Feb. 4, 1969 A. E. MURRAY 3,425,075

METHOD OF MAKING LEATHER FOOTWEAR

Filed June 24, 1965

Sheet 1 of 3

FIG. 1

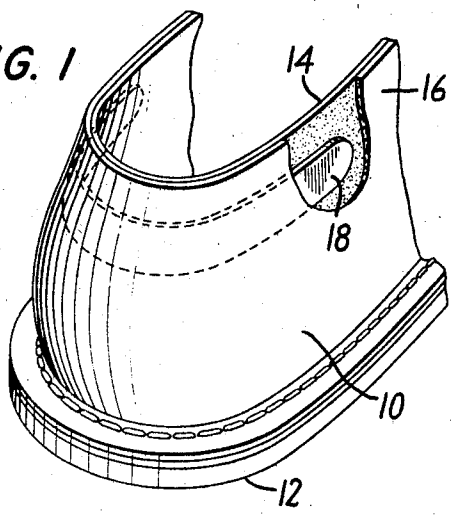
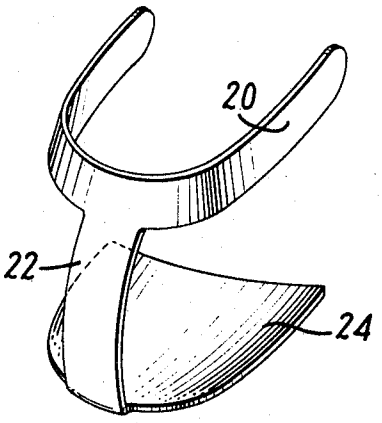


FIG. 2



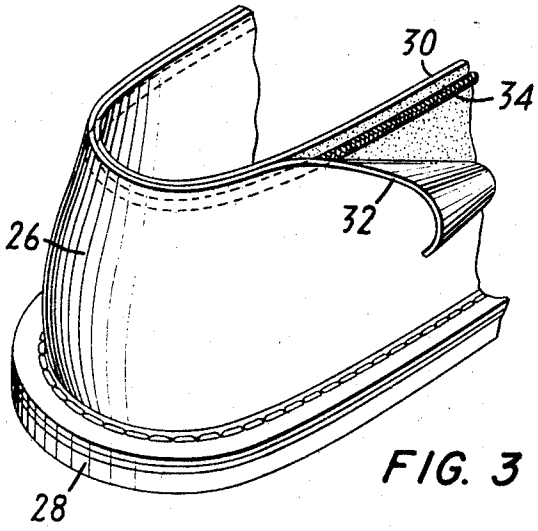


FIG. 3

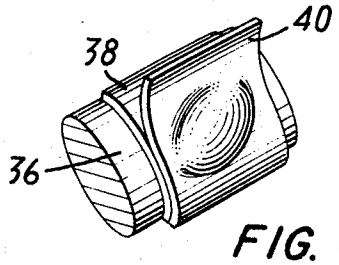


FIG. 4

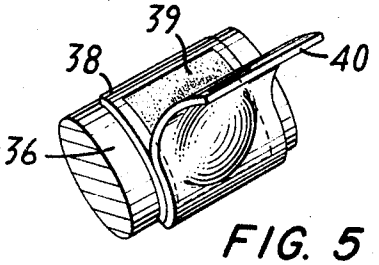


FIG. 5

FIG. 6

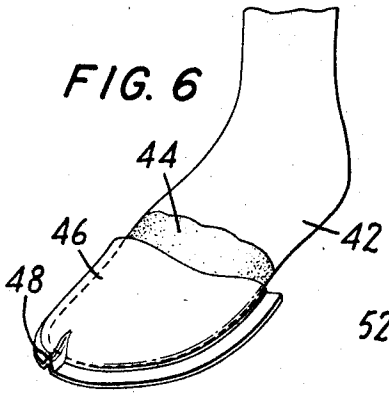
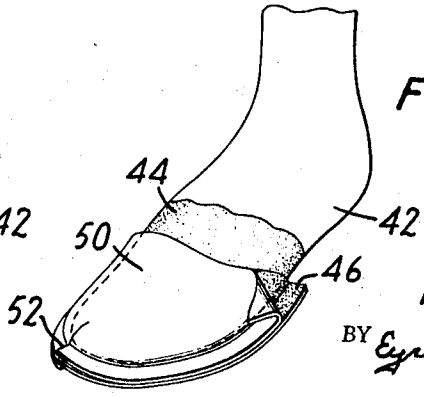


FIG. 7



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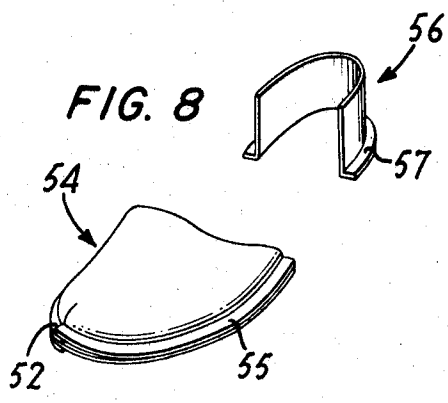
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FIG. 8



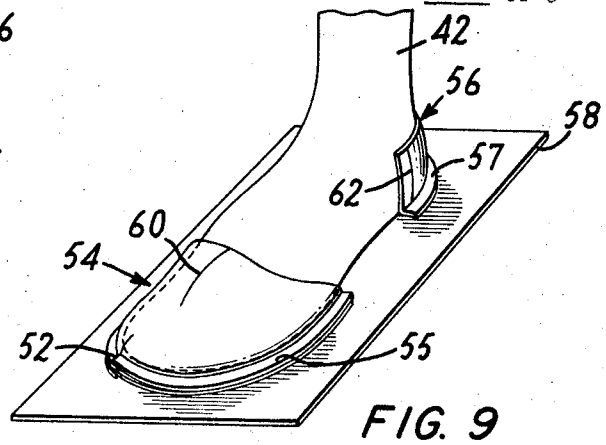
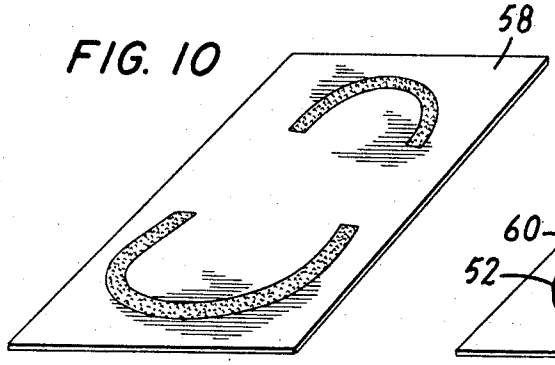


