April 16, 1968 R. R. JOHNSON 3,377,721

REINFORCED SKI BOOT AND METHOD OF MAKING THE SAME

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Fig. 5.

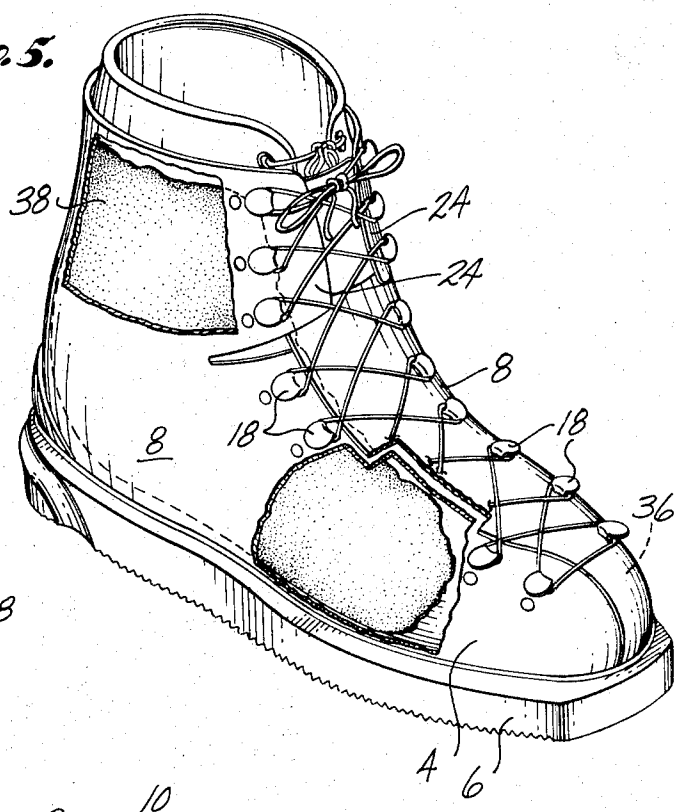


Fig. 6.

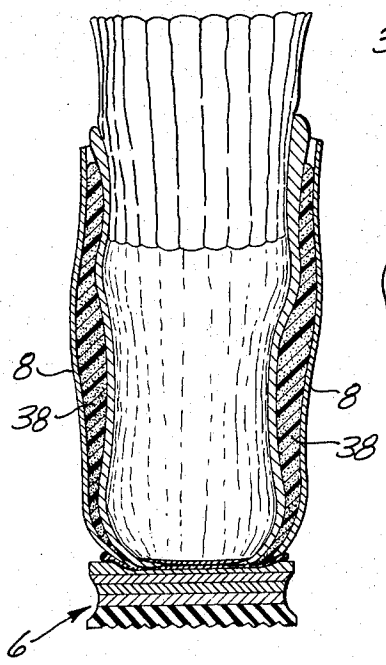
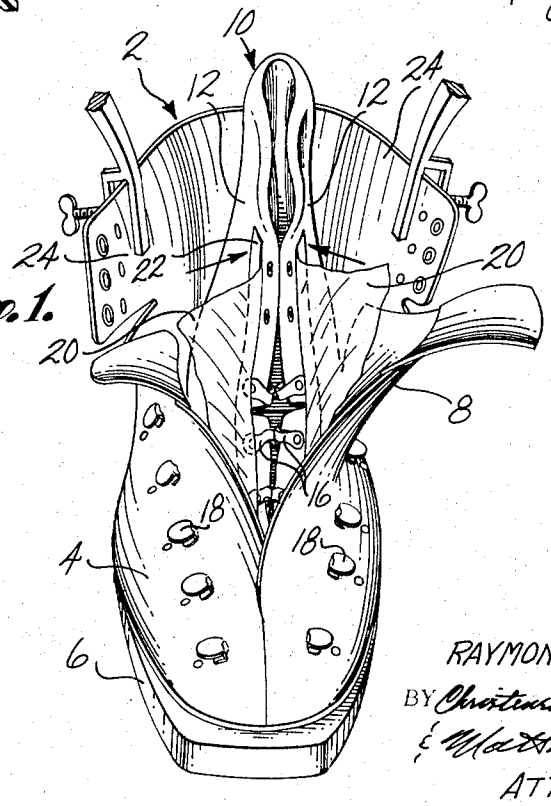


Fig. 1.



