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[54] **SKI BINDING TESTER**

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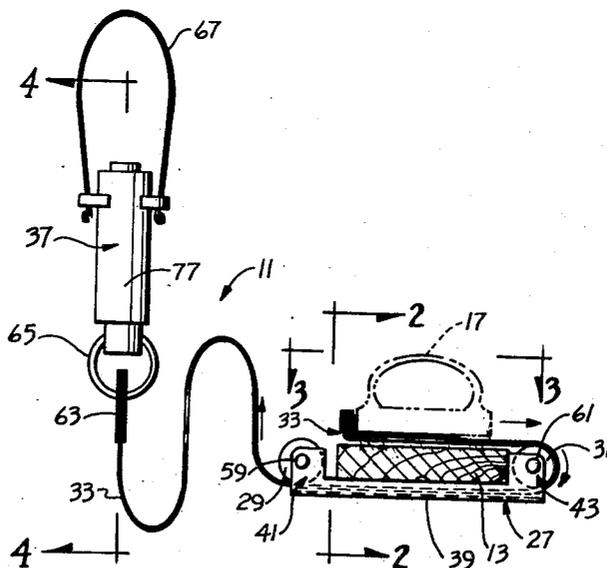
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[57] **ABSTRACT**

A ski binding tester for determining the force required to actuate a ski binding to permit separation of a ski and a ski boot. The ski binding tester includes a generally flexible, elongated, tension element drivingly connected to the ski boot and a scale attached to the tension element for measuring the maximum value of the pulling force applied through the tension element to the ski boot.

14 Claims, 5 Drawing Figures



SKI BINDING TESTER

BACKGROUND OF THE INVENTION

Mechanisms utilized to attach a ski boot to a ski are known as ski bindings. A ski binding of the safety type releasably connects the ski boot to the ski with the binding being releasable in response to the application of a predetermined separating force between the boot and the ski. Generally a ski binding of this type incorporates features which permit the skier to vary or select the force at which the binding will release the ski boot.

The load at which release occurs is conventionally selected on the basis of the skier's physical characteristics, expertise, age, etc. Predictable binding release depends, among other things, on the condition and lubrication of the release mechanism and the friction between the boot sole and the ski surface. Reliable lateral release, in particular, is sensitive to these factors and either of these, if altered, can significantly effect the actual force at which the binding will release.

Serious skiing accidents can result when a ski binding does not release at the proper load. Accordingly, it behooves the skier to periodically check the release point of the ski binding, and this function is normally performed by a ski binding tester.

Prior art ski binding testers are subject to several serious disadvantages. At least some prior art testers require that the test be carried out with the boot on the ski but with the skier out of the boot. Under these conditions, the force of friction between the boot and the ski is virtually negligible, and the release point is set accordingly. However, while skiing the weight of the skier causes the force of friction between the boot sole and the ski to be substantial thereby significantly altering the effective relative force between the boot and the ski which will be effective to cause the release of the ski binding.

While skiing, mud, ice and other material may accumulate on the binding or elsewhere thereby tending to require a new setting of the binding while the skier is on the slope. However, prior art ski binding testers are heavy, bulky and not sufficiently portable to be carried with the skier. In addition, these prior art devices cannot be conveniently operated by the skier himself in a standing position.

SUMMARY OF THE INVENTION

The present invention provides a ski binding tester which can be easily operated with the weight of the skier on the boot so that the force of friction between the ski boot and the ski is the same as during skiing. Accordingly, the release point of the binding can be set to account for this frictional force. Moreover, the ski binding tester of this invention can be easily operated by the skier himself in a standing position without assistance. Also of importance is the fact that the ski binding tester of this invention is a light-weight readily portable, pocket-sized unit which can easily be carried with the skier to thereby permit testing of the ski binding on the slopes.

One structural feature of the present invention which contributes to at least some of the advantages obtainable is the use of a generally flexible tension element to apply a pulling force for testing the release point of a ski binding. As the tension element is flexible, at least a portion of it may extend upwardly to allow the skier to apply the pulling or testing force while standing on the skis in an upright position. Thus, no assistance from others is required to conduct the test. The flexible tension element can also be used to advantage because it is of much lighter weight than a rigid, rod-like force applying member, and it can be folded compactly for storage and transport of the ski binding tester.

In order for the tension element to apply a testing force, it must be drivingly connected to either the boot or the ski, and it is preferably drivingly connected to the boot. This can be easily accomplished by attaching one end of the tension element to a relatively rigid member having an upright leg for engaging one side of the ski boot and a generally horizontal leg adapted to lie between the ski boot and the ski.

