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Rathmell

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[54] **SKI BOOT HINGED ON SOLE**

[76] Inventor: **Richard K. Rathmell,** 12 Pine Tree Rd., Ramsey, N.J. 07446

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[51] **Int. Cl.** **A43b 00/00**

[58] **Field of Search**..... 36/2.5 R, 2.5 AL, 2.5 AA, 36/2.5 AB, 2.5 E, 2.5 F, 7.5

[56] **References Cited**

UNITED STATES PATENTS

288,406	11/1883	Carroll	36/2.5 AA
3,479,753	11/1969	Wade	36/7.5
3,775,866	12/1973	Marker	36/2.5 AL

Primary Examiner—Patrick B. Lawson

[57] **ABSTRACT**

A ski boot that includes an upper that supports the skiers foot, ankle, and lower leg as a relatively rigid unit, a separate rigid sole with means for the sole to be attached to the ski, a hinge that connects the sole to the upper, and means to adjust the effective rigidity of the total boot and to adjust the angle of forward lean by constraining motion about the hinge.

15 Claims, 2 Drawing Figures

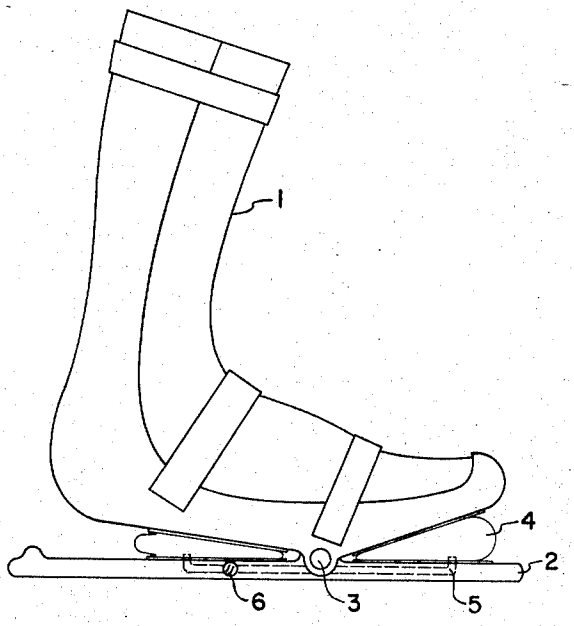


FIG. 1

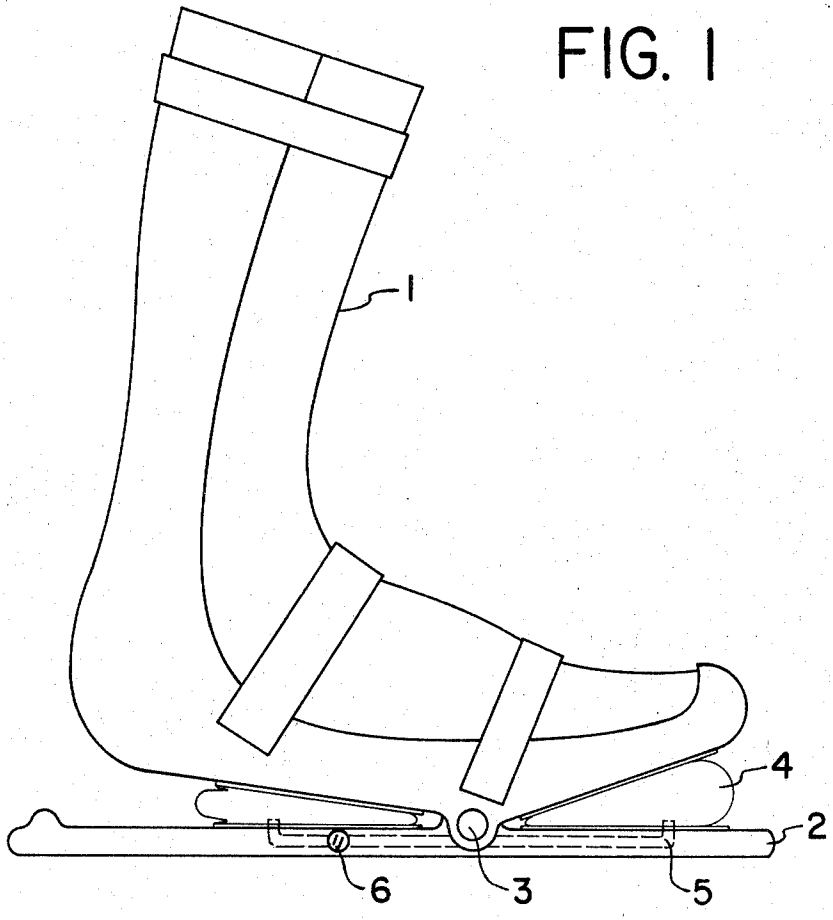
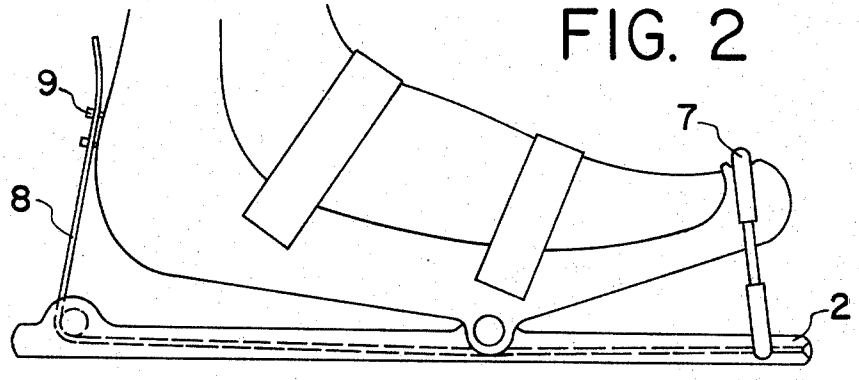


FIG. 2



SKI BOOT HINGED ON SOLE

BACKGROUND FOR INVENTION

For strenuous high-speed skiing over a typical downhill course, relatively rigid boots that support the skiers legs in a pronounced forward lean are preferred. This is because the knees can be held in a bent position, and force shocks can be adsorbed by allowing the knees to bend more. Thus, the skiers body can maintain a relatively steady course while the skis follow the undulating contour of the snow. However for less strenuous skiing a more vertical leg position is less tiring, especially if the knees can be locked in a vertical stand-up position. In either case it is preferable to have a relatively rigid and responsive connection between the skiers lower leg and the ski so that the skier can shift more or less pressure to the front or back of the ski simply by applying leg pressure against the top of the boot.