FIG. 9

FIG. 10



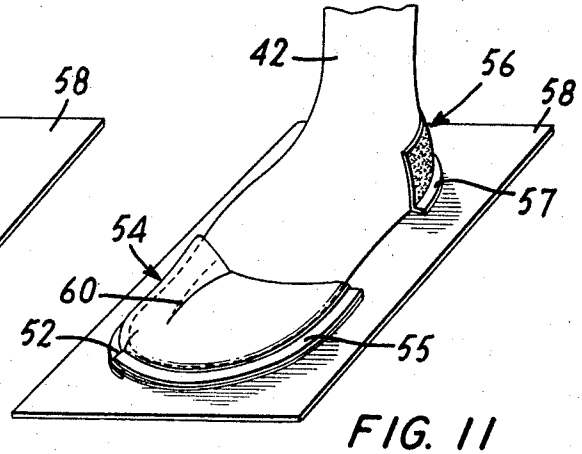


FIG. 11

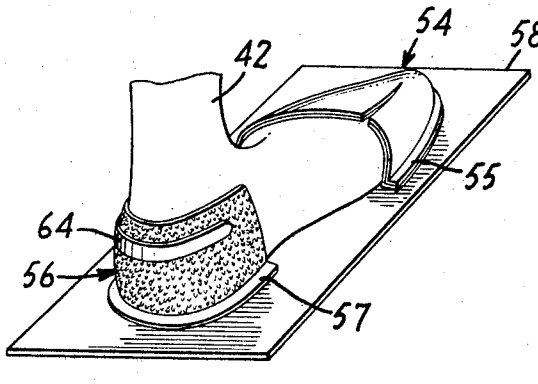


FIG. 12

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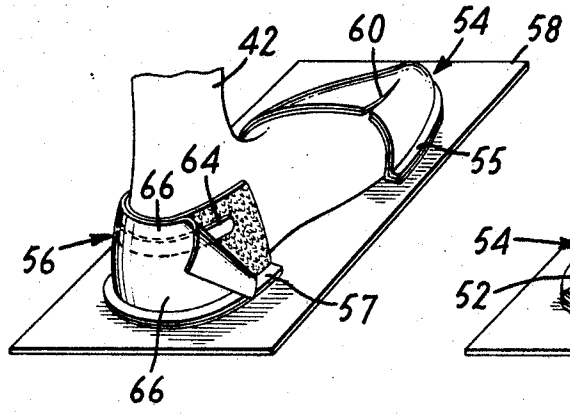


FIG. 13

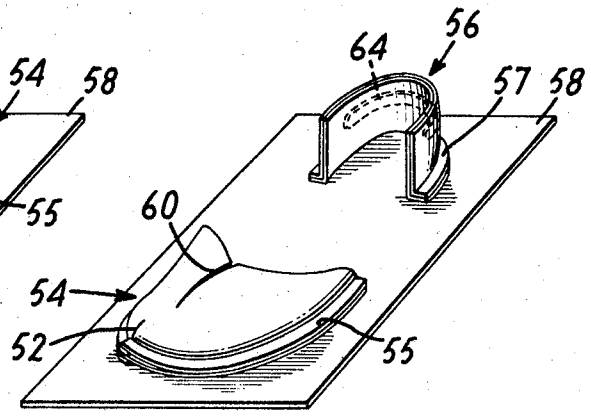


FIG. 14

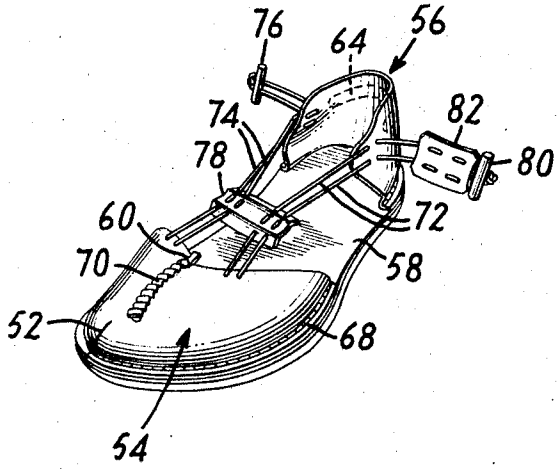


FIG. 15

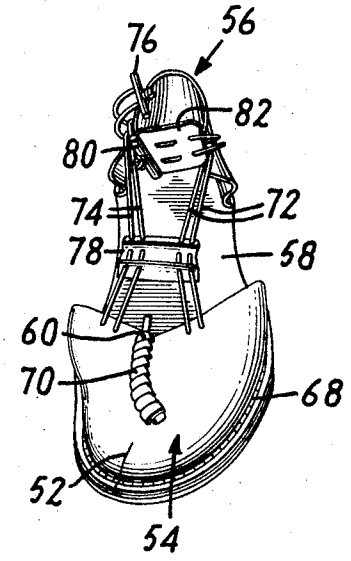


FIG. 16

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United States Patent Office

3,425,075

Patented Feb. 4, 1969

3,425,075

METHOD OF MAKING LEATHER FOOTWEAR

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Filed June 24, 1965, Ser. No. 466,752
U.S. Cl. 12—142 9 Claims
Int. Cl. A43d 9/00; A43b 23/08; B29h 7/08

ABSTRACT OF THE DISCLOSURE

The invention provides; two control devices for footwear, one a resilient U-shaped strip mounted upon the counter of the footwear to exert pressure upon the upper portion of the calcaneus, and the other a flexible filament mounted along peripheral edges of the footwear to conform the same to the adjacent foot contour; three-dimensional, shape-retaining laminates of at least two plies of leather bonded flesh side-to-flesh side with a rubber latex; sealed leather surfaces the pores and interstices of which are filled with synthetic plastic material; and all-leather footwear made with molded toe and heel, leather laminates which are bonded to a bottom sole in a spacing corresponding to the length of the wearer's foot.

