

[54] SKI SAFETY DEVICE

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[58] Field of Search 280/11.35 N, 11.35 K, 280/11.35 R; 403/111; 267/150

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[57] ABSTRACT

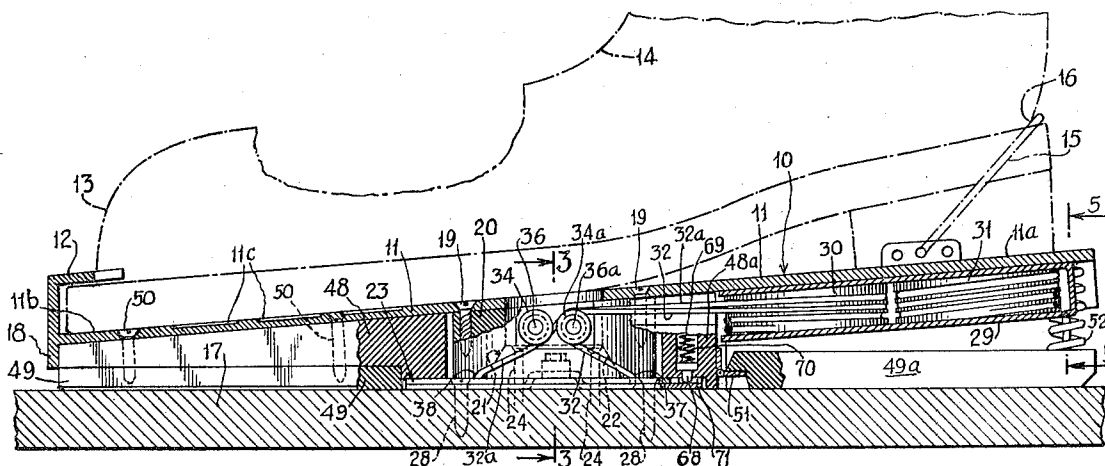
A ski safety device is provided for minimizing transmission of injurious force to a skier's legs by facilitating controlled excursion of a skier's foot from normal alignment with the ski upon the occurrence of predetermined rotational and lifting forces. The device is an

assemblage adapted for mounting at the foot engaging portion of a ski and comprising an elongated tread portion having means at the forward and rear ends thereof for firmly clamping a ski boot thereto, a mounting plate for securing to the ski having upwardly projecting means interfitted with coacting means centrally of said tread portion in a manner to permit rotaty and lifting movement of the tread portion with respect to said mounting plate, and said tread portion and mounting plate being joined together by tensioned strands extending from points on said mounting plate radially and circumferentially spaced with respect to said upwardly projecting means, through guide means at the sides of said tread portion above said mounting plate, to tensioning means longitudinally spaced from said mounting plate, thereby restraining said tread portion against both lifting and rotary motion with respect to said mounting plate.

The upwardly projecting and coacting means on said plate and tread portion are of tapered, suitably frustoconical, contour permitting disengagement by transverse tilting along one edge of said tread portion against the restraining force of said tensioned strands; and an optional or supplemental resistance to rotary displacement may be provided by vertically oriented spring tensioned means and coacting depressed means on said mounting plate and tread portion.

The tread portion is preferably inclined to be substantially elevated above a ski at the rear end thereof. This provides both desirable forward lean for the skier, and means within said rear portion for housing at least one spring tensioned spool providing adjustable tension in said strands.

