United States Patent [19]

Hanson et al.

[11] **3,738,025**

[45] **June 12, 1973**

[54] **SKI BOOT HAVING VARIABLE STIFFNESS**

[75] Inventors: **Alden B. Hanson; Chris A. Hanson,** both of Boulder, Colo.

[73] Assignee: **Hanson Industries Inc.,** Boulder, Colo.

[22] Filed: **July 31, 1972**

[21] Appl. No.: **276,561**

[52] **U.S. Cl.** ..... **36/2.5 AL**

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

[58] **Field of Search** ..... 36/2.5 R, 2.5 AL, 36/51

[56] **References Cited**

UNITED STATES PATENTS

3,535,800	10/1970	Stohr	36/2.5 AL
3,552,044	1/1971	Wiele	36/2.5 AL

Primary Examiner—Patrick D. Lawson

Attorney—Charles J. Merriam, Owen J. Murray, Jerome B. Klose et al.

[57] **ABSTRACT**

A ski boot having variable stiffness is provided with a transverse slot in ankle portion which narrows in response to forward lean pressure. Stiffness of boot is controlled by rotating an oval rod positioned within the slot to limit the extent of deformation of the slot.

7 Claims, 5 Drawing Figures

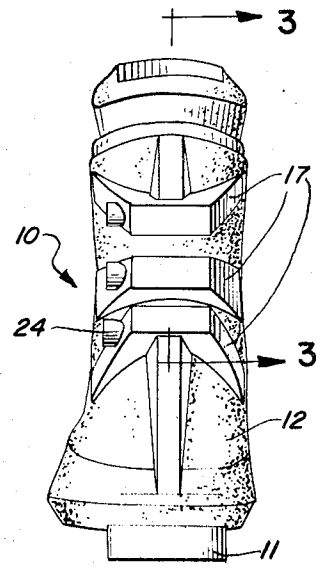
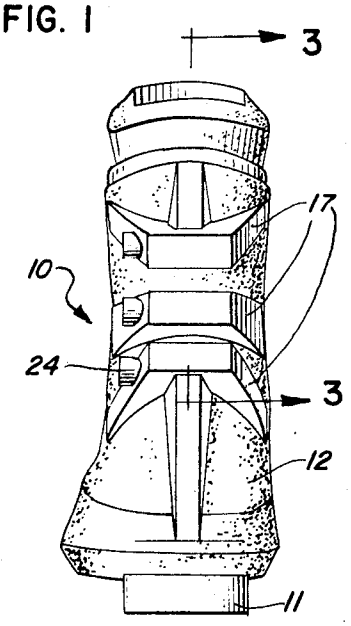


FIG. 1



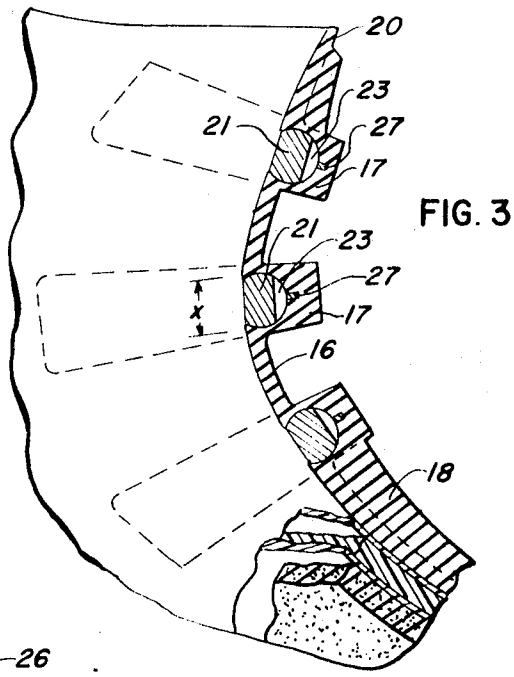


FIG. 3

FIG. 5

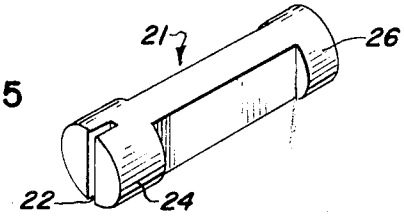
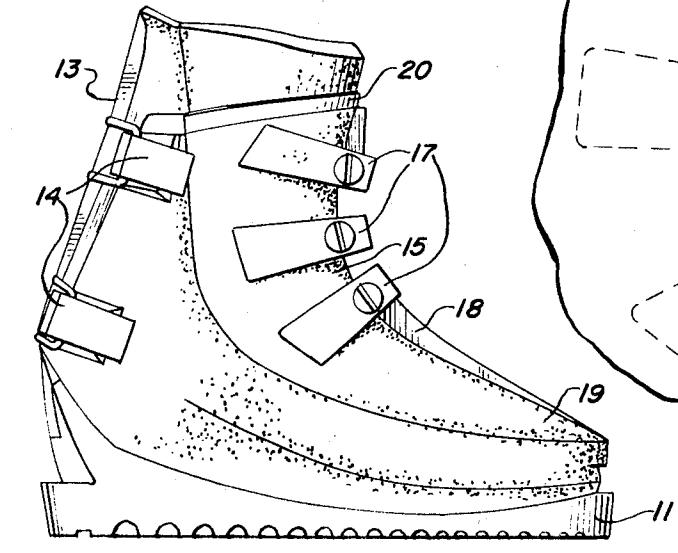