INVENTOR.
RAYMOND R. JOHNSON
BY Christensen, Sanborn & Matthews
ATTORNEYS

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Fig. 3.

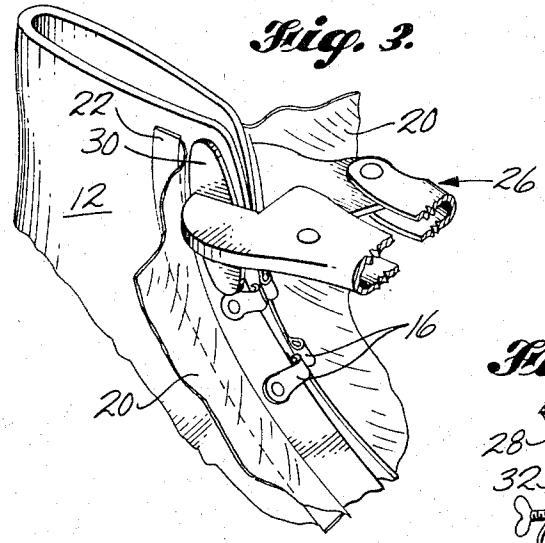
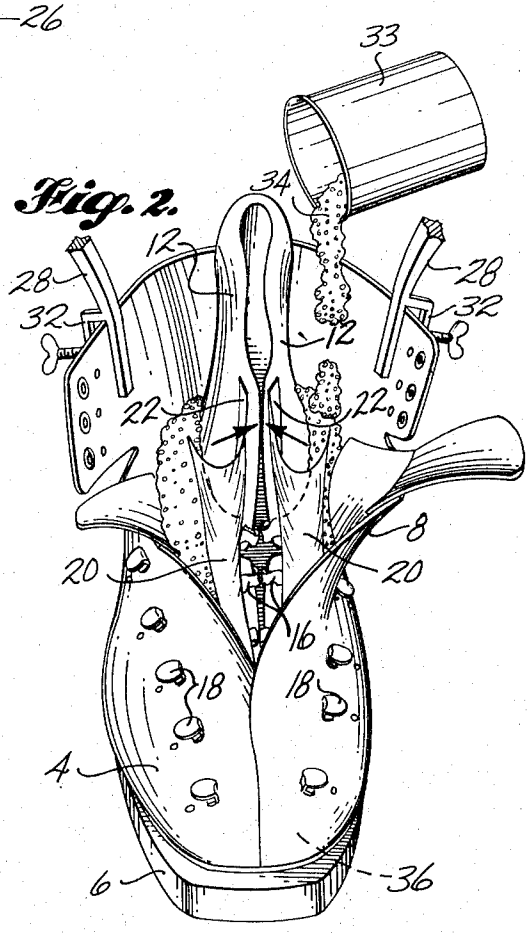


Fig. 2.



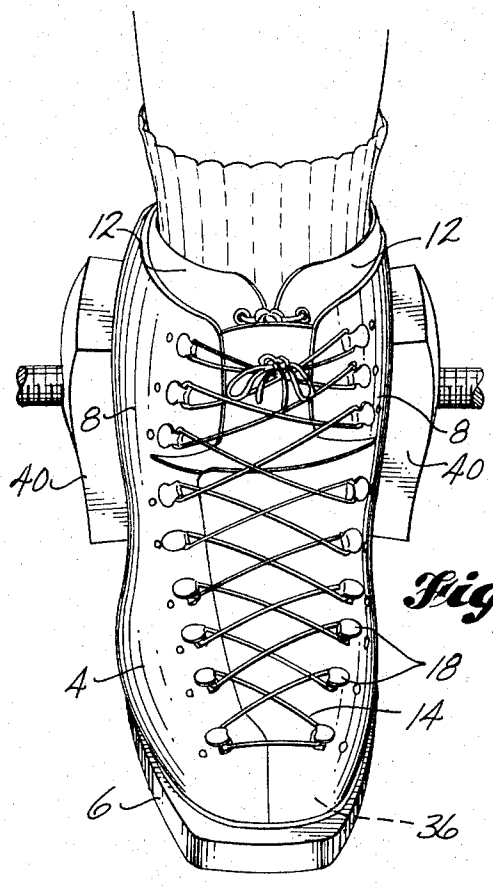


Fig. 4.

