Aug. 3, 1954 R. A. WALKER 2,685,448

SKI AND BINDING THEREFOR

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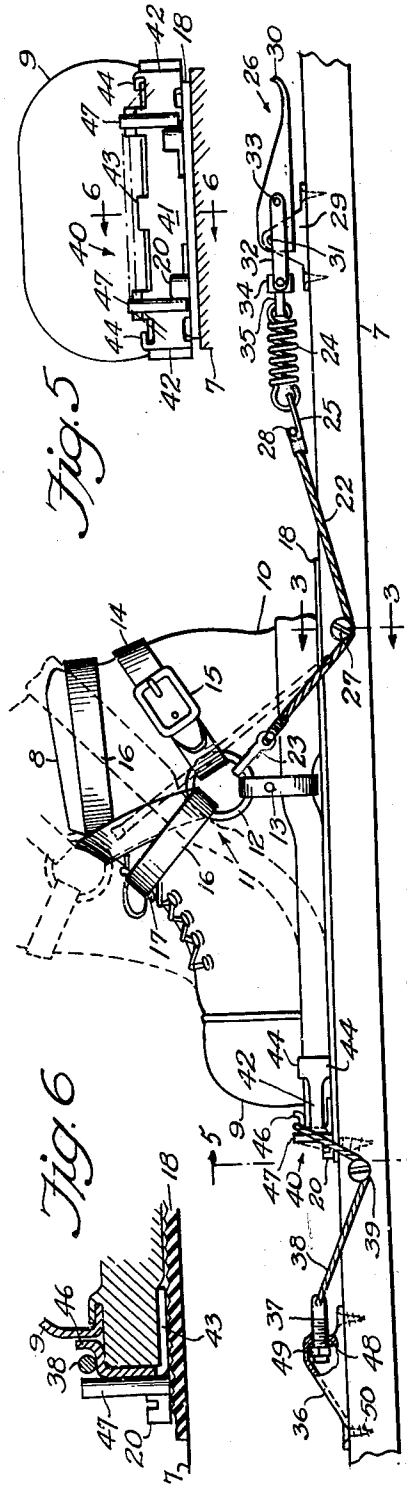


