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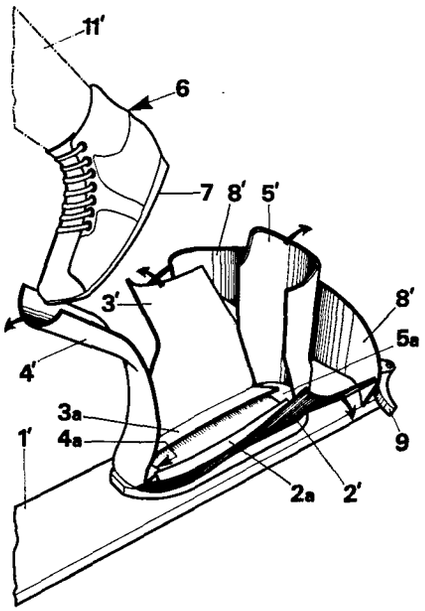
(54) A safety footwear, preferably a ski boot.

(57) The present invention relates to a safety footwear, preferably a ski boot, comprising several pivotally arranged shape permanent elements (2–5) forming part of an openable cover, which encloses at least the lower leg (11) of the user of the footwear, and a locking means (8) arranged to release at an adjustable allowed maximum force between the lower leg and the cover, for keeping the cover together in its closed position.

The invention is characterized in that the shape permanent elements (2–5) are pivoted about axes (2A–5A) at the base of the elements and that the locking means (8) securing said elements in their closed position around the lower leg (11) is arranged to be actuated by the force transferred directly from the lower leg to the locking means, with subsequent releasing of the locking means and thus opening of said elements at the allowed maximum force set.



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A SAFETY FOOTWEAR, PREFERABLY A SKI BOOT

The present invention relates to a safety footwear, preferably a ski boot, comprising serveral pivotally arranged shape permanent members forming parts of a cover which can be opened and which contacts at least the lower leg of the user of the footwear, and locking means to keep the cover in its closed position,said locking means being releasable at a preset maximum force between the lower leg and the cover.

The safety footwear according to the present invention will find the widest use in connection with down--hill skiing, and hence, the invention will be described in connection with the use of the footwear as a slalom boot. The safety footwear of the present invention can, of course, be used whereever there is a risk of injuring feet and legs if such injure is caused by the appearance of too great forces between the user of the footwear and the footwear proper.

Slalom boots of today have very high shanks which may cause fractures of the lower legs, e.g. when the skier falls forwards and when the conventional safety ski-bindings, usually connecting the ski boot to the ski at the toe and heel portions of the boot, do not release in the normal way. This normal releasing may be prevented e.g. by icing or jamming of the releasing mechanism, but it can also be prevented by downward bending of the ski as well, which means that the toe and heel portions of the safety binding are pressed against the boot and prevent normal releasing. This type of injure and the cause therefor is typical in connection with "tourist-skiing" in slalom hills insufficiently prepared. The fractions arising on the lower leg in that case are often of a very serious type, as the bone is partly splintered at the place of the fracture and in some cases will penetrate

through the soft portions of the leg. Also without said jamming of the releasing mechanism at the forward and backward edges of the ski boot due to the ski being bent downwards, there is a risk of fractures of the lower leg as a conventional safety binding is not always able to release in time. This may occur when the skier at a high speed goes e.g. into a snow bank or is retarded by spots of snow-less ground, snow spots or spots with rough-snow or ice, the body of the skier tending to continue forward by inertia. Then, the lower leg will act as a lever, the upper shank portion of the boot forming the fulcrum. The stress on the lower leg may reach such a magnitude and may occur so suddenly that the safety binding does not always have time to release before a fracture of the lower leg has occurred. The arising stresses on the lower leg may also be too great if the lower leg is somewhat movable in relation to the shank portion of the boot because in that case the lower leg may move in relation to the shank portion of the boot over a limited distance and then may be suddenly stopped in its movement, which provides a shock-loading of the lower leg. Thus, conventional safety bindings require a firm fixation particularly of the shank portion of the boot to the lower leg of the skier and an exact adjustment and a minute care of the releasing mechanism to obtain the intended release function. The firm fixation of the shank portion of the boot around the lower leg of the skier is of decisive importance to the transfer of the releasing forces to the ski bindings. Thus, this means that some of the inertia resulting in actuation by forces when the skier falls, has to be transferred from the skier's legs to the safety bindings via the ski boots.