INVENTOR.
RAYMOND R. JOHNSON
BY Christensen, Sanborn & Matthews
ATTORNEYS

April 16, 1968 R. R. JOHNSON 3,377,721

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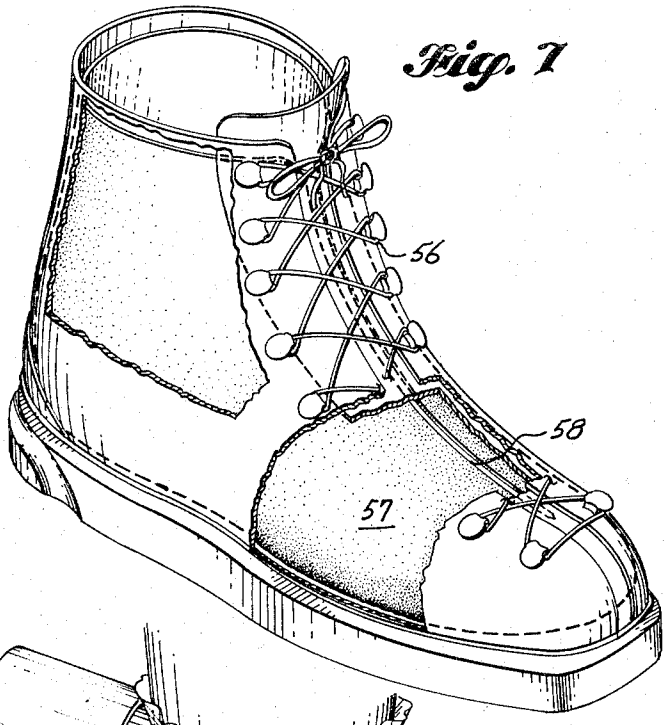
Fig. 7



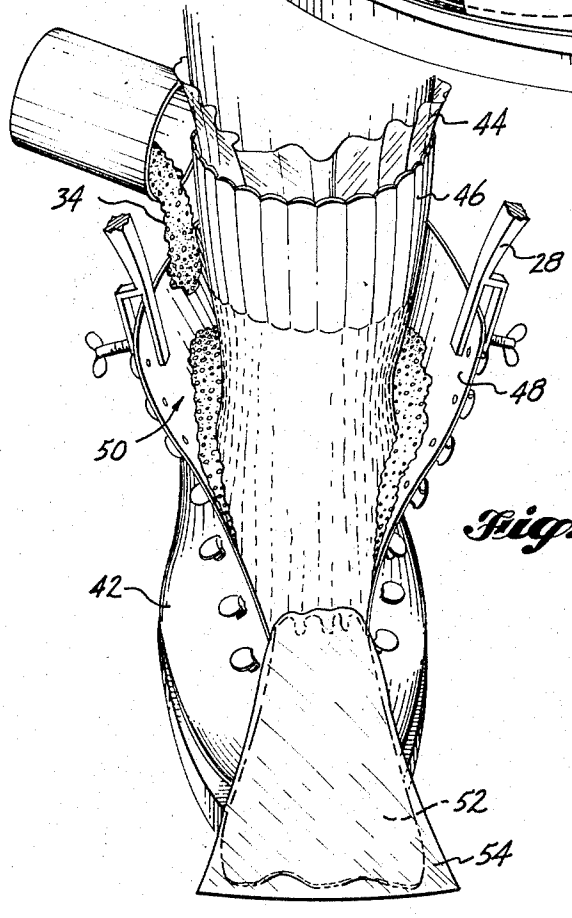


Fig. 8

INVENTOR.
RAYMOND R. JOHNSON
BY Christensen, Sanborn & Matthews
ATTORNEYS

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3,377,721

REINFORCED SKI BOOT AND METHOD OF MAKING THE SAME

Raymond R. Johnson, 6457 S. 124th, Seattle, Wash. 98178

Filed May 4, 1966, Ser. No. 547,459
14 Claims. (Cl. 36—2.5)

ABSTRACT OF THE DISCLOSURE

A reinforced ski boot or the like is disclosed, together with the method for reinforcing it. According to the method, the boots are mounted over mandrels corresponding to the wearer's feet, having ankle portions thereon which occupy the foot access openings in the tops of the boots. These mandrels may be constituted by the wearer's feet themselves. In any event, cavities are formed between the mandrels and the sides of the boots, which communicate with the ambient outside surroundings of the boots, through ankle openings in the tops of the boots at a level adjacent the aforesaid ankle portions of the mandrels. A foamable liquid resin compound is introduced into each such cavity, through the ankle opening thereof, when the resin is in a viscous catalyzed, but substantially uncured, foamed condition. The sides of the boots are then compressed against the mandrels, while the cavities are in communication with the outside surroundings of the boots through the ankle openings, so that the foam cells are collapsed and the resin is formed into semi-rigid ankle-fitting plates as it cures.

