April 24, 1956 A. E. MURRAY 2,742,717

FOOTWEAR

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Fig. 1.

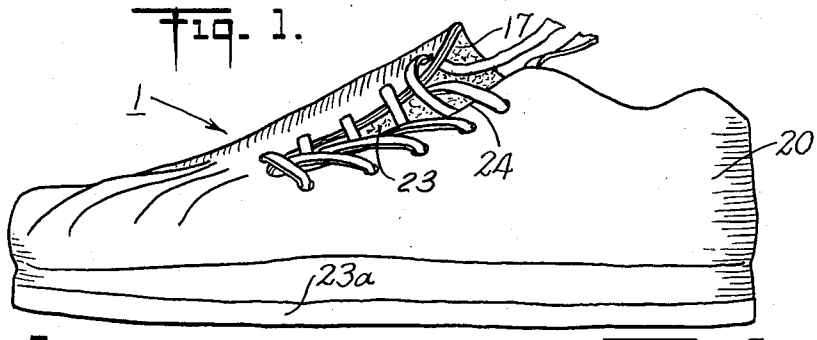

Fig. 2.

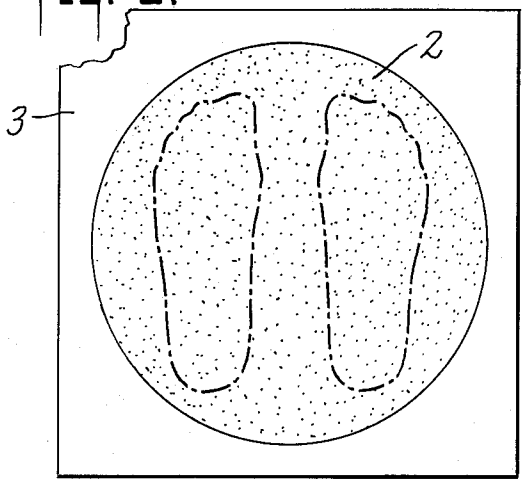

Fig. 3.

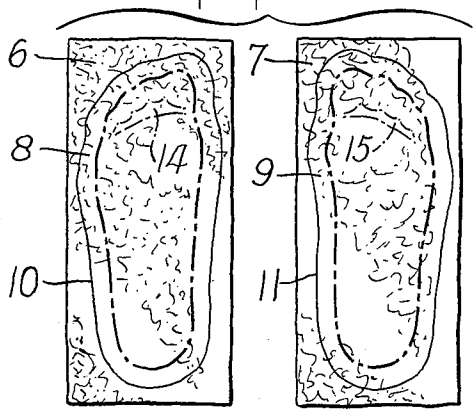

Fig. 4.

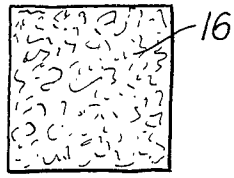

Fig. 5.

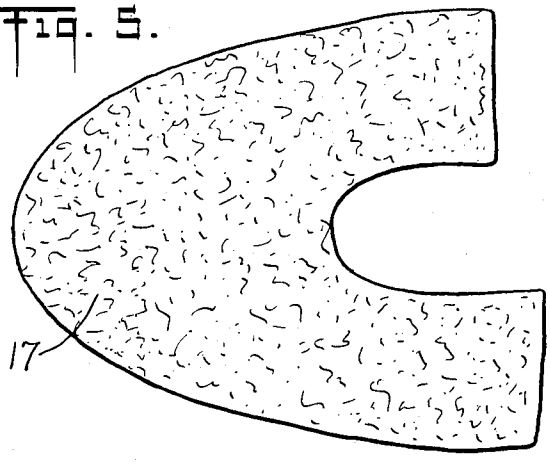

Fig. 6.

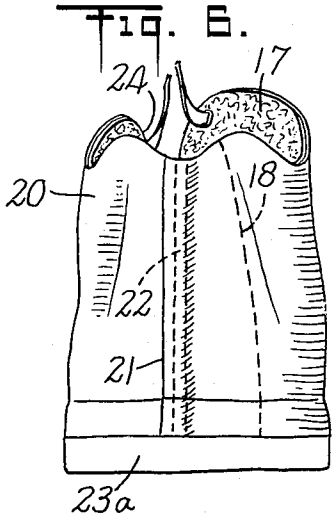

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Fig. 7.