This invention relates in general to footwear and to improvements in both the manufacture and the dynamic functions thereof. More particularly, the invention provides (1) a control device for establishing alignment and dynamic correlation between the calcaneus and the counter of shoes or other footwear, (2) a control device for conforming the peripheral edges and margins of shoes or other footwear to the adjacent contour line of the foot, (3) a method of tenaciously bonding together thin plies of leather, (4) a method of treating leather to achieve unexpected advantages upon its exposure to skin by direct or indirect contact, and (5) a simplified and rapid method of manufacturing molded leather shoes using one or more of the aforenoted innovations.

In regard to the first aspect of the invention, one of the most prevalent problems with conventional footwear, particularly shoes, is the lack of control over the dynamics of the counter, which is the rear end portion of the shoe adjacent the back of the foot. During walking or other dynamic use of footwear, the positions assumed by conventional counters are the result almost exclusively of the integral relationship of the counter to the remainder of the shoe. Thus, in the execution of a step, the counter moves simply because it is a unitary portion of the shoe and has no choice but to move as the shoe is being flexed along the instep by the pivoting of the foot. There is however very little correlation, if any, between the movement of the counter and that of the calcaneus because neither one has the means with which to influence or correlate to the other. The conventional shoe counter therefore is almost always misaligned or out of correlation with the calcaneus, and this misalignment generally becomes more severe as the dynamics of the calcaneus intensify, e.g. running, jumping, skating as compared to walking. Some of the more familiar problems resulting from the foregoing deficiency are the "turning" or "rolling" of shoe heels wherein the heel wears more in one area than in another, inflammation of the back of the foot when shoes too short are worn in an effort to achieve cooperation between the calcaneus and the counter, "flopping" counters and heels when shoes loosely fitted for comfort are worn, etc.

I have now discovered a simple form of control device which can be incorporated in all forms of footwear and which for the first time provides a means for the calcaneus to control the dynamic functions of the counter,

whereby each cooperates with and is correlated to the other. The device is a strip of flexible but resilient material which is bent into a general U-shape and incorporated in or upon the counter of footwear in such position that it will cause the counter to exert a gentle pressure upon the upper margin of the calcaneus. The resiliency of the strip will readily permit the large tuberosity of the calcaneus to slip through its confines as the footwear is being donned, but thereafter the counter will always be "mated" so-to-speak to the calcaneus by the pressure derived from the strip, so that the counter will faithfully follow and assume positions corresponding to those of the calcaneus and the dynamic functions of both will be in perfect correlation. By varying the flexibility or the resiliency of the strip, subtle changes in the pressure of the counter upon the calcaneus can be achieved to exactly suit the dynamic requirements (e.g. skating vs. walking), as will be more fully explained hereafter. In all cases, however, footwear equipped with the above-described device, by the fact of the calcaneus dynamically controlling the counter and the counter dynamically supporting and complementing the calcaneus with a precision not heretofore possible, gives a remarkable sense of control and comfort to the wearer which is unique and truly of first impression.

In the second aspect of the invention, I have discovered a second control device for conforming the peripheral edge profile of footwear, particularly shoes, to the corresponding contour line of the foot adjacent said peripheral edge. This device comprises a filament of flexible and resilient material which is incorporated in the peripheral margins of footwear, whereby the peripheral margins and edges can be conformed to the opposite contour line of the foot by bending the filament into the same or substantially the same contour line. Thus, the filament will cause the peripheral margins and edges of footwear to assume and retain the same shape as that of the adjacent contour line of the foot, and by selection of a filament with sufficient resiliency, the peripheral margins and edges can even be made to exert a gentle pressure against the foot, similar to the first-described control device. The net result again is an unusual sense of control and comfort because the wearer is aware for the first time of full cooperation and correlation between the peripheral edges and margins of his shoes or footwear with adjacent surfaces of his feet.

In a third aspect of the invention, I have unexpectedly discovered a method of tenaciously bonding together two thin plies of tanned leather, while conforming the same to three dimensional surfaces, whereby the resulting laminate assumes and permanently retains the three dimensional shape. In this method, I saturate the leather plies with aqueous dispersions of latex rubber, and then separately conform the same to a three dimensional surface, for example, a cast of the foot to bond together the two plies in the shape of the cast. In doing this, I have found to my surprise that it is necessary to form the laminate by contacting the flesh side of one ply to the flesh side of the other ply. For some reason which I do not fully understand, the flesh-to-flesh contact results in a bonded laminate having tremendous peel and shear strength after the latex has cured completely. In fact, the bond is so intimate and so tenacious that in most cases it is virtually impossible even when looking at the edge cross-section to distinguish one leather ply from the other, and the laminate instead has the appearance and body of a single thickness of leather. This combined with the fact that the laminate assumes a permanent three-dimensional shape substantially identical to the shape to which it was conformed makes possible the construction of strong lightweight shoes or other forms of footwear made entirely of leather and having many

resulting advantages as will be more fully explained hereafter.

In the fourth aspect of the invention, I have found that leather can be treated with plastic material in such manner that the leather can remain exposed directly or indirectly to skin, especially of the feet, without deterioration as one would expect but rather with some very surprising and unexpected advantages. The unexpected aspect of the results arises from the fact that my treatment seals all of the pores and openings of the leather surface exposed to the skin with a film or coating of plastic material, and this cannot help but destroy the so-called "breathing" capacity of the leather which has long been extolled as the great advantage of this material. While the supposed "breathing" capacity of leather has never in my opinion been accurately or satisfactorily defined, it is the fact that when I eliminate any such capacity and use the treated leather in footwear I achieve a number of remarkable effects which make the leather a far more valuable material for this application than it has ever been before.

