May 19, 1970 H. MARKER ET AL 3,512,797

HEEL-HOLDING DEVICE FOR SAFETY SKI BINDINGS

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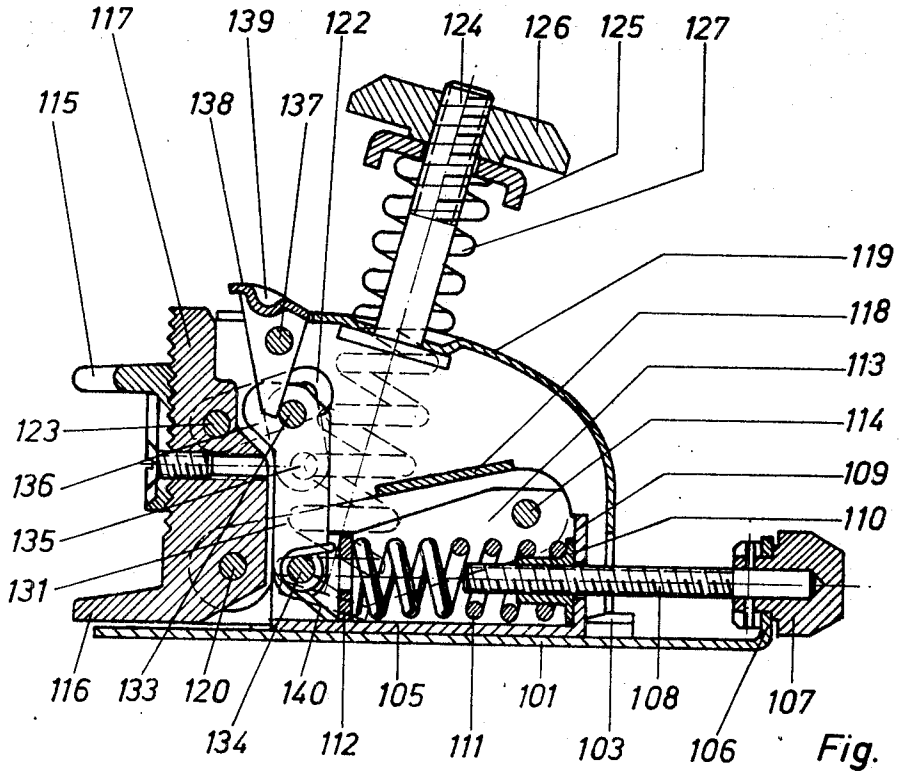


Fig. 1

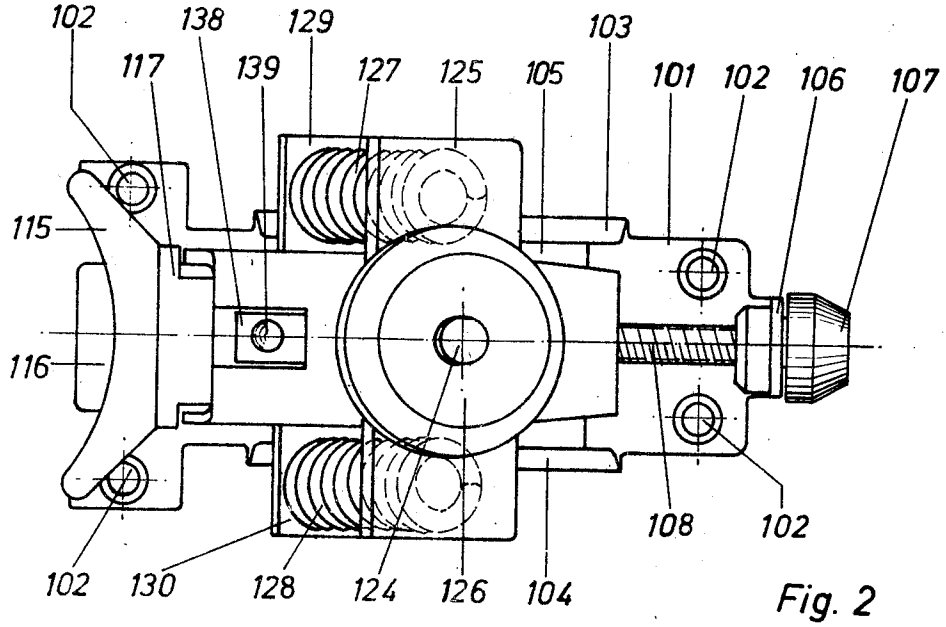


Fig. 2

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HEEL-HOLDING DEVICE FOR SAFETY SKI BINDINGS

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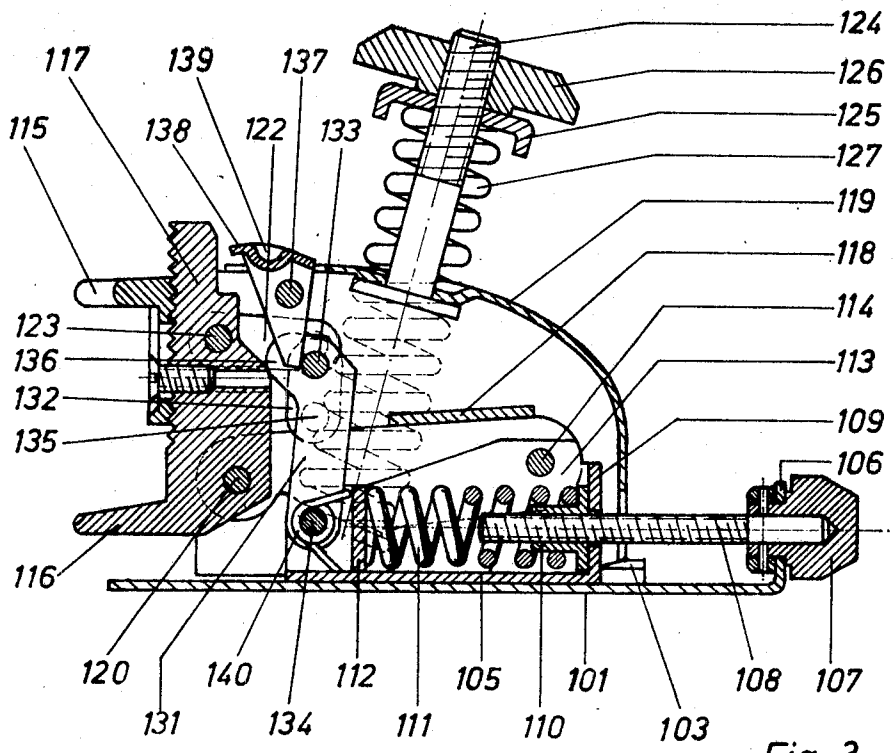


