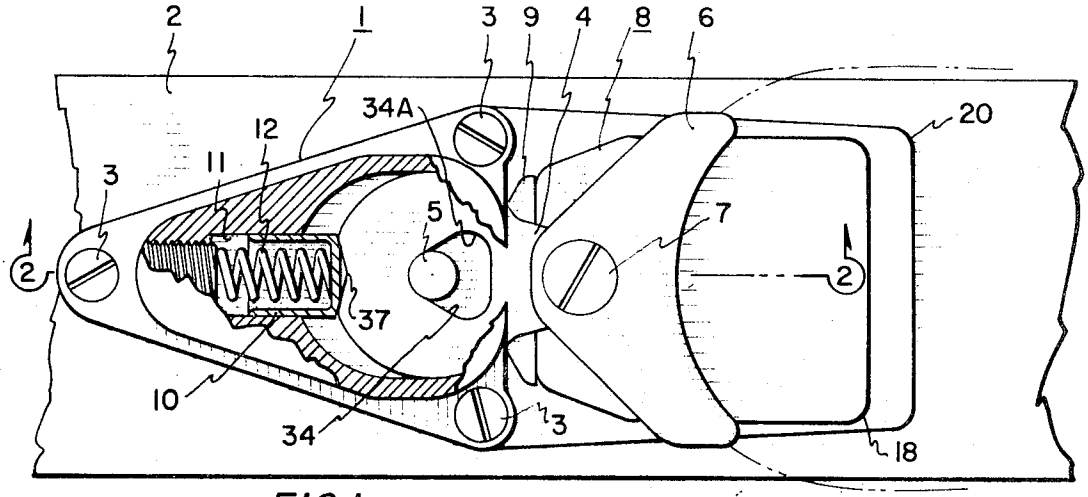


FIG. 1

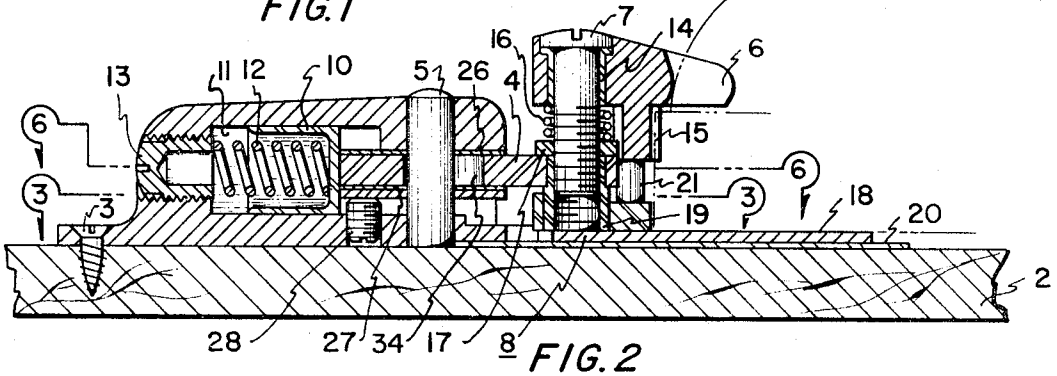


FIG. 2

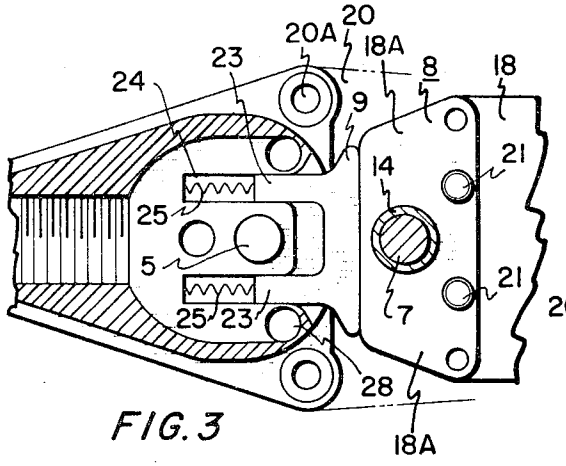


FIG. 3

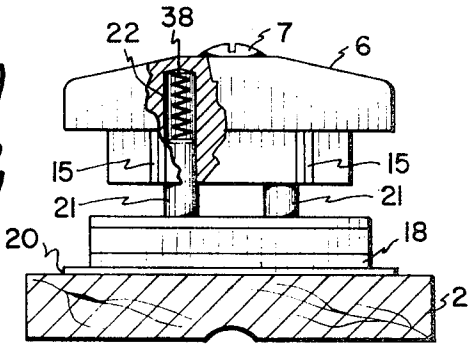


FIG. 4

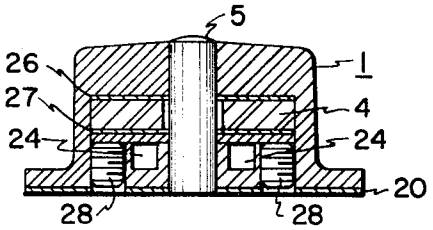


FIG. 5

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June 6, 1972 J. S. LAWRENCE 3,667,770