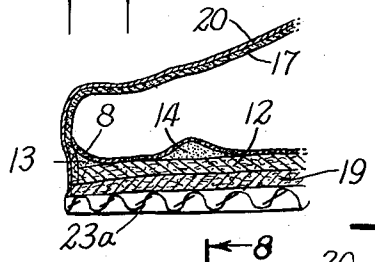

Fig. 8.

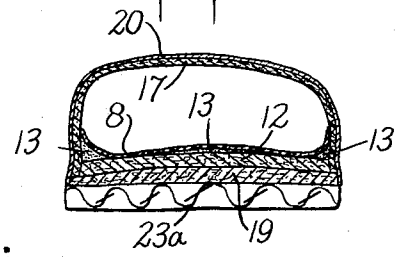

Fig. 9.

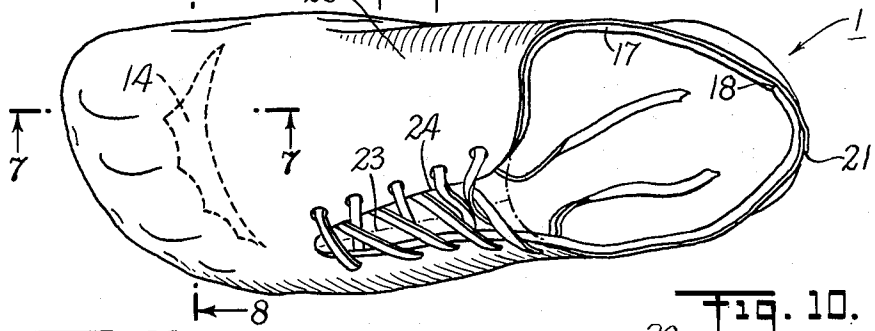

Fig. 10.

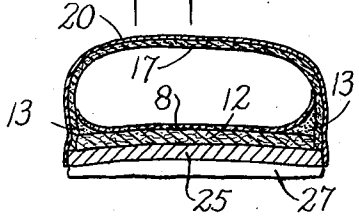

Fig. 11.

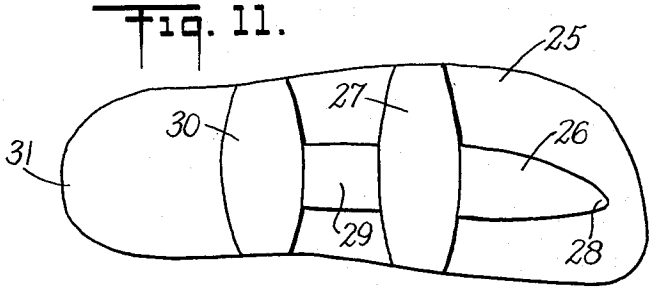

Fig. 12.

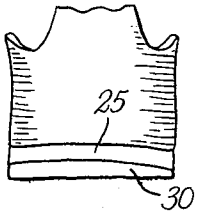

Fig. 13.

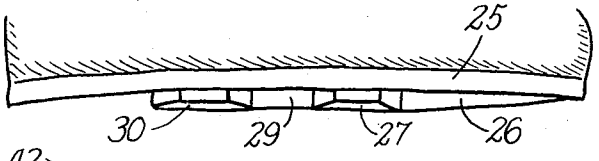

Fig. 14.

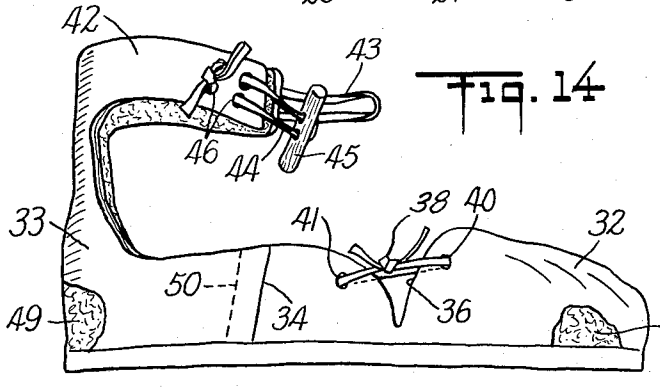

Fig. 15.

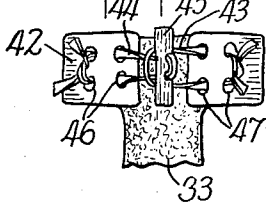

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Fig. 16.

