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SKI BOOTS HAVING A THIXOTROPIC MATERIAL ENCIRCLING THE ANKLE PORTION THEREOF

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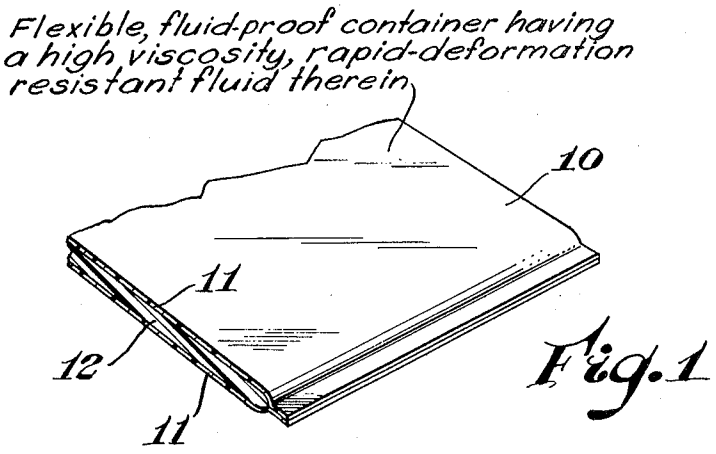


Fig. 1

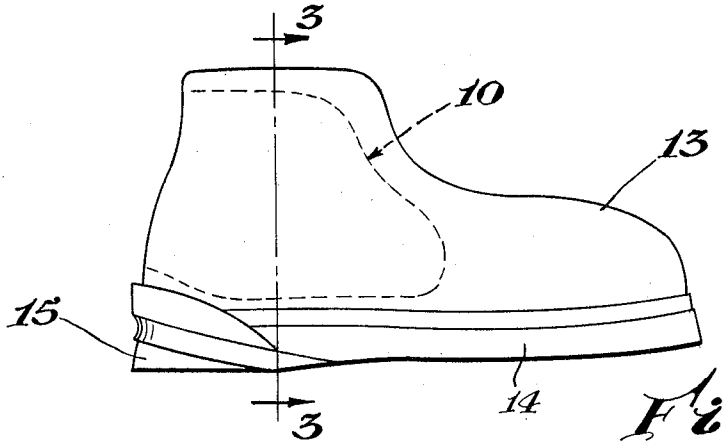


Fig. 2

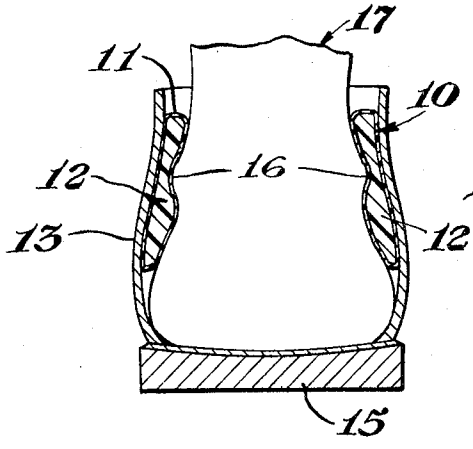


Fig. 3

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SKI BOOTS HAVING A THIXOTROPIC MATERIAL ENCIRCLING THE ANKLE PORTION THEREOF

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6 Claims. (Cl. 36—2.5)

The present invention relates to ski boots and similar sports shoes where rigid encasement of the ankle part of the foot is desired. More specifically, the present invention relates to a pad of thixotropic material at least partially encasing the ankle of the wearer, itself being encased by the boot or article of footwear.

This application is a continuation-in-part of my application Serial No. 249,062 filed January 2, 1963, which in turn is a continuation-in-part of my application Serial No. 861,111 filed December 21, 1959, both now abandoned.

Considerable study has been accomplished in the past to provide a ski boot which would be comfortable and at the same time give sufficient support to the foot and ankle. For example, U.S. Patent 2,444,428 is directed to a pivotal external ankle bone covering designed to hold the heel flat in the boot while at the same time allowing forward flexing of the knee. However, if this boot is tightened sufficiently to give adequate support and control, uniform but unceasing pressure is applied all over the side of the ankle, even the tender portions, thereby creating an uncomfortable or even painful condition. An attempt to overcome this discomfort problem has been shown in U.S. Patent No. 2,531,763 wherein the rearward portion of the boot has pads adapted to fit into the depressions in back of the ankle. Here too, in actual use, these pads are uncomfortable because substantial pressure is expended over a relatively small area. The next development of the art is exemplified by U.S. Patent No. 2,774,152 wherein a fluid filled pad designed to encase the ankle is provided. The fluid used would either be air or (as in a subsequent development) water containing an antifreeze agent. While this boot was relatively comfortable, it suffered from the problem that any pressure applied was instantaneously and continuously applied over the whole surface of the pad with consequent pain to tender portions of the ankle.

