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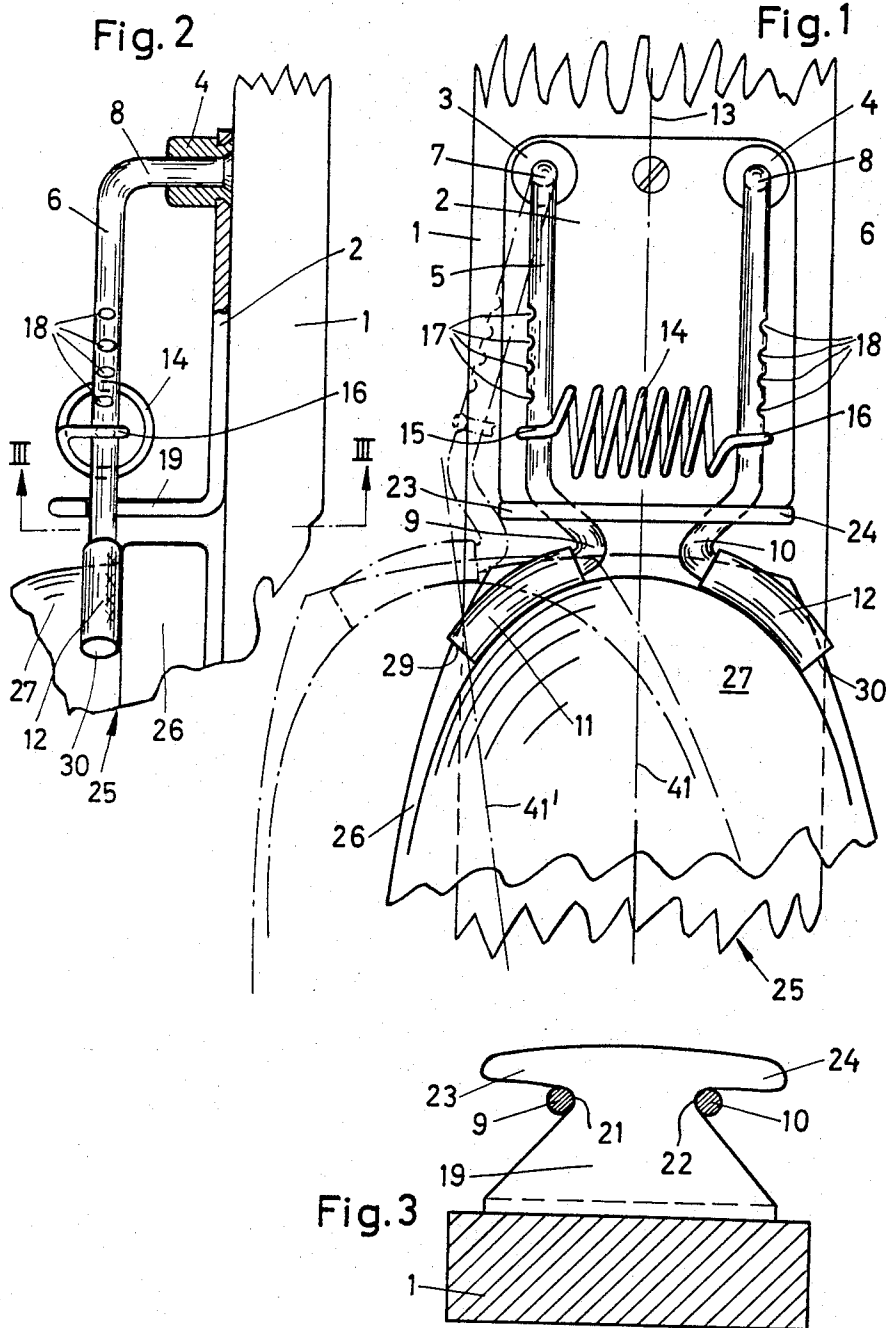
R. LUSSE