This invention relates to ankle supportive ski boots, orthopedic shoes and the like, and in particular to a method for reinforcing the ankle supporting capacity of such shoes and boots, either at the time they are manufactured or at a subsequent time when the person using or wearing the shoes or boots may desire to add to or strengthen the ankle supporting capacity of the same.

There are essentially two forms of ski boots on the market today. Each form has thick layers of leather or other stiff covering material which form the side walls of the boots and which are buckled, laced or otherwise fastened together over the tops of the wearer's feet to lend support and rigidity to his ankles during the skiing operation. One form has essentially no more than a single layer of this material at each of the sides. The other form has a second layer in that high topped inner shoes are inserted within the boots and secured to the bottom thereof so that in effect each boot has hollow double walled side panels which are seamed shut along the sole and open along the top. The backs of the inner shoes may also be secured to the backs of the boots so that the panels are separated from one another at the rear. But, in general, the boots and shoes are otherwise so loosely interconnected that while they resist any tendency to collapse in the lateral direction, they nevertheless provide ample freedom of movement for the wearer's toes and ankles to enable him to wiggle his toes for warmth and comfort and to bend his legs forward at the instep for proper positioning of his body on the skis.

To a large extent, new boots of either construction provide good support for the wearer's ankles. However, this support rapidly diminishes as the boots are put to use. The covering materials with which the boots are made are chosen for the fact that they impart stiffness and rigidity to the sides of the boots, yet are sufficiently flexible and stretchable to form comfortably over the outline of the wearer's ankles. Unfortunately, as time passes and as the materials are flexed and stretched in use, they tend to soften and become more pliable and supple, and

therefore less capable of imparting stiffness to the boots. Ultimately—and often about the same time as the boots seem well "broken in" to the wearer—the materials afford so little ankle support that the wearer can easily experience a collapsed ankle on a sharp turn or other abrupt maneuver.

One object of the invention is to provide a means and technique whereby the ankle supporting capacity of ski boots, orthopedic shoes and the like can be reinforced. Another object is to provide a means and technique for refurbishing the ankle supporting capacity of old or worn boots of this nature. A still further object is to reinforce the ankle supporting capacity of boots of this nature without detracting from the necessary toe and instep characteristics which the boots must provide during use. Still other objects include the provision of a technique for lining or packing the sides of the boots with wedges or plates of semirigid plastic resin material which increase the stiffness and rigidity of the sides, without altering the toe and instep characteristics of the boots. They also include the provision of a technique whereby the wedges or plates can be made to take on the contour of the wearer's ankles, and the process of forming the same can be carried out quickly and easily with inexpensive equipment, and with a resin material that is readily obtainable and easily manipulated in the steps involved. Still further objects will become apparent from the description of the invention which follows.

These objects are realized by a means and technique of my invention wherein the wearer's boots are mounted over a pair of mandrels corresponding to his feet, and preferably over his feet themselves; and either at this time or before, double-walled, open-topped cavities are formed between the mandrels and the sides of the boots and a foamable liquid resin compound is introduced into each such cavity through its top opening, and the sides of the boots are compressed against the mandrels, i.e., the wearer's feet, to collapse the foam cells and form the resin into impressed semirigid ankle fitting plates as the resin cures. The resin compound is in a viscous catalyzed, but substantially uncured foamed condition when introduced, and has considerable residual foaming action so that the tendency to froth can be used in reaching the relatively inaccessible portions of the cavities. Polyurethane foam is best suited to the operation, although other liquid resins which can be foamed in place at room temperature are also applicable. Examples of the latter are those liquid epoxy and phenolic resins which can be foamed and spread controllably from a container, preferably after they have entered into the frothing stage.

In the case of boots which are equipped with inner shoes, the shoes operate with the boots to form cavities down the sides of the boots. If desired, these cavities may be used for purposes of the reinforcing operation. In doing so, however, the resin is preferably introduced at points behind the toes of the boots and in a quantity sufficiently limited to spread through the cavities without entering the toes when the sides of the boots are compressed.