Fig. 3

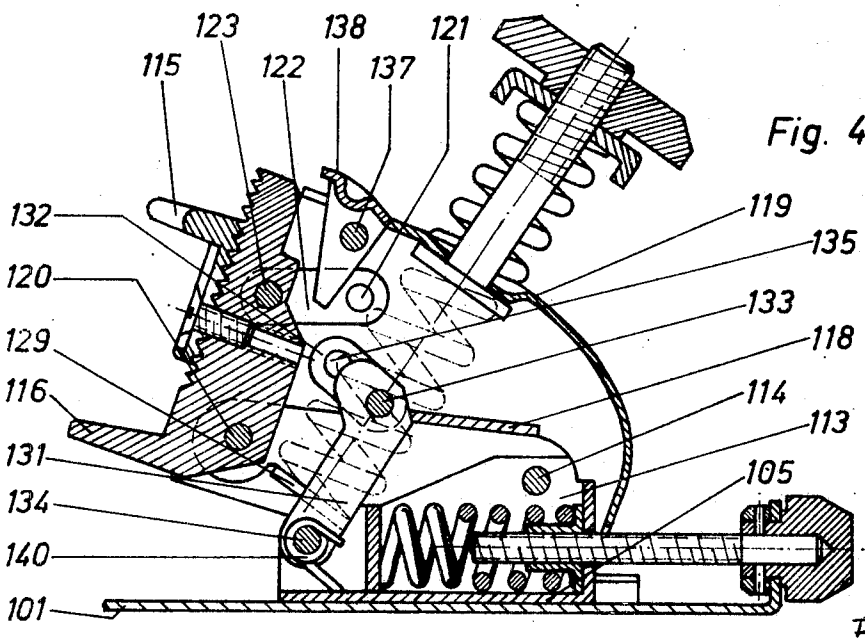


Fig. 4

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HEEL-HOLDING DEVICE FOR SAFETY SKI BINDINGS

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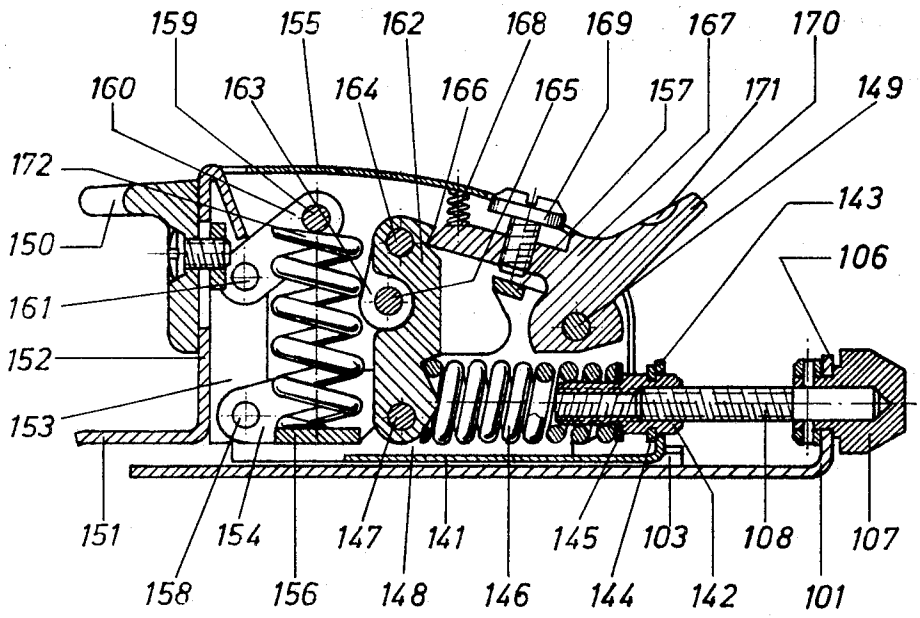


