Sept. 20, 1971 T. G. SMOLKA ET AL 3,606,368

SAFETY SKI BINDING

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FIG. 1

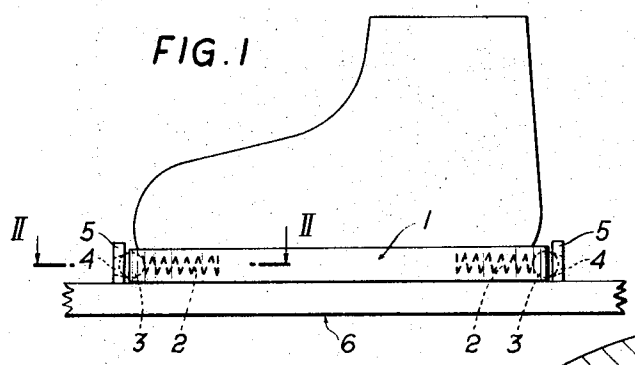

FIG. 2

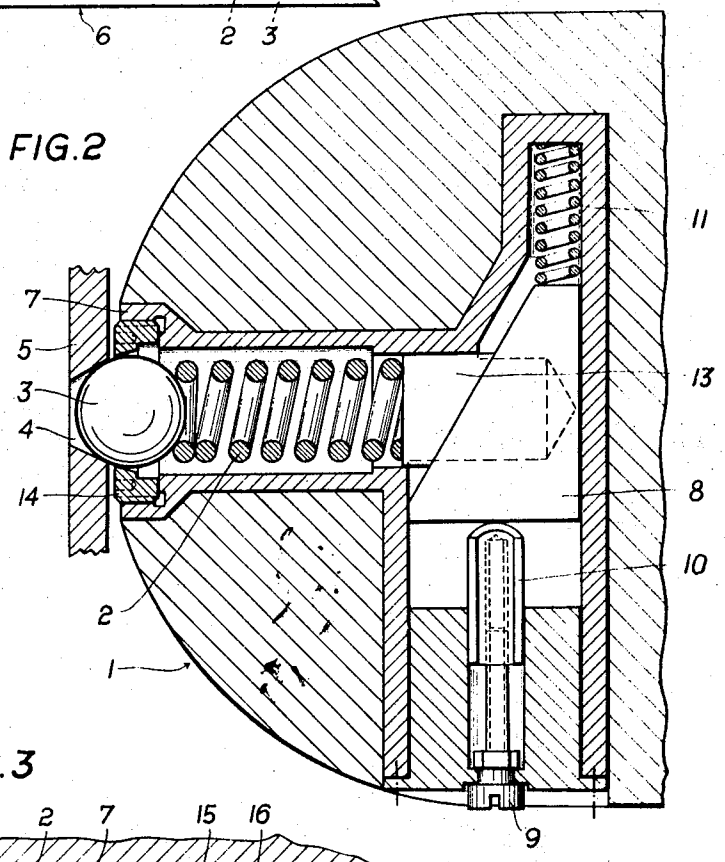

FIG. 3

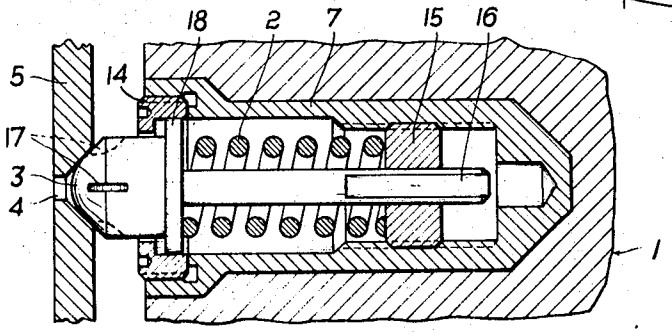