First of all, I have found that a leather surface which has been sealed with a plastic film can be contacted directly to the skin of feet for prolonged periods without development of any offensive or foul odors. The tendency of leather footwear to become malodorous is well-known, but no effective preventive has been found to my knowledge. While I am not entirely certain, I believe that with my treated leather the skin secretions are blocked by the plastic film from penetrating the leather whereby bacteria, whose metabolic actions cause malodors not the secretions themselves, are unable to deposit metabolic wastes in the pores or interstices of the leather. Thus, the leather remains uncontaiminated and free of deterioration from skin secretions over its entire life of service.

A very surprising additional benefit is that leather treated as described above feels very cool and dry in the form of footwear. Contrary to what would be expected, the leather does not become hot and moist even though perspiration and other skin secretions are blocked from entering the pores. While I have no definite explanation for this effect, I believe that conventional leather, being absorbent of skin secretions, rapidly becomes saturated with such fluids whereby the feet are always kept in contact with moisture and the natural cooling effect of evaporation of perspiration is lost. With leather sealed by my process, the perspiration and skin fluids are rapidly removed by evaporation since they are unable to enter and become stored in the pores or interstices of the leather. The net result is that the feet feel cool and dry regardless of the period of time they remain confined in footwear made of the treated leather.

In the fifth and final aspect of my invention, I provide a method of manufacturing molded leather shoes or other forms of footwear made substantially entirely of leather in which one or more of the above-described other aspects of my invention is used to achieve the advantages thereof in the all-leather footwear. In one embodiment of this new method of making molded leather shoes or other footwear, I use pre-molded toe and heel portions whereby the shoes or footwear can be made very simply and rapidly by persons not skilled in manufacturing techniques for this form of footwear. By use of the pre-molded toe and heel pieces, it is possible to prepare molded shoes in ordinary retail outlets since the toe and heel pieces so simplify the manufacturing technique that they may be retained in stock in several basic sizes and be fitted to virtually any form or shape of feet by certain finer adjustment techniques which are part of the overall method. In particular, the toe and heel pieces are reduced in volume when used in my method whereby they acquire a perfect fit with the wearer's feet as an integral part of the manufacturing process.

Furthermore, my new method of manufacturing all-leather shoes or footwear can be made on more than one basic foundation. For example, the method may be used directly upon the wearer's feet, upon a wooden last, upon a positive plaster cast or upon a negative plaster shell cast which is hollow and supported by the wearer's feet. The method permits the manufacture of sandals having large open areas or shoes which entirely cover the wearer's feet in all forms of designs and configurations so that many interesting appearances can be achieved in the final product. The molded all-leather shoes or footwear in general are very attractive and have the appearance and functional advantages of mobility, lightness of weight and modernness of design.

Further details of the invention will be readily understood by reference to the accompanying drawings of which:

FIG. 1 is a perspective view of a shoe counter having incorporated therein the control device of the invention for providing calcaneus-counter correlation;

FIG. 2 is a perspective view of a modified form of the control device illustrated in FIG. 1;

FIG. 3 is a perspective view of a shoe counter having a second control device provided by the invention for conforming the peripheral edges and margins of footwear to the corresponding adjacent contour line of the foot;

FIG. 4 is a perspective view showing two thin plies of leather being bonded together by the method of the invention;

FIG. 5 is a perspective view similar to FIG. 4 showing the use of a filler "split" layer of leather in the laminate of the thin plies of leather;

FIGS. 6–16 inclusive are perspective views showing the manufacture of all leather molded footwear in accordance with the invention using one or more of the devices and techniques illustrated in the preceding figures.

Referring to FIG. 1, reference numeral **10** indicates a shoe counter supported upon bottom sole **12**. Between the inner layer **14** and the outer layer **16** of the counter, a control device **18** is positioned along the upper portion of the counter. As shown, the control device **18** consists of a band or strip which is bent in a general U-shape to follow the curve of the counter and so positioned that it is capable of exerting a grip or pressure, transmitted through the inner layer **14**, upon the upper margin of the calcaneus of the wearer's foot.

The strip **18** is made of a material having both flexibility and some degree of resilience. The flexibility may be such that the strip can be bent by hand or the material may be more rigid so as to require mechanical assistance to change its configuration relative to the calcaneus. Materials which can be bent by hand are useful when the control device **18** is included in the shoes or other forms of footwear used for ordinary activities. The more rigid materials are useful for control devices incorporated in dancing shoes, skates and other forms of footwear which are especially suited for sports and other activities more strenuous than walking.

Although the strip **18** is bent to such a position that the inner layer **14** of the counter **10** will exert a pressure upon the upper margin of the calcaneus, the resilience of the strip **18** permits the wearer's foot to pass by the grip of the strip **18** and the strip **18** will then return to its said position to exert the pressure upon the calcaneus. As previously described, this connects the calcaneus and the counter **10** so that there is correlation and support between these two working dynamic areas when the wearer walks or otherwise uses the footwear in movement. In addition to the foregoing advantages, the control device **18** gives practical benefits in that the "rolling" of heels is substantially minimized or eliminated with counters having the device incorporated therein and shoes or other footwear can be made to fit the wearer's feet perfectly without any tendency for the shoes to flop or otherwise

not remain in an accurately correlated position with respect to the calcaneus.

FIG. 2 illustrates a modified form of the control device **18** of FIG. 1. In the modified form, the U-shaped calcaneus pressure strip **20** is integral with a vertical arm **22**. The vertical arm **22** in turn is integral with a platform **24**.

The modified form of control device shown in FIG. 2 is designed to be attached to footwear externally. More specifically, the platform **24** is placed beneath the heel of the footwear and attached thereto by screws, or other fastening means. When so attached, vertical arm **22** of the device overlies the Achilles tendon and the pressure strip **20** again is positioned to cause pressure to be exerted upon the upper margin of the calcaneus. The modified form of FIG. 2 is especially useful for skates and other forms of special footwear which are used in vigorous activities such as dancing, skating and athletics. The modified form of FIG. 2 is especially useful in connection with the form of ice skate blade which is disclosed in my prior U.S. Patent No. 3,061,324. When used with that blade, the heel platform **24** preferably is eliminated and the vertical arm **22** is joined integrally with the rear end of the ice skate blade. The modified form of FIG. 2 may also be found very useful in orthopedic footwear since by proper selection of the material and particularly its resiliency, varying degrees of corrective control can be exerted over the calcaneus and the rear portion of the foot.