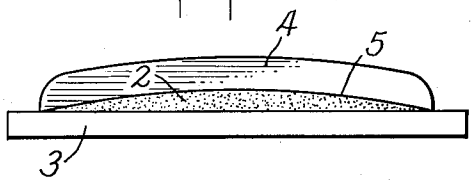


Fig. 17.

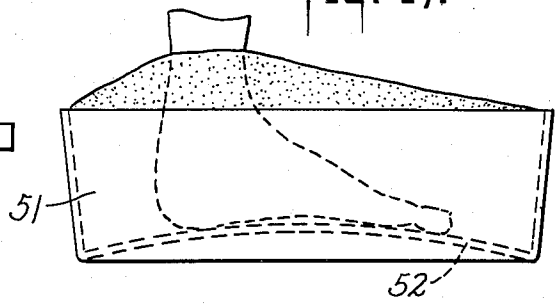


Fig. 18.

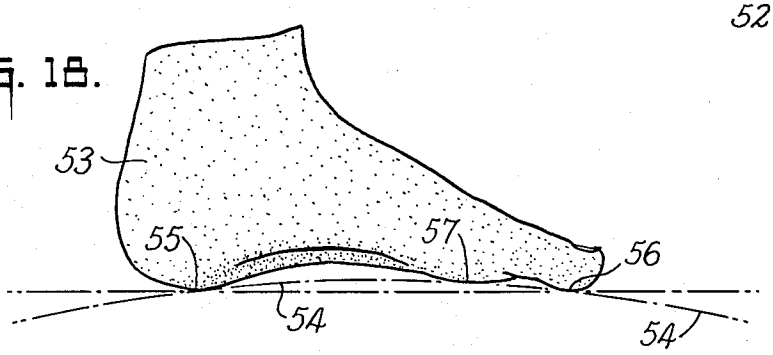


Fig. 19.

Fig. 20.

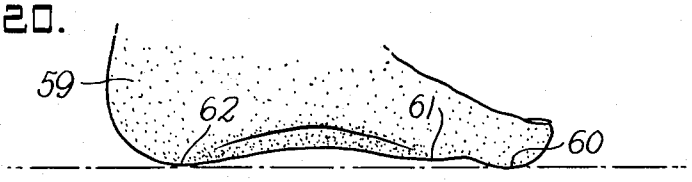
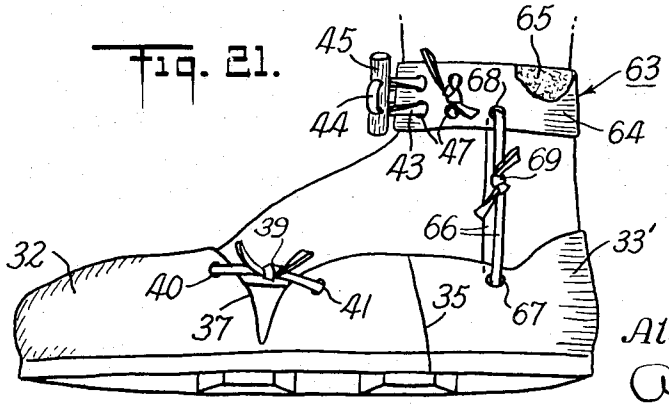


Fig. 21.



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2,742,717

FOOTWEAR

Alan E. Murray, New York, N. Y.

Application October 9, 1953, Serial No. 385,094

3 Claims. (Cl. 36—8.5)

My invention relates particularly to footwear, including shoes, sandals and elements thereof, etc., of an advantageous and more effective character.

An object of my invention is to provide footwear which not only fit the particular feet on which they are made to be worn, but which are more compatible with the inherent natural characteristics of the feet before distortion or deformation thereof due to wearing arbitrary forms of footwear not made to fit the particular feet. Thus, one of the objects of my invention is to provide footwear for preventing and correcting deformities of the feet.