Fig. 1

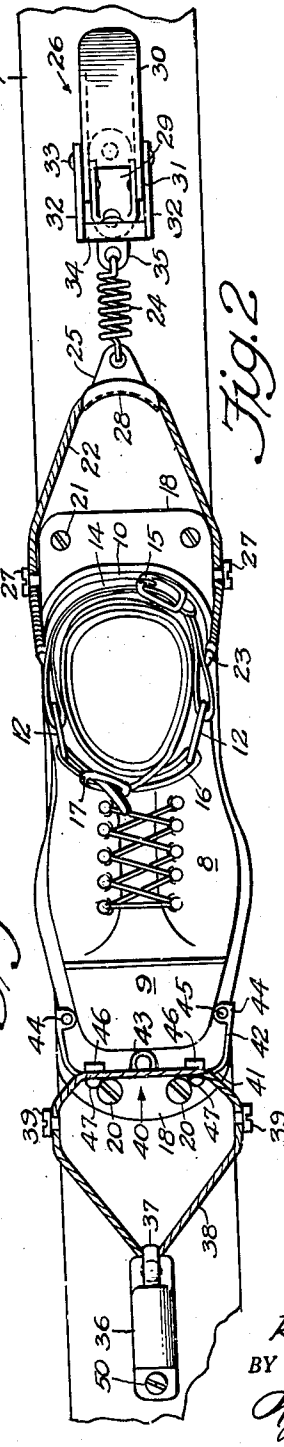


Fig. 2

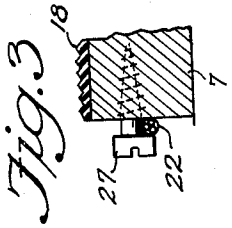


Fig. 3

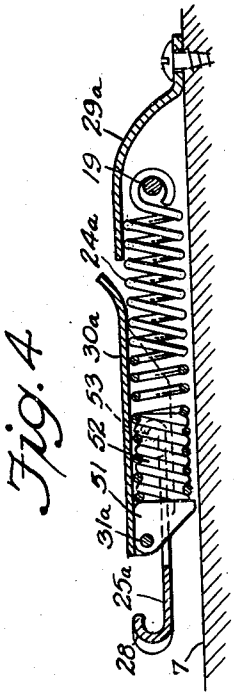


Fig. 4

Fig. 6

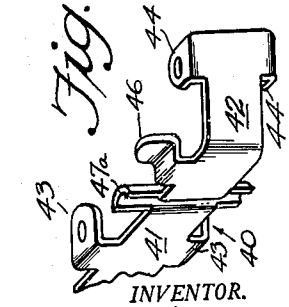


Fig. 7

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SKI AND BINDING THEREFOR

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This invention relates to mechanism for attaching ski shoes to skis, commonly known as "ski bindings." The general object of the invention is to provide a ski binding that will provide secure fastening of the shoes to the skis and at the same time allow the shoes to pivot upwardly about the balls of the feet while exerting a tension pull which will lighten the heels of the skis during various maneuvers in which it is desirable for the operator's legs to bend forwardly with reference to the skis.

In general, the invention contemplates a ski binding that provides a yielding connection between the heel and the ski, whereby the heel is normally pulled against the ski but is allowed to raise from the ski in response to forward and upward straining of the operator's foot, pivoting on the toe. Broadly, the concept of employing such a yielding connection is not new, but prior proposals along this line have not proven satisfactory for a number of reasons. A rearward and downward pull, applied to the instep in such devices, imposes a continuous strain against the foot which is extremely tiring. Furthermore, with the pull acting predominantly in a rearward direction, it offers too great a resistance to forward pivoting movement of the foot, and if the strain is relaxed sufficiently to eliminate this objection, there will not be sufficient downward pull to maintain the needed anchorage of the heel to the ski. Still more objectionable is the loss of lateral stability in the anchorage of the heel to the ski, allowing lateral yielding of the heel relative to the ski to a considerable degree. Such lateral yielding will virtually destroy the operator's control over his skis during a turn. Important objects of my invention are: to provide a ski binding that will provide for upward yielding of the heel while maintaining adequate anchorage of the heel to the ski; to maintain completely adequate lateral control at all times, both in the lowered and the raised positions of the heel; and to reduce ankle-strain to a minimum.

A further object of my invention is to provide a ski binding which will increase a skier's safety and control by allowing the heel to raise a substantial amount from the ski during a bad fall and to allow the body to rotate about the ball of the foot which is a safer and more logical joint than the ankle. A further object is to provide a ski binding which will allow the skier to use a cheaper and lighter sole ski shoe than is practical with the present compression system binding. A further object is to provide a ski

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binding which will enable the skier, by leaning forward or bending the ankle, to obtain a tension pull to the heel of the ski which will actually lighten that portion of the ski thereby inducing and increasing the tendency of the ski to turn.

Another object of the invention is to provide a ski binding having a heel anchorage which, in addition to the improved features outlined above, provides for substantially instantaneous attachment and release between the heel and the ski. The invention also provides for a take-up adjustment of the heel anchorage, without complicating the mechanism.

A further object is to provide a ski binding embodying an upwardly yieldable connection between the heel and ski, applied at both sides of the heel and incorporating means to fully equalize the pull between the two sides.

A further object of the invention is to provide a ski binding having an improved toe anchorage which provides for instantaneous attachment and release between the toe of the shoe and the ski, and which at the same time will maintain an absolutely tight connection having no looseness either vertically or laterally. The invention, in this respect, further provides for adjustment of the tightness of the toe connection. Another object is to provide a toe anchorage which operates in tension to maintain a firm connection between the toe and the ski while allowing quick attachment and release.

Other objects will become apparent in the ensuing specifications and appended drawings in which:

Fig. 1 is a side view of a portion of a ski and ski shoe assembly embodying the invention;

Fig. 2 is a plan view of the same;

Fig. 3 is a detail sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a longitudinal sectional view of a modified form of the heel tie anchor;

Fig. 5 is a transverse sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 5; and

Fig. 7 is a perspective view of a portion of a modified form of the toe anchorage.

As an example of one form in which the invention may be embodied, I have shown in the drawings a ski binding arrangement for a ski 7 and a ski shoe 8 having a toe 9 and a heel 10. The binding includes a halter 11 embodying a pair of rings 12, one on each side of the shoe, a tie 13 attached at each end to a respective ring 12 and extending beneath the instep of the shoe,

a heel strap 14 attached to one of the rings 12, adapted to be passed around the heel, through the other ring 12 and thence back around the heel, a buckle 15 to secure the two ends of the heel strap 14 together, an ankle strap 16 having one end secured to one of the rings 12 and adapted to be passed over the instep and wrapped around the ankle, and a buckle 17 for securing the ends of the ankle strap together.