It is, therefore, a principal object of the present invention to provide an article of footwear which gives excellent support to the foot with comfort.

Still another object is to provide a ski boot pad whereby the pressure may be locally lowered, for example on one side of the foot by pressure of the foot toward the other side of the boot and vice versa. Such periods allow free blood circulation and avoid the discomfort of long periods of unchanging pressure as applied by compressed rubber or plastic foam, air or liquid filled pads, etc., all of which follow changes in foot "pressure" very rapidly to provide an inescapable, uniform force which acts to cut blood supply.

Still another object of the invention is to provide a ski boot which will conform, with limited use, to the foot of the wearer, yet be comfortable upon the application of stresses.

Other objects will become apparent hereinafter.

The accompanying drawings illustrate a preferred embodiment of the present invention but are not to be construed as limiting.

FIG. 1 is a section of the pad which, when appropriately located at the sides of the wearer's ankle and enclosed by an ankle covering boot, comprise the present invention.

FIG. 2 shows the positioning of the pad of FIG. 1 around the back and side of the ankle within the boot.

FIG. 3 is a section 3—3 taken from FIG. 2.

Generically, the pad of the present invention may be

defined as a high-viscosity, flowable material resistant to rapid deformation contained within the ankle encasing means of an article of footwear. This high-viscosity-flowable material may further be defined as thixotropic, that is, responding to instantaneous pressure in the same manner as a solid, but responding to a continuously applied pressure as a liquid. These properties are also known as dilatancy. Representative high viscosity flowable fluids resistant to rapid deformation are materials such as (a) those described in U.S. Patent No. 2,431,878 having a liquid dimethylsilicone base into which has been mixed boric oxide, commonly known as "bouncing putty"; (b) stereospecific polybutadiene rubber prepared by the alkyllithium catalysis of butadiene, which contains over 90% 1,4-addition (30–40% cis-1,4-), has a relatively narrow molecular weight distribution, is amorphous but of linear structure, is gel-free, characterized by cold flow, absence of nerve, good low temperature properties, minimum tack, and better steel ball rebound at room temperature (23° C.) than natural rubber; (c) some epoxy resin gels; (d) gels of hydrous ferric oxide, alumina, vanadium, pentoxide, zirconium dioxide, stannic oxide; (e) gelatin gels or sols, fine suspensions of certain clays, particularly bentonites, and (f) specialized protein mixtures. Stereospecific polybutadiene rubber is preferred. Additional viscosity may be imparted to these thixotropic (dilatant) materials, if desired, by incorporating up to an equal weight of a fiber, either natural, for example cotton or wool fibers and the like, or synthetic, for example polystyrene, nylon, acrylonitrile and the like.

The thixotropic material is contained within a flexible sheet material, for example, leather, plastic, cloth or rubber sheet material, such as boot leather, Saran, polyethylene, polyvinyl chloride, mylar, synthetic or natural rubber, nylon, or laminates of these materials. Leather is preferred since the thixotropic material tends to "marry" with the leather thereby avoiding excessive slumping of the material when the boot is not in use. The edges of the pad may be glued, heat sealed, welded or sewn in a manner such that the thixotropic material will be retained within the pad.

The pad will be substantially flat and will have an original or nominal thickness of from about 0.04 inch to about 0.6 inch depending upon the desires of the user. Placement of the pad is readily accomplished by positioning it about the sides, and if desired, back of the ankle within the boot. Upon tightening the boot, momentary discomfort will be noted, but after a few minutes [depending upon the viscosity of the thixotropic (dilatant) material] the pad will flow to conform to shape of ankle giving a high degree of comfort. Thereafter, upon the application of instantaneous pressure, the pad will be resistant to flow, and the stresses will be applied at those portions of the ankle best able to withstand them.

Referring now to the drawing, pad **10** is composed of two layers of a fluid proof flexible film **11** having sufficient strength to retain the thixotropic material **12**. Pad **10** is positioned within boot **13** having a sole **14** and heel **15** portion. Pad **10** is within the vamp or upper of boot **13** in a preferred embodiment next to ankle extremities **16** of foot **17**. Stated another way, pad **10** is placed in the boot **13** in a manner such that it is positioned from near the front of one quarter portion, encircles the side and the back of the ankle, and proceeds to near the front of the other quarter portion whereby substantially complete confinement of the ankle extremities **16** of foot **17** is achieved by pad **10**. Of course, the foot **17** may be encased in stockings and/or light leather pads with pad **10** being between the relatively rigid or upper of boot **13** and the stockings or light leather pads. Also, if an appropriate thixotropic material is selected, such as the stereospecific butadiene rubber identified as (b) above, a

thickness of this material may be placed between the inner and outer boot of a ski boot without the need for a separate layer of film **11**, the outer boot serving as the outer layer and the inner boot serving as the inner layer of film **11**. Of course, a light cloth covering over the pad can be provided in this embodiment, if desired.