27 Claims, 10 Drawing Figures



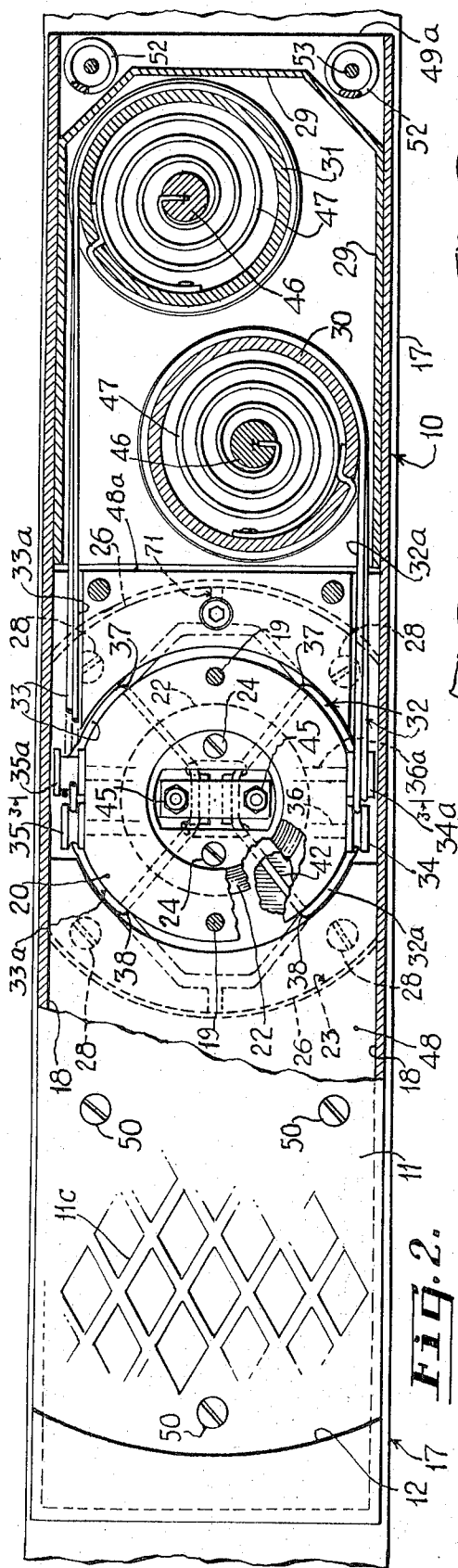
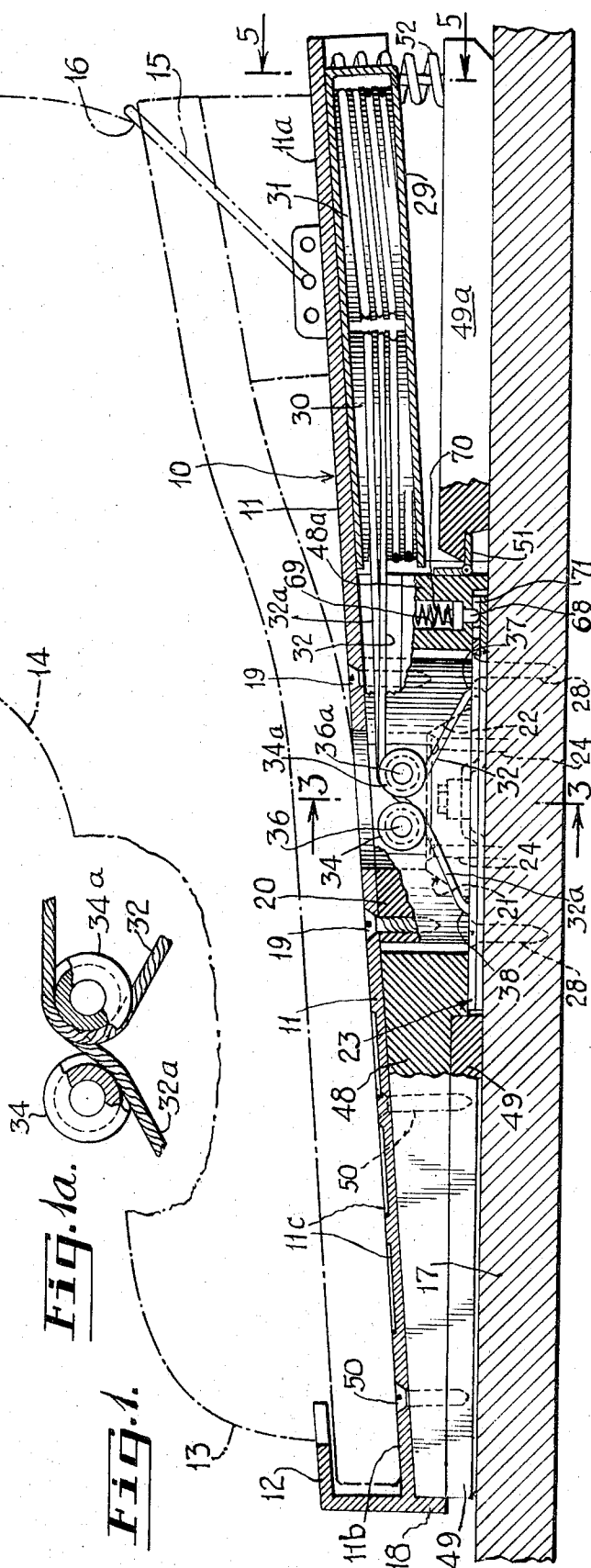
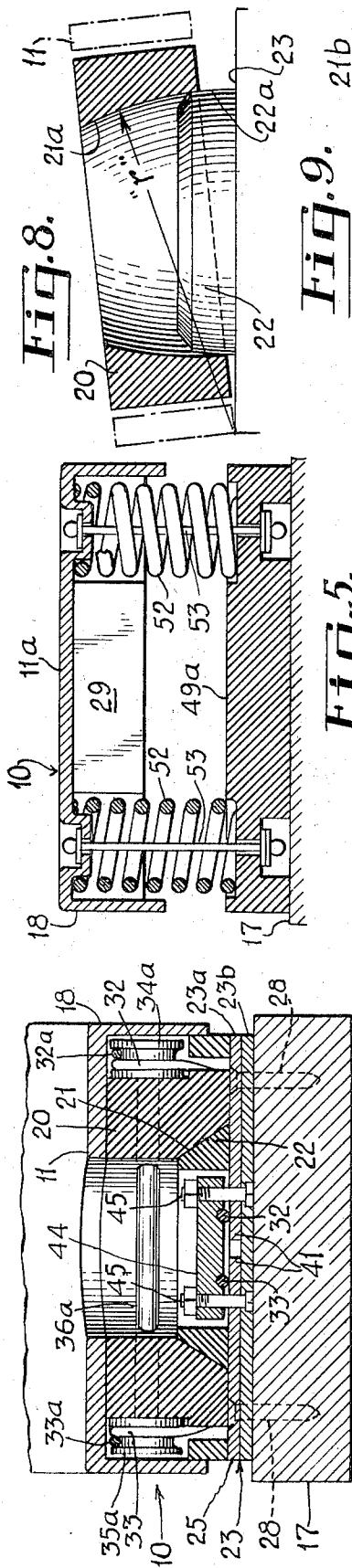
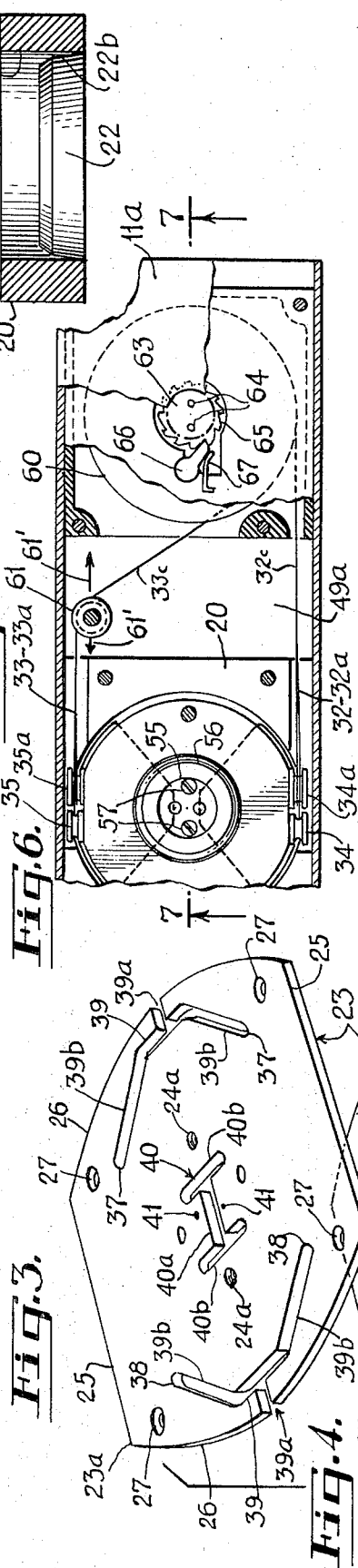
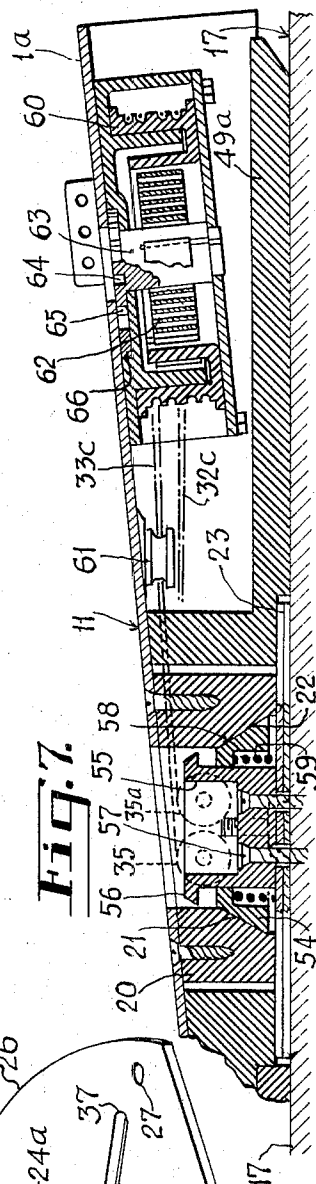