To the upper surface of the ski is attached a sole plate 18 which, at the toe, has a pair of laterally spaced abutment studs 20 projecting upwardly therefrom. The studs 20 may take the form of wood screws passed through the sole plate 18 and anchored in the ski, thus securing the toe portion of the plate to the ski. The heel portion of the plate will be secured by wood screws 21.

The yielding heel connection comprises a cable 22 the ends of which are provided with snap fasteners 23 for releasably attaching them to the respective rings 12, a yielding tension element such as the coil spring 24, an equalizer yoke 25 connecting the central part of the cable 22 to one end of the spring 24, and a quick-release anchor 26 to which the other end of the spring 24 is attached. Intermediate portions of the cable 22 are caught beneath hooks 27 attached to the respective edges of the ski, whereby the pull of the cable ends against the harness 11 is in a downwardly and rearwardly inclined direction, and the pull of the rear portion of the cable is exerted upwardly against the ski. Preferably the hooks 27 are arranged so as to direct the pull predominately in a downward direction. The hooks 27 may take the simple form of screws having heads spaced from the adjacent edges of the ski so as to provide spaces to receive the cable 22. The equalizer yoke 25 has at one end an opening to receive the end of the spring 24 and at its other end a bearng flange 28, channel shaped in section and arcuate from end to end, in which the bight of the cable 22 is received. The flange 28 provides a smooth, polished inner surface against which the cable 22 may freely slide so as to equalize tension between its ends.

The anchor 26 is of an over-center type comprising a bracket 29 attached to the ski and having two spaced, upstanding ears, a toggle lever 30 pivoted at 31 at one end between the ears of the bracket 29, a pair of links 32 each pivoted at 33 at one end to an intermediate portion of the lever 30, and a cross bar 34 pivoted at its ends to the other ends of the links 31 and having attached to its center an apertured coupling element 35 into which the end of the spring 24 opposite the yoke 25, is hooked.

The toe connection comprises a bracket 36 secured to the ski, a screw shaft 37 one end of which is threaded into the bracket 36, a cable 38 in loop form attached to the other end of the screw shaft 37, a pair of hooks 39 attached to the ski, around which respective portions of the cable 38 are caught, and a toe fitting 40 attached to the toe of the shoe and adapted to securely engage the bight of the cable 38 remote from screw shaft 37. The toe fitting 40 comprises a yoke 41, preferably of sheet metal stamping, having an intermediate portion which fits the forward end of the toe portion of the shoe sole, a pair of side arms 42 fitting the side edges of the toe portion of the sole, apertured ears 43 and 44 which embrace the forward and lateral portions respectively of the toe of the sole, and are adapted to be secured thereto by nails or screws 45. The yoke 41 also includes a pair of hooks 46 disposed one on either side of the upper ear 43, and a pair of vertical claws 47 having projecting upper ends which are spaced from hooks 46 to define notches for receiving the bight of cable 38. The lower ends of claws 47 straddle the two abutment studs 20 and are drawn into snug engagement therewith by the pull of cable 38. The claws 47 engage the curved sides of studs 20 at points where the lateral surfaces of studs 20 slant rearwardly and inwardly. Consequently, there is a camming, self-centering action which accurately locates the toe of the shoe relative to the sole plate 18 and tightly wedges the toe against any possible lateral looseness.

The claws 47 may be welded to the web portion of the yoke 41, or, alternatively, may be formed integrally with the yoke 41 at points offset from the hooks 46, as indicated in Fig. 7. In this case, the claws would be embossed to a channel shape as indicated in Fig. 7 at 47*a*. Aside from this modificatiton, Fig. 7 discloses a yoke 41*a* having all of the features of the yoke 41.

Screw shaft 37 extends through an opening in a vertical wall 48 of bracket 36, and is secured by a nut 49 threaded on its inner end, within the bracket 36. Bracket 36 is secured to ski 7 by wood screws 50 passing through ears at its respective ends and embedded in the ski. Nut 49 is embraced by the side walls of bracket 36 and thereby held against rotation, whereby adjustment of screw shaft 37 is effected by rotating the same. This of course must be done when the cable 38 is released from the shoe and the hooks 39.