On the other hand, when the skier is walking or striding it is preferable to permit the leg to articulate freely forward and backward. It would be almost impossible to walk in very rigid boots that have a fixed high degree of forward lean. It would also be uncomfortable and tiring simply to stand in such boots.

Therefore most boots must compromise between the preferred degrees of forward lean and compromise between the preferred degrees of rigidity. Such boots have a fixed degree of forward lean when the boot is not strained and a fixed degree of rigidity when the boot is completely buckled.

A few advanced boots have independent means for adjusting the forward lean or for unlatching the constraint systems that control the amount of pivotal motion in the skiers ankle joints. All of these more advanced boots have some characteristic that has not been well accepted by the public; they may be relatively bulky, complicated, expensive, or difficult to adjust or unlatch out on the mountain. Variable amounts of ankle joint movement within an upper that is well fitted to the foot at one position can cause problems with poor fit when the ankle joint is bent.

It is an object of this invention to provide an improved ski boot with adjustable rigidity and adjustable forward lean control, with a comfortable fit in an upper that is relatively trim and close fitting without complicated projecting devices.

It is a further object to provide a boot that will be responsive and accept strenuous shock loads in a forward lean position and which can also be changed to a more vertical leg position for less strenuous skiing, without sacrificing the responsive connection between the leg and the ski.

It is a further object to permit the skier to make the adjustments relatively conveniently.

It is a further object to make changes in the forward lean angle without the skier having to stop during a ski run.

