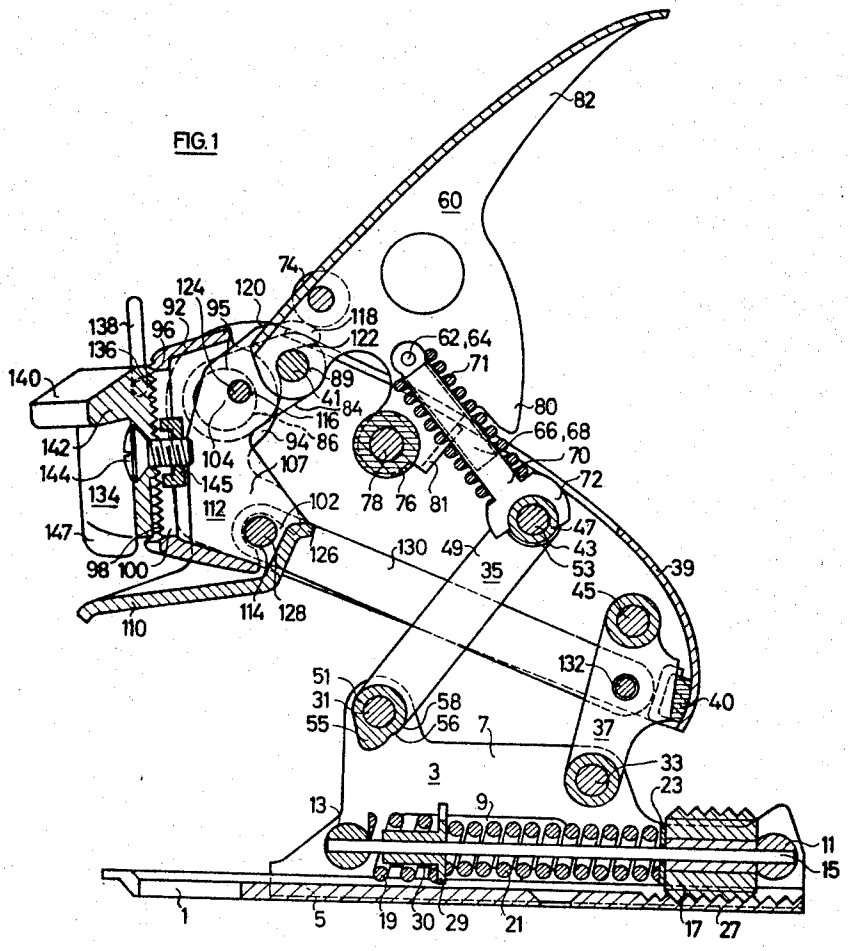
March 11, 1969 W. SUHNER 3,432,180

HEEL ENGAGING UNIT FOR A SAFETY SKI BINDING

Original Filed Nov. 8, 1966 Sheet 1 of 5

FIG. 1



INVENTOR.
Willy Suhner

BY
Michael S. Striker

March 11, 1969 W. SUHNER 3,432,180

HEEL ENGAGING UNIT FOR A SAFETY SKI BINDING

Original Filed Nov. 8, 1966 Sheet 2 of 5

FIG. 2

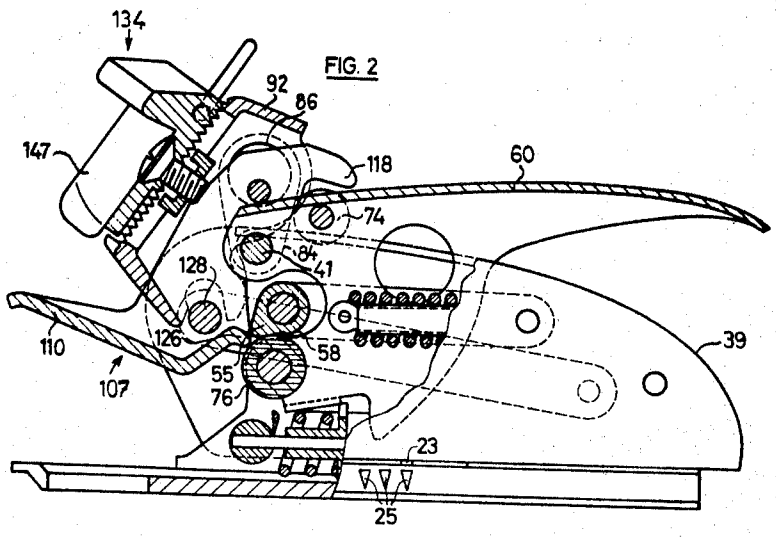
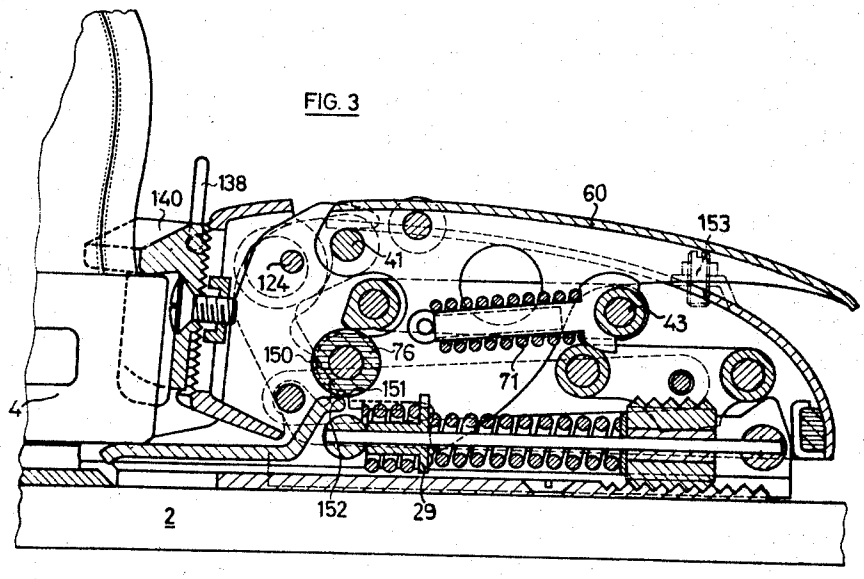


FIG. 3



INVENTOR.