FIG. 1a.

FIG. 1.

FIG. 2.



SKI SAFETY DEVICE

This invention relates to a ski safety device for minimizing transmission of injurious forces to a skier's legs by providing controlled excursion of a skier's foot from normal alignment with the ski upon occurrence of predetermined rotational and lifting forces. More particularly, the invention relates to a device of the character described in the form of an assemblage adapted for mounting at the foot engaging portion of a ski and comprising an elongated tread portion having means at the forward and rear ends thereof for firmly clamping a ski boot thereto, a mounting plate for securing to the ski having upwardly projecting means interfitting with coacting means centrally of said tread portion in a manner to permit rotary, tilting and lifting movements of the tread portion with respect to said mounting plate, and said tread portion and mounting plate being joined together by tensioned strands extending from points on said mounting plate radially and circumferentially spaced with respect to said upwardly projecting means, through guide means at the side of said tread portion above said mounting plate, to tensioning means longitudinally spaced from said mounting plate.

Skiing is a sport which has experienced a tremendous increase in popularity in recent years and much has been done in the way of developing improved bindings and other means for safely and effectively securing the feet to skis while at the same time attempting to safeguard the skier in the event of falls or other accidents by appropriately releasing the couplings between the feet and skis. Simple release of the feet from the skis is not enough, however, as a loose ski sliding down a slope creates a serious hazard to other skiers. Another problem arises in that various of the available bindings tend to increase the danger to the skier in that stresses developed in maneuvers to prevent an accident can frequently trigger the release mechanisms and in so doing lead to an accident which otherwise might not have occurred.

Many of the available bindings and safety devices include anchoring means on the ski extending forwardly and/or rearwardly of the feet and presenting sharp irregular contours which can increase the extent of injury incurred in a fall on the skis.

Many of the binding or anchoring means secure the feet too firmly to the skis so that bone breaking stresses can be experienced without the feet being released. While means is frequently provided for adjusting the point of release, laxity or lack of skill in making such adjustment tends to minimize the effectiveness of such adjustment as a safety factor.

As for providing means for preventing a released ski from running free on a ski slope, this is generally accomplished by means independent of the bindings per se involving additional hardware creating problems in the event of a fall on the skis.

These and various other problems have been encountered in working with rescue teams at commercial ski resorts, and the ski safety device of the present invention has been developed in the hope of overcoming many of these problems and minimizing the danger and injury that can result from others.

An object of the present invention is to provide a ski safety device which controls certain dangerous forces upon the skier by rotation of the member or tread to which the boot is attached on an axis, the center of

which is within the member, by both allowing such rotation when forces upon the device develop in excess of predetermined values, and causing a reverse rotation and return to normal position when the forces upon the device drop below predetermined values.

Another object of the invention is to provide a rotary support for the foot engaging member or tread which does not in any way interfere with disengagement of the foot engaging member or tread from the ski by forces having a vertical component, including vertical forces generated in forward, rearward or side tilting of the foot engaging member or tread, with such movement being permitted when the vertical component force exceeds a predetermined value, and being reversed, to return the foot engaging member to its original position, when such force drops below a predetermined value.

A still further object of the invention is to provide a safety device of the character described, wherein rotary and vertical excursions and return of the foot engaging member or tread responsive to applied forces is controlled by multiple strand means leading from anchorage points on the ski, through guides on the foot engaging member or tread at points transversely and radially spaced with respect to the pivot axis thereof and upwardly spaced from the ski, to adjustably tensioned spool means within said foot engaging member, said spool means accommodating sufficient length of strands to permit complete disengagement of the foot engaging member or tread from the associated ski, in the event that forces leading to a rotational and/or vertical displacement of said foot engaging member are of extended duration and/or intensity.

