July 29, 1969 H. MARKER ET AL 3,458,211

TOE- OR HEEL-HOLDING DEVICE FOR SAFETY SKI BINDINGS

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Fig. 1

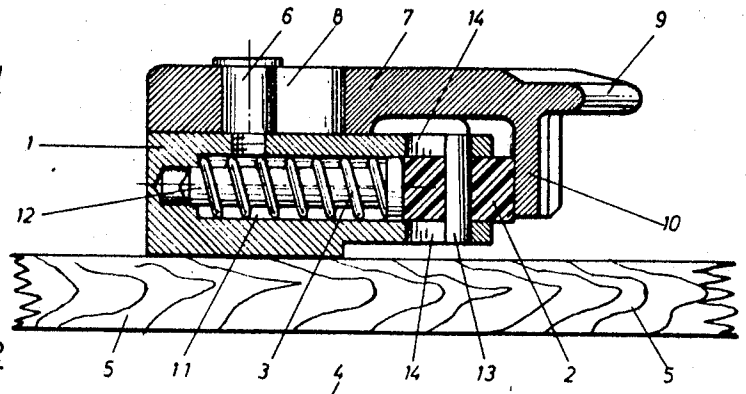


Fig. 2

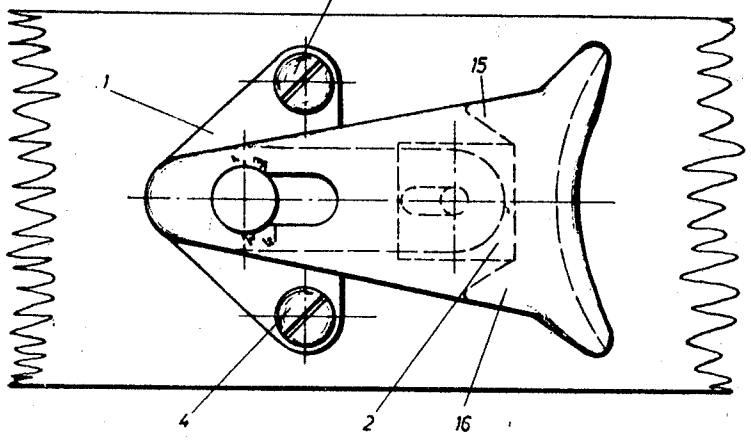
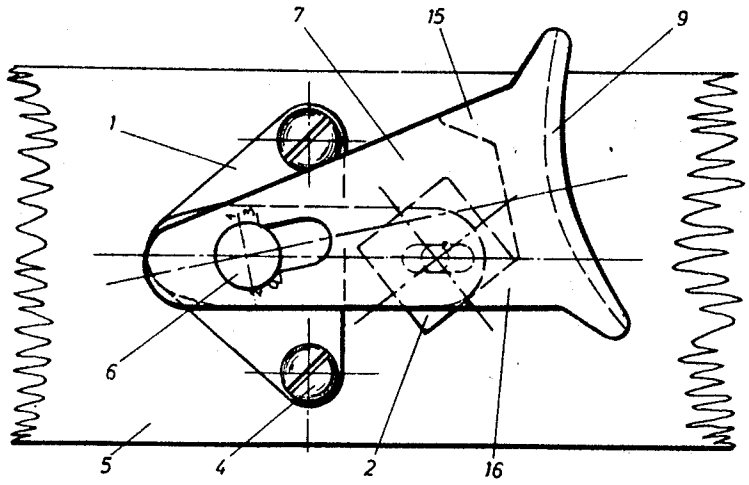


