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Hinterholzer et al.

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[54] **SAFETY BINDING FOR SKIS**

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[52] **U.S. Cl.** ..... **280/11.35 D,** 280/11.35 K, 280/11.35 T

[51] **Int. Cl.** **A63c 9/081**

[58] **Field of Search** ..... 280/11.35 D, 11.35 K, 280/11.35 Y, 11.35 A, 11.35 C, 11.35 B, 11.35 R, 11.35 T

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[57] **ABSTRACT**

A ski safety binding comprising a front binding unit and a backbinding unit, parts of these units being mounted on the bottom side of the sole of the ski boot and parts being mounted on the ski trunk, for releasable engagement within each unit, whereby the engagement in each unit is obtained by a pair of jaws under spring tension which may be overcome by extraordinary movement of the boot sole so as to be released from the engagement.

13 Claims, 9 Drawing Figures

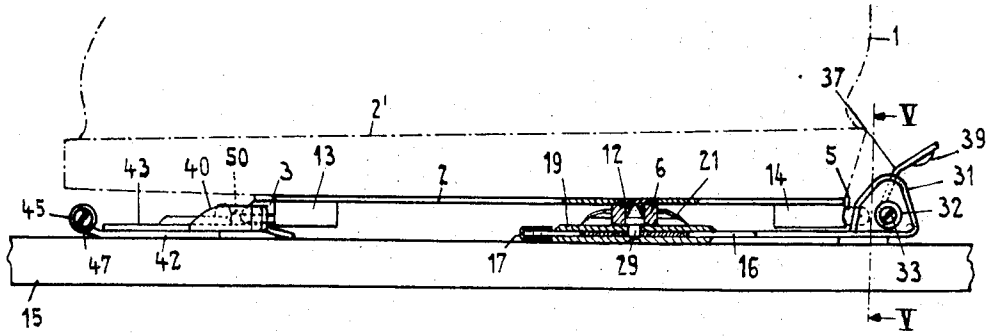


FIG.1

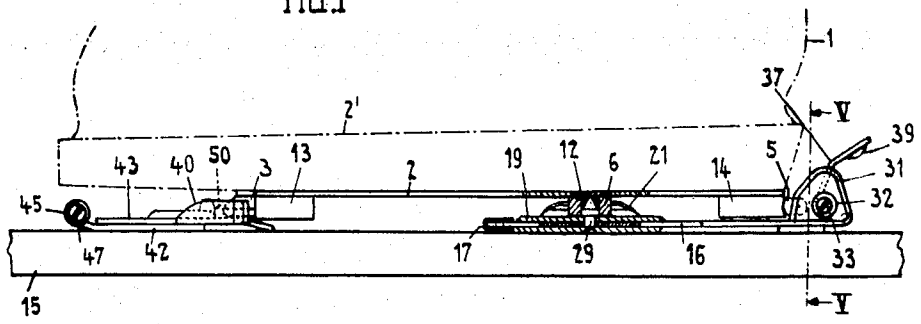


FIG.2

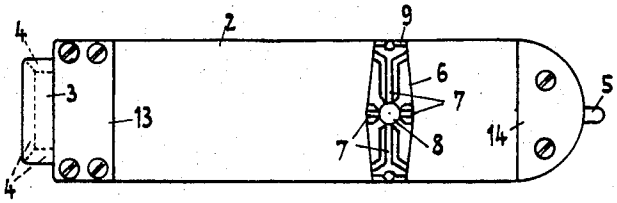


FIG.3

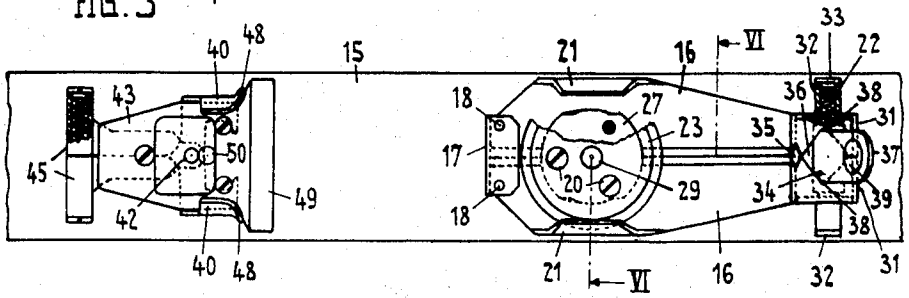


FIG.5

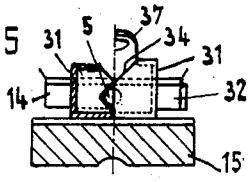


FIG.4

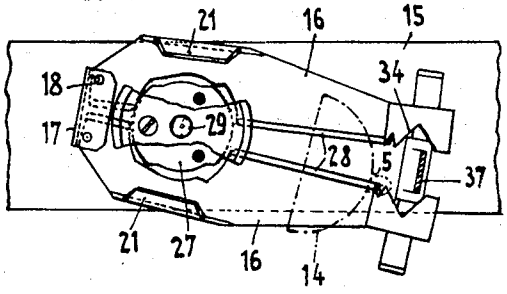


FIG.6

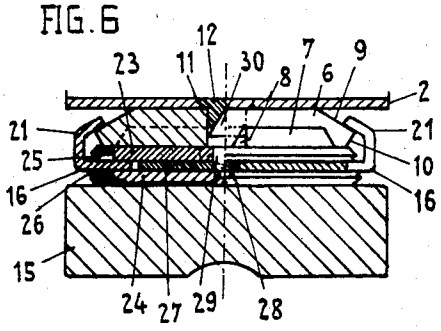


FIG.7

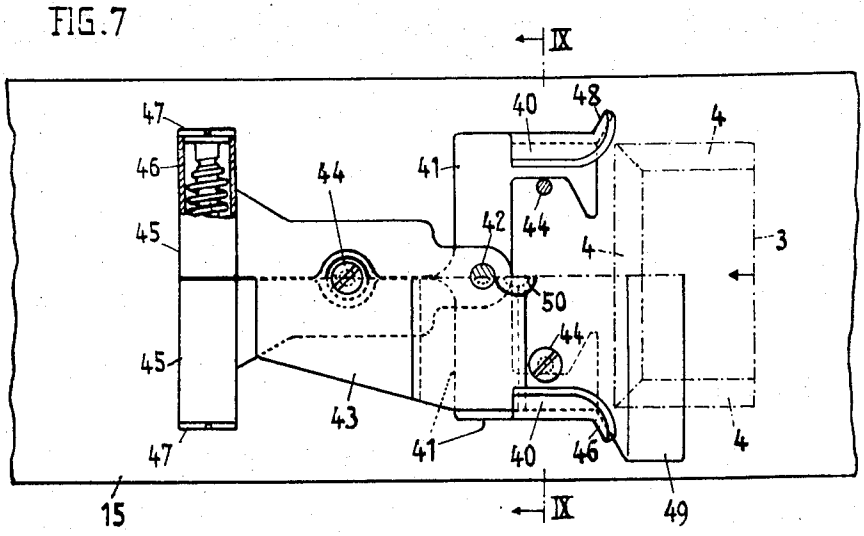


FIG.8

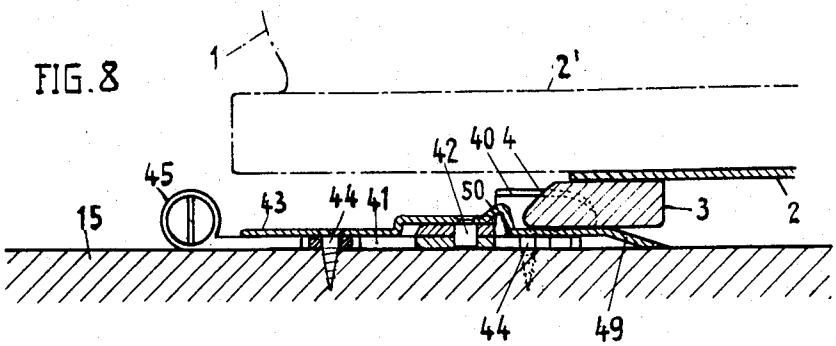
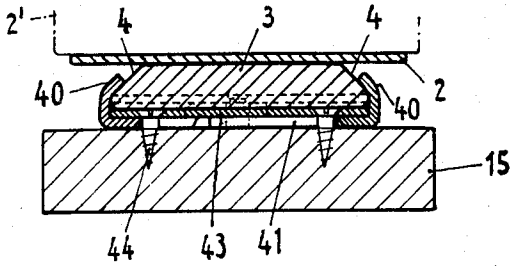


FIG.9



SAFETY BINDING FOR SKIS

BACKGROUND OF THE INVENTION

