SAFETY TOE IRON FOR SKI BINDINGS

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ABSTRACT OF THE DISCLOSURE

A soleholder member is connected by a carrier to a baseplate which is fixed to the ski. The carrier is movable from its central position against the force of at least one spring element relative to the baseplate transverse to the longitudinal direction of the ski and about a vertical axis. The soleholder member is movable relative to the carrier in the longitudinal direction of the ski and about a vertical axis. A locking device is interposed between the carrier and the soleholder member and serves to hold the latter in its normal position relative to the carrier and to automatically unlock the soleholder member when the carrier has performed a predetermined movement relative to the baseplate from its central position.

This invention relates to safety toe irons for ski bindings, in which toe irons the soleholder member is connected by a carrier to a baseplate, which is fixed to the ski. The carrier is movable from its central position against the force of at least one spring element relative to the baseplate transverse to the longitudinal direction of the ski and about a vertical axis. Compared to the so-called ball-locked toe irons, in which a pivoted soleholder carrier is locked to a part that is fixed to the ski, such known safety toe irons have the advantage that they elastically take up the forces which act obliquely or transversely to the longitudinal direction of the ski and are smaller than the force required for a release rather than presenting a rigid resistance to such forces. These known toe irons, however, have also disadvantages, which should be avoided in a safety toe iron intended for use in a ski.

The essential advantage resides in that said known toe irons do not positively and suddenly release the toe portion of the skiing boot at the end of a sufficiently large elastic zone. In various kinds of toe irons, the skiing boot must virtually squeeze itself out of the toe iron or past the soleholder. This results in a high friction and precludes a check and exact adjustment of the releasing force. There is always the danger that the skiing boot may be caught by the toe iron, which means that when the boot is not released it is not returned to its normal position. In this case a fall is inevitable.

It is an object of the present invention to remedy this situation and so to improve and design a toe iron of the kind previously described so that the disadvantages of the known toe irons are avoided in a simple and reliable manner, particularly, that the release position of the toe iron on both sides is exactly defined.

In a safety toe iron for ski bindings, in which toe iron the soleholder member is connected by a carrier to a baseplate which is fixed to the ski, the carrier is movable from its central position against the force of at least one spring element relative to the baseplate transverse to the longitudinal direction of the ski and about a vertical axis. The soleholder member is movable relative to the carrier in the longitudinal direction of the ski and about a vertical axis. The above-mentioned object is accomplished according to the invention in that a locking device is interposed between the carrier and the soleholder member and serves to hold the latter in its normal position relative to the carrier and to automatically unlock the soleholder member when the carrier has performed a predetermined movement relative to the baseplate from its central position.

When the soleholder member has been unlocked, the latter no longer presents any substantial resistance to the skiing boot so that the latter is suddenly released from the toe iron.

In a development of the invention, the locking device comprises a locking member, which is vertically slidably mounted in the carrier and in dependence on the position of the carrier relative to the baseplate enabling either only a movement of the carrier relative to the baseplate or only a movement of the soleholder member relative to the carrier.

It has proved desirable to provide a locking member which consists of a pin, which has a tapered top end portion e.g., in the shape of a spherical cap, a cone or a pyramid, which tapered portion normally extends into a mating recess formed in the soleholder member. The lower end of the pin bears on a horizontal surface of a part which is fixed to the ski, which surface is so limited on both sides of the vertical longitudinal axis of the toe iron that it permits a vertical downward displacement of the pin after the predetermined movement of the carrier relative to the baseplate, and at least one return spring is provided, which opposes the downward vertical displacement of the pin.

Alternatively, the locking member may consist of a pin, which is tapered at both ends, the tapered top end portion of the pin normally extending into a mating recess formed in the soleholder member, and the lower end of the pin bearing on a horizontal surface of a part which is fixed to the ski, which surface is formed on both sides of the vertical longitudinal axis of the toe iron and at a predetermined distance from said axis with respective depressions mating the tapered lower end portion of the pin.

In this embodiment, there is no need for a return spring for the pin.

