Oct. 5, 1943. B. W. KLEIN 2,330,978

ARCH SUPPORTER

Filed Oct. 30, 1940 2 Sheets-Sheet 1

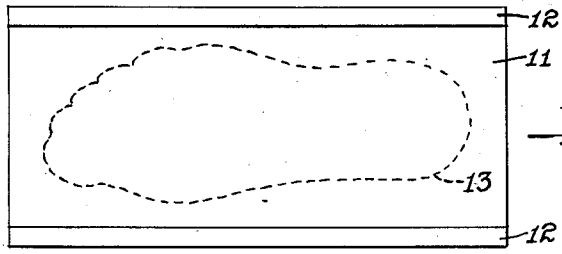


Fig. 1.

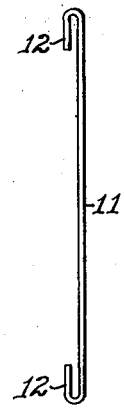


Fig. 2.

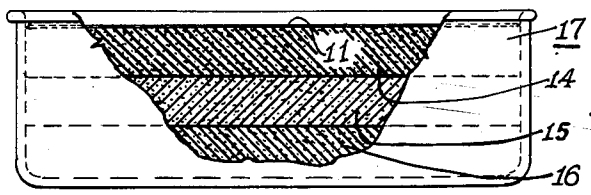


Fig. 3.

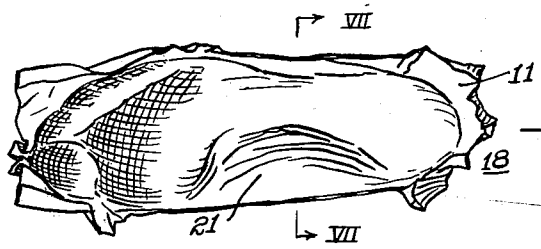


Fig. 4.

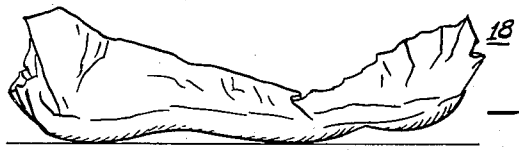


Fig. 5.

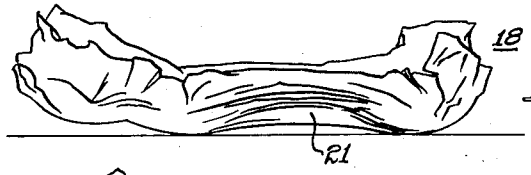


Fig. 6.

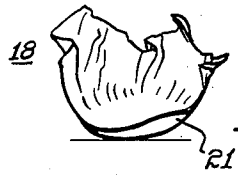


Fig. 7.

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ARCH SUPPORTER

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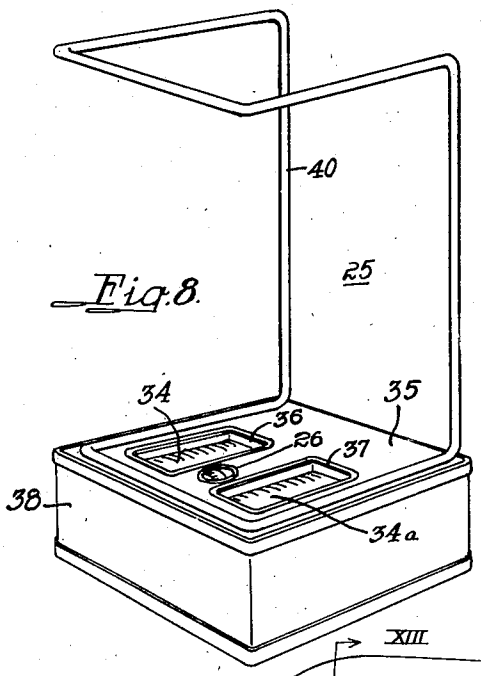


Fig. 8.

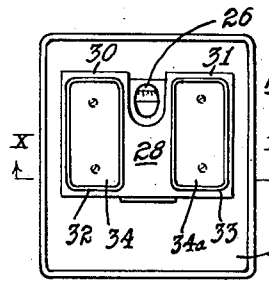


Fig. 9.

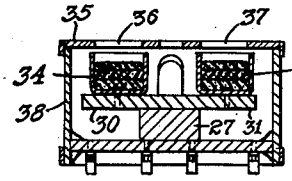


Fig. 10.

