United States Patent [19]

McAusland et al.

[11] **3,834,044**

[45] **Sept. 10, 1974**

[54] **METHOD OF FOAMING SKI BOOTS**

[75] Inventors: **Robert R. McAusland,** Seattle; **John M. Powell,** Federal Way, both of Wash.

[73] Assignee: **Anderson & Thompson Ski Co., Inc.,** Seattle, Wash.

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[21] Appl. No.: **19,914**

[52] **U.S. Cl.** ..... **36/2.5 AL**

[51] **Int. Cl.** **A43b 00/00**

[58] **Field of Search** 36/2.5; 12/142

[56] **References Cited**

UNITED STATES PATENTS

3,325,919	6/1967	Robinson	36/2.5
3,325,920	6/1967	Werner et al.	36/2.5
3,377,721	4/1968	Johnson	36/2.5
3,521,385	7/1970	Dalebout	36/2.5 AL

Primary Examiner—Patrick D. Lawson
Attorney, Agent, or Firm—Seed, Berry, Vernon & Baynham

[57] **ABSTRACT**

A double-wall liner of flexible material is put on the foot of the wearer or a mandrel corresponding to the foot of the wearer, the outer wall of the liner having therein an injection opening for an uncured foaming material and one or more vent openings. The mandrel or wearer's foot, with the liner thereon, is then inserted into a ski boot having one or more openings corresponding to the openings in the outer wall of the liner. The liner is keyed in position in the boot. The boot is then laced or buckled. An uncured resinous material and a catalyst therefor are mixed together and immediately injected into the liner through the injection opening. The foaming gas generated by reaction of the catalyst and resin foams the resin to produce an elastomeric foam which expands to fill the area between the walls of the liner and causes the outer wall of the liner to conform substantially to the inner surface of the boot and the inner wall of the liner to conform substantially to the mandrel or foot of the wearer. The foamed material is allowed to cure adequately in the liner before removal of the foot or mandrel from the liner. Stitching is provided along the instep of the liner to prevent the elastomeric foam from entering that portion of the liner, allowing that portion of the liner to expand laterally, and allowing the foaming gas to vent through the stitching into the atmosphere.