I have found that when the foot from very early childhood has worn only footwear made to fit accurately the detailed contours of the soft tissues of the foot, the said foot will preserve and retain an underneath concave shape with a high arch, both longitudinally and transversely, the characteristics of which would otherwise be destroyed partly or entirely by constant use of the foot in non-conforming ill-fitting shoes, or due to constant walking on flat or approximately flat shoe surfaces. I have discovered, furthermore, that there is a natural overall curvature or concavity which is most comfortable to and therefore compatible with the plantar or underneath shape of the foot in the case of substantially all feet in their natural shape, and that when shoes are made with the aid of such concavity for the particular foot, the shoes thus made are more capable of aiding the feet in retaining and assuming the natural shape of the foot as unchanged or unspoiled by incorrect footwear. I have, furthermore, found that the encouragement of the foot in this way to maintain its natural shape and characteristics, by preventing and correcting deformities of the feet, is aided and made feasible by the experience in connection with my previous footwear directed to maintaining the natural conformation of the soft tissues of the foot.

In carrying out my invention I, thus, utilize fundamentally the law of non-interference with the foot contours, to which I may apply a corrective by building the shoe while the bottom of the foot assumes a concave position compatible with the natural concavity or dome-shape which is conformable to, that is to say most comfortable to, the general shape of the plantar surface of the foot. My invention, thus, provides for shoe making manifold accomplishments previously unattainable therein, comparable to orthodontics or orthodontistry for duplicating the shape and position of the teeth in nature, by obviating and correcting deformities of the teeth.

Another object is, therefore, to accomplish these purposes in order to provide shoes which do, in fact, preserve the natural conformation and characteristics of the particular feet for which the shoes are made.

Still another object is to provide a shoe upper and sidewalls conforming to the individual contours of the particular feet for which the footwear is made.

Further objects of my invention will appear from the detailed description of the same hereinafter.

While my invention is capable of embodiment in many different ways, for the purpose of illustration I have described in detail only certain examples thereof hereinafter and have shown in the drawings only certain embodiments in connection therewith, in which—

Fig. 1 is a side elevation of a left foot shoe made in accordance with my invention, which also exemplifies the corresponding right shoe construction;

Fig. 2 is a plan view of a dome or convex surface on a square plate, showing an example of a position or placement of the two feet thereon, on which the shoes or other footwear are made;

Fig. 3 is a plan view of two pieces of felt from which underneath pieces are cut out for said feet;

Fig. 4 is a plan view of a heel piece applied to the foot in the making of the shoe;

Fig. 5 is a plan view of the felt cover piece and of the leather piece of the upper of the shoe;

Fig. 6 is a rear elevation of the completed left shoe indicating thereon the position of the rear ends of the cover pieces;

Fig. 7 is a longitudinal section of the front part of the completed shoe, taken on line 7—7 of Fig. 9;

Fig. 8 is a transverse section of the same taken on line 8—8 of Fig. 9;

Fig. 9 is a plan view of the shoe in making the same, indicating the position of the laced front slit made on the top of the shoe;

Fig. 10 is a transverse section, taken on a position similar to Fig. 8, of the second type of shoe made with a modified form of ground sole, through the shoe instep;

Fig. 11 is an underneath view of a right shoe, shown in Fig. 10, with added sole plates;

Fig. 12 is a rear elevation of the lower portion of the shoe in Fig. 11;

Fig. 13 is a side elevation of the lower portion of the shoe shown in Fig. 11;

Fig. 14 is a side elevation of a sandal in accordance with my invention;

Fig. 15 is a front elevation of the upper portion of said sandal shown in Fig. 14;

Fig. 16 is a side elevation showing means for producing the dome or convex surface in Fig. 2;

Fig. 17 is a side elevation of a pan which may be used in which to rest the feet while making a cast according to the procedure of my Patent No. 2,177,304, but with the feet resting on the convex bottom of the pan for the negative mold or baffles for the upper part of the feet;

Fig. 18 is a side elevation of a positive cast of a teenage child's foot, which from babyhood has always worn Murray molded shoes;

Fig. 19 is a fragmental side elevation of a positive cast of a child's foot before having worn Murray shoes;

Fig. 20 is a fragmental side elevation of a positive cast of the same foot of the same child, as in Fig. 19, the cast having been made, however, after wearing Murray molded shoes for about a year, or more; and

Fig. 21 is a side elevation of a modified form of sandal.

The shoe can be made either on the foot itself or on an accurate cast thereof, having in detail the same contours as the foot on which the shoe is to be worn. Preferably, however, the shoe is made on the foot itself.

In my footwear, referring first to Figs. 1 to 9 and 16, such as a shoe 1, I utilize plastic materials which, for example, will have a maximum plasticity. For this purpose I prefer to utilize latex which may be of three different consistencies, that is to say latex or thickened latex or thin latex. The thickened latex is derived by thickening the latex and the thin latex is produced by thinning said latex.