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FIG. 4

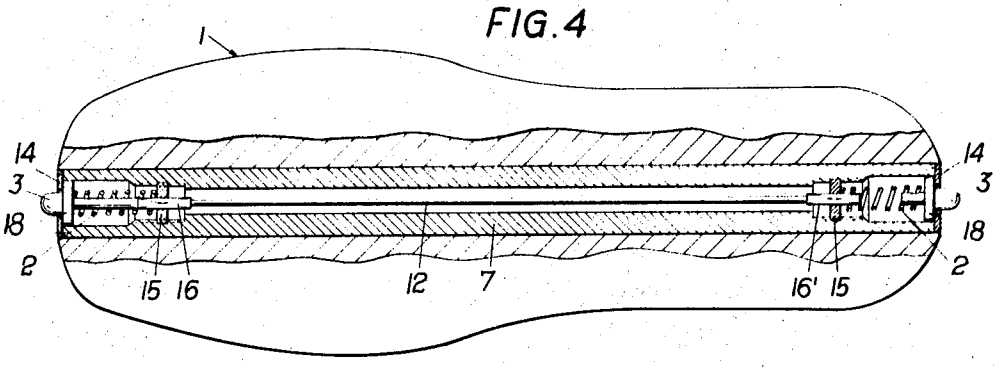

FIG. 5

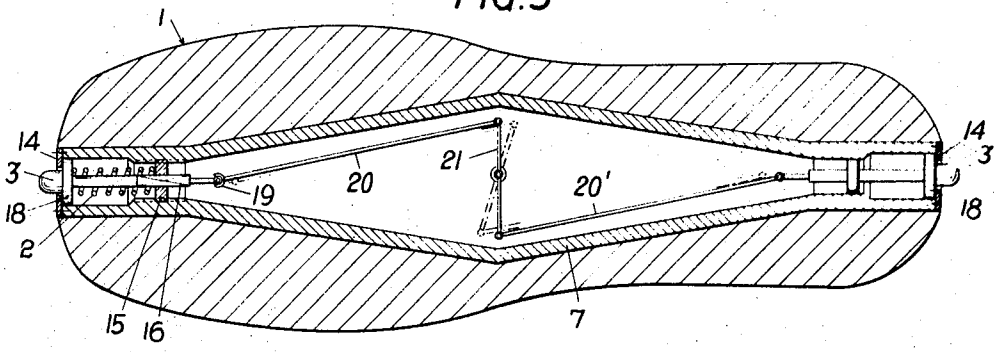

FIG. 6

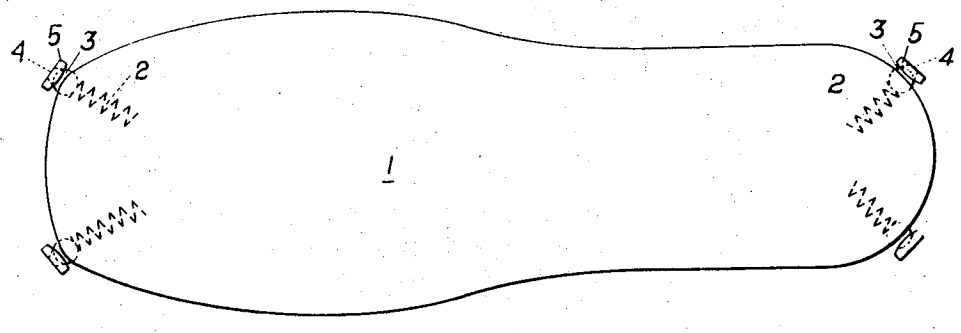

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FIG. 7

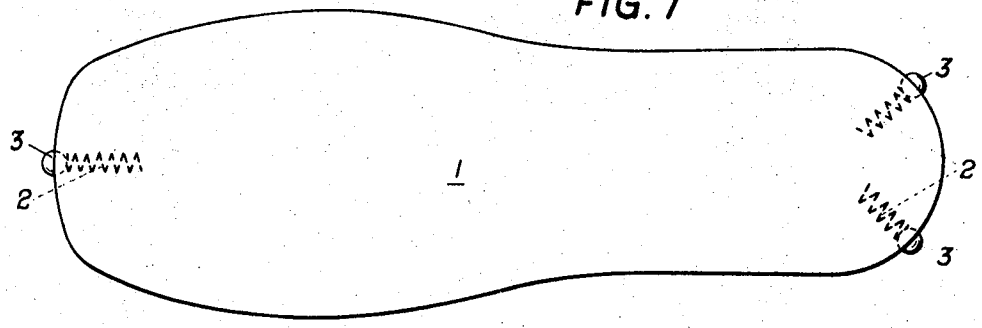

FIG. 8