In another design, the locking member comprises at least one ball, which has a portion normally protruding from the carrier and engaging a mating depression of the soleholder member and bears downwardly on a horizontal surface of a part which is fixed to the ski, which surface is formed on opposite sides of the vertical longitudinal axis of the toe iron at a predetermined distance from said axis with respective depressions which are identical to the depression in the soleholder member. From the structural aspect it has proved desirable to provide a locking member which consists of two or more balls, which are vertically superimposed.

Whereas the carrier is movable from its central position relative to the baseplate against the force of at least one spring element, the movement of the soleholder member relative to the carrier need not be opposed by spring force. If the latter movement is also spring-opposed, the spring force should be so weak that it presents virtually no appreciable resistance to the movement but serves only to restore the soleholder member when the skiing boot has been released.

In a safety toe iron in which the soleholder member is movable relative to the carrier against the force of a spring element, a development of the invention calls for using one and the same spring element to oppose the movement of the carrier relative to the baseplate and to bias the soleholder member.
In a preferred embodiment of a safety toe iron according to the invention, the soleholder member may consist of two mirror-symmetrical parts, which are only outwardly movable relative to the carrier, and the locking device comprises respective locking members for each of said two parts.

In a safety toe iron according to the invention in which the carrier and the soleholder member are pivoted, both parts are suitably coaxial.

In a safety toe iron comprising a pivoted carrier it has proved desirable to hold the latter in or on or at a guide which is adapted to the ski and which is curved toward the tip of the ski and symmetrical with respect to the longitudinal center line of the toe iron.

In this case the radius of curvature may be as large as possible so that during a movement of the soleholder member within the elastic zone the movement of the skiing boot in the longitudinal direction of the ski will be virtually insignificant.

In a preferred embodiment of the safety toe iron according to the invention in which the carrier is pivoted, there will be no movement of the skiing boot in the longitudinal direction of the ski during a movement of the soleholder member within the elastic zone if the carrier is held in or on or at a guide which is fixed to the ski and which is curved toward the rear end of the ski and symmetrical to the longitudinal center line of the toe iron. In this design the radius of curvature is preferably as large as the radius of the ski.

Whether the movement of the carrier relative to the baseplate is transverse to the longitudinal direction of the ski or performed about a vertical axis, it is a special development of the invention to provide a safety toe iron which has a pivoted soleholder member which is held to the carrier in or on or at a guide which is curved toward the tip of the ski and symmetrical to the longitudinal center line of the carrier.

Embodiments of the invention will now be explained in detail and are shown by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a central longitudinal sectional view showing a safety toe iron according to a first embodiment,

FIG. 2 a top plan view showing the toe iron of FIG. 1,

FIG. 3 a transverse sectional view taken through the toe iron on line III—III of FIG. 2,

FIG. 4 a longitudinal sectional view showing a safety toe iron according to a second embodiment,

FIG. 5 a top plan view showing the toe iron of FIG. 4,

FIG. 6 a transverse sectional view taken through the toe iron on line VI—VI of FIG. 5.

FIG. 7 a top plan view showing a safety toe iron according to a third embodiment,

FIG. 8 a longitudinal sectional view taken through the toe iron on line VIII—VIII of FIG. 7, and

FIG. 9 a transverse sectional view taken on line IX—IX of FIG. 7.

The safety toe iron according to a first embodiment of the invention, shown in Figs. 1 to 3, comprises a base-plate 1, which is adapted to be screwed onto the ski. For this purpose, three screw holes 2 are formed in the base-plate. A guide strip 3 of dovetail shape in cross-section is firmly connected to the baseplate and extends transversely to the longitudinal direction of the toe iron. A carrier 4 is formed with a recess which mates the cross-section of the guide strip and is push-fitted on the guide strip. In known manner, not shown, the carrier is displaceable relative to the baseplate from its central position to both sides to a predetermined extent against the force of a spring.

As described, the embodiment of the carrier is provided with a mating guide strip 5, which is dovetail-shaped in cross-section. Differing from the guide strip 3 of the baseplate, the guide strip 5 is curved toward the forward end of the toe iron.