3,329,438

FRONT BINDING OF A SAFETY BINDING FOR SKIS

Filed April 15, 1966

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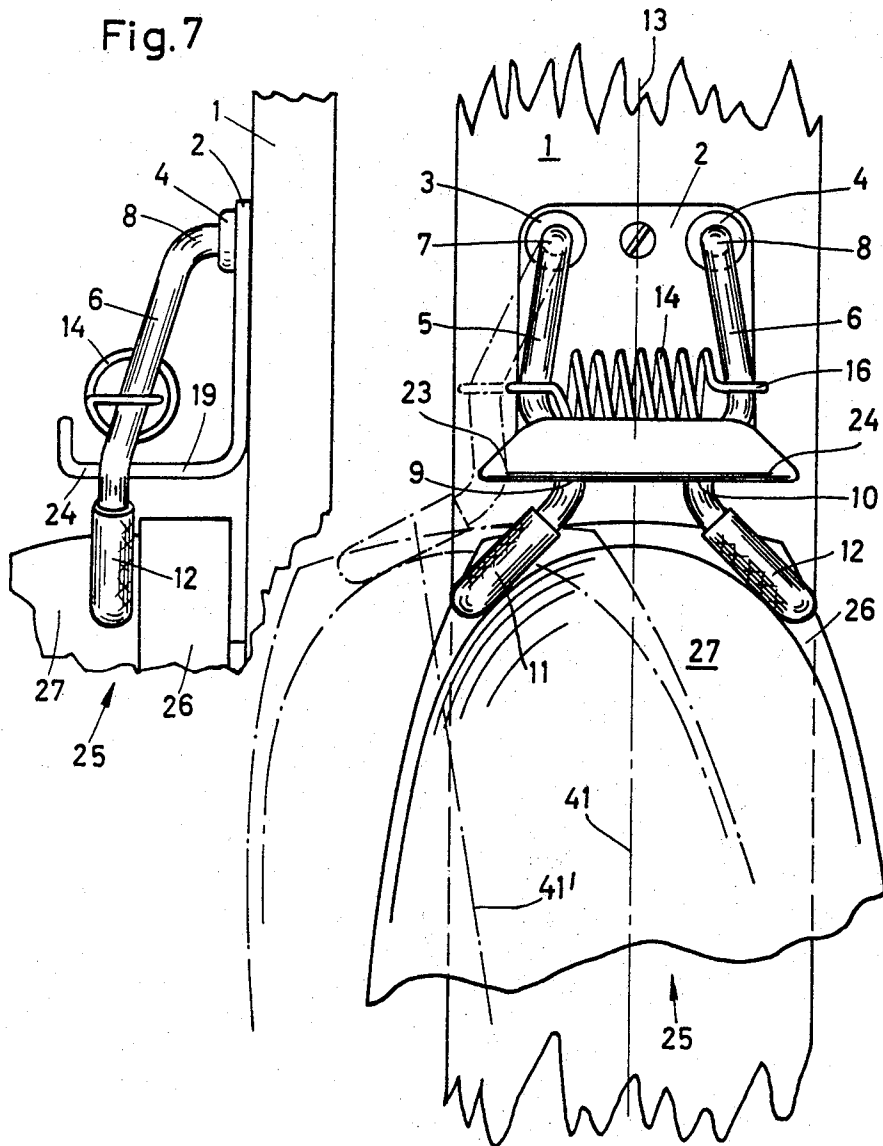
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FRONT BINDING OF A SAFETY BINDING FOR SKIS

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Fig. 6



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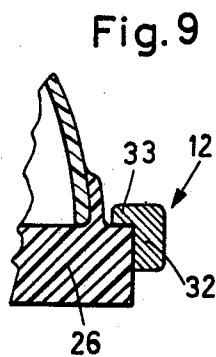
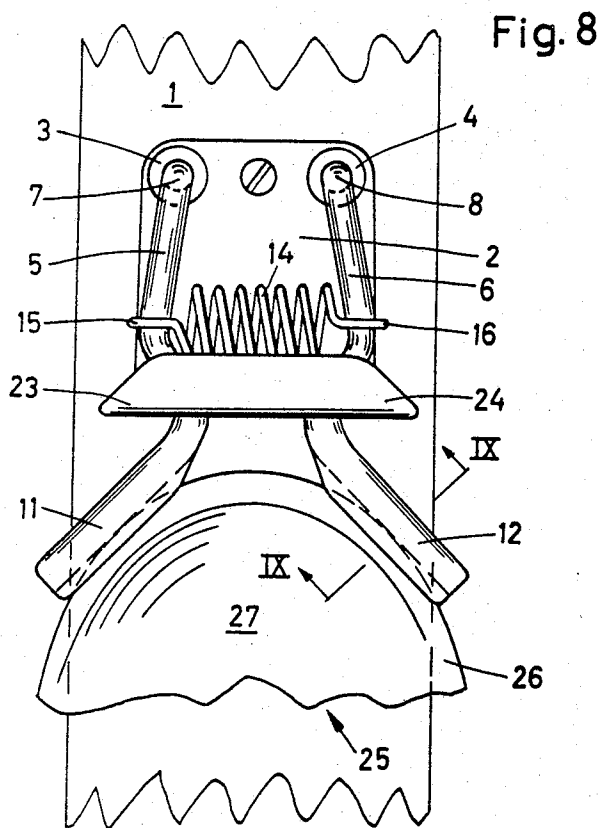
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FRONT BINDING OF A SAFETY BINDING FOR SKIS

