June 20, 1967 L. ROBINSON 3,325,919

CUSTOM FOOTWEAR HAVING AN INNER SURFACE MOLDED TO THE FOOT OF A WEARER

Filed May 31, 1963

Fig. 1.

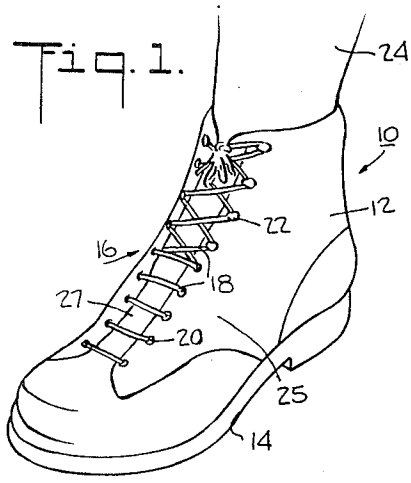


Fig. 2.

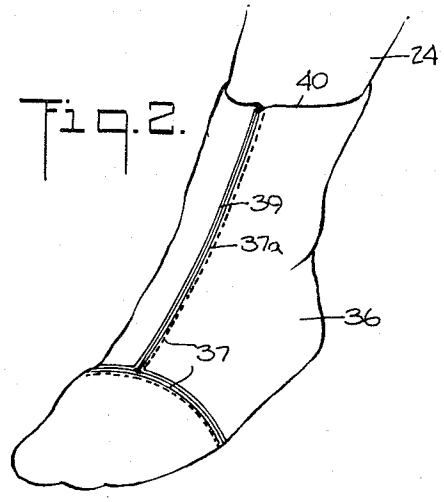


Fig. 3.

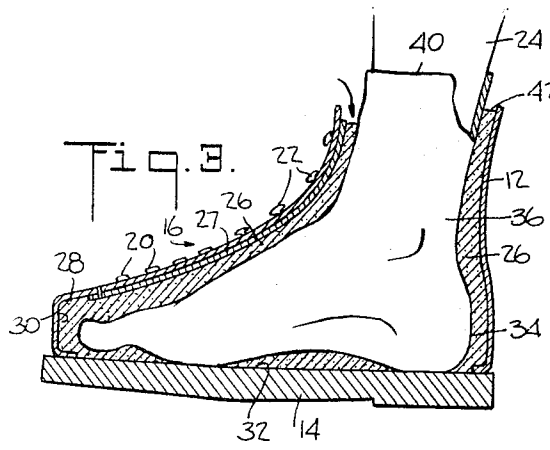


Fig. 5.

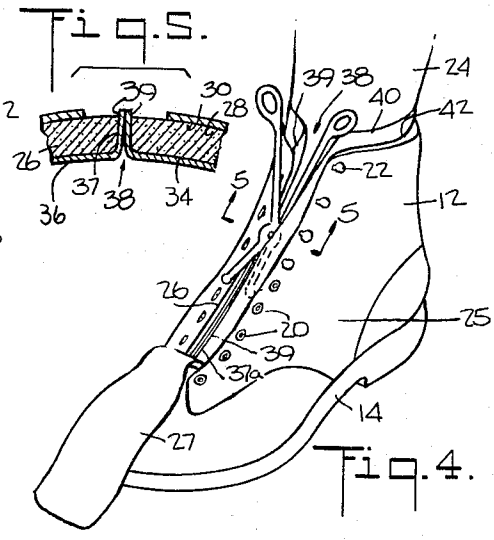


Fig. 4.

Fig. 6.

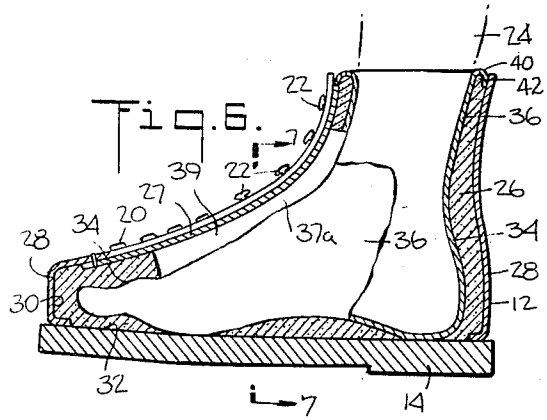
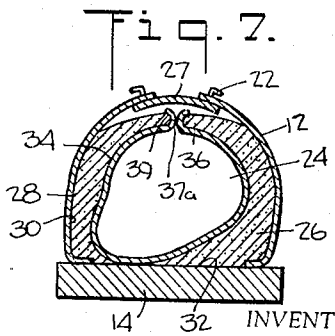


Fig. 7.