Fig. 5

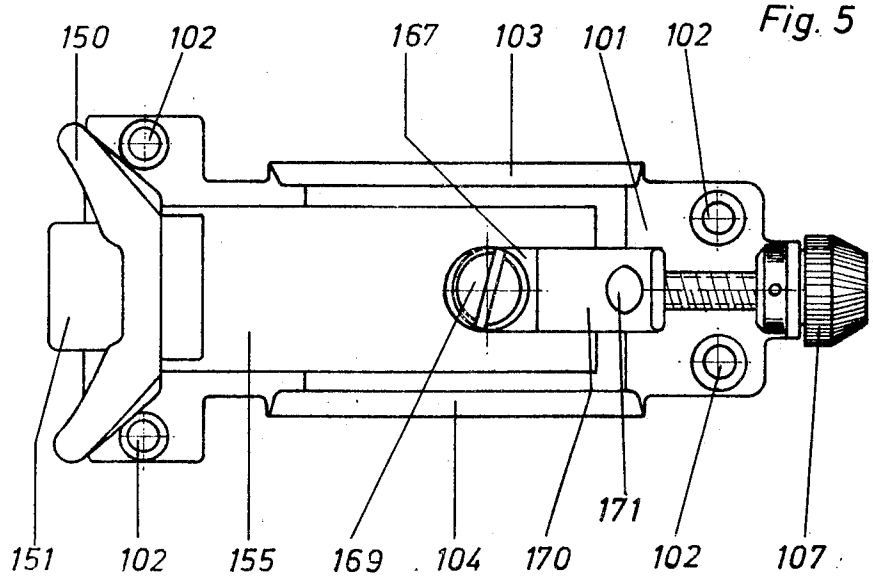


Fig. 6

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HEEL-HOLDING DEVICE FOR SAFETY SKI BINDINGS

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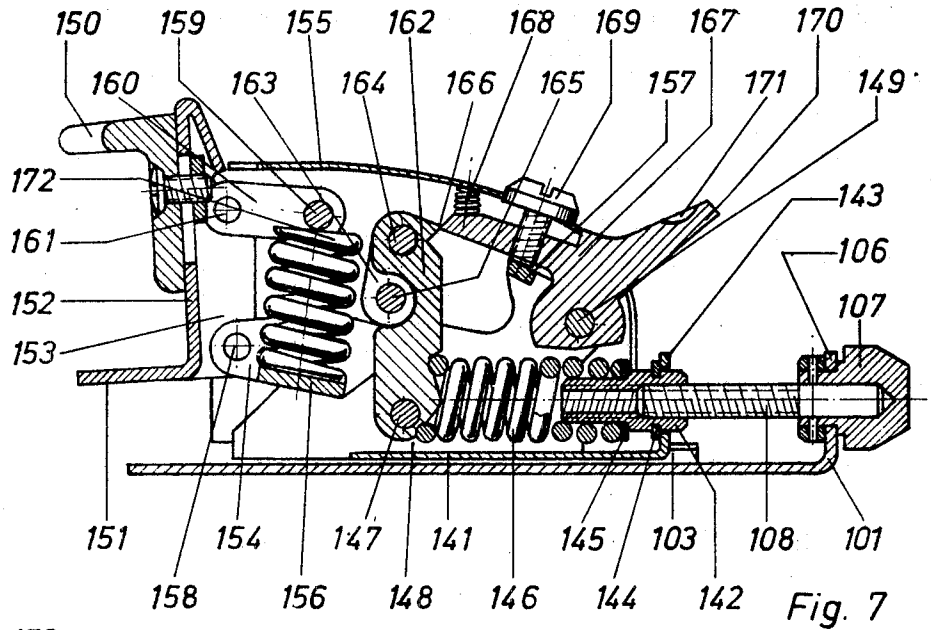