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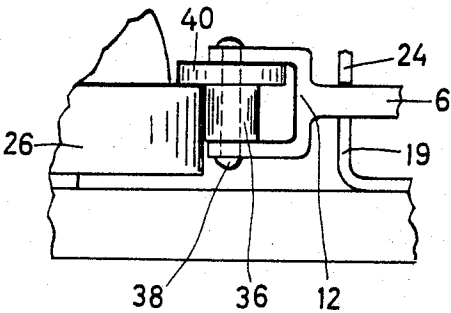


Fig. 11

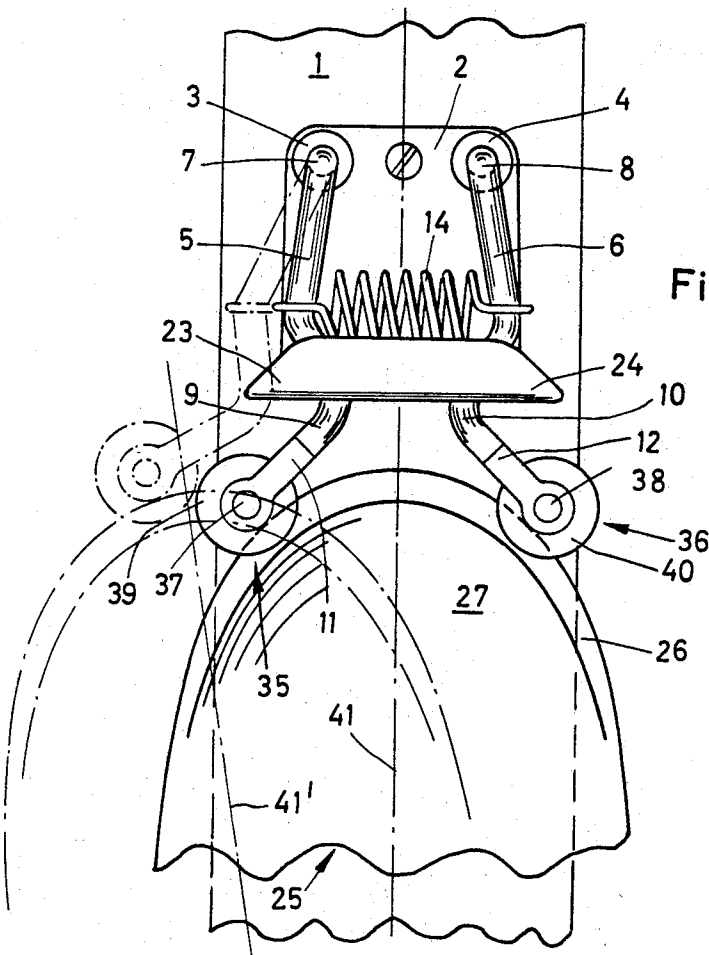


Fig. 10

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3,329,438

FRONT BINDING OF A SAFETY BINDING FOR SKIS

Robert Lusser, Steinhauserstrasse 27, Munich, Germany
Filed Apr. 15, 1966, Ser. No. 542,871

Claims priority, application Germany, Apr. 17, 1965,
L 50,500

17 Claims. (Cl. 280—11.35)

The present invention relates to ski safety bindings and more particularly to a front or toe binding arrangement for attaching a ski boot to a ski.

More specifically, this invention pertains to a front binding of the above character including two rearwardly diverging jaws which jaws, upon attaining a predetermined torsional force acting upon a ski boot against the effect of spring means tending to maintain the jaws in their position normally fixing the position of the toe of the ski boot, are permitted to swing laterally outwardly from the toe of the boot a distance about a pivotal point located forwardly in a plane parallel to the upper surface of the ski until the toe of the ski boot is released or freed from the outwardly swung or pivoted jaws.

In a known type of binding of this general character there is provided an assemblage including a casing mounted for swingable movement relative to a pin extending vertically upward from the ski and the two diverging jaws project rearwardly from the casing in parallelism to the plane of the upper surface of the ski and engage or contact the toe cap of the ski boot firmly held in the binding. The angle enclosed between the two jaws can be adjusted for enabling the assemblage to be adapted to ski boots of varying configurations or shapes but is unchangeable when the binding is in use. A rearwardly directed surface provided on the casing functions as a front abutment for the ski boot wherein the front edge of the sole of the boot is supported against the effect of a forwardly directed force component developed by the rear or heel binding. The casing above-mentioned is formed with a tubular projection extending forwardly in substantial parallelism to the upper surface of the ski and a helical pressure spring is lodged in the bore of such projection. The spring engages a forwardly located adjusting screw tapped into the front end of the bore and the opposite end of the spring is in operative relationship with a piston, which piston coacts in such a fashion with a forwardly directed level surface on the vertically extending pin that the casing is maintained by virtue of the spring pressure in its normal position.