7 Claims, 6 Drawing Figures

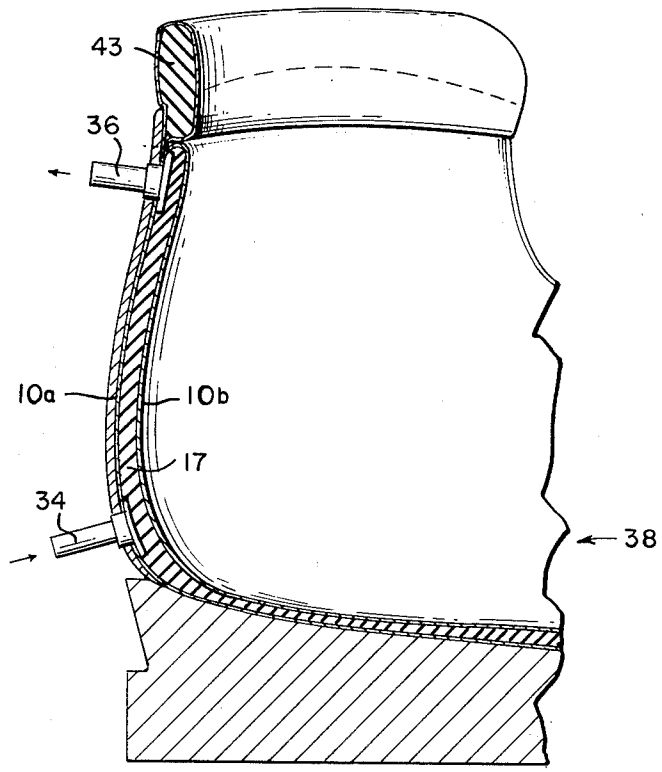
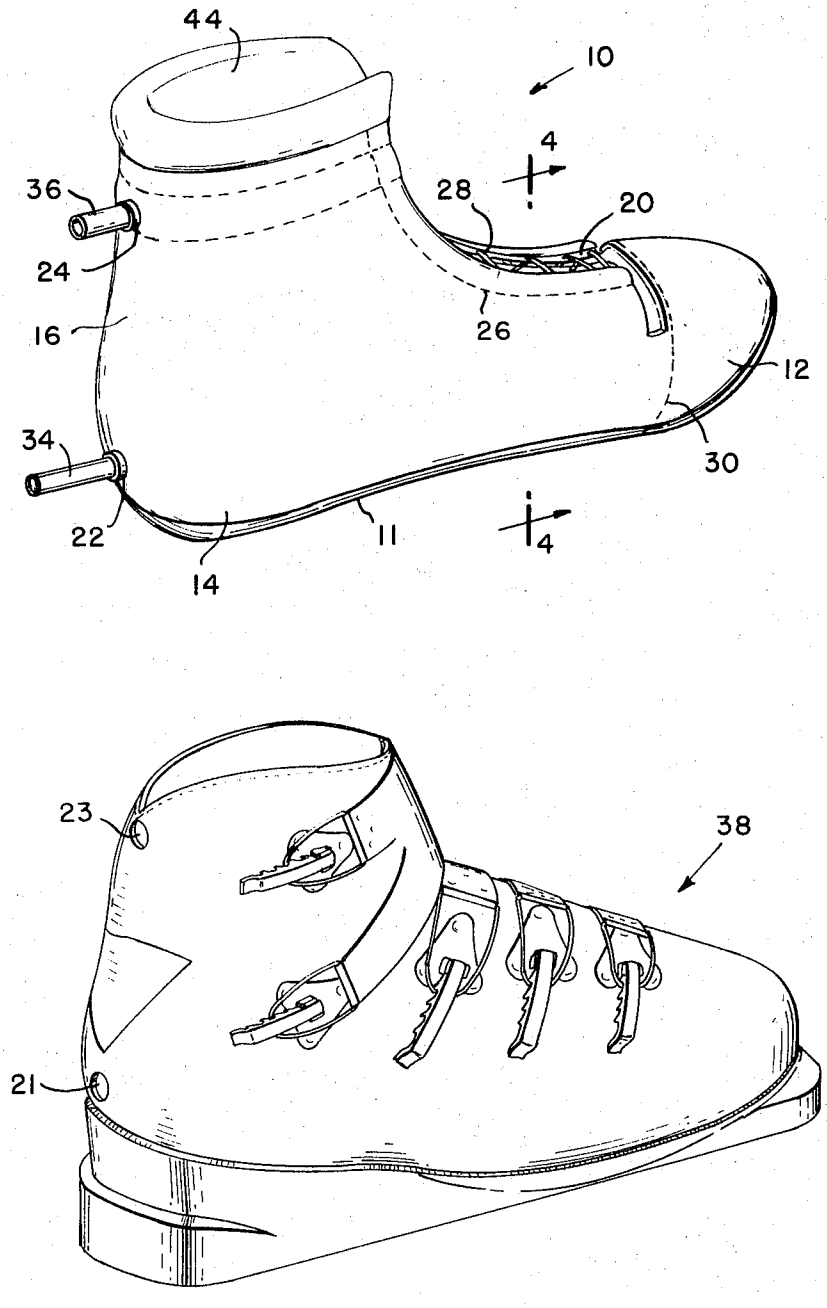


FIG. 1



JOHN M. POWELL
ROBERT R. MC AUSLAND
INVENTORS.