Modern ski boots with high shanks thus prevent fracture or wriggle (a stretching of the ligaments) of the ankle-joint, as this joint is fixed by the boot, but on the contrary may cause serious injuries of the

kind referred to above.

Accordingly, the object of the present invention is to provide a safety footwear, preferably a ski boot by the use of which the risk of foot and leg injuries is essentially eliminated.

This is achieved according to the present invention by a safety footwear which has been given the characteristics of the claims.

By arranging the pivotable shape permanent elements for swinging movement about axes at the base of the elements, it is possible to arrange these elements foldable from a fixed position at the lower leg when the force acting on the locking means securing the elements in their closed position thereof around the lower leg, exceeds an allowed maximum magnitude.

To eliminate the risk of injuring the ankle-joint, which may occur subsequent to the releasing of the locking means around the collapsible cover, the shape permanent elements preferably are foldable against the bias of a yieldable force. It is advantageous if this force is progressively increasing and accordingly will be able to restrain gently twisting of the lower leg in the ankle-joint. Thus, a safety footwear according to the present invention will keep the ankle-joint fixed, unless such forces arise between the lower leg and the shank portion of the footwear as are able to release the locking means keeping the shape permanent elements on place against the user's lower leg. When the locking means has been released by the occurring allowable maximum force, subsequent twisting in the ankle-joint will be progressively restrained when the opening movement of the shape permanent elements, caused by influence from the leg, takes place against the bias of the yieldable force.

The yieldable force counteracting the opening movement of the shape permanent elements may be adjustable,

which makes possible to obtain a certain degree of mobility in the ankle-joint when the shape permanent elements are not abutting the lower leg. Then, the footwear will facilitate a more natural walking as compared to conventional high-shanked ski boots. Thus, this means that the collapsible cover should form the shank part of the footwear, the shape permanent elements being pivoted at the level of the ankle-joint of the user.

An alternative embodiment of the safety footwear according to the present invention can have the sole of the footwear attached e.g. to a ski, the pivotable shape permanent elements being pivoted two and two about longitudinal and transverse axes, respectively, at the base of the elements, positioned in connection with the upper side of the ski. In this embodiment of the invention an inner footwear is used which is kept in position by the pivotable shape permanent elements forming the safety footwear. At the release of the locking means and a folding of the shape permanent elements, which may occur under the action of a yieldable force or not, the foot carrying the inner footwear is free to slip out of the safety footwear. The shape permanent elements then will act as effective braking means of the released ski.

In this second embodiment of the safety footwear of the invention, it is advantageous if the shape permanent elements have lower inwardly angled portions biased by resilient devices which tend to keep the elements in an unfolded position. When the inner footwear is placed within the cover a pressure from the inner footwear will automatically fold back the shape permanent elements to engage the inner footwear and the lower leg of the user, which facilitates the attachment and the removal of the safety footwear.

The locking means used to keep the shape permanent elements in position against the lower leg and, in the

second embodiment, against the inner footwear as well, may consist of a spring biased link mechanism, one end of which is attached to a connecting piece of strip, preferably attached to a rearward element of the cover, hook or loop means being placed at the other end of the piece of the strip and co-operating with the link mechanism to lock the shape permanent elements. The link mechanism may be of a known type and preferably includes at least one lever to provide the locking action, said lever decreasing progressively at increasing load to a position wherein the locking means will release. To said link mechanism also a resiliently yieldable member surrounding the shape permanent elements may be attached. Said resilient member will not be released when the locking means is released, but will be progressively tensioned while accumulating energy.

The locking means may also comprise adjustably yieldable means at one part of the locking means, said yieldable means co-operating with recesses at the other part of the locking means in such a way that the locking means will release at the occurrence of an adjustable predetermined maximum force on the locking means. The detailed construction of the locking means may be of any kind and e.g. may be based on the technique used in conventional safety bindings, wherein spring biased balls engage grooves or recesses between two parts movable in relation to each other. However, they may also include breakpins etc, which are dimensioned to break at a predetermined maximum load. Such breakpins of different strength may be available and provide the advantage that the maximum forces occurring on the skier's lower leg will be transferred directly to the locking means to cause said means to release. Thus, the use of a locking means is avoided, which is dependent on the friction between members movable in relation to each other, such friction being difficult to determine.