The aforementioned type of front binding possesses numerous disadvantages which partly arise from the fact that the spring is mounted into the casing. The middle coil diameter of a helical spring should correspond to at least four times the thickness of the metal stock so that the spring may have an adequate period of operating effectiveness. A spring adapted, in the situation of the above-mentioned known binding, for holding the jaws in the normal position with sufficient force can, by virtue of the diameter ratio above referred to, be accommodated only in a relatively large and, as a consequence, heavy casing. To prevent or avoid an icing of the spring and as a result thereof a possible blocking, so to speak, of the binding, the casing must be both water-tight and fully air-tight for preventing the collection of condensation water within the interior of the casing. It will be appreciated, therefore, that such a

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casing which is quite expensive by virtue of its complex nature is rendered even more expensive.

With further respect to the known type binding, there is the additional danger that in the even of a fall the toe of the boot may, during the swinging out action, become locked with the casing since its field of travel will, when the heel of the boot is held fast or secure in the rear binding, cross the field or traverse of the rearwardly directed abutment surface of the casing.

It is a salient object of this invention to overcome the objectionable characteristics existing in the front binding of ski safety bindings and at the same time provide a particularly safe, lightweight and inexpensive front binding.

Generally speaking, the problems are solved in the instant invention by providing jaws located at the ends of independently swingable arms suitably interconnected by spring means and wherein the jaws in their normal position are maintained by the spring means against a rigid stop carried by the ski with the spring force maintaining the jaws against the rigid stop being selected of such magnitude that the jaws, which at the same time function as the only forward abutments for the ski boot, cannot by virtue of the forwardly directed force component emanating from the rear or heel binding, be spread or extended by the toe of the boot away from the rigid stop.

The forwardly directed force component which is developed by the rear or heel binding coacting with the front binding should not be too great so that the force of the spring means interconnecting the swingably mounted arms can be sufficiently small that the skier in the event of a twisting fall is protected adequately against injuries. It should be mentioned that a rear or heel binding which is particularly efficacious for use with the present front binding is shown and described in United States Patent No. 3,129,951.

The present front binding can be so constructed and arranged that the two swingably mounted arms can swing about a common pivot point, but with such arrangement the spring means interconnecting the arms must, at any given length of the arms, be of such relative strength that the jaws will not be spread or extended apart by the toe of the boot from the stop due to the forwardly directed force component of the rear or heel binding. To reduce such spreading effect of the forwardly directed force component, the pivotal axes of the swingable arms are, in a preferred embodiment of the invention, located at a distance from each other on both sides of the symmetrical plane or the longitudinal center line of the ski.

In a further development of the feature referred to in the preceding paragraph, the spreading or extending effect of the jaws can be still further reduced inasmuch as each jaw is in contact or engagement with the toe of the boot along an arc, the inner end of which lies closer to the symmetrical plane of the ski than is the case of the pivotal axes of the arms. It should be mentioned, however, that this particular development can be omitted or eliminated if a rear or heel binding is selected which produces only a relatively small forwardly directed force component.

The binding of the present invention, as is true of all front bindings, must transmit not only lateral guiding forces upon the toe of the boot, the purpose of which is to maintain the toe in its normal position, but provision must be made that the toe of the boot cannot tilt in an upward direction out of the binding. This result can be achieved, for example, by means of a support carried by

the ski at a distance from the toe of the boot and which is provided with a fixed sole holder or clamp adapted to engage over the edge of the sole at approximately the midpoint of the boot toe. However, an even better connection between the boot and the ski is realized if the sole holder or clamp engages on each side of the boot toe and this, according to the invention, can be achieved by providing each of the jaws with a sole holder or clamp.

A particularly simple front binding is provided if the jaws function at the same time as sole holders or clamps by engaging the zone between the sole of the boot and the toe cap wherein the jaws transmit the lateral guide forces directly to the toe cap of the boot, since the toe cap of the presently used ski boots is circular in plane and can, in the event of a twisting fall, roll itself uniformly with respect to that jaw which is swung in an outward direction by the toe of the boot.

The spring means which is located transversely with respect to the upper surface of the ski and which interconnects the swingably mounted arms is preferably located at a particular distance forwardly of the toe of the boot, by virtue of which it is possible to mount the spring means at a distance above the ski surface for protecting the spring safely against icing conditions as well as make it possible to employ a spring means having a diameter as large as is necessary for accomplishing the desired ends.