Fig. 3



TOE- OR HEEL-HOLDING DEVICE FOR SAFETY SKI BINDINGS

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Fig.4

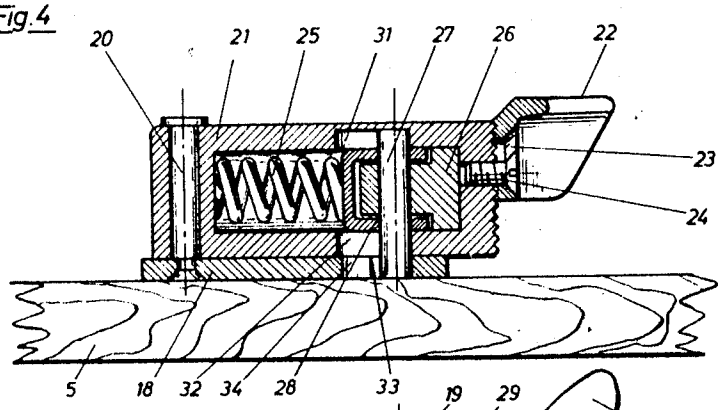


Fig.5

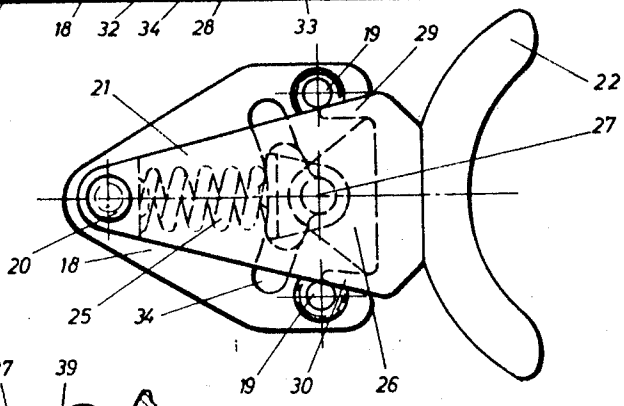


Fig.7

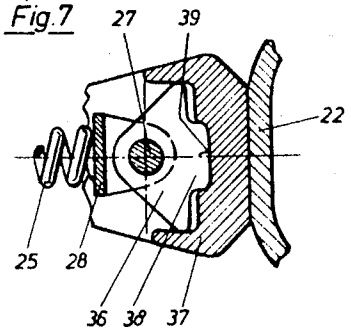
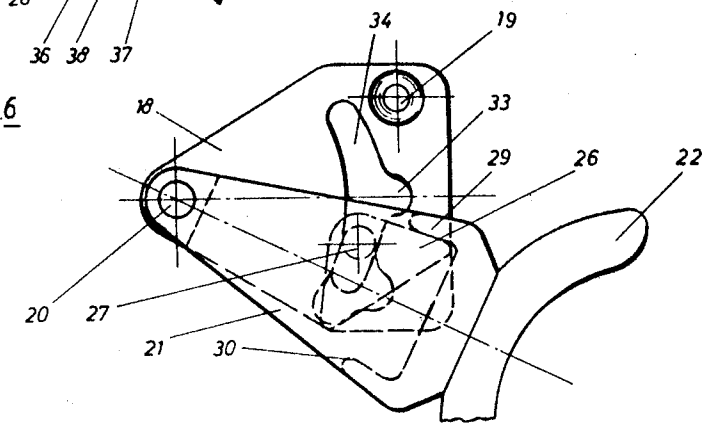