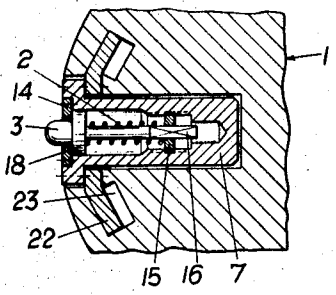

FIG. 9

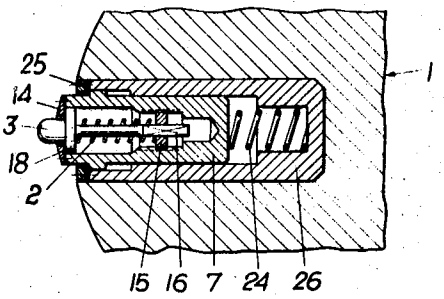

FIG. 11

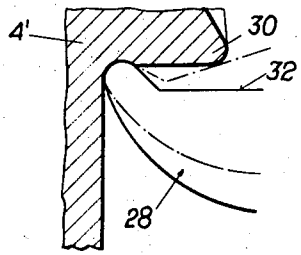

FIG. 10

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FIG. 12

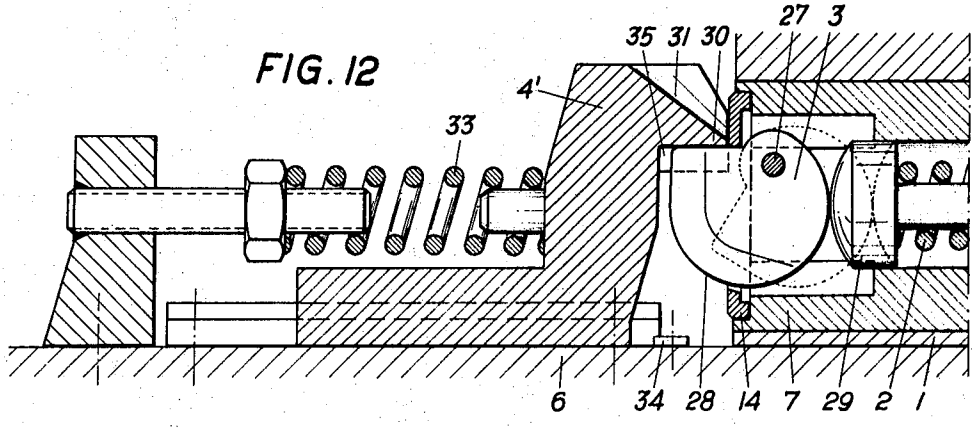
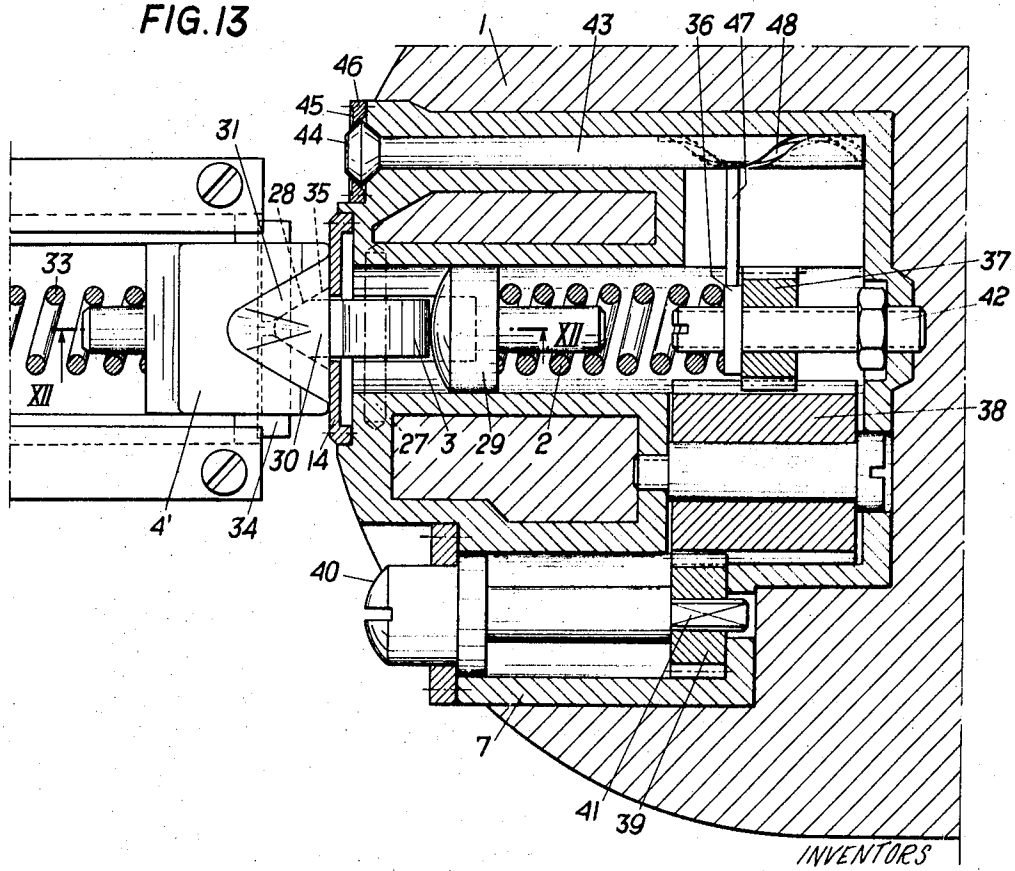