It will be appreciated that care must be exercised that the swingable arms can withstand the upwardly directed forces which develop particularly when the skier leans or falls backwardly and, as a consequence, tends to pull the tips of the ski boots upwardly, and these forces can become particularly great if the jaws are respectively equipped with a sole holder or clamp to function as sole holders or clamps per se.

Consequently, in a preferred embodiment of the invention, there is provided at the rearward end of the base plate of the binding, which plate supports the bearing means for the swingable arms, an upwardly projecting support which constitutes a rigid stop for the swingable arms laterally having extending guide means for guiding the swingable arms in parallelism to the upper surface of the ski and such support can be provided for forming the upper or free end of the base plate with a rearwardly directed flange for coaction with the sole of the boot.

If the swingable arms are guided, respectively, by guide means and thereby secured against excessive bending strains, each arm including its jaw can consist of a piece of round steel having its forward end portion bent in a downward direction and mounted in a sleeve secured to the base plate and having the portion thereof coacting with the guide means formed with an offset portion extending in the direction of the symmetrical plane of the ski. This particular binding can be fabricated at a relatively inexpensive cost and is of very little weight, with the offset assuring that each jaw is still guided by the guide means even if such jaw is swung a distance with respect to the stop that the toe of the boot is released with certainty therefrom.

It should further be mentioned that the particular structure of the swingable arms in the form of round steel brackets makes it possible to effect a particularly simple mounting of the spring means on the arms, which mounting comprehends the hooking, so to speak, of the respective ends of the spring means into a notch or indentation formed on the exterior of the respective arms. The force with which the arms are maintained against the rigid stop can be altered by exchanging or substituting a stronger or weaker spring and such alteration may also be effected by forming a plurality of axially spaced notches or indentations in the respective arms for receiving the anchoring ends of one or more springs.

When, during a twisting fall, the toe of the boot swings one of the jaws in an outward direction a rolling-off movement between the boot toe and the jaw occurs and

on which a sliding or shifting movement is superimposed. The friction opposing the sliding or shifting movement is to be maintained as small as possible so that substantially only the accurately determinable force of the spring means interconnecting the swingable arms has to be overcome.

In a further development of the invention, each jaw is provided with a cover or casing of a synthetic material possessing a low frictional coefficient such as tetrafluoroethylene, and such cover is efficacious in that the friction is not only held to a minimum but is substantially totally independent irrespective of whether the toe of the boot is leather or rubber or dry, wet or icy. Hence, the very minor still occurring friction can be given consideration from the outset in determining the strength of the spring interconnecting the swingable arms.

With respect to yet a further feature of the invention, the friction between the toe of the boot and jaws can be further reduced if each jaw contacts the ski boot via a roller freely rotatable about an axis perpendicular to the plane of the skis and the rollers can engage the angle between the sole and the toe cap and rest against the cap. In such a situation the rollers must be of sufficiently large diameter so that the toe cap will not be subjected to an excessively great specific contact pressure.

If the front edge or margin of the sole of the ski boot possesses an approximately circular configuration, it is advantageous, according to an additional feature of the invention, to assure that the rollers rest against the front edge of the sole and incorporate an upper flange which coacts with the upper edge of the sole for serving as a sole holder or clamp, and in such situations the rollers may be of relatively small diameter in view of the fact that the sole of the boot can be subjected to greater contact pressures than is true of the toe cap.

Further objects and advantages of the invention will become more readily apparent from the ensuing detailed description and annexed drawings, and in which drawings:

FIGURE 1 is a fragmentary top plan view of a front binding incorporating the principles of the present invention,

FIGURE 2 is a fragmentary side view, partly in elevation and partly in cross section, of the binding illustrated in FIGURE 1,

FIGURE 3 is a view taken along the line III—III of FIGURE 2, the view looking in the direction of the arrows,

FIGURES 4 and 5 are views generally similar to FIGURES 1 and 2, illustrating a second embodiment of the invention,

FIGURES 6 and 7 are generally similar views to FIGURES 1 and 2, showing a third embodiment of the invention,

FIGURE 8 is a fragmentary top plan view of a fourth embodiment of the front binding,

FIGURE 9 is a view taken along the line IX—IX of FIGURE 8, the view looking in the direction of the arrows, and

FIGURES 10 and 11 are views generally similar to those shown in FIGURES 1 and 2 of a fifth embodiment of the front binding.

