A boot, especially ski boot, which comprises a hard-elastic outer shoe with a first step-in opening, and a relatively thick-walled soft-elastic inner shoe arranged within said outer shoe and consisting primarily of cellular polyurethane on the basis of polyester and having a spreadable second step-in opening extending up to the leg area of the inner shoe. Deformable chamber means are provided between the two shoes and are adapted to be filled with a viscous fluid while valve means are associated with the chamber means for selectively closing the same or feeding fluid into or withdrawing fluid from the chamber means.

9 Claims, 9 Drawing Figures
The present invention relates to a boot, especially ski boot, which comprises a hard-elastic outer shoe and an inserted thick-walled soft-elastic one-piece inner shoe of preferably cellular material, and which is provided with a step-in opening, adapted to be spread open, on the inner as well as on the outer shoe and is furthermore provided with at least one hollow chamber which in order to adapt the same to the shape of the foot may be filled with a filling substance, the hollow chamber being formed, for instance, by an inflatable body closed by a valve, into which hollow body through a mouth piece connected to the valve the filling substance may be injected and may be released.

For adapting such ski boots to the shape of a foot, it is known to fill into the inflatable body of the inner shoe a hardening foam after the foot has been slipped into the boot. The adaptability of such known ski boots is also affected by an improper arrangement of the step-in openings which, depending on the size of the foot, can either not be completely closed or cannot be closed tightly enough.

It is, therefore, an object of the present invention to provide a boot, especially ski boot, of the above outlined general character which will overcome the above outlined drawbacks.

This object and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 is a vertical cross section through a ski boot according to the invention, said section passing through the region of the ankle.

FIG. 2 shows a portion of FIG. 1 with the inner shoe adapted to the shape of the foot.

FIG. 3 is a side view of the inner shoe.

FIG. 4 is a top view of FIG. 3.

FIG. 5 is a front view of FIG. 3.

FIG. 6 is a side view of the inner shoe with a filling device.

FIG. 7 shows on a larger scale than that of FIGS. 1 to 6 a valve for use in connection with the present invention.

FIG. 8 is an embodiment of an outer shoe according to the invention consisting of two sections.

FIG. 9 is a section taken along the line IX — IX of FIG. 8.

The boot according to the present invention, which has an inner shoe and an outer shoe, is characterized primarily in that the inner shoe consists of cellular polyurethane on the basis of polyester while the filling mass consists of a viscous liquid, the opening of the outer shoe being located in the vertical longitudinal central plane, and the opening of the inner shoe extending from the front of the central plane toward the rear while spreading laterally toward the side of the small toe, the marginal areas of the opening in their extension along the leg overlapping over half their sides. During the reaction of toluenediisocyanate with polyester, a relatively soft but rather unelastic polyurethane is formed which, when being subjected to a pressure load, is supposed to have a saddle-shaped characteristic curve. The viscous liquid forming the filling mass should be composed of from 70 to 80 percent water, 27 to 17 percent glycerin or glycol and 3 percent cellulose derivate and should have a viscosity of from 15,000 to 20,000 centipoise at room temperature. This liquid changes its viscosity only slightly with changing temperatures and is frost resistant at temperatures customary in ski areas. The cellulose derivate increases the viscosity of the liquid and is added until the above mentioned value is obtained. The liquid which can easily be deformed without offering any particular resistance acts together with a relatively strong but only slightly elastic material which, when not considering any possible shoe lining or thin cushioning layers, comes into direct contact with the foot and due to the pressure of the liquid conforms to the shape of the foot. The only slight elasticity of the layer formed from the described substances will together with the viscous liquid prevent a change in its once adopted shape, so that even when the boot is not worn for days or even weeks, it will retain this shape. A change in the shape will occur only when greater forces act upon the boot for a longer period of time, as is the case, for instance, when another person wears the boots for some time. An immediate considerable change in the shape can always be effected by a new filling in of the liquid into the hollow chamber of the boot.