Fig.6



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TOE- OR HEEL-HOLDING DEVICE FOR SAFETY SKI BINDINGS

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Fig.8

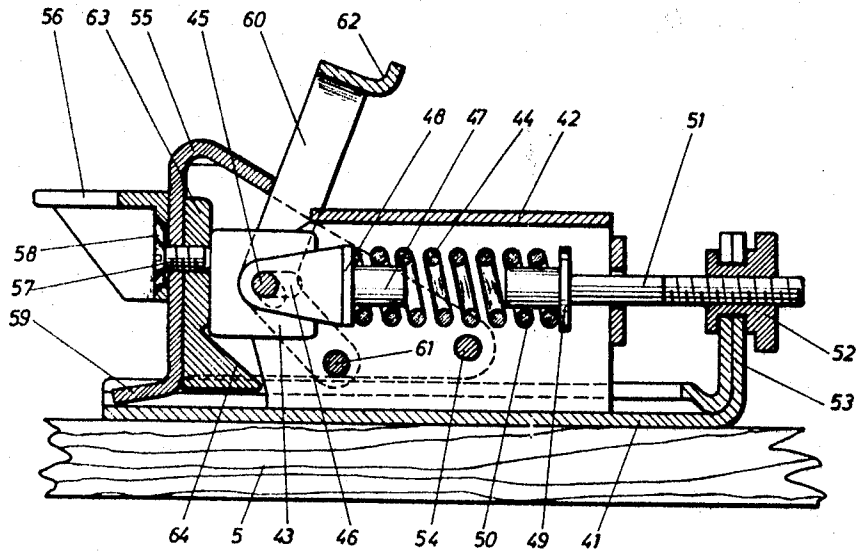
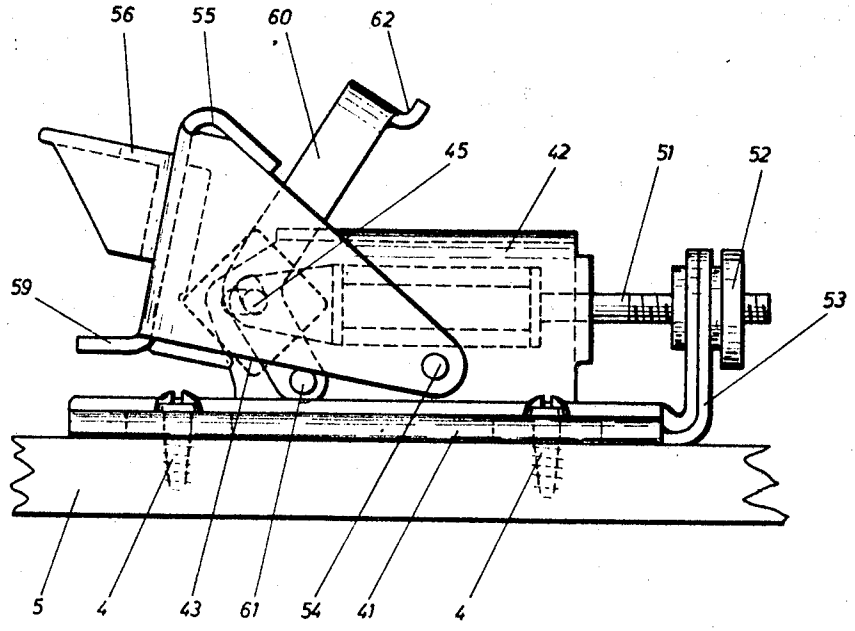


Fig.9



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3,458,211

TOE- OR HEEL-HOLDING DEVICE FOR SAFETY SKI BINDINGS

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Int. Cl. A63c 9/085
U.S. Cl. 280—11.35 15 Claims

ABSTRACT OF THE DISCLOSURE

A carrier for at least one sole holder is pivoted on a vertical or horizontal axis extending at right angles to the longitudinal direction of the ski and is under the action of a spring element. A restoring member having a cam-like action is interposed between the spring element and the carrier. The sole holder is spaced from the pivotal axis of the carrier by a larger distance than from the axis of the restoring member. The axis of the restoring member is displaceable within limits at least in the longitudinal direction of the ski in a guide which is fixed to the ski.

This invention relates to toe- or heel-holding devices for safety ski bindings, which devices have a carrier for at least one sole holder, which carrier is pivoted on a vertical or horizontal axis extending at right angles to the longitudinal direction of the ski and is under the action of a spring element, a restoring member having a cam-like action being interposed between the spring element and the carrier.

In known devices of this kind, the restoring member consists of flattened pins or camwheels. These devices should be capable of resiliently taking up a relative movement between the skiing boot and the ski, which relative movement is caused by the action of an unintended force, up to a predetermined magnitude of said movement, and to restore the skiing boot to its initial position when the deflecting force is reduced, whereas they release the skiing boot in response to an excessive force which endangers the skier's leg so that an overstraining of the leg and an injury is avoided.

It has been found in practice that the damping excursion, i.e., the range of the pivotal movement to the release point, in which range the boot is automatically restored when the deflecting force is reduced, is too small in the known holding devices. In many cases the holding device releases the boot before the deflecting force has reached a magnitude which is dangerous to the skier's leg. The release will then inevitably result in a fall of the skier.

It is an object of the invention so to design toe- or heel-holding devices for safety ski bindings of the kind described initially hereinbefore that the damping excursion is sufficiently large whereas no disadvantage is incurred compared to the known holders.