For testing the toe binding, it is normally necessary to apply a generally laterally directed force to the ski boot. Accordingly, the present invention provides means for converting the generally vertical pulling force applied by the skier to the tension element to a generally laterally directed force on the ski boot. This can advantageously be accomplished by one or more rollers or other low friction surfaces which cause the tension element to apply a lateral force to the ski boot.

According to a preferred practice of the present invention, a body member is utilized for mounting the rollers. The body member preferably provides a recess for receiving the ski to thereby prevent the ski from moving sideways a substantial distance relative to the body member. The body member preferably has upright sections at the opposite ends thereof with each such sections mounting a roller. The tension element preferably extends over both rollers and beneath the ski with the body member having means thereon to hold the ski above the tension element to prevent the ski from arresting movement of the tension element.

A scale is provided to measure the force applied to the ski binding. As it is difficult or impossible to read the instantaneous value of the force applied at the instant release occurs, it is preferred to utilize a scale which has a memory for indicating the force applied when release occurred, which force corresponds to the maximum force applied. Preferably, the scale is attached to the flexible member so that the force applied to the tension element is also applied to the scale.

Although various forms of scales may be utilized, it is preferred to utilize a scale having an indicator which maintains a substantially zero reading when the testing force is being progressively increased and which is responsive to discontinuing the pulling force to cause the indicator to indicate the maximum value of the pulling force. This desirable result can be accomplished by utilizing a scale having a spring, the amount of compression of which is proportional to the testing force. The spring is compressed between first and second members when the pulling force is applied, and the indicator is drivingly connected to one of these members by unidirectional drive means which imparts no movement to the indicator when the spring is being compressed, i.e., when the pulling force is being applied. However, when the binding releases and the pulling force is discontinued, the spring expands to its original condition, and the unidirectional drive means is operative to move the indicator a distance proportional to the increase in length of the spring as a result of such expansion. Accordingly, the indicator indicates the force applied to the ski binding at the instant release occurred.

Another advantage of this scale is that it can be constructed in relatively small sizes. Preferably, the length of the scale is approximately the width of the ski. With this size relationship, the scale can fit between the rollers of the body member for maximum compactness in a stowed position.

The invention, both as to its organization and method of operation together with further features and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying illustrative drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front elevational view partially in section of a ski binding tester constructed in accordance with the teachings of this invention and with the tester being arranged to apply a force to a ski boot.

FIG. 2 is a fragmentary sectional view taken generally along line 2—2 of FIG. 1.

FIG. 3 is a fragmentary plan view taken generally along line 3—3 of FIG. 1.

FIG. 4 is an enlarged sectional view taken generally along line 4—4 of FIG. 1.

FIG. 5 is a front elevational view of the ski binding tester in a stowed position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing and in particular to FIG. 1 thereof, reference numeral 11 designates a ski binding tester constructed in accordance with the teachings of this invention. The ski binding tester 11 is illustrated as being used with a ski 13 having a toe binding 15 (FIG. 2) and with a ski boot 17 being mounted on the ski 13 by the toe binding and a heel binding (not shown). The ski 13 also has a sole pad 19 (FIG. 2) suitably mounted thereon as by a plurality of screws (not shown). As shown in FIG. 2, the sole pad 19 lies beneath the ski boot 17 in a conventional manner.

The toe binding 15 and the heel binding (not shown) may be of any suitably conventional design. The toe binding 15 includes a plate 21 adapted to overhang the forward portion of the sole 23 to thereby retain the toe of the ski boot 17 in position. The toe binding 15 also includes an adjustment member 25 for adjusting the release point, i.e., the force required to separate the ski boot from the toe binding 15.

The ski binding tester 11 generally includes a body member 27, rollers 29 and 31 rotatably mounted on the body member, an elongated, flexible, tension element 33, a rigid member 35 and a scale 37. The body member 27 is preferably a relatively rigid member and may be constructed, for example, of a single piece of sheet metal. Generally the body member 27 includes a base 39 adapted to underlie and support the ski 13 and upright sections 41 and 43 extending upwardly from the base 39 at the opposite ends thereof as shown in FIG. 1. The base 39 and the upright sections 41 and 43 define a generally rectangular cavity for receiving the ski 13.

More particularly with reference to FIG. 2, the base 39 includes a web 45 and a pair of parallel spaced upstanding flanges 47 and 49. The flanges 47 and 49 support the ski 13 above the web 45.