In the case of boots which have no manufactured inner shoes, the mandrels may define the cavities or some other form of inner shoe or inner liner may be interposed between the mandrels and the sides of the boots. The liners may or may not be incorporated into the finished product. If they are not incorporated into the boots, they must, of course, be nonlaminable with the resin so that they can be parted from the boots after the resin has cured. My present practice is to use a composite inner liner of two separable layers, the inner layer of which acts as a parting medium, and the outer layer of which is laminable with the resin so as to be incorporated into the finished boot.

Preferably, the inner liner should also function as a

bleeder for the foam cells when the sides of the boots are compressed against the wearer's feet. My present practice for this purpose is to use a composite in which the outer layer is fibrous or coarsely textured and sufficiently porous to enable the foam cells to bleed upwardly over the surface of the parting medium.

The operation may be expedited by spreading apart the sides of each boot, and blowing, tamping, or otherwise packing the resin into the depths of the cavities about the mandrel. In some instances, however, all such agitation is avoided until after the sides of the boots are under compression.

It is advisable to use a parting film to mask the fastener means along the top of each boot.

In a practical application of this concept I use polyurethane foam and prepare the same shortly before introducing it into the cavities. The preparation is compounded with components and fillers adapted to produce the flexible or soft and resilient form of the cured foam. However, it will be appreciated that the foam packing and compression steps tend to break down much of the foam, and that as a consequence the resin takes on a semirigid nature when cured.

My technique is illustrated for each type of boot in the accompanying drawings. In the drawings FIGURE 1 is a top perspective view of a type of ski boot which is equipped with inner shoes, the boot having been masked and opened at the top for introduction of the resin compound;

FIGURE 2 is a similar view of the boot illustrating the manner in which the compound may be introduced by pouring;

FIGURE 3 is a part perspective view of the inner shoe of the boot, illustrating the manner in which it may be clamped shut during the resin pouring operation;

FIGURE 4 is a top perspective view of the boot after the wearer has inserted his foot and the sides of the boot have been compressed against it;

FIGURE 5 is a side perspective view of the finished boot with the side of the same partly broken away to illustrate the semirigid resin plate which is formed therein;

FIGURE 6 is an upright cross section through the ankle portion of the finished boot in FIGURE 5;

FIGURE 7 is a view of the type used in FIGURE 1 but relating instead to a boot which has no inner shoe and in which an inner wall for the cavities is formed, therefore, by other means, as shown;

FIGURE 8 is a view similar to that of FIGURE 5 but relating in this case, to the boot of FIGURE 7.

In the drawings, the double-walled boot of FIGURES 1–6 is indicated by reference character **2**. The boot has a heavy leather upper construction **4** which is formed over and secured to a thick multilayer composition sole **6** that is suitably adapted to be clamped or otherwise fastened to a ski (not shown). To facilitate putting on and removing the boot, the flanks or sides **8** of the same are separable along the instep so that they can be folded away from one another in the manner illustrated in FIGURES 1 and 2. Inside of the boot is a high topped inner shoe **10** which is also constructed from leather or similar pliable material. As with the boot, the flanks or walls **12** of the shoe are also separable along the instep to admit the wearer's foot.

In FIGURE 4, the wearer has inserted his foot and a lacing or binding **14** has been used between fastener means on the flanks of the shoe and boot to lash first the shoe and then the boot over his instep. Typically the shoe fasteners take the form of riveted leather loops **16**, whereas the boot fasteners are in the form of short metal hooks **18**. Of course, other means such as buckles may be used. It is my present practice to stretch a strip of polyethylene parting film **20** over the fastener means of the inner shoe before beginning the operation. Two such strips can be seen in FIGURE 1, and it will be noted that each is secured in place by laying a companion strip of masking tape **22** along the lower edge of the film to adhere it to the face of the flap.

It is also my present practice to enlarge or broaden the top opening of each cavity **24** before beginning the wedge or plate forming operation. This can be accomplished by applying a clamp **26** to the walls **12** of the inner shoe and a pair of spreader arms **28** to the sides **8** of the boot. For the sake of clarity, the clamp is indicated schematically in FIGURE 1. However, the jaws of the same can be seen in detail in FIGURE 3. It will be noted that they are equipped with opposing platens **30** that operate to draw up the full length of the walls **12** to one another. The spreader arms **28** are also seen only in part for the sake of clarity.