A soleholder member 6 has a mating curved and dovetail-shaped recess and with the latter is push-fitted on the guide strip 5. The soleholder proper is designated 7 and is screw-connected by a screw 8 to the soleholder member. A slot 9 is formed in the vertical arm of the soleholder and enables in known manner an adjustment of the latter to soles having different thicknesses.

According to the invention, the carrier 4 contains a pin 10, which has a conical tapered top end portion 11. This conical tapered end portion normally extends into a mating recess of the soleholder member 6 so that the latter cannot move relative to the carrier. The lower end of the pin 10 bears on the surface of the guide strip 3.

With reference particularly to FIG. 3, the carrier 4 is formed with two blind holes 12, which are symmetrically arranged with respect to the central longitudinal axis of the toe iron and engageable by the free end portion of the pin 10 when the carrying member has performed a sufficient transverse displacement. A weak helical compression spring 13 is fitted onto the pin 10 and bears at one end on the top end portion 11 of the pin and at the other end on a shoulder formed in the bore which is formed in the carrier 4 and receives the pin.

Under the influence of the spring element, not shown, the carrying member 4 is normally held in its central position on the baseplate 1. If the soleholder 7 is acted upon by a force in a direction which is transverse or oblique to the longitudinal direction of the toe iron and consequently transverse or oblique to the longitudinal direction of the ski and said force exceeds the opposing force exerted by the prestressed spring, the carrier 4 will be displaced along the baseplate 1 because the soleholder member 6 is locked by the pin 10 to the carrier. If the force decreases, the spring, not shown, will return the carrier 4 and the soleholder member 6 to their central position. If the soleholder 7 is acted upon by a large force, which endangers the leg of the skier, the carrier 4, and the carrier are first displaced again along the guide strip 3 against the spring force. As soon as the pin 10 lies over the corresponding blind hole 12, the soleholder member 6 urges the lower end portion of the pin 10 into the blind hole 12 because the soleholder member runs up on the conical top end portion of the pin to depress the latter against the force of the weak helical compression spring 13. At this time, the carrier 4 is locked relative to the baseplate 1 and the soleholder member 6 can continue to move under virtually no force on the carrier 4 along the guide strip 5, which is curved toward the tip of the ski so that the toe portion of the boot is released by the soleholder 7, or by suitable stops, not shown, are provided to limit the movement of the soleholder member 6 relative to the carrier 4 toward both sides. In this embodiment, the soleholder member 6 is not automatically returned to its normal position on the carrier 4. To move the toe iron to a position ready for skiing, the soleholder member 6 must first be moved by hand into the correct position relative to the carrier 4.

In this position, the helical compression spring 13 displaces the pin upwardly to unlock the carrier from the baseplate 1. At the same time, the conical tapered top end portion of the pin engages the mating recess in the soleholder member 6 to lock the same relative to the carrier 4. In this case, the carrier 4 will be automatically returned to its central position under the influence of the spring, not shown.

FIGS. 4 to 6 show a second embodiment of the safety toe iron according to the invention. With reference not shown, a baseplate 15, the toe iron can be screw-connected to the ski and for this purpose has two screw holes 16. A vertical pivot pin 17 is riveted in the baseplate. A carrier 18 and a soleholder member 19 are pivoted on said pivot pin and held against axial displacement thereon. Just as in the embodiment described, the carrier 18 and the carrier 20 is vertically adjustably held by a screw 21 to the soleholder member. A centering and damping spring 23 for the carrier 18 is accommodated in a recess 22 in the baseplate 15. The spring 23 is prestressed to produce the retaining force which is required to retain the skiing boot in
the binding. The spring 23 bears at each of its two ends on two opposite projections 24 and 25, which are formed on the baseplate and between which respective extensions 26 of the carrier 18 are disposed.

