July 6, 1943. D. F. HYLAND ET AL 2,323,540

FOOT MODELING DEVICE

Original Filed July 8, 1940 3 Sheets-Sheet 1

Fig. 1.

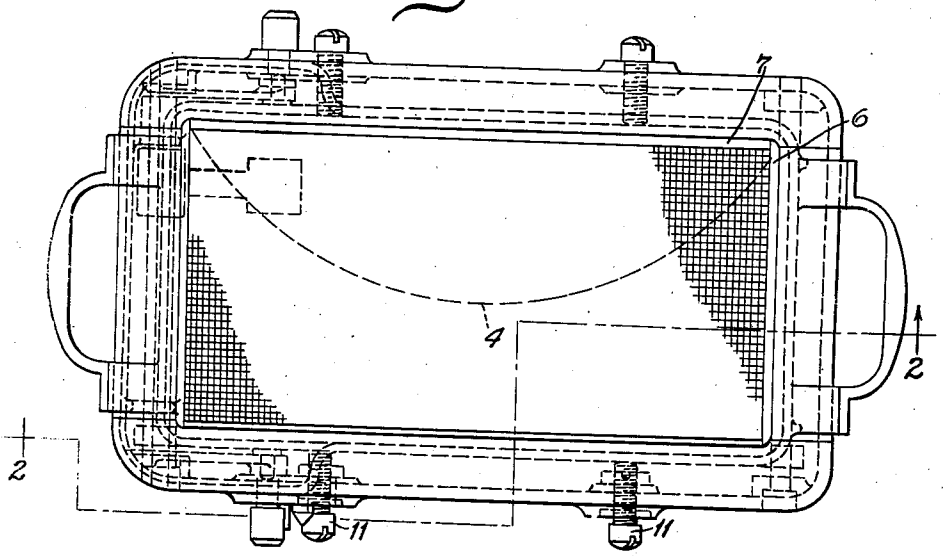
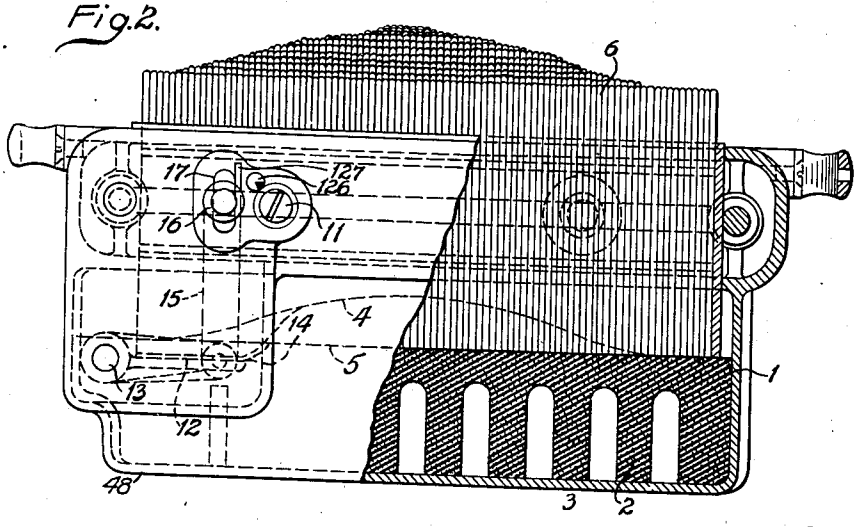


Fig. 2.



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Fig.4.

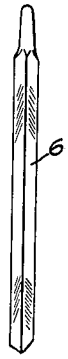


Fig.3.

