July 6, 1943. D. F. HYLAND ET AL 2,323,539

METHOD FOR FITTING SHOES TO FEET

Original Filed July 8, 1940 3 Sheets-Sheet 1

Fig. 1.

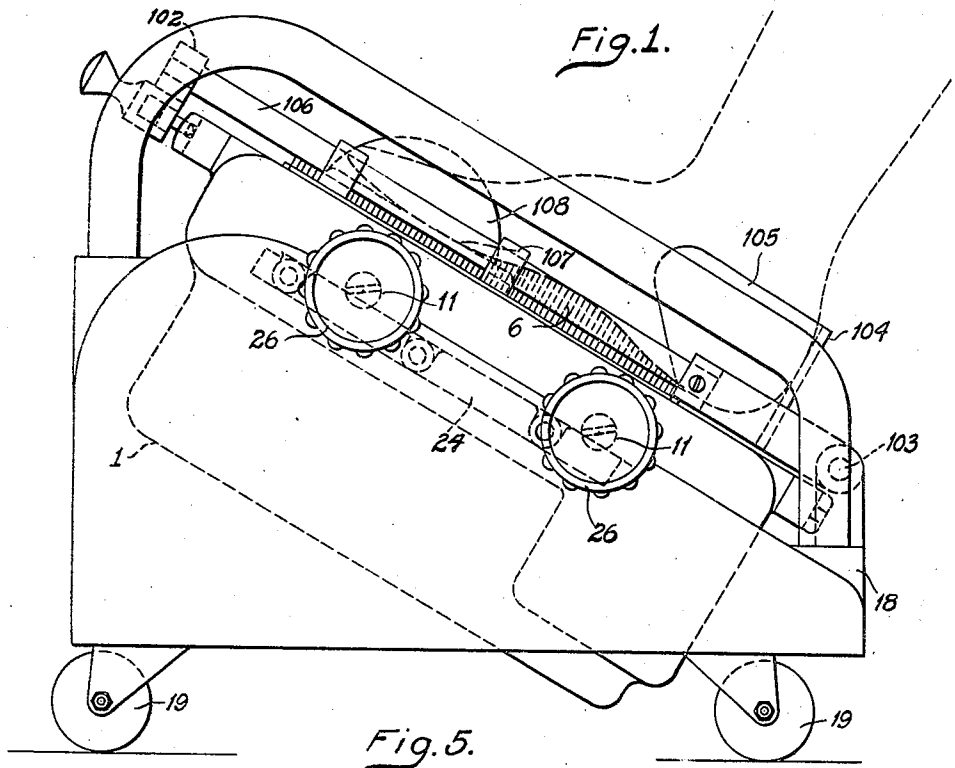


Fig. 5.

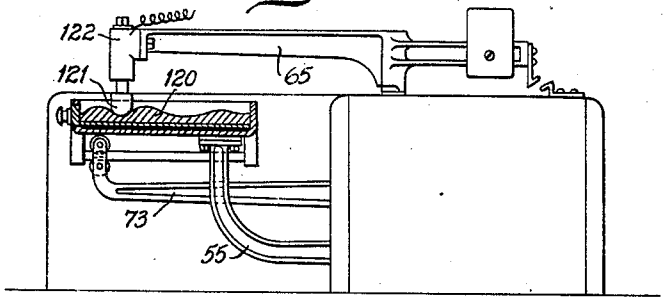
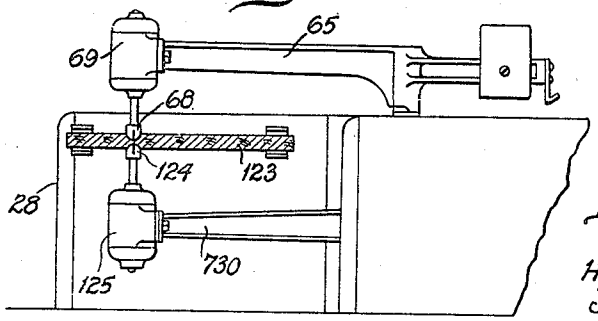


Fig. 2.



Fig. 6.