The carrier 18 has a bore 27, which extends in the central longitudinal plane and in which two balls 28 and 29 are supported. The arrangement is such that the upper ball 29 protrudes to some extent from the bore 27. The soleholder member 19 is formed with a depression, which mates said protruding portion so that the soleholder member is normally locked against a pivotal movement relative to the carrier. The lower ball 28 bears on the baseplate 23. The baseplate is formed with two depressions 30, which have the same shape as the depression in the soleholder member 19 and are symmetrical to the longitudinal center line of the toe iron. After a certain pivotal movement of the carrier 18, the lower ball 28 can run into the corresponding depression 30.

This safety toe iron has basically the same function as the toe iron shown in FIGS. 1 to 3. Under the action of the spring 23, a carrier 18 is normally held in its central position. If the soleholder 20 is acted upon by forces which are transverse to the longitudinal direction of the ski and do not endanger the leg of the ski but exceed the opposing force produced by the prestressed spring, the latter will necessarily take up the said forces. Owing to the locking action of the ball 29, the carrier 18 and the soleholder member 19 perform a joint pivotal movement around the pivot pin 17. When the force decreases, the spring 23 returns the carrier and the soleholder member to their central position. If the soleholder 20 is acted upon by a force which endangers the leg of the ski, the soleholder member and the carrier are pivotally moved against the force of the spring 23 about the pivot pin 17 to such an extent that the ball 28 enters the depression 30 of the baseplate. At the same time, the soleholder member depresses the upper ball 29 to unlock the soleholder member from the carrier whereas the latter is locked to the baseplate. The soleholder member 19 can now continue its pivotal movement around the pivot pin 17 virtually under no force so that the toe portion of the boot is released by the soleholder 20. In this embodiment the movement of the soleholder member relative to the carrier 18 is limited by suitable stops, not shown, on both sides. Just as in the embodiment first described, the soleholder member 19 must be returned by hand in this embodiment. When the sole is returned, the carrier 18 is automatically returned under the influence of the spring 23.

A completely automatic return of the toe iron after a release can be obtained in a simple manner in that a weak return spring is disposed between the carrier 18 and the soleholder member 19 and leaves the safety release function of the toe iron virtually unaffected. It is sufficient if the force of the spring is large enough to overcome the friction. The spring may be arranged, e.g., like the spring 23.

A third embodiment of the safety toe iron according to the invention is shown in FIGS. 7 to 9. Just as in the embodiments described before, there is a baseplate 33, which can be screw-connected to the ski. In the present case, a guide strip 34, which is dovetail-shaped in cross-section, is firmly connected to the baseplate and slightly curved toward the rear end of the toe iron. The curvature is selected so that the center of curvature coincides with the pivot axis of the skiing boot. A carrier 35 is formed with a recess, which mates the guide strip 34 and slidable receives the same. Just as in the embodiments shown by way of the previous example, this carrier is resiliently held in its central position and is slidable from the same to a predetermined extent on both sides along the guide strip 34 against a progressively increasing spring resistance. In this embodiment, shown by way of the previous example, the soleholder member of the present toe iron consists of two parts 36 and 37 having mirror symmetry. For each of these two parts, the carrier 35 has a vertical pivot pin 38 or 39. Each soleholder member is pivotally movable only in an outward direction about the pivot pin relative to the carrier from its normal position. The locking device comprises in the present case two locking members, which are associated with respective parts of the soleholder member. Just as in the embodiment shown in FIGS. 4 to 6, each locking member consists of two balls 40 and 41, which are mounted in two vertical bores 42 and 43 of the carrier 35. Each part of the soleholder member is locked by the respective upper ball just as in the embodiment described before so that this description need not be repeated. Just as in the embodiment described before, the balls are depressions 44, which are adapted to receive after a predetermined pivotal movement of the carrier, the ball 40 of the respective pair of balls which are associated with that part of the soleholder member which is acted upon by the force. The freedom of movement of the parts 36 and 37 of the soleholder member relative to the carrier 35 in an outward direction is limited by a stop 45 (see FIG. 7) on the carrier.

