

Sept. 8, 1970

L. BERCHTOLD

3,527,468

HEEL-RELEASING DEVICE FOR SAFETY SKI BINDINGS

Filed Nov. 27, 1967

9 Sheets-Sheet 2

Fig. 2

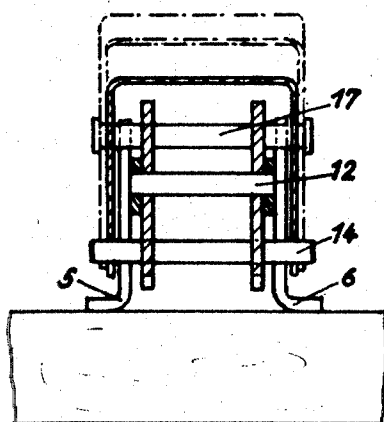


Fig. 6

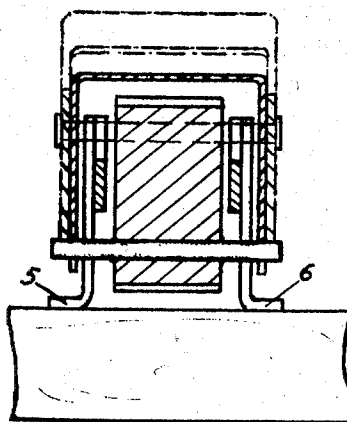
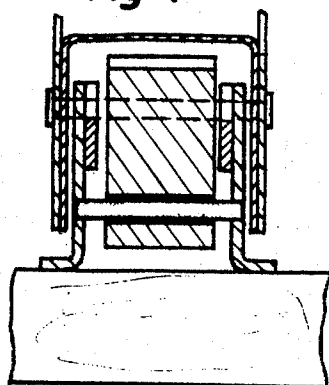


Fig. 7



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Fig. 5

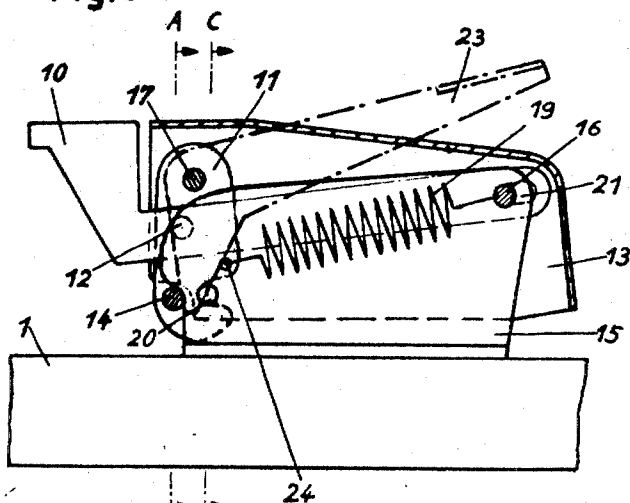


Fig. 8

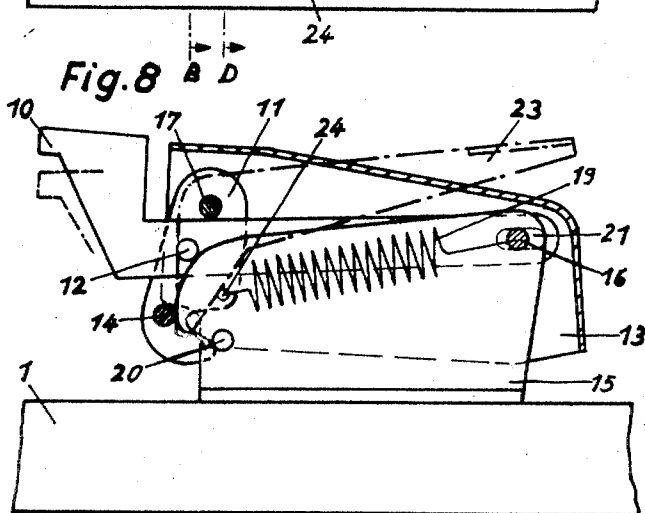
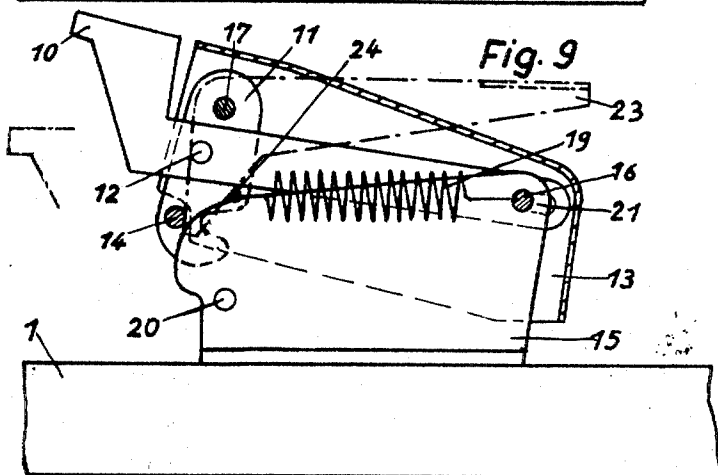