Willy Suhner

BY

Richard V. Stevens
Atty

March 11, 1969 W. SUHNER 3,432,180

HEEL ENGAGING UNIT FOR A SAFETY SKI BINDING

Original Filed Nov. 8, 1966 Sheet 3 of 5

FIG. 4

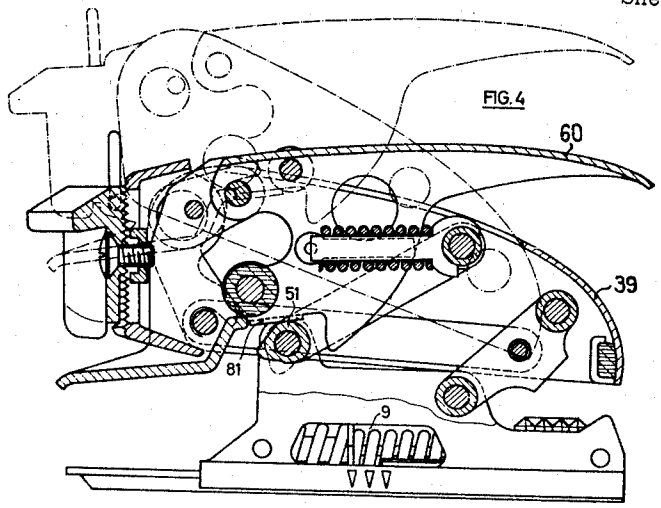


FIG. 5

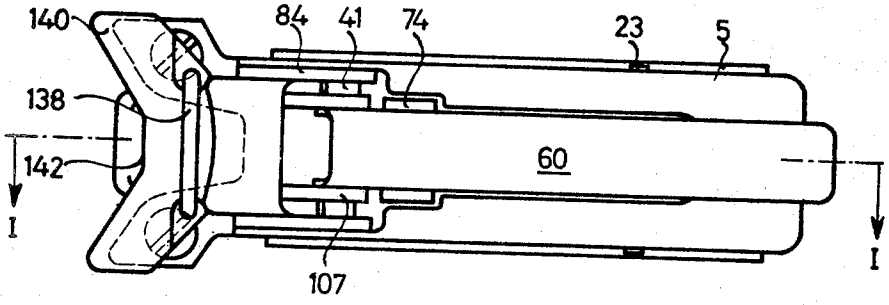


FIG. 6

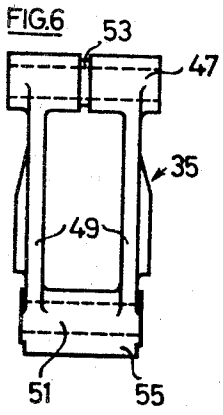


FIG. 7

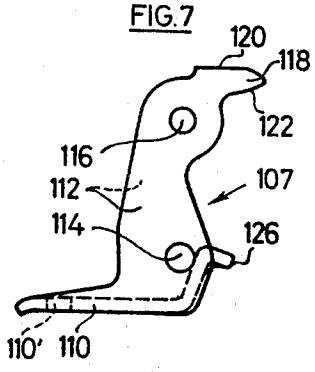
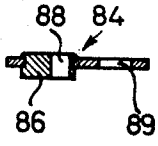


FIG. 8



INVENTOR.
Willy Suhner
BY
Michael J. Striker

HEEL ENGAGING UNIT FOR A SAFETY SKI BINDING

Original Filed Nov. 8, 1966

FIG. 9

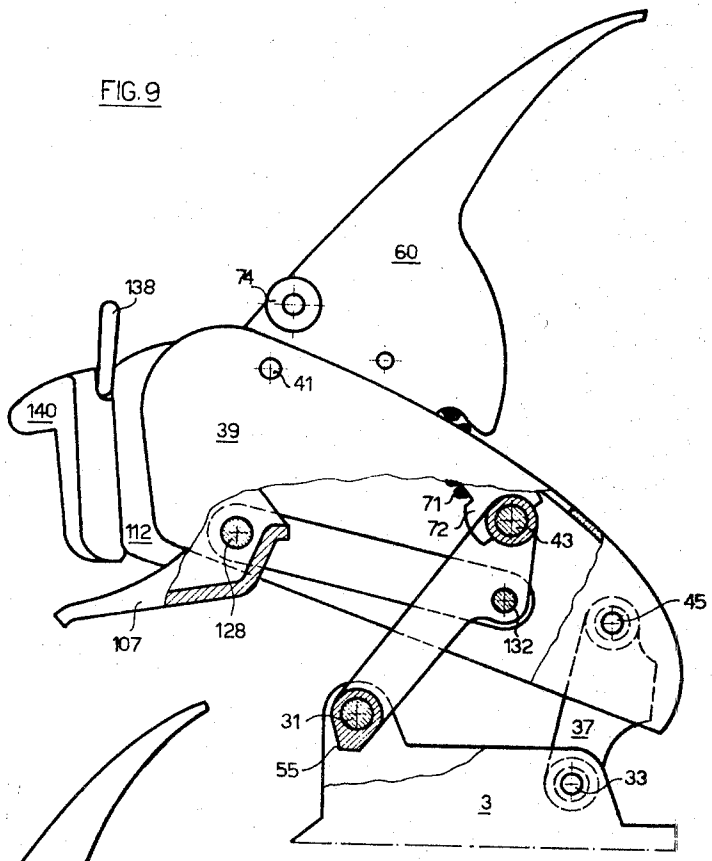
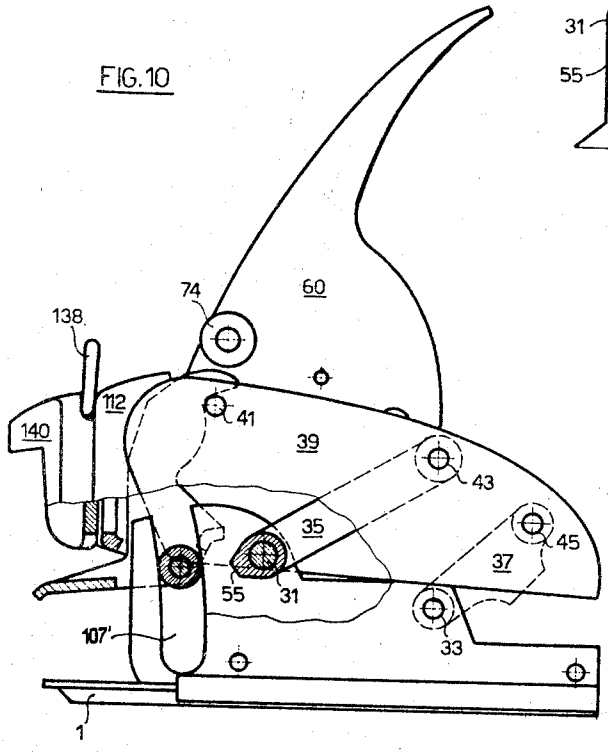