INVENTOR.
LEON ROBINSON

BY

Kirschstein, Kirschstein & Ottinger
ATTORNEYS

United States Patent Office 3,325,919
Patented June 20, 1967

3,325,919

CUSTOM FOOTWEAR HAVING AN INNER SURFACE MOLDED TO THE FOOT OF A WEARER

Leon Robinson, 161 Henry St., Brooklyn, N.Y. 11201

Filed May 31, 1963, Ser. No. 284,507
6 Claims. (Cl. 36—2.5)

This invention relates to footwear having an inner surface that is molded to precisely conform to the individual wearer's foot and to a method for making same, in minutes, directly upon the wearer's foot. More particularly, this invention relates to footwear consisting of a prefabricated joined vapor permeable upper and sole and, preferably, a supple vapor permeable inner liner initially fitted to the wearer's foot and a vapor permeable molded-in-place elastomeric core which bonds these parts into an integral vapor permeable structure.

It is highly desirable to provide a shoe having an inner surface, or a portion thereof, which has a shape and size conforming exactly to the contours of the surface of the wearer's foot for effective support or restraint, or both. Such footwear conforms initially to the shape of the wearer's foot and envelops the foot, or a substantial part thereof, with uniform distribution of pressure. There is no uncomfortable "break-in" period as is necessary with leather shoes made to an idealized last which is a compromise of all the variations in foot shapes within a given size range. Such leather shoes can only approximate the shape of the wearer's foot and can never conform exactly to the subtle contours of an individual foot. Moreover, certain synthetic leather, i.e. "poromeric," materials used in shoes have a strong memory of their "as new" condition, i.e. they do not exhibit significant permanent deformation under the stresses encountered in use. This property tends to preserve the new look of such shoes, but does not permit them to "break-in." Such shoes are uniquely complemented by incorporation of the molded inner surface which embodies this invention.

The problem of fit is especially important when athletic shoes such as skates or ski boots are used. It is essential in these sports to have a boot which will translate movements directed to equipment on the wearer's foot, such as skis or skates, via the wearer's foot, into equipment response and not movement of the wearer's foot within the boot. Such foot movement within the boot dissipates the forces transmitted to the foot so that the equipment attached to the foot of the wearer does not instantly and exactly respond to the movements applied by the wearer.

In an attempt to overcome this difficulty, such sport shoes or boots generally have lacing systems more elaborate than conventional shoes since the inexact fit of conventional shoes becomes unacceptable in such sport shoes. The length of time spent fastening and in subsequent readjustment of such boots is well known to participants of such sports who exert extensive efforts to take up the space between the inside of the boot as manufactured to a standard last and the individual shape of the wearer's foot, so that there will be a tight fit between them. Since, however, the sports shoe or boot is so laced, and is pulled from its shape at repose to that approximating the shape of the wearer's foot, the boot pushes unevenly against the foot of the wearer, compressing the foot of the wearer in certain areas (pressure points) while allowing looseness in other areas because it does not exactly correspond to the contours of the individual foot.

Conventional methods for making "molded" shoes require that a "negative" impression of the wearer's foot be formed first, that a "positive" impression which reproduces the shape of the wearer's foot be made from such negative impression, and that this positive impression be utilized as a last upon which the final shoe is manufactured. I desire to provide a simpler and more economical method for making custom-fit shoes wherein these several costly and time consuming steps are eliminated, and, in lieu thereof, the inner surface is formed by casting in situ. The initial and only impression of the wearer's foot is made in the first instance within the shoe, with the wearer's foot in place therein, and thereafter the impression or cast, remains in place as a permanent and integral part of the shoe structure.

