United States Patent

Salomon

[15] **3,686,950**

[45] **Aug. 29, 1972**

[54] **ADJUSTMENT OF SKI BINDINGS**

[72] Inventor: **Georges Pierre Joseph Salomon,** 34, Avenue de Loverchy, Annecy (Haute-Savoie), France

[22] Filed: **Dec. 8, 1970**

[21] Appl. No.: **96,058**

[30] **Foreign Application Priority Data**

Dec. 24, 1965 Switzerland.............19227/69

[52] **U.S. Cl.**...................................**73/379 R,** 73/133

[51] **Int. Cl.**...**G01l 5/02**

[58] **Field of Search**.....73/379 R, 380 R, 381 R, 133, 73/99; 280/11.35

[56] **References Cited**

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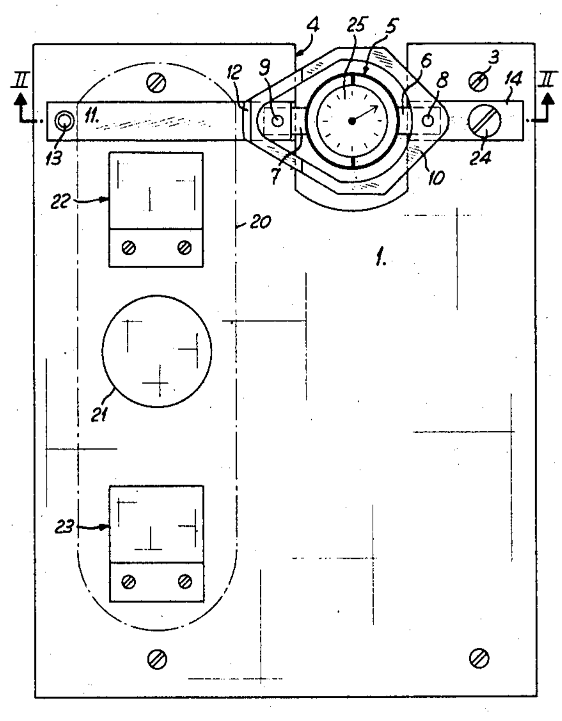
Primary Examiner—Charles A. Ruehl
Attorney—Emory L. Groff and Emory L. Groff, Jr.

[57] **ABSTRACT**

The effort required to safely release ski bindings is adjusted as a function of a measurement of the muscular strength of a skier taken in at least one direction corresponding to release of a binding. A measuring apparatus comprises a plate for rotatably supporting a ski boot and means for measuring a torsional effort supplied by the skier to tend to turn the boot.