In a toe- or heel-holding device having a carrier for at least one sole holder, which carrier is pivoted on a vertical or horizontal axis extending at right angles to the longitudinal direction of the ski and is under the action of a spring element, a restoring member having a cam-like action being interposed between the spring element and the carrier, this object is accomplished in that the the sole holder is spaced from the pivotal axis of the carrier by a larger distance than from the axis of the restoring member and that the axis of the restoring member is displaceable within limits at least in the longitudinal direction of the ski in a guide which is fixed to the ski.

This design results in a large radius for the pivotal movement of the sole holder so that the latter does not release the sole as quickly as the sole holder in the known holders, where a pivotal movement of the sole holder through a given angle causes the sole holder to describe a much smaller arc, which has a correspondingly higher curvature because this movement is effected on a smaller radius. In the known holding devices the pivotal axis of the carrier coincides with the pivotal axis of the restoring member. In some cases, the carrier and the restoring member are combined in one part.

In a special development of a toe-holding device according to the invention, the pivoted carrier is mounted on a part which is fixed to the ski and the carrier is movable relative to said part in the longitudinal direction of the ski or of the carrier. This arrangement enables a control of the initial stress of the spring element so that the release hardness can be adjusted to a desired value.

Particularly in a toe-holding device where the carrier and the sole holder are rigidly connected, the carrier should preferably be pivotally movable through a large angle so that the skiing boot is readily released by the holding device when the carrier is in its limiting position. For this purpose it is suggested in a development of the invention that the guide for the pivot of the restoring member, which guide extends in the longitudinal direction of the ski, opens at that end which is near the pivot for the carrier centrally into another, arcuate guide, which is centered on the pivotal axis of the carrier or on a nearer point on the central straight line. To enable a smooth transition in the movement of the restoring member from one guide into the other, the guide extending in the longitudinal direction of the ski is preferably enlarged, e.g., rounded, at its open end.

In a simple embodiment of the invention, the carrier and the sole holder may be made in one piece. Preferably, however, the sole holder consists of a separate member, which is secured to the carrier so as to be adjustable in height for adaptation to the thickness of the sole of the skiing boot.

It has been found particularly desirable to provide a restoring member in the form of a right prism having preferably triangular or quadrangular base surfaces and a pivotal axis at right angles to its base surfaces. With this design of the restoring member, the frictional resistance is minimized because there is only a linear contact between the prism and the carrying member during the pivotal movement of the latter.

When simple spring elements, such as helical compression springs, are used, it is desired that the resistance opposing the deflection of the carrying carrier should increase with the angle of said deflection. This is not necessarily the case where a prismatic restoring member is employed because the component of force acting on the spring element varies even if the force tending to effect said deflection is constant. For this reason, a development of the invention resides in that the prismatic restoring member is provided on its surface confronting the sole holder with a central rib, which in the normal position of the holder engages a mating recess in the carrier so that the outer edges of the prism are spaced from the carrier in the longitudinal direction of the ski. As a result, the force tending to effect the deflection acts at two points on each side of the prismatic restoring member. The force acts first on that of these points which is nearer the center of the holder in its normal position. The other point is acted upon when a certain deflection has been performed.

A further adaptation can be obtained if the rib is reduced in width in steps toward the sole holder and the recess in the carrier is formed with steps which mate with the steps of the rib.

A toe-holding device should automatically return to its normal position when the skiing boot has been released in response to an excessive force acting laterally with respect to the longitudinal direction of the ski. On the other hand, a heel-holding device should be held in its open position after an automatic release and an arbitrary opening to release the skiing boot in order to enable a convenient stepping of the skiing boot into the binding. In the heel-holding device according to the invention this is accomplished in that the prismatic restoring member has an outermost edge, which is parallel to the axis and which is pivotally movable through the plane of action of the spring element and said plane includes the pivotal axis of the prism. When said edge of the prismatic restoring member is above the plane of action of the spring element, the latter will act on the carrier in an opening sense. To effect a pivotal movement of the carrier into the locking position when the skiing boot is stepped into the binding, the carrier is provided with a closing pedal.