In addition to this surprisingly good adaptability and shape retaining property, the boot according to the invention has the further advantage that the foot is very firmly rested in the boot. This is due in part to the good shape retaining property of the boot and in part to the strong layer of polyurethane located between the foot and the liquid. The low elasticity of this layer brings about a good connection to the shoe so that the feeling of the foot floating in the boot is entirely eliminated. The material of the layer should according to the rubber technology be a kind of "dead material" as is the case with rubber having a high proportion of reclaimed rubber.

For purposes of further improving the adaptation of the boot to the foot, the outer shoe is provided with a known gaping opening and with a flap covering up this opening. The inner shoe is likewise provided with an opening adapted to be spread open and offset with regard to the opening of the outer shoe. The opening of the inner shoe is designed as gaping opening in the region of the upper arched portion of the foot and as overlapping opening in the leg region. If, when closing the outer shoe, the part above the upper arched foot portion is closed and tensioned, the gaping opening of the inner shoe will also close and the edge portions will be pressed against each other in a butt joint and tight manner. In this way no elevation can form which would interfere with the fit of the inner shoe because, when the opening edges abut each other, a smooth almost gap-free surface is formed on the inside while any possible upsetting is conveyed to the walls surrounding the entire foot. That portion of the inner shoe, however, which surrounds the lower leg is providing with overlapping sections at the step-in opening since the leg carries out angular movements relative to the foot and, more specifically, in the ankle joint, even though these angular movements are only small; these overlapping sections at the edges of the step-in opening will prevent that the opening will not be properly closed or a gap is left open, with the result that always a proper closing of the boot will be assured. Thus, the foot which does not move in the shoe, is in a manner best suited more effectively sealed by the abutting edges or rims of the opening, whereas the leg area is sealed by overlapping
opening sections which provide a better sealing of the working leg. In addition thereto, the entire opening of the inner shoe is offset with regard to the opening of the outer shoe so that in addition to the comfort also an optimum sealing effect will be obtained.

In the present invention, the viscous liquid is provided in an inflatable body which is arranged on the outer surface of the inner shoe and has a valve adapted selectively to permit the inlet or outlet of the viscous substance. The inner shoe is on its outside precisely adapted to the shape of the outer shoe, whereas the inner part of the shoe is designed in conformity with the normal shape of a foot. By a corresponding filling of the inflatable body, the inner shoe can be precisely adapted to the shape of the foot of the respective wearer of the boot. To this end, there is provided a valve which for filling and emptying the inflatable body consists of a self-closing rubber elastic hose piece the lining of which seals itself when it is punctured.

For filling the inflatable body, a hollow needle is directly or indirectly connected to a container containing the filling substance and is inserted into the valve or is pierced through the valve.

Finally, the further adaptability of the boot to the foot is assured by providing the upper edge of the outer shoe with perforations or the like which make this part of the shoe more bending elastic than the remaining portion of the shoe, and by providing the inner shoe with a collar which is angled off with regard to the leg and which has a sealing lip.

Referring now to the drawings in detail, the boot illustrated in FIGS. 1 and 2 is composed primarily of two parts, namely an outer shoe 1 and an inserted inner shoe 2. The outer shape of the inner shoe 2 corresponds to the inner shape of the outer shoe 1. In those areas of the inner shoe 2 where relative to the foot normally hollow spaces are present, recesses 3 are provided on each side as clearly shown in FIGS. 3 and 4. Into these recesses 3 there is inserted a single flexible and/or inflatable body 4 which covers up both sides of the inner shoe 2 and has a fitting cut while being fastened to the inner shoe, for instance, by an adhesive. The body 4 which has its walls in flat superimposed arrangement with each other has its rear portion provided with a valve 5 which comprises a thick-walled hose section with an insert, the hose section being self-sealing. When through valve 5 a viscous liquid is pressed into the body 4, the inner shoe will adapt itself to the shape of the foot and of the lower part of the leg 6 of the wearer of the boot as will be evident from FIG. 2. The inner shoe 2, regardless of whether it is lined or not, is at its inner surface provided with a layer of soft cellular rubber of uniform thickness (not shown). This layer may, if desired, be connected to the lining and then together with the lining may be connected to the inner shoe 2. Such layer has a thickness of approximately 2 mm and provides the inner walls of the inner shoe with an inner surface which snugly engages the foot but which is sufficiently thin to maintain the required firm contact of the foot with the inner shoe.