The safety problem derives from the desirability of there being a ski binding that automatically and quickly releases the ski boot whenever there occurs undue stress endangering the leg or foot bones of the skier; this problem has not been satisfactorily and reliably solved by ski safety bindings in use up to now. The main reason for this is as follows: the often complicated lever-and-spring systems holding the binding shut must withstand all normally occurring running stresses, but the marginal release values valid for such systems, on attainment of which the binding should open, are not in every case sufficiently below the bone fracture limit of the given individual, this value varying widely depending on the age, physical condition and state of circulation (resistance to cold) of the skier and the duration of the undue stress. As regards the force required for an automatic opening of the ski binding, the marginal values, then, are per se unreliable and are additionally falsified by modifications in the rigidity and expansion of the boot sole as a result of weather influences. In the case of most ski bindings, the bending of the ski exerts a additional negative influence on the actual marginal release value, in that the boot sole resists the reduction of the shoe attachment length on the ski and thus puts correspondingly greater strain on the locking spring, which can occasion an appreciably higher opening force. Also one of the great disadvantages in such ski bindings is the circumstance that when boots or skis are changed the binding has to be re-set or readjusted each time, which is often done only very carelessly by users.

SUMMARY

In the ski safety binding, the back binding part on the ski trunk comprises between the vise-jaws a rigidly mounted central member, and the back binding part on the boot is constituted by an engaging element attached thereto beneath the heel area and having lateral edges which are engageable by the vise-jaws of the back binding part on the ski trunk and having further a central organ for coaxial co-operation with the central member in the engaging position of the back binding unit, these co-operating central organ and member forming together an upright bearing for permitting the boot to be turned thereon to become released, and the front binding part on the boot sole is mounted at least approximately beneath the toes area or the ball area of the foot, the interval between this front binding part and the back binding part being invariable.

Previous systems have also included front bindings as part of safety ski bindings, in which two arms are provided each pivoting alone about a stationary axis and each equipped with a lateral jaw, these arms being held normally each at a stop by a connecting tension spring, to hold the front end of the ski boot in its running position. The two jaws, directly or indirectly, constitute the sole front fastening for the ski boot, which is further held down on the ski by the heel binding being the other unit of the safety binding. Many well known heel binding units exert a considerable forward pressure on the ski boot, which has to be taken up by the front binding unit, so that its spring has to be pre-set or rated for that this forward pressure and the normal running stresses together do not suffice to spread the pivoting

arms of the front binding away from their stops; there is normally required for this an additional spreading force which as a rule occurs only in case of falls.

However, when the skier falls, if the front binding is to release the ski boot, not only must this tensile strength be overcome but at the same time with one or both jaws a disengagement path must be covered on which the tensile strength of the spring increases still more owing to the extension of the spring.