FIG. 13



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United States Patent Office

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SAFETY SKI BINDING

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Claims priority, application Austria, Jan. 12, 1968, 348/68
Int. Cl. A63c 9/00
U.S. Cl. 280—11.35D 11 Claims

ABSTRACT OF THE DISCLOSURE

A safety ski binding in which pairs of releasable members are arranged at either or both of the toe and heel of a ski shoe, one part of said locking members being arranged on the ski and the other part being arranged on, or as a part of, the ski shoe. One preferred form contemplates the location of tensioned releasable means within the sole of the ski shoe and the part against which said tensioned means operate being mounted on the ski. Alternatively, the tensioned releasable means may be mounted primarily within the ski with a sole gripping portion projecting therefrom and arranged for engaging the sole of the ski shoe. In the first-named form, recess means are mounted fixedly, or longitudinally adjustably as desired, onto the ski and projecting means are mounted at least partially within the ski shoe and projecting outwardly therefrom for engaging said recess means, said projecting means being resiliently urged into engaging position but retractible in response to pressure applied thereto. Where said tensioned releasable means are provided at both ends of the ski shoe, same may be independently adjustable or common means may be provided for simultaneously adjusting the tension on both of said tensioned releasable means. Similarly, connecting means may be provided between tensioned releasable means at both the toe and heel of the ski shoe whereby the release effected at either thereof will mechanically and positively release the other.

This invention relates to a safety ski binding which releases the shoe from the ski upon the occurrence of an overstress condition, and particularly to apparatus wherein the locking elements are normally held resiliently in place.

Ski bindings are generally mounted to the ski and are thus very much exposed to outside influences like icing, snow, dirt, damage during both transport and use, etc. For example, during a fall, during which the shoe is released from the ski, there exists also the danger that the ski which is then connected to the shoe only through a safety strap accidentally hurts the user with the relatively heavy binding parts (particularly when only a single safety strap is used and the so-called "windmilling" action occurs).

Furthermore, a ski binding is known in which a plate having locking elements is arranged on the shoe sole. These locking elements are engageable by locking elements which are arranged on the ski and which are spring-loaded. In such arrangement, all ski binding parts are located underneath the shoe sole with the result that as a practical matter these shoes can be conveniently put on only directly before stepping onto the ski. This is because ice, snow or dirt will often get into the recesses of the plate arranged on the shoe sole during walking in snow, ice or dirt and if one then steps onto the ski, the desired locking of the safety ski binding elements is very difficult or impossible to achieve. Thus, such a construction cannot be effectively used in practice.

The purpose of the invention is to construct a ski binding in which the important parts are arranged under cover within the ski, or inside the shoe sole and the ski, or the shoe sole has projecting from it only locking elements which then engage directly corresponding locking elements arranged on the shoe sole or in the ski. The arrangement must be such that penetration of ice, snow, dirt and the like is prevented.

To attain this purpose, the invention provides that parts of the binding are arranged in the shoe, preferably in the sole of the shoe and/or in the ski. Further, the locking spring and a locking element are arranged in the shoe sole or in the ski and the other locking element associated therewith is provided on the ski or on the shoe sole.

The one locking element and the spring are advantageously arranged in a housing which is anchored in the shoe sole or in the ski. Furthermore, the housing can be vulcanized, cast, glued or the like into the shoe sole or into the ski. Of course, it is also possible that the housing is formed by the shoe sole or by the ski itself.

According to one particular construction, the spring is supported at its one end on the one locking element and at its other end on a part movable in axial direction of the spring, which part, with a sloped surface, abuts a wedge which is movable for adjusting the spring force. The movable wedge abuts a pressure member which is provided with internal threads in which a screw engages. A return spring is arranged on the side of the wedge which is oppositely positioned to the pressure member.

According to a further construction, the spring is supported at its one end on the one locking element and at its other end on a threaded member. The threaded member is screwed into the housing with an external thread and has a square, hexagonal, or similar opening which is engaged by a square, hexagonal, or similar portion of an extension of the locking element. The locking member has operating slots for effecting its rotation and thus for adjusting the spring force.

According to a still further construction, there are provided at least two pairs of locking elements, each such pair comprising two locking elements which are positioned in either the shoe sole or in the ski and are arranged to cooperate with one another. One of such locking elements has at the respective ends of a central rod, square, hexagonal, or the like, members which each respectively engage a threaded member. Thus, upon a rotation of said central rod, the force of a pair of springs which are both supported on the threaded members is adjustable.