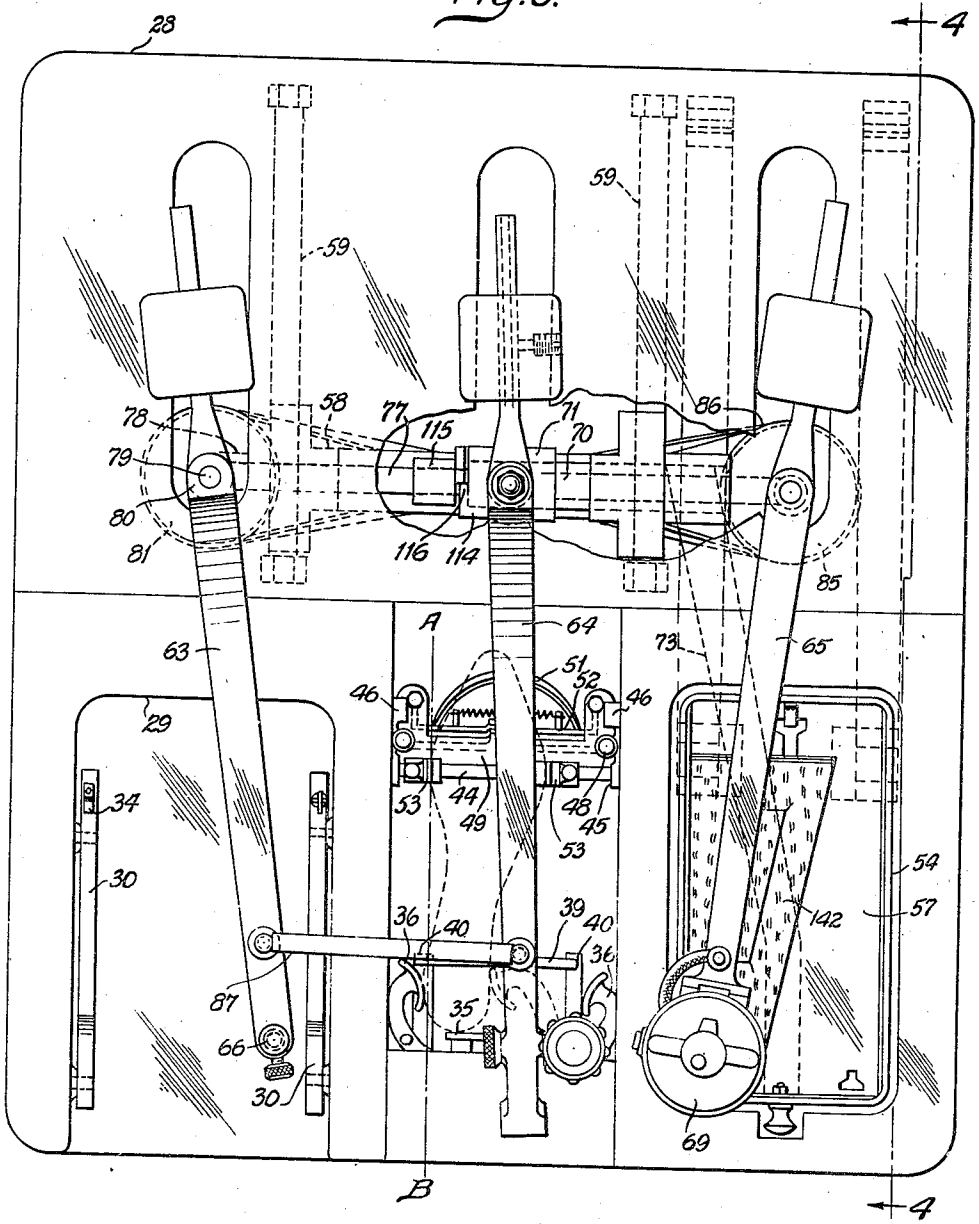
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Fig. 3.



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Original Filed July 8, 1940 3 Sheets-Sheet 3