A pivoted lever acting on the axis of the restoring member may be provided for an arbitrary opening of the device.

If the heel-holding device is used togther with a toe-holding device against which the skiing boot must be urged by resilient pressure, the carrier will be mounted on a housing, which is held on the ski for limited displacement in the longitudinal direction of the ski. In this case the arrangement is preferably such that the spring element acting on the carrier produces also the force whereby the boot is urged against the toe-holding device so that there is no need for an additional spring element.

Embodiments of the holding device according to the invention will be described in detail hereinafter by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a central longitudinal sectional view showing a toe-holding device,

FIG. 2 is a top plan view of the toe-holding device of FIG. 1,

FIG. 3 is a view similar to FIG. 2 showing the toe-holding device in an outwardly deflected position,

FIG. 4 is a central longitudinal sectional view showing a second embodiment of the toe-holding device,

FIG. 5 is a top plan view showing the toe-holding device of FIG. 4,

FIG. 6 is a view similar to FIG. 5 showing the toe-holding device in an outwardly deflected position,

FIG. 7 shows a detail of a toe-holding device to illustrate a modified prismatic restoring member,

FIG. 8 is a central longitudinal sectional view showing a heel-holding device, and

FIG. 9 is a side elevation showing the heel-holding device of FIG. 8 in the open position.

The toe-holding device shown in FIGS. 1–3 comprises a baseplate, which forms a housing **1** for restoring member **2** and a spring element **3**. The baseplate is secured to the ski **5** with screws **4**. A carrier **7** is movably mounted on the housing **1** by means of a pin **6**. The pin extends through a slot **8** in the carrier so that the latter can be moved pivotally and in the longitudinal direction of the ski.

The free end of the carrier **7** constitutes a sole holder having a right-angled cross-section. The limb **9** which is parallel to the ski **5** serves for engaging the top rim of the sole of a skiing boot. The limb **10** forms a forward abutment or stop for the toe portion of the sole.

The spring element **3** consists of a helical compression spring, which is disposed in the housing **1** in a recess **11** which is parallel to the axis of the ski. The spring is mounted on a guide pin **12**. This pin has a head, which serves as a spring abutment and for applying pressure to the restoring member **2**. In the present embodiment the restoring member consists of a right prism having quadrangular base surfaces. It has a central pivot **13**, which is at right angles to the base surfaces of the prism and at right angles to the ski. The recess **11** merges into a slot, which contains a major potrion of the prismatic restoring member **2**. The lands of the housing **1** on both sides of the slot are formed with two opposite slots **14**, in which the free ends of the pivot **13** are slidable in the longitudinal direction of the ski. The prismatic restoring member **2** acts by the limb **10** on the carrier **7**. On the side facing the prismatic restoring member, the limb **10** is so shaped to serve this purpose. The form of this side is apparent from FIGS. 2 and 3. A central side portion conforming to the adjoining side of the prism is followed on both sides by projections **15** and **16**, which are engaged by the prism in the limiting positions of the carrier **7** (see FIG. 3).

When there is no skiing boot in the binding, the movable parts of the toe-holding device are in the position shown in FIGS. 1 and 2. The pin **6** and the pivot **13** are at one end of the respective guide slots **8** and **14**. When the skiing boot is stepped into the binding, the heel-holding device forces the sole against the limb **10** of the carrier **7**. This pressure is opposed by the compression spring **3**. The heel-holding device can be adjusted to control the initial stress of the compression spring so as to adjust a desired release hardness. The adjusted release hardness is indicated at a scale provided at the edge of the slot **8**.

A force which is laterally directed with respect to the longitudinal direction of the ski and which acts on the sole holder portion of the carrier **7** during skiing will tend to deflect the carrier about the pin **6**. This deflection of the carrier is opposed by the compression spring **3** acting through the restoring member **2** as the restoring member can follow the pivotal movement of the carrier only by compressing the spring. When the force acting on the sole holder portion of the carrier **7** is reduced, the compression spring will cause the restoring member **2** and with it the carrier **7** to perform a pivotal movement back to their respective initial positions. If the carrier **7** is subjected to a force which is laterally directed with respect to the longitudinal direction of the ski and which is dangerous to the skier's leg, e.g., during a twisting fall, the carrier will be deflected to its limiting position, in which the outer edge of the restoring member **2** actuated by the carrier has moved almost to the central vertical plane. Now the sole holder portion of the carrier **7** releases the toe of the skiing boot so that the latter is released by the binding. As the spring force exerts a restoring torque on the restoring member **2** even in the limiting positions of the carrier **7**, this force will automatically restore the carrier **7** to its initial position when the boot has been released so that it is not necessary to restore the toe-holding device by hand before the skiing boot is again inserted into the binding. Such restoring by hand is necessary with most of the conventional toe-holding devices.