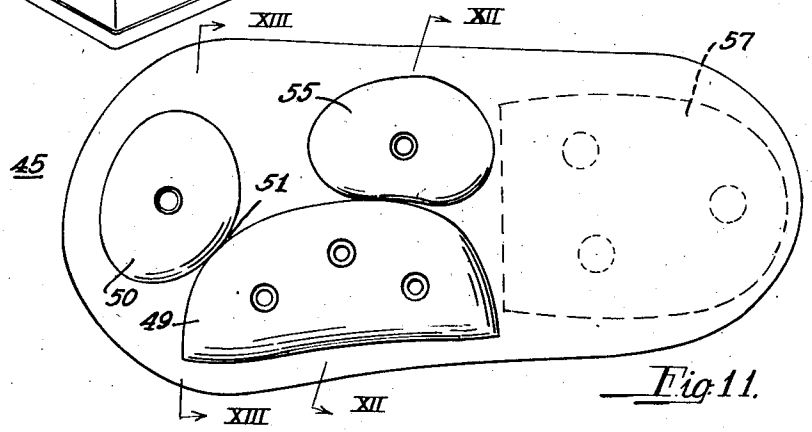


Fig. 11.

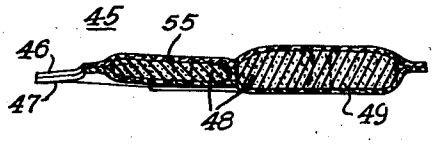


Fig. 12.

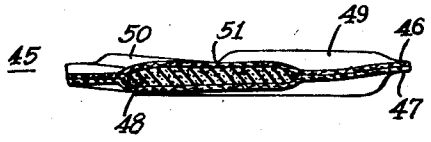


Fig. 13.

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UNITED STATES PATENT OFFICE

2,330,978

ARCH SUPPORTER

Benjamin W. Klein, Pittsburgh, Pa.

Application October 30, 1940, Serial No. 363,417

4 Claims. (Cl. 128—2)

My invention relates to arch supports and to a method of and apparatus for ascertaining the proper shape and dimensions which it should have to properly fit a foot with which it is to be used.

One object of my invention is to provide an arch supporting device consisting of a soft, flexible, leathery article that may be placed in the shoe of a wearer, and which will have such shape as to provide a soft, resilient, compressible support for the arch of the foot.

Another object of my invention is to provide an arch supporting device of the foregoing character in which the tendency of the compressible element for the arch to touch the foot about its normal longitudinal axis is equalized and counter-balanced by a correlative, resilient, compressible element of appropriate dimensions located to engage the metatarsal region of the foot.

Another object of my invention is to provide an arch supporting device of the foregoing character that shall be initially shaped to embody a certain amount of concavity about the longitudinal axis, to enable the device to more readily fit the foot, and to impose a minimum requirement upon the foot to shape the device for proper fitting engagement.

Another object of my invention is to provide a simple apparatus whereby a matrix may be formed by the foot under normal standing pressure conditions to enable a properly fitting arch supporting device to be made for each foot, or simultaneously for both feet, according to normal standing pressures.

Another object of my invention is to provide a simple method of and apparatus for procuring and forming a matrix that will show the dimensions and contours of the foot to be fitted.

Another object of my invention is to provide the fitting apparatus in such form that it may be readily shipped or mailed to persons who may not be conveniently near a store or other place where the foot measurements might normally be taken.

In order to procure a matrix of the foot to be fitted, I employ a platform of relatively soft, resilient, compressible material, such as sponge rubber, which is approximately flat and level in its initial state. A layer of aluminum foil is placed on this rubber platform. The person whose foot is to be fitted then places his foot on the aluminum foil with his entire weight, so that the foil will be shaped to his foot by the rubber base according to normal standing and walking pressure conditions. After the sheet of aluminum foil is pressed into shape, it is self-sustaining and retains that shape to provide a matrix to permit the measurements of the foot to be taken for the making of a suitable arch supporting device for that foot.

In order to permit the foot to adjust itself to a maximum degree according to its natural tendencies, I make the arch supporting device as soft as possible, while retaining, of course, the necessary physical strength to maintain the required relative disposition of the associates and cooperative elements or parts of the arch supporting device.