Fig. 9



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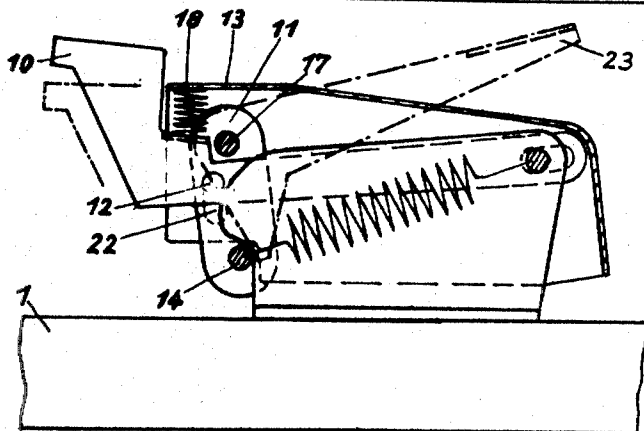
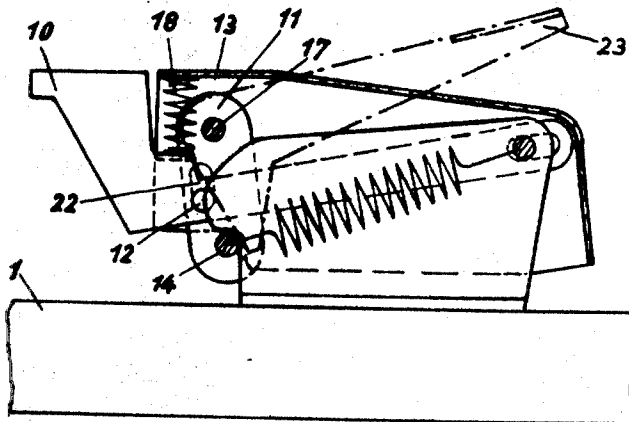
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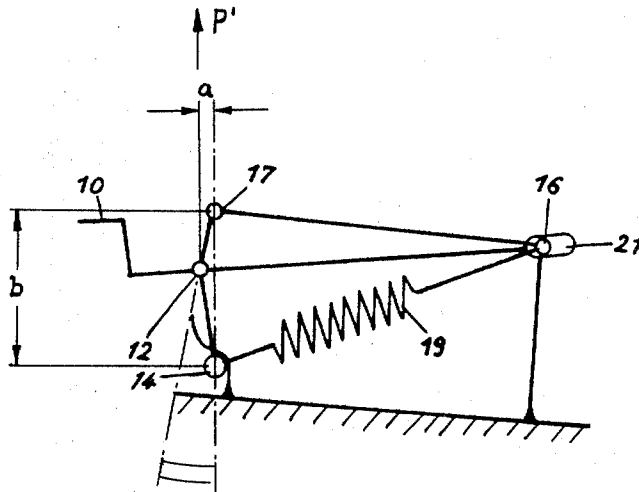


Fig. 12

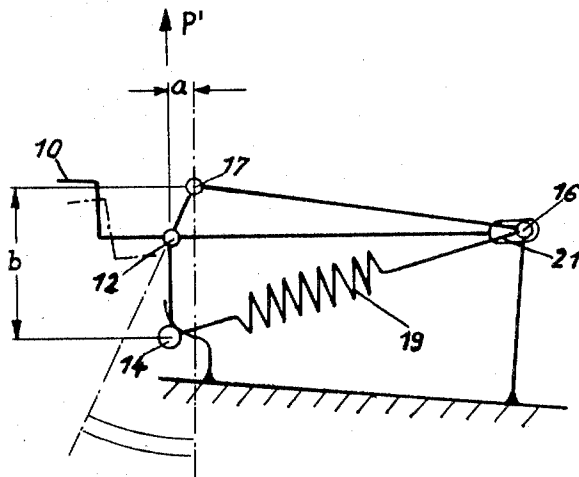


Fig. 13

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Fig. 14

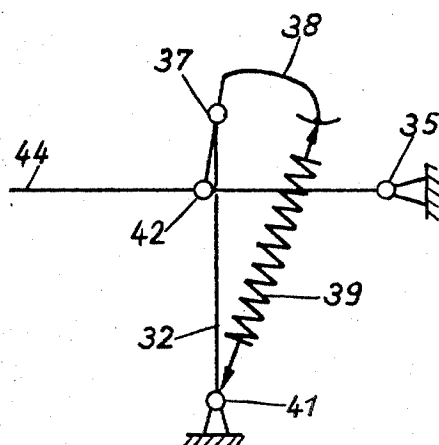
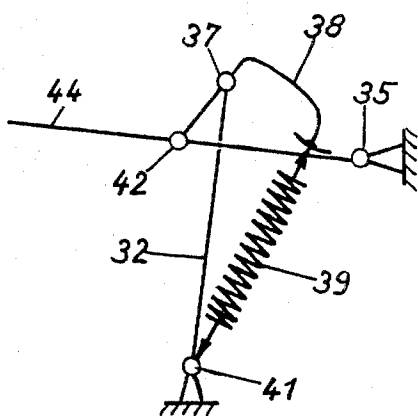