A locking means, the release of which occurs by one of the breakpins being sheared may be designed in several ways. Thus, the breakpin may be positioned e.g. such that it forms simultaneously a pivot of a spanner for tightening stripes or the like locking the cover, around the upper portion of the shank. Such a stripe can also consist of several elements interconnected by breakpins ensuring a safe release of "the locking means" independently of the direction in which the allowable maximum force from the user's lower leg acts onto the shank portion of the footwear.

It may also be possible to use cover-locking stripes only which will break when the allowable maximum force is applied to the shank portion of the footwear.

A practical embodiment of cover-locking stripes and locking means permitting the opening of the cover against a yieldable force comprises a resilient stripe, the resilient elongation of which in a non-released position will be prevented by the stripe being connected in parallel with a non-resilient link stripe consisting of link elements interconnected by breakpins. Then, a satisfactory locking of the different cover elements against the user's lower leg is obtained, the opening of the cover elements against the bias of a yieldable force at the same time being ensured when any of the breakpins is sheared at the appearance of an unallowably great force between the user's lower leg and the shank portion of the footwear.

The breakable stripes and/or the breakpins used for releasing "the locking means" may have different colours or combinations of colours representing different strengths, so as to make possible a correct release when the safety footwear is used e.g. by skiers, having a body weight and a degree of skill which allow a different magnitude of the permitted maximum force between the skier's lower leg and

the shank portion of the footwear. A well-trained and experienced skier thus may be expected to control great forces appearing between the lower leg and the shank portion of the boot and, accordingly, breakpins/breakable stripes of a greater strength may be used by that skier as compared with the forces between the shank portion of the boot and the lower leg, which can be allowed for less skilful skiers.

The openable cover of the safety footwear according to the present invention may comprise the only releasing mechanism/safety binding between the user of the footwear and e.g. a ski, or it can comprise a releasing mechanism supplementary to conventional releasing mechanisms acting between the ski and the boot.

The safety footwear according to the present invention may be used with or without an inner footwear in the two embodiments shown herein, the inner footwear being equipped with a high shank, the upper part of which is formed such that the transfer of the forces from the lower leg to the shank portion of the safety footwear will not be obstructed. The rear portion of the shank of the inner footwear thus may be made relatively rigid to counteract to some extent the yieldability of the muscles of the leg, which in some cases may counteract a correct release of the locking means of the safety footwear.

The invention will now be described with reference to embodiments shown in the accompanying drawings wherein

FIG. 1 is a perspective view of a first embodiment of the safety footwear according to the invention, wherein the shank portion of the footwear consists of pivotally arranged shape permanent elements, the elements fixing and locking the shape permanent elements against the user's lower leg being omitted;

FIG. 2 is a perspective view showing diagrammatically a safety footwear according to FIG. 1 the shape

permanent elements being locked against the lower leg of the user;

FIG. 3 is a perspective view showing a second embodiment of the safety footwear according to the invention in a released position; and

FIG. 4 is a perspective view showing diagrammatically the safety footwear according to FIG. 3 the shape permanent elements fixed and locked against the user's lower leg.

In FIG. 1 a ski 1 is shown on which a safety footwear according to the invention can be releasably attached by conventional releasing mechanisms co-operating with the sole 10 of the footwear, or the sole 10 of the footwear is fixedly attached to the upper side of the ski 1. The shank portion of the footwear consists of several pivotally arranged shape permanent elements 2-5, forming parts of an openable cover. The shape permanent elements 2-5 are pivotable about axes 2A-5A at the level of the ankle-joint of the user, possibly against the bias of yieldable forces.

In FIG. 2 the shape permanent elements are shown in a locked position engaging the user's lower leg 11, a locking means 8 fixing the elements, being arranged around the upper portions of the elements. This locking means 8 consists of a stripe without or with low resiliency and is held together around the elements by a conventional releasable spanner. The locking means 8 may also be held around the upper portions of the elements by a non-releasable spanner, the releasing action being obtained by using one or more breakpins 14 interconnecting two or more parts of the locking means 8. The ends of the portions of the locking means 8, at which the breakpins are positioned, are suitably arranged as hinges, two places on each breakpin preferably being exposed to shearing caused by a pulling force on the locking means 8. The

material of the breakpins is of a decisive importance to obtain a correct operation of the releasable locking means. The material of the breakpins suitably should have a low shearing strength to make possible a release within permitted limits by the dimensioning of the breakpins, because the forces which shall release the locking means will be relatively small, although disastrous consequences will arise if such forces are exceeded.