FIG. 10



INVENTOR.
Willy Suhner

BY

Richard J. Stevens
Atty

March 11, 1969 W. SUHNER 3,432,180

HEEL ENGAGING UNIT FOR A SAFETY SKI BINDING

Original Filed Nov. 8, 1966 Sheet 5 of 5

FIG. 11

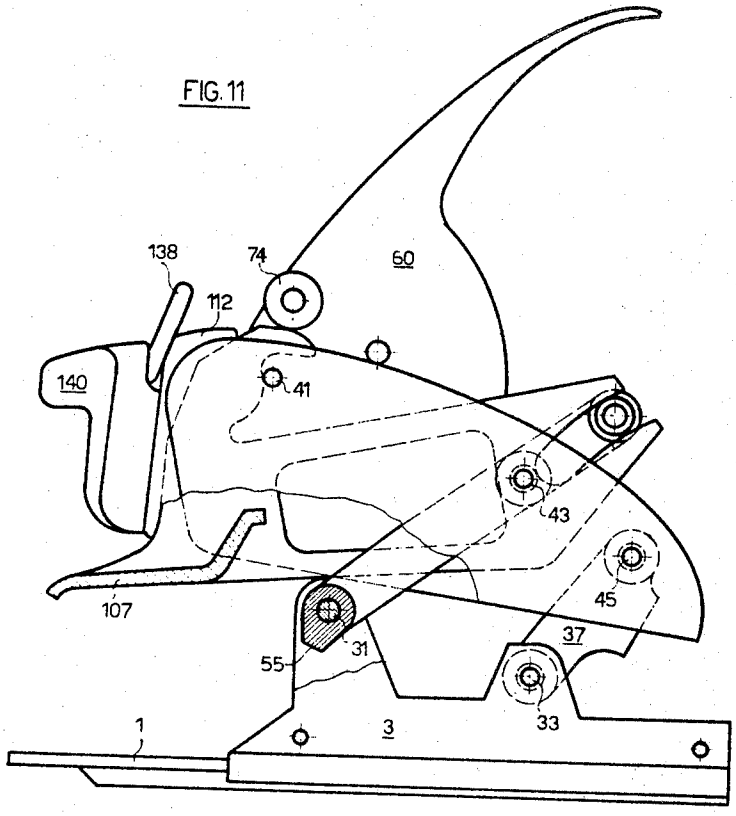
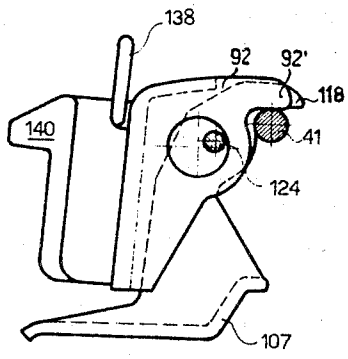


FIG. 12



INVENTOR.
Willy Suhner

BY

Michael J. Striker
Atty.

United States Patent Office 3,432,180 Patented Mar. 11, 1969

3,432,180

HEEL ENGAGING UNIT FOR A SAFETY SKI BINDING

Willy Suhner, 38 Aarauerstr., 5200 Brugg, Switzerland

Continuation of application Ser. No. 592,866, Nov. 8, 1966. This application May 6, 1968, Ser. No. 727,087
Claims priority, application Switzerland, Nov. 11, 1965, 15,587/65
U.S. Cl. 280—11.35 31 Claims
Int. Cl. A63c 9/00

ABSTRACT OF THE DISCLOSURE

The present invention relates to a heel engaging unit for a safety ski binding, and more specifically to a strapless heel engaging unit provided with heel engaging means which automatically secure the heel of a ski boot to the unit when the user steps with the heel into the heel engaging means while the latter are in a step-in position and which subsequently holds the ski engaging means in a downhill run position in which the bottom surface of the heel will be maintained closely adjacent to the top surface of the ski or in a walking or cross-country skiing position in which the heel of the ski boot may move within certin limits upwardly and downwardly with respect to the top surface of the ski.

This is a continuation of application Ser. No. 592,866, filed Nov. 8, 1966.

Heel engaging units for safety ski bindings are known in the art in which the heel engaging unit cooperates with a front engaging unit for automatically securing the heel engaging unit to the heel of a ski boot when the user steps with the ski boot into the binding, however these known safety ski bindings have the disadvantage that they are adapted only for use during downhill run since in these bindings the heel of the ski boot cannot be lifted from the top surface of the ski.

Other strapless ski bindings are known in the art which are suitable for downhill run as well as for cross-country skiing. These ski bindings are usually provided for cross-country skiing with additional members, for instance a plate extending beneath the sole of the ski boot. Such plates are liable to twist or break, and in addition these ski bindings use for cross-country skiing mechanical linkage systems which have to be closed by means of a tightening member. The changeover of these known ski bindings for downhill run use or for cross-country skiing use is usually difficult and time-consuming, and these known ski bindings are also very often dependent on a specific shape of the heel of the ski boot for their proper function. In addition these known ski bindings have usually a poorly functioning release mechanism for releasing the heel engaging means from the heel of a ski boot during a fall of the skier to thus prevent injury to the skier during such fall.

It is an object of the present invention to provide a heel engaging unit for a safety ski binding which avoids the above-mentioned disadvantages of such units known in the art.

It is a further object of the present invention to provide a heel engaging unit for a safety ski binding suitable for downhill run use as well as for cross-country skiing which not only permits a faultless and quick engagement and disengagement with the heel of a ski boot, but which will also permit, even during skiing, a quick change-over from one to the other use.

It is also an object of the present invention to provide a heel engaging unit for a safety ski binding of the aforementioned kind which not only permits a perfect guiding of the ski during cross-country skiing, but which also permits to limit the up-and-down movement of the heel of the ski boot relative to the ski during cross-country skiing so that the user will tire less than with other ski bindings known in the art.

It is an additional object of the present invention to provide a heel engaging unit for a safety ski binding with exactly adjustable means for instantaneously releasing the heel engaging means of the unit from the heel of the ski boot during excessive upward pressure on the heel engaging means, as will occur during a forward fall of the skier.

The heel engaging unit according to the present invention is strapless and does not require any connecting elements which protrude laterally to opposite sides of the ski boot or which are arranged beneath the sole of the ski boot. It is further adapted for use with most of the ski boots presently available without requiring any additional elements or metal fittings mounted on the ski boot. The heel engaging unit is also usable in combination with various front units or front jaws presently available on the market. The pressure at which the front portion of a ski boot is pressed against the front jaws by the heel engaging unit of the present invention is steplessly adjustable and so is the releasing moment for releasing the heel engaging means of the heel engaging unit from the heel of a ski boot during forward fall of the skier. The aforementioned pressures are readable on the heel engaging unit after the skier has stepped into the safety ski binding and the means for indicating the pressure will not indicate the adjusted pressure but the actually acting pressure.

With the above objects in view, the heel engaging unit according to the present invention adapted to cooperate with a front unit of a safety ski binding for pressing the front portion of a ski boot into said front unit of the ski binding mainly comprises support means adapted to be mounted on a ski rearwardly of the front unit thereon, heel engaging means constructed and arranged to automatically egage the heel of a ski boot when the user steps with the heel onto the heel engaging means, and linkage means connecting the heel engaging means to the support means and guiding the heel engaging means movable relative to the ski along a predetermined portion of a substantially circular path having its turning axis in the region of the top surface of the ski and adjacent the front unit of the ski binding so that during the use of the ski binding for walking the heel engaging means remain substantially non-shiftably connected to the heel of the ski boot.

