

March 19, 1946.

A. E. MURRAY

2,396,926

PROCESS OF SHOEMAKING

Filed June 25, 1942

4 Sheets-Sheet 1

Fig. 1.

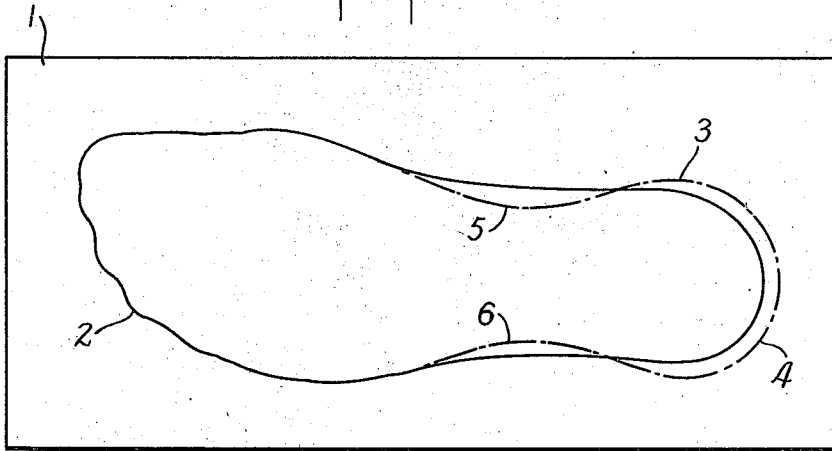


Fig. 2.

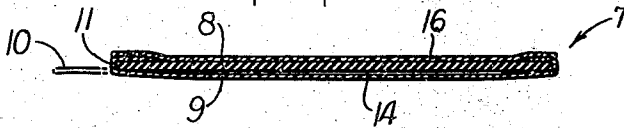
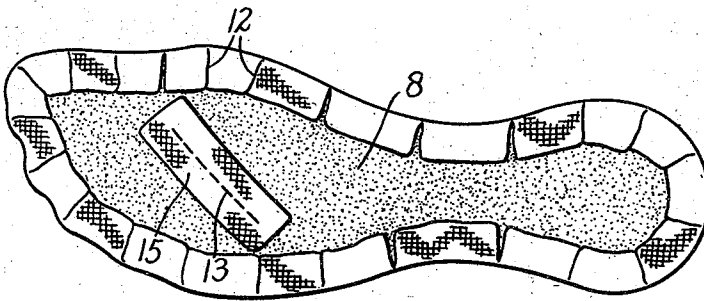


Fig. 3.



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Fig. 4.

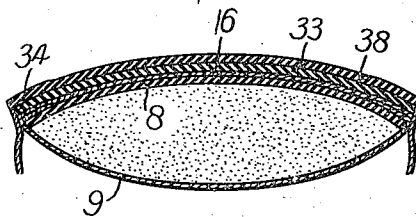


Fig. 5.

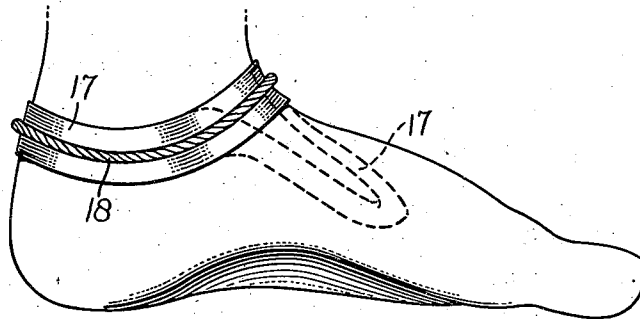
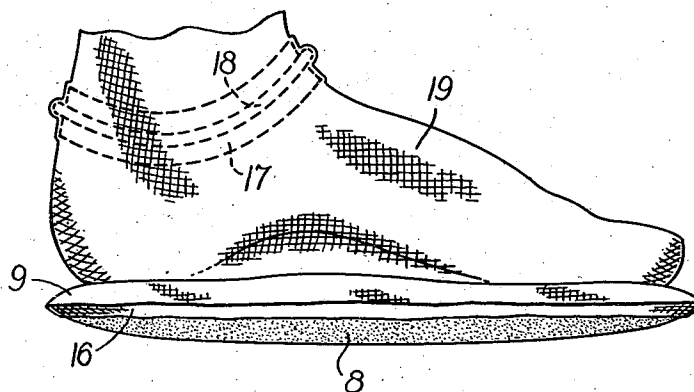


Fig. 6.