With that in mind, I form the arch supporting device of two pieces of relatively soft leather between which I place pads of soft compressible material such as sponge rubber, properly spaced and of proper dimensions and contours, to provide the amount of support that will be necessary for the arch of the foot, as indicated by the matrix of aluminum foil previously formed by the foot. The two layers of leather material and the inserted pads of compressible material are then cemented together to form a single integral laminated unit that may be placed in the shoe of the wearer, and that will then constitute a soft resilient support for the arch of the foot.

Due to the softness of the material of the arch-supporting device, the foot will be fitted as though with a soft glove that will conform to the foot with a minimum of external shape pressure, except in those regions where the inserted material is specifically provided to impose a definite reaction pressure against the foot.

In order to keep the arch-supporter in place in the shoe so that it will not slide forward and out of proper position, in response to the sliding friction force impressed on it when the foot is inserted into the shoe, the bottom surface of the arch-supporter is provided with a layer of highly frictional non-skidding material that tends to hold the arch-supporter in place against the tendency of the foot to move it forward when the foot is inserted into the shoe.

An important feature of the arch-supporter of my invention is the provision and location of an insert in the arch-supporter to engage the foot in the metatarsal region behind the first phalanges.

The provision, in the arch-supporter of an element which imposes an external pressure upwardly against the arch, has a tendency to throw the foot off normal position by rotating it around the longitudinal axis of the foot, according to the amount of lift upon the arch by that element

of the support which is directly under the arch. In order to compensate for that turning force, I provide a slight amount of lift in the metatarsal region to be effective upwardly on the opposite side of the longitudinal axis of the foot, and thereby restore the foot to a balanced position, while supplying the necessary support under the arch.

In order further to aid the foot in maintaining a normal position and form, both with respect to its longitudinal axis and with respect to the bottom of the foot, the arch-supporter may be shaped to embody a certain amount of concavity about the longitudinal axis so it will conform to the foot as much as possible, even before pressure is exerted by the foot against the supporter.

In order to compensate for the weight of the wearer, the thickness of the inserts is varied. The arch-supporter and the apparatus which I employ to procure a proper measurement for it, according to my invention, are illustrated in the accompanying drawings, in which,

Figure 1 is a plan view of a sheet of metallic foil, such as aluminum, of sufficient size to take the impression of a foot, as indicated;

Figure 2 is an edge view of the sheet in Figure 1;

Figure 3 is a perspective view with a part of a front side wall broken away, of a box containing a soft rubber material to serve as a platform for a sheet of metallic foil which is to be shaped into a matrix by the pressure of a foot which is to be fitted;

Figure 4 is a plan view of a sheet of the metallic foil showing a typical impression of a right foot;

Figure 5 is a side elevational view of the matrix formed of the metallic foil as shown in Figure 4; the view being taken from a position at the outer side of the foot;

Figure 6 is a side elevational view of the matrix taken from the inner side of the foot;

Figure 7 is a transverse sectional view of the matrix of Figure 5;

Figure 8 is a perspective view of an apparatus for procuring impressions of the feet to form the matrices;

Figure 9 is a plan view of the apparatus of Figure 8, with the floor removed to show the location and disposition of the foot-measuring units on the scale;

Figure 10 is a vertical transverse sectional view of the apparatus of Figure 9;

Figure 11 is a plan view of an arch-supporter;

Figure 12 is a vertical section taken along lines 12—12 of Figure 11; and

Figure 13 is a vertical section taken along lines 13—13 of Figure 11.

As shown in Figure 1, a sheet of metallic foil 11, such as aluminum foil, is employed to take the imprint of a foot to form a matrix from which the shape of the foot may be measured to make a proper arch-supporting device. The edge of the sheet 11 may be provided with a border 12 doubled over to aid the sheet in retaining its matrix form after having the foot impressed therein. The sheet should be sufficiently large to receive the print of the foot as indicated by the dotted outline 13, with some additional material around the edges to be bent upward as re-inforcing flange material.

In order to form the metal foil sheet into a matrix, to conform to the shape of the foot under pressure, as it would be when the person is standing, I prefer to use a material such as soft or sponge rubber as a base for the sheet of metal foil 11, so that when the person stands on the sheet, supported by the rubber, the metal foil will be caused to conform to the shape of the foot as the foot pressure compresses the yieldable resilient rubber material.