These and other objects of the invention will be more readily apparent from a consideration of the following description, in which preferred adaptations of the invention have been illustrated with the various parts thereof identified by suitable reference characters in each of the views, and in which:

FIG. 1 is a side view of the ski safety device shown in association with a ski boot and portion of a ski, with part of the structure broken away and in section.

FIG. 1a is an enlarged fragmentary view of a portion of the device, as shown in FIG. 1, partially broken away and in section to better illustrate the detail thereof.

FIG. 2 is a plan view of the device, as shown in FIG. 1, with part of the top surface broken away to show inner detail.

FIG. 3 is a sectional view substantially on the line 3—3 of FIG. 1.

FIG. 4 is an exploded perspective view of the two-part mounting plate shown in FIGS. 1 to 3.

FIG. 5 is a sectional view substantially on the line 5—5 of FIG. 1.

FIG. 6 is a fragmentary view, similar to FIG. 2, illustrating modified pivot and tensioning means.

FIG. 7 is a sectional view substantially on the line 7—7 of FIG. 6.

FIG. 8 is a fragmentary sectional view transversely of the device showing a modified structure for the central pivot of the assemblage and illustrating the parts during a side tilting action of the foot engaging member or tread; and

FIG. 9 is a fragmentary sectional view, similar to FIG. 8, with the parts in the normal or rest position, and showing a modified structure.

A preferred embodiment of the ski safety device in accordance with the present invention has been

shown in FIGS. 1 to 5 of the drawing as comprising a foot engaging member or tread 11 having anchor means 12 at the forward portion thereof for engaging the toe 13 of a ski boot 14 and having adjustable means 15 at the other end thereof for engaging a suitable groove 16 in the heel portion of said ski boot. The anchor means 12 and adjustable means 15 have been more or less diagrammatically illustrated, as these components form no part of the present invention and the details thereof can be extensively varied without in any way influencing the operation or effectiveness of the mechanism of the improved safety device.

The tread 11 has a generally planar upper surface which is inclined with respect to a ski 17, as clearly seen in FIG. 1, to dispose the heel end 11a thereof substantially higher than the toe end 11b. Peripherally of the tread 11 are downwardly extending flange means, generally indicated at 18 in FIGS. 1, 2, 3 and 4 at least partially enveloping components of the device located beneath the tread 11, as more fully hereinafter described. The surface of the tread 11 preferably has a grid pattern 11c fashioned from or coated with a friction reducing plastic to facilitate the removal of packed snow from the tread.

Secured centrally of the tread 11, as by means of the screws 19, is an essentially cylindrical hub 20 having, in the lower surface thereof, a tapered or generally frustoconical recess 21. The recess 21 interfits with a tapered or frustoconical projection 22 which is positioned centrally of a mounting plate assemblage 23, as by the screws 24 passing through apertures 24a in the mounting plates.

The mounting plate assemblage 23 comprises an upper mounting plate 23a and a lower mounting plate 23b having similar peripheral contours with parallel side edges 25 adapted to be spaced slightly inwardly of side edges of a ski 17 and arcuate forward and rearward edges 26 of a curvature larger than and concentric with the curvature of a hub 20. Aligned apertures 27 in the plates 23a, 23b permit firm mounting of the assemblage 23 to the ski 17, as by screws 28.

Within a casing 29 secured to the underside of the tread at the heel portion 11a thereof are spring tensioned spools 30, 31 having spirally disposed grooves receiving strand members 32, 32a and 33, 33a, respectively, which strands pass between pairs of grooved rollers 34, 34a and 35, 35a, respectively, which are located at opposed sides of the cylindrical member 20 on axes 36, 36a which are at right angles to the center line of the associated ski 17 and substantially elevated with respect to the mounting plate assemblage 23.

The strands, after passing over the rollers, follow the outer contour of the cylindrical member 20 at an inclination with respect thereto with strands 32 and 33 extending rearwardly to spaced rear anchor points 37 on said mounting plate and the strands 32a, 33a extending forwardly to spaced forward anchor points 38 on said mounting plate, as clearly shown in FIGS. 1, 1a and 2. This provides a symmetrical anchoring of the strands at a uniform radial spacing from the axis of the projection 22 and uniform circumferential spacings from the respective rollers or guide means 34, 34a and 35, 35a. It should be noted, in this connection, that the circumferential spacing between the rollers and the respective rearward and forward anchor points 37 and 38 can be larger or smaller than that shown in the drawing, provided the spacings are equal. In the illustrated adapta-

tion of the invention, however, the spacing of the anchor points 37 and 38 at approximately 45° rearwardly and forwardly of the roller or guide means is considered preferable for the intended functioning of the device as hereinafter described. It should be noted in this connection that by reason of the elevation of the guide means 34, 34a and 35, 35a the strand angle between the anchor points 37, 38 and guide means will be about 38°.

The strands can be secured to the mounting plate assemblage 23 at the anchor points 37 and 38 in any desired manner, but the detail structure of the mounting plate assemblage 23, as shown in the exploded perspective illustration of FIG. 4, provides added strength and dependability by permitting the use of single strands in which the portion uniting the divided sections 32, 32a and 33, 33a are interlocked with the mounting plate assemblage 23. To accomplish this, the upper mounting plate 23a is provided with generally Y-shaped cutouts 39 extending from mid-points 39a of the arcuate ends 26 of said mounting plate through divergent branches 39b to the locus of the anchor points 37, 38, as indicated. The mounting plate 23a is further provided centrally thereof with a substantially H-shaped cutout 40 having a crosshead 40a in alignment with portions 39a of the cutouts 39 and the legs 40b extending sufficiently to provide tongues 41 therebetween. The lower mounting plate 23b contains radially disposed cutouts 42 extending from the locus of anchor points 37, 38 to symmetrically disposed inner ends 43 which align with the leg ends 40b of the H-shaped cutout in the upper plate 23a.