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Fig. 7.

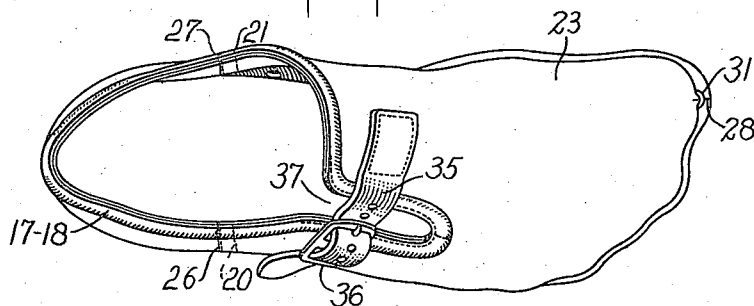


Fig. 8.

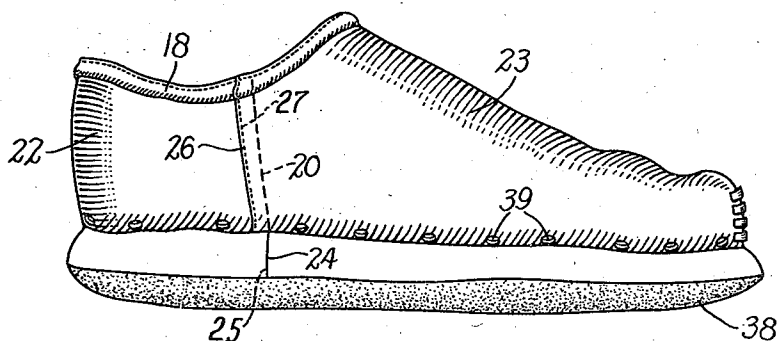
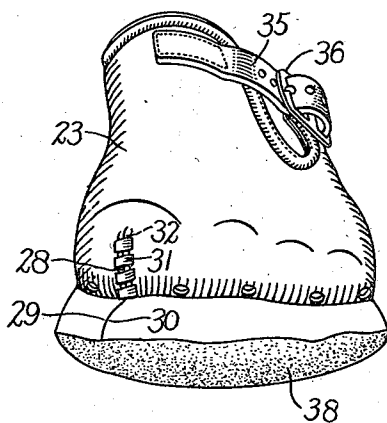


Fig. 9.



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Fig. 10.

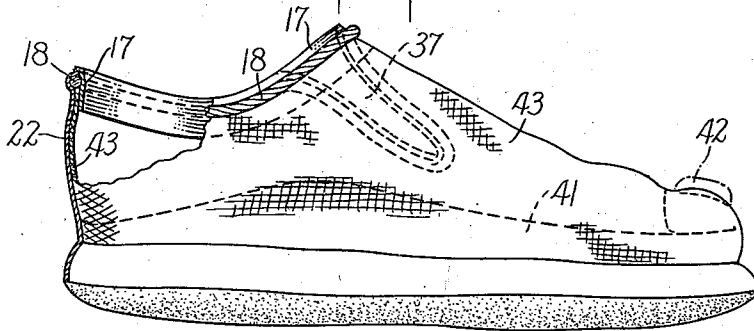


Fig. 11.