For the latex herein referred to, I preferably use a

latex which is a water-suspension of self-vulcanizing artificial rubber known as "neoprene," although latex made of natural rubber or any artificial rubber can be used herein. For the thickened latex herein I may use the "thickened latex" such as referred to in my Patent No. 2,568,291, which is made, as stated therein, by adding a thickener, such as methyl cellulose, to the self-vulcanizing water-suspended neoprene latex generally sold under the name latex." Also, in carrying out my process I may use as the thinned latex, for example, the said neoprene latex unthickened, which is generally sold under the name "latex," and from which the said "thickened latex" is made, which is thinned as hereinafter referred to. By the term "latex" merely I mean to refer to the said unthickened, unthinned latex.

Together with the latex, I may also employ sheet materials, such as felt and leather. For the felt I prefer to use the cheaper grades thereof, and which are generally what is known as fibre refuse or mill ends, of one or more of the fibres, wool or cotton or rayon or other fibres. For the leather, I preferably employ a very soft leather which is stretchable in various directions, as for instance goat leather or cape or glove leather, although other types of leather can be used if desired.

For obtaining the shoe, I first produce a convex dome 2 of plaster of Paris, preferably spherical in shape, as produced for instance by placing a body of the moldable plaster of Paris and water, in the form of a mud, on a square plywood plate 3, and then, while the plaster of Paris is soft, rotating, on a fixed axis, in a horizontal plane over the same a thin template 4 of plywood with an under-margin 5, preferably circular in shape, and having a curvature made on about a radius of from 2' to 4', but preferably about 34". Said dome is then allowed to harden. There is thus obtained a dome in the form of a hard convex mound 2 on which the person for whom the shoes are made is allowed to stand in the position, as shown in Fig. 2, in which, by trial and error, the feet are found to rest in the most compatible, that is to say most comfortable, position. This will be found to approximate the natural metatarsal curvature of the underneath or plantar portion of each of the particular feet. For convenience, these positions of the feet may be marked with outlines on the dome 2. Thereupon, at about the said foot positions on the dome 2, rectangular pieces 6 and 7 of the felt, approximately 3/32" in thickness, preferably obtained as split, with a smooth side next to the foot, from felt 1/2" thick, are placed over the said foot-positions and the said person is made to stand on the felts 6 and 7 over the said foot positions. Outlines 10 and 11 are now made on said felts 6 and 7, extending around the foot but about 1" to 1 1/2" beyond the foot margins, as shown in Fig. 3 and by the interior outlines. Pieces 8 and 9 are now cut out around the outlines 10 and 11.

These felts 8 and 9 are now dipped in latex so as to become saturated thereby and the excess latex is squeezed out by rolling the pieces 8 and 9 up, respectively, and wringing out the excess.

These pieces 8 and 9 are now replaced over the foot outlines previously made on the dome 2 and while the person stands on the said wet pieces 8 and 9 underneath the feet they are molded up around the margins of the feet with the smooth sides next to the feet. I also make from thicker pieces of felt similar to the felt used for pieces 8 and 9, about 1/2" thick, two felt platforms 12, one for each foot, by cutting out the same to accord with the marginal outline of the feet. One of the pieces 12 is placed under each of the pieces 8 and 9. Between each of these platforms 12 and the respective underneath pieces 8 and 9 I produce pyramids by making a mud, of about the consistency of cottage cheese, from latex kneaded together with granules made by cutting into cubes strips of the said felt having a thickness of 3/32" and a width of about the same dimension. By lifting one of the feet at a time I then press beneath each of the underneath pieces 8 and 9, a body of this mud and then press the felt and mud up into the pyramid or toe cavity which is located at the rear of the toes. Also, it will be understood that, if desired, some of this felt mud 13, about 1/8" thick, could be spread over the whole under-surface of the underneath pieces 8 and 9.