The locking elements arranged in the shoe sole or in the ski can also be connected through a lever system so that upon operation of the one locking element the second locking element is also operated. The lever system has two rods which are connected jointedly at one end of each respectively with one locking element which is arranged in the shoe sole or in the ski and at the other end with a cross lever which is pivotally supported approximately in its center.

In a preferred embodiment, there is provided only one spring for the two locking elements in the shoe sole or in the ski. The one pivot point of a guide arm is constructed in a ball-and-socket-joint manner on the locking element.

A further possible embodiment is that several locking elements, for example three or four, are arranged in the shoe sole or in the ski. The housing can also be releasably secured to a part anchored in the shoe sole or in the ski.

In a further construction, the one locking element and the locking spring are provided in a housing which is arranged movably against the force of a spring.

Furthermore, in another construction, the locking element arranged in the shoe sole or in the ski is a pivotable lever acted upon by the spring, an extension of said lever gripping the locking element arranged on the ski or on the shoe sole. The pivotable locking lever has a slot in its swivel point.

The locking element arranged on the ski can be provided either movably or fixed on the ski or it can be arranged on the ski for movement against the force of a spring. The spring-loaded locking element which is arranged on or in the ski abuts the shoe sole and thus applies thrust onto the shoe.

A further construction is that the spring is supported on a gear which is rotatably supported with an internal spline on a pin. The gear is then connected to an operating member through suitable gearing.

An indicating device can be advantageously provided. A washer is arranged for this purpose between the gear and the spring, said washer having an extension which engages the helical groove of a rotatably supported shaft. The shaft is provided with markings as desired which are positioned in suitable relationship to markings on the housing, on the shoe sole, on the ski or the like.

Suitable ribs, extensions or the like can be provided to securely hold the housing, or corresponding part, in the shoe sole or in the ski, whichever it is to which the housing is secured.

In order to be able to use the construction of the invention for cross-country skiing, a locking element is provided on a plate arranged on the ski, which plate is pivotable with respect to the ski after a release for the purpose of cross-country skiing.

If the locking elements are arranged in the ski, same can be two-armed, pivotable levers, in which case one arm of each lever is arranged in a spring-loaded manner in the ski and the other arm extends above the ski surface and engages the shoe sole. The arm extending above the ski surface can also be constructed as a clamp which is preferably adjustable in height.

The subject matter of the invention is illustrated by way of example in several embodiments in the drawings in which:

FIG. 1 is a side-elevational view of the fastening of a shoe to a ski by means of the invention.

FIG. 2 is a cross-sectional view of a locking device of the invention, said section being taken along the line II—II of FIG. 1.

FIG. 3 is a cross-sectional view of a further structural possibility for the locking means of the invention.

FIG. 4 illustrates the arrangement of two locking means which are in cooperative relationship to each other.

FIG. 5 illustrates also the arrangement of two locking means which are connected.

FIGS. 6 and 7 illustrate the arrangement of four and three, respectively, locking means in one shoe sole.

FIG. 8 illustrates a locking device replaceably arranged in the shoe.

FIG. 9 illustrates a further structural possibility of the invention.

FIG. 10 illustrates a locking device between parts which are constructed like levers.

FIG. 11 illustrates a detail of FIG. 10.

FIGS. 12 and 13 are cross-sectional views in planes

associated with one another of a further embodiment of the invention whereby FIG. 12 is a cross section along the line XII—XII of FIG. 13.

As can be recognized by inspecting FIG. 1, locking balls **3** are arranged in the shoe sole **1**, which locking balls are loaded by the springs **2** and engage the locking grooves **4** which are arranged in support parts **5** provided on the ski **6**. During a safety release, for example during a fall in both the forward or sideward direction, a ball **3** is pressed back against the force of the spring and can thus escape from the locking groove **4** so that the shoe is freed. The illustrated arrangement allows freeing of the shoe in practically any direction. The shoe is connected to the ski in a known manner through a safety strap but since this is not the subject matter of the invention, it is therefore not illustrated. The safety strap could, for example, also be arranged on the support part **5**. It is also possible to arrange the support parts or at least one support part **5** movably to permit change of the prestress of the spring. Only one such part is mounted to the ski in the invention and only a small adjustment is required.

According to FIG. 2, the housing **7** is vulcanized, cast or the like, into the shoe sole depending on whether the sole is made of rubber or plastic. The invention is particularly suitable for cast shoes which are manufactured of plastic. Ribs, extensions or the like which would further improve the anchoring could be provided on the housing.