SKI-BINDING TOE MECHANISM

Filed Oct. 6, 1970 2 Sheets-Sheet 2

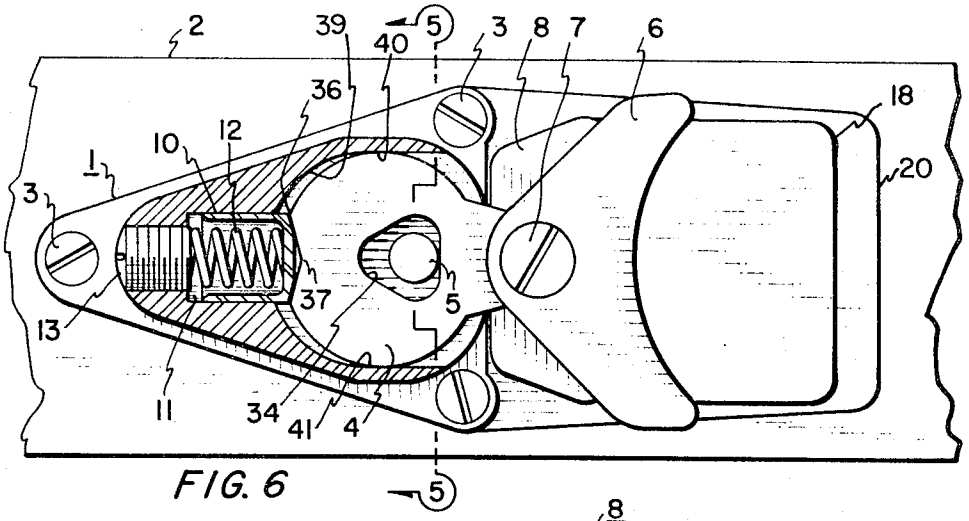


FIG. 6

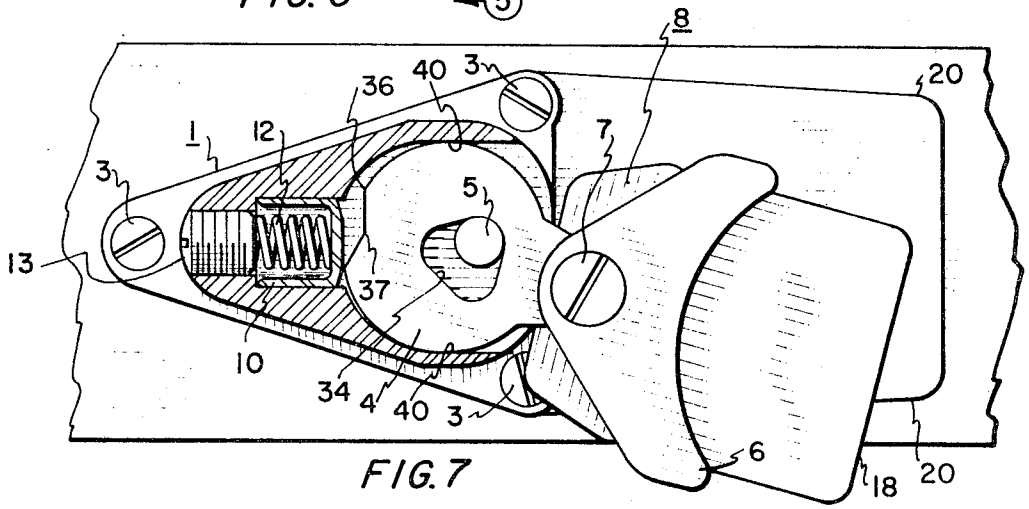


FIG. 7

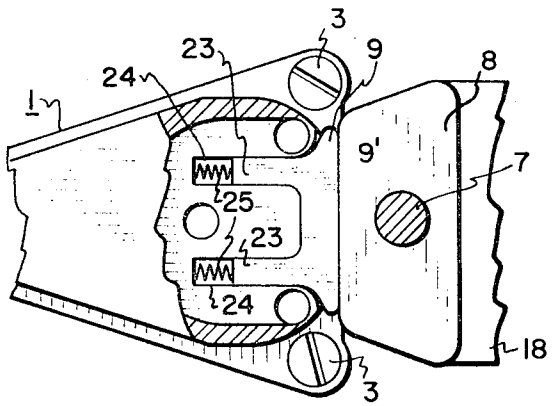


FIG. 8

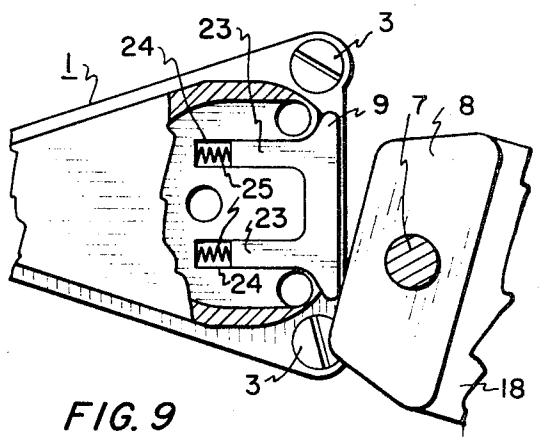


FIG. 9

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SKI-BINDING TOE MECHANISM

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U.S. Cl. 280—11.35 T 10 Claims

ABSTRACT OF THE DISCLOSURE

A toe ski safety binding comprising a base support constructed for mounting on a ski and ski boot toe holding means for releasably holding the toe end of a ski boot to said ski, the ski boot toe holding means consisting of a cam plate whose forward end is in rotary contact with a spring-loaded cam follower; the cam plate constrained to move horizontally within a predetermined area and is linked to a base-supported post. Also provided is a cam-controlled skid plate structure to releasably support the toe end of said ski boot.

This invention relates to a toe ski boot binding which operates to laterally release the toe of a ski boot when lateral force acting on said toe ski boot binding exceed a pre-determined, adjustable threshold level.

A skier's legs are normally subjected to strong longitudinal and lateral forces when skiing. If such forces are allowed to stress the skier's legs too severely, the skier may suffer sprained muscles, torn ligaments, or even broken bones. In order to avoid such injuries, releasable bindings at both the toe and heel ends of the skier's boots are generally used to fasten each ski boot to its respective ski runner, or ski, said bindings operating to release instantaneously when subjected to forces exceeding a pre-set level. The releasable binding at the toe end, herein referred to as the toe ski safety binding, is particularly effective in preventing injury to a skier when said toe ski safety binding is constructed to allow said ski boot to move out of the binding laterally, thus preventing injurious torques from being exerted upon the skier's legs.

To be practical and safe, the toe ski safety binding must always release the toe end of the ski boot whenever lateral forces exceed the pre-set level, regardless of the condition and frictional characteristics of the ski boot.