5 Claims, 2 Drawing Figures



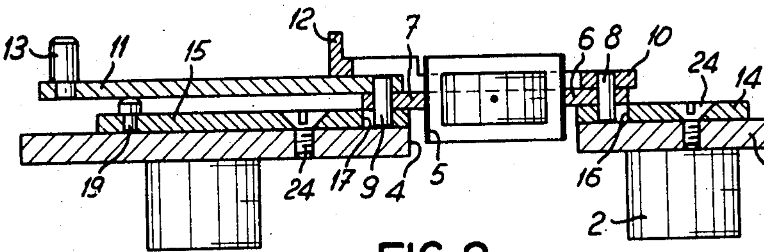
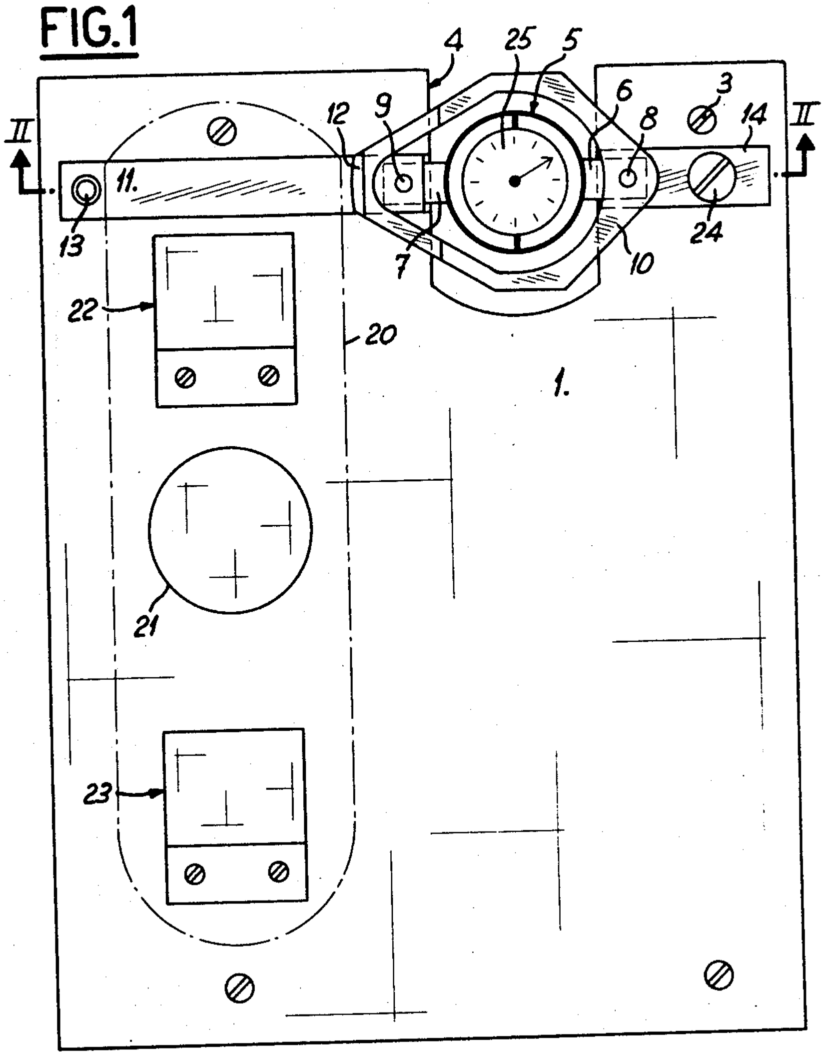


FIG. 2

FIG. 1



INVENTOR

GEORGES P. J. SALOMON

BY Emory L. Groff Jr.

ATTORNEY

ADJUSTMENT OF SKI BINDINGS

Adjustment of the effort for releasing ski safety bindings as a function of the individual characteristics of skiers is a delicate operation for which numerous methods have been proposed, none of which has been widely adopted. Indeed, no absolutly satisfactory method has yet been proposed.

Among the methods already proposed is one which consists of measuring a member of the skier and, by means of an empirical table, calculating the release effort likely to be suitable for the skier in question. Of course, this method may give satisfactory results for certain skiers, but it cannot pretend to be a general method, since the measurement is taken statically while skiing is essentially a dynamic exercise.

In practical terms, however, a measurement taken in or simulating the conditions encountered while skiing is not absolutely essential and would in any case raise serious practical difficulties.

An object of the invention is to remedy the above-outlined situation in a simple and efficient manner.

According to the invention, there is therefore proposed a method for enabling adjustment of the effort required to safely release adjustable safety ski bindings in at least one direction, comprising measuring the muscular strength of a skier in at least one direction corresponding to release of a binding.

Preferably, after taking said measurement, the binding is adjusted for release in said direction as a function of said measurement.

In other words, the invention is based upon the principle of action and reaction, according to which the leg opposes a torsion to which it subjected by an equal torsional effort up to a maximum limiting amount; of course, this theoretical digression is not necessary to the understanding, nor to the validity of the present invention.

According to an advantageous manner of carrying out the method of the invention, a measurement of the effort that can be supplied by a skier by turning his leg about a vertical axis from the knee to the ankle is made at a known distance from the center of rotation located approximately under the heel, the skier preferably wearing ski boots during this measurement. Subsequently, this effort is related to that which can be transferred to the retaining jaw (or retaining means) of the binding, using a coefficient so as to obtain the correct adjustment of the effort necessary to release the binding.

Advantageously, the measurement of torsional efforts which can be supplied by the skier laterally towards the right and towards the left are taken one after the other in a single operation, the means employed for this measurement providing indications of measurement without differentiating these two directions.