The outer shoe is made of relatively hard polyurethane, for instance of a hardness of 90 Shore A, and forms the outer shell or envelope of the ski boot while being provided with an opening 7. The opening 7 is adapted to be enlarged or spread open for the insertion of the inner shoe 2. By providing a non-illustrated flap, the opening 7 is closed and is held in this position by customary closing means. The opening 7 is located in the vertical longitudinal central plane of the boot and has a small opening gap so that when closing the boot, the marginal areas of the opening 7 can be brought to meet each other.

The inner shoe 2 is provided with an opening 8 which starts directly behind the toes and is offset in the direction toward the small toe with regard to the opening 7 of the outer shoe 1. In the region of the foot proper, the opening 8 has its marginal rims slightly spaced apart so that these marginal rims in finished condition of the inner shoe 2 will be spaced from each other by a distance of approximately one half or 1 centimeter. When closing the outer shoe, the marginal rims of the opening 7 are pressed against each other, whereby the region of the foot covered by the inner shoe 2 will be sealed toward the outside. The opening 8 will accordingly, in conformity with FIG. 5, follow the line 9. Above the foot portion, the opening 8 changes from a zone where the rims of the opening are slightly spaced from each other to a zone in the lower leg portion where the rims of the opening 8 overlap each other. In this leg zone, that rim of the opening 8 which starts at the side of the small toe ends in the end 10 engaging the leg, whereas that rim of the opening 8 which starts at the side of the large toe ends in the end 11 resting from the outside on the end 10. The ends 10 and 11 gradually decrease in thickness in the overlapping range so as to supplement their respective thickness to the full thickness of the boot wall.

For filling and emptying the body 4, a device is employed which is shown in FIG. 6. This device primarily comprises a valve 12 and a hollow needle 13. Valve 12, shown in FIG. 7 on an enlarged scale, comprises a short tubular section 14 with a collar 15 and a flange 16 which latter serves for connecting the valve 12 to the outer wall of the body 4.

For filling the body 4, the valve 12 is pierced by the hollow needle 13 and the filling substance is passed therethrough. Inversely, by piercing valve 12 with the hollow needle 13, filling substance can be withdrawn from the body 4. Each time the hollow needle 13 is withdrawn from the valve 12, the material of valve 12 returns to its original position and thus seals the piercing hole.

The hollow needle 13 has its rear end provided with a hollow collar 17 which has an inner thread by means of which the hollow collar 17 can be connected to a feeding or discharge line. The front end of the hollow needle 13 is closed. The two discharge openings 18 of the hollow needle 13 which are directed toward the side and are located opposite to each other will prevent that, when the hollow needle is stuck in too deeply, the inner wall of the body 4 is damaged or that the flow of the filling substance will be impeded. FIG. 7 shows only one opening 18 inasmuch as the other opening is located opposite to and behind the opening 18 visible in FIG. 7.

As a container for the filling substance there is employed a pressure can 19 which at its head end has a valve adapted to be opened by exerting a pressure thereon. The outlet tube 20 of can 19 is connected with the hollow collar 17 of needle 13. In the pressure can 19 there is provided a bellows 21 into which is filled the highly viscous liquid 22 forming the filling substance. The space in the pressure can surrounding the bellows 21 is filled with nitrogen at a pressure of approximately
8 atmospheres above atmospheric pressure, which when actuating the valve forces the liquid 22 from the bellows 21 through the hollow needle 13 into the body 4.

FIGS. 8 and 9 show a special design of the outer shoe according to the invention. In conformity with FIGS. 8 and 9, the upper margin or rim of the outer shoe 1 has perforations 23 which weaken the connection of the rim portion with the remaining wall portions of the shoe and thereby make the rim more yieldable. The perforations 23 are located on both ankle sides of the outer shoe 1; the rear portion of the outer shoe 1 is formed by a non-weakened rim connected to the remaining wall portions. Ther rear rim portion is separated from the perforated rim portions by cutouts 24.