Fig. 7

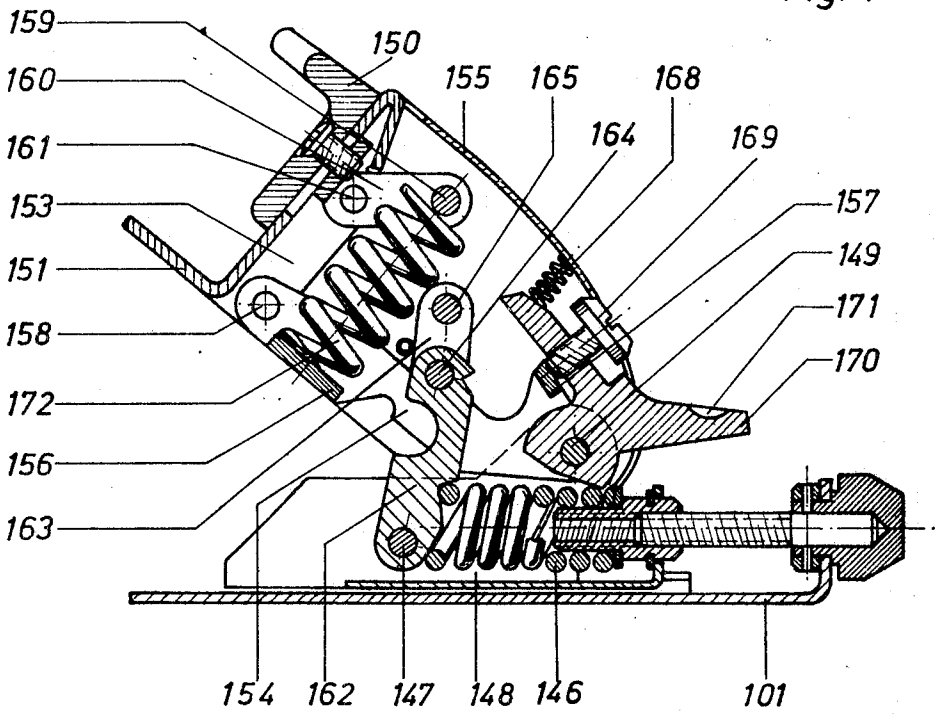


Fig. 8

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HEEL-HOLDING DEVICE FOR SAFETY SKI BINDINGS

Filed Oct. 2, 1967 5 Sheets-Sheet 5

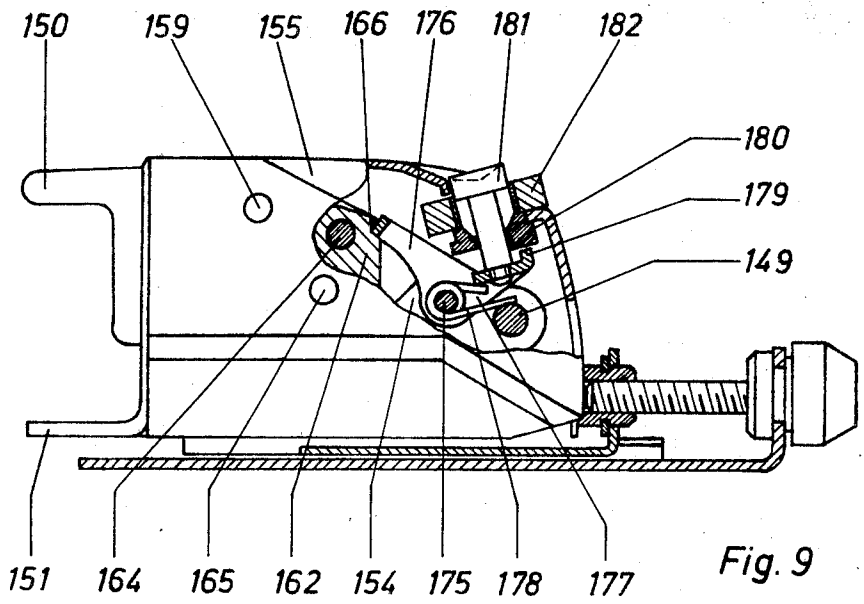


Fig. 9

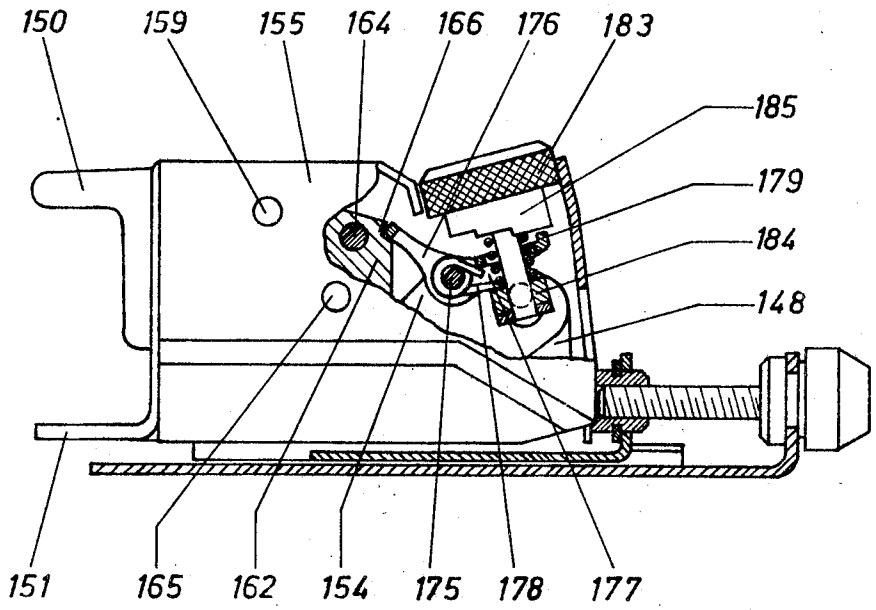


Fig. 10

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HEEL-HOLDING DEVICE FOR SAFETY SKI BINDINGS

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Claims priority, application Germany, July 5, 1967, 74,643
Int. Cl. A63c 9/084
U.S. Cl. 280—11.35 19 Claims

ABSTRACT OF THE DISCLOSURE

A carrying member for a soleholder and a closing pedal is pivoted on an axis disposed behind the heel and is under the influence of a spring element. The heel-holding device automatically assumes a locking position in response to the insertion of a skiing boot into the binding and can be arbitrarily open, e.g., by the application of slight pressure with a ski stick to a release member, and can be automatically released in response to an excessive upward tensile force, which is approximately vertical. The carrying member consists of two jaw arms, which are pivotally movable relative to each other against the force of the spring element. One of said jaw arms is directly connected to the soleholder. A locking device is provided, which is under the action of the soleholder or of that arm of the carrying member which is directly connected to the soleholder. The locking device acts on the other arm of the carrying member and releases said other arm after a predetermined upward movement of the soleholder.

The present invention relates to a heel-holding device for safety ski bindings, which device comprises a carrying member for a soleholder and a closing pedal, which carrying member is pivoted on an axis disposed behind the heel and is under the influence of a spring element, and which device automatically assumes a locking position in response to the insertion of a skiing boot into the binding and can be arbitrarily opened, e.g., by the application of slight pressure with a ski stick to a release member, and can be automatically released in response to an excessive upward tensile force, which is approximately vertical.

Various types of such heel-holding devices are known. Compared to other known heel-holding devices which operate according to different principles, they have the important advantage that the force which acts in a releasing sense on the soleholder is opposed by a progressively increasing, elastic resistance until a predetermined, adjustable release position is reached, and that resistance damps the force. On the other hand, the heel-holding devices of the kind defined have an important disadvantage, which reduces their utility and opposes their practical use. In said heel-holding device, the carrying member for the soleholder and the closing pedal is so mounted on a part which is fixed to the ski that a certain displacement of said carrying member in an approximately vertical upward direction is required before it can perform a rearward pivotal movement to its open position. That upward displacement is opposed by the force of the spring element. A lock is provided to prevent a downward displacement of the carrying member by the spring element when the carrying member has been outwardly deflected. During the insertion of the skiing boot into the binding, the carrying member is pivotally moved forwardly so that the spring element is released to effect a sudden return displacement of the carrying member. With this design, the

manipulation may result in an injury due to an intended or unintended release of the spring element because the carrying member can be forwardly deflected relatively easily and there is no special safety feature to prevent said movement.

It is an object of the present invention reliably to avoid this disadvantage in a heel-holding device of the kind defined initially hereinbefore and so to design the heel-holding device that it can be manufactured simply and at low cost and is not liable to be deranged.

In a heel-holding device for safety ski bindings, which device comprises a carrying member for a soleholder and a closing pedal, which carrying member is pivoted on an axis disposed behind the heel and is under the influence of a spring element, and which device automatically assumes a locking position in response to the insertion of a skiing boot into the binding and can be arbitrarily opened, e.g., by the application of slight pressure with a ski stick to a release member, and can be automatically released in response to an excessive upward tensile force, which is approximately vertical, this object is accomplished according to the invention in that the carrying member consists of two jaw arms, which are pivotally movable relative to each other against the force of the spring element, one of said jaw arms carries the soleholder and/or the closing pedal, a locking device is provided, which is under the action of the soleholder or of that arm of the carrying member which is directly connected to the soleholder, and said locking device acts on the other arm of the carrying member and releases said other arm after a predetermined upward movement of the soleholder. Owing to the principle employed by the invention for the cooperation of the two arms of the carrying member and of the locking device, the carrying member can be pivotally moved as a whole when the second arm of the carrying member has been unlocked; this pivotal movement of the carrying member is not affected by the spring element. The spring element may preferably consist of a pair of helical compression springs or of a pair of helical tension springs. As it is not connected to a part fixed to the ski, as with the known heel-holding device, said spring element cannot influence the closing movement of the carrying member.

To ensure that the soleholder remains in good contact with the upper edge of the sole of the boot before the release position is attained—bearing in mind that the fulcrum of the sole of the boot is approximately at the point of engagement of the ball of the foot—a special development of the heel-holding device according to the invention resides in that the soleholder is directly pivoted to one arm of the carrying member and is pivoted to the other arm by means of a coupling link so that an upward movement of the soleholder and closing pedal causes the soleholder to perform an additional movement toward the tip of the ski relative to the closing pedal.

In a simple embodiment of the heel-holding device according to the invention, the locking device comprises a toggle joint, one arm of which is pivoted to a part of the device that is fixed to the ski, whereas the other toggle arm is pivoted to the arm of the carrying member which is not directly connected to the soleholder, said toggle joint being under the influence of a spring tending to urge said toggle joint toward the soleholder.