The linkage means preferably comprise a first parallelogram guide including an elongated member having a front portion and a rear portion and a pair of first link means respectively pivotally connected at opposite ends thereof to said support means and the elongated member in the region of the rear portion of the latter, and a second parallelogram guide including a pair of second link means one of which is pivotally connected at one end thereof to one of the first link means and at the other end thereof to the heel engaging means and the other of which is pivotally connected at one end thereof to the elongated member in the region of the front portion of the latter and at the other end thereof to the heel engaging means.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a longitudinal section taken along the line I—I of FIG. 5 of a heel engaging unit according to the

present invention and showing this unit in the uppermost position during use of the unit for walking or cross country skiing;

FIG. 2 is a partially cross sectioned side view of the unit illustrated in FIG. 1 and showing the unit in a step-in position ready to receive the heel of a ski boot;

FIG. 3 is a sectional view similar to FIG. 1 and showing the unit in downhill run position;

FIG. 4 is a partially sectioned side view of the unit and showing the unit adjusted for walking on steep slopes whereby the position shown in full lines is the lowest and the position shown in dash-dotted lines the highest of the thus adjusted positions;

FIG. 5 is a top view of the unit shown in the position as in FIG. 3;

FIGS. 6–8 illustrate certain components of the unit respectively in side view, front view and section; and

FIGS. 9–12 illustrate some alternatives of parts of the unit.

Referring now to the drawings and more specifically to FIG. 1 of the same, it will be seen that the heel engaging unit according to the present invention for a strapless safety ski binding mainly comprises support means which include a base plate **1** adapted to be connected by screws or the like to the top surface of a ski **2**, as indicated in FIG. 3, and a frame **3** mounted on the base plate **1** movable in longitudinal direction of the ski. The frame **3** includes a pair of guide rails **5** which respectively encompass lateral edge portions of the base plate **1** to guide the frame in longitudinal direction of the base plate, and a pair of lateral walls **7** projecting upwardly from the guide rails **5** and being connected at the front end the rear end thereof by a pair of transverse bolts **11** and **13**, respectively. The bolts **11** and **13** are formed with bores therethrough aligned along a common axis normal to the axis of the bolts and a rod **15** extends through the aforementioned bores preferably fixed to the bolts **11** and **13** in any convenient manner. A cylindrical member **17** provided on the outer surface thereof with a screw thread engaging in corresponding threads **27** on the base plate **1** is mounted on the rod **15** coaxially therewith and tunably and axially movable with respect thereto. A pair of coil compression springs **19** and **21** are arranged to the left side, as viewed in FIG. 1, of the member **17** about the rod **15**. An indicator member **23** is slidably arranged on the rod **15** between the left end face, as viewed in FIG. 1, of the member **17** and the right end of the spring **21**, and the indicating member **23** extends with at least one lateral portion through a cutout **9** in at least one of the side walls **7** of the frame **3**. The indicating member **23** cooperates with marks **25** provided on the guide rails **5**. An abutment member **29** is located between opposed ends of the springs **19** and **21** and guided on the rod **15** by means of a sleeve **30** fixedly connected to or integral with the member **29**.

The heel engaging unit comprises further heel engaging means including the members **92**, **107** and **134** constructed and arranged, as will be described later on in detail, to automatically engage the heel of a ski boot when the user of the ski steps with the bottom face of the heel onto a forwardly projecting engaging portion **110** on the member **107**.

The heel engaging unit includes further linkage means connecting the heel engaging means to the frame **3** of the support means for guiding the heel engaging means relative to the ski along a predetermined portion of a substantially circular path having its turning axis in the region of the top surface of the ski and adjacent to a front unit provided thereon so that during use of the ski binding for walking the heel engaging means remains substantially non-shiftably connected to the heel of the ski boot.

The linkage means comprise a first parallelogram guide including a pair of first link means or link arms **35** and **37**. The longer arm **35** is pivotally connected at its bottom end to a bearing bolt **31** extending between a front portion of the side walls **7**, whereas the lower end of the shorter arm **37** is pivotally connected to a bearing bolt **33** extending between a rear portion of the aforementioned side walls. The first parallelogram guide includes further an elongated member **39** which is preferably cap-shaped and a pair of upper bearing bolts **43** and **45** extend between and are connected to side walls of the cap-shaped member **39** and the upper ends of the link arms **35** and **37** are respectively pivotally connected to the bearing bolts **43** and **45**. A rubber buffer is preferably connected to the rear end of the cap-shaped member **39**.

The longer link arm **35** includes an upper and a lower bearing bushing **47**, **51** respectively mounted on the bearing bolts **43** and **31** and connected to each other by parallel walls **49** extending spaced from each other and substantially normal to the axes of the bushing **47** and **51**, as best shown in FIG. 6. The upper bushing **47** is provided substantially midway between opposite ends thereof with an annular groove **53**, for a purpose as will be described later on. A cam **55** projects from the lower bushing **51**, which cam has a stepped portion **56** and which defines together with the cam a cam face **58**.

The heel engaging unit includes further a second parallelogram guide including two pairs of link members **84** and **130**. The upper shorter link members **84** are pivotally mounted at the rear ends thereof on a pivot pin **41**, whereas the lower longer link members **130** are pivotally mounted at the rear ends thereof by means of a pivot pin **132** on the link member **37** between the ends of the latter. The front ends of the link members **84** and **130** are pivotally connected to the heel engaging means for movably carrying the same. As best shown in FIG. 8 each of the link members **84** is formed adjacent one end thereof with an opening **89** through which the pivot pin **41** extends, whereas in the region of the opposite end thereof a short cylindrical member or shaft **86** is turnably mounted. The short shafts **86** of the link members **84** respectively extend through bores **95** in upper portions **94** of the member **92** so that the latter may turn about the axes **104** of the two short shafts **86**. The member **92** has a front wall **96** which is provided at its front surface thereof with a plurality of teeth **98** and which if formed substantially midway with a longitudinal slot **100**. The member **92** is further formed in the side walls thereof with mouth-shaped guide slots **102**.

A first heel engaging member **134** is adjustably connected to the member **92** and for this purpose the heel engaging member **134** is provided at its rear face teeth **136** corresponding to the teeth **98** and interengaged with the latter. The heel engaging member **134** is connected by means of a screw **144** extending through the slot **100** and a nut **145** to the member **92**. Preferably the nut **145** has projections extending into the slot **100** to prevent turning of the nut during tightening of the screw **144**. The heel engaging member **134** has at its upper end a forwardly projecting heel engaging portion **142** adapted to engage the upper surface of a rim portion of a heel **4** of a ski boot as indicated in FIG. 3. The heel engaging portion **142** has an upper downwardly inclined guide surface **140** and this member has also a front guide surface **147** adapted to guide the heel of a ski boot onto a forwardly projecting portion **110** of the second heel engaging member **107**.