Thus, it is an object of my invention to provide a shoe having an inner surface which is custom-fitted, i.e. precisely conformed, to the shape of an individual wearer's foot and which by this means firmly, snugly and comfortably supports the wearer's foot, and restrains it against undue or undesirable movement within the shoe.

It is a further object of my invention to provide a shoe having an inner surface of the character described supported by a molded-in-place core of a material not subject to decomposition and with appropriate physical properties, both to facilitate molding and, in subsequent use, to provide vapor permeability as subsequently to be described, resiliency, moderate compressibility, flexibility and viscoelasticity so as to be capable of comfortably supporting and restraining the wearer's foot in all conditions of use. When such shoe is tightened its local areas yield under the pressure of uneven lacing forces, normal variations in foot size due to exercise, temperature, or small transient swellings or protuberances on the foot, while at teh same time the shoe firmly supports the foot.

I further desire that the formative core material not be toxic or have a deleterious or uncomfortable effect on the skin or body of the wearer both during fabrication and in subsequent use.

Another object of my invention is to provide a shoe having a molded-in-place core and adjoining structure which is capable of breathing, i.e. transpiring water vapor and air, in a manner equivalent to leather. Such characteristic, called leather permeability, is requisite for comfortable wearing of shoes by virtue of allowing perspiration from the feet to evaporate to the atmosphere through a multitude of pores within the core and in the adiacent structure.

I further desire to provide a shoe incorporating an inner surface of the character described, which has particular value for use with athletic shoes such as ski and skate boots, mountain boots and various military boots. In such applications the boot is required to support the foot often to a height considerably above the ankle, to restrain movement of the ankles and to snugly envelop the foot so that the foot does not shift within the boot. By providing an inner surface having the qualities described, such a boot may be tightened to the foot of the wearer by moderate effort without causing either uncomfortable pressure points, foot distortion and strangulation of circulation, and resultant chilling in low temperature exposure, or, alternatively, looseness, foot sliding and consequent poor control.

I further desire to provide a shoe or boot, incorporating a conformed inner surface, which provides wide styling freedom in its external appearance both to esthetic and functional advantage. By custom fitting only the inner surface of my shoe, I am able to use a joined assembly of upper and sole of conventional manufacture, thus benefiting from the advantages of factory production economies, while at the same time providing custom fit as well as a variety of fashionable stylings.

It is another object of my invention to provide a shoe having an inner surface of the character described which is ready for wear by the purchaser within minutes by a method which is readily effected at a local retail store,

without the requirement of elaborate or specially designed equipment, or of extensive skills by store personnel.

Futher, it is an object of my invention to provide such an inner surface which may be simply repaired, modified, or replaced. Such repair may be necessary due to accidental damage to the inside of the shoe, or to normal growth or other change in the shape of the wearer's foot. Also, orthopedic treatment may dictate that special shapes be formed into the inner surface. It will be seen that through the use of my invention such replacement, modification, repair, or shaping is simply effected at minimum time and expense.

Other objects of my invention in part will be obvious and in part will be pointed out hereinafter.

My invention accordingly consists in the features of construction, combinations of elements, arrangements of parts and series of steps which will be exemplified in the article of footwear and method for making the same hereinafter described and of which the scope of application will be indicated in the appended claims.

I carry out my invention by providing a shoe consisting of a joined upper and sole, a core within the joined upper and sole which precisely conforms to the surface of the wearer's foot, and, desirably, an inner flaccid protective liner initially fitted closely over the wearer's foot. The joined upper and sole are prefabricated and are conventional in manufacture, i.e. the joined upper and sole are supplied in such condition to the retail store or other location where the customer fitting is to take place.

In general, the method of making such an article consists of first, fitting the supple vapor permeable protective liner of leather, chamois or the like, closely to the foot of the wearer. An appropriate amount of a mushy, viscous fluid admixture of oatmeal-like consistency containing a room temperature vulcanizing silicone rubber or the like, and other components more fully to be described later, including a freshly added catalyzer, is prepared. About one-third of this viscous (not yet cured) admixture is introduced into the opened shoe consisting of a joined upper and sole. The wearer then centers his foot within the shoe while placing his weight upon it. The balance of the admixture is then added to the shoe to completely and uniformly fill it as the shoe is closed to its median position. The admixture solidifies (cures) within about 10 minutes. The shoe is then opened, the core is slit along the instep, and the foot is removed. Thereupon, the shoe is finished and can be worn. Subsequent evaporation within several days at normal room temperature and humidity of a liquid from the core leaves the shoe in its final condition.