As has been mentioned hereinbefore, the spring element of the novel heel-holding device is not connected to a part of the device that is fixed to the ski. As a result, the device will present virtually no resistance to the skiing boot when the release position has been reached and the boot is then suddenly released by the device so that the skiing boot does not squeeze itself out as with the known devices. The spring acting with a relatively small force on

the toggle joint serves for holding the carrying member for the sole-holder and the closing pedal in its open position. Only this small spring force must be overcome during the closing movement.

The toggle joint may suitably consist of an over-center lever and its knee may be movable over center to the release position under the influence of the soleholder or of that arm of the carrying member which is directly connected to the soleholder. Alternatively, the toggle joint may be held in the locking position by a locking lever, which is pivotally movable to its release position against the force of a weak restoring spring by that arm of the carrying member which is directly connected to the soleholder.

To enable an adjustment of the heel-holding device to the mass and force and the skiing technique of a given skier, provision may be made for varying the initial stress and/or the spring deflection range so as to set different release hardness values.

A lever acting directly on the locking devices may be pivoted to that arm of the carrying member which is not directly connected to the soleholder. This lever may serve as an actuating member for an arbitrary opening of the device.

Where a locking lever cooperates with the toggle joint, it has proved desirable to provide a two-armed locking lever, the second arm of which serves as an actuating member for an arbitrary opening of the device. For design reasons the arrangement is preferably such in this case that the pivotal axis of the locking lever coincides with the pivotal axis of the carrying member for the soleholder. That arm of the carrying member which is directly connected to the soleholder acts preferably by an adjustable stop on the locking lever. In this case, an adjustment of the stop will change the spring deflection and with it the release hardness value.

An ever more closed design can be obtained in a modification of the embodiment just described if the locking lever is pivoted to that arm of the carrying member which is directly connected to the soleholder and the locking lever has two arms, one of which forms the locking nose whereas the other arm bears on that arm of the carrying member which is not directly connected to the soleholder. For a change of the release hardness value in this case, that arm of the carrying member which is directly connected to the soleholder may have an adjustable stop. The adjustable stop may comprise a central pressure pin for use as an actuating member for an arbitrary opening of the device.

In a special development of the means for an arbitrary opening of the heel-holding device, an arrangement has been found suitable in which the arm of the locking lever bears on a pressure pin on that arm of the carrying member which is not directly connected to the soleholder. Said pressure pin serves as an actuating member for an arbitrary opening of the device. In this case, the pressure pin may be rotatably mounted and may comprise a collar, which is stepped or spiral-shaped. Such pressure pin is provided with means to prevent an undesired rotation thereof. This design results in a simple and extremely stable device, which ensures also a reliable function.

If the heel-holding device is used together with a toe-holding device, against which the skiing boot must be resiliently urged, one arm of the toggle joint and the carrying member for the soleholder are pivoted to a carriage of the heel-holding device, which carriage is held for adjustment in the longitudinal direction of the ski on a base plate that is fixed to the ski and a compression spring is interposed between the carriage and the base plate. In this case an arrangement has been found suitable in which the compression spring acting on the carriage forces also the toggle joint toward the soleholder so that there is no need for a separate spring for this purpose.

Embodiments of the invention will now be described

more fully by way of example with reference to the accompanying drawings, in which FIG. 1 is a central longitudinal sectional view showing a first embodiment of the heel-holding device according to the invention and FIG. 2 is a top plan view of FIG. 1. FIG. 3 shows in a view similar to FIG. 1 the position immediately before the release and FIG. 4 in a view similar to FIG. 1 the open position. FIG. 5 is also a central longitudinal sectional view showing a second embodiment of the heel-holding device according to the invention and FIG. 6 a top plan view of FIG. 5. FIG. 7 shows in a view similar to FIG. 5 the position immediately before the release and FIG. 8 in a view similar to FIG. 5 the open position. FIG. 9 is a side elevation, partly cut open, showing a third embodiment of the heel-holding device according to the invention and FIG. 10 a view similar to FIG. 9 showing a fourth embodiment of the heel-holding device according to the invention.

In the first embodiment of the heel-holding device according to the invention, shown in FIGS. 1–4, a base plate **101** serves for the fixation of the device to a ski. To this end, the base plate has four screw holes **102**. The base plate is provided at its longitudinal sides in its intermediate portion with lugs **103**, **104**, which are upwardly and inwardly angled and form guideways for a carriage **105**, which is held on the base plate for a displacement in the longitudinal direction. The rear end of the base plate is right-angled upwardly to form a lug **106**, in which an actuating knob **107** is rotatably mounted and axially fixed. This knob serves for rotating a screw **108**, which is firmly connected to the knob and extends freely through a vertical transverse wall **109** of the carriage **105**. The screw **108** carries on its free end portion a tapped bushing **110**, which has a collar forming a spring abutment and is locked against rotation. A helical compression spring **111** bears at one end on the collar of the tapped bushing and at the other end on a second transverse wall **112** of the carriage **105**. When the heel-holding device is unloaded, the helical compression spring has a slight initial stress whereby the carriage **105** is urged against the collar of the tapped bushing **110**. The carriage **105** has two vertical side walls **113**, which are respectively disposed on opposite sides of the helical compression spring **111**. A pivot **114** is mounted in the two side walls **113** and the carrying member for the soleholder **115** and the closing pedal **116** is pivoted on said pivot. The closing pedal is formed by the short arm of a bell-crank lever. The soleholder **115** is screw-connected to the long arm **117** of said lever for adjustment in height so that it can be adapted in known manner to skiing boot soles differing in thickness.