Fig. 15



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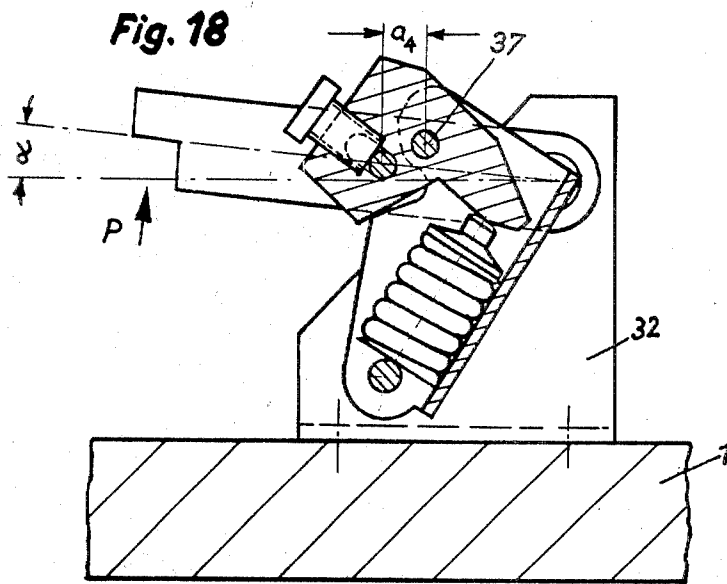
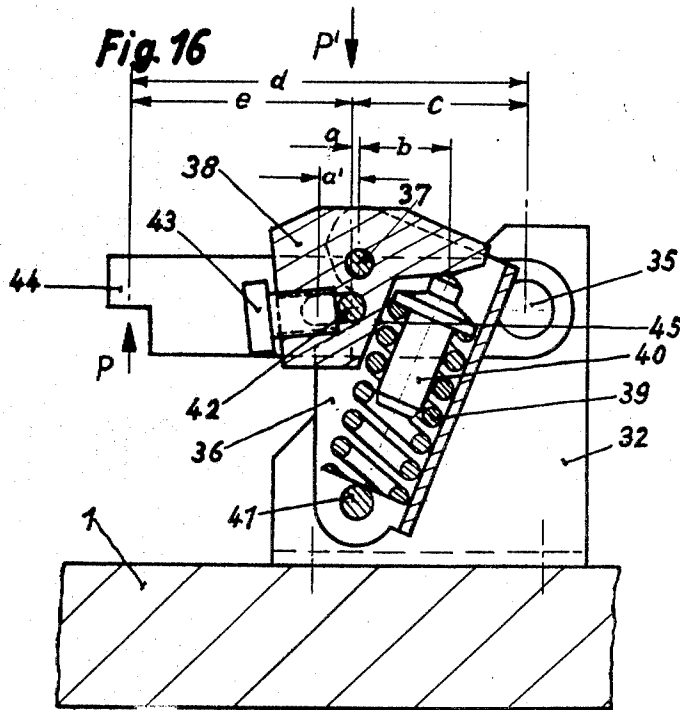
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Fig. 21

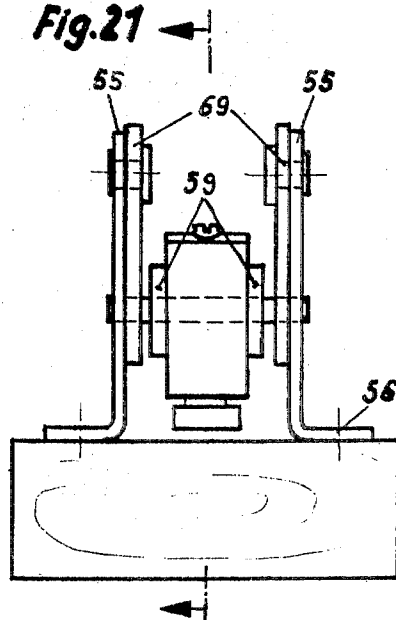
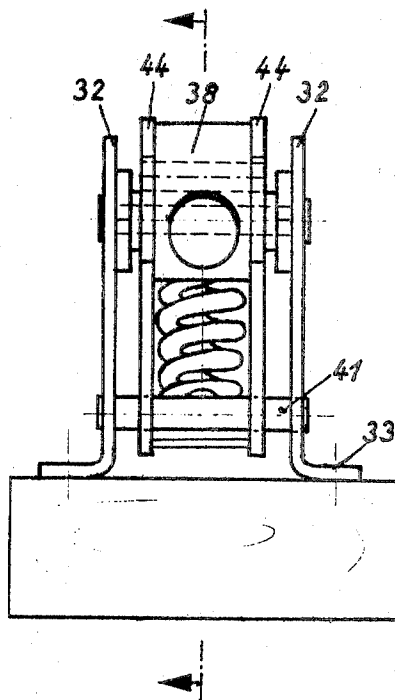