The second heel engaging member **107** has a bottom wall, the front portion **110** of which forms a second heel engaging portion adapted to engage the bottom surface of the heel of a ski boot, as shown in FIG. 3, and a pair of side walls **112**, each provided with a pair of bores **114** and **116** as best shown in FIG. 7. The side walls **112** are extended at the upper end thereof into rearwardly projecting noses **118** each having an upper guide surface **120** and a bottom edge **122** adapted to engage onto the bolts **41**. A bolt **124** extends through the bores **116** in the side walls of the member **107**, and the bolt **124** extends also through bores **88** in the short shafts **86** carried by the link members **84**, which bores **88** are eccentrically arranged with regard to the axis **104**

of the shafts **86**. The bottom wall of the member **107** has a rearwardly projecting locking portion **126**. A pin **128** extending through the bores **114** in the side walls of the member **107** pivotally connects the latter to the front ends of the link members **130**.

Since ski shoes are manufactured which have so-called walking heels, in which the rear end of the sole is rounded and would therefore not properly engage the portion **110** of the member **107**, a bore **110'**, as shown in FIG. 7 may be provided in which a projecting pin or the like, not shown in the drawings, may be secured.

A lever **60** is pivotally mounted at the front end thereof by means of the bolt **41** on the cap-shaped member **39**. The side walls of the lever **60** carry in the region of the front end thereof a pair of rollers **74**, as best shown in FIGS. 1 and 5, which are adapted to engage the upper faces **120** of the noses **118** on the member **107**. The lever **60** carries further a roller **76** turnably mounted thereon by a pin **78**. Spring means in form of a coil spring **71** are operatively connected to the lever **60** tending when stressed to turn the latter depending on the position of the lever in counterclockwise or clockwise direction about the pivot pin **41**. The coil spring **71** is guided by means of guides **66**, **68** respectively connected at the upper ends thereof by short stud pins **62**, **64**, only one of which is actually illustrated in the drawings, to side walls of the lever **60**. Sandwiched between these guide members **66** and **68** is an additional guide member **70** which is connected by means of a fork **72** located in the groove **53** of the bushing **47** to the link member **35**. The lever **60** has further two downwardly projecting noses **80**, a rearwardly extending handle portion **82** and further between the noses **80** and the roller **76** and further two outwardly extending abutment portions **81**.

The above-described heel engaging unit will operate as follows:

In FIG. 2 the unit is illustrated in a step-in position ready to receive a heel of a ski boot. In this position the cap-shaped member **39** is in its lowest position just above the two guide rails **5** and covers the adjusting screw **17** and the coil springs **19** and **21**. Only the indicator slide **23** projects with lateral portions thereof through the cutouts **9** of the side walls **7**. The lever **60** is in slightly lifted position in which the roller **76** carried thereby abuts against the portion **56** of the cam **55** as well as against the rearwardly projecting locking portion **126** of the member **107**. The two rollers **74** are located beneath the noses **118** of the member **107** so that the latter is freely turnable about the bolt **128**.

The member **92**, which is turnable about the short shafts **86** of the links **84**, is through the guide slots **102** and the bolt **128** in operative connection with the member **107**. The locking portion **126** of the member **107** engages the roller **76** in this position at a point which is above the turning axis of the roller **76**. In this position of the unit the heel **4** of a ski boot is pushed against the heel engaging portion **110** of the member **107** by moving the heel along the guide faces **147** of the member **134** and if the heel is then pressed downwardly onto the portion **110**, the members **107** and the links **84** will be turned about the bearing bolt **41** while the guide slots **102** move along the pin **128** downwardly and rearwardly. At the same time the whole movable upper part of the unit is pushed rearwardly whereby the bearing bolts **31**, respectively **33** serve at fixed points, whereas the link members **132** swing downwardly and rearwardly. During this movement of the members **107** and **92** the short shafts **86** are also turned so that the bolts **124** will move from the position shown in FIG. 2 to the position shown in FIG. 3, whereby the spacing between the members **134** and **107** respectively between the heel engaging portions **142** and **110** of these members will be changed corresponding to the eccentricity of the axes of the bolts **124** and the short shafts **86**.

In this way a proper securing of the heel between the members **107** and **134**, which in the step-in position as shown in FIG. 2 are spread apart to facilitate easy insertion of the heel, is assured. The link members **84** will turn about the bearing bolt **41** until the heel engaging portion **142** of the member **134** will engage the upper rim surface of the heel. If the heel is now further pressed downwardly, then the movable parts of the unit are pushed rearwardly since the shoe engages with a front portion thereof a front unit of the ski binding, not shown in the drawing. Thereby the two springs **19** and **21** are compressed. This pressure acts in longitudinal direction of the shoe sole and will obtain a predetermined value depending on the adjustment of the adjusting screw **17**. The thus obtained pressure is readable on the lateral marks **25**.

During lifting of the ski boot the member **92** has the tendency to turn about the axis of the short shaft **86** whereby the lower part of the member **134** is pressed against the heel **4** while the upper part tends to move away from the latter. This tendency is partly counteracted by the pressure exerted by the springs **19** and **21**. This tendency can be completely eliminated by the following provisions:

(a) The member **92** is guided on the member **107** in such a manner that these members are movable relative to each other in direction of a line connecting the centers of the bores **114** and **116** in the member **107** or slightly inclined to this line and so that the member **92** may also turn about the axis of the shafts **86** within narrow limits. This guiding is obtained by means of the guide slots **102** which are cooperating with the bolt **128** fixed to the member **107**. The thus obtained limited turning movement assures that the ski boot in the downhill run position shown in FIG. 3 is not pressed too hard against the top surface of the ski.

(b) Another possible solution consists in providing the member **92** with two noses **92'** similar to the noses on the member **107**, which extend over the bearing bolt **41** and which during lifting of the heel **4** abut against this bolt. The shoe releasing effect occurs in this case only shortly before displacement of the roller **76**. The force acting thereby on this roller is, due to the lever action produced by the turnable mounting of the member **107** between the member **134** and the mentioned abutment on the bearing bolt **41**, greater than the force produced during lifting of the heel (FIG. 12).

During movement of the various elements of the heel engaging unit from the position as shown in FIG. 2 to the position as shown in FIG. 3, the locking portion **126** will glide downwardly along the surface of the roller **76** and when the locking portion **126** passes downwardly beyond the critical point **150** (FIG. 3), the lever **60** tends under the influence of the spring **71** to turn in clockwise direction so that the roller **76** is moved on the cam surface **58** of the cam portion **55** against the point of the cam portion to thereby exert on the members **92**, **107** and **134** a closing moment and to hold these members in locked position. Since the locking portion **126** slides on the turnable roller **76**, the wear on these two components will be very small.