According to the present invention, the carrying member for the soleholder consists of two parts. The soleholder forms a unit with the closing pedal. The two parts **118** and **119** of the carrying member are pivoted on the pivot **114**. The inner part **118** consists of a U-shaped, bent piece of sheet metal. The limbs of said piece extend at their free end beyond the web and to positions on the side of the long arm **117** of the bell-crank lever. The extensions are pivoted to said arm by a pivot **120**. The outer part **119** of the carrying member consists of a housing. Each of the side walls of the housing is mounted on the pivot **114** and carries a pivot **121** (see particularly FIG. 4) for a respective coupling link **122**. These coupling links lie in the planes of the arms of the inner part **118** of the carrying member and just as said latter arms extend to positions beside the long arm **117** of the bell-crank lever. The coupling members **122** are pivoted to the arm **117** by a pivot **123**. An end wall connects the two side walls of the outer part **119** of the carrying member and carries a screw **124**, on which a yoke **125** is fitted, which is held by a knurled nut **126** against an outward displacement. Two helical compression springs **127**, **128** bear on the yoke **125** and extend on both sides of the outer part **119** of the carrying member. At its other end,

each of the springs **127**, **128** acts on an associated, outwardly angled lug **129** or **130** of the respective arm of the inner part **118** of the carrying member (see particularly FIG. 2).

In this embodiment, the locking device consists of two congruent over-center levers, which are are disposed on both sides of the vertical center plane of the heel-holding device and consist each of two lever arms **131**, **132** and the common knee **133**. The lever arms **131** are pivoted on a pivot **134**, which is mounted on the side walls **113** of the carriage **105**. Each of the lever arms **132** is pivoted on a pivot pin **135**. The pivot pins **135** are fixed in the side walls of the outer part **119** of the carrying member, e.g., by riveting. Close to the knee **133**, each lever arm **131** has a nose **136**, which extends toward the soleholder **115** into the range of action of a run-up ramp, which is machined at the rear of the long lever arm **117**. A two-armed lever **138** is pivoted on a pivot **137**, which is secured in the outer part **119** of the carrying member. The lever **138** serves as an actuating member for an arbitrary opening of the device and consists of a U-shaped sheet-metal member, the free limb ends of which act against the knee **133** and which has a web formed with a pressed depression **139** for receiving the tip of a ski stick. A torsion spring **140** is mounted on the pivot **134** between the two lever arms **131** and urges the knee **133** toward the soleholder **115**.

FIG. 4 shows the heel-holding device in an open position. During the insertion of the skiing boot into the binding, the heel contacts the closing pedal **116** and effects a pivotal movement thereof together with the soleholder **115** and the two parts **118**, **119** of the carrying member to the locked position, shown in FIG. 1. During this movement, the over-center lever **131**, **132**, **133** is moved to an over-center position, in which it is held by the weak torsion spring **140**. FIGS. 1 and 3 show the heel-holding device in a locked state but without an exertion of contact pressure toward the toe-holding device. During the insertion of the skiing boot in the binding, the contact pressure is exerted in that the boot displaces the carriage **105** and the parts mounted thereon more or less to the right in the drawings against the force of the spring **111**. The tapped bushing **110** can be adjusted on the screw **108** to vary the contact pressure and to adjust the heel-holding device to skiing boots having different lengths. The soleholder **115** has previously been adjusted to the thickness of the sole of the skiing boot so that it correctly engages the top rim of the sole. During the stepping into the binding, no force is applied to the springs **127**, **128**, which are required for the safety release.

An arbitrary opening of the heel-holding device may be effected in that pressure is applied to the lever **138**. For this purpose, e.g., the tip of a ski stick may be inserted into the depression **139** of the lever **138**. The lever **138** is thus rotated in the counter-clockwise sense about the pivot **137** in the drawings so that the inwardly extending lever arm acts on the knee **133** to move the over-center lever against the small force of the torsion spring **140** to an over-center position, in which the carrying member can be pivotally moved as a whole to the locking position shown in FIG. 4.

If an approximately vertically upwardly directed tension force acts on the soleholder **115** during skiing, the soleholder can move upwardly against the force of the helical compression springs **127**, **128**. During this movement, the soleholder is positively constrained by the inner part **118** and the coupling links **122**. This positive constraint ensures that the movement of the soleholder is adapted to the movement of the rear end of the sole of the skiing boot. When the force acting on the soleholder decreasese, the springs **127**, **128** act through the inner part **118** of the carrying member to urge the soleholder back to its initial position. When a larger force acts on the soleholder **115**, the two springs **127**, **128** are compressed to such an extent that the long lever arm **117**, which carries the soleholder, engages with its run-up ramp the nose **136** of the lever arm **131** of the over-center lever to pivotally move the same toward its center position during the upward movement of the arm **117**. When the over-center lever moves beyond the center position, the outer part **119** of the carrying member **119** is released and both parts of the carrying member as well as the soleholder and the bell-crank lever which carries the soleholder can pivotally move as a whole about the pivot **114** to the open position. As a result, the heel of the skiing boot is virtually suddenly released and without a resistance at the end of the damping excursion.

FIGS. 5–8 show a second embodiment of the heel-holding device according to the invention. As in the embodiment described hereinbefore, a base plate **101** has four screw holes **102** passed through by fixing screws. In its intermediate portion, the base plate is also provided at its longitudinal sides with lugs **103**, **104**, which are bent to form guideways for a carriage **141**, which is held on the base plate for a displacement in the longitudinal direction. The rear end of the base plate is also bent upwardly at right angles to form a lug **106**, in which the actuating knob is rotatably mounted and held against axial displacement. The knob **107** serves for rotating the screw **108**, which is firmly connected to the knob **107**. The screw **108** carries a tapped bushing **142**, which is held against rotation and which extends outwardly through a hole in a vertical transverse wall **143** of the carriage **141**. As a stop for the transverse wall, the bushing carries a lock washer **144**. A spring abutment **145** bears on a collar of the tapped bushing. A helical compression spring **146** bears at one end on the spring abutment **145** and at the other end on a pivot **147**, which is mounted in vertical side walls **148** of the carriage **141**. These side walls are disposed on opposite sides of the helical compression spring. In the unloaded state of the heel-holding device, the spring **146** is under a slight initial stress so that the transverse wall **143** of the carriage bear on the lock washer **144** for the tapped bushing **142**. A second pivot **149** is mounted in the two side walls **148** of the carriage **141**. The carrying member for the soleholder **150** and the closing pedal **151** is pivoted on the pivot **149**. In this embodiment the closing pedal is also formed by the short arm of a bell-crank lever. The soleholder **150** is screw-connected to the long arm **152** for adjustment in height. The long arm has in cross-section the shape of a U, which has limbs **153** extending away from the soleholder.