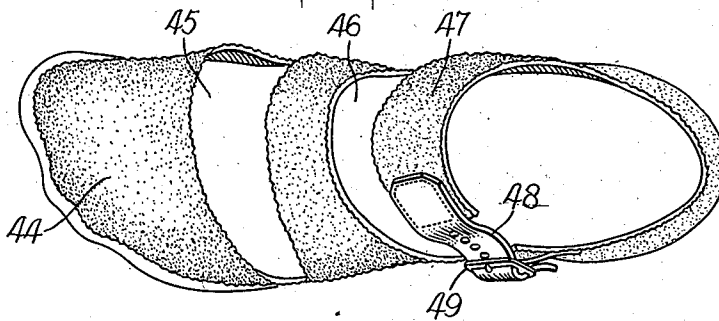
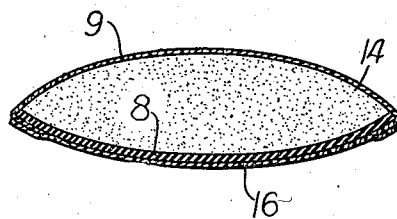


Fig. 12.



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UNITED STATES PATENT OFFICE

2,396,926

PROCESS OF SHOEMAKING

Alan E. Murray, Wilmington, Del.

Application June 25, 1942, Serial No. 448,474

9 Claims. (Cl. 12-142)

My invention relates particularly to a process of making shoes adapted to give effective support to the feet.

The object of my invention is to provide a process of shoe making so as to produce shoes giving correct support to the feet, whereby a very great saving of labor is attained and by means of which shoes of this character may be produced which are light in weight. A further object is to produce shoes which not only conform to the natural contours of the feet but which incorporate into the shoes the dynamic shape taken by the feet when in action. Still another object is to provide a process in which the portion of the shoe which supports the foot is given the dynamic shape of the foot when in action and in which the shoe is built around the portion of the shoe thus preformed for supporting the foot. Another object is to build a shoe in this manner on the foot of the wearer, no last thus being needed. Further objects of my invention will appear from the detailed description of the same hereinafter.

While my invention is capable of being carried out in many different ways for the purpose of illustration I have shown only certain ways of carrying out my invention in the accompanying drawings, in which—

Fig. 1 is a view of a sheet of paper on which the original outline of the foot is taken;

Fig. 2 is an inverted cross-section of the foot-supporting pad before being filled with powder;

Fig. 3 is an underneath view of a portion of the pad at one step in its manufacture;

Fig. 4 is an inverted cross-section of a modified form of pad shown in the course of its manufacture;

Fig. 5 is a side elevation of the foot showing a part of the shoe applied to the foot in the course of manufacture;

Fig. 6 is a side elevation of the partially completed shoe with the fabric partly broken away;

Fig. 7 is a plan view of the completed shoe;

Fig. 8 is a side elevation of the completed shoe;

Fig. 9 is a front view of the completed shoe;

Fig. 10 is a side elevation, partly in section, of a modified form of shoe made in accordance with my invention;

Fig. 11 is a plan view of another modified form of shoe made in accordance with my invention; and

Fig. 12 is a cross-section of the completed pad shown in Fig. 2.

For example, referring first to the form of my invention illustrated in Figs. 1 to 9 and 12, I place each of the feet of the wearer of the shoes

to be made upon a sheet of paper such as the sheet 1, as illustrated in Fig. 1, and make an outline 2 of each of the feet of the wearer. I then produce a modified outline 3 of the foot, which is widened by about $\frac{1}{4}$ " around the heel at 4 in order to add stability to the foot in the resulting shoe. Also, at the middle of the foot I produce narrower inwardly curved portions 5 and 6 of the outline so as to narrow the outline opposite the instep to prevent the body of powder, hereinafter referred to, becoming built up too high and so as to, likewise, control the flow of the powder within the supporting part of the shoe. I then form a supporting pad 7 for each of the feet, as shown in Fig. 2, the same being preferably produced in inverted position. For this pad 7, there is provided a layer of elastic vulcanized rubber 8 cut out according to the outline 3 and beneath the rubber layer 8 I place a layer of cotton duck 9 having the same outline but provided all around the same with an excess margin 10, about 1" in width, extending beyond an edge 11 of the rubber layer 8. This edge 11 is then first wet with rubber cement. The marginal portion 10 of the duck layer 9 is then folded up around the edge 11 to adhere to the same. This procedure prevents any of the adhesive entering between the layers 8 and 9 and thus avoids these layers sticking together. This sticking together is to be prevented as the body of powder, hereinafter referred to, is to be received between the layers 8 and 9. Furthermore, this procedure prevents any lack of evenness of the duck around the margin 11. Thereafter, the upwardly directed margin 10 is provided with V-shaped cut-outs 12 all around the margin 10 so that when folded over, in Fig. 3, these portions of the margin 10 will abut but not overlap. Then the inner face of these portions is coated with rubber cement so that the margin 10 may be folded down against the rubber layer 8, so as to adhere to the same. A slit 13 is then made through the rubber layer 8 and a dry, permanently non-setting, flowable powder of any desired character, such as described in my copending application upon Foot support, Ser. No. 412,936, filed September 30, 1941, but preferably balsa wood flour, is packed tight between the layers 8 and 9. In order to obtain a set but flexible foot support, I may substitute for the balsa wood flour at the beginning of the shoe or after the completion of the entire shoe hereinafter described, a mud made of any desired proportions of balsa wood flour and the "thick latex," hereinafter referred to. When the mud is introduced and before it has set the foot