While the underneath pieces 8 and 9 are still very wet with the latex and having pyramids 14 partially formed thereon, the platform pieces 12 are placed over the foot outlines on the dome 2, said platforms having had thickened latex put thereon, followed by said plaster of Paris dust, and with further thickened latex on top of the plaster of Paris. Then the feet, with the underneath pieces 8, 9 and pyramids 14 thereon, are placed over the platforms 12, preferably while the said person is seated, the weight of the legs being allowed to bear on the feet which now rest on the underneath pieces 8 and 9, the pyramids 14 and 15 and the platforms 12. As a result the pyramids 14 and 15 become formed more completely and attain a sharp, accurate curvature of the respective concavities at the rear of the toes. Also, some of the felt mud may be pressed in around the marginal curves between the pieces 8 and 9 and the platform pieces 12. Next, I trim down the edges of the felts 8 and 9 to approximately the under-cut lines of the respective feet. The platform felts 12 can now be molded by the fingers around the edges of the feet, while still very plastic.

There are two alternative types of shoes which may be made, each of which types can be made in the form of a shoe or sandal, as desired.

For obtaining the first type of shoe, as in Figs. 1 to 9, I provide a square heel piece 16 of the 3/32" thick felt for each of the feet. These heel pieces 16, which are about 3" square, are then dipped into latex, rolled up and wrung out to remove excess latex. I thereupon apply the said heel pieces 16 while wet, with the smooth side towards the heel of the foot, after having applied thickened latex followed by powdered plaster of Paris to the rear heel portions of the underneath pieces 8 and 9 which are carried by the feet. These heel pieces 16 are then pressed into the adjacent portions of the underneath pieces 8 and 9 by the rear portions of the feet of the person for whom the shoes are made.

Next, I provide a felt cover piece 17 for each of the feet, made of the said 3/32" thick felt, cut out so as to have the smooth side thereof next to the foot. These felt cover pieces 17 are then dipped in latex, rolled up and wrung out to remove the excess latex. Thereupon, I apply all around the margin of the turned-up underneath pieces 8 and 9 and to the edges of the platforms 12, and so as to extend all around the foot very slightly above said pieces 8 and 9, onto the foot itself, some of the thickened latex followed by powdered plaster of Paris, and lay onto each foot and its turned-up underneath pieces 8 and 9 its cover piece 17 while wet, as above, while pressing the same into place with the fingers. If desired, some small pieces of dry cotton could be placed from above into the crevices between the toes up to partly fill, to just below the upper level of the toes, the cavities between the same before applying the said cover pieces 17. With a thin spatula, or other tool, the outline of the welt all around the shoe and the recesses between the respective toes can be brought out or emphasized by pressing the cover pieces into the same with the tool. I now make an abutting joint 18 at the rear in each felt cover piece 17, but not in the middle of the heel, as shown in Fig. 6.

I next make a spacing element 19 for each of the shoes out of the 1/2" thick felt rectangular in shape and dip it into latex, roll the same up and wring it out to eliminate excess latex. To the upper surface of the spacing element 19 I apply thickened latex, followed by powdered plaster of Paris, after which there is again applied thickened latex. I then place the spacing element 19 on the dome 2 and apply the foot, with the partly completed shoe thereon, to the spacing element 19 until the spacing element has ad-

hered to its platform **12**. After this, the foot together with the shoe is raised and the spacing element **19** is trimmed off laterally around the margin of the shoe. The foot and the shoe are now put back on the dome **2** and a cover piece **20** of leather shaped like the felt cover piece **17**, is prepared by dipping it in thin latex and thereafter applying the latex which has not been thinned, as set forth in detail in my Patent No. 2,493,310. Then, thickened latex, followed by powdered plaster of Paris, is applied all over the felt cover piece **17** and the leather cover piece **20** is placed thereover and molded into place, with the fingers and a spatula, all over the shoe. A leather cover piece seam **21** adjacent to a vertical cord **22**, with one leather margin overlapping the cord, is made at the rear of the shoe in the center of the heel. The leather cover piece **20** now extends down far enough to cover the lower edge of the platform **12** and the spacing element **19**.

The said person now stands in the shoe on the dome **2**, as above referred to, for about one minute, in order to form the foot contours against the pyramid **14** and the other parts of the shoe. A slanting slit **23**, as shown in Figs. 1 and 9, is then made down the front of the shoe and the foot is taken out of the shoe. Thereupon, the shoe is allowed to dry for about twelve hours under an electric fan. The spacing element **19** will have become considerably hardened by this time, and has at its bottom surface a concave curvature transversely and longitudinally substantially matching the spherical concave curvature of the dome **2** where the particular shoe has rested while being made.