When securing a continuous strand, such as the strand 32, 32a to the mounting plate assemblage with the plates separated, as shown in FIG. 4, the center of the strand is first passed up through the H-shaped cutout and looped over the tongue 41. Then the portions of the strand 32, 32a are passed into the rearward and forward Y-shaped cutouts 39, respectively, and brought to the locus of anchor points 37 and 38. It will be seen that the portions of the strands 32, 32a thereby projecting from the undersurface of the mounting plate 23a will seat within the cutouts 42 in mounting plate 23b, so that there is no obstruction to the tight clamping together of the plates in final assemblage.

While this intermeshing of the strand, such as strand 32, 32a, could sufficiently anchor the strand to the mounting plate, it is preferable to supplement this anchorage with a clamp block 44, as shown in FIG. 3, secured by suitable bolts 45 which serve to clamp the strand portions 32, 33 against the tongues 41. This clamping prevents any possible movement of the strands 32, 33 so that, when the mounting plate assemblage 23 has been secured to a ski by screws passing through the apertures 27, there has been achieved a very firm positioning of the strand members at the anchor points 37, 38.

When the slack in the strands 32, 32a and 33, 33a is taken up by adjustment of the spools 30, 31 and finally tensioned taken up by adjustment of the spool 30, 31 and finally tensioned by rotation of the hubs 46 to load the coil springs 47, it will be seen that the tread 11 and cylindrical member 20 are held firmly against the mounting plate assemblage 23 and ski 17 and positioned with respect thereto by interengagement of the projection 22 and recess 21. As properly balanced to align the tread 11 with the ski, each of the strands 32,

32a and 33, 33a will carry an equal tension of x pounds, x being adjusted to the size, weight and strength of the skier to yield for the particular skier at stresses somewhat below what are considered to be injury inducing stresses. An interesting aspect of this mounting and tensioning mechanism is that any rotary movement, such for example as a clockwise rotation of the tread with respect to the ski as shown in FIG. 2 which would inherently tend to vary the distance between the rollers or guide means 34, 34a and 35, 35a and the associated anchor points 37 and 38, will relax tension in two of the strand members and substantially double the tension in the other two strand members. Thus, for example, a stress tending to rotate the tread 11 in a clockwise direction, as shown in FIG. 2, will substantially double the tension in strands 32 and 33a. This means that any excursion of the skier's foot from a position of alignment with the ski 17 creates immediate forces tending to bring the ski back into alignment with the tread and the skier's foot.

When an excursion from a position of alignment involves a tilting movement of the type shown in FIG. 8, this will be resisted by the downward force in portions of the strands 32, 32a, 33, 33a which are angularly disposed peripherally of the cylindrical member 20, as seen in FIGS. 1, 1a and 2. This resistance to tilting can be borne equally by the two strands 32, 32a or 33, 33a, or if the stress combines a rotary or pivotal movement with the tilting movement, it can be borne by either of strands 32, 32a or either of strands 33, 33a, with a concentration force in the activated strand, depending upon in which direction a rotary or pivotal movement is combined with a tilting movement.

A third basic type of disengagement between the tread portion 11 and the ski 17, which can be independent of or combined with the other movements, is a lifting movement tending to disengage the projection 22 from the socket or recess 21. Such lifting movement is the type of movement generally encountered in falls and it is to be noted that the reserve of strand members 32, 32a, 33, 33a on the spools 30, 31 is such as to permit complete separation of the tread portion 11 from the ski 17, while at the same time limiting the distance by which they can be separated. This permits free movement and reorientation of the skier's legs and feet with respect to the skis, while at the same time preventing the skis from becoming separated from the skier and, hence, a hazard on the ski slope.

It will be apparent that the lifting type of excursions can vary from relatively small to extreme excursions utilizing the full reserve of strands on the spools 30, 31. The tension in the strands, however, is sufficient so that momentary lifting excursions, such as develop when a skier encounters difficulty but is able to maneuver out of the difficulty, can be quite extensive and still permit the treads 11 and skis 17 to regain their normal alignment as soon as the emergency has passed.

It will be appreciated that with the essentially frustoconical projection 22 and recess 21, as shown in FIG. 2 of the drawing, a lifting excursion, even of a relatively minor nature, can create a radial displacement or play between the parts which may be objectionable particularly among expert skiers, and to minimize this type of problem the projection 22 and recess 21 may be specially contoured in various ways, as shown for example in FIGS. 8 and 9. In FIG. 8, the projection 22 has been shown as having a slightly curved and tapered periph-

eral contour 22a interfitting with a curved recess contour 21a having a radius r approximately equal to the distance from such surface to the opposed edge of the tread assemblage 11. With this construction, tilting excursions of the type illustrated in FIG. 8 can occur without developing appreciable amounts of play between the projection 22 and the recess 21a.

Another variation of this structure has been shown in FIG. 9, wherein a projection 22 is provided with a very slightly tapered side 22b and interfits with a straight or cylindrically sided recess 21b. In this variation, the inclination of the wall 22b can be as great as that of a chord to the arcuate curvature 22a described in FIG. 8 and still provide no interference with tilting disengagement by the member 20.