According to FIG. 9, the inner shoe 2 ends at the upper rim, which latter has the shape of a collar, in a sealing lip 25 which in its rest position extends considerably inwardly and after placing the foot into the boot closely engages the same. If the foot is inserted into the boot at an angle, the sealing lip 25 will due to its considerably inwardly protruding section remain in engagement with the leg. The inner shoe 2 is furthermore provided with protrusions or dogs 26 which when inserting the inner shoe into the outer shoe, will engage the cutouts 23 or latch thereto. The protrusions 26 will retain the inner shoe 2 in its intended position and will prevent the inner shoe from lifting itself off or separating from the outer shoe at the upper margin so that a possible entrance of moisture will be eliminated.

It is, of course, to be understood that the present invention is, by no means, limited to the particular showing in the drawings but also comprises any modifications within the scope of the appended claims.

What we claim is:

1. A boot, especially ski boot, which includes: a hard-elastic outer shoe having a spreadable first-step-in opening extending along the central longitudinal plane thereof, a relatively thick-walled soft-elastic inner shoe consisting of a single piece and located within said outer shoe, said inner shoe consisting primarily of cellular polyurethane on the basis of polyester and having a spreadable second-step-in opening extending from the front portion of the inner shoe at the longitudinal central plane thereof toward the rear of said inner shoe while gaping laterally toward the small toe side, the rim areas of said second-step-in opening in the leg area of said inner shoe having portions laterally overlapping each other, deformable chamber means being provided between said shoes and adapted selectively to be filled with a viscous liquid, and valve means associated with said chamber means for selectively closing said chamber means and feeding liquid into and releasing the same from said chamber means.

2. A boot according to claim 3, in which said chamber means is deformable by admitting thereinto a highly viscous liquid.

3. A boot, especially ski boot, which includes: a hard-elastic outer shoe having a spreadable first-step-in opening extending along the central longitudinal plane thereof, a relatively thick-walled soft-elastic inner shoe consisting of a single piece and located within said outer shoe, said inner shoe consisting primarily of cellular polyurethane on the basis of polyester and having a spreadable second-step-in opening extending from the front portion of the inner shoe at the longitudinal central plane thereof toward the rear of said inner shoe while gaping laterally toward the small toe side, the rim areas of said second-step-in opening in the leg area of said inner shoe half laterally overlapping each other, deformable chamber means being provided between said shoes and adapted selectively to be filled with a viscous fluid, and valve means associated with said chamber means for selectively closing said chamber means and feeding fluid into and releasing same from said chamber means, the end of the inner one of the rim areas overlapping each other extending from the small toe side of the inner shoe while decreasing in thickness with increasing distance from said small toe side and having the inner surface of said end adapted to the outer contour of the lower leg portion of a person.

4. A boot according to claim 3, in which said chamber means contains a highly viscous liquid composed of from approximately 70 to 80 percent of water, from 27 to 17 percent of ethylene glycol, and of approximately 3 percent cellulose derivative, said viscous liquid having a viscosity of from 15,000 to 20,000 Centipoise at room temperature.

5. A boot according to claim 3, in which said chamber means is formed by an inflatable body interposed between said inner and outer shoe.

6. A boot according to claim 3, in which said valve means includes a tubular element with a rubber elastic self-sealing insert.

7. A boot according to claim 6, in which the interior of the hollow needle has lateral passage means leading into said chamber means.

8. A boot according to claim 3, in which the upper marginal area of said outer shoe is provided with perforation means to thereby make said upper marginal area more bend elastic than the remaining wall portion of said outer shoe, and in which the upper portion of said inner shoe forming the leg region thereof is provided with collar means angled off toward the leg region and having a sealing tip.

9. A boot according to claim 8, in which the upper portion of the inner shoe is provided with protrusion means corresponding in shape to said perforation means for interlocking engagement therewith.

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