The marginal edges beneath the lower surface of the spacing element **19** may now be ground off partly or entirely, as indicated in Figs. 7 and 8, at the sides, front and rear, wherever necessary to produce a less concave surface or even a substantially flat surface on the underside of the spacing element **19**. On the said flat surface beneath the spacing element **19** there may be applied a sole **23***a*, for example the terry cloth sole set forth in my Patent No. 2,448,455. However, other types of soles may be applied instead, if desired, as for instance a sole made of a fine neoprene sponge with microscopic holes therein, or any other rubber or artificial rubber soling, as desired. The slit **23** may be widened, if desired, into a U-shaped cut-out **24** and may be provided with the usual eyelets and laces. In applying the neoprene sponge sole, adequate bonding can be readily obtained with the aid of a tacky neoprene cement. Afterward, the shoe may be cleaned out inside to remove any particles of latex adhering thereto, with the aid of power-driven rotary brushes.

Instead of the said first type of shoe, a second type of shoe, referring particularly to Figs. 10 to 13, may be made in which case the same procedure as above will be followed up to and including applying the leather cover piece **20**, but not including applying the spacing element **19**. In this instance, there is applied to the platform **12**, which has the concave shape derived from the convex dome **2**, a neoprene sponge rubber sole **25**, of the kind above referred to, with the neoprene tacky cement. The underneath surface of the neoprene sole **25** will likewise have a concave surface similar to the concave surface of the platform **12**. To adjust it to the needs of the particular person who is to wear the shoes, I may provide and fasten to the bottom of the neoprene sole **25**, with the tacky cement, a dart-shapd longitudinal narrow plate of the neoprene soling **26** and immediately at the rear of the plate **26** I apply crosswise thereof, in the same way, a transverse plate **27** extending completely across the shoe. The underneath margins of the plate **26** may be tapered slightly, for example, at the front end **28** of the plate **26** and the plate **27** may be likewise tapered at the two marginal sides of the plate **27** so as to have the over-all combined undersurface of the plates **26** and **27** less concave or even approximately in a flat plane together with a rear end **31** of the heel. Additional plates **29** and **30** may be optionally added, the latter plate **30** being tapered at its two sides, according to the wishes of the particular person. This may be accomplished by grinding off one or more of the marginal portions of said plates **26**, **27**, **29** and **30**, for the same purpose.

If desired, either of said above two types of shoes may be made into sandal form, as shown in Figs. 14 and 15. In that event, instead of having single cover pieces of felt and leather **17** and **20**, a front cover piece **32** of leather and a rear cover piece **33** of leather are prepared in the same way and applied in a similar manner, but so as to produce marginal abutting joints **34** and **35** on opposite sides of the shoe. In this instance, furthermore, there can be at the two sides of the shoe, V-shaped cut-outs **36** and **37** at the place where the shoe bends, which may be bridged by thongs **38** and **39** passing through eyelets **40** and **41** at the two sides of the cut-outs **36**, **37**. Also, in the case of this sandal type, the rear leather cover piece **33** will extend upwardly to form an enclosing strip **42** around the ankle above the ankle joint, the two ends of which will be capable of being fastened together by means of a looped thong **43** and a thong **44** having a cleat **45**, the thongs **43** and **44** being passed through a number of eyelets **46** and **47**. Also, in the instance of this sandal type, beneath the front cover piece **32** and the rear cover piece **33**, respectively, there will be applied felt cover pieces **48** and **49**, prepared as in the case of the cover piece **17**, shaped substantially like the leather cover pieces **32** and **33**, but with lateral abutting edges **50** placed rearwardly of the abutting edges **34** and **35**, of the leather cover pieces **32** and **33**.

As shown in Fig. 17, if desired, in making any or all of the shoes and sandals herein above referred to, instead of using the plywood board having thereon the plaster of Paris dome **2**, I may make and utilize for the same purpose a circular pan or tray of sheet metal having an approximately cylindrical side wall **51** of any desired height, shallow or deep, provided with a convex bottom **52**, and having any of the above mentioned spherical curvatures described above, for the chosen foot positions.