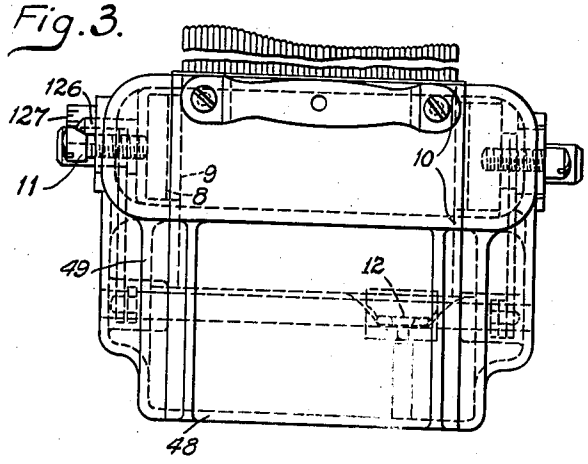
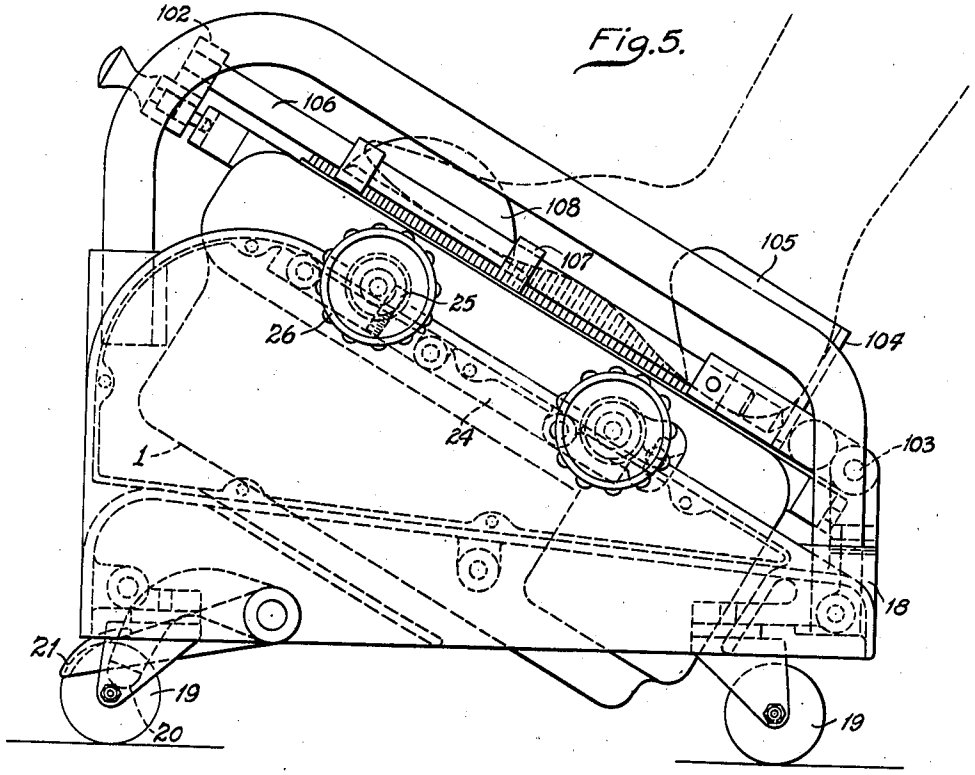


Fig.5.