In the case of previously proposed front bindings of this type, the disengagement path is long in relation to the length of the spring. Depending on the location of the pivot axis of the arm and its distance from the pertinent jaw, the disengagement path of the jaw up to release of the ski boot can consist of a comparatively large lateral component and only a small forward component, for which reason over-extension of the spring can easily occur.

It is also an object of the invention to avoid these drawbacks, in that the jaw arms cross and the spring engages in the parts of the jaw arms projecting each over its allotted axis. With an arrangement like this, the spring can be dimensioned much better to adapt to requirements than if it is located in the area between the axes and the jaws.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational lengthwise view of the safety binding with parts in vertical section;

FIG. 2 is a view from beneath of the sole plate attached to the boot;

FIG. 3 is a top view of the ski binding parts mounted on the ski, in closed position;

FIG. 4 is a top view of the heel binding part of FIG. 3, in release position;

FIG. 5 is an elevational view of the back end of the heel binding part, with portions in vertical section, along line V — V in FIG. 1;

FIG. 6 shows a vertical cross section along line VI — VI in FIG. 3, in larger scale;

FIG. 7 is a top view of the front binding part mounted on the ski trunk as shown in FIG. 3, however in larger scale;

FIG. 8 shows a vertical longitudinal section; and

FIG. 9 shows a cross section along line IX — IX in FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The binding parts mounted on the ski boot 1 are fixed on a thin plate 2 attached rigidly to the boot sole 2'; however, they could just as well be attached directly to the bottom of the sole. The front binding part consists of a wedge element 3 located beneath the toes area or the ball area of the foot. This wedge element has formed in front and on both sides an inclined surface 4 sloping down forwardly or laterally, respectively. The back binding parts comprise a rearward projecting pin 5 on the plate 2 and a traverse 6 attached beneath the foot heel area on the plate 2, which traverse has on its underface, in cruciform arrangement, four ribs 7 and, in the center of the cross, a center borehole 8. The lateral ends of the traverse 6 are formed by two diverging bevelled surfaces 9 and 10 each, of which bevelled surfaces 9 obliquely upward and bevelled surfaces 10 obliquely downward. A plug 12, with its flange 11 held in a hole of the plate 2, of elastically flexible material

occupies the borehole 8 as far as the ribs 7 for keeping out snow. Near the wedge element 3 and near the pin 5 there is fastened, in each case, a calk 13 and 14, respectively, of rubbery material on the underface of the plate 2.

In the back binding part attached on the ski trunk 15 there is a pair of jawed levers 16 hinged together in front by means of a lashing 17, each over an axis 18, and being turnable round a fastening plate 19 which consists of several superimposed disks 23, 24, 27 and is attached to the ski trunk by means of screws 20. These levers 16 each form thereon a vise-jaw 21 on the lateral outside, with which they engage (FIG. 6) the bevelled surfaces 9 of the traverse 6, with ski boot 1 fixed in the ski binding, in order to hold it therein, with the levers 16 being held in place by means of a tension spring 22 attached to their back ends, in this closed or clamping position (FIG. 3).

On the fastening plate 19 the round top and bottom disks 23 and 24 are each furnished on their edges with a packing ring 25 and 26, respectively, which lies with its flexible outer edge on the levers 16, either from above or from below, and prevents the entrance of dirt between the disks and levers. The middle disk 27 has an unround periphery, as can be seen in FIG. 3 and 4, with which the two levers practically congrue (FIG. 3) when in clamping position. When the levers 16 are turned about the disk axis relative to the disk 27, they are gradually spread open owing to these unround contours and can thus release the traverse 6. The inner longitudinal edges 28 of the levers are sharp (FIG. 6) in order to permit the sealing effect by the packing rings even when the levers 16 are spread and also to facilitate the clamping action if snow lies between the levers.