In the modification of the heel anchor, shown in Fig. 4, spring 24*a* has its rear end received beneath an inverted channel shaped bracket 29*a*, and is attached thereto by a pin 19. An over-center lever 30*a* has its forward end pivoted, at 31*a*, to the head 51 of a screw stud 52 which is threaded into the forward end of spring 24*a*. Equalizer yoke 25*a* is bifurcated, its respective arms being pivoted at 53 to the respective sides of lever 30*a*. When lever 30*a* rests against spring 24*a*, pivots 53 are below pivot 31*a*. Thus the lever is locked.

The operation of the ski binding is as follows: Normally the heel 10 is held tightly against the sole plate 18 by the downward pull of cables 22 against halter rings 12. The heel is held snugly against lateral movement relative to the ski. The pull of the cable is distributed from rings 12 to the heel and the instep of the shoe by straps 14 and 16 respectitvely. The cables 22 are placed under tension by stretching of spring 24. The spring is stretched when lever 30 is moved from a released position (in which it extends upwardly and forwardly from pivot 31) to the securing position shown in full lines in the drawings, in which pivots 33 are drawn to points rearwardly of pivots 31, and the line of pull between pivots 33 and hooks 27 is disposed below pivots 31 so that the lever 30 is locked overcenter against movement to the released position under the pull of spring 24.

The toe of the shoe is secured in snug engagement with studs 20 by tension in cable 38 which is established in the act of applying the shoe to the ski, as follows: The heel of the shoe is tilted upwardly (e. g., to a position such as that indicated in dotted lines in Fig. 1), and with the shoe in this tilted position, the projecting upper ends of claws 47 are hooked into the bight of cable 38. The heel of the shoe is then thrust down-

wardly, the lower ends of claws **47** coming into contact with studs **20** and fulcruming thereagainst as the heel of the shoe is moved into its final position in contact with sole plate **18**. During this fulcruming movement, the shoe acts as a lever to force the upper ends of claws **47** rearwardly, thereby establishing tension in the cables **38**. The amount of tension thus established is regulated by the previous adjustment of screw **37**. It will now be apparent that with this arrangement it is possible to secure any desired amount of tension to hold the toe of the shoe tightly against abutment studs **20**, resisting any rearward movement of the shoe under the pull of cables **22**, and resisting any lateral looseness of the toe with reference to the ski, the latter function deriving from the camming engagement of claws **47** against the inclined sides of studs **20**. The bight of cable **38** extends upwardly at a rearward inclination which is of the proper amount to establish the desired forward pull of the toe against abutment studs **20**. At the same time, the bight of the cable exerts a downward pull to securely hold the toe against the sole plate **18**. The hooks **39** are so placed with reference to studs **20** that the upward inclination of the cable bight is greater than 45 degrees with reference to the horizontal plane of the ski, so that the vertical component of tension in the cable bight is greater than its horizontal component, i. e., the downward pull is greater than the forward pull. Vertical strains acting between a ski and a ski shoe are normally greater than longitudinal forces between the two, and consequently the invention provides for a greater resistance to the relative vertical strains than to relative longitudinal forces. The longitudinal component of the tension in cable **38** is, however, adequate to resist the rearward pull of cables **22** against the shoe.

The angle of inclination of the portions of cable **22** between hooks **27** and rings **12** with reference to the horizontal plane of the ski is preferably slightly greater than a 45 degree angle, so that the pull of cables **22** against the heel of the shoe is predominantly downwardly. Since the pull is distributed to both the heel and the instep of the shoe, the rearward pull against the instep is not sufficiently high to be objectionable as it is in the prior art discussed above.

When the skier bends his knees or leans forwardly, the upward pull of the heels against cable **22** will overcome the tension in spring **24** and the heels will raise from the skis, the shoes bending at the balls of the feet. If, during such forward leaning, the entire shoe should pivot about the points of fulcruming engagement between claws **47** and studs **20** at the toes of the shoes, the bight of cable **38** will swing about the axis of hooks **39**, and the tension therein will relax to some extent, but this relaxing of tension cannot result in releasing the toe connection, since the rearward pull of cable **22** will prevent the tension dropping below that existing in cable **22**. Even though the claws **47** may disengage slightly from abutment studs **20**, their lower ends will be held in tight bearing engagement with sole plate by the downward component of pull of cable **38** energized by the weight of skier's body, and maintained by the rearward pull of cable **22** when the heels are raised. Thus the opposing tension in cables **38** and **22** acting downwardly and away from each other will function at all times, in all positions of action of the shoe relative to the ski, to maintain adequate anchoring of the shoe to the ski while allowing free upward pivotal movement of the shoe around the toe thereof.