In the accompanying drawings, in which I have shown an embodiment of my invention,

FIG. 1 is a perspective view of a ski boot made in accordance with my invention;

FIG. 2 is a view of a foot of a wearer with a closely fitting protective liner thereon;

FIG. 3 is a central longitudinal vertical cross-sectional view through an uncompleted boot;

FIG. 4 is a perspective view of the boot showing the step of cutting a slit in the core and liner;

FIG. 5 is an enlarged sectional view taken substantially along the line 5—5 of FIG. 4;

FIG. 6 is a view similar to FIG. 3 but through a completed boot; and

FIG. 7 is a sectional view taken substantially along the line 7—7 of FIG. 6.

Referring now in detail to the drawings, the reference numeral **10** indicates a custom-fitted shoe made pursuant to my invention. The shoe **10** illustrated is a ski boot, it being understood however that my invention is not limited to this type of shoe, but rather can be used with any type of footwear. Said shoe includes an upper **12** and a sole **14** conventionally joined thereto. A typical boot of this type incorporates an extended instep-to-toe lacing system **16** comprising laces **18** connecting eyelets **20** and hooks **22** along an instep-to-toe separation in order that the boot can be adequately tightened to snugly fit a foot **24** of the wearer. My invention may also be readily used in conjunction with shoes incorporating other forms of fastening systems such as hooks, snaps, slides and zippers. Flaps **25**, each integral with one quarter of the boot, overlap a tongue **27** of the boot to provide a closure under the lacing system **16**.

The joined upper **12** and sole **14** of the boot **10** are prefabricated and are of conventional manufacture. By prefabricated it is meant that the upper and sole may be manufactured and joined at the factory from natural or synthetic leather or the like, thus permitting the utilization of already existing forms for such manufacture, and allowing mass production of such items.

An in situ molded core **26** is disposed within the joined upper **12** and sole **14**, enveloping the foot **24** of the wearer. It is within the scope of my invention, however, with suitable blocking inserts to mold the core **26** about only certain selected portions of the foot **24** of the wearer. Since the core **26** is molded in situ within the closed boot, it conforms precisely to all the internal surfaces of the shoe filling all the voids therein. The outer face or surface **28** of the core **26** is closely conformed both to the inner surface **30** of the upper **12** and to the upper surface **32** of the sole **14**.

The core **26** has an inner surface **34** which precisely conforms to the surface of the wearer's foot **24**. The thickness of the core **26** at any point is such as to completely fill any space between the internal surfaces **30**, **32** of, respectively, the upper **12**, and the sole **14**, and the wearer's foot **24**. In a typical adult ski boot used for field tests, core thickness was found to measure as much as 1⅛ inches.

A protective liner **36** envelops and is disposed adjacent to the wearer's foot **24** between the core **26** and the foot. The liner **36** is made of a limp, supple material such as glove leather, chamois or the like which gives a pleasant appearance and serves as a comfortable walking or bearing surface for the wearer's foot. The liner has outwardly protruding seams **37**. The vertical seam **37***a* carries a quantity of selvage **39**.

A conventional sock (not shown) of wool, cotton, nylon, etc., of the type which will subsequently be worn with the shoe, is first placed on the foot and worn during the fitting of the liner and the molding of the core for maximum molding accuracy.

The molded core **26** is made from a fluid admixture which solidifies (cures) in minutes into an elastomeric material. Such a mixture is comprised, e.g., of fluid silicone rubber stock, a catalyst for the same, a filler such as granulated cork and a volatile pore-forming liquid that is not a solvent for any of the mentioned components. After curing of the rubber stock and subsequent evaporation of the pore-forming liquid, the resultant elastomeric material is self-form-maintaining and has other properties which make it valuable for use in such an application.