A wedge is movably supported in the housing **7**. By rotating the screw **9**, the compression member **10** is moved and thus the wedge **8** is also moved. The spring **11** constantly urges the wedge **8** for abutment against the compression member **10**. The sloping surface of a part **13** which is movable in axial direction of the locking spring **2** is supported on the sloped surface of the wedge **8**. The spring is stressed to a greater or lesser degree upon movement of the wedge **8** and thus determines whether a greater or lesser force is necessary for the release of the ball **3** from the locking groove **4**. The threaded part **14** is a fitting for the ball so that same cannot escape when the shoe is not on the ski. This construction also assures that snow, ice, dirt or the like cannot penetrate thereinto.

Markings can be provided in connection with the adjustment screw **9** from which the adjusted spring force or the adjusted safety release can be read.

In the construction of FIG. 3, the locking element **3** is pin-shaped and is urged into the locking groove **4** by the spring **2**. The spring is supported on a threaded member **15** which includes rectangular key projecting into a corresponding slot of the locking element **3**. Furthermore, the locking element **3** comprises slots **17** which allow rotation of the locking element **3**. At such a rotation, the threaded member **15** is also rotated and compresses the spring **2** together more or less depending on the direction of rotation. This permits adjustment of the safety release as desired. The flange **18** limits the outward movement of the locking element **3** since said flange **18** butts the screw portion **14** as soon as the ski sets the shoe free.

In the construction of FIG. 4, the leftward arrangement of the locking element corresponds approximately to the construction of FIG. 3. However, adjoining the rectangular rod **16** of the locking element **3** there is provided an extension **12** which has a further rectangular section **16'** at its other end. Said rectangular section **16'** engages a threaded member **15**. Thus, by rotating the leftward locking element **3**, both threaded members **15** are also rotated and thus both springs **2** are stressed to a greater or lesser degree as desired. This construction permits control over the second locking arrangement during adjustment of the first locking arrangement. The force of both springs **2** can in this embodiment be chosen to be the same or to be different, as desired. In the latter case, for example, the springs can be chosen in such a manner that the shoe is released more easily at the toe than at the heel.

The locking arrangement in the leftward zone of FIG. 5 is constructed similarly to the one in FIG. 3, the difference being that a rod **20** is hinged to the connection of the recangular section **16'** by means of a ball-and-socket joint **19**. The other end of the rod **20** is hingedly connected to a cross lever **21**. The cross lever is pivotably supported approximately in its center. A second rod **20'** is hingedly connected also to the cross lever **21** and to the locking element **3** illustrated on the right in the drawing. By this lever system, a movement of either of the two locking elements **3**, independently of whether the left or the right one is moved, will cause also the movement of the other locking element. Thus, if, for example, during a safety release one locking element **3** is pressed back against the force of the spring **2**, then the other locking element **3** is pulled back automatically at the same time through the lever system so that the shoe is freed simultaneously in front and in back. A ball-and-socket-joint connection **19** is required for the locking means arranged on the leftward side in the drawing because there the locking element **3** must be rotated to change the stress of the spring **2**. The locking element arranged on the rightward side in the drawing is moved only axially so that there a simple joint is sufficient. The position of the lever system **20**, **21**, **20'** indicated in dash-dotted lines illustrates the position in which the locking elements **3** are pressed or pulled back when the locking system is released.

FIG. 6 illustrates four pairs of locking elements **3**, **4**. This arrangement permits an easier release of the shoe particularly in the case of a diagonal fall. An easy release in the case of a diagonal fall is also assured through the arrangement of three pairs of locking elements as illustrated in FIG. 7. Two locking means are provided in the zone of the heel and one locking is provided in the zone of the toe.

In FIG. 8, the housing **7** is releasably secured to a mounting part **22** which is anchored in the shoe sole **1**, for example, by means of screws. The binding can thus be easily replaced or removed and can easily be installed in a different shoe. The mounting part **22** has ribs, extensions or the like for a safe anchoring of said part **22** in the shoe sole **1**, said ribs, extensions or the like being surrounded by the material (plastic, rubber or similar material) of said shoe sole **1**.

In FIG. 9, the housing **7** is arranged movably against the force of a spring **24** in the shoe sole **1**. A cover plate **25** prevents the housing **7** with the locking parts from being pressed out. An opening can be provided in the shoe sole for the housing **7** and the spring **24** or, as illustrated, a sleeve-shaped member **26** can be cast, vulcanized, glued or the like into the shoe sole. This additional spring **24** permits a thrust to act on the shoe.