With reference to FIG. 3, the upright section 41 includes upright flanges 51 and 53 and the upright section 43 includes upstanding flanges 55 and 57. The flanges 51 and 55 constitute enlarged end portions of the flange 47 and the flanges 53 and 57 similarly constitute enlarged end portions of the flange 49. As shown in FIG. 3, the flanges 51, 53, 55 and 57 retain the ski 13 against substantial lateral movement relative to the body member 27.

The roller 29 is rotatably mounted on a pin 59 (FIG. 1) which extends between the flanges 51 and 53 and which is affixed thereto. Similarly, the roller 31 is mounted on a pin 61 which extends between the flanges 55 and 57 and which is affixed thereto. As shown in FIG. 1, the uppermost portions of the rollers 59 and 61 lie above the upper surface of the ski 13. The diameters of the rollers 29 and 31 are insufficient to permit them to contact the edges of the ski 13 as shown in FIG. 1.

The tension element 33 can be constructed of any relatively strong flexible material such as a fabric type of webbing. The tension element 33 is preferably elongated to permit the skier to apply a force thereto while in the standing position. A relatively rigid reinforcement 63, which may be in the form of a pair of metal plates on opposite sides of the tension element 33, is suitably attached as by rivets 64 (FIG. 4) to the outer end of the tension element 33. The reinforcement 63 has an aperture therethrough to permit attachment thereof to a ring 65 which in turn is attached to the scale 37. A suitable handle 67 is attached to the scale 37 to permit the skier to apply a force through the scale 37 to the tension element 33. In the embodiment illustrated, the handle 67 is in the form of a length of flexible webbing suitably affixed to the scale 37.

The inner end of the tension element 33 can be drivingly connected to the ski boot 17 by the rigid member 35. The rigid member 35 has an upright leg 69 and a horizontal leg 71. The upright leg 69 is suitably affixed, as by rivets (not shown) to the inner end of the tension element 33 and engages one side of the ski boot 17. The horizontal leg 71 extends between the ski boot 17 and the ski 13. If desired suitable metal reinforcement may be provided to prevent tearing of the tension

member 33 at the location where it is attached to the upright leg 69.

As shown in FIG. 1, the rigid member 35 engages the left side of the ski boot 17. The tension element 33 extends from the rigid member 35 to the right as viewed in FIG. 1 partially around the roller 31, through the channel-shaped base 39 (FIG. 2), and partially around the roller 29. The height of the flanges 47 and 49 (FIG. 2) is sufficient to prevent the ski 13 from clamping the tension element 33 against the web 45. After leaving the roller 29, the tension element 33 may extend in any direction desired depending upon the manner in which the ski binding tester 11 is to be operated. If it is to be operated by the skier, it would undoubtedly be pulled vertically generally above the roller 29 by the skier. On the other hand if the ski binding tester 11 is to be operated by an assistant, it may extend from the roller 27 in any direction which is convenient for such assistant.

Although the scale 37 may take different forms, in the embodiment illustrated it includes a housing 73 and a sleeve 75 coaxially mounted for relative axial movement. The housing 73 in the embodiment illustrated includes a sleeve 77, the upper end of which is substantially closed by an apertured end cap 79. The sleeve 77 has a circumferential flange 81 projecting radially inwardly and supporting a reinforcing washer 83.

The sleeve 75 has a peripheral flange 85 at the upper end thereof and aligned apertures 87 (only one being shown in FIG. 4) for receiving the ring 65 to thereby attach the tension element 33 to the sleeve 75.

A coil spring 88 acts between the washer 83 and the flange 85 to thereby urge the sleeve 75 and the housing 73 in opposite axial directions. In the position shown in FIG. 4, the sleeve 75 is in its innermost position within the housing 73 as the flange 85 is "bottomed out" against the inner face of the end cap 79.

An indicator 89 having suitable indicia 91 thereon projects through the apertured end cap 79 into the sleeve 75. The indicator 89 includes a head 93 of sufficient area so that it will not pass through the aperture in the end cap 79 and a shank 95 which has the indicia 91 thereon and which projects into the sleeve 79. The inner end of the shank 95 has a pair of lands 97 and 99 defining an annular groove 101 therebetween. A friction drive member which may be in the form of a rubber O-ring 103 is mounted within the groove 101 and frictionally engages the inner surface of the sleeve 75. The force of friction between the O-ring 103 and the sleeve 75 should be sufficient to cause the indicator 89 to move with the sleeve 75 in the upward direction as viewed in FIG. 4.