impression is made therein, as referred to hereinafter. If it is introduced therein at the beginning of the shoe the shoe is completed after the foot impression has been made and before or after the said mud has set. However, the procedure using the balsa wood flour alone is preferable. This is done by stuffing the powder in both directions longitudinally into the pocket 14 formed between the layers 8 and 9, the stuffing operation being, of course, carried out after the cement is dry on the margin 10. By placing the slit 13 over the ball of the foot away from the heel portion of the pad 7, a more effective stuffing of the heel portion, which sustains the main weight of the body, is obtained. The slit 13 is then covered over and sealed with a strip of fabric 15, such as duck, etc., having rubber cement applied to the face thereof to cause it to adhere to the rubber layer 8. I then cover over the face of the rubber layer 8 with a layer of cotton duck 16, which, in order to make it adhere properly, is first coated with a layer of thin "latex," that is to say comprised of a solution made of 3 parts by volume of distilled water to 1 part by volume of the ordinary "latex" or "thick latex" hereinafter referred to. The "thick latex" is the ordinary "latex" containing approximately the usual 60% of the rubber body and 40% of water. After this is dried I apply over the layer of "latex" a layer of rubber cement. The layer of duck 16 is then caused to adhere securely to the rubber 8 by applying weights to the pad in any desired manner. The pad 7 will now be, as a result of the above, tightly packed with the balsa wood powder so that in cross-section throughout the pad the latter will be bowed upwardly and downwardly, the thickest part of the pad being preferably about 1" thick, whereas the margin of the pad all around the same comes down to a rather sharp edge. The pad may then be beaten with a heavy mallet to more tightly pack the powder in the pad. This pad 7, tightly filled with a flowable powder, is ready to take the conformation of the dynamic shape of the undersurface of the foot.

The next step in the making of the shoe is for the person, for whom the shoes are to be made, to wear these pads beneath the feet for an interval of time, for example from one half an hour to five days, but preferably the latter, so that the pad 7 will receive and substantially retain the dynamic contours of the undersurface of the foot in action such as the feet naturally take in the course of walking or other locomotion by the feet. For this purpose the two, right and left, pads 7 are placed in socks with the duck layer 9 uppermost, so that the wearer causes the pads to conform to the dynamic shapes of the feet in action, as above referred to, by walking thereon, etc. Instead of using socks for this purpose, however, the wearer can attach the pads to his feet with adhesive tape, in any desired way.

The upper surfaces of the pads having thus been made to conform to the undersurfaces of the feet in action, it will be found that the formed surfaces of the pads will have acquired, likewise, the angles of the feet to the horizontal positions of the pads, according to the characteristics of the particular person, so that the pads have, in effect, different wedge shapes transversely at different portions of the pad. Accordingly, the pads are now ready to be made into shoes for the wearer, based on these dynamic contours and angles which have been taken by the pads. This tendency to produce the wedge-like positions re-