A resiliently yieldable member 12 may be arranged around the shape permanent elements to obtain a yieldable force against which the shape permanent elements can be opened subsequent to releasing of the locking means. Preferably, the resilient member 12 can be engaged around the shape permanent element by means of a conventional spanner 13. As mentioned above, this resilient member 12 may be arranged in parallel with the locking means 8 and then may be tightened by means of one and the same spanner. The resiliently yieldable member in that case can be positioned inside the locking means 8.

In the embodiment shown in FIG. 3 the safety footwear of this invention consists of a cover 2'-5' which can be fully opened, enclosing a soft shoe or inner boot 6. In this embodiment the cover consists of rigid shell members and comprises two side portions 2' and 3' and a front portion 4' and a back portion 5'. These portions are pivoted about longitudinal and transverse axes, respectively, between an open position (FIG. 3) and a closed enclosing position (FIG. 4). The different portions 2'-5' of the cover have lower inwardly directed edge portions 2a-5a which are positioned and can be actuated in such a way that a pressure from the sole 7 of the inner shoe or boot 6 provides an automatic folding of said different parts.

When the inner shoe 6 has been placed within the cover onto the lower edge portions 2a-5a, the portions 2-5 which will be folded towards the inner shoe 6, will be locked in the closed position by a releasable locking member 9 arranged at the ends of a locking band 8' fixedly attached to one of the portions of the cover, e.g. to the back portion 5'.

In this embodiment of the invention the releasable locking member 9 is of the kind which opens automatically when a predetermined maximum force is applied between the ends of the locking band 8'.

In the embodiment of the safety footwear according to the present invention shown in FIGS. 3 and 4, the inner boot 6 will be removed from the opened portions of the cover when the locking means has been released.

The rigid elements of the cover may be manufactured of carbon fiber reinforced plastics which provides the necessary rigidity of the elements 2-5, and also imparts to these elements a favourable low weight.

The invention is not restricted to the shown embodiments; modifications can be made within the scope of the following claims.

CLAIMS

1. Safety footwear, preferably a ski boot, comprising several pivotally arranged shape permanent elements forming parts of an openable cover covering at least the lower leg of the user of the footwear, and locking means arranged to release at an adjustable allowed maximum force between the lower leg and the cover, for keeping the cover together in its closed position, c h a r a c t e r i z e d in that the elements (2-5) are pivotable about axes (2A-5A) at the base of the elements and that the locking means (8) securing said elements in their closed position around the lower leg (11), is arranged to be actuated by the force transferred directly from the lower leg to the locking means, with subsequent releasing of the locking means and thus opening of said elements when the allowable maximum force set is exceeded.

2. A footwear according to claim 1, c h a r a c t e r i z e d in that the shape permanent elements (2-5) are arranged to be opened against the bias of a yieldable force.

3. A footwear according to claim 2, c h a r a c t e r i z e d in that the yieldable force is arranged to increase progressively during opening of the shape permanent elements (2-5).

4. A footwear according to claim 2 or 3, c h a r a c t e r i z e d in that the yieldable force is adjustable.

5. A footwear according to any of the preceding claims, c h a r a c t e r i z e d in that the shape permanent elements (2-5) form the shank portion of the boot, said elements being pivoted at the level of the ankle-joint of the user.

6. A footwear according to claim 1, c h a r a c t e r i z e d in that the sole (10) of the footwear is

secured to a ski (1) the shape permanent elements (2-5) being pivoted in pairs about longitudinal and transverse axes, respectively, at the base of the elements at the level of the sole of the footwear.

7. A footwear according to claim 6, c h a r a c - t e r i z e d in that the shape permanent elements have lower, inwardly angled portions (2a-5a) biased by resilient members tending to keep said elements in an open position.