In the movements of the tread 11 with respect to the ski 17, as above described, it is important that there be a minimum of resistance to such movement, except as controlled by the tension in the strands 32, 32a and 33, 33a. For this reason, the forward end of the tread 11b which is built up with suitable filler material 48 is provided at its lower ski engaging portion with a layer 49 of rigid plastic material having what might be referred to as lubricant or non-adhering properties with respect to the surface of the ski 17. While sheets of Teflon are ideal for this purpose, high density polyethylene and other plastic materials can also be employed.

The interrelated parts can be secured together in various ways and, merely for purpose of illustration, they have been shown as assembled by means of screws 50 extending from the tread portion 11b into the ski engaging member 49.

In alignment with the heel engaging portion 11a of the tread and bearing against the ski 11 is another plastic member 49a generally similar to the member 49. While this can be rigidly supported with respect to the tread portion 11a as previously described, it is preferable, to compensate for longitudinal flexing of the ski 17, to provide an articulating structure. One such structure has been illustrated in FIG. 1 of the drawing as involving a hinge 51 joining the member 49a to an extension 48a of the filler material 48. The opposed end of the member 49a engages spring means 52 suitably located at rear corners of the heel engaging portion 11a of the tread and coaxial tie members 53 extending between the tread portion 11a and the member 49a to restrict the separating movement thereof, as shown in FIG. 5.

The articulating structure comes into play primarily when the skier is passing over a depression, i.e., with the front and rear of the ski supported but the center unsupported, causing a downward flexure of the center of the ski. Without the articulation above described, such flexure of the ski could cause partial disengagement between the projection 22 and the recess 21, but it will be apparent that with the articulation such separation of the parts will be virtually eliminated in spite of substantial longitudinal flexing of the ski.

An alternative to the articulating structure above mentioned has been illustrated in FIGS. 6 and 7, wherein the plastic member 49a is rigidly supported with respect to the heel engaging tread portion 11a and the compensation for ski flexure is accomplished by a structure which provides movement of the projection 22. In this modification, the projection 22 comprises a frustoconical collar 54 axially slidable on a stud 55 having a restricting flange 56 at the upper end thereof and

which is secured by fastening means 57 to the mounting plate assemblage 23 and ski 17.

An annular recess 58 in the collar 54 and receiving a coil spring 59 bearing against the mounting plate assemblage 23 urges the member 22 into constant engagement with the tapered recess 21 in cylindrical member 20.

It will be apparent that this movable and spring tensioned variation of the projection 22 functions not only during longitudinal flexing of the skis but also in the tilting and lifting stresses earlier described to maintain the projection 22 and tapered recess 21 in aligning engagement during minor excursions from the normal orientation of the tread 11 with respect to the ski 17.

FIGS. 6 and 7 show a further modification wherein the separate spools 30, 31 are replaced further a single spool 60 carrying both the tension strands 32, 32a and 33, 33a. If the spool 60 is oriented to align the strands 32, 32a with the roller and guide members 34, 34a, then roller means 61, secured to the tread 11 on a vertical axis as shown, can serve to properly orient the strands 33, 33a with the roller and guide means 35, 35a.

It is important with the construction shown in FIGS. 6 and 7 to balance the tensions in the strands 32, 32a and 33, 33a. This can be accomplished by adjustable strand mounting means on the spool. Tension balancing can also be effected by providing an adjustable mount for the roller 61 which permits relocation of its axis along the general direction of the arrows 61'.

At points spaced from the roller and guide means 34, 34a and 35, 35a, but before reaching the spool 60, the separate strands 32, 32a and 33, 33a can suitably be united as single strands 32c and 33c for engagement with the spool 60, thereby simplifying the winding of practical lengths of the strand members thereon. While initial adjustment of strand tensions may be a little more intricate with this single spool adaptation, subsequent use and adjustment can be easier. Furthermore, this modification has the advantage of providing enhanced resistance to tilting movements of the type shown in FIG. 8, since the initiation of such tilting movement immediately switches to the strands at the lifting side of the tread the full power of the spring 62 within the spool 60. In all other rotary and lifting movements, the performance will be similar to that previously described with the separate spools 30, 31.

In FIGS. 6 and 7, there has been diagrammatically shown a means for applying adjustable tension to the spring 62 by rotating a hub 63 through engagement with key notches 64 to move peripheral ratchet teeth 65 with respect to a pawl 66 normally held in ratchet engagement by a spring 67.

It will be seen from the foregoing description that the novel anchoring and spring tensioning means, whereby all movements or excursions of a foot engaging tread with respect to a ski are controlled centrally of and at a unitary pivot axis with respect to the tread and mounting plates, has the distinct advantage of eliminating extraneous and dangerous hardware of the type usually associated with ski bindings. While the self-contained tensioning means which is readily adjustable to the needs of an individual skier contributes materially to this end result, the full advantage is provided by tensioned strands which, by virtue of their orientation with respect to the tread portion and mounting plates, effectively restrain lifting, tilting and twisting excursions

of the tread portion from its normally aligned position on the ski. At the same time, the spring tensioned strands can yield sufficiently so that the skier's feet can be completely disengaged from the ski, but still prevent "escape" of the skis from the skier.

It is significant to note that in emergencies involving either a forward or backward fall by the skier, the tread will tend to pivot about the forward or rear end of the member 49, 49a, both widely spaced from the strand guides 34, 34a 35, 35a and anchor points 37, 38. On the other hand, tilting movement of the tread involves a leverage controlled by the distance from one edge of the tread to the opposed guides 34, 34a or 35, 35a, while twisting movement about the axis of projection 22 involves leverage which is, in effect, twice the distance from said axis to anchor points 37, 38. It is this difference in effective leverage, coupled with the angular disposition of the strands between the guide means 34, 34a and 35, 35a and the anchor points 37, 38 which allows the disclosed strand and tensioned spool arrangement to effectively control the various excursions of the tread from its normal position of alignment with the ski.