Pad **10** may be designed so as to wrap around the ankle portion of the foot completely, or it may cover just the area at the sides and back of the ankle. If this latter design is utilized a pad **10** in the tongue of the boot adapted to cover the front of the ankle may also be employed.

Also the pad of the present invention may be affixed to or a part of the tongue of the boot. In this configuration the tongue of the boot will have extensions adapted to encase the sides and back of the ankle of the wearer when the boot is worn. If the boots and tongues are made interchangeable, a store can inventory fewer boots and still achieve fits, and will allow good fitting of those people having different sized feet.

The pad of the present invention, unlike air bladders of the prior art is not noticeably temperature sensitive. This is particularly significant with ski boots which are usually put on in a warm area and used in a cold area. Air bladders will, when subjected to cold, decrease substantially in size and correspondingly in control. Also those ski boots that utilize air bladders, sponge rubber or foam rubber as the ankle encasing means are uncomfortable because they can be tightened sufficiently to stop the flow of blood in localized areas. When the foot is shifted to relieve the resulting localized pain, the air or sponge or foam will instantaneously follow and no relief is possible. However, with pad of the present invention such instantaneous following occurs and relief is possible.

If a thixotropic material is employed that has flow characteristics such that excessive slumping of the pad occurs during storage, or, if it is desired to provide additional warmth for the wearer, a laminate of aluminum foil and thixotropic material may be provided as the pad of the present invention. This laminate will have alternate layers of thixotropic material and aluminum foil, generally with the thixotropic material as the outside layers. Several thicknesses of aluminum foil separated by thixotropic material may be employed, if desired. The aluminum foil chosen for the laminate should have a maximum thickness of less than .007 inch, preferably about .0015 inch. The thixotropic material in the laminate should have a thickness of at least about .001 inch, preferably at least .002 inch.

A specific example of the use of the pad of the present invention was to replace the air pad of Henke Air-Flite ski boot with a similarly shaped pad using the "bouncing putty" hereinbefore defined, in the pad. The other boot was used in a conventional manner with air pressure serving as the pad. It was noted that the boot containing the pad of the present invention could be tightened sufficiently to cause the leather to tear without discomfort to the foot of the wearer. This could not be accomplished with the other boot without excessive pain. Better control of the skis may be obtained from the boot containing the pad of the present invention than can be obtained with conventional boots.

Another specific example of the use of the pad of the present invention was to replace the sponge rubber in the ankle portion of a Henke buckle boot with a pad having a nominal thickness of 0.19 inch of stereospecific polybutadiene rubber as hereinbefore defined. While the same boot with sponge rubber was uncomfortable to the

wearer, the boot with the pad of the present invention was, after being worn for ten minutes (to allow the pad to conform to the shape of the wearer's ankle) was comfortable even when sufficiently tightened to give excellent control of the skis.

Satisfactory results may also be obtained by incorporating the pad of the present invention in the ankle portion of a stocking, the pad forming a unit with the stocking, or with the ski trousers worn inside the boot.

If desired, foam or sponge rubber may be used in conjunction with the thixotropic pad of the present invention, provided that the total area of sponge or foam rubber is less than 20% of the total nominal area of the pad of the present invention.

Various modifications may be made in the present invention without departing from the spirit or scope thereof and it is to be understood that I limit myself only as defined in the appended claims.

I claim:

1. In a boot that covers the ankle of the wearer, the improvement which comprises providing in combination with said boot along the sides and back of the ankle portion thereof, a pressure compensating ankle support that assumes the shape of the ankle, said support having covered, high-viscosity, thixotropic material maintained in place within a flexible, protective, sealing envelope, said confined thixotropic material not substantially changing in volume responsive to ambient temperatures, having a nominal thickness of about 0.04 inch to about 0.6 inch, and being resistant to flow in response to instantaneous pressure and flowing in response to continuously applied pressure to provide pressure on those portions of the ankle that can best withstand it and to allow portions of the ankle momentarily to move away from pressure.

2. The improved boot of claim **1** wherein the thixotropic material is dimethylsilicone rubber mixed with boric oxide.

3. The improved boot of claim **1** wherein the thixotropic material is stereospecific polybutadiene rubber.

4. The improved boot of claim **1** wherein said boot is constructed of inner and outer layers and said envelope is formed of said layers.

5. The improved boot of claim **1** wherein said envelope is a pad positioned within the boot.

6. The improved boot of claim **1** wherein the thixotropic material is provided in a laminate of alternate layers of thixotropic material and aluminum foil, said aluminum foil having a maximum nominal thickness of about 0.007 inch, and said thixotropic layers having a minimum nominal thickness of at least about 0.001 inch.

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