In FIG. 10, the locking element **3** is a lever pivotable about the axis **27**, said lever having an extension **28**. The locking spring **2** presses the locking lever **3** into the front position through a rod **29**, as this is illustrated. The extension **28** engages (grips under) the nose **30** of the locking element **4'** arranged on the ski **6**. This locking element **4'** can be arranged movably or fixedly on the ski so that an adjustment to fit various shoe sizes is possible. The prestress of the spring **2** can also be increased by moving the locking element **4'** closer to the shoe. A suitable surface **31** on the locking element **4**, which converges also laterally, extends conically toward the center thereof to direct the locking element **3** or its extension **28** to the center during stepping in so that said locking element is placed in the correct position. The locking element **3** is pressed back against the force of the spring during the stepping-in procedure and snaps in underneath the nose **30** at the end of the stepping-in movement so that a position, as illustrated in FIG. 10, is obtained.

In order to make the engagement easier, the extension **28** can be constructed in the manner as illustrated in FIG. 11. Here the extension **28** is rounded off at one end and can thus deviate from its normal position through a limited zone until it butts the nose **30** with the surface **32**. This position is illustrated in dash-dotted lines. Such a position of the locking element **3** or the extension **28** is taken when the shoe sole does not sit entirely on the ski. The extension **28** is pressed back during the safety release until said extension can move upwardly past the nose **30**.

Of course, it would also be possible in the construction of FIG. 10 to support the housing **7** movably against the force of a spring (as in FIG. 9) in the shoe sole through which a thrust acts onto the shoe. A thrust can also act onto the shoe from the locking spring **2** if same is slightly more tensioned as above described.

FIGS. 12 and 13 illustrate a construction similar to that illustrated in FIG. 10. Different from FIG. 10, however, the locking element **4'** arranged on the ski is movably arranged against the force of a spring **33** on the ski and presses against the shoe sole **1** with its front part so that thrust acts onto the shoe. If not in use, the locking member **4'** moves against the stop **34** in response to the spring **33** and remains in this position. The shoe is lifted off in an upward direction during the safety release and the locking element **3** moves thus into the position indicated in dash-dotted lines in FIG. 12 by compressing the locking spring **2**. The locking element **3** thus moves inwardly until it can be moved past the nose **30** of the locking element **4'**. A lateral safety release is also possible because the locking member abuts the sloped surfaces **35** of the locking element **4'** and, at an overload, slides along one of said surfaces in a simultaneous movement until the locking element **3** is entirely released from the locking element **4'**.

The stepping into the binding is done in the same manner as has already been described in FIG. 10. Here the locking element **3** will slide along the sloped surface **31** and is pressed back until it can engage the nose **30** and takes the illustrated position.

The spring **2** is supported at one end on the pin **29** and at the other end on a gear **37** through a washer **36**. The gear **37** is internally threaded and is associated with a threaded screw **42** which is threaded into the housing **7**. The gear **37** is in engagement with a further gear **38** which also engages a gear **39**. A pin **40** has at its end a rectangular section **41** which extends into a corresponding opening in the last gear **39**. The rotary movement is transmitted to the gear **37** through the gears **39**, **38** by rotating the pin **40**. Through this, the gear **37** travels back and forth on the threaded screw **42** and thus stresses the spring **2** to a greater or lesser degree as desired. Thus, the required release force can be adjusted by rotating the pin **40**.

In order to be able to read the adjusted release force, an indicating device is provided. For this the washer **36** has an extension **47** which engages the helical groove **48** of a rotatably supported shaft **43**. As soon as the gears, particularly the gear **37**, are rotated, an axial movement of the washer **36** will occur through which the pin slides in the groove of the shaft **43** and causes a rotation of same. A marking **44** is provided at the outer end of the shaft **43**, also markings **45** are arranged on the cover plate **46**. This gives a reading to indicate how the release force is adjusted.

The invention is not limited to the illustrated embodiment. A number of structural possibilities are given which lie within the scope of the invention. For example, it is possible to provide a plate swingable on the ski for cross-country skiing, said plate carrying a locking element **4** or **4'**. This plate is locked with respect to the ski during down-hill skiing. The invention is particularly suitable for plastic and/or rubber soles.

There exists also the possibility of arranging the single parts immediately in recesses of the shoe sole without first separately casting a housing or the like. The housing itself then is a part of the shoe sole. Also, it is possible to use, in place of the illustrated pressure springs, tension springs, rubber springs and similar ones in a suitable

construction. Further, the shoe sole could be constructed resiliently at least in the zone of the locking elements in such a manner that it provides the effect of a spring.