As previously mentioned, the material of the control device **18** and the modified form in FIG. 2 can vary from sufficient flexibility for adjustment by hand up to greater rigidity requiring adjustment of position with mechanical tools. For shoes or other forms of footwear which have a conventional function, I have achieved excellent results with use of metals and metal alloys as the material for the strip **18**. In particular, I have used aluminum and copper alloys for control devices such as those described in FIG. 1 with excellent results. For the modified form of device illustrated in FIG. 2, greater rigidity is required and I have achieved excellent results with the use of steels. The material of the control device as well as its position around the calcaneus can be readily varied to achieve the pressure on the calcaneus which exactly suits the requirements of the footwear in which it is to be incorporated.

FIG. 3 illustrates the second aspect of my invention wherein I provide a control device for conforming the peripheral edges and margins of shoes or other footwear to the corresponding adjacent contour line of the foot. FIG. 3 illustrates a shoe counter **26** again supported upon bottom sole **28**. Between the inner layer **30** and the outer layer **32** of the counter **26**, a filament **34** is positioned which extends along the line of the upper peripheral edge of the counter **26**. The material of the filament is flexible and may have very little or a great degree of resilience. The filament **34** is preferably bendable by hand so that the wearer may conform the filament to the contour of his feet after he has put on a shoe containing the filament. If the filament **34** has little or no resilience, it will exert little pressure upon the adjacent contour line of the foot. As the resiliency of the filament is increased, however, it acquires sufficient springback so that pressure begins to be exerted upon the adjacent contour line of the foot and this can be varied to suit the wearer's desires.

As with the control device described for FIGS. 1 and 2, the filament of FIG. 3 may be made of metals and metal alloys or any other flexible and, if desired, resilient material. When the peripheral edges or margins of footwear are conformed to the wearer's feet with the filament **34**, the wearer again achieves a sense of cooperation and control between the surface of his feet and the footwear which increases both the comfort and the dynamic functions of the footwear. Of course, the two forms of control devices of FIGS. 1 and 2 on the one hand and of FIG. 3 on the other may be used in connection with footwear, singly or in combination. The filament **34** may be a woven filament of a plurality of individual strands as illustrated in FIG. 3, or the filament may be of a completely solid cross section. The woven and the solid filaments can be made to have equivalent control capabilities with proper selection of the material.

FIG. 4 illustrates steps in the method of tenaciously bonding together thin plies of leather in accordance with my invention in order to form a laminate having the appearance of a single sheet of leather. In FIG. 4 a three dimensional surface **36** is illustrated and by my method this shape can be permanently imparted to the tenaciously-bonded leather laminate whereby the inner surface of the laminate will match exactly the contour or shape of the surface. In this method it is first necessary to thoroughly saturate a first ply of leather **38** with an aqueous dispersion of synthetic or natural latex. In this connection, I have found that it is necessary to impregnate the latex into the leather sheet with mechanical means such as a brush or revolving buffer wheel or reciprocating paddle beater which can drive the latex into the leather sheet under pressure. I have attempted to carry out the method by merely dipping the leather sheet in the dispersion of latex, and I find that this is ineffective to achieve the valuable results that are possible when the leather sheet is thoroughly impregnated with latex under mechanical pressure.

After the first sheet **38** is thoroughly impregnated with latex, it is placed down upon the curved surface **36** with the hair side in contact with the surface **36**, leaving the flesh side of the leather sheet exposed to view. The sheet **38** is molded into place upon the curved surface **36** under pressure so that every portion of the leather sheet **38** is brought into intimate contact with all of the curves and contours thereof. In this connection, I have found that the impregnation of the leather sheet **38** with the rubber latex dispersion makes the sheet extremely pliable and tractable so that the sheet can be intimately molded to every detail of contour of an underlying foundation such as surface **36**.

Next, a second leather sheet **40** is again thoroughly impregnated with the latex dispersion. The second sheet **40** is placed in contact with the sheet **38** with the flesh side of the sheet **40** being brought into contact with the exposed flesh side of sheet **38**, which is a critical requirement for a tenaciously-bonded laminate. Again, sheet **40** is molded into place so that every surface portion thereof is brought into intimate contact with the underlying sheet **38**. Both sheets **38** and **40** are conformed to the underlying surface **38** preferably as rapidly as the nature of the work permits since the natural acidity of the leather will begin curing the latex dispersion immediately and thus cause it to set up in a tough, elastic body. If necessary, additional latex dispersion can be added to the first or second leather sheet to regain pliability and additional time for conforming the sheets to the underlying surface **36**. After the second sheet **40** has been molded upon the underlying sheet **38**, the resulting laminate is maintained in place upon the curved surface **36** so that the latex in the sheets **38** and **40** may set up and cause the laminate to permanently retain the shape corresponding to the curved surface **36**. This will occur in a very short time, perhaps even as short as five minutes depending on the form of latex that is used.

As I have mentioned, the thorough impregnation of each leather sheet with rubber latex dispersion makes the leather completely pliable and flexible for molding. As a result, the leather sheets can be conformed to the most intricate and subtle surface contours and when the latex in the sheets cures, the laminate permanently acquires the same intricate contour, especially the hair side of the first sheet **38** which is in contact with the surface **36**. Another important advantage is the fact that the bond

beween the leather plies **38** and **40** becomes stronger as the latex ages therein. In a short time, the leather sheets **38** and **40** will be so intimately and tenaciously bonded together that the entire laminate will have the appearance of a single thickness of leather in which there are no discernible parts such as the plies **38** and **40**. This gives tremendous strength to the thin wall laminate that is formed of the plies **38** and **40** and makes the laminate an especially valuable structure for the manufacture of shoes and other footwear.