While the proper tensioning of strands in the manner above described can support the tread portion and ski in sufficiently strong alignment so that pivotal movement of the skier's feet with respect to the skis does not occur in normal maneuvering, it will be recognized that, if the strand tensioning is somewhat below the optimum amount, such pivotal movement could develop. Typical instances of this might be when the size and strength of the skier limits the amount of tension which should be applied to the strands, or when the normal maneuvering of an expert skier can be creating forces tending to induce pivotal movement when none is desired.

To deal with this type of situation, supplemental means can be employed between the tread 11 and ski 17, and radially spaced from the pivot axis provided by the projection 22, to provide added resistance to initial pivotal movement therebetween. Illustrative of such supplemental means, there has been shown in FIG. 1 of the drawing a vertically movable projection 68 mounted in a recess 69 in the filler extension 48a and urged downwardly by spring 70 into a slot or detent 71 in the mounting plate assemblage 23. In the particular structure shown in FIGS. 1 and 3, one of the cutouts 39a in the upper mounting plate 23a, as shown in FIG. 3, can function as the detent 71.

It will be apparent, however, that the supplemental restraining means radially spaced from the axis of projection 22 can be provided in various other ways. Thus, for example, the spring actuated projection 68 might be located at the forward or rear end of the tread 11 and engage a detent in or detent plate attached to the ski 17. The spring actuated projection 68 could also be rotated 90° in the filler extension 48a to extend parallel to the ski 17 and engage a vertical slot in the hub 20. Such alternatives could be especially advantageous if ski conditions, as on rough terrains, are likely to cause excessive longitudinal flexing of the ski.

With such supplemental restraining means, the resistance to pivotal movement between the tread and ski can be pre-set by appropriate loading of the spring 70 to provide for the individual skier the support against pivotal movement which the skier desires for normal maneuvering. It will be recognized, however, that the

supplemental restraining means in no way interferes with the performance of the assemblage in permitting tilting, lifting and rotary movements or combinations thereof when emergency, such as accident, may be encountered by the skier.

The inclination of the tread portion 11 with the elevated heel engaging end housing the tensioning means is inherently advantageous, and consistent with present trends in construction of ski boots and bindings since it encourages a desirable forward lean on the part of the skier. Thus, with proper adjustment of the tensioning means to fit the needs of the individual skier, the ski safety device as herein described is considered to go beyond the provision of enhanced safety and facilitate improved control and, hence, better skiing by all skiers, regardless of their degree of training and proficiency.

Throughout the foregoing description, the novel means for limiting and correcting excursions from prealigned association between pivotally associated parts has been combined and axial displacement of components of the mechanism to at the same time limit and correct axial excursions from its position of prealigned association because both lifting and rotary excursions are peculiarly characteristic of relative movements between skis and a skier's feet. It should be noted, however, that in adapting the basic principles of the invention to uses other than as ski bindings, the pivotal excursions may be of primary importance and the axial excursions nonexistent. In such adaptations of the invention, there would be no need for the axial displacement of the roller or guide means 34, 34a, 35, 35a above the plane of the anchor points 37, 38. Indeed, greater tension in the strands 32, 32a and 33, 33a as they pass from the rollers or guide means 34, 34a and 35, 35a would develop if portions of the strands were substantially in the plane of the anchor points 37, 38.

It is considered within the scope of the present invention to modify the structure as above described and in related ways in instances where the pivotally movable parts are not subject to any relative axial movement. In such modification, however, the structure will perform in the manner earlier described with respect to instantly increasing tension in the opposed strands 32, 33a or 32a, 33 for restricting and correcting rotary excursions from the position of prealigned pivotal association of the parts.

Various changes and modifications in the ski safety device as herein disclosed may occur to those skilled in the art and, to the extent that such changes and modifications are embraced by the appended claims, it is to be understood that they constitute part of the present invention.

I claim:

1. A ski safety device for minimizing transmission of injurious forces to a skier's legs by providing controlled excursion of a skier's foot from normal alignment with a ski upon the occurrence of predetermined rotational and lifting forces, said device being an assemblage adapted for mounting at the foot engaging portion of a ski and comprising an elongated tread portion having means at the forward and rear ends thereof for firmly clamping a ski boot thereto, a mounting plate for securing to the ski having upwardly projecting means interfitting with coacting means centrally of said tread portion in a manner to permit rotary movement and lifting movement of the tread portion with respect to said mounting plate, and said tread portion and mounting

plate being joined together by tensioned strands extending from anchor points on said mounting plate radially and circumferentially spaced with respect to said upwardly projecting means through guide means at the sides of said tread portion above said mounting plate to tensioning means longitudinally spaced from said mounting plate.

2. A ski safety device as defined in claim 1, wherein said guide means are carried by a circular downwardly oriented hub within and centrally of said tread portion, said hub having in the lower surface thereof an axial recess which comprises the means coacting with the upwardly projecting means on said mounting plate, and said tensioned strands following the outer contour of said hub at each side of said assemblage to anchor points on said mounting plate equally spaced forwardly and rearwardly with respect to a diameter of said hub passing through said guide means.

3. A ski safety device as defined in claim 2, wherein said spaced anchor points on the mounting plate are approximately 45° forwardly and rearwardly of said diameter passing through said hub.

4. A ski safety device as defined in claim 2, wherein said spaced anchor points on the mounting plate are approximately 45° forwardly and rearwardly of said diameter passing through said hub, and the spacing of said guide means above said plate providing an angle of about 38° between said plate and portions of said strands between said guide means and said anchor points.

5. A ski safety device as defined in claim 2, wherein the upwardly projecting means on said mounting plate and the coacting wall of said recess are of sufficiently tapered contour to permit disengagement thereof by transverse rocking movement of said tread portion with respect to the ski on which said assemblage is mounted as well as by lifting of the forward and rear ends of said tread portion.