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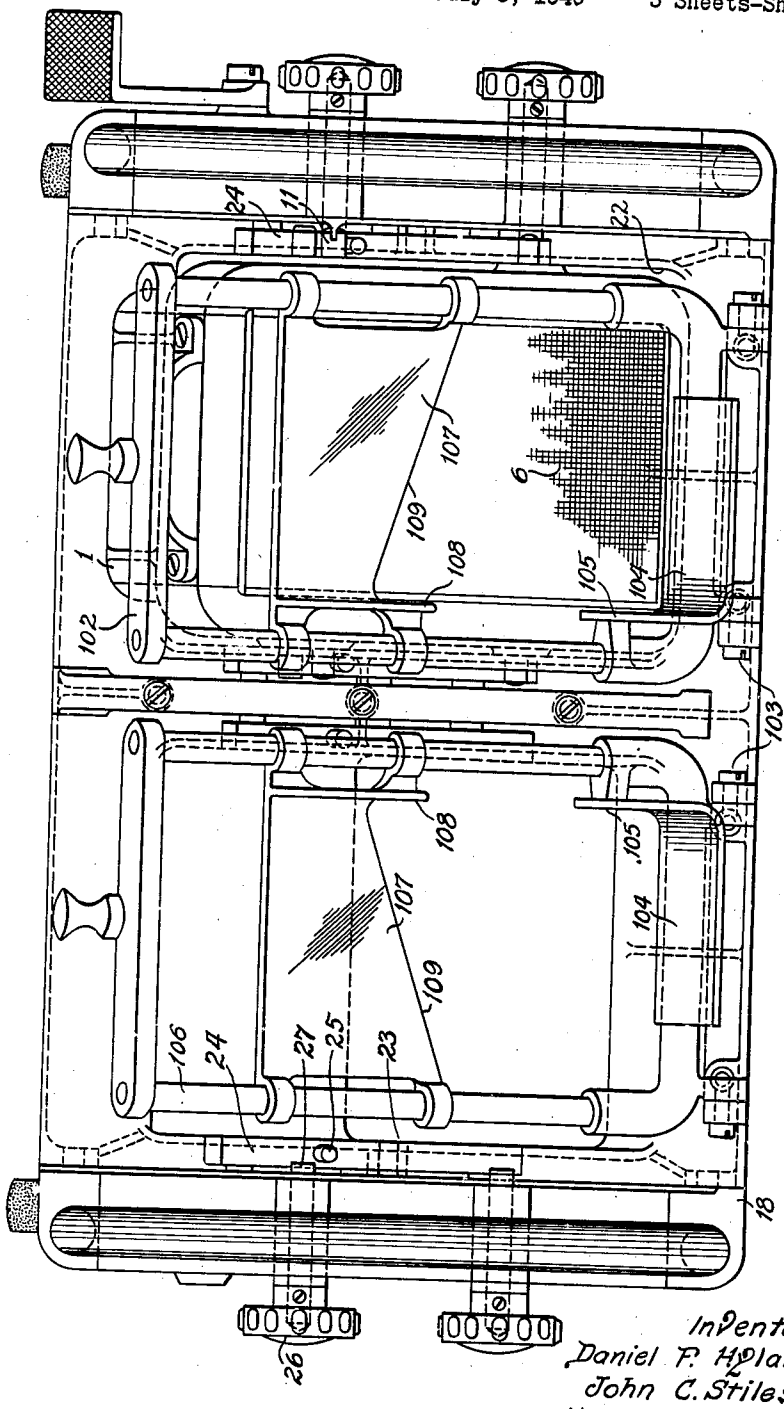


Fig. 6.

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UNITED STATES PATENT OFFICE

2,323,540

FOOT MODELING DEVICE

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Original application July 8, 1940, Serial No. 344,458. Divided and this application June 12, 1941, Serial No. 397,703

12 Claims. (Cl. 33—3)

This invention relates to orthopedics and is concerned particularly with apparatus for fitting shoes to the feet of the wearer.

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 built shoe of the proper size is a perfect or even a comfortable fit.

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, as part of a mechanism for forming lifts which are to be placed in shoes in order to fit the shoes to the feet of the wearer, means for taking off an accurate model of the shoe surface. Such apparatus for the purpose of fitting a foot to a foot, by forming a lift in accordance with the shape of the foot surface and also in accordance with the shape of the inside sole surface of the shoe, is disclosed in our co-pending application Serial No. 344,458, filed July 8, 1940, of which this application is a division.

Another object is to provide such modeling mechanism so constructed and arranged that after taking off a model of the foot surface, it may be set into the lift-forming machine so as to provide a model from which the lift may be formed.

Another object is to provide a novel structure for such modeling means whereby a model of the foot surface of improved accuracy may be obtained.

Another object is to provide improved means for mounting the modeling mechanism so that it may be presented to the foot to be modeled in a simple and convenient manner.

Further objects will appear from the following description, taken in connection with the accompanying drawings, in which:

Figure 1 is a plan view of the contour device for taking off the contour of the foot.

Figure 2 is a side view of the same.

Figure 3 is an end view of the same.

Figure 4 is a detail perspective view of one of the contour elements.

Figure 5 is an end view of the carrier in which the contour devices are mounted for taking the foot impression.

Fig. 6 is a plan view of the carrier in which the contour devices are mounted for taking the foot impression.

In accordance with the method of use of the machine disclosed in the above-mentioned application, a model of the plantar surface of the foot, preferably in its normal position, is taken off by means of the modeling apparatus hereinafter described. This model is then placed in cooperative relation with lift-forming mechanism, which mechanism is provided with following means adapted for engagement with the model and arranged so that the model surface may be followed thereby. Lift-forming means connected to be controlled by said following means are arranged to operate on a lift-blank to form the same in accordance with the surface of the model. At the same time, the shoe which is to be fitted is placed in the same lift-forming apparatus, and other control members adapted for following the inside sole surface of the shoe are also connected to control the lift-forming means. This combined control is effective to cause said forming means to shape the lift in such a manner that its thickness at any point is in accordance with the difference between the height of the foot model and the height of the inside shoe surface at the corresponding points thereof. Such apparatus and its operation are disclosed in the above-mentioned application.