FIG. 5 illustrates a modification of the bonding method described in connection with FIG. 4 whereby additional rigidity and thickness can be formed in the laminate. In FIG. 5 the same steps as described for FIG. 4 are followed in connection with conforming the first ply of leather **38** to the underlying curved surface **36**. Thereafter, a layer of so-called "split" leather **39** is bonded to the exposed flesh side of the first leather sheet **38**. The "split" leather is a thin sheet of leather which is cut out of a thicker tanned sheet of leather. Thus, the split layer of leather is an internal section which has the same surface on both sides and this surface is sufficiently porous to form a good bond with cements and adhesives. The split layer of leather is a commercially available material and is thoroughly impregnated with latex as with the first sheet **38** when used as an intervening layer in laminates formed according to my invention, The latex-impregnated split layer **39** is placed in contact with the flesh side of the first leather layer **38** and intimately conformed with the underlying leather surface. After the split layer **39** has acquired the shape and set of the underlying leather surface **38**, the second leather sheet **40** is impregnated with latex and intimately molded upon the split layer **39** and the first leather layer **38** as it was in the method described for FIG. 4. In this way, a composite laminate of three layers is formed in which the hair sides of the leather layers **38** and **40** constitute the exposed surfaces of the laminate and the split layer **39** is contained within these outer layers. The resulting laminate has greater rigidity and thickness than that formed in connection with the description given for FIG. 4. However, the thicker and more rigid laminate of FIG. 5 will still have the permanent shape and set of the underlying curved surface **36**. Thus, the thicker and more rigid laminate of FIG. 5 also is very useful as a material for the manufacture of shoes or other forms of molded footwear.

Referring now to FIGS. 6–14 and specifically FIG. 6 for details of my method of manufacturing light-weight molded all-leather footwear, a positive cast of the foot is indicated by **42**. I coat the front surface of cast **42** with an aqueous dispersion of rubber latex **44**. Next, I impregnate a thin sheet of leather **46** with the rubber latex dispersion, using mechanical pressure means such as a brush to drive the latex deeply into all pores and interstices on both sides of the leather as described above in connection with FIGS. 4 and 5.

As illustrated in FIG. 6, I place the latex-impregnated sheet **46** over the latex-coated front portion of cast **42**, the hair side of sheet **46** being contacted with the cast. The leather sheet **46**, being saturated with aqueous latex, again is very pliable and flexible and therefore readily conformable to every nuance and detail of contour and curvature of the underlying surface of cast **42**. Mechanical aids such as rods, spoons, rollers, etc, may be used to press the leather sheet **46** into the shape of the underlying cast and excess leather is gathered into a tuck **48** in front of the big toe. The tuck **48** is trimmed by cutting as the latex in leather sheet **46** sets to retain the shape of cast **42**.

A second sheet of leather **50** (FIG. 7) is now impregnated with rubber latex dispersion in the same way as was the sheet **46**. The exposed flesh side of the leather sheet **46** in place upon cast **42** is also coated with latex dispersion, and leather sheet **50** is placed upon and molded into exact conformity with the underlying sheet **46** by the technique described in connection with FIG. 6. It is of critical importance that the flesh side of leather sheet **50** be contacted with the flesh side of leather sheet **46** in order to achieve the tenacious bond described in connection with FIGS. 4 and 5. The excess of the second leather sheet **50** is also tucked and trimmed in the manner described for sheet **46**, leaving the line of cut **52** which is hardly noticeable. When the latex in the second leather has set sufficiently for retention of shape by the leather, the laminated assembly of sheets **46** and **50** may be removed from the cast **42**.

The result of the above process is a molded laminated front piece **54**, illustrated in FIG. 8, which consists entirely of leather and which has a permanent three dimensional shape exactly the same as the front portion of cast **42**. As previously described, the plies of the laminated front piece **54** become so tenaciously and intimately bonded that the laminate is virtually indistinguishable from a single sheet of leather, and the strength of this bond increases as the latex in the plies advances to a complete cure. This form of construction gives a support capacity and a degree of strength in the front piece **54** which to be duplicated with a single sheet of leather requires such a substantially greater thickness that it becomes impossible to mold the single sheet. Hence, as compared to conventional footwear construction, molded footwear made in accordance with my process although far thinner and lighter in weight offers substantially greater durability, toughness and strength, and also offers a greater range of design and appearance possibilities in view of the intricate three-dimensional shapes that can be given to a laminated assembly such as front piece **54**.

FIG. 8 also illustrates a counter **56** having a laminated construction shaped permanently in the contour of the rear portion of cast **42**. The preparation of the counter **56** involves the same steps as was used for the front piece **54**, and therefore the details need not be described again. As will be noted, both the front piece **54** and the counter **56** have peripheral flanges **55** and **57** respectively, extending out from the undercut line which is the trace of the maximum inward thrust of the curved walls of the front piece and the counter with respect to a flat plane supporting the bottom of cast **42**. The peripheral flanges **55** and **57** are very useful in the further assembly of shoes or footwear as will be described below.

Referring now to FIG. 9, the cast **42** is placed upon a relatively thick sheet of leather **58** suitable for a bottom inner sole of a shoe. The laminated front piece **54** and counter **56** are placed upon the cast **42** and lines are drawn upon the sheet **58** marking the outline of the peripheral edges of the flanges **55** and **57**.

If the same cast **42** is used at this point as was used to pre-mold the front piece **54** and counter **56**, the front piece and counter will fit the cast exactly like a glove and no reduction in the volume of these pieces about the cast will be required. However, where a different support is used at this point as compared to the cast that was used to prepare the front piece **54** and counter **56**, as for example where the wearer's foot is placed on the leather sheet **58**, then it will usually be necessary to reduce the volume of at least the front piece **54** and perhaps the counter **56** as well about the foot. In order to do this, the front piece is cut along the ridge line **60** and the counter may be cut along one or more lines such as **62**. Thereafter, the opposite sides along the cut lines **60** and **62** are overlapped to the degree required to reduce the volume of the front piece **54** and counter **56** for a perfect fit about the wearer's foot, and the excess leather of the overlap is cut away. Such overlapping is illustrated in FIG. 11 for the front piece **54** and as will be evident the cut line **60** provides a simple means for adjusting the fit of the front piece **54** to various contours or volumes of different feet.