A second embodiment of the toe-holding device according to the invention is shown in FIGS. 4 to 6. This toe-holding device has a baseplate **18**, which is secured to the ski **5**, shown only in FIG. 4, by means which are not shown. Two screw holes **19** are formed in the baseplate for use in securing the latter. A bolt **20** is fixed to the baseplate. A carrier **21** is pivoted on said pin and axially fixed relative to the same. A sole holder **22** is provided at the free end of the carrier **21**. For adaptation to soles having different thicknesses, the sole holder is adjustable in height in known manner by a screw **24**, which extends through a slot **23** and holds the sole holder on the carrier **21**.

The carrier **21** accommodates the spring element, which consists again of a helical compression spring **25**, and the restoring member **26**, which consists in this case of a prism having triangular base surfaces. A spring abutment **28** for the compression spring **25** is pivoted on the pivot **27** of the restoring member. Just as in the embodiment described before, one side of the prismatic restoring member **26** is also held in engagement with a mating surface of the carrier **21** in the normal condition of the holding

device. Projections 29, 30 are again provided on both sides of this surface and are engaged by the prism after a certain deflection of the carrier (see FIG. 6). The upper and lower surfaces of the carrier 21 in FIG. 4 are formed with congruent recesses 31, 32, which have substantially the form of a triangle which is rounded at the corners (see FIGS. 5 and 6) and serve for guiding the pivot 27 in the carrier 21. In the normal position of the holding device, the lower free end of the pivot 27 engages a guide recess 33, which is formed in the baseplate and extends in the longitudinal direction of the ski. At its end facing the pivot pin 20 for the carrier, the recess 33 merges centrally into another, arcuate recess 34, which is centered on a point suitably disposed before the pivot for the carrier and which also serves for guiding the pivot 27.

This design results in a very large range for the pivotal movement of the carrier 21. This is desirable for a reliable release of the skiing boot in response to an excessive deflecting force if the carrier and the sole holder are rigidly connected to each other as in the present embodiment.

In FIGS. 4 and 5, the movable parts of the toe-holding device are in their normal position. The skiing boot is urged against the carrier 21 in known manner by a heal-holding device or a rear pulling device. A force which is laterally directed with respect to the longitudinal direction of the ski and which acts on the sole holder 22 and consequently on the carrier 21 during skiing will tend to deflect the carrier about the pin 20. Just as in the embodiments described first, the deflection of the carrier is opposed by the compression spring 25 acting through the restoring member 26 to restore the carrier and the toe of the skiing boot to their respective normal positions when the deflecting force is reduced. Under the action of an excessive force which is laterally directed with respect to the longitudinal direction of the ski and which endangers the skier's leg, the carrier 21 will take the restoring member 26 along during the first part of its pivotal movement so that the pivot of the restoring member is urged toward the pin 20 and from the recess 33 in the baseplate into the recess 34 thereof. At the end of this first part of the pivotal movement, one side face of the restoring member engages the corresponding projection 29 or 30 of the carrier 21. During the following part of the pivotal movement, the free end of the pivot 27 moves in the recess 34 of the baseplate. During the second part of the pivotal movement, the stress of the compression spring is only slightly increased because the difference between the radii of the pivotal movement is small. At the end of the outward pivotal movement the sole holder 22 releases the toe of the skiing boot so that the latter is released from the ski. As the recess 34 is closer to its center of curvature than to the pin 20, the pressure of the spring 25 restores the pivot 27 into the recess 33 in the baseplate and swings the restoring member 26 and the carrier 21 back to their respective normal positions when the skiing boot has been released.