Referring more particularly to Figures 1 to 4, 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 2. 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.

The pad shown particularly in Figure 2 is of soft sponge rubber and provided with a series of perforations or recesses 3, usually extending upwardly thereinto from the bottom to a desired

height. These are usually round holes which are spaced more or less regularly through the length and breadth of the pad. It has also been found desirable to form the pad with a portion of its top surface, indicated at 4, raised above the normal top surface of the pad, which is indicated at 5. This raised portion is given a contour approximating that of the hollow arch of a foot, but considerably larger, so that it will not only completely occupy the hollow part of the largest foot but will actually be compressed thereby.

Mounted upright in the box 1 and so as to rest upon the top surfaces 4 and 5 of the pad 2 is a series of contour-forming elements 6. These elements may be of any desired form. It has, however, been found preferably to make them rectangular with their upper ends rounded off, as shown in Figure 4. 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 7 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 2. 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 2, 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 2 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.

Arranged along one side of the upper part of the box 1 is a movable abutment 8 which extends along the entire assembly of elements 6. This abutment may be faced with a slightly yielding facing 9 of cork or similar material, against which the elements 6 may be pressed. On the opposite side of the box the elements 6 may bear against shoulders 10 formed inside the box. The bar 8 may be forced against the assembly of contour elements by means of clamping screws 11. Accordingly, when the clamp screws 11 are tightened the entire mass of elements 6 is placed under pressure and clamped in whatever position the individual elements may be at the time. The yielding facing 9 provides that pressure may be applied to every row of elements so that all may be securely clamped. This provides, therefore, that when the impression of a foot sole has been made in the upper surface provided by the tops of all the elements or pins 6 the contour thereof may be fixed by clamping these elements by means of the screws 11.

In order to provide for establishing a certain standard of pressure at which the foot contour is to be taken, the box 1 has mounted therein a heel gauge 12 in the form of an arm pivoted at 13 and resting upon the top surface of the pad 2. If desired, a layer of fabric or leather 14 may be placed over the pad so as to provide a smooth change of contour at the end of the gauge. This gauge is connected by a link 15 with a pin 16 projecting through a slot 17 in the side of the box 1. This pin indicates the height of the gauge 12 and may be set to any suitable position along the slot 17 by adjusting the pressure of the heel upon the tops of the elements 6, which at this point rest upon the gauge 12. If desired, a suitable index 126 may be placed upon the box to cooperate with a scale 127 on the pin so as to indicate the desired position to which the pin 16 should be moved under pressure of the heel.

Figures 5 and 6 show a carrier 18 which may be provided with rollers 19 for moving it along the floor, and, if desired, a stop or brake 20 operated by a pedal 21. This carrier is provided with two compartments 22 and 23, each of which is arranged to accommodate one of the contour devices, such as shown in Figures 1 to 3. Each compartment is provided with a pair of rails 24 which may be set at an inclination, as shown in Figure 5, 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 the screws 11 on said rails and against a suitable stop 25 which locates said screw heads each in a position to be engaged by a manipulating element 26 having its inner end 27 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. 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 109 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 5. 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 heel plate 12 and bring the pin 16 to a desired level. An index mark may be placed on the frame 1 to indicate approximately the desired level. When this position has been obtained and 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 27 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 simultaneousy, 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 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.

It will be seen, therefore, that this invention provides means whereby the shape of the foot surface may be reproduced with great accuracy in the form of the surface taken by the upper ends of the elements **6**. As these elements are extremely thin and therefore closely spaced, a substantially uniform surface is presented to the following element of the lift-forming machine. The arrangement whereby these thin elements rest upon a continuous resilient pad makes it possible to space them close together and in mutual contact and still have each one controlled by the counterpressure provided by the resiliency of the pad.

The arrangement of the heel gauge provides a control of the standard pressure under which the model is taken off. At the same time, the provision of the plate **107** provides an adjustable locating member for positioning the ball of the foot. The arrangement of the portable carrier **18** provides that the impressions of both feet may be taken simultaneously and that the subject may be seated during this operation. This also provides that, by suitably positioning the carrier **18** with reference to the subject, any desired position of the foot with respect to the leg and ankle may be obtained. This is often a useful provision when foot correction is desired.