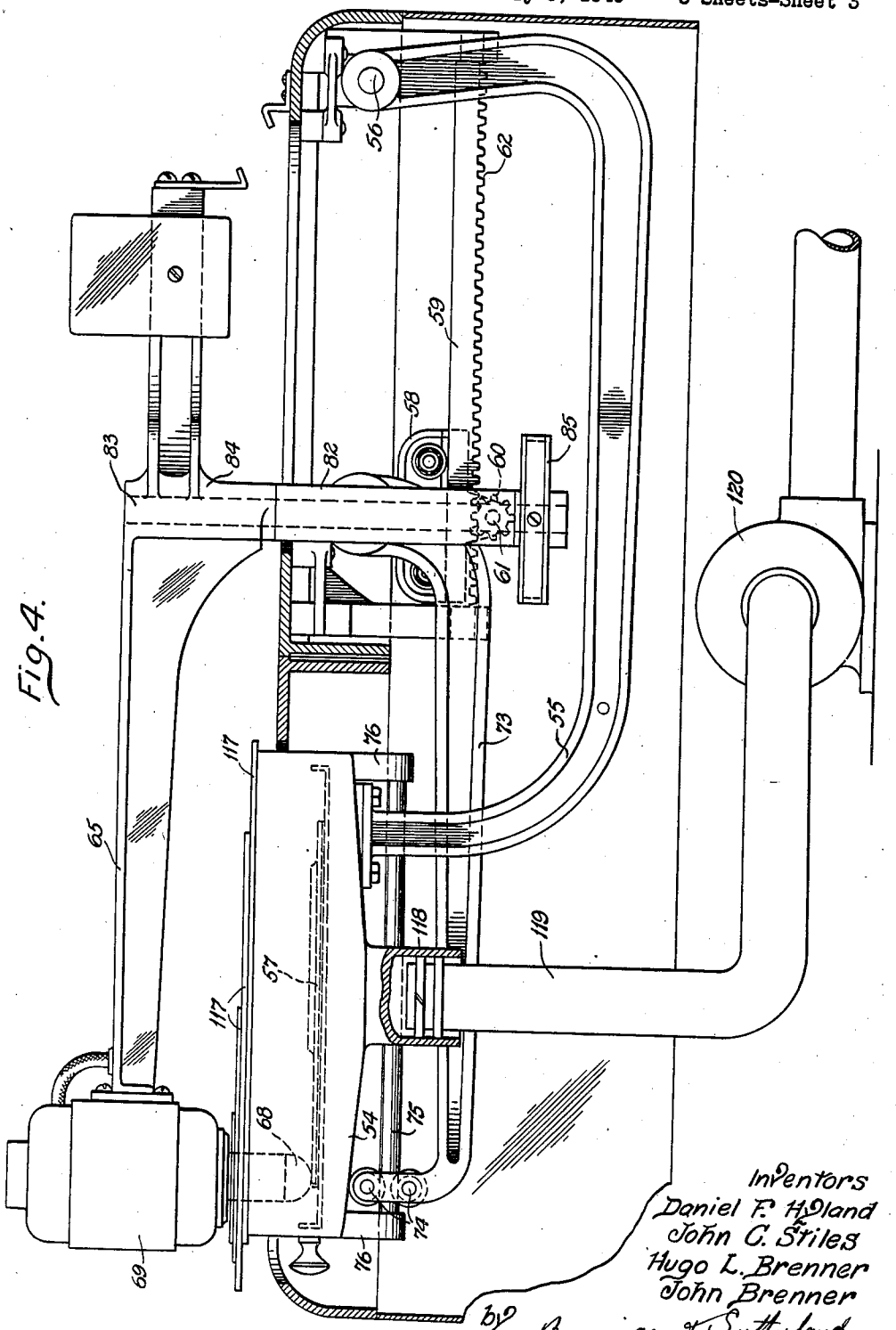


Fig. 4.

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UNITED STATES PATENT OFFICE

2,323,539

METHOD FOR FITTING SHOES TO FEET

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Original application July 8, 1940, Serial No. 344,458. Divided and this application June 12, 1941, Serial No. 397,702

18 Claims. (Cl. 12—142)

This invention relates to orthopedics and is concerned particularly with methods for fitting shoes to the feet of the wearer. This application is a division of application Serial No. 344,458, filed July 8, 1940.

As is well-known, it is impossible to manufacture shoes on standard lasts and expect them to fit all human feet of that particular size with any degree of accuracy. No two pairs of feet are alike, and, in fact, it is very rare that a pair of feet are exact mates. There is so much variation in the shape of different feet of the same approximate size that it is the exception rather than the rule that a standard shoe of the proper size is a perfect or even a comfortable fit.

The principal difficulty arises from the variation of the shape of the plantar surface of the foot. This surface is determined largely by the shape of the arch, and arches vary greatly in height and also in their lateral characteristics.

It is also true that shoes, even when manufactured to the same last, are by no means uniform in the shape of the foot supporting surface of the sole. And shoes of the same size made on different lasts vary from each other to a still greater extent. Accordingly, when such shoes are worn without correction, the foot must adjust itself to the shape of the shoe, and this often requires distortion of the normal position of the foot to such an extent as to cause serious discomfort.

One of the objects of this invention, therefore, is to provide a method whereby a foot of any form may have fitted to it a shoe built upon any last and, particularly, shoes built upon standard lasts in the usual processes of manufacture.

Another object is to provide a method whereby a foot, even though it may be defective in its shape or form due to deformation from any cause, may have fitted to it any particular shoe in such a manner as to provide a comfortable fit such that the weight of the wearer is properly distributed without discomfort.

Another object is to provide a method whereby a lift may be formed to such form as to occupy with a considerable degree of exactness the difference between the shape of the inside sole surface of the shoe and the plantar surface of the foot so as to support the latter in a normal and comfortable position.

Another object is to provide a method whereby such a lift may be formed by taking off the engaging surfaces of the foot and shoe sole with a high degree of accuracy so that the corresponding surface of the lift will fit accurately the sole surface of the foot and the shoe.

Another object is to provide a method whereby a lift may be formed by means operating upon both surfaces thereof and accurately guided in accordance with the form of the model and of the sole surface of the shoe, so as to produce a lift having a thickness at any point thereof corresponding to the difference at that point between the height of the model surface and the height of the inside sole surface of the shoe.

Another object is to provide a method whereby a lift may be formed by means guided in accordance with the variations in the surfaces of the model and the shoe sole and those variations applied differentially to the same surface of the lift-blank in forming the same.

The invention thus brings a solution of the problem of accurately forming a lift so dimensioned as to occupy the space representing the difference between the foot and the shoe so as to support the foot in a normal position, whatever may be the form of the inside sole surface of the shoe.

Further objects will appear from the following description of one embodiment of the invention selected for illustration and explanation taken in connection with the accompanying drawings, in which:

Figure 1 is a side view of a device for taking off a model of the sole of the foot in accordance with this invention;

Figure 2 is a detail perspective view of one of the contour elements;

Figure 3 is a plan view of the apparatus for transferring the form set up on the contour devices and the inside sole surface of the shoe to the lift-blank to form the latter to correspond to said contour and the shoe surface.

Figure 4 is a vertical longitudinal section of the apparatus on line 4—4 of Figure 3, showing the former arm and its relation to the blank;

Figure 5 is a view to a reduced scale similar to Figure 4, illustrating another apparatus for carrying out the process of this invention; and

Figure 6 is a view similar to Figure 5, illustrating still another form of apparatus adapted for that purpose.