Accordingly, it is an object of this invention to provide a toe ski safety binding that releasably holds the toe end of a ski boot to a ski, in such a manner that said toe ski safety binding automatically releases the toe end of said ski boot when lateral forces exceed a pre-set, adjustable level, and further, releases the toe end of said ski boot laterally.

Another object of the present invention is to provide a toe ski safety binding of the character described, having a laterally-releasable toe clamp pivoted to a cam that is linked to a fixed center post by an oversized aperture, said cam being capable of a predetermined limited yield relative to its longitudinal axis.

A further object of the present invention is to provide a toe ski safety binding that deflects when subjected to shock and vibration as encountered in normal skiing without releasing, but which releases when lateral forces exceed the pre-set level for release.

A further object is to provide a toe ski safety binding that can yield in a direction parallel to the length of the ski while laterally releasing the toe end of the ski boot.

A further object is to provide a toe skid plate to support the toe end of a ski boot, said toe skid plate being

cam-controlled and pivoted to release the toe end of said ski boot laterally when an adjustable, predetermined lateral force upon said toe skid plate is exceeded.

Other objects are to provide a toe ski safety binding as herein described that is reliable, durable, easy-to-use, and inexpensive.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings in which:

FIG. 1 is a top view of the toe ski safety binding, attached to the upper surface of a ski, said toe ski binding partially cut away to show certain internal parts. The toe end of the ski boot is shown by the phantom line.

FIG. 2 is a cross-sectional view of the toe ski safety binding taken along line 2—2 of FIG. 1.

FIG. 3 is a horizontal cross-sectional view of the lower portion of the toe ski safety binding taken along line 3—3 in FIG. 2.

FIG. 4 is a front view of the toe ski safety binding with part of the toe clamp cut away to show one of the two locking pins used to connect the toe clamp with the skid plate structure.

FIG. 5 is a transverse cross-sectional view of the toe ski safety binding taken along line 5—5 in FIG. 6.

FIG. 6 is a horizontal cross-sectional view of the toe ski safety binding, taken along line 6—6 in FIG. 2, showing said toe ski safety binding in a forward position when forward thrust is imposed.

FIG. 7 is the same horizontal cross-sectional view as shown in FIG. 6, but with said toe ski safety binding shown in a forwardly and laterally displaced position.

FIG. 8 is a horizontal cross-sectional view of the toe ski safety binding taken along line 3—3 in FIG. 2, showing the relative position of the bifurcated cam follower plate and the skid plate assembly when said toe ski safety binding is in the normal or latched position.

FIG. 9 is the view of the toe ski safety binding taken along the same horizontal cross-section as in FIG. 8, when said toe ski safety binding is in the unlatched, or released position.

In FIG. 1, a main housing 1 is shown attached to the upper surface of a ski 2, by means of screws 3. A cam plate 4, linked internally to post 5, is movably connected to toe clamp 6 by means of pivot bolt 7 attached to cam plate 4. A skid plate structure 8, having skid plate cam 18A with attached skid plate 18, is also pivoted to bolt 7 and is in rotary contact with cam follower plate 9. In FIG. 6, the cam plate 4 is seen to link post 5 by means of an oversized, triangular aperture 34 having rounded corners 34A. The front surface of said cam plate 4, shaped with indentation 37, is in rotary contact with cam follower 10, where cam follower 10 is constrained to move in channel 11 against installed compression spring 12. The spring 12, normally in a compressed state, pushes on the inside surface of the cam follower 10, causing said cam follower 10 to exert a pressure against the front surface of the cam plate 4. Said pressure exerted by spring 12 is adjusted by set screw 13.