8. A footwear according to claim 6, c h a r a c - t e r i z e d in that the locking means comprises a spring biased link mechanism (9) attached to one end of a connecting piece of stripe (8'), preferably attached to a rear cover element (5') a hook or loop portion being placed at the other end of the piece of stripe and co-operating with the link mechanism to lock the shape permanent elements (2-5).

9. A footwear according to claim 1, c h a r a c - t e r i z e d in that at least one breakpin (14) is positioned between and connects different members forming part of the locking means (8), the releasing of the locking means when the predetermined maximum force between the lower leg of the user and the shank portion of the footwear is exceeded, taking place by shearing of the breakpin.

10. A footwear according to claim 1, c h a r a c - t e r i z e d in that the locking means consists of a continuous non-resilient flexible member, the strength of which is such that the member will break when the allowed maximum force between the lower leg (11) and the shape permanent elements is exceeded.

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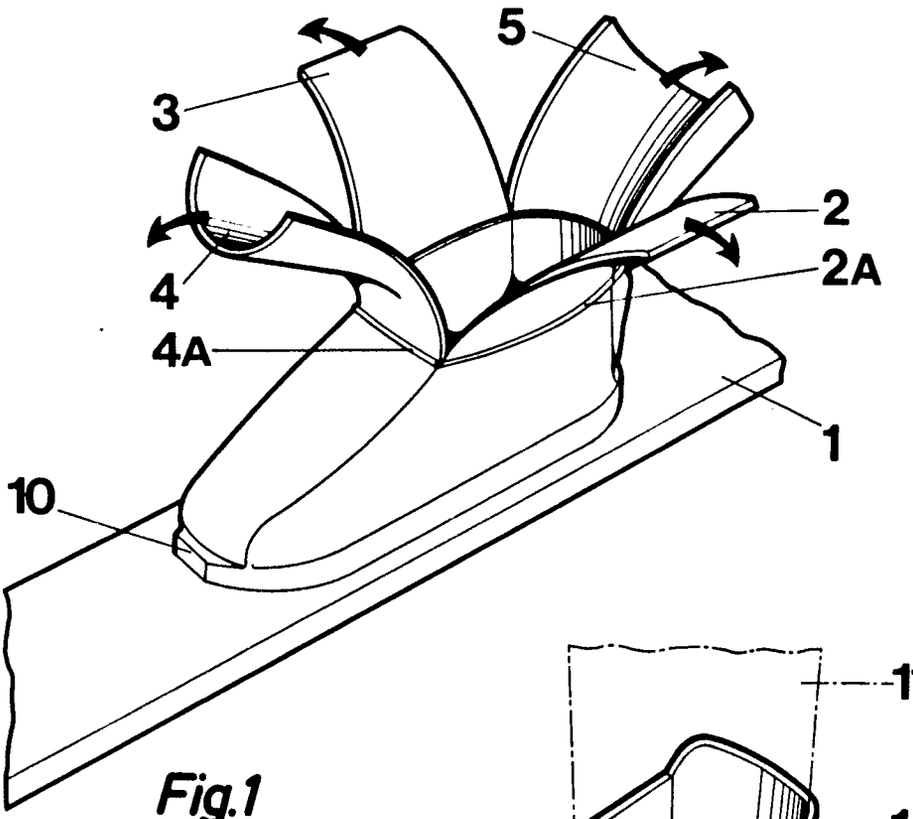