As best shown in FIGS. 4, 5 and 6, a slit **38** in the seam **37** of the liner **36** and in the core **26** runs from the upper edges **40**, **42** respectively of the liner **36** and the core **26** downwardly over the instep toward the sole **14** and tip of the shoe **10**. The slit **38** is preferably made adjacent to and beneath the lacing system **16** of the boot where the boot opens to allow removal or insertion of the wearer's foot. The core material is sufficiently flexible so that when the boot is unlaced the areas of the core **26** adjacent to the slit **38** may be bent or flexed out of the way to facilitate the foot movement mentioned.

The admixture from which the core material is formulated comprises the following components:

(1) *Binder.*—Fluid room temperature vulcanizing (RTV) silicone rubber stock, e.g. containing dimethylpolysiloxane. Good results are obtainable from such stock sold under the name "Silastic RTV 502" by the Dow

Corning Corp., of Midland, Michigan. The stock has a viscosity approximately equal to that of honey at 65° F.

(2) *Foaming binder.*—RTV foam silicone rubber stock as sold by Dow Corning Corp. as "Silastic RTV Foam S–5370."

(3) *Thinner for binder.*—Silicone oil (dimethylpolysiloxane) such as that sold by Dow Corning Corp. as "Silastic RTV Thinner."

(4) *Binder catalyst.*—Stannous octoate for vulcanizing both binders at room temperature as well as an activator for the foaming binder. A good product is that sold by Dow Corning Corp. as "Foam System Catalyst S–5370."

(5) *Pore-forming liquid.*—1% (by weight) aqueous solution of hydroxypropyl methylcellulose, sold by Dow Chemical Co. as "Methocel 65 H.G. (Standard)."

(6) *Filler.*—40 mesh granulated cork, balsa wood or the like.

Other suitable room temperature vulcanizable silicone rubber stocks, foaming agents such as nitrous methyl urea, and catalysts are disclosed in British Patent No. 888,777, to which reference is made.

The procedure for formulating the admixture includes preparing initially a master batch of components to which the binder catalyst is added immediately prior to molding of the core **26** The master batch itself may be prepared in advance and stored in a sealed container at a cool temperature for several months. The shelf life of the master batch is the same as that of the silicone rubber stock.

All parts hereinafter specified are by volume, it being understood that the volumetric quantities are not critical and one skilled in the art may, with the following description in mind, readily attain good results therefrom.

A master batch is made as follows:

(a) Thoroughly mix at room temperature by hand with a spatula: 6 parts binder (silicone rubber stock) and 1 part thinner.

(b) Add thereto and thoroughly stir in by hand with a spatula 1 part foaming binder (foam silicone rubber stock).

(c) Next add thereto and thoroughly stir in by hand with a spatula the filler (granulated cork), q.s. to 10.5 parts.

(d) Next add thereto and thoroughly stir in by hand with a spatula until the whole is homogenous, 7.5 parts of the pore-forming liquid.

The sequence of steps is not critical.

Immediately prior to the introduction of the admixture into the shoe **10**, the master batch (having been previously prepared) is thoroughly and vigorously mixed with the catalyst in the proportion by weight of 100 parts of master batch to 1 part of catalyst and is then introduced into the shoe cavity. It is convenient to catalyze a test sample of the admixture to check the reactivity of new catalyst and to make adjustment in its concentration in order that the stock be cured in about 10 minutes.

The viscosity of the admixture described is such that it flows to approximately its own level from 10 to 30 seconds after a one-inch deep finger-sized indentation has been made therein.

The admixture remains workable for about 3 minutes after addition of the catalyst. The admixture sets up, i.e., vulcanizes (cures), to an elastomeric solid in about 10 minutes without exothermic action. Within several days at normal room temperature and humidity, the pore-forming liquid, initially in the form of interconnected pockets, evaporates, leaving a dispersion of interconnected cells or pores in the core material. This gives the core the desirable physical quality of vapor permeability. It is substantially uniformly vapor permeable having interconnected pores up to approximately 50 mils in diameter dispersed throughout, up to and including its external surface. Approximately 40% by volume of the core material is composed of such pores in the formulation described herein. Field tests have demonstrated that this

porosity provides breathing qualities, of the characteristics described in United States Letters Patent No. 2,773,286, that make a leather shoe incorporating such a structure comfortable to wear for extended periods.