During downward movement of the heel **4** the springs **19** and **21** will be compressed, since the front portion of the ski boot is held by a front unit of the ski binding, not shown in the drawing. The forward pressure produced by the springs **19** and **22** will depend on the adjustment of the screw member **17** on the base plate **1** and the forward pressure exerted by the springs is indicated by the indicator slide **23** and the marks **25**. The compression of the spring **19** can, due to the length of the sleeve **30**, not surpass a predetermined magnitude. The adjusting screw **17** may be adjusted in such a manner that when a desired compression of the springs **19** and **21** is obtained in the downhill run position, the lever **60** abuts against the cap-shaped member **39** and prevents that the roller **76** is moved further forwardly along the locking portion

126 so that the whole system would be locked and could be opened only by turning the lever 60 by means of extraneous forces in counterclockwise direction, that is, the heel engaging members would not open during a forward fall of the skier, and the ski binding would not act as safety ski binding any longer.

In the downhill run position, as shown in FIG. 3, the roller 76 is moved forwardly by the lever 60 until the two noses 80 on the side walls of the lever abut with front faces thereof against the abutment member 29 which is arranged axially movable between the opposed ends of the springs 19 and 21.

The compression of the springs 19 and 21 determines therefore the position of the member 29 and therewith the position of the roller 76 with regard to the locking portion 126. The greater the compression of the springs 19 and 21 is, the further will the roller 76 move over the locking portion 126 and the greater will be the necessary force to open the binding during overloads, that is, during a forward fall of the skier. The release moment is therefore dependent on the adjustment of the adjusting screw 17 and the thus produced compression of the springs 19 and 21. This simplifies proper adjustment of the safety ski binding.

To adjust the moment at which the binding opens during a forward fall of the user it is also possible to provide the following means:

The maximum forward movement of the roller 76 over the locking portion 126 may be adjusted by providing an adjusting screw 153 as shown in dash-dotted lines in FIG. 3 which abuts with its upper end against the bottom surface of the handle portion of the lever 60 to prevent thereby further turning of the lever in clockwise direction and resulting forward movement of the roller 76.

Furthermore, the elements cooperating with the spring 71 may be designed in such a manner that the closure pressure acting on the roller 76 and produced by the spring 71 is provided with a characteristic which is desirable for the opening of the binding during a fall of the skier.

When during a fall of the skier the roller 76 is pressed upwardly, due to upward forces exerted on the heel engaging member 134, then the spring 71 will be compressed during a first part of this movement. The counterpressure of the spring 71 increases therefore. Since, however, the lever 60 is turnable mounted on the bolt 41 and the guide rod 70 of the spring 71 is turnably mounted by means of the fork 72 on the bearing sleeve 47 of the link member 35, there will result during turning of the two bolts 62 and 46, against which the spring 71 abuts, about the bearing bolt 41, a reduction of the acting lever arm for the force of the spring 71, which in the position shown in FIG. 3 tends to turn the lever 60 in clockwise direction about the bearing bolt 41. The system may be designed in such a manner that during upward movement of the roll 76 the acting lever arm of the spring 71 decreases more than the spring pressure increases so that the closing moment decreases with increasing upward movement of the roller to thereby assure a sudden release of the heel during a fall.

In order to bring the heel engaging unit from the downhill run position, as shown in FIG. 3, to a walking or cross-country skiing position, the lever 60 is lifted by hand or by the plate of the ski pole to the position shown in FIG. 1. The roller 76 is thereby disengaged from the locking portion 126 of the member 107 and the spring 71 is released. The outwardly bent portions 81 on the lever 60 will engage with the top portion of the cap-shaped member 39 to limit the turning movement of the lever 60. The two rollers 74 are moved over the noses 181 of the member 107 so that the latter may turn about the axis of the bearing bolt 41 and so that the members 92 and 134 are also turned about the bearing bolt 41, while the turning movement is produced by the link members 130. Due to the disengagement of the roller 76 from the locking portion 126, the upper part of the unit may swing about the link arms 35 and 37 so that the cap-shaped member 39 with the elements connected thereto may be swung upwardly to the position as shown in FIG. 1 and again downwardly to the position as shown in FIG. 3. This position of the lever 60 permits therefore during walking to tilt or roll the sole of the ski boot on the top surface of the ski 2. Thereby the members 92 and 134 will move substantially on a circular arc, the turning axis of which is located between the front unit of the ski binding and the heel engaging unit, preferably in the region of the toes of the skier, so that the distance between the portion 110 of the member 107 and the portion 142 of the member 134 will remain substantially constant and so that during this movement there will practically be no relative movement between the heel and the heel engaging portions which would result in damage to the ski boot.

The members which engage the heel of the ski boot will, due to the circular movement of the heel engaging means not change the position relative to the heel. This result is obtained in the following manner:

During movement of the lever 60 from the position shown in FIG. 3 to the position shown in FIG. 1, the two rollers 74 which are mounted on the lever are moved over the two noses 118 of the member 107. The noses 118 are therefore held onto the bearing bolt 41, which prevents an upward tilting of the link members 84 since the pin 124, extending through the bores 88 and fixed at the outer ends thereof to the member 107, will prevent such movement. The two noses 118 of the member 107 are formed in such a manner that during movement of the lever 60 to the position shown in FIG. 1 the bottom edge faces 122 of the noses 118 are tightly pressed against the bearing bolt 41 even if such a tight engagement should initially be prevented by snow accumulations or the like.

The above-described substantially circular movement of the heel engaging means, that is the members 92, 107 and 134, is obtained in the construction shown in the drawing by connecting the member 107 to the shorter link member 37 by means of the link members 130.

The substantially circular movement of the heel engaging means can, however, also be obtained in the following manner:

(a) The link members 130 may also be connected at the rear ends thereof to the longer link member 35 instead to the shorter link member 37 (FIG. 9).

(b) Instead of the link members 130, a roller or a slide member may be connected to the lower portion of the member 107 and this roll or slide member may be guided along a path which preferably is in the form of an upwardly extending circular arc 107' (FIG. 10).

(c) The members 130 may be fixedly connected or be integrally formed with the member 107 and provided at the rear ends thereof with slots in which rollers or guide members are arranged which are mounted on a rearwardly extended portion of the link arm 35 or on an elongated portion of the link arm 37 (FIG. 11).

During lifting of the lever 60 to the position shown in FIG. 1 the link members 84 are maintained in a stable locking position in which the common axis of the short shafts 86 is located below a horizontal line passing through the axis of the bearing bolt 41, and therefore the heel of the ski boot will not be released during movement of the elements of the unit to the position shown in FIG. 1. The forces of the heel of the ski boot which are transmitted to the link members 84 tend to turn the latter to an even further stable position.