ferred to is demonstrated in ordinary shoes, by the tendency of the foot ordinarily to wear down more at one side of the heel or at one side of the sole than another. This effect in the shoes produced in accordance with my invention, gives an extremely even distribution of pressures beneath the feet and also causes the uppers, applied as hereinafter referred to, to take a more correct position. Accordingly, the pads are now placed beneath the feet of the wearer and a new marginal line is drawn on the top of each of the pads around the same with the pencil being directed inwardly at an angle of approximately 45° beneath the foot of the wearer while his feet rest on the pads. I then make an edge liner 17, preferably of leather, which has the shape as shown in Fig. 7, intended to be positioned entirely around the upper margin of the shoe so that the two ends of the edge liner abut in the front portion of the shoe. This edge liner 17 preferably has a wide upper margin extending above the intended top of the shoe, which upper margin is later to be cut away in the completed shoe. This edge liner, which is preferably of thin leather, is cemented to the foot of the wearer with rubber cement, with the hair side of the leather placed innermost against the foot. I next fasten to the edge liner 17 a cord 18 which is applied thereto with rubber cement. The upper side of this cord 18 defines the position of the upper edge of the completed shoe. The entire outside of the edge liner 17 and cord 18 are then wet with the thin or thick "latex," above referred to. I next place over the feet of the wearer a pair of socks 19 or any other covering, which is equivalent thereto, made of any desired material, knit or woven, such as cotton, silk, wool, rayon, etc., and by choosing a tight or loose sock I can in this way control the tightness or looseness of the resultant shoes. The pads 7 are then wet within the outlines which have been drawn thereon, as above, with a "thick latex" and the feet are then pressed down onto the pads by standing thereon so that the socks 19 adhere firmly to the pads. At the same time the socks will be pressed inwardly to adhere tightly to the edge liner 17 and the cords 18. If an outer covering is to be applied, which, however, is not essential, I next draw on opposite sides of each of the socks vertical lines 20 and 21, said lines being provided to indicate the adjacent lines of the edges of leather heel piece 22 and leather front piece 23 to form the outsides or uppers of the shoes. The heel pieces 22 are cut out of flat sheets of soft leather so that their edges will extend to the lines 20 and 21 and extend above the cords 18. The socks are then made wet with the "thick latex" opposite to the positions of the heel pieces 22 and the heel pieces are wet first on the inside with the thin "latex" and then, while still wet, with the "thick latex," and the heel pieces are then applied in position over the heel portions of the socks. The leather heel pieces 22 are then caused to take the conformation of the foot and the marginal recess between the foot and the outside of the pad by working the leather into the surface with the aid of a wet cloth and saddle soap. A blunt tool can be used to work the leather in the recesses, and particularly around the cord 18. Front pieces of leather 23 are then cut out of a flat piece of soft leather, and applied in the same way, so as to fit over the front of the shoe and to abut against the heel pieces 22 at lower positions 24, 25, but provide overlapping flaps 26, 27 on the opposite sides of the shoe

above the lower positions 24 and 25. Also, at the front of the front pieces 23, as shown in Fig. 9, opposite to the big toe, I cut out a V-shaped portion 28 of the leather so that the adjacent lower edges 29 and 30 will abut against each other, and above the pads 7 the adjacent edges 29 and 30 are bound together by a binding of a leather thong 31, a short piece of cord 32 being stuck vertically with rubber cement to the sock 19 between the said adjacent edges 29, 30. It will be noted that the lower margins of the heel pieces 22 and the front pieces 23 extend downwardly so as to cover the marginal edge of the duck layer 16, but in order to obtain a better bonding at the lower edge of the leather 22 and 23 I preferably apply over the duck layer 16 a layer 33 of elastic vulcanized rubber, as shown in Fig. 4, by coating the adjacent surfaces of the layers 16 and 33 first with the thin "latex" and then with the "thick latex." In this instance, the lower margin of the leather around the shoe will extend to and over an edge 34 of the rubber layer 33, said edge 34 having previously received a layer of rubber cement. This insures the retention of the lower edge of the leather in position so that it will not become thereafter separated from the shoe in use. Thereupon, I complete the sewing of the shoe by sewing around the upper marginal edge, above the cord 18, also along the flaps 26, 27, and by sewing in place a strap 35 and a buckle 36 on the front pieces 23. It will be noted that these straps 35 and buckles 36 are arranged to bridge over V-shaped recesses 37 in the shoes left between the ends of the edge liner 17, it being understood, of course, that the cord 18 extends around the V-shaped recess 37 and that the front pieces 23 are cut out at any stage in the manufacture to conform to said recesses 37. The sock and shoe having been removed from the foot, the edges thereof are now trimmed off all around the shoe, both at the top above the cord 18 and bottom wherever necessary, and a rubber sole 38 is then applied over the lowermost layer 16 or 33, causing the same to adhere tightly in place by applying rubber cement. The rubber sole 38 is preferably comprised of a portion of an inner tube of an automobile tire, which is desirable because of the curvature longitudinally and transversely thereof and which readily fits onto the shoe, although any other rubber layer could be used for this purpose if desired. All the rubber layers used in the shoe are preferably from $\frac{1}{8}$ to $\frac{1}{2}$ " thick. Thereafter, I bore all around the shoe, preferably between the pads and the uppers of the shoe, a series of holes 39 which pass entirely through the wall of the shoe to the outer air to provide ample ventilation. A motor-driven rotary brush can now be used to clean out any excess "latex" from the interior of the shoe.