It should be observed at this point that the admixture described vulcanizes before it becomes permeated by the air filled pores which make it vapor permeable. As has been stated, this phenomenon takes place since the vaporizable liquid, e.g., water, remains finely dispersed throughout the admixture up to and including the admixture surfaces as the silicone rubber stock vulcanizes, the liquid evaporation taking place over a considerably longer time (3 days) than the initial curing time (10 mins.) of the stock.

The filler, e.g., cork granules, helps maintain the homogeneity of the master batch so that subsequent evaporation yields a uniformly vapor permeable surface as well as a vapor permeable interior. The vapor permeability of the core material will be substantially uniform in any cross-section, i.e., the surface of the material will be as permeable as the internal portions of the core. In addition, the filler provides firmness with lightness and increases the thermal insulative properties of the resultant material.

Disadvantageously in contrast thereto, porous elastomeric materials whose pores are produced by gas generation (rather than liquid evaporation as present in the described process) must undergo considerable volumetric expansion with the result that the narrow and constricted passages between the foot and the shoe within the shoe cavity which offer high resistance to filling by the molding material, cause considerable variation in density and porosity. Such passages also entrap the generated gas and cause undesirable voids. Gas-generated systems are also characterized by formation of an impermeable or less permeable skin or rind on their surfaces. In addition, during expansion these systems are highly fragile so that small movements such as may be expected from the wearer's foot within the shoe, would cause considerable deformation of the mold.

The admixture herein described contains a small amount of a foaming binder for the purpose of facilitating the cure of the silicone rubber stock whose cure is otherwise inhibited in thick cross-sections. One catalyst serves for both the foaming binder as well as the solid binder (silicone rubber stock).

After cure and subsequent evaporation of the pore-forming liquid, the core material consists principally of cured silicone rubber and filler. Traces of residue left by evaporation of the pore-forming liquid line the networks of interconnected pores in the core **26**.

The compressibility of the material made according to the formulation herein described in its cured, i.e., final, form has a Shore "00" durometer reading of approximately 65 which is equivalent to 15 lbs. per sq. in. compression causing a 25% deflection in the material, such durometer reading being considered by the art to impart a "firm" quality to an elastomer. The silicone rubber of the core material is virtually unaffected, and retains its elastomeric properties, over a temperature range of −40° F. to 400° F.

The core material as herein formulated is sufficiently compressible to yield in the presence of moderate swells or protuberances on the foot of the wearer, or small wrinkles in the liner **36** or of a sock worn by the wearer.

The compressibility, or yielding quality, of the core material will also allow it to yield when the foot assumes different shapes as for example when the foot bears the weight of the wearer as compared to a weightless state. Field tests indicate that the core material yields to these different forms sufficiently so as to be comfortable, yet is firm enough to closely support the foot. The aforesaid degree of compressibility is best described as "moderate."

When used in combination with stiff leather uppers as are desirable in ski boots, my core serves as a firm yet

comfortable intermediate layer and coupling medium so that the stiffness and rigidity of the upper can secure the foot firmly to the ski in complete comfort to the wearer. Since the core material is viscoelastasic, it attenuates shocks applied to the boot by virtue of its inherent damping characteristic.

The formulation herein described may be modified to obtain varying degrees of firmness of the core material. Firmer core material may be produced by increasing the filler to binder ratio, at a constant ratio of pore-forming liquid to total admixture volume. Ratios, by volume, of filler to binder materials of up to 1:2 have been used successfully to produce very firm cores. Higher filler ratios have the additional effect of further lowering the apparent specific gravity of the core material since the specific gravities of the binders are approximately 1.1, and that of the cork filler is approximately 0.25. Conversely, softer core materials have been produced by lower filler to binder ratios. Ratios, by volume, as low as 1:4 have been used succesfullly. Also, increasing the pore-former to total admixture volume ratio produces a softer core material. Ratios of up to 5:4, in conjunction with low filler to binder ratios, have been used successfully to produce very soft cores of adequate strength.

The core material during fabrication, cure, and in subsequent use, is completely inert and harmless to the human body. Silicone rubber stocks are well known to be physiologically inert, and are used extensively for various surgical and medical appliances and even as implants within the human body as is extensively documented in The Bulletin of the Dow Corning Center for Aid to Medical Research (1959–1963). The pore-forming liquid, hydroxypropylmethylcellulose solution is similarly harmless. Premium grades have been approved for food additives and cosmetic use. Reference is made to the Federal Register of Sept. 17, 1960 on p. 8949, sec. 121.1021.