On the fastening plate 19 there is located, as a center axis, a tapering pin 29 whose cylindrical shaft fits into the center borehole 8 of the traverse 6 and whose point 30 presses against the elastically flexible plug 12, while by the penetration of the pin 29 any snow that has entered the entrance of the borehole 8 will get pushed out through the gaps between the ribs 7. When the ski boot 1 is properly fixed in the binding, the pin 29 is in this borehole with the traverse 6 in centrally engaged position (FIG. 6).

The levers 16 extend beyond the back end of the boot sole 2' and there constitute each an upward projecting cam 31 with a sleeve 32 running across. In the two sleeves 32 the tension spring 22 is located unrotatably and has its two ends engaged by the outermost thread of a set-screw 33, whose head is rotatably supported on the front of the pertinent sleeve 32, being thus adapted for setting the basic spring tension.

The opposing inner edges 34 of the cams 31 are so shaped (FIG. 3 and 4) that therebetween they each limit one half of a small lower aperture 35 and of a large upper aperture 36. With the ski boot 1 fixed in the binding the pin 5 extends into the aperture 35. A pivotable opening lever 37 turnably mounted on the two sleeves 32 extends through aperture 36 upwards and its lateral edges normally lie against the deepest concavity 38 of the bevelled tappet edges 34 of the aperture 36. The free end 39 of the lever 37 is cupped and serves as a handle when the skier wants to swing down the opening lever 37 directly with his hand or by means of the point of his ski pole, in order to spread the vise-jaw levers 16 over the cams 31 against the action of the spring 22 and thus to open the ski binding.

The front binding part attached to the ski trunk 15 comprises two jaws 40 for engaging the wedge element 3 from both outer sides, these jaws being parallel to each other in their closed position and being provided each on one of two crossing levers 41 which are pivotable about a common stationary axis 42. This axis is fastened to a cover plate 43 which is screwed down to the ski trunk 15 with screws 44 and partly overlaps the two levers 41 and holds them down on the ski trunk 15. The levers 41 project forward beyond the cover plate 43 and constitute at the front end each a transverse sleeve 45. A tension spring 46 is housed unrotatably in these two sleeves 45, both of whose terminal threads, as in the case of the spring 22 (FIG. 3), are engaged by the thread of a set-screw 47, one on each side, the head of which is rotatably supported by the outer front of the pertinent sleeve 45 so as to permit setting the basic spring tension. The spring 46 connects the levers 41 with each other and is designed to hold in closed position the two jaws 40 bent upwards and inwards from the outer sides of the levers 41. In this position the levers 41 each lie against part of a lateral stop edge of the cover plate 43, and the wedge element 3 can be slipped in (FIG. 7), in longitudinal direction of the ski, without spreading of tbe levers, until it is stopped by a lug 50 provided on the cover plate 43, this wedge element 3 fitting exactly between the jaws 40. Since the above-described heel binding in clamping position does not exert any forward pressure on the ski boot, the tension of spring 46 can be set more finely than if it had to take up an appreciable forward pressure of a heel binding.

As moreover, the length of the lever arms carrying the jaws 40 is shorter than that of the lever arms carrying the spring, there results on the jaws an excess spring resistance to a spreading of the jaws, owing to the lever ratio. Also significant here are the practically parallel contact points along the length of the ski between the wedge element 3 and the jaws 40 in closed position, which means that when the ski trunk 15 greatly bends, the wedge element 3, owing to its invariable distance from the traverse center 8, 29 relative to the jaws 40, can slip all the way up to the lug 50; this guarantees a length compensation of the ski binding without any opening action on the jaws 40. It should also be noticed that this distance between the fastening places of the front and back binding parts amounts to only approximately one half of the boot clamping length previously found in known safety bindings.

The back ends 48 of the jaws 40 are with advantage bent slightly outwards in order to facilitate the slipping of the wedge element 3 into the front binding, since the wedge element is located beneath the boot sole 2'. The same purpose is served by a bevelling 49 of the back end of the cover plate 43 and a rounding of the front end of the wedge surface 4.