The longitudinal pressure produced by the compression springs 19 and 21 hardly changes due to the substantially circular lifting movement of the heel 4 so that any wear on the rails 5 will be relatively small. By means of spacer discs, which may be inserted between the top surface in the ski and the base plate 1, it is possible

to vary the position of the mentioned circular movement to obtain, during use of ski boots of different size, the same relationship with regard to the longitudinal pressure produced by the springs **19** and **21**.

Since the longitudinal pressure during lifting of the heel remains substantially constant, the resistance against lifting of the heel will be very small, since only frictional forces will have to be overcome. This is especially advantageous during use of the ski binding for cross-country skiing. The change-over from the position shown in FIG. 1 for cross-country skiing to the downhill run position shown in FIG. 3 is produced by downward pressure on the handle portion **82** of the lever **60**.

Rubber buffers **40** connected to the inner surface of the cup-shaped member **39** at the rear end of the latter by bent-over flaps integral with the member **39** form resilient abutments for the link member **37** during cross-country skiing.

In order to bring the heel engaging unit into the step-in position as shown in FIG. 2, the lever **60** is lifted from the position shown in FIG. 3 until the roller **76** abuts against the portion **56** of the cam **55** on the lower bearing bushing **51** of the longer link arm **35**, and thereafter pulling on the yoke **138** on the member **92** so that the latter, together with the member **134**, is lifted and tilted backwardly to the position shown in FIG. 2.

By moving the lever **60** to an intermediate position as shown in FIG. 4, the outwardly bent portions or limiting means **81** on the lever **60** will abut against the lower bearing bushing **51** limiting thereby downward movement of the heel engaging means so that the latter may not move to the position shown in FIG. 3, which is especially desirable during use of the ski for upward walking on steep slopes.

The movable upper part of the heel engaging unit can be removed from the ski **2** while leaving the base plate **1** connected thereto. In order to remove the upper part of the unit from the ski it is only necessary to disengage the adjusting screw **17** from the base plate by screwing the screw **17** rearwardly and afterwards the whole upper part of the unit may be slid rearwardly along the guide rails **5** and removed from the base plate **1**. If the skier has several pairs of skis, it is only necessary to obtain base plates **1** for each pair of skis and to mount then the upper part of the unit on the respective base plate. For skis to be rented, it is preferred to obtain longer base plates **1** to provide for a greater adjustability so that the unit may be used for ski boots of different size. In the downhill run position the adjusting screw **17** is protected by the cap-shaped member **39** and an adjustment of the screw **17** is possible only when the unit is in the walking position. Furthermore, due to the specific configuration of the lever **60** and the cap-shaped member **39** as shown in the drawing, the whole unit has a closed and pleasing appearance. Due to the pressure of the springs **19** and **21**, the threads of the adjusting screw **17** are in tight frictional engagement with the threads **27** on the base plate so that an inadvertent turning of the adjusting screw is prevented.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of heel engaging units for a safety ski binding differing from the types described above.

While the invention has been illustrated and described as embodied in a heel engaging unit for a safety ski binding adjustable between a downhill run position and a cross-country skiing position, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be secured by Letters Patent is:

1. A heel engaging unit for a safety ski binding adapted to cooperate with a front unit of the ski binding for pressing a front portion of a ski boot into the front unit of the ski binding, said heel engaging unit comprising support means adapted to be mounted on a ski rearwardly of the front unit thereon; heel engaging means constructed and arranged to automatically engage the heel of a ski boot when the user steps with the heel into said heel engaging means; and linkage means connecting said heel engaging means to the support means, said linkage means extending rearwardly of said heel engaging means and guiding said heel engaging means movably relative to the ski along a predetermined portion of a substantially circular path having its turning axis in the region of the top surface of the ski and adjacent the front unit of the ski binding so that during use of the ski binding for walking said heel engaging means remains substantially non-shiftably connected to the heel of the ski boot.

2. A heel engaging unit as defined in claim **1**, wherein said linkage means comprises a first parallelogram guide including an elongated member having a front portion and a rear portion, and a pair of first link means respectively pivotally connected at opposite ends thereof to said support means and said elongated member in the region of the rear portion of the latter, and a second parallelogram guide including a pair of second link means, one of said second link means being pivotally connected at one end thereof to one of said first link means and at the other end thereof to said heel engaging means, and the other of said second link means being pivotally connected at one end thereof to said elongated member in the region of the front portion of the latter and at the other end thereof to said heel engaging means.

3. A heel engaging unit as defined in claim **2**, wherein said heel engaging means includes a first heel engaging member having a first heel engaging portion adapted to engage an upper face of a rim portion on the heel of the ski boot, a second heel engaging member having a second heel engaging portion adapted to be engaged by a bottom face of the heel, said first and second heel engaging members being connected to each other movable between a step-in position in which said second heel engaging portion projects forwardly beyond said first heel engaging portion, and an engaging position in which said heel engaging portions are spaced from each other a distance smaller than in said step-in position, said heel enaging portions being brought to said engaged position by pressing the bottom face of the heel against the second heel engaging portion.

4. A heel engaging unit as defined in claim **3**, and including locking means cooperating with said heel engaging members for locking the same in said engaged position.

5. A heel engaging unit as defined in claim **4**, wherein said locking means include lever means pivotally mounted on said elongated member movable between a first position in which said lever means cooperates with said heel engaging means for maintaining the same in a downhill run position in which said second heel engaging member is maintained closely adjacent the top surface of the ski, and a walking position in which said heel engaging means may move along said circular path.

6. A heel engaging unit as defined in claim **5**, wherein said lever means include a first engaging portion cooperating with said heel engaging means in said first position of said lever means for maintaining said heel engaging means in said downhill run position, and a second engaging portion cooperating with said heel engaging means in said second position of the lever means for permitting said heel engaging means to move along said circular path while maintaining said heel engaging members in said engaged position.

7. A heel engaging unit as defined in claim **6**, wherein said first and second engaging portions are constituted by rollers turnably mounted on said lever means.

8. A heel engaging unit as defined in claim **3**, and in-

cluding eccentric means cooperating with said heel engaging members for moving the same relative to each other to said engaged position during exertion of pressure on said second heel engaging portion.

9. A heel engaging unit as defined in claim 8, wherein said eccentric means includes a first member turnably about a first axis and engaging one of said heel engaging members, and a second member carried by said first member and having an axis arranged eccentrically with respect to said first axis and engaging the other of said heel engaging members, the distance between said axes determining movement of said heel engaging members relative to each other.

10. A heel engaging unit as defined in claim 9, wherein said first member of said eccentric means is carried by said other of said second link means in the region of the other end thereof and turnably about said first axis.