Of course, it would also be possible to provide the illustrated constructions in a slightly altered form instead of in the shoe sole on the ski. Further, it is possible to support several pivotable two-armed levers in the ski. One arm of each lever is spring-loaded and the other arm extends above the surface of the ski and engages the shoe sole either directly or through corresponding metal fittings. The arm extending above the surface of the ski could have the structure of a clamp adjustable in height. Furthermore, in view of the constantly changing shoe constructions, it would also be possible to provide the parts of the binding in a double shoe, in the heel reinforcement or in other parts of the shoe than in the sole.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A safety ski binding for normally holding a ski shoe in fixed relationship to a ski but capable of releasing same upon the application of a predetermined value of force urging separation of one from the other, comprising in combination:

means defining a housing in the sole of said ski shoe, said housing being of substantially T-shaped cross section, the central plane of the housing substantially paralleling the central plane of the sole;

abutment means mounted on said ski;

locking means in said housing adapted to be movable against resilient biasing means relative to said ski shoe and further adapted to releasably engage said abutment means; and

adjustment means operatively associated with said resilient biasing means and adapted to regulate the force required to release said ski shoe from said ski, said adjustment means including first and second wedge-shaped cooperable members, said resilient biasing means including a spring bearing against said first wedge-shaped member and said locking means, said second wedge-shaped member including means for adjusting same relative to said first wedge-shaped member to regulate said predetermined value of force, said locking means, spring and first wedge-shaped member being located in the leg of said T-shaped housing and said second wedge-shaped member being slideable in the cross arm of said T-shaped housing and in opposition to said leg.

2. A safety ski binding according to claim **1**, wherein said first and second wedge-shaped members are supported for movement at ringt angles to each other; and wherein said means for adjusting the position of said second wedge-shaped member relative to said first wedge-shaped member includes longitudinally adjustable screw means.

3. A safety ski binding according to claim **1** including a second resilient biasing means bearing against said second wedge-shaped member in opposition to said means for adjusting said second wedge-shaped member, said second biasing means being located in said cross arm of said T-shaped housing.

4. A safety ski binding for normally holding a ski shoe in fixed relationship to a ski but capable of releasing same upon the application of a predetermined value of force urging separation of one from the other, comprising in combination:

means defining a housing in the sole of said ski shoe, said housing means including a threaded portion and a threaded member threadedly engaged therewith;

abutment means mounted on said ski;

locking means in said housing adapted to be movable against resilient biasing means relative to said ski shoe and further adapted to releasably engage said abutment means, said resilient biasing means including a spring bearing at one end against said locking means and at the other end against said threaded members, and

adjustment means operatively associated with said resilient biasing means and adapted to regulate the force required to release said ski shoe from said ski, said adjusting means including means non-rotatably but slideably engaged with said threaded member and movable for moving said threaded member relative to said threaded portion, said locking means being fixedly connected to said means engaging said threaded member, said locking means including radial slots thereon for engagement by a tool for rotating same to move said threaded member relative to said threaded portion, whereby the same element engageable with the abutment means on the ski for locking the ski shoe thereto is manipulatable to change the force of such engagement.

5. A safety ski binding according to claim **4**, wherein said threaded member has an opening therein; and wherein said means engaged with said threaded member is an elongated extension rod cooperably engaging said opening in said threaded member.

6. A safety ski binding according to claim **4**, wherein said housing means includes means for releasably securing same to said ski shoe.

7. A safety ski binding according to claim **4**, wherein said housing means includes means supporting same for movement relative to said ski shoe against the urging of said spring means.

8. A safety ski binding for normally holding a ski shoe in fixed relationship to a ski but capable of releasing same upon the application of a predetermined value of force urging separation of one from the other, comprising in combination:

means defining a housing in the sole of said ski shoe, a pair of housing means being provided and located on substantially opposed faces of said ski shoe;

abutment means mounted on said ski;

locking means in said housing adapted to be movable against resilient biasing means relative to said ski shoe and further adapted to releasably engage said abutment means, two spaced apart abutment means being mounted on said ski and operatively associated with locking means within each of said housings, the locking means associated with each of said pair of housing means being connected through means defining a lever system; and

adjustment means operatively associated with said resilient biasing means and adapted to regulate the force required to release said ski shoe from said ski.

9. A safety ski binding according to claim **8**, wherein only one spring is provided for said locking means.

10. A safety ski binding for normally holding a ski shoe in fixed relationship to a ski but capable of releasing same upon the application of a predetermined value of force urging separation of one from the other, comprising in combination:

means defining a housing in the sole of said ski shoe; shoe;

abutment means mounted on said ski, said abutment means including a horizontal lip extending parallel to said ski;

locking means in said housing adapted to be movable against resilient biasing means relative to said ski shoe and further adapted to releasably engage said abutment means, said locking means comprising a lever pivotally secured to said housing means and adapted for movement toward said abutment means under said lip and away therefrom; and

adjustment means operatively associated with said resilient biasing means and adapted to regulate the force required to release said ski shoe from said ski.

11. A safety ski binding according to claim 10, wherein said housing means includes means for pivotally supporting said lever about a generally horizontal axis.

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