When the skier falls with a torsion between ski and boot around the center axis 8, 29 one jaw 40 is turned by the wedge element 3 against the action of the tension spring 46 outwards. Since the geometrical connecting lines from the axis 42 to the engagement place of the jaws 40 in the wedge element 3 include a center angle of at least 90°, the forward component of the swing motion of the jaws is at the outset already as large as its lateral component, and increases, which leads to the rapid release of the wedge element, so that the tension on the spring 46 remains linear in character. At the same time, the torsion in the heel binding causes the

pin 5 to swing out the jaw levers 16 (FIG. 4) over one cam 31 and the spring 22. Since the levers have their inner surface lying against the unround contour of the disk 27 fastened to the ski trunk, there results a sufficient spreading of these levers with extension of the spring 22, so that the jaws 21 release the traverse 6.

When the skier falls forwards, the pin 5 starts at the cams 31 the spreading action of the levers 16, and the traverse 6 continues same, with its bevelled surfaces 9 to the jaws 21, which are thereby displaced outwards. In the same way the lateral bevelled surfaces 4 of the wedge element 3 of the front binding press the jaws 40 outwards. When the skier tips over sideways without torsion or falls backwards, the bevelled surfaces 4 and 9 are again effective and displace the jaws 40 and 21, respectively, outwards on one or the other side of the ski. When skiers fall, these disengagement movements frequently occur combined, with torsion being most often involved.

In the case of the above-described ski safety binding, no adaptation of binding parts to the ski boot is required, since the invariable distance between the wedge element 3 and the traverse center 8, 29 can apply at least to certain sizes of boots.

To fit the ski boot into the binding, it is first introduced with the wedge element 3 forward between the jaws 40 of the front binding as far as the stop lug 50. Then the traverse 6 with its center borehole 8 is located above the point 30 of the pin 29 and the pin 5 of the sole plate 2 is located in the upper aperture 36 between the cams 31. When the ski boot is forced down into the heel binding, the pin 5 acting via the bevelled edges 34 of the cams 31, spreads the levers 16, and the lower bevelled edges 10 of the traverse 6 force the jaws 21 outwards so far that it passes therebetween and will get engaged by the jaws 21 overlapping thereby the lateral edges of the traverse owing to the pressure of the spring 22. At the same time the pin 5 enters the lower aperture 35 between the cams 31 and the pin 29 enters the center borehole 8.

To prevent a possible stretching of the tension spring 22 or 46 its ends can be connected by a cable set in the spring, which will be stretched upon attainment of the maximum admissible spring extension and will thereby prevent over-stretching of the spring.

Instead of arranging the vise-jaw levers 16 in a turnable way, as described above, around the fastening plate 19, these can only be adapted to spread outwards transversely to the ski. Then, however, the engaging length of the jaws 21 is shortened on each of the lateral edges 9 of the transverse 6 in longitudinal direction of the ski trunk in such a way that a turning of the ski boot about the axis of the centering member 29 of the fastening plate 19 by more than an angle of 30° from the clamping position, of course with simultaneous deviation from the front binding, is sufficient to release the traverse 6 from the jaws 21. In this modification, the pin 5 can be omitted.

We claim:

1. A ski safety binding comprising a front binding unit and a back binding unit, parts of said units being mounted on the underface of the sole of the ski boot and the other parts on the ski trunk for releasable engagement within each unit, said back binding parts on the boot sole including a catching element which has formed an edge on two opposite lateral sides and therebetween beneath the heel area of the foot a central organ defining an axis at right angle to said underface of the boot sole, said binding parts on the ski trunk including a pair of spring-loaded oppositely movable vise-jaws for resiliently engaging said edges of said catching element, between said jaws a fastening member rigidly mounted on the ski trunk and formed for coaxial and rotational co-operation with said central organ, when said binding units are in engaged condition, a single front binding part rigidly mounted on the boot sole beneath the toes area or ball area of the foot at an invariable distance from the axis of said central organ, and said front binding parts on the ski trunk including a pair of spring-loaded lateral jaws for resiliently engaging together said single part in their closed position and being separately movable therefrom outwardly for releasing said single part.