The handle 67 is attached to the housing 73. In the embodiment illustrated, the ends of the handle 67 are suitably attached to eyes 105 on the sleeve 77 (FIG. 1).

To use the ski binding tester 11, the ski 13 is positioned on the base 39 intermediate the upright sections 41 and 43 as shown in FIG. 1. The rigid member 35 is positioned with the upright leg 69 engaging one side of the ski boot. The horizontal leg 71 lies between the ski boot 17 and the ski 13. With the toe portion of the ski boot 17 elevated slightly above the ski 13 by the sole pad 19, there is sufficient clearance between the ski boot 17 and the ski 13 to accommodate the horizontal leg 71 and the tension element 33 without these elements being clampingly restrained by the ski and the ski boot. The tension element 33 extends about 180° around the roller 31, through the channel-shaped base 39 (FIG. 2) and partially around the roller 29.

The user then grasps the handle 67 and applies a progressively increasing pulling force thereto which is transmitted to the ski boot 17 through the scale 37 and the tension element 33. As the pulling force is applied, the housing 73 is urged in one direction and the sleeve 75 is urged in the opposite axial direction thereby compressing the spring 88 between the washer 83 and the flange 85. Because of the force of friction between the O-ring 103 and the sleeve 75, the indicator 89 is urged downwardly with the sleeve 75 (as viewed in FIG. 4); however, such movement is prevented by the head 93 of the

indicator 89 which bears against the end cap 79. Accordingly, the indicator 89 reflects a zero reading during the application of the pulling or testing force.

The pulling force is applied to the ski boot 17 as a lateral force by the upright leg 69 of the rigid element 35. Ultimately, the lateral force becomes sufficient to actuate or release the toe binding 15 to cause separation of the toe of the ski boot 17 from the ski 13. At this instant, the pulling force is reduced to zero whereupon the spring 88 expands to return the sleeve 75 to its innermost position within the housing 73 in which the flange 85 abuts against the inner face of the end cap 79. During such return movement of the sleeve 79, the force of friction between the O-ring 103 and the inner surface of the sleeve 75 is sufficient to cause the indicator to move with the sleeve 75 to thereby expose a length of the indicator above the outer surface of the end cap 79 with such length being a function of the amount of spring compression. Of course, the amount of spring compression is proportional to the pulling force applied through the scale 37. Accordingly, by appropriately locating the indicia 91, the marking appearing at the outer end surface of the end cap 79 will represent the maximum force applied by the ski binding tester 11 to the ski boot 17 and hence the release point of the toe binding 15.

The overall length of the scale 37 is preferably selected so that it will fit between the upright sections 41 and 43 as shown in FIG. 5. In the stowed position, the rigid member 35 may be positioned adjacent the base 39 and against the roller 29 with the scale 37 overlying the horizontal leg 71 of the rigid member 35. The tension element 33 and the flexible handle 67 can be folded or wound around the rigid parts of the apparatus in any desired manner and the entire unit may be positioned, if desired, in a small storage case 107.

It should be understood that the ski binding tester 11 is usable with many different kinds of skis, ski bindings and ski boots and is not necessarily limited to the particular configurations shown or described. Furthermore, use of the words "upper" and "lower" with reference to the scale 37 have been used only to correspond to the particular orientation of the scale shown in FIG. 4. Obviously, the scale 37 can be used in any desired spatial orientation.

Although an exemplary embodiment of the invention has been shown and described, many changes, modifications and substitutions may be made by one having ordinary skill in the art without necessarily departing from the spirit and scope of this invention.

We claim:

1. A ski binding tester for determining the force required to cause a ski binding to release to permit separation of the ski and the ski boot, said ski binding tester comprising:

a generally flexible, elongated tension element;
first means for releasably drivingly connecting the tension element to the ski boot, at least a first portion of said tension element being extendible upwardly to permit the skier to apply a generally vertical pulling force to the tension element;

second means engageable with said tension element for converting the general vertical pulling force applied by the user to the tension element to a generally lateral pulling force on the ski boot; and

scale means drivingly connected to the tension element for measuring at least one of the pulling forces.

2. A ski binding tester as defined in claim 1 including a body member having a base adapted to underlie the ski and an upwardly extending section, said second means being mounted on said upwardly extending section.

3. A ski binding tester as defined in claim 1 including a body member, said second means including a roller mounted on said body member, said tension element extending over at least a region of said roller, a second portion of said tension element between said roller and said boot extending generally laterally of the roller.

4. A ski binding tester as defined in claim 1 including a body member including means cooperable with the ski for prevent-

ing substantial relative movement between the ski and said body member in the direction of the generally lateral pulling force, said second means including a curved surface on said body member.