The tips are equipped with C clamps **32** for attaching the arms to the sides of the boot. In essence, any means can be used which serves the function of pinching the shoe and spreading and holding apart the sides of the boot. Such a means might also serve to mask the fastener means on the shoe.

Having masked the fastener means on the shoe and having laid open the tops of the cavities **24**, the next step is to pack each of the cavities with a suitable resin. As indicated earlier, I prefer to use collapsed polyurethane foam. At present, I prepare the foam from Arothane 8150A and 8150B, a polyester and diisocyanate blend manufactured by Archer-Daniels-Midland Company of Minneapolis, Minn. The two components are intermixed in a container **33** and almost immediately, i.e. within minutes after mixing, the mixture **34** is poured into each of the cavities in the manner illustrated in FIGURE 2. Under such conditions, the "creme" formed in the container begins to froth and while it contains residual foaming action, is applied to the boot. I find that under such conditions the resin is easily workable, that is, spreadable yet sufficiently tacky and viscous to remain cohesive and relatively nonflowable so that I can control its application. It has a tendency to spread in the cavities by slow gravity flow and by continued frothing, and to some extent will work its way into the depths of the cavities. However, it is expeditious to tamp or otherwise pack the foam into the cavities, as by using a short rod or other plunger-like element (not shown) that can be inserted well down between the walls of the same. Of course, no foam should be tamped into the toe **36** of the boot if it is desired to leave this unoccupied.

The foamed condition of the resin **34** also enables the wearer to insert his foot into the boot and to lace it about his foot in the manner of FIGURE 4. Many of the foam cells are collapsed in the packing operation; however, the density of the resin remains sufficiently low that the walls **12** of the shoe can be spread apart and opened at the flaps for insertion of his foot. Preferably, he should put on his sock and take all steps necessary to simulate the conditions under which he will wear the boot. He should also lace up the boot with the same thought in mind. Because much of the volume of the cavities is taken up in the loss of foam cells, there is little internal pressure on his foot and little tendency for the resin to spread beyond the limits prescribed for it. There is, however, some tendency for the resin to swell the boot in lateral directions, and in order to collapse the foam into relatively thin wedges or plates **38** as seen in FIGURE 6, a pair of wide-faced clamps **40** are applied to the sides of the boot to impress the resin over the contour of the wearer's ankle. With the sides thus clamped about his foot, the wearer should remain in a standing position for approximately twenty minutes or more while the resin cures and hardens in the cavities. In this way the cured plates take on the contour of his ankle under the same conditions in which he will wear the boot, that is, with the full weight of his body supported on the same and with the boot tightly fastened about it as in use. Once the resin has hardened or substantially so, the boot can be removed and the parting film **20** and any excess

of resin along the tops of the cavities clipped away to complete the operation.

As purchased on the market, the boot 42 seen in FIGURES 7 and 8 has no inner shoe and it is desirable therefore to provide an inner liner for the reinforcing operation. My present practice is to form the same from a polyethylene bag 44 and a heavy wool or cotton sock 46 over each foot. The wearer slides the bag and then the sock over his foot and then inserts the same into the boot. The spreader arms 28 are applied to the sides 48 of the boot and as the wearer leans slightly forward, the resin 34 is poured into the cavities 50 formed between the sock and the sides. The tongue 52 of the boot, which is also covered with a polyethylene bag 54, is then laid over the wearer's instep and the two sides 48 are drawn together and fastened by lacing 56, as seen in FIGURE 8. Under compression from the sides 48, the resin moves freely through the cavities 50 and seeks out any voids which remain. It also penetrates the sock 46 so that the sock is laminated to the cured resin 57 and becomes part of the finished boot. Preferably, the resin should be introduced immediately after the two ingredients are brought together so as to afford the maximum residual foaming action, and the wearer should "rock" or otherwise shift his foot about in the boot to assist in spreading the resin through the cavities.

When the resin has cured so as to become substantially form-sustaining, the boot is unfastened, the tongue is pulled out to expose the sock, and a cut 58 is made down the instep of the sock to enable the wearer to remove his foot from the boot. The polyethylene bag 44 is also removed and the exposed portion of the sock is trimmed away at a level even with the top of the boot to complete the product. See FIGURE 7.