Fig.1

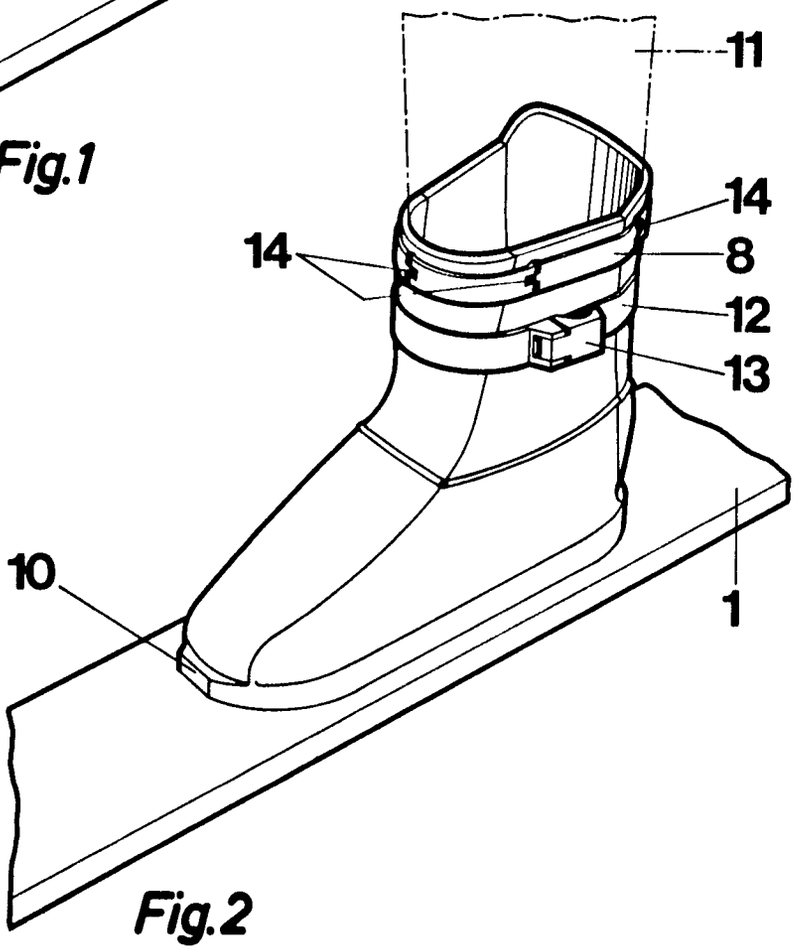

Fig.2

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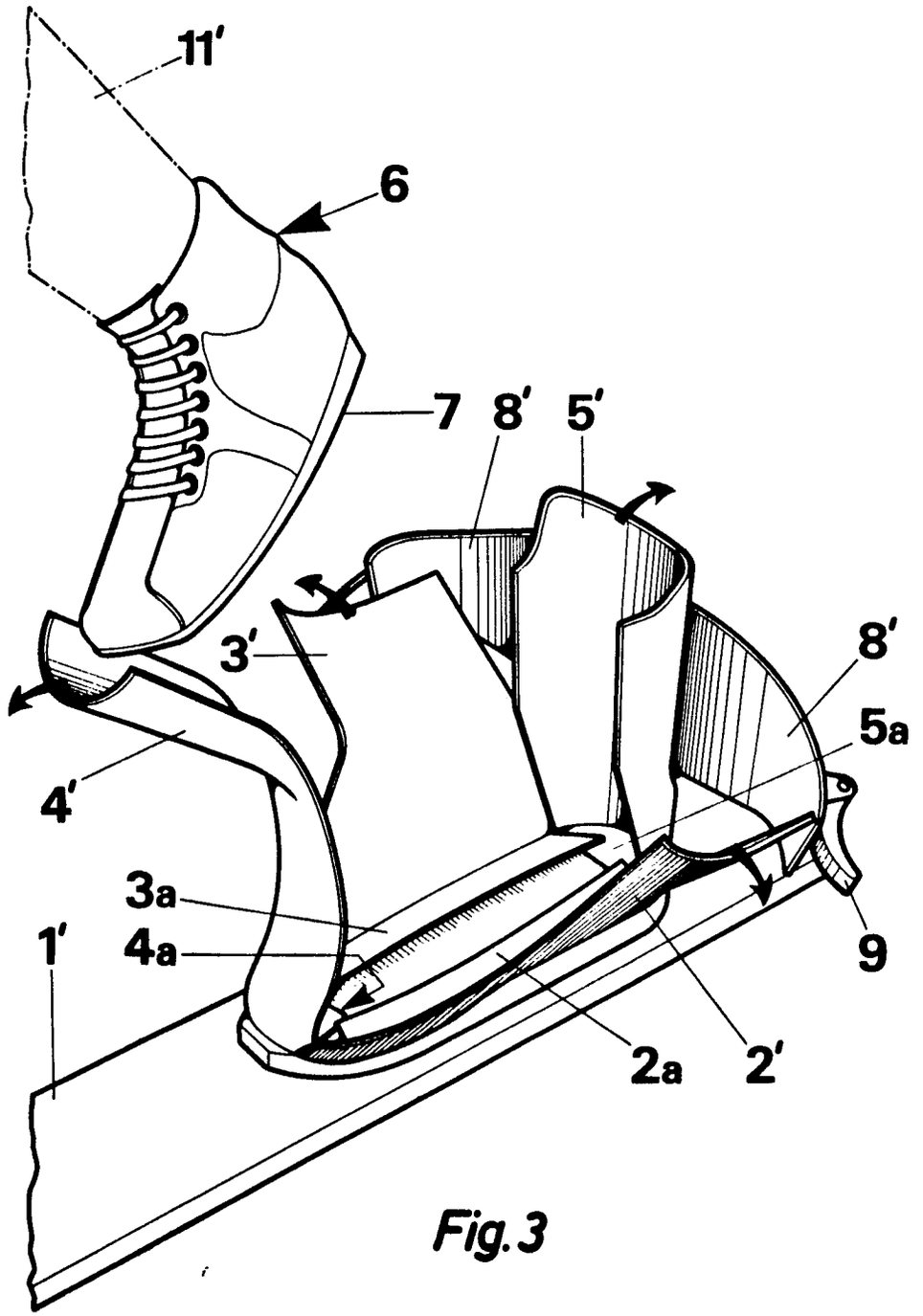