In accordance with the process of this invention, a model is taken off the plantar surface of the foot, preferably in its normal position. This may be done by means of apparatus which will be described hereinafter, in which a series of shiftable elements are moved into engagement with the foot surface. This may be done by hand, or otherwise, so that the degree of pressure applied in engaging the elements with the foot may be regulated with the necessary skill. When all these elements have been engaged with the foot surface, they are clamped in shifted position so as to form collectively a model of the foot surface. This model is then placed in suitable apparatus, an embodiment of which will also be described hereinafter. The shoe which is to be worn on the foot from which the model

was taken is also placed in the machine in adjusted position. A lift-blank is placed in a holder suitably related to the machine. One or more forming tools are then brought to operate upon the lift. Certain of these tools operate upon one surface of the lift-blank, and these are guided by means of suitable mechanical connections, which will be described, in accordance with the shape of the model which has been taken from the foot surface. By this is meant that the movement of the tool is regulated to follow the contour of the model at every point of the lift face corresponding to a given point on the model and, therefore, on the foot surface. By passing such a forming tool so guided over the complete face of the lift, the latter is formed to a shape corresponding to that of the model.

In accordance with this invention, the opposite face of the lift blank may also be operated upon in accordance with the shape of the inside sole surface of the shoe. This operation may be a forming operation similar to that just described for the first surface. It has been found advantageous, however, instead of cutting or forming the opposite surface, to simply move this surface in accordance with the height of the inside sole surface of the shoe at each point thereof, so that instead of reproducing on the opposite surface the variations in the form of a shoe sole, these variations are superimposed upon those of the foot model, and the total variation is reproduced in the form of the first face of the lift. Accordingly, the total thickness of the resulting lift at any given point thereof will correspond to the difference at the corresponding point of the sole between the height of the model surface and the height of the inside sole surface of the shoe.

In this description and the appended claims, the term "height of the model," or model surface, refers to the height of that surface above any selected datum plane therebelow, and similarly the height of the sole surface of the shoe refers to the height of that surface above the same datum plane.

In accordance with this method, therefore, the blank may be formed by operating on one face thereof, say the upper face, by means of a cutting or forming tool which is raised and lowered in accordance with the height of the model surface, while at the same time the blank itself is raised and lowered in accordance with the height of the inside sole surface of the shoe; and by these operations the lift will be cut or formed, so that its thickness corresponds accurately to the difference between the foot sole and the shoe sole.

Referring more particularly to Figures 1 and 2, the contour device comprises a supporting frame in the form of a box 1, in the bottom of which may be mounted a resilient pad. This pad is preferably made very soft, so that it is easily compressed by the pressure of the foot while taking the impression. A type of pad which has been found satisfactory for this purpose is a pad usually constructed of sponge rubber which has been used for mattresses, seat cushions, and the like. However, the pads used for these purposes are usually a little too stiff. Accordingly, it is preferable to have such pads made up so as to provide greater yieldability.

Mounted upright in the box 1 and so as to rest upon the top surface of the pad is a series of contour-forming elements 6. These elements may be of any desired form. It has, however, been found preferable to make them rectangular with their upper ends rounded off, as shown in Figure 2. Their lower ends may also be rounded. It has been found convenient to form these elements with a square cross section at about one-eighth inch on the side and to assemble a great many of them in mutual contact with one another so as to fill the entire upper rim of the box 1. When so assembled the upper ends of all these pins form a surface having the same contour as the upper surface of the pad. However, any element or group of elements may be depressed as by the pressure of a foot sole thereon against the resiliency of the pad, and when so depressed the upper ends will take the contour of the plantar surface of the foot.

Where the lift is intended for foot correction, as in cases of pronation, pads of different degrees of stiffness may be provided so that the elements 6 may be applied to the sole under a pressure adjusted in accordance with the degree of correction desired.

Figure 1 shows a carrier 18 which may be provided with rollers 19 for moving it along the floor, and, if desired, a stop or brake operated by a pedal, not shown. This carrier is provided with two compartments, each of which is arranged to accommodate one of the contour devices, only one of which is shown in Figure 1. Each compartment is provided with a pair of rails 24 which may be set at an inclination, as shown in Figure 1 so as to position the top surface of the contour elements 6 in a convenient position for engagement by the feet to be fitted. Each contour device may be placed upon a pair of rails 24 by resting the heads of clamping screw 11 on said rails and against a suitable stop which locates said screw heads each in a position to be engaged by a manipulating element 26 having its inner end formed to engage the head of the screw 11 for operating the latter to clamp the contour elements. These devices 26 are arranged to slide in and out so that when the contour elements have been clamped the manipulating devices may be pulled out to release them from the screw heads and permit the contour devices to be lifted out of the carrier 18. When so removed from the carrier the contour devices will then be securely locked so as to retain a foot impression made therein.

When the foot impression has been taken, each of the contour devices in turn, together with the shoe to which the lift is to be fitted, are placed in the apparatus whose function is to transfer the contour of the foot sole from the contour device or model and the contour of the inside sole of the shoe to the lift-blank in order to form the latter to a variable thickness according to the difference between the foot sole and the shoe sole at every point thereof. The lift so formed may then be placed in the shoe and a perfect fit insured.

Referring now to Figures 3 and 4, this apparatus is supported by and housed in a frame or casing 28. In the forward part of this apparatus, which is the lower part in Figure 3, there is provided a receiving opening or socket 29 to receive the contour device. Properly located within the opening 29 is a pair of rails 30 upon which the contour device may be supported by resting the heads of the screws 11 upon these rails in substantially the same manner in which the contour device was supported on the rails 24 of the carrier 18. One of the rails 30 may be provided with a stop 34 formed to provide a spring catch adapted to grip and hold the screw head 11 when engaged therewith. When the contour device

has been set upon the rails 30 and moved back so as to be secured by the catch 34, it is in position for the operation of transferring its contour to the lift-blank.