While the invention has been described above as applied to a unitary machine, it will be understood that individual features or subcombinations thereof may be useful by themselves without reference to other features or the complete combination, and the employment of such individual features or subcombinations is contemplated by this invention when within the scope of the appended claims.

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.

The invention having thus been described, what is claimed is:

1. In an apparatus of the character described for fitting shoes to feet, means for taking off a model of the foot comprising, a series of shiftable elements engageable with the plantar surface of the foot to take off a three-dimensional model of said surface, means for securing said elements in shifted position, and a continuous plate extending over certain of said elements for engagement by the foot to form a continuation of the model surface.

2. In an apparatus of the character described, model-forming means comprising, a portable carrier, one or more model-forming assemblies each provided with yieldable contour-receiving means and an operable element for fixing a received contour therein, supporting means on said carrier arranged to receive and position said assembly and means on said carrier engageable with said operable element to operate the same and releasable therefrom to render said assembly removable from said carrier.

3. In an apparatus of the character described, model-forming means including, a supporting frame, a series of elongated, relatively movable contour-receiving elements arranged in said frame in adjacent relation so that their tops collectively provide a contour-receiving surface, a sponge-rubber pad yieldably supporting said elements, and means for securing said elements against movement.

4. In an apparatus of the character described, model-forming means including, a supporting frame, a series of elongated, relatively movable contour-receiving elements arranged in said frame in mutually contacting relation so that their tops collectively provide a contour-receiving surface, a sponge-rubber pad yieldably supporting said elements, and means for clamping said elements against each other to secure them against movement.

5. In an apparatus of the character described, model-forming means including, a supporting frame, a series of elongated, relatively movable contour-receiving elements arranged in said frame in adjacent relation so that their tops collectively provide a contour-receiving surface, a resilient pad supporting said elements resiliently against depression, means for indicating the extent of movement of certain of said elements so as to indicate the pressure applied thereto, and means for securing said elements against movement.

6. In an apparatus of the character described, model-forming means including, a supporting frame, a series of elongated, relatively movable contour-receiving elements arranged in said frame in adjacent relation so that their tops collectively provide a contour-receiving surface, a resilient pad resiliently supporting said elements against depression, an operated member depressable by certain of said elements engaging the heel of the foot whose impression is being taken, means indicating the extent of depression of said member in order to indicate the pressure on said elements, and means for securing said elements against movement.

7. A foot-modeling device, comprising, a supporting frame, a continuous resilient pad supported on said frame, and relatively movable contour-receiving elements arranged in said frame in mutually contacting relation and resting on said pad.

8. A foot-modeling device, comprising, a supporting frame, a continuous resilient pad supported on said frame, and relatively movable contour-receiving elements each not more than one-eighth inch in thickness arranged in said frame in mutually contacting relation and resting on said pad.

9. A foot-modeling device, comprising, a supporting frame, a resilient pad supported on said frame, relatively movable contour-receiving elements arranged in said frame in adjacent relation and resting on said pad, and a gauge providing a stop for certain of said elements in a position corresponding to a selected pressure on said pad.

10. A foot-modeling device, comprising, a supporting frame, a resilient pad supported on said frame, relatively movable contour-receiving elements arranged in said frame in adjacent rela-

tion and resting on said pad, and a plate extending over certain of said elements for engagement by the foot to form a continuation of the model surface and having an angular rear edge conforming to the angle of the ball of a foot.

11. A foot-modeling device, comprising, a supporting frame, a resilient pad supported on said frame, relatively movable contour-receiving elements arranged in said frame in adjacent relation and resting on said pad, locating means adjustable to cooperative relation with said elements, and a plate adjustable on said locating means to extend over certain of said elements for engagement by the foot to form a continuation of the model surface.

12. A foot-modeling device, comprising, a supporting frame, a resilient pad supported on said frame, relatively movable contour-receiving elements arranged in said frame in adjacent relation and resting on said pad, locating means adjustable to cooperative relation with said elements, a plate adjustable on said locating means to extend over certain of said elements for engagement by the foot to form a continuation of the model surface.

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