In FIG. 2, the toe clamp 6 is seen to pivot closely about bolt 7 by the use of a closely machined bushing 14. Knife edge prongs 15 extend downward from said toe clamp 6 to hold the toe end of a ski boot, shown by the phantom line, securely. Said toe clamp 6 may be adjusted vertically by turning bolt 7, allowing the toe ski safety binding to accommodate different sized ski boots. A restoring spring 16 is installed concentrically about bolt 7 between the lower surface of toe clamp 6 and jam nut 17, and keeps said toe

clamp 6 at its uppermost position along bolt 7. Jam nut 17 secures bolt 7 firmly to cam plate 4. Skid plate structure 8 is fixed to bolt 7 by means of an internally threaded sleeve 19; the toe clamp is keyed to the skid plate structure 8 by a pair of plunger pins 21 upstanding from skid plate cam 18A, where the plunger pins 21 are constrained to move in passageways 22 as shown in the cutaway portion of FIG. 4. Both the toe clamp 6 and the skid plate structure 8 hold the toe end of the ski boot and rotate together about bolt 7. The skid plate structure 8, pivoted about bolt 7, is in cam contact at its leading edge with cam follower plate 9, shown in FIG. 3. The cam follower plate 9 is bifurcated into two extension portions 23 at the forward end which move along channels 24, compressing springs 25. The cam plate 4 is slideably held between an upper bearing plate 26 and a lower bearing plate 27, where set screws 28 are used to adjust the pressure at which the cam plate 4 is slideably held.

The operation of the toe ski safety binding is as follows:

In the normal or latched position, the ski boot is held from above by toe clamp 6 and supported by skid plate structure 8. Due to the force exerted against the cam plate 4 by spring 12 by way of cam follower 10, the cam plate 4 normally links the post 5 as far rearward as possible, so that the foremost corner of the triangular shaped aperture of the cam plate 4 is in contact with the post 5 as shown in FIG. 1 and FIG. 2. Under normal skiing conditions, the toe ski safety binding yields longitudinally and laterally, as shown in FIG. 6. Normal longitudinal forces cause the toe end of the ski boot to push the cam plate 4 forward against the restoring pressure of spring 12, while at the same time lateral forces cause the cam plate 4 to rotate about post 5, said rotation resulting in indentation 37 moving out from the center of cam follower 10 against the restoring pressure exerted by the cam follower 10.

When sufficient force is encountered by the toe ski safety binding to effect a release, forward-and-lateral thrust of the ski boot against the binding moves the toe clamp 6, skid plate assembly 18, and the cam plate 4 forward to the position shown in FIG. 6. The post 5, pressed by the surface of aperture 34 in the cam plate 4, forces the cam plate 4 to one side or the other, so that aperture 34 is made to contact said post 5 at one of the rearward corners of aperture 34, as shown in FIG. 7. This cornering action results in a corresponding rotation of cam plate 4 and a corresponding laterally outward motion of the toe clamp 6 and skid plate assembly 8, effecting lateral release of the toe end of the ski boot. Of course, lateral thrust alone will pivot cam plate 4 to effect release.

In FIGS. 6 and 7 the cross-sectioned area of the base support 1 is shown to be provided with a generally circular, cam receiving recess 39 provided with parallel side bearing surfaces 40 and 41. These bearing surfaces engage the opposite, circularly arcuate sides of cam plate 4.

Where there is no forward thrust exerted by the ski boot against the toe clamp 6, then the post 5 will be situated forwardly against the forward rounded corner of triangular aperture 34 in the manner illustrated in FIG. 1.

When the ski boot exerts a forward thrust against the toe clamp 6, then there will be a relief motion forwardly of cam plate 4, tending to compress spring 12 and move the cam plate 4 forward in the manner shown in FIG. 6. It is noted, however, that no lateral release occurs at this point, or even forward release since the heel release mechanism not shown will be relied upon to release the ski boot in the event that a severe thrust urges the skier forwardly.

Suppose that with the imposition of a forward thrust against the toe clamp there is also a lateral thrust tending to rotate the cam plate forward in a clockwise direction as shown in FIG. 7. In such event, in order to retain the surface of the cam plate in bearing contact against the slide bearing surfaces 40, the pivot point of the cam plate will have to be shifted. This shifting of pivot point is accommodated by the lateral or triangular shape of the aperture wherein the post 5 is enabled to seat in the upper curved corner of the enlarged aperture 34, such that the pivot now is above or to the right of the center line or longitudinal axis of the cam plate. It is noted that the shape of the aperture permits a simple longitudinal channel shape for the recess opening 39 and in addition allows rotation of the cam plate independent of longitudinal forces acting on toe clamp 6 and the corresponding compression of spring 12.