In the forward middle portion of the apparatus shown in Figure 3 a shoe holder is provided. This is constructed so as to be capable of receiving and securing a shoe of any type or size in proper relation to the contour device mounted in the socket 29.

The shoe holder comprises a heel plate 35 against which the heel of the shoe is placed as indicated in Figure 3. A pair of side heel rests 36 is provided between which the heel of the shoe may be grasped. In Figure 3 the position of the shoe is indicated in dotted lines, a right shoe being indicated. For a right shoe the heel is moved against the left-hand side plate 36, as shown in Figure 3. These heel plates 36 are formed upon arms pivoted and tensioned by springs to hold each arm either in its extreme side position, as shown by the left-hand plate in Figure 3, or in the position shown in dotted lines for the right-hand plate in Figure 3, where the spring operates to press that side plate against the heel of the shoe to force the heel against the other side plate. By this arrangement the heel of the shoe is definitely located in its lateral position.

A horizontal heel support is provided in the form of a bar 39 supported upon a pair of arms 40 pivoted on the support 28. The arms 40 are spring-tensioned, tending to retract the bar 39 toward the front of the machine. The arms 40 are also resiliently supported by vertical springs. The bar 39 is adapted to support the heel of the shoe at a proper elevation when clamped between the side plates 36. The bar may be so placed as to bear against the bottom of an ordinary heel, or, in the case of a lady's high heel, it may be placed forwardly of the breast of the heel. Such a position is chosen as will place the average level of the inside sole surface of the shoe substantially in a horizontal plane.

The forward part of the shoe is arranged to rest upon a sole support in the form of a horizontal bar 44 arranged for vertical adjustment by being supported upon a pair of side arms 45 pivoted at 46 and each provided with an upright bracket in which an adjusting screw 48 is threaded. The lower end of the screw 48 rests upon a bracket 49, which also carries the pivot 46 and which is slidable longitudinally of the frame 28 upon rails, not shown. By this arrangement the support 44 may be placed at any desired point along the shoe and raised to any desired elevation in order to level the average plane of the inside sole surface.

In the embodiment illustrated a toe strap 51 is provided which may be passed over the toe of the shoe to hold the same down upon the support 44. A pair of side stops 53 is also provided for the forward part of the shoe. These may be arranged to slide upon the bar 44 and to be clamped thereon so as to be adjustable to any size shoe. These stops are preferably arranged so that when in their extreme side positions they are so positioned as to locate properly the inside line of any right or left shoe, respectively. By inside line is meant a line joining the inside surfaces of the heel and toe, as indicated by the line A—B in Figure 3. This line is determined for right and left shoes, respectively, by the shoe engaging surfaces of the plate 36 and the stop 53 on the proper side when each is moved to its extreme position.

In the right-hand side of the apparatus, shown in Figure 3, means are provided for holding a lift-blank which is to be formed in accordance with the foot contour and the shoe contour. This supporting device is also illustrated in Figure 4. A vertically movable table 54 is supported upon a pair of arms 55 pivoted at 56 in the extreme rear portion of the frame 28. This mounting permits the table 54 to swing vertically on the pivot 56, and as said pivot is located at a considerable distance from the table, the rise and fall will be practically a straight line movement with the forward portion of the table moving only slightly more than the rear portion. The means for imparting and controlling the vertical movement will be more fully explained hereinafter. A blank holder 57 is removably mounted upon the table 54.

The mechanism for transferring the contours of the model and the shoe sole to the blank is shown generally in Figures 3 and 4. A carriage 58 is arranged for longitudinal movement on the frame 28 by rolling upon rails 59. This movement is maintained in parallel relation by a pair of pinions 60 carried by a cross-shaft 61 suitably journaled in the carriage 58, said pinions meshing with racks 62 on the undersides of the rails 59, one of said racks being shown in Figure 4. Mounted on the carriage 58 for movement transversely of the frame 28 are three arms. For the sake of distinguishing between them in this description and the appended claims, these will be designated a follower-arm 63, a stylus arm 64, and a former-arm 65. The arm 63 carries a follower 66 arranged for engagement with the contour or model set up in the contour device mounted in the socket 29. The arm 64 carries a stylus 67 arranged for engagement with the inside sole surface of a shoe in the shoe holder. The arm 65 carries a forming tool which in the embodiment illustrated is in the form of a rotary cutter 68 and having operating means in the form of a motor 69. The functions and operation of the follower 66 and the stylus 67 are very similar. They are called by these different names in this description for the purpose of distinguishing between them.

Suitably journaled in the carriage 58 is a hollow shaft 70. Mounted near the left-hand end, Figure 3, of the shaft 70 and keyed thereto is a bracket 71. This bracket carries an upright pivot shaft 72, upon which the hub 73 of the stylus arm 64 is pivoted. By this connection raising and lowering the arm 64 will rotate the hollow shaft 70. Mounted at the right-hand end, Figure 3, of the shaft 70 is an arm 73 extending forwardly beneath the table 54. This arm carries at its end a pair of rollers 74 embracing a bar 75 mounted in end brackets 76 on the table 54.