DESCRIPTION OF THE INVENTION

In accordance with the present invention, there is provided a ski boot that includes an upper section (1) that can receive and structurally support the skier's foot, ankle, and more or less of his lower leg all as a relatively rigid unit, a separate rigid sole (2) with means for the sole to be attached to the ski, a hinge (3) that connects the top of the sole with the bottom of the upper, and adjustable means to limit and constrain the

movement of the upper relative to the sole about the hinge. The invention is primarily concerned with the position of the hinge, the means for establishing various degrees of forward lean when no stress is applied to the boot, and the means for varying the rigidity or stress-strain characteristics of the total ski boot.

It is well recognized that a ski boot should not allow a skiers leg to cant sideways relative to the bottom of the ski, but that some forward and backward motion of the leg is needed for comfortable walking. A rigid upper connected by a hinge to a sole meets these requirements when the axis of the hinge is perpendicular to the length of the ski.

The forward and backward motion about the hinge may be controlled by constraints that resist compression forces or by constraints that resist tensile forces. For example, compressive constraints may consist of blocks of some material having the desired stress-strain characteristics when they are positioned between the top of the sole and the bottom of the upper. When so positioned they fix some unstrained angle of forward lean for the ski boot. The rigidity of the total boot is affected by the elastic characteristics and the size of the blocks chosen. Removal of any such constraint provides a way of unlatching the constrain so the upper can be moved freely on the hinge.

There is some advantage to having compressive type constraints contain a fluid, so that the elastic characteristics and the geometry of the constraint can be adjusted by the amount or type of fluid used. Such constraints can be inflated or pressurized to various degrees to influence the degree of rigidity as well as the unstrained angle of forward lean. When such constraints are like inflatable pillows or inflatable bellows the elastic characteristics of the sidewalls as well as the elastic characteristics of the contained fluid become important. When the flexible sidewalls are relatively strong, and low pressure air is the contained fluid, the elastic characteristics of the air will control the rigidity of the boot. If the contained fluid is a non-compressible liquid and the flexible sidewalls stretch with pressure, it is the sidewalls that control the rigidity of the boot. It is more convenient to vary the pressure of air to adjust the rigidity or angle of forward lean than it is to vary the amount of hydraulic fluid or to vary the elastic characteristics of the sidewalls. However, liquid filled systems can be more constant in performance at various temperatures.

When, as in FIG. I, there is a fluid-filled compressive type constraint **4** positioned in front of the hinge between the sole and the upper, and another such constraint positioned behind the hinge, and a conduit **5** such as a tube is provided to permit fluid flow from one constraint to the other, the normal position of the upper **1** can be changed relative to the sole **2.** If a valve **6** is provided to stop fluid flow the unstrained or normal angle of forward lean can be adjusted conveniently. If the sidewalls of the constraints **4** are relatively strong and the upper **1** is relatively rigid, more or less air pressure in the constraints can control the overall rigidity of the boot.

Further, when the valve **6** is throttled to limit the rate of fluid flow to some relatively low rate, all sudden forces will be transmitted from the skiers leg to the ski in a desirable and responsive manner, while steady and sustained forces can be used to change the unstrained angle of forward lean. Thus, a skier can strenuously at-

tack a downhill course with his knees bent forward, and then without stopping he can bring his knees up slowly to a position where he can stand straighter and ski less strenuously.

It should be observed that when the upper part of the boot is fitted to give comfortable support at any one position or degree of rigidity, the comfortable fit is not disturbed when the angle of forward lean is changed or the rigidity of the connection between the leg and the ski is changed.