Simultaneous with this function there will likewise be caused a movement of skid plate structure 8 over the friction plate 20 so as to effect a complete lateral release of the ski boot toe from the toe clamp 6 and said skid plate structure 8.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

I claim:

1. A toe ski safety binding including in combination, a base support constructed for securement to a ski above its upper surface and having a longitudinal recess; a cam plate disposed in said recess, said cam plate having a cam surface with a centrally-disposed, forward indentation and a vertical centrally-disposed aperture; a post, dimensionally undersized with respect to said aperture, fixed to said base support, said post passing through said aperture being made sufficiently large with respect to the cross section of said post to allow for rotational displacement of said cam plate within said recess as said cam plate moves longitudinally within said recess; and adjustable, spring-biased cam follower channeled to said base support and engaging said forward indentation to releasably retain said cam plate in its normal position; constraining means for confining said cam plate to movement in a plane parallel to said upper surface of said ski; and a toe clamp, pivoted to said cam plate about an axis perpendicular to said cam plate, said toe ski safety binding being constructed to hold the toe end of a ski boot to a ski and to laterally release said ski boot when lateral forces exerted upon said toe safety binding exceed an adjustable pre-set level.

2. Structure according to claim 1, wherein said oversized aperture of said cam plate has the shape of a triangle with rounded corners, where one corner of said triangle is oriented forwardly along the longitudinal axis of said cam plate.

3. Structure according to claim 1, wherein said constraining means comprise bearing plates provided with attachment means to prevent rotation of the toe end of said ski boot about an axis parallel to the longitudinal axis of said ski.

4. Structure according to claim 1, wherein said toe clamp has adjustable screw means to fit said toe clamp to different sized boots.

5. Structure according to claim 1, wherein said toe clamp has vertical, rearwardly facing knife edge prong means to securely hold said ski boot to said toe clamp.

6. Structure according to claim 1, wherein said base support is provided with a recess having opposite, side surfaces disposed in said base support to slidably engage said cam plate to limit translation of said cam plate to longitudinal translation.

7. A toe ski safety binding including in combination, a base support constructed for securement to a ski above its upper surface and having a longitudinal recess and an upstanding post; a cam plate disposed in said recess, said cam plate having an oversized, vertical, centrally disposed aperture, said aperture linking said cam plate to said post; means for constraining said cam plate to movement in a plane parallel to said ski; a toe clamp pivoted to said cam plate about an axis perpendicular to said cam plate; a skid plate structure for supporting the toe of a ski boot and

having a leading edge, said skid plate structure being pivoted to said cam plate along said axis and having means linking said skid plate structure to said toe clamp, a spring-loaded cam follower plate projecting rearwardly of and channeled within said cam plate and engaging said leading edge of said skid plate structure, said toe ski safety binding being constructed to hold the toe end of a ski boot to a ski and to laterally release said toe end of said ski boot when lateral forces exerted upon said toe ski safety binding exceed an adjustable pre-set level.

8. Structure according to claim 7 wherein there is provided a friction plate constructed for attachment to the upper surface of a ski, said skid plate structure being disposed for slideable movement over said friction plate.

9. Structure according to claim 7 wherein said cam plate is provided with an adjustment bolt, said adjustment bolt pivotally engaging said toe clamp.

10. A toe ski safety binding including in combination, a base support constructed for securement to a ski above its upper surface; a toe clamp pivoted about an axis perpendicular to said upper surface of said ski; adjustable means for pivotally mounting said toe clamp to said base support at a preselected height above said ski, said means comprising a pivot; a skid plate structure movable about said pivot, disposed above the upper surface of said ski, and having spring-biased pin means linking said skid plate structure to said to e clamp, said toe ski safety binding being constructed to hold the toe end of a ski boot to a ski and to laterally release said ski boot when lateral forces exerted upon said toe ski safety binding exceed an adjustable pre-set level.

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