In most instances, I also place a loose packing (not shown) in the toe of the boot, or wrap the wearer's foot in something of the same before he inserts it into the boot, and in fact before he inserts it in the polyethylene bag 44, in order to maintain a clearance around his toes for the time when the boots are put to use. The packing is, of course, removed with the bag.

The above described techniques and the products therefrom are only illustrative of my present practices. It will be appreciated, therefore, that many modifications and additions can be made in and to these practices without departing from the spirit and scope of the invention as defined in the claims following.

I claim as my invention:

1. An ankle supportive ski boot or the like having a foot access opening in the top thereof, and a plate of semi-rigid collapsed-foam resinous compound formed contiguously adjacent each side thereof over the region of the ankle and in form-fitting contour in relation to such ankle, the upper surfaces of the plates being openly exposed to the ambient outside surroundings of the boot, at a level adjacent the foot access opening therein.

2. An ankle-supportive ski boot or the like according to claim 1 wherein the resinous compound is collapsed polyurethane foam.

3. An ankle-supportive ski boot according to claim 1 wherein the plates are interposed between the sides of the boot and an inner liner within the boot.

4. An ankle-supportive ski boot according to claim 3 wherein the inner liner takes the form of a sock which is laminated with the plates.

5. An ankle-supportive ski boot according to claim 3 wherein the inner liner takes the form of an inner shoe which is secured to the bottom of the boot.

6. A method of reinforcing ankle supportive ski boots and the like which comprises mounting the boots over mandrels corresponding to the wearer's feet, there being double-walled, open-topped cavities formed between the mandrels and the sides of the boots, introducing into each such cavity through its top opening, a foamable liquid resin compound which is in a viscous catalyzed, but substantially uncured, foaming condition when introduced, and compressing the sides of the boots against the mandrels to collapse the foam cells and form the resin into semirigid ankle fitting plates as the resin cures, the boots being equipped with inner shoes which operate to form the cavities with the sides of the boots, and the resin being introduced into the cavities at points behind the toes of the boots and in a quantity sufficiently limited to spread through the cavities without entering the toes when the sides of the boots are compressed.

7. The method according to claim 6 wherein the resin is packed into the cavities before the mandrels are inserted into the boots.

8. A method of reinforcing ankle supportive ski boots and the like which comprises mounting the boots over mandrels corresponding to the wearer's feet, there being double-walled, open-topped cavities formed between the mandrels and the sides of the boots, introducing into each such cavity through its top opening, a foamable liquid resin compound which is in a viscous catalyzed, but substantially uncured, foaming condition when introduced, and compressing the sides of the boots against the mandrels to collapse the foam cells and form the resin into semirigid ankle fitting plates as the resin cures, there being inner liners interposed between the mandrels and the sides of the boots, to form the cavities with the sides of the boots, and the inner liners being nonlaminable with the resin so that they can be parted from the boots after the resin has cured.

9. The method according to claim 8 wherein the inner liners are a composite of two separable layers, the inner layer of which acts as a parting medium, and the outer layer of which is laminable with the resin so as to be incorporated into the finished boot.

10. A method of reinforcing ankle supportive ski boots and the like having foot access openings in the tops thereof, comprising mounting the boots over mandrels corresponding to the wearer's feet, having ankle portions thereon which occupy the access openings of the boots, there being cavities formed between the mandrels and the sides of the boots, which communicate with the ambient outside surroundings of the boots, through ankle openings in the tops of the boots at a level adjacent the aforesaid ankle portions of the mandrels, introducing into each such cavity, a foamable liquid resin compound which is in a viscous catalyzed, but substantially uncured, foamed condition when introduced, and compressing the sides of the boots against the mandrels, while the cavities are in communication with the outside surroundings of the boots through the ankle openings, so that the foam cells are collapsed and the resin is formed into semi-rigid ankle fitting plates as it cures.

11. The method according to claim 10 wherein the resin compound is introduced into the cavities through the ankle openings thereof.

12. The method according to claim 10 wherein inner liners or shoes are interposed between the mandrels and the sides of the boots, to form open-topped cavities with the sides of the boots.

13. The method according to claim 10 wherein the boots are fastened about the mandrels to compress the sides of the boots against the same.

14. The method according to claim 10 wherein the foamable resin compound is polyurethane.

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PATRICK D. LAWSON, *Primary Examiner.*