Fig. 17



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Fig. 19

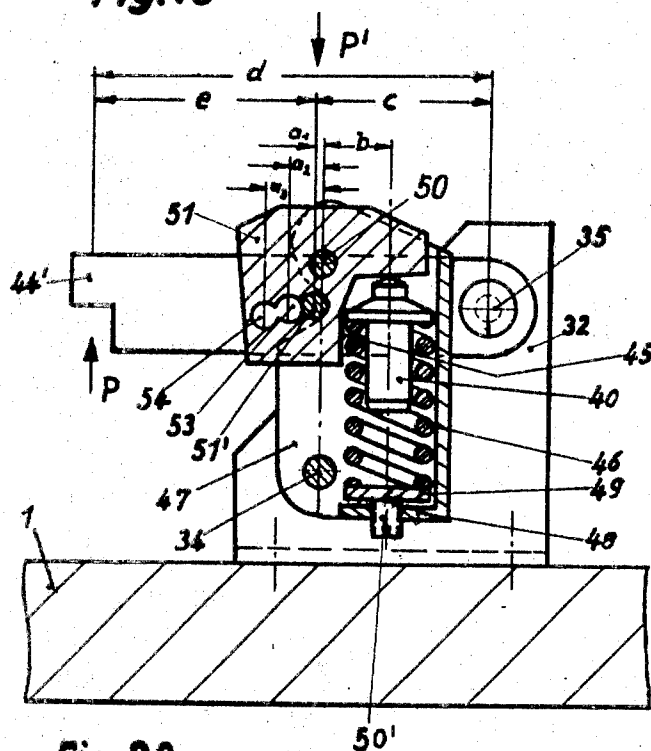
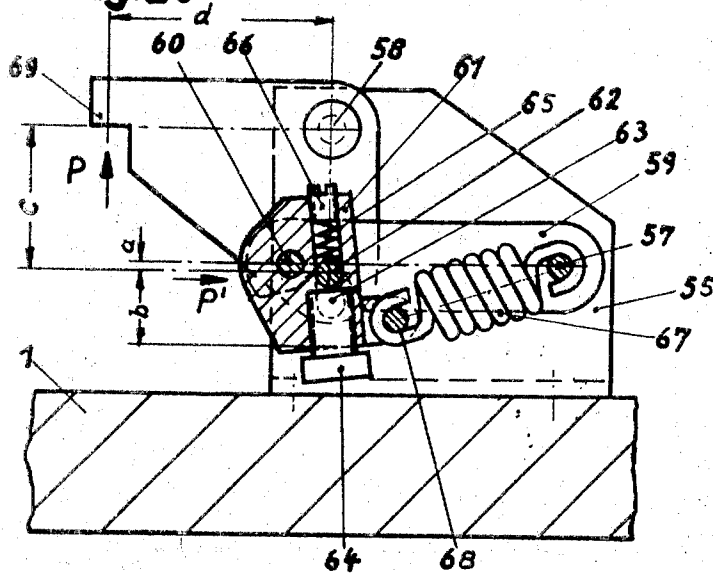


Fig. 20



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**HEEL-RELEASING DEVICE FOR
SAFETY SKI BINDINGS****Ludwig Berchtold, Munich, Germany, assignor to Hannes
Marker, Garmisch-Partenkirchen, Germany****Filed Nov. 27, 1967, Ser. No. 685,909****Claims priority, application Germany, Dec. 5, 1966,****B 90,155; May 30, 1967, B 92,786****Int. Cl. A63c 9/084****U.S. Cl. 280—11.35****11 Claims****ABSTRACT OF THE DISCLOSURE**

A soleholder is provided at the free end of a lever, which is pivoted to a part that is fixed to the ski. The soleholder is spring-urged into its locking position. The spring force is applied to the soleholder by means of a connecting lever, which has pivotal connections on different axes to the soleholder and to the carrying member, respectively. The carrying member is pivotally movable about a fulcrum axis, which is parallel to the surface of the ski and transverse to the longitudinal direction of the ski. The distance from the axis of the pivotal connection between the connecting lever and the soleholder to an imaginary straight line connecting the fulcrum axis of the carrying member to the axis of the pivotal connection between the carrying member and the connecting lever increases as the soleholder is pivotally moved away from its locking position.

This invention relates to a heel-releasing device for safety ski bindings, which device comprises a soleholder, which is provided at the free end of a lever, which is pivoted to a part that is fixed to the ski, said soleholder being spring-urged into its locking position.

In most safety toe or heel irons for safety ski bindings, the release function results in the release of a pivoted locking member when a torque is exceeded, which is preferably adjustable by a detent device. The release may be suddenly effected, e.g., where ball detents or cams are released, or the release may be damped and be effected only when a predetermined angle of opening has been exceeded, so that a certain safety is obtained. The binding yields elastically to short, harmless shocks, such as often occur, and thereafter returns to its normal position.

In order to ensure a reliable control of the ski with such bindings, particularly with heel-holding devices, the same must always be adjusted so that the force opposing a release is as large as is permissible to the skier. It is important, therefore, that this force opposing a release does not increase during a release operation. In order to avoid danger to the skier, the force opposing a release should remain at least the same or preferably decrease as the angle of opening increases. This requirement is particularly important with ski racers, who need a particularly firm connection between the skiing boot and the ski. In most cases, this requirement leads to the setting of the conventional ski bindings to the maximum force opposing a release. As the opening operation of these bindings involves an increase in the force opposing a release, although this increase is only temporary, these bindings may not be released at all so that they can no longer be considered as safety bindings. The extreme conditions which are encountered in ski racing show most clearly that the force opposing a release must not increase when the binding is being opened.