The fulcrum hooks **27** direct the forces in cable **22** so as to increase the downward pull, and decrease the rearward pull against the skier's ankle. The increased downward pull is not objectionable, since it is transmitted directly through the heel to the ski. The decrease in rearward pull relieves a tiring load on the ankle.

Expert skiers who have utilized my improved ski bindings have found that they can derive therefrom a greatly increased freedom of movement of the legs with reference to the skis without sacrificing control. It is a great advantage to be able to pivot the toes with reference to the ski rather than to have to bend the ankles in order to accommodate forward bending of the forelegs. It eliminates to a great extent the tiring effect of ankle bending. It actually increases control because it maintains the feet and forelegs in a more natural relation to each other at all times.

I claim:

1. In a ski binding, in combination with a ski and a ski shoe therefor; an abutment attached to the ski, for engagement by the toe of the shoe; a toe anchorage acting in tension between the toe of the shoe and the ski for drawing the toe against said abutment and downwardly against the ski, said toe anchorage comprising a yoke attachable to the toe of the shoe, said yoke having a pair of laterally spaced upwardly projecting claws, a cable in loop form having a bight to receive said claws, means to anchor an opposed portion of said cable to the ski, and a pair of hooks attached to respective sides of the ski, under which lateral portions of said cable may be caught; said hooks being disposed below and forwardly of said abutment means and said claws projecting above said abutment means, whereby the upward pivoting of the shoe will be attended by forward shifting of said claws to loosen said cable whereas downward pivoting of the shoe will, conversely, tighten the cable; and a heel anchorage acting in tension between the ski and the heel of the shoe, for drawing the heel downwardly against the ski and exerting a rearward pull against the shoe in opposition to the forward pull of said first mentioned tension means; said heel anchorage comprising a halter attachable to the shoe and including a pair of connector rings adapted to be disposed at the respective sides of the shoe adjacent the ankle axis thereof, a pair of hooks secured to the respective sides of the ski below the rear extremity of the shoe heel, a cable having respective side portions secured at their forward ends to the respective connector rings, adapted to extend downwardly and rearwardly therefrom at angles of approximately 45° and thence beneath said hooks, and thence rearwardly from said hooks, a stretchable tension element secured to the rear extremity of said cable, a bracket secured to the ski rearwardly of the heel and hooks, and releasable coupling means connecting the rear end of said tension element to said bracket, said coupling means being operable from a position placing said stretchable element under tension to a position releasing the tension therein, and vice versa.

2. In a ski binding in combination with a ski and a ski shoe therefor; an abutment attached to the ski, for engagement by the toe of the shoe; a toe anchorage acting in tension between the toe of the shoe and the ski for drawing the toe

against said abutment and downwardly against the ski, said toe anchorage comprising a yoke attachable to the toe of the shoe, said yoke having a pair of laterally spaced upwardly projecting claws, a cable in loop form having a bight to receive said claws, and a pair of hooks attached to the respective sides of the ski, under which lateral portions of said cable may be caught, and means to anchor an opposed portion of said cable to the ski, said anchoring means comprising a bracket attached to the upper surface of the ski and having an upright portion facing the said abutment means, and an adjusting screw adjustably anchored in said upright portion and connected to said cable; and a heel anchorage acting in tension between the ski and the heel of the shoe, for drawing the heel downwardly against the ski, said heel anchorage comprising a halter attachable to the shoe and including a pair of connector rings adapted to be disposed at the respective sides of the shoe adjacent the ankle axis thereof, a pair of hooks secured to the respective sides of the ski below the rear extremity of the shoe heel, a cable having respective side portions secured at their forward ends to the respective connector rings, adapted

to extend downwardly and rearwardly therefrom at angles of approximately 45° and thence beneath said hooks, and thence rearwardly from said hooks, a stretchable tension element secured to the rear extremity of said cable, a bracket secured to the ski rearwardly of the heel and hooks, and releasable coupling means connecting the rear end of said tension element to said bracket, said coupling means being operable from a position placing said stretchable element under tension to a position releasing the tension therein, and vice versa.

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