FIG. 2



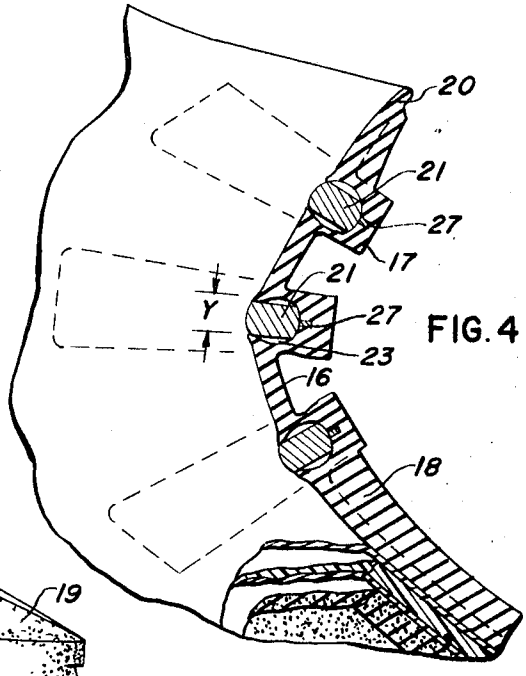


FIG. 4

SKI BOOT HAVING VARIABLE STIFFNESS

This invention relates to a ski boot having a substantially rigid outer shell which is provided with means permitting the skier to adjust the degree of stiffness in the forward direction.

Although it is generally desirable that lateral stiffness in a ski boot should be as high as can be practically attained, the same is not true of the degree to which a ski boot should flex in response to forward lean by a skier. There are circumstances under which, depending on the terrain and the nature of the snow, a skier, particularly an expert or racer, may desire to adjust the stiffness or resistance of his boots to flexure in the forward direction, i.e., the extent to which the boots resist an increase in the amount of forward lean which the skier applies.

In accordance with the invention, there is provided a stiffness control or flexure system, which when incorporated in a ski boot, enables a skier to adjust the stiffness of his boots while on the mountain, in response to snow or slope conditions, or his own personal preference. The flexure system of the invention is intended primarily for incorporation in a ski boot of the type employing a substantially rigid outer shell, typically formed of a plastic material. A typical boot of this type is described in the copending application of Alden B Hanson and Chris A. Hanson, Ser. No. 216,080, filed Jan. 7, 1972. Since the flexure system is associated with the portion of the boot immediately adjacent the forward surface of the wearer's ankle, it is particularly designed for use in boots having an unobstructed front surface in which the flexure system can be installed.

Briefly described, the invention depends for its effectiveness on the presence in the ankle portion of the boot of at least one and preferably several transverse slots in the wall of the shell. The slots extend through or materially reduce the thickness of the shell wall and thereby permit greater flexibility in the ankle portion of the shell than would otherwise obtain. In order to be able to control the amount of flexibility thus created, there is positioned within each slot a substantially rigid elongated flex rod having a generally oval cross-section. Each rod can be rotated to a position in which its width substantially fills the slot, thereby in effect eliminating the slot and the flexibility resulting therefrom. By rotating the rod so that a narrower dimension is positioned within the slot, partial deformation or compression of the slot is permitted, i.e., the ankle portion will flex until the walls of a slot bear against the sides of its associated flex rod. In this position, greater flexibility of the wall is permitted, as will hereinafter become apparent.

The invention will be better understood from the following detailed description thereof, taken in conjunction with the accompanying drawings, wherein like numerals are used to represent like elements, and in which:

FIG. 1 is a front view of a boot embodying the invention, showing three flex rods positioned in the instep area of a ski boot;

FIG. 2 is a view from the left side of the ski boot of FIG. 1;

FIG. 3 is a partial section along the line 3—3 of FIG. 1, showing the operation of the boot when the flex rods are set for maximum stiffness;

FIG. 4 is a view similar to that of FIG. 3 showing the flex rods adjusted for minimum stiffness; and

FIG. 5 is an isometric view of the flex rods used in the embodiment of FIG. 1, showing the slot used to rotate the flex rod for adjustment of the stiffness of the boot.