Fig.3

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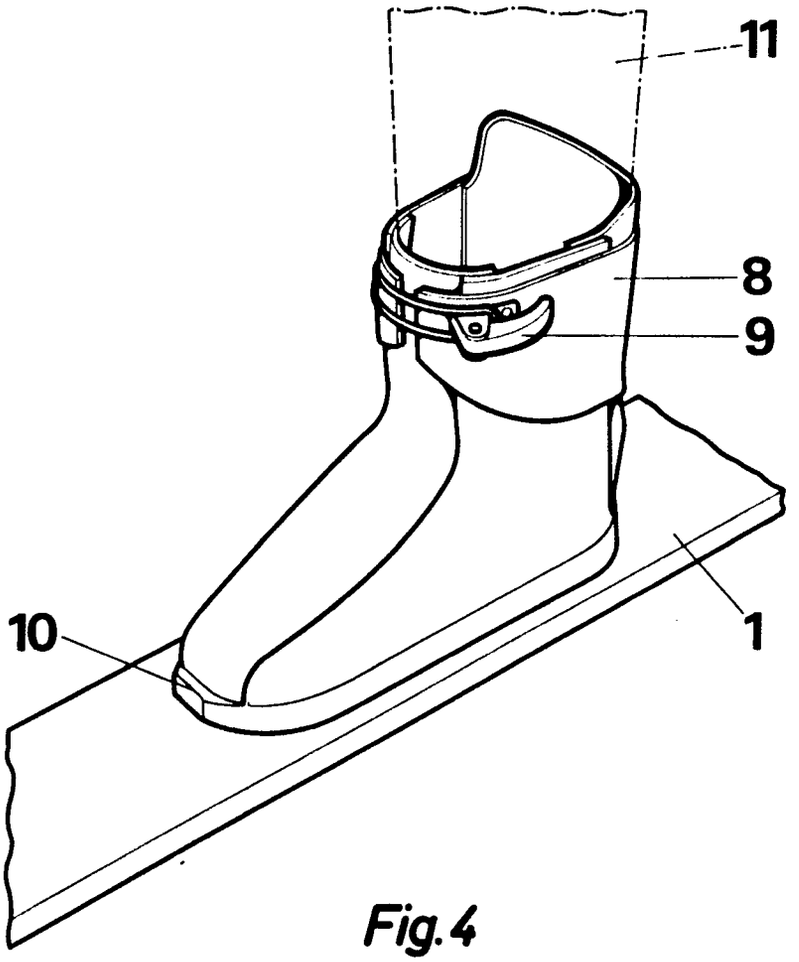

Fig.4

European Patent Office

EUROPEAN SEARCH REPORT

Application number
0020315
EP 80 85 0074

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	FR - A - 2 292 497 (SALOMON)	1,5,6
A	DE - A - 2 434 218 (W. RIEDER)	1
A	DE - A - 2 317 408 (GERTSCH)	1

CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)

A 43 B 5/04
A 63 C 9/00

TECHNICAL FIELDS SEARCHED (Int.Cl. ³)

A 43 B
A 63 C

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21-08-1980	DECLERCK

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