According to the invention, the carrying member for the soleholder and for the closing pedal consists of two parts **154**, **155**, which are pivoted on the pivot **149**. The inner part of the carrying member consists of two congruent pivoted arms, which lie in vertical planes on both sides of the helical compression spring **146**. The two pivoted arms are interconnected by two cross-struts **156**, **157**. The free ends of the pivoted arms which form the inner part of the carrying member are pivoted by pins **158** to the arms **153** of the unit which forms the soleholder ad the closing pedal. The outer part **155** of the carrying member forms again a housing. A pivot **159** is mounted in the side walls of the housing. Two coupling links **160** are pivoted to the pivot **159** and lie in the planes of the pivoted arms of the inner part **154** of the carrying member and just as these arms are connected to the limbs **153** of the U-shaped unit by pivot pins **161**. The cross-strut **156** of the inner part **154** of the carrying member forms a spring abutment for a helical compression spring **172**. The other end of the latter bears on the pivot **159** in the outer part **155** of the carrying member.

The locking device of this heel-holding device comprises a toggle joint, which consists of the lever arms **162**, **163** and the knee **164**. The free end of the lever arm **162** is pivoted on the pivot **147**. The free end of the lever arm **163** is pivoted on a pivot **165**, which is mounted in the side walls of the outer part **155** of the carrying member. Close to the knee **164**, the lever arm **162** is

formed with a machined nose **166**, which cooperates with a locking lever **167**, which is pivoted on the pivot **149**. The locking lever is under the action of a weak restoring spring **168**, which tends to hold said locking lever in its locking position and which bears on the end wall of the outer part **155** of the carrying member. The locking lever has an adjusting screw **169**, which lies over the cross-strut **157** of the inner part **154** of the carrying member and forms an adjustable stop for that part. The locking lever **167** has a second arm **170**, which serves as an actuating member for an arbitrary opening of the device and which is provided with a depression **171** for receiving the tip of a ski stick. The helical compression spring **146** acts via the lever arm **162** of the toggle joint on the pivot **147**. The point where the spring acts on the lever arm is so selected that the force produces a small torque, which tends to hold the toggle joint in its locking position so that the torsion spring **140** of the first emobdiment can be omitted.

The embodiment of the heel-holding device according to the invention just described with reference to FIGS. 5–8 has substantially the same mode of operation as the embodiment of FIGS. 1–4. FIG. 8 shows the heel-holding device in an open position. Just as in the first embodiment, the insertion of the skiing boot into the binding results in a contact between the heel and the closing pedal **151** so that the unit consisting of the soleholder and the closing pedal and the two parts **154, 155** are pivotally moved to the locking position shown in FIG. 5. The knee **164** moves at the same time to its locking position about the pivot **165** in the outer part **155** of the carrying member in a counter-clockwise sense. When the closing pedal has been fully depressed, the locking lever **167** assumes its locking position, in which the free end of the lever engages from behind the locking nose **166** of the lever arm **162** of the toggle joint. Just as FIGS. 1 and 3, FIGS. 5 and 7 show the heel-holding device in a locked state but without an exertion of contact pressure toward the toe-holding device. The exertion of the contact pressure, its variation and the adjustment to skiing boots having different lengths are effection just as with the embodiment first described. When the boot is stepped into the binding, the helical compression spring **172** is not stressed beyond its initial stress so that virtually no force is required for stepping into a binding in which this embodiment is employed.

The heel-holding device can be arbitrarily opened by the application of pressure on the second arm **170** of the locking lever **167**. The pressure can be applied, e.g., by means of a ski stick, the tip of which can be inserted into the depression **171** of the lever arm **170**. A pivotal movement of the locking lever **167** in the clockwise sense in the drawings releases the toggle joint so that during a movement of the carrying member as a whole about the pivot **149** the knee **164** can perform a pivotal movement away from the soleholder about the axis **165** against the slight restoring torque produced by the helical compression spring **146**.

When an approximately vertically upwardly directed force acts on the soleholder **150** during skiing, the soleholder can move upwardly against the force of the helical compression spring **172**. During this movement, the soleholder is positively constrained just as in the embodiment first described. When the force acting on the soleholder is decreased, the spring **172** urges the inner part **154** of the carrying member and the soleholder back to the initial position. If a larger force which endangers the leg of the skier acts on the soleholder **150**, the spring **172** will be compressed to such an extent that the cross-strut **157** of the inner part **154** of the carrying member engages the adjusting screw **169** so that a further upward movement results in a pivotal movement of the locking lever **167** to disengage it from the locking nose **166**. The movement of the outer part **155** of the carrying member is then no longer resisted by the toggle joint so that the carrying member as a whole can perform a pivotal movement to the open position, shown in FIG. 8. In this embodiment too, the heel of the skiing boot is virtually suddenly released and without a resistance at the end of the damping excursion.

In this embodiment, different release hardness values are set in that the adjusting screw **169**, which forms the stop at the locking lever **167**, is screwed inwardly to a smaller or larger extent to change the amount by which the helical compression spring **172** must be compressed before a release.

In the embodiment of the heel-holding device according to FIGS. 1–4, different release hardness values are set by a change of the initial stress of the helical compression springs **127, 128**.

FIG. 9 shows in a side elevation, partly cut open, the heel-holding device according to the invention in an embodiment which is similar to that of FIGS. 5–8. In the embodiment of FIGS. 5–8, the locking lever is coaxial with the carrying member for the soleholder **150** and the closing pedal **151**. In the present case, it is pivoted on a pivot **175**, which is parallel to the pivot **149** and which is mounted in the inner part **154** of the carrying member. The locking lever has two arms **176, 177**. The free end of one of these arms, **176**, cooperates with the locking nose **166** of the toggle joint. The locking lever is biased by a torsion spring **178**, which is mounted on the pivot **175** and tends to hold the locking lever in locking position. The free end of the lever arm **177** is angled upwardly to form a nose **179**, which serves to coact with a stepped end face of a sleeve **180**. The latter is mounted in the outer part **155** of the carrying member. The stepped end face of the sleeve forms a stop for the nose **179** of the locking lever. A pressure pin **181** is axially fixed to the lever arm **177** and extends through the sleeve **180** and has a depression formed in its free end. The sleeve carries at its upper end a flange **182**, which serves as a grip for rotating the sleeve and is suitably knurled or milled at its outer periphery. The sleeve can be rotated so that a certain portion of its end face is in registry with the nose **179** of the locking lever. As a result, various distances between the nose of the locking lever and the extreme end of the sleeve can be set to vary the release hardness value.