Referring now to FIG. 10, the areas of the sheet **58** which correspond to the flanges **55** and **57** are abraded so that the flanges can be joined to the sheet **58** with

cement. The entire outer surface of the counter **56** is also abraded as illustrated in FIG. 11. This prepares the counter **56** for incorporation of the control device described in connection with FIGS. 1 and 2. However, it is not necessary to abrade the entire surface of counter **56** if for design purposes only a smaller piece of thin leather sheet is intended as the cover piece over the control device.

Referring to FIG. 12, the control device **64** consisting of a strip of flexible resilient material is placed upon the counter **56** and the strip is aligned in the proper position with respect to the calcaneus. More specifically, the strip **64** is so located on the counter **56** that the counter, from the pressure of the strip **64**, is caused to exert a grip upon the upper margin of the calcaneus. When the proper alignment has been achieved, the position of the strip **64** is marked upon the counter **56** with pencil or other means and then the strip **64** is removed and a quick-setting contact cement is applied to the area of the counter enclosed within the outline of the strip **64**. The strip **64** is then placed upon the cement which holds it in place in the aligned position.

Referring now to FIG. 13, a thin sheet of leather is thoroughly impregnated with latex dispersion in the manner previously described and the latex is also impregnated into the abraded portion of counter **56** which now has the control strip **64** in place thereon. Next, the thin sheet of leather **66** is placed upon the counter **56** with the flesh side of the sheet contacted with the abraded surface of the counter. The sheet **66** is intimately conformed to the counter **56** so that every portion of the sheet is tenaciously bonded to the counter **56** in the maner previously described. As a result, the strip **64** becomes enclosed in a laminated leather sandwich and is securely locked in the aligned position for dynamic control and correlation with the calcaneus.

Now cement is applied to the under side of the peripheral flanges **55** and **57** and also to the abraded surface areas of the sheet **58**. The cast **42** is removed from the sheet **58** and, as illustrated in FIG. 14, the front piece **54** and counter **56** are cemented in place upon the sheet **58** by means of the peripheral flanges **55** and **57** and correspondingly abraded areas on sheet **58**. The sheet **58** is next trimmed to the shape of a bottom sole as illustrated in FIG. 15. The lateral outward extension of the peripheral flange of sheet **58** in the form of a bottom sole can be made large enough so that stitching **68** can be inserted in the flange as illustrated in FIG. 15. However, with certain conventional contact cements, the adhesive bond between the flanges **55** and **57** and the sheet **58** is strong enough so that stitching is not required to hold the front piece **54** and counter **56** in place upon the sheet **58**. The stitching **68**, however, gives not only additional bonding, but also has a decorative effect which may be desired.

As illustrated in FIG. 15, the sides of the cut line **60** are laced together with a decorative lace **70** of plastic or other material. The lace **70** may be of a material with substantial elasticity or, if less lateral freedom of movement along the cut line **60** is desired, the lace may be of relatively inelastic material.

The front piece **54** is connected to the counter **56** under tension so that there is a slight curl in the sole **58**. This is achieved by providing elastic strands **72** and **74** which are attached to the front piece **54** and the counter **56**. The elastic strand **74** comprises a closed loop starting at the keeper bar **76** passing through holes in the counter **56** then through keeper plate **78** and then in a return path from the front piece **54** to the keeper bar **76**. The elastic lace **72** is also a closed loop starting at keeper bar **80**, through holes in keeper plate **82**, counter **56**, keeper plate **78** and then through front piece **54** and back along an identical return path to keeper bar **80** (FIGS. 15 and 16). The keeper bars **76** and **80** and the keeper plates **78** and **82** are also made of leather and, as illustrated in FIG. 16, keeper bars **76** and **80** are positioned adjacent each other in locking relationship to hold the keeper plate **82** against the front portion of the ankle of the wearer's foot when the shoe is donned.

The elastic strands **72** and **74** may be the same as the strands disclosed in my previous U.S. Patent No. 3,142,844. The advantage of the strands is that they urge the front piece **54** and counter portion **56** of the shoe to follow the shortening of the foot in its natural dynamics and at the same time permit a flexing of the shoe to increase the length thereof when the foot lengthens in its dynamics. As previously noted, the control device **64** urges the counter **56** to exert a pressure grip upon the upper margin of the calcaneus for dynamic correlation and control.

While the construction of the shoe of FIG. 15 has been described in connection with a cast **42**, other supporting foundations may be used in carrying out the method described for manufacturing light-weight molded leather shoes. For example, the front and counter portions, as well as the remaining steps of assembly, can be made directly upon the wearer's foot or upon a wooden last or upon a positive plaster cast or upon the outer surface of a negative shell cast prepared in accordance with the method of my copending application Ser. No. 133,096, filed Aug. 22, 1961 now U.S. Patent No. 3,197,534, dated July 27, 1965. If the negative shell cast is used, however, the foot will have to be placed in the cast to support it in view of the fact that the negative cast is very thin and flexible and by itself would tend to distort under the manufacturing steps for the molded shoe.

The molded front piece **54** and counter **56** can be prepared in advance in several basic sizes and retained as inventory in retail establishments. This permits the manufacture of molded shoes directly upon the consumer's foot starting with the steps of assembly described for FIG. 9 et seq., without having to stock in inventory every conceivable size since the manufacturing process allows for volume reduction and perfect fitting along for example the cut lines **60** and **62**. While a somewhat open sandal-type of shoe has been described in connection with the drawings, the same method steps may be used to attach additional laminated assemblies to close the open areas of the shoe illustrated in the drawings whereby the foot may be completely covered by the final shoe as with conventional footwear. By use of the basic method described in connection with the drawings, many variations in the coverage of the foot and the design or appearance of the footwear are possible.