BY Seed, Berry & Lowrey
ATTORNEYS

FIG. 2

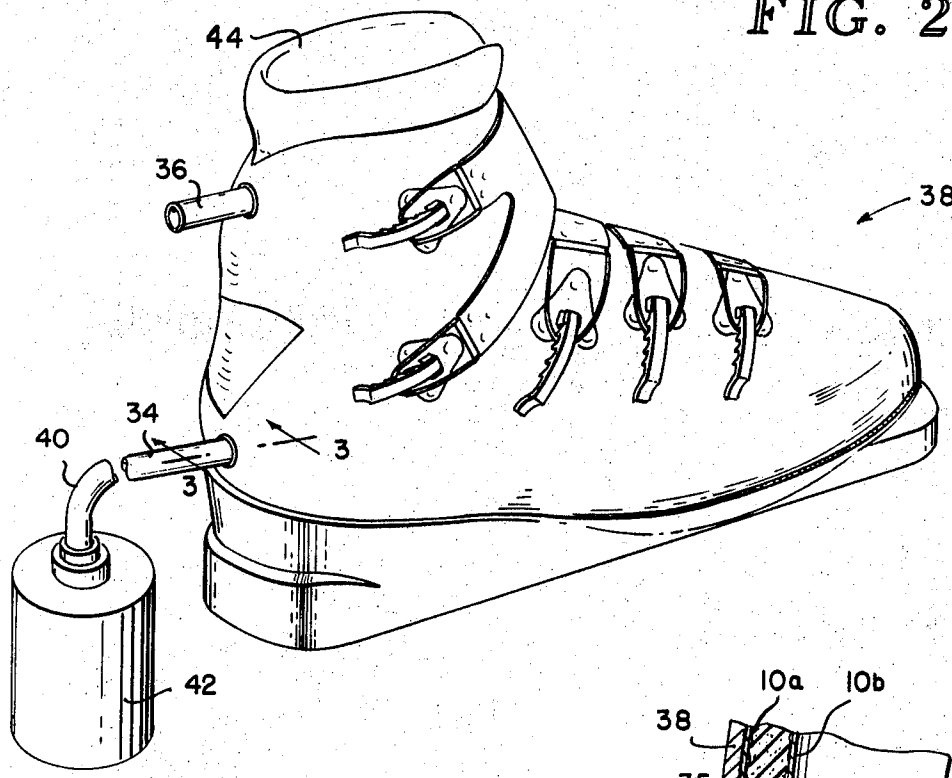


FIG. 3

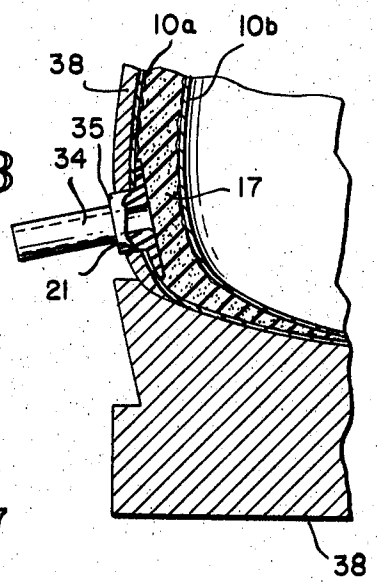
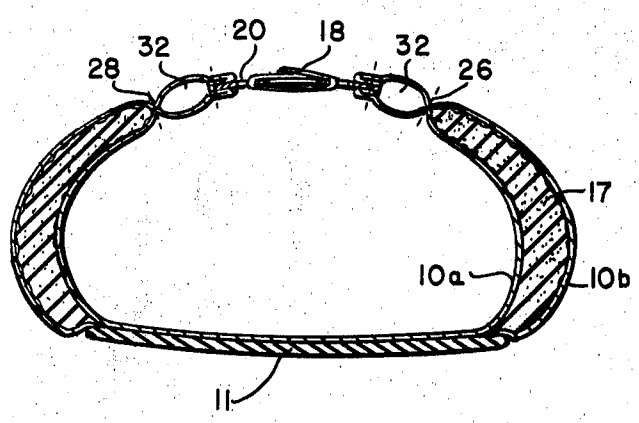


FIG. 4



JOHN M. POWELL
ROBERT R. MCAUSLAND
INVENTORS.