Journaled within the hollow shaft 70 and at its left end, Figure 3, in the carriage 58 is a second shaft 77. Mounted on the left-hand end of the shaft 77 is a bracket 78. This bracket is also keyed to the shaft 77 so that rocking the bracket will rock the shaft. Journaled in the bracket 78 is a vertical shaft 79, to the upper end of which the hub 80 of the arm 63 is keyed. Accordingly, the arm 63 may swing transversely of the frame 28 on the shaft 79 as a pivot, and said shaft will be rocked by such transverse movement. The shaft 79 extends downwardly through the bracket 78 and carries at its lower end a pulley 81. In a similar manner the right-hand end, Figure 3, of the shaft 77 has keyed thereto a bracket 82 hav-

ing journaled therein a vertical shaft 83, to the upper end of which the hub 84 of the arm 65 is keyed and the lower end of which extends below the bracket 82 and carries a pulley 85. The pulleys 81 and 85 are connected by a belt 86. This belt is preferably a steel band crossed between the pulleys 81 and 85 and secured to each of said pulleys against slippage relative thereto. It will be seen that by these connections transverse swinging movement of the arm 63 will be communicated through the shaft 79 to the pulley 81 and from said pulley, by way of the belt 86, to the pulley 85 and thereby to the shaft 83 and the arm 65, causing a corresponding transverse swinging movement of the arm 65. Since the belt 86 is crossed between the pulleys 81 and 85, the movement of the arm 65 will be in reverse relation to that of the arm 63.

A link 87 connects the outer ends of the arms 63 and 64, said link having a universal joint, such as a ball and socket joint, at its connection to each arm so as to permit universal movement between the link and the arm. This link causes the arms 63 and 64 to move together for a purpose which will appear presently.

The lift-blank 142 may be mounted as illustrated in Figure 1, which shows a plan view of what is the upper surface of the blank while being operated upon, but which, according to the method of this invention, becomes the under-surface when the lift is applied to the shoe. The flat side of the blank may be provided with a suitable finished surface, such as a facing or sock lining of fabric, leather, or the like, so that when the opposite face of the blank has been formed and the same is inverted and placed in a shoe, this surface will be uppermost and will provide a finished surface for the inside of the shoe.

The table or pan 54 is so positioned that the forming tool 68 will operate within the side flanges thereof, and in order to prevent the cuttings from being scattered about, one or more closure plates 117 may be placed upon the top edges of said flanges. In order to carry away the cuttings, the lower portion of the pan 54 may be formed into a spout 118 into which extends the open upper end of an exhaust pipe 119 connected to a suction blower 120, which carries off the cuttings for disposal in any suitable manner. The arrangement is such that the pan 54 may rise and fall, as previously described, and still maintain its connection with the exhaust pipe 119.

In the operation of this apparatus, in order to fit a pair of shoes to the feet of the wearer in accordance with the method of this invention, two of the contour devices or models are mounted in the carrier 18, as shown in Figure 1. This carrier is further provided for cooperation with each of the contour devices with a frame 102 pivoted at 103 on the carrier. The frame is provided at its lower portion with a rear heel plate 104 and a side heel plate 105 against which the heel of the foot is placed for proper alignment. The side plate 105 is on the inside of the foot. The frame 102 is provided with longitudinal side bars 106, upon which is slidably mounted a sole plate 107 adapted to provide a rest for the ball of the foot. The plate 107 is also provided with a side plate 108 on the inside of the foot. The plate 107 is preferably provided with an angular edge running about at the angle of the ball of the foot. This plate depresses the elements 6 below it to a given level which is fixed for a given apparatus. This may be deemed the zero level. The foot is now placed upon the contour device with the inside surface thereof against the plates 105 and 108 and the heel against the plate 104 with the sole at the ball of the foot resting upon the plate 107. The position of the foot is indicated approximately in dotted lines in Figure 1. The operator may first adjust the position of the carrier 18 with respect to the subject by rolling it forward or back until the desired position of the foot with respect to the leg is obtained. The subject is then required to put enough pressure on the feet to depress the elements 6 to a desired level. When the operator is satisfied that the feet are in normal position for that subject and for the purpose for which the lift is intended, the manipulating elements 26 are pushed into engagement with the screw heads 11 and operated so as to cause said screws to clamp the elements 6 in the position given them by the pressure of the foot. This may be done for both feet simultaneously, as it is often easier to obtain a normal position of the foot when the subject places both feet simultaneously upon two separate contour devices. When these devices have been securely clamped, they are removed one at a time from the carrier 18 and placed in the socket 29 of the apparatus shown in Figure 3.

Each lift-blank is formed separately in the machine illustrated, as will now be described. One of the contour devices or models, say of the right foot, is now placed in the socket 29 on the rails 30 and pushed rearwardly until arrested by the stop 34, as already described. The shoe to be fitted to the right foot is then placed in the shoe holder. After the shoe has been inserted in the holder the follower 66 and the stylus 67 are suitably adjusted.