When the toe portion of the skiing boot has been released under the action of a releasing force, the swung out part of the soleholder must be swung back by hand. The carrier is then automatically released just as in the embodiments previously described by way of example. In this embodiment, the toe iron can be completely automatically returned after a release if a weak return spring is interposed between the two parts of the soleholder member and after the release of the toe portion of the skiing boot swings back the corresponding part of the soleholder member to its normal position where after the force of the spring which biases the carrier 35 forces the two springs upwardly to unlock the carrier 35 from the baseplate 33. At the same time, the part of the soleholder member is locked to the carrier 35.

In this embodiment, the parts of the soleholder member do not carry separate, vertically adjustable soleholders and an adjustment to boot soles differing in thickness is enabled with the aid of shims placed in a suitable number under the baseplate 33.

What is claimed is:
1. A safety toe iron for ski bindings comprising a base plate adapted to be secured relative to a ski, a carrier connected to said baseplate and a soleholder member connected to said carrier, said carrier being movable about a vertical axis from a central position against the force of at least one spring element relative to the base plate transversely to the longitudinal direction of a ski, said soleholder member being movable relative to the carrier in the longitudinal direction of a ski and about a vertical axis, a locking device interposed between said carrier and said soleholder member, said locking device serving to hold said soleholder member in a normal position relative to the carrier and to automatically unlock the soleholder member when the carrier has performed a predetermined movement relative to the baseplate.
2. A safety toe iron according to claim 1, wherein the locking device comprises a locking member, which is vertically slidably mounted in the carrier and in dependence on the position of the carrier relative to the baseplate, said locking device enabling only two relative movements of the carrier, one of said movements being the movement of the carrier relative to the baseplate with the other movement being the movement of the soleholder member relative to the carrier.
3. A safety toe iron according to claim 2, wherein the locking member comprises a pin having a tapered top end portion, said tapered portion normally extending into a mating recess defined by the soleholder member with the lower end of the pin bearing on a horizontal surface of a part, said surface being provided on both sides of the vertical longitudinal axis of the toe iron to permit a vertical downward displacement of the pin after a predetermined movement of the carrier relative to the baseplate.
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with at least one return spring being provided to oppose the downward vertical displacement of the pin.

4. A safety toe iron according to claim 2, wherein the locking member comprises a pin which is tapered at both ends, the tapered top end portion of the pin normally extending into a mating recess defined by the soleholder member and the lower end of the pin bearing on a horizontal surface of a part, said surface defining respective depressions on both sides of the vertical longitudinal axis of the toe iron and at a predetermined distance from said axis to allow mating of the tapered lower end portion of the pin.

5. A safety toe iron according to claim 2, wherein the locking member comprises at least one ball means which has a portion normally protruding from the carrier and engaging a mating depression of the soleholder member and another portion bearing downwardly on a horizontal surface of a part, said part surface defining depressions formed on opposite sides of the vertical longitudinal axis of the toe iron at a predetermined distance from said axis, each said depression being identical to the depression in the soleholder member.

6. A safety toe iron according to claim 5, wherein the locking member consists of at least two balls which are vertically superimposed.

7. A safety toe iron according to claim 1, wherein the soleholder member is movable relative to the carrier against the force of the spring element, said spring element also being used to oppose the movement of the carrier relative to the baseplate and to bias the soleholder member.

8. A safety toe iron according to claim 1, wherein the soleholder member comprises two mirror-symmetrical parts which are only outwardly movable relative to the carrier, and the locking device comprises respective locking members for each of the said two parts.

9. A safety toe iron according to claim 1, wherein the carrier and the soleholder member are pivoted and co-axial.

10. A safety toe iron according to claim 1, wherein the carrier is pivoted and is held in cooperation with a guide, said guide, when fixed to a ski being curved toward the tip of the ski and symmetrical with respect to the longitudinal center line of the toe iron.

11. A safety toe iron according to claim 1, wherein the carrier is pivoted and held in cooperation with a guide, said guide when fixed to the ski being curved toward the rear end of the ski and symmetrical to the longitudinal center line of the toe iron.

12. A safety toe iron according to claim 1, wherein the soleholder member is pivoted and held to the carrier by a guide, said guide, when fixed to a ski, being curved toward the tip of the ski and symmetrical to the longitudinal center line of the carrier.

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