BY Seed, Berry & Dorner

ATTORNEYS

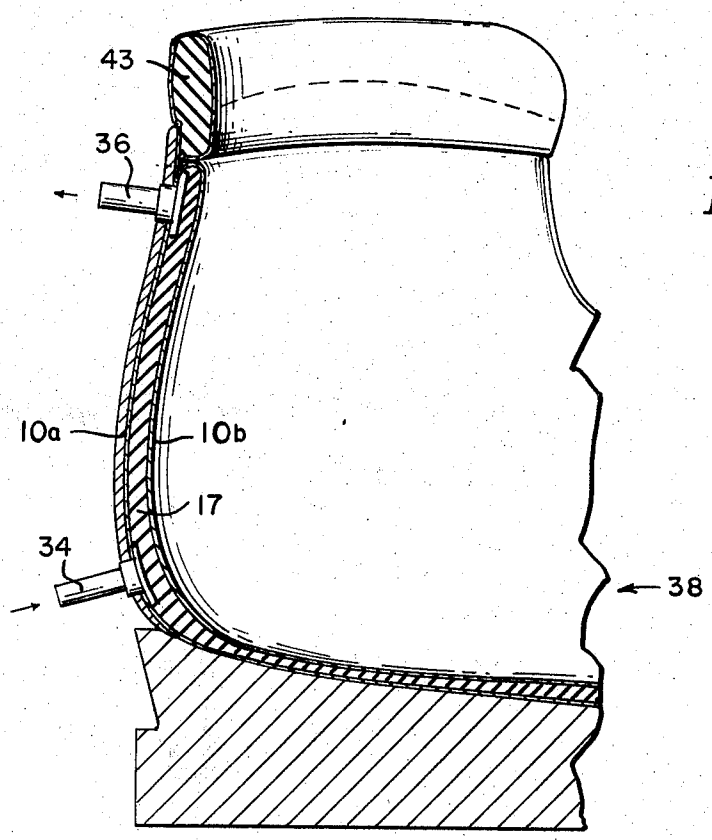


FIG. 5

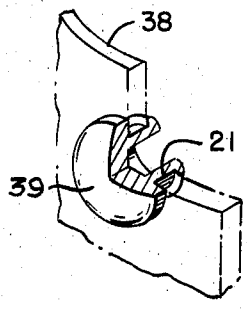


FIG. 6

JOHN M. POWELL
ROBERT R. MC AUSLAND
INVENTORS.

BY Seed, Berry & Downey

ATTORNEYS

METHOD OF FOAMING SKI BOOTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method of fitting a boot to the foot of the wearer and the fitted boot per se.

2. Prior Art Relating to the Disclosure

Ski boots are primarily designed to provide ankle support for the ankle of the wearer in addition to warmth and protection. For ski boots it is highly desirable to have fitted boots which will translate movements of the wearer directly to the skis without dissipation due to movement of the feet in the boots. Boots, if not fitted correctly, compress the foot of the wearer at certain pressure points and are too loosely fitted at other points. The uneven pressure can be very painful to the wearer of the boot. With many of the ski boots today being fabricated of a heavy gauge rigid plastic, correct fitting of the boots is necessary as the rigid plastic outer boot will not, in time, conform to the foot of the wearer. It is difficult to pad individual ski boots because of the difference in size and shape of individual feet.

Custom fitting of ski boots and other athletic boots by casting of a foaming material around the foot in situ is known. Generally, a single wall liner is put around the foot of the wearer. An uncured foaming resin is then put in the boot. The wearer then inserts his foot with the liner thereon into the boot and the boot is laced or buckled to the desired tightness. The foam expands to fill the areas between the liner and the inner surfaces of the boot. Difficulties have been experienced with the previously described process because of precure of the foam material. The top of the boot presents a generally unfinished appearance unless the exposed foamed area is covered. If not covered water from melting snow crusted on the boots during skiing soaks into the elastomeric foam. Thereafter it is difficult to completely remove the water from the foamed area.

Other techniques of custom fitting boots are disclosed in U.S. Pat. Nos. 3,325,919, 3,325,920, 3,329,953 and 3,377,721.

SUMMARY OF THE INVENTION

Ski boots and other athletic type boots are fitted to the foot of the wearer utilizing a double-wall liner having an inner wall approximating the wearer's foot, the liner adapted to fit into an outer ski boot shell. Corresponding access openings are provided in the boot and the outer wall of the double-wall liner to allow an elastomeric material to be injected between the walls of the double-wall liner. The liner is keyed in position in the outer boot. The wearer puts the double-wall liner on a mandrel corresponding to his foot or his foot, and steps in the boot, or the wearer may step into the boot with the liner previously installed. An uncured resin, catalyst and foaming agent are mixed together and injected through the injection opening in the liner. The uncured foam expands after injection into the liner and conforms the outer wall of the liner substantially to the contour of the inner surface of the outer boot and conforms the inner wall of the liner to the outer surface of the foot of the wearer. After allowing the resin to cure with the foot in the liner and the liner in the boot the liner may be removed from the boot and the foot. The liner is provided with means allowing the foaming gas

to vent and allowing it to stretch laterally. Such means may include stitching running the length of the liner, the stitching preventing the foaming material from entering that portion of the liner. The liner is made of a pliable, elastomeric material.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view of the liner and boot of this invention;

FIG. **2** is a perspective view of the liner in the outer boot with a mandrel or the wearer's foot positioned in the boot, foaming resin being injected into the space between the walls of the double-wall liner through the tube connected to the container;

FIG. **3** is a cross sectional view along section line **3—3** of FIG. **2**;

FIG. **4** is a cross sectional view along section line **4—4** of FIG. **1.**

FIG. **5** is a cross sectional view of the boot with the foamed liner in position, the liner keyed in position; and

FIG. **6** is a partial view of one means of plugging the injection and vent openings in the outer boot after the boot has been fitted to the foot of the wearer.