FIG. 7 shows a restoring member 36 and that portion of a carrier 37 which cooperates with the restoring member in a modification of the embodiment last described. Just as in the previously described embodiment, the sole holder 22 is secured to the free end of the carrier. Besides, the spring abutment 28 for the helical compression spring 25 is mounted on the pivot 27 of the restoring member.

On its face confronting the sole holder 22, the restoring member 36 has a central rib 38, which engages a mating recess 39 of the carrier 37 when the toe-holding device is in the normal position shown in FIG. 7. As a result, the outer edges of the prism are spaced from the carrier in the longitudinal direction of the ski. This design enables the deflecting forces to act on the prismatic restoring members at two points on each side. The force acts first on that of said points which is nearer to the center of the holding device in normal condition. Only after a certain deflection, when the corresponding outer edge of the prism has engaged the corner of the carrier, does the force act on the second point which is defined by said engagement. This design ensures in a simple manner that the component of force acting against the compression spring 25 will not exceed a maximum value whereas there is no need for tolerating an undesirably high spring rate during the first part of the pivotal movement. It must be borne in mind that the component of force acting against the compression spring increases during a deflecting movement even if the deflecting force is constant.

For a further decrease of the variation of the component of force acting against the compression spring throughout the range of the pivotal movement of the restoring member, the rib may have at its base a much larger width than in FIG. 7 and may be reduced in width in steps toward the sole holder. Each step in the rib must be associated with a mating step in the recess of the carrier.

FIGS. 8 and 9 show a heel-holding device for safety ski bindings embodying the invention. This device comprises a baseplate 41, which is secured with screws 4 to the ski 5. A housing 42 is mounted on the baseplate and is slidable in the longitudinal direction of the ski. This housing contains the restoring member, which consists of a prism 43 having quadrangular base surfaces, and the spring element, which consists of a helical compression spring 44. By means of its pivot 45, the restoring member is mounted in slots 46, which are formed in the housing and extend in the longitudinal direction of the ski. A spring abutment 48 is provided with a pin 47 and pivotally mounted on the pivot 45. The compression spring 44 acts by means of said abutment on the restoring member. The other end of the compression spring bears on a spring abutment 49, which has a guide pin 50 and forms the head of a screw bolt 51. The latter is threaded in a finger nut 52, which is rotatably mounted on a vertically upwardly bent part 53 of the baseplate 41 and held against rotation.

A carrier 55 for a sole holder 56 is pivoted to the housing 42 on the outside thereof by means of an axis 54, which extends laterally with respect to the longitudinal direction of the ski. The sole holder is detachably secured to the carrier by means of a screw 57, which extends through a slot 58 formed in the sole holder to enable an adjustment of the latter in height. Under the sole holder, the carrier 55 has a portion which forms a closing pedal 59. A lever 60, which is bent in U-shape, serves for an arbitarary opening of the heel-holding device. The free ends of the limbs of said lever are pivoted on a pin 61, which is secured in the housing 42. The opening lever is angled for design reasons and is formed in both limbs with slots fitted on the pivot pin 45 at the free end portions thereof, which protrude from the housing 42. The web of the U-shaped opening lever has an angled extension, which forms a depression 62 for receiving the tip of the ski stick when the opening lever is to be actuated.

For coacting with the restoring member 43, the carrier 55 has a portion 63, which is provided with a surface for engagement with a side face of the restoring member, and a projection 64 underlying said member. Just as in the toe-holding devices the arrangement is such that the corresponding edge of the restoring angle lies at the apex of the angle formed by the two surfaces which coact with the restoring member. The range of the pivotal movement of the carrying member 55 is dimensioned so that said edge of the restoring member can be pivotally moved just through the plane of action of the compression spring and the carrying member is thus held in its unlocked position.

This heel-holding device serves also for urging the skiing boot against the toe-holding device. The pressure for urging the skiing boot against the toe-holding device

is also effected by the compression spring **44**. If the heel-holding device described with reference to FIGS. 1 to 3 is used, the boot need not be urged against the toe-holding device by the heel-holding device through the intermediary of a spring element because in this case the sole holder is slidable toward the tip of the ski under the pressure urging it against the toe-holding device.