Fig. 10 illustrates a modified form of procedure in accordance with my invention. In this modified form of my process, the procedure is the same as described in detail in connection with the preceding figures except in the following respects: In this instance a sock is not used in the making of the shoe, but, instead of the sock, at the same stage of the manufacture in which the sock was used I apply to the foot a lower layer of monk's cloth 41, the upper margin of which follows around the foot along the undercut line thereof, the upper inner margin of this layer of monk's cloth 41 being made wet with the "thick latex" so that it will adhere around the margin to the foot. At the front of the piece of monk's

cloth 41 three longitudinal puckers 42, above the big toe, the middle toe and the little toe, are made in order to draw the fabric tightly over the foot and these raised puckers are then clipped off with a pair of scissors. A second or upper layer of monk's cloth 43 is then cut out so as to fit over the top of the foot and extend down both sides of the same to a point beneath the undercut line of the foot, and preferably down to the outer edge of the pad 7, the only joint being the abutting edges of this piece of monk's cloth 43 at the rear of the heel. It will be noted also that the upper edge of the monk's cloth 43 terminates just below the cord 18. This monk's cloth 43, wherever it overlies the lower piece of monk's cloth 41 and the pad 7, is provided on the inner surface thereof with the "thick latex" so that when placed over the foot the overlapping edges of the two pieces of monk's cloth 41 and 43 will become cemented together, and in this cementing operation the portion of the monk's cloth 41 overlaid by the monk's cloth 43 may likewise have rubber cement applied to it to increase the bond between the same. Likewise, the monk's cloth 43 is bonded by cement in a similar manner to the edge liner 17 and to the pad 7 wherever the monk's cloth contacts with the same. Therefore, due to the location of the upper edge of the monk's cloth 43 beneath the cord 18, the upper edge of the shoe will be comprised merely of the edge liner 17 sewed to the leather back piece 22 in this instance.

Referring to Fig. 11, I have shown a modified form of shoe which may be constructed exactly like either of the two forms of shoes shown in Figs. 1 to 9, 12 and 10 but without the overlapping leather pieces 22 and 23. Instead, in this instance the outer portion of the upper is provided by applying onto the sock 19 or monk's cloth 41, 43, a flexible plastic or liquid material. For example, I may stipple onto the outside of the sock or monk's cloth a batter made of "latex" and wood flour, and when this has dried I may spray onto the same a rubber cement, to which I may apply, while the cement is wet, a metal powder, such for example as of aluminum, bronze, copper, etc., of which there is a great choice of colors, as desired. In this instance, also, there is no front cord 32, nor any binding 31, nor is there any stitching. A shoe 44 thus made, as shown in Fig. 11, may have a crescent shaped cut-out 45 near the front of the shoe and another similarly shaped cut-out 46 at the rear thereof, so as to provide a free end 47 for the attachment of a strap 48, by sewing, which strap is arranged to pass through a buckle 49 attached to the side of the shoe by sewing or otherwise. The lightness and flexibility of this particular form of the shoe make the openings 45 and 46 desirable.