In Figure 3, I have illustrated one arrangement which may be employed. As shown there, a rubber base is illustrated as a laminated structure consisting of three layers, 14, 15, and 16, of soft sponge rubber disposed in a box or container 17. The sheet of metal foil 11 is initially flat and rests on the top of the soft rubber base. The foot that is to be fitted is pressed down on the metal foil 11, and presses the foil into a matrix 18, as indicated in line in Figure 4. The box 17 is provided with a cover so the entire unit may be utilized as a shipping container, when the device is to be sent to anyone who has no ready access to the usual shoe shop where such measurements might be otherwise taken.

The matrix 18 when formed, will take a shape such as shown in Figures 4, 5, and 6, with the imprint of the bottom of the foot indicating the dimensions of the various parts of the foot under normal standing or walking pressure conditions. From this matrix thus formed may be gotten the dimensions necessary to make up the arch-supporting device that will fit the corresponding foot. Where metal foil is used, and a matrix formed as shown in Figures 4, 5, and 6, any excess material, pressed upward beyond that needed, may be trimmed at the time the matrix is made.

As indicated in Figures 5 and 6, and in Figure 7, the arch of the foot is indicated by the concave space 21 at the middle of the matrix. Since the concave space or arch 21 was formed by the pressure of the foot on a yielding material such as the rubber, the arch indicates the natural position which the foot should have, and the support for the foot should therefore be such as to aid the foot in maintaining that arched shape and condition.

The apparatus 25 for taking the foot impression is shown in Figures 8, 9, and 10.

As illustrated in those figures, the apparatus 25 comprises, generally, a weighing scale having a weight indicator 26 and a platform 27. An auxiliary platform 28 is attached to the scale platform 27, and is of substantially U-shape to provide two side arms 30 and 31 that serve as supporting platforms for two containers or pans 32 and 33 respectively, similar to that shown in Figure 3. Each pan 32 and 33 contains thick pads 34 and 34a of sponge rubber, similar to the rubber forms shown in Figure 3.

A floor cover 35 is disposed above the pans 32 and 33, and it is provided with adjacently spaced openings 36 and 37 above the pans, and of sufficient size to permit a foot to be inserted through either openings 36 or 37 onto the rubber pad 34 or 35 of the underlying pan. The openings 36 and 37 are slightly smaller than the peripheral dimensions of the associated pans, so that neither pan can project up through the opening directly above it, but will be stopped and prevented from moving upwardly through its opening upon engaging the under surface of the floor 35.

The floor 35 is also provided with a depending apron 38, encircling and surrounding the scale and the pans, and serving also as a wall structure to support the floor 35. By providing castors 39 attached to the bottom of the apron 38; and by suitably supporting the scale and its pans

from the floor **35** and the apron **38**, the entire apparatus may be made movable to be shifted from place to place, as desired.

A hand rail **40** is attached to and supported on the floor **35**, and is provided to enable a person to balance himself to prevent falling, while stepping onto the rubber in the two pans to form an impression of the foot or feet that are to be fitted.

As previously explained, when an impression of the foot is to be taken, a sheet of aluminum foil is laid on top of the rubber pads in either or in both pans, as the case may be; and the person whose foot is to be fitted steps onto the aluminum foil sheet with his full weight to form a matrix of the foot arch.

At the same time, the weight of the person to be fitted is indicated by the scale and that reading of his weight will provide an indication of the proper amount of supporting material to be used in making up the arch-supporter for that person.

As previously explained, the pans are slightly larger than the openings through which the foot may be pressed onto the rubber. Consequently, pressure on one pan will tilt the other pan only to a limited amount, until such tilted pan engages the bottom surface of the floor **35** as a stop.

The matrix formed by either foot as it presses the aluminum foil against the yielding rubber will then provide an indication of the natural proper form which the arch of the foot should have, and also serves to indicate those areas on the sole of the foot which have been subjected to excessive pressure during normal walking operations of the patient. The location of those high-pressure areas on the matrix will indicate the areas that must be relieved by the arch-supporter. The inserts in the arch-supporter may then be disposed in the proper areas adjacent the high-pressure areas to provide sufficient lifting support to the foot, at the corresponding areas of the foot, to relieve those areas previously subjected to excess-pressure.

Such excess-pressure areas usually indicate the presence of a callus on the sole of the foot. By relieving the presure at that area, the callus is permitted to soften so it can be more readily treated and removed; and the relief from pressure at that region of the foot eliminates the discomfort otherwise caused by the excess pressure and reaction pressure of the calloused area.