11. A heel engaging unit as defined in claim 3, wherein said second heel engaging member has a rearwardly projecting locking portion, and including locking means cooperating with said locking portion for releasably maintaining said heel engaging means in a downhill run position in which said heel engaging members are in said engaged position and in which said heel engaging portion of said second heel engaging member is located adjacent the top surface of the ski.

12. A heel engaging unit as defined in claim 11, wherein said locking means comprise a lever pivotally mounted on said elongated member turnably between a plurality of positions, and a roller carried by said lever and engaging in one of said positions of said lever said locking portion for releasably maintaining said heel engaging means in said downhill run position.

13. A heel engaging unit as defined in claim 12, and including spring means cooperating with said lever and being biased to yieldably maintain the latter in said one position thereof, said lever being movable against the force of said spring means to a releasing position in which said roller is disengaged from said locking portion upon lifting of the bottom face of the heel from said second heel engaging portion and simultaneously exerting a predetermined upward pressure against said first heel engaging portion.

14. A heel engaging unit as defined in claim 13, wherein said spring means are connected at one end thereof to said lever and at the other end thereof to said one of said pair of first link means.

15. A heel engaging unit as defined in claim 13, wherein said roller cooperates with said locking portion of said second heel engaging member in such a manner to cause, upon lifting of the heel from said second heel engaging portion and simultaneously exerting upward pressure against said first heel engaging portion, first an increased stressing of said spring means, and after said locking portion engages a predetermined point of said roller, relaxing of said spring means.

16. A heel engaging unit as defined in claim 15, wherein said spring means is mounted and connected to said lever in such a manner that during movement of said lever from said one to said releasing position, the lever arm of the force component of the spring means which resists turning of the lever to said releasing position will continuously decrease so that the moment necessary to turn said lever to said releasing position decreases while the stress of said spring means increases during a first part of the turning movement of the lever from said one to said releasing position.

17. A heel engaging unit as defined in claim 13 and including additional spring means acting substantially in longitudinal direction of the ski and being arranged and constructed to assist, when said lever is in said one position thereof, the action of said first mentioned spring means to maintain said lever in said one position thereof.

18. A heel engaging unit as defined in claim 17 and including adjusting means for adjusting the force of said additional spring means.

19. A heel engaging unit as defined in claim 17, wherein said support means includes a base plate adapted to be mounted on the ski, a frame mounted on said base plate movable in longitudinal direction of the ski, said additional spring means being connected to said base plate and said frame and being biased to resist rearward movement of said frame relative to said base plate, said pair of first link means being pivotally connected at one of the opposite ends thereof to said frame.

20. A heel engaging unit as defined in claim 19, wherein said additional spring means includes a pair of springs aligned with each other substantially in longitudinal direction of the ski, and an abutment member located between and engaged by opposing ends of said pair of springs and movable in said direction, said lever engaging in said one position thereof said abutment member in such a manner so as to increase the force holding said lever in said one position.

21. A heel engaging unit as defined in claim 12 and including stop means engaging said lever in said one position thereof for determining in said one position of the lever the position of said roller relative to said engaging portion.

22. A heel engaging unit as defined in claim 21, wherein said stop means includes a screw threadingly connected to said elongated member for adjusting said one position of said lever.

23. A heel engaging unit as defined in claim 5 and including limiting means cooperating with said heel engaging means for limiting downward movement of said heel engaging means so as to maintain said heel engaging means in said walking position above said downhill run position.

24. A heel engaging unit as defined in claim 23, wherein said limiting means are mounted on said lever means and engaging a part on said support means during downward movement of said heel engaging means to limit further downward movement of the latter.

25. A heel engaging unit as defined in claim 3, and including means on said second heel engaging portion for securing there to a member upwardly projecting therefrom for assuring proper engagement of the heel with said second heel engaging portion.

26. A heel engaging unit as defined in claim 3, wherein said first heel engaging member has at least one guide face for guiding a heel onto said second heel engaging portion.

27. A heel engaging unit as defined in claim 3, wherein said first heel engaging member includes a first component provided with said first heel engaging portion, a second component connected to said other one of said second link means, and means for adjustably connecting said first and second component to each other for adjusting the position of said first and second heel engaging portions in said engaged position of said heel engaging members relative to each other.

28. A heel engaging unit as defined in claim 1, wherein said heel engaging means includes a first heel engaging member having a first heel engaging portion adapted to engage an upper face of a rim portion of the heel of a ski boot, a second heel engaging member having a second heel engaging portion adapted to be engaged by a bottom face of the heel, said first and second heel engaging members being connected to each other movable between a step-in position in which said second heel engaging portion projects forwardly beyond said first heel engaging portion and an engaged position in which said heel engaging portions are spaced from each other a distance smaller than in said step-in position, said heel engaging portions being brought to said engaged position by pressing the bottom face of the heel against said second heel engaging portion, and guide means connected to one of said heel engaging

members for guiding the same along a substantially circular path.

29. A heel engaging unit for a safety ski binding adapted to cooperate with a front unit of the ski binding for pressing a front portion of a ski boot into the front unit of the ski binding, said heel engaging unit comprising a first quadrangular guide linkage including a support member adapted to be mounted on the ski rearwardly of the front unit thereon, a pair of first link means having lower ends pivotally connected spaced from each other to said support member, and an elongated member having a rear portion to which upper ends of said pair of first link means are pivotally connected; heel engaging means constructed and arranged to automatically move to a closed position gripping the heel of a ski boot when the user steps with the heel into the heel engaging means; a pair of second link means, one of said second pair of link means being pivotally connected at one end thereof to one of said first pair of link means and at the other end thereof to said heel engaging means, and the other of said second pair of link means being pivotally connected at one end thereof to said elongated member in the region of a front portion of the latter and at the other end thereof to said heel engaging means so that said pair of second link means form with said heel engaging means a second quadrangular guide linkage; and releasable locking means cooperating with said heel engaging means for yieldably maintaining the same in said closed position and adjacent said top surface of the ski.

30. A heel engaging unit as defined in claim 29, wherein said one of said first link means is longer than the other of said first link means.

31. A heel engaging unit as defined in claim 30, wherein said heel engaging means has a locking portion, and wherein said locking means comprises lever means pivotally connected to said elongated member so as to be movable to and from a locking position, an engaging portion on said lever means and engaging said locking portion of said heel engaging means when said lever means is in said locking position so as to maintain said heel engaging means adjacent the top surface of the ski, and spring means cooperating with said lever means and biased to yieldably maintain the latter in said locking position.

References Cited

UNITED STATES PATENTS

2,758,846	8/1956	Swensen	280—11.35
3,244,431	4/1966	Hatlapa	280—11.35
3,317,217	5/1967	Poiger	280—11.35
3,328,044	6/1967	Klamt	280—11.35
3,333,859	8/1967	Smolka et al.	280—11.35

BENJAMIN HERSH, *Primary Examiner.*

L. DANIEL MORRIS, JR., *Assistant Examiner.*