The shoe and the model having been placed in proper relation to each other, a lift-blank 142 is placed in the holder 57 and adjusted on the table 54. The operation of the forming tool 68 may now be started by starting the motor 69. This tool is arranged to cut or otherwise form the lift-blank so as to bring the height of its top surface, as it is placed in the holder, to a level corresponding to that of the model at the point where the follower engages the latter. As will be seen from Figure 3, the operator may now manipulate the stylus 67 so as to pass its tip successively over every point of the inside sole surface of the shoe from the ball of the foot clear back to the rear of the heel. In so doing, the operator may, for instance, start at the ball of the foot and move the stylus laterally back and forth across the shoe sole. The movement of the stylus to the ball of the foot pushes the carriage 58 rearwardly to a corresponding position which carries with it the arms 63 and 65 to corresponding points upon the model and the lift-blank, respectively. The sidewise movement back and forth of the stylus over the shoe sole causes a corresponding swinging movement of the arms 63 and 65 so as to carry them respectively back and forth across the model and the lift-blank. It will be noted that the arm 63 swings in the same direction as the arm 64, while the arm 65 moves in reverse relation to the stylus arm 64. The reason for this is that the blank is placed in inverted position in the blank holder so that its right and left sides are in reverse relation to those of the shoe. It is in fact the bottom surface of the lift-blank that is operated upon by the forming tool 68. Accordingly, as the stylus is swung from right to left across the shoe sole, the forming tool moves from left to right across the lift-blank.

As the follower 66 is moved back and forth across the model in accordance with the operation of the stylus, the difference in elevation of different parts of the model will cause the arm 63 to rise and fall. This up-and-down movement is communicated by the chain of connections already described, including the shaft 77, to the arm 65, which rises and falls in accordance with the rise and fall of the arm 63. Accordingly, the forming tool will operate upon the blank and would form its top surface (as placed in the holder) to a contour like that of the model but in reverse relation thereto as concerns right and left, if there were no vertical movement of the blank.

As the stylus moves over the sole of the shoe it is also subjected to a vertical movement in accordance with the difference in level of different points of the inside sole surface. This up-and-down movement of the arm 64 is communicated to the arm 73, which causes the blank holder to rise and fall accordingly. It will be seen, therefore, that the thickness of the lift is formed to the difference between the height of the model and the height of the inside sole surface of the shoe. In order to insure against the table 54 being moved high enough at any point so that the cutter 68 will cut clear through the blank, the stops 115 and 116, on the shafts 77 and 70, respectively, are provided.

It will be seen, therefore, that by this operation the lift is formed with its bottom surface (that is, the surface turned uppermost in the holder) formed to a contour corresponding to that of the sole of the foot as set up in the model or contour device. At the same time, the lower surface of the blank as it is mounted in the holder is operated upon in accordance with the contour of the inside sole surface of the shoe. In this case, however, instead of cutting or forming this lower surface, it is simply raised and lowered so that the entire forming operation is performed differentially by the forming tool 68. As a result a lift is formed whose thickness at any point is the difference between the height of the sole of the foot and that of the inside sole of the shoe. When this forming operation has been completed, the blank may be removed from the holder and trimmed in accordance with the shoe size so as to fit the shoe. The lift may now be placed in the shoe with its formed surface down against the inside sole of the shoe and may, if desired, be adhesively secured therein. Of course, when the lift has been completed for one shoe, the other contour device is set in the socket 29 and another lift formed for the other shoe in the same manner.

In Figures 5 and 6 are shown modified forms of apparatus capable of carrying out the general method of this invention in different specific ways. In Figure 5 the lift-blank takes the form of a plastic material 120. This material may be such as to be formable, either by heat or by pressure, and the forming tool may take a suitable form adapted to the purpose. In Figure 5 the forming tool 121 is illustrated as a heating tool adapted to form the lift by heat and pressure. This may be provided with operating means therefor such as a heating coil 122. The operation of forming the lift is the same in this case as has already been described. The shaping of the lift, however, takes place thermoplastically instead of by a cutting operation.

In Figure 6 the bottom surface of the lift-blank as placed in the holder is operated upon by a forming tool instead of simply by being raised and lowered. In this case the blank 123 may be suspended in any suitable manner so as to render both upper and lower surfaces thereof accessible to the forming tools. The upper surface may be operated upon by a cutting tool such as 68 operated by a motor 69, as already described. In this case, however, an arm 730, corresponding to the arm 73 described above, carries a forming tool 124 illustrated in Figure 6 as a cutter operated by a motor 125. In this case, also, in place of the cutter forming tools such as 121 may be employed for forming either or both top and bottom surfaces.

Figures 5 and 6 are more or less diagrammatic and are intended to illustrate the method rather than the details of the apparatus in each case.

It is obvious that various changes may be made in the details of operation or procedure, within the scope of the appended claims, without departing from the spirit of this invention, and that the invention is not limited to the specific details shown or described.

Having thus described the invention, what is claimed is:

1. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surface of the foot in normal position, and forming, from the model and the shoe to be fitted to the foot, as guides, a lift to a thickness at any point thereof corresponding to the difference at that point between height of the model and the height of the inner sole of the shoe.

2. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surface of the foot, passing a forming tool over one face of a lift-blank to shape the same, guiding the movement of the tool to conform to the shape of the model, and operating on the opposite face of the blank in accordance with the shape of the inner sole of the shoe to be fitted to the foot, whereby to form the lift to a thickness at any point thereof corresponding to the difference at that point between the height of the model surface and the height of the inner sole of the shoe.