A very important requirement, which has not been met in any known binding, calls for a device for setting the force opposing a release so that said force is independent of the deflection and a change in the dimensions, particularly in the length, of a sole of the boot due to an absorption of water or due to drying will not affect the set

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force which is required for a release. In the systems known, e.g., as "Tyrolia rocket 1-2-3," a check is enabled by a triple window, in which a red mark is exposed. Continual corrections are required to ensure that the force which is required for a release remains constant.

Another requirement resides in the force which is required for a release should be infinitely adjustable rather than in steps, e.g., in positions 1-2-3. In view of the large force range from about 50 to 200 kilograms, settings 1-2-3 involve too large differences between the steps because such a system enables only a setting, e.g., to position 1 (50 kg.), position 2 (120 kg.) and position 3 (200 kg.). It is then difficult to obtain an intermediate setting in adaption to the weight and structure of the body of a given skier.

The invention provides a release element and a force-setting device which are intended for use in safety ski bindings and enables an infinite adjustment of the force which is required for a release through a wide range, whereas the setting of the force which is required for a release is not affected by a change in the dimensions of the skiing boot, the force opposing a release is not increased during the release operation, and a damping effect is obtained.

This is accomplished according to the invention in that the spring force is applied to the soleholder by means of a connecting lever, which has pivotal connections on different axes to the sole holder and to a carrying member, respectively, which is pivotally movable about a fulcrum axis which is parallel to the surface of the ski and transverse to the longitudinal direction of the ski, and the distance from the axis of the pivotal connection between the connecting lever and the soleholder to an imaginary straight line connecting the fulcrum axis of the carrying member to the axis of the pivotal connection between the carrying member and the connecting lever increases as the soleholder is pivotally moved away from its locking position.

In a development of the invention, the connecting lever is adapted to be urged by the spring force against a stationary, noselike guide, and the soleholder is provided with a slot, which is engaged with the stationary fulcrum member for the carrying member.

In a further development of the invention, the stationary, noselike guide is formed by the end edges of the side portions of a bearing bracket, which is fixed to the ski and carries the fulcrum member for the carrying member, and the connecting lever bears on the end edges of the side portions by means of a pin, which protrudes laterally beyond the side portions of the bearing bracket and which may be provided with rollers and in the closed position engages the depression in the guide formed by the nose.

Such a heel-releasing device is highly desirable for various reasons. For instance, the formation of the nose on the bearing bracket which is fixed to the ski enables an outward pivotal movement of about 3-5° in a response to a force which acts on the soleholder and which is not sufficient for an immediate release of the device and such force will not result in a complete release of the boot. A release will not be effected until the outward pivotal movement has exceeded said angle. This feature substantially increases the convenience of skiing because smaller shocks, such as often occur, are resiliently absorbed. A change in a dimension of the skiing boot will not affect the force which is required for a release of the skiing boot because said force which has been set is independent of the contact pressure between the soleholder and the skiing boot. Besides, such a device according to the invention enables the use of technically sound springs, e.g., with a spring rate $c=3-6$ kg./mm.,

and a small, compact design. Owing to the slot in the soleholder of the device according to the invention, the shoeholder will follow the pivotally moving heel of the boot by about 1-1.5 mm. during the opening operation. In view of the above-mentioned shock absorption, the soleholder can return to its locking position without a release of the boot when the outward pivotal movement does not exceed a value between 3° and 5°.

In a preferred embodiment, the connecting lever has a slot, which extends in its longitudinal direction substantially parallel to the imaginary straight line which connects the axis of the pin, which protrudes laterally beyond the side portions of the bearing bracket, and the axis of the pivotal connection between the connecting lever and the carrying member and said slot is engaged by the pin for the pivotal connection to the soleholder. A spring is provided between the soleholder and the top wall of the carrying member, which constitutes a housing, and said spring is compressed and relaxed, respectively, in response to an upward and downward movement of the pin in the slot formed in the connecting lever.

This arrangement enables an elastic up and down movement of the soleholder by about 3 mm. so that a desirable absorption of shocks is enabled in addition to the shock absorption which is afforded by the above-mentioned design of the nose.

The pin which protrudes laterally beyond the side portions of the bearing bracket is preferably provided with rollers, which facilitate the sliding of the pin on the bearing bracket surfaces in contact with the pin.

In another embodiment of the present invention, the connecting lever carrying the pin which engages the end edges of the bearing bracket has a recess, which in the locking position engages under the action of the spring a pin, which is secured to the bearing bracket and extends transversely to the longitudinal direction of the ski. The nose on the bearing bracket consists of a guide, on which the pin protruding laterally beyond the side portions of the bearing bracket slides during the opening and closing movements of the heel-releasing device.

In the embodiments of the invention which have been described hereinbefore, the contour of the nose of the bearing bracket is preferably designed so that after the action of a force which is larger than the set force required for a release the pin which slides on the nose is moved under the action of the spring into a position which enables the skier to step into the binding.