2. A ski safety binding as claimed in claim 1, wherein said central organ of said catching element defines a downward aperture with a lateral circular surface, and said fastening member forms a top piece adapted to fit against said circular surface of said central organ in engaged condition of said back binding unit.

3. A ski safety binding as claimed in claim 1, wherein said central organ of said catching element defines a downward opening borehole with a cylindrical surface, an elastically compressible plug resiliently occupying said borehole, and said fastening member forms a cylindrical pin tapering upwards to a point and adapted to fit in said borehole while compressing said plug.

4. A ski safety binding as claimed in claim 1, wherein a sole plate is rigidly attached to the underface of the boot sole and carries on its own underface said single front binding part and said catching element in unvariable space from each other.

5. A ski safety binding as claimed in claim 1, wherein two levers hinged together at one end have formed each one of said vise jaws, a cam on the other end of each of said levers and a tension spring connecting said other lever ends, said fastening member constitutes a bearing which defines an axis perpendicular to the upper face of the ski trunk and holds said levers swingable about said axis and further defines an unround contour which contacts said levers for spreading same against the action of said spring when they swing from their initial position, and a tappet at the back end of the boot sole for engaging at least one of said cams in swinging direction.

6. A ski safety binding as claimed in claim 5, wherein said fastening member consists of three superposed disks fixed on the ski trunk, the middle disk thereof defining said unround contour, the others of said disks projecting with their periphery beyond said unround contour and holding said two levers between them, and packing rings mounted each on the periphery of said other disks for bearing upon said levers from above and below, respectively.

7. A ski safety binding as claimed in claim 5, wherein a sleeve is carried in each of said two cams, said two sleeves housing said tension spring, and a manipulating lever journalled on said sleeves for spreading said cams and jaw levers against the action of said tension spring.

8. A ski safety binding as claimed in claim 1, wherein said catching element has formed four ribs in cruciform on its underside and defines a downward aperture in the center of said cross thus displaying by said aperture lateral gaps between said ribs.

9. A ski safety binding as claimed in claim 1, wherein said front binding parts on the ski trunk comprise two levers crossing each other and being swingable about an axis perpendicular to the upper face of the ski trunk, each lever forming at its back end a lateral jaw for engaging said single front binding part on the boot sole from one or the other of opposite lateral sides, a tension spring connecting the front ends of said levers so as to urge same into their engaging position, said single front binding part being a wedge element having on opposite lateral sides an upwardly bevelled wedge surface and an upwardly bevelled front surface, said surfaces being provided to spread said lateral jaws when the boot is forced out of engagement in a direction different from the longitudinal direction of the ski trunk.

10. A ski safety binding as claimed in claim 9, wherein with said levers the geometrical lever arm between said lever axis and said jaws is shorter than the geometrical lever arm between said lever axis and said spring, the longitudinal direction of the ski trunk and said geometrical lever arm defining at said lever axis in the engaging position of said levers an angle in the range of 30° to 60°.

11. A ski safety binding as claimed in claim 9, wherein a stop member is mounted on the ski trunk between said front binding jaws to define the utmost forward position of said wedge element engaged by said jaws, which position ascertains co-operation for an intended engagement among said parts of said back binding unit.

12. A ski safety binding as claimed in claim 1, wherein a tension spring is provided in each case for maintaining under spring load said pair of vise-jaws and said pair of lateral jaws, a cable connecting the ends of each of said springs for preventing any overstretching of the same.

13. A ski safety binding as claimed in claim 1, wherein said lateral edges of said catching element extend in engaged position each in the longitudinal direction of the ski trunk over a length which corresponds to a maximum angle of approximately 30° of a releasing rotation of said catching element.

* * * * *