DETAILED DESCRIPTION OF THE INVENTION

Fitting of ski boots by the method of this invention can be done with existing boots of leather or synthetic material or with new boots. If an existing boot is used the padding in the boot is generally removed to provide ample room in the boot for the foaming material to expand the walls of the liner against the inner surface of the boot and the outer surface of the foot of the wearer.

Referring to FIGS. **1** and **4** the double-wall liner **10** includes an inner wall **10***a* and an outer wall **10***b* fabricated into a toe section **12** a foot section **14** and a leg section **16.** A flexible sole **11** may be provided if desired. A slit **18** runs from the top of the liner downwardly towards the toe section allowing a mandrel corresponding to the foot of the wearer or the foot of the wearer to be easily inserted and removed from the liner. The liner is provided with "speed laces" **20,** a zipper or flap so that the liner can be closed about the mandrel or foot of the wearer. The outer wall of the liner is provided with one or more openings **22** and **24** for injection of an uncured foaming resin into the space between the walls of the liner and venting of air and the foaming gas from the space. The uncured foaming resin may be injected into the space near the heel of the liner as shown in FIG. **1.** A vent opening or openings **24** may be placed at any suitable location such as in the toe portion or, as shown, near the ankle. The liner is fabricated from a flexible material such as neoprene, leather, vinyl plastic, etc. Both walls of the liner may be of the same or of different material. Preferably the inner wall is fabricated from lined neoprene with the outer wall made from relatively thin vinyl or leather. As shown in FIGS. **1** and **4** parallel seams **26** and **28** extend parallel to slit **18.** Seam **30** extends around the toe portion of the liner. These seams permit gas generated as a result of the reaction between the catalyst and resin to be vented through the seams to the atmosphere. Very small amounts of the uncured foaming resin are able to penetrate into the stitched areas as shown in FIG. **4.** It is desirable to leave the toe portion of the liner unfoamed so that the toes of the wearer have

ample room for movement in the boot. It is also desirable that no foam enter the space between the seams **26** and **28** and slit **18** of the liner, thus providing space **32** of the liner which can be expanded laterally by the foot of the wearer.

Bosses **34** and **36** of rubber or other suitable material are secured to openings **22** and **24** by adhesive or other means. Bosses **34** and **36** include a shoulder portion **35** of substantially the same diameter as openings **21** and **23** in the outer boot. The shoulder portions key the liner in position in the boot and aid in preventing upward movement of the heel portion of the liner in the boot during use. The inlet openings of the bosses should be long enough to extend through corresponding openings **21** and **23** in the outer boot.

Ankle padding **44** may be included as an integral portion of liner **10** as shown in FIG. **1** or the padding **43** may be stitched around the top of the outer boot as shown in FIG. **5.** The padding secured to the boot as shown in FIG. **5** serves a second function, that of preventing the heel of the liner from moving or working upwardly during use of the boots by the wearer.

The outer boot **38** is a conventional ski boot. Although the boot shown is closed by buckles, lace boots may also be used. The outer boot has openings **21** and **23** therein positioned relative to the openings **22** and **24** in the outer wall of the liner.

METHOD OF FITTING

In practice a liner is fabricated so that the inner wall thereof approximates the foot of the wearer. A conventional sock of wool, cotton or nylon, which is generally worn with any ski boot, is placed on the foot of the wearer and worn during foam fitting of the liner to the foot and to the outer boot. The liner may be provided with lacing, zippers or other means for holding it on the foot. When the liner is inserted into the boot the shoulder portion **35** of bosses **34** and **36** is keyed into position in openings **21** and **23** of the outer boot.

A tube **40** is attached to the inlet end of boss **34** extending through opening **21** in boot **38,** the opposite end of the tube having means thereon securing it to a container **42.** Measured amounts of resin and catalyst for the resin are poured together in container **42,** the container closed, and the components mixed by shaking, swirling or other suitable manner. The resin used is perferably of the type which reacts immediately and cures within minutes of the time the components are mixed together. Commerically available urethane or silicone foams are typical of the elastomeric foams which may be used. The gaseous foaming agent generated on mixing of the resin and catalyst generates pressure within the container **42** which aids in forcing the uncured, foaming resin through tube **40** into the space between the inner and outer walls of the double-wall liner **10.** As the foaming material enters between the walls of the liner it continues to expand and fills the interstices therein with the result that the outer wall of the liner conforms substantially to the inner surface of the outer boot and the inner wall of the liner conforms substantially to the mandrel or foot of the wearer. Excess gas in the liner is vented through the stitched seams **26** and **28** and to the atmosphere and through vent opening **24.** If needed, additional vent openings may be provided. By providing vent passages the generated gas is not entrapped in the liner with resulting formation of voids.