The heel-holding device can be arbitrarily opened by the application of pressure to the pin **181**, e.g., by means of a ski stick, if the tip thereof is inserted into the depression at the upper end of the pin. A downward movement of the pin **181** causes a pivotal movement of the locking lever **176, 177** in the clockwise sense in the drawing so that the locking lever releases the locking nose **166** at the lever arm **162** of the toggle joint. Just as in the embodiment described just before, the carrying member as a whole can now perform a pivotal movement about the pivot **149** to the open position virtually without an effort. When an approximately vertically upwardly directed tension force acts on the soleholder **150** during skiing and moves the soleholder upwardly against the force of the helical compression spring **172** not shown here, the pivot **175** of the locking lever performs a pivotal movement about the pivot **149** as the pivot **175** is mounted in the inner part **154** of the carrying member. After a certain upward movement, the nose **179** engages the end face of the sleeve **180**. When the inner part of the carrying member continues its upward pivotal movement, a pivotal movement will be imparted to the locking lever so that its arm **176** disengages the locking nose **166** of the toggle joint. After this disengagement, the carrying member as a whole can perform a pivotal movement about the pivot **149** to its open position.

The embodiment shown in FIG. 10 is slightly modified from that of FIG. 9. As in the embodiment of FIG. 9, the locking lever is pivoted by a pivot **175** to the inner part **154** of the carrying member. The embodiment of FIG. 10 comprises a headed pressure pin **183**, which is

mounted to be rotatable and to be axially displaceable against a spring force. The head of the pin serves as a grip and is knurled or milled on its periphery for this purpose. The free shank end of the pin is mounted in a guide member **184**, which has a central portion that is rectangular in cross-section whereas the end portions of the guide member form pivot pins, by which the guide member is mounted in the side walls **148**. The carrying member is pivoted to said pivot pins of the guide member. A stepped collar **185** is disposed between the head and shank of the pin **183**. Just as in the embodiment of FIG. 9, the headed pin can be rotated to change the release hardness value in that another step is engaged with the nose **179** of the locking lever. In this embodiment, the arbitrary opening and the automatic release are effected just as in the embodiment of FIG. 9.

In all embodiments of the invention which have been described hereinbefore, indicators are provided for the release hardness value and for the forward contact pressure applied to the toe-holding device. These devices have not been shown and described because they are known.

What is claimed is:

1. A heel-holding device for safety ski bindings which automatically assumes a locking position in response to the insertion of a skiing boot into the binding and can be arbitrarily opened by the application of slight pressure with a ski stick to a release member and can be automatically released in response to an excessive upward tensile force, which is approximately vertical, comprising carrying means including a soleholder and a closing pedal, means pivotally mounting said carrying means on an axis disposed to the rear thereof, said carrying means further comprised of a pair of members which are pivotally movable relative to each other, spring means biasing said members apart, means connecting one of said members directly to said soleholder, a locking means including an overcenter linkage interconnecting said pair of members in a relatively fixed arrangement which is actuated responsive to a predetermined upward thrust and concomitant movement of the soleholder to release said members and enable said spring means to move said members apart so that the skiing boot will be automatically released from the safety binding.

2. A heel-holding device according to claim **1** wherein the soleholder is pivoted to said other member by means of a coupling link.

3. A heel-holding device according to claim **1** wherein the initial stress of the spring means is variable for an adjustment of different release hardness values.

4. A heel-holding device according to claim **1** wherein the deflection range of the spring means is variable for an adjustment of different release hardness values.

5. A heel-holding device according to claim **1** wherein a lever acting directly on the locking device is pivoted to said other member and serves as an actuating member for an arbitrary opening of the device.

6. A heel-holding device according to claim **1** wherein one end of the locking device and said carrying means are pivoted to a carriage which is held for adjustment in the longitudinal direction of the ski on a base plate, which is fixed to the ski, and a spring is interposed between the carriage and the base plate.

7. A heel-holding device according to claim **6** wherein said spring also forces the locking device toward the soleholder.

8. A heel-holding device according to claim **1** wherein the locking means comprises a toggle joint, one arm of which is pivoted to the ski, whereas the other toggle arm is pivoted to said other member, said toggle joint being biased by a spring tending to urge said toggle joint toward the soleholder.

9. A heel-holding device according to claim **8** wherein the toggle joint consists of an over-center lever, and its knee is movable over center to the release position under the influence of one of the soleholder and said one member.

10. A heel-holding device according to claim **8** wherein the toggle joint is held in the locking position by a locking lever which is pivotally movable to its release position against the force of a weak restoring spring by said one member.

11. A heel-holding device according to claim **10** wherein said one member acts on the locking lever by an adjustable stop.

12. A heel-holding device according to claim **10** wherein the locking lever consists of a two-armed lever, the second arm of which serves as an actuating member for an arbitrary opening of the device.

13. A heel-holding device according to claim **12** wherein the pivotal axis of the locking lever coincides with the pivotal axis of said carrying means.

14. A heel-holding device according to claim **10** wherein the locking lever is pivoted to said one member, and the locking lever has two arms, one of which forms a locking nose, whereas the other bears on said other member.

15. A heel-holding device according to claim **14** wherein said other arm of the locking lever bears on an adjustable stop of said other member.

16. A heel-holding device according to claim **15** wherein the adjustable stop has a central pressure pin serving as an actuating member for an arbitrary opening of the device.

17. A heel-holding device according to claim **14** wherein said other arm of the locking lever bears by a pressure pin on said other member, and said pressure pin is longitudinally slidable in an unlocking sense and serves as an actuating member for an arbitrary opening of the device.

18. A heel-holding device according to claim **17** wherein the pressure pin is rotatably mounted and has a collar which is one of stepped- and spiral-shaped.

19. A heel-holding device according to claim **18** further including means for preventing an unintended rotation of the pressure pin.

References Cited

UNITED STATES PATENTS

3,351,354	11/1967	Smolka.
3,366,394	1/1968	Shimizu.

FOREIGN PATENTS

1,299,447	6/1962	France.

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