In wearing these shoes, it will be understood that the mobile powder, such as balsam wood flour, carried in the pocket 14 of the body of the shoe has not only been pre-formed to give it the same shape as the dynamic contours of the foot in action, but that the contours in the pad can readily change either quickly or slowly to conform to the position of the foot in action and under the different circumstances of use. Furthermore, owing to the fact that the heel of the pad is slightly wider than the heel of the foot, greater stability for the heel is attained. It is found, accordingly, that the shoes made in this way not only provide extraordinary comfort but conduce to the maintenance and restoration of the feet to the normal natural positions which

they assume in action, thus increasing the feeling of well being of the wearer to a marked degree. These effects are, furthermore, attained by means of a shoe which may be produced with a very much smaller amount of the rubber than I have found necessary previously in making shoes.

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. The process which comprises applying to the foot an impressionable pad filled with a body of a flowable, dry, permanently non-setting, finely divided material, making an impression of the foot in the pad under the entire foot and thereafter building the shoe around the impressed pad while on the foot by securing an edge liner to the foot, securing a fabric which fits the foot to the edge liner and securing the fabric to the pad.
2. The process which comprises applying to the foot an impressionable pad filled with a body of a flowable, dry, permanently non-setting, finely divided material, making an impression of the foot in the pad under the entire foot and thereafter building the shoe around the impressed pad while on the foot by securing an edge liner to the foot, securing a sock which fits the foot to the edge liner, securing the sock to the pad and applying an outer covering to the sock.
3. The process which comprises applying to the foot an impressionable pad filled with a body of a flowable, dry, permanently non-setting, finely divided material, making an impression of the foot in the pad under the entire foot and thereafter building the shoe around the impressed pad while on the foot by securing an edge liner to the foot, securing a sock which fits the foot to the edge liner, securing the sock to the pad and applying an outer covering to the sock, said covering being in the form of a heel piece and a front piece joined together along vertical lines.
4. The process which comprises applying to the foot an impressionable pad filled with a body of a flowable, finely divided material, making an impression of the foot in the pad under the entire foot and thereafter building the shoe around the impressed pad while on the foot by securing an edge liner to the foot, securing a fabric which fits the foot to the edge liner and securing the fabric to the pad.
5. The process which comprises applying to

the foot an impressionable pad filled with a body of a flowable, finely divided material, making an impression of the foot in the pad under the entire foot and thereafter building the shoe around the impressed pad while on the foot by securing an edge liner to the foot, securing a sock which fits the foot to the edge liner, securing the sock to the pad and applying an outer covering to the sock.

6. The process which comprises applying to the foot an impressionable pad filled with a body of a flowable, finely divided material, making an impression of the foot in the pad under the entire foot and thereafter building the shoe around the impressed pad while on the foot by securing an edge liner to the foot, securing a sock which fits the foot to the edge liner, securing the sock to the pad and applying an outer covering to the sock, said covering being in the form of a heel piece and a front piece joined together along vertical lines.

7. The process which comprises applying to the foot an impressionable pad filled with a body of a flowable, finely divided setting material, making an impression of the foot in the pad under the entire foot and thereafter building the shoe around the impressed pad while on the foot by securing an edge liner to the foot, securing a fabric which fits the foot to the edge liner and securing the fabric to the pad.

8. The process which comprises applying to the foot an impressionable pad filled with a body of a flowable, finely divided setting material, making an impression of the foot in the pad under the entire foot and thereafter building the shoe around the impressed pad while on the foot by securing an edge liner to the foot, securing a sock which fits the foot to the edge liner, securing the sock to the pad and applying an outer covering to the sock.

9. The process which comprises applying to the foot an impressionable pad filled with a body of a flowable, finely divided setting material, making an impression of the foot in the pad under the entire foot and thereafter building the shoe around the impressed pad while on the foot by securing an edge liner to the foot, securing a sock which fits the foot to the edge liner, securing the sock to the pad and applying an outer covering to the sock, said covering being in the form of a heel piece and a front piece joined together along vertical lines.

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