3. In the art of fitting shoes to feet, the process comprising, passing a pressure-forming tool over one face of a plastic lift-blank to shape the same, guiding the movement of the tool to conform to the shape of the plantar surface of the foot in normal position, operating on the opposite face of the blank in accordance with the shape of the inner sole of the shoe to be fitted to the foot, whereby to form the lift to a thickness at any point thereof corresponding to the difference at that point between the height of the model surface and the height of the inner sole of the shoe, and treating the formed lift to fix its shape.

4. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surface of the foot, passing a forming tool over one face of a lift-blank to shape the same, guiding the movement of the tool to conform to the shape of the model of the foot in normal position, passing a second forming tool over the opposite face of the blank, and guiding the movement of the second tool in accordance with the shape of the inner sole of the shoe to be fitted to the foot, whereby to form the lift to a thickness at any point thereof corresponding to the difference at that point between the height of the model surface and the height of the inner sole of the shoe.

5. In the art of fitting shoes to feet, the proc-

ess comprising, taking off a model of the plantar surface of the foot, passing a heated forming tool over one face of a lift-blank of thermoplastic material to shape the same, guiding the movement of the tool to conform to the shape of the model, and operating on the opposite face of the blank in accordance with the shape of the inner sole of the shoe to be fitted to the foot, whereby to form the lift to a thickness at any point thereof corresponding to the difference at that point between the height of the model surface and the height of the inner sole of the shoe.

6. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surface of the foot under a substantially uniform resilient pressure against said surface adjusted in accordance with the degree of correction to be applied to the foot, and shaping a lift for the shoe in accordance with the model so taken off.

7. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surface of the foot under a pressure against said surface adjusted in accordance with the degree of correction to be applied to the foot, and forming a lift for the shoe to a thickness at any point thereof corresponding to the difference at that point between the height of the model so taken off and the height of the inner sole of the shoe.

8. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surface of the foot, forming the bottom surface of a lift-blank to correspond to the form of the model but in reverse relation thereto, and placing the formed lift in a shoe with said bottom surface against the inside sole of the shoe.

9. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surface of the foot, forming the bottom surface of a lift-blank to correspond to the form of the model but in reverse relation thereto while simultaneously moving the blank so as to position its top surface in accordance with the elevation of the inner sole of the shoe at the point thereof corresponding to the point being formed on the bottom surface, and placing the formed lift in the shoe with said bottom surface against the inside sole of the shoe.

10. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surface of the foot by pressing the foot upon resilient model-forming means with a predetermined uniform pressure, forming a lift to correspond with the model so taken off, and placing the lift in the shoe to be fitted.

11. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surface of the foot by pressing the foot upon resilient model-forming means with a predetermined uniform pressure while the ball of the foot is supported by a fixed support, forming a lift to correspond with the model so taken off, and placing the lift in the shoe to be fitted.

12. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surfaces of both feet of a subject by pressing both feet simultaneously upon yieldable model-forming means in order to position the feet as desired with relation to the legs and ankles of the subject, forming one or more lifts to correspond with the model or models so taken off, and placing the lift or lifts in the shoes to be fitted.

13. In the art of fitting shoes to feet, the process comprising, taking off a model of the surface of the foot, passing a forming tool over one face of a lift-blank to shape the same, and guiding the movement of the tool to conform to the shape of the model while simultaneously moving the blank so as to position its other face in accordance with the elevation of the inner sole of the shoe to be fitted at the point thereof corresponding to the point being formed on the first face so as to apply the height corrections for matching both the foot and the shoe differentially to the same face of the blank.

14. In the art of fitting shoes to feet, the process comprising, taking off a model of the surface of the foot, applying a forming tool to one face of a lift-blank to shape the surface thereof, and varying the relative positions of the tool and the blank in accordance with the difference between the height of the model surface at any point thereof and the height of the inside sole surface of the shoe to be fitted at the corresponding point, so as to shape the tooled face of the blank to conform to such difference.

15. In the art of fitting shoes to feet, the process comprising, taking off a model of the surface of the foot, applying a forming tool to one face of a lift-blank to shape the surface thereof, mechanically following the variations in height of the respective surfaces of the model and the inside sole of the shoe at corresponding points of both simultaneously, and applying the variations so obtained differentially to vary the relative positions of the tool and the blank, so as to shape the tooled face of the blank to conform to the difference between the corresponding heights of the model and the shoe sole.

16. In the art of fitting shoes to feet, the process comprising, preparing a lift-blank with a facing on one face thereof, taking off a model of the surface of the foot, applying a forming tool to the other face of the blank to shape the surface thereof, varying the relative positions of the tool and the blank in inverse relation laterally but in accordance with the difference between the height of the model surface at any point thereof and the height of the inside sole surface of the shoe to be fitted at the corresponding point, so as to shape the tooled face of the blank to conform to such difference, inverting the finished lift, and placing the inverted lift in the shoe.

17. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surface of the foot by pressing the foot upon resilient model-forming means with a predetermined pressure, securing the model-forming means against change so as to retain the foot impression, and forming a lift by operating on a lift blank under guidance of said model.

18. In the art of fitting shoes to feet, the process comprising, taking off a model of the plantar surface of the foot by pressing the foot upon resilient model-forming means, causing the model-forming means to engage said surface under substantially uniform pressure throughout while the foot is positioned thereon so as to shape the arch, securing the model-forming means against change so as to retain the foot impression, and forming a lift by operating on a lift blank under guidance of said model.

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