The invention will be explained more fully hereinafter with reference to embodiments shown by way of example in the drawings, in which—

FIG. 1 is a vertical longitudinal sectional view showing an embodiment of the heel-releasing device according to the invention in closed position and

FIG. 2 is a sectional view taken on line A-B in FIG. 1.

FIGS. 3 and 4 are sectional views showing the heel-releasing device of FIG. 1 in various phases of the release operation.

FIG. 5 is a vertical longitudinal sectional view showing another embodiment of the heel-releasing device according to the invention.

FIG. 6 is a sectional view taken on line A-B in FIG. 5 and

FIG. 7 is a sectional view taken on line C-D in FIG. 5.

FIGS. 8 and 9 are side elevations showing the heel-releasing device of FIG. 5 in various phases of the release operation.

FIG. 10 shows a modification of the heel-releasing device of FIG. 1 with a damping spring providing for resilience, which spring is shown in a relaxed state.

FIG. 11 shows the device of FIG. 10 with the damping spring compressed.

FIGS. 12 and 13 are simplified showings of the device according to the invention in closed and open positions to illustrate the lever ratios used in the heel-releasing device according to the invention.

FIGS. 14 and 15, respectively, are diagrammatic views showing another embodiment of a heel-releasing device according to the invention in closed position and in a position assumed after a pivotal movement out of the closed position.

FIG. 16 is a longitudinal sectional view showing the embodiment diagrammatically represented in FIG. 14.

FIG. 17 is a side elevation of the device of FIG. 16.

FIG. 18 shows the heel-releasing device of FIG. 16 in its open position.

FIG. 19 is a longitudinal sectional view showing another embodiment of a heel-releasing device according to the invention.

FIGS. 20 and 21, respectively, are a longitudinal sectional view and a side elevation showing another embodiment of a binding according to the invention.

In the illustrations of all embodiments of the present invention shown in the drawing, the elements known per se, such as a pedal which is substantially parallel to the soleholder and movable in unison with it to enable the skier to step into the open heel-releasing device and to close the device by depressing the pedal, as well as means for changing the distance from the soleholder to the surface of the ski in adaptation to the height of the boot for which the heel-releasing device is intended, and means for moving the bearing bracket which is fixed to the ski in the longitudinal direction thereof in adaptation to different boot sizes, are omitted for the sake of clarity. It is emphasized that all elements which are required in a heel-releasing device for safety ski bindings and which are not expressly mentioned in the present specification and the accompanying drawings are of known design.

FIGS. 1 to 4 show an embodiment of the release element according to the invention. A bearing bracket 15 consists of two angles 5 and 6, which are secured to a ski 1 and are connected by a pin 16, which extends parallel to the surface of the ski and at right angles to the longitudinal direction of the ski. Pivotaly mounted on the pin 16 are the soleholder 10 at its end nearer to the tip of the ski, and a carrying member 13, which consists of a housing. The soleholder 10 is pivoted by a pin 12 to a connecting lever 11, which is pivoted to the carrying member 13 by a pivot 17 disposed above the pivot 12. A pin 14 is provided below the pivots 12 and 17 and protrudes laterally beyond the side portions of the bearing bracket 15. A tension spring 19 is secured to the pin 14 and the pivot 16. The tensile force of said spring can be adjusted in known manner. Those ends of the two angles 5 and 6 which are nearer to the tip of the ski have the form of a nose, which enables the pin 14 to snap in under the action of the spring 19 when the heel-releasing device is in closed position. The nose is designed so that the tension of the spring 19 causes the soleholder 10 to continue its outward pivotal movement when the pin 14 has moved beyond the extreme projection of the noses of the angles 5 and 6 under the action of a force applied to the soleholder so that the heel-releasing device assumes its step-in position. Near the pivot 16, the soleholder 10 is provided with a slot 21, which extends in the longitudinal direction of the ski 1 and enables the soleholder 10 to move forwardly past the noses of the angles 5 and 6. The drawing shows in dotted lines a right-angled bell-crank lever 23, which is pivotally mounted on the pin 17 and has one arm resting on the pin 14. The other arm of the lever 23 protrudes from the housing 13. Pressure applied to the latter arm, e.g., by hand or with the ski stick, will then force the pin 14 past the nose of the angles 5 and 6 so that the release element can be opened when it is desired to step out of the binding. For the purposes of the invention it is important that the axis of the pivot 12 is somewhat offset toward the tip of the ski from the imaginary straight line connecting the axes of pivots 14 and 17 so that there is a lever arm *a*. The significance

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of this lever arm *a* for the setting and function of the release device according to the invention will be explained hereinafter.

FIGS. 5 to 9 show another embodiment of the invention. A bearing bracket 15 consisting of two angles 5 and 6 is provided on a ski 1. The angles 5 and 6 are connected by a pin 16, which extends parallel to the surface of the ski and at right angles to the longitudinal direction of the ski. A soleholder 10 and a carrying member 13 are provided on the pin 16. The soleholder 10 is pivoted by a pin 12 to a connecting lever 11, which is pivoted to a carrying member 13 by means of a pin 17, the axis of which is disposed above the axis of pin 12. The connecting lever 11 comprises also a pin 14, which protrudes laterally beyond the angles 5 and 6. The connecting lever 11 is formed with a recess or indentation on that side which faces the rear end of the ski. In the closed position of the heel-releasing device, this recess or indentation engages a pin 20, which connects the angles 5 and 6 and extends parallel to the surface of the ski and at right angles to the longitudinal direction of the ski. In the embodiment, a tension spring 19 is secured to the pivot 16 and at 24 to the connecting lever 11. A slot 21 and the right-angled bell-crank lever 23 are provided just as in the embodiment of FIGS. 1 to 4.