Furthermore, this pan **51** may be used for producing an accurate, correct cast, of each foot, on which any of the shoes or sandals above described can be made. In making the said cast substantially the same procedure can be followed as described in my Patent No. 2,177,304, above referred to, except that in making the initial negative cast of the upper part of the foot or "baffle," the foot will rest on a dome-shaped curvature **52** of the pan **51**, having the same curvature as on the dome **2**, instead of on the "arbitrary" support in the form of a "lump of clay" referred to in said patent. (See particularly Figs. 2 and 3 of said patent.) For making the lower part of the negative cast a flat bottom pan, as in said patent (see Figs. 5 and 6 of said patent) is utilized so as to form said lower part of the negative cast against the previously produced "baffle," that is to say negative cast, of the upper part of the foot made while the foot is being rested on said surface **52**. A positive cast **53** may be made from the negative cast formed by fastening together with any desired cement the two halves of the negative cast which have thus been obtained. The procedure of pouring, etc., for obtaining the said positive cast, may be as described in the said Patent No. 2,177,304.

In Fig. 18 I have shown the cast **53** thus obtained from a foot of a child about twelve years of age, who has always worn molded Murray shoes beginning from early babyhood, said cast **53** showing an over-all spherical concave curvature **54** beneath the foot extending from the heel **55** to and including the big toe, which latter is even below the level of the big toe joint **57**, and located in the line of said spherical curvature. This tendency of the foot to adjust itself into this concave curvature is confirmed as seen from the cast **58** of a child's foot, Fig. 19, before wearing Murray shoes, as compared with a cast **59** of the same foot after having worn molded Murray shoes for more than a year. It will be noted that in Fig. 20, as in

Fig. 18, the big toe **60** has a position below the level of the big toe joint **61** so that the heel **62**, the big toe joint **61** and the big toe **60** are all located in the line of a concave spherical curve, as in Fig. 18. This is not so, however, in the cast in Fig. 19, of a foot which has not worn the molded Murray type of shoe but which for a number of years has been wearing the usual kind of shoes made in stock sizes and shapes for wear by the public, not matching or fitting the contours of the particular foot on which the shoe is worn.

In Fig. 21 I have shown a modified form of sandal which may be made substantially like the sandal as shown in Fig. 14 except that in this instance the rear leather cover piece **33'** does not extend upwardly around the ankle above the ankle joint. Instead thereof, I provide an ankle band **63** having an outer leather layer **64** and an inner layer of felt **65** which are prepared and applied around the ankle in the same manner as the enclosing strip **42** the ankle, referred to in connection with Fig. 14, and which has the looped thongs **43** and **44**, as well as the cleat **45**, as in the case of the said strip **42**, passing through the eyelets **46** and **47**. Also, in this instance, as shown in Fig. 21, there is provided on each side of the foot, passing approximately over the ankle joint, a thong **66** which extends through an eyelet **67** in the rear cover piece **33'** and an eyelet **68** in the ankle band **63**, a knot **69** being made in the thong **66** after taking up the slack in the said thong. Each thong **66** is thus located in a position in which its length is not changed by the bending of the foot while walking, etc.

Also, it will be understood that other sandals or shoes can be made following any of the above described techniques, by producing sandals or shoes, for instance, in accordance with the processes set forth in any of my previous Letters Patent or applications, filed June 30, 1953, such as Patent No. 2,606,333, filed January 4, 1952, now Patent No. 2,663,887, granted December 29, 1953, and applications Ser. Nos. 365,093, 268,036, filed January 24, 1952, now Patent No. 2,663,887, granted December 29, 1953, and 296,826, filed July 2, 1952.

While I have described my invention above in detail I wish it to be understood that many changes may be made therein without departing from the spirit of the same.

I claim:

1. An article comprising a shoe upper provided with a foot-supporting sheet of set plastic material, said sheet having an inner spherical convex foot-receiving curvature on one side thereof and on the other side a spherical concave single curvature extending from end to end and side to side of said sheet.

2. An article for each of two feet comprising a shoe upper provided with a foot-supporting sheet of set plastic material, said sheet having an inner spherical convex foot-receiving curvature on one side thereof and on the other side a spherical concave single curvature extending from end to end and side to side longitudinally and transversely of said sheet, said curvatures being spherical, the said curvatures for the respective two feet having transversely upwardly directed inclinations towards each other.

3. An article for each of two feet comprising a shoe upper provided with a foot-supporting sheet of set plastic material, said sheet having an inner spherical convex foot-receiving curvature on one side thereof passing approximately through the under surface of the heel, toe joint and big toe of said foot and on the other side a spherical concave single curvature extending from end to end and side to side longitudinally and transversely of said sheet, said curvatures being spherical, the said curvatures for the respective two feet having transversly upwardly directed inclinations towards each other.

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