Referring to FIGURES 1-3, it will be noted that the ski safety binding comprises a base plate 2 of sheet metal, preferably steel, attached firmly to the upper surface of a ski 1 such as by screws or the like. In proximity to the forward edge of the plate 2 are two upwardly extending spaced-apart sockets 3 and 4 which may be riveted to the plate 2. Swingable arms 5 and 6, respectively, are operably related to the sockets 3 and 4 and, as shown in FIGURE 2, the forward ends of the arms 5 and 6 are displaced perpendicularly with respect to the plane of the arms as indicated at 7 and 8, with such displaced portions being received in the bores of the sockets 3 and 4, thereby enabling the arms to swing relative to the base

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plate 2. The rearward portions of the arms 5 and 6 are formed with inwardly directed offsets 9 and 10, respectively, and from such offsets extend jaws 11 and 12, respectively, arranged in parallelism with the plane of the ski obliquely rearwardly with respect to the symmetrical plane of the ski, with such plane being denoted 13.

The swingable arms 5 and 6 are interconnected by means of a helical tension spring 14 and the respective ends of such spring denoted 15 and 16 are formed in the nature of hooks which engage notches 17 and 18 formed in the outer portion of the arms 5 and 6, respectively. The spring 14 maintains the arms 5 and 6 under substantial tension such as, for example, 10 kg., against a stop plate 19 as shown in FIGURES 2 and 3. The stop plate 19 is formed by bending the rear end of the base plate 2 upwardly perpendicularly to the plane of the plate 2 at a point rearwardly of the spring 14. As perhaps best shown in FIGURE 3, the stop plate 19 is formed with inwardly inclined edges which merge with recesses 21 and 22 located below outwardly extending guide means 23 and 24 provided at the upper limit of the stop plate, with such upper limit being in parallelism to the upper surface of the ski 1. It will be noted that the offsets 9 and 10 are guided in their swinging movements below the guide means 23 and 24, respectively.

In the position of the arms 5 and 6 shown in full lines, the toe of a ski boot generally denoted 25 is held between the jaws 11 and 12 with the heel of the boot being attached to the ski 1 by a rear or heel binding (not shown). Manifestly, as readily apparent from FIGURES 1-3, the jaws 11 and 12 function as sole holders or clamps, that is to say, these components engage the surface between sole 26 and toe cap 27 of the ski boot 25 with the jaws 11 and 12 being curved in such a fashion that such jaws are in contact with the toe cap 27 along an arc beginning at the offsets 9 and 10. The inner end of such arc is located closed to the symmetrical plane 13 of the ski 1 than is true of the pivotal axes (3, 7 and 4, 8) of the swingable arms 5 and 6. This particular arrangement is especially important in that the front binding can also coact with a conventional heel binding which produces a forwardly directed component of force of considerable magnitude. The portion of such component of force taken up by each of the jaws is passed mainly through the pivotal axes 3, 7 and 4, 8 of the arms 5 and 6 and, as a consequence, the action of the spring 14 need not be particularly great to prevent positively that the jaws 11 and 12, under the effect of the forwardly directed component of force of the heel binding, are spread or extended from the stop plate 19 by the toe of the ski boot 25.

As previously mentioned, the arms 5 and 6 are provided with notches 17 and 18 and, as clearly shown in FIGURE 1, a plurality of axially spaced notches may be provided in order that the force with which the arms 5 and 6 are maintained against the stop plate 19 can be varied by engaging the respective ends 15 and 16 of the spring 14 with notches 17 and 18 at a greater or lesser distance from the pivotal axes 3, 7 and 4, 8.

It will further be noted that the jaws 11 and 12 are each encased in tubular coverings 29 and 30, respectively, of synthetic material having a low coefficient of friction and such material preferably being tetrafluoroethylene.

In the other embodiments of the invention the same reference legends will be applied to similar or corresponding parts and, in the binding illustrated in FIGURES 4 and 5, it will be observed that the jaws 11 and 12 of the swingable arms 5 and 6 are located closer to the upper surface of the ski 1 and make engagement with the sole 26 of the ski boot 25 in proximity to the front edge of such sole. It should be mentioned that this embodiment is feasible only in the case of ski boots where the front edge

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of the sole has a rounded contour as close as possible to a circular arc and, in such situation, the jaws 11 and 12 do not function as sole holders or clamps. In order to provide the sole holder or clamp, the upper edge of the stop plate 19 of the base plate 2 is displaced rearwardly to form a flange 31 which overlies and engages the front edge of the sole 26. This particular front binding is substantially unaffected by a forwardly directed component of force of considerable magnitude developed by the heel binding.

Referring now to the modified front binding illustrated in FIGURES 6 and 7, this binding is simple structurally and light in weight and can be utilized if the rear or heel binding associated therewith produces only a relatively small forwardly directed component of force. In contrast to the sockets 3 and 4 shown in FIGURES 1-5, it will be seen that such sockets in which the arms 5 and 6 are suitably mounted by the portions 7 and 8 are located at a closer distance to the symmetrical plane 13 of the ski 1 and the portions 7 and 8 can be of lesser length than the portions shown in the aforementioned figures. As more clearly shown in FIGURE 7, the arms 5 and 6 are inclined upwardly towards the rear of the base plate 2 and the offsets 9 and 10 of the arms are located directly below the guide means 23 and 24 of the plate 19.