According to a variant, the skier, instead of supplying a driving effort on the measuring means, could provide a resistance against the action of a device providing an increasing, measured effort on a ski boot or ski until the leg can no longer supply a sufficient effort to resist. At this moment, the boot would move thereby stopping action of the device to provide a greater effort, the device stopping with the "release" value of the effort shown by indicating means.

The invention also concerns an apparatus to enable adjustment of the effort required to safely release adjustable safety ski bindings in at least one direction, comprising means for measuring the muscular force of a skier in at least one direction corresponding to release of a binding.

The measuring means for this apparatus preferably comprise support means for at least one ski boot, means for allowing angular displacement of said boot about a chosen axis of rotation, at least one stop member displaceable upon angular displacement of said boot in at least one direction, and means actuatable by said stop member for measuring the torsional effort supplied by the skier to angularly displace the boot.

This apparatus is clearly equally suitable for measurement with toe bindings having lateral release as for heel bindings with lateral release, simply by reversing the direction of the boot therein.

Such a method and such an apparatus also apply to adjustment of the releasing effort of bindings in a direction perpendicular to the plane of a ski. However, for the sake of simplification, the following description will be limited solely to the measurement of releasing efforts in a plane parallel to the plane of the ski.

Of course, any known devices for measuring force can be used to carry out the present invention, whether these devices are mechanical, pneumatic, hydraulic, or electrical, and with or without recording means.

The invention will be better understood from the following description, made by way of example, of a particularly simple means of carrying out the invention, reference being made to the accompanying drawings, in which:

FIG. **1** is a plan view of a device according to the invention, and

FIG. **2** is a cross-section along line II—II of FIG. **1**.

Referring to the drawings, the device comprises a support plate **1**, for example in light alloy, thick enough so that it cannot be deformed by the application thereto of the weight of a person. This support plate **1** can rest in a horizontal plane on cross-bars **2** fixed thereon by means of screws **3**. A generally U-shaped cut-out **4** is provided in the plate **1** so as to house a measuring device comprising, in this example, a resilient ring **5** the elastic deformation of which can be measured by means of a dial comparator **25** mounted on gimbals in the ring **5**. Such measuring devices are known, and will therefore not be described in full detail. The ring **5** comprises two laterally extending feet **6** and **7** each pierced with a hole through which pass axles **8** and **9** respectively fixed to pieces **10** and **11**. The ring-shaped piece **10** has a lip **12**, and the rod-like piece **11** a head **13**; lip **12** and head **13** serve as lateral stops for an end of a boot **20** placed on the plate **1** for the purpose of measurement. Piece **11** is supported above the plate **1** by an antifriction bearing **19**, while the part of piece **10** adjacent lip **12** rests on the piece **11**.

The axles **8** and **9** also engage in holes **16** and **17** of flat pieces **14** and **15** fixed against the support plate **1** by screws **24**. The holes **16** and **17** could be extended into the support plate **1**. Optionally, pieces **14** and **15** could be omitted, if required, upon the condition that the antifriction bearing **19** upon which the piece **11** rests is retained.

As shown in Fig. 2, the holes 16 and 17 have a greater diameter than the axles 8 and 9, the play being necessary for operation according to which the efforts of the boot 20 on the stops 12 and 13 are transformed into deformation of the ring 5 in the same direction. Of course, when the axle 9 is pulled, the axle 8 must abut against the edge of the hole 16. This is achieved by locating the axles 8 and 9 normally off the center of the holes 16 and 17, with the arrangement shown in Fig. 2. The sole of the boot 20 rests on a turnable disc 21 and, optionally, on anti-friction means 22 and 23, at least the parts 21 and 23 being interchangeable so that the center of rotation can be located under the toe or heel of the boot. The boot sole, by turning about disc 21 in the counter-clockwise direction, abuts against the head 13, under the action of a torsion supplied by the skier's leg, causing displacement of the piece 11; the axle 8 abuts against the edge of the hole 16, while the axle 9 remains free in the hole 17, which permits deformation of the ring 5. When the sole abuts against the lip 12, the axle 9 abuts against the edge of the hole 17 and the axle 8 is displaced in the hole 16 and causes deformation of the ring 5.