As previously mentioned, I have found that the sealing of the pores and interstices of the leather in direct or indirect contact with skin gives great advantages and preferably this is utilized in the final treatment for the light-weight molded shoes. The sealing of the leather surface may be achieved with coatings of various flexible plastic material such as cellulose esters, specifically cellulose nitrate, cellulose acetate, cellulose acetate propionate and cellulose acetate butyrate. These cellulosic plastics can be applied by brush, spray or any other coating means in the form of organic solutions in volatile solvents which evaporate after the coating has been deposited on the leather surface, leaving behind the cellulosic plastic filled in all the pores and interstices of the leather. Other flexible plastic materials may be used such as vinyl polymers for example polyvinyl chloride, polyvinyl acetate, polyvinyl chloride-acetate copolymers and acetals such as polyvinyl butyral, etc. Other materials which may be used are silicone polymers and acrylic esters dissolved in volatile organic solvents.

It is of critical importance that the counter control device and the method of bonding thin plies of leather be used in the construction of the light-weight molded shoe. Optionally, the split leather sheets may be employed to rigidify all or a portion of the leather walls of the shoe. Finally, the sealing of the pores of the leather sheets is highly desirable, even though not critical to the manufacture of molded shoes, since the sealed leather

very much increases the life of service for the molded light-weight shoe.

It will be understood that it is intended to cover all changes and modifications of the preferred embodiments of the invention herein chosen for the purpose of illustration which do not depart from the spirit and scope of the invention.

What I claim is:

1. A method of treating leather to form tenaciously-bonded laminates thereof which comprises impregnating a leather sheet with an aqueous dispersion of rubber latex by applying the same under mechanical pressure, impregnating at least a second leather sheet in the manner aforesaid, abutting the flesh sides of said leather sheets and pressing said sheets together while the rubber latex therein is still in a curable state, abrading one side of the resulting laminate, impregnating said abraded side with an aqueous dispersion of rubber latex by applying the same under mechanical pressure, impregnating a third leather sheet with an aqueous dispersion of rubber latex under mechanical pressure as aforesaid, abutting said abraded side of said laminate and the flesh side of said third leather sheet and pressing said laminate and third sheet together while the rubber latex therein is still in a curable state, and maintaining said laminate and third sheet together until the rubber latex therein has cured sufficiently to render the resulting laminate shape-retaining.

2. A method of treating leather to form a tenaciously-bonded laminate thereof which comprises coating a three dimensional surface with an aqueous dispersion of rubber latex, said surface having a configuration desired for said leather laminate, impregnating a flexible leather sheet with said rubber latex dispersion by applying the same under mechanical pressure, placing the hair side of said leather sheet upon said three-dimensional surface while the rubber latex of both is still in a curable state, impregnating a split leather sheet with an aqueous dispersion of rubber latex applied under mechanical pressure, said split leather sheet comprising an internal layer cut out of tanned leather, placing said split leather sheet upon said first leather sheet while the rubber latex of both is still in a curable state, impregnating a second flexible leather sheet with said rubber latex dispersion by applying the same under mechanical pressure, placing the flesh side of said second leather sheet upon the exposed flesh side of said first leather sheet and said split leather sheet and pressing said sheets together and down upon said three-dimensional surface while the rubber latex of said sheets is still in a curable state, and maintaining said sheets in place upon said three-dimensional surface until the rubber latex therein has cured sufficiently to render the resulting laminate shape-retaining in the configuration of said three-dimensional surface.

3. A method of manufacturing footwear which comprises impregnating a leather sheet with an aqueous rubber latex dispersion by applying the same under mechanical pressure, conforming said leather sheet by contact of its hair side about the front portion of a foot-shaped support while the rubber latex therein is still in a curable state, impregnating at least a second leather sheet with rubber latex in the manner aforesaid, conforming said second leather sheet by contact of its flesh side about said first leather sheet while the rubber latex of both said sheets is still in a curable state, impregnating a third leather sheet with rubber latex in the manner aforesaid, conforming said third leather sheet by contact of its hair side about the counter portion of said support while the rubber latex therein is still in a curable state, impregnating at least a fourth leather sheet with rubber latex in the manner aforesaid, conforming said fourth leather sheet by contact of its flesh side about said third leather sheet while the rubber latex of both said sheets is still in a curable state, removing the resulting front portion and counter portion laminates formed by said leather sheets when the rubber latex therein has cured sufficiently to render said laminates shape-retaining in the configuration of said support, and attaching said front portion and counter portion laminates to a leather bottom sole in a spacing corresponding to the length of the wearer's foot.

4. A method as in claim 3 wherein said front portion and counter portion laminates are made with integral peripheral flanges extending out from the undercut line of said foot-shaped support, said peripheral flanges being cemented to said bottom sole in the attaching step.

5. A method as in claim 3 which includes the step of incorporating a strip of flexible and resilient material in said counter portion laminate, said strip having a generally U-shaped configuration and being disposed in a position to exert pressure transmitted through at least a portion of said laminate upon the upper margin of the calcaneus when said footwear is donned.

6. A method as in claim 3 which includes the step of incorporating a filament of flexible material between said first and second leather sheets and between said third and fourth leather sheets along the peripheral margins of said front portion and counter portion laminates respectively, said filament being conformable to the adjacent contour line of a foot when said footwear is donned and thereby causing the material of said footwear in the vicinity of said filament to assume a shape substantially corresponding to said contour line.

7. A method as in claim 3 which includes the steps of applying a synthetic plastic material to the inner surfaces of said front portion and counter portion laminates and bottom sole, said plastic material being applied in an amount sufficient to seal substantially all of the pores and interstices in said surfaces.

8. A method as in claim 3 which includes the steps of connecting said front portion and counter portion laminates with elastic strands which provide a slight tension in said connection.

9. A method as in claim 3 which includes the steps of preforming a quantity of said front portion and counter portion laminates to provide a supply thereof in advance of further steps, and then drawing upon said supply to complete the manufacture of the footwear.

References Cited

UNITED STATES PATENTS

914,377	3/1909	Baker	12—142
1,704,299	3/1929	Marsh et al.	36—58.5
1,759,034	5/1930	Blair	36—58.5
2,088,158	7/1937	Spelman	12—146 X
2,739,096	3/1956	Bayon.	
3,269,858	8/1966	Mattei.	

FOREIGN PATENTS

296,372	11/1929	Great Britain.

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U.S. Cl. X.R.

36—58.5, 69; 156—212