Outline of method

The method of making such an article initiates by fitting the pliable vapor permeable liner **36** of glove leather, chamois or the like to the foot of the wearer which is already clad with a conventional sock (not shown) of a type which will subsequently be worn with the shoe. Such a liner **36** serves as the liner of the shoe **10** and remains permanently therein. This liner is snugly fited over the wearer's foot **24** in order that the core material will closely conform to the shape of the wearer's foot without causing unsightly wrinkles in this liner. It may either be fabricated to the individual foot, or prefabricated and stocked in a variety of sizes and altered for exact fit by machine or hand stitching, stapling or similar methods at the retail store during the fiting of the shoe. FIG. 2 illustrates a liner **36** of the type which can be fitetd to the wearer's foot **24** at the retail store, having seams **37**. The vertical seam **37***a* carries a sufficient quantity of selvage **39** so that this selvage may be later used to give a finished appearance to the boot or shoe **10**.

The exact amount of admixture required can be determined by measuring the volume of sand required to fill the shoe with the wearer's foot in place therein.

The required amount of the admixture as previously described, is catalyzed. About one-third of this admixture is immediately introduced into the vacant boot with a spatula or a spoon. The foot **24** of the wearer is then placed, with the liner **36** thereon, into the unfastened open shoe or boot **10** and then the boot is partially closed while the foot is centered within the boot and the wearer stands upon it. The balance of the admixture is then added within several minutes with the spatula or a caulking gun between the inner surface **30** of the upper **12** and the upper surface **32** of the sole **14** and the liner **36** on the wearer's foot **24** to fill all the vacant space. When fitting the normal foot, the wearer stands with full weight bearing on such foot, thereby forming a plantar surface conforming to the foot in weight bearing position to prevent subsequent arch blockage.

Partial or non-weight bearing impressions can be made if desired, and inserts and/or arch supports may be placed within the boot prior to introduction of the admixture, for orthopedic purposes.

The admixture soon thereafter, e.g. in about 10 minutes, cures i.e. solidifies permititng removal of the wearer's foot **24**. The shoe **10** is unlaced and the liner **36** and the core **26** are slit together along and separating the vertical instep seam **37***a*, as with surgical scissors, from the upper edges **40**, **42** downwardly along the instep toward the toe and sole **14**. The slit **38** thus formed is preferably made adjacent and beneath the lacing system **16** of the boot **10**. The liner **36** is retained within the boot becoming the inner protective liner thereof. The core **26** adheres to the inner surface **30** of the upper, to the upper surface **32** of the sole **14** and to the liner **36**, forming an integral structure of core, liner and outer. The edges of the slit are flexed apart to permit removal of the wearer's foot.

Thereafter, within several days the pore-forming liquid evaporates through the pores of the upper and the liner **36**, leaving the core material with interconnected pores that render the material uniformly vapor permeable from the core interior up to and including the core surface.

If repair or replacement is later necessary, a flap may be cut into the liner to expose a section of the core, which may then be cut away to permit remolding. Catalyzed admixture may then be applied with a spatula or by hand to form the desired contour. The flap is then replaced and the section cured as in the original process. Alternatively, the core may be detached and removed from the upper **12** and sole **14** with the aid of a blunt knife or spatula. The required modification may then be accomplished through the external surface of the core without cutting into the liner. Upon replacing the core within the shoe, it may be re-adhered, if desired, by spot cementing with binder material, i.e. catalyzed silicone rubber (Dow Corning RTV 502), as used in the admixture.

A neat finished appearance for the exposed core edges is obtained by providing the liner **36** with an upper edge **40** higher than that of the boot **10** and with selvage **39** along the seam **37***a*. As seen in FIG. 6, after the core material is vulcanized and the inner liner **36** and core **26** are mutually slit and the seam **37***a* opened, the liner edges **40** are folded over the upper edges **42** of the core **26** and the terminal portions thereof tucked between the core **26** and the upper edge of the upper **12**. The edge **40** of the liner may also be secured therein by binder material, catalyzed silicone rubber stock (Dow Corning RTV 502). Similarly, for the instep cut **38**, the selvage of the seam **37***a* may be tucked into and adhered to the cut edge of the core. Additional strip material (not shown) may be used to cover the core below the tongue. Alternatively, any of the core **26** which may be exposed along slit **38** may be covered with this silicone rubber, pigmented if desired, to seal and protect the core.