Moreover, the jaws 11 and 12 extending from the offsets 9 and 10 are straight and diverge rearwardly at an angle of approximately 45° relative to the symmetrical plane 13. As was the case in FIGURES 1-3, the jaws 11 and 12 engage the surface between the sole 26 and the toe cap 27 of the boot 25, but such jaws are in contact with the cap 27 only at one point, as is readily apparent in FIGURE 6. Consequently, the toe cap 27 must have an adequate compression strength in the area of its transition into the sole 26 in order that the cap will not suffer noticeable deformations, but this presents no particular problem in the case of present day ski boot structure.

In the event it is desirable to avoid subjecting the toe cap 27 to pressure from the jaws 11 and 12, and if the front edge of the sole 26 is of approximately a circular arc contour, the jaws can be of the type disclosed in FIGURES 8 and 9. With particular reference to FIGURE 9 which illustrates the jaw 12, it being understood that the jaw 11 is of a similar nature, it will be seen that the jaw is formed with a downwardly directed leg 32 which engages the edge of the sole 26 laterally in proximity to the front thereof and a leg 33 located in the direction of the toe cap 27 is parallelism to the plane of the ski 1, with such latter leg engaging over the edge of the sole 26 yet not making contact with the toe cap. As a consequence, in this particular embodiment the jaws 11 and 12 function also as sole holders or clamps and the surfaces of the jaws which cooperate with the sole 26 are covered with tetrafluoroethylene or a like material possessing a low coefficient of friction.

In the modified front binding shown in FIGURES 10 and 11, it will be observed that the jaws 11 and 12 in lieu of having a covering of tetrafluoroethylene are in the form of a fork (FIGURE 11) and the arms carry rollers 35 and 36 freely rotatable about shafts 37 and 38 positioned perpendicularly to the upper surface of the ski, with such shafts being riveted to the jaws 11 and 12, respectively. The rollers 35 and 36 engage the front edge of the sole 26 of the ski boot and are provided with upper flanges 39 and 40, which flanges engage over the upper edge of the sole 26 thus serving as sole holders or clamps.

The mode of operation of the present front binding in the various embodiments is substantially the same. The tension of the spring 14 assures that the jaws 11 and 12 will hold the toe of the ski boot in its normal position with an adequate basic holding force and when the torsional force acting on the boot 25 exceeds such basic holding force, then the toe of the boot gradually swings the jaw 11 or 12 which opposes the twisting of the ski boot outwardly, and in this regard attention is directed

to the dot-dash lines shown in FIGURES 1, 6 and 10. In such connection, the spring 14 is extended and the restoring force acting upon the jaw in question increases in proportion to the travel of the spring.

The torsional moment acting upon the ski boot 25 which endeavors to hold the toe in its normal position increases with an increase in the restoring force of the spring 14 acting on the jaw 11 or 12 and decreases with a reduction of the angle which the forces transmitted from the jaws to the toe of the boot enclosed with the longitudinal plane 41 of the ski boot 25. It should be mentioned that the longitudinal plane of the ski boot 25 is denoted in its normal position at 41 and in the outwardly swung position at 41'. This angle decreases with increasing removal of the tip of the ski from its normal position, but simultaneously the restoring force of the spring 14 acting on the jaw 11 or 12 increases proportionately relative to the travel of the spring. The distance of the jaws 11 and 12 from their pivotal axis 3, 7 and 4, 8 and the angle at which the jaws engage the toe of the boot in its normal position are so selected that the restoring torsional moment working on the ski boot 25 increases gradually up to a divergence of the tip of the ski corresponding to substantially one-half the width of the ski, as shown in FIGURES 1-5, or remains constant as shown in FIGURES 6-11.

Inasmuch as the travel of the spring is particularly great in the case of the present front binding, the spring receives a considerable impact load at short torsional force thrusts such as may occur frequently during fast skiing on rolling terrain. The accumulated thrust load results in the fact that the tip of the ski is forced back into its normal position by the deflected jaw 11 or 12 when the torsional force operating on the ski boot 25 again declines prior to reaching a magnitude perilous or dangerous to the skier.

Hence, it is only when the torsional force acting on the ski boot 25 following a deflection of the toe of the boot by approximately half of the width of the ski increases further to the position shown in FIGURES 1, 6 and 10 by the dot-dash lines does the tip of the boot swing the jaw 11 or 12 which resists the deflection so far outwardly until the toe of the boot traveling outwardly in a plane parallel to the upper surface of the ski 1 releases itself from the outwardly swung jaw.