As soon as all of the foaming material is injected into the boot **38,** tube **40** is removed from boss **36** and the foam allowed to cure with the mandrel or foot of the wearer in the boot. Generally the foams used are substantially cured in a matter of minutes. The boot is then unbuckled and the mandrel or foot removed. The liner may be removed if desired. It is recommended that the foam in the liner be allowed to fully cure for a period of 12 or more hours before actual use of the liner. There is usually a small amount of shrinkage in the liner due to shrinkage of foam in the boot. It is desirable to provide an unfoamed space **32** which allows the liner to stretch laterally upon re-insertion of the foot of the wearer into the liner. The ends of bosses **34** and **36** protruding from the outer wall of the liner are cut flush with the outer surface of the boot **38** after the foam has been injected. The openings **21** and **23** in the outer boot are then plugged with plug **39** as shown in FIG. **6** or other suitable means.

The liner may be provided, if desired, with a semi-rigid sole **11** on the bottom thereof. In addition, the top of the liner may be provided with conventional padding **44** for the ankle of the wearer, or the outer boot may be provided with the necessary padding.

The method of this invention allows measured amounts of resin and catalyst to be mixed together so that waste of the foaming materials is avoided. By venting the gas generated during foaming through stitched areas of the liner, voids in the foamed material are not formed. The pressure generated by the gas during foaming in the container acts to drive the foaming material into the space between the walls of the liner, the foam further expanding in the area between the walls of the liner to fill every available space with foam.

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

1. A method of custom fitting a boot to a mandrel corresponding to the foot of the wearer or to the foot of the wearer comprising:

providing an outer boot shell made of a substantially rigid material with an injection opening therethrough,

providing a flexible, double-wall liner for the boot shell, the inner wall of which approximates the surface of the mandrel or foot of the wearer and the outer wall of which has an injection inlet adapted to register with the injection opening in the boot shell,

inserting a mandrel or foot of the wearer in the liner,

inserting the liner into the boot shell with the injection inlet registering with the injection opening,

closing the boot shell around the liner,

mixing an uncured foamable liquid resinous material and catalyst in a flexible closed container having an outlet tube, the resin and catalyst reacting to generate a foaming gas,

connecting the outlet tube with the injection inlet of the liner in a closed system, the foaming gas generated by mixing of the resin and catalyst aiding to force the uncured foaming resin into the space between the walls of the liner.

2. The method of claim **1** wherein the injection opening for injection of the foaming resin is located near the heel of the boot and liner.

3. The method of claim 1 wherein the liner includes a vent opening having an outwardly protruding gas outlet secured thereto, the boot having a corresponding opening adapted to receive the outwardly protruding outlet.

4. A boot fitted to the foot of the wearer comprising,

an outer boot of substantially rigid material having a sole and an upper and at least two plugged openings in the upper, including an injection opening and a vent opening,

a flexible, double-wall liner having a toe section, foot section and leg section,

a closeable slit running from the upper edge of the liner downwardly of the instep towards the toe section of the liner, allowing the foot to be inserted and removed from the liner,

openings in the outer boot of the liner corresponding to the injection and vent openings in the outer boot for entry of an uncured foam into the space between the walls of the double-wall liner and vent of foaming gas from the space between the walls of the double-wall liner,

fittings secured around each of the openings in the outer wall of the liner having shoulder portions thereon adapted to key into the corresponding openings in the outer boot aiding and preventing upward movement of the heel portion of the liner in the boot during use, and

a cured elastomeric foam between the walls of the liner which conform the inner wall of the liner substantially to the foot of the wearer and the outer wall of the liner substantially to the inner surface of the outer boot.

5. The boot of claim 4 wherein the liner includes stitched seams running substantially parallel to the slit, the seams allowing foaming gas to vent therethrough, thereby preventing formation of voids.

6. The boot of claim 4 wherein the outer boot includes a padded portion secured around the top of the leg section thereof, the padded section aiding and preventing upward movement of the double-wall liner in the boot.

7. The boot of claim 4 wherein the double-wall liner is removable from the outer boot.

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