It will be appreciated that the admixture can be employed for other uses, e.g. to make casts for broken bones, or to form other firm restraining vapor permeable closely fitting cores. Also, inserts of rods or plates within such casts can be used to impart complete rigidity thereto. The inserts can be used so as to permit freedom of movement along selected axes. Reference is made to the Bulletin, Dow Corning Center for Aid to Medical Research, Midland, Michigan.

It thus will be seen that I have provided a device and method for making same which achieves the several objects of my invention, and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiment and method set forth, it is to be understood that all matter herein set forth or shown

in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim as new and desire to secure by Letters Patent,

1. A shoe custom fitted to the foot of a wearer comprising:

a leather-like prefabricated upper,

a sole joined to the upper,

a self-form-maintaining inner restraint and support core cast in situ and composed of an elastomeric material characterized by its leather-like uniform vapor permeability, flexibility, moderate compressibility and stability over a wide ambient temperature range, said core having an outer surface with a shape directly conformed to and juxtaposed against the inner face of the upper and the upper face of the sole, and an inner surface having a shape directly conformed to the surface of the foot of the wearer, and

a limp, pliable, vapor permeable, protective liner internal of said shoe, and juxtaposed against the inner surface of the core, the core and liner having a slit running from the upper edges thereof downwardly over the instep towards the tip of the shoe.

2. A shoe custom fitted to the foot of a wearer comprising:

a leather-like prefabricated upper,

a sole joined to the upper,

a self-form-maintaining inner restraint and support core cast in situ and composed of an elastomeric material characterized by its leather-like uniform vapor permeability, flexibility, moderate compressibility and stability over a wide ambient temperature range, said core having an outer surface with a shape directly conformed to and juxtaposed against the inner face of the upper and the upper face of the sole, and an inner surface having a shape directly conformed to the surface of the foot of the wearer, the core material including room temperature vulcanizable silicone rubber, and

a limp, pliable, vapor permeable, protective liner internal of said shoe, and juxtaposed against the inner surface of the core.

3. A shoe as set forth in claim 2 wherein the core material includes a dispersion of interconnected pores uniformly throughout its cross-section of which the outermost and the innermost pores extend to the outer and inner surfaces, respectively, of the restraint core.

4. A shoe as set forth in claim 3 wherein the core material includes a uniform dispersion of granulated filler.

5. A shoe as set forth in claim 3 wherein the core material includes a dispersion of a volatile pore-forming liquid which forms the pores upon evaporation.

6. A shoe custom fitted to the foot of a wearer comprising:

a leather-like prefabricated upper,

a sole joined to the upper,

a self-form-maintaining inner restraint and support core cast in situ and composed of an elastomeric material characterized by its leather-like uniform vapor permeability, flexibility, moderate compressibility and stability over a wide ambient temperature range, said core having an outer surface with a shape directly conformed to and juxtaposed against the inner face of the upper and the upper face of the sole, and an inner surface having a shape directly conformed to the surface of the foot of the wearer, the core material including room temperature vulcanizable rubber, and

a limp, pliable, vapor permeable, protective liner internal of said shoe, and juxtaposed against the inner surface of the core.

References Cited

UNITED STATES PATENTS

2,136,815	11/1938	Forster et al.	12—142
2,287,026	6/1942	Craig et al.	36—55
2,668,304	2/1954	Murray	12—1420
2,917,850	12/1959	Scholl	36—44 X
2,973,529	3/1961	Silverman	12—1420
2,974,270	3/1961	Dubner	36—2.5
3,058,240	10/1962	Osgood	36—2.5
3,244,649	4/1966	Levitt	36—43 X

JORDAN FRANKLIN, *Primary Examiner.*

R. C. MADER, PATRICK D. LAWSON, F. J. COHEN, H. H. HUNTER, *Assistant Examiners.*