In view of the fact that the spring 14 is a tension spring and lies entirely free, and as the binding does not possess any surfaces sliding relative to each other but only turnable connections, the force opposing the outward swinging movement of the jaw 11 or 12 cannot increase materially if the binding is iced.

It should be stressed that the coverings for the jaws 11 and 12 illustrated in FIGURES 1-9 and the rollers 35 and 36 in FIGURES 10 and 11 maintain the friction between the jaws and the toe of the boot to a minimum and make the same substantially completely independent, whether the toe of the boot is leather or rubber or dry, wet or iced. Consequently, the force with which the present binding affixes the toe of the boot can be predetermined with great accuracy by the proper selection of the strength and disposition of the spring 14. The minimal friction achieved also improves the ability of the binding to return the toe of the boot immediately into its normal position following the expiration of a thrust which did not lead to the releasing of the ski boot.

This invention is not to be confined to any strict conformity to the showings in the drawings but changes or modifications may be made therein so long as such changes or modifications mark no material departure from the spirit and scope of the appended claims.

What is claimed is:

1. In a front ski safety binding, two arms extending substantially longitudinally of a ski, means swingably mounting each arm adjacent one end thereof to the ski

for movement in a plane substantially parallel to the upper surface of the ski, a jaw for the free end of each arm extending outwardly with respect to the plane of symmetry of the ski, a fixed stop on the ski intermediate the means swingably mounting the arms to the ski and the jaws for coaction with said arms, and spring means interconnecting said arms for normally maintaining the jaws in engagement with the toe of a ski boot and the arms against the fixed stop, the spring force being so selected that the arms and hence jaws cannot swing away from the fixed stop due to the effect of a forwardly directed component of force of a rear binding yet upon a predetermined torsional force acting upon the ski boot exceeding the spring force normally maintaining the jaws in engagement with the toe of the boot, the arm and jaw can swing outwardly until the toe of the boot moving outwardly in a plane parallel to the ski is released from the outwardly swung jaw.

2. The front ski binding as claimed in claim 1 in which the means swingably mounting the arms are located at a distance from each other on both sides of the symmetrical plane of the ski.

3. The front ski binding as claimed in claim 1 in which each jaw engages the toe of the boot along an arc, the inner end of which lies closer to the symmetrical plane of the ski than the means swingably mounting the arms to the ski.

4. The front ski binding as claimed in claim 1 including sole holding means for each jaw.

5. The front ski binding as claimed in claim 1 in which said jaws engage the toe of the boot between the sole and cap of the boot thereby serving as sole holding means.

6. The front ski binding as claimed in claim 1 in which said spring means is disposed transversely with respect to the plane of symmetry of the ski at a distance forward of the toe of the boot.

7. The front ski binding as claimed in claim 1 including a base plate secured to the ski, said means swingably mounting said arms comprising a pair of spaced-apart sockets affixed to the base plate and a bent end portion on each arm positioned in the sockets, said fixed stop being integrally formed with an projecting upwardly from the end of the base plate opposite the sockets, and said fixed plate having laterally extending guide means for guiding the arms in a plane parallel to the upper surface of the ski.

8. The front ski binding as claimed in claim 7 in which said fixed stop is formed by displacing the base plate upwardly at right angles to the plane of the base plate.

9. The front ski binding as claimed in claim 8 in which each arm is defined by round steel and in that area thereof coacting with the guide means of the fixed stop is provided with an offset directed toward the plane of symmetry of the ski.

10. The front ski binding as claimed in claim 1 in which the respective ends of the spring means are lodged in notches provided on the outside of the arms.

11. The front ski binding as claimed in claim 10 in which each arm is provided with a plurality of axially spaced notches for permitting the ends of at least one spring means to be lodged in such notches.

12. The front ski binding as claimed in claim 1 including a covering of synthetic material possessing a low coefficient of friction for each jaw.

13. The front ski binding as claimed in claim 12 in which each covering is tetrafluoroethylene.

14. The front ski binding as claimed in claim 1 in which each jaw includes a roller freely rotatable about an axis perpendicular to the plane of the ski engageable with the sole of the ski boot.

15. The front ski binding as claimed in claim 14 in which each roller is provided with a flange at the upper end thereof for engaging the top of the sole for serving as a sole holding means.

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16. The front ski binding as claimed in claim 1 in which said fixed stop is provided with a rearwardly directed flange for engaging over the top of the sole for serving as a sole holding means.

17. The front ski binding as claimed in claim 1 in which each jaw is provided with a downwardly directed leg for engaging the edge of the boot sole and a second leg extending in parallelism to the plane of the ski for engaging the upper edge of the sole without contacting the toe cap.

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