By way of example, measurements carried out to enable adjustment of the lateral release effort of a toe binding with the center of rotation located under the heel, have given, as a function of the persons in question, values comprised between 15 and 40 kg, this large amplitude emphasizing the usefulness of such measurements. Additionally, these measurements enable different adjustment for the right and left ski bindings as a function of the difference in efforts that the skier in question can provide with his right and left legs.

In practice, for the adjustment of the releasing effort of a binding (either left or right), the mean reading of the torsional efforts which can be provided by the skier towards the right and left can be taken.

Additionally, in this case, no coefficient of correction need be applied since the parts 12 and 13 are located substantially in the same place as the wings of the binding jaw(s).

Experience has shown that adjustment on the basis of such measurements ensures adequate safety during skiing.

It should be noted that the skier places one or both feet on the support plate and measurements can be taken for all of the relative positions of the two legs.

As a variant, instead of comprising a single measuring device for one boot only, the apparatus could be provided with a support plate carrying two symmetrically located measuring devices enabling simultaneous testing of the skier's two legs. Of course, in this case gripping means, such as a hand rail, could be provided to enable the skier to hold his balance on the support plate 1 while effecting torsional movements with his legs.

Alternatively, instead of taking the measure on the boot, it would be possible to take it on a ski or on a ski-like member fixed to the boot. In this case, all of the length of the ski would be available as a lever. A correction coefficient would consequently be applied. Whatever be the type adopted, the measuring apparatus can be directly graduated with a reference scale suitable for the binding in question.

In another possible embodiment of the apparatus, a measuring device with a deformable element 5 and comparator 25 could be provided on either side of the position occupied by a boot, each stop 12, 13 respectively being connected to its own individual measuring device.

When such an apparatus is used to test the efforts involved upon, for example, a forward fall, a retaining member must be provided to prevent (or oppose) raising of the boot heel. The measuring device would thus measure the effort exerted by the skier to raise his boot, an oscillating movement of the heel taking place in a vertical plane.

I claim:

1. Apparatus to enable adjustment of the effort required to safely release adjustable safety ski bindings in at least one direction, comprising means for measuring the muscular strength of a skier in at least one direction corresponding to release of a binding, said measuring means including support means for at least one ski boot, means for allowing angular displacement of said boot about a chosen axis of rotation, at least one stop member displaceable upon angular displacement of said boot in at least one direction, and means actuatable by said stop member for measuring the torsional effort supplied by the skier to angularly displace the boot.

2. Apparatus according to claim 1, in which said measuring means further includes an elastically deformable element, said element cooperating with said stop member so that angular displacement of the boot is opposed by elastic deformation of said element, and means for measuring the elastic deformation of the element.

3. Apparatus according to claim 2, in which said support means comprises a plate, said axis of rotation is vertical and said element cooperates with first and second stop members between which the boot can be placed.

4. Apparatus according to claim 3, including first and second parts connected to opposite sides of said elastically deformable element, said first and second stop members fixed to said first and second parts, means for allowing displacement of said first stop member and first part in a first direction in relation to said support plate to cause elastic deformation of said element while holding said second part and second stop member fixed in relation to said support plate, and means for allowing displacement of said second stop member and second part in a second direction opposite the first direction in relation to said support plate to cause elastic deformation of said element while holding said first part and said first stop member fixed in relation to said support plate.

5. Apparatus according to claim 4, including first and second axles connecting said first and second stop members to said first and second parts, said support plate having first and second openings therein, first and second axles engaging with play in said first and second openings so that angular displacement of the boot in a first direction causes said first stop member to elastically deform said element by displacement of said first axle in said first opening while said second stop member is positionally held by bearing of said second axle against an edge of said second opening, and angu-

lar displacement of the boot in a second direction opposite the first direction causes said second stop member to elastically deform said element by displacement of said second axle in said second opening while said first stop member is positionally held by bearing of said first axle against an edge of said first opening.

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