In the embodiment of FIGS. 5 to 9, those portions of the angles 5 and 6 which face the tip of the ski form also noses but these noses need not permit the pin 14 to snap in because this function is provided for by the recess in the connecting lever 11 in combination with the pin 20. It is sufficient if the noses of the angles 5 and 6 are designed to guide the pin 14 during the opening and closing movements of the heel-releasing device according to the invention. Just as in the first embodiment, the nose has such a contour that the spring 19 pulls the heel-releasing device into the position in which the skier can step into the binding when a force acting on the soleholder 10 has moved the pin 14 beyond the projection of the noses on the angles 5 and 6.

Another embodiment of the invention is shown in FIGS. 10 and 11 and differs from the embodiment of FIGS. 1 to 4 in that a connecting lever 11 is provided adjacent to the pivot 12 for connection to a soleholder 10 with a slot 22, which is substantially parallel to an imaginary straight line which connects the axes of pivots 14 and 17, and a spring 18 is provided between the soleholder 10 and the top wall of the housing 13 and is compressed or relaxed when the pivot 12 connected to the soleholder 10 moves along the slot 22.

Such slot 22 in conjunction with such spring 18 may be provided also in the embodiment of the heel-releasing device according to the invention shown in FIGS. 5 to 9.

FIGS. 12 and 13 show diagrammatically the lever ratios of the heel-releasing device according to the invention. Two lever arms *a* and *b* are provided. A force *P'* opposes the release of the system according to the invention and is related to the parameters of the heel-releasing device in accordance with the equation

$$P' = \frac{P_F \times b}{a}$$

where *P_F* is the force which is determined by the tension spring of the device.

The force which opposes a release of the heel-releasing device according to the invention can thus be varied by a variation of lever arm *a* if the spring force and the lever arm *b* are constant, and by a variation of the spring force *P_F* if the lever arms *a* and *b* are constant. All parameters which are involved may also be varied. As is particularly apparent from FIG. 13, the lever arm *a* increases from its length in the closed position continuously during the action of a force applied to the soleholder in the direction of the arrow shown in the drawing so that the force *P'* opposing a release decreases as the angle of opening *α* of the heel-releasing device in-

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creases. It is emphasized, however, that the lever arms *a* and *b* and the spring force *P_F* may be selected so that the force *P'* opposing a release does not decrease but remains constant or increases during the release operation.

It will be emphasized that in the embodiment shown in FIGS. 1 to 4 an adjustment of the force which is required for a release is possible only at the adjustable tension spring. The connecting lever 11 can easily be replaced, however, by another connecting lever having a different lever arm *a*. In this embodiment, the connecting lever 11 is stressed only in compression so that inexpensive sheet metal stampings can be used because there is no danger of a breakage. Besides, the number of parts required is smaller by two than in the embodiment of FIGS. 5 to 9 where the double connecting lever 11 is stressed in tension so that there is danger of breakage.

With springs having a spring constant *c*=3-6 kg./mm., such as may be used in the heel-releasing device according to the invention, the force which is required for a release may be infinitely adjustable between about 50 and 220 kg.

Means may be provided for a visual indication of the set forces required for a release. These means may comprise a window in which the forces *P'* generated by the system and opposing a release are directly indicated in dependence on the setting of the tension spring 19. Different ranges of the force required for a release may alternatively be indicated by different colors or other symbols.

FIGS. 14 to 21 show three additional, different embodiments of heel-releasing devices according to the invention. To facilitate the understanding, a complete toe or heel iron on a ski has not been shown but only a simplified structure on a ski.

According to FIGS. 14 to 18, a ski 1 is provided with two bearing bracket angles 32, which are secured at 33 to the ski. The two bearing bracket angles 32 comprise two bearings 41 and 35. A U-shaped carrying member 36 is pivotally mounted between the angles 32 by means of a pin 41. A connecting lever 38 is pivoted by a pin 37 to the carrying member 36. The latter receives also a compression spring 39 and a pin 40. The compression spring 39 bears on the bearing pin 41, which extends through the carrying member. The connecting lever 38 is connected by a pivot 42 to a soleholder 44. The bearing of the pivot 42 at the connecting lever 38 consists of a slot so that the lever arm can be infinitely adjusted from *a* to *a'*. A screw 43 limits the movement of the pivot 42 in the direction of the acting force. The soleholder 44 is pivoted to the angles 32 by the pin 35 and on an axis which is spaced by a distance *c* from the axis of the pin 35 is connected to the connecting lever 44, which has a surface 45 bearing on the compression spring 39. FIGS. 15 and 18 show the actuated release device when it has been pivotally moved out of the closed position by the angle *α*.