In order to support the foot properly, I form an arch-supporting device **45**, as shown in Figures 11, 12 and 13. The arch-supporter **45** is made up of two layers **46** and **47** of soft, flexible, leather, or leather-like material, with filling material or inserts **48** of soft, compressible, resilient sponge rubber. The filling material **48** is disposed between the top and bottom layers **46** and **47** to provide a raised portion in the areas **49** that will fit under the arch of the foot at the region corresponding to the concavity or arch space **21** in the matrix of Figure 6. An insert in the area **50** co-operates with the front portion of the insert material in the area **49** to provide a transverse support for the metatarsal region of the foot, to relieve the excess pressure usually found at the main joint of the large toe, and usually indicated by the presence of a hardened area or callus there. This is one of the important features of the arch-supported embodying my invention, whereby the excess-pressure area of the foot may be relieved by providing a resilient lifting support adjacent to the pressure area.

In order to provide a proper lift, the inserts **48** are preferably made of rubber pads with square or sharp-cut edges, rather than tapered feather edges. With such square or sharp-cut edges, the entire area of the insert is available as a support. The two portions **49** and **50** are preferably formed as separate areas, substantially as indicated, for flexibility, although they may be formed as a continuous portion without any intermediate bend line, such as indicated at the region **51**. The perforations **52** extending through the material in areas **49** and **50** serve as vents or ventilating openings to permit the transmission of air.

An additional area **55** is provided with a filler insert to provide a support to the region of the foot slightly on the opposite side of the longitudinal foot axis from the side on which the arch is supported by the insert **49**. That support **55** serves to provide a balance and to prevent the lifting effect of the arch-supporting regions **49** and **50** from tilting the foot from its proper normal position. Any tilting tendency of the arch-supporting insert areas is counter-balanced by the lifting tendency of the area **55**.

In order to prevent the arch-supporter from slipping or sliding in the shoe, either when the foot is first inserted in the shoe or during walking, an anti-skid layer **57** of friction-producing material is cemented to the under surface of the rear or heel portion of the device. This layer **57** may be of rubber or treated to have a rubber-like surface to provide the desired friction.

The front edge **60** of the arch-supporter is located to be behind the toes so there will be no interference with their freedom of movement.

By means of the apparatus illustrated above, procuring a matrix of the print and form of a foot under pressure, I am enabled to procure the information and data relative to size and shape of the foot under normal standing or walking conditions, to enable me to properly form and shape the arch-supporting unit as described in Figure 11.

The matrix, in showing the exact location of the excess-pressure regions, indicates how the arch-supporter should be formed and shaped to provide the proper relief to eliminate the discomfort suffered by that measured foot.

In addition to the data given by the matrix for the actual dimensions of the foot under pressure, I also have available and utilize the reading of the scale showing the weight of the person as a factor in determining the amount of pressure to which the insert areas of the arch-supporter may be subjected, so that the appropriate thickness of material may be inserted to maintain the proper contours under the pressure of the full weight of the individual when standing or walking.

My invention is not limited to the specific details of the apparatus or of the arch-supporter, that are illustrated, since various changes and modifications may be made therein without departing from the spirit and scope of the invention, as set forth in the appended claims.

I claim as my invention:

1. The method of forming a matrix to show the form of a foot under pressure of standing weight, which consists in placing the foot on a sheet of metallic foil supported on a resilient yieldable base, with the full pressure of the body on the foot.

2. An apparatus for forming a matrix impression of a foot to serve as a guide in making a

supporting device for the arch of the foot, comprising a base of compressible yielding resilient material having a relatively flat top surface of sufficient area to accommodate a foot; a layer of metallic foil on the top surface to receive the foot impression; and means for supporting and confining the compressible base material against excessive lateral displacement.

3. Apparatus for forming a matrix of a human foot under normal standing pressure conditions, to provide an indication of excess-pressure areas on the foot, to permit correcting supports to be provided for the foot; said apparatus comprising a platform scale; a beam across the platform; a box on each end of the beam; a resilient rubber pad in the box; and a layer of metallic foil on each rubber pad to receive the pressure of a foot to be fitted and to be formed by such pressure into a matrix showing the excess-pressure areas on the sole of the foot and the form of the arch.

4. An apparatus as in claim 3, with a floor supported above the two boxes, and provided with two openings, one above each box to permit a foot to be inserted through the opening and onto the rubber in the box below.

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