FIG. II illustrates a similar ski boot, sole, and hinge which has alternative types constraints that work in tension rather that in compression. Constraint 7 is a yoke that is attached to the sides of the sole and pivots where it is attached. When it is moved over the toe section of the rigid boot upper it constrains the boot in a forward lean position, allowing additional forward lean but preventing additional rear lean. Constraint 7 can be unlatched simply by leaning forward and swinging the yoke forward on its pivots. Preferably, it is constructed with adjustable stops that may be screw adjusted for example and limit its length when stressed in tension, and constructed with elastic members that cause the yoke to follow the toe down when the skier leans forward. Constraint 8 is another type of constraint that resists elongation when stressed in tension. It may extend around a pulley in the sole and extend forward in the sole to an adjustment screw and/or a latching mechanism concealed in the sole. Also, it may be attached to the boot upper by pins 9 or quick-acting connecting means so that the skier can easily adjust the connection to vary the tension, or the skier can disconnect the constraint from the boot upper. Constraint 8 may be a flexible cable or strap connected to a spring or an elastomeric member in the sole, or simply a flexible member with the desired length and elastic characteristics.

Obviously one tension type of constraint can be used with one compression type of constraint, or a tension type of constraint may augment a compression type, for instance if both work to constrain forward motion. Various combinations are possible, including the use of torque constraints built into the hinge.

What is claimed is:

1. A ski boot that includes an upper that can support the skiers foot, ankle, and lower leg as a relatively rigid unit, a separate sole with means to attach the sole to the ski, a hinge that connects the upper to the sole, and means to constrain movement of the upper relative to the sole about the hinge.

2. A ski boot as in claim **1**, wherein the means to constrain movement of the upper relative to the sole about the hinge may be removed and replaced, or replaced by constraining means with different stress/strain or elastic characteristics.

3. A ski boot as in claim **1**, wherein the means to constrain movement of the upper relative to the sole about the hinge can be unlatched and latched again, either in the same position or in a new position to give a different degree of forward lean to the skiers lower leg.

4. A ski boot as in claim **1**, wherein the means to constrain movement of the upper relative to the sole can be adjusted to vary the stress-strain or elastic characteristics.

5. A ski boot as in claim **1** wherein the means to constrain movement of the upper relative to the sole about the hinge include one or more pneumatic devices wherein the volume and pressure of the gas in the device affects the rigidity of the ski boot.

6. A ski boot as in claim **5** wherein the pneumatic device(s) include one or more compressible containers that can be inflated to a greater or lesser degree to affect the angle of forward lean or the rigidity of the ski boot, said container(s) being located beneath the upper and over the sole.

7. A ski boot as in claim **6** wherein more or less liquid hydraulic fluid may be substituted for gas to affect the rigidity of the ski boot.

8. A ski boot as in claim **1** wherein the means to constrain movement of the upper relative to the sole about the hinge includes two compressible containers that are located on opposite sides of the hinge and between the bottom of the upper and the top of the sole, said containers being filled with more or less fluid, and said containers being connected by a conduit that can permit fluid flow between the containers.

9. A ski boot as in claim **1** wherein the means to constrain movement of the upper is a pivoted yoke that resists being elongated when stressed in tension, and the said yoke can be set to limit or constrain upward travel of that part of the upper it engages or is connected to, or it can be pivoted to an unlatched position which allows more free movement of the upper relative to the sole.

10. A ski boot as in claim **9** wherein the pivoted yoke has means for adjusting its effective length.

11. A ski boot as in claim **9** wherein the pivoted yoke has elastic members that cause the yoke to shorten when the corresponding position of the upper is moved closer to the sole.

12. A ski boot as in claim **1** wherein the means to constrain movement is a flexible member which offers resistance to elongation when stressed in tension but offer substantually no resistance when strained compressively, said member being connected both to the sole plate and the upper portion of the ski boot.

13. A ski boot as in claim **12** wherein the flexible member is connected to a concealed mechanism in the sole that has means to change the effective point of connection and/or the effective tension on the flexible member for any given angle of forward lean of the upper relative to the sole.

14. A ski boot as in claim **13** wherein a pivoted yoke engages the toe of the upper and the flexible member constrains upward movement of the heel.

15. A ski boot as in claim **1** wherein the means to constrain movement of the upper relative to the sole about the hinge includes two flexible containers that are located on opposite sides of the hinge and between the bottom of the upper and the top of the sole, said containers being inflated with more or less fluid, and being connected by a conduit that permits fluid flow between the containers, and the said conduit is equipped with means to regulate or stop the fluid flow.

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