The embodiment of FIG. 19 is basically similar to the embodiment of FIGS. 14 to 18, from which it differs, however,

- (1) by a different arrangement of a compression spring 46, which does not bear on a fulcrum member extending through a carrying member but on a carrying member 47, which has a spring abutment wall 48. The compression spring 46 can be restressed by a disc 49, which is operable by a thrust screw 50'; besides
- (2) a pivot 51' in a connecting lever 51 cannot be infinitely adjusted by additional bearing bores 53, 54 are provided, which are spaced definite distances *a*₂ and *a*₃ from a normal through the pivotal axis 50 of the carrying member 47.

The embodiment shown in FIGS. 20 and 21 is similar in function to the embodiments shown in FIGS. 14 to 19 but comprises a tension spring. Two bearing bracket

angles 55 are secured to the ski 1 at 56 and have two pivot pins 57 and 58. A carrying member 59 is pivoted on the pin 57 and the soleholder 69 is pivoted on the pin 58. A connecting lever 61 is connected to the soleholder 69 and the carrying member 59 by pivot pins 60 and 62, respectively. The pivot pin 62 can be infinitely adjusted in a slot 63. A screw 64 limits the movement along the slot 63 in the direction of the acting force, and a compression spring 65 in combination with a screw 66, which is threaded into a connecting lever 71, ensures that the pin 62 always engages the screw 64 during the adjustment of the latter. The tension spring 67 is connected to the pivot pin 57, which extends through the carrying member 59, and at 68 to the connecting lever 71.

When the force P is acting on the soleholder 44 or 44' in the embodiments of FIGS. 14 to 19, the force P' must be overcome for a pivotal movement, e.g., through the angle α . This force is generated by the prestressed compression spring 39 or 46, which acts with a lever arm b on the connecting lever 38 or 51. The connecting lever has a surface 45 bearing on the compression spring 39 or 46. The force P' depends on the lever arms a and b.

Hence,

$$P' = \frac{P_F \times b}{a}$$

where P_F is the spring force, and

$$P = \frac{P' \times c}{d}$$

so that any desired force P' opposing a release and any desired force P required for a release can be adjusted. The equation

$$P' = \frac{P_F \times b}{a}$$

shows that P_F would become infinite for $a=0$. Hence, the release element is rigid if $a=0$.

When the release element is pivotally moved by the angle α , the lever arm a is increased to a4 and P' and P are decreased. The resulting increase of the force of the compression spring is negligible compared to the increase of the lever arm to a4.

What is claimed is:

1. A heel-releasing device for safety ski bindings comprising: a mounting member connected to the ski for mounting the heel-releasing mechanism; a carrying member pivotally connected to said mounting member about a first fulcrum, the axis of which is parallel to the surface of the ski and transverse to the longitudinal direction of the ski; a soleholder having a locking position and pivotally mounted on a second fulcrum, the axis of which is also parallel to the surface of the ski and transverse to the longitudinal direction of the ski; a connecting lever pivotally mounted on said soleholder for rotation about a first axis and pivotally mounted on said carrying member for rotation about a second axis; spring means for urging said soleholder into its locking position, the spring force being applied to the soleholder through the connecting lever; wherein the distance between the first axis and the foot of a perpendicular through the second axis

where intersecting the line between said second fulcrum and said first axis increases as the soleholder is pivotally moved away from its locking position.

2. The device of claim 1 wherein said fulcrum coincides with said first fulcrum, wherein said soleholder is provided with a slot, wherein said second fulcrum is positioned through said slot, and wherein said mounting member is provided with a noselike guide against which said spring urges said soleholder.

3. The device of claim 2 wherein said connecting lever is provided with a pin extending beyond the ends of said mounting member and serving, when the device is in its closed position, to engage said guide.

4. The device of claim 3 wherein said pin is provided with rollers.

5. A heel-releasing device according to claim 4, and further comprising a second pin connected to said mounting member and extending transverse to the longitudinal direction of the ski, characterized in that the connecting lever has a recess therein, which in the locking position, engages said second pin under the action of the spring.

6. A heel-releasing device according to claim 2, characterized in that the noselike guide serves to release the soleholder and the connecting lever when a predetermined force required for a release has been exceeded, the connecting lever subsequently being pivotally moved under the spring force into the open position.

7. A heel-releasing device according to claim 1, characterized in that the distance between said first and said second axes is adjustable and adapted to be fixed in the operating position.

8. A heel-releasing device according to claim 7, characterized in that the connecting lever is provided with a slot for receiving a pin forming said axis to enable an adjustment of the distance between said first and said second axes.

9. A heel-releasing device according to claim 7, characterized in that the connecting lever is provided with a plurality of bores for receiving a pin defining said first axis.

10. A heel-releasing device according to claim 1, and further comprising second spring means disposed between the soleholder and the carrying member and serving to effect a pivotal movement of the carrying member and the soleholder apart from each other.

11. A heel-releasing device according to claim 1, characterized in that the carrying member for the connecting lever and the soleholder form two cranks of a dihedral articulated quadrangle and the connecting lever forms a link of said quadrangle.

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BENJAMIN HERSH, Primary Examiner
JOHN A. PEKAR, Assistant Examiner