6. A ski safety device as defined in claim 5, wherein the tapers of said projection and recess are of essentially frustoconical contour.

7. A ski safety device as defined in claim 2, wherein anchorage of said strands to said mounting plate is facilitated by providing a composite assemblage of upper and lower plates, the upper plate having apertures at said forwardly and rearwardly spaced anchor points through which said strands may pass, and the lower plate having cutouts in alignment therewith to receive anchoring portions of said strands.

8. A ski safety device as defined in claim 7, wherein said two plate assemblage provides for anchoring a looped strand at each side of said plate by including in the upper plate cutouts at each end thereof extending to said strand positioning apertures, and a generally H-shaped aperture centrally of said upper plate with the legs extending transversely and the crossmember extending longitudinally thereof for providing inwardly extending lugs for engaging said looped strand, and the cutout means of said lower plate extending from said strand positioning apertures to the leg extremities of said H-shaped aperture for accommodating the looped strand thus engaged with the lugs of said upper plate.

9. A ski safety device as defined in claim 8, wherein adjustable means is provided centrally of said plate for clamping engaged portions of said looped strands firmly against said inwardly projecting lugs.

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10. A ski safety device as defined in claim 8, wherein spring tensioned projecting means on said tread portion outwardly of the hub thereof in alignment with at least one of the end cutouts in said upper plate provide a controlled initial resistance to rotary movement of said tread portion with respect to said mounting plate.

11. A ski safety device as defined in claim 2, wherein initial resistance to rotation of said tread portion with respect to said mounting plate is provided by at least one spring loaded projecting member on said tread portion outwardly of said hub, and co-acting detent means on said ski receiving said projecting means when said tread is properly aligned with said ski.

12. A ski safety device as defined in claim 2, wherein said guide means comprise pairs of closely spaced grooved rollers mounted on parallel axes extending transversely of said tread portion.

13. A ski safety device as defined in claim 2, wherein said tread portion is inclined to provide substantially greater height at the rear end than at the forward end thereof imparting desirable forward lean to a user of the device, and said higher rear portion housing said tensioning means at a position rearwardly spaced from said hub.

14. A ski safety device as defined in claim 13, wherein said tensioning means comprises separate spring tensioned spools, with each spool coacting with the tensioned strands at one side of said assemblage.

15. A ski safety device as defined in claim 13, wherein said tensioning means comprises a single spring tensioned spool having axially spaced grooves for separately receiving tensioned strands from opposed sides of said tread portion.

16. A ski safety device as defined in claim 13, wherein the upper boot engaging portion of said tread is of unitary rigid construction, and the ski engaging portion of said tread is of rigid construction to a point rearwardly of said mounting plate and continues as a second rigid member transversely hinged thereto, said second rigid member extending to a position of vertical alignment with the rear end of the boot engaging surface of the tread, and compression spring members being disposed at the rear corners of said tread between the boot engaging surface and said second ski engaging portion providing accommodation of the assemblage to longitudinal flexing of a ski as when negotiating uneven terrain.

17. A ski safety device as defined in claim 16, wherein the ski engaging surfaces of said first and second rigid members comprise low friction plastic material.

18. A ski safety device as defined in claim 13, wherein said tread portion includes side walls extending substantially to the level of an associated ski enveloping and protecting the strand and tensioning means within said tread portion.

19. A ski safety device as defined in claim 1, wherein at least one of said upwardly projecting means and co-acting means centrally of said tread portion is fashioned from low friction plastic material.

20. A ski safety device as defined in claim 1, wherein said upwardly projecting means and coacting means centrally of said tread portion, as well as surfaces of said tread portion which directly engage an associated ski, are fashioned from low friction plastic material.

21. A ski safety device as defined in claim 1, wherein said upwardly projecting means on said mounting plate is of generally frustoconical contour.

22. A ski safety device as defined in claim 1, wherein said upwardly projecting means on said mounting plate is of generally frustoconical contour and comprises a composite structure of an inner cylindrical part having a radially protruding flange at its upper end, a frustoconical sleeve vertically slidable on said cylindrical part to an uppermost position in engagement with said flange, and resilient means urging said sleeve in the direction of said flange, whereby said frustoconical sleeve remains in aligning engagement with said coacting means centrally of said tread portion during limited upward movement of said tread portion with respect to said mounting plate.

23. A ski safety device as defined in claim 1 wherein the upper surface of said tread has a grid pattern of depressions fashioned from or coated with friction reducing plastic, thereby facilitating easy removal of packed snow from said tread.

24. A mechanism for limmiting and correcting pivotal excursions from a position of pre-aligned association between pivotally movable members, said mechanism comprising spring tensioned strands carried by one of said parts through guide means diametrically opposed to each other and radially spaced from the axis of rotation between said parts, and said strand means dividing at said guide means and passing to anchor points on said second part equally spaced from and at opposite sides of the diameter defined by said guide means, the tension in all strands being equal when said parts are in said position of pre-aligned association, and the tension in one diametrically opposed pair of strands being relaxed, while the tension in the other diametrically opposed pair of strands is substantially doubled as one of said parts initiates a pivotal excursion from said position of pre-aligned association, thereby tending to limit said excursion and reestablish said position of pre-aligned association.

25. A mechanism as defined in claim 24 wherein the axis of rotation between said parts is defined by a circular projection on one part interfitting with a circular recess on the other part.

26. A mechanism as defined in claim 25 wherein at least one of said interfitting projection and recess is of tapered contour permitting disengagement by tilting or lifting of one of said parts with respect to said axis of rotation.

27. A mechanism as defined in claim 26 wherein said guide means on said one part are spaced axially with respect to the anchor points on said second part whereby said tensioned strand means restrains the relative tilting or lifting movement of said parts.

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