Referring to the figures, FIGS. 1 and 2 represent a typical ski boot in which the invention can be used to advantage. The boot as shown in FIGS. 1 and 2 comprises an exterior shell 10 having a sole portion 11 and an upper or foot receiving portion 12 formed of a substantially rigid plastic material. Entry to the boot for the wearer's foot is provided by rear access opening 13 which is closed by buckles 14. The front ankle portion 15 of upper 12, i.e., the portion immediately adjacent the wearer's instep, is provided with three horizontal or transverse side stiffening ribs 17 and a vertical front stiffening rib 18 extending from the lowermost of the side stiffening ribs to the toe portion 19 of the boot. A continuation of front stiffening rib 18 also extends from the uppermost side rib to the top of the shell 10. Each of side stiffening ribs 17 houses a flex rod 21, illustrated in FIG. 5, which is rotatably held within the rib and can be rotated by engaging slot 22 in flex rod 21 with a suitable instrument, such as a coin.

As shown in FIGS. 3 and 4, the wall 16 in the ankle portion 15 of shell 10 is substantially uniform in thickness except in the areas of the side stiffening ribs 17 and front stiffening rib 18. Each of side stiffening ribs 17 has a hollow chamber 23 adapted to receive its rod 21, the chamber extending through the shell wall 16 in the ankle portion, thereby creating a slot in said wall associated with each flex rod, into which slot each flex rod partially extends.

A flex rod useful in the invention is generally cylindrical in shape and has an oval cross-section, with a major axis (X, FIG. 3) and a smaller minor axis (Y, FIG. 4) at an angle thereto. The major axis of the flex rod should be substantially equal to the width of its associated slot in the unstressed state, thereby substantially preventing the slot from becoming narrower and thereby increasing the resistance of the shell to forward flexure. When the flex rod is rotated so that its minor axis is within the slot, the slot can be distorted by forward lean until the walls of the slot bear on the flex rod and further flexing is prevented. The particular flex rod shown in FIG. 5 can be made from a circular cylinder by cutting portions of the cylinder to create two parallel plane surfaces diametrically opposite each other.

One end, i.e., 24, of flex rod 21 extends out of the stiffening rib with which it is associated. This provides the user with means for rotating the flex rod as necessary to adjust the stiffness of the boot. The other end, i.e., 26, of flex rod 21 is entirely contained within its associated side stiffening rib.

FIG. 3 illustrates the position of flex rods 21 when adjusted so as to provide maximum stiffness in the boot. As shown, each flex rod is positioned with its major axis X within the slot associated with the stiffening rib. In the configuration shown, the flex rod occupies substantially all of the slot when the boot is in its rest or undistorted condition. With the flex rods adjusted as in FIG. 3, forward pressure by the wearer's leg on the top 20 of shell 10 would only minimally deform the forward wall of the boot shell. The boot would thus exhibit the maximum stiffness of which it is capable.

When the flex rods in each stiffening rib are rotated to the position shown in FIG. 4, the stiffness of the boot

is at its minimum. As shown, the minor axis Y of each flex rod is located within its associated slot in shell wall **16**. Accordingly, pressure on the top of the boot permits the boot to compress in an accordion or bellows fashion, thereby causing ankle portion **15** of the shell to flex in the manner shown in FIG. **4**. In order to facilitate forward flexure, each of ribs **17** is provided with a small longitudinal channel **27** which creates a hinge effect, allowing the opposing walls of chamber **23** to flex towards each other until contact with flex rod **21** is made.

In order to confine the flexure of the boot to the ankle portion of the shell and to avoid distortion of the lower portion thereof which might cramp the wearer's foot, the front of the boot is provided with a front stiffening rib **18** extending from the uppermost side rib **17** to the top **20** of shell **10** and from the lowermost rib to the toe **19** of the shell. Such a front stiffening rib is an advantageous adjunct to the invention but it is not a necessary feature thereof.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

We claim:

1. A ski boot comprising a substantially rigid outer shell, including an ankle portion covering the forward surface of a wearer's ankle, and means for controlling the stiffness of said shell against flexure in a forward direction, said means comprising:

at least one transverse slot formed in said ankle portion of said shell, said slot reducing the wall thickness of said shell sufficiently to substantially decrease the resistance to flexure of said ankle portion in the forward direction, said slot being compressed by forward flexure of said ankle portion; and

adjustable control means associated with said slot to limit the compression thereof on the application of forward pressure and thereby to control the stiffness of said shell.

2. The boot of claim **1** wherein said control means includes an elongated generally cylindrical member having a generally oval cross-section, said member being rotatably positioned longitudinally within said slot to limit the extent of compression thereof caused by flexure of said ankle portion.

3. The boot of claim **2** wherein said cylindrical member has a cross-section defined by two opposing circular segments and two opposing straight lines, the distance between said circular segments being greater than that between said straight lines.

4. The boot of claim **3** wherein an end of said cylindrical member extends exteriorly of said shell and is provided with means for rotation by said wearer, whereby the stiffness of said shell can be adjusted.

5. The boot of claim **1** in which said shell is provided with a vertical stiffening rib extending from the lowermost said slot to the toe portion thereof.

6. The boot of claim **2** in which each said slot has associated therewith an external transverse rib, spanning said slot, said rib serving as a housing for said cylindrical member.

7. The boot of claim **6** in which said external rib has a hinge zone of lessened thickness parallel to the length of said slot, permitting said slot to compress as necessary for forward flexure of said shell.

* * * * *