A vertically upwardly directed force acting on the sole holder **56** of a heel-holding device according to the invention during skiing will tend to deflect the carrier **55** about the axis **54**. This deflection of the carrier is opposed by the compression spring **44** through the intermediary of the restoring member **43** as the latter can follow the pivotal movement of the carrier only by compressing the spring. When the force acting on the sole holder is reduced, the restoring member will swing back to its initial position under the action of the compression spring. When the sole holder **56** is subjected to an upward force which endangers the skier's leg, e.g., during a forward fall, the carrying member will be deflected to its limiting position, in which the outer edge of the restoring member, which edge is parallel to the axis of said member and coacts with the portion **63** of the carrier, is disposed above the plane of action of the comprsesion spring **44**. From this position, in which the sole holder **56** has released the sole of the skiing boot, the carrier **55** is not automatically restored to its locking position so that the heel-holding device is ready to receive the boot.

For an arbitrary opening of the heel-holding device, the opening lever **60** is swung to the right in the drawings, e.g., by the ski stick. The carrier **55** is thus relieved and can easily be swung to the unlocking position, in which it is then held when the opening lever **60** is released.

The present invention is not restricted to the toe-and heel-holding devices for safety ski bindings which have been shown and described. As stated hereinbefore, the sole holder is spaced from the pivotal axis of the carrier by a larger distance than from the axis of the restoring member so that the sole holder is initially deflected approximately in the direction of the force acting thereon and does not release the sole of the skiing boot after a short excursion but can be deflected within a larger range, in which it holds said sole and restores the sole to its normal position when the force is reduced.

We claim:

1. A toe- or heel-holding device comprising a carrier carrying at least one sole holder, said carrier being pivotally mounted on an axis extending at right angles to the longitudinal direction of the ski upon which the device is mounted, a spring element biasing said carrier to a response position, a pivotally mounted restoring member having a cam-like action being interposed between the spring element and the carrier, said sole holder being spaced from the pivotal axis of said carrier by a larger distance than from the pivotal axis of said restoring member, and guide means for the pivotal axis of said restoring member enabling displacement thereof in the longitudinal direction of the ski.

2. A holding device according to claim **1**, wherein further guide means are provided for the pivotal axis of the carrier to enable displacement thereof in the longitudinal direction of the ski.

3. A holding device according to claim **1**, wherein said guide means communicates at that end which is near the pivotal axis of said carrier centrally into another, arcuate guide means to enable transverse displacement.

4. A holding device according to claim **3**, wherein said guide means is enlarged at its open end.

5. A holding device according to claim **1**, wherein said carrier and sole holder are integral.

6. A holding device according to claim **1**, wherein said sole holder is secured to the carrier so as to be adjustable in height.

7. A holding device according to claim **1**, wherein said restoring member consists of a right prism having its pivotal axis at right angles to its base surfaces.

8. A holding device according to claim **7**, wherein said restoring member is provided on its surface confronting said carrier with a central rib, which in the normal position of said carrier engages a mating recess in said carrier so that the outer edges of the prism are spaced from the carrier in the longitudinal direction of the ski.

9. A holding device according to claim **8**, wherein the rib is reduced in width in steps, and the recess in the carrier is formed with steps which mate with the steps of the rib.

10. A holding device according to claim **7**, wherein said restoring member has an outermost edge, which is parallel to the axis of and which is pivotally movable through the plane of action of the spring element, said plane including the pivotal axis of said restoring member.

11. A holding device according to claim **1**, wherein a closing pedal is mounted in said carrier.

12. A holding device according to claim **11**, wherein a pivoted lever acting on the pivot of the restoring member serves for arbitrarily opening the device.

13. A holding device according to claim **1**, wherein said carrier is mounted on a housing which is held on the ski for limited displacement in the longitudinal direction of the ski.

14. A holding device according to claim **1**, wherein the pivotal axis of said carrier is vertical.

15. A holding device according to claim **1**, wherein the pivotal axis of said carrier is horizontal.

References Cited

UNITED STATES PATENTS

3,149,854 9/1964 Marker.

FOREIGN PATENTS

1,359,294 3/1964 France.

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