5. A ski binding tester as defined in claim 1 wherein said first means includes a rigid angle member having an upright leg for engaging one side of the ski boot and a generally horizontal leg adapted to lie between the ski boot and the ski.

6. A ski binding tester as defined in claim 1 wherein said second means includes means for converting the vertical pulling force to a horizontal pulling force in a first direction and means for converting the horizontal pulling force in said first direction to a horizontal pulling force in a second direction which is generally opposite to said first direction.

7. A ski binding tester for determining the force required to release a ski binding to permit separation of a ski and a ski boot, said ski binding tester comprising:

a body member including a base and first and second upright sections spaced apart along the base sufficiently to permit the ski to be positioned on the base between the upright sections, said base having a passage extending therethrough in alignment with said upright sections; first and second members on the first and second upright sections, respectively;

a generally flexible, elongated, tension element;

first means for releasably drivingly connecting the tension element to one side of the ski boot;

said tension element being extendible from said one side of the ski boot between the ski and the ski boot toward said second upright section, said tension element extending about 180° around the second member and through said passage of said base and at least partially around the first member to thereby provide an exposed portion of the tension element; and

scale means connected to said exposed portion of the tension element for measuring the force applied therethrough to said ski boot.

8. A ski binding tester as defined in claim 7 wherein said passage of said base is partially defined by a pair of spaced upright flanges, said ski being positionable on said flanges.

9. A ski binding tester as defined in claim 8 wherein each of said upright sections includes a pair of brackets and said first and second members include first and second rollers, respectively, rotatably mounted on their respective pair of brackets, said first means including a rigid element having an upright portion engageable with said one side of the ski boot and a generally horizontal portion adapted to lie between the ski boot and the ski.

10. A ski binding tester as defined in claim 10 wherein said second upright section includes a pair of upright brackets and said second member includes a roller rotatably mounted on said brackets.

11. A ski binding tester as defined in claim 10 wherein said scale means is sized to fit between said first and second members to thereby facilitate storage of the ski binding tester.

12. A ski binding tester for determining the force required to release a ski binding to permit separation of a ski and ski boot, said ski binding tester comprising:

a generally flexible, elongated, tension element;

means attached to said tension element for drivingly connecting the tension element to the ski boot to permit a user to apply a progressively increasing pulling force to the ski boot through the tension element;

scale means attached to said tension element for measuring said pulling force, said scale means including memory means for indicating the maximum value of said pulling force; and

said scale means including an indicator, means for causing said indicator to provide a substantially zero reading when the pulling force is being progressively increased, said memory means being responsive to discontinuing said pulling force to cause said indicator to indicate the maximum value of said pulling force.

13. A ski binding tester for determining the force required to release a ski binding to permit separation of a ski and ski boot, said ski binding tester comprising:

a generally flexible, elongated, tension element;
means attached to said tension element for drivingly connecting the tension element to the ski boot to permit a user to apply a progressively increasing pulling force to the ski boot through the tension element;

scale means attached to said tension element for measuring said pulling force, said scale means including memory means for indicating the maximum value of said pulling force; and

said scale means including first and second members, means for mounting said first and second members relative to each other along a predetermined path, spring means acting between said members and urging said members in opposite directions along said path, one of said members being drivingly connected to said tension element and the other of said members being subjected to the pulling force by the user whereby application of the pulling force to the scale means causes said members to move in opposite directions along said path and compress said spring means, an indicator, unidirectional drive means for moving said indicator with said first member, when said first member is moving in a direction to allow expansion of said spring means whereby compression of said spring means results in relative movement between said first

member and said indicator and movement of said first member in a direction to allow said spring means to expand causes movement of said indicator member a distance proportional to the distance which the spring means has been compressed to thereby provide an indication of the maximum pulling force supplied through said scale means.

14. A ski binding tester for determining the force required to release a ski binding to permit separation of a ski and a ski boot, said ski binding tester comprising:

a body member including a base, the ski being positionable on the base; means for retaining the ski on said base; a bearing member on the body members; a generally flexible, elongated, tension element;

first means for releasably drivingly connecting the tension element to the ski boot;

said tension element being extendible from the ski boot between the ski and the ski boot toward said bearing member, said tension element extending at least partially around the bearing member and along a passage in said base to thereby provide an exposed portion of the tension element, said bearing member changing the direction in which the tension element extends; and

scale means connected to said exposed portion